ZERTIFIKAT ◆ CERTIFICATE ◆ СЕРТИФИКАТ ◆ CERTIFICADO ◆ CERTIFICAT

Certificate of Conformity

Certificate No.: UTT202211917C

Date of Issued: Nov. 22, 2022

The EUT described above has been test by us with the listed standards and found in compliance with the council **MD Directive 2006/42/EC&LVD Directive 2014/35/EU&EMC Directive 2014/30/EU**, So Universal Test Technology hereby acknowledges that the Manufacturer may issue a COC apply the CE marking in accordance with European Union Rules.

Certificate Holder:	WIAIR CORPORATION (SHANGHAI) CO., LTD
Address:	No.540,2/F, Lane 500, XinNongHe Road, Song Jiang District, Shanghai 201619, China
Manufacturer:	1teck Automation Technology Co., Ltd.
Address:	2nd Floor, Building 2, No. 529, Jinyuan Road, Gaoyang Village Industrial Zone, Shimen Town, Tongxiang City, Jiaxing City, Zhejiang Province, Post Code : 314512
Product Name:	Paper-Bubble Machine
Brand Name:	wiAIR®
Model(s):	PB340、 PB340pro、PB-340、 PB-340pro
Rating:	Input: 100-230V~, 50Hz, 120W
Standard:	LVD: EN 60204-1:2018; MD: EN ISO 12100:2010; EMC: EN IEC 61000-6-2:2019; EN IEC 61000-6-4:2019; EN 61000-3-12: 2011; EN 61000-3-3: 2013+A1:2019
Test Report No.:	EMC: UTT202211917E LVD: UTT202211918S MD: UTT202211919M

Joseph Zhang

For and on behalf of
Universal Test Technology

CE

Shenzhen Universal Test Technology Service Co., Ltd.
10/F., Building 153, Yucui New village, Yucui Community, Longhua street, Longhua district, Shenzhen , Guangdong, China.
Tel.: +86-755-33146812 E-mail: service@utt-cert.com Website: www.uttcert.com

TEST REPORT

EN IEC 61000-6-2:2019/EN IEC 61000-6-4:2019
EN 61000-3-12: 2011/EN 61000-3-3: 2013+A1:2019

Report Reference No..... :	**UTT202211917E**
Compiled by (position+printed name+signature).. :	File administrators Jowin Huang
Supervised by (position+printed name+signature).. :	Test Engineer Bill Wu
Approved by (position+printed name+signature).. :	Manager Aiden Zhang
Date of issue..... :	Nov. 22, 2022
Representative Laboratory Name.. :	**Shenzhen Universal Test Technology Service Co., Ltd.**
Address..... :	10/F., Building 153, Yucui New village, Yucui Community, Longhua street, Longhua district, Shenzhen , Guangdong, China.
Applicant's name..... :	**WIAIR CORPORATION (SHANGHAI) CO., LTD**
Address..... :	No.540,2/F, Lane 500, XinNongHe Road, Song Jiang District,Shanghai 201619, China
Test specification..... **:**	
Standard..... :	EN IEC 61000-6-2:2019/EN IEC 61000-6-4:2019 EN 61000-3-12: 2011/EN 61000-3-3: 2013+A1:2019
TRF Originator..... :	**Shenzhen Universal Test Technology Service Co., Ltd.**
Master TRF..... :	Dated 2019-12

Product Name ..... :	Paper-Bubble Machine
Trade Mark..... :	WIAIR®
Manufacturer..... :	1teck Automation Technology Co., Ltd.
Address..... :	2nd Floor, Building 2, No. 529, Jinyuan Road, Gaoyang Village Industrial Zone, Shimen Town, Tongxiang City, Jiaxing City, Zhejiang Province, Post Code : 314512
Model/Type reference..... :	PB340、 PB340pro、PB-340、 PB-340pro
Ratings..... :	Input: 100-230V~, 50Hz, 120W
Result..... :	**PASS**

TEST REPORT

Test Report No. :	UTT202211917E	Nov. 22, 2022 Date of issue

Equipment under Test	:	Paper-Bubble Machine
Model /Type	:	PB340、 PB340pro、PB-340、 PB-340pro
Applicant	:	**WIAIR CORPORATION (SHANGHAI) CO., LTD**
Address	:	No.540,2/F, Lane 500, XinNongHe Road, Song Jiang District, Shanghai 201619, China
Manufacturer	:	**1teck Automation Technology Co., Ltd.**
Address	:	2nd Floor, Building 2, No. 529, Jinyuan Road, Gaoyang Village Industrial Zone, Shimen Town, Tongxiang City, Jiaxing City, Zhejiang Province, Post Code : 314512

Test Result	PASS

The test report merely corresponds to the test sample.
It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

Contents

1. TEST STANDARDS

The tests were performed according to following standards:

PASS Indicates that the test is applicable
N/A Indicates that the test is not applicable

Standard	Test Items	Status
EN IEC 61000-6-4:2019	Disturbance Voltage at The Mains Terminals (150KHz To 30MHz)	PASS
	Radiated Disturbances (30MHz To 1000MHz)	PASS
EN 61000-3-12: 2011	Limits for harmonic currents produced by equipment connected to public low-voltage systems with input current > 16 A and <= 75 A per phase	PASS
EN 61000-3-3:2013/A1:2019	Voltage Fluctuations	PASS
EN61000-4-2:2009	Electrostatic discharge Immunity	PASS
EN61000-4-3:2006/A2:2010	Radiated Susceptibility (80MHz to 1GHz)	PASS
EN61000-4-4:2012	Electrostatic Fast Transient/Burst Immunity	PASS
EN61000-4-5:2014/A1:2017	Surge Immunity	PASS
EN61000-4-6:2014/AC:2015	Conducted Susceptibility (150KHz to 80MHz)	PASS
EN61000-4-8:2010	Power Frequency Magnetic Field Immunity (50/60Hz)	PASS
EN61000-4- 11:2004/AC:2017	Voltage Dips Short Interruptions Immunity Tests	PASS

2. SUMMARY

2.1. General Remarks

Date of receipt of test sample	:	Nov. 16, 2022
Testing commenced on	:	Nov. 16, 2022
Testing concluded on	:	Nov. 04, 2022

2.2. Product Description

Product Name:	Paper-Bubble Machine
Trade Mark:	wiAIR®
Model/Type reference:	PB340、 PB340pro、PB-340、 PB-340pro
Power supply:	Input: 100-230V~, 50Hz, 120W

2.3. EUT configuration

The following peripheral devices and interface cables were connected during the measurement:

○ - supplied by the manufacturer
○ - supplied by the lab

○		M/N:	
		Manufacturer:	

2.4. Modifications

No modifications were implemented to meet testing criteria.

3. TEST ENVIRONMENT

3.1. Address of the test laboratory

Shenzhen Universal Test Technology Service Co., Ltd.
10/F., Building 153, Yucui New village, Yucui Community, Longhua street, Longhua district, Shenzhen , Guangdong, China.

3.2. Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Normal Temperature:	15-35 ° C
Lative Humidity	30-60 %
Air Pressure	950-1050mbar

3.3. Statement of the measurement uncertainty

All measurements contained in this report were conducted with CISPR 16- 1, radio disturbance and immunity measuring apparatus, and CISPR16-2, Method of measurement of disturbances and immunity.
All measurement required was performed at laboratory of Shenzhen Universal Test Technology Service Co., Ltd.

Test	Range	Measurement Uncertainty	Notes
Radiated Emission	30~1000MHz	4.10 dB	(1)
Radiated Emission	1~18GHz	4.32 dB	(1)
Conducted Disturbance	0.15~30MHz	3.12 dB	(1)

(1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

3.4. Equipments Used during the Test

Conducted Emission						
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal.Due
1	EMI Test Receiver	ROHDE & SCHWARZ	ESCI	101102	2022/9/18	2023/9/17
2	Artificial Mains	ROHDE & SCHWARZ	ESH2-Z5	893606/008	2022/9/18	2023/9/17
3	Pulse Limiter	Agilent	11947A	3107A04120	2022/9/18	2023/9/17

Radiated Emission						
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal.Due
1	ULTRA-BROADBAND ANTENNA	Schwarzbeck	VULB9163	000976	2022/9/18	2023/9/17
2	EMI Test Receiver	Rohde&Schwarz	ESCI	101102	2022/9/18	2023/9/17
3	Horn Antenna	Schwarzbeck	BBHA 9120D	01622	2022/9/18	2023/9/17
4	Pre-Amplifier	Schwarzbeck	BBV 9743	#202	2022/9/18	2023/9/17
5	Pre-Amplifier	Chenyi	EMC051845B	980355	2022/9/18	2023/9/17

Harmonic Current/ Voltage Fluctuation and Flicker						
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal.Due
1	Harmonic and Flicker Analyzer	EMC Partner	HARMONICS 1000	HAR1000-1P 230V-0221	2022/9/18	2023/9/17

Electrostatic Discharge						
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal.Due
1	ESD Simulators	EMC Partner	ESD3000	ESD3000-1680	2022/9/18	2023/9/17

Electrical Fast Transient/Surge/Dips						
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal.Due
1	Ultra Compact Simulator	EMC Partner	TRANSIENT3000	TRA3000 F5-S-D-V-1527	2022/9/18	2023/9/17

RF Field Strength Susceptibility						
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal.Due
1	SIGNAL GENERATOR	IFR	2032	203002/100	2022/9/18	2023/9/17
2	AMPLIFIER	AR	150W1000	301584	2022/9/18	2023/9/17
3	DUAL DIRECTIONAL COUPLER	AR	DC6080	301508	2022/9/18	2023/9/17
4	POWER HEAD	AR	PH2000	301193	2022/9/18	2023/9/17
5	POWER METER	AR	PM2002	302799	2022/9/18	2023/9/17
6	Bilog Antenna	ETS-LINDGREN	3142D	00135452	2022/9/18	2023/9/17

Conducted Susceptibility						
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal.Due
1	CS Test system	Frankonia	CIT-10-75	126B1333	2022/9/18	2023/9/17
2	6dB Attenuator	Frankonia	75-A-FFN-06	1509	2022/9/18	2023/9/17
3	CDN	Frankonia	M2+M3	A2210239	2022/9/18	2023/9/17

The calibration interval is 1 year.

4. TEST CONDITIONS AND RESULTS

4.1. EMISSION

4.1.1. Radiated Emission

LIMIT

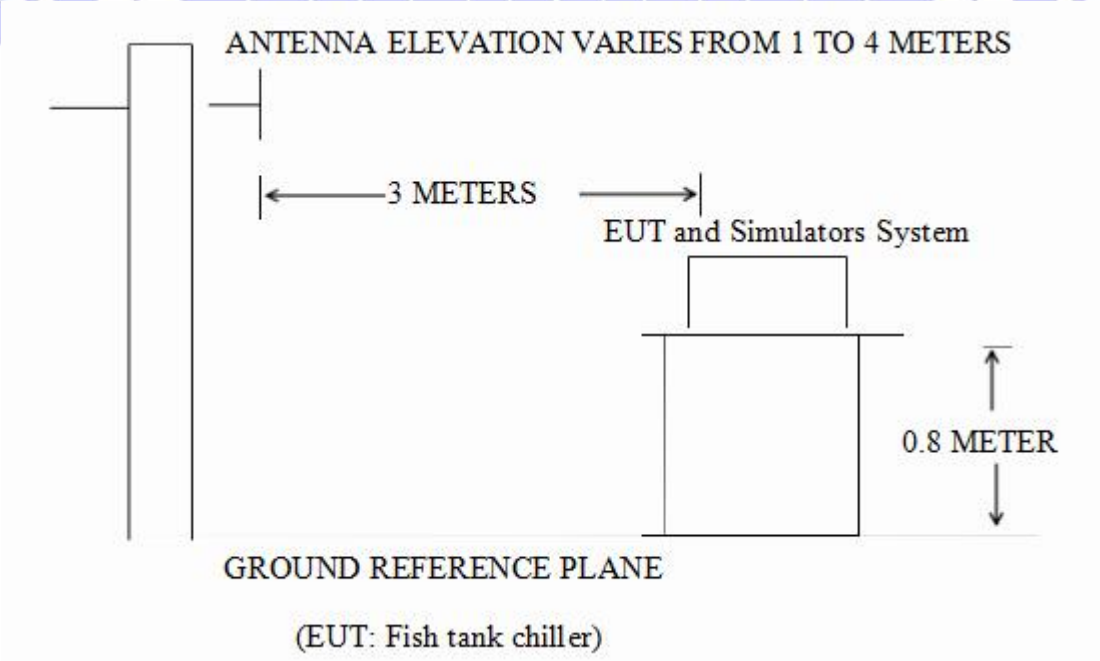
EN IEC 61000-6-4: 2019
Radiated Emission Limits
including any network ofconductors and apparatus connected thereto, shall not exceed the level of field strengths specified below:

FREQUENCY (MHz)	DISTANCE (Meters)	FIELD STRENGTHS LIMIT (dBμV/m)
30 ~ 230	3	50
230 ~ 1000	3	57

Note: (1) The smaller limit shall apply at the combination point between two frequency bands.
(2) If the internal emission source(s) is operating at a frequency below 9 kHz then measurements need only to be performed up to 230 MHz.
(3) Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part ofthe EUT.

TEST CONFIGURATION

Block diagram of test setup (In chamber):



(EUT: Fish tank chiller)

TEST PROCEDURE

The EUT is placed on a turn table which is 0.8 meter high above the ground. The turn table can rotate 360 degrees to determine the position ofthe maximum emission level. The EUT is set 3 meters away from the receiving antenna which is mounted on a antenna tower. The antenna can be moved up and down from 1 to 4 meters to find out the maximum emission level. Bilog antenna (calibrated by Dipole Antenna) is used as a receiving antenna. Both horizontal and vertical polarization ofthe antenna are set on test.

The bandwidth of the Receiver (ESCS30) is set at 120kHz.

The frequency range from 30MHz to 1000MHz is investigated.

Radiation Uncertainty: Ur = ± 3.84 dB

EUT Configuration on Test

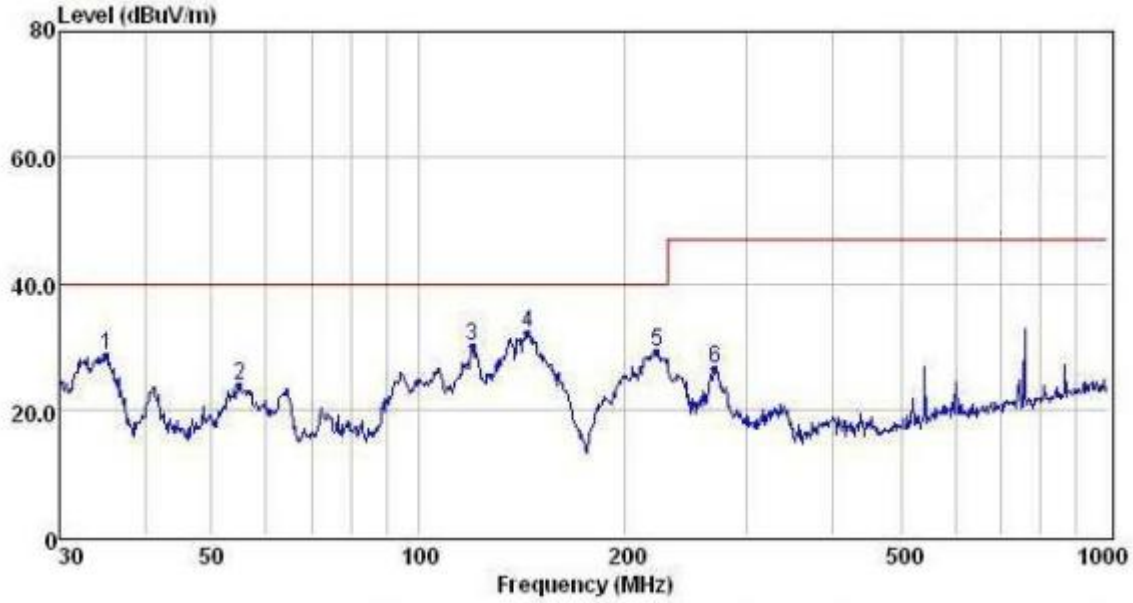
The EN 61000-6-4 regulations test method must be used to find the maximum emission during radiated emission measurement.

TEST RESULTS

Passed

Please refer to the below test data:

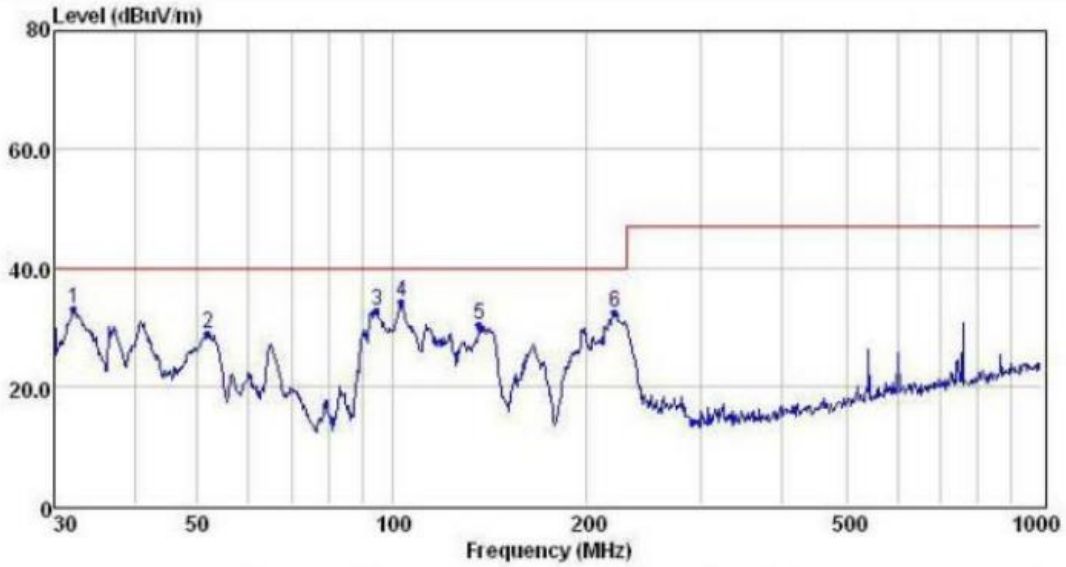
Test mode:	Mode 1	Polarization	Horizontal



	Freq	Reading	CabLos	Antfac	Measured	Limit	Over	Remark
	MHz	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1	35.13	15.76	0.41	12.33	28.50	40.00	-11.50	QP
2	54.83	10.40	0.46	13.03	23.89	40.00	-16.11	QP
3	119.86	18.89	0.64	10.51	30.04	40.00	-9.96	QP
4	144.33	23.34	0.71	8.22	32.27	40.00	-7.73	QP
5	222.17	16.86	0.95	11.30	29.11	40.00	-10.89	QP
6	270.37	13.13	0.99	12.37	26.49	47.00	-20.51	QP

Note: 1. All readings are Quasi-peak values.
2. Measured= Reading + Antenna Factor + Cable Loss
3. The emission that are 20db below the official limit are not reported

Test mode:	Mode 1	Polarization	Vertical



	Freq	Reading	CabLos	Antfac	Measured	Limit	Over	Remark
	MHz	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1	32.18	20.31	0.37	12.32	33.00	40.00	-7.00	QP
2	51.84	15.12	0.54	13.17	28.83	40.00	-11.17	QP
3	94.76	19.34	0.58	12.79	32.71	40.00	-7.29	QP
4	103.44	20.70	0.61	12.85	34.16	40.00	-5.84	QP
5	136.46	21.30	0.70	8.45	30.45	40.00	-9.55	QP
6	220.62	20.32	0.95	11.23	32.50	40.00	-7.50	QP

Note: 1. All readings are Quasi-peak values.
2. Measured= Reading + Antenna Factor + Cable Loss
3. The emission that are 20db below the official limit are not reported

4.1.2. Conducted Emission (AC Mains)

LIMIT

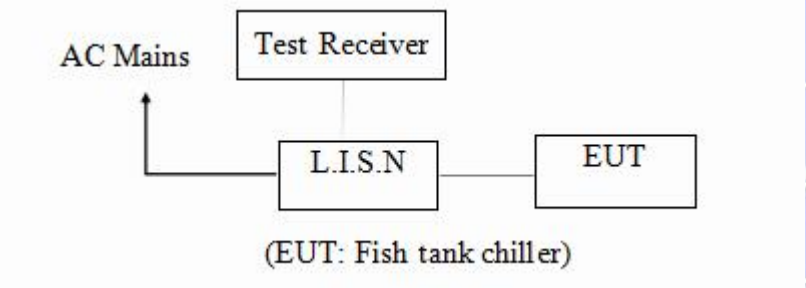
EN IEC 61000-6-4: 2019

Power Line Conducted Emission Limits

Frequency (MHz)	Limit (dBμV)	
	Quasi-peak Level	Average Level
0.15 ~ 0.50	79	66
0.50 ~ 30.00	73	60
NOTE- Impulse noise(clicks) which occur less than five times per minute is not considered. For clicks appearing more often than 30 times per minute the limits apply. For clicks appearing between 5 and 30 times per minute, a relaxation of the limits is allowed of 20 log 30/ N dB (where N is the number of clicks per minute). Criteria for separated cli cks may be found in CISPR 14-1.		

TEST CONFIGURATION

Block Diagram of Test Setup



TEST PROCEDURE

The EUT is put on the plane 0.8m high above the ground by insulating support and connected to the AC mains through Line Impedance Stability Network (L.I.S.N). This provided a 50ohm coupling impedance for the tested equipments. Both sides of AC line are investigated to find out the maximum conducted emission according to the EN 61000-6-4 regulations during conducted emission measurement.

The bandwidth of the field strength meter (R&S Test Receiver ESCS30) is set at 9KHz in 150KHz~30MHz and 200Hz in 9KHz~150KHz.

The frequency range from 150kHz to 30MHz is investigated .

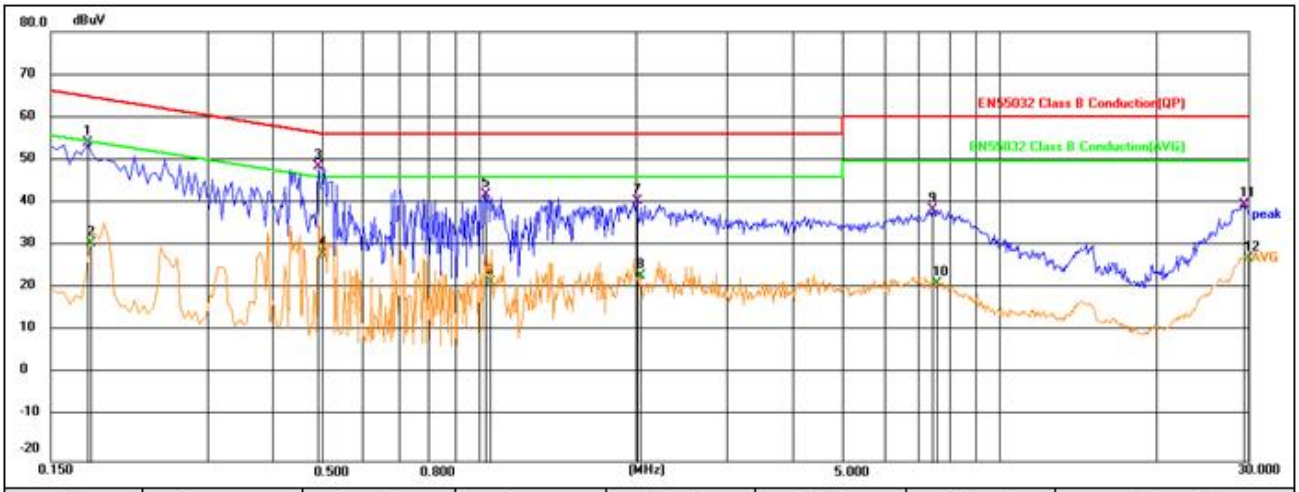
Conduction Uncertainty: Uc = ± 2.72 dB

EUT Configuration on Measurement

The following equipments are installed on Conducted Emission Measurement to meet EN61000-6-4 requirements and operating in a manner which tends to maximize its emission characteristics in a normal application.

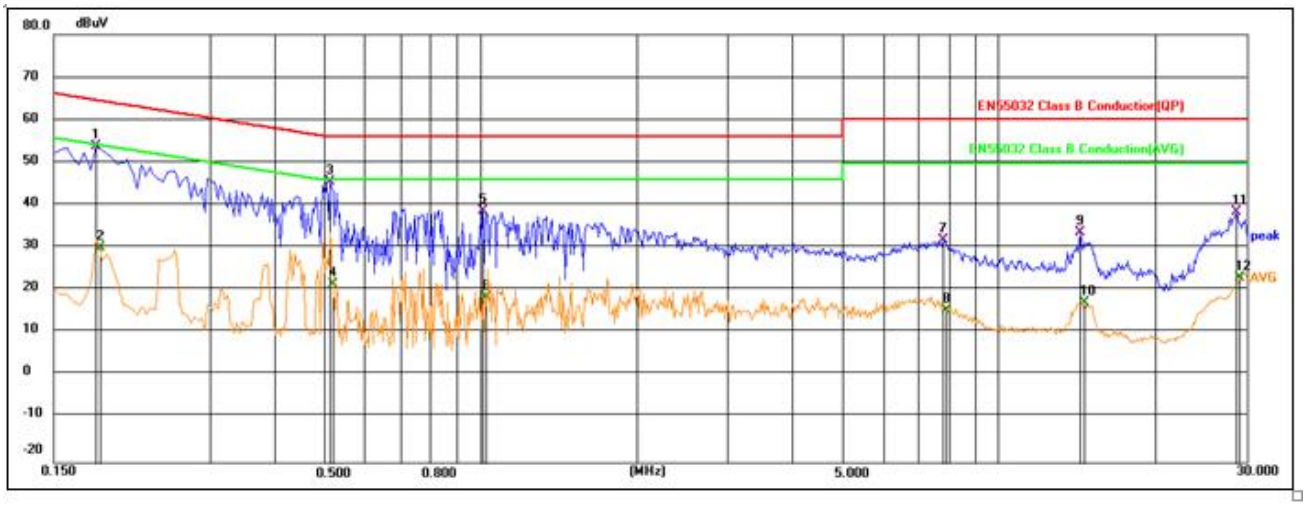
TEST RESULTS

Test mode:	Mode 1	Polarization	L



No.	Frequency (MHz)	Reading (dBuV)	Correct (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	0.1771	42.53	11.53	54.06	64.62	-10.56	QP
2	0.1796	19.28	11.53	30.81	54.50	-23.69	AVG
3	0.4921	37.15	11.52	48.67	56.13	-7.46	QP
4	0.5011	16.62	11.52	28.14	46.00	-17.86	AVG
5	1.0276	30.15	12.00	42.15	56.00	-13.85	QP
6	1.0456	9.60	12.01	21.61	46.00	-24.39	AVG
7	2.0086	28.15	12.40	40.55	56.00	-15.45	QP
8	2.0401	10.83	12.40	23.23	46.00	-22.77	AVG
9	7.4761	26.35	12.32	38.67	60.00	-21.33	QP
10	7.5841	9.19	12.32	21.51	50.00	-28.49	AVG
11	29.6611	26.80	13.10	39.90	60.00	-20.10	QP
12	30.0000	14.14	13.08	27.22	50.00	-22.78	AVG

Test mode:	Mode 1	Polarization	N



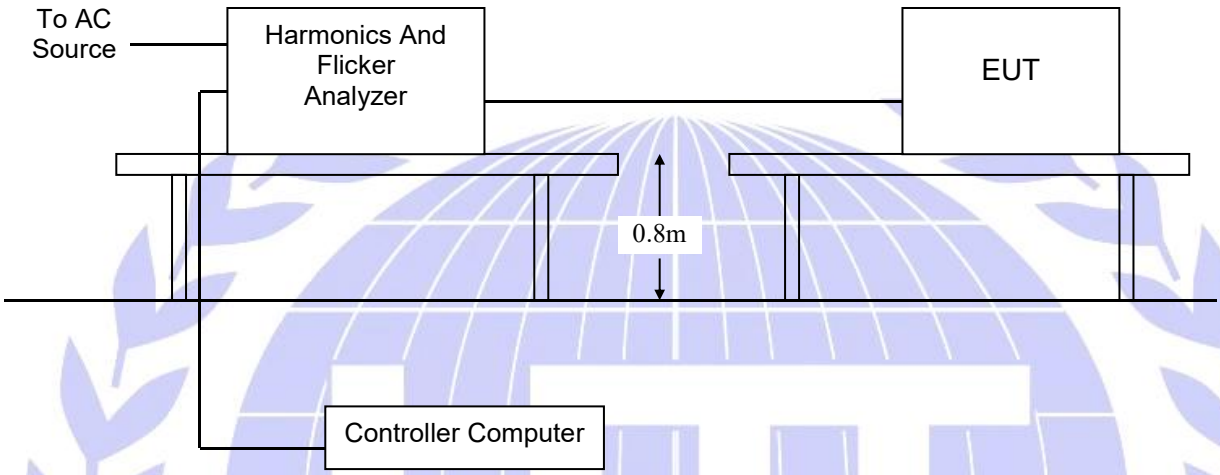
No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	(dB)	(dBuV)	(dBuV)	(dB)	
1	0.1816	42.44	11.53	53.97	64.41	-10.44	QP
2	0.1835	18.80	11.53	30.33	54.33	-24.00	AVG
3	0.5146	34.08	11.51	45.59	56.00	-10.41	QP
4	0.5191	10.06	11.51	21.57	46.00	-24.43	AVG
5	1.0051	26.82	11.98	38.80	56.00	-17.20	QP
6	1.0231	6.58	11.99	18.57	46.00	-27.43	AVG
7	7.8271	19.67	12.33	32.00	60.00	-28.00	QP
8	7.8991	3.28	12.34	15.62	50.00	-34.38	AVG
9	14.2981	20.51	13.27	33.78	60.00	-26.22	QP
10	14.6716	4.23	13.25	17.48	50.00	-32.52	AVG
11	28.7026	25.30	13.16	38.46	60.00	-21.54	QP
12	29.1436	10.01	13.14	23.15	50.00	-26.85	AVG

4.1.3. Harmonic Current Emission

LIMIT

Please refer to EN 61000-3-12

TEST CONFIGURATION



TEST PROCEDURE

Please refer to EN 61000-3-12 for the measurement methods.

TEST RESULTS

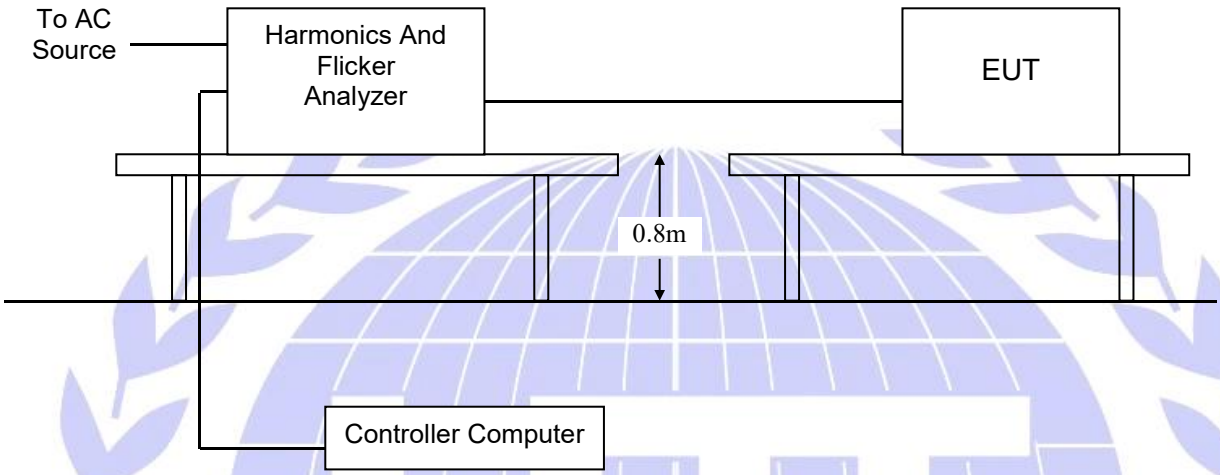
Pass

4.1.4. Voltage Fluctuation and Flicker

LIMIT

Please refer to EN 61000-3-3

TEST CONFIGURATION



TEST PROCEDURE

Please refer to EN 61000-3-3 for the measurement methods.

TEST RESULTS

Product	Paper-Bubble Machine	Tested by	Jowin Huang
Model	PB340、 PB340pro、PB-340、 PB-340pro	Observation Period (Tp)	10 mins
Test Mode	Full Load	Test Result	Pass
Environmental Conditions	23.1℃, 58 % RH, 101.32 kPa		

Please refer to the following test data:

Voltage Fluctuation	Limit	Value
Relative Voltage Change Characteristic Tmax （dc＞3%）	500 ms	0 ms
Maximum Relative Voltage	4%	0.00
	6%	/
Change dmax	7%	/
Relative Steady-state Voltage Change dc	3.3%	0.00

Flicker	Limit	Value
Short-term Flicker Indicator Pst	1.0	0.064
Long-term Flicker Indicator Plt	0.65	/

4.2. IMMUNITY

4.2.1. Performance criteria

Criterion A: The equipment shall continue to operate as intended without operator intervention. No degradation of performance of loss of function is allowed below a performance level specified by the manufacturer when the equipment is used as intended.

Criterion B: After the test, the equipment shall continue to operate as intended without operator intervention. No degradation of performance or loss of function is allowed, after the application of the phenomena below a performance level specified by the manufacturer, when the equipment is used as intended.

Criterion C: Loss of function is allowed, provided the function is self-recoverable, or can be restored by the operation of the controls by the user in accordance with the manufacturer's instructions.

Criteria A:	During and after the test the EUT shall continue to operate as intended without operator intervention. No degradation of performance or loss of function is allowed below a minimum performance level specified by the manufacturer when the EUT is used as intended. The performance level may be replaced by a permissible loss of performance. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, then either of these may be derived from the product description and documentation, and by what the user may reasonably expect from the EUT if used as intended.
Criteria B:	After the test, the EUT shall continue to operate as intended without operator intervention. No degradation of performance or loss of function is allowed, after the application of the phenomena below a performance level specified by the manufacturer, when the EUT is used as intended. The performance level may be replaced by a permissible loss of performance. During the test, degradation of performance is allowed. However, no change of operating state or stored data is allowed to persist after the test. If the minimum performance level (or the permissible performance loss) is not specified by the manufacturer, then either of these may be derived from the product description and documentation, and by what the user may reasonably expect from the EUT if used as intended.
Criteria C:	During and after testing, a temporary loss of function is allowed, provided the function is self-recoverable, or can be restored by the operation of the controls or cycling of the power to the EUT by the user in accordance with the manufacturer's instructions. Functions, and/or information stored in non-volatile memory, or protected by a battery backup, shall not be lost.

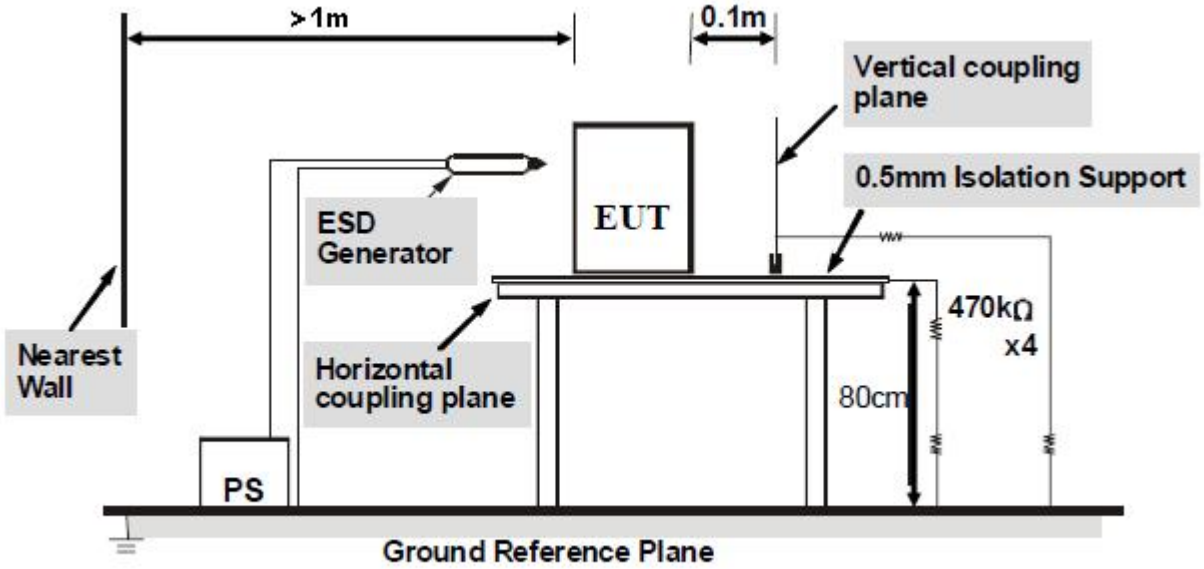
4.2.2. Electrostatic Discharge

LIMIT

SEVERITY LEVELS OF ELECTROSTATIC DISCHARGE

Test level: Contact Discharge at ±2KV, ±4KV Air Discharge at ±2KV, ±4KV, ±8KV

TEST CONFIGURATION



TEST PROCEDURE

Please refer to EN 61000-4-2 for the measurement methods.

Contact Discharge:

The ESD generator is held perpendicular to the surface to which the discharge is applied and the tip of the discharge electrode touch the surface of EUT. Then turn the discharge switch. The generator is then re-triggered for a new single discharge and repeated at least 10 times for each pre-selected test point. This procedure shall be repeated until all the air discharge completed.

Air Discharge:

Air discharge is used where contact discharge can't be applied. The round discharge tip of the discharge electrode shall be approached as fast as possible to touch the EUT. After each discharge, the discharge electrode shall be removed from the EUT. The generator is then re-triggered for a new single discharge and repeated at least 10 times for each pre-selected test point. This procedure shall be repeated until all the air discharge completed.

Indirect discharge for horizontal coupling plane:

At least 10 single discharges shall be applied to the horizontal coupling plane, at points on each side of the EUT.

Indirect discharge for vertical coupling plane:

At least 10 single discharges shall be applied to the center of one vertical edge of the coupling plane. The coupling plane, of dimensions 0.5m X 0.5m, is placed parallel to, and positioned at a distance of 0.1m from the EUT. Discharges shall be applied to the coupling plane, with this plane in sufficient different positions that the four faces of the EUT are completely illuminated.

TEST MODE

Please reference to the section 2.3

TEST RESULTS

Pass

Air Discharge					
Test Points	Test Levels	Results			
	± 8 kV	***Pass***	***Fail***	***Observation***	**Performance Criterion**
Shell 4 Points	☒	☒	☐	Note ☐1☒2☐3	B

Contact Discharge					
Test Points	Test Levels	Results			
	± 4 kV	**Pass**	**Fail**	***Observation***	**Performance Criterion**
HCP 4 Points	☒	☒	☐	Note ☒1 ☐2 ☐3	B
VCP 4 Points	☒	☒	☐	Note ☒1 ☐2 ☐3	B
Positive pole 1 Point	☒	☒	☐	Note ☒1 ☐2 ☐3	B
Negative pole 1 Point	☒	☒	☐	Note ☒1 ☐2 ☐3	B

Note: 1) There was no change compared with initial operation during the test.
2) During the test and After the test, the EUT can resume to operate as intended without operator intervention.
3) During the test and After the test, During and after testing, the EUT needs to return to normal operation with operator intervention.

4.2.3. RF Electromagnetic Field

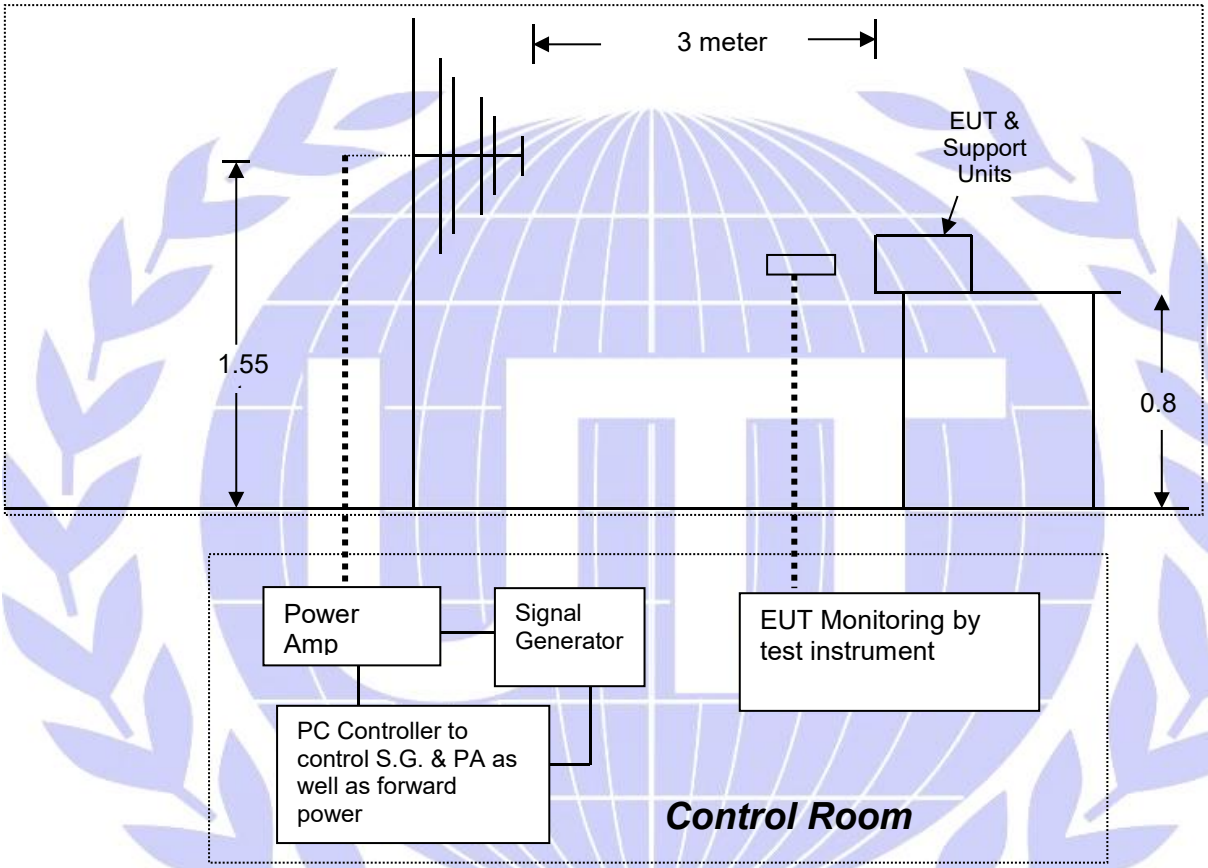
PERFORMANCE CRITERION

Criteria A

TEST LEVEL

3V/m (80%, 1kHz Amplitude Modulation)

TEST CONFIGURATION



TEST PROCEDURE

EN IEC 61000-6-2:2019 (EN61000-4-3: 2006/A2:2010 (Severity Level: 3, 10V / m))

TEST MODE

Please reference to the section 2.3

TEST RESULTS

Pass

Frequency	Level	Modulation	Antenna Polarization	EUT Face	Observations (Performance Criterion)	Result
80 MHz-1 GHz 1.8 GHz 2.6 GHz 3.5 GHz 5 GHz	3 V/m	1 kHz, 80 % Amp. Mod, 1 % increment, dwell time=3seconds	V	Front	A	Pass
			H		A	Pass
			V	Rear	A	Pass
			H		A	Pass
			V	Left	A	Pass
			H		A	Pass
			V	Right	A	Pass
			H		A	Pass
			V	Top	A	Pass
			H		A	Pass
			V	Bottom	A	Pass
			H		A	Pass

Note: 1) There was no change compared with initial operation during the test.
2) During the test and After the test, the EUT can resume to operate as intended without operator intervention.
3) During the test and After the test, During and after testing, the EUT needs to return to normal operation with operator intervention.

4.2.4. Surges

PERFORMANCE CRITERION

Criteria B

TEST LEVEL

Mains:1kV Line to Line: Differential mode

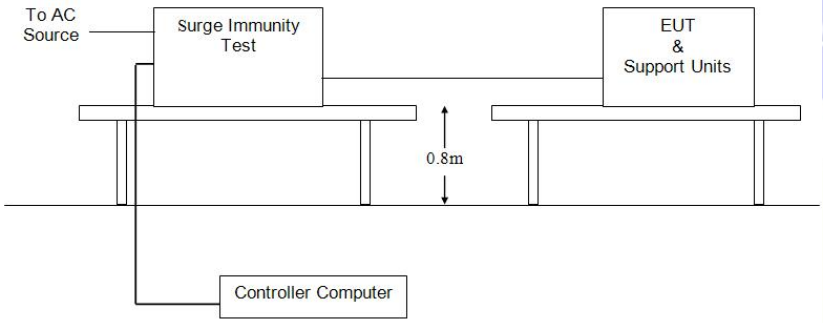
2kV Line to Ground: Common mode

(Voltage Waveform: 1.2/50 us; Current Waveform: 8/20 us)

Signal port:1kV Line to Ground: Common mode

(Voltage Waveform: 10/700 us; Current Waveform: 5/320 us)

TEST CONFIGURATION



TEST PROCEDURE

EN IEC 61000-6-2:2019 (EN61000-4-5: 2014/A1:2017)

Severity Level: Line to Line: Level 2, 1.0KV, Line to PE: level 3, 2.0KV

TEST MODE

Please reference to the section 2.3

TEST RESULTS

Pass

Test Point	Polarity	Test Level (kV)	Observation	Performance Criterion
L - N	+/-	1	Note ☒1 ☐2 ☐3	B
L - PE	+/-	2	Note ☒1 ☐2 ☐3	N/A
N - PE	+/-	2	Note ☒1 ☐2 ☐3	N/A

Note: 1) There was no change compared with initial operation during the test.

2) During the test and After the test, the EUT can resume to operate as intended without operator intervention.

3) During the test and After the test, During and after testing, the EUT needs to return to normal operation with operator intervention.

4.2.5. RF- Common Mode 0.15MHz to 80MHz

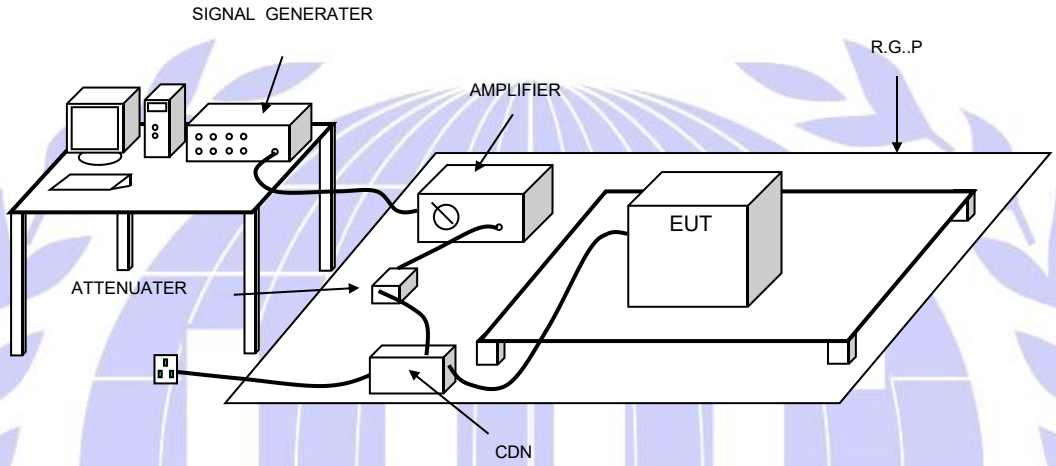
PERFORMANCE CRITERION

Criteria A

TEST LEVEL

3Vrms on AC main port (80%, 1kHz Amplitude Modulation)

TEST CONFIGURATION



TEST PROCEDURE

Please refer to EN 61000-4-6 for the measurement methods.

TEST MODE

Please reference to the section 2.3

TEST RESULTS

Pass

Frequency (MHz)	Field Strength (Vrms)	Injected Position	Injection Method	Observation	Performance Criterion
0.15 –80MHz	3	AC Mains	CDN-M2/M3	Note ☒1☐2☐3	A

Note: 1) There was no change compared with initial operation during the test.
2) During the test and After the test, the EUT can resume to operate as intended without operator intervention.
3) During the test and After the test, During and after testing, the EUT needs to return to normal operation with operator intervention.

4.2.6. Fast Transients Common Mode

PERFORMANCE CRITERION

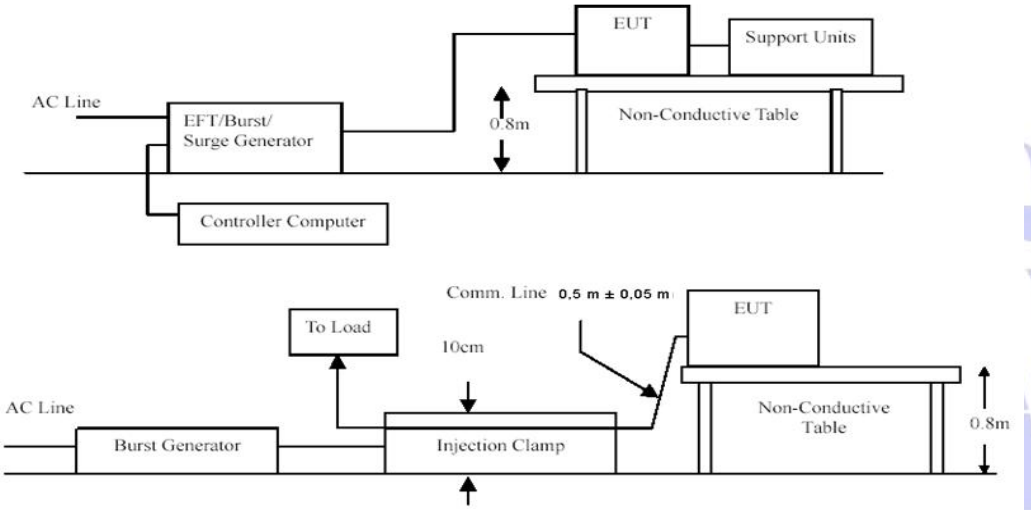
Criteria B

TEST LEVEL

1KV for AC main port

(Impulse Frequency: 5 kHz; Tr/Th: 5/50ns; Burst Duration: 15ms; Burst Period: 3Hz)

TEST CONFIGURATION



TEST PROCEDURE

Please refer to EN 61000-4-4 for the measurement methods.

TEST MODE

EN IEC 61000-6-2:2019 (EN61000-4-4:2012, Severity Level, Level 3: 2KV)

TEST RESULTS

Pass

Test Point	Polarity	Test Level (kV)	Observation	Performance Criterion
L	+/-	1	Note ☒1 ☐2 ☐3	B
N	+/-	1	Note ☒1 ☐2 ☐3	B
L – N	+/-	1	Note ☒1 ☐2 ☐3	B
PE	+/-	1	Note ☒1 ☐2 ☐3	N/A
L – PE	+/-	1	Note ☒1 ☐2 ☐3	N/A
N – PE	+/-	1	Note ☒1 ☐2 ☐3	N/A
L – N – PE	+/-	1	Note ☒1 ☐2 ☐3	N/A

Note: 1) There was no change compared with initial operation during the test.
2) During the test and After the test, the EUT can resume to operate as intended without operator intervention.
3) During the test and After the test, During and after testing, the EUT needs to return to normal operation with operator intervention.

4.2.7. Voltage Dips and Interruptions

PERFORMANCE CRITERION

>95% VD, 0.5 period----Performance criterion: B

>95% VD, 1.0 period----Performance criterion: B

30% VD, 25 period----Performance criterion: C

>95% VI, 250 period----Performance criterion: C

TEST LEVEL

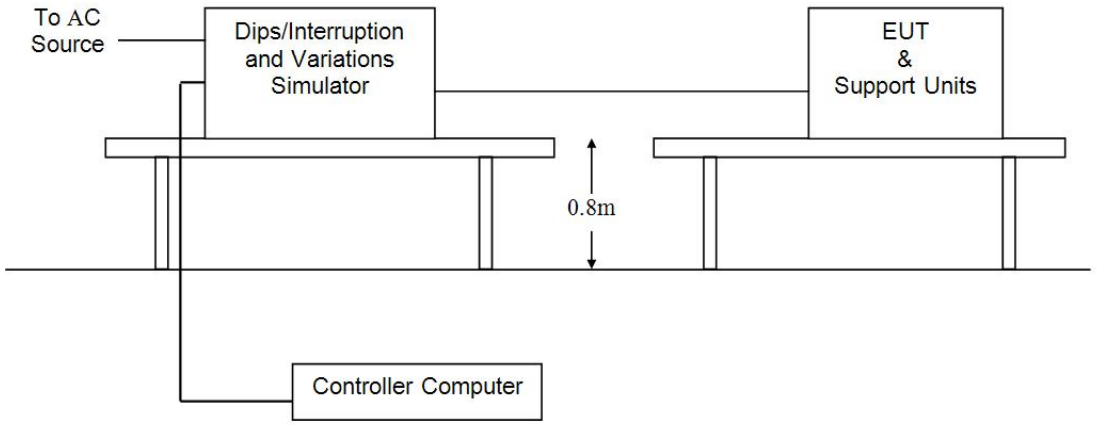
0% of VT(Supply Voltage) for 0.5 period

0% of VT(Supply Voltage) for 1.0 period

70% of VT(Supply Voltage) for 25 period

0% of VT(Supply Voltage) for 250 period

TEST CONFIGURATION



TEST PROCEDURE

EN IEC 61000-6-2:2019 (EN61000-4- 11: 2004/AC:2017)

TEST MODE

Please reference to the section 2.3

TEST RESULTS

Pass

Voltage (% Reduction)	Duration (Period)	Observation	Performance Criterion
100	0.5 P	Note ☒1 ☐2 ☐3	B
30	25 P	Note ☒1 ☐2 ☐3	C
100	250 P	Note ☒1 ☐2 ☐3	C

Note: 1) There was no change compared with initial operation during the test.

2) During the test and After the test, the EUT can resume to operate as intended without operator intervention.

3) During the test and After the test, During and after testing, the EUT needs to return to normal operation with operator intervention.

5. External and Internal Photos of the EUT

Photo 1

View:

☒ front

☐ rear

☐ right side

☐ left side

☐ top

☐ bottom

☐ internal

Photo 2

View:

☐ front

☐ rear

☒ right side

☐ left side

☐ top

☐ bottom

☐ internal

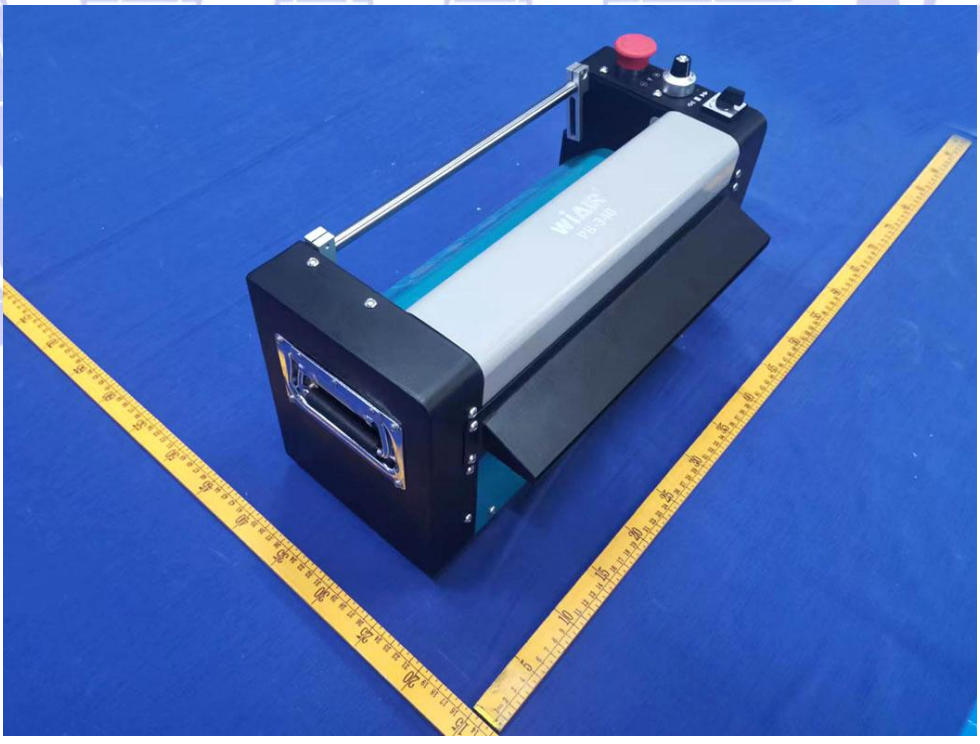


Photo 3

View:

☐ front

☐ rear

☐ right side

☒ left side

☐ top

☐ bottom

☐ internal

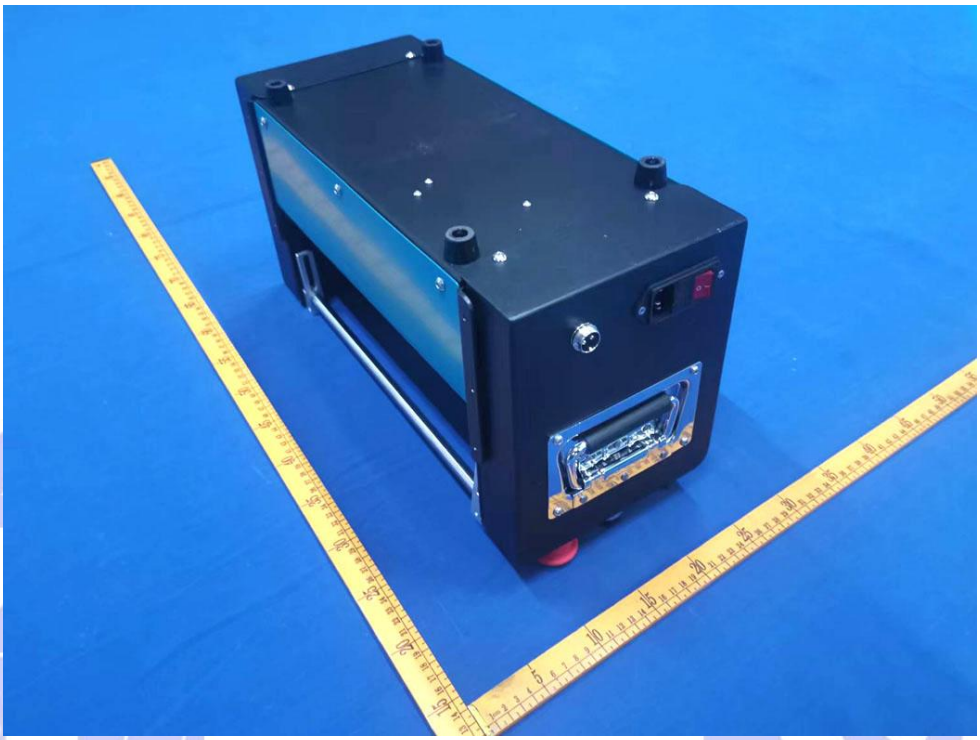


Photo 4

View:

☐ front

☒ rear

☐ right side

☐ left side

☐ top

☐ bottom

☐ internal

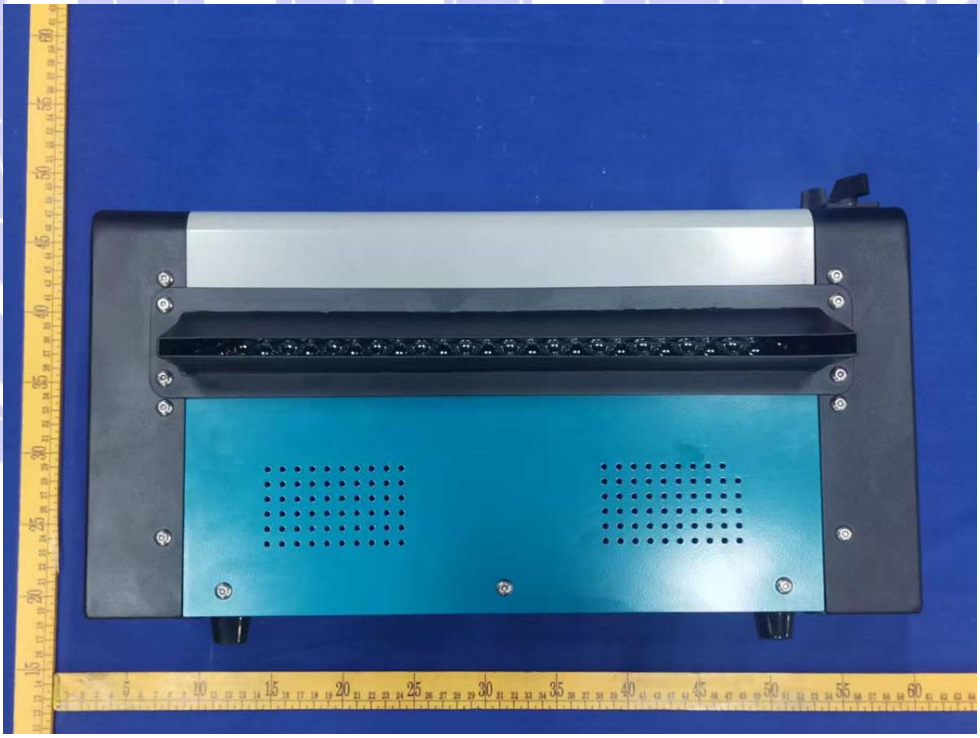


Photo 5

View:

☐ front

☐ rear

☐ right side

☐ left side

☐ top

☐ bottom

☒ internal

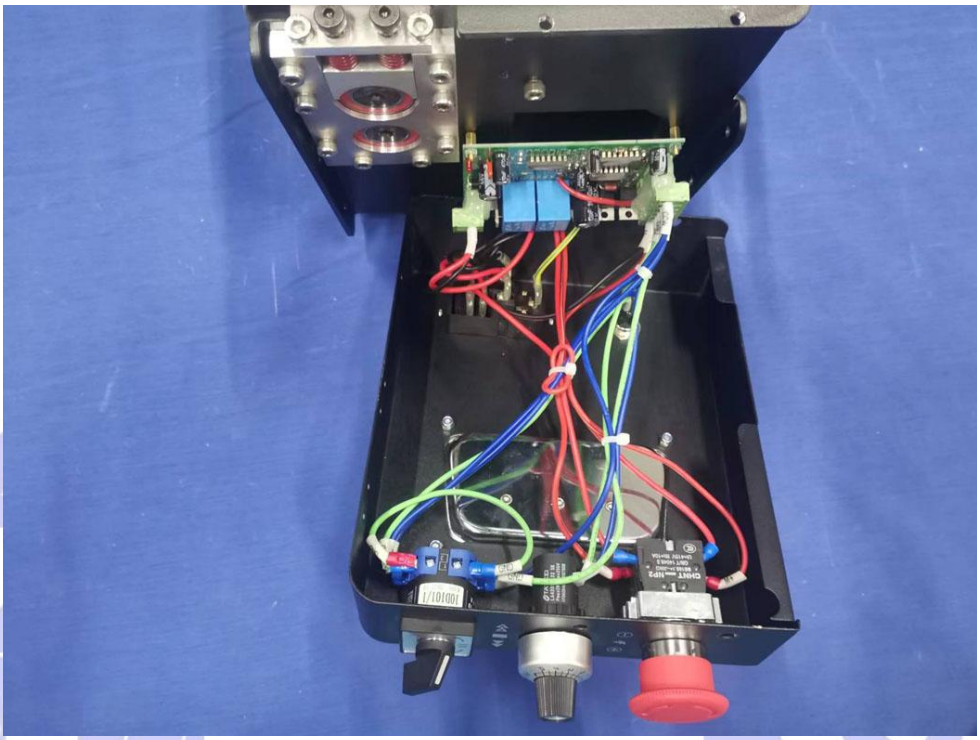


Photo 6

View:

☐ front

☐ rear

☐ right side

☐ left side

☐ top

☐ bottom

☒ internal

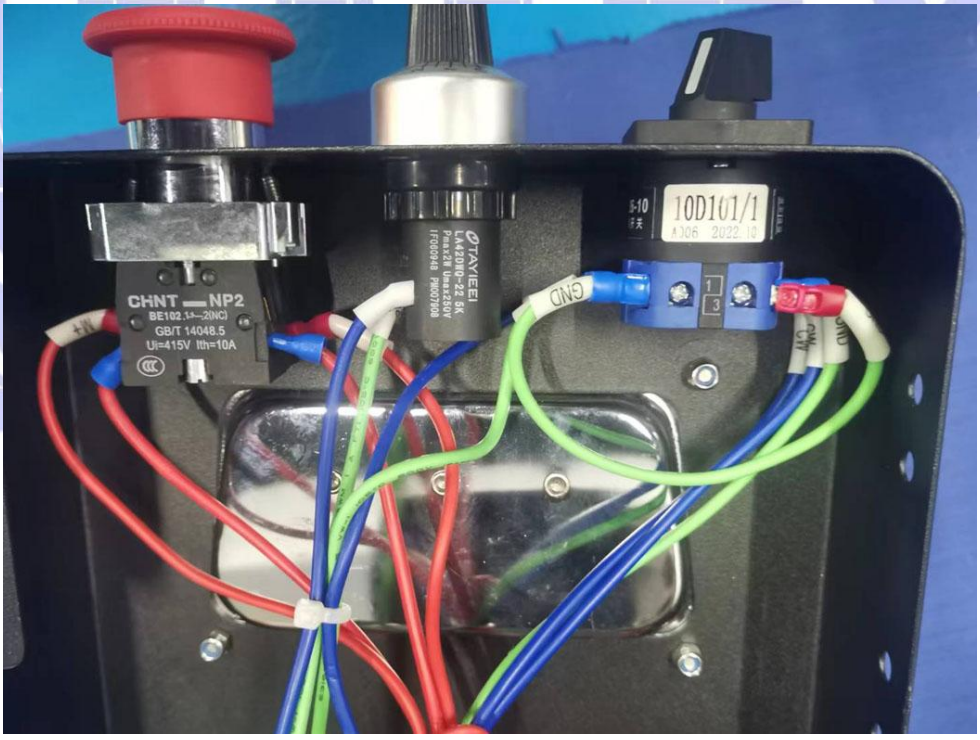


Photo 7

View:

☐ front

☐ rear

☐ right side

☐ left side

☐ top

☐ bottom

☒ internal

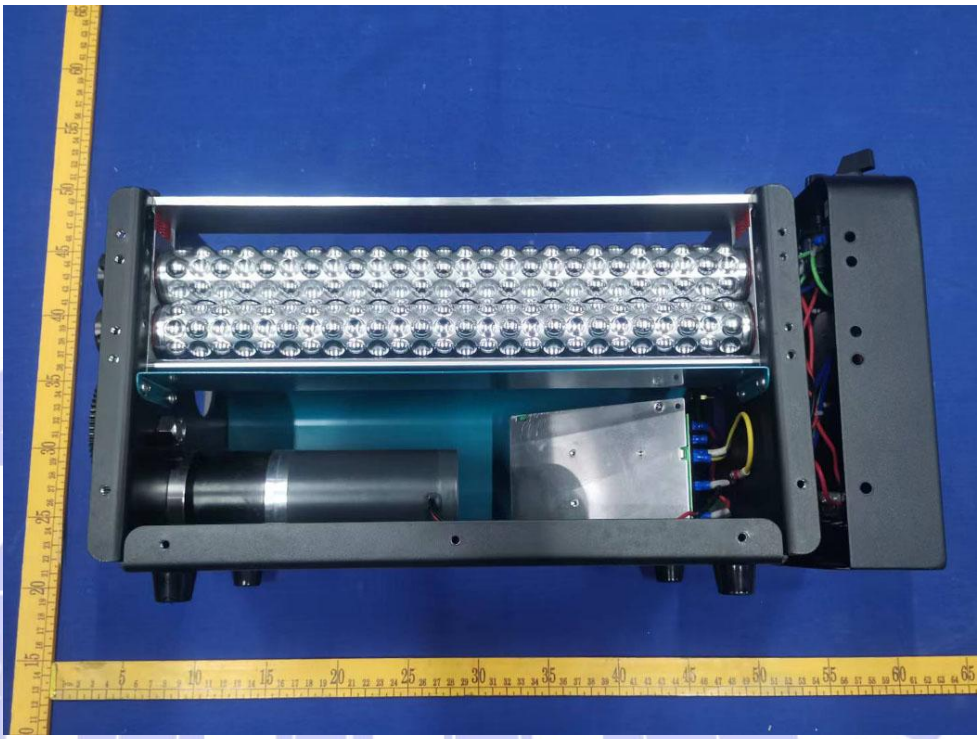


Photo 8

View:

☐ front

☐ rear

☐ right side

☐ left side

☐ top

☐ bottom

☒ internal

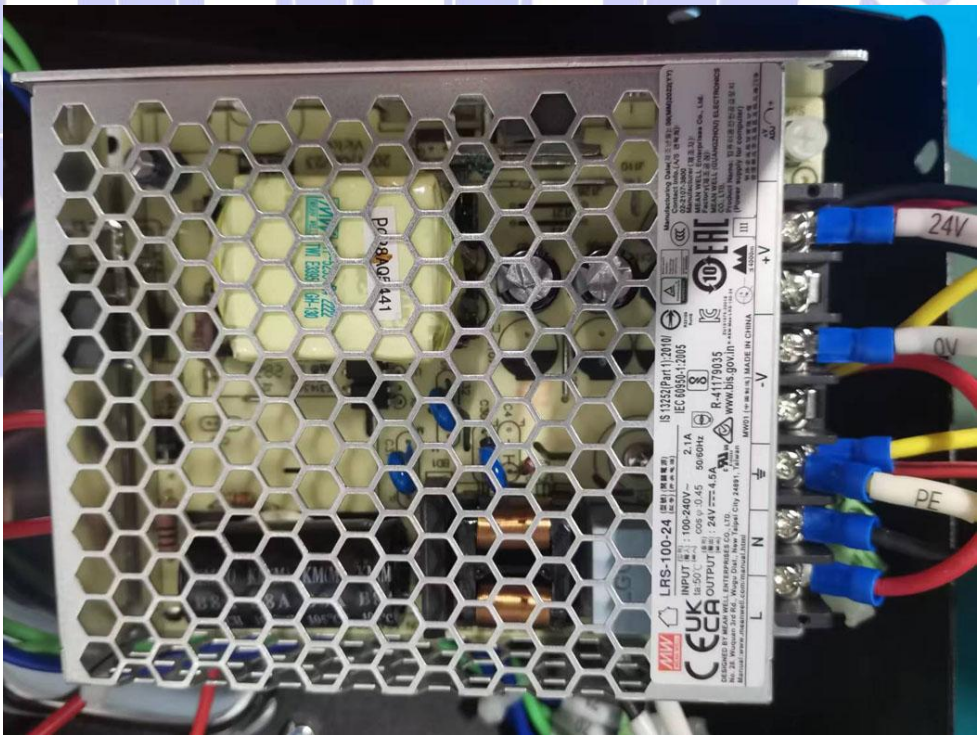


Photo 9

View:

☐ front

☐ rear

☐ right side

☐ left side

☐ top

☐ bottom

☒ internal

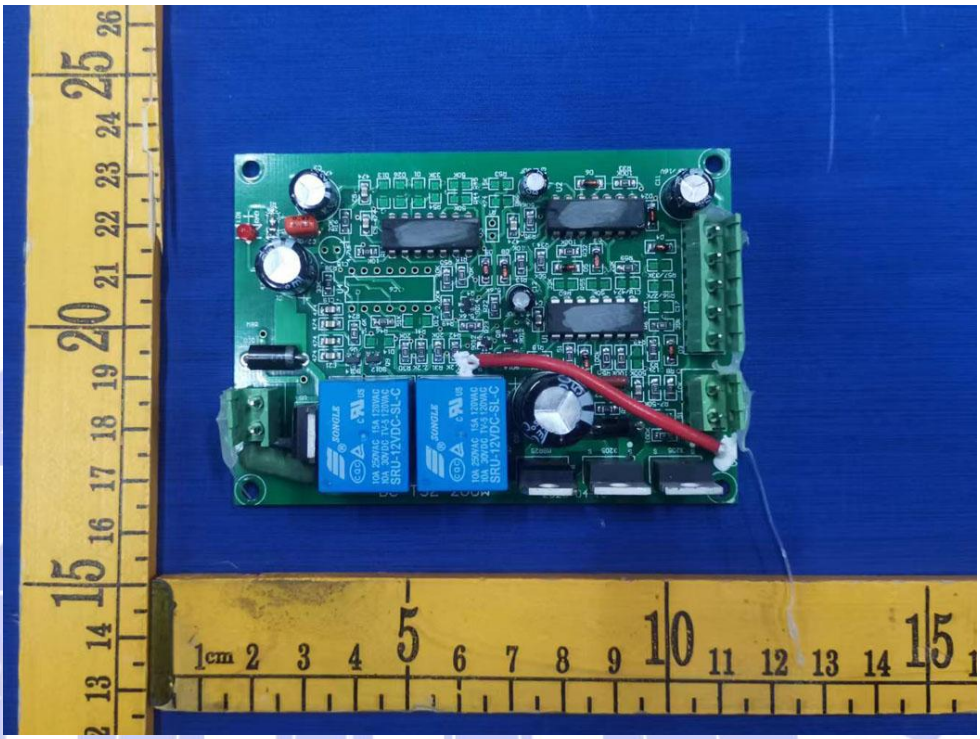


Photo 10

View:

☐ front

☐ rear

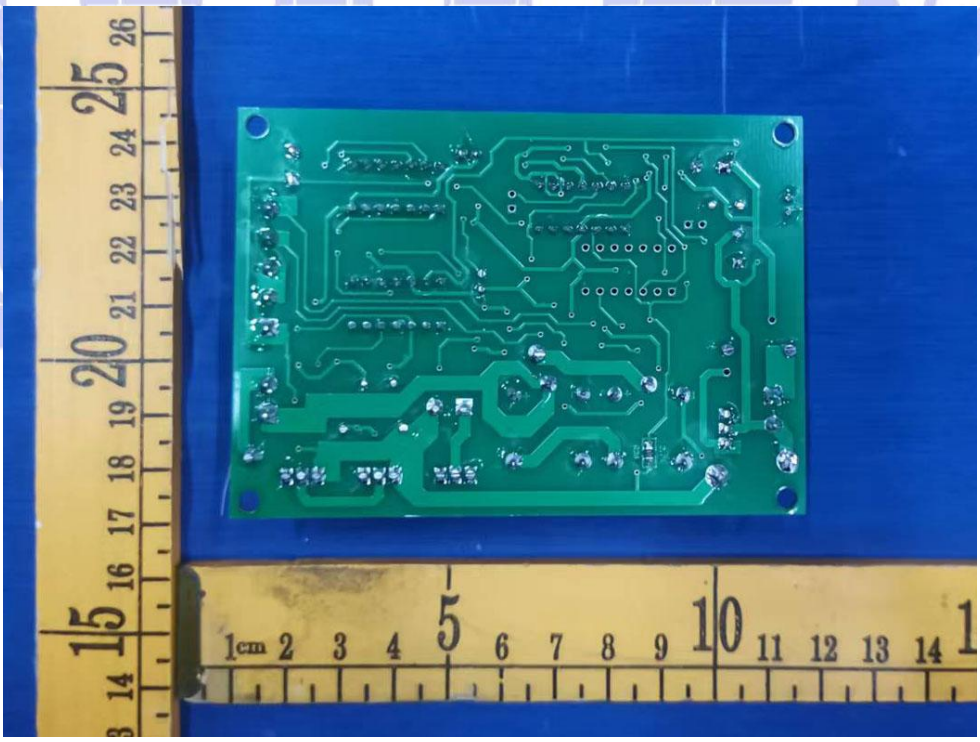
☐ right side

☐ left side

☐ top

☐ bottom

☒ internal



.....End of Report.....

APPLICATION FOR CE LVD TEST REPORT

On Behalf of

Prepared For	:	WIAIR CORPORATION (SHANGHAI) CO., LTD No.540,2/F, Lane 500, XinNongHe Road, Song Jiang District, Shanghai 201619, China
Product Name	:	Paper-Bubble Machine
Model	:	PB340、PB340pro、PB-340、PB-340pro
Prepared By	:	Shenzhen Universal Test Technology Service Co., Ltd. 10/F., Building 153, Yucui New village, Yucui Community, Longhua street, Longhua district, Shenzhen , Guangdong, China.
Test Date	:	Nov. 16, 2022 – Nov. 22, 2022
Date of Report	:	Nov. 22, 2022
Report No.	:	UTT202211918S

Note: This test report is limited to the above client company and the product model only. It may not be duplicated without prior written consent of Shenzhen Universal Test Technology Service Co., Ltd.

TEST REPORT

EN 60204-1: 2018
Safety of machine- Electrical equipment of machines,
Part 1: General requirements

Report Reference No..... :	UTT202211918S
Tested by (printed name + signature)..... :	File administrators Nike Huang
Reviewed by: ..... :	Test engineer Angelia Shi
Approved by (printed name + signature)..... :	Manager Joseph Zhang
Date of issue..... :	Nov. 04, 2022
Contents..... :	51 Pages Total including the front pages.
Testing Laboratory..... :	**Shenzhen Universal Test Technology Service Co., Ltd.**
Address..... .:	10/F., Building 153, Yucui New village, Yucui Community, Longhua street, Longhua district, Shenzhen , Guangdong, China.
Applicant's name..... .:	**WIAIR CORPORATION (SHANGHAI) CO., LTD**
Address..... ..:	No.540,2/F, Lane 500, XinNongHe Road, Song Jiang District, Shanghai 201619, China
Test specification:	
Directive/ standard..... :	EN 60204-1:2018
Test procedure..... .:	CE-LVD
Product Name ..... .:	Paper-Bubble Machine
Trademark..... :	WIAIR®
Manufacturer..... :	1teck Automation Technology Co., Ltd.
Address..... ..:	2nd Floor, Building 2, No. 529, Jinyuan Road, Gaoyang Village Industrial Zone, Shimen Town, Tongxiang City, Jiaxing City, Zhejiang Province, Post Code : 314512
Model/Type reference..... :	PB340、 PB340pro、PB-340、 PB-340pro
Rating(s)..... :	Input: 100-230V~, 50Hz, 120W

Test case verdicts	
Test case does not apply to the test object ..... :	N(/A)
Test item does meet the requirement ..... :	P(ass)
Test item does not meet the requirement ..... :	F(ail)
Testing	
Date of receipt of test item ..... :	Nov. 16, 2022
Date(s) of performance of test ..... :	Nov. 16, 2022 – Nov. 22, 2022

General remarks

This report shall not be reproduced except in full without the written approval of the testing laboratory.

The test results presented in this report relate only to the item(s) tested.

"(see remark #)" refers to a remark appended to the report.

"(see Annex #)" refers to an annex appended to the report.

Throughout this report a comma is used as the decimal separator.

General product information:

All models are the same except model and appearance, and all tests are based on PB340

Copy of marking plate:

Product Name: Paper-Bubble Machine
Model: PB340

Input: 100-230V~, 50Hz, 120W

CE

1teck Automation Technology Co., Ltd.

Summary of Testing:

1. The product has been tested and found in compliance with EN60204-1 for Safety of machine- Electrical equipment of machines, Part 1: General requirements.
2. The test result complies with the requirements of the relevant standard.

EN 60204-1			
Clause	Requirement	Test Result	Verdict

EN 60204-1 Electrical equipment of machines–Part 1: General requirments			
4	**General requirments**		
4.1	**General considerations**		
	This part of IEC 60204 is intended to apply to electrical equipment used with a wide variety of machines and with a group of machines working together in a co-coordinated manner. The risks associated with the hazards relevant to the electrical equipment shall be assessed as part of the overall requirements for risk assessment of the machine. This will determine the adequate risk reduction and the necessary protective measures for persons who can be exposed to those hazards, while still maintaining an acceptable level of performance of the machine and its equipment.		P
4.2	**Selection of equipment**		
4.2.1	**General**		
	Electrical components and devices shall: —be suitable for their intended use; and —conform to relevant IEC standards where such exist; and —be applied in accordance with the supplier's instructions risk assessment of the machine.	Be suitable for their intended use and conform to relevant IEC/EN standards.	P
4.2.2	**Electrical equipment in compliance with the EN 60439 series**		
	Depending upon the machine, its intended use and its electrical equipment, the designer may select parts of the electrical equipment of the machine that are in compliance with EN 60439-1 and, as necessary, other relevant parts of the EN 60439 series (see also Annex F).		P
4.3	**Electrical supply**		
4.3.1	**General**		
	The electrical equipment shall be designed to operate correctly with the conditions of the supply: —as specified in 4.3.2 or 4.3.3, or —as otherwise specified by the user (see Annex B), or as specified by the supplier in the case of a special source of supply such as an on-board generator.	Comply with clause 4.3.2.	P
4.3.2	**AC supplies**		

EN 60204-1			
Clause	Requirement	Test Result	Verdict
	Voltag: Steady state voltage: 0,9 to 1,1 of nominal voltage. Frequency: 0,99 to 1,01 of nominal frequency continuously; 0,98 to 1,02 short time. Harmonics: Harmonic distortion not exceeding 10 % of the total r.m.s. voltage between live conductors for the sum of the 2nd through to the 5th harmonic. An additional 2 % of the total r.m.s. voltage between live conductors for the sum of the 6th through to the 30th harmonic is permissible. Voltage unbalance: Neither the voltage of the negative sequence component nor the voltage of the zero sequence components in three-phase supplies exceeding 2 % of the positive sequence component. Voltage interruption:		P
	Supply interrupted or at zero voltage for not more than 3 ms at any random time in the supply cycle with more than 1 s between successive interruptions	Voltage interruption <=3ms	P
	Voltage dips: Voltage dips not exceeding 20 % of the peak voltage of the supply for more than one cycle with more than 1 s between successive dips	Voltage dips<=20%	P
4.3.3	**DC supplies**		
	From batteries, Voltage 0,85 to 1,15 of nominal voltage 0,7 to 1,2 of nominal voltage in the case of battery-operated vehicles . Voltage interruption: Not exceeding 5 ms From converting equipment: Voltage: 0,9 to 1,1 of nominal voltage. Voltage interruption: Not exceeding 20 ms with more than 1 s between successive interruptions. Ripple (peak-to-peak): Not exceeding 0,15 of nominal voltage.	Only AC supplies.	N
4.3.4	**Special supply systems**		
	For special supply systems such as on-board generators, the limits given in 4.3.2 and 4.3.3 may be exceeded provided that the equipment is designed to operate correctly with those conditions.		N
4.4	**Physical environment and operating conditions**		
4.4.1	**General**		
	The electrical equipment shall be suitable for the physical environment and operating conditions of its intended use. The requirements of 4.4.2 to 4.4.8 cover the physical environment and		

EN 60204-1			
Clause	Requirement	Test Result	Verdict
	operating conditions of the majority of machines covered by this part of EN 60204. When special conditions apply or the limits specified are exceeded, an agreement between user and supplier (see 4.1) is recommended (see Annex B).		P
4.4.2	**Electromagnetic compatibility (EMC)**		
	The electrical equipment shall not generate electromagnetic disturbances above levels that are appropriate for its intended operating environment. In addition, the electrical equipment shall have a sufficient level of immunity to electromagnetic disturbances so that it can function in its intended environment.		P
4.4.3	**Ambient air temperature**		
	Electrical equipment shall be capable of operating correctly in the intended ambient air temperature. The minimum requirement for all electrical equipment is correct operation between air temperatures of +5 °C and +40 °C.		P
4.4.4	**Humidity**		
	The electrical equipment shall be capable of operating correctly when the relative humidity does not exceed 50 % at a maximum temperature of +40 °C. Higher relative humilities are permitted at lower temperatures (for example 90 % at 20 °C). Harmful effects of occasional condensation shall be avoided by design of the equipment or where necessary, by additional measures (for example built-in heaters, air conditioners, drain holes).		P
4.4.5	**Altitude**		
	Electrical equipment shall be capable of operating correctly at altitudes up to 1 000 m above mean sea level.	<1000m.	P
4.4.6	**Contaminants**		
	Electrical equipment shall be adequately protected against the ingress of solids and liquids. The electrical equipment shall be adequately protected against contaminants (for example dust, acids, corrosive gases, salts) that can be present in the physical environment in which the electrical equipment is to be installed (see Annex B).	For electrical equipment, IP2X.	P
4.4.7	**Ionizing and non-ionizing radiation**		
	When equipment is subject to radiation (for example microwave, ultraviolet, lasers, X-rays), additional measures shall be taken to avoid malfunctioning of the equipment and accelerated deterioration of the insulation.	No ionizing and non-ionizing radiation outside this equipment.	P
4.4.8	**Vibration, shock, and bump**		

EN 60204-1			
Clause	Requirement	Test Result	Verdict
	Undesirable effects of vibration, shock and bump (including those generated by the machine and its associated equipment and those created by the physical environment) shall be avoided by the selection of suitable equipment, by mounting it away from the machine, or by provision of anti-vibration mountings.	Undesirable effects be avoided by the selection of suitable equipment.	P
4.5	**Transportation and storage**		
	Electrical equipment shall be designed to withstand, or suitable precautions shall be taken to protect against, the effects of transportation and storage temperatures within a range of –25 °C to +55 °C and for short periods not exceeding 24 h at up to +70°C. Suitable means shall be provided to prevent damage from humidity, vibration, and shock	Within the SMPS during approval	P
4.6	**Provisions for handling**		
	Heavy and bulky electrical equipment that has to be removed from the machine for transport or that is independent of the machine, shall be provided with suitable means for handling by cranes or similar equipment.		P
4.7	**Installation**		
	Electrical equipment shall be installed in accordance with the electrical equipment supplier's Instructions.		P
5 Incoming supply conductor terminations and devices for disconnecting and switching off			
5.1	**Incoming supply conductor terminations**		
	It is recommended that, where practicable, the electrical equipment of a machine is connected to a single incoming supply. Where another supply is necessary for certain parts of the equipment (for example, electronic equipment that operates at a different voltage), that supply should be derived, as far as is practicable, from devices (for example, transformers, converters) forming part of the electrical equipment of the machine. For large complex machinery comprising a number of widely-spaced machines working together in a coordinated manner, there can be a need for more than one incoming supply depending upon the site supply arrangements (see 5.3.1) . Unless a plug is provided with the machine for the connection to the supply (see 5.3.2 e), it is recommended that the supply conductors are terminated at the supply disconnecting device. where a neutral conductor is used it shall be clearly indicated in the technical documentation of the machine, such as in the	Plugs and couplers are provided. All terminals marked correct labels.	P
	installation diagram and in the circuit diagram, and a separate insulated terminal, labeled N in accordance with 16.1, shall be provided for the neutral conductor. There shall be no connection between the neutral conductor and the protective bonding circuit inside the electrical .		P
5.2	**Terminal for connection of the external protective conductor**		
	At each incoming supply point, the terminal for connection of external protective conductor shall be marked or labelled with the letters PE (see IEC 60445).	PE label used.	P
5.3	**Supply disconnecting (isolating) device**		
5.3.1	**General**		

EN 60204-1			
Clause	Requirement	Test Result	Verdict
	supply disconnecting device shall be provided: —for each incoming source of supply to a machine(s); —for each on-board power supply. The supply disconnecting device shall disconnect (isolate) the electrical equipment of the machine from the supply when required (for example for work on the machine, including the electrical equipment). When two or more supply disconnecting devices are provided, protective interlocks for their correct operation shall also be provided in order to prevent a hazardous situation, including damage to the machine or to the work in progress.		P
5.3.2	**Type**		
	The supply disconnecting device shall be one of the following types: a) switch-disconnect or, with or without fuses, in accordance with IEC 60947-3, utilization category AC-23B or DC-23B; b) control and protective switching device suitable for isolation, in accordance with IEC 60947-6-2; c) a circuit-breaker suitable for isolation in accordance with IEC 60947-2; d) any other switching device in accordance with an IEC product standard for that device and which meets the isolation requirements and the appropriate utilization category and/or specified endurance requirements defined in the product standard; e) a plug/socket combination for a flexible cable supply.	Comply with requirement e). Plugs used.	P
5.3.3	**Requirements**		
	When the supply disconnecting device is one of the types specified in 5.3.2 a) to d) it shall fulfill all of the following requirements:		P
	—isolate the electrical equipment from the supply and have one OFF (isolated) and one ON position marked with "O" and "I" (symbols IEC 60417-5008 (DB:2002-10) and IEC 60417-5007 (DB:2002-10), see 10.2.2);		P
	— have a visible contact gap or a position indicator which cannot indicate OFF (isolated) until all contacts are actually open and the requirements for the isolating function have been satisfied;		N
	— ave an external operating means		P
	—be provided with a means permitting it to be locked in the OFF (isolated) position (for example by padlocks). When so locked, remote as well as local closing shall be prevented;		N
	—disconnect all live conductors of its power supply circuit. However, for TN supply systems, the neutral conductor may or may not be disconnected except in countries where		N
	—disconnection of the neutral conductor (when used) is compulsory;		N

EN 60204-1			
Clause	Requirement	Test Result	Verdict
	—have a breaking capacity sufficient to interrupt the current of the largest motor when stalled together with the sum of the normal running currents of all other motors and other loads. The calculated breaking capacity may be reduced by the use of a proven diversity factor. Where motor(s) are supplied by converter(s) or similar devices, the calculation should take into account the possible effect on the required breaking capacity		N
5.3.4	**Operating means of the supply disconnecting device**		
	The operating means (for example, a handle) of the supply disconnecting device shall be external to the enclosure of the electrical equipment.	The supply disconnecting device is easily accessible.	P
5.3.5	**Excepted circuits**		
	The following circuits need not be disconnected by the supply disconnecting device:		N
	—lighting circuits for lighting needed during maintenance or repair;		N
	—socket outlets for the exclusive connection of repair or maintenance tools and equipment		N
	—under voltage protection circuits that are only provided for automatic tripping in the event of supply failure;		N
	—circuits supplying equipment that should normally remain energized for correct operation (for example emperature controlled measuring devices, product (work in rogress) heaters, program storage devices)		N
	Where such a circuit is not disconnected by the supply disconnecting device:		N
	—permanent warning label(s) shall be appropriately placed in proximity to the operating means of the supply disconnecting device to draw attention to the hazard;		N
	—a corresponding statement shall be included in the maintenance manual, and one or more of the following shall apply:		N
	.the conductors are identified by colour taking into account the recommendation of 13.2.4.		N
	.the excepted circuit is separated from other circuits,		N
	.excepted circuits are identified by permanent warning label(s).		N
5.4	**Devices for switching off for prevention of unexpected start-up**		
	Devices for removal of power for the prevention of unexpected start-up shall be provided where a start-up of the machine or part of the machine can create a hazard (for example during maintenance). Such devices shall be appropriate and convenient for the intended use, be suitably placed, and readily identifiable as		P

EN 60204-1			
Clause	Requirement	Test Result	Verdict
	to their function and purpose. Where their function and purpose is not otherwise obvious (e.g. by their location) these devices shall be marked to indicate the extent of removal of power		
5.5	**Devices for disconnecting electrical equipment**		
	be carried out when it is de-energized and isolated. Such devices shall be: —appropriate and convenient for the intended use;		P
	equipment is served. Where their function and purpose is not otherwise obvious (e.g. by their location) these devices shall be marked to indicate the extent of the equipment that they isolate.		
5.6	**Protection against unauthorized, inadvertent and/or mistaken connection**		
	Where the devices described in 5.4 and 5.5 are located outside an enclosed electrical operating area they shall be equipped with means to secure them in the OFF position (disconnected state), (for example by provisions for padlocking, trapped key interlocking).		P
	When so secured, remote as well as local reconnection shall be prevented.		P
6 Protection against electric shock			
6.1	**General**		
	The electrical equipment shall provide protection of persons against electric shock from: —basic protection (see 6.2 and 6.4); —fault protection (see 6.3 and 6.4). The measures for protection given in 6.2, 6.3, and, for PELV, in 6.4, are a selection from IEC 60364-4-41. Where those measures are not practicable, for example due to the physical or operational conditions, other measures from IEC 60364-4-41 may be used.	See below	P
6.2	**Protection against direct contact**		
6.2.1	**General**		
	For each circuit or part of the electrical equipment, the measures of either 6.2.2 or 6.2.3 and where applicable, 6.2.4 shall be applied.	IP2X.	P
6.2.2	**Protection by enclosures**		
	Live parts shall be located inside enclosures that provide protection against contact with live parts of at least IP2X or IPXXB (see IEC 60529).	IP2X, protected by earthed metal enclosure.	P
6.2.3	**Protection by insulation of live parts**		
	Live parts protected by insulation shall be completely covered with insulation that can only be removed by destruction. Such insulation shall be capable of withstanding the mechanical, chemical, electrical, and thermal stresses to which it can be subjected under normal operating conditions.		P
6.2.4	**Protection against residual voltages**		

EN 60204-1			
Clause	Requirement	Test Result	Verdict
	Live parts having a residual voltage greater than 60 V after the supply has been disconnected shall be discharged to 60 V or less within a time period of 5 s after disconnection of the supply voltage provided that this rate of discharge does not interfere with the proper functioning of the equipment. Exempted from this requirement are components having a stored charge of 60 µC or less. Where this specified rate of discharge would interfere with the proper functioning of the equipment, a durable warning notice drawing attention to the hazard and stating the delay required before the enclosure may be opened shall be displayed at an easily visible location on or immediately adjacent to the enclosure containing the capacitances. In the case of plugs or similar devices, the withdrawal of which results in the exposure of conductors (for example pins), the discharge time shall not exceed 1 s, otherwise such conductors shall be protected against direct contact to at least IP2X or IPXXB. If neither a discharge time of 1 s nor a protection of at least IP2X or IPXXB can be achieved (for example in the case of removable collectors on conductor wires, conductor bars, or slip-ring assemblies, see 12.7.4), additional switching devices or an appropriate warning device (for example a warning notice in accordance with 16.1) shall be applied	IP2X, residual voltage less than 60V after 1s.	P
6.2.5	**Protection by barriers**		
	For protection by barriers, 412.2 of IEC 60364-4-41 shall apply.		N
6.2.6	**Protection by placing out of reach or protection by obstacles**		
	For protection by placing out of reach, 412.4 of IEC 60364-4-41 shall apply. For protection by obstacles, 412.3 of IEC 60364-4-41 shall apply. For conductor wire systems or conductor bar systems with a degree of protection less than IP2X, see 12.7.1.		P
6.3	**Fault protection**		
6.3.1	**General**		
	Fault protection (3.31) is intended to prevent hazardous situations due to an insulation fault between live parts and exposed conductive parts.	See below.	P
	For each circuit or part of the electrical equipment, at least one of the measures in accordance with 6.3.2 to 6.3.3 shall be applied:		P
	– measures to prevent the occurrence of a touch voltage (6.3.2); or		P
	– automatic disconnection of the supply before the time of contact with a touch voltage can become hazardous (6.3.3).		P
6.3.2	**Prevention of the occurrence of a touch voltage**		

EN 60204-1			
Clause	Requirement	Test Result	Verdict
6.3.2.1	**General**		
	Measures to prevent the occurrence of a touch voltage include the following: —provision of class II equipment or by equivalent insulation; —electrical separation.	Class I equipment.	P
6.3.2.2	**Protection by provision of class II equipment or by equivalent insulation**		
	This measure is intended to prevent the occurrence of touch voltages on the accessible parts through a fault in the basic insulation. This protection is provided by one or more of the following: —class II electrical devices or apparatus (double insulation, reinforced insulation or by equivalent insulation in accordance with IEC 61140); —switchgear and control gear assemblies having total insulation in accordance with IEC 60439-1; —supplementary or reinforced insulation in accordance with 413.2 of IEC 60364-4-41.		N
6.3.2.3	**Protection by electrical separation**		
	Electrical separation of an individual circuit is intended to prevent a touch voltage through contact with exposed conductive parts that can be energized by a fault in the basic insulation of the live parts of that circuit. For this type of protection, the requirements of 413.5 of IEC 60364-4-41 apply.		P
6.3.3	**Protection by automatic disconnection of supply**		
	Automatic disconnection of the supply of any circuit affected by an insulation fault is intended to prevent a hazardous situation resulting from a touch voltage.		P
6.4	**Protection by the use of PELV**		
6.4.1	**General requirements**		
	The use of PELV (Protective Extra-Low Voltage) is to protect persons against electric shock from indirect contact and limited area direct contact (see 8.2.1).		N
	PELV circuits shall satisfy all of the following conditions: a) the nominal voltage shall not exceed: • 25 V AC r.m.s. or 60 V ripple-free DC when the equipment is normally used in dry locations and when large area contact of live parts with the human body is not expected; or • 6 V AC r.m.s. or 15 V ripple-free DC in all other cases;		N
	b) one side of the circuit or one point of the source of the supply of that circuit shall be connected to the protective		N

EN 60204-1			
Clause	Requirement	Test Result	Verdict
	bonding circuit;		
	c) live parts of PELV circuits shall be electrically separated from other live circuits. Electrical separation shall be not less than that required between the primary and secondary circuits of a safety isolating transformer		N
	d) conductors of each PELV circuit shall be physically separated from those of any other circuit. When this requirement is impracticable, the insulation provisions of 13.1.3 shall apply;		N
	e) plugs and socket-outlets for a PELV circuit shall conform to the following: • plugs shall not be able to enter socket-outlets of other voltage systems; • socket-outlets shall not admit plugs of other voltage systems		N
6.4.2	**Sources for PELV**		
	The source for PELV shall be one of the following: —a safety isolating transformer in accordance with IEC 61558-1 and IEC 61558-2-6; —a source of current providing a degree of safety equivalent to that of the safety isolating transformer (for example a motor generator with winding providing equivalent isolation); —an electrochemical source (for example a battery) or another source independent of a higher voltage circuit (for example a diesel-driven generator); —an electronic power supply conforming to appropriate standards specifying measures to be –taken to ensure that, even in the case of an internal fault, the voltage at the outgoing terminals cannot exceed the values specified in 6.4.1.		N
7 Protection of equipment			
7.1	**General**		
	This Clause details the measures to be taken to protect equipment against the effects of: —overcurrent arising from a short circuit; —overload and/or loss of cooling of motors; —abnormal temperature; —loss of or reduction in the supply voltage; —overspeed of machines/machine elements; —earth fault/residual current; —incorrect phase sequence; —overvoltage due to lightning and switching surges		P
7.2	**Overcurrent protection**		
7.2.1	**General**		

EN 60204-1			
Clause	Requirement	Test Result	Verdict
	Overcurrent protection shall be provided where the current in a machine circuit can exceed either the rating of any component or the current carrying capacity of the conductors whichever is the lesser value. The ratings or settings to be selected are detailed in 7.2.10.		P
7.2.2	**Supply conductors**		
	Unless otherwise specified by the user, the supplier of the electrical equipment is not responsible for providing the overcurrent protective device for the supply conductors to the electrical equipment.		P
	The supplier of the electrical equipment shall state in the installation documents the data necessary for conductor dimensioning (including the maximum cross-sectional area of the supply conductor that can be connected to the terminals of the electrical equipment) and for selecting the overcurrent protective device (see 7.2.10 and 17).		P
7.2.3	**Power circuits**		
	evices for detection and interruption of overcurrent, selected in accordance with 7.2.10 shall be applied to each live conductor. The following conductors, as applicable, shall not be disconnected without disconnecting all associated live conductors: —the neutral conductor of a.c. power circuits; —the earthed conductor of d.c. power circuits; —d.c. power conductors bonded to exposed conductive parts of mobile machines. Where the cross-sectional area of the neutral conductor is at least equal to or equivalent to that of the phase conductors, it is not necessary to provide over current detection for the neutral conductor nor a disconnecting device for that conductor. For a neutral conductor with a cross-sectional area smaller than that of the associated phase conductors, the measures detailed in 524 of IEC 60364-5-52 shall apply. In IT systems, it is recommended that the neutral conductor is not used. However, where a neutral conductor is used, the measures detailed in 431.2.2 of IEC 60364-4-43 shall apply.	The cross-sectional area of the neutral conductor is equal to the phase conductors.	P
7.2.4	**Control circuits**		

EN 60204-1			
Clause	Requirement	Test Result	Verdict
	Conductors of control circuits directly connected to the supply voltage and of circuits supplying control circuit transformers shall be protected against over current in accordance with 7.2.3. Conductors of control circuits supplied by a control circuit transformer or d.c. supply shall be protected against over current (see also 9.4.3.1.1): —in control circuits connected to the protective bonding circuit, by inserting an over current protective device into the switched conductor; —in control circuits not connected to the protective bonding circuit; where all control circuits of the equipment have the same current carrying capacity, by inserting an overcurrent protective device into the switched conductor, or; where different control circuits of the equipment have different current carrying capacity, by inserting an overcurrent protective device into both switched and common conductors of each control circuit.	Switch provided.	P
7.2.5	**Socket outlets and their associated conductors**		
	Overcurrent protection shall be provided for the circuits feeding the general purpose socket outlets intended primarily for supplying power to maintenance equipment. Overcurrent protective devices shall be provided in the unearthed live conductors of each circuit feeding such socket outlets.		N
7.2.6	**Lighting circuits**		
	All unearthed conductors of circuits supplying lighting shall be protected against the effects of short circuits by the provision of over current devices separate from those protecting other circuits.	No provided.	N
7.2.7	**Transformers**		
	Transformers shall be protected against over current in accordance with the manufacturer's instructions. Such protection shall (see also 7.2.10): —avoid nuisance tripping due to transformer magnetizing inrush currents; —avoid a winding temperature rise in excess of the permitted value for the insulation class of transformer when it is subjected to the effects of a short circuit at its secondary terminals.	No provided.	N
7.2.8	**Location of over current protective devices**		

EN 60204-1			
Clause	Requirement	Test Result	Verdict
	An over current protective device shall be located at the point where a reduction in the cross-sectional area of the conductors or another change reduces the current-carrying capacity of the conductors, except where all the following conditions are satisfied: —the current carrying capacity of the conductors is at least equal to that of the load; —the part of the conductor between the point of reduction of current-carrying capacity and the position of the over current protective device is no longer than 3 m; —the conductor is installed in such a manner as to reduce the possibility of a short-circuit for example, protected by an enclosure or duct.		P
7.2.9	**Overcurrent protective devices**		
	The rated short-circuit breaking capacity shall be at least equal to the prospective fault current at the point of installation. Where the short-circuit current to an over current protective device can include additional currents other than from the supply (for example from motors from power factor correction capacitors), those currents shall be taken into consideration. Where fuses are provided as over current protective devices, a type readily available in the country of use shall be selected, or arrangements shall be made for the supply of spare parts.	Using overcurrent protective device	P
7.2.10	**Rating and setting of overcurrent protective devices**		
	The rated current of fuses or the setting current of other over current protective devices shall be selected as low as possible but adequate for the anticipated over currents (for example during starting of motors or energizing of transformers). When selecting those protective devices, consideration shall be given to the protection of switching devices against damage due to over currents The rated current or setting of an over current protective device is determined by the current carrying capacity of the conductors to be protected in accordance with 12.4, D.2 and the maximum allowable interrupting time *t* in accordance with Clause D.3, taking into account the needs of co-ordination with other electrical devices in the protected circuit.		P
7.3	**Protection of motors against overheating**		
7.3.1	**General**		
	Protection of motors against overheating shall be provided for each motor rated at more than 0,5 kW. Protection of motors against overheating can be achieved by: —overload protection (7.3.2), —over-temperature protection (7.3.3), or —current-limiting protection (7.3.4). Automatic restarting of any motor after the operation of protection against overheating shall be prevented where this can cause a hazardous situation or damage to the machine or to the work in progress.		P

EN 60204-1			
Clause	Requirement	Test Result	Verdict
7.3.2	**Overload protection**		
	Where overload protection is provided, detection of overload(s) shall be provided in each live conductor except for the neutral conductor. However, where the motor overload detection is not used for cable overload protection (see also Clause D.2), the number of overload detection devices may be reduced at the request of the user (see also Annex B). For motors having single- phase or d.c. power supplies,detection in only one unearthed live conductor is permitted. For motors that cannot be overloaded (for example torque motors, motion drives that either are protected by mechanical overload protection devices or are adequately dimensioned) overload protection is not required.		P
7.3.3	**Over-temperature protection**		
	The provision of motors with over-temperature protection (see IEC 60034-11) is recommended in situations where the cooling can be impaired (for example dusty environments). Depending upon the type of motor, protection under stalled rotor or loss of phase conditions is not always ensured by over-temperature protection, and additional protection should then be provided. Over-temperature protection is also recommended for motors that cannot be overloaded (for example torque motors, motion drives that are either protected by mechanical overload protection devices or are adequately dimensioned), where the possibility of over-temperature exists (for example due to reduced cooling).		N
7.4	**Protection against abnormal temperature**		
	Equipment shall be protected against abnormal temperatures that can result in a hazardous situation		P
7.5	**Protection against the effects of supply interruption or voltage reduction and subsequent restoration**		
	Where a supply interruption or a voltage reduction can cause a hazardous situation, damage to the machine, or to the work in progress, undervoltage protection shall be provided by, for example, switching off the machine at a predetermined voltage level. Where the operation of the machine can allow for an interruption or a reduction of the voltage for a short time period, delayed undervoltage protection may be provided. The operation of he undervoltage device shall not impair the operation of any stopping control of the machine.		P
7.6	**Motor overspeed protection**		
	Overspeed protection shall be provided where overspeeding can occur and could possibly cause a hazardous situation taking into account measures in accordance with 9.3.2. Overspeed protection shall initiate appropriate control responses and shall prevent automatic restarting. The overspeed protection should operate in such a manner that the mechanical speed limit of the motor or its load is not exceeded		P
7.7	**Additional earth fault/residual current protection**		

EN 60204-1			
Clause	Requirement	Test Result	Verdict
	in addition to providing overcurrent protection for automatic disconnection as described in 6.3,earth fault/residual current protection can be provided to reduce damage to equipment due to earth fault currents less than the detection level of the overcurrent protection	Using copper wires connect to the earth system.	P
7.8	**Phase sequence protection**		
	Where an incorrect phase sequence of the supply voltage can cause a hazardous situation or damage to the machine, protection shall be provided.		P
7.9	**Protection against over voltages due to lightning and to switching surges**		
	Surge protective devices (SPDs) can be provided to protect against the effects of overvoltages due to lightning or to switching surges. Where provided: —SPDs for the suppression of overvoltages due to lightning shall be connected to the incoming terminals of the supply disconnecting device. —SPDs for the suppression of overvoltages due to switching surges shall be connected as necessary for equipment requiring such protection.		P
7.10	**Short-circuit current rating**		
	The short-circuit current rating of the electrical equipment shall be determined. This can be done by the application of design rules or by calculation or by test.		P
8 Equipotential bonding			
8.1	**General**		
	This Clause 8 provides requirements for protective bonding and functional bonding. Figure 4 illustrates those concepts.		P
8.2	**Protective bonding circuit**		
8.2.1	**General**		
	The protective bonding circuit consists of: —PE terminal(s) (see 5.2); —the protective conductors (see 3.1.51) in the equipment of the machine including sliding contacts where they are part of the circuit; —the conductive structural parts and exposed conductive parts of the electrical equipment; —conductive structural parts of the machine. All parts of the protective bonding circuit shall be so designed that they are capable of withstanding the highest thermal and mechanical stresses that can be caused by earth-fault currents that could flow in that part of the protective bonding circuit.	Complied	P
8.2.2	**Protective conductors**		
	Protective conductors shall be identified in accordance with 13.2.2. Copper conductors are preferred. Where a conductor material	Copper conductors comply with	P

EN 60204-1			
Clause	Requirement	Test Result	Verdict
	other than copper is used, its electrical resistance per unit length shall not exceed that of the allowable copper conductor and such conductors shall be not less than 16 mm 2 in cross-sectional area for reasons of mechanical durability.	relevant clause, and PE label marked.	
8.2.3	**Continuity of the protective bonding circuit**		
	Where a part is removed for any reason (for example routine maintenance), the protective bonding circuit for the remaining parts shall not be interrupted. Connection and bonding points shall be so designed that their current-carrying capacity is not impaired by mechanical, chemical, or electrochemical influences. Where enclosures and conductors of aluminium or aluminium alloys are used, particular onsideration should be given to the possibility of electrolytic corrosion.	See clause 18.2.	P
8.2.4	**Protective conductor connecting points**		
	All protective conductors shall be terminated in accordance with 13.1.1. The protective conductor connecting points are not intended, for example, to attach appliances or parts.		P
8.2.5	**Mobile machines**		
	On mobile machines with on-board power supplies, the protective conductors, the conductive structural parts of the electrical equipment, and those extraneous-conductive-parts which form the structure of the machine shall all be connected to a protective bonding terminal to provide protection against electric shock. Where a mobile machine is also capable of being connected to an external incoming power supply, this protective bonding terminal shall be the connection point for the external protective conductor	Consider control desk	P
8.2.6	**Additional requirements for electrical equipment having earth leakage currents higher than 10 mA**		
	Where electrical equipment has an earth leakage current that is greater than 10 mA AC or DC in any protective conductor, one or more of the following conditions for the integrity of each section of the associated protective bonding circuit that carries the earth leakage current shall be satisfied:		P
	a) the protective conductor is completely enclosed within electrical equipment enclosures or otherwise protected throughout its length against mechanical damage;		N
	b) the protective conductor has a cross-sectional area of at least 10 mm 2 Cu or 16 mm 2 Al;		N
	c) where the protective conductor has a cross-sectional area of less than 10 mm 2 Cu or 16 mm 2 Al, a second protective conductor of at least the same cross-sectional area is provided up to a point where the protective conductor has a cross-sectional area not less than 10 mm 2 Cu or 16 mm 2 Al. This can require that the electrical equipment has a separate terminal for a second protective conductor		N
	d) the supply is automatically disconnected in case of loss of continuity of the protective conductor;		N

EN 60204-1			
Clause	Requirement	Test Result	Verdict
	e) where a plug-socket combination is used, an industrial connector in accordance with IEC 60309 series, with adequate strain relief and a minimum protective earthing conductor cross-section of 2,5 mm 2 as part of a multi-conductor power cable is provided.		N
8.3	**Functional bonding**		
	Protection against maloperation as a result of insulation failures can be achieved by connecting to a common conductor in accordance with 9.4.3.1.1. For recommendations regarding functional bonding to avoid maloperation due to electromagnetic disturbances, see 4.4.2 and Annex H.		P
9 Control circuits and control functions			
9.1	**Control circuits**		
9.1.1	**Control circuit supply**		
	Where control circuits are supplied from an AC source, transformers having separate windings shall be used to separate the power supply from the control supply.		P
9.1.2	**Control circuit voltages**		
	The nominal value of the control voltage shall be consistent with the correct operation of the control circuit.		P
	The nominal voltage of AC control circuits should preferably not exceed – 230 V for circuits with 50 Hz nominal frequency, – 277 V for circuits with 60 Hz nominal frequency		P
	The nominal voltage of DC control circuits should preferably not exceed 220 V.		N
9.1.3	**Protection**		
	Control circuits shall be provided with over current protection in accordance with 7.2.4 and 7.2.10.		P
9.2	**Control functions**		
9.2.2	**Categories of stop functions**		
	There are three categories of stop functions as follows:		P
	stop category 0: stopping by immediate removal of power to the machine actuators (i.e.an uncontrolled stop – see 3.1.64);		P
	stop category 1: a controlled stop (see 3.1.14) with power available to the machine actuators to achieve the stop and then removal of power when the stop is achieved;		N
	stop category 2: a controlled stop with power remaining available to the machine actuators		N
9.2.3.3	**Stop**		

EN 60204-1			
Clause	Requirement	Test Result	Verdict
	Stop category 0 and/or stop category 1 and/or stop category 2 stop functions shall be provided as indicated by the risk assessment and the functional requirements of the machine		P
9.2.3.4	**Emergency operations (emergency stop, emergency switching off)**		
9.2.3.4.1	**General**		
	Emergency stop and emergency switching off are complementary protective measures that are not primary means of risk reduction for hazards (for example trapping, entanglement, electric shock or burn) at a machine (see ISO 12100).		P
9.2.3.4.2	**Emergency stop**		
	Requirements for functional aspects of emergency stop equipment are given in ISO 13850.		P
9.2.3.4.3	**Emergency**		
9.2.3.5	**Operating modes**		N
9.2.3.6	**Monitoring of command actions**		N
9.2.3.7	**Hold-to-run controls**		N
9.2.3.8	**Two-hand control**		N
9.2.3.9	**Enabling control**		N
9.2.3.10	**Combined start and stop controls**		N
9.2.4	**Cableless control system (CCS)**		
9.2.4.1	**General requirements**		
	Subclause 9.2.4 deals with the functional requirements of control systems employing cableless (for example radio, infra-red) techniques for transmitting control signals and data between operator control station(s) and other parts of the control system(s).		N
9.2.4.2	**Monitoring the ability of a cableless control system to control a machine**		
	The ability of a cableless control system (CCS) to control a machine shall be automatically monitored, either ontinuously or at suitable intervals. The status of this ability shall be clearly indicated		N
9.2.4.3	**Control limitation**		
	Measures shall be taken (e.g. coded transmission) to prevent the machine from responding to signals other than those from the intended cableless operator control station(s)		N
9.2.4.4	**Use of multiple cableless operator control stations**		

EN 60204-1			
Clause	Requirement	Test Result	Verdict
	When more than one cableless operator control station is used to control a machine: • only one cableless operator control station shall be enabled at a time except as necessary for the operation of the machine; • transfer of control from one cableless operator control station to another shall require a deliberate manual action at the control station that has control; • during machine operation, transfer of control shall only be possible when both cableless operator control stations are set to the same mode of machine operation and/or function(s) of the machine; • transfer of control shall not change the selected mode of machine operation and/or function(s) of the machine; • each cableless operator control station that has control of the machine shall be provided with an indication that it has control (by for example, the provision of an indicating light, a visual display indication).		N
9.2.4.5	**Portable cableless operator control stations**		
	Portable cableless operator control stations shall be provided with means (for example key operated switch, access code) to prevent unauthorized use.		N
9.2.4.6	**Deliberate disabling of cableless operator control stations**		
	Where a cableless operator control station is disabled when under control, the associated machine shall meet the requirements for loss of ability of a CCS to control a machine in 9.2.4.2		N
9.2.4.7	**Emergency stop devices on portable cableless operator control stations**		
	Emergency stop devices on portable cableless operator control stations shall not be the sole means of initiating the emergency stop function of a machine.		N
9.2.4.8	**Emergency stop reset**		
	Restarting of cableless control after power loss, disabling and re-enabling, loss of communication, or failure of parts of the CCS shall not result in a reset of an emergency stop condition.		N
9.3	**Protective interlocks**		
9.3.1	**Reclosing or resetting of an interlocking safeguard**		
	The reclosing or resetting of an interlocking safeguard shall not initiate hazardous machine operation		N
9.3.2	**Exceeding operating limits**		
	Where an operating limits (for example speed, pressure, position) can be exceeded leading to a hazardous situation, means shall be provided to detect when a predetermined limit(s) is exceeded and		N
9.3.3	**Operation of auxiliary functions**		N
	The correct operation of auxiliary functions shall be checked by appropriate devices (for example pressure sensors). Where the non-operation of a motor or device for an auxiliary		N

EN 60204-1			
Clause	Requirement	Test Result	Verdict
	function (for example lubrication, supply of coolant, swarf removal) can cause a hazardous situation, or cause damage to the machine or to the work in progress, appropriate interlocking shall be provided.		
9.3.4	**Interlocks between different operations and for contrary motions**		
	All contactors, relays, and other control devices that control elements of the machine and that can cause a hazardous situation when actuated at the same time (for example those which initiate contrary motion), shall be interlocked against incorrect operation. Reversing contactors (for example those controlling the direction of rotation of a motor) shall be interlocked in such a way that in normal service no short circuit can occur when switching. Where, for safety or for continuous operation, certain functions on the machine are required to be interrelated, proper co-ordination shall be ensured by suitable interlocks. For a group of machines working together in a co-coordinated manner and having more than one controller provision shall be made to co-ordinate the operations of the controllers as necessary. Where a failure of a mechanical brake actuator can result in the brake being applied when the associated machine actuator is energized and a hazardous situation can result, interlocks shall be provided to switch off the machine actuator.		N
9.3.5	**Reverse current braking**		
	Where braking of a motor is accomplished by current reversal, measures shall be provided to prevent the motor starting in the opposite direction at the end of braking where that reversal can cause a hazardous situation or damage to the machine or to the work in progress. For this purpose, a device operating exclusively as a function of time is not permitted. Control circuits shall be so arranged that rotation of a motor shaft, for example manually shall not result in a hazardous situation.		N
9.3.6	**Suspension of safety functions and/or protective measures**		
	Where it is necessary to suspend safety functions and/or protective measures (for example for setting or maintenance purposes), the control or operating mode selector shall simultaneously: • disable all other operating (control) modes; • permit operation only by the use of a hold-to-run device or by a similar control device positioned so as to permit sight of the hazardous elements; • permit operation of the hazardous elements only in reduced risk conditions (e.g. reduced speed, reduced power / force, step-by-step operation, e.g. with a limited movement control device); • prevent any operation of hazardous functions by voluntary or involuntary action on the machine's sensors.		N

EN 60204-1			
Clause	Requirement	Test Result	Verdict
9.4	**Control functions in the event of failure**		
9.4.1	**General requirements**		
	Where failures or disturbances in the electrical equipment can cause a hazardous situation or damage to the machine or to the work in progress, appropriate measures shall be taken to minimize the probability of the occurrence of such failures or disturbances. The required measures and the extent to which they are implemented, either individually or in combination depend on the level of risk associated with the respective application (see 4.1).		P
9.4.2	**Measures to minimize risk in the event of failure**		
9.4.2.1	**General**		
	Measures to minimize risk in the event of failure include but are not limited to: • use of proven circuit techniques and components; • provisions of partial or complete redundancy; • provision of diversity; • provision for functional tests.	(See appended table)	P
9.4.2.2	**Use of proven circuit techniques and components**		
	These measures include but are not limited to: • bonding of control circuits to the protective bonding circuit for functional purposes (see 9.4.3.1.1 and Figure 4); • connection of control devices in accordance with 9.4.3.1.1; • stopping by de-energizing; • the switching of all control circuit conductors (for example both sides of a coil) of the device being controlled; • switching devices having direct opening action (see IEC 60947-5- 1); • monitoring by: – use of mechanically linked contacts (see IEC 60947-5-1); – use of mirror contacts (see IEC 60947-4-1); • circuit design to reduce the possibility of failures causing undesirable operations		N
9.4.2.3	**Provisions of partial or complete redundancy**		
	By providing partial or complete redundancy, it is possible to minimize the probability that one single failure in the electrical circuit can result in a hazardous situation. Redundancy can be effective in normal operation (on-line redundancy) or designed as special circuits that take over the protective function (off-line redundancy) only where the operating function fails.		N
9.4.2.4	**Provision of diversity**		
	Functional tests may be carried out automatically by the control system, or manually by inspection or tests at start-up and at predetermined intervals or a combination as appropriate (see also 17.2 and 18.6).		P
9.4.2.5	**Provision for functional tests**		
	Functional tests may be carried out automatically by the control system, or manually by inspection or tests at start-up and at predetermined intervals, or a combination as		N

EN 60204-1			
Clause	Requirement	Test Result	Verdict
	appropriate (see also 17.2 and 18.6)		
9.4.3	**Protection against malfunction of control circuits**		
9.4.3.1	**Insulation faults**		
9.4.3.1.1	**General**		
	The measures to meet the requirements include but are not limited to the following methods: – method a) Earthed control circuits fed by transformers; – method b) Non-earthed control circuits fed by transformers; – method c) Control circuits fed by transformer with an earthed centre-tap winding; – method d) Control circuits not fed by a transformer.	method b)	P
9.4.3.1.2	**Method a) – Earthed control circuits fed by transformers**		
	The common conductor shall be connected to the protective bonding circuit at the point of supply		N
9.4.3.1.3	**Method b) – Non-earthed control circuits fed by transformers**		
	Control circuits fed from a control transformer that is not connected to the protective bonding circuit		P
9.4.3.1.4	**Method c) – Control circuits fed by transformer with an earthed centre-tap winding**		
	Control circuits fed from a control transformer with its centre-tap winding connected to the protective bonding circuit shall have overcurrent protective devices that break both the conductors.		N
9.4.3.2	**Voltage interruptions**		
	Where the control system uses a memory device(s), proper functioning in the event of power failure shall be ensured (for example by using a non-volatile memory) to prevent any loss of memory that can result in a hazardous situation.		P
9.4.3.3	**Loss of circuit continuity**		
	Where the loss of continuity of safety-related control circuits depending upon sliding contacts can result in a hazardous situation, appropriate measures shall be taken (for example by duplication of the sliding contacts).		N
10 Operator interface and machine-mounted control devices			
10.1	**General**		
10.1.1	**General device requirements**		

EN 60204-1			
Clause	Requirement	Test Result	Verdict
	This Clause contains requirements for devices mounted outside or partially outside control enclosures. As far as is practicable, those devices shall be selected, mounted, and identified or coded in accordance with relevant parts of IEC 61310. The possibility of inadvertent operation shall be minimized by, for example, positioning of devices, suitable design, and provision of additional protective measures. Particular consideration shall be given to the selection, arrangement, programming and use of operator input devices such as touch screens, keypads and keyboards, for the control of hazardous machine operations. See IEC 60447.		P
10.1.2	**Location and mounting**		
	As far as is practicable, machine-mounted control devices shall be: —readily accessible for service and maintenance; —mounted in such a manner as to minimize the possibility of damage from activities such as material handling. The actuators of hand-operated control devices shall be selected and installed so that: —they are not less than 0,6 m above the servicing level and are within easy reach of the normal working position of the operator; —the operator is not placed in a hazardous situation when operating them. The actuators of foot-operated control devices shall be selected and installed so that: —they are within easy reach of the normal working position of the operator; —the operator is not placed in a hazardous situation when operating them.	Easily reach and control.	P
10.1.3	**Protection**		
	The degree of protection (see IEC 60529) together with other appropriate measures shall afford protection against: —the effects of aggressive liquids, vapours, or gases found in the physical environment or used on the machine; —the ingress of contaminants (for example swarf, dust, particulate matter). In addition, the operator interface control devices shall have a minimum degree of protection against direct contact of IPXXD (see IEC 60529).		P
10.1.4	**Position sensors**		
	Position sensors (for example position switches, proximity switches) shall be so arranged that they will not be damaged in the event of over travel. Position sensors in circuits with safety-related control functions shall have direct opening action (see IEC 60947-5-1) or shall provide similar reliability (see 9.4.2).		P
10.1.5	**Portable and pendant control stations**		

EN 60204-1			
Clause	Requirement	Test Result	Verdict
	Portable and pendant operator control stations and their control devices shall be so selected and arranged as to minimize the possibility of inadvertent machine operations caused by shocks and vibrations (for example if the operator control station is dropped or strikes an obstruction) (see also 4.4.8).		N
10.2	**Actuators**		
10.2.1	**Colors**		
	The colors for START/ON actuators should be WHITE, GREY, BLACK or GREEN with a preference for WHITE. RED shall not be used. The color RED shall be used for emergency stop and emergency switching off actuators. The colors for STOP/OFF actuators should be BLACK, GREY, or WHITE with a preference for BLACK. GREEN shall not be used. RED is permitted, but it is recommended that RED is not used near an emergency operation device. WHITE, GREY, or BLACK are the preferred colors for push-button actuators that alternately act as START/ON and STOP/OFF push- buttons. The colors RED, YELLOW, or GREEN shall not be used (see also 9.2.6). WHITE, GREY, or BLACK is the preferred colors for push-button actuators that cause operation while they are actuated and cease the operation when they are released (for example hold-to-run). The colors RED, YELLOW, or GREEN shall not be used. Reset push-buttons shall be BLUE, WHITE, GREY, or BLACK. Where they also act as a STOP/OFF button, the colors WHITE, GREY, or BLACK are preferred with the main preference being for BLACK. GREEN shall not be used. Where the same color WHITE, GREY, or BLACK is used for various functions (for example WHITE for START/ON and for STOP/OFF actuators) a supplementary means of coding (for example shape, position, symbol) shall be used for the identification of push-button actuators.	Complied.	P
10.2.2	**Markings**		
	In addition to the functional identification as described in 16.3, recommended symbols to be placed near to or preferably directly on certain actuators are given in Table 2 or 3.		P
10.3	**Indicator lights and displays**		
10.3.1	**General**		

EN 60204-1			
Clause	Requirement	Test Result	Verdict
	Indicator lights and displays serve to give the following types of information: —Indication: to attract the operator's attention or to indicate that a certain task should be performed. The colors RED, YELLOW, BLUE, and GREEN are normally used in this mode; for flashing indicator lights and displays, see 10.3.3. —confirmation: to confirm a command, or a condition, or to confirm the termination of a change or transition period. The colors BLUE and WHITE are normally used in this mode and GREEN may be used in some cases. Indicator lights and displays shall be selected and installed in such a manner as to be visible from the normal position of the operator. Indicator light circuits used for warning lights shall be fitted with facilities to check the operability of these devices.		P
10.3.2	**Colors**		
	Unless otherwise agreed between the supplier and the user Indicator lights shall be color-coded with respect to the condition (status) of the machine in accordance with Table 4. Indicating towers on machines should have the applicable colors in the following order from the top down; RED, YELLOW, BLUE, GREEN and WHITE.		P
10.3.3	**Flashing lights and displays**		
	For further distinction or information and especially to give additional emphasis, flashing lights and displays can be provided for the following purposes: —to attract attention; —to request immediate action; —to indicate a discrepancy between the command and actualstate;		P
10.4	**Illuminated push-buttons**		
	Illuminated push-button actuators shall be colour-coded in accordance with 10.2.1. Where there is difficulty inassigning an appropriate colour, WHITE shall be used. The colour of active emergency stop actuators shall remain RED regardless of the state of the illumination.		N
10.5	**Rotary control devices**		
	Devices having a rotational member, such as potentiometers and selector switches, shall have means of prevention of rotation of the stationary member. Friction alone shall not be considered sufficient.		N
10.6	**Start devices**		
	Actuators used to initiate a start function or the movement of machine elements (for example slides, spindles, carriers) shall be constructed and mounted so as to minimize inadvertent operation		P
10.7	**Emergency stop devices**		
10.7.1	**Location of emergency stop devices**		

EN 60204-1			
Clause	Requirement	Test Result	Verdict
	Devices for emergency stop shall be readily accessible. Emergency stop devices shall be located at each operator control station and at other locations where the initiation of an emergency stop can be required. There can be circumstances where confusion can occur between active and inactive emergency stop devices caused by disabling the operator control station. In such cases means (for example, information for use) shall be provided to minimize confusion		P
10.7.2	**Types of emergency stop device**		
	The types of device for emergency stop include: —a push-button device for actuation by the palm or the fist —a pull-cord operated switch; —a pedal-operated switch without a mechanical guard. The devices shall be in accordance with IEC 60947-5-5.		P
10.7.3	**Operation of the supply disconnecting device to effect emergency stop**		
	Where a stop category 0 is suitable, the supply disconnecting device may serve the functionof emergency stop where: • it is readily accessible to the operator; and • it is of the type described in 5.3.2 a), b), c), or d).		P
10.8	**Emergency switching off devices**		
10.8.1	**Location of emergency switching off devices**		
	Emergency switching off devices shall be located as necessary for the given application. Normally, those devices will be located separate from operator control stations. Where confusion can occur between emergency stop and emergency switching off devices, means shall be provided to minimise confusion		P
10.8.2	**Types of emergency switching off device**		
	The types of device for emergency switching off include: —a push-button operated switch with a palm or mushroom head type of actuator; —a pull-cord operated switch.		P
10.8.3	**Local operation of the supply disconnecting device to effect emergency switching off**		
	Where the supply disconnecting device is to be locally operated for emergency switching off, it shall be readily accessible and shall meet the colour requirements of 10.2.1		P
	Devices for emergency stop shall be readily accessible. Emergency stop devices shall be located at each operator control station and at other locations where the initiation of an emergency stop can be required. There can be circumstances where confusion can occur between active and inactive emergency stop devices caused by disabling the operator control station. In such cases means (for example, information for use) shall be provided to minimize confusion		P
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EN 60204-1			
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10.8	**Emergency switching off devices**		
10.8.1	**Location of emergency switching off devices**		
	Emergency switching off devices shall be located as necessary for the given application. Normally, those devices will be located separate from operator control stations. Where confusion can occur between emergency stop and emergency switching off devices, means shall be provided to minimise confusion		P
10.8.2	**Types of emergency switching off device**		
	The types of device for emergency switching off include: —a push-button operated switch with a palm or mushroom head type of actuator; —a pull-cord operated switch.		P
10.8.3	**Local operation of the supply disconnecting device to effect emergency switching off**		
	Where the supply disconnecting device is to be locally operated for emergency switching off, it shall be readily accessible and shall meet the colour requirements of 10.2.1		P
10.9	**Enabling control device**		
	Enabling control devices shall be selected and arranged so as to minimize the possibility of defeating. Enabling control devices shall be selected that have the following features: —designed in accordance with ergonomic principles; —for a two-position type: —position 1: off-function of the switch (actuator is not operated); —position 2: enabling function (actuator is operated). —for a three-position type: —position 1: off-function of the switch (actuator is not operated); —position 2: enabling function (actuator is operated in its mid position); —position 3: off-function (actuator is operated past its mid position); —when returning from position 3 to position 2, the enabling function is not activated.	Obvious to operator.	P
11 Control gear: location, mounting, and enclosures			

EN 60204-1			
Clause	Requirement	Test Result	Verdict
11.1	**General requirements**		
	All control gear shall be located and mounted so as to facilitate: —its accessibility and maintenance; —its protection against the external influences or conditions under which it is intended to operate; —operation and maintenance of the machine and its associated equipment.		P
11.2	**Location and mounting**		
11.2.1	**Accessibility and maintenance**		
	All items of control gear shall be placed and oriented so that they can be identified without moving them or the wiring. For items that require checking for correct operation or that are liable to need replacement, those actions should be possible without dismantling other equipment or parts of the machine (except opening doors or removing covers, barriers or obstacles). Terminals not part of control gear components or devices shall also conform to these requirements. All control gear shall be mounted so as to facilitate its operation and maintenance from the front. Where a special tool is necessary to adjust, maintain, or remove a device, such a tool shall be supplied. Where access is required for regular maintenance or adjustment, the relevant devices shall be located between 0,4 m and 2,0 m above the servicing level. It is recommended that terminals be at least 0,2 m above the servicing level and be so placed that conductors and cables can be easily connected to them. No devices except devices for operating, indicating, measuring, and cooling shall be mounted on doors or on normally removable access covers of enclosures. Where control devices are connected through plug-in arrangements, their association shall be made clear by type (shape), marking or reference designation, singly or in combination (see 13.4.5). Plug-in devices that are handled during normal operation shall be provided with no interchangeable features where the lack of such a facility can result in malfunctioning. Plug/socket combinations that are handled during normal operation shall be located and mounted so as to provide unobstructed access. Test points for connection of test equipment, where provided, shall be: —mounted so as to provide unobstructed access; —Sufficiently spaced.		P
11.2.2	**Physical separation or grouping**		

EN 60204-1			
Clause	Requirement	Test Result	Verdict
	Non-electrical parts and devices, not directly associated with the electrical equipment, shall not be located within enclosures containing control gear. Devices such as solenoid valves should be separated from the other electrical equipment (for example in a separate compartment). Control devices mounted in the same location and connected to the supply voltage, or to both supply and control voltages, shall be grouped separately from those connected only to the control voltages. Terminals shall be separated into groups for:		P
11.2.3	**Heating effects**		
	Heat generating components (for example heat sinks, power resistors) shall be so located that the temperature of each component in the vicinity remains within the permitted limit.		N
11.3	**Degrees of protection**		
	The protection of control gear against ingress of solid foreign objects and of liquids shall be adequate taking into account the external influences under which the machine is intended to operate (i.e. the location and the physical environmental conditions) and shall be sufficient against dust, coolants, and swarf. Enclosures of control gear shall provide a degree of protection of at least IP22 (see IEC 60529). Exceptions: a) an electrical operating area provides an appropriate degree of protection against ingress of solids and liquids, or: b) removable collectors on conductor wire or conductor bar systems are used and the measures of 12.7.1 are applied.	Degrees of protection: IP22.	P
11.4	**Enclosures, doors and openings**		P
11.5	**Access to electrical equipment**		P
	Doors in gangways and for access to electrical operating areas shall: – be at least 0,7 m wide and 2,0 m high; – open outwards; – have a means (for example panic bolts) to allow opening from the inside without the use of a key or tool.		P
12 Conductors and cables			
12.1	**General requirements**		
	Conductors and cables shall be selected so as to be suitable for the operating conditions (for example voltage, current, protection against electric shock, grouping of cables) and external influences (for example ambient temperature, presence of water or corrosive substances mechanical stresses (including stresses during installation), fire hazards) that can exist.	Reinforce/double insulation cables provided.	P
12.2	**Conductors**		
	conductors shall be of copper. Where aluminum conductors are used, the cross-sectional area shall be at least 16 mm^2. To ensure adequate mechanical strength, the cross-sectional area of conductors should not be less than as shown in Table 5. However, conductors with smaller cross-sectional areas or	Copper used, conform to relevant IEC/EN standards.	P

EN 60204-1			
Clause	Requirement	Test Result	Verdict
	other constructions than shown in Table 5 may be used in equipment provided adequate mechanical strength is achieved by other means and proper functioning is not impaired.		
12.3	**Insulation**		
	Where the insulation of conductors and cables can constitute hazards due for example to the propagation of a fire or the emission of toxic or corrosive fumes, guidance from the cable supplier sh be sought. It is important to give special attention to the integrity of a circuit having a safety-related function	Protection degree of electrical operation box: 2000Vac for 5min.	P
12.4	**Current-carrying capacity in normal service**		
	The current-carrying capacity depends on several factors, for example insulation material number of conductors in a cable, design (sheath), methods of installation, grouping and ambient temperature.		P
12.5	**Conductor and cable voltage drop**		
	The voltage drop from the point of supply to the load shall not exceed 5 % of the nominal voltage under normal operating conditions. In order to conform to this requirement, it can be necessary to use conductors having a larger cross-sectional area than that derived from Table 6.		P
12.6	**Flexible cables**		
12.6.1	**General**		
	Flexible cables shall have Class 5 or Class 6 conductors.		P
12.6.2	**Mechanical rating**		
	The cable handling system of the machine shall be so designed to keep the tensile stress of the conductors as low as is practicable during machine operations. Where copper conductors are used, the tensile stress applied to the conductors shall not exceed 15 N/mm2 of the copper cross-sectional area. Where the demands of the application exceed the tensile stress limit of 15 N/mm2, cables with special construction features should be used and the allowed maximal tensile stress should be agreed with the cable manufacturer. The maximum stress applied to the conductors of flexible cables with material other than copper shall be within the cable manufacturer's specification.	Flexible cables: VDE or UL certificate provided.	P
12.6.3	**Current-carrying capacity of cables wound on drums**		
	Cables to be wound on drums shall be selected with conductors having a cross-sectional area such that, when fully wound on the drum and carrying the normal service load, the maximum allowable conductor temperature is not exceeded. For cables of circular cross-sectional area installed on drums, the maximum current-carrying capacity in free air should be derated in accordance with Table 7 (see also Clause 44 of IEC 60621-3).		P

EN 60204-1			
Clause	Requirement	Test Result	Verdict
12.7	**Conductor**		
12.7.1	**Basic protection**		
	Conductor wires, conductor bars and slip-ring assemblies shall be installed or enclosed in such a way that, during normal access to the machine, protection against direct contact is achieved by the application of one of the following protective measures:		P
12.7.2	**Protective conductor circuit**		
	Where conductor wires, conductor bars and slip-ring assemblies are installed as part of the protective bonding circuit, they shall not carry current in normal operation. Therefore, the protective conductor (PE) and the neutral conductor (N) shall each use a separate conductor wire, conductor bar or slip-ring..		P
12.7.3	**Protective conductor current collectors**		
	Movement or action of a machine or part of a machine that can result in a hazardous situation shall be monitored by providing, for example, over travel limiters, motor overspeed detection, mechanical overload detection or anti-collision devices.		N
12.7.4	**Removable current collectors with a disconnector function**		
	Removable current collectors having a disconnector function shall be so designed that the protective conductor circuit is interrupted only after the live conductors have been disconnected, and the continuity of the protective conductor circuit is re-established before any live conductor is reconnected (see also 8.2.3).		N
12.7.5	**Clearances in air**		
	Clearances between the respective conductors and between adjacent systems, of conductor wires, conductor bars, slip-ring assemblies and their current collectors shall be suitable for at least a rated impulse voltage of an overvoltage category III in accordance with IEC 60664-1.		P
12.7.6	**Creepage distances**		
	Creepage distances between the respective conductors, between adjacent systems of conductor wires, conductor bars and slip-ring assemblies, and their current collectors shall be suitable for operation in the intended environment, for example open air (IEC 60664-1), inside buildings, protected by enclosures. In abnormally dusty, moist or corrosive environments, the following creepage distance requirements apply: —unprotected conductor wires, conductor bars, and slip-ring assemblies shall be equipped with insulators with a minimum creepage distance of 60 mm; —enclosed conductor wires, insulated multipole conductor barsand insulated individual conductor bars shall have a minimum creepage distance of 30 mm. The manufacturer's recommendations shall be followed regarding special measures to prevent a gradual reduction in the insulation valuesdue to unfavorable ambient conditions (for example deposits of conductive dust, chemical attack).	>60 mm.	P
12.7.7	**Conductor system sectioning**		

EN 60204-1			
Clause	Requirement	Test Result	Verdict
	Where conductor wires or conductor bars are arranged so that they can be divided into isolated sections, suitable design measures shall be employed to prevent the energization of adjacent sections by the current collectors themselves.		P
12.7.8	**Construction and installation of conductor wire, conductor bar systems and slip-ring assemblies**		
	Conductor wires, conductor bars and slip-ring assemblies in power circuits shall be grouped separately from those in control circuits. Conductor wires, conductor bars and slip-ring assemblies shall be capable of withstanding without damage, the mechanical forces and thermal effects of short-circuit currents. Removable covers for conductor wire and conductor bar systems laid underground or under floor shall be so designed that they cannot be opened by one person without the aid of a tool. Where conductor bars are installed in a common metal enclosure, the individual sections of the enclosure shall be bonded together and connected to a protective bonding conductor at several points depending upon their length. Metal covers of conductor bars laid underground or under floor shall also be bonded together and connected to a protective bonding conductor. The protective bonding circuit shall include the covers or cover plates of metal enclosures or under floor ducts. Where metal hinges form a part of the bonding circuit, their continuity shall be verified (see Clause 18). Underground and under floor conductor bar ducts shall have drainage facilities.		P
13 Wiring practices			
13.1	**Connections and routing**		
13.1.1	**General requirements**		
	All connections, especially those of the protective bonding circuit, shall be secured against accidental loosening.	Terminal and bonding used for fixing.	P
13.1.2	**Conductor and cable runs**		

EN 60204-1			
Clause	Requirement	Test Result	Verdict
	Conductors and cables shall be run from terminal to terminal without splices or joints. Connections using plug/socket combinations with suitable protection against accidental disconnection are not considered to be joints for the purpose of this Sub clause. Exception: Where it is impracticable to provide terminals in a junction box (for example on mobile machines, on machines having long flexible cables; cable connections exceeding a length which is not practical to be supplied by the cable manufacturer on one cable drum; repair of cable due to mechanical stresses during installation and operation), splices or joints may be used. Where it is necessary to connect and disconnect cables and cable assemblies, a sufficient extra length shall be provided for that purpose. The terminations of cables shall be adequately supported to prevent mechanical stresses at the terminations of the conductors. Wherever practicable, the protective conductor shall be placed close to the associated live conductors in order to decrease the impedance of the loop.		P
13.1.3	**Conductors of different circuits**		
	Conductors of different circuits may be laid side by side, may occupy the same duct (for example conduit, cable trunking system), or may be in the same multiconductor cable provided that the arrangement does not impair the proper functioning of the respective circuits. Where those circuits operate at different voltages, the conductors shall be separated by suitable barriers or shall be insulated for the highest voltage to which any conductor within the same duct can be subjected, for example line to line voltage for unearthed systems and phase to earth voltage for earthed systems.	Conductors for different circuits lie side by side or occupy the same duct.	P
13.1.4	**AC circuits – Electromagnetic effects (prevention of eddy currents)**		
	Conductors of AC circuits installed in ferromagnetic enclosures shall be arranged so that all conductors of each circuit, including the protective conductor of each circuit, are contained in the same enclosure. Where such conductors enter a ferrous enclosure, they shall be arranged		P
13.1.5	**Connection between pick-up and pick-up converter of an inductive power supply system**		
	The cable between the pick-up and the pick-up converter shall be: – as short as practicable; – adequately protected against mechanical damage		N
13.2	**Identification of conductors**		
13.2.1	**General requirements**		
	Each conductor shall be identifiable at each termination in accordance with the technical documentation. It is recommended (for example to facilitate maintenance) that conductors be identified by number, alphanumeric, color (either solid or with one or more	Identification at each termination.	P

EN 60204-1			
Clause	Requirement	Test Result	Verdict
	stripes), or a combination of color and numbers or alphanumeric. When numbers are used, they shall be		
13.2.2	**Identification of the protective conductor / protective bonding conductor**		
	The protective conductor shall be readily distinguishable by shape, location, marking, or color. When identification is by color alone, the bicolor combination GREEN-ANDYELLOWshall be used throughout the length of the conductor. This colour identification is strictly reserved for the protective conductor. For insulated conductors, the bicolor combination GREEN-AND- YELLOW shall be such that on any 15 mm length, one of the colors covers at least 30 % and not more than 70 % of the surface of the conductor, the other color covering the remainder of the surface. Where the protective conductor can be easily identified by its shape, position, or construction (for example a braided conductor, uninsulated stranded conductor), or where the insulated conductor is not readily accessible, color coding throughout its length is not necessary but the ends or accessible locations shall be clearly identified by the graphical symbol IEC 60417-5019 (DB: 2002-10) or by the bicolor combination GREEN-AND-YELLOW.	GREEN-ANDYELLOW conductor used.	P
13.2.3	**Identification of the neutral conductor**		
	Where a circuit includes a neutral conductor that is identified by color alone, the color used for this conductor shall be BLUE. In order to avoid confusion with other colors, it is recommended that an unsaturated blue be used, called here “light blue” (see 6.2.2 of IEC 60445). Where the selected color is the sole identification of the neutral conductor, that color shall not be used for identifying any other conductor where confusion is possible. Where identification by color is used, bare conductors used as neutral conductors shall be either colored by a stripe, 15 mm to 100 mm wide in each compartment or unit and at each accessible location, or colored throughout their length.		P
13.2.4	**Identification by color**		
	Where color-coding is used for identification of conductors (other than the protective conductor (see 13.2.2) and the neutral conductor (see 13.2.3)), the following colors may be used: BLACK, BROWN, RED, ORANGE, YELLOW, GREEN, BLUE (including LIGHT BLUE), VIOLET, GREY, WHITE, PINK, TURQUOISE.		P
13.3	**Wiring inside enclosures**		

EN 60204-1			
Clause	Requirement	Test Result	Verdict
	Conductors inside enclosures shall be supported where necessary to keep them in place. Non-metallic ducts shall be permitted only when they are made with a flame-retardant insulating material (see the IEC 60332 series). It is recommended that electrical equipment mounted inside enclosures be designed and constructed in such a way as to permit modification of the wiring from the front of the enclosure (see also 11.2.1). Where that is not practicable and control devices are connected from the rear of the enclosure, access doors or swing out panels shall be provided.	Keep in place and modify from front panel ,and against flame.	P
13.4	**Wiring outside enclosures**		
13.4.1	**General requirements**		
	The means of introduction of cables or ducts with their individual glands, bushings, etc., into an enclosure shall ensure that the degree of protection is not reduced (see 11.3).		P
13.4.2	**External ducts**		
	Conductors and their connections external to the electrical equipment enclosure(s) shall be enclosed in suitable ducts (i.e. conduit or cable trunking systems) as described in 13.5except for suitably protected cables that may be installed without ducts and with or without the use of open cable trays or cable support means. Where devices such as position switches or proximity switches are supplied with a dedicated cable, their cable need not be enclosed in a duct when the cable is suitable for the purpose, sufficiently short, and so located or protected, that the risk of damage is minimized. Fittings used with ducts or multiconductor cable shall be suitable for the physical environment.		P
13.4.3	**Connection to moving elements of the machine**		
	Connections to frequently moving parts shall be made using conductors in accordance with 12.2 and 12.6. Flexible cable and flexible conduit shall be so installed as to avoid excessive flexing and straining, particularly at the fittings.		N
13.4.4	**Interconnection of devices on the machine**		
	Where several machine-mounted switching devices (for example position sensors, pushbuttons) are connected in series or in parallel, it is recommended that the connections between those devices be made through terminals forming intermediate test points. Such terminals shall be conveniently placed, adequately protected, and shown on the relevant diagrams.		P
13.4.5	**Plug/socket combinations**		
	Plug/socket combinations intended to be connected or disconnected during load conditions shall have sufficient load-breaking capacity.Where the plug/socket combination is rated at 30 A, or greater, it shall be interlocked with a switching device so that the connection and disconnection is possible only when the switching device is in the OFF position. Plug/socket combinations that are rated at more than 16 A shall have		P

EN 60204-1			
Clause	Requirement	Test Result	Verdict
13.4.6	**Dismantling for shipment**		
	Where it is necessary that wiring be disconnected for shipment, terminals or plug/socket combinations shall be provided at the sectional points. Such terminals shall be suitably enclosed and plug/socket combinations shall be protected from the physical environment during transportation and storage.		P
13.4.7	**Additional conductors**		
	Consideration should be given to providing additional conductors for maintenance or repair. When spare conductors are provided, they shall be connected to spare terminals or isolated in such a manner as to prevent contact with live parts.		P
13.5	**Ducts, connection boxes and other boxes**		
13.5.1	**General requirements**		
	Ducts shall provide a degree of protection suitable for the application (see IEC 60529). All sharp edges, flash, burrs, rough surfaces, or threads with which the insulation of the conductors can come in contact shall be removed from ducts and fittings. Where necessary additional protection consisting of a flame-retardant, oil-resistant insulating material shall be provided to protect conductor insulation. Drain holes of 6 mm diameter are permitted in cable trunking systems, connection boxes, and other boxes used for wiring purposes that can be subject to accumulations of oil or moisture.	No sharp edges, flash, burrs, rough surfaces or threads.	P
13.5.2	**Rigid metal conduit and fittings**		
	Fittings shall be compatible with the conduit and appropriate for the application. Fittings should be threaded unless structural difficulties prevent assembly. Where threadless fittings are used, the conduit shall be securely fastened to the equipment		P
13.5.3	**Flexible metal conduit and fittings**		
	A flexible metal conduit shall consist of a flexible metal tubing or woven wire armour. It shall be suitable for the expected physical environment. Fittings shall be compatible with the conduit and appropriate for the application.		N
13.5.4	**Flexible non-metallic conduit and fittings**		
	Flexible non-metallic conduit shall be resistant to kinking and shall have physical characteristics similar to those of the sheath of multiconductor cables. The conduit shall be suitable for use in the expected physical environment. Fittings shall be compatible with the conduit and appropriate for the application.	Comply with relevant requirements.	P
13.5.5	**Cable trunking systems**		

EN 60204-1			
Clause	Requirement	Test Result	Verdict
	Cable trunking systems external to enclosures shall be rigidly supported and clear of all moving parts of the machine and of sources of contamination. Covers shall be shaped to overlap the sides; gaskets shall be permitted. Covers shall be attached to cable trunking systems by suitable means. On horizontal cable trunking systems, the cover shall not be on the bottom unless specifically designed for such installation. Where the cable trunking system is furnished in sections, the joints between sections shall fit tightly but need not be gasketed. The only openings permitted shall be those required for wiring or for drainage. Cable trunking systems shall not have opened but unused knockouts.		N
13.5.6	**Machine compartments and cable trunking systems**		
	The use of compartments or cable trunking systems within the column or base of a machine to enclose conductors is permitted provided the compartments or cable trunking systems are isolated from coolant or oil reservoirs and are entirely enclosed. Conductors run in enclosed compartments and cable trunking systems shall be so secured and arranged that they are not subject to damage.		N
13.5.7	**Connection boxes and other boxes**		
	Connection boxes and other boxes used for wiring purposes shall be accessible for maintenance. Those boxes shall provide protection against the ingress of solid bodies and liquids, taking into account the external influences under which the machine is intended to operate (see 11.3). Those boxes shall not have opened but unused knockouts nor any other openings and shall be so constructed as to exclude materials such as dust, flying, oil, and coolant.		P
13.5.9	**Motor connection boxes**		
	Motor connection boxes shall enclose only connections to the motor and motor-mounted devices.		P
14 Electric motors and associated equipment			
14.1	**General requirements**		
	Electric motors should conform to the relevant parts of IEC 60034 series. The protection requirements for motors and associated equipment are given in 7.2 for over current protection, in 7.3 for overload protection, and in 7.6 for overspeed protection. As many controllers do not switch off the supply to a motor when it is at rest, care shall be taken to ensure compliance with the requirements of 5.3, 5.4, 5.5, 7.5, 7.6 and 9.4. Motor control equipment shall be located and mounted in accordance with Clause 11.		P
14.2	**Motor enclosures**		

EN 60204-1			
Clause	Requirement	Test Result	Verdict
	It is recommended that motor enclosures be chosen from those included in IEC 60034-5. The degree of protection shall be dependent on the application and the physical environment (see 4.4). All motors shall be adequately protected from mechanical damage		P
14.3	**Motor dimensions**		
	As far as is practicable, the dimensions of motors shall conform to those given in the IEC 60072 series.		P
14.4	**Motor mounting and compartments**		
	Each motor and its associated couplings, belts, pulleys, or chains, shall be so mounted that they are adequately protected and are easily accessible for inspection, maintenance, adjustment and alignment, lubrication, and replacement. The motor mounting arrangement shall be such that all motor hold-down means can be removed and all terminal boxes are accessible. Motors shall be so mounted that proper cooling is ensured and the temperature rise remains within the limits of the insulation class (see IEC 60034-1). Where practicable, motor compartments should be clean and dry, and when required, shall be ventilated directly to the exterior of the machine. The vents shall be such that ingress of swarf, dust, or water spray is at an acceptable level. There shall be no opening between the motor compartment and any other compartment that does not meet the motor compartment requirements. Where a conduit or pipe is run into the motor compartment from another compartment not meeting the motor compartment requirements, any clearance around the conduit or pipe shall be sealed.		P
14.5	**Criteria for motor selection**		

EN 60204-1			
Clause	Requirement	Test Result	Verdict
	The characteristics of motors and associated equipment shall be selected in accordance with the anticipated service and physical environmental conditions (see 4.4). In this respect, the points that shall be considered include: —type of motor; —type of duty cycle (see IEC 60034-1); —fixed speed or variable speed operation, (and the consequent variable influence of the ventilation); —mechanical vibration; —type of motor control; —influence of the harmonic spectrum of the voltage and/or current feeding the motor (particularly when it is supplied from a static convertor) on the temperature rise; —method of starting and the possible influence of the inrush current on the operation of other users of the same power supply, taking also into account possible special considerations stipulated by the supply authority; —variation of counter-torque load with time and speed; —influence of loads with large inertia; —influence of constant torque or constant power operation; —possible need of inductive reactors between motor and converter.		P
14.6	**Protective devices for mechanical brakes**		
	Operation of the overload and over current protective devices for mechanical brake actuators shall initiate the simultaneous de-energization (release) of the associated machine actuators.		P
15 Accessories and lighting			
15.1	**Socket-outlets for accessories**		
	Where the machine or its associated equipment is provided with socket-outlets that are intended to be used for accessory equipment (for example hand-held power tools, test equipment), the following apply: – the socket-outlets should conform to IEC 60309-1. Where that is not practicable, they should be clearly marked with the voltage and current ratings; – the continuity of the protective bonding circuit to the socket-outlet shall be ensured; – all unearthed conductors connected to the socket-outlet shall be protected against overcurrent and, when required, against overload in accordance with 7.2 and 7.3 separately from the protection of other circuits; – where the power supply to the socket-outlet is not disconnected by the supply discon-necting device for the machine or the section of the machine, the requirements of 5.3.5apply; – where fault protection is provided by automatic disconnection of supply, the disconnection time shall be in accordance with Table A.1 for TN systems or Table A.2 for TT systems; – circuits supplying socket-outlets with a current		N

EN 60204-1			
Clause	Requirement	Test Result	Verdict
	rating not exceeding 20 A shall be provided		
15.2	**Local lighting of the machine and equipment**		
15.2.1	**General**		
	The ON/OFF switch shall not be incorporated in the lampholder or in the flexible connecting cords. Stroboscopic effects from lights shall be avoided by the selection of appropriate luminaries. Where fixed lighting is provided in an enclosure, electromagnetic compatibility should be taken into account using the principles outlined in 4.4.2.	No lamp used.	N
15.2.2	**Supply**		
	The nominal voltage of the local lighting circuit shall not exceed 250V between conductors. A voltage not exceeding 50 V between conductors is recommended.		N
15.2.3	**Protection**		
	Local lighting circuits shall be protected in accordance with 7.2.6.		N
15.2.4	**Fittings**		
	Adjustable lighting fittings shall be suitable for the physical environment. The lamp holders shall be: —in accordance with the relevant IEC standard; —constructed with an insulating material protecting the lamp cap so as to prevent unintentional contact. Reflectors shall be supported by a bracket and not by the lamp holder.		N
16 Marking, warning signs and reference designations			
16.1	**General**		
	Warning signs, nameplates, markings, and identification plates shall be of sufficient durability to withstand the physical environment involved.		P
16.2	**Warning signs**		
16.2.1	**Electric shock hazard**		
	Enclosures that do not otherwise clearly show that they contain electrical equipment that can give rise to a risk of electric shock shall be marked with the graphical symbol IEC 60417-5036 (DB:2002-10). The warning sign shall be plainly visible on the enclosure door or cover. The warning sign may be omitted (see also 6.2.2 b)) for: —an enclosure equipped with a supply disconnecting device; —an operator-machine interface or control station; —a single device with its own enclosure (for example position sensor).		P

EN 60204-1			
Clause	Requirement	Test Result	Verdict
16.2.2	**Hot surfaces hazard**		
	Where the risk assessment shows the need to warn against the possibility of hazardous surface temperatures of the electrical equipment, the graphical symbol IEC 60417-5041 (DB: 2002-10) shall be used.		N
16.3	**Functional identification**		
	Control devices and isual indicators shall be clearly and durably marked with regard to their functions either on or adjacent to the item. It is recommended that such markings are made in accordance with IEC 60417 and ISO 7000.		P
16.4	**Marking of enclosures of electrical equipment**		
	The following information shall be legibly and durably marked in a way that is plainly visible after the equipment is installed on enclosures that receive incoming power supplies: —name or trade mark of supplier; —type designation or model, where applicable —serial number where applicable; —main document number (see IEC 62023) where applicable —rated voltage, number of phases and frequency (if AC), and full- load current for each incoming supply		P
16.5	**Reference designations**		
	All enclosures, assemblies, control devices, and components shall be plainly identified with the same reference designation as shown in the technical documentation.		P
17 Technical documentation			
17.1	**General**		
	The information necessary for identification, transport, installation, use, maintenance, decommissioning and disposal of the electrical equipment shall be supplied. Annex I should be considered as guidance for the preparation of information and documents		P
17.2	**Information related to the electrical equipment**		

18	**Verification**			
18.2	**TABLE: Earth bonding**			P
	Test Current (A)..... :	10A		
	Ambient (℃).....:	25		
Test locations (most unfavorable case)		Conductor diameter (mm^2)	Measure resistance (mΩ)	
	PE – enclosure outside	2.5	21.2	

EN 60204-1			
Clause	Requirement	Test Result	Verdict

18.3	**TABLE: Insulation resistance test**		P
	Test Voltage (V)..... :	500Va.c.	
	Ambient (℃).....:	24.2	
Test locations (most unfavorable case)		Insulation resistance (MΩ)	
	PE - L	>100	
	PE - N	>100	
18.4	**TABLE: Dielectric test**		P
	Test Voltage (V)..... :	1000Va.c.	
	Test Duration (s)..... :	1 min.	
Test locations (most unfavorable case)		Observation	
	PE - L	No found Puncture Flash-over	
	PE - N	No found Puncture Flash-over	
18.5	**Protection against residual voltages**		
	Where appropriate, tests shall be performed to ensure compliance with 6.2.4.	See clause 6.2.4.	P
18.6	**Functional tests**		
	The functions of electrical equipment shall be tested. The function of circuits for electrical safety (for example earth fault detection) shall be tested.		P

EN 60204-1			
Clause	Requirement	Test Result	Verdict

Table 4.2	**List of Components**					
Symbol	object/part No.	Manufacturer/ trademark	type/model	technical data	standard	mark(s) of conformity1)
---	Internal wire	QINGYUAN JUNFENG WIRE & CABLE CO LTD	1332	200℃, 300V	UL 758	UL E476194
---	PCB	TONGYUAN TECHNOLOGY HUIZHOU CO LTD	TY-1	V-0, min. 130℃	UL 796	UL E486376
Note: N/A.						

Photo Documentation

Photo 1

View:

☒ front

☐ rear

☐ right side

☐ left side

☐ top

☐ bottom

☐ internal

Photo 2

View:

☐ front

☐ rear

☒ right side

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☐ bottom

☐ internal

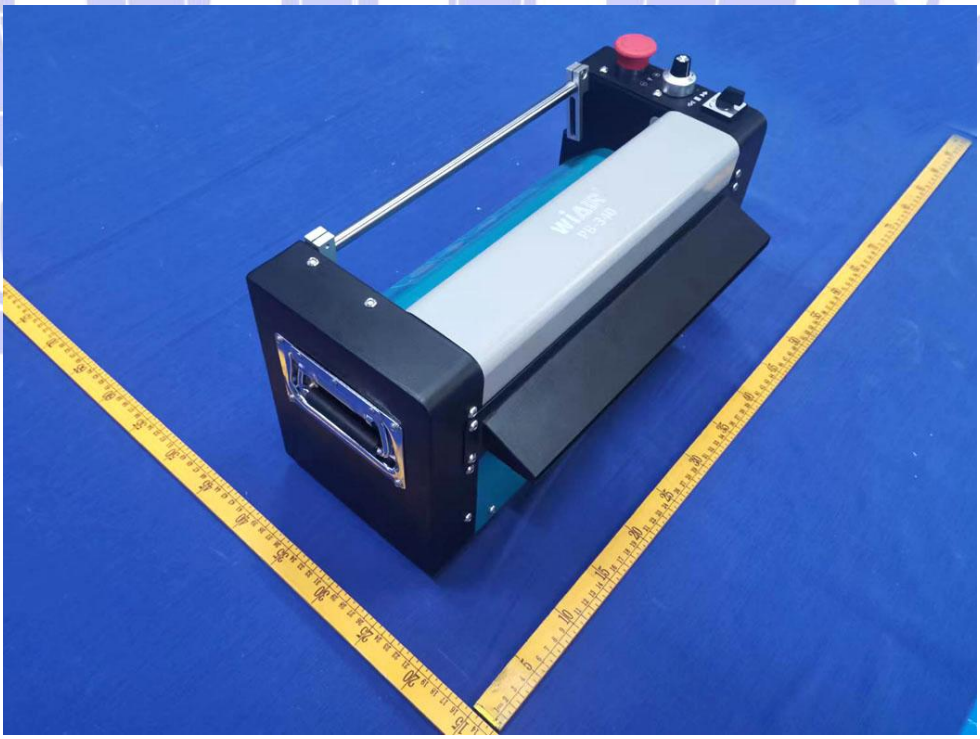

Photo 3

View:

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☐ rear

☐ right side

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☐ top

☐ bottom

☐ internal

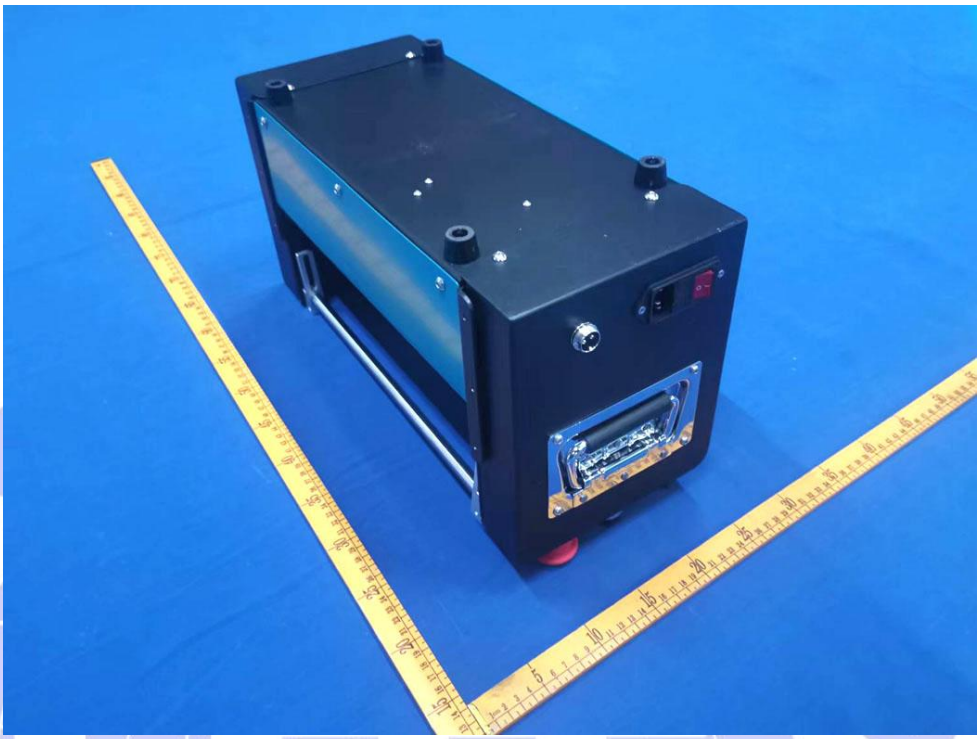

Photo 4

View:

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☐ left side

☐ top

☐ bottom

☐ internal

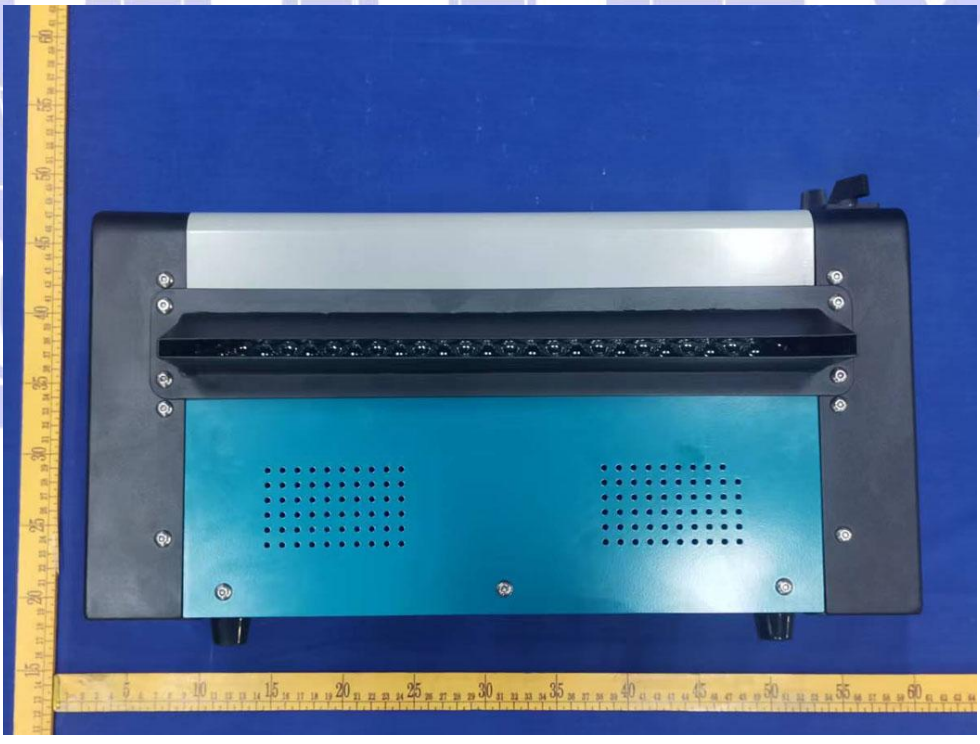

Photo 5

View:

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☐ bottom

☒ internal

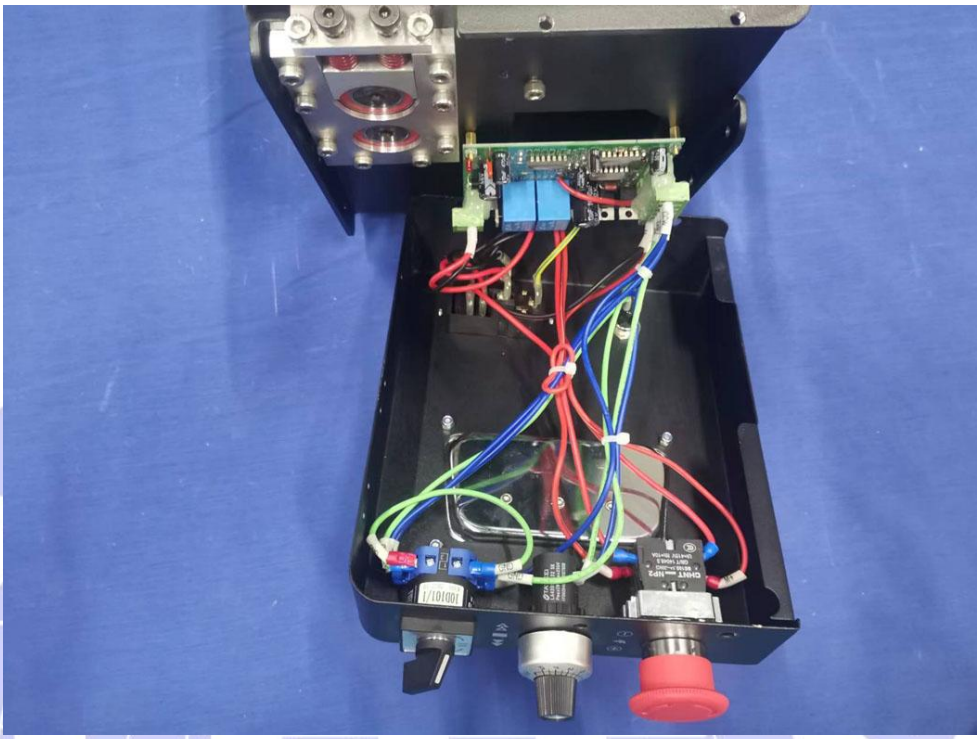

Photo 6

View:

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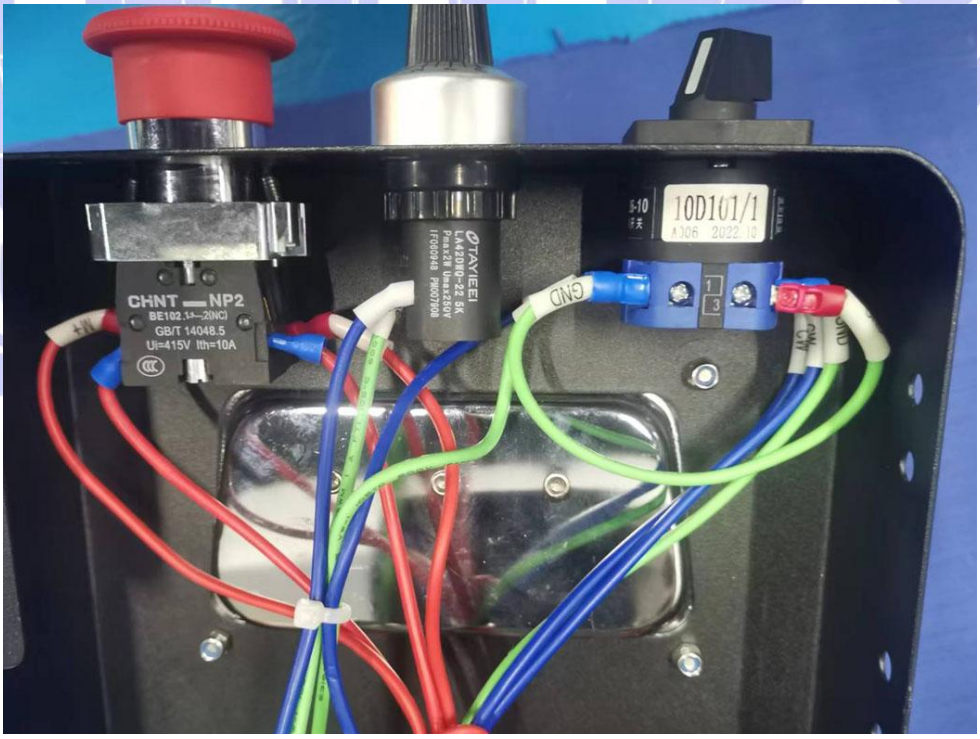

Photo 7

View:

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☒ internal

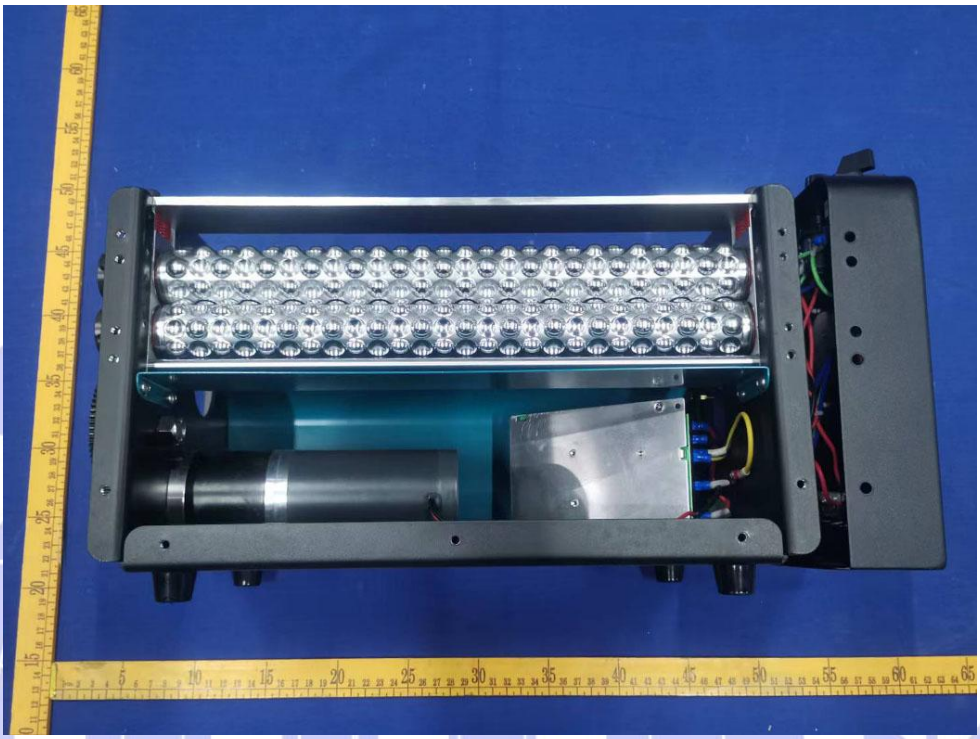

Photo 8

View:

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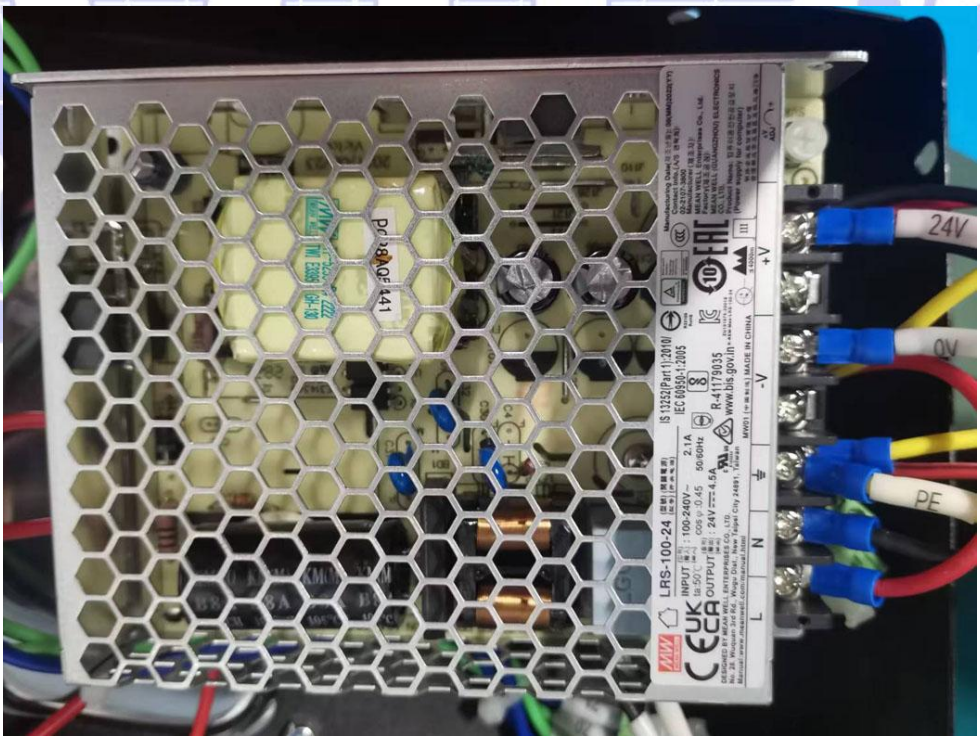

Photo 9

View:

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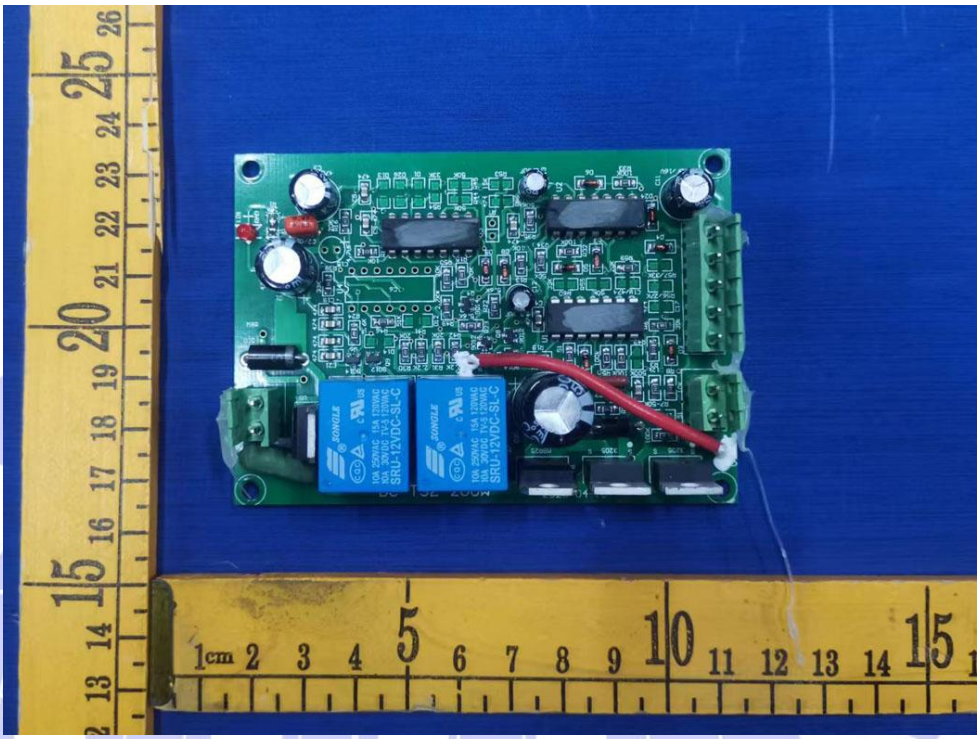

Photo 10

View:

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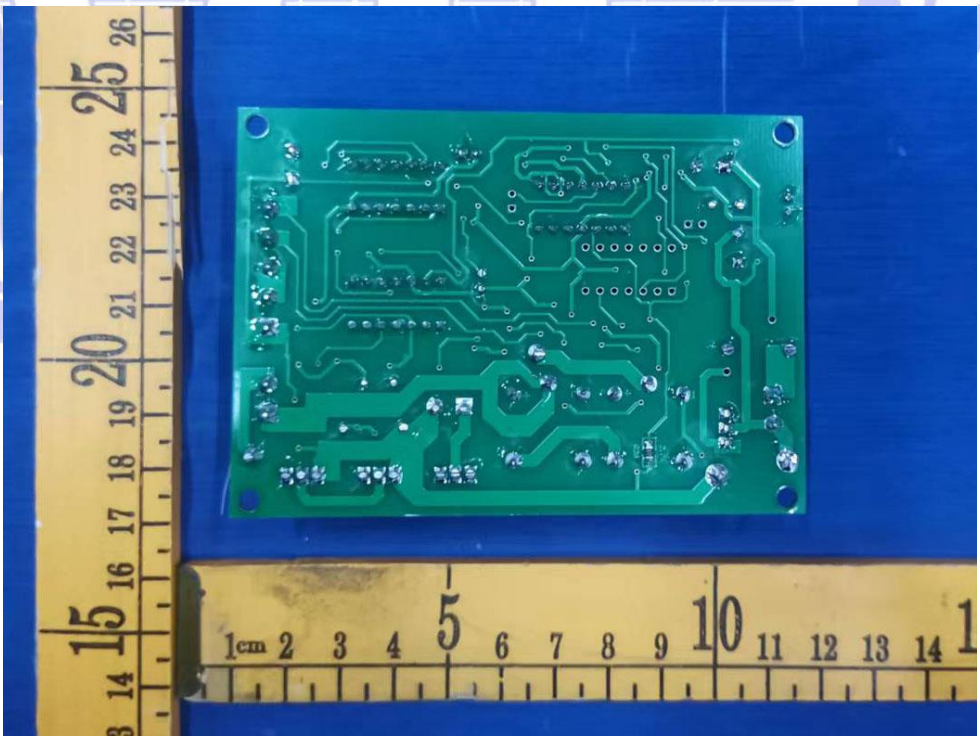
☐ bottom

☒ internal



.....End of Report.....

APPLICATION FOR CE-MD TEST REPORT

On Behalf of

Prepared For	:	WIAIR CORPORATION (SHANGHAI) CO., LTD No.540,2/F, Lane 500, XinNongHe Road, Song Jiang District, Shanghai 201619, China
Product Name	:	Paper-Bubble Machine
Model	:	PB340、 PB340pro、PB-340、 PB-340pro
Prepared By	:	Shenzhen Universal Test Technology Service Co., Ltd. 10/F., Building 153, Yucui New village, Yucui Community, Longhua street, Longhua district, Shenzhen , Guangdong, China.
Test Date	:	Nov. 16, 2022 - Nov. 22, 2022
Date of Report	:	Nov. 22, 2022
Report No.	:	UTT202211919M

TEST REPORT

Council Directive 2006/42/EC, Annex I

Essential health and safety requirements relating to the design and construction of machinery and safety components

EN ISO 12100

Safety of machinery - General principles for design

- Risk assessment and risk reduction

Report Reference No.....:	UTT202211919M
Tested by (printed name + signature).....:	File administrators Nike Huang
Reviewed by: .....:	Test engineer Angelia Shi
Approved by (printed name + signature).....:	Manager Joseph Zhang
Date of issue.....:	Nov. 22, 2022
Testing Laboratory.....:	**Shenzhen Universal Test Technology Service Co., Ltd.**
Address.....:	10/F., Building 153, Yucui New village, Yucui Community, Longhua street, Longhua district, Shenzhen , Guangdong, China.
Applicant's name.....:	**WIAIR CORPORATION (SHANGHAI) CO., LTD**
Address.....:	No.540,2/F, Lane 500, XinNongHe Road, Song Jiang District, Shanghai 201619, China
Machine Directive.....:	Council Machine Directive 2006/42/EC, Annex I, EN ISO 12100:2010
Product Name ....:	Paper-Bubble Machine
Manufacturer.....:	1teck Automation Technology Co., Ltd.
Address.....:	2nd Floor, Building 2, No. 529, Jinyuan Road, Gaoyang Village Industrial Zone, Shimen Town, Tongxiang City, Jiaxing City, Zhejiang Province, Post Code : 314512
Trademark.....:	wiAIR®
Model/Type reference.....:	PB340、 PB340pro、PB-340、 PB-340pro
Rating(s)..... :	Input: 100-230V~, 50Hz, 120W

Test case verdicts:

Test case does not apply to the test object…..: N(/A)

Test object does meet the requirement……: P(ass)

Test object does not meet the requirement….: F(ail)

Testing:

Date of receipt of test item……..: Nov. 16, 2022

Date (s) of performance of tests……: Nov. 16, 2022 – Nov. 22, 2022

General remarks:

This report shall not be reproduced except in full without the written approval of the testing laboratory.

The test results presented in this report relate only to the item(s) tested.

”(see remark #)" refers to a remark appended to the report.

"(see Annex #)" refers to an annex appended to the report.

Throughout this report a comma is used as the decimal separator.

General product information:

All models are the same except model and appearance, and all tests are based on PB340 .

EN ISO 12100			
Clause	Requirement – Test	Result - Remark	Verdict

EN ISO 12100:2010 General principles for design–Risk assessment and risk reduction			
6 Risk reduction			
	The objective of risk reduction can be achieved by the elimination of hazards, or by separately or simultaneously reducing each of the two elements that determine the associated risk: —severity of harm from the hazard under consideration; —probability of occurrence of that harm. All protective measures intended for reaching this objective shall be applied in the following sequence, referred to as the three-step method (see also Figures 1 and 2). **Step 1: Inherently safe design measures** **Step 2: Safeguarding and/or complementary protective measures** **Step 3: Information for use**		P
6.2	Inherently safe design measures		
6.2.1	Genera		
	Inherently safe design measures are the first and most important step in the risk reduction process. This is because protective measures inherent to the characteristics of the machine are likely to remain effective, whereas experience has shown that even well-designed safeguarding can fail or be violated and information for use may not be followed. Inherently safe design measures are achieved by avoiding hazards or reducing risks by a suitable choice of design features for the machine itself and/or interaction between the exposed persons and the machine.		P
6.2.2	Consideration of geometrical factors and physical aspects		
6.2.2.1	Geometrical factors		
	Such factors include the following. a)The form of machinery is designed to maximize direct visibility of the working areas and hazard zones from the control position —reducing blind spots, for example —and choosing and locating means of indirect vision where necessary (mirrors, etc.) so as to take into account the characteristics of human vision, particularly when safe operation requires permanent direct control by the operator, for example: —the travelling and working area of mobile machines; —the zone of movement of lifted loads or of the carrier of machinery for lifting persons; —the area of contact of the tool of a hand-held or hand-guided machine with the material being worked. The design of the machine shall be such that, from the main control position, the operator is able to ensure that there are no exposed persons in the danger zones.		P

EN ISO 12100			
Clause	Requirement – Test	Result - Remark	Verdict
	b) The form and the relative location of the mechanical components parts: for instance, crushing and shearing hazarare avoided by increasing the minimum gap between the moving parts, such that the part of the body under consideration can enter the gap safely, or by reducing the gap so that no part of the body can enter it (see ISO 13854 and ISO 13857). c) Avoiding sharp edges and corners, protruding parts: in so far as their purpose allows, accessible parts of the machinery shall have no sharp edges, no sharp angles, no rough surfaces, no protruding parts likely to cause injury, and no openings which can “trap” parts of the body or clothing. In particular, sheet metal edges shall be deburred, flanged or trimmed, and open ends of tubes which can cause a “trap” shall be capped. d) The form of the machine is designed so as to achieve a suitable working position and provide accessible manual controls (actuators).		P
6.2.2.2	Physical aspects		
	Such aspects include the following: a) limiting the actuating force to a sufficiently low value so that the actuated part does not generate a mechanical hazard; b) limiting the mass and/or velocity of the movable elements, and hence their kinetic energy; c) limiting the emissions by acting on the characteristics of the source using measures for reducing 1) noise emission at source (see ISO/TR 11688-1), 2) the emission of vibration at source, such as redistribution or addition of mass and changes of process parameters [for example, frequency and/or amplitude of movements (for handheld and hand-guided machinery, see CR 1030-1)], 3) the emission of hazardous substances, including the use of less hazardous substances or dust-reducing processes (granules instead of powders, milling instead of grinding), and 4) radiation emissions, including, for example, avoiding the use of hazardous radiation sources, limiting the power of radiation to the lowest level sufficient for the proper functioning of the machine, designing the source so that the beam is concentrated on the target, increasing the distance between the source and the operator or providing for remote operation of the machinery [measures for reducing emission of non-ionizing radiation are given in 6.3.4.5 (see also EN 12198-1 and EN12198-3)].		P
6.2.3	Taking into account general technical knowledge of machine design		

EN ISO 12100			
Clause	Requirement – Test	Result - Remark	Verdict
	This general technical knowledge can be derived from technical specifications for design (standards, design codes, calculation rules, etc.), which should be used to cover a) mechanical stresses such as —stress limitation by implementation of correct calculation, construction and fastening methods as regards, for example, bolted assemblies and welded assemblies, —stress limitation by overload prevention (bursting disk,		P
	pressurelimiting valves, breakage points,torque-limiting devices, etc.), —avoiding fatigue in elements under variable stresses (notably cyclic stresses), and —static and dynamic balancing of rotating elements, b) materials and their properties such as —resistance to corrosion, ageing, abrasion and wear, —hardness, ductility, brittleness, —homogeneity, —toxicity, and —flammability, and c) emission values for —noise, —vibration, —hazardous substances, and —radiation. When the reliability of particular components or assemblies is critical for safety (for example, ropes, chains, lifting accessories for lifting loads or persons), stress limits shall be multiplied by appropriate workingcoefficients.		P
6.2.4	**Choice of appropriate technology**		
	One or more hazards can be eliminated or risks reduced by the choice of the technology to be used in certainapplications such as the following: a)on machines intended for use in explosive atmospheres, using —appropriately selected pneumatic or hydraulic control system and machine actuators, —intrinsically safe electrical equipment (see IEC 60079-11); b)for particular products to be processed (for example, by a solvent), by using equipment that ensures thetemperature will remain far below the flash point; c)the use of alternative equipment to avoid high noise levels, such as —electrical instead of pneumatic equipment, —in certain conditions, water-cutting instead of mechanical equipment.	**a) and c)**	P
6.2.5	**Applying principle of positive mechanical action**		

EN ISO 12100			
Clause	Requirement – Test	Result - Remark	Verdict
	Positive mechanical action is achieved when a moving mechanical component inevitably moves another component along with it, either by direct contact or via rigid elements. An example of this is positive opening operation of switching devices in an electrical circuit (see IEC 60947-5-1 and ISO 14119).		P
6.2.6	**Provisions for stability**		P
	Machines shall be designed so that they have sufficient stability to allow them to be used safely in their specified conditions of use. Factors to be taken into account include —the geometry of the base, —the weight distribution, including loading, —the dynamic forces due to movements of parts of the machine, of the machine itself or of elements held by the machine which can result in an overturning moment, —vibration, —oscillations of the centre of gravity, —characteristics of the supporting surface in case of travelling or installation on different sites (ground conditions, slope, etc.), and —external forces, such as wind pressure and manual forces. Stability shall be considered in all phases of the life cycle of the machine, including handling, travelling, installation, use, dismantling, disabling and scrapping. Other protective measures for stability relevant to safeguarding are given in 6.3.2.6.		P
6.2.7	**maintainability factors**		
	When designing a machine, the following maintainability factors shall be taken into account to enable maintenance of the machine: —accessibility, taking into account the environment and the human body measurements, including the dimensions of the working clothes and tools used; —ease of handling, taking into account human capabilities; —limitation of the number of special tools and equipment.		P
6.2.8	**Observing ergonomic principles**		

EN ISO 12100			
Clause	Requirement – Test	Result - Remark	Verdict
	Ergonomic principles shall be taken into account in designing machinery so as to reduce the mental or physical stress of, and strain on, the operator. These principles shall be considered when allocating functions to operator and machine (degree of automation) in the basic design. NOTE Also improved are the performance and reliability of operation and hence the reduction in the probability of errors at all stages of machine use. Account shall be taken of body sizes likely to be found in the intended user population, strengths and postures, movement amplitudes, frequency of cyclic actions (see ISO 10075 and ISO 10075-2). All elements of the operator–machine interface, such as controls, signalling or data display elements shall be designed to be easily understood so that clear and unambiguous interaction between the operator and the machine is possible. See EN 614-1, EN 13861 and IEC 61310-1. The designer's attention is particularly drawn to following ergonomic aspects of machine design. a) Avoid the necessity for stressful postures and movements during the use of the machine (for example, providing facilities to adjust the machine to suit the various operators).		P

EN ISO 12100			
Clause	Requirement – Test	Result - Remark	Verdict
	b) Design machines, especially hand-held and mobile machines, so as to enable them to be operated easily, taking into account human effort, actuation of controls and hand, arm and leg anatomy. c) Limit as far as possible noise, vibration and thermal effects such as extreme temperatures. d) Avoid linking the operator's working rhythm to an automatic succession of cycles. e) Provide local lighting on or in the machine for the illumination of the working area and of adjusting, setting-up and frequent maintenance zones when the design features of the machine and/or its guards render the ambient lighting inadequate. Flicker, dazzling, shadows and stroboscopic effects shall be avoided if they can cause a risk. If the position or the lighting source has to be adjusted, its location shall be such that it does not cause any risk to persons making the adjustment. f) Select, locate and identify manual controls (actuators) so that —they are clearly visible and identifiable, and appropriately marked where necessary (see 6.4.4), —they can be safely operated without hesitation or loss of time and without ambiguity (for example, a standard layout of controls reduces the possibility of error when an operator changes from a machine to another one of similar type having the same pattern of operation), —their location (for push-buttons) and their movement (for levers and hand wheels) are consistent with their effect (see IEC 61310-3), and —their operation cannot cause additional risk. See also ISO 9355-3.		P
6.2.9	**Electrical hazards**		
	For the design of the electrical equipment of machines, IEC 60204-1 gives general provisions about disconnection and switching of electrical circuits and for protection against electric shock. For requirements related to specific machines, see corresponding IEC standards (for example, IEC 61029, IEC 60745 or IEC 60335).		P
6.2.10	**Pneumatic and hydraulic hazard**		
	Pneumatic and hydraulic equipment of machinery shall be designed so that —the maximum rated pressure cannot be exceeded in the circuits (using, for example, pressure-limiting devices), —no hazard results from pressure fluctuations or increases, or from loss of pressure or vacuum, —no hazardous fluid jet or sudden hazardous movement of the hose (whiplash) results from leakage or component failures, —air receivers, air reservoirs or similar vessels (such as in gas-loaded accumulators) comply with the applicable design standard codes or regulations for these elements,		N

EN ISO 12100			
Clause	Requirement – Test	Result - Remark	Verdict
	—all elements of the equipment, especially pipes and hoses, are protected against harmful external effects, —as far as possible, reservoirs and similar vessels (for example, gas-loaded accumulators) are automatically depressurized when isolating the machine from its power supply (see 6.3.5.4) and, if not possible, means are provided for their isolation, local depressurizing and pressure indication (see also ISO 14118:2000, Clause 5), and —all elements which remain under pressure after isolation of the machine from its power supply are provided with clearly identified exhaust devices, and there is a warning label drawing attention to the necessity of depressurizing those elements before any setting or maintenance activity on the machine.		N
6.2.11	**Applying inherently safe design measures to control systems**		
6.2.11.1	**General**		
	The design measures of the control system shall be chosen so that their safety-related performance provides a sufficient amount of risk reduction (see ISO 13849-1 or IEC 62061). The correct design of machine control systems can avoid unforeseen and potentially hazardous machine behavior. Typical causes of hazardous machine behavior are —an unsuitable design or modification (accidental or deliberate) of the control system logic, —a temporary or permanent defect or failure of one or several components of the control system, —a variation or a failure in the power supply of the control system, and —inappropriate selection, design and location of the control devices. Typical examples of hazardous machine behavior are —unexpected start-up (see ISO 14118), —uncontrolled speed change, —failure to stop moving parts, —dropping or ejection of part of the machine or of a workpiece clamped by the machine, and —machine action resulting from inhibition (defeating or failure) of protective devices. In order to prevent hazardous machine behaviour and to achieve safety functions, the design of control systems shall comply with the principles and methods presented in this subclause (6.2.11) and in 6.2.12. These principles and methods shall be applied singly or in combination as appropriate to the circumstances (see ISO 13849-1, IEC 60204-1 and IEC 62061).	See IEC/EN 60204-1 report for detail	P
6.2.11.2	**Starting of an internal power source/switching on an external power supply**		

EN ISO 12100			
Clause	Requirement – Test	Result - Remark	Verdict
	The starting of an internal power source or switching-on of an external power supply shall not result in a hazardous situation. For example: —starting the internal combustion engine shall not lead to movement of a mobile machine; —connection to mains electricity supply shall not result in the starting of working parts of a machine. See IEC 60204-1:2005, 7.5 (see also Annexes A and B).		P
6.2.11.3	**Starting/stopping of a mechanism**		
	The primary action for starting or accelerating the movement of a mechanism should be performed by the application or an increase of voltage or fluid pressure, or — if binary logic elements are considered — by passage from state 0 to state 1 (where state 1 represents the highest energy state). The primary action for stopping or slowing down should be performed by removal or reduction of voltage or fluid pressure, or — if binary logic elements are considered — by passage from state 1 to state 0 (where state 1 represents the highest energy state). In certain applications, such as high-voltage switchgear, this principle cannot be followed, in which case other measures should be applied to achieve the same level of confidence for the stopping or slowing down. When, in order for the operator to maintain permanent control of deceleration, this principle is not observed (for example, a hydraulic braking device of a self-propelled mobile machine), the machine shall be equipped with a means of slowing and stopping in case of failure of the main braking system		P
6.2.11.4	**Restart after power interruption**		
	If a hazard could be generated, the spontaneous restart of a machine when it is re-energized after power interruption shall be If a hazard could be generated, the spontaneous restart of a machine when it is re-energized after power interruption shall be prevented (for example, by use of a self-maintained relay, contactor or valve).		P
6.2.11.5	**Interruption of power supply**		

EN ISO 12100			
Clause	Requirement – Test	Result - Remark	Verdict
	Machinery shall be designed to prevent hazardous situations resulting from interruption or excessive fluctuation of the power supply. At least the following requirements shall be met: —the stopping function of the machinery shall remain; —all devices whose permanent operation is required for safety shall operate in an effective way to maintain safety (for example, locking, clamping devices, cooling or heating devices, power-assisted steering of self-propelled mobile machinery); —parts of machinery or workpieces and/or loads held by machinery which are liable to move as a result of potential energy shall be retained for the time necessary to allow them to be safely lowered.		P
6.2.11.6	**Use of automatic monitoring**		P
	Automatic monitoring is intended to ensure that a safety function or functions implemented by a protective measure do not fail to be performed if the ability of a component or an element to perform its function is diminished, or if the process conditions are changed such that hazards are generated. Automatic monitoring either detects a fault immediately or carries out periodic checks so that a fault is detected before the next demand upon the safety function. In either case, the protective measure can be initiated immediately or delayed until a specific event occurs (for example, the beginning of the machine cycle). The protective measure may be, for example, —the stopping of the hazardous process, —preventing the restart of this process after the first stop following the failure, or —the triggering of an alarm.		P
6.2.11.7	**Safety functions implemented by programmable electronic control systems**		
6.2.11.7.1	**General**		

EN ISO 12100			
Clause	Requirement – Test	Result - Remark	Verdict
	A control system that includes programmable electronic equipment (for example, programmable controllers) can, where appropriate, be used to implement safety functions at machinery. Where a programmable electronic control system is used, it is necessary to consider its performance requirements in relation to the requirements for the safety functions. The design of the programmable electronic control system shall be such that the probability of random hardware failures and the likelihood of systematic failures that can adversely affect the performance of the safety-related control function(s) is sufficiently low. Where a programmable electronic control system performs a monitoring function, the system behavior on detection of a fault shall be considered (see also the IEC 61508 series for further guidance). NOTE Both ISO 13849-1 and IEC 62061, specific to machinery safety, provide guidance applicable to programmable electronic control systems. The programmable electronic control system should be installed and validated to ensure that the specified performance [for example, safety integrity level (SIL) in IEC 61508] for each safety function has been achieved. Validation comprises testing and analysis (for example, static, dynamic or failure analysis) to show that all parts interact correctly to perform the safety function and that unintended functions do not occur.		P
6.2.11.7.2	**Hardware aspects**		P
	The hardware (including, for example, sensors, actuators and logic solvers) shall be selected, and/or designed and installed, to meet both the functional and performance requirements of the safety function(s) to be performed, in particular, by means of —architectural constraints (the configuration of the system, its ability to tolerate faults, its behaviour on detection of a fault, etc.), —selection, and/or design, of equipment and devices with an appropriate probability of dangerous random hardware failure, and		P
	—the incorporation of measures and techniques within the hardware so as to avoid systematic failures and control systematic faults.		P
6.2.11.7.3	**Software aspects**		

EN ISO 12100			
Clause	Requirement – Test	Result - Remark	Verdict
	The software, including internal operating software (or system software) and application software, shall be designed so as to satisfy the performance specification for the safety functions (see also IEC 61508-3). Application software should not be reprogrammable by the user. This may be achieved by use of embedded software in a non-reprogrammable memory [for example, micro-controller, application-specific integrated circuit (ASIC)]. When the application requires reprogramming by the user, the access to the software dealing with safety functions should be restricted (for example, by locks or passwords for the authorized persons).		P
6.2.11.8	**Principles relating to manual control**		
	These are as follows. a) Manual control devices shall be designed and located according to the relevant ergonomic principles given in 6.2.8, item f). b) A stop control device shall be placed near each start control device. Where the start/stop function is performed by means of a hold-to-run control, a separate stop control device shall be provided when a risk can result from the hold-to-run control device failing to deliver a stop command when released. c) Manual controls shall be located out of reach of the danger zones (see IEC 61310-3), except for certain controls where, of necessity, they are located within a danger zone, such as emergency stop or teach pendant. d) Whenever possible, control devices and control positions shall be located so that the operator is able to observe the working area or hazard zone. 1) The driver of a ride-on mobile machine shall be able to actuate all control devices required to operate the machine from the driving position, except for functions which can be controlled more safely from other positions. 2) On machinery intended for lifting persons, controls for lifting and lowering and, if appropriate, for moving the carrier shall generally be located in the carrier. If safe operation requires controls to be situated outside the carrier, the operator in the carrier shall be provided with the means of preventing hazardous movements. e) If it is possible to start the same hazardous element by means of several controls, the control circuit shall be so arranged that only one control is effective at a given time. This applies especially to machines which can be manually controlled by means of, among others, a portable control unit (such as a teach pendant), with which the operator can enter danger zones.		P

EN ISO 12100			
Clause	Requirement – Test	Result - Remark	Verdict
	f) Control actuators shall be designed or guarded so that their effect, where a risk is involved, cannot occur without intentional operation (see ISO 9355-1, ISO 9355-3 and ISO 447). g) For machine functions whose safe operation depends on permanent, direct control by the operator, measures shall be implemented to ensure the presence of the operator at the control position (for example, by the design and location of control devices). h) For cableless control, an automatic stop shall be performed when correct control signals are not received, including loss of communication (see IEC 60204-1).		P
6.2.11.9	**Control mode for setting, teaching, process changeover, fault-finding, cleaning or maintenance**		
	Where, for setting, teaching, process changeover, fault-finding, cleaning or maintenance of machinery, a guard has to be displaced or removed and/or a protective device has to be disabled, and where it is necessary for the purpose of these operations for the machinery or part of the machinery to be put into operation, the safety of the operator shall be achieved using a specific control mode which simultaneously a) disables all other control modes, b) permits operation of the hazardous elements only by continuous actuation of an enabling device, a two-hand control device or a hold-to-run control device, c) permits operation of the hazardous elements only in reduced risk conditions (for example, reduced speed, reduced power/force, step-by-step, for example, with a limited movement control device), and d) prevents any operation of hazardous functions by voluntary or involuntary action on the machine's sensors. NOTE For some special machinery other protective measures can be appropriate. This control mode shall be associated with one or more of the following measures: —restriction of access to the danger zone as far as possible; —emergency stop control within immediate reach of the operator; —portable control unit (teach pendant) and/or local controls (allowing sight of the controlled elements). See IEC 60204-1.		P
6.2.11.10	**Selection of control and operating modes**		

EN ISO 12100			
Clause	Requirement – Test	Result - Remark	Verdict
	If machinery has been designed and built to allow for its use in several control or operating modes requiring different protective measures and/or work procedures (for example, to allow for adjustment, setting, maintenance, inspection), it shall be fitted with a mode selector which can be locked in each position. Each position of the selector shall be clearly identifiable and shall exclusively allow one control or operating mode. The selector may be replaced by another selection means which restricts the use of certain functions of the machinery to certain categories of operators (for example, access codes for certain numerically controlled functions).		P
6.2.11.12	**Provision of diagnostic systems to aid fault-finding**		
	Diagnostic systems to aid fault-finding should be included in the control system so that there is no need to disable any protective measure. NOTE Such systems not only improve availability and maintainability of machinery, they also reduce the exposure of maintenance staff to hazards.		N
6.2.12	**Minimizing probability of failure of safety functions**		
6.2.12.1	**General**		
	Safety of machinery is not only dependent on the reliability of the control systems but also on the reliability of all parts of the machine. The continued operation of the safety functions is essential for the safe use of the machine. This can be achieved by the measures given in 6.2.12.2 to 6.2.12.4.		P
6.2.12.2	**Use of reliable components**		
	“Reliable components” means components which are capable of withstanding all disturbances and stresses associated with the usage of the equipment in the conditions of intended use (including the environmental conditions), for the period of time or the number of operations fixed for the use, with a low probability of failures generating a hazardous malfunctioning of the machine. Components shall be selected taking into account all factors mentioned above (see also 6.2.13). NOTE 1 “Reliable components” is not a synonym for “well-tried components” (see ISO 13849-1:2006, 6.2.4). NOTE 2 Environmental conditions for consideration include impact, vibration, cold, heat, moisture, dust, corrosive and/or abrasive substances, static electricity and magnetic and electric fields. Disturbances which can be generated by those conditions include insulation failures and temporary or permanent failures in the function of control system components.		P
6.2.12.3	**Use of “oriented failure mode” components**		

EN ISO 12100			
Clause	Requirement – Test	Result - Remark	Verdict
	"Oriented failure mode" components or systems are those in which the predominant failure mode is known in advance and which can be used so that the effect of such a failure on the machine function can be predicted. NOTE In some cases, it will be necessary to take additional measures to limit the negative effects of such a failure. The use of such components should always be considered, particularly in cases where redundancy (see 6.2.12.4) is not employed.		P
6.2.12.4	**Duplication (or redundancy) of components or subsystems**		
	In the design of safety-related parts of the machine, duplication (or redundancy) of components may be used so that, if one component fails, another component or components continue to perform the respective function(s), thereby ensuring that the safety function remains available. In order to allow the proper action to be initiated, component failure shall be detected by automatic monitoring (see 6.2.11.6) or in some circumstances by regular inspection, provided that the inspection interval is shorter than the expected lifetime of the components. Diversity of design and/or technology can be used to avoid common cause failures (for example, from electromagnetic disturbance) or common mode failures.		P
6.2.13	**Limiting exposure to hazards through reliability of equipment**		
	Increased reliability of all component parts of machinery reduces the frequency of incidents requiring intervention, thereby reducing exposure to hazards. This applies to power systems (operative part, see Annex A) as well as to control systems, and to safety functions as well as to other functions of machinery. Safety-related components (for example, certain sensors) of known reliability shall be used. The elements of guards and of protective devices shall be especially reliable, as their failure can expose persons to hazards, and also because poor reliability would encourage attempts to defeat them.		P
6.2.14	**Limiting exposure to hazards through mechanization or automation of loading(feeding)/unloading (removal) operations**		

EN ISO 12100			
Clause	Requirement – Test	Result - Remark	Verdict
	Mechanization and automation of machine loading/unloading operations and, more generally, of handling operations — of workpieces, materials or substances — limits the risk generated by these operations by reducing the exposure of persons to hazards at the operating points. Automation can be achieved by, for example, robots, handling devices, transfer mechanisms and air-blast equipment. Mechanization can be achieved by, for example, feeding slides, push-rods and hand-operated indexing tables. While automatic feeding and removal devices have much to offer in preventing accidents to machine operators, they can create danger when any faults are being corrected. Care shall be taken to ensure that the use of these devices does not introduce further hazards, such as trapping or crushing, between the devices and parts of the machine or workpieces/materials being processed. Suitable safeguards (see 6.3) shall be provided if this cannot be ensured.Automatic feeding and removal devices with their own control systems and the control system of the associated machine shall be interconnected after thorough study of how all safety functions are performed in all the control and operation modes of the entire equipment.		P
6.2.15	**Limiting exposure to hazards through location of setting and maintenance points outside danger zones**		
	The need for access to danger zones shall be minimized by locating maintenance, lubrication and setting points outside these zones.		P
6.3	**Safeguarding and complementary protective measures**		
6.3.1	**General**		
	Guards and protective devices shall be used to protect persons whenever an inherently safe design measure does not reasonably make it possible either to remove hazards or to sufficiently reduce risks. Complementary protective measures involving additional equipment (for example, emergency stop equipment) may have to be implemented. NOTE The different kinds of guards and protective devices are defined in 3.27 and 3.28. Certain safeguards may be used to avoid exposure to more than one hazard. EXAMPLE A fixed guard preventing access to a zone where a mechanical hazard is present used to reduce noise levels and collect toxic emissions.		P
6.3.2	**Selection and implementation of guards and protective devices**		
6.3.2.1	**General**		

EN ISO 12100			
Clause	Requirement – Test	Result - Remark	Verdict
	This subclause gives guidelines for the selection and the implementation of guards and protective devices the primary purpose of which is to protect persons against hazards generated by moving parts, according to the nature of those parts (see Figure 4) and to the need for access to the danger zone(s). The exact choice of a safeguard for a particular machine shall be made on the basis of the risk assessment for that machine. In selecting an appropriate safeguard for a particular type of machinery or hazard zone, it shall be borne in mind that a fixed guard is simple and shall be used where the access of an operator into a danger zone is not required during the normal operation (operation without malfunction) of the machinery. As the need for frequency of access increases, this inevitably leads to the fixed guard not being replaced. This requires the use of an alternative protective measure (movable interlocking guard, sensitive protective equipment). A combination of safeguards can sometimes be required. For example, where, in conjunction with a fixed guard, a mechanical loading (feeding) device is used to feed a workpiece into a machine, thereby removing the need for access to the primary hazard zone, a trip device can be required to protect against the secondary drawing-in or shearing hazard between the mechanical loading (feeding) device, when reachable, and the fixed guard. Consideration shall be given to the enclosure of control positions or intervention zones to provide combined protection against several hazards including a) hazards from falling or ejected objects, using, for example, protection in the form of a falling object protection structure (FOPS), b) emission hazards (protection against noise, vibration, radiation, substances hazardous to health, etc.), c) hazards due to the environment (protection against heat, cold, foul weather, etc.), d) hazards due to tipping over or rolling over of machinery, using, for example, protection in the form of roll-over or tip-over protection structures (ROPS and TOPS). The design of enclosed work stations, such as cabs and cabins, shall take into account ergonomic principles concerning visibility, lighting, atmospheric conditions, access, posture.		P
6.3.2.2	**Where access to the hazard zone is not required during normal operation**		

EN ISO 12100			
Clause	Requirement – Test	Result - Remark	Verdict
	Where access to the hazard zone is not required during normal operation of the machinery, safeguards should be selected from the following: a) fixed guards (see also ISO 14120); b) interlocking guards with or without guard locking (see also 6.3.3.2.3, ISO 14119 and ISO 14120); c) self-closing guards (see ISO 14120:2002, 3.3.2); d) sensitive protective equipment, such as electrosensitive protective equipment (see IEC 61496) or pressure-sensitive protective devices (see ISO 13856).		P
6.3.2.3	**Where access to the hazard zone is required during normal operation**		
	Where access to the hazard zone is required during normal operation of the machinery, safeguards should be selected from the following: a) interlocking guards with or without guard locking (see also ISO 14119, ISO 14120 and 6.3.3.2.3 of this document); b) sensitive protective equipment, such as electrosensitive protective equipment (see IEC 61496); c) adjustable guards; d) self-closing guards (see ISO 14120:2002, 3.3.2); e) two-hand control devices (see ISO 13851); f) interlocking guards with a start function (control guard) (see 6.3.3.2.5).		P
6.3.2.4	**Where access to the hazard zone is required for machine setting, teaching, process changeover, fault-finding, cleaning or maintenance**		
	production operator also ensure the protection of personnel carrying out setting, teaching, process changeover, fault-finding, cleaning or maintenance, without hindering them in the performance of their task. Such tasks shall be identified and considered in the risk assessment as parts of the use of the machine (see 5.2). NOTE Isolation and energy dissipation for machine shut-down (see 6.3.5.4, and also ISO 14118:2000, 4.1 and Clause 5) ensure the highest level of safety when carrying out tasks (especially maintenance and repair tasks) that do not require the machine to remain connected to its power supply.		P
6.3.2.5	**Selection and implementation of sensitive protective equipment**[1)]		

EN ISO 12100			
Clause	Requirement – Test	Result - Remark	Verdict
6.3.2.5.1	Due to the great diversity of the technologies on which their detection function is based, all types of sensitive protective equipment are far from being equally suitable for safety applications. The following provisions are intended to provide the designer with criteria for selecting, for each application, the most suitable device(s). Types of sensitive protective equipment include —light curtains, —scanning devices, for example, laser scanners, —pressure-sensitive mats, and —trip bars, trip wires. Sensitive protective equipment can be used —for tripping purposes, —for presence sensing, —for both tripping and presence sensing, or —to re-initiate machine operation — a practice subject to stringent conditions.		P
	NOTE Some types of sensitive protective equipment can be unsuitable either for presence sensing or for tripping purposes. The following characteristics of the machinery, among others, can preclude the sole use of sensitive protectiveequipment: —tendency for the machinery to eject materials or component parts; —necessity to guard against emissions (noise, radiation, dust, etc.); —erratic or excessive machine stopping time; —inability of a machine to stop part-way through a cycle.		P
6.3.2.5.2	**Implementation**		

EN ISO 12100			
Clause	Requirement – Test	Result - Remark	Verdict
	Consideration should be given to a) the size, characteristics and positioning of the detection zone (see ISO 13855, which deals with the positioning of some types of sensitive protective equipment), b) the reaction of the device to fault conditions (see IEC 61496 for electrosensitive protective equipment), c) the possibility of circumvention, and d) detection capability and its variation over the course of time (as a result, for example, of its susceptibility to different environmental conditions such as the presence of reflecting surfaces, other artificial light sources and sunlight or impurities in the air). NOTE 1 IEC 61496 defines the detection capability of electrosensitive protective equipment. Sensitive protective equipment shall be integrated in the operative part and associated with the control system of the machine so that —a command is given as soon as a person or part of a person is detected, —the withdrawal of the person or part of a person detected does not, by itself, restart the hazardous machine function(s), and therefore the command given by the sensitive protective equipment ismaintained by the control system until a new command is given, —restarting the hazardous machine function(s) results from the voluntary actuation by the operator of a control device placed outside the hazard zone, where this zone can be observed by the operator, —the machine cannot operate during interruption of the detection function of the sensitive protective equipment, except during muting phases, and —the position and the shape of the detection field prevents, possibly together with fixed guards, a person or part of a person from entering or being present in the hazard zone without being detected. NOTE 2 Muting is the temporary automatic suspension of a safety function(s) by safety-related parts of the control system (see ISO 13849-1). For detailed consideration of the fault behaviour of, for example, active optoelectronic protective devices, IEC 61496 should be taken into account.		P
6.3.2.5.3	**Additional requirements for sensitive protective equipment when used for cycle initiation**		

EN ISO 12100			
Clause	Requirement – Test	Result - Remark	Verdict
	In this exceptional application, the starting of the machine cycle is initiated by the withdrawal of a person or of the detected part of a person from the sensing field of the sensitive protective equipment, without any additional start command, hence deviating from the general requirement given in the second point of the dashed list in 6.3.2.5.2, above. After switching on the power supply, or when the machine has been stopped by the tripping function of the sensitive protective equipment, the machine cycle shall be initiated only by voluntary actuation of a start control. Cycle initiation by sensitive protective equipment shall be subject to the following conditions: a) only active optoelectronic protective devices (AOPDs) complying with IEC 61496 series shall be used; b) the requirements for an AOPD used as a tripping and presence-sensing device (see IEC 61496) are satisfied — in particular, location, minimum distance (see ISO 13855), detection capability, reliability and monitoring of control and braking systems; c) the cycle time of the machine is short and the facility to re-initiate the machine upon clearing of the sensing field is limited to a period commensurate with a single normal cycle; d) entering the sensing field of the AOPD(s) or opening interlocking guards is the only way to enter the hazard zone; e) if there is more than one AOPD safeguarding the machine, only one of the AOPDs is capable of cycle re-initiation; f) with regard to the higher risk resulting from automatic cycle initiation, the AOPD and the associated control system comply with a higher safety-related performance than under normal conditions. NOTE 1 The hazard zone as referred to in d) is any zone where the hazardous function (including ancillary equipment and transmission elements) is initiated by clearing of the sensing field. NOTE 2 See also IEC/TS 62046.		P
6.3.2.6	**Protective measures for stability**		
	If stability cannot be achieved by inherently safe design measures such as weight distribution (see 6.2.6), it shall be maintained by the use of protective measures such as —anchorage bolts, —locking devices, —movement limiters or mechanical stops, —acceleration or deceleration limiters, —load limiters, and —alarms warning of the approach to stability or tipping limits.		P
6.3.2.7	**Other protective devices**		

EN ISO 12100			
Clause	Requirement – Test	Result - Remark	Verdict
	error of the operator can generate a hazardous situation, this machine shall be equipped with the necessary devices to enable the operation to remain within specified limits, in particular —when the operator has insufficient visibility of the hazard zone, —when the operator lacks knowledge of the actual value of a safety-related parameter (distance, speed,mass, angle, etc.), and —when hazards can result from operations other than those controlled by the operator. The necessary devices include a) devices for limiting parameters of movement (distance, angle, velocity, acceleration), b) overloading and moment limiting devices, c) devices to prevent collisions or interference with other machines, d) devices for preventing hazards to pedestrian operators of mobile machinery or other pedestrians, e) torque limiting devices, and breakage points to prevent excessive stress of components and assemblies, f) devices for limiting pressure or temperature, g) devices for monitoring emissions, h) devices to prevent operation in the absence of the operator at the control position, i) devices to prevent lifting operations unless stabilizers are in place, j) devices to limit inclination of the machine on a slope, and k) devices to ensure that components are in a safe position before travelling. Automatic protective measures triggered by such devices that take operation of the machinery out of the control of the operator (for example, automatic stop of hazardous movement) should be preceded or accompanied by a warning signal to enable the operator to take appropriate action (see 6.4.3).		P
6.3.3	**Requirements for design of guards and protective devices**		
6.3.3.1	**General requirements**		
	Guards and protective devices shall be designed to be suitable for the intended use, taking into account mechanical and other hazards involved. Guards and protective devices shall be compatible with the working environment of the machine and designed so that they cannot be easily defeated. They shall provide the minimum possible interference with activities during operation and other phases of machine life, in order to reduce any incentive to defeat them. NOTE For additional information, see ISO 14120, ISO 13849-1, ISO 13851, ISO 14119, ISO 13856, IEC 61496 and IEC 62061. Guards and protective devices shall a) be of robust construction,		P

EN ISO 12100			
Clause	Requirement – Test	Result - Remark	Verdict
	b) not give rise to any additional hazard, c) not be easy to bypass or render non-operational, d) be located at an adequate distance from the danger zone (see ISO 13855 and ISO 13857), e) cause minimum obstruction to the view of the production process, and f) enable essential work to be carried out for the installation and/or replacement of tools and for maintenance by allowing access only to the area where the work has to be carried out — if possible, without the guard having to be removed or protective device having to be disabled. For openings in the guards, see ISO 13857.		
6.3.3.2	**Requirements for guards**		
6.3.3.2.1	**Functions of guards**		
	The functions that guards can achieve are —prevention of access to the space enclosed by the guard, and/or —containment/capture of materials, workpieces, chips, liquids which can be ejected or dropped by the machine, and reduction of emissions (noise, radiation, hazardous substances such as dust, fumes, gases) that can be generated by the machine. Additionally, they could need to have particular properties relating to electricity, temperature, fire, explosion, vibration, visibility (see ISO 14120) and operator position ergonomics (for example, usability, operator's movements, postures, repetitive movements).		P
6.3.3.2.2	**Requirements for fixed guards**		
	Fixed guards shall be securely held in place either —permanently (for example by welding), or —by means of fasteners (screws, nuts) making removal/opening impossible without using tools; they should not remain closed without their fasteners (see ISO 14120). NOTE A fixed guard can be hinged to assist in its opening.		P
6.3.3.2.3	**Requirements for movable guards**		
	Movable guards which provide protection against hazards generated by moving transmission parts shall a) as far as possible when open remain fixed to the machinery or other structure (generally by means of hinges or guides), and b) be interlocking (with guard locking when necessary) (see ISO 14119). See Figure 4. Movable guards against hazards generated by non-transmission moving parts shall be designed and associated with the machine control system so that		P

EN ISO 12100			
Clause	Requirement – Test	Result - Remark	Verdict
	—moving parts cannot start up while they are within the operator's reach and the operator cannot reach moving parts once they have started up, with this able to be achieved by interlocking guards, with guard locking when necessary, —they can be adjusted only by an intentional action, such as the use of a tool or a key, and —the absence or failure of one of their components either prevents starting of the moving parts or stops them, with this able to be achieved by automatic monitoring (see 6.2.11.6). See Figure 4 and ISO 14119.		P
6.3.3.2.4	**Requirements for adjustable guards**		
	Adjustable guards may only be used where the hazard zone cannot for operational reasons be completely enclosed. Manually adjustable guards shall be —designed so that the adjustment remains fixed during a given operation, and —readily adjustable without the use of tools.		N
6.3.3.2.5	**Requirements for interlocking guards with a start function (control guards)**		
	An interlocking guard with a start function may only be used provided that a) all requirements for interlocking guards are satisfied (see ISO 14119), b) the cycle time of the machine is short, c) the maximum opening time of the guard is preset to a low value (for example, equal to the cycle time) and, when this time is exceeded, the hazardous function(s) cannot be initiated by the closing of the interlocking guard with a start function and resetting is necessary before restarting the machine, d) the dimensions or shape of the machine do not allow a person, or part of a person, to stay in the hazard zone or between the hazard zone and the guard while the guard is closed (see ISO 14120), e) all other guards, whether fixed (removable type) or movable, are interlocking guards, f) the interlocking device associated with the interlocking guard with a start function is designed such that —for example, by duplication of position detectors and use of automatic monitoring (see 6.2.11.6) — its failure cannot lead to an unintended/unexpected start-up, and g) the guard is securely held open (for example, by a spring or counterweight) such that it cannot initiate a start while falling by its own weight.		N
6.3.3.2.6	**Hazards from guards**		

EN ISO 12100			
Clause	Requirement – Test	Result - Remark	Verdict
	Care shall be taken to prevent hazards which could be generated by —the guard construction (sharp edges or corners, material, noise emission, etc.), —the movements of the guards (shearing or crushing zones generated by power-operated guards and by heavy guards which are liable to fall).		P
6.3.3.3	**Technical characteristics of protective devices**		
	Protective devices shall be selected or designed and connected to the control system such that correct implementation of their safety function(s) is ensured. Protective devices shall be selected on the basis of their having met the appropriate product standard (for example, IEC 61496 for active optoelectronic protective devices) or shall be designed according to one or several of the principles formulated in ISO 13849-1 or IEC 62061. Protective devices shall be installed and connected to the control system so that they cannot be easily defeated.		P
6.3.3.4	**Provisions for alternative types of safeguards**		
	Provisions should be made to facilitate the fitting of alternative types of safeguards on machinery where it is known that it will be necessary to change the safeguards because of the range of work to be carried out.		P
6.3.4	**Safeguarding to reduce emissions**		
6.3.4.1	**General**		
	If the measures for the reduction of emissions at source specified in 6.2.2.2 are not adequate, the machine shall be provided with additional protective measures (see 6.3.4.2 to 6.3.4.5).		P
6.3.4.2	**Noise**		
	Additional protective measures against noise include —enclosures (see ISO 15667), —screens fitted to the machine, and —silencers (see ISO 14163).		P
6.3.4.3	**Vibration**		
	Additional protective measures against vibration include —vibration isolators, such as damping devices placed between the source and the exposed person, —resilient mounting, and —suspended seats. For measures for vibration isolation of stationary industrial machinery see EN 1299.		P
6.3.4.4	**Hazardous substances**		

EN ISO 12100			
Clause	Requirement – Test	Result - Remark	Verdict
	Additional protective measures against hazardous substances include —encapsulation of the machine (enclosure with negative pressure), —local exhaust ventilation with filtration, —wetting with liquids, and —special ventilation in the area of the machine (air curtains, cabins for operators). See ISO 14123-1.		N
6.3.4.5	**Radiation**		
	Additional protective measures against radiation include —use of filtering and absorption, and —use of attenuating screens or guards.		N
6.3.5	**Complementary protective measures**		
6.3.5.1	**General**		
	Protective measures which are neither inherently safe design measures, nor safeguarding (implementation of guards and/or protective devices), nor information for use, could have to be implemented as required by the intended use and the reasonably foreseeable misuse of the machine. Such measures include, but are not limited to, those dealt with in 6.3.5.2 to 6.3.5.6.		P
6.3.5.2	**Components and elements to achieve emergency stop function**		
	If, following a risk assessment, a machine needs to be fitted with components and elements to achieve an emergency stop function for enabling actual or impending emergency situations to be averted, the following requirements apply: —the actuators shall be clearly identifiable, clearly visible and readily accessible; —the hazardous process shall be stopped as quickly as possible without creating additional hazards, but if this is not possible or the risk cannot be reduced, it should be questioned whether implementation of an emergency stop function is the best solution;		P
	—the emergency stop control shall trigger or permit the triggering of certain safeguard movements where necessary. NOTE For more detailed provisions, see ISO 13850. Once active operation of the emergency stop device has ceased following an emergency stop command, the effect of this command shall be sustained until it is reset. This reset shall be possible only at the location where the emergency stop command has been initiated. The reset of the device shall not restart the machinery, but shall only permit restarting. More details for the design and selection of electrical components and elements to achieve the emergency stop function are provided in IEC 60204.		P
6.3.5.3	**Measures for the escape and rescue of trapped persons**		

EN ISO 12100			
Clause	Requirement – Test	Result - Remark	Verdict
	Measures for the escape and rescue of trapped persons may consist, among others, of —escape routes and shelters in installations generating operator-trapping hazards, —arrangements for moving some elements by hand, after an emergency stop, —arrangements for reversing the movement of some elements, —anchorage points for descender devices, —means of communication to enable trapped operators to call for help.		N
6.3.5.4 Measures for isolation and energy dissipation			
	Machines shall be equipped with the technical means to achieve isolation from power supply(ies) and dissipation of stored energy by means of the following actions: a) isolating (disconnecting, separating) the machine (or defined parts of the machine) from all power supplies; b) locking (or otherwise securing) all the isolating units in the isolating position; c) dissipating or, if this is not possible or practicable, restraining (containing) any stored energy which can give rise to a hazard; d) verifying, by means of safe working procedures, that the actions taken according to a), b) and c) above have produced the desired effect. See ISO 14118:2000, Clause 5, and IEC 60204-1:2005, 5.5 and 5.6.		P
6.3.5.5	**Provisions for easy and safe handling of machines and their heavy component parts**		
	Machines and their component parts which cannot be moved or transported by hand shall be provided or be capable of being provided with suitable attachment devices for transport by means of lifting gear. These attachments may be, among others, —standardized lifting appliances with slings, hooks, eyebolts, or tapped holes for appliance fixing, —appliances for automatic grabbing with a lifting hook when attachment is not possible from the ground, —fork locating devices for machines to be transported by a lift truck, —lifting and stowing gear and appliances integrated into the machine. Parts of machinery which can be removed manually in operation shall be provided with means for their safe removal and replacement. See also 6.4.4 c), item 3).		P
6.3.5.6	**Measures for safe access to machinery**		

EN ISO 12100			
Clause	Requirement – Test	Result - Remark	Verdict
	Machinery shall be so designed as to enable operation and all routine tasks relating to setting and/or maintenance to be carried out as far as possible by a person remaining at ground level. Where this is not possible, machines shall have built-in platforms, stairs or other facilities to provide safe access for those tasks; however, care should be taken to ensure that such platforms or stairs do not give access to danger zones of machinery. The walking areas shall be made from materials which remain as slip resistant as practicable under working conditions and, depending on the height from the ground, shall be provided with suitable guard-rails (see ISO 14122-3).		P
	In large automated installations, particular attention shall be given to safe means of access, such as walkways, conveyor bridges or crossover points. Means of access to parts of machinery located at height shall be provided with collective means of protection against falls (for example, guard-rails for stairways, stepladders and platforms and/or safety cages for ladders). As necessary, anchorage points for personal protective equipment against falls from height shall also be provided (for example, in carriers of machinery for lifting persons or with elevating control stations). Openings shall, whenever possible, open towards a safe position. They shall be designed to prevent hazards due to unintended opening. The necessary aids for access shall be provided (steps, handholds, etc.). Control devices shall be designed and located to prevent their being used as aids for access. When machinery for lifting goods and/or persons includes landings at fixed levels, these shall be equipped with interlocking guards for preventing falls when the platform is not present at a level. Movement of the lifting platform shall be prevented while the guards are open. For detailed provisions see ISO 14122.		P
6.4	**Information for use**		
6.4.1	**General requirements**		
6.4.1.1	Drafting information for use is an integral part of the design of a machine (see Figure 2).Information for use consists of communication links, such as texts, words, signs, signals, symbols or diagrams,used separately or in combination to convey information to the user. Information for use is intended for professional and/or non-professional users. NOTE See also IEC 62079 for structuring and presentation of information for use.		P

EN ISO 12100			
Clause	Requirement – Test	Result - Remark	Verdict
6.4.1.2	Information shall be provided to the user about the intended use of the machine, taking into account, notably, all its operating modes. The information shall contain all directions required to ensure safe and correct use of the machine. With this in view, it shall inform and warn the user about residual risk. The information shall indicate, as appropriate, —the need for training, —the need for personal protective equipment, and —the possible need for additional guards or protective devices (see Figure 2, Footnote d). It shall not exclude uses of the machine that can reasonably be expected from its designation and description and shall also warn about the risk which would result from using the machine in other ways than the ones described in the information, especially considering its reasonably foreseeable misuse.		P
6.4.1.3	Information for use shall cover, separately or in combination, transport, assembly and installation, commissioning, use of the machine (setting, teaching/programming or process changeover, operation, cleaning, fault-finding and maintenance) and, if necessary, dismantling, disabling and scrapping.		P
6.4.2	**Location and nature of information for use**		
	Depending on the risk, the time when the information is needed by the user and the machine design, it shall be decided whether the information — or parts thereof — are to be given a) in/on the machine itself (see 6.4.3 and 6.4.4), b) in accompanying documents (in particular instruction handbook, see 6.4.5), c) on the packaging, d) by other means such as signals and warnings outside the machine. Standardized phrases shall be considered where important messages such as warnings are given (see also IEC 62079).		P
6.4.3Signals and warning devices			

EN ISO 12100			
Clause	Requirement – Test	Result - Remark	Verdict
	Visual signals, such as flashing lights and audible signals such as sirens may be used to warn of an impending hazardous event such as machine start-up or overspeed. Such signals may also be used to warn the operator before the triggering of automatic protective measures (see 6.3.2.7). It is essential that these signals a) be emitted before the occurrence of the hazardous event, b) be unambiguous, c) be clearly perceived and differentiated from all other signals used, and d) be clearly recognized by the operator and other persons. The warning devices shall be designed and located such that checking is easy. The information for use shall prescribe regular checking of warning devices. The attention of designers is drawn to the possibility of “sensorial saturation”, which can result from too many visual and/or acoustic signals and which can also lead to defeating the warning devices. NOTE Consultation of the user on this subject is often necessary.		P
6.4.4Markings, signs (pictograms) and written warnings			
	Machinery shall bear all markings which are necessary a) for its unambiguous identification, including at least 1) the name and address of the manufacturer, 2) the designation of series or type, and 3) the serial number, if any, b) in order to indicate its compliance with mandatory requirements, comprising 1) marking, and 2) written indications, such as the authorized representative of the manufacturer, designation of the machinery, year of construction, and intended use in potentially explosive atmospheres), c) for its safe use, for example, 1) maximum speed of rotating parts, 2) maximum diameter of tools, 3) mass (in kilograms) of the machine itself and/or of removable parts, 4) maximum working load5) necessity of wearing personal protective equipment, 6) guard adjustment data, and 7) frequency of inspection. Information printed directly on the machine should be permanent and remain legible throughout the expected life of the machine. Signs or written warnings indicating only “Danger” shall not be used.		P

EN ISO 12100			
Clause	Requirement – Test	Result - Remark	Verdict
	Markings, signs and written warnings shall be readily understandable and unambiguous, especially as regards the part of the function(s) of the machine to which they are related. Readily understandable signs (pictograms) should be used in preference to written warnings. Signs and pictograms should only be used if they are understood in the culture in which the machinery is to be Used. Written warnings shall be drawn up in the language(s) of the country in which the machine will be used for the first time and, on request, in the language(s) understood by operators. NOTE In some countries the use of specific language(s) is covered by legal requirements. Markings shall comply with recognized standards (for example, ISO 2972 or ISO 7000, for pictograms,symbols and colours in particular). See IEC 60204-1 as regards marking of electrical equipment. See ISO 4413 and ISO 4414 for hydraulic and pneumatic equipment.,		P
6.4.5	**Accompanying documents (in particular — instruction handbook)**		
6.4.5.1	**Contents**		

EN ISO 12100			
Clause	Requirement – Test	Result - Remark	Verdict
	The instruction handbook or other written instructions (for example, on the packaging) shall contain, among others, the following: a) information relating to transport, handling and storage of the machine, such as 1) storage conditions for the machine, 2) dimensions, mass value(s), position of the centre(s) of gravity, and 3) indications for handling (for example, drawings indicating application points for lifting equipment); b) information relating to installation and commissioning of the machine, such as 1) fixing/anchoring and dampening of noise and vibration requirements, 2) assembly and mounting conditions, 3) space needed for use and maintenance, 4) permissible environmental conditions (for example, temperature, moisture, vibration, electromagnetic radiation), 5) instructions for connecting the machine to power supply (particularly on protection against electrical overloading), 6) advice on waste removal/disposal, and 7) if necessary, recommendations related to protective measures which have to be implemented by the user — for example, additional safeguards (see Figure 2, Footnote d), safety distances, safety signs and signals; c) information relating to the machine itself, such as 1) detailed description of the machine, its fittings, guards and/or protective devices, 2) the comprehensive range of applications for which the machine is intended, including prohibited usages, if any, taking into account variations of the original machine if appropriate, 3) diagrams (especially schematic representation of safety functions), 4) data on noise and vibration generated by the machine, and on radiation, gases, vapours and dust emitted by it, with reference to the measuring methods (including measurement uncertainties) used, 5) technical documentation of electrical equipment (see IEC 60204), and 6) documents attesting that the machine complies with mandatory requirements; d) information relating to the use of the machine, such as that related to or describing		P

EN ISO 12100			
Clause	Requirement – Test	Result - Remark	Verdict
	1) intended use, 2) manual controls (actuators), 3) setting and adjustment, 4) modes and means for stopping (especially emergency stop), 5) risks which could not be eliminated by the protective measures implemented by the designer, 6) particular risks which can be generated by certain applications, by the use of certain fittings, and about specific safeguards necessary for such applications, 7) reasonably foreseeable misuse and prohibited applications, 8) fault identification and location, for repair and for restarting after an intervention, and 9) personal protective equipment needed to be used and the training that is required; e) information for maintenance, such as 1) the nature and frequency of inspections for safety functions, 2) specification of the spare parts to be used when these can affect the health and safety of operators, 3) instructions relating to maintenance operations which require a definite technical knowledge or particular skills and hence need to be carried out exclusively by skilled persons (for example, maintenance staff, specialists), 4) instructions relating to maintenance actions (replacement of parts, etc.) which do not require specific skills and hence may be carried out by users (for example, operators), and 5) drawings and diagrams enabling maintenance personnel to carry out their task rationally (especially fault-finding tasks); f) information relating to dismantling, disabling and scrapping; g) information for emergency situations, such as 1) the operating method to be followed in the event of accident or breakdown, 2) the type of fire-fighting equipment to be used, and 3) a warning of possible emission or leakage of hazardous substance(s) and, if possible, an indication of means for fighting their effects; h) maintenance instructions provided for skilled persons [item e) 3) above] and maintenance instructions provided for unskilled persons [item e) 4) above], that need to appear clearly separated from each other.		P
6.4.5.2	**Production of instruction handbook**		

EN ISO 12100			
Clause	Requirement – Test	Result - Remark	Verdict
	The following applies to the production and presentation of the instruction handbook. a) The type fount and size of print shall ensure the best possible legibility. Safety warnings and/or cautions should be emphasized by the use of colours, symbols and/or large print. b) The information for use shall be given in the language(s) of the country in which the machine will be used for the first time and in the original version. If more than one language is to be used, each should be readily distinguished from another, and efforts should be made to keep the translated text and relevant illustration together.		P
6.4.5.3	**Drafting and editing information for use**		
	The following applies to the drafting and editing of information for use. a) Relationship to model: the information shall clearly relate to the specific model of machine and, if necessary, other appropriate identification (for example, by serial number). b) Communication principles: when information for use is being prepared, the communication process “see – think – use” should be followed in order to achieve the maximum effect and should follow sequential operations. The questions, “How?” and “Why?” should be anticipated and the answers provided. c) Information for use shall be as simple and as brief as possible, and should be expressed in consistent terms and units with a clear explanation of unusual technical terms. d) When it is foreseen that a machine will be put to non-professional use, the instructions should be written in a form that is readily understood by the non-professional user. If personal protective equipment is required for the safe use of the machine, clear advice should be given, for example, on the packaging as well as on the machine, so that this information is prominently displayed at the point of sale. e) Durability and availability of the documents: documents giving instructions for use should be produced in durable form (i.e. they should be able to survive frequent handling by the user). It can be useful to mark them “keep for future reference”.		P
7 Documentation of risk assessment and risk reduction			

EN ISO 12100			
Clause	Requirement – Test	Result - Remark	Verdict
	The documentation shall demonstrate the procedure that has been followed and the results that have been achieved. This includes, when relevant, documentation of a) the machinery for which the risk assessment has been made (for example, specifi cations, limits, intended use); b) any relevant assumptions that have been made (loads, strengths, safety factors, etc.); c) t he hazards and hazardous situations identified and the hazardous events considered in the risk assessment; d) the information on which risk assessment was based (see 5.2 1) the data used and the sources (accident histories, experience gained from risk reduction applied to similar machinery, etc.); 2) the uncertainty associated with the data used and its impact on the risk assessment; e) the risk reduction objectives to be achieved by protective measures; f) the protective measures implemented to eliminate identified hazards or to reduce risk; g) residual risks associated with the machinery; h) the result of the risk assessment (see Figure 1); i) any forms completed during the risk assessment. Standards or other specifications used to select protective measures referred to in f) above should be referenced. NOTE No requirement is given in this International Standard to deliver the risk assessment documentation together with the machine. See ISO/TR 14121-2 for information on documentation.		P

Annex: Technical Information

A.1 User manual with related specification information

Photo Documentation

Photo 1

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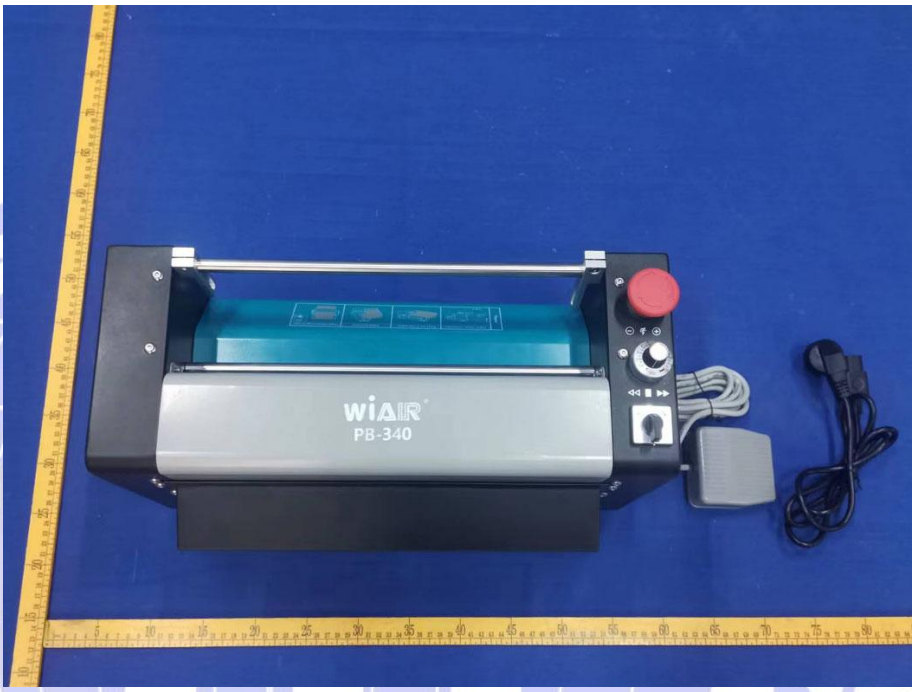

Photo 2

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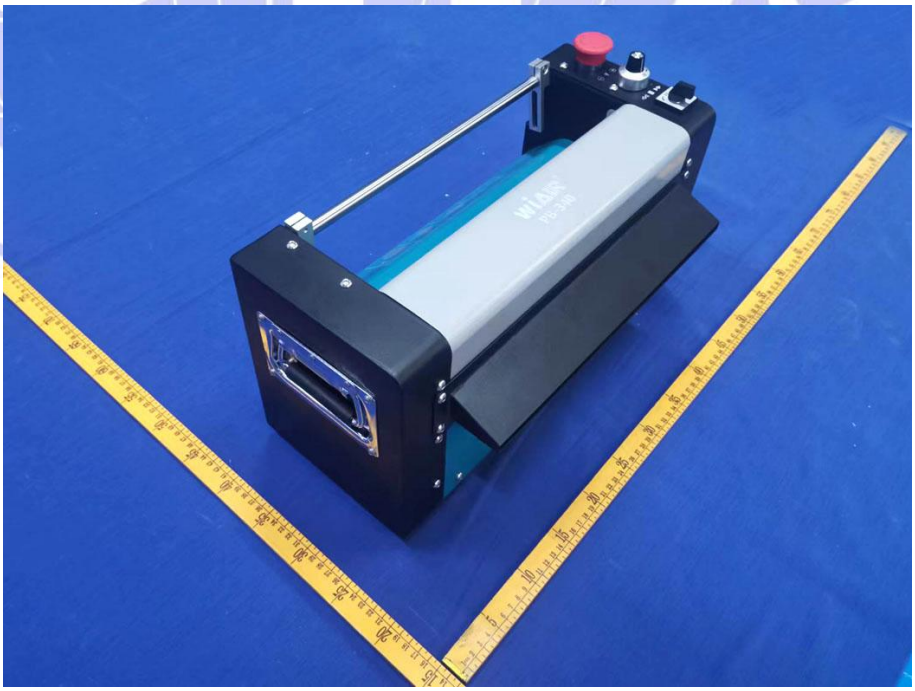

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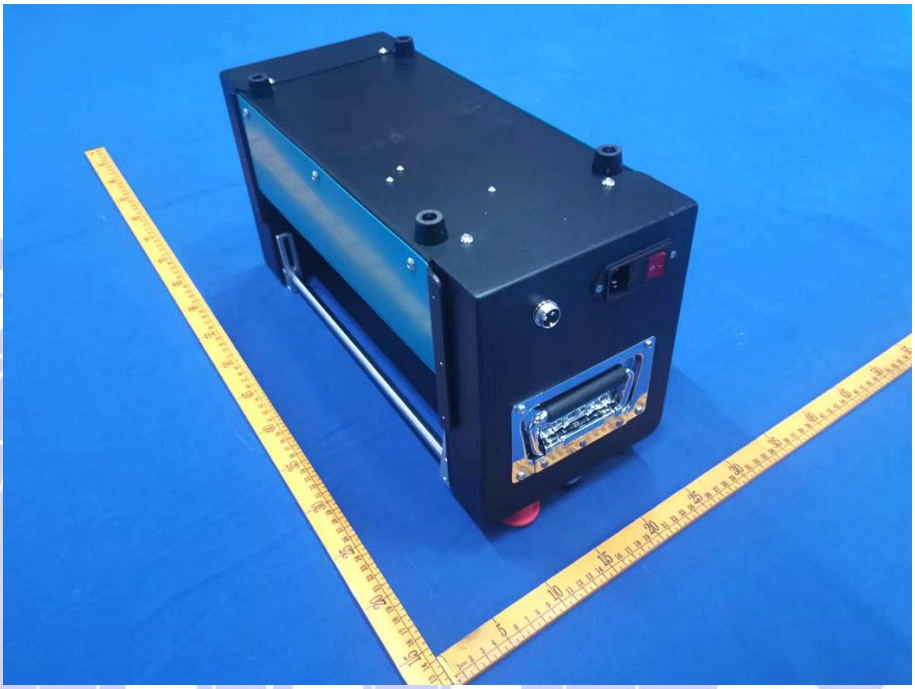

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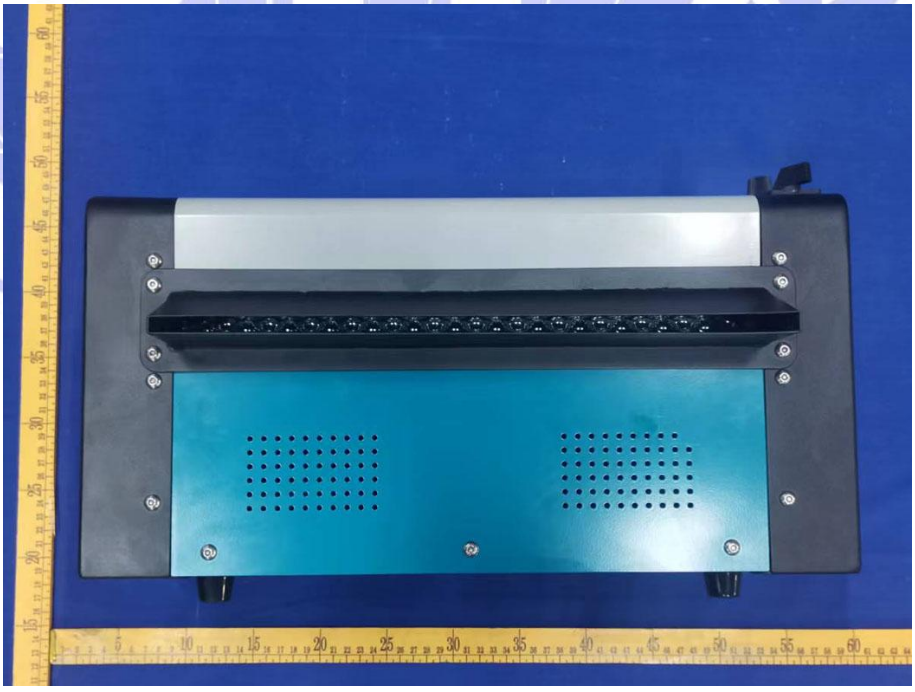

Photo 5

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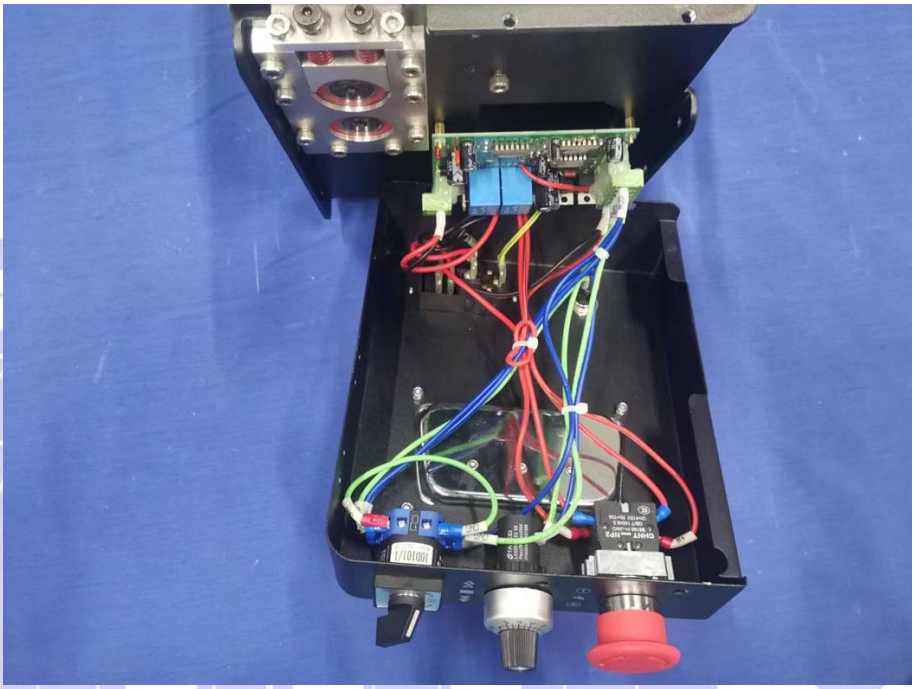

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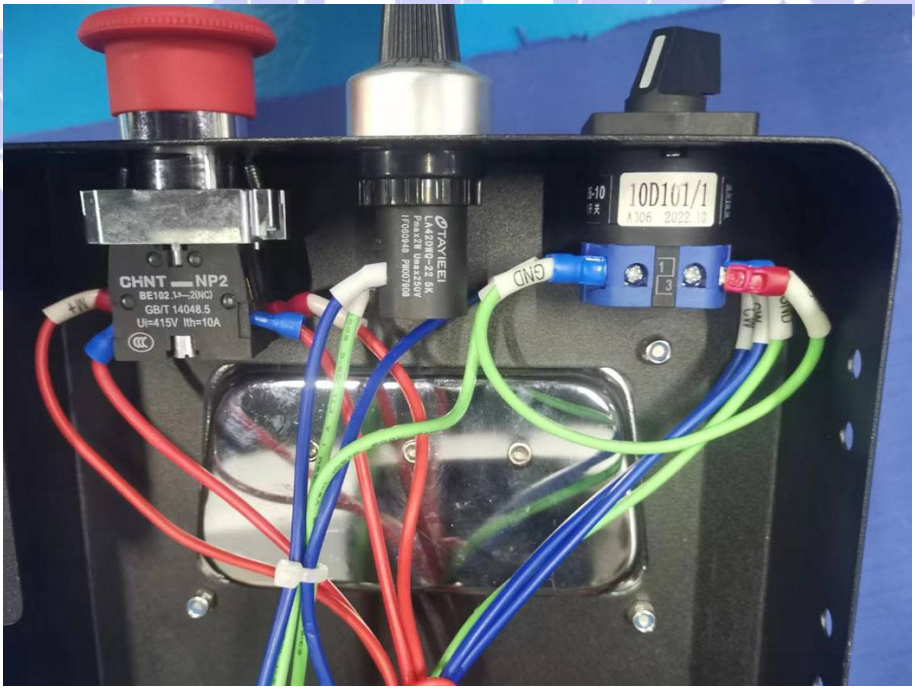

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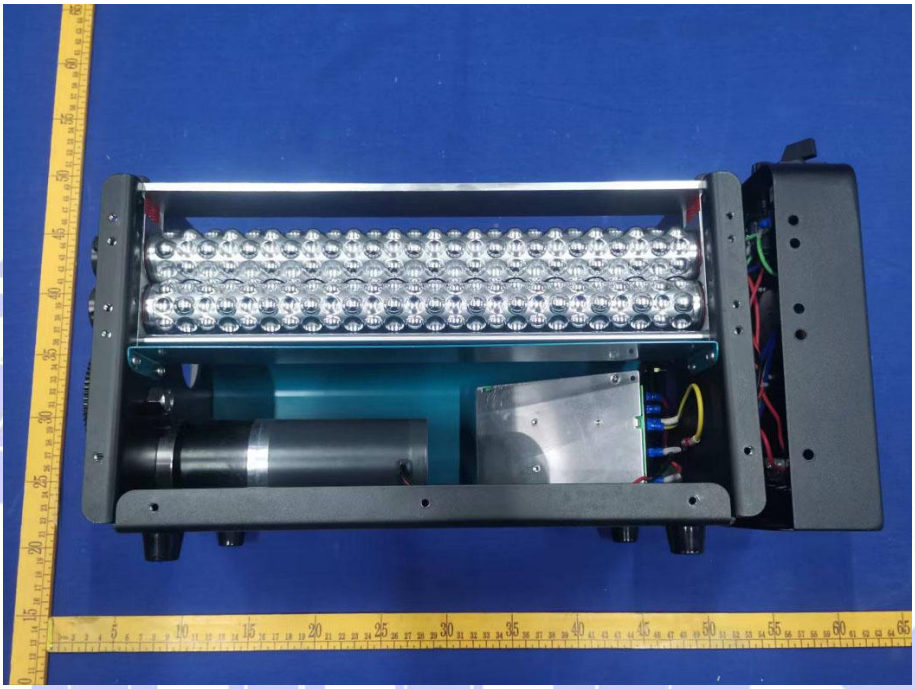

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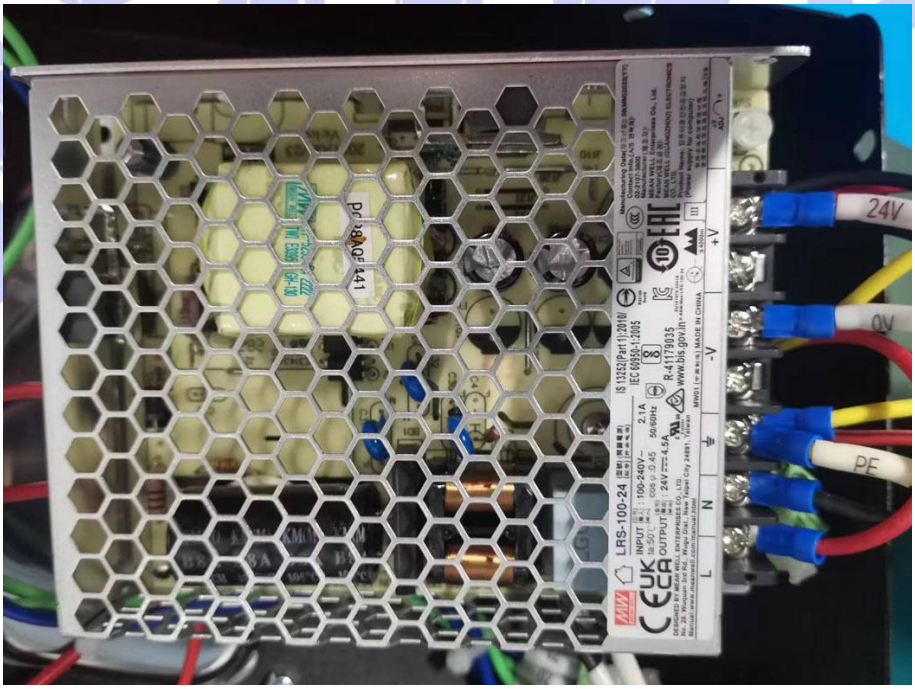

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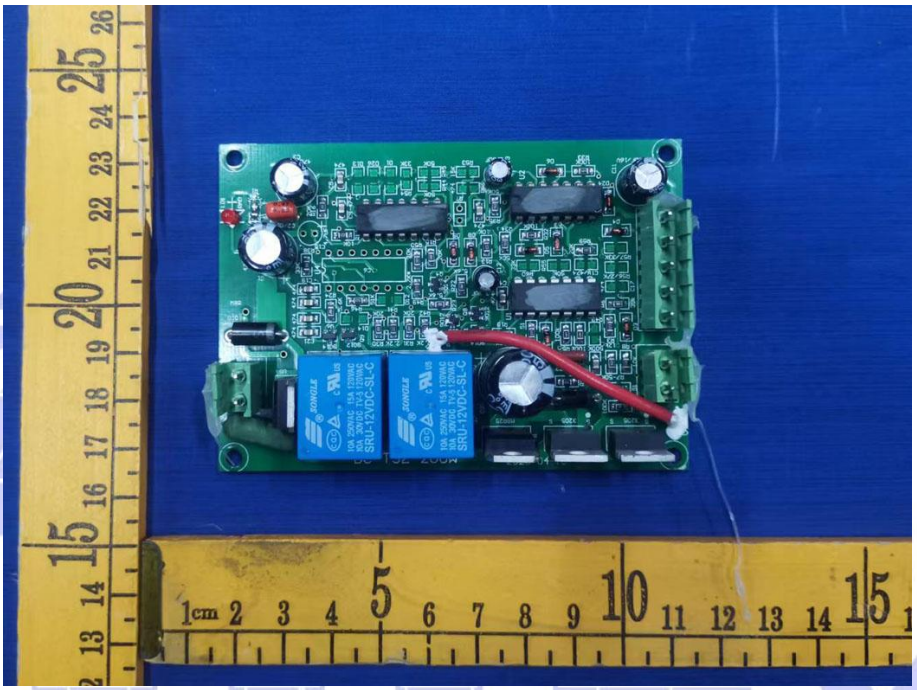

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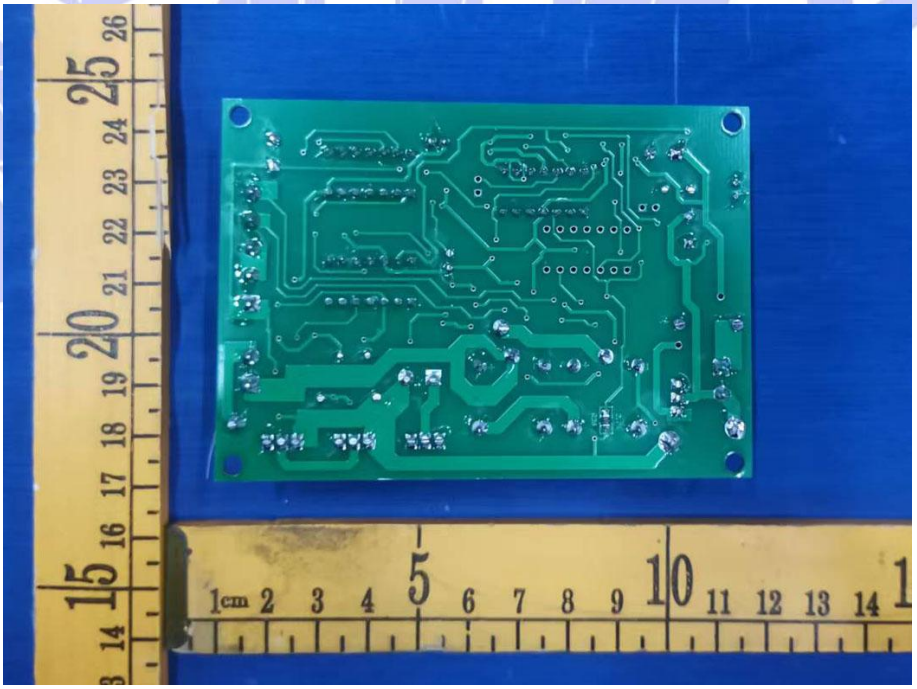

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