



工程指示 / 要求簡箋 ENGINEER INSTRUCTIONS(E.I.)

工程指示編號:	EI- 6564 / 23	修改版本:	-
	HK- /		
工程編號:	J 859	工程名稱:	啟德6551
收件人:	maggie	發件人:	Nero
工程項目:	佛沙窗&後裝窗(玻璃) - 報價用資料	日期:	31/07/2023

<input type="checkbox"/> 原合約工程包	<input type="checkbox"/> 原合約工程加 / 減賬 QT-	<input type="checkbox"/> 新工程報價 QT-
---------------------------------	--	------------------------------------

信件批核號碼/圖紙參考編號:	批核模具圖紙編號:
客戶指示附件:	管理內部批簽署:

<input type="checkbox"/> 初步鋁料 B.M.	<input type="checkbox"/> 加工拆圖, 然後生產	<input type="checkbox"/> 尺寸表
<input type="checkbox"/> 正式鋁料 B.M.	<input type="checkbox"/> 技術上資料/指示	<input type="checkbox"/> 報價
<input type="checkbox"/> 配件 B.M.	<input type="checkbox"/> 樣辦或貨品說明書	<input type="checkbox"/> 分判合約
<input type="checkbox"/> 其他:		

內容:
附件是報價用859 中/英文Spec, 參考用玻璃數量。

完成上列要求日期: ASAP


國內

<input type="checkbox"/> 生產技術總監	<input type="checkbox"/> 連附件	<input type="checkbox"/> 技術部	<input type="checkbox"/> 連附件	<input type="checkbox"/> 生產部	<input type="checkbox"/> 連附件
<input type="checkbox"/> 採購部	<input type="checkbox"/> 連附件	<input type="checkbox"/> 生產統籌部	<input type="checkbox"/> 連附件	<input type="checkbox"/> 報關組	<input type="checkbox"/> 連附件
<input type="checkbox"/> 質檢部	<input type="checkbox"/> 連附件	<input type="checkbox"/> 會計部	<input type="checkbox"/> 連附件	<input type="checkbox"/> 機械設計部	<input type="checkbox"/> 連附件
<input type="checkbox"/> 香港辦	<input type="checkbox"/> 連附件	<input type="checkbox"/> 其他:			

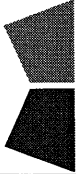
香港

<input type="checkbox"/> 行政部	<input type="checkbox"/> 連附件	<input type="checkbox"/> 會計部	<input type="checkbox"/> 連附件	<input type="checkbox"/> 統籌部	<input type="checkbox"/> 連附件	<input type="checkbox"/> 工程部	<input type="checkbox"/> 連附件
<input checked="" type="checkbox"/> 採購部	<input checked="" type="checkbox"/> 連附件	<input type="checkbox"/> QS部	<input type="checkbox"/> 連附件	<input type="checkbox"/> 地盤管理	<input type="checkbox"/> 連附件	<input type="checkbox"/> 維修部	<input type="checkbox"/> 連附件


*發件人簽署:		*組別成員批核簽署:	
傳遞編號:	/	項目經理簽署:	

		工程號: J-859	計算: 劉燦	日期: 2023.07.11	送呈: 施哥					
地盤名稱: 啟德		核對: 徐詳坤	核對: 徐詳坤	日期: 2023.07.11	副本:					
項目類別: 佛沙窗		批准: 林仁安	批准: 林仁安	日期: 2023.07.11						
A/C Code:		數量: 1037	總計玻璃面積 (平方米):		708.293					
BM編號:										
序號	修改標示	玻璃編號	顏色與名稱	厚度(mm)	玻璃尺寸		數量 (塊)	面積(平方米)		備註
					高度(mm)	寬度(mm)		單件	總面積	
1		W5P-T6-1/G1	G1 - 8mm PDE32/45A on clear#2 +12a +10mm clear (Sample No. 20230518058)	30.00	622	1946	21	1.210	25.419	見G1
2		W5P-T6-2/G1			462	675	21	0.312	6.549	見G1
3		W1P-T8/G1			490	1176	6	0.576	3.457	見G1
4		W11P-T6/G1			583	1146.5	1	0.668	0.668	見G1
5		W5P-T1/G1			825	1176	20	0.970	19.404	見G1
6		W2P-T1/G1			783	1176.5	20	0.921	18.424	見G1
7		W1P-T2/G1			265	1176	21	0.312	6.544	見G1
8		W5P-T5-1/G1			622	1946	21	1.210	25.419	見G1
9		W5P-T5-2/G1			462	675	21	0.312	6.549	見G1
10		W4P-T2/G1			745	1146.5	15	0.854	12.812	見G1
11		W10P-T9/G1			590	1176	6	0.694	4.163	見G1
12		W12P-T9/G1			465	1176	14	0.547	7.656	見G1
13		W4P-T9/G1			415	1176	20	0.488	9.761	見G1
14		W13P-T9/G1			575.5	1176	14	0.677	9.475	見G1
15		W15P-T9/G1			771	1176	1	0.907	0.907	見G1
16		W5P-T6/G2	G2 - 8mm PDE32/45A on clear#2 +12a + 8mm clear (Sample No. 20230518059)	28.00	460	1189	21	0.547	11.486	見G2
17		W8aP-T5/G2			712	1174	2	0.836	1.672	見G2
18		W2P-T7			680	1174	21	0.798	16.765	見G2
19		W1P-T8/G2			419	1174	6	0.492	2.951	見G2
20		W11P-T6/G2			574.5	1144	1	0.657	0.657	見G2
21		W1P-T7-1/G2			585	1144	21	0.669	14.054	見G2
22		W1P-T7-2/G2			360	1144	21	0.412	8.649	見G2
23		W5P-T5/G2			460	1189	21	0.547	11.486	見G2
24		W5P-T1/G2			604.5	1174	20	0.710	14.194	見G2
25		W8aP-T1/G2			692	1194	2	0.826	1.652	見G2
26		W12P-T2			560	1149	1	0.643	0.643	見G2
27		W2P-T1/G2			722	1174	20	0.848	16.953	見G2
28		W1P-T2/G2			584.5	1174	21	0.686	14.410	見G2
29		W1P-T3			660	1174	21	0.775	16.272	見G2
30		W4P-T2/G2			574.5	1144.5	15	0.658	9.863	見G2
31		W13aP-T9	617	1174	4	0.724	2.897	見G2		

BM編號:		工程號:	J-859	計算:	劉燦	日期:	2023.07.11	送呈: 施哥			
地盤用玻璃B.M.表		地盤名稱:	启德	核對:	徐詳坤	日期:	2023.07.11	副本:			
		項目類別:	佛沙窗	批准:	林仁安	日期:	2023.07.11				
		A/C Code:		數量:	1037	總計玻璃面積 (平方米):		708.293			
序號	修改標示	玻璃编号	顏色與名稱	厚度(mm)	玻璃尺寸		數量	面積(平方米)		備註	
				寬度(mm)		高度(mm)	(塊)	單件	總面積		
32		W10P-T9-1/G2	G2 - 8mm PDE32/45A on clear#2 +12a + 8mm clear (Sample No. 20230518059)	28.00	840	1174	6	0.986	5.917	見G2	
33		W10P-T9-2/G2			519	1174	6	0.609	3.656	見G2	
34		W3P-T9			960	1149	20	1.103	22.061	見G2	
35		W9P-T9			660	1149	6	0.758	4.550	見G2	
36		W4P-T9A			720	1174	20	0.845	16.906	見G2	
37		W12P-T9/G2			564	1174	14	0.662	9.270	見G2	
38		W3P-T9A			630	1174	21	0.740	15.532	見G2	
39		W16aP-T9			475	1144	1	0.543	0.543	見G2	
40		W4P-T9A			720	1174	21	0.845	17.751	見G2	
41		W13P-T9/G2			734.5	1174	14	0.862	12.072	見G2	
42		W15P-T9/G2	584.5	1174	2	0.686	1.372	見G2			
43		W4P-T6-1/G2a	G2a-8mmHS+12mm AIR GAP+8mmTP+1.52PVB+6mm(PLANNING) FEATURED GLASS (I.G.U.)	35.52	614.5	1174	21	0.721	15.150	見G2a	
44		W4P-T6-2/G2a			345.5	1176	21	0.406	8.532	見G2a	
45		W3P-T6-1/G2a			634.5	1174	21	0.745	15.643	見G2a	
46		W3P-T6-2/G2a			645.5	1176	21	0.759	15.941	見G2a	
47		W1P-T9			520	1144	20	0.595	11.898	見G2a	
48		W4P-T1-1/G2a			604.5	1174	20	0.710	14.194	見G2a	
49		W4P-T1-2/G2a			195	1176	20	0.229	4.586	見G2a	
50		W3P-T5-1/G2a			634.5	1174	21	0.745	15.643	見G2a	
51		W3P-T5-2/G2a	645.5	1176	21	0.759	15.941	見G2a			
52		W4P-T5	930.5	1174	21	1.092	22.941	見G2a			
53		W2aP-T9A	360	1150	21	0.414	8.694	見G2a			
54		W6P-T1	550	1173	20	0.645	12.903	見G8			
55		W1P-T1	520	1144.5	20	0.595	11.903	見G8			
56		W3P-T2	520	1144	15	0.595	8.923	見G8			
57		W9P-T1	500	1144	1	0.572	0.572	見G8			
58		W5P-T9	560	1174	20	0.657	13.149	見G8			
59		W6P-T8	510	1195	21	0.609	12.798	見G8			
60		W14P-T9	400	1174	16	0.470	7.514	見G8			
61		W2P-T9A	520	1144	21	0.595	12.492	見G8			
62		W5P-T2	530	1174	15	0.622	9.333	見G8			
			G8 - 6mm euro grey + 0.76 milky white + 0.76pvb + 6mm euro grey (Sample No. R20230526002)	13.52							

		工程號:	J-859	計算:	劉燦	日期:	2023.07.11	送呈: 施哥			
		地盤名稱:	启德	核對:	徐詳坤	日期:	2023.07.11	副本:			
		項目類別:	佛沙窗	批准:	林仁安	日期:	2023.07.11				
BM編號:		A/C Code:		數量:	1037	總計玻璃面積 (平方米):		708.293			
序號	修改標示	玻璃编号	顏色與名稱	厚度(mm)	玻璃尺寸		面積(平方米)		備註		
					寬度(mm)	高度(mm)	單件	總面積			
63		W10P-T6	G8 - 6mm euro grey + 0.76 milky white + 0.76pvb + 6mm euro grey (Sample No. R20230526002)	13.52	449	1174	2	1.054	見G8		
64		W2P-T6			560	1174	21	0.657	13.806	見G8	
65		W7aP-T5			560	1174	1	0.657	0.657	見G8	
66		W12P-T1			530	1173	1	0.622	0.622	見G8	
67		W1P-T5			560	1174	21	0.657	13.806	見G8	
68		W15P-T2			462	1176	1	0.543	0.543	見G8	
69		W1P-T6			560	1174	21	0.657	13.806	見G8	
70		W2P-T5			560	1174	21	0.657	13.806	見G8	
					總合計:		1037	708.293			
<p>1). 本表中所有玻璃對角線尺寸偏差要求不超過正負2mm.</p> <p>2). 本表中所有玻璃要求粗磨邊處理並倒棱角.</p> <p>3). 本表中玻璃要求粗磨邊處理並倒棱角, 攔河玻璃頂底要精磨邊, 而所有玻璃之入爐方向需保持一致。</p> <p>4). 本表中不同種類玻璃參照玻璃加工圖加工。</p> <p>5). 本表中所有強化玻璃均需HEAT SOAK TEST。</p> <p>6). 本表中所有玻璃均需注明室內外面及其玻璃編號, 以便識別。</p>											
加工注意事項:											

序號		修改標示	玻璃編號	顏色與名稱	厚度 (mm)	玻璃尺寸		數量 (塊)	面積(平方米)		備註
						寬度(mm)	高度(mm)		單件	總面積	
		工程號: J-859		計算: 劉燦		日期: 2023.07.11		送呈: 施哥			
		地盤名稱: 啓德		核對: 徐詳坤		日期: 2023.07.11		副本:			
地盤用玻璃B.M.表		項目類別: 後裝窗 / FD門 / 趟門		批准: 林仁安		日期: 2023.07.11					
BM編號:		A/C Code:		數量: 613		總計玻璃面積 (平方米)		652.707			
1			W7-T1	G1 - 8mm PDE32/45A on clear#2 +12a +10mm clear (Sample No. 20230518058)	30.00	563	2255	20	1.270	25.391	見G1
2			W8-T1/G1			512	2255	19	1.155	21.937	見G1
3			W12-T1			598	2255	1	1.348	1.348	見G1
4			W9-T2			563	2255	15	1.270	19.043	見G1
5			W16-T2			598	2255	1	1.348	1.348	見G1
6			W15-T2-1/G1			583	1877	1	1.094	1.094	見G1
7			W15-T2-2/G1			1343	1160	1	1.558	1.558	見G1
8			W5-T3			548	2255	23	1.236	28.422	見G1
9			W7-T3			600	2255	1	1.353	1.353	見G1
10			W6-T5-1			626.5	2239	21	1.403	29.457	見G1
11			W6-T5-2			626.5	2404	21	1.506	31.628	見G1
12			W7-T5-1			591.5	2239	21	1.324	27.812	見G1
13			W7-T5-2			591.5	2404	21	1.422	29.861	見G1
14			W10-T5			598	2255	1	1.348	1.348	見G1
15			W6-T6-1			626.5	2239	21	1.403	29.457	見G1
16			W6-T6-2			626.5	2404	21	1.506	31.628	見G1
17			W7-T6-1			591.5	2239	21	1.324	27.812	見G1
18			W7-T6-2			591.5	2404	21	1.422	29.861	見G1
19			W9-T6			598	2255	1	1.348	1.348	見G1
20			W6-T7			548	2255	21	1.236	25.951	見G1
21			W7-T7			563	2255	21	1.270	26.661	見G1
22			W8-T7			598	2255	1	1.348	1.348	見G1
23			W2-T8/G1			548	2255	21	1.236	25.951	見G1
24			W5-T8/G1			548	2255	15	1.236	18.536	見G1
25			W7-T8			598	2255	1	1.348	1.348	見G1
26			W2-T9-1			641.5	2239	20	1.436	28.726	見G1
27			W2-T9-2			641.5	2404	20	1.542	30.843	見G1
28			W8-T9			563	2255	6	1.270	7.617	見G1

		工程號: J-859	計算: 劉燦	日期: 2023.07.11	送呈: 施哥					
地盤名稱: 啟德		核對: 徐詳坤	核對: 徐詳坤	日期: 2023.07.11	副本:					
項目類別: 後裝窗 / FD門 / 趟門		批准: 林仁安	批准: 林仁安	日期: 2023.07.11						
A/C Code: BM編號:		數量: 613	總計玻璃面積 (平方米): 652.707							
序號	修改標示	玻璃編號	顏色與名稱	厚度 (mm)	玻璃尺寸		數量 (塊)	面積(平方米)		備註
					寬度(mm)	高度(mm)		單件	總面積	
29		W11-T9	G1 - 8mm PDE32/45A on clear#2 +12a +10mm clear (Sample No. 20230518058)	30.00	563	2255	14	1.270	17.774	見G1
30		W5A-T9A-1			187	2352	20	0.440	8.796	見G1
31		W5A-T9A-2			377	1103	20	0.416	8.317	見G1
32		W5A-T9A-3			473	1023	20	0.484	9.678	見G1
33		W16-T9-1	G2 - 8mm PDE32/45A on clear#2 +12a + 8mm clear (Sample No. 20230518059)	28.00	1617	1161	1	1.877	1.877	見G1
34		W16-T9-2			633	2257	1	1.429	1.429	見G1
35		W8-T1/G2	G2a - 8mm PDE32/45A on clear#2 + 12a + 8mm clear +1.52pvb + 6mm clear (Sample No. R20230410046)	35.52	685	1195	19	0.819	15.553	見G2
36		W15-T2-1/G2			460	1160	1	0.534	0.534	見G2
37		W15-T2-2/G2			440	1160	1	0.510	0.510	見G2
38		W2-T3			600	1175	21	0.705	14.805	見G2
39		W2-T8/G2	G8 - 6mm euro grey + 0.76 milky white + 0.76pvb + 6mm euro grey (Sample No. R20230526002)	13.52	510	1175	21	0.599	12.584	見G2
40		W5-T8/G2			410	1175	15	0.482	7.226	見G2
41		W16-T9-1	G8		535	1160	1	0.621	0.621	見G2
42		W11-T1			565	2255	1	1.274	1.274	見G2a
43		W7-T9	G2a		530	1175	6	0.623	3.737	見G2a
44		W1-T9A-1			467	1103	20	0.515	10.302	見G2a
45		W1-T9A-2	G8		565	1023.5	20	0.578	11.566	見G2a
46		W10-T1			630	1175	2	0.740	1.481	見G8
47		W8-T2	G8		380	1175	15	0.447	6.698	見G8
48		W8a-T2			455	1175	15	0.535	8.019	見G8
49		W9-T5			548	2255	1	1.236	1.236	見G8
					總合計:		613		652.707	

1).本表中所有玻璃對角線尺寸偏差要求不超過正負2mm.

2).本表中所有玻璃要求粗磨邊處理並倒棱角.

3).本表中玻璃要求粗磨邊處理並倒棱角,攔河玻璃頂底要精磨邊,而所有玻璃之入爐方向需保持一致。

4).本表中不同種類玻璃參照玻璃加工圖加工。

5).本表中所有強化玻璃均需HEAT SOAK TEST。

6).本表中所有玻璃均需注明室內外面及其玻璃編號,以便識別。

加工注意事項:

GENERAL TECHNICAL SPECIFICATION
OF
EXTERNAL FAÇADE SYSTEMS

PREPARED ON BEHALF OF

SUN HUNG KAI REAL ESTATE AGENCY LTD.

&

SANFIELD MANAGEMENT LTD.

March, 2023

4. All steelwork exposed to external conditions including elements hidden behind external metal cladding panels shall be hot-dip galvanized according to BS EN ISO 1461. Where steelwork is visually exposed, it shall be painted with Polyurethane paint (DFT min. 80um) as approved or directed by the Architect. Where steelwork is exposed to wet areas and not able to be inspected, it shall be grade 316 Stainless Steel.

3.4 STAINLESS STEEL

1. Stainless steel in plate, sheet and strip shall comply with BS EN 10029, BS EN 10048, BS EN 10088, BS EN 10258 and BS EN 10259 as appropriate.
2. Austenitic grade 1.4401 (formerly grade 316) stainless steel shall be used for exterior visible, exposed condition, unexposed condition in wet areas, or structural components. Austenitic grade 1.4301 (formerly grade 304) stainless steel can be used in all other circumstances. However, Austenitic grade 1.4404 (formerly grade 316L) stainless steel shall be used where stainless steel welding is required.
3. Grade A4 shall be used for exterior or exposed fixings and fasteners, in all other circumstances grade A2 can be used.
4. All visible surfaces in stainless steel shall be as specified by the Architect. The direction of the texturing shall be the same in any continuous run of panels. The stainless steel finish selected shall not discolour during its design life when subjected to normal atmospheric conditions. With the exception of hidden welds, welds shall be fully finished to match adjacent surfaces.

3.5 GLASS

3.5.1 General

1. Glass shall comply with the following minimum standards:

Generally:	BS EN 572, BS 952, BS 6262, AS 1288, ASTM E1300
Flat Glass:	ASTM C1036 (Minimum requirement of one-half the published tolerances for this standard)
Heat-Strengthened Glass:	ASTM C1048 (Minimum requirement of one-half the published tolerances for this standard)
Tempered Glass:	ASTM C1048 (Minimum requirement of one-half the published tolerances for this standard)
Insulated Glass Unit:	ASTM E773 & E774
Laminated Glass:	ASTM C1172 (Minimum requirement of one-half the published tolerances for this standard)
Heat Soak Process:	BS EN 14179 and Buildings Department requirements
Surface Stress Testing:	ASTM C1279 & C1048
Glass Impact Testing:	BS 6206 and/or BS EN 12600 for each glass type of glass being used for safety glazing
Glass Coating:	ASTM C1376

2. Because of its high strength, tempered glass may be used in facade systems to resist high wind pressure and horizontal imposed load. However, tempered glass is susceptible to spontaneous breakage induced by Nickel Sulphide inclusions. For this reason, annealed glass,

heat-strengthened glass, laminated glass or other combinations of these types are recommended to use in the facade systems above ground floor in buildings. Unless otherwise specified by Architect, a single lite of tempered glass is prohibited to use as outermost glass panel above the ground floor in buildings.

3. The thickness and heat-treatment of glass shown on drawings are not prescribed data or values. The Sub-Contractor shall calculate the required glass thickness to meet the structural, environmental, acoustic and safety requirements. Structural calculation of strength and deflection for glass panels and glass structures shall be determined by proper engineering analysis with working stress and deflection. Direct use of charts is not acceptable due to discrepancy in underlying assumption for probability of failure, load duration and other criteria. Visual distortion of the glass will not be acceptable. The Sub-contractor shall increase the glass thickness as necessary to prevent visible distortion from occurring. All Glass in the same visual pane shall be the same thickness and/or 2mm different unless otherwise approved in writing.
4. Sub-Contractor shall submit heat soak process and QC program for approval by the Architect to ensure conformance with requirements listed in BS EN 14179-1. Detailed quality assurance scheme as stipulated in PNAP APP-37 and CoP for Structural Use of Glass 2018 shall be submitted for RSE and Consultant approval prior to consent submission. All records of heat soaking shall be submitted to the Architect for review following delivery of glass to the assembly factory or to site.
5. Provide approved glazing system, glass and glazing accessories with detailed technical information that complies with all performance requirements. Use installation method that prevents the glass making direct contact with metal or other non-resilient material.
6. Test reports on glass (surface stress, heat soak process, impact resistance, inter-alia) are to be prepared by a recognized independent HOKLAS accredited or equivalent test laboratory and endorsed by the Sub-Contractor to be submitted to and approved by the Architect prior to material ordering.
7. As part of quality assurance, 100% joint inspection by glass factory QC, SHKP QC and sub-contractor QC in factory ensure the glass panel shall be clean cut, without significant edge faults (including feathered edges, shells or other imperfections) and free from bubbles, inclusions, cracks, ripping, dimples or other defects. Inspection distance should be in 1m from glass surface by naked eye. A Provisional Sum allowed for inspection distance 0.2m from glass surface if the instruction is issued by Client / PM.
8. 100% non-destructive photoelastic measurement of surface stresses in heat strengthened glass to ASTM C1279 should be conducted by glass factory.

On-site non-destructive photoelastic measurement of surface stresses in heat strengthened and tempered glass to ASTM C1279 should be conducted. Unless otherwise accepted by the Architect, the number of on-site measurement should follow SHKP “加工廠外牆系統生產監督檢查計劃” and “工地安裝外牆系統監督檢查計劃” requirement.

9. Where the glass is used as part of or whole of a protected barrier, impact test report particular to the project shall be submitted to substantiate the impact resistance for safety requirement.
10. All technical requirements and visual acceptance shall also comply with Client's and Architect's particular specification. For residential project, Client and Architect shall have the absolute right to request the Sub-Contractor to replace any glass units that in the Architect's professional opinion for visual acceptance or do not satisfy this criteria; the Sub-Contractor shall have no claim whatsoever on cost and time.

11. Upon Architect and Consultant request, computation should be submitted demonstrating the elimination of thermal stress breakage risk, method of overcoming thermal stress problem, and all assumptions. The Sub-contractor shall consider all potential risk locations including but not limited to the following:
 - i) Heat build-up at shadow box and other unvented spaces/zones.
 - ii) Make provision for internal curtain or blind, which may temporarily create unvented space prone to heat build-up adjacent to the vision section of the System.
 - iii) Shadowing effect.
12. Glass replacement. Submit detail of replacement procedure, including glass size limitation, and equipment required. Include estimated maximum lead-time required by the glass manufacturer to supply replacement unit for each type of glass unit. On-site structural glazing work is not allowed for any future glass replacement work in residential projects.

3.5.2 Source

1. The source of glass supply shall be subject to review and approval by the Architect prior to the award of The Works. The source must have a satisfactory proven track record of glass supplied for the type, size and thickness concerned, appropriate QA/QC measures, and compliance with the design / manufacturing / testing standards as specified in the Specifications or the best practice in glass manufacture approved by the Architect. The brand of float glass can be South Glass, Shanghai Yaohua Pilkington, JinJing, Xinyi or equivalent.
2. All glass units shall be supplied, manufactured, assembled and warranted by a single manufacturer. The glass shall be from a single source and the Sub-Contractor shall submit details of how he will control the colour consistency, flatness and other visual manufacturing quality issues for each elevation prior to glass ordering.
3. Products from the approved manufacturers are to be assessed individually in satisfying the technical requirement of this Project. Various specific quality control procedures may be implemented for manufacturers who have been submitted for Architect's approval. Agreement with and compliance with all required quality control procedures will be a requirement for Architectural approval as a glass source for this project.
4. Glass that requires replacement through breakage by the Sub-Contractor or other causes shall be replaced with the same glass as was damaged which shall be from the same source.

3.5.3 Annealed glass (Float glass)

1. All flat glass shall be in accordance with ASTM C1036, Table 4, Type "Q3".
2. All glass shall be free from crack, scratch, bubble, blister, all inclusion of deleterious matter including nickel sulphide and other defects, which detract from appearance or interfere with performance.
3. All glass shall have clean, wheel cut edges with minimum feather, free from vents, notches, or shell.
4. Submit production and test records to ASTM 1036, Table 4, proportionally adjusted to proposed project glass thickness. Indicate test procedure, acceptance criteria and pass and/or fail rate.
5. Dimensional tolerances of glass generally shall comply with ASTM C1036, but the minimum requirement shall be one-half the published tolerances in this standard.

3.5.4 Heat Strengthened and Fully Tempered glass

1. Base material shall be an approved selected quality float glass in accordance with the acceptance criteria listed on annealed glass (float glass) as above. Heat strengthened glass and fully tempered glass shall be manufactured using the “roller furnace”, or an equivalent approved process in accordance with ASTM C1048 standard. Minimum requirement shall be one-half the published tolerances for this standard.
2. Surface compression stress of heat strengthened glass shall be within the range of 24 MPa and 52 MPa. Surface compression stress of fully tempered glass shall be within the range of 69 MPa and 130 MPa. The surface stress shall be checked at least once for each batch and at a regular time interval of not more than four hours.
3. All fully tempered glass shall be heat soaked in accordance with BS EN 14179-1: 2016 and fulfilling requirement as stipulated in Buildings Department Practice Notes – PNAP APP-37. Heat soak report and associated test report shall be submitted to Project office for record.
4. Submit production and test record to ASTM 1048 or equivalent. Indicate test procedure, acceptance criteria and pass and/or fail rate.
5. Unless otherwise specified by Architect, edge working shall be flat ground with small ground arris chamfers and have a frosted appearance. Exposed edges shall be chamfered and polished. Corners shall be dubbed. Small shells and/or chips shall be ground out prior to toughening. Maximum chip/shell diameter shall not exceed 2 mm, and there shall not be more than four randomly placed chip/shells in any single pane of glass. Overall bow shall be in accordance with ASTM C1048 Table 2 and all figures of maximum bow in the table shall not be exceed 3mm of any glass dimension. Localized bow or roller wave shall not exceed 0.1 mm over any 300 mm.
6. Referred Standards:
 - ASTM C1036 - Standard Specification for Flat Glass.
 - ASTM C1048 - Standard specification for heat-treated flat glass - Kind HS, kind FT coated and uncoated glass.
 - ASTM C1279 - Standard Test Method for Non-Destructive Photoelastic Measurement of Edge and Surface Stresses in Annealed, Heat-Strengthened, and Fully Tempered Flat Glass
 - BS EN 14179-1: 2016 - Glass in building. Heat-soaked thermally-toughened soda lime silicate safety glass. Definition and description
 - BS 6262 - Code of practice for glazing for building.
 - AAMA 101 - Voluntary specification for aluminium prime window and sliding glass door.

3.5.5 Laminated glass

1. Base material shall be an approved selected quality float glass or heat-treated glass in accordance with the acceptance criteria listed as above. Glass for laminating is to be cut into individual panels prior to the laminating process. Laminated glass shall be fabricated with autoclaved edges on all four sides. When large unit sizes or unusual shapes are encountered, it may be necessary to vacuum bag each special size/shape, in addition to the autoclaving process to ensure proper lamination.
2. Lamination procedure and quality control manual should be submitted before fabrication. The manufacturer will have to prove satisfactory lamination and resistance exposure to high

temperatures and humidity of special size/shape units by performing a full size (or largest size) boil test from the first batch of laminated glass.

3. Polyvinyl Butyral (PVB) interlayers shall be approved Butacite®, Saflex®, Sekosui S-Lec™ or Trosifol®. Edges of laminated glass are to be protected to prevent delamination, contamination or other defect, caused by moisture, sealant contact or other external/internal source. SentryGlas® (SGP) interlayer can be used to enhance the weathering durability of lamination glass.
4. The minimum thickness of the interlayer shall be 1.52 mm (single layer or 2 layers of 0.76 mm) for flat glass and 2.28 mm (single layer or 3 layers of 0.76 mm) for curved glass panels or glass panel thicker than 12 mm. All laminated glass edges (specifically the PVB interlayer) shall be protected from contact with silicone sealants or exposure to the atmosphere unless written acceptance of such application issued by the glass and interlayer manufacturers are made available during the tender stage. All glass holes shall be ground chamfered. Maximum allowable offset of glass panes at visible finished edges, 1.6mm over the complete length of the glass panel. In the case of 3D curved glass pane, the tolerance should follow Project Consultant Specification requirement or Architect / Consultant approval.
5. Submit production and test record to ASTM C1048, ASTM C1172 or equivalent. Indicate test procedure, acceptance criteria and pass and/or fail rate. Submit material record for interlayer. Provide daily record of maximum factory temperature and humidity and weekly record of water quality used for washing glass. In the event that Interlayer Supplier application requirement are not satisfied, batches of non-complying glass shall be rejected.
6. Use glazing material that does not cause deterioration or discolouration of the interlayer. Submit test result in accordance with and approved test programme to confirm the compatibility of laminated glass with adjacent glazing material.
7. There shall be no observable delamination or shrinkage at the edges of laminated glass by the end of defect liability period and delamination or shrinkage shall not exceed 5 mm throughout the warranty period as required by this Specification. Written confirmation from the glass and interlayer manufacturers shall be made available for the Architect's approval prior to ordering of the glass. The Sub-Contractor shall replace all delaminated glass panels within the warranty; all associated costs, including but not limited to scaffolding, material and labour shall be borne solely by the Sub-Contractor.
8. Referred Standards:
 - GANA - Glazing Manual
 - ANSI Z97.1 - Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test (includes errata)
 - ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass.

3.5.6 Insulating Glass Unit

1. Insulating glass units (IGU) (or also known as double glazed units) of approved types in accordance with ASTM E774, AS 2208, and the recommendations of SIGMA. Submit complete details, including all construction details, primary and secondary seals, gas filling, corner treatment, nature of spacers, moisture evacuation and assembly process.
2. IGU shall incorporate approved polyisobutylene primary (vapor) seals continuously bonded to glass, and two-part silicone secondary (structural) seals. Primary seal shall be not less than 3 mm deep. Secondary seal shall be Dow Corning or G.E. approved equal two-part structural silicone sealant. Secondary seal shall completely cover spacer with no gaps or voids,

continuously bonded to glass. Spacer bar shall be an approved proprietary aluminium type, desiccant filled, anodized in an approved colour compatible with seals. Conceal spacer bar within the depth of the glazing gasket line to ensure smooth sight line. Details and colour samples should be submitted for Architect's approval.

3. Distance between the outer edge of the glass and the innermost edge of the aluminium spacer indicating minimum bite of secondary (structural) seal and spacer bar depth shall be supported by structural calculation in accordance with ASTM C1249. Include sealant manufacturer's recommendations and load table.
4. IGU Production and test records (such as test procedures, acceptance criteria and pass/fail rate to AS 2208 or equivalent Standards) shall be submitted for review. Test report from a recognized testing laboratory shall be submitted which indicates the IGU type attaining Class A as defined in ASTM E774 when having tested in accordance with ASTM E773.
5. All IGU glasses shall be fabricated in compliance with ASTM E2190. Testing proposal for the IGU to check the structural integrity should be submitted for statutory approval before production. Test report/certificate indicating compliance with ASTM E2190 with respect to specification and seal durability for IGU should be submitted.
6. Unless otherwise specified on the Drawings, the exterior glass pane of IGU shall be heat strengthened glass and the interior glass pane of IGU should be tempered glass. Tin side of the glass panes should be located on the outermost surfaces of IGU for future surface stress measurement.
7. All IGU shall be free from evidence of manufacturing defects and shall be from:
 - i) Intrusion of moisture or dirt.
 - ii) Internal condensation at temperature above 10°C.
 - iii) Other visual evidence of seal failure or performance failure.
8. Referred Standards:
 - ASTM C1087 - Standard test method for determining compatibility of liquid-applied sealants with accessories used in structural glazing techniques.
 - ASTM C1249 - Standard guide for secondary seal for sealed insulating glass units for structural sealant glazing applications.
 - ASTM C1265 - Standard test method for determining the tensile properties of an insulating glass edge seal for structural glazing applications.
 - ASTM C1369 - Standard specification for secondary edge sealants for structural glazed insulating glass units.
 - ASTM E546 - Test for dew point of sealed insulating glass units.
 - ASTM E773 - Standard test methods for seal durability of sealed insulating glass units.
 - ASTM E774 - Standard specification for sealed insulating glass units.
 - ASTM E2188 - Standard test method for insulating glass unit performance.
 - ASTM E2189 - Standard test method for testing resistance to fogging in insulating glass units.
 - ASTM E2190 - Standard specification for insulating glass unit performance and evaluation.
 - SIGMA - Sealed and insulating Glass Manufacturer's Association

3.5.7 Visual Acceptance Criteria

1. The glass shall be clean cut, without significant edge faults (including feathered edges, shells or other imperfections) and free from bubbles, inclusions, cracks, ripping, dimples or other defects. Distortion shall be kept to an absolute minimum and no local defects producing irregular reflections shall be allowed.
2. Acceptance criteria shall comply with ASTM C1036 - Type "Q3" for architectural glass product in general and ASTM C1048 for heat strengthened glass and fully tempered glass. The minimum requirement shall be one-half the published tolerances in this standard.
3. The quality of all glass shall be assessed for optical and visual faults as described in BS EN 572-2. Spot faults shall not be worse than category C. There shall be no linear/extended faults. For optical faults, acceptance levels shall be as described.
4. In the absence of a British standard covering visual process blemishes in laminated glass, reference shall be made to ASTM C1172 Table 3 for architectural quality glass.
5. Glass manufacturers' logos and glass type identification marks shall be sized as small as possible. They shall be located in the bottom left hand corner of the panes when viewed from the inside to the outside. Samples of each glass type with logo attached shall be submitted for the Architect's approval. The marks can be a temporary sticker in generally, easy to remove after final inspection and cleaning.
6. Client and Architect may invite inspectors from related parties for 100% inspection carried out from internal side after cleaning by the Sub-Contractor.
 - i) Inspection should be done at 1 meter distance from glass surface by naked eye.
 - ii) All glass shall be free from blemishes (e.g. crack, scratch, bubble, blister, all inclusion of deleterious matter and other defects).
 - iii) Point blemish size should not greater than 0.5 mm. Blemish size includes associated distortion of image. The allowable blemish size should not form a cluster that is detectable at 1.8 meter distance from glass surface by naked eye.
 - iv) Any blemish, scratch and/or any defect seen should be marked and kept record for further replacement with inspection.
 - v) Defective glass to be replaced by the Sub-Contractor on their own expenses.
7. For residential project, Client and Architect shall have the absolute right to request the Sub-Contractor to replace any glass units that in the Architect's professional opinion for visual acceptance or do not satisfy this criteria; the Sub-Contractor shall have no claim whatsoever on cost and time.

3.6 SEALANT MATERIAL

1. The Sub-Contractor must ensure that the sealant proposed is compatible with, and can develop adhesion to, the type of glass, cladding, stone, plaster, flashing, waterproofing, etc., that they come in contact with and are used for the project.
2. Sealant shall be one-part silicone sealant for weather and air seals and two-part silicone sealant for structural glazing:
 - i) Structural glazing:
 - DOWSIL 983, G.E. SSG4400 or statutory approved equal.

Maximum offset between glass framing members at corners of glazing pockets shall not exceed 0.8mm.

4.4 Glazing

1. Glazing shall be accomplished from the inside of building wherever possible. The glazing system shall be designed to this end using continuous neoprene compression gaskets on both sides. A continuous "wet" seal shall be employed to insure complete water tight. Maintain a minimum glazing bite, edge clearance and surface clearance depending on the glass used as recommended by the glass manufacturer.
2. Glazing by Structural Silicone Sealant
 - a) The glass to be glazed with structural silicone sealant applied in strict accordance with the manufacturer's published instructions and shall be applied only by workman specifically trained or experienced in their use.
 - b) All QC records shall be kept in the factory.
 - c) On-site structural sealant glazing shall strictly follow manufacturer's published instruction and on-site deglazing test is required to ensure the quality of work.
3. Gasket and Sealant Application
 - a) Sealant and gasket shall be provided where shown on the drawing or required for a permanently weather tight installation. The sealing mechanism for each location and use shall be as indicated on drawing. In those locations where a mechanism is necessary but is not indicated, it shall be of type recommended by the Sub-contractor and approved by the Architect.
 - b) Protect all adjoining surface not to receive sealant against staining by masking and/or other method.
 - c) Joint and joint surface shall be clean, dry, and free of any material that may have an adverse effect on the bonding and/or seal of the sealant and gasket material.
 - d) Apply sealant and gasket under the condition recommended by the manufacturer(s). Prime all surface to receive sealant and gasket unless recommended otherwise, use no sealant that has started to set in its container or a sealant that has exceeded the self life published by the manufacturer.
 - e) Fill all joint continuously and completely with sealant, forming neat, uniform, concave beads. Finish the material flush with adjoining surface unless otherwise shown on the drawing. All sealant surface shall be tooled smooth.

4.5 ANCHORAGE SYSTEM AND SUPPORT BRACKET

4.5.1 General

1. Provide all required anchor and fixing to assemble and install work in a neat, secure manner, including bolt, washer, screw, rivet, weld, proprietary fastener, and the like, template and other accessories of approved type for a completion installation.
2. For façade elements (such as windows, louvres and doors etc.), the fixing lug shall be stainless steel of minimum grade 304 (1.4301 to BS EN 10088) and fixed to outer frame of façade

5. Return to site on completion of building work to remove protective tape and leave clean. Lubricate and adjust moving component, and leave in perfect working order on completion.

6. For the requirement of protection, referring to General Principle Protection Method for Curtain Wall System and General Principle Protection Method for Windows / Doors. The PVC tape should be WC-280, Nitto protective tape N-380, 3M surface protective tape 331TBN or product which approved by purchasing dept. If the protective material is transparent peelable coating, it should be OmniGuard 110 NP, WindOcoat 4880, Seal 'n' Peel 8000 or PAW 55.

SOM's Specification for External Facade Works

DOCUMENT 00 01 10

TABLE OF CONTENTS

<i>Document</i>	<i>Title</i>	<i>Date</i>	<i>No. Pages</i>
DIVISION 01 – GENERAL REQUIREMENTS			
01 33 00	SUBMITTAL PROCEDURES	16 APR 2021	6
01 42 00	REFERENCES	16 APR 2021	7
01 45 00	QUALITY CONTROL	16 APR 2021	4
01 60 00	PRODUCT REQUIREMENTS	16 APR 2021	3
01 81 13	SUSTAINABLE DESIGN REQUIREMENTS	16 APR 2021	8
DIVISION 03 – CONCRETE			
03 45 00	PRECAST ARCHITECTURAL CONCRETE	16 APR 2021	12
DIVISION 04 – MASONRY			
04 30 00	STONEMWORK	16 APR 2021	10
DIVISION 05 – METALS			
05 70 00	DECORATIVE METAL	16 APR 2021	7
DIVISION 07 – THERMAL AND MOISTURE PROTECTION			
07 18 00	TRAFFIC COATINGS	16 APR 2021	5
07 27 00	AIR AND WATER BARRIER	16 APR 2021	6
07 42 16	ALUMINUM WALL PANEL SYSTEM	16 APR 2021	7
07 55 56	RUBBERIZED ASPHALT PROTECTED MEMBRANE ROOFING	16 APR 2021	10
07 62 00	SHEET METAL FLASHING AND TRIM	16 APR 2021	3
07 84 00	FIRESTOPPING	16 APR 2021	10
07 92 00	JOINT SEALANTS	16 APR 2021	5
DIVISION 08 – OPENINGS			
08 05 50	EXTERIOR WALL	16 APR 2021	11
08 11 13	HOLLOW METAL DOORS AND FRAMES	16 APR 2021	6
08 41 00	ENTRANCES AND STOREFRONTS	16 APR 2021	6
08 44 00	CURTAIN WALL AND GLAZED ASSEMBLIES	16 APR 2021	10
08 80 00	GLAZING	16 APR 2021	11
08 91 00	LOUVERS	16 APR 2021	5
DIVISION 09 – FINISHES			
09 30 00	TILING	16 APR 2021	6
09 91 00	PAINTING	16 APR 2021	6

END OF TABLE

**SECTION 08 80 00
GLAZING**

PART 1 - GENERAL

1.1 SUMMARY

- A. General:** Provide Glazing in accordance with requirements of the Contract Documents.
- B. Sustainable Design Requirements:** Provide the Work, and submit documentation, as necessary for compliance with sustainable requirements specified in Section 01 81 13, Sustainable Design Requirements.
- C. Section Includes the Following:**
 - 1. **GL-01:** Interior glass balustrade at operable window.
 - 2. **GL-02:** Glass spandrel areas.
 - 3. **GL-12:** Exterior balustrades at all typical balconies.
 - 4. **GL-21:** Typical vision, operable, glass spandrel, tower doors, sliding door glass, window glass, sky villas.

1.2 REFERENCES

- A. ASTM International (ASTM):**
 - 1. ASTM C1036, "Standard Specification for Flat Glass".
 - 2. ASTM C1048, "Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass".
 - 3. ASTM C1172, "Standard Specification for Laminated Architectural Flat Glass".
 - 4. ASTM C1376, "Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass".
 - 5. ASTM C1422, "Standard Specification for Chemically Strengthened Flat Glass".
 - 6. ASTM C1464, "Standard Specification for Bent Glass".
 - 7. ASTM E1300, "Standard Practice for Determining Load Resistance of Glass in Buildings".
 - 8. ASTM E2188, "Standard Test Method for Insulating Glass Unit Performance".
 - 9. ASTM E2189, "Standard Test Method for Testing Resistance to Fogging in Insulating Glass Units".
 - 10. ASTM E2190, "Standard Specification for Insulating Glass Unit Performance and Evaluation".
- B. Glazing Association of North America (GANA):** "GANA Glazing Manual".
- C. Standard for Safety Glazing:** Federal Standard 16 CFR 1201, Consumer Product Safety Commission (CPSC) "Safety Standard for Architectural Glazing Materials", as published in the Code of Federal Regulations (CFR).

1.3 SUBMITTALS

- A. Product Data:** Submit for Architect's action. Furnish manufacturer's literature, specifications and installation instructions describing the general properties of each material and accessory to be used in the Work.

1. Furnish technical data describing the quality and performance of each material component or system to be used in the Work, e.g., the acoustical rating, "U" value, shading coefficient, glass Design Factor (D.F.) or other such primary characteristics as required by the Drawings or Specifications.
- B. Samples:** Submit for Architect's action. Label samples to indicate product, characteristics, and locations in the Work. Samples will be reviewed for color and appearance only. Compliance with all other requirements is the exclusive responsibility of the Contractor. Furnish samples of the following.
 1. Furnish (300 x 300mm) samples for each type of glass to be used in the Work, except clear transparent glass.
 2. Furnish color range samples for glass if production run color variations are expected.
 3. Furnish (300 x 300mm) samples of expected production run appearance defects, if any.
- C. Calculations:** Submit for Architect's information.
 1. Thermal stress analysis for glass units.
- D. Certifications:** Submit for Architect's information.
 1. **Insulating Glass:** Furnish Insulating Glass Certification Council (IGCC) certification that the insulating glass units to be used in the Work meet the specified performance requirements.
 2. **Test Reports:** Furnish test reports of the insulating glass units showing successful results. Tests shall be conducted and reports prepared by an approved independent testing agency.
- E. Sustainable Design Submittals:** Submit for Sustainable Design Coordinator's review. Necessary documentation to verify compliance with requirements specified in Section 01 81 13, Sustainable Design Requirements.
- F. Closeout Submittals:** Submit for Owner's documentation.
 1. Furnish specified warranties.

1.4 QUALITY ASSURANCE

- A. Contractor's Quality Control Responsibilities:** Contractor is solely responsible for quality control of the Work.
- B. Qualified Installers:** For installation of the structural glass components, employ only experienced tradesmen who have been trained by the materials manufacturers in the use of the materials.
- C. Details:** Glazing details are for convenience of detailing only and are to be confirmed by the Contractor and glass manufacturer relative to the cited standards and final framing details.
- D. Workmanship:** Comply with GANA standards, and comply with the manufacturer's instructions for the use and installation of each product. Do not use different glazing materials in the same joint system unless the manufacturer of each material has stated in writing that his material is fully compatible with the other material. Employ only tradesmen experienced in the use of the materials. The installation of each lite of glass shall be watertight and airtight, and capable of withstanding temperature changes, wind loading, and impact from operation of doors or operable sash, without failure of any kind, including loss or breakage of glass, failure of seal, exudation of sealant and excessive deterioration of glazing materials.

- E. **Glass and Sealant Manufacturers' Representatives:** Do not use glass or sealant produced by any manufacturer who will not agree to send a qualified technical representative to the project site, when requested, for the purpose of rendering advice concerning the proper installation of materials.
- F. **Field Samples:** After the required submittal and review of finish samples, prepare samples of each type glazing system at locations in the building to be designated by the Architect. Utilize the same materials and installation methods in the samples as required for the final Work. Schedule the installations with allowance for sufficient curing time so that samples may be examined, and any necessary adjustments made, at least 1 week prior to date scheduled for commencing installation of the Work. When accepted, sample areas shall serve as the standard for materials, workmanship, and appearance for such work throughout the project, and shall remain part of the final Work.
- G. **Regulatory Requirements:** Comply with applicable requirements of the laws, codes, ordinances and regulations of authorities having jurisdiction. Obtain necessary approvals from all such authorities.
 - 1. Comply with the requirements of 16 CFR 1201 for safety glazing.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. **General:** Deliver and store materials in manufacturer's original packaging labeled to show name, brand, type, and grade. Store materials in protected dry location off ground in accordance with manufacturer's instructions. Do not open packaging nor remove labels until time for installation. Provide cushions at edges of glass to prevent impact damage. Protect glass faces from scratches and abrasion.

1.6 PROJECT / SITE CONDITIONS

- A. **Low Temperatures:** Do not perform glazing operations when temperature is below (4.5 deg C), unless the manufacturer of the glazing materials specifically recommends application of his materials at lower temperatures. If job progress or other conditions require glazing when temperatures are below (4.5 deg C) or below the minimum temperature recommended by the manufacturer, consult the manufacturer and establish the minimum provisions required to ensure satisfactory Work. Record in writing to the manufacturer, with copy to the Architect, the conditions under which such glazing Work was performed and the provisions made to ensure satisfactory Work.

1.7 WARRANTY

- ~~A. **Special Warranty:** Submit for Owner's documentation. Furnish 5-year written warranty in form stipulated by Architect, signed by the Contractor and Installer, agreeing to repair or replace Work which has failed to provide airtight or watertight joints, failed in adhesion or cohesion, failed in resistance to abrasion, weather, extrusion, migration, staining, or otherwise failed as a result of defects in materials or workmanship. Upon notification of such defects, within the warranty period, make necessary repairs or replacement at the convenience of the Owner. Other guarantees or warranties may not be substituted by the Contractor for the terms of this special warranty.~~
- ~~B. **Warranty for Insulating Glass:** Submit for Owner's documentation. Furnish 10-year written warranty, signed by the manufacturer, agreeing to replace insulating glass units which develop material obstruction of vision from dust or film formation on the internal glass surfaces due to failure of the hermetic seal or which otherwise fail as a result of defects in materials or workmanship. Upon notification of such defects, within the warranty period, make necessary replacement at the convenience of the Owner.~~

~~C. **Warranty for Reflective and Mirror Glass:** Submit for Owner's documentation. Furnish 10-year written warranty, signed by the manufacturer, agreeing to replace glass which shows evidence of cracking, peeling, color change, or other form of deterioration in the reflective coating as a result of defects in materials or workmanship. Upon notification of such defects, within the warranty period, make necessary replacement at the convenience of the Owner.~~

D. **Warranty for Laminated Glass:** Submit for Owner's documentation. Furnish 5-year written warranty, signed by the manufacturer, agreeing to replace laminated glass which shows evidence of color change, delamination, deterioration of laminating film, loss of transparency, or other form of deterioration as a result of defects in materials or workmanship. Upon notification of such defects, within the warranty period, make necessary replacement at the convenience of the Owner.

1.8 MAINTENANCE

A. **Extra Stock:** Furnish _____. Deliver extra stock to the Owner in manufacturer's original packaging and store at the project site where directed.

PART 2 – PRODUCTS

2.1 PERFORMANCE AND DESIGN CRITERIA

A. **Performance Criteria:** Comply with the requirements specified in Section 08 05 50, "Exterior Wall, Section 08 41 00, "Entrances And Storefronts", and Section 08 44 00, "Curtain Wall And Glazed Assemblies".

B. **Glass Design Factor:** Provide glass in thickness such that the statistical probability of glass breakage at the "Design Wind Pressure" shall not exceed 8 lites per 1000 lites, based on a Design Factor (D.F.) of 2.5 for annealed glass. Determine glass thickness in accordance with ASTM E1300, based upon the design wind pressure and glass design factor. Submit glass manufacturer's data substantiating the probable glass breakage, if such data is not otherwise available in manufacturer's published literature.

1. **Laminated Glass for Sloped Glazing:** For glass inclined more than 15 degree from vertical, including glass for skylights, provide glass in thickness such that the statistical probability of glass breakage at the "Design Wind Pressure", plus snow load if any, shall not exceed 1 lite per 1000 lites.

C. **Glass Deflection:** L/60, maximum center deflection of all glass, exterior or interior, shall not exceed (25 mm) at "Design Wind Pressure".

1. **Thermal Breakage:** Design insulating glass units and glazing pockets to minimize the possibility of thermal breakage.

~~2. **Thermal Stresses:** Design glass units to withstand thermal stresses. Base thermal stress calculations on the use of blinds mounted not less than (62 mm) from the inside face of glass units and slab edge pocket as indicated. Glass units shall withstand thermal stresses created by shadowing of exterior components or assembly, and elevated interstitial space temperatures. Submit glass thermal stress analysis.~~

3. **Labels:** All types shall not be visible on the finished work, except where identification of safety glass as required by authority having jurisdiction.

D. **Minimum Thickness:** Provide glass that complies with performance requirements and is not less than the thickness indicated.

~~1. **Minimum Glass Thickness for Exterior Lites:** Provide minimum 15mm thick laminated glass.~~

- E. **Safety Glazing:** Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

2.2 GLASS MATERIALS AND FABRICATION

- A. **Glass Quality:** Provide glass fabricated in conformance with requirements of the specified standards. The acceptable range of color and/or defects as defined by the specified standards shall be determined by samples of such defects and/or color range. Glass which does not fall within the accepted sample range shall be subject to rejection by the Architect. In the event such samples are not or cannot be furnished, the Architect will determine the acceptability of glass relative to color and/or observable defects in each case.
- B. **Glass Sizes:** Obtain sizes from shop drawings or by field measurement. When glass will be pre-cut to sizes obtained from shop drawings, take field measurements of each opening before glazing so that there will be not less than the minimum edge clearances and bite on the glass. Openings which do not fall within the tolerances for which pre-cut glass has been sized shall be glazed only with glass specially cut to fit such openings.
- C. **Glass Cutting:** Cut and process edges in accordance with glass manufacturer's recommendations. Cut glass at factory to required sizes as determined by accurate measurement of each opening to be glazed, with not less than the minimum edge clearances and bite on glass as recommended by glass manufacturer. Provide glass with "clean-cut" edges as defined in the GANA "Glazing Manual", except comply with manufacturer's recommendations when they are at variance therewith. Edges may be wheel cut or sawed and seamed at manufacturer's option. Do not nip glass edges. Do not cut, seam, abrade or treat edges of glass which has been heat-treated. Do not cut the glass nor treat edges in the field.
1. **Finish for Exposed Edges and Butt Glazing:** For glass edges to remain exposed and edges to be butt joined with silicone sealant, grind the surfaces to provide a satin finish flat edge and arrised corners.
- D. **Clear Annealed Float Glass:** ASTM C1036, Type I transparent, Class 1 clear, Quality Q3 glazing select.
- E. **Clear Low Iron Glass:** ASTM C1036, Type I transparent, Class 1 clear, Quality Q3 glazing select. Low iron composition soda lime glass. Minimum 91% visible light transmission and a minimum 0.87 solar heat gain coefficient.
- F. **Tinted Annealed Heat-Absorbing Float Glass:** ASTM C1036, Type I transparent, Class 2 tinted, Quality Q3 glazing select, Style B low light transmittance. Color as indicated.
- G. **Reflective Glass:** ASTM C1036, Type I transparent, Class 1 clear, Quality Q3 glazing select.
- H. **Low-E Coating on Glass:** ASTM C1376, low-emissivity metallic coating, pyrolytically or sputter coated on surface of glass to reflect invisible long wave infrared light. At insulating glass units remove low-E coating at edges, comply with coating manufacturer's recommendation.
- I. **Textured Pattern Glass Finish:** Uniform sandblasted / etched texture in pattern as indicated on Drawings and to match Architect's sample.
- J. **Textured Glass Surface Sealer:** Clear transparent sealer suitable for application on textured glass surface to protect from retaining oils or other foreign substances and to allow cleaning of the surface. Apply surface sealer immediately after texturing of glass in accordance with sealer manufacturer's instructions.

K. Heat-Treated Glass: Do not exceed maximum warpage on either face in any direction for each piece of heat-treated glass as listed in the GANA standards and manufacturer's printed literature. Perform glass cutting and edge processing in accordance with glass manufacturers' recommendations and prior to heat-treatment.

1. **Tempered Glass:** ASTM C1048, Kind FT fully tempered. Provide glass tempered to increase flexural strength 4 to 5 times the strength before treatment.
 - a. **Heat Soaking:** Provide for all tempered glass, label each piece of glass indicating heat soaking has been performed.
 - b. **Glass Railing Supports:** Provide (19 mm) thick panels for glass-supported railings specified in Section 057000, DECORATIVE METAL. Grind exposed vertical edges flat with a satin finish edge and arrised corners. Sizes and configurations as indicated.
2. **Heat-Strengthened Glass:** ASTM C1048, Kind HS heat strengthened. Provide glass strengthened by heat-treatment to increase flexural strength not less than 2 times the strength before treatment.
 - a. **Ceramic Coated Spandrel Glass:** Colored ceramic enamel permanently fire-fused to the inside face. Color as selected by Architect.
3. **Process Markings:** For glass which has been heat treated horizontally, maintain roller marks running horizontally in the final installation, wherever possible. For glass which has been heat treated vertically, locate tong marks along an edge which will be concealed in the glazing system.
 - a. **Overall Bow and Warp Tolerances:** Manufacturer shall examine heat treated glass to detect and discard any lights which exceed half or 50% of the maximum bow and warp tolerances in any direction as listed in ASTM C1048, Table 2.
 - b. **Roll Ripple Tolerances:** Where the heat treatment process results in essentially parallel ripples or waves, the deviation from flatness at any peak to valley deviation shall not exceed (0.125 mm), or the average roller wave distortion shall be certified not to exceed (0.050 mm), with a maximum sag at the leading and trailing edge of (0.250 mm), the more stringent requirement governing. A site inspection, if required for roller wave and bow tolerances, shall be viewed from a minimum distance of ~~(3-m)~~ 1m.

L. Laminated Glass: ASTM C1172. Factory-laminate the units using the manufacturer's standard heat-plus-pressure process. Exclude dirt and other foreign matter from the lamination, and eliminate all voids and delaminated surfaces from the units. Cut units to proper size and perform edge treatment at factory in accordance with the glass manufacturer's recommendations.

1. **Adhesive Laminating Film:** Except as may be otherwise required to produce a successful lamination, fabricate with ionomeric polymer interlayer intended specifically for laminating glass. Unless otherwise indicated, use clear sheet of (0.38mm) minimum thickness.
 - a. **Interlayer Physical Properties:**
 - 1) **Young's Modulus:** (300 MPa), when tested in accordance with ASTM D5026.
 - 2) **Tensile Strength:** (34.5 MPa), when tested in accordance with ASTM D638.

- 3) **Elongation:** 400%, when tested in accordance with ASTM D638.
 - 4) **Flex Modulus:** (345 MPa), when tested in accordance with ASTM D790.
 - 5) **Heat Deflection Temperature at(460 kPa):** (43 deg C), when tested in accordance with ASTM D648.
- b. **Film for Heat–Strengthened or Tempered Glass:** Provide laminating film of (1.52 mm) minimum thickness.
 - c. **Film for Sloped Glazing Application:** Provide laminating film of (0.76 mm) minimum thickness.
2. **Glass Railing Supports:** Provide laminated tempered glass panels for glass–supported railings specified in Section 05 70 00, “Decorative Metal”. Trim interlayer so edges of interlayer are flush with the edges of glass and there ar no exposed edges. Sizes and configurations as indicated.
- a. **Base:** PVB interlayer, glass with no coating.
 - b. **Alternate:** Ionoplast interlayer, glass with hard coating to match typical glass.
 - 1) **Interlayer Physical Properties:**
 - a) **Young's Modulus:** (300 MPa), when tested in accordance with ASTM D5026.
 - b) **Tensile Strength:** (34.5 MPa), when tested in accordance with ASTM D638.
 - c) **Elongation:** 400%, when tested in accordance with ASTM D638.
 - d) **Flex Modulus:** (345 MPa), when tested in accordance with ASTM D790.
 - e) **Heat Deflection Temperature at(460 kPa):** (43 deg C), when tested in accordance with ASTM D648.
 - c. **Laminated Glass Mismatch:** Maximum mismatch for glass lites is (0.8mm) in length and width.
- M. **Insulating Glass:** ASTM E2190. Each unit shall bear the Insulating Glass Certification Council (IGCC) certification label and meet the certification program requirements. Manufactured with sheets of glass separated at perimeter by continuous high performance polypropylene covered stainless steel color as selected by Architect edge spacer rated for SSG use, double sealed black polyisobutylene primary seal black silicone secondary seal. Configurations as noted on Drawings.
- N. **Custom Ceramic Coated Opaque Glass:** ASTM C1048. Screen printed opaque pattern of ceramic enamel, permanently fire–fused to the face of (6 mm) thick glass, in color and design as selected by Architect. Transparent protective overcoat fired over the enamel on outside glass surface. Heat strengthened to increase flexural strength not less than 2 nor more than 2–1/2 times the strength before treatment. Do not exceed maximum warpage in either face of each piece, in any direction, as listed in the GANA standards and manufacturer's printed literature.
- O. **Custom Pattern Ceramic Coated Glass:** ASTM C1048. Screen printed open pattern of ceramic enamel, permanently fire–fused to the glass face, in color and design as selected by Architect. Heat strengthened to increase flexural strength not less than 2 nor more than 2–1/2 times the strength before treatment. Do not exceed maximum warpage in either face of each piece, in any direction, as listed in the GANA standards and manufacturer's printed literature.

- P. Safety Glazing Labeling:** Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

2.3 DESCRIPTION OF SCHEDULED GLASS TYPES

- ~~A. **Performance Properties:** For insulating glass units including SHGC, U-Values, visible light, LSG, etc are indicated on Drawings.~~
- ~~B. **GL-01:** Tempered glass monolithic.~~
- ~~C. **GL-21:** Insulating glass, clear, with low-e coating, SC: 0.37, U-value: 1.7, VLT: 0.44-0.55, reflect in: 15% or less, reflect out: 18-20%.~~

2.4 SETTING BLOCKS AND SPACERS

- A. Setting and Edge Blocks:** ASTM C1115. Dense heat cured silicone rubber. 85 ±5 Shore A durometer hardness for sill setting blocks and 65 ±5 Shore A durometer hardness for other edge blocks. Tested for compatibility to allow adhesion with glazing sealant.
- B. Spacers and Shims:** ASTM C1115. Dense heat cured silicone rubber. 20 to 40 Shore A durometer hardness for use with sealant. 40 to 60 Shore A durometer hardness for use with preformed tape. Adhesive backed on one face only. Tested for compatibility to prevent adhesion with glazing sealant.
- C. Expanded Polyethylene Backer Rod:** ASTM C1330 and D5249, extruded closed cell polyethylene foam in rod form to suit the application. ASTM C1016, water absorption less than 0.03 g/cc. Non-outgassing. ASTM D5249, greater than (20.5 kPa) compression deflection. Resistant to petroleum oils and solvents. Provide one of the following, as acceptable to the sealant manufacturer.

2.5 SILICONE STRUCTURAL GLAZING MATERIALS

- A. Silicone Structural Glazing Sealant (SSGS):**
- Shop Applied Structural Sealant:** ASTM C1184, Type S. Two-component. ±12% movement capability. Neutral cure. Provide primer as required by manufacturer for the application or as determined by adhesion test.
 - Field Applied Structural Sealant:** ASTM C1184, Type S. One-component. ±50% movement capability. Neutral cure. Provide primer as required by manufacturer for the application or as determined by adhesion test. Use field-applied structural sealant only for re-glazing and as otherwise acceptable to the Architect.
- B. Silicone Blocks, Gaskets and Spacers:** ASTM C1115. Dense heat cured 100% silicone rubber, UV resistant. Tested for adhesion and compatibility with silicone structural glazing sealant. Type as made or recommended by the silicone structural glazing sealant manufacturer.
- Sill setting blocks 85 ±5 Shore A durometer hardness and other edge blocks 65 ±5 Shore A durometer hardness.
 - Gaskets and spacers 45 Shore A durometer hardness and extruded shape with interlocking fit to the glazing frame components.

2.6 GLAZING GASKETS

- A. Sponge Neoprene Glazing Gaskets (for interior applications only):** ASTM C509, closed cell, with durable outside skin.

- B. Silicone Glazing Gaskets (SGG):** ASTM C1115. Dense heat cured 100% silicone rubber, UV resistant. 45 Shore A durometer hardness and extruded shape with interlocking fit to the glazing frame components. Tested for adhesion and compatibility with glazing sealant. Type as made or recommended by the silicone glazing sealant manufacturer.

2.7 GLAZING SEALANTS

- A. Silicone Glazing Sealant (Curtain Wall):** ASTM C920, Type S, Grade NS. One-component. Neutral cure. $\pm 50\%$ movement capability. Provide primer as required by manufacturer for the application or as determined by adhesion test.
- B. Clear Silicone Glazing Sealant (Interior):** Provide for glazing at interior locations only. ASTM C920, Type S, Grade NS, Class 25. One-component. Medium modulus. Clear, colorless, translucent.

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions:** Examine the areas to receive the Work and the conditions under which the Work would be performed. Remedy conditions detrimental to the proper and timely completion of the Work. Do not proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Cleaning:** Clean the surfaces of glazing materials, stops, channels and rabbets to remove deleterious substances which interfere with sealant bond or otherwise impair the Work. Do not apply sealants to surfaces unless a durability test of bond/cohesion has been performed in accordance with ASTM C794, or other acceptable standard, and successfully proven that sealant system shall properly bond to substrate. Comply with sealant manufacturer's instructions and prepare the bonding surfaces immediately before application of primer or sealant by cleaning with solvent or other process as recommended by sealant manufacturer.

3.3 INSTALLATION

- A. General:** Inspect each piece of glass immediately before installation. Do not install any pieces which have damaged edges, scratches or abrasion, or any other evidence of damage. Remove labels from glass before installation. Set glass in a manner which produces greatest possible degree of uniformity in appearance.
- B. Setting Blocks:** Locate setting blocks at sill one-quarter in from each end of the glass, unless otherwise recommended by the glass manufacturer. Use blocks of proper size to support the glass in accordance with manufacturer's recommendations.
- C. Spacers:** Provide spacers for all glass sizes larger than (1250 mm), to separate glass from stops, except where continuous glazing gaskets are provided. Locate spacers not more than (600 mm) apart and not closer than (300 mm) to a corner. Place spacers opposite one another. Make bite of spacer on glass a nominal (6 mm) or greater.
- D. Joint Fillers/Backer Rods:** Provide closed-cell joint filler or backer rod of type acceptable to sealant manufacturer. Do not use open-cell material. Provide proper size and shape in accordance with manufacturers' recommendations, considering movement and conditions at time of installation. Do not puncture the surface or skin of closed cell joint fillers. Depress face of joint fillers as required for proper application of sealant.
- E. Masking:** Confine sealants to joint areas by use of masking tapes or other precautions to prevent spillage or migration onto adjoining surfaces.

- F. Priming for Sealants:** Prime or seal the bonding joint surfaces in accordance with the sealant manufacturer's recommendations. Avoid migration of primer or sealer onto adjoining surfaces and remove any spillage promptly.
- G. Application of Sealants:** Provide in accordance with the manufacturer's recommendations. Do not use a sealant which would be deleterious or incompatible with the materials to be glazed, such as laminated or coated glass, or is not recommended by the sealant manufacturer for the intended application. Apply sealant in continuous manner so as to fill entire width and required depth of joint without voids or air pockets. Tool exposed surfaces slightly concave, except provide a slight wash on horizontal joints where horizontal and vertical surfaces meet.
- 1. Silicone Structural Glazing:** Do not permit movement of the sealant joint while sealant is curing.
 - 2. Curing:** Cure the glazing sealants in accordance with the manufacturer's instructions, to obtain maximum bond to surfaces, cohesive strength and durability at the earliest possible date.
 - 3. Clean-Up:** Remove excess sealant promptly as the Work progresses and clean the adjoining surfaces as may be necessary to eliminate any evidence of spillage.
- H. Preformed Tape Sealants:** Apply accurately to form the joint profile. Provide tapes in sizes recommended by manufacturer for specific glazing conditions. Provide watertight and airtight corners and joints in the manner specified by the manufacturer. Trim excess tape to make flush at exposed joint surfaces.
- I. Glazing of Insulating Glass:** Set insulating glass units with void between edge of units and glazing channel, except in cases where a heel bead is required to prevent water leakage. Do not glaze insulating glass units with sealant which might have a deleterious effect on the hermetic seal of the units. Completely conceal the edge binding of insulating glass units with glazing material and extend material a minimum of (3 mm) onto glass surfaces at each edge, to provide glazing seal independent of hermetic seal.
- J. Adhesive Mounting of Mirrors:** Paint back of mirror with an additional coat of moisture-resistant paint of the type recommended by the mirror manufacturer. Support mirror on setting blocks or continuous glazing gasket. Apply mirror mastic in accordance with mastic manufacturer's instructions. Do not cover more than 25% of mirror back. Apply mirror to substrate so that areas not covered with mastic will remain open for ventilation, with (3 mm) minimum clearance from substrate. Provide temporary rigid support until adhesive has set.

Palmer "Mirro-Mastic", Sommer & Maca, Chicago, IL.

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service:** At the start of the installation, periodically as the Work progresses, and after completion, furnish the services of the glass and sealant manufacturers' technical representatives at the job site as necessary to advise on every phase of the Work. As a minimum, furnish full-time attendance during the first 2 work days, at least once every week thereafter, and furnish technical assistance to the Installer as may be required.
- B. Inspection and Testing of Adhesives:** Perform inspection and testing of structural adhesives and sealants used as adhesives. Inspect material in each new batch delivered for use in the Work. Examine shipping invoices and packaging, keep records of manufacturing batch numbers, dates of manufacture and delivery. Maintain accurate records of the locations where each material is installed in the Work. Log the names of the installation crew members and locations of their work for each day. Perform adhesion tests for each different batch of material in accordance with ASTM C794.

3.5 CLEANING

- A. **General:** Maintain glass in a reasonably clean condition during construction to prevent staining and deterioration of glazing materials. When glass is installed adjacent to or below concrete, masonry or cementitious surfaces exposed to weather, examine glass monthly during construction. Wash glass immediately when inspection reveals dirt, scum, deposits or staining, or after rainstorms, to remove any corrosive wash or dirt which may adhere. Wash glass on both faces, not more than 4 days prior to acceptance by the Owner. Comply with instructions and recommendations of the glass manufacturer and glazing materials manufacturer for cleaning in each case. The use of metal scrapper is prohibited

3.6 PROTECTION

- A. **General:** Protect glass from breakage immediately upon installation. Use streamers or ribbons suitably attached to framing and held free of the glass. Do not apply warning markings directly to the glass. Protect glass and glazing materials during the construction period so that they will be without any indication of damage or deterioration at the time of acceptance. Cover glass as required to protect it from welding, sandblasting and other activities that might abrade the surfaces. Remove and replace glass, during the construction period, which is broken cracked, chipped or damaged in any way and from any source, including weather, vandalism or accidents.

END OF SECTION

NKIL 6551 - FAÇADE MATERIAL SPECIFICATION

Date: 9/6/2021

Category		Description	Status
3	Glass	G1 Fixed Vision Area	IGU Min. 8mm Clear Heat Strengthened glass Low-E (PDE32/45#2) + 12mm air space + 10mm Clear Tempered glass Confirmed by PM dated 4 June 2021
		G2 Openable Window	IGU Min. 8mm Clear Heat Strengthened glass Low-E (PDE32/45#2) + 12mm air space + 8mm Clear Tempered glass Confirmed by PM dated 4 June 2021
		G3 Spandrel	Min. 8mm Clear Heat Strengthened glass Low-E (PDE58/54#2) Confirmed by PM dated 4 June 2021 Alum back panel: Color B (JCT539626FXL-5)
		G3 Glass Cladding	
		G1 Sliding Door	IGU Min. 8mm Clear Heat Strengthened glass Low-E (PDE32/45#2) + 12mm air space + 10mm Clear Tempered glass Confirmed by PM dated 4 June 2021
		G4 Glass Barrier	Min. 10mm Low Iron Tempered glass Confirmed by PM dated 4 June 2021
		G6 Balustrade	Laminated Glass Min. 19mm Low Iron Tempered glass + 2.28 PVB + 19mm Low Iron Tempered glass (with Edge Capping) Confirmed by PM dated 4 June 2021
		G6a	[OPTION] Laminated Glass Min. 12mm Low Iron Tempered glass Low-E (PDE32/45#2) + 1.52 SGP + 15mm Low Iron Tempered glass (with 55% composite action) Confirmed by PM dated 8 June 2021
		G8 Window for Store/ Lav.	Min. 6mm Crystal Grey TP + (0.38 milky + 1.14 clear) PVB + 6mm Clear TP

** Confirmed highlight in GREEN

 Updated as per meeting dated 8 June 2021

玻璃熱浸 (Heat Soak Test) T1 / T3 Inspection Log Book

地盤名稱： _____

工程項目： _____

Heat Soak Test 日期/時間： _____

分判公司名稱： _____

1. 強化玻璃生產商名稱 : _____
2. Heat Soak Test 施工地點 : _____
3. T3 (from RSE) 檢視人員姓名 (如適用) : _____ 簽名 (_____)
4. T1 (from RC) 檢視人員姓名 : _____ 簽名 (_____)
5. 均質爐編號 : _____ ; 均質爐之 Calibration Report 編號 : _____
6. Calibration Report 之均質爐評估日期 : _____ (註：必須為今天之一年內有效)
7. _____ 點 玻璃廠方 Thermocouple (TC) 之資料 : (JJG351-1996 溫度允差 $\leq \pm 2.5^{\circ}\text{C}$)

TC#	編號 Serial #	位置號碼 (根據 Calibration Report 內之指示)	校對證書 編號	校對證書 日期	建議覆檢 日期	是否符合 有效期 (半年期限)	升溫至 280°C 的 速度結果 * = 最高 / 快 # = 最低 / 慢
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							

是否所有 Thermocouple 之擺放位置與 Calibration Report 要求相同: 是 / 否 (如否, 請說明: _____)
(擺放位置必須離開玻璃邊 25mm, 而其中一點應放在該爐最大/最厚的玻璃上。)

8. T1 (from RC) 之 Thermocouple / Data-logger 編號 及 對應 TC# : (建議放在該爐最大/最厚的玻璃上)
 - (1) _____ 校對日期 _____ 所對應 TC# _____
 - (2) _____ 校對日期 _____ 所對應 TC# _____
9. 每件玻璃間距是否足夠 20mm : 是 / 否 (如否, 請說明: _____)
10. 每件玻璃底有否墊高以免直接接觸鐵架 : 是 / 否 (如否, 請說明: _____)
11. 每款厚度之玻璃按 BS EN 14179 規定放入五塊 1100x360mm 試片
是 / 否 (如否, 請說明: _____)
12. 入爐玻璃總重量為 _____ 是否少於 Calibration Report 100% loaded 玻璃總重量
是 / 否 (如否, 請說明: _____)

13. 玻璃入爐日期及時間： _____
14. 玻璃入爐時溫度(Air Temperature $\leq 35^{\circ}\text{C}$)： _____ $^{\circ}\text{C}$
15. 玻璃到達衡溫 $290 \pm 10^{\circ}\text{C}$ 之大概時間： _____
16. 玻璃保持衡溫 $290 \pm 10^{\circ}\text{C}$ 之時間： _____ 小時 _____ 分鐘
17. 玻璃開始降溫時間： _____
18. 玻璃出爐(Air Temperature $\leq 70^{\circ}\text{C}$)日期及時間： _____
19. 玻璃出爐時爆破數量： _____ (如有，請看附件 2)
20. 於整個升溫過程中，玻璃廠方 Thermocouple 曾否顯示玻璃表面溫度高於 300°C 但低於 320°C
是 / 否 (如是，請回答 21。 如否，請回答 22 及 23)
21. 依照 BS EN 14179 中之規定將第 11 項中之全數試片通過碎片測試 (Fragmentation test) 之要求：
是 / 否 (如是，請看附件 3)
(如否，請說明： _____)
22. QA/QC: 每十爐最少做一個碎片測試 (Fragmentation Test)
23. QA/QC: 每爐抽樣量度其中一片玻璃的中央部份之表面應力 (Surface Stress Measurement)

- 附件 1. T1 (RC) 之 Data-logger 圖表記錄
- 附件 2. 入爐玻璃數量資料表
- 附件 3. 碎片 / 表面應力測試資料表

*玻璃熱浸過程(HEAT SOAK PROCESS)是根據及符合 BS EN 14179-1:2005 及 PNAP APP37 進行測試

玻璃熱浸 (Heat Soak Test) T1 / T3 Inspection Log Book - 附件 3

碎片 / 表面應力測試資料表

碎片測試 (Fragmentation Test) 結果：

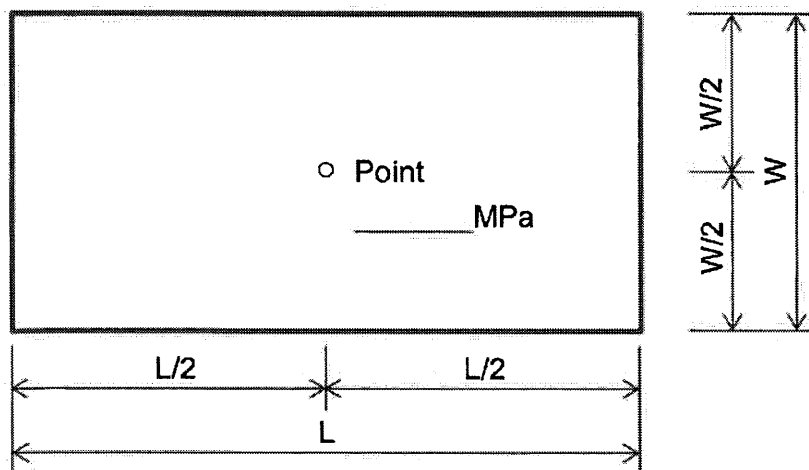
Minimum particle count values

Glass type	Nominal thickness (d) mm	Minimum particle count
Float and drawn sheet	3	15
	4 to 12	40
	15 to 19	30
Patterned	4 to 10	30

Note: the length of the longest particle shall not exceed 100mm

Specimen	Glass Thickness	Particle Count

表面應力測試 (Surface Compressive Stress Measurement) 結果：



Glass Size: _____

**Proposed Comprehensive Development
at New Kowloon Inland Lot No.6551,
Kai Tak Area 4C, Site 3,
Kai Tak, Kowloon.**

**Performance Specification
for Façade Systems**

Issue 1
28 May 2021

ALPHA
Steel Structure & Façade Specialist

J2007



Content	Page
1. Introduction.....	1
1.1 General.....	1
1.2 Definitions.....	1
1.3 Architects Endorsement.....	2
1.4 Sub-Contractors.....	2
1.5 Materials and Workmanship.....	2
1.6 Fabrication and Installation.....	2
1.7 Acceptance of Existing Structure.....	3
1.8 Design Life and Durability.....	3
1.9 Maintenance and Replacement Capacity.....	3
1.10 Quality Assurance.....	4
1.11 Warranties.....	6
2. Tender Requirements.....	9
2.1 General.....	9
2.2 Documents for Submission with Tender.....	9
2.3 Samples Submissions.....	12
3. Scope of Works.....	13
3.1 General.....	13
3.2 Description of Systems.....	13
3.3 Description of Works.....	14
3.4 Sub-Contractor's Responsibilities.....	15
3.5 Related Works by Other Trades.....	17
3.6 Project Completion.....	18
4. Submissions.....	19
4.1 Schedule of Submission.....	19
4.2 Requirements for Facade Design.....	22
4.3 Samples Submissions.....	26
5. Performance Requirements.....	27
5.1 General.....	27
5.2 Performance Schedule.....	27
5.3 Basic Data.....	33
6. Materials and System Components.....	37
6.1 General.....	37
6.2 Aluminium.....	38
6.3 Structural Steel.....	43
6.4 Stainless Steel.....	44
6.5 Glass.....	45
6.6 Sealant.....	53
6.7 Others.....	56
6.8 Stone.....	67
7. Manufacturing.....	70
7.1 General.....	70
7.2 Fabrication.....	70
7.3 Assembly.....	70
7.4 Glass.....	71
7.5 Sealant Application.....	72
7.6 Structural Silicone.....	72
7.7 Weather Seals and Air Seals.....	73
7.8 Fabrication & Assembly Tolerances.....	74
7.9 Material Protection.....	74
7.10 Factory Inspections.....	74
7.11 Stone.....	75

8.	Installation.....	78
8.1	General.....	78
8.2	Site Quality Control Mock-up.....	79
8.3	Fixing.....	79
8.4	Embedded Anchors.....	80
8.5	Glass.....	81
8.6	Insulation.....	82
8.7	Sealant Application.....	82
8.8	Gutters.....	83
8.9	Flashings and Vapour Retarders.....	83
8.10	Finishes.....	84
8.11	Tolerances.....	84
8.12	Inspection and Testing.....	85
8.13	Handling, Hoisting and Storage.....	85
8.14	Protection and Cleaning.....	86
8.15	Field Installation of Stone.....	87
9.	Testing and Inspections.....	90
9.1	Prototype Performance Test.....	90
9.2	Visual Mock-up.....	98
9.3	On-site Water Testing of the Facade.....	98
9.4	Sealant Testing.....	99
9.5	Embed Testing.....	101
9.6	Weld Testing.....	101
9.7	Aluminium Coating.....	101
9.8	Post-fix Anchor Testing.....	102
9.9	Pull-out and Shear Tests of Fasteners.....	103
9.10	Site Gutter Testing.....	103
9.11	Testing of Casting.....	103
9.12	Aluminium Stud.....	104
9.13	Surface Stress Testing of Flat Glass.....	104
9.14	Insulating Glass Units - Testing.....	105
9.15	Glass Impact Test.....	105
9.16	Boil Test.....	105
9.17	Bending Test.....	105
9.18	Lightning Protection - Testing.....	105
9.19	Stone Testing.....	106
APPENDICES.....	A1	
A1	Materials (To be completed by Tenderer).....	A2
A2	Performance Test Mock-up and Visual Mock-up.....	A5
A3	Standards and Codes.....	A6
A4	Facade Maintenance Manual.....	A14
A5	Specification of Structural Steelwork.....	A15
A6	Protection Methods.....	A25

6.5 Glass

6.5.1 General

1. Glass shall comply with the following minimum standards:

Generally:	BS EN 572, BS 952, BS 6262, AS 1288, ASTM E1300 & CoP for Structural Use of Glass 2018.
Flat Glass:	ASTM C1036 (Minimum requirement of one-half the published tolerances for this standard)
Heat-strengthened Glass:	ASTM C1048 (Minimum requirement of one-half the published tolerances for this standard)
Tempered Glass:	ASTM C1048 (Minimum requirement of one-half the published tolerances for this standard)
Glass Coating:	ASTM C1376 (Minimum requirement of one-half the published tolerances for this standard)
Insulated Glass Units:	ASTM E773 & E774
Laminated Glass:	ASTM C1172 (Minimum requirement of one-half the published tolerances for this standard)
Bent Glass	ASTM C1464 (Minimum requirement of one-half the published tolerances for this standard)
Heat Soak Process:	BS EN 14179-1
Surface Stress Testing:	ASTM C1279 & C1048
Glass Impact Testing:	BS EN 12600 for each glass type of glass being used for safety glazing
2. Submit samples of glass in accordance with Section 4.3.
3. Because of its high strength, tempered glass may be used in facade systems to resist high wind pressure and horizontal imposed load. However, tempered glass is susceptible to spontaneous breakage induced by Nickel Sulphide inclusions. For this reason, annealed glass, heat-strengthened glass, laminated glass or other combinations of these types are recommended to use in the facade systems above ground floor in buildings. A single lite of tempered glass is prohibited to use as outermost glass panel above the ground floor in buildings.
4. The thickness and heat-treatment of glass shown on drawings are not prescribed data or values. The Sub-Contractor shall calculate the required glass thickness to meet the structural, environmental, acoustic and safety requirements.
5. Test reports on glass (surface stress, heat soak, inter-alia) are to be prepared by a recognized independent HOKLAS accredited or equivalent test laboratory and endorsed by the Sub-Contractor to be submitted to and approved by the Architect prior to material ordering.
6. On-site non-destructive photoelastic measurement of surface stresses in heat-treated glass to ASTM C1279 should be conducted by independent HOKLAS accredited laboratory. Unless otherwise accepted by the Architect, the number of on-site measurements should not be less than 1% of total number of panels.

7. Sub-Contractor shall submit heat soak process and QC program for approval by the Architect to ensure conformance with requirements listed in BS EN 14179-1. Detailed quality assurance scheme as stipulated in latest Code of Practice and/or PNAP APP-37 shall be submitted for RSE and Consultant approval prior to consent submission. All records of heat soaking shall be submitted to the Architect for review following delivery of glass to the assembly factory or to site.
8. Heat-treated glass such as Heat-strengthened glass and Tempered glass shall be examined by the glass manufacturer to detect and discard any lites which exceed the following tolerances:
 - a. Glass that has any deviation from flat (bow) of 0.1% of the glass dimension not greater than 2 m and 0.2% of the glass dimension greater than 2 m.
 - b. Where the heat-treating process results in essentially parallel ripples or waves (roller waves), the deviation from flatness at any peak shall not exceed 0.13 mm, and the difference between adjacent peaks shall not exceed 0.08 mm.
 - c. Where bow tolerance and roller wave tolerance differ, the stricter requirements shall govern.
 - d. Direction of ripples shall be horizontal, consistent, and in conformance with architectural design.
 - e. Bubbles and inclusions in glass panels are considered as unacceptable.
9. The appearance of anisotropy or "Leopard Spots", a multi-coloured pattern, is known to be associated with heat-treated glass under certain polarized lighting conditions. This will not be considered a fault unless it is visible in a range of reasonably typical naturally occurring conditions. Any coatings applied to the glass must not increase the tendency to show these effects and samples must be submitted for assessment. Control samples, as indicated in Section 4.3 of the Specifications, shall be submitted for approval prior to ordering of the project glass.
10. All technical requirements and visual acceptance shall also comply with Client's and Architect's particular specification.

6.5.2 Source

1. The source of glass supply shall be subject to review and approval by the Architect prior to the award of The Works. The source must have a satisfactory proven track record of glass supplied for the type, size and thickness concerned, appropriate QA/QC measures, and compliance with the design / manufacturing / testing standards as specified in the Specifications or the best practice in glass manufacture approved by the Architect.
 - a. Acceptable raw glass material suppliers for this Project are as follows:
 - Viracon (Europe)
 - Pilkington (Europe)
 - Saint Gobain (Europe)
 - Shanghai Yaohua Pilkington Glass – SYP (China)
 - China Southern Glass – CSG (China)
 - Xinyi Glass (China)
 - b. Acceptable glass manufacturers / fabricators for glass panel for this Project are as follows:
 - Cricursa / Cristec (Overseas)
 - Sedak / Sunglass (Overseas)
 - Tianjin North Glass (China)
 - GnT (China)
 - Sanxin (China)

2. All glass units shall be supplied, coated, manufactured, assembled and warranted by a single manufacturer. The glass shall be from a single source and the Sub-Contractor shall submit details of how he will control the colour consistency, flatness and other visual manufacturing quality issues for each elevation prior to glass ordering.
3. Products from the approved manufacturers are to be assessed individually in satisfying the technical requirement of this Project. Various specific quality control procedures may be implemented for manufacturers who have been submitted for Architect's approval. Agreement with and compliance with all required quality control procedures will be a requirement for Architectural approval as a glass source for this project.
4. Glass that requires replacement through breakage by the Sub-Contractor or other causes shall be replaced with the same glass as was damaged which shall be from the same source.

6.5.3 Heat-strengthened Glass

1. All heat-strengthened glass shall be processed on a roller hearth furnace eliminating tong marks.
2. Unless otherwise accepted by the Architect, three (3) full size glass samples each with designated tinting, heat treatment, build-up and coating shall be provided for each thickness of glass to demonstrate the strain patterns, roller wave distortion, leopard spots, colour variations (tinting and coating) and the like that will be obtained. The Architect shall keep the accepted samples as control samples of the acceptance range of visual deviations.
3. Edge working shall be flat ground with small ground arris chamfers and have a frosted appearance. Corners shall be dubbed. Small shells and/or chips shall be ground out prior to toughening. Maximum chip/shell diameter shall not exceed 2 mm, and there shall not be more than four randomly placed chip/shells in any single pane of glass.
4. The surface compressive stress shall be demonstrated by non-destructive testing to be between 24 N/mm² and 52 N/mm². The surface stress shall be 100% checked by GASP and kept in QC production record.

6.5.4 Tempered Glass

1. All tempered glass shall be processed on a roller hearth furnace eliminating tong marks.
2. Unless otherwise accepted by the Architect, three (3) full size glass samples each with designated tinting, heat treatment, build-up and coating shall be provided for each thickness of glass to demonstrate the strain patterns, roller wave distortion, leopard spots, colour variations (tinting and coating) and the like that will be obtained. The Architect shall keep the accepted samples as control samples of the acceptance range of visual deviations.
3. Edge working shall be flat ground with small ground arris chamfers and have a frosted appearance. Exposed edges shall be chamfered and polished. Corners shall be dubbed. Small shells and/or chips shall be ground out prior to toughening. Maximum chip/shell diameter shall not exceed 2 mm, and there shall not be more than four randomly placed chip/shells in any single pane of glass.
4. The surface compressive stress shall be demonstrated by non-destructive testing to be controlled at the factory within the range of 69 N/mm² to 130 N/mm². The surface stress shall be checked at least once for each batch and at a regular time interval of not more than four hours.
5. The Sub-Contractor must satisfy himself that glass tempering requirements are satisfactory to meet wind or other loads anticipated in The Works. The prime manufacturer of the tempered glass shall be made aware of its intended use in the construction. Any drilling and notching is to be done with the agreement of the prime manufacturer of the tempered glass and prior to the processing being carried out.

6. Where tempered glass is used as part of or whole of a protective barrier, impact test report of the tempered glass particular to the project shall be submitted for RSE's and the Architect record.
7. The calibration report and the selected monitoring thermocouples of the heat soak oven for flat glass may not be applicable for curved glass. With this regard, unless otherwise specified by the Architect or Buildings Department, the heat soak process of the curved glass shall be carried out with a total of 20 numbers of monitoring thermocouples being used as for oven calibration.

6.5.5 Laminated Glass

1. Laminated glass units shall be fabricated with autoclaved edges on all four sides. When large unit sizes or unusual shapes are encountered, it may be necessary to vacuum bag each special size/shape, in addition to the autoclaving process to ensure proper lamination. The manufacturer, if required by the Architect, will have to prove satisfactory lamination and resistance exposure to high temperatures and humidity of special size/shape units by performing a full size boil test. All edges and cuts shall be accurate, clean, sharp, square, smooth and free of burrs. For all point fixing glazing, the glass edges shall be flat ground with ground arris chamfers. For all framed glazing, the glass edges shall be ground arris chamfers.
2. The minimum thickness of the interlayer shall be 1.52 mm (single layer or 2 layers of 0.76 mm) for flat glass and 2.28 mm (3 layers of 0.76 mm) for curved glass. All laminated glass edges (specifically the PVB interlayer) shall be protected from contact with silicone sealants or exposure to the atmosphere unless written acceptance of such application issued by the glass and interlayer manufacturers are made available during the tender stage. All glass holes shall be ground chamfered.
3. Unless otherwise specified or accepted by the Architect, the Polyvinyl Butyral (PVB) interlayer shall be Saflex®, Butacite® or Trosifol®. Ionoplast interlayer by Kuraray, such as SentryGlas® (SGP) interlayer, can be used to enhance the weathering durability of glass laminates, but may not accounted for composite action in terms of strength & stiffness in structural design. When composite action is taken into account for the structural design of laminated glass, the assumed degree of composite action should be verified by bending test as stipulated in the Code of Practice for Structural Use of Glass 2018 before fabrication.
4. The glass and interlayer manufacturers must perform a shop drawing print review noting all glazing details, design loading and operating environment conditions and confirm that the glass, as detailed and supplied, will meet and perform as specified for the conditions it will be used. This review and written statement from the glass and interlayer manufacturers is to be submitted to the Sub-Contractor and the Architect.
5. Lamination procedure and quality control manual should be submitted before fabrication. Boil test should be performed on the full size (or largest size) glass unit from the first batch of laminated glass.
6. There shall be no observable delamination or shrinkage of the inner layer material at the edges of laminated glass in excess of 5 mm. Written confirmation from the glass and interlayer manufacturers shall be made available for the Architect's approval prior to ordering of the glass.
7. For laminated glass specified with Kuraray SentryGlas® (SGP) interlayer, the SGP laminated glass should be manufactured by a Qualified Networking Laminator (QNL) with Certificate issued by Kuraray. Also, the Sub-contractor should provide the purchase record of Kuraray SGP interlayer with indication of both quantity and project information.
8. Where coating is applied to glass surface in contact with the interlayer of a laminated glass, the compatibility test report of coating and interlayer should be submitted before fabrication.
9. Maximum allowable offset of glass panes at the visible finished edges shall be 1.6 mm over the completed length of the laminated glass. Unless

otherwise accepted by the Architect, the maximum allowable offset of glass panes at the visible finished edge shall be 2.5mm over the completed length of 3D curve laminated glass.

6.5.6 Insulating Glass Units

1. Insulating glass units (IGU) (or also known as double glazed units) of approved types in accordance with ASTM E774, AS 2208, and the recommendations of SIGMA. Submit complete details, including all construction details, primary and secondary seals, gas filling, corner treatment, nature of spacers, moisture evacuation and assembly process. Condensation within the insulating glass cavity is unacceptable.
2. All IGU shall be free from evidence of manufacturing defects and shall be free from:
 - a. Intrusion of moisture or dirt.
 - b. Internal condensation at temperatures above -10°C.
 - c. Other visual evidence of seal failure or performance failure.
3. IGU shall incorporate approved polyisobutylene primary (vapor) seals continuously bonded to glass, and two-part silicone secondary (structural) seals. Primary seal shall be not less than 3 mm deep. Secondary seal shall completely cover spacer with no gaps or voids, continuously bonded to glass. Spacer bar shall be an approved proprietary aluminium type or other metal material including stainless steel, desiccant filled, or anodized, to an approved colour compatible with seals. Conceal spacer bar within the depth of the glazing gasket line to ensure smooth sight line. Details and colour samples should be submitted for Architect's approval.
4. Distance between the outer edge of the glass and the innermost edge of the aluminium spacer indicating minimum bite of secondary (structural) seal and spacer bar depth shall be supported by structural calculation in accordance with ASTM C1249.
5. IGU Production and test records (such as test procedures, acceptance criteria and pass/fail rate to AS 2208 or equivalent Standards) shall be submitted for review. Test report from a recognized testing laboratory shall be submitted which indicates the IGU type attaining Class A as defined in ASTM E774 when having tested in accordance with ASTM E773.
6. All IGU glasses shall be fabricated in compliance with ASTM E2190. Testing proposal for the IGU to check the structural integrity should be submitted for statutory approval before production. Test report/certificate indicating compliance with ASTM E2190 with respect to specification and seal durability for IGU should be submitted.
7. Unless otherwise specified on the Drawings, the exterior glass pane of IGU should be heat-strengthened glass and the interior glass pane of IGU should be tempered glass. Tin side of the glass panes should be located on the outermost surfaces of IGU for future surface stress measurement.
8. Relevant Standards:
 - a. ASTM C1087 - Standard test method for determining compatibility of liquid-applied sealants with accessories used in structural glazing techniques.
 - b. ASTM C1249 - Standard guide for secondary seal for sealed insulating glass units for structural sealant glazing applications.
 - c. ASTM C1265 - Standard test method for determining the tensile properties of an insulating glass edge seal for structural glazing applications.
 - d. ASTM C1369 - Standard specification for secondary edge sealants for structural glazed insulating glass units.
 - e. ASTM C11376 - Standard specification for pyrolytic and vacuum deposition coatings on flat glass
 - f. ASTM E546 - Test for dew point of sealed insulating glass units.

- g. ASTM E773 - Standard test methods for seal durability of sealed insulating glass units.
- h. ASTM E774 - Standard specification for sealed insulating glass units.
- i. ASTM E2188 - Standard test method for insulating glass unit performance.
- j. ASTM E2189 - Standard test method for testing resistance to fogging in insulating glass units.
- k. ASTM E2190 - Standard specification for insulating glass unit performance and evaluation.
- l. BS EN 1279 - Glass in building. Insulating glass units
- m. SIGMA - Sealed and insulating Glass Manufacturer's Association.

6.5.7 Low Emissivity Coating

1. Low emissivity coating to achieve the performance criteria specified, shall be nominally neutral in colour and uniform in tone, hue, colour, texture, pattern, reflectivity and opacity and shall provide a consistent appearance to the glazed units.
2. Unless otherwise specified or accepted by the Architect, the Low-E glass shall be temperable solar control low emissivity coating Solarban®. Provide coatings, and visual effect of paint or film to glass to match approved samples.
3. Data sheets for project specified glass assemblies in accordance with BS EN 410 (light transmittance, radiant transmittance of glazing) shall be submitted in respect of solar and visible light performance confirming compliance with Code requirement and Project specification.
4. Facilities shall be maintained to evaluate and report on expected solar performance under varying conditions of solar radiation and external/internal air velocity.
5. Coatings shall be neutral in colour, durable and sufficiently hard on exposed surfaces to avoid damage. For the purposes of the Specification, neutral shall be defined as a colour having no unacceptable hue quantified by range of samples and being capable of refracting light without chromatic aberration when viewed from any direction.
6. Colour variation for the same type of Low-E coated glass shall not exceed $3\Delta E$. Glass panes with coating shall be examined for defects in accordance with BS EN 1096: Part 1.
7. Defects, including scratches, and pin-holes shall not be visible at 1 meter distance from glass surface by naked eye.
8. Coatings shall not crack, disintegrate or corrode in any way under the extremes of the conditions. Low-E coating and reflective coating can only be supplied by processors with more than 10 year experience in the related coating.
9. Edge deletion shall be required. The tolerances in edge deletion and insulating glass unit (IGU) shall be controlled. There is no visible gap between the edge of the soft coating and the primary seal of the insulating glass unit that results in narrow bands of bright light more than 1 mm wide being visible.
10. The soft coating shall not intrude beneath the primary seal of the IGU, Polyisobutylene (PIB) sealant or butyl seal, to the extent that less than 2 mm.
11. In the event of the glass manufacturer is unable to comply with the above requirements, the matter should be identified at the tender stage and the glass manufacturer's proposals should be submitted in writing for consideration.

6.5.8 Low Iron Glass

1. Low iron glass shall be subject to the Architect's approval for clarity.

6.5.9 Thermal Stresses

1. The Sub-Contractor shall ensure that no glass or glazing combination develops stresses that may lead to damage of glass, glazing materials, components and/or framing systems.
2. The Sub-Contractor shall conduct a thermal stress analysis, undertake thermal calculations and make due allowance for any heat-treated glass, which may be required.
3. The Sub-Contractor shall take into account shading stresses that might occur from adjacent components and buildings including shading devices.

6.5.10 Sizes

1. All glasses shall be cut to accurate sizes and, if applicable, delivered to factory/site, as the case may be, in the required sizes.
2. No glazing factory or on-site cutting or nipping shall be allowed.
3. The glass shall be clearly marked to show its intended final position and orientation.

6.5.11 Glass Production Quality

1. The glass shall be clean cut, without significant edge faults (including feathered edges, shells or other imperfections) and free from bubbles, inclusions, cracks, ripping, dimples or other defects. Distortion shall be kept to an absolute minimum and no local defects producing irregular reflections shall be allowed.
2. The quality of all glass shall be assessed for optical and visual faults as described in BS EN 572-2. Spot faults shall not be worse than category C. There shall be no linear/extended faults. For optical faults, acceptance levels shall be as described.
3. In the absence of a British standard covering visual process blemishes in laminated glass, reference shall be made to ASTM C1172 Table 3 for architectural quality glass.
4. Full size glass samples of each type shall be submitted with the exact Project condition thickness, same tinting, heat treatment, build-up and coating so as to allow viewing of strain patterns, roller wave distortion and/or other conditions that might affect the visual appearance of the glass and allow approval by the Architect.
5. Glass manufacturers' logos and glass type identification marks shall be sized as small as possible. They shall be located in the bottom left hand corner of the panes when viewed from the inside to the outside. Samples of each glass type with logo attached shall be submitted for the Architect's approval.

6.5.12 Visual Acceptance Criteria

1. General requirement of visual acceptance criteria refers to Section 6.5.1.
2. Visual inspection should be done at 1 meter distance from glass surface by naked eye.
3. Point blemish size on the surface of the glass (*e.g. dirt, knots, or other similar imperfections*) and/or in the body of the glass (*e.g. knots, gaseous inclusions or other imperfections*) should not greater than 0.5 mm.

4. Linear blemish size on the surface of the glass (*e.g. scratches or other similar imperfections*) should not greater than 25 mm in length with minimum separation of 1.5 m.
5. The allowable blemish size should not form a cluster or induce distortion of image that is detectable at 1.8 meter distance from glass surface by naked eye.
6. **For residential project**, all glass shall be free from blemishes in the body of the glass (*e.g. knots, gaseous inclusions or crack*) in addition to any manufacturing standard.
7. The Client may invite inspectors from related parties for 100% inspection carried out from internal side after cleaning by the Sub-Contractor. Any blemish, scratch and/or any defect seen should be marked and kept record for further replacement with inspection. Client/Architect's decision will be final. Defective glass to be replaced by the Sub-Contractor on their own expenses.

surfaces unless designed otherwise. Other joints shall be rigidly secured to prevent all but designed movement, unless shown otherwise.

- 7.3.4 The construction and fabrication of all work, corner, butt and angular joints and fastenings shall be sufficiently strong and rigid to withstand all temporary loads imposed on any prefabricated assemblies.
- 7.3.5 Metals shall be welded in accordance with the relevant standards using methods to avoid distortion. The type, size and spacing of welds shall be shown on drawings and reviewed by the Architect, prior to fabrication.
- 7.3.6 Welds shall be fully bonded throughout their length, descaled and without holes, inclusions, cracks, slag or porosity so that the long-term performance is not compromised and the welds are strong enough for the design requirements. The welds shall be ground smooth and flush with the adjoining surfaces where visible or impinging on other work. The completed welded construction shall be finished to prevent corrosion. All welds shall be cleaned as necessary to ensure the durability of the connections.
- 7.3.7 All stud welding shall be by the capacitor discharge process on freshly cleaned, degreased and oxide-free base metal shielded with argon gas, 99.95% pure, in accordance with Recommended Practice for Stud Welding by the American Welding Society. Should the design of the systems require the use of welded studs, the structural calculations for tension and shear allowable loading for the stud size being used should be based on aluminium stud weld test. The characteristic strength obtained by testing should not be less than 3 times of the allowable working load. Additionally, 100% of the actual project studs will require torque testing to 1.25 times the allowable torque design requirements.
- 7.3.8 Welds behind finished surfaces shall be completed as to minimise distortion and/or discoloration on the finished side. Weld splatter and welding oxides on finished surfaces shall be removed by descaling and/or grinding. Telegraphing of welds through a finished surface will not be accepted.
- 7.3.9 Welds of gutters and end dams shall not constitute a water seal. All welds in areas intended to retain and channel water shall be completely sealed with approved sealant.
- 7.3.10 All welding consumables used for the arc welding of carbon and carbon manganese steels are to comply with BS EN 1011, BS 4872 and BS 5465. Welding consumables and procedures are to give mechanical properties for the deposited weld metal not less than the minima specified for the parent metal. Welding consumables, welding procedures, welding standards, welder qualification tests, Destructive and Non-destructive tests shall also comply with the latest version of Standards and Codes, and PNAP APP53.
- 7.3.11 Welding: Refer to Code of Practice for the Structural Uses of Steel 2011 or equivalent Standards and Specification.
- 7.3.12 Bolting: Refer to Code of Practice for the Structural Uses of Steel 2011 or equivalent Standards and Specification.

7.4 Glass

7.4.1 Glazing

1. Protect glass from edge damage at all times during handling, installation and operation of the building. Glass breakage during the guarantee period will be considered a form of faulty material or workmanship unless known to result from vandalism or other causes not related to materials and workmanship.
2. Where applicable, comply with GANA (Glazing Association of North America) Glazing Manual Guidelines. Provide a minimum nominal glass bite of 13 mm. Where joint movement will result in variable glass bite, increase nominal bite as required and provide 6 mm minimum edge clearance, or greater clearance where lateral building movement is taken by the glazing seals.

3. Thoroughly clean glazing pocket before setting glass. Solvents shall be compatible with finished aluminium, glass and glazing materials. Take care to prevent cleaning solvents from coming into contact with joinery seals. Place setting blocks at locations as shown on the shop drawings and supported by the deflection criteria. Place side blocks in the upper half of each jamb, where required. Side blocks, setting blocks and chairs shall be positively retained in their position in all directions.
4. Each and every piece of glass shall be subject to Architect's approval, and any piece or pieces may be rejected after having been set or erected. Rejected glass shall be carefully removed and replaced with new suitable glass without delay and without cost to the Client. Any piece or pieces damaged in the replacement/resetting of the new glass shall also be removed, with new and acceptable pieces provided and set at no cost to the Client.

7.5 Sealant Application

- 7.5.1 Sealant shall comply with this Contract Document and be of the appropriate type to achieve the appearance and performance required. Sealant shall be applied to clean surfaces, primed as necessary, in accordance with the manufacturer's recommendations and procedures agreed following adhesion and application tests. Conditions of application shall be conducive to producing satisfactory results and avoid undue stress in uncured material.
- 7.5.2 Sealant utilized within the frame system to seal joints between components should withstand all stresses during assembly, transportation and installation, and shall provide an air and watertight seal in service.
- 7.5.3 Sealant and their primers, or other bonding agents, shall be compatible with the materials and finishes with which they are likely to come in contact. Before showing sealant on his design drawings, the Sub-Contractor shall obtain the Manufacturer's assurance, in writing, that they are suitable and appropriate for their intended use and will satisfy this Contract Document. Quality control adhesion tests shall be carried out throughout the period of manufacture to monitor the effectiveness of the material and application techniques.
- 7.5.4 Sealant shall be applied over bond breakers/backer rods, set into the joint to control the depth of sealant and to prevent three-sided adhesion.
- 7.5.5 Backing rods shall be used strictly in accordance with the sealant manufacturers' recommendations, and the Specifications.
- 7.5.6 Architect's approval is required in order to use closed cell sections for sealant backing materials, only non-off-gassing products shall be considered.
- 7.5.7 The colour of visible sealant used shall be as specified on the Architects Drawings.

7.6 Structural Silicone

- 7.6.1 The Sub-Contractor shall provide a Quality Management program for the installation of the structural silicone seals. This shall include, but not be limited to:
 1. Documentation of the sealant manufacturer's requirements for the particular substrates of the project regarding joint size, limitations, backer rod, mixing, cleaning, surface preparations, priming and application, temperature and humidity of glazing conditions and any other criteria which may affect sealant performance.
 2. The Sub-Contractor shall provide certification from sealant manufacturer that the sealant manufacturer has reviewed all sealant details and tested all contact surfaces, and finds same suitable for use with proposed sealant, the purpose intended and compatible with and will not stain the surfaces with which they are in contact. Sealant manufacturer's certification as to compatibility, adhesion sufficiency and non-staining shall be accompanied by actual test results on production substrates performed in accordance with

- applicable ASTM procedures and shall include tests performed on production run materials as required in Section 9.4 of the Specifications.
3. Determination of bite requirement from design wind pressure and panel size, using the sealant manufacturer's recommended procedure. Joint design must be in accordance with the sealant manufacturer's recommendation for glue-line and bite to glue-line ratio.
 4. Care shall be exercised to prevent "Three Surface Adhesion". Bond breakers shall be provided where necessary. "L"-shaped silicone joints combining the structural and weather seal shall not be used.
 5. Glazing procedures including frame assembly, cleaning, priming (if necessary) gunning, tooling, frame handling after glazing and curing. Primers shall be used, only when, and as advised by the sealant manufacturer. Sealant shall be applied in a controlled condition regarding temperature, humidity and cleanliness. Units shall not be moved until structural silicone seal has achieved full cure.
 6. Site glazing procedures must be determined and include all of the above items (1) to (5). Sealant shall not be applied when the temperature is below 4°C and sealant shall not be applied onto surface at temperatures greater than 40°C. If gunning procedures vary in any way from the established factory method, then the adequacy of the seal shall be established as indicated in above items (1) and (5). Ability to achieve an adequate joint in site conditions must be established. A method of ensuring undisturbed curing irrespective of applied wind load during the curing period must be documented.
 7. All Quality Management records shall be provided to the Main Contractor starting from the date of commencement of glazing and updated on a monthly basis. These will include all records of points above. At the completion of the project, the Sub-Contractor shall provide the Main Contractor with four (4) complete sets of all Quality Management records, as part of the Facade Maintenance Manual.
 8. Each frame/unit shall be individually numbered with a unique number when manufacturing. The unique numbering of frames/units must be installed at the predetermined location on the building, as per the Sub-Contractor's installation drawings (As-Built Drawings) so as to allow for checking in maintenance manual at any time during the warranty period. Sealant application record shall provide information of every frame/unit, including number, silicone sealant type, batch number, date of application, person of application, humidity and temperature of factory.

7.7 Weather Seals and Air Seals

- 7.7.1 In using specific sealant, the Sub-Contractor shall strictly observe the printed instructions of sealant manufacturer regarding joint size, limitations, backer rod, mixing, cleaning, surface preparations, priming application, and tooling, as well as the requirements of the Specifications. A primer shall be used only when the manufacturer's instructions say to do so. Sealant shall not be applied when substrates are wet or when the temperature is below 4°C. Sealant shall not be applied onto surface at temperatures greater than 40°C.
- 7.7.2 Care shall be exercised to prevent "Three Surface Adhesion". Bond breakers shall be provided where necessary.
- 7.7.3 Gaskets and seals used to achieve the required weather and air tightness shall be selected to fully accommodate the range of dimensional tolerances associated with fabrication and installation of the facade. They shall be formed with materials capable of maintaining their elastic qualities, dimensions and resistance to physical and chemical attack sufficient to maintain the full acoustic performance specified. Glazing gaskets providing the water and air seals shall be formed into complete frames with factory formed injection moulded vulcanized corner joints.

- 7.7.4 Glazing gaskets jointed by bonding with adhesive are not acceptable as a substitute for moulded frame gaskets. Gaskets shall be free from contact and migration stain and shall be compatible with all substrate, sealants and finishes with which they are likely to come into contact. The gaskets shall be free of mould flash.
- 7.7.5 All glazing gasket frames should be normally manufactured to a small but predetermined oversize tolerance, to ensure that when seated into position, the lineal lengths and corners of the gaskets are in slight compression.

7.8 Fabrication & Assembly Tolerances

- 7.8.1 The maximum allowable cutting tolerances for the entire Facade framework shall be:
1. ± 0.75 mm on length on mullion
 2. ± 0.50 mm on length on transoms
- 7.8.2 The allowable tolerances on individual panes of glass shall be:
1. ± 2.0 mm on height and width
- 7.8.3 The maximum allowable metal panel face tolerance shall be
1. ± 0.75 on dimensions up to 1.5 meters
 2. ± 1.50 on dimensions greater than 1.5 meters
- 7.8.4 The maximum difference in diagonal measurements of an assembled unit shall be:
1. 1.5 mm for units up to 3.0 m²
 2. 3.0 mm for units from 3.01-7.0 m²
 3. 4.5 mm for units from units 7.01 m² or greater
- 7.8.5 Maximum offset between glass framing members at corners of glazing pockets shall not exceed 0.8 mm.

7.9 Material Protection

- 7.9.1 Materials, assembled units, elements of framing and all components shall be protected in such a manner that will prevent damage, distortion, uneven weathering or degradation under normal conditions of handling and storage. Particular attention shall be given to the protection of edges, projecting features, corners and other vulnerable areas.

7.10 Factory Inspections

- 7.10.1 The Sub-Contractor shall allow for minimum of five (5) persons of the Client, Architect and Consultant Team to visit the place of fabrication (and assembly if different) once every three months. This shall include the transportation to and from the factory and hotel accommodation at reasonable grade, and expenses shall be paid by the Sub-Contractor. Unlimited access to factories in China undertaking work for this Project will be provided.
- 7.10.2 Should, in the professional judgement of the Architect and in the opinion of the Client, any area or facet of the Sub-Contractor's work being performed be considered deficient, substandard or cause for concern for any reason whatsoever, the Sub-Contractor will be notified and periodic or full time supervision over The Works will be implemented by the Architect or his Consultants, Main Contractor or Client. All cost associated with this additional supervision (including fees and travel expenses) will be borne by the Sub-Contractor. No delays or claims for extension of time will be considered as a result of this implementation.

3. Remedial anchors shall be designed and installed by the Sub-Contractor in accordance with the performance requirements as specified herein for embedded anchors.
4. The Sub-Contractor shall verify the adequacy of all such remedial anchors used in the Facade by means of testing. Tests shall be carried out to 1.5 times (x) the safe working load of the anchor as specified by the anchor manufacturer on all remedial anchors used on the Project.

8.5 Glass

8.5.1 General

1. Glazing shall be carried out in accordance with manufacturer's recommendations, which shall take into account the recommendations of the Glass and Glazing Federation, the requirements of BS 6262, and other relevant standards such as GANA (Glazing Association of North America) Glazing Manual Guidelines.
2. Protect glass from edge damage at all times during handling, installation and operation of the building. Glass breakage during the guarantee period will be considered a form of faulty material or workmanship unless known to result from vandalism or other causes not related to materials and workmanship.
3. Provide a minimum nominal glass bite of 13 mm. Where joint movement will result in variable glass bite, increase nominal bite as required and provide 6 mm minimum edge clearance or greater clearance where lateral building movement is taken by the glazing seals.
4. Thoroughly clean glazing pocket before setting glass. Solvents shall be compatible with finished aluminium, glass and glazing materials. Take care to prevent cleaning solvents from coming into contact with joinery seals. Place setting blocks at locations as shown on the Shop Drawings and supported by the deflection criteria. Place side blocks in the upper half of each jamb, where required. Side blocks, setting blocks and chairs shall be positively retained in their position in all directions.
5. Defer glazing of openings, which are obstructed during construction. Glaze such openings when obstructions are removed.
6. Remove and replace exterior glass lites/units which are broken, chipped, stained or otherwise damaged including coating defects or which, in opinion of the Architect, do not conform to the specification requirements. Where directed, remove and replace lites, which do not match adjoining work. Provide new matching lites, install as specified and seal joints to eliminate evidence of replacement.
7. No grinding or welding shall be permitted within 10 m of unprotected glass.

8.5.2 Visual Acceptance Criteria – Viewing Area

1. Inspection shall be made at a distance of 1.0 m from the glass, viewing perpendicular to the glass plane, using natural light for locating flaws, which are clearly visible.
2. The central area is a square or rectangle concentric with the daylight opening and having width and height respectively equal to 80% of the daylight opening width and height.
3. The outer area extends from the border of the central area to the edges of the daylight opening.
4. Distortion of images of viewing shall be kept to an absolute minimum and no local defects producing irregular reflections shall be allowed.
5. For residential projects, the glass shall be free from pinholes, bubbles, inclusions, cracks, ripping, dimples, scratches, rub marks, gaps in the coating or other defects as specified in 6.5.12.

6. Pinhole/bubble/inclusion diameter shall not exceed 0.5 mm in the central area, and 1.2 mm in the outer area. Within any 300 mm diameter circle, in the central area, there shall be no more than one pinhole/ bubble/ inclusion with diameter not exceeding 0.5 mm. Within any 300 mm diameter circle, in the outer area, there shall be no more than four pinholes/ bubble/ inclusion with diameters not exceeding 1.2 mm.
 7. Scratches, pinholes, rub marks, or other gaps in the coating, glass surface, or laminate are not permitted where any portion thereof could include a circle with diameter exceeding 0.5 mm. Where the included circle is 0.5 mm or less, length of the scratch, rub marks or other gap shall not exceed 25 mm in the central area and 75 mm in the outer area.
 8. Streaks or splotches resulting from non-uniformity of the coating that are visible from the building interior or exterior are not permitted.
 9. Colour range must fall within the limits established by approved samples.
- 8.5.3 The Architect shall have the absolute right to request the Sub-Contractor to replace any glass units that in the Architect's professional opinion do not satisfy this criteria; the Sub-Contractor shall have no claim whatsoever on cost and time.

8.6 Insulation

- 8.6.1 Insulation shall be installed as shown on the Sub-Contractor's drawings in accordance with manufacturers' recommendations. It shall be held in place by non-ferrous "mushroom" head fixings mechanically attached to the backing structure, or other approved mechanical attachment method. Installations relying upon adhesives only shall not be permitted.
- 8.6.2 The method of attachment to the supporting components shall be selected to eliminate the risk of bulging, sagging, delamination or detachment of the insulation. It shall be installed so that there are no gaps or lips between individual pieces of insulation or between insulation and any penetrations through the insulation.

8.7 Sealant Application

- 8.7.1 Remove all temporary coatings, tapes, loosely adhering material, dust, oil, grease and other contaminants, which may affect bond.
- 8.7.2 Clean and prepare joint surfaces before application in accordance with the sealant manufacturer's recommendations.
- 8.7.3 Mask all joints with non-staining tape prior to application of sealant or primer materials to avoid staining, etching, or scratching of the adjacent materials.
- 8.7.4 Primer for sealant adhesion is only to be applied when required by the sealant manufacturer. The primer must be applied as directed by the sealant manufacturer.
- 8.7.5 Install properly sized backer rod or bond breaking material per the Specifications and approved shop drawings at the correct depth according to the sealant manufacturer. Closed cell backer-rods are not allowed on site sealant applications.
- 8.7.6 Apply sealant so that joints subject to ingress of water are made watertight and are in accordance with the joint details on the approved shop drawings and sealant manufacturer's specifications.
- 8.7.7 Produce a smooth, slightly concave surface by tooling the sealant into the joint using a tool designed for the purpose. Wet tooling techniques will not be accepted.

- 9.11.5 Destructive Testing
1. A minimum of five (5) samples of each casting type shall be tested to destruction and a minimum safety factor of 3 is required.
 2. The tests for cast elements shall be carried out at least four (4) weeks prior to the performance mock-up tests as required in this section.
 3. Test report of such shall be submitted prior to the performance mock-up test.

9.12 Aluminium Stud

- 9.12.1 Aluminium Stud Fixings
1. Prior to the start of fabrication, demonstrate the strength of welded aluminium stud fixings by testing in tension and shear to destruction minimum of ten (10) fixings attached to test panels cut from sheets identical to the permanent aluminium panels. Testing to demonstrate that their characteristic strength is not less than 3 times the allowable working load. Repeat process at 50% stage of the fabrication program. Submit a test report prepared by HOKLAS accredited laboratory or equivalent prior to the start of fabrication.
 2. Acceptance of the fixing system is dependent on the average of each set of stud test failure loads being at least twice the design load and the absence of permanent deformation at 1.5 times the design load. A Minimum of ten (10) numbers of each stud type shall be tested by pull-out and shear tests to demonstrate that its characteristic strength is not less than 3 times the allowable working load.
- 9.12.2 During production, torque test 100% of the studs to 1.25 times their designed torque load capacity. Record and submit records when requested. Replace failures and retest. Duly report all such incidents, including the date of manufacture and panel mark number, and subsequent unit assembly mark number if applicable.
- 9.12.3 Other non-destructive examinations and/or destructive testing:
1. Quality control testing in factory shall be referred to ISO 14555.
 2. Test procedures and frequency shall be according to the stud manufacturer's recommendation. Test procedures shall be submitted for the Architect's approval.

9.13 Surface Stress Testing of Flat Glass

- 9.13.1 To prove the surface stress of the flat glass, on-site non-destructive measurement of surface stress in flat glass be carried out to ASTM C1279 using Laser Grazing Angle Surface Polarimeter. The surface stress testing shall be carried out by approved test consultant of HOKLAS accredited laboratory.
- 9.13.2 The glass to be tested will be selected by the Architect. The number of tempered glass panel should be 1% of total number of glass panel but not less than twenty (20) pieces of each batch. The surface stress of all heat strengthened glass should be measured and recorded by qualified person.
- 9.13.3 The surface compressive stress shall be demonstrated by non-destructive testing to be between 24 N/mm² and 52 N/mm² for heat strengthened glass. The surface compressive stress shall be demonstrated by non-destructive testing to be between 69 N/mm² to 130 N/mm² for fully tempered glass.
- 9.13.4 If, following the test, there is evidence of surface stress not compliance with the specification, the glass shall be considered unsatisfactory. The Sub-Contractor shall carry out rectification. Further tests shall then be carried out at the expense of the Subcontractor until a satisfactory result is achieved. All costs for remedial tests, including fees and costs incurred by the Client, the Architect and the Consultants and their test consultants shall be paid by the Sub-Contractor.
- 9.13.5 Remedial measures shall maintain standards of quality and durability and are subject to approval.

9.14 Insulating Glass Units - Testing

- 9.14.1 To demonstrate and substantiate the durability of the project insulating glass units, the following testing is to be carried out during glass manufacturing:
- 9.14.2 Frost Point test of the sealed insulating glass units to ASTM E546 shall be included in the glass manufacturer's quality control/assurance procedures/manual for review and approval.

9.15 Glass Impact Test

- 9.15.1 Provision of impact test to BS EN 12600 shall be allowed for each glass type. Glass types for impact test shall be accepted and approved by the Architect.
- 9.15.2 The test specimen shall be the same as the project glass of dimensions, heat treatment, build-up and fixing conditions.

9.16 Boil Test

- 9.16.1 Boil test for laminated glass shall be carried out by the glass manufacturer with quality supervision to determine the probable effect of exposure to high temperature and humidity conditions for a long period of time.
- 9.16.2 Three (3) 300 mm by 300 mm flat specimens shall be immersed in water at $66^{\circ}\text{C} \pm 6^{\circ}\text{C}$ for 3 minutes and then quickly transferred to and similarly immersed in boiling water. The specimens shall be kept in the boiling water for two (2) hours.
- 9.16.3 The laminated glass pane may crack in the test, but no bubbles or other defects shall develop more than 12 mm from the outer edge of the specimen or from any crack that may develop. Any specimen in which the glass cracks to an extent confusing the results shall be discarded without prejudice and tested again with another specimen.
- 9.16.4 For aesthetic concern, at least one test specimen should be tested to full size or the largest size of laminated glass pane of the project.

9.17 Bending Test

- 9.17.1 Standard four point bending test on flat glass to BS EN 1288-3 under room temperature shall be referred to substantiate the minimum bending strength of decorative treated glass and fritted glass such as ceramic fritted, enamel painted, wired, patterned, sand blasted and acid etched glass.
- 9.17.2 For laminated glass designed with composite action, bending tests referred to BS EN 1288-3 under room temperature (20°C) and elevated temperature (50°C) should be carried out to evaluate the degree of composite action.
- 9.17.3 The test shall be carried out by an independent HOKLAS accredited laboratory within its scope of accreditation. The effects of various factors (e.g. stiffness, thickness, inter-layer materials and temperature) on the degree of composite action under bending test shall be reviewed and assessed before adopting in design and requirements.

9.18 Lightning Protection - Testing

- 9.18.1 Demonstrate the electrical continuity of the facade and lightning conductor connection points using the prototype facade. Apply an electrical charge to a nominated point on the test rig and measure continuity as directed by the testing consultant.

BS EN 10210	Hot Finished Structural Hollow Sections of Non-Alloy and Fine Grain Structural Steels
BS EN 10293	Steel Castings for General Engineering Uses
BS EN 22063	Metallic and Other Inorganic Coatings. Thermal Spraying. Zinc, Aluminium and Other Alloys.

Notes:

BS 5950 is replaced by Code of Practice for the Structural Use of Steel 2011

Concise Guide to the Structural Design of Stainless Steel by Stainless Steel Advisory Centre/Steel Construction Institute

Design of Stainless Steel Fixings and Ancillary Components by Stainless Steel Advisory Centre/Steel Construction Institute

A3.4 Fabrication

BS 4870-4	Specification for Automatic Fusion Welding of Materials, including Welding Operator Approval
BS 4871-3	Specification for Approval Testing of Welders Working to Approved Welding Procedures
BS 3019-1	TIG welding. Specification for TIG Welding of Aluminium, Magnesium and Their Alloys
BS 3571-1	MIG Welding. Specification for MIG Welding of Aluminium and Aluminium Alloys
BS 7475	Specification for Fusion Welding of Austenitic Stainless Steel
BS EN 287	Approval Testing of Welders for Fusion Welding
BS EN 288	Specification and Approval of Welding Procedures for Metallic Materials
BS EN 1011-4	Welding. Recommendations for Welding of Metallic Materials. Arc Welding of Aluminium and Aluminium Alloys

A3.5 Glazing and Caulking

CP 153	Code of Practice for Windows and Roof Lights
BS 952	Glass for Glazing
BS 4254	Specification for Two-part Polysulphide Based Sealants.
BS 4255-1	Rubber Used in Preformed Gaskets for Weather Exclusion from Buildings. Specification for Non-Cellular Gaskets.
BS 5215	Specification for One-Part Gun Grade Polysulphide Based Sealants.
BS 5713	Specification for Hermetically Sealed Flat Double Glazing Units
BS 5889	Silicone Seals
BS 6206	Specification for Impact Performance Requirements for Flat Safety Glass and Safety Plastics for Use in Buildings
BS 6262	Code of Practice for Glazing of Buildings
BS 6375	Performance of Windows and Doors
BS EN 410	Glass in Building. Determination of luminous and solar characteristics of glazing
BS EN 572	Glass in Building. Basic Soda Lime Silicate Glass Products.

BS EN 1096	Glass in Building. Coated Glass.
BS EN 1863	Glass in Building. Heat-strengthened Soda Lime Silicate Glass.
BS EN 12150	Glass in Building. Thermally Toughened Soda Lime Silicate Safety Glass.
BS EN 12600	Glass in Building. Pendulum Test - Impact Test Method and Classification for Flat Glass.
BS EN 29046	Building Construction. Sealants. Determination of Adhesion/Cohesion Properties at Constant Temperature
BS EN ISO 12543	Glass in Building. Laminated Glass and Laminated Safety Glass.
BS ISO 11485-2	Glass in Building. Curved Glass. Quality Requirements.
BS ISO 11485-3	Glass in Building. Curved Glass. Requirements for curved tempered and curved laminated safety glass.
ASTM C509	Standard Specification for Elastomeric Cellular Preformed Gasket and Sealing Material
ASTM C794	Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants
ASTM C864	Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks and Spacers
ASTM C1036	Standard Specification for Flat Glass
ASTM C1048	Standard Specification for Heat Treated Flat Glass
ASTM C1172	Standard Specification for Laminated Architectural Flat Glass
ASTM C1184	Standard Specification for Structural Silicone Sealants
ASTM C1249	Standard Guide for Secondary Seal for Sealed Insulating Glass Units for Structural Sealant Glazing Applications
ASTM C1376	Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass
ASTM C1464	Standard Specification for Bent Glass
ASTM E774	Standard Specification for the Classification of the Durability of Sealed Insulating Glass Units
ANSI Z97.1	Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test
19/GP-18M	Sealing Compound Elastomeric Type, Multi-Component. (Canadian Government Specification Board)
TT-S-0227E	Sealing Compound Elastomeric Type, Multi-Component. (US Federal Interim Specification Board)
AS 1288	Glass in Buildings - Selection and Installation
DIN 18516	Außen-wandbekleidungen, hinterlüftet, Einscheiben-Sicherheits-glas; Anforderungen, Bemessung, Prüfung. Berlin
GB 11614-2009	平板玻璃 Flat glass
GB 15763.2-2005	建筑用安全玻璃 第2部分：钢化玻璃 Safety glazing materials in building - Part 2: Tempered glass
GB 15763.3-2009	建筑用安全玻璃 第3部分：夹层玻璃 Safety glazing materials in building - Part 3: Laminated glass
GB 15763.4-2009	建筑用安全玻璃 第4部分：均质钢化玻璃 Safety glazing materials in building - Part 4: Heat soaked thermally tempered glass

GB/T 17841-2008	半钢化玻璃 Heat strengthened glass
GB/T 18915.2-2013	镀膜玻璃 第 2 部分：低辐射镀膜玻璃 Coated glass - Part 2: Low emissivity coated glass
GB/T 11944-2012	中空玻璃 Insulating glass unit
GANA (Glass Association of North America) Glazing Manual, Latest Edition	
Glazing Manual by The Glass and Glazing Federation	

A3.6 Protective Coatings

CP 3012	Code of Practice for Cleaning and Preparation of Metal Surfaces
BS 1615	Method for Specifying Anodic Oxidation Coatings on Aluminium and its Alloys
BS 4842	Specification for Liquid Organic Coatings for Application to Aluminium Alloy Extrusions, Sheet and Preformed Sections for External Architectural Purposes, and for the Finish on Aluminium Alloy Extrusions, Sheet and Preformed Sections Coated with Liquid Organic Coatings.
BS 5411	Method of Test for Metallic and Related Coatings
BS 5493	Code of Practice for Protective Coating of Iron and Steel Structures Against Corrosion
BS 6161	Methods of Test for Anodic Oxidation Coatings on Aluminium and its Alloys
BS 6161.8	Methods of Test for Anodic Oxidation Coatings on Aluminium and its Alloys. Determination of the Fastness to Ultraviolet Light of Coloured Anodic Oxide Coatings.
BS 6496	Specification for Powder Organic Coatings for Application and Stoving to Aluminium Alloy Extrusions, Sheet and Preformed Sections for External Architectural Purposes, and for the Finish on Aluminium Alloy Extrusions, Sheet and Preformed Sections Coated with Powder Organic Coatings.
BS 6497	Specification for Powder Organic Coatings for Application and Stoving to Hot-Dip Galvanized Hot-Rolled Steel Sections and Preformed Steel Sheet for Windows and Associated External Architectural Purposes, and for the Finish on Galvanized Steel Sections and Preformed Sheet Coated with Powder Organic Coatings.
BS EN 12373-1	Aluminium and Aluminium Alloys. Anodizing. Method for Specifying Decorative and Protective Anodic Oxidation Coatings on Aluminium
ASTM D523	Standard Test Method for Specular Gloss
ASTM D714	Standard Test Method for Evaluating Degree of Blistering of Paints
ASTM D968	Standard Test Method for Abrasion Resistance of Organic Coatings by the Falling Abrasive
ASTM D1400	Standard Test Method for Nondestructive Measurement of Dry Film Thickness of Nonconductive Coatings Applied to a Nonferrous Metal Base
ASTM D1654	Standard Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
ASTM D1730	Standard Practices for Preparation of Aluminum and Aluminum-Alloy Surfaces for Painting

- 7.2 請參照附圖則表 Tender drawing List (P1/2 to P2/2) (Addendum 1)
- 7.3 Facade Material Specification
- 7.4 T1/T3 Heat Soak Test Inspection Log Book
- 7.5 SOM's Specification for External Facade Works
- 7.6 Alpha's Performance Specification for Facade Systems
- 7.7 Technical Specification - BEAM Plus Requirement
- 8 工程說明：
- 8.1 [此項不適用]
- 8.2 [此項不適用]
- 8.3 [此項不適用]
- 8.4 承判人包供應一切材料，包括鋁/鋼/鐵料、磨耳、底掌、玻璃、百葉、五金及唧膠料等，包於適當地方鑽窿及安裝介子供電器承判商安裝水線。承判人需提供足夠位置供其他機電喉管暗藏於鐵架底廊內 (包開界骨廊配合)。包開妥鋁窗玻璃窿位，供電器承判商安裝抽氣扇。
- 8.5 [此項不適用]
- 8.6 承判人須於定判後到地盤覆核所有圖則所示之尺寸及現場實際環境，才好進行繪劃 Shop Drawing。
- 8.7 圖則、工程量清單及工程說明所列之材料尺寸只供參考，如結構或屋宇署需要加大材料之要求 (例如：玻璃厚度、採用 Structural Sealant、改用其它厚料鋼材或增加五金配件等)，承判人須要依指示做妥，不可藉詞索取補價。承判人於計價前須有此預算，主判人不作任何額外補價。
- 8.8 [此項不適用]
- 8.9 承判人包工料做窗邊拉泥 (所有現場安裝的鋁窗/鋁門)，英泥/沙由主判人供應，防水劑由承判人自行提供，包於拉泥完成 100%後，拉泥位試水及於裝妥玻璃唧膠後鋁窗位及鋁門位進行試水。並提交試水報告予主判人。以及外牆窗 / 門四周包工料鬆 150mm 闊 “Masterseal 540 formerly Barralastic” 防水漿。
- 8.10 所有力學數據 (Structure Calculations) 附 RSE endorsement 簽署確認；(Provisional Item)。
- 8.11 主墨線及平水 Bench Mark 由主判人在承判人進場時交予承判人，其餘施工墨線及借墨，由承判人自行負責。
- 8.12 承判人負責定期清理所有剩餘材料及垃圾，所有垃圾須放入垃圾袋，大件之木箱及卡板，包運到地面管工指定地方堆放，由主判人負責夾走。
- 8.13 承判人要根據 BD 之要求/指引及合約內的相關章程/要求，提交 Tempered Glass 之廠証及 Performance Test Report, Heat Soak Process Report (比率為 100%)，Sealant Compatibility Test Report, Sealant Adhesion Report, Print Review Report & Glass Impact Test Report 等以作呈交屋宇署 或呈交則師及結構工程師批核。另外，承判人須提供但不限於以下項目：

- 8.13.1 為配合 Heat Soak Process 之執行, 承判人須提供交通、膳食及住宿予主判人代表 TCP-1 (100%) 及 RSE TCP-3 (30%)。
- 8.13.2 每次 Heat Soak Process 執行時, 承判人須提供最少 2 條 Type K thermocouple 予主判人 TCP-1 作接駁 Data-logger 用, 該 thermocouple 須備有合格 calibration certificate, 而 Data-logger 由主判人自行安排。
- 8.13.3 承判人須編定所有強化玻璃之數量總表及每次 Heat Soak Process 之數量記錄, 以便檢討 Heat Soak Process 進度。
- 8.13.4 承判人須依據 2016 年 3 月 11 日制定的 T1/T3 Inspection Log Book 內的要求 (見 SK-01 至 SK-04) 配合、做妥相關檢測項目。
- 8.13.5 每塊強化玻璃角位離邊位 100mm 須加上一張透明貼紙(貼紙上印上承判人公司、生產商 Logo 及 Heat Soak Test 字樣)。
- 8.13.6 承判人須提供安排配合疫情期間 RSE-T3 親自在香港採用「視訊電話」進行品質監察。
- 8.14 承判人包於所有鋁窗腳拉泥水位置都要留 6mm 吼, 以機電判頭能收水氣線於鋁窗。所有其他項目之框料位置亦須提供水線吼, 位置及數量後定。
- 8.15 申請 O.P.日期暫定為 Phase 1 (T1 至 T6): 2024 年 3 月 / Phase 2 (T7 至 T9/T9A): 2024 年 7 月; 交樓日期暫定為 Phase 1: 2024 年 12 月 / Phase 2: 2025 年 4 月; 保用期為 15 年, 由 Practical Completion 日開始計算。保養期內所有 Defective 項目 (包括物料及手工) 須由承判人包工料做妥一切維修工作直至取得則師/主判人/小業主滿意為止。
- 8.16 [此項不適用]
- 8.17 GMS 全部為永久熱浸鍍鋅鐵, 鍍鋅厚度必須符合屋宇署相關規定/指引的要求。
- 8.18 承判人須於回標時呈交全套初步 Shop Drawing, 列明所有材料尺寸及樣辦主判人考慮, 才作定判。定判後 21 天內要交整套完整 Shop Drawing 予主判人及則樓批核。Shop Drawing 之最低要求如下:
- All detailed elevation
 - Sectional detail
 - Window area and openable area calculation of each window
 - Thickness of glazed panel
 - Information of hinges and other ironmongery
 - Details of supporting elements, i.e. base plate and fixing lug
- 8.19 承判人需於本工程定判後 14 日內提交全部工程之排期表, 內容要包括如下: -
- a. Shop drawing 批圖時間
 - b. 材料訂貨及來料時間
 - c. 各個位置之詳細施工排期表

- 8.35 水電由主判人供應，承判人自行拉線及駁喉取用。
- 8.36 承判人需呈報詳細施工方法及預算施工期予主判人批核後才可開工。主判人有權要求承判人配以足夠或增加人手，以配合工程所需，有關費用已包括在合約總價之內。
- 8.37 凡承判人有關掌位及槽鐵面需於面焊燒硬身批盪網連鐵支，以用作批盪之用。主判人有權要求承判人增加鐵支數量及批盪網的尺寸。一切由承判人包工料做妥，有關費用已包括在合約總價之內。
- 8.38 承判人需包工料在所有焊口位油上防銹油，而承判人所用的防銹油需經則師批核。
- 8.39 承判人需呈交妥所有有關的唧膠，色辦及材料予則師批核。承判人包做妥則師批准之顏色，無論任何顏色，不可藉詞索取補價。承判人於計價前須有此預算，主判人不作任何額外補價。
- 8.40 承判人包工料用 3M 保護膠紙、珍珠棉及保護夾板 (或主判人同意之保護材料) 做妥玻璃 / 鋁料 / 鋼料的保護，並需依照主判人的指示及於指定的時間內清走保護，包括一切有關的費用。
- 8.41 大樓於外牆拆棚前，由承判人包清潔所有外牆玻璃/鋁料/鋼料/唧膠；驗樓前，承判人需依主判人指示做妥內牆清潔至可驗樓為止；最後，交樓前承判人需依主判人指示做妥最後內外牆微細清潔至交貨予小業主收貨為止。(此乃共三個階段清潔要求，清潔完要得主判人接受才算合格，其間承判人包無限次翻清，直至主判人收貨為止)
- 清潔項目附帶之工作細節如下：
- 8.41.1 拆外牆棚架前，承判人須清理框料的保護紙至見回原有框料，若遇有其他物料 (如英泥沙等) 亦需清妥。
- 8.41.2 框料清妥保護膠紙後，須檢查所有框料及玻璃線，若有損壞或刮花者要更換妥當，方可進行唧膠及安裝玻璃。
- 8.41.3 所有框料被其他行業施工時所引致的損毀及染污，承判人需包工料清潔、更換或執補至主判人滿意為止。
- 8.42 若圖則之間存有不同之處，承判人需立即向主判人提出，若因錯誤理解而引致的問題或缺陷，承判人需自己負責，包括一切有關的費用。
- 8.43 主判人有權不定期抽查框料之塗層 Coating 厚度是否符合合約要求，承判人須提供測試儀器。
- 8.44 承判人包一切生財工具 / 小五金。
- 8.45 承判人包一切內外運輸費用，包括機械、貨車、鏟車及人手一切的費用。
- 8.46 保險：承判人包一切機械保險，主判人只負責提供勞工保險及 CAR，如承判人之員工屬於自雇人士，則需自行購買意外或人壽保險，方可進入地盤。
- 8.47 承判人必須妥善地安排及控制所有材料到貨，盡可能即到即安裝，不可早或遲到貨，若因承判人早到貨而將材料暫存地盤，期間引致或出現材料之損壞及缺陷 (包括花痕、彩虹玻璃等)，一切後果由承判人承擔。
- 8.48 預制件項目之特別安排：

新輝(建築管理)有限公司

Sanfield (Management) Ltd.

敬啟者：

有關：T1 職級適任技術人員與玻璃廠熱浸測試配合事宜

為更嚴格執行及遵守屋宇署對熱浸測試過程中的要求，各分判需負責其 T1 職級適任技術人員與玻璃廠作出配合，指引如下：

1. 在熱浸過程中，錄像機和熱浸爐的系統控制屏幕周圍應有適當的圍封及警告，以免有其他工作人員誤碰鏡頭而妨礙拍攝過程；
2. 為避免其他人在熱浸過程中不小心碰撞，錄像機除需要拍攝系統控制屏幕外，拍攝範圍應包括鍵盤，以及應在不影響電腦系統運行下拔除熱浸爐控制面板的鼠標控制，令其他人不能涉及熱浸過程；
3. 在熱浸測驗開始和結束階段，螢幕應顯示隱藏的熱電偶數據及其曲線，以供 T3 代表參考；
4. 熱浸測試完成後半小時內需提供熱浸測試曲線的 Excel 檔案，以便 T3 代表監測玻璃表面最大升溫速率；
5. 工廠代表要與 T3 代表保持良好的配合，確保 T3 代表的指令能夠全面傳遞到工廠，如果工廠代表在熱浸測試中需要離開（如休息、用膳或上洗手間），必須先向 T3 代表報告，並且必須得到 T3 代表的批准方能離開。此外，工廠代表必須與 T3 代表維持聯繫，直至重返工作崗位；
6. 根據香港屋宇處 PNAP APP-37 內要求，T1 必須持續不間斷地進行監督工作，因此如 T1 在熱浸測試過程中需要用膳，必須先與工廠代表聯繫，並且請其協助購買食物，不得擅自離開崗位。

隨函附上 PNAP APP-37 第五頁的相關要求以供參考。

此致

各鋁窗 / 幕牆 / 玻璃欄河承判商



馮志安

建築部購料組

購料總監

二零二二年七月六日

WMS/TC/EC/mc


the B(A)R at least 14 days before the commencement of the tempered glass production in the factory. A standard form of supervision plan together with a list of typical items for quality supervision and a sample of the inspection record are provided in Appendix B for reference.

Qualified supervision

(c) the required qualified supervision under item 6 of section 17(1) of the BO should be provided as follows-

(i) the RSE should assign a quality control supervisor (QCS) to supervise a certain number of tempered glass panes undergoing the heat soak process. The RSE should determine the necessary frequency of supervision, which should cover at least 30% of the number of tempered glass panes used in the project. The minimum qualifications and experience of the QCS are to be the same as grade T3 technically competent person (TCP) under the RSE's stream, as stipulated in the Code of Practice for Site Supervision 2009 (2021 edition) (Supervision Code). As an alternative, the RSE's QCS may employ videotelephony³ to conduct supervision. In this connection, the QCS should work with his/her assistant in the factory who is not a member of the team of supervisory personnel of the RC stream providing the required continuous supervision;

(ii) the RC should assign a quality control co-ordinator (QCC) to provide full time continuous supervision of the heat soak process of all tempered glass panes in the factory. The minimum qualifications and experience of the QCC are to be the same as grade T1 TCP under the RC's stream, as stipulated in the Supervision Code. To ensure the heat soak process is properly conducted by the glass manufacturer, the QCC should measure the glass surface temperature independently by using his/her own data logger. The information recorded by the data logger should be set at one-minute intervals and kept in the factory; and

(iii) the names and qualifications of the QCS and QCC of the RSE and the RC respectively should be recorded in their inspection log books. The details of heat soak process for tempered glass panes should also be recorded in their log books and kept in the factory. If the alternative arrangement of employing videotelephony as described in

/paragraph ...

³ Videotelephony means two-way simultaneous communication with both audio and video in real time through telephone or computer network connections. The video should be recorded in colour with resolution of not less than 480p in a non-rewritable DVD-ROM.