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INSPECTION REPORT

Report No.: JC2025A09A00017E

Entrusted by: Shandong Lanjing Glass Technology Co., Ltd.

Inspection Object: Heat Soak Oven for tempered glass

Inspection Category: Entrustment Inspection

China Testing & Certification International Group Co., Ltd.

JC2025A09A00017

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China Testing & Certification International Group Co., Ltd.

Inspection Report

Entrusted by	Shandong Lanjing Glass Technology Co., Ltd.
Authorized by	Shandong Lanjing Glass Technology Co., Ltd.
Address	3,500 meters west of Yinjia Village, at the southern end of Juyuan, Wangcun Town, Zhoucun District, Zibo City, Shandong Province
Inspection Object	Heat Soak Oven for tempered glass
Inspection Item	Heat soaked thermally process and system inspection
Inspection Methods	BS EN 14179-1:2016 Annex A
Criterion	BS EN 14179-1:2016 Annex A
Date of Inspection	12/11/2025~13/11/2025
Conclusion	* The inspection results conform to the requirement of BS EN 14179-1:2016 Annex A. The inspection results are shown from page 2 to page 15.* **Date of issue:** 2025-11-21 **(Seal)**
Remarks : （Blank）	

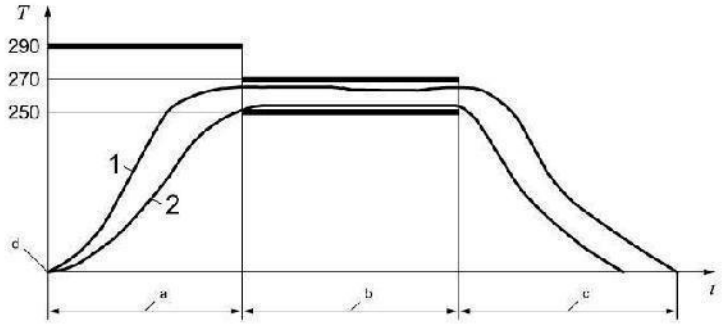
Approved by: **Checked by:** **Compiled by:**

1. Purpose of heat soak process

NiS is a kind of crystal, there are two kinds of crystal phase, high temperature phase α-NiS and phase β-NiS. Volume expand when high temperature hexagonal crystal system α- NiS transform into low temperature trigonal crystal system β-NiS. When the glass is heated in a tempering furnace, NiS transforms to α-phase, in the quenching process, not all α-NiS transforms into β-NiS, part of α-NiS is frozen and cool down to room temperature together with the tempered glass. However, at room temperature, α-NiS is not stable, tends to β-NiS. When the crystal phase transformation occurs, the internal volume expands. Volume expansion will produce micro cracks in the debris around, when the crack extend into the tensile stress region, sudden fracture occur, and this is what called “spontaneous breakage”. The heat soak process is to heat the tempered glass to about 260℃ again, and kept for several hours so that α to β transformation is accelerated, and push the glass that maybe break during its working life time to break before it is released from plant.

2. Briefing of BS EN 14179-1:2016

The heat soak process cycle consists of a heating phase, a holding phase and a cooling phase (see Fig. 1).



Key

*T:*glass temperature at any point, °C; *t:*time, h;

1: first glass to reach 250 °C; 2: last glass to reach 250 °C;

a: heating phase; b: holding phase; c: cooling phase; d: ambient temperature

Fig. 1 Heat soak process cycle

2.1 Heating phase

The heating phase commences with all the glasses at ambient temperature and concludes when the surface temperature of the last glass reaches 250 °C. To facilitate economic heating, the air temperature within the oven may exceed 290 °C. However, the glass surface temperature shall not be allowed to exceed 290 °C. The period of glass surface temperature in excess of 270 °C shall be minimized.

2.2 Holding phase

The holding phase commences when the surface temperature of all the glasses has reached a temperature of 250 °C. The duration of the holding phase is 2 h.

Precise oven control is necessary in order to ensure that the glass surface temperature shall be maintained in the range of 260 °C ±10 °C during the holding phase.

2.3 Cooling phase

The cooling phase commences when the last glass to reach 250 °C has completed its holding phase. During this phase the glass temperature shall be brought down to ambient temperature.

The cooling phase can be concluded when the air temperature in the oven reaches 70 °C.

The rate of cooling should be controlled to minimize the risk of glass breakage as a result of thermal stress.

3. Summary of the inspection procedure

3.1 Calibrate 20 thermocouples against a reference thermocouple.

3.2 Check and record the size and amount of glass panels to be heat soaked and calculate the total weight. The glass density is 2.5g/cm^3.

3.3 Check and record the size, material and shape of the used glass separators.

3.4 Stick the thermocouple on the glass panels' surfaces and ensure there is a good contact with the glass surface. Location of thermocouples when full load is shown in Fig.3.

3.5 Close the oven door, connect all thermocouples on the data logger, and set parameters on

the data logger.

3.6 Confirm that the temperature in the heat soak oven does not exceed 40℃， The heat soak process is started according to the procedure set by the plant，The data logger began recording automatically.

3.7 Record all thermocouple readings every 30 seconds during the heating phase, holding phase and cooling phase.

3.8 Confirm that the doors of the oven are not allowed to be opened until the temperature of the control element has dropped to 70°C, stop the data logger and end the whole heat soak process.

3.9 The data in the data logger is collated and analyzed and the heat soak process curve is obtained. Find out the highest temperature of each temperature monitoring point recorded by the data logger in the heat soak process, and mark the four temperature monitoring points with the highest temperature and the four temperature monitoring points with the lowest temperature. Find out the first, the second， the last and the second last to reach 250℃ temperature monitoring points in the heating phase respectively.

4. Inspection equipment

The inspection equipment is shown in Table 1.

Table 1

Equipment name	Equipment type	Equipment serial number	Date of expiry
Data logger	GL840	J-100	11/08/2026
Thermocouples	Type J	/	14/11/2025
Steel measuring tapes	10m	J-49-5	27/04/2026
Digital vernier caliper	200mm	Q-48	28/04/2026

5. Size, Quantity and Weight of glass

Full load is shown in Table 2.

Table 2

Length/mm	Width/mm	Thickness/mm	Quantity /pcs	Weight/kg
3344	1254	12	12	1509.6
3344	1254	12	10	1258.0
3456	1334	12	2	276.6
3344	868	12	4	348.3
3456	868	12	2	180.0
3456	951	12	2	197.2
3344	568	12	2	114.0
Total			34	3883.7

6. Heat Soak Oven

Heat soak oven information is shown in Table 3.

Table 3

Heat soak oven, type	2560
Heat soak oven, producer	Humamglass Machine Engineering Co., Ltd.
Location of oven	workshop of plant
Outside size (L× W× H)/mm	6800×2800×3800
Internal size (L× W× H)/mm	6300×1850×3000

Fig.2 Heat Soak oven of Shandong Lanjing Glass Technology Co., Ltd.

7. Inspection result

7.1 Full load inspection result is shown in Table 4 and Table 5.

Table 4

Weight of Glass	3883.7kg
t_1 time for the first thermocouple and a glass to reach a temperature of 250 °C	123min
T_{c1} temperature of control element at time t_1	260°C
T_{cmax} maximum temperature of the control element during the heating phase	260°C
t_{cmax} time at which T_{cmax} occurs	115min
t_2 time for the last thermocouple and a glass to reach a temperature of 250 °C	181min
Minimum holding time for the thermocouple and a glass at 260°C±10°C	132min
Was the air temperature in the oven at the beginning of the calibration ≤ 40 °C?	Yes
Did any glass temperature exceed 290°C at any time?	No
Was the heating rate not greater than 3°C/min in the heating phase?	Yes
T_c temperature of control element (at any time)	Shown in Fig.4
T_{glass} temperature of the glass surface, measured by the thermocouples (at any time)	Shown in Fig.5
Glass separation distance	20mm
Separator position, material, shape	Top of the glass, PTFE, L-shaped
Stillage(s) configuration	1st category, double sided stillage

Table 5

Location	Heat up time to 250℃/min	Remark	Max. Temp. Records/℃	Remark
1	123	First to reach	261.4	The Highest
2	137	----	257.2	----
3	126	2nd to reach	260.7	3rd Highest
4	144	----	255.8	4th Lowest
5	173	2nd Last to reach	258.7	----
6	144	----	259.5	4th Highest
7	140	----	256.3	----
8	145	----	256.2	----
9	131	----	261.3	2nd Highest
10	167	----	258.2	----
11	130	----	259.4	----
12	160	----	253.7	3rd Lowest
13	153	----	252.4	2nd Lowest
14	140	----	255.9	----
15	181	Last to reach	256.8	----
16	159	----	258.2	----
17	145	----	256.2	----
18	161	----	252.1	The Lowest
19	137	----	259.1	----
20	168	----	256.8	----

8. Suggestions for heat soak process control settings in plant

8.1 The temperature control program settings of heat soak oven in the process of inspection is shown in Table 6.

Table 6

Load	Setting temperature/℃	Heating phase /min	Holding phase /min
Full	260	115	150

8.2 According to BS EN 14179-1:2016 Annex A, the temperature control program of heat soak oven in Clause 8.1 meet the requirements. So daily heat soak process control can be carried out according to Clause 8.1.

8.3 Based on the inspection data, we suggest that at least 8 locations in Fig.13 shall be monitored during the daily heat soak process.

9.Validity of the report

One year from the issue date.

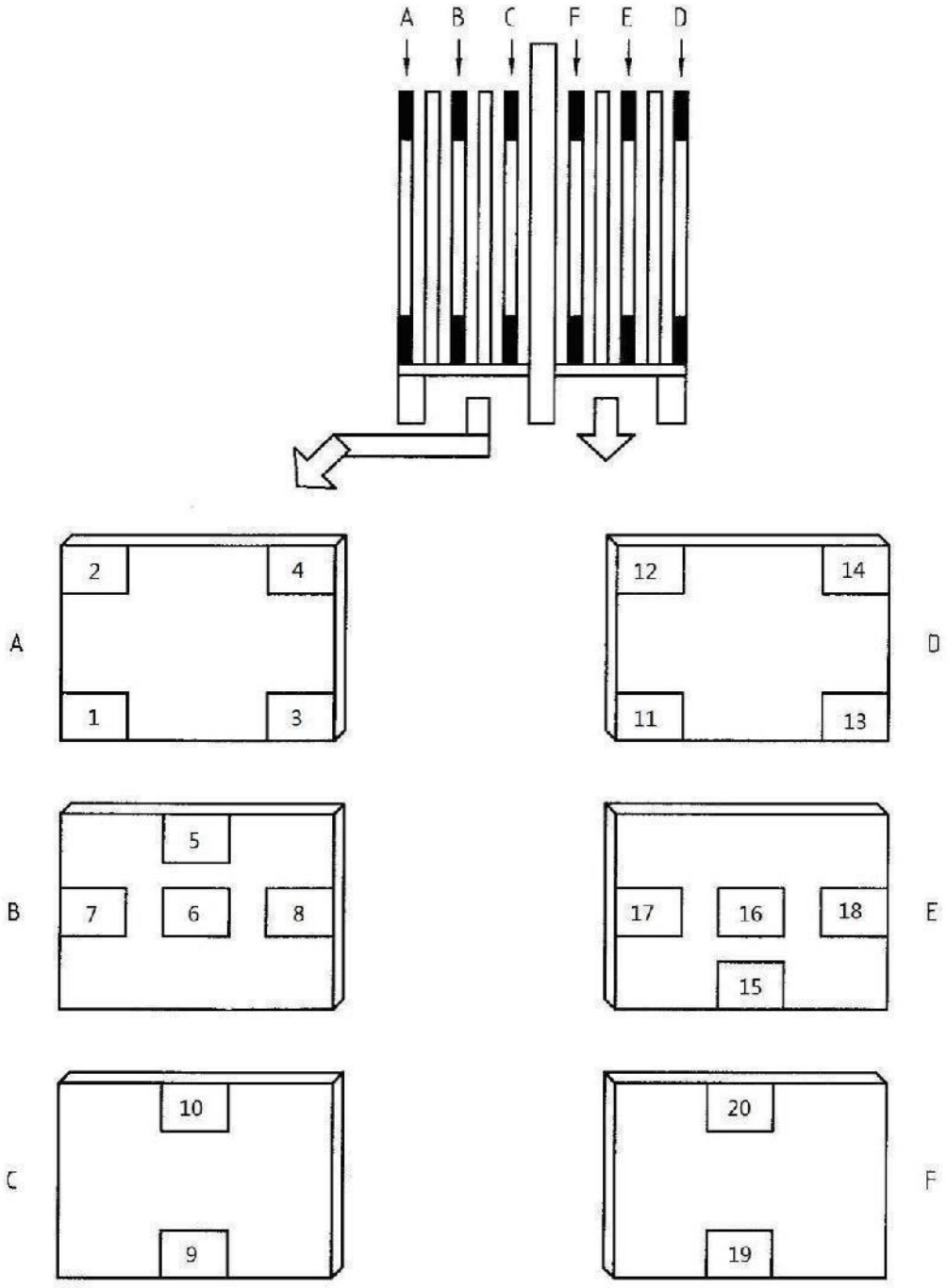


Fig.3 Location of thermocouples (Full load)

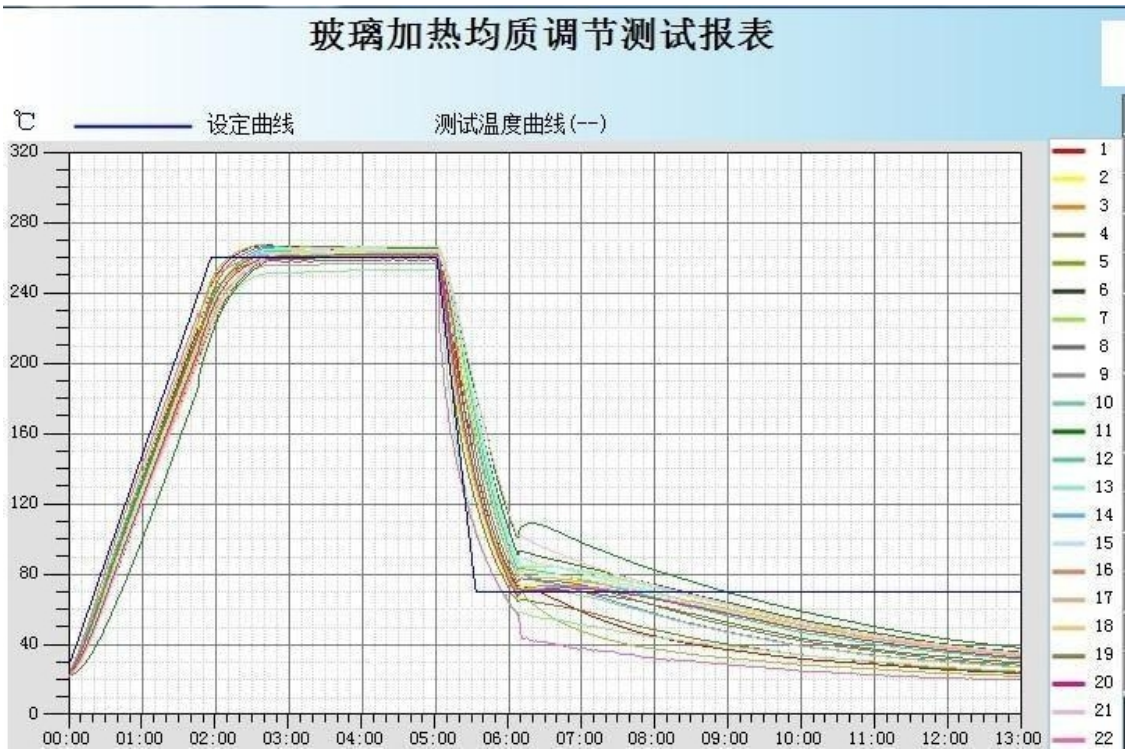


Fig. 4 Heat soak oven temperature, Full load, record automatically (control element)

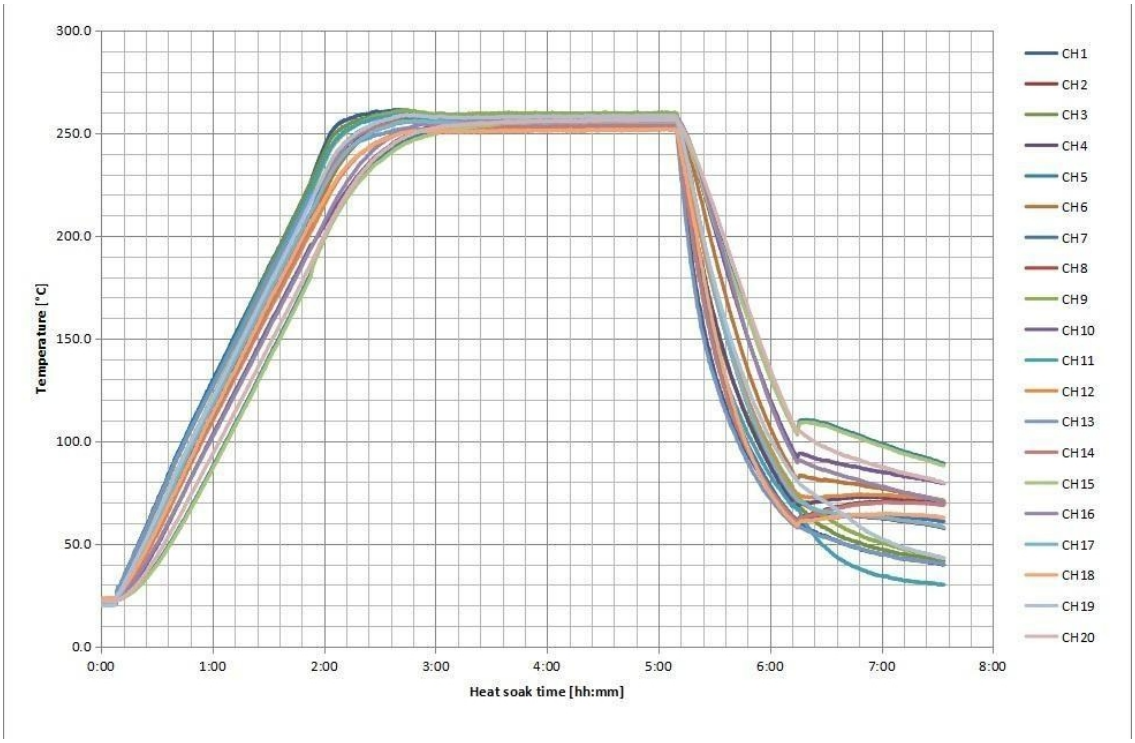


Fig.5 Heat soak oven temperature, Full load, Glass surface temperature records

Fig.6 Measure the dimension of glass

Fig.7 Measure the thickness of glass

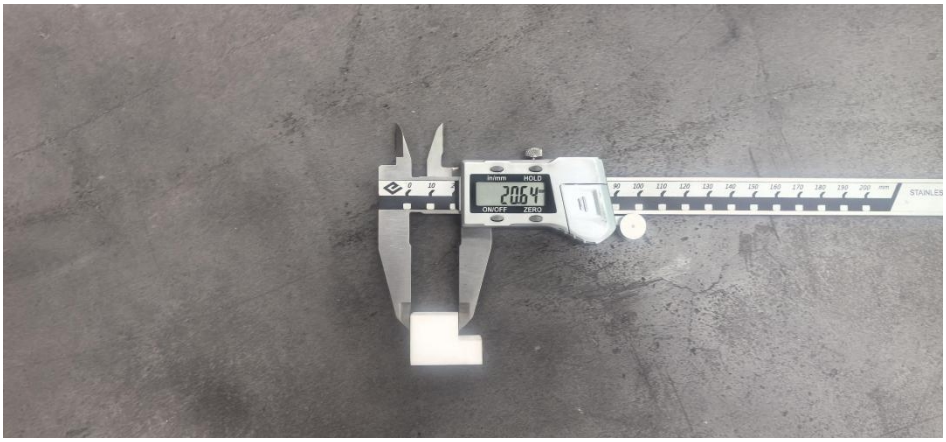


Fig.8 Measure the dimension of separator

Fig.9 Heat soak oven temperature control machine

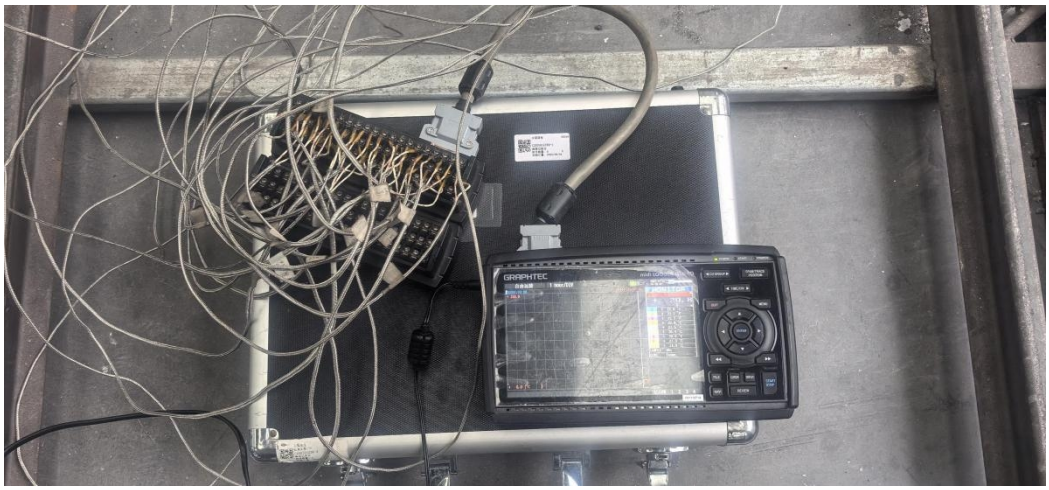


Fig.10 GL840 Data Logger in working

Fig.11 Glass before heat soak, Full load

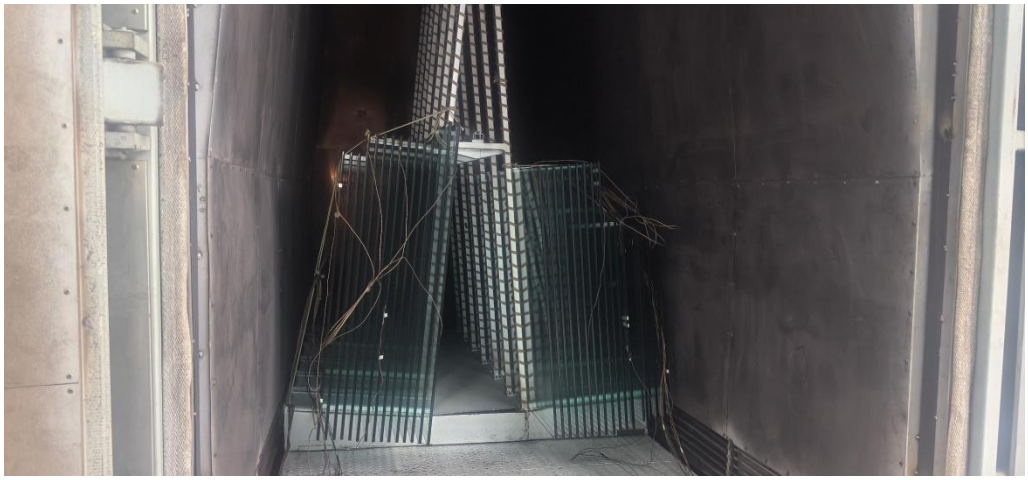


Fig.12 Glass after heat soak, Full load

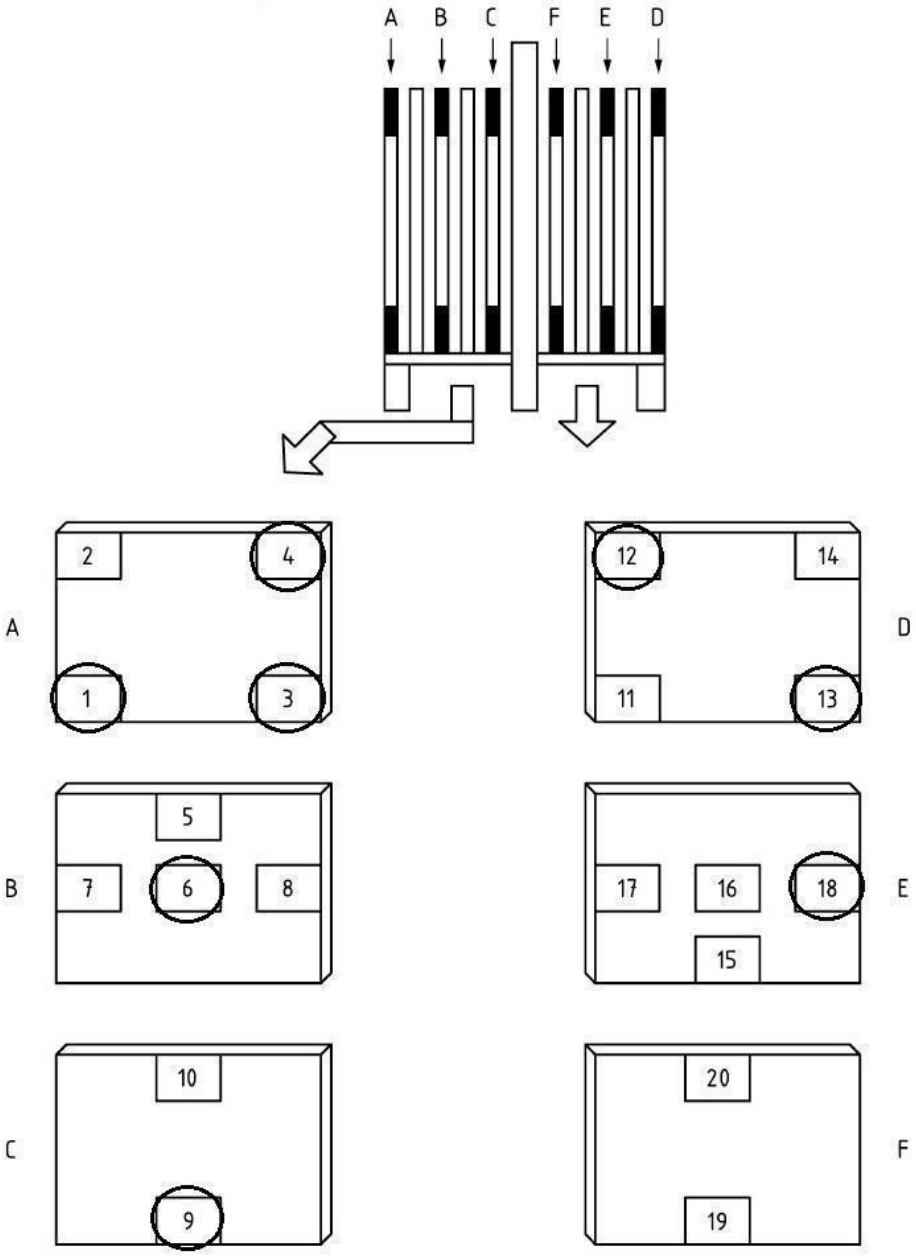


Fig.13 Suggested 8 Thermocouples Positions for Daily Operations

The end of the report