

附件 2

中华人民共和国第三届职业技能大赛

机械行业选拔赛机电一体化项目

专业技术规范


机械工业教育发展中心


二〇二五年五月

Skill 04 - Mechatronic (项目 04 - 机电一体化)




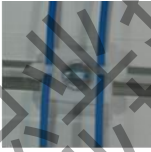
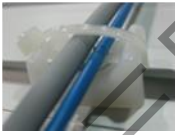


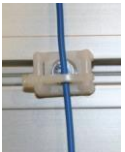




Guideline Professional practice judgment 2024 (2024 专业规范评分指南)








0. GUIDELINES	3 POINTS:	2 POINTS:	1 POINT:	0 POINTS:
	Excellence 优秀	Professional / Still acceptable 专业/仍可接受 (80% Solution)	Optimization / rework necessary 需要优化/返工	Not acceptable 不可接受
Guidelines for marking the aspect - Step 1 标记方面指导-Step 1	ok		not ok	
Guidelines for marking the aspect - Step 2 标记方面指导-Step 2	<p>If all conditions below are fulfilled. To award a mark less than 3 the experts must show the competitors what they need to improve.</p> <p>以下要求全部达到。如果没有得到 3 分，裁判应指出选手需要改进之处。</p>	<p>If there are one or a few minor deviations.</p> <p>有一个或少许小偏差。</p>	<p>If there is a major deviation or more than a few minor deviations.</p> <p>有一个重大偏差或很多小偏差。</p>	<p>If the work is far from the standard specified.</p> <p>与指定标准差距很大。</p>






1. CLEANLINESS OF THE WORKPLACE AND THE STATION 1. 工作场所和工作站的清洁程度	3 POINTS: Excellence 优秀	2 POINTS: Professional / Still acceptable 专业/仍可接受 (80% Solution)	1 POINT: Optimization / rework necessary 需要优化/返工	0 POINTS: Not acceptable 不可接受
Tools must not be left on the stations, chairs, or the floor of workspace. 工具不能留在工作站、椅子或工位的地板上。				
Unused components and workpieces must be removed from the stations. 未使用的组件和工件必须从工作站上拿走。				
Stations must be free of waste, off-cuts or any other debris. This also includes the inside of cable channels. 工作站上和线槽内必须无垃圾、边角料或任何其他物料碎片。				
Unused parts have to be placed together on the table or in a box. Unused parts shall be separated from tools, waste, and consumables that the team have supplied. Also Documentation in EN have to be placed in the box 未使用的零件必须统一放在桌子上或盒子里。 未使用的零件应与团队提供的工具、垃圾、耗材分开。 英文的文档资料必须放在盒子里。				

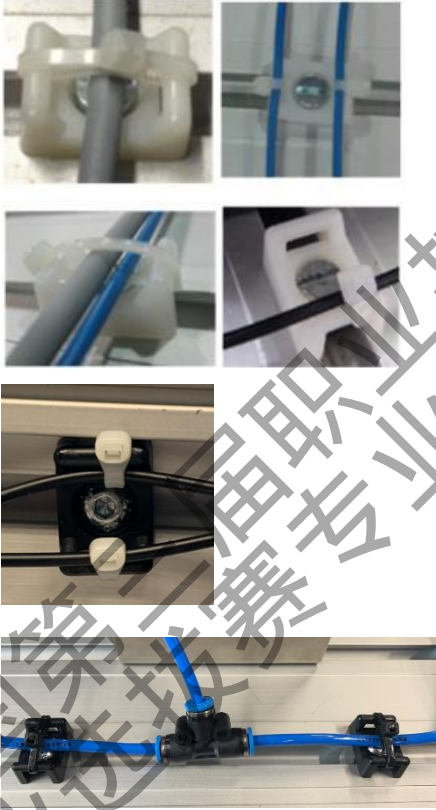
<p>Markings (tape, pencil, etc.) may be used during the tasks, but in that case, they must be removed completely before evaluation.</p> <p>标记物(胶带、铅笔等)在工作期间可以使用,但在评分之前必须将其完全清除。</p>		
<p>The floor of the workspace shall be clean from waste generated from the competitors work.</p> <p>工位的地板应打扫干净,没有选手在工作中产生的垃圾。</p>		
	<p>At the end of competition time, the workplace is tidy, including on the tables.</p> <p>The floor of the workspace shall be clean from waste generated from the competitor's work.</p>	

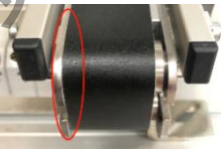


	3 POINTS:	2 POINTS:	1 POINT:	0 POINTS:
2. ROUTING OF TUBES AND CABLES 2. 气管和缆线的布置	Excellence 优秀	Professional / Still acceptable 专业/仍可接受 (80% Solution)	Optimization / rework necessary 需要优化/返工	Not acceptable 不可接受
<p>Cable, tubes and water piping must be routed separately. Optical cables may be tied to electrical cables.</p> <p>Exception to this rule when the cables and tubes are connected to a moving module. In this case routing all cables and tubes together is preferred.</p> <p>电缆、气管、水管必须分开布置。光纤可以与电缆一起绑扎固定。当电缆和气管连接到移动模块时例外，在这种情况下，所有电缆和气管一起布置是首选。</p>				
<p>Remaining length of cut cable ties, A: $A \leq 1$ mm</p> <p>剪断后的扎带长度 A:</p> <p>$A \leq 1$ mm</p>				
<p>All cables and tubes going downwards on a profile e.g. at the “Pick & Place” station have to be mounted with cable- holders and tie.</p> <p>所有的电缆和气管都沿型材往下，例如在“提取 & 放置”站，电缆和气管必须用电缆固定座和扎带固定。</p>				



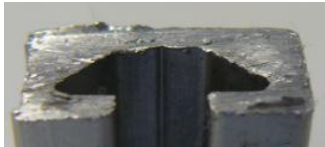

<p>Distance between cable ties: ≤ 50 mm. This also applies to cables line under the profile plate. 扎带间距: ≤ 50 mm. 这同样适用于型材台面下的电缆线。</p>		
<p>The only acceptable method for binding Cable / Wire / Optical Cables / Tubes is to use cable holders. Cables and tubes shall be tightened to the cable holder. The cable tie shall go through both sides of the holder. For single wire it is allowed to use just one side. 只能用电缆固定座来固定电缆/电线/光纤/气管。电缆和气管应被紧固到电缆固定座上。扎带应穿过固定座的两端。对于单根电线，允许只穿过固定座一侧。</p>	   	  
<p>Distance between cable holders ≤ 120 mm Short connections between optical sensor and transmitter are also allowed. No coiling of the cables, if proper cut to length is possible. Exceptions can be announced in special cases. 电缆固定座间距 ≤ 120 mm 光电传感器和发射器之间的短连接也是允许的。如果可以把电缆剪切成适当长度的情况下，不能将其盘成圈。 在特殊情况下可以公布例外情况。</p>		  
<p>Conductors passing over DIN rails or routed around sharp corners must be secured using 2 cable holders. 必须使用 2 个电缆固定座来固定通过 DIN 导轨或绕</p>		



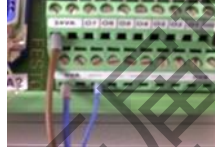





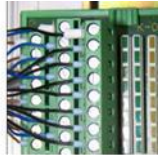
尖角转弯的导线。		
<p>Airflow must not be restricted by kinks in the tubing, over-tight cable ties, etc.</p> <p>不能让气管弯折或过紧的扎带等阻碍气流。</p>		
<p>No pneumatic tubes routed through cable channels.</p> <p>气管不能从线槽中穿过。</p>		
<p>All cables and tubes routed through a flexible cable duct / drag chain must be fixed to the end of the chain, using cable ties.</p> <p>所有穿过拖链的电缆和气管都必须使用扎带将其固定在拖链的末端。</p>		
<p>Distance from the shortest pneumatic connection to the first cable tie: 60 mm +/- 5mm</p> <p>Airflow must not be restricted</p> <p>气动接头到第一根扎带的距离为: 60 mm +/- 5mm</p> <p>不能阻碍气流</p>		
<p>Pneumatic and water connections must be leak-free.</p> <p>气管、水管的连接处必须无泄漏。</p>		


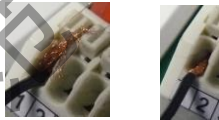


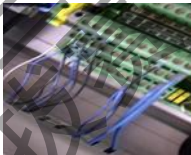
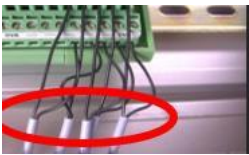
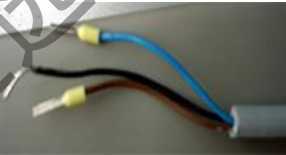
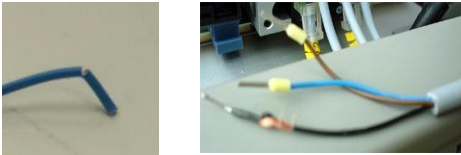
<p>Bending radius of light conductor > 25 mm 光纤的弯曲半径>25 mm</p>		<p>Radius too small but sensor works 弯曲半径太小但能工作</p>	<p>Light conductor broken because of too small bending radius. 由于弯曲半径太小光纤损坏</p> 
<p>Cables and tubes tied together do not cross each other more than necessary. 若非必要，绑在一起的电缆和气管不得相互交叉。</p>			
	<p>The only acceptable method for binding Cable / Wire / Optical fiber / Tubes is to use cable holders. Cables and tubes shall be tightened to the cable holder. The cable tie shall go through both sides of the holder. For single wire and for optical fiber it is allowed to use just one side. 对于线缆/导线/光缆/气管唯一可接受的捆扎方式就是使用线缆固定器，电缆和气管应该扎紧在固定器上，线缆扎带可以穿过固定器的两侧，单根导线只能用固定器的一侧。</p>		 <p>0 Points</p>

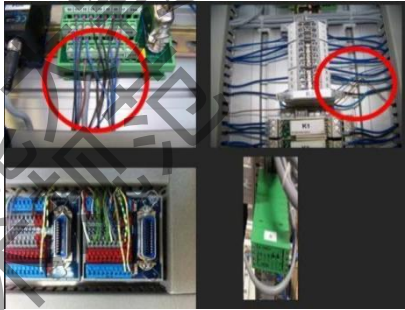



			
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3. MECHANICAL IMPLEMENTATION 3. 机械安装	3 POINTS: Excellence 优秀	2 POINTS: Professional / Still acceptable 专业/仍可接受 (80% Solution)	1 POINT: Optimization / rework necessary 需要优化/返工	0 POINTS: Not acceptable 不可接受
All system components and modules must be secured. Check by Hand of Expert 保证系统中所有元件和模块必须紧固。 此项由专家用手检查				
All actors and workpieces have to move without collisions. Note: This must be noted by PLC evaluation team 所有的执行器和工件在移动时不得发生碰撞注意: 此项由 PLC 评分组记录	Free movement of all actuators, cables, tubing and workpieces.	Minor collision, for example tubing touching a moving part, not affecting the function. 	Major collision, for example if gripper crashes to the workpiece, or workpieces fall off the system.	
Adjoining stations must be connected with at least 2 connectors. 相邻的工作站的连接必须用至少 2 个单元连接件。				
All ends of profiles must be fitted with caps. 所有型材的末端都必须安装盖子。				



<p>Use min. at least 2 screws with washers to secure any section of cable channel.</p> <p>Expert will open the cable channel to see that.</p> <p>固定线槽，需要使用至少 2 个带垫片的螺钉。</p> <p>此项由专家打开线槽盖检查。</p>		
<p>Screw heads have to be undamaged. 螺钉头必须没有损坏。</p>		
<p>Saw-cuts must be burr-free.</p> <p>锯切口必须无毛刺。</p>		
<p>Parts of devices and components should not extend beyond the profile plate.</p> <p>Exceptions will be announced by the expert team.</p> <p>设备和组件的部分不得超出型材台面之外。</p> <p>例外情况将由专家团队宣布。</p>		
<p>All components shown in the 3d sketches and photos have to be assembled and placed approximately in the designated area on the correct MPS Station / Trolley / Profile plate - function as intended</p> <p>3D 草图和照片中的所有部件必须大致组装并放置在正确的 MPS 站/小车/型材板上的指定区域 - 功能如预期</p>		<p>Missing component not affecting the function of the system.</p> <p>缺少元件，但不影响系统功能。</p>
		<p>Missing component affecting the function of the system.</p> <p>缺少元件，影响了系统功能。</p>


4. ELECTRICAL INSTALLATION AND WIRING OF THE COMPONENTS 4. 电气安装和元件接线	3 POINTS: Excellence 优秀	2 POINTS: Professional / Still acceptable 专业/仍可接受 (80% Solution)	1 POINT: Optimization / rework necessary 需要优化/返工	0 POINTS: Not acceptable 不可接受
All signal terminations must be secured. Check by Hand of Expert 所有信号接头必须固定好。 此项由专家用手检查。				
Bare conductors must not be visible at end sleeves. 冷压端子处不能看到裸露的导线				
Insertion of end sleeves into terminals 将冷压端子全部插入端子座。			Uninsulated portion of end sleeve visible 	
Insulated end sleeves of the correct size for the wire must be used on all screw terminals Available sizes are: 0.25, 0.5, 0.75 mm ² Exceptions for clamp connections (only for screws) 所有螺钉式接线端子上必须使用恰当尺寸的冷压端子。 可用尺寸为: 0.25、0.5、0.75mm ² 夹钳式连接除外 (只适用于螺钉式)				

<p>Clamp type connections may be made without the use of end sleeves. 夹钳式连接可以不使用冷压端子。</p>		<p>Bare conductors must not extend beyond terminal.</p> 
<p>Electrical cables must have a minimum of 100 mm reserve in the cable channel. Unnecessary when it is a bridge in the same cable channel. Expert will open the cable channel to see that. 电缆必须在线槽中至少保留 100mm 的长度。 同一线槽内的短接线，则不需要预留长度。 此项由专家打开线槽盖检查。</p>		
<p>Outer cable insulation must not extend beyond cable channel. 电缆外部绝缘层不得超出线槽外。</p>		
<p>No damage to wire insulation or exposure of bare conductors. Check by Hand of Expert 不得损坏电线绝缘层，或裸露导体。 此项由专家用手检查。</p>		

<p>Conductors between cable channel and terminals must not cross.</p> <p>One sensor / actuator connection per cable duct slot is allowed.</p> <p>No wiring over components</p> <p>线槽和接线端子间的导线不得交叉。</p> <p>一个传感器/执行器允许对应一个线槽槽齿。</p> <p>电线不得在组件上跨越。</p>		
<p>Loose ends of wire must be tied back to cable and must have the same length as used wires.</p> <p>Insulation must be left to prevent any contact being made. This applies both inside and outside of the cable channel.</p> <p>松散的电线必须绑回电缆上，并且必须和已使用的电线长度相同。</p> <p>必须保留绝缘层，以防止发生短路接触。</p> <p>这项规范适用于线槽内外。</p>		
<p>Cable channels must be completely closed with all teeth under the cover.</p> <p>线槽必须完全关闭，所有槽齿必须盖严。</p>		
<p>Removal of cable channel teeth.</p> <p>Note: There will be no replacement of the channel.</p> <p>线槽槽齿的去除</p> <p>注意：没有多余的线槽提供替换。</p>		
<p>光纤、传感器电缆、线缆预留指定长度</p>	<p>光纤、传感器电缆、线缆长度 \geq 指定长度</p>	<p>光纤、传感器电缆、线缆长度 $<$ 指定长度</p>

	3 POINTS:	2 POINTS:	1 POINT:	0 POINTS:
5. HMI – DESIGN 5. 人机界面设计	Excellence 优秀	Professional / Still acceptable 专业/仍可接受 (80% Solution)	Optimization / rework necessary 需要优化/返工	Not acceptable 不可接受
The colors of the Switches and push buttons match like in the T-description 开关和按钮的颜色与任务描述中的一致				
The forms match like in the T-description! 形状与任务描述中的一致!				
The texts and Symbols match like in the T-description and ther is no overlap! 文本和符号与任务描述中的一致, 没有重叠!				
All required components are implemented like designed in the T- description! 所有必需的组件都按照任务描述中的设计实现功能!				
The elements are arranged like the designed grid! 各元素按照设计的网格排列!				
The overall impression of the HMI pages! HMI 页面的整体印象!				

6. SPECIAL CASES, ANNOUNCED BY EXPERTS AND THE OVERALL IMPRESSION 6. 由专家公布的特殊情况及整体印象	3 POINTS:	2 POINTS:	1 POINT:	0 POINTS:
	Excellence 优秀	Professional / Still acceptable 专业/仍可接受 (80% Solution)	Optimization / rework necessary 需要优化/返工	Not acceptable 不可接受
No parts or components should be lost or damaged during assembly of equipment. Note: This must be noted by the time keeper if replacements need to be supplied 设备组装过程中，零部件不得丢失或损坏。 注意：如果需要更换零部件，必须由计时裁判记录。				
Competitors shall not work in a way where they risk injury to themselves, or other people. This includes the use of prohibited tools and cleaning with compressed air. Note: This must be noted by the time keeper and verified by the ESR for H&S. 选手不能使用对自己或其他人造成伤害的方式工作。这包括使用违禁工具和使用压缩空气清洁。 注意：此项由计时裁判记录，并由健康与安全特别职责专家审核。				
All warning labels must be affixed and in the specified positions. 所有警告标签必须贴在指定位置。				
For the evaluation the profile plate has to be in the lowest possible position. 为便于评分，型材台面必须在可以达到的最低位置。				

<p>It is not allowed to prepare workpieces with tape or similar additives.</p> <p>Note: This must be noted by PLC evaluation team Exceptions will be announced by the expert team.</p> <p>不允许准备带有胶带或类似记号的工件。注意：此项由PLC 评分组记录。例外情况将由裁判宣布。</p>		
	<p>Aspects not evaluated in previous aspects and which have not yet influenced the overall impression</p> <p>在之前的评判中没有评价过的方面和那些还没有影响到整体印象的方面</p>	