

Checklist report EN ISO 11553-1:2020/A11:2020 Safety of machinery - Laser processing machines - Part 1: General safety requirements	
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Applicant name & Address:	DONGGUAN THUNDERLASER INDUSTRIAL CO., LTD Room 1101, Building 3, No. 68, Xingzhou Road, Shatian Town, Dongguan, Guangdong, China
Manufacturer name & Address	Same as applicant
Assess item description:	Thunder Laser Systems
Trade Mark:	THUNDER LASER
Model/Type reference:	Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36
Ratings:	230V; 50/60Hz; 1Ph
Location of assessment	Room 1101, Building 3, No. 68, Xingzhou Road, Shatian Town, Dongguan, Guangdong, China
Assess performed (name & clause of assess specification):	Full items of EN ISO 11553-1:2020/A11:2020



Summary of assessment

All assessment and inspection are performed on the prototype of Bolt Pro 32.

Assessment and inspection were conducted according to EN ISO 11553-1:2020/A11:2020, the items under assess and inspection are IN COMPLIANCE with the requested specifications specified in the standard.

Copy of nameplate

Refer to report NR.2025.1117B.1

General remarks:

The assess results presented in this report relate only to the object assessed.

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General product information and other remarks:

Thunder Bolt, Bolt Plus, Bolt plus24, Bolt Pro 22, Bolt Pro 32, Bolt Pro 36 are used for engraving and cutting of signs, stamps and suchlike.

A wide variety of materials such as rubber, acrylic, coated metal, tin, special steel, anodized aluminum, cork, cardboard, glass, leather, marble, several plastics and wood can be processed on the laser.

Possible assess case verdicts:

- subclause does not apply to the assess object: N/A
- assess object does meet the requirement: P (Pass)
- assess object does not meet the requirement: F (Fail)

EN ISO 11553-1			
Clause No.	Requirement	Result - Remark	Verdict
5.	Safety requirements and measures		P
5.1	General requirements		P
	The extent to which hazards are covered is indicated in the Scope. Manufacturers shall ensure the safety of laser processing machines by a) hazard identification and risk assessment, b) implementation of safety measures to minimize risks by laser radiation, c) verification of the safety measures, and d) provision of appropriate information for the user. Based on the risk assessment (see 5.2), appropriate safety measures against laser radiation shall be incorporated into the laser processing machine by design and manufacture.	Risk assessment and risk reduction by 3 step method have been done.	P
5.2	Risk assessment with regard to laser radiation hazards		P
	The accessibility to hazardous laser radiation decisively depends on the status of a laser machine. Therefore, a risk assessment with regard to laser radiation hazards shall be performed: — for the whole life cycle of the machine, as applicable, (for examples see ISO 12100:2010); — for all operating modes (The operating modes described in Clause 3 are only examples. The operating modes of the machine incl. terminology and content should be defined by the risk assessment of the manufacturer.); — after each modification of the machine by the person or organization responsible for the modification; and — for each reasonably foreseeable misuse/operation not included by the intended use.	These factors have been taken into consideration during risk assessment.	P

EN ISO 11553-1			
Clause No.	Requirement	Result - Remark	Verdict
	A risk assessment includes but is not limited to: a) hazards caused by the direct or reflected laser beam; b) hazard zones, particularly those associated with 1) the laser or the laser system, 2) the laser beam path/beam delivery system, 3) the process zone, 4) the laser hazard area, and 5) the area in which laser radiation can dazzle people; c) "interferences" listed in 4.3.	These factors have been taken into consideration during risk assessment.	P
	The results of the risk assessment shall be duly documented. See ISO 12100:2010 for principles for risk assessment.	Risk assessment document has been completed.	P
5.3	Implementation of risk reduction measures		P
5.3.1	General		P
	Safety measures against laser radiation hazards shall be incorporated in the machine by design and manufacture as specified in 5.3.2 to 5.3.4. Safety measures against laser hazards shall follow the priority principle according to ISO 12100:2010.		P
5.3.2	Safety measures against laser radiation hazards in dependence of the locations		P
	NOTE In the following, requirements for safety measures against laser radiation hazards are given in dependence of the location, where the laser processing machine operates.		--
5.3.2.1	Safety measures at locations with unrestricted and uncontrolled access		P
	For laser processing machines operating in locations with unrestricted and uncontrolled access, the possibility of people being exposed to hazardous levels of laser radiation exceeding the accessible emission limit (AEL) for Class 1 according to IEC 60825-1:2014 shall be eliminated during all operating modes (production and any other operating mode).		P

EN ISO 11553-1			
Clause No.	Requirement	Result - Remark	Verdict
	To satisfy these requirements, the following conditions shall be met: — Unauthorized human access to a hazard zone shall be prevented solely by engineering safety measures as stipulated in IEC 60825-1:2014 and ISO 12100:2010. — Guarding shall be applied to protect against laser radiation. — SRP/CS shall be used to safely isolate the laser radiation, the requirements of ISO 13849-1:2015 shall be met.		P
	NOTE Most commonly by means of an enclosure or guards/screens as described in IEC 60825-4:2006. EXAMPLE Typically, these machines are exhibited or demonstrated on fairs and exhibitions. Since the public can have access to the location, no hazards may emanate from the laser processing machine.		--
5.3.2.2	Safety measures at locations with restricted access		N/A
	For laser processing machines operating in locations with restricted access, predominantly engineering safety measures specified in IEC 60825-1:2014 and ISO 12100:2010 shall be taken to prevent human access to a laser hazard area (NOHA).	Not intend to be operated in such location.	N/A
	To satisfy these requirements, the following conditions shall be met: a) Engineering safety measures for guarding and for shielding of laser radiation shall reduce the irradiance below the MPE of eye and skin. SRP/CS for the safe isolation of the laser radiation shall comply with ISO 13849-1:2015. b) In addition to engineering measures organizational measures might be necessary (e.g. for operating mode "service") to prevent human access to hazardous laser radiation. Exposure above the MPE shall be eliminated by additional use of administrative/organizational safety measures.		N/A
	Organizational safety measures shall be carried out with secondary priority in accordance with ISO 12100:2010 and IEC 60825-1:2014. The manufactures shall inform the user, how to carry out the organizational measures in order to avoid risks (exceed MPE) by laser radiation.		N/A

EN ISO 11553-1			
Clause No.	Requirement	Result - Remark	Verdict
	If the laser hazard area is shielded or partially shielded by laser guards the manufacturer shall inform the user how to determine the FEL and provide adequate laser guards (with sufficient PEL according to IEC 60825-1:2014).		N/A
	If the laser safety is provided by distance the manufacturer shall inform the user how to determine the NOHA. The manufacturer shall inform the user, how to install barriers (e.g. with barrier tapes) at the respective Nominal Ocular Hazard Distances. He shall provide information how to implement the organisational measures in training/education and safety instructions.		N/A
	EXAMPLE Performing service at a laser processing machine located in a shop floor, which is the restricted area. The laser hazard area is screened by means of vertical mobile laser guards/walls, which are labelled with safety signs respectively. Reflected laser radiation can propagate to upper floors or scaffold platforms. Personnel having access to the shop floor is trained in organizational measures, to follow the organizational safety measures (prohibitions/warnings). By this, the residual risk by laser radiation can be eliminated by organizational measures; here e.g. prohibition of entry to upper floors.		N/A
5.3.2.3	Safety measures at locations with controlled access		N/A
	For laser processing machines operating in locations with controlled access, the possibility of people being exposed to levels of laser radiation exceeding the maximum permissible exposure (MPE _{eye} and MPE _{skin}) shall be eliminated.	Not intend to be operated in such location.	N/A

EN ISO 11553-1			
Clause No.	Requirement	Result - Remark	Verdict
	To satisfy this requirement, the following conditions shall be met in addition to all safety measures related to operating modes, where 5.3.3.2 to 5.3.3.5 apply. a) Unauthorized human access to the laser hazard zone shall be prevented predominantly by engineering safety measures as specified in IEC 60825-1:2014 and ISO 12100:2010. The manufacturer shall specify the kind of authorization control enabling/preventing access to the laser hazard zone (e.g. door with key, password/transponder). b) If authorized access (e.g. by key or password/transponder) is necessary for laser processing machines operating in locations with controlled access (e.g. for service mode, see also 5.3.3.4) the manufacturer shall provide information on how to work safely in a laser hazard area (see IEC 60825-1:2014). Exposure above the MPE in the controlled area shall be eliminated by use of engineering and administrative controls, including Personal Protective Equipment (PPE). The manufacturer shall provide the following information to the user: — Engineering measures: Emergency stop in the laser hazard area. — Organizational measures: The qualification of personnel authorized to access the laser hazard zone, which means level of training and education of the personnel and on safety instructions given to the personnel. — PPE: The required personal protective equipment (type, level of protection).		N/A
	EXAMPLE Service engineers that need to work in a guarded laser hazard area, or in excess of the MPE respectively. Protective measures include, besides technical and administrative means, adequate personal protective equipment (laser protective eyewear, protective clothing).		N/A
5.3.3	Safety measures against laser radiation hazards		P
	NOTE In the following, design requirements for safety measures against laser radiation hazards are given.		--
5.3.3.1	Design requirements for safety measures		

EN ISO 11553-1			
Clause No.	Requirement	Result - Remark	Verdict
	For all laser processing machines, without regard to restricted or controlled access, the following shall apply.		P
	a) The laser machine shall be equipped with protective devices to ensure a safe isolation of the laser beam (e.g. by a safety shutter or deactivation by shutting off the power to the pumping diodes).	Deactivation by shutting off the power to the pumping diodes	P
	b) If human presence in a hazard zone is unavoidable while the machine is functioning (e.g. during service), the machine shall be equipped with an enabling switch of machine motion, laser beam direction and laser beam isolation. See 5.3.3.5.	No such case.	N/A
	c) The design of protective devices, such as switches, shutters, beam dissipation devices and deterring/impeding devices, shall meet the requirements specified in IEC 60825-1:2014 and ISO 12100:2010. A single protective device may be used to provide simultaneous protection against more than one hazard.		P
	d) Protective housings (enclosures) are not subject to IEC 60825-4:2006, Annex D, but shall otherwise conform to IEC 60825-4:2006 or IEC 60825-1:2014. Laser guards (not part of a protective housing) shall comply with requirements specified in IEC 60825-4:2006, Annex D.		P
	e) If active guards (e.g. equipped with sensors) are used within the enclosure or guarding the component shall be integrated in the safety control (SRP/CS) of the laser processing machine. Requirements on active guards are specified in IEC 60825-4:2006, Annex D. The manufacturer shall indicate the achieved PL (according to ISO 13849-1:2015) or SIL (according to IEC 62061:2005) and the system reaction time for isolating the laser beam and shall ensure that the passive laser resistance (time) of guard/windows is sufficient (longer) than the system reaction time. NOTE 1 Passive laser guards: Laser guard which relies for its operation on its physical properties only. They are used, when the physical laser resistance of the material is sufficient for the given inspection time and FEL (see IEC 60825-4:2006). NOTE 2 Active laser guards: If the FEL cannot be reduced to a value where common guarding materials provide adequate protection in the form of a passive laser guard, an active laser guard can be used (see IEC 60825-4:2006) NOTE 3 IEC 60825-4:2006, Annex E provides informative guidelines on the arrangement and installation of laser guards, Annex F provides information for assessing the suitability of laser guards.	No active guard.	N/A

EN ISO 11553-1			
Clause No.	Requirement	Result - Remark	Verdict
	f) The beam delivery system or parts of a beam delivery system shall comply with the requirements specified in IEC 60825-4:2006, Annex G.		P
	g) Whenever and wherever there are multiple laser sources [e.g. from a back-up laser, energy share multiplex (beam split) or time share multiplex (beam switch)] the safety controls for each respective work station, process zone or laser hazard zone shall be automatically connected or associated with each respective laser source, such that when that station's interlocks or emergency stops or other protective device sensors are activated, no hazardous laser energy can be directed to that station or zone. NOTE 4 The laser machine can be operated in manual intervention mode under the conditions described under the modes for production, service or setting.	Only one laser source.	N/A
5.3.3.2	Protection against laser radiation hazards during production		
	The principal hazard zone is usually the process zone but the hazard zone shall be defined as a result of the risk assessment. The risk assessment shall indicate which type of guarding (local protection or peripheral protection) is to be used. The applicable type of guarding depends on the design of the machine and the guards respectively (see also IEC 60825-4:2006, Annex F: Guideline for assessing the suitability of laser guards).		P
	Local protection is a method of guarding to reduce laser radiation and associated optical radiation to a safe level based on a risk assessment (e.g. by means of a nozzle or a small guard fitted close to the beam focus at the workpiece) without totally enclosing the workpiece, the workpiece support and/or machine motion system. EXAMPLE 1 Applied for laser marking systems being integrated in a complex packaging machine or bottling line.		N/A

EN ISO 11553-1			
Clause No.	Requirement	Result - Remark	Verdict
	Peripheral protection is a method of guarding to reduce laser radiation and associated optical radiation to a safe level based on a risk assessment by means of one or more distant guards (e.g. a protective enclosure or a laser cabin) that enclose the workpiece, workpiece support and, usually, most of the machine motion system. EXAMPLE 2 Applied for laser cutting machines, micromachining laser machines, laser additive manufacturing.		P
	The type of protection and the requirements on the guarding will depend on several factors, for instance (see also IEC 60825-4:2006, Annex F): a) the power determining laser parameters, (e.g. laser power, pulse duration, pulse energy, repetition rate, wavelength); b) the optical elements (for example, focal length), resulting in irradiance or radiant exposure at the work piece or guard; c) the direction (fixed or variable) of beam propagation with regard to the work piece, (working with static optical elements or scanner optics); d) the type of machining operation to be realized (cutting, welding, etc.), (e.g. handling or robot system: dimensions, number of axis, laser head); e) the material and shape of the workpiece to be processed, (e.g. size of the workpiece, shape); f) the workpiece support, (e.g. manually/automatically, continuous support for e.g. tubes/hoses, discontinuous support); g) the visibility of the process zone (e.g. type of laser window: active/passive, process viewing by camera and monitor systems).		P
5.3.3.3	Protection against laser radiation hazards during setting mode (teaching, path programming and programme verification without processing)		P

EN ISO 11553-1			
Clause No.	Requirement	Result - Remark	Verdict
	During setting mode, human access to laser radiation exceeding the AEL for Class 1 shall be prevented except for laser radiation emitted in the wavelength range of 400 nm to 700 nm when human access to laser radiation shall not exceed the AEL for Class 3R. NOTE Exposure limits for the eye and the skin of employees in the workplace and the general public are in many countries specified in national laws. The legally binding national exposure limits might differ from the MPEs used in this standard. Therefore, radiation emitted in the wavelength range of 400 nm to 700 nm when human access to laser radiation might be limited to the AEL for Class 2.		P
5.3.3.4	Protection against laser radiation hazards during service mode		P

EN ISO 11553-1			
Clause No.	Requirement	Result - Remark	Verdict
	During service mode, human access to laser radiation exceeding the AEL for Class 1 is sometimes unavoidable. Machines shall therefore be designed, and appropriate safety measures provided, with respect to the following four situations (listed in order of preference): a) servicing takes place outside the laser hazard area (according to IEC 60825-1:2014); no further protection is necessary. b) servicing takes place in a laser hazard area to which access is controlled in the same manner as during production; protective measures in c) apply. c) servicing takes place in a laser hazard area (e.g. with open guards that are normally closed during production) but accessible laser radiation does not exceed the AEL for Class 1. Exposure above AEL for class 1 shall be predominantly prevented by engineering safety measures described in IEC 60825-1:2014, e.g. protective equipment to detect the presence of persons e. g. opto-electronic protective devices (Laser scanner). If parts are integrated in a safety control, requirements specified in ISO 13849-1:2015 and/or ISO 62061:2005 shall be met. Administrative safety measures (lock-out/tagout: LOTO), e.g. to lock-out (e.g. with a padlock) a laser cabin door so that the door/interlock is open and therefore exposure above AEL for class 1 is prevented by SRP/CS, shall be used as subordinated measure. d) servicing takes place in hazard zones, for example because opening of guards (normally closed during production) is necessary. In this case accessible laser radiation exceeds the AEL for Class 1. If servicing takes place in the laser hazard area the requirements of 5.3.2.3 shall be met.	b)	P
5.3.3.5	Protection against laser radiation hazard by operating mode selector switch		P
	The operating mode selector switch enables the selection of machine functions characterized by different risk levels with regard to laser radiation hazards; e.g. normal use/automatic mode vs. service mode.		P

EN ISO 11553-1			
Clause No.	Requirement	Result - Remark	Verdict
	On the basis of the risk assessment the manufacturer shall define requirements on the operating mode selector switch and the authorization control for the operating mode selector switch.		P
	If the mode selection can give rise to unsafe operation of the machine (e.g. by unauthorized or wrong selection of service mode resulting in hazardous accessible emission level (AEL) of laser radiation), the operating mode selector switch shall be lockable and integrated in the safety control of the machine. The requirements on the operating mode selector switch (here PLr) shall be determined in accordance with ISO 13849-1:2015 and ISO 12100:2010. NOTE If appropriate, an operating mode selector switch can be applied to avoid manipulation (see also ISO 14119:2013).		P
5.3.4	Engineering control measures		P
	In the following, engineering control measures with regard to design and controls are listed:		P
	— The manufacturer shall follow general principles for design, risk assessment and risk reduction for laser processing machines explained in ISO 12100:2010.		P
	— The general requirements for the safety of the electrical equipment of laser processing machines described in IEC 60204-1:2016 shall be observed.		P
	— The start/stop controls of a laser processing machine shall comply with the requirements specified in ISO 60204-1:2016 and ISO 13849-1:2015.		P
	— The emergency stop controls shall be designed according to the requirements specified in ISO 13850:2012 and IEC 60204-1:2016.		P
	— Safety related parts of control systems of laser processing machines shall comply with the requirements given in IEC 60825-1:2014, IEC 60204-1:2016, ISO 13849-1:2015, or ISO 62061:2005. A risk assessment shall be performed according to ISO 12100:2010.		P

EN ISO 11553-1			
Clause No.	Requirement	Result - Remark	Verdict
	— This risk estimation for damage to sight leads at least to a required Performance Level PLr = c or in a Safety Integrity Level SIL = 1. If the accessible irradiance or the radiant exposure exceeds ten times the AEL of laser class 1 as defined in IEC 60825-1:2014, then a Performance Level PLr = d is required.		P
	— Provisions for the safe isolation of the laser beam shall be designed in compliance with IEC 60825-1:2014, 4.3 (reasonably foreseeable single fault condition for normal operation).		P
6	Verification of the safety requirements and risk reduction measures		P
	The manufacturer shall verify the following.		P
	The verification of the safety requirements and risk reduction measures for the laser processing machine and the validation of the design and the function of the laser processing machine shall be carried out in accordance with relevant standards, see Table 2.		P
	The risk assessment shall be verified to ensure that all reasonably foreseeable hazards and reasonably foreseeable fault conditions are identified and, if necessary, corrective measures have been taken.		P
	The verification and validation of the safety requirements and risk reduction measures includes following measures, but are not limited to a) visual inspection, b) practical inspection/functional tests, c) measurements, d) observation during operation, e) Verification of application-specific schematics, circuits layouts and design document, f) Verification of safety-related application specific hardware and software or software documentation (SRP/CS), g) Verification of the risk assessment, (incl. evaluations, calculations), h) Verification of the detailed description, the layout drawings and mounting description, i) Verification of specification values and information to user. NOTE See Table 2.		P

EN ISO 11553-1			
Clause No.	Requirement	Result - Remark	Verdict
	Verification of risk reduction measures against laser radiation hazards is related to different technical issues. Table 2 provides information on the safety requirement/measure, the method of verification/validation and gives reference to applicable standards.		P
7	Information for use		P
	The manufacturer shall follow the requirements of ISO 12100:2010, 6.4, preparing the chapter "information for use".		P
	The manufacturer should consider IEC/IEEE 82079 -1:2019.		P
	The information for use (manual) of the laser machine shall at least include the following laser radiation hazards related issues. The manufacturer shall:		P
	— define the normal use of the machine and all other operating modes intended for the laser processing machine. — describe the residual risks or the hazards related to laser radiation respectively for all phases of machine life and for every applicable operating mode and shall indicate the level of accessible laser radiation or the laser class (according to IEC 60825-1:2014) respectively. — advise users of known potential laser radiation hazards by providing a prominently placed warning statement in the user instructions and/or operator's manual.		P
	— include information on laser safety requirements for all operating modes, including if applicable for the setting mode, the manual intervention mode and service mode. This information shall include general notes on — technical protective measures, — organizational protective measures, — personal protective measures, or personal protective equipment, respectively,		P

EN ISO 11553-1			
Clause No.	Requirement	Result - Remark	Verdict
	— if necessary, specify requirements on the required protective equipment and refer to respective standards; e.g. — technical and organizational laser protective measures: IEC 60825-1:2014, — laser guards: IEC 60825-4:2006, — SRP/CS for safe isolation of the laser radiation: ISO 13849-1:2015, ISO 13849-2:2012 (and/or IEC 62061:2005), — laser protective eyewear: EN 207:2017.		P
	— provide sufficient and adequate information how to operate the laser processing machine in other operating modes than the normal use without being exposed to laser hazards; especially if safety equipment is removed or overridden instructions for the use of adequate protective measures including personal protective equipment shall be given. — define which authorization measures (to enter the laser hazard area) are comprised and have to be followed if access to hazardous laser radiation can be possible. — if necessary, define the level of qualification of personnel (related to laser safety), gained by training and education and instructions, which is required to select specified operating modes and/or which is required according to the accessible laser radiation or the location (see Table 1), in which the laser processing machine is operated.		P
8	Labelling		
	Laser processing machines shall be labelled regarding laser radiation hazards as following:		P
	a) Each laser processing machine shall be equipped with labelling in accordance with ISO 3864 (all parts). — Safety signs (prohibition/warning/mandatory signs); — Colours, sizes and print styles of the labels shall comply with the design principles for product safety labels according to ISO 3864 (all parts); — Laser radiation labels shall be as described in IEC 60825-1:2014.		P

EN ISO 11553-1			
Clause No.	Requirement	Result - Remark	Verdict
	b) The location of labels shall satisfy the following requirement: — the size and location of the labels shall be such as to make the appropriate labels legible from outside the hazard zones without exposing anyone to any of the laser hazards listed in Clause 4. — if different operation modes make different sets of safety signs necessary (e.g. for normal use and service), it shall clearly be indicated for which operating mode which set of safety signs is applicable.		P

--- End of checklist report ---