LVD TEST REPORT

EN 60204-1: 2018

Safety of machinery - Electrical equipment of machines - Part 1: General requirements

EN 62471: 2008

Photobiological safety of lamps and lamp systems

For

Shenzhen ShenWangda Technology Co.,Ltd

4th floor, buiding C, KelunTe Low-carbonindustrial park, HuaRong Road, Longhua area, ShenZhen

Series model:

TBK938,TBK938M,TBK938L,TBK958,TBK958D,TBK983A, TBK988,TBK988C,TBK988D,TBK988Z,TBK968,TBK968C,TBK968D, TBK568,TBK568R,TBK228,TBK238,TBK258UV,TBK268,TBK288,TBK008, TBK009

2022-07-19

This Report Concerns:	**Equipment Type:**
☒ Original Report	LCD Temperature Controller

Test Engineer:	Eric Tao/ Eric Tao
Report Number:	TH2207169-C03-R01
Test Date:	2022-07-08 to 2022-07-19
Reviewed By:	Prince Huang/ Prince Huang
Approved By:	Prince Huang/ Prince Huang
Prepared By:	**Shenzhen Tian Hai Test Technology Co.,Ltd.** 4F, A3 BLDG, The Silicon Valley Power intelligent terminal industrial park, Guan Lan street, Longhua district, Shenzhen Tel : 86-755-86615100 Fax: 86-755-86615105

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 Tian Hai Test Technology Co,.Ltd.

4F,A3 BLDG,The Silicon Valley Power intelligent terminal industrial park,Guan lan street,Longhua district,Shenzhen
Tel:+86-755-86615100 Fax:+86-755-86615105 http://www.tianhaitest.com

EN 60204-1: 2018
Safety of machinery–Electrical equipment of machines Part 1: General requirements
EN 62471: 2008
Photobiological safety of lamps and lamp systems

Report		
Report reference No.	:	TH2207169-C03-R01
Tested by (+signature)	:	Eric Tao
Reviewed by (+signature)	:	Prince Haung
Approved by (+signature)	:	Prince Huang
Date of issue	:	2022-07-19
Testing laboratory		
Name	:	**Shenzhen Tian Hai Test Technology Co.,Ltd.**
Address	:	4F, A3 BLDG, The Silicon Valley Power intelligent terminal industrial park, Guan Lan street, Longhua district, Shenzhen
Test location	:	Same as above
Client		
Applicant Name	:	**Shenzhen ShenWangda Technology Co.,Ltd**
Address	:	4th floor, buiding C, KelunTe Low-carbonindustrial park, HuaRong Road, Longhua area, ShenZhen
Manufacturer	:	**Shenzhen ShenWangda Technology Co.,Ltd**
Address	:	4th floor, buiding C, KelunTe Low-carbonindustrial park, HuaRong Road, Longhua area, ShenZhen
Test specification		
Standards	:	EN 60204-1: 2018; EN 62471: 2008
Non-standard test method	:	N.A.
Test item		
Description	:	**LCD Temperature Controller**
Trade mark	:	TBK
Model	:	TBK938,TBK938M,TBK938L,TBK958,TBK958D,TBK983A, TBK988,TBK988C,TBK988D,TBK988Z,TBK968,TBK968C,TBK968D, TBK568,TBK568R,TBK228,TBK238,TBK258UV,TBK268,TBK288,TBK008, TBK009
Rating	:	AC 110V/220V
Note:	:	All tests performed on model:TBK568.

4F,A3 BLDG,The Silicon Valley Power intelligent terminal industrial park,Guan lan street,Longhua district,Shenzhen
Tel:+86-755-86615100 Fax:+86-755-86615105 http://www.tianhaitest.com

Test case verdicts	
Test case does not apply to the test object	: N/A (Not apply)
Test item does meet the requirement	: P(Pass)
Test item does not meet the requirement	: F(Fail)

General remarks:

"”See remark #)"”refers to a remark appended to the report.
"”See appended table)"”refers to a table appended to the report.
Throughout this report a comma is used as the decimal separator.
The test results presented in this report relate only to the object tested.
This report shall not be reproduced except in full without the written approval of the testing laboratory.

Attachment include:
Appendix for photo

Remarks:
Copy of the marking plate

LCD Temperature Controller
Model: TBK568
Input: AC 110V/220V

CE Hazard Level: 1catagory hazard (Low hazard)

Shenzhen ShenWangda Technology Co.,Ltd
4th floor, buiding C, KelunTe Low-carbonindustrial park, HuaRong Road, Longhua area, ShenZhen

4F,A3 BLDG,The Silicon Valley Power intelligent terminal industrial park,Guan lan street,Longhua district,Shenzhen
Tel:+86-755-86615100 Fax:+86-755-86615105 http://www.tianhaitest.com

EN 60204-1			
Clause	**Requirement Test**	**Result**	**Verdict**
4	**General requirements**		P
4.1	General	Complied	P
4.2	Selection of equipment		P
4.2.1	General		P
	Electrical components and devices shall:		P
	– be suitable for their intended use		P
	– conform to relevant IEC standards where such exist		N/A
	– be applied in accordance with the supplier's instructions.		P
4.2.2	Electrical equipment in compliance with the EN 60439 series	Complied	P
4.3	Electrical supply		P
4.3.1	General		P
	The electrical equipment shall be designed to operate correctly with the conditions of the supply:		P
	– as specified in 4.3.2 or 4.3.3,		P
	– as otherwise specified by the user (see Annex B)		N/A
	– as specified by the supplier in the case of a special source of supply such as an on-board generator.		N/A
4.3.2	AC supplies	AC 110V/220V	P
	Voltage Steady state voltage: 0,9 to 1,1 of nominal voltage.		N/A
	Frequency 0,99 to 1,01 of nominal frequency continuously; 0,98 to 1,02 short time.		P
	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.	<10%	P
	Voltage unbalance Neither the voltage of the negative sequence component nor the voltage of the zero sequence component in three-phase supplies exceeding 2 % of the positive sequence component.	<2%	N/A
	Voltage interruption 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.	<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.	<20%	P
4.3.3	DC supplies		N/A
4.3.4	Special supply systems		N/A
	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/A
4.4	Physical environment and operating conditions		P

4F,A3 BLDG,The Silicon Valley Power intelligent terminal industrial park,Guan lan street,Longhua district,Shenzhen
Tel:+86-755-86615100 Fax:+86-755-86615105 http://www.tianhaitest.com

EN 60204-1			
Clause	**Requirement Test**	**Result**	**Verdict**
4.4.1	General		P
	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 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).	Complied	P
4.4.2	Electromagnetic compatibility (EMC)		P
	The equipment shall not generate electromagnetic disturbances above levels that are appropriate for its intended operating environment. In addition, the equipment shall have a level of immunity to electromagnetic disturbances so that it can function in its intended environment.	See report no.TH2207169-C01-R01	P
4.4.3	Ambient air temperature		P
	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. For very hot environments (for example hot climates, steel mills, paper mills) and for cold environments, additional measures are recommended (see Annex B).	Complied	P
4.4.4	Humidity		P
	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 humidities are permitted at lower temperatures (for example 90 % at 20 °C).	Complied	P
	Harmful effects of occasional condensation shall be avoided by design of the quipment or, where necessary, by additional measures (for example built-in heaters, air conditioners, drain holes).		N/A
4.4.5	Altitude		P
	Electrical equipment shall be capable of operating correctly at altitudes up to 1 000 m above mean sea level.	Complied	P
4.4.6	Contaminants		N/A
4.4.7	Ionizing and non-ionizing radiation	Complied	P
4.4.8	Vibration, shock, and bump		P
	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 uitable equipment, by mounting it away from the machine, or by provision of anti-vibration mountings. A special agreement is recommended between the supplier and the user (see Annex B).	Complied	P
4.5	Transportation and storage		P

4F,A3 BLDG,The Silicon Valley Power intelligent terminal industrial park,Guan lan street,Longhua district,Shenzhen
Tel:+86-755-86615100 Fax:+86-755-86615105 http://www.tianhaitest.com

EN 60204-1			
Clause	**Requirement Test**	**Result**	**Verdict**
	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. A special agreement can be necessary between the supplier and the user (see Annex B).	Complied	P
4.6	Provisions for handling		P
	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		P
	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**		**P**
5.1	Incoming supply conductor terminations	Non-detachable Power Supply	P
5.2	Terminal for connection to the external protective earthing system		P
5.3	Supply disconnecting (isolating) device	Plug	P
5.3.1	General		P
5.3.2	Type	Power switch	P
5.3.3	Requirements		P
5.3.4	Operating means		P
5.3.5	Excepted circuits	No such circuits	N/A
5.4	Devices for switching off for prevention of unexpected start-up		P
5.5	Devices for disconnecting electrical equipment		P
5.6	Protection against unauthorized, inadvertent and/or mistaken connection		P
6	**Protection against electric shock**		P
6.1	General	Complied	P
6.2	Protection against direct contact		P
6.2.1	General	Complied	P
6.2.2	Protection by enclosures		P
6.2.3	Protection by insulation of live parts		P
6.2.4	Protection against residual voltages		P
6.2.5	Protection by barriers	No barriers	N/A
6.2.6	Protection by placing out of reach or protection by obstacles		N/A
6.3	Protection against indirect contact		P
6.3.1	General		P
6.3.2	Prevention of the occurrence of a touch voltage		N/A

4F,A3 BLDG,The Silicon Valley Power intelligent terminal industrial park,Guan lan street,Longhua district,Shenzhen
Tel:+86-755-86615100 Fax:+86-755-86615105 http://www.tianhaitest.com

EN 60204-1			
Clause	**Requirement Test**	**Result**	**Verdict**
6.3.2.1	General		N/A
6.3.2.2	Protection by provision of class II equipment or by equivalent insulation		N/A
6.3.2.3	Protection by electrical separation	Complied	P
6.3.3	Protection by automatic disconnection of supply	No such protection methods	N/A
6.4	Protection by the use of PELV		N/A
6.4.1	General requirements		N/A
6.4.2	Sources for PELV		N/A
7	**Protection of equipment**		P
7.1	General		P
7.2	Overcurrent protection		P
7.2.1	General		P
7.2.2	Supply conductors		P
7.2.3	Power circuits		P
7.2.4	Control circuits		P
7.2.5	Socket outlets and their associated conductors	No socket outlets	N/A
7.2.6	Lighting circuits	No lighting circuits	N/A
7.2.7	Transformers		P
7.2.8	Location of overcurrent protective devices		P
7.2.9	Overcurrent protective devices		P
7.2.10	Rating and setting of overcurrent protective devices		P
7.3	Protection of motors against overheating	CE certification motor	P
7.4	Abnormal temperature protection		P
7.5	Protection against supply interruption or voltage reduction and subsequent Restoration	No such protection	N/A
7.6	Motor overspeed protection	Step motor	P
7.7	Earth fault/residual current protection		N/A
7.8	Phase sequence protection		N/A
7.9	Protection against overvoltages due to lightning and to switching surges	Not provided	N/A
8	**Equipotential bonding**		P
8.1	General		P
8.2	Protective bonding circuit		P
8.2.1	General		P
8.2.2	Protective conductors		P
8.2.3	Continuity of the protective bonding circuit		P
8.2.4	Exclusion of switching devices from the protective bonding circuit		P

4F,A3 BLDG,The Silicon Valley Power intelligent terminal industrial park,Guan lan street,Longhua district,Shenzhen
Tel:+86-755-86615100 Fax:+86-755-86615105 http://www.tianhaitest.com

EN 60204-1			
Clause	**Requirement Test**	**Result**	**Verdict**
8.2.5	Parts that need not be connected to the protective bonding circuit		P
8.2.6	Protective conductor connecting points		P
8.2.7	Mobile machines	Not mobile machine	N/A
8.2.8	Additional protective bonding requirements for electrical equipment having earth leakage currents higher than 10 mA a.c. or d.c.		N/A
8.3	Functional bonding		P
8.4	Measures to limit the effects of high leakage current		P
9	**Control circuits and control functions**		P
9.1	Control circuits	Complied	P
9.1.1	Control circuit supply		P
9.1.2	Control circuit voltages		P
	The nominal value of the control voltage shall be consistent with the correct operation of the control circuit. The nominal voltage shall not exceed 277 V when supplied from a transformer.		P
9.1.3	Protection		P
	Control circuits shall be provided with overcurrent protection in accordance with 7.2.4 and 7.2.10.		P
9.2	Control functions		P
9.2.1	Start functions		P
9.2.2	Stop functions		P
	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 3.56);		P
	– stop category 1: a controlled stop (see 3.11) with power available to the machine actuators to achieve the stop and then removal of power when the stop is achieved;		N/A
	– stop category 2: a controlled stop with power left available to the machine actuators.		N/A
9.2.3	Operating modes	One operating mode	P
9.2.4	Suspension of safety functions and/or protective measures		P
9.2.5	Operation		P
9.2.5.1	General		P
	The necessary safety functions and/or protective measures (for example interlocks (see 9.3)) shall be provided for safe operation.	Complied	P
	Measures shall be taken to prevent movement of the machine in an unintended or unexpected manner after any stopping of the machine (for example due to locked-off condition, power supply fault, battery replacement, lost signal condition with cableless control).	Complied	P

4F,A3 BLDG,The Silicon Valley Power intelligent terminal industrial park,Guan lan street,Longhua district,Shenzhen
Tel:+86-755-86615100 Fax:+86-755-86615105 http://www.tianhaitest.com

EN 60204-1			
Clause	**Requirement Test**	**Result**	**Verdict**
	Where a machine has more than one control station, measures shall be provided to ensure that initiation of commands from different control stations do not lead to a hazardous situation.		N/A
9.2.5.2	Start		P
	The start of an operation shall be possible only when all of the relevant safety functions and/or protective measures are in place and are operational	Complied	P
9.2.5.3	Stop		P
	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 (see 4.1).	category 0	P
9.2.5.4	Emergency operations (emergency stop, emergency switching off)		P
9.2.5.4.1	General		P
9.2.5.4.2	Emergency stop		P
	Principles for the design of emergency stop equipment, including functional aspects, are given in ISO 13850.		P
	The emergency stop shall function either as a stop category 0 or as a stop category 1 (see 9.2.2). The choice of the stop category of the emergency stop depends on the results of a risk assessment of the machine.	category 0	P
9.2.5.4.3	Emergency switching off		P
9.2.5.5	Monitoring of command actions		P
	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, overtravel limiters, motor overspeed detection, mechanical overload detection or anti-collision devices.	Complied	P
9.2.6	Other control functions		P
9.2.6.1	Hold-to-run controls		N/A
	Hold-to-run controls shall require continuous actuation of the control device(s) to achieve operation.		N/A
9.2.6.2	Two-hand control	No such control	N/A
9.2.6.3	Enabling control	No such control	N/A
9.2.6.4	Combined start and stop controls		P
9.2.7	Cableless control	No such control	N/A
9.2.7.1	General		N/A
9.2.7.2	Control limitation		N/A
	Measures shall be taken to ensure that control commands:		N/A
9.2.7.3	Stop		N/A
9.2.7.4	Use of more than one operator control station		N/A
9.2.7.5	Battery-powered operator control stations		N/A
9.3	Protective interlocks		N/A

4F,A3 BLDG,The Silicon Valley Power intelligent terminal industrial park,Guan lan street,Longhua district,Shenzhen
Tel:+86-755-86615100 Fax:+86-755-86615105 http://www.tianhaitest.com

EN 60204-1			
Clause	**Requirement Test**	**Result**	**Verdict**
9.3.1	Reclosing or resetting of an interlocking safeguard		N/A
9.3.2	Exceeding operating limits		N/A
9.3.3	Operation of auxiliary functions		N/A
9.3.4	Interlocks between different operations and for contrary motions		N/A
9.3.5	Reverse current braking		N/A
9.4	Control functions in the event of failure		P
9.4.1	General requirements		P
	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).	Complied	P
	The electrical control circuits shall have an appropriate level of safety performance that has been determined from the risk assessment at the machine. The requirements of IEC 62061 and/or ISO 13849-1:1999, ISO 13849-2:2003 shall apply.	Complied	P
	Measures to reduce those risks include but are not limited to:		P
	– protective devices on the machine (for example interlocking guards, trip devices);		P
	– protective interlocking of the electrical circuit;		N/A
	– use of proven circuit techniques and components (see 9.4.2.1);		P
	– provision of partial or complete redundancy (see 9.4.2.2) or diversity (see 9.4.2.3);		N/A
	– provision for functional tests (see 9.4.2.4).		P
9.4.2	Measures to minimize risk in the event of failure	Complied	P
9.4.2.1	Use of proven circuit techniques and components		P
	These measures include but are not limited to:		P
	– bonding of control circuits to the protective bonding circuit for functional purposes (see 9.4.3.1 and Figure 2);		P
	– connection of control devices in accordance with 9.4.3.1;		P
	– stopping by de-energizing (see 9.2.2);		P
	– the switching of all control circuit conductors to the device being controlled (see 9.4.3.1);		P
	– switching devices having direct opening action (see IEC 60947-5-1);	No such switching devices	N/A
	– circuit design to reduce the possibility of failures causing undesirable operations.		P
9.4.2.2	Provisions of partial or complete redundancy		N/A
	Where off-line redundancy which is not active during normal operation is provided, suitable measures shall be taken to ensure that those control circuits are available when required.		N/A

4F,A3 BLDG,The Silicon Valley Power intelligent terminal industrial park,Guan lan street,Longhua district,Shenzhen
Tel:+86-755-86615100 Fax:+86-755-86615105 http://www.tianhaitest.com

EN 60204-1			
Clause	**Requirement Test**	**Result**	**Verdict**
9.4.2.3	Provision of diversity		N/A
	– the combination of normally open and normally closed contacts operated by interlocking guards;		N/A
9.4.2.4	Provision for functional tests		P
9.4.3	Protection against maloperation due to earth faults, voltage interruptions and loss of circuit continuity		P
9.4.3.1	Earth faults		P
	Earth faults on any control circuit shall not cause unintentional starting, potentially hazardous motions, or prevent stopping of the machine.	Complied	P
	Method a) Control circuits, fed by control transformers:		P
	1) In case of earthed control circuit supplies, the common conductor is connected to the protective bonding circuit at the point of supply. All contacts, solid state elements etc., which are intended to operate an electromagnetic or other device (for example, a relay, indicator light) are inserted between one side, the switched conductor of the control circuit supply and one terminal of the coil or device. The other terminal of the coil or device (preferably always having the same marking) is connected directly to the common conductor of the control circuit supply without any switching elements (see Figure 3).	Complied	P
	2) Control circuits fed from a control transformer and not connected to the protective bonding circuit, having the same arrangement as shown in Figure 3 and provided with a device that interrupts the circuit automatically in the event of an earth fault (see also 7.2.4).		P
	Method b) Control circuits fed from a control transformer with a centre-tapped winding, this centre tap connected to the protective bonding circuit, arranged as shown in Figure 4 with the overcurrent protective device having switching elements in all control circuit supply conductors.		N/A
	Method c) Where the control circuit is not fed from a control transformer and is either:		N/A
	1) directly connected between the phase conductors of an earthed supply, or;		N/A
	2) directly connected between the phase conductors or between a phase conductor and a neutral conductor of a supply that is not earthed or is earthed through a high impedance,		N/A
	Multi-pole control switches that switch all live conductors are used for START or STOP of those machine functions that can cause a hazardous situation or damage to the machine in the event of unintentional starting or failure to stop, or in the case of c) 2), a device shall be provided that interrupts the circuit automatically in the event of an earth fault.		N/A
9.4.3.2	Voltage interruptions		N/A
9.4.3.3	Loss of circuit continuity		N/A

4F,A3 BLDG,The Silicon Valley Power intelligent terminal industrial park,Guan lan street,Longhua district,Shenzhen
Tel:+86-755-86615100 Fax:+86-755-86615105 http://www.tianhaitest.com

EN 60204-1			
Clause	**Requirement Test**	**Result**	**Verdict**
	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/A
10	**Operator interface and machine-mounted control devices**		P
10.1	General		P
10.1.1	General device requirements		P
	This Clause contains requirements for devices mounted outside or partially outside control enclosures.		P
	As far as is practicable, those devices shall be selected, mounted, and identified or coded in accordance with relevant parts of IEC 61310.	Complied	P
10.1.2	Location and mounting	Complied	P
10.1.3	Protection		P
	The degree of protection (see IEC 60529) together with other appropriate measures shall afford protection against:	Complied	P
10.1.4	Position sensors		P
	Position sensors (for example position switches, proximity switches) shall be so arranged that they will not be damaged in the event of overtravel.	Complied	P
	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).	Complied	P
10.1.5	Portable and pendant control stations		N/A
	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/A
10.2	Push-buttons		P
10.2.1	Colours	Complied	P
10.2.2	Markings	Complied	P
	In addition to the functional identification as described in 16.3, it is recommended that pushbuttons be marked, near to or preferably directly on the actuators, with the symbols given in Table 3.	Complied	P
10.3	Indicator lights and displays		P
10.3.1	General	Complied	P
10.3.2	Colours	Complied	P
10.3.3	Flashing lights and displays	Complied	P
10.4	Illuminated push-buttons		N/A

4F,A3 BLDG,The Silicon Valley Power intelligent terminal industrial park,Guan lan street,Longhua district,Shenzhen
Tel:+86-755-86615100 Fax:+86-755-86615105 http://www.tianhaitest.com

EN 60204-1			
Clause	**Requirement Test**	**Result**	**Verdict**
	Illuminated push-button actuators shall be colour-coded in accordance with Tables 2 and 4. Where there is difficulty in assigning an appropriate colour, WHITE shall be used. The colour RED for the emergency stop actuator shall not depend on the illumination of its light.	No such push-buttons	N/A
10.5	Rotary control devices		N/A
	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.	No such devices	N/A
10.6	Start devices		P
	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. However, mushroom-type actuators may be used for two-hand control (see also ISO 13851).	Complied	P
10.7	Emergency stop devices		P
10.7.1	Location of emergency stop devices		P
	Devices for emergency stop shall be readily accessible.	Complied	P
10.7.2	Types of emergency stop device		P
	The types of device for emergency stop include:		P
	– a push-button operated switch with a palm or mushroom head type;	Complied	P
	– a pull-cord operated switch;		N/A
	– a pedal-operated switch without a mechanical guard.		N/A
10.7.3	Colour of actuators		P
	Actuators of emergency stop devices shall be coloured RED. If a background exists immediately around the actuator, then this background shall be coloured YELLOW. See also ISO 13850.	Complied	P
10.7.4	Local operation of the supply disconnecting device to effect emergency stop		P
	The supply disconnecting device may be locally operated to serve the function of emergency stop when:		P
	– it is readily accessible to the operator; and	Complied	P
	– it is of the type described in 5.3.2 a), b), c), or d).	Complied	P
10.8	Emergency switching off devices		P
10.8.1	Location of emergency switching off devices		P
	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 it is necessary to provide a control station with an emergency stop device and an emergency switching off device, means shall be provided to avoid confusion between these devices.		P
10.8.2	Types of emergency switching off device		P
	The types of device for emergency switching off include:		P

4F,A3 BLDG,The Silicon Valley Power intelligent terminal industrial park,Guan lan street,Longhua district,Shenzhen
Tel:+86-755-86615100 Fax:+86-755-86615105 http://www.tianhaitest.com

EN 60204-1			
Clause	**Requirement Test**	**Result**	**Verdict**
	– a push-button operated switch with a palm or mushroom head type of actuator;		P
	– a pull-cord operated switch.		P
10.8.3	Colour of actuators		P
	Actuators of emergency switching off devices shall be coloured RED. If a background exists immediately around the actuator, then this background shall be coloured YELLOW.		P
10.8.4	Local operation of the supply disconnecting device to effect emergency switching off		P
	Where the supply disconnecting device is to be locally operated for emergency switching off, it shall be readily accessible and should meet the colour requirements of 10.8.3.		P
10.9	Enabling control device		N/A
11	**Controlgear: location, mounting, and enclosures**		P
11.1	General requirements		P
	– its accessibility and maintenance;		P
	– its protection against the external influences or conditions under which it is intended to operate;		P
	– operation and maintenance of the machine and its associated equipment.		P
11.2	Location and mounting		P
11.2.1	Accessibility and maintenance		P
11.2.2	Physical separation or grouping		P
	Non-electrical parts and devices, not directly associated with the electrical equipment, shall not be located within enclosures containing controlgear. Devices such as solenoid valves should be separated from the other electrical equipment (for example in a separate compartment).	Complied	P
	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.	Complied	P
11.2.3	Heating effects		P
	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.	Complied	P
11.3	Degrees of protection		P
	The protection of controlgear 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.	Complied	P
11.4	Enclosures, doors and openings	Complied	P
11.5	Access to control gear		N/A
12	**Conductors and cables**		P

4F,A3 BLDG,The Silicon Valley Power intelligent terminal industrial park,Guan lan street,Longhua district,Shenzhen
Tel:+86-755-86615100 Fax:+86-755-86615105 http://www.tianhaitest.com

EN 60204-1			
Clause	**Requirement Test**	**Result**	**Verdict**
12.1	General requirements		P
	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.	IEC standard cord	P
12.2	Conductors	Complied	P
12.3	Insulation	polyvinyl chloride (PVC)	P
12.4	Current-carrying capacity in normal service	Complied	P
12.5	Conductor and cable voltage drop	Complied	P
12.6	Flexible cables		P
12.6.1	General		P
	Flexible cables shall have Class 5 or Class 6 conductors.		P
12.6.2	Mechanical rating		P
12.6.3	Current-carrying capacity of cables wound on drums		N/A
12.7	Conductor wires, conductor bars and slip-ring assemblies		P
12.7.1	Protection against direct contact		P
12.7.2	Protective conductor circuit		P
12.7.3	Protective conductor current collectors		N/A
	Protective conductor current collectors shall have a shape or construction so that they are not interchangeable with the other current collectors. Such current collectors shall be of the sliding contact type.		N/A
12.7.4	Removable current collectors with a disconnector function		N/A
	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 8.2.4).		N/A
12.7.5	Clearances in air		P
	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		P
	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.		P

4F,A3 BLDG,The Silicon Valley Power intelligent terminal industrial park,Guan lan street,Longhua district,Shenzhen
Tel:+86-755-86615100 Fax:+86-755-86615105 http://www.tianhaitest.com

EN 60204-1			
Clause	**Requirement Test**	**Result**	**Verdict**
12.7.7	Conductor system sectioning		P
	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.	Complied	P
12.7.8	Construction and installation of conductor wire, conductor bar systems and slip-ring assemblies	Complied	P
	Conductor wires, conductor bars and slip-ring assemblies in power circuits shall be grouped separately from those in control circuits.	Complied	N/A
13	**Wiring practices**		P
13.1	Connections and routing		P
13.1.1	General requirements	Complied	P
13.1.2	Conductor and cable runs		P
	Conductors and cables shall be run from terminal to terminal without splices or joints.		P
13.1.3	Conductors of different circuits		N/A
	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.		N/A
13.1.4	Connection between pick-up and pick-up converter of an inductive power supply system		N/A
	– as short as practicable;		N/A
	– adequately protected against mechanical damage.		N/A
13.2	Identification of conductors		P
13.2.1	General requirements		P
	Each conductor shall be identifiable at each termination in accordance with the technical documentation (see Clause 17).		P
	It is recommended (for example to facilitate maintenance) that conductors be identified by number, alphanumeric, colour (either solid or with one or more stripes), or a combination of colour and numbers or alphanumeric. When numbers are used, they shall be Arabic; letters shall be Roman (either upper or lower case).		P
13.2.2	Identification of the protective conductor	Complied	P
13.2.3	Identification of the neutral conductor	Complied	P
13.2.4	Identification by colour	Complied	P
13.3	Wiring inside enclosures		P

4F,A3 BLDG,The Silicon Valley Power intelligent terminal industrial park,Guan lan street,Longhua district,Shenzhen
Tel:+86-755-86615100 Fax:+86-755-86615105 http://www.tianhaitest.com

EN 60204-1			
Clause	**Requirement Test**	**Result**	**Verdict**
	Conductors inside enclosures shall be supported where necessary to keep them in place.	Complied	P
13.4	Wiring outside enclosures		P
13.4.1	General requirements		P
	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).	Complied	P
13.4.2	External ducts		N/A
13.4.3	Connection to moving elements of the machine		N/A
13.4.4	Interconnection of devices on the machine		N/A
	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.		N/A
13.4.5	Plug/socket combinations		P
13.4.6	Dismantling for shipment		N/A
13.4.7	Additional conductors		N/A
	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.		N/A
13.5	Ducts, connection boxes and other boxes		N/A
13.5.1	General requirements		N/A
	Ducts shall provide a degree of protection suitable for the application (see IEC 60529).		N/A
13.5.2	Percentage fill of ducts		N/A
	Consideration of the percentage fill of ducts should be based on the straightness and length of the duct and the flexibility of the conductors.		N/A
13.5.3	Rigid metal conduit and fittings		N/A
	Rigid metal conduit and fittings shall be of galvanized steel or of a corrosion-resistant material suitable for the conditions.		N/A
13.5.4	Flexible metal conduit and fittings		N/A
	A flexible metal conduit shall consist of a flexible metal tubing or woven wire armour. It shall be suitable for the expected physical environment.		N/A
13.5.5	Flexible non-metallic conduit and fittings		N/A
	Flexible non-metallic conduit shall be resistant to kinking and shall have physical characteristics similar to those of the sheath of multiconductor cables.		N/A
13.5.6	Cable trunking systems		N/A

4F,A3 BLDG,The Silicon Valley Power intelligent terminal industrial park,Guan lan street,Longhua district,Shenzhen
Tel:+86-755-86615100 Fax:+86-755-86615105 http://www.tianhaitest.com

EN 60204-1			
Clause	**Requirement Test**	**Result**	**Verdict**
	Cable trunking systems external to enclosures shall be rigidly supported and clear of all moving or contaminating portions of the machine.		N/A
13.5.7	Machine compartments and cable trunking systems		N/A
	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..		N/A
13.5.8	Connection boxes and other boxes		N/A
	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		N/A
13.5.9	Motor connection boxes		N/A
	Motor connection boxes shall enclose only connections to the motor and motor-mounted devices		N/A
14	**Electric motors and associated equipment**		P
14.1	General requirements		P
	Electric motors should conform to the relevant parts of IEC 60034 series.	Complied	P
	The protection requirements for motors and associated equipment are given in 7.2 for overcurrent protection, in 7.3 for overload protection, and in 7.6 for overspeed protection.	Complied	P
	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.	Complied	P
14.2	Motor enclosures		P
	It is recommended that motor enclosures be chosen from those included in IEC 60034-5.	Complied	P
14.3	Motor dimensions		P
	As far as is practicable, the dimensions of motors shall conform to those given in the IEC 60072 series.	Complied	P
14.4	Motor mounting and compartments		P
	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.	Complied	P
14.5	Criteria for motor selection		P
	The characteristics of motors and associated equipment shall be selected in accordance with the anticipated service and physical environmental conditions (see 4.4).	Complied	P

4F,A3 BLDG,The Silicon Valley Power intelligent terminal industrial park,Guan lan street,Longhua district,Shenzhen
Tel:+86-755-86615100 Fax:+86-755-86615105 http://www.tianhaitest.com

EN 60204-1			
Clause	**Requirement Test**	**Result**	**Verdict**
14.6	Protective devices for mechanical brakes		P
	Operation of the overload and overcurrent protective devices for mechanical brake actuators shall initiate the simultaneous de-energization (release) of the associated machine actuators.	Complied	P
15	**Accessories and lighting**		N/A
15.1	Accessories		N/A
	– 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;		N/A
	– the continuity of the protective bonding circuit to the socket-outlet shall be ensured except where protection is provided by PELV;		N/A
	– 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;		N/A
	– where the power supply to the socket-outlet is not disconnected by the supply disconnecting device for the machine or the section of the machine, the requirements of 5.3.5 apply.		N/A
15.2	Local lighting of the machine and equipment		N/A
15.2.1	General		N/A
	Connections to the protective bonding circuit shall be in accordance with 8.2.2.		N/A
	The ON/OFF switch shall not be incorporated in the lampholder or in the flexible connecting cords.		N/A
	Stroboscopic effects from lights shall be avoided by the selection of appropriate luminaires.		N/A
15.2.2	Supply		N/A
	The nominal voltage of the local lighting circuit shall not exceed 250 V between conductors. A voltage not exceeding 50 V between conductors is recommended.		N/A
	– a dedicated isolating transformer connected to the load side of the supply disconnecting device. Overcurrent protection shall be provided in the secondary circuit;		N/A
	– a dedicated isolating transformer connected to the line side of the supply disconnecting device. That source shall be permitted for maintenance lighting circuits in control enclosures only. Overcurrent protection shall be provided in the secondary circuit (see also 5.3.5 and 13.1.3);		N/A
	– a machine circuit with dedicated overcurrent protection;		N/A
	– an isolating transformer connected to the line side of the supply disconnecting device, provided with a dedicated primary disconnecting means (see 5.3.5) and secondary overcurrent protection, and mounted within the control enclosure adjacent to the supply disconnecting device (see also 13.1.3);		N/A
15.2.3	Protection		N/A

4F,A3 BLDG,The Silicon Valley Power intelligent terminal industrial park,Guan lan street,Longhua district,Shenzhen
Tel:+86-755-86615100 Fax:+86-755-86615105 http://www.tianhaitest.com

EN 60204-1			
Clause	**Requirement Test**	**Result**	**Verdict**
	Local lighting circuits shall be protected in accordance with 7.2.6.		N/A
15.2.4	Fittings		N/A
	– in accordance with the relevant IEC standard;		N/A
	– constructed with an insulating material protecting the lamp cap so as to prevent unintentional contact.		N/A
16	**Marking, warning signs and reference designations**		P
16.1	General		P
	Warning signs, nameplates, markings, and identification plates shall be of sufficient durability to withstand the physical environment involved.	Complied	P
16.2	Warning signs		P
16.2.1	Electric shock hazard		P
	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).	Complied	P
	The warning sign shall be plainly visible on the enclosure door or cover.		P
	The warning sign may be omitted (see also 6.2.2 b)) for:		P
	– an enclosure equipped with a supply disconnecting device;		P
	– an operator-machine interface or control station;		P
	– a single device with its own enclosure (for example position sensor).		P
16.2.2	Hot surfaces hazard		P
	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.		P
16.3	Functional identification		P
	Control devices, visual indicators, and displays (particularly those related to safety) shall be clearly and durably marked with regard to their functions either on or adjacent to the item. Such markings may be as agreed between the user and the supplier of the equipment (see Annex B). Preference should be given to the use of standard symbols given in IEC 60417-DB:2002 and ISO 7000.		P
16.4	Marking of equipment		P
	– name or trade mark of supplier;		P
	– certification mark, when required;		P
	– serial number, where applicable;	See in the manual	P
	– rated voltage, number of phases and frequency (if a.c.), and full-load current for each supply;	110V/220V	P
	– short-circuit rating of the equipment;		N/A

4F,A3 BLDG,The Silicon Valley Power intelligent terminal industrial park,Guan lan street,Longhua district,Shenzhen
Tel:+86-755-86615100 Fax:+86-755-86615105 http://www.tianhaitest.com

EN 60204-1			
Clause	**Requirement Test**	**Result**	**Verdict**
	– main document number (see IEC 62023).		P
16.5	Reference designations		P
	All enclosures, assemblies, control devices, and components shall be plainly identified with the same reference designation as shown in the technical documentation.	Complied	P
17	**Technical documentation**		P
18	**Verification**		P
18.1	General		P
	a) verification that the electrical equipment complies with its technical documentation;		P
	b) in case of protection against indirect contact by automatic disconnection, conditions for protection by automatic disconnection shall be verified according to 18.2;		N/A
	c) insulation resistance test (see 18.3);		P
	d) voltage test (see 18.4);		P
	e) protection against residual voltage (see 18.5);		P
	f) functional tests (see 18.6).		P
	The results of the verification shall be documented.		P
18.2	Verification of conditions for protection by automatic disconnection of supply		N/A
18.2.1	General		N/A
18.2.2	Test methods in TN-systems		N/A
	Test 1 – Verification of the continuity of the protective bonding circuit		N/A
	Test 2 – Fault loop impedance verification and suitability of the associated overcurrent protective device		N/A
18.2.3	Application of the test methods for TN-systems		N/A
18.3	Insulation resistance tests		P
	When insulation resistance tests are performed, the insulation resistance measured at 500 V d.c. between the power circuit conductors and the protective bonding circuit shall be not less than 1 M.The test may be made on individual sections of the complete electrical installation.	See table 18.3	P
18.4	Voltage tests		P
	When voltage tests are performed, test equipment in accordance with IEC 61180-2 should be used.	See table 18.4	P
18.5	Protection against residual voltages		P
	Where appropriate, tests shall be performed to ensure compliance with 6.2.4.	Complied	P
18.6	Functional tests		P
	The functions of electrical equipment shall be tested.		P
	The function of circuits for electrical safety (for example earth fault detection) shall be tested.		P

4F,A3 BLDG,The Silicon Valley Power intelligent terminal industrial park,Guan lan street,Longhua district,Shenzhen
Tel:+86-755-86615100 Fax:+86-755-86615105 http://www.tianhaitest.com

EN 60204-1			
Clause	**Requirement Test**	**Result**	**Verdict**
18.7	Retesting		N/A
	Where a portion of the machine and its associated equipment is changed or modified, that portion shall be reverified and retested, as appropriate (see 18.1).		N/A
Annex A	**Protection against indirect contact in TN-systems**		N/A
A.1	General		N/A
A.2	Conditions for protection by automatic disconnection of the supply by overcurrent protective devices		
A.3	Condition for protection by reducing the touch voltage below 50 V		N/A
A.4	Verification of conditions for protection by automatic disconnection of the supply		N/A
A.4.1	General		N/A
A.4.2	Measurement of the fault loop impedance		N/A
A.4.3	Consideration of the difference between the measured value of resistance of the conductors and the actual value under fault conditions		N/A
Annex B	**Enquiry form for the electrical equipment of machines**		P
	It is recommended that the following information be provided by the intended user of the equipment. It can facilitate an agreement between the user and supplier on basic conditions and additional user requirements to enable proper design, application and utilization of the electrical equipment of the machine (see 4.1).		P
Annex C	**Examples of machines covered by this part of IEC 60204**		P
	The following list shows examples of machines whose electrical equipment should conform to this part of IEC 60204. The list is not intended to be exhaustive but is consistent with the definition of machinery (3.35). This part of IEC 60204 need not be applied to machines that are household and similar domestic appliances within the scope of the IEC 60335 series of standards.		P
Annex D	**Current-carrying capacity and overcurrent protection of conductors and cables in the electrical equipment of machines**		P
	The purpose of this Annex is to provide additional information on the selection of conductor sizes where the conditions given for Table 6 (see Clause 12) have to be modified (see notes to Table 6).		P
D.1	General operating conditions		P
D.1.1	Ambient air temperature		P
	The current carrying capacity for PVC insulated conductors given in Table 6 is related to an ambient air temperature of +40 °C. For other ambient air temperatures, the correction factors are given in Table D.1.		P
D.1.2	Methods of installation		P
D.1.3	Grouping		P
	Where more loaded conductors in cables or conductor pairs are installed, derate the values of Iz, given in Table 6 or by the manufacturer in accordance with Tables D.2 or D.3.		P

4F,A3 BLDG,The Silicon Valley Power intelligent terminal industrial park,Guan lan street,Longhua district,Shenzhen
Tel:+86-755-86615100 Fax:+86-755-86615105 http://www.tianhaitest.com

EN 60204-1			
Clause	**Requirement Test**	**Result**	**Verdict**
D.2	Co-ordination between conductors and protective devices providing overload protection		P
D.3	Overcurrent protection of conductors		P
Annex E	**Explanation of emergency operation functions**		P
	Emergency stop		P
	An emergency operation intended to stop a process or a movement that has become hazardous.		P
	Emergency start		P
	An emergency operation intended to start a process or a movement to remove or to avoid a hazardous situation.		P
	Emergency switching off		P
	An emergency operation intended to switch off the supply of electrical energy to all or a part of an installation where a risk of electric shock or another risk of electrical origin is involved.		P
	Emergency switching on		P
	An emergency operation intended to switch on the supply of electrical energy to a part of an installation that is intended to be used for emergency situations.		P
Annex F	**Guide for the use of this part of IEC 60204**		P
F.1	General		P

TABLE: 18.3	**Insulation resistance and dielectric strength**		**P**
Test points		Measured value	Limit
From	To		
Line &neutral	Metal Enclosure	>100MΩ	1MΩ
Line &neutral	Plastic Enclosure	>100MΩ	1MΩ

TABLE: 18.4	**Eectric strength measurements**	**P**
Test voltage applied between:	Test voltage (V rms)	Breakdown
Line &neutral to Metal Enclosure	1000	No
Line &neutral to Plastic Enclosure	1000	No

4F,A3 BLDG,The Silicon Valley Power intelligent terminal industrial park,Guan lan street,Longhua district,Shenzhen
Tel:+86-755-86615100 Fax:+86-755-86615105 http://www.tianhaitest.com

EN 62471: 2008			
Clause	**Requirement + Test**	**Result - Remark**	**Verdict**
4	EXPOSURE LIMITS		**P**
4.1	General		**P**
	The exposure limits in this standard is not less than 0,01 ms and not more than any 8-hour period and should be used as guides in the control of exposure	Hazard Level: 1catagory hazard (Low hazard)	**P**
	Detailed spectral data of a light source are generally required only if the luminance of the source exceeds $10^4 cdm^{-2}$	See clause 4.3	**P**
4.3	Hazard exposure limits		**P**
4.3.1	Actinic UV hazard exposure limit for the skin and eye	No UV hazard	**N/A**
	The exposure limit for effective radiant exposure is 30 J m^{-2} within any 8-hour period		**N/A**
	To protect against injury of the eye or skin from ultraviolet radiation exposure produced by a broadband source, the effective integrated spectral irradiance , Es, of the light source shall not exceed the levels defined by:		**N/A**
	$E_s \cdot t = \sum_{200}^{400} \sum_{t} E_\lambda(\lambda,t) \cdot S_{UV}(\lambda) \cdot \Delta t \cdot \Delta\lambda \le 30$ J·m^{-2}		**N/A**
	The permissible time for exposure to ultraviolet radiation incident upon the unprotected eye or skin shall be computed by:		**N/A**
	$t_{max} = \frac{30}{E_s}$ s		**N/A**
4.3.2	Near-UV hazard exposure limit for eye		**N/A**
	For the spectral region 315 nm to 400 nm (UV-A) the total radiant exposure to the eye shall not exceed 10000 J m^{-2} for exposure times less than 1000 s. For exposure times greater than 1000 s (approximately 16 minutes) the UV-A irradiance for the unprotected eye, EUVA, shall not exceed 10 W m^{-2}		**N/A**
	he permissible time for exposure to ultraviolet radiation incident upon the unprotected eye for time less than 1000 s, shall be computed by:		**N/A**
	$t_{max} \le \frac{10\,000}{E_{UVA}}$ s		**N/A**
4.3.3	Retinal blue light hazard exposure limit		**P**
	To protect against retinal photochemical injury from chronic blue-light exposure, the integrated spectral radiance of the light source weighted against the blue-light hazard function, B(λ), i.e., the blue-light weighted radiance , LB, shall not exceed the levels defined by:		**P**
	$L_B \cdot t = \sum_{300}^{700} \sum_{t} L_\lambda(\lambda,t) \cdot B(\lambda) \cdot \Delta t \cdot \Delta\lambda \le 10^6$ J · m^{-2} · sr^{-1}	for t ≤ 10^4s $t_{max} = \frac{10^6}{L_B}$	**P**

4F,A3 BLDG,The Silicon Valley Power intelligent terminal industrial park,Guan lan street,Longhua district,Shenzhen
Tel:+86-755-86615100 Fax:+86-755-86615105 http://www.tianhaitest.com

EN 62471: 2008			
Clause	**Requirement + Test**	**Result - Remark**	**Verdict**
	$L_B = \sum_{300}^{700} L_\lambda \cdot B(\lambda) \cdot \Delta\lambda \le 100$ $W \cdot m^{-2} \cdot sr^{-1}$		**N/A**
4.3.4	Retinal blue light hazard exposure limit - small source		**N/A**
	Thus the spectral irradiance at the eye E_λ, weighted against the blue-light hazard function B(λ) shall not exceed the levels defined by:		**N/A**
	$E_B \cdot t = \sum_{300}^{700} \sum_{t} E_\lambda(\lambda,t) \cdot B(\lambda) \cdot \Delta t \cdot \Delta\lambda \le 100$ $J \cdot m^{-2}$		**N/A**
	$E_B = \sum_{300}^{700} E_\lambda \cdot B(\lambda) \cdot \Delta\lambda \le 1$ $W \cdot m^{-2}$		**N/A**
4.3.5	Retinal thermal hazard exposure limit		**P**
	To protect against retinal thermal injury, the integrated spectral radiance of the light source, L_λ, weighted by the burn hazard weighting function R(λ) (from Figure 4.2 and Table 4.2), i.e., the burn hazard weighted radiance, shall not exceed the levels defined by:		**P**
	$L_R = \sum_{380}^{1400} L_\lambda \cdot R(\lambda) \cdot \Delta\lambda \le \frac{50\,000}{\alpha \cdot t^{0,25}}$ $W \cdot m^{-2} \cdot sr^{-1}$	(10 µs ≤ t ≤ 10 s)	**P**
4.3.6	Retinal thermal hazard exposure limit – weak visual stimulus		**P**
	For an infrared heat lamp or any near-infrared source where a weak visual stimulus is inadequate to activate the aversion response, the near infrared (780 nm to 1400 nm) radiance, L_{IR}, as viewed by the eye for exposure times greater than 10 s shall be limited to:		**P**
	$L_{IR} = \sum_{780}^{1400} L_\lambda \cdot R(\lambda) \cdot \Delta\lambda \le \frac{6\,000}{\alpha}$ $W \cdot m^{-2} \cdot sr^{-1}$	t > 10 s	**P**
4.3.7	Infrared radiation hazard exposure limits for the eye		**P**
	The avoid thermal injury of the cornea and possible delayed effects upon the lens of the eye (cataractogenesis), ocular exposure to infrared radiation, E_{IR}, over the wavelength range 780 nm to 3000 nm, for times less than 1000 s, shall not exceed:		**P**
	$E_{IR} = \sum_{780}^{3000} E_\lambda \cdot \Delta\lambda \le 18\,000 \cdot t^{-0,75}$ $W \cdot m^{-2}$		**N/A**
	For times greater than 1000 s the limit becomes:		**P**

4F,A3 BLDG,The Silicon Valley Power intelligent terminal industrial park,Guan lan street,Longhua district,Shenzhen
Tel:+86-755-86615100 Fax:+86-755-86615105 http://www.tianhaitest.com

EN 62471: 2008			
Clause	**Requirement + Test**	**Result - Remark**	**Verdict**
	$E_{IR} = \sum_{780}^{3\,000} E_\lambda \cdot \Delta\lambda \le 100 \qquad W \cdot m^{-2}$		**P**
4.3.8	Thermal hazard exposure limit for the skin		**P**
	Visible and infrared radiant exposure (380 nm to 3000 nm) of the skin shall be limited to:		**P**
	$E_H \cdot t = \sum_{380}^{3\,000} \sum_{t} E_\lambda(\lambda,t) \cdot \Delta t \cdot \Delta\lambda \le 20\,000 \cdot t^{0,25} \qquad J \cdot m^{-2}$		**P**
5	**MEASUREMENT OF LAMPS AND LAMP SYSTEMS**		**P**
5.1	Measurement conditions		**P**
	Measurement conditions shall be reported as part of the evaluation against the exposure limits and the assignment of risk classification.		**P**
5.1.1	Lamp ageing (seasoning)	Not lamp	**N/A**
	Seasoning of lamps shall be done as stated in the appropriate IEC lamp standard.		**N/A**
5.1.2	Test environment		**N/A**
	For specific test conditions, see the appropriate IEC lamp standard or in absence of such standards, the appropriate national standards or manufacturer's recommendations.		**N/A**
5.1.3	Extraneous radiation	No extraneous radiation	**N/A**
	Careful checks should be made to ensure that extraneous sources of radiation and reflections do not add significantly to the measurement results.		**N/A**
5.1.4	Lamp operation		**N/A**
	Operation of the test lamp shall be provided in accordance with:		**N/A**
	–the appropriate IEC lamp standard, or		**N/A**
	–the manufacturer' s recommendation		**N/A**
5.1.5	Lamp system operation	Not lamp system	**N/A**
	The power source for operation of the test lamp shallbe provided in accordance with:		**N/A**
	–the appropriate IEC lamp standard, or		**N/A**
	–the manufacturer' s recommendation		**N/A**
5.2	Measurement procedure		**P**
5.2.1	Irradiance measurements		**P**
	Minimum aperture diameter 7mm.		**P**
	Maximum aperture diameter 50 mm.		**P**

4F,A3 BLDG,The Silicon Valley Power intelligent terminal industrial park,Guan lan street,Longhua district,Shenzhen
Tel:+86-755-86615100 Fax:+86-755-86615105 http://www.tianhaitest.com

EN 62471: 2008			
Clause	**Requirement + Test**	**Result - Remark**	**Verdict**
	The measurement shall be made in that position of the beam giving the maximum reading.		**P**
	The measurement instrument is adequate calibrated.		**P**
5.2.2	Radiance measurements		**P**
5.2.2.1	Standard method		**N/A**
	The measurements made with an optical system.		**N/A**
	The instrument shall be calibrated to read in absolute radiant power per unit receiving area and per unit solid angle to acceptance averaged over the field of view of the instrument.		**N/A**
5.2.2.2	Alternative method		**P**
	Alternatively to an imaging radiance set-up, an irradiance measurement set-up with a circular field stop placed at the source can be used to perform radiance measurements.		**P**
5.2.3	Measurement of source size		**P**
	The determination of α, the angle subtended by a source, requires the determination of the 50% emission points of the source.		**P**
5.2.4	Pulse width measurement for pulsed sources	Continuous source	**N/A**
	The determination of Δt, the nominal pulse duration of a source, requires the determination of the time during which the emission is > 50% of its peak value.		**N/A**
5.3	Analysis methods		**P**
5.3.1	Weighting curve interpolations		**P**
	To standardize interpolated values, use linear interpolation on the log of given values to obtain intermediate points at the wavelength intervals desired.		**P**
5.3.2	Calculations		**P**
	The calculation of source hazard values shall be performed by weighting the spectral scan by the appropriate function and calculating the total weighted energy.		**P**
5.3.3	Measurement uncertainty		**P**
	The quality of all measurement results must be quantified by an analysis of the uncertainty.		**P**
6	**LAMP CLASSIFICATION**		**P**
	For the purposes of this standard it was decided that the values shall be reported as follows:	see table 6.1	**P**
	- for lamps intended for general lighting service, the hazard values shall be reported as either irradiance or radiance values at a distance which produces an illuminance of 500 lux, but not at a distance less than 200 mm		**N/A**

4F,A3 BLDG,The Silicon Valley Power intelligent terminal industrial park,Guan lan street,Longhua district,Shenzhen
Tel:+86-755-86615100 Fax:+86-755-86615105 http://www.tianhaitest.com

EN 62471: 2008			
Clause	**Requirement + Test**	**Result - Remark**	**Verdict**
	- for all other light sources, including pulsed lamp sources, the hazard values shall be reported at a distance of 200 mm	200 mm used	**P**
6.1	Continuous wave lamps		**P**
6.1.1	Exempt Group		**P**
	In the exempt group are lamps, which does not pose any photobiological hazard. The requirement is met by any lamp that does not pose:	See table 6.1	**P**
	– an actinic ultraviolet hazard (E_S) within 8-hours exposure (30000 s), nor		**N/A**
	– a near-UV hazard (E_{UVA}) within 1000 s, (about 16 min), nor		**N/A**
	– a retinal blue-light hazard (L_B) within 10000 s (about 2,8 h), nor		**P**
	– a retinal thermal hazard (L_R) within 10 s, nor		**P**
	– an infrared radiation hazard for the eye (E_{IR}) within 1000 s		**N/A**
6.1.2	Risk Group 1 (Low-Risk)		**N/A**
	In this group are lamps, which exceeds the limits for the exempt group but that does not pose:		**N/A**
	– an actinic ultraviolet hazard (Es) within 10000 s, nor		**N/A**
	– a near ultraviolet hazard (E_{UVA}) within 300 s, nor		**N/A**
	– a retinal blue-light hazard (L_B) within 100 s, nor		**N/A**
	– a retinal thermal hazard (L_R) within 10 s, nor		**N/A**
	– an infrared radiation hazard for the eye (E_{IR}) within 100 s		**N/A**
	Lamps that emit infrared radiation without a strong visual stimulus and do not pose a near-infrared retinal hazard (L_{IR}), within 100 s are in Risk Group 1.		**N/A**
6.1.3	Risk Group 2 (Moderate-Risk)		**N/A**
	This requirement is met by any lamp that exceeds the limits for Risk Group 1, but that does not pose:		**N/A**
	– an actinic ultraviolet hazard (Es) within 1000 s exposure, nor		**N/A**
	– a near ultraviolet hazard (E_{UVA}) within 100 s, nor		**N/A**
	– a retinal blue-light hazard (L_B) within 0,25 s (aversion response), nor		**N/A**
	– a retinal thermal hazard (L_R) within 0,25 s (aversion response), nor		**N/A**
	– an infrared radiation hazard for the eye (E_{IR}) within 10 s		**N/A**
	Lamps that emit infrared radiation without a strong visual stimulus and do not pose a near-infrared retinal hazard (L_{IR}), within 10 s are in Risk Group 2.		**N/A**
6.1.4	Risk Group 3 (High-Risk)		**N/A**
	Lamps which exceed the limits for Risk Group 2 are in Group 3.		**N/A**

4F,A3 BLDG,The Silicon Valley Power intelligent terminal industrial park,Guan lan street,Longhua district,Shenzhen
Tel:+86-755-86615100 Fax:+86-755-86615105 http://www.tianhaitest.com

EN 62471: 2008			
Clause	**Requirement + Test**	**Result - Remark**	**Verdict**
6.2	Pulsed lamps		**N/A**
	Pulse lamp criteria shall apply to a single pulse and to any group of pulses within 0,25 s.		**N/A**
	A pulsed lamp shall be evaluated at the highest nominal energy loading as specified by the manufacturer.		**N/A**
	The risk group determination of the lamp being tested shall be made as follows:		**N/A**
	– a lamp that exceeds the exposure limit shall be classified as belonging to Risk Group 3 (High-Risk)		**N/A**
	– for single pulsed lamps, a lamp whose weighted radiant exposure or weighted radiance does is below the EL shall be classified as belonging to the Exempt Group		**N/A**
	– for repetitively pulsed lamps, a lamp whose weighted radiant exposure or weighted radiance dose is below the EL, shall be evaluated using the continuous wave risk criteria discussed in clause 6.1, using time averaged values of the pulsed emission		**N/A**

Table 4.1	Spectral weighting function for assessing ultraviolet hazards for skin and eye		**P**
Wavelength, λ, nm	**UV hazard function $S_{UV}(\lambda)$**	**Wavelength, λ, nm**	**UV hazard function $S_{UV}(\lambda)$**
200	0.030	313*	0.006
205	0.051	315	0.003
210	0.075	316	0.0024
215	0.095	317	0.0020
220	0.120	318	0.0016
225	0.150	319	0.0012
230	0.190	320	0.0010
235	0.240	322	0.00067
240	0.300	323	0.00054
245	0.360	325	0.00050
250	0.430	328	0.00044
254*	0.500	330	0.00041
255	0.520	333*	0.00037
260	0.650	335	0.00034
265	0.810	340	0.00028
270	1.000	345	0.00024
275	0.960	350	0.00020
280*	0.880	355	0.00016
285	0.770	360	0.00013
290	0.640	365*	0.00011
295	0.540	370	0.000093
297*	0.460	375	0.000077
300	0.300	380	0.000064

4F,A3 BLDG,The Silicon Valley Power intelligent terminal industrial park,Guan lan street,Longhua district,Shenzhen
Tel:+86-755-86615100 Fax:+86-755-86615105 http://www.tianhaitest.com

303*	0.120	385	0.000053
305	0.060	390	0.000044
308	0.026	395	0.000036
310	0.015	400	0.000030

Wavelengths chosen are representative: other values should be obtained by logarithmic interpolation at intermediate wavelengths.
* Emission lines of a mercury discharge spectrum.

Table 4.2	Spectral weighting functions for assessing retinal hazards from broadband optical sources	P

Wavelength nm	Blue-light hazard function B (λ)	Burn hazard function R (λ)
300	0.01	
305	0.01	
310	0.01	
315	0.01	
320	0.01	
325	0.01	
330	0.01	
335	0.01	
340	0.01	
345	0.01	
350	0.01	
355	0.01	
360	0.01	
365	0.01	
370	0.01	
375	0.01	
380	0.01	0.1
385	0.013	0.13
390	0.025	0.25
395	0.05	0.5
400	0.10	1.0
405	0.20	2.0
410	0.40	4.0
415	0.80	8.0
420	0.90	9.0
425	0.95	9.5
430	0.98	9.8
435	1.00	10.0
440	1.00	10.0
445	0.97	9.7
450	0.94	9.4
455	0.90	9.0
460	0.80	8.0
465	0.70	7.0
470	0.62	6.2
475	0.55	5.5
480	0.45	4.5
485	0.40	4.0
490	0.22	2.2
495	0.16	1.6
500-600	$10^{[(450-\lambda)/50]}$	1.0
600-700	0.001	1.0

4F,A3 BLDG,The Silicon Valley Power intelligent terminal industrial park,Guan lan street,Longhua district,Shenzhen
Tel:+86-755-86615100 Fax:+86-755-86615105 http://www.tianhaitest.com

700-1050		$10^{[(700-\lambda)/500]}$
1050-1150		0.2
1150-1200		$0.2.10^{0.02(1150-\lambda)}$
1200-1400		0.02

Table 5.4	Summary of the ELs for the surface of the skin or cornea (irradiance based values)	P

Hazard Name	Relevant equation	Wavelength range nm	Exposure duration sec	Limiting aperture rad (deg)	EL in terms of constant irradiance $W \cdot m^{-2}$
Actinic UV skin & eye	$ES = \sum E\lambda \cdot S(\lambda) \cdot \Delta\lambda$	200-400	< 30000	1.4 (80)	30/t
Eye UV-A	$EUVA = \sum E\lambda \cdot \Delta\lambda$	315-400	≤1000 >1000	1.4 (80)	10000/t 10
Blue-light small source	$EB = \sum E\lambda \cdot B(\lambda) \cdot \Delta\lambda$	300-700	≤1000 >1000	< 0,011	100/t 1,0
Eye IR	$EIR = \sum E\lambda \cdot \Delta\lambda$	780-3000	≤1000 >1000	1.4 (80)	$18000/t^{0.75}$ 100
Skin thermal	$EH = \sum E\lambda \cdot \Delta\lambda$	380-3000	< 10	2π sr	$20000/t^{0.75}$

Table 5.5	Summary of the ELs for the retina (radiance based values)	P

Hazard Name	Relevant equation	Wavelength range nm	Exposure duration sec	Field of view radians	EL in terms of constant irradiance $W \cdot m^{-2} \cdot sr^{-1}$
Blue light	$L_B = \sum L_\lambda \cdot B(\lambda) \cdot \Delta\lambda$	300-700	0,25 – 10 10-100 100-10000 ≥ 10000	$0.011 \cdot \sqrt{(t/10)}$ 0.011 $0.0011 \cdot \sqrt{t}$ 0,1	$10^6/t$ $10^6/t$ $10^6/t$ 100
Retinal thermal	$L_R = \sum L_\lambda \cdot R(\lambda) \cdot \Delta\lambda$	380-1400	< 0,25 0.25 – 10	0,0017 $0.011 \cdot \sqrt{(t/10)}$	$50000/(\alpha \cdot t^{0.25})$ $50000/(\alpha \cdot t^{0.25})$
Retinal thermal (weak visual stimulus)	$LIR = \sum L\lambda \cdot R(\lambda) \cdot \Delta\lambda$	780-1400	>10	0.011	$6000/\alpha$

Table 6.1	Emission limits for risk groups of continuous wave lamps	P

Risk	Action spectrum	Symbol	Units	Emission Measurement					
				Exempt		Low risk		Mod risk	
				Limit	Result	Limit	Result	Limit	Result
Actinic UV	$S_{UV}(\lambda)$	E_S	$W \cdot m^{-2}$	0.001	--	0.003	--	0.03	--

4F,A3 BLDG,The Silicon Valley Power intelligent terminal industrial park,Guan lan street,Longhua district,Shenzhen
Tel:+86-755-86615100 Fax:+86-755-86615105 http://www.tianhaitest.com

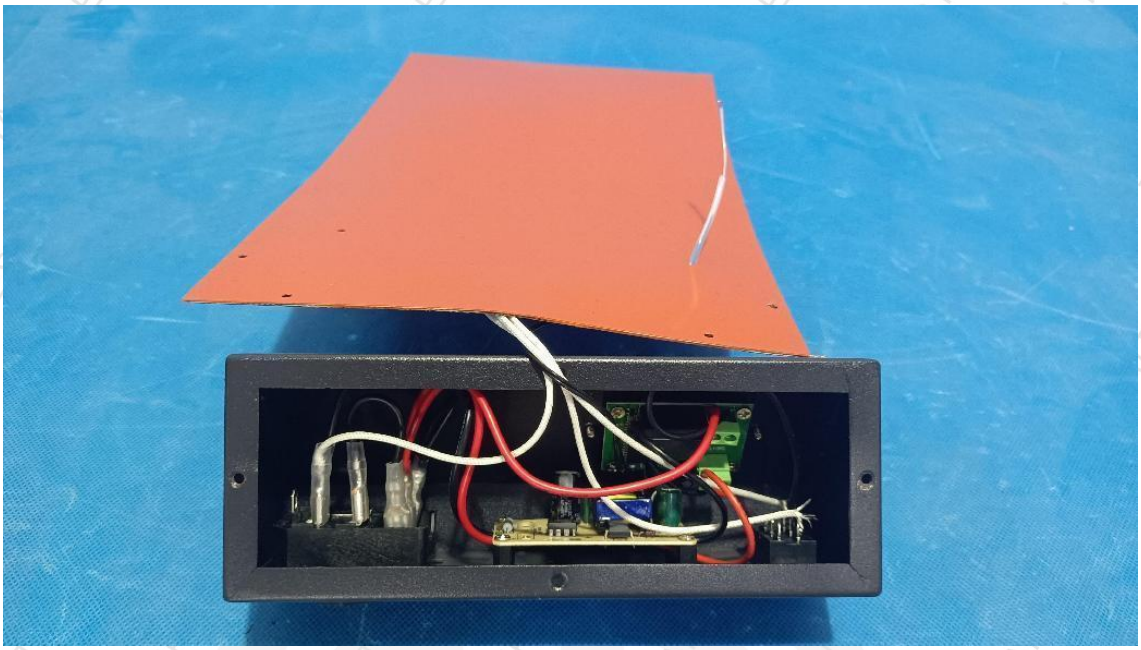
Near UV		E_{UVA}	$W \cdot m^{-2}$	10	--	33	--	100	--
Blue light	B(λ)	L_B	$W \cdot m^{-2} \cdot sr^{-1}$	100	58.0	10000	--	4000000	--
Blue light, small source	B(λ)	E_B	$W \cdot m^{-2}$	1.0*	--	1.0	--	400	--
Retinal thermal	R(λ)	LR	$W \cdot m^{-2} \cdot sr^{-1}$	28000/α	47546.4	28000/α	--	71000/α	--
etinal thermal, weak visual stimulus**	R(λ)	LIR	$W \cdot m^{-2} \cdot sr^{-1}$	6000/α	--	6000/α	--	6000/α	--
IR radiation, eye		E_{IR}	$W \cdot m^{-2}$	100	--	570	--	3200	--

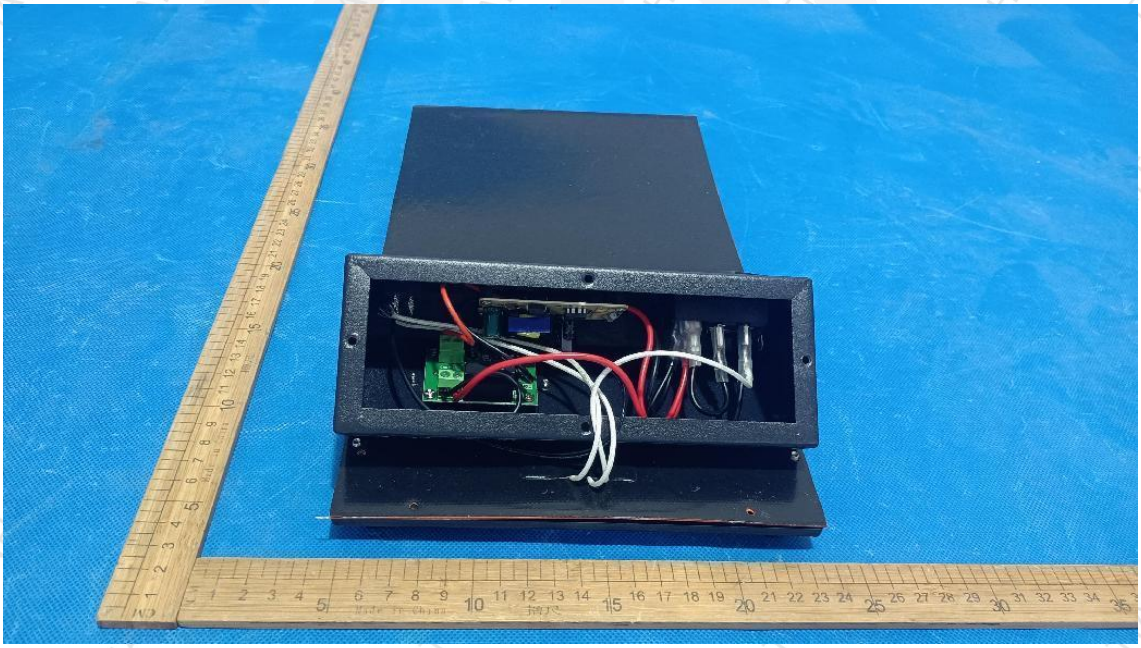
Remark:
* Small source defined as one with α < 0,011 radian. Averaging field of view at 10000 s is 0,1 radian.
** Involves evaluation of non-GLS source

4F,A3 BLDG,The Silicon Valley Power intelligent terminal industrial park,Guan lan street,Longhua district,Shenzhen
Tel:+86-755-86615100 Fax:+86-755-86615105 http://www.tianhaitest.com

Appendix for EUT photos

4F,A3 BLDG,The Silicon Valley Power intelligent terminal industrial park,Guan lan street,Longhua district,Shenzhen
Tel:+86-755-86615100 Fax:+86-755-86615105 http://www.tianhaitest.com





****END OF THE REPORT****

4F,A3 BLDG,The Silicon Valley Power intelligent terminal industrial park,Guan lan street,Longhua district,Shenzhen
Tel:+86-755-86615100 Fax:+86-755-86615105 http://www.tianhaitest.com