

18 Electrical Installation

WorldSkills Standards Specification

Section	WSSS Marks
1	Work organization and management
2	Communication and interpersonal skills
3	Problem solving, innovation, and creativity
4	Planning and design
5	Installation
6	Testing, reporting, and commissioning
7	Maintenance, fault finding, and repair

Criteria

ID	Name
A	Testing, Reporting and Commissioning

B	Circuit Design & Manual Function
C	Measurements & Level/Plumb
D	Installation of Equipment & Wire-ways
E	Wiring & Terminations
F	Fault finding, Testing and Reporting
G	Programming & Automatic Function
H	
I	

Sub Criterion ID	Sub Criterion Name or Description	Day of Marking	Aspect Type M = Meas J = Judg	Aspect - Description	Judg Score
A1	Commissioning process	4	M M M M M M M M	Installation complete when electrical supply is requested Safe electrical installation when electrical supply is requested Safe work practices Safe work practices Safe work practices No short circuits or earth faults Labeling Function chart	
Sub Criterion ID	Sub Criterion Name or Description	Day of Marking	Aspect Type M = Meas J = Judg	Aspect - Description	Judg Score

B1	Circuit design	4	M	Size - supply cabling PS to A1	
			M	Colour codes - supply cabling PS to A1	
			M	Size - supply cabling A1 to B1	
			M	Colour codes - supply cabling A1 to B1	
			M	Size - supply cabling B1 to Motor	
			M	Size - cabling for lights	
			M	Size - cabling for power outlets	
			M	Size - cabling for heater	
			M	Size - cabling for air condition	
B2	Manual Function - KNX	4	M	Switch actuator Channel A1	
			M	Switch actuator Channel A2	
			M	Switch actuator Channel A3	
			M	Switch actuator Channel A4	
			M	Switch actuator Channel A5	
			M	Switch actuator Channel A6	
			M	Switch actuator Channel A7	
B3	Manual function - Motor	4	M	Motor runs in forward direction when S11 is pressed. Motor stays	
			M	Forward indicator lamp H11 operated when motor running in forw	
			M	Motor swith from Star to Delta after 5 seconds (S11 still pressed)	
			M	S13 have no function until motor has stopped	
			M	Motor runs in reverse direction when S13 is pressed. Motor stays	
			M	Forward indicator lamp H13 operated when motor running in reve	
			M	Motor swith from Star to Delta after 5 seconds (S13 still pressed)	
			M	S11 have no function until motor has stopped	
			M	Emergency stop S12 stops motor when running in any direction.	
B4	Manual function - Lighting	4	M	S1, S2, S3, S4 controlles H1 independantly as per instructions. A	
Sub Criterion ID	Sub Criterion Name or Description	Day of Marking	Aspect Type M = Meas J = Judg	Aspect - Description	Judg Score
C1	Measurements	2	M	Measurement 1 (A1 right hand side to center line)	

C2	Plumb/Level	2	M M M M M M M M M	Measurement 2 (Difference from right and left hand side of B1 to Measurement 3 (Center of B3 to centerline) Measurement 4 (Center of H2 to back wall) Measurement 5 (Top of PS to center line) Item 1 (B2) Level/Plumb Item 2 (B3) Level/Plumb Item 3 Horizontal tray on right hand panel - Level Item 4 Vertical trunking on center wall - Plumb Item 5 Vertical minitrunking to S2- Plumb	
Sub Criterion ID	Sub Criterion Name or Description	Day of Marking	Aspect Type M = Meas J = Judg	Aspect - Description	Judg Score
D1	Installation of Equipment	3	M M M M M M M M M M M M	Correct equipment in correct locations on left wall of cubicle as per drawing Correct equipment in correct locations on back wall of cubicle as per drawing Correct equipment in correct locations on right hand wall of cubicle as per drawing Correct equipment in correct locations in panel B1 as per drawing Correct equipment in correct locations in B1 A1 securely installed B1 securely installed B2 securely installed B3 securely installed S1 securely installed S5 securely installed S8 securely installed	
D2	Installation of Wireways (Trunking and tray)	3	J J	PVC Trunking. Securely fitted. Joints and angles are neat with no visible gaps PVC Mini Trunking. Securely fitted. Joints and angles are neat with no visible gaps	0 1 2 3 0 1

D3	Installation of Wireways (Cable and conduits)	3	J	Mesh tray. Securely fitted. Bends are equally shaped. Secure with	2 3 0 1 2 3
			J	Cable. Correctly clipped with straight runs and even bends.	0 1 2 3
			J	PVC conduits. Bends, angles and jumps are even with no distortion	0 1 2 3
			J	Flexible conduit. Bends and angles are even	0 1 2 3
Sub Criterion ID	Sub Criterion Name or Description	Day of Marking	Aspect Type M = Meas J = Judg	Aspect - Description	Judg Score
E1	Wiring in boards	4	J	Neatness of wiring in A1	0 1 2 3
			J	Neatness of wiring in B1,	0 1

E2	Cabling on tray	3	J	Neatness of cables on mesh tray	2 3
E3	Terminations	4	M M M M M	A1: All conductors securely terminated with no bare copper show B1: All conductors securely terminated with no bare copper show B2: All conductors securely terminated with no bare copper show S1: All conductors securely terminated with no bare copper show H4: All conductors securely terminated with no bare copper show	0 1 2 3
Sub Criterion ID	Sub Criterion Name or Description	Day of Marking	Aspect Type M = Meas J = Judg	Aspect - Description	Judg Score
F1	Fault Finding	3	M M M M M M M M M M M	Fault 1 Fault 2 Fault 3 Fault 4 Fault 5 Fault 6 Fault 7 Fault 8 Fault 9 Fault 10	
F2	Testing and reporting	4	M M M M	Insulation resistance test - instrument and procedure Insulation resistance test - value and unit report sheet Earth Continuity test - instrument and procedure Earth Continuity test - value and unit report sheet	

Sub Criterion ID	Sub Criterion Name or Description	Day of Marking	Aspect Type M = Meas J = Judg	Aspect - Description	Judg Score
G1	Programming/Automatic function KNX	4	M M M M M M M M M M	S5 Button 1 ON/DIM up H1, S5 Button 2 OFF/DIM down H1 S5 Button 3 ON/OFF H1, S5 Button 4 DIM up/down H1 S6 Button 1 set S6 Thermostat in heating mode, S6 Button 2 set S6 Thermostat in cooling mode S6 Button 3 switch on sockets O1, O2, O3 and O4. S6 Button 4 switch off sockets O1, O2, O3 and O4 S6 Display shift between internal temperature and temperature from room S6 Thermostat operates P1 and P2 in heating and cooling mode S7 Button 1 ON/OFF H3, S5 Button 2 DIM up/down H3 S7 Button 3 Scenario: H1=50%, H2=ON, H3=100%, O1 and O2=ON S7 Button 4 Scenario: All dimmer channels=OFF, All switch actuators=ON S8 rocker up=S6 Thermostat in comfort mode, S8 rocker down=S6 Thermostat in heating mode	
G2	Programming/Automatic function Motor LOGO	4	M M M M	Function 1 - Operation Function 2 - Operation Function 3 - Operation Function 5 - Operation	
G3	Interworking LOGO/KNX	4	M M M	Function 1 - Interworking Function 2 - Interworking Function 3 - Interworking	
Sub Criterion ID	Sub Criterion Name or Description	Day of Marking	Aspect Type M = Meas J = Judg	Aspect - Description	Judg Score
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	WSSS Marks	Aspect Marks	Variation
	5.00	4.00	1.00
	5.00	5.00	0.00
	5.00	6.50	1.50
	10.00	9.00	1.00
	35.00	34.50	0.50
	25.00	25.00	0.00
	15.00	16.00	1.00
	Total Variation		5.00

	Mark
	10.00

	20.00
	10.00
	15.00
	10.00
	15.00
	20.00

Extra Aspect Description (Meas or Judg) OR Judgement Score Description (Judg only)	Requirement (Measurement Only)	WSSS Section	Calculation Row (Export only)	Max Mark
Installation fully complete (all equipment and covers in place)	yes or no	5		1.00
Installation electrically safe (all equipment fixed in place and covers in place)	yes or no	5		1.00
Safe work practices during power-up (all circuits powered)	yes or no	6		0.75
Safe work practices during commissioning. If any unsafe practices observed	yes or no	6		0.75
Safe work practices during programming. If any unsafe practices observed	yes or no	6		0.50
No short circuits or earth faults during power-up and commissioning	yes or no	6		2.00
All equipment labelled correctly following commissioning	yes or no	6		2.00
Function chart completed by competitor reflecting actual function	yes or no	6		2.00
Extra Aspect Description (Meas or Judg) OR Judgement Score Description (Judg only)	Requirement (Measurement Only)	WSSS Section	Calculation Row (Export only)	Max Mark

Criterion A

Total
Mark

10.00

Criterion B

Total
Mark

20.00

2,5mm2	yes/no	4		0.75
Colour code as per instructions	yes/no	7		0.50
2,5mm2	yes/no	4		0.75
Colour code as per instructions	yes/no	7		0.50
2 parallell 4x1,5 and both earth conductors terminated in b	yes/no	4		0.75
1,5mm2	yes/no	7		0.50
1,5mm2	yes/no	4		0.50
2,5mm2	yes/no	7		0.25
1,5mm2	yes/no	4		0.25
Note:If any item requiring an earth is not earthed then any	yes/no	6		0.50
Operates Socket for Heater	yes/no	6		0.50
Operates Socket for Cooler (Air Condition)	yes/no	6		0.50
Operates Socket O3	yes/no	6		0.75
Operates Socket O1	yes/no	6		0.75
Operates Socket O2	yes/no	6		0.75
Operates Socket O4	yes/no	6		0.75
Note:If any item requiring an earth is not earthed then any	yes/no	7		1.25
Sequence 2	yes/no	7		0.50
Sequence 3	yes/no	7		1.25
Sequence 4	yes/no	7		1.00
Sequence 5	yes/no	7		1.25
Sequence 6	yes/no	7		0.50
Sequence 7	yes/no	7		1.25
Sequence 8	yes/no	7		1.00
Sequence 9	yes/no	7		1.25
On/Off from all places without light leaving on or off when	yes/no	5		1.50
Extra Aspect Description (Meas or Judg) OR Judgement Score Description (Judg only)	Requirement (Measurement Only)	WSSS Section	Calculation Row (Export only)	Max Mark
Plus or minus 2mm horizontally	300	5		1.00

Criterion C Total Mark 10.00

Plus or minus 2mm horizontally	0	5		1.00
Plus or minus 2mm horizontally	400	5		1.00
Plus or minus 2mm	200	5		1.00
Plus or minus 2mm vertically	800	5		1.00
Bubble on or between lines on level, not outside	yes/no	5		1.00
Bubble on or between lines on level, not outside	yes/no	5		1.00
Bubble on or between lines on level, not outside	yes/no	5		1.00
Bubble on or between lines on level, not outside	yes/no	5		1.00
Bubble on or between lines on level, not outside	yes/no	5		1.00
Extra Aspect Description (Meas or Judg) OR Judgement Score Description (Judg only)	Requirement (Measurement Only)	WSSS Section	Calculation Row (Export only)	Max Mark
Visual Check by marking team	yes/no	1		0.80
Visual Check by marking team	yes/no	1		0.80
Visual Check by marking team	yes/no	1		0.80
Visual Check by marking team	yes/no	1		0.80
Visual Check by marking team	yes/no	1		0.80
No roll or movement of A1	yes/no	5		0.75
No roll or movement of B1	yes/no	5		0.75
No roll or movement of B2	yes/no	5		0.50
No roll or movement of B3	yes/no	5		0.50
No roll or movement of S1	yes/no	5		0.50
No roll or movement of S5	yes/no	5		0.50
No roll or movement of S8	yes/no	5		0.50
		5		1.25
Below industry standard or no attempt: Joints are badly cut				
Meets industry standard: Joints are neat and even but with				
Industry standard with elements of good practice: Joints are				
Excellent in comparison to industry standard: Joints are ne				
		5		0.75
Below industry standard or no attempt: Joints are badly cut				
Meets industry standard: Joints are neat and even but with				

Criterion D Total Mark 15.00

Industry standard with elements of good practice: Joints are neat and even Excellent in comparison to industry standard: Joints are neat and even		5		1.25
Below industry standard or no attempt: Joints are badly cut and uneven Meets industry standard: Joints are neat and even but with some minor issues Industry standard with elements of good practice: Joints are neat and even Excellent in comparison to industry standard: Joints are neat and even		5		1.25
Below industry standard or no attempt: Clips unevenly spaced Meets industry standard: Cable straight and even with good clips Industry standard with elements of good practice: Cable straight and even Excellent in comparison to industry standard: Cable straight and even		5		1.75
Below industry standard or no attempt: Saddles not evenly spaced Meets industry standard: Majority of bends have even radii Industry standard with elements of good practice: All of the bends have even radii Excellent in comparison to industry standard: All of the bends have even radii		5		0.75
Below industry standard or no attempt: Saddles not evenly spaced Meets industry standard: Majority of bends have even radii Industry standard with elements of good practice: All of the bends have even radii Excellent in comparison to industry standard: All of the bends have even radii				
Extra Aspect Description (Meas or Judg) OR Judgement Score Description (Judg only)	Requirement (Measurement Only)	WSSS Section	Calculation Row (Export only)	Max Mark
Below industry standard or no attempt: All cables not loomed Meets industry standard: All looms are neat and tidy but with some minor issues Industry standard with elements of good practice: All looms are neat and tidy Excellent in comparison to industry standards: All looms are neat and tidy		5		2.00
Below industry standard or no attempt: All cables not loomed Meets industry standard: All looms are neat and tidy but with some minor issues Industry standard with elements of good practice: All looms are neat and tidy Excellent in comparison to industry standards: All looms are neat and tidy		5		2.00

Criterion E Total Mark 10.00

Industry standard with elements of good practice: All looms Excellent in comparison to industry standards: All looms w				
		5		2.00
Below industry standard or no attempt: All cables not cable Meets industry standard: Cables neat and tidy but cable tie Industry standard with elements of good practice: Cables Excellent in comparison to industry standards: Cables we				
No copper visible when viewed at 90 degrees and no dam		5		1.00
No copper visible when viewed at 90 degrees and no dam		5		1.00
No copper visible when viewed at 90 degrees and no dam		5		0.75
No copper visible when viewed at 90 degrees and no dam		5		0.75
No copper visible when viewed at 90 degrees and no dam		5		0.50
Extra Aspect Description (Meas or Judg) OR Judgement Score Description (Judg only)	Requirement (Measurement Only)	WSSS Section	Calculation Row (Export only)	Max Mark
The correct fault symbol must be drawn in the correct loca	yes/no	7		1.00
The correct fault symbol must be drawn in the correct loca	yes/no	2		1.00
The correct fault symbol must be drawn in the correct loca	yes/no	7		1.00
The correct fault symbol must be drawn in the correct loca	yes/no	2		1.00
The correct fault symbol must be drawn in the correct loca	yes/no	7		1.00
The correct fault symbol must be drawn in the correct loca	yes/no	2		1.00
The correct fault symbol must be drawn in the correct loca	yes/no	7		1.00
The correct fault symbol must be drawn in the correct loca	yes/no	2		1.00
The correct fault symbol must be drawn in the correct loca	yes/no	7		1.00
The correct fault symbol must be drawn in the correct loca	yes/no	2		1.00
Suitable instrument and correct procedure used to get the	yes/no	6		1.25
Both value and unit must be entered correctly	yes/no	3		1.25
Suitable instrument and correct procedure used to get the	yes/no	6		1.25
Both value and unit must be entered correctly	yes/no	3		1.25

Criterion F Total Mark 15.00

Extra Aspect Description (Meas or Judg) OR Judgement Score Description (Judg only)	Requirement (Measurement Only)	WSSS Section	Calculation Row (Export only)	Max Mark
Operation as per instructions	yes or no	6		0.25
Operation as per instructions	yes or no	6		0.25
Operation as per instructions	yes or no	6		0.50
Operation as per instructions	yes or no	6		0.50
Operation as per instructions	yes or no	6		1.00
Operation as per instructions	yes or no	6		1.00
Operation as per instructions	yes or no	6		1.50
Operation as per instructions	yes or no	6		1.50
Operation as per instructions	yes or no	6		1.50
Operation as per instructions	yes or no	6		2.00
Push S21, H24 immediately switch off, after 2 seconds H2	yes or no	4		2.00
Push S22, H22 immediately switch off, after 2 seconds H2	yes or no	4		2.00
H22 and H24 can never be energized at the same time	yes or no	4		1.00
H21 and H23 shall always be turned on initially when control	yes or no	4		1.00
H2 lights up 5 seconds after a passage in through traffic control	yes or no	3		1.50
H2 and H3 switch off 5 seconds after passage out through traffic control	yes or no	3		1.50
H4 dims down 10 seconds after passage out through traffic control	yes or no	3		1.00
Extra Aspect Description (Meas or Judg) OR Judgement Score Description (Judg only)	Requirement (Measurement Only)	WSSS Section	Calculation Row (Export only)	Max Mark
Extra Aspect Description (Meas or Judg) OR Judgement Score Description (Judg only)	Requirement (Measurement Only)	WSSS Section	Calculation Row (Export only)	Max Mark

Criterion G Total Mark 20.00

Criterion H Total Mark 0.00

Criterion I Total Mark 0.00

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Competition	Total Mark	100.00
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