

TEST REPORT EN ISO 10218-1:2011 Robots and robotic devices — Safety requirements for industrial robots —Part 1: Robots	
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Testing Laboratory Name	SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch.
Address	No. 1 Workshop, M-10, Middle Section, Science & Technology Park, Shenzhen, Guangdong, China 518057
Applicant's name	Shenzhen Yuejiang Technology Co., Ltd.
Address	Room 1003, Building 2, Chongwen Park, No.3370, Liuxian Blvd, Fuguang Community, Taoyuan Street, Nanshan District, Shenzhen
Manufacturer's name	Same as applicant
Address	Same as applicant
Test specification:	
Standard	EN ISO 10218-1:2011
Test procedure	SGS-CSTC
Non-standard test method	N/A
Test Report Form No.	EN ISO 10218-1_A
TRF originator	SGS-CSTC
Master TRF	2014-04
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Test item description	Collaborative Robot (Product name: BOBOT CR5)
Trade Mark	
Model/Type reference	DT-CR-6R050-00I
Ratings	AC100V~240V/47~63HZ/400W



Testing procedure and testing location:	
<input checked="" type="checkbox"/> Testing Laboratory: Testing location/ address..... : Tested by (name + signature) : Approved by (name + signature).... :	SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch. No. 1 Workshop, M-10, Middle Section, Science & Technology Park, Shenzhen, Guangdong, China 518057 Shawn Chen Jerry Zheng
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<input type="checkbox"/> Testing procedure: RMT Tested by (name + signature) : Approved by (+ signature)..... : Supervised by (+ signature) : Testing location/ address..... :	

Shawn Chen
Jerry Zheng



Summary of testing

All tests and assessments are performed on the prototype of the original sampled machine and the technical file which are submitted by the client.

Considering the results of the test according to standard EN ISO 10218-1:2011, the items under test are IN COMPLIANCE with the requested specifications specified in the standard.

Tests performed (name of test and test clause):

Full tests of standard

Testing location:

SGS-CSTC Standards Technical Services Co., Ltd.
Shenzhen Branch

No. 1 Workshop, M-10, Middle Section, Science & Technology Park, Shenzhen, Guangdong, China
518057

Copy of marking plate

Label for Manipulator



中国·深圳市越疆科技有限公司
深圳市南山区留仙大道3370号南山智园崇文园区2号楼10层
Shenzhen Yuejiang Technology Co.,Ltd |China
10 Floors, Building No.2, Chongwen Garden, Nanshan i-Park, Nanshan District, Shenzhen

产品名称	PRODUCT NAME	DOBOT CR5
产品型号	PRODUCT MODEL	DT-CR-6R050-00I
生产日期	PRODUCTION DATE	2020.03
重量	WEIGHT	25kg
最大负载	MAX.PAYLOAD	5kg
臂长	MAX.REACH	900mm
额定电流	RATED CURRENT	7.3A
额定电压	RATED VOLTAGE	DC48V
防护等级	IP CLASSIFICATION	IP54



SERIAL NO.: CR5-4018-0731



Label for Robot controller



中国·深圳市越疆科技有限公司
深圳市南山区留仙大道3370号南山智园崇文园区2号楼10层
Shenzhen Yuejiang Technology Co.,Ltd |China
10 Floors, Building No.2, Chongwen Garden, Nanshan i-Park, Nanshan District, Shenzhen

产品名称	PRODUCT NAME	DOBOT CC161
产品型号	PRODUCT MODEL	DT-CR-CC161-00I
生产日期	PRODUCTION DATE	2020.03
重量	WEIGHT	12kg
短路电流	SHORT -CIRCUIT CURRENT	100 A
输入电压	INPUT VOLTAGE	1PHASE, AC100V~240V
额定功率	RATED POWER	400W
输入频率	INPUT FREQUENCY	47~63HZ



SERIAL NO.: CC161-4036-0731



<p>Testing case verdicts</p> <p>Test case does not apply to the test object.....: N/A</p> <p>Test item does meet the requirement.....: P(ass)</p> <p>Test item does not meet the requirement.....: F(ail)</p>	
<p>Testing</p> <p>Date of receipt of test item.....: 2020-03-16</p> <p>Date(s) of performance of test.....: 2020-03-16 to 2020-06-05</p>	
<p>General remarks</p> <p>"(See Enclosure #)" refers to additional information appended to the report.</p> <p>"(See appended table)" refers to a table appended to the report.</p> <p>Throughout this report a <input type="checkbox"/> comma / <input checked="" type="checkbox"/> point is used as the decimal separator.</p> <p>This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at http://www.sgs.com/en/Terms-and-Conditions.aspx and, for electronic format documents, subject to Terms and Conditions for Electronic Documents at http://www.sgs.com/en/Terms-and-Conditions/Terms-e-Document.aspx. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law. Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 30 days only. This document cannot be reproduced except in full, without prior approval of the company</p>	
<p>General product information:</p> <p>The collaborative robot system DOBOT CR5 mainly consists of the following parts: Manipulator (mode DT-CR-6R050-00I), Robot controller (model DT-CR-CC161-00I), Teach pendant, Connecting cables, Software and optional accessories.</p>	

EN ISO 10218-1			
Clause	Requirement – Test	Result – Remark	Verdict
5	Design requirements and protective measures		–
5.1	General		–
	The robot shall be designed in accordance with the principles of ISO 12100 for relevant hazards. Significant hazards, such as sharp edges, are not dealt with by this part of ISO 10218.	Compliance with EN ISO 12100, see relevant test report.	P
	Robots shall be designed and constructed to comply with the requirements in 5.2 to 5.15.	Compliance with these requirements, see below test report.	P
5.2	General requirements		–
5.2.1	Power transmission components		–
	Exposure to hazards caused by components such as motor shafts, gears, drive belts, or linkages which are not protected by integral covers (e.g. panel over a gear box) shall be prevented either by fixed guards or movable guards. The fixing systems of the fixed guards which are intended to be removed for routine service actions shall remain attached to the machine or the guard. Movable guards shall be interlocked with the hazardous movements in such a way that the hazardous machine functions cease before they can be reached.	Fixed guard is used	P
	The safety-related control system performance of an interlocking system shall conform to the requirements of 5.4.	No interlocking guard	N/A
5.2.2	Power loss or change		–
	Loss of, or variations in power shall not result in a hazard.	Compliance with this requirement	P
	Re-initiation of power shall not lead to any motion.	Compliance with this requirement	P
	Robots shall be designed and constructed so that loss or change of electrical, hydraulic, pneumatic or vacuum power does not result in a hazard. If hazards exist that are not protected by design, then other protective measures shall be taken to protect against those hazards. Unprotected hazards of the expected use shall be identified in the information for use.	Loss or change of electrical power shall not result in a hazard	P
5.2.3	Component malfunction		–
	Robot components shall be designed, constructed, secured, or contained so that hazards caused by breaking or loosening, or releasing stored energy are minimized.	Compliance with this requirement	P
5.2.4	Sources of energy		–
	A means of isolating any hazardous energy source to the robot shall be provided. This means shall be provided with capability of locking or otherwise securing in the de-energized position.	Plug-socket combination is used for supply disconnecting device.	P
5.2.5	Stored energy		–

EN ISO 10218-1			
Clause	Requirement – Test	Result – Remark	Verdict
	A means shall be provided for the controlled release of stored hazardous energy. A label shall be affixed to identify the stored energy hazard.	Compliance with this requirement	P
5.2.6	Electromagnetic compatibility (EMC)		-
	The design and construction of the robot shall prevent hazardous motion or situations due to the expected effects of electromagnetic interference (EMI), radio frequency interference (RFI) and electrostatic discharge (ESD).	See EMC test report	P
5.2.7	Electrical equipment		-
	The robot electrical equipment shall be designed and constructed in accordance with the relevant requirements of IEC 60204-1.	Compliance with IEC 60204-1, see relevant test report	P
5.3	Actuating controls		-
5.3.1	General		-
	Actuating controls that initiate power or motion shall be designed and constructed to meet the performance criteria mentioned in 5.3.2 to 5.3.5.	Compliance with 5.3.2 to 5.3.5	P
5.3.2	Protection from unintended operation		-
	Actuating controls shall be constructed or located so as to prevent unintended operation. For example, appropriately designed push-buttons or key selector switches in appropriate locations can be used.	Unintended operation is prevented by appropriately designed push-buttons	P
5.3.3	Status indication		-
	The status of the actuating controls shall be clearly indicated, e.g. power on, fault detected, automatic operation.	The status of the actuating controls are clearly indicated	P
	If an indicator light is used, it shall be suitable for its installed location and its colour shall meet the requirements of IEC 60204-1.	Indicator light meets the requirements of IEC 60204-1	P
5.3.4	Labelling		-
	Actuating controls shall be labelled to clearly indicate their function.	Actuating controls are labelled clearly	P
5.3.5	Single point of control		-
	The robot control system shall be designed and constructed so that when the robot is placed under local pendant control or other teaching device control, initiation of robot motion or change of local control selection from any other source is prevented.	Compliance with this requirement	P
5.4	Safety-related control system performance (hardware/software)		-
5.4.1	General		-

EN ISO 10218-1			
Clause	Requirement – Test	Result – Remark	Verdict
	Safety-related control systems (electric, hydraulic, pneumatic and software) shall comply with 5.4.2, unless the results of the risk assessment determine that an alternative performance criterion as described in 5.4.3 is appropriate. The safety-related control system performance of the robot and any furnished equipment shall be clearly stated in the information for use.	Only electric control system and it is compliance with relevant requirements	P
	For the purposes of this part of ISO 10218, safety-related control system performance is stated as: - Performance Levels (PL) and categories as described in ISO 13849-1:2006, 4.5.1; - Safety Integrity Levels (SIL) and hardware fault tolerance requirements as described in IEC 62061:2005, 5.2.4.		P
	Those two standards address functional safety using similar but different methods. Requirements in those standards should be used for the respective safety-related control systems for which they are intended. The designer may choose to use either of the two standards. The data and criteria necessary to determine the safety-related control system performance shall be included in the information for use.		P
	Other standards offering alternative performance requirements, such as the term “control reliability” used in North America, may also be used. When using these alternative standards to design safety-related control systems, an equivalent level of risk reduction shall be achieved.	Not applicable	N/A
	Any failure of the safety-related control system shall result in a stop category 0 or 1 in accordance with IEC 60204-1.	Category 1 stop are used.	P
5.4.2	Performance requirement		-
	Safety-related parts of control systems shall be designed so that they comply with PL=d with structure category 3 as described in ISO 13849-1:2006, or so that they comply with SIL 2 with a hardware fault tolerance of 1 with a proof test interval of not less than 20 years, as described in IEC 62061:2005.		P
	This means in particular: a) a single fault in any of these parts does not lead to the loss of the safety function; b) whenever reasonably practicable, the single fault shall be detected at or before the next demand upon the safety function; c) when the single fault occurs, the safety function is always performed and a safe state shall be maintained until the detected fault is corrected; and d) all reasonably foreseeable faults shall be detected.	Compliance with these requirement	P

EN ISO 10218-1			
Clause	Requirement – Test	Result – Remark	Verdict
	The requirements a) to d) are considered to be equivalent to structure category 3 as described in ISO 13849-1:2006.		
5.4.3	Other control system performance criteria		–
	The results of a comprehensive risk assessment performed on the robot and its intended application may determine that a safety-related control system performance other than that stated in 5.4.2 is warranted for the application.	Not applicable	N/A
	Selection of one of these other safety-related performance criteria shall be specifically identified, and appropriate limitations and cautions shall be included in the information for use provided with the affected equipment.	Not applicable	N/A
5.5	Robot stopping functions		–
5.5.1	General		–
	Every robot shall have a protective stop function and an independent emergency stop function. These functions shall have provision for the connection of external protective devices. Optionally, an emergency stop output signal may be provided. Table 1 shows a comparison of the emergency stop and protective stop functions.	Compliance with this requirement	P
5.5.2	Emergency stop		–
	The robot shall have one or more emergency stop functions (stop category 0 or 1, in accordance with IEC 60204-1).	Category 1 stop	P
	Each control station capable of initiating robot motion or other hazardous situation shall have a manually initiated emergency stop function that: a) complies with the requirements of 5.4 and IEC 60204-1; b) takes precedence over all other robot controls; c) causes all controlled hazards to stop; d) removes drive power from the robot actuators; e) provides capability for controlling hazards controlled by the robot system; f) remains active until it is reset; and g) shall only be reset by manual action that does not cause a restart after resetting, but shall only permit a restart to occur.	Emergency compliance with this requirement	P
	Selection of a category 0 or category 1 stop (in accordance with IEC 60204-1) function shall be determined from the risk assessment.	Category 1 stop	P
	When an emergency stop output signal is provided: –the output shall continue to function when the robot power is removed; or –if the output does not continue to function when the robot power supply is removed, an emergency stop signal shall be generated.	An emergency stop output signal is provided	P

EN ISO 10218-1			
Clause	Requirement – Test	Result – Remark	Verdict
	The emergency stop device shall be in accordance with IEC 60204-1 and ISO 13850.	The emergency stop devices are compliance with IEC 60204-1 and ISO 13850	P
5.5.3	Protective stop		-
	The robot shall have one or more protective stop functions designed for the connection of external protective devices. The protective stop function performance shall comply with the requirements of 5.4.	Compliance with this requirement	P
	This stop function shall cause a stop of all robot motion, remove or control power to the robot drive actuators, and allow for the control of any other hazard controlled by the robot. This stop may be initiated manually or by control logic.	By control logic	P
	At least one protective stop function shall be a stop category 0 or 1, as described in IEC 60204-1. The robot may have an additional protective stop function using stop category 2 as described in IEC 60204-1 that does not result in drive power being removed but does require monitoring of the standstill condition after the robot stops. Any unintended motion of the robot in the monitored standstill condition or detected failure of the protective stop function shall result in a category 0 stop in accordance with IEC 60204-1. The monitored standstill function performance shall comply with 5.4. This function may also be initiated from external devices (input stop signal from protective devices).	Category 1 stop	P
	The manufacturer shall include the stop category of every protective stop circuit input in the information for use.	Compliance with this requirement	P
5.6	Speed control		-
5.6.1	General		-
	The speed of the robot end-effector mounting flange and of the tool centre point (TCP) shall be controllable at selectable speeds. An off-set feature (defining the location of the TCP relative to the mounting flange) shall be provided to enable the TCP speed to be controlled.	Compliance with this requirement.	P
5.6.2	Reduced speed control operation		-
	When operating under reduced speed control, the speed of the TCP shall not exceed 250 mm/s. It should be possible to select speeds lower than 250 mm/s as the assigned limit.	The reduced speed is below 250mm/s	P
5.6.3	Safety-rated reduced speed control		-

EN ISO 10218-1			
Clause	Requirement – Test	Result – Remark	Verdict
	When provided, safety-rated reduced speed control shall be designed and constructed in accordance with 5.4.2 so that in the event of a fault, the speed of the TCP does not exceed the limit for reduced speed (see 5.6.2) and a protective stop is issued when a fault occurs.	The speed of the TCP does not exceed the limit for reduced speed	P
5.6.4	Safety-rated monitored speed		-
	When provided, the speed of the TCP or of an axis shall be monitored in accordance with 5.4.2. If the speed exceeds the limit selected, a protective stop shall be issued.	The speed is monitored by display	P
5.7	Operational modes		-
5.7.1	Selection		-
	Operational modes shall be selectable with a mode selector which can be locked in each position (e.g. a key operated switch which can be inserted and extracted in each position). Each position of the selector shall be clearly identifiable and shall exclusively allow one control or operating mode.	Operational modes is selectable by password	P
	The selector can be replaced by another selection means which restricts the use of certain functions of the robot (e.g. access codes). These means shall: a) unambiguously indicate the selected operating mode; and b) by themselves not initiate robot motion or other hazards.		P
	An optional output(s) may be provided to indicate the mode selected. When provided for safety-related purposes, the output(s) shall comply with the requirements of 5.4 (see Annex D).	Not applicable	N/A
5.7.2	Automatic		-
	In automatic mode, the robot shall execute the task programme and the safeguarding measures shall be functioning.	Compliance with this requirement	P
	Automatic operation shall be prevented if any stop condition is detected.		P
	Switching from this mode shall result in a stop.		P
5.7.3	Manual reduced speed		-
	Manual reduced-speed mode shall meet the requirements of 5.3.4 and 5.6 and shall allow a robot to be operated by human intervention. Automatic operation is prohibited in this mode. This mode is used for jogging, teaching, programming and programme verification of the robot; it may be the mode selected when performing some maintenance tasks.	Compliance with this requirement	P

EN ISO 10218-1			
Clause	Requirement – Test	Result – Remark	Verdict
	Manual control of the robot from inside the safeguarded space shall be performed with a reduced speed in conjunction with either of the following: a) hold-to-run controls in conjunction with an enabling device in accordance with 5.8, or b) for programme verification only, a start/stop control in conjunction with an enabling device in accordance with 5.8.		P
	Information for use shall contain appropriate instructions and warnings that, wherever possible, the manual mode of operation shall be performed with all persons outside the safeguarded space. Information for use shall also instruct that prior to selecting automatic mode, any suspended safeguards shall be returned to their full functionality.		P
5.7.4	Manual high speed		-
	If this mode is provided, speeds greater than 250 mm/s can be achieved. This mode is used for programme verification only. In this case, the robot shall: a) have a means to select manual high-speed mode which requires a deliberate action (e.g. a key switch on the robot control panel) and an additional confirming action; b) provide a pendant conforming to 5.8 with a hold-to-run function in addition to the enabling device that permits robot motion to continue; c) set an initial speed limit of up to, but not exceeding, 250 mm/s upon selection of manual high-speed mode; d) provide on the pendant a means for the operator to incrementally adjust the speed from the initial value to the full programmed value in multiple steps; e) provide on the pendant an indication of the adjusted speed; f) ensure that: -its speed is limited to the initial speed limit when the enabling device is re-initiated by placing the switch in the centre-enabled position after either having been released or fully compressed, and -a separate deliberate action is required to return to the higher speed that was selected before the enabling device switch was released or compressed, and -the option to resume the higher speed using the separate action shall become inoperative after no more than five minutes after the release of the enabling device.	No this mode	N/A

EN ISO 10218-1			
Clause	Requirement – Test	Result – Remark	Verdict
	The option to resume the higher speed and the time-out is not safety-rated. Information for use shall contain appropriate instructions and warning that, wherever possible, the manual mode of operation shall be performed with all persons outside the safeguarded space. Information for use shall also instruct that prior to selecting automatic mode, any suspended safeguards shall be returned to their full functionality.		N/A
5.8	Pendant controls		-
5.8.1	General		-
	Where a pendant control or other teaching control device has the capability to control the robot from within the safeguarded space, the requirements in 5.3.5 and 5.8.2 to 5.8.7 shall apply.	Compliance with this requirement	P
5.8.2	Motion control		-
	Motion of the robot initiated from the pendant or teaching control device shall be under reduced speed control as described in 5.6. When the controls contain provisions for selecting manual high speed, the robot shall meet the requirements in 5.7.4.		P
5.8.3	Enabling device		-
	The pendant or teaching control device shall have a three-position enabling device in accordance with IEC 60204-1. When continuously held in a centre-enabled position, the enabling device shall permit robot motion and any other hazards controlled by the robot. The enabling device shall have the performance characteristics outlined below. a) The enabling device may be integral with, or physically separate from (e.g. a grip-type enabling device), the pendant control and shall operate independently from any other motion control function or device. b) Release of or compression past the centre-	Three-position enabling device is compliance with these requirements	P

EN ISO 10218-1			
Clause	Requirement – Test	Result – Remark	Verdict
	<p>enabled position of the device shall stop hazards (e.g. robot motion) in accordance with 5.4 and 5.5.3.</p> <p>c) After compression past the centre-enabled position of the enabling device, the enabling device needs to be fully released. Going from fully compressed to the centre position shall not permit robot motion.</p> <p>d) When two or more enabling switches are provided on a single enabling device/pendant to allow alternating left- or right-handed operation, any or all switches can be in the centre-enabled position:</p> <p>1) when only one of the switches is being used and is in the centre-enabled position it shall function as described in b);</p> <p>2) when the enabling device design allows both switches to be held in the centre-enabled position to allow changing from left- to right-hand operation, releasing one switch shall not cause a protective stop but fully depressing either switch shall override the control of the other switches and cause a protective stop.</p> <p>Information for use shall contain a description of this functional operation and a warning that a potential hazard could exist.</p> <p>e) When more than one enabling device is in operation (i.e. more than one person is in the safeguarded space with an enabling device), motion shall only be possible when each device is held in the centre (enabled) position at the same time.</p> <p>f) Dropping the enabling device shall not result in a failure that would allow motion to be enabled.</p> <p>g) If an enabling output signal is provided, then the output shall signal a stop condition when the safetyrelated system supply is off and shall comply with the requirements of 5.4.</p> <p>h) When the mode is changed while the enabling device is in the centre-enabled position, a protective stop shall be initiated. The control system shall require that the enabling device be released and re-enabled before drive power can be applied. See IEC 60204-1 for guidance on preventing the defeat of an enabling device.</p>		
5.8.4	Pendant emergency stop function		-
	The pendant or teaching control device shall have an emergency stop function in accordance with 5.5.2.	Pendant emergency stop function is compliance with this requirement	P
5.8.5	Initiating automatic operation		-

EN ISO 10218-1			
Clause	Requirement – Test	Result – Remark	Verdict
	It shall not be possible to activate robot automatic operation using the pendant or teaching control device exclusively. There shall be a means for a separate confirmation action located outside the safeguarded space prior to activating the automatic mode.	Compliance with this requirement	P
5.8.6	Cableless or detachable teach controls		-
	Where pendant or other teaching controls have no cables connecting to the robot control, or where they may be detached, the following shall apply.		P
	a) A visual indication shall be provided to show that the pendant is active, e.g. at the teach pendant display.		P
	b) Loss of communication shall result in a protective stop for all robots being controlled when in manual reduced-speed or manual high-speed modes. Restoration of communication shall not restart robot motion without a separate deliberate action.		P
	c) Confusion between active and inactive emergency stop devices shall be avoided by providing appropriate storage or design. Information for use shall contain a description of the storage or design.		P
	d) When applicable, the maximum response times for data communication (including error correction) and for loss of communication shall be stated in the information for use.		P
5.8.7	Control of multiple robots		-
	Where a pendant control has the capability to control multiple robots, the requirements in 5.9 shall apply.	Not applicable	N/A
5.9	Control of simultaneous motion		-
5.9.1	Single pendant control		-
	One or more robot controls may be linked to a single teach pendant. When so configured, the teach pendant shall have the capability to move one or more of the robots independently or in simultaneous motion. When in the manual operational mode, all functions of the robot system shall be under the control of the one pendant.	Not applicable	N/A
5.9.2	Safety design requirements		-
	All robots in a robot system, designed for simultaneous motion, shall normally be in the same operating mode, e.g. manual or automatic, and in the same state, e.g. power on or power off. Capability shall be provided to allow one or more robots to be in a servo-disconnected state for the purpose of troubleshooting or running errors or in test cases. These disconnected robots are then not included in the simultaneous motion.	Not applicable	N/A

EN ISO 10218-1			
Clause	Requirement – Test	Result – Remark	Verdict
	For the robots to be included in simultaneous motion, each robot shall be selected before it can be moved. To be selected, all robots shall be in the same operating mode (e.g. manual reduced speed). An indication shall be provided at the point of selection (e.g. at the pendant, control cabinet, or robot) of the robot(s) that have been selected. Only selected robot(s) shall be moved.	Not applicable	N/A
	It shall also be possible to deactivate any robot, i.e. to have it in a power off state. An indication, clearly visible from within the safeguarded space, of the robot(s) that have been activated shall be provided.	Not applicable	N/A
	Unexpected start-up of any robots not selected shall be prevented. This function shall comply with the requirements of 5.4.	Not applicable	N/A
5.10	Collaborative operation requirements		–
5.10.1	General		–
	Robots designed for collaborative operation shall provide a visual indication when the robot is in collaborative operation and shall comply with one or more of the requirements in 5.10.2 to 5.10.5.	Compliance with 5.10.3 to 5.10.5	P
5.10.2	Safety-rated monitored stop		–
	The robot shall stop when a human is in the collaborative workspace. The stop function shall comply with 5.4 and 5.5.3. The robot may resume automatic operation when the human leaves the collaborative workspace.	Not applicable	N/A
	Alternatively, the robot may decelerate, resulting in a category 2 stop in accordance with IEC 60204-1. Once stopped, this standstill shall be monitored by the safety-related control system in accordance with 5.4. Fault of the safety-rated monitored stop function shall result in a category 0 stop.	Not applicable	N/A
5.10.3	Hand guiding		–
	When provided, hand guiding equipment shall be located close to the end-effector and shall be equipped with the following: a) an emergency stop complying with 5.5.2 and 5.8.4, and b) an enabling device complying with 5.8.3.	Not applicable	N/A
	The robot shall operate with a safety-rated monitored speed function active (see 5.6.4). The safety-rated monitored speed limit shall be determined by the risk assessment.	Not applicable	N/A
5.10.4	Speed and separation monitoring		–

EN ISO 10218-1			
Clause	Requirement – Test	Result – Remark	Verdict
	The robot shall maintain a determined speed and separation distance from the operator. These functions may be accomplished by integral features or a combination of external inputs. Detection of the failure to maintain the determined speed or separation distance shall result in a protective stop (see 5.5.3). The speed and separation monitoring functions shall comply with 5.4.2.	Not applicable	N/A
	The robot is simply a component in a final collaborative robot system and is not in itself sufficient for a safe collaborative operation. The collaborative operation applications are dynamic and shall be determined by the risk assessment performed during the application system design. Information for use shall contain direction for implementing speed values and separation distances. ISO 10218-2 shall be used for designing collaborative operations. Additional information will be contained in ISO/TS 15066 (currently under preparation).	Not applicable	N/A
	The relative speeds of the operator and robot need to be considered when calculating the minimum safe separation distance. Minimum distance requirements can be found in ISO 13855.	Not applicable	N/A
5.10.5	Power and force limiting by inherent design or control		-
	The power or force limiting function of the robot shall be in compliance with 5.4. If any parameter limit is exceeded, a protective stop shall be issued.	Compliance with this requirement	P
	The robot is only a component in a final collaborative robot system and alone is not sufficient for a safe collaborative operation. The collaborative operation application shall be determined by the risk assessment performed during the application system design. Information for use shall include details for setting established parameter limits in the controlled robot. ISO 10218-2 shall be used for designing collaborative operations. Additional information will be contained in ISO/TS 15066 (currently under preparation).	Compliance with this requirement	P
5.11	Singularity protection		-
	Motions defined in Cartesian space that pass near singularities can produce high axis speeds. These high speeds can be unexpected to an operator. When in the manual reduced-speed mode or hand guiding (see 5.10.3), the robot control shall do one of the following:	Singularity protection is achieved by automatic stop the move and in reduce speed mode	P

EN ISO 10218-1			
Clause	Requirement – Test	Result – Remark	Verdict
	<p>a) stop robot motion and provide a warning prior to the robot passing through or correcting for a singularity during coordinated motion (control wherein the axes of the robot arrive at their respective end points simultaneously, giving a smooth appearance to the motion and control wherein the motions of the axes are such that the TCP moves along a prescribed path) initiated from the teach pendant, or</p> <p>b) generate an audible or visible warning signal and continue to pass through the singularity with the velocity of each link of the robot arm limited to a maximum speed of 250 mm/s, or</p> <p>c) in the case that the singularity can be controlled without creating any hazardous motion, no additional protection is required.</p>	By visual warning	P
5.12	Axis limiting		-
5.12.1	General		-
	A means shall be provided to establish a restricted space around the robot by using limiting devices. A means for installing adjustable mechanical stops shall be provided to limit the motion of the axis with the greatest displacement motion (primary axis) of the robot. The robot shall comply with either 5.12.2 or 5.12.3, or both.	Compliance with 5.12.3	P
	This does not apply to robots with a limiting structure resulting from construction, e.g. parallel kinematic construction.	Not applicable	N/A
	When the robot reaches an axis limit, the robot shall be stopped. Whether the robot motion can continue at the point of the axis limit or not should be stated in the information for use.	Compliance with this requirement	P
5.12.2	Mechanical and electro-mechanical axis limiting devices		-
	Provisions for adjustable mechanical or non-mechanical limiting devices shall be provided for axes two and three (the axes with the second and third largest displacement motions).	Not applicable	N/A
	Mechanical stops shall be capable of stopping robot motion at rated load, maximum speed conditions, and at maximum and minimum extension. Testing of mechanical hard stops shall be without any assisted stopping.	Not applicable	N/A
	Alternative methods of limiting the range of motion may be provided only if they are designed, constructed and installed to meet the performance specified in 5.4.2.	Not applicable	N/A
	The control circuit performance of electro-mechanical limiting devices shall comply with the requirements in 5.4. The robot control and task programmes shall not change electro-mechanical limit device settings.	Not applicable	N/A

EN ISO 10218-1			
Clause	Requirement – Test	Result – Remark	Verdict
	The adjustable devices allow the user to minimize the size of the restricted space. The degree of adjustment should be included in the required information for use as specified in 6.2.		N/A
	Information for use shall include information on stopping time at maximum speed for electro-mechanical limiting devices including monitoring time and distance travelled before full stop is achieved. Additional information is given in Annex B.		N/A
5.12.3	Safety-rated soft axis and space limiting		-
	Soft limits are software-defined limits to robot motion. Space limiting is used to define any geometric shape which may be used as an inclusionary or exclusionary zone, either limiting robot motion within the defined space, or preventing the robot from entering the defined space.	The software and the robot construction are used to define the space limit	P
	Safety-rated soft limits are permitted as a means to define and reduce the restricted space provided they can effect a stop of the robot at full-rated load and speed. The restricted space shall be defined at the actual expected stopping position that accounts for the stopping distance travel. The manufacturer shall state the capability in the information for use and shall disable safety-rated soft limits if this capability is not supported.	Same as above	P
	Control programmes that monitor and perform soft axis and space limiting functions based on safety-rated soft limits shall comply with 5.4 and be changeable only by authorized personnel. If the safety-rated soft limit is violated, a protective stop shall be initiated. Motion during a limit violation shall be under reduced speed control as described in 5.6.3. Information on the active settings and configuration of the safety limits shall be capable of being viewed and documented with a unique identifier so that changes to the configuration can be easily identified.	Same as above	P
	A safety-rated soft limit shall be set as a stationary zone that cannot be changed without re-initialization of the safety-related sub-system and shall not be reconfigured during automatic execution of the task programme. Authorization to change the safety-rated soft limit shall be protected and secure, e.g. require authorized persons to enter a password. Once set, safety-rated soft limits shall always become activated upon power up.	Same as above	P
	Information for use shall include information on stopping time at maximum speed for safety-rated soft limits including monitoring time and distance travelled before full stop is achieved. Additional information is given in Annex B.	Same as above	P

EN ISO 10218-1			
Clause	Requirement – Test	Result – Remark	Verdict
	Safety-rated zone outputs for use in dynamic restricted space applications shall comply with 5.4. The hardware configuration of the outputs shall be stated in the information for use.	Same as above	P
5.12.4	Dynamic limiting devices		-
	Dynamic limiting is the automatically controlled change in a robot's restricted space during a portion of the robot system's operation. Control devices such as, but not limited to, cam-operated limit switches, light curtains or control-activated retractable hard stops may be utilized to further limit robot movement within the restricted space while the robot performs its task programme. For this, the device and associated control systems shall be capable of stopping the robot motion under rated load and speed conditions and the associated safety-related control systems shall comply with 5.4.2, unless a risk assessment is performed and determines that another category is required.	Not applicable	N/A
5.13	Movement without drive power		-
	The robot shall be designed so that the axes are capable of being moved without the use of drive power in emergency or abnormal situations. Where practicable, moving the axes shall be carried out by a single person.	Moving the axes can be carried out by a single person	P
	Controls shall be readily accessible but protected from unintended operation. Instructions for doing this shall be included in the information for use along with recommendations for training personnel on responding to emergency or abnormal situations.	Only training personnel can operate the machine	P
	The information for use shall include warnings that gravity and the release of braking devices can create additional hazards. Where practicable, warning notices shall be posted near to the activating controls.	Warning notices are provided	P
5.14	Provisions for lifting		-
	Instructions and provisions for lifting the robot and its associated components shall be provided and shall be adequate for handling the anticipated load.	Instructions for lifting the robot are provide in the manual	P
5.15	Electrical connectors		-
	Electrical connectors that can cause a hazard if they are separated, or if they break away, shall be designed and constructed so as to prevent unintended separation.	Compliance with this requirement	P
	Connectors shall be provided with a means to prevent cross-connection.	Compliance with this requirement	P
6	Verification and validation of safety requirements and protective measures		-
6.1	General		-

EN ISO 10218-1			
Clause	Requirement – Test	Result – Remark	Verdict
	The robot manufacturer shall provide for the verification and validation of design and construction of robots including appropriate safeguarding devices in accordance with the principles described in Clauses 4 and 5.	The verification and validation of design and construction of robots in accordance with the principles described in Clauses 4 and 5.	P
	The risk assessment should be reviewed to assess if all reasonably foreseeable hazards have been identified and corrective actions taken.	Risk assessment is done according to EN ISO 12100	P
6.2	Verification and validation methods		-
-	Verification and validation can be satisfied by methods including but not limited to: - A visual inspection; - B practical tests; -C measurement; -D observation during operation; -E review of application-specific schematics, circuit diagrams and design material; -F review of task-based risk assessment; -G review of specifications and information for use.	Verification and validation are satisfied by methods of A to G	P
6.3	Required verification and validation		-
	Annex F lists specific performance requirements that are identified as essential to the safety of the robot that shall be verified or validated, or both. Using appropriate methods, requirements shall be evaluated to determine if they have been adequately met by the design and construction of the robot.	Verified according to Annex F	P
7	Information for use		-
7.1	General		-
	Markings (e.g. signs, symbols) and instructional material (e.g. manuals for operation, maintenance) shall be provided by the manufacturer in accordance with ISO 12100 and IEC 60204-1.	Accordance with ISO 12100 and IEC 60204-1	P
	When provided, machine warning devices (e.g. audible and visual signals) shall be in accordance with ISO 12100 and IEC 60204-1.	Warning devices is in accordance with ISO 12100 and IEC 60204-1	P
7.2	Instruction handbook		-
	In addition to the requirements of 6.1, each robot shall be accompanied by an instruction handbook or appropriate media containing:	See operation manual	P

EN ISO 10218-1			
Clause	Requirement – Test	Result – Remark	Verdict
	<p>a) the business name, full address, and necessary contact information of the manufacturer and if necessary of the authorized representative or authorized supplier;</p> <p>b) instruction for commissioning, programming and restarting procedure including installation requirements such as utility needs, floor loading, environmental conditions, etc.;</p> <p>c) instructions for how the initial test and examination of the robot and its protective measures are to be carried out before first use and being placed into production, including functional testing of reduced speed control;</p> <p>d) instructions for any test or examination necessary after change of component parts or addition of optional equipment (both hardware and software) to the robot which can affect the safety-related functions, including an emergency stop output signal as in 5.5.2 and common enabling circuit as in 5.8.3 d);</p> <p>e) instructions for safe operation, setting and maintenance, including safe working practices, hazardous energy control procedures and the training required to achieve the necessary skill level of persons operating the equipment;</p> <p>f) instructions on location and function of all control systems including diagrams of the interface of electrical, hydraulic, and pneumatic systems necessary for setup and installation;</p>	See operation manual	P
	<p>g) information on the capability of selecting high-speed control using the pendant;</p> <p>h) instructions in order to inform the machine designer that restricted space shall be provided when the robot is foreseen to be used in manual high speed;</p> <p>i) information on installation of limiting devices, including number, location and degree of adjustment of mechanical limiting capability;</p> <p>j) instructions on the number, location and implementation of any non-mechanical limiting devices;</p> <p>k) capabilities of dynamic limiting, when included;</p> <p>l) information on the actual expected stopping position that accounts for the stopping distance travel when using safety-rated soft limiting;</p> <p>m) information on the number and operation of enabling devices and instructions for installation of additional devices including the data and criteria necessary to determine the safety-related control system performance;</p>	See operation manual	P

EN ISO 10218-1			
Clause	Requirement – Test	Result – Remark	Verdict
	<p>n) information on the stopping time and distance or angle from initiation of stop signal of the three axes with the greatest displacement and motion in accordance with the metric in Annex B;</p> <p>o) the safety-related control system performance of the robot safety functions as determined in 5.4;</p> <p>p) the specification for any fluids or lubricants to be used in lubrication, braking, or transmission system internal to the robot, including guidance on correct selection, preparation, application and maintenance of process-unique expendables;</p> <p>q) guidance on the means for the release of persons trapped in or by the machine;</p> <p>r) instructions for movement of robot axes without drive power, including warnings that gravity and the release of braking devices can create additional hazards;</p> <p>s) recommendations for training personnel on responding to emergency or abnormal situations;</p> <p>t) information defining the limits for the range of motion and load capacity, including maximum mass, position of the centre of gravity of the workpiece and work holding fixture;</p> <p>u) procedures to avoid errors of fitting during maintenance of the machine;</p> <p>v) information on relevant standards the robot meets, including any that have been certified by a third party;</p> <p>w) response time of detection of loss of communication signal for cableless pendants;</p> <p>x) information on unprotected hazards associated with expected use of the machine;</p> <p>y) instructions and warnings that manual operation shall be performed with all persons outside the safeguarded space;</p>	See operation manual	P
	<p>z) instructions that prior to selecting automatic mode any suspended safeguards shall be returned to full functionality;az</p> <p>aa) instructions for the proper storage of cableless pendants, if so configured;</p> <p>bb) information on response time and loss of communication of cableless pendants, if so configured;</p> <p>cc) information on the stop category of every protective stop circuit input.</p>	See operation manual	P
	Any changes or additions to the applicable information as provided by the manufacturer shall be provided by the party that makes the change or addition to the robot system.	See operation manual	P
7.3	Marking		-

EN ISO 10218-1			
Clause	Requirement – Test	Result – Remark	Verdict
	<p>Each robot shall be marked in a distinct, legible and durable manner with:</p> <ul style="list-style-type: none"> a) the manufacturer's and, where appropriate, the authorized supplier's business name and complete address; b) the designation of type of machine (i.e. industrial robot) and model number or reference number (if any); c) the month and year of manufacture; d) the mass and/or weight of machine; e) the maximum reach and load capacity; f) supply data for electrical and, where applicable, hydraulic and pneumatic systems (e.g. minimum and maximum pneumatic pressures); g) lifting points for transportation and installation purposes, where applicable. 	See nameplate	P
	<p>Guards, protective devices and other parts that are part of the robot but not fitted shall be clearly identified for their purpose. Any other information needed for fitting shall be provided.</p>	Not applicable	N/A

---End of the report---

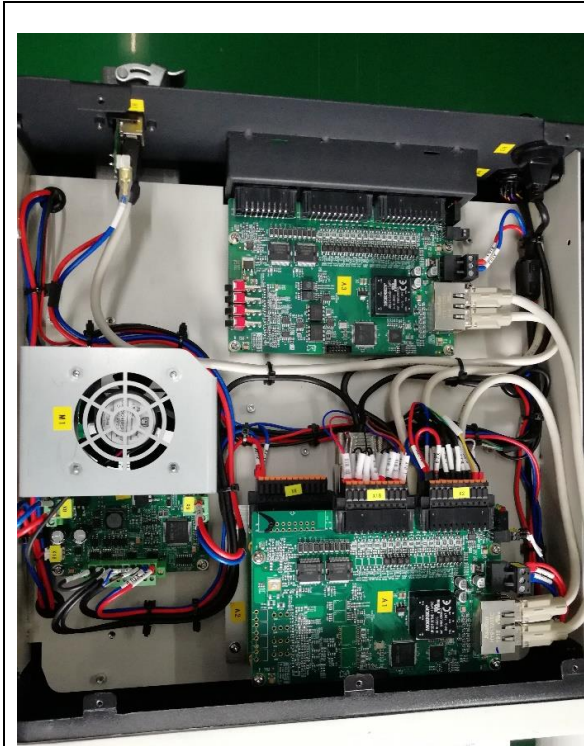
Annex I Photo document

Manipulator



Control box





Teach pendant



---End of Annex I ---