

ELECTRICAL INSTALLATION



Participant's name	Nationality

The judges	Nationality

Description of the competition task

The participant shall install and put into service the electrical installation as provided in the attached documentation. All work must be performed in accordance with HSE and electrical safety regulations. The competition task must be installed, controlled and put into operation within the available time.

The task is divided into three parts: lighting control - heating system - motor control.

The task contains the following documents:

- Description of the competition task
- Evaluation of the competition task
- Time schedule
- Overview over components in the installation
- Plans of the installation
- Documentation of group central GC
- Documentation of motor central MC
- Measuring scheme
- Assessment criteria with points

A total of 7.5 hours have been set aside for the assignment.

Group Central GC

The group central is completed and installed in the workstation in advance. The central shall provide all parts of the assignment. The cable insulation should be led 10-30 mm inside the central. There must be a minor rebuilding in the central. Before starting installation work, the circuit breaker used on group no. 8 has to be replaced with a more suitable circuit breaker, which will be available.

All equipment must be installed in accordance with HSE and electrical safety regulations in such a way that the completed installation can be put into operation.

Wiring for power supply of circuits must be carried out so that the end connected to the central is the last to be connected.

Motor Central MC

The motor is a three-phase asynchronous short-circuit motor which is controlled using a contactor and smart relay / PLS located in motor central MC. The MC has been completed in forehand and the smart relay / PLS has been pre-programmed. The participant shall perform mounting and connection of wire for power supply to the MC and wire from MC to the motor.

Central MC shall be supplied from GC. The cable insulation should be led 10-30 mm inside the central.

Cables and conductors

Cables and conductors should be fastened according to good installation method. The cables must be fastened with nail clamps and / or screw fasteners. Installation shall be carried out as on surface arrangement.

A protective pipe adapted to industrial-like environments must protect the wire for power supply of the motor. Wires from the centrals must be installed in accordance with the group listings and associated circuit breaker.

The cable insulation should be inserted 5-10 mm into equipment as junction boxes, switches, lamps and motors.

Operation of electric motor

Condition of the motor must be measured before installation of the motor commences and the results must be recorded on a dedicated form following the documentation of the task. The direction of rotation of the motor must be clockwise, and it must be mounted on the wall so that the motor shaft is horizontally and to the right.

Lighting

Lighting control includes a luminaire, which is controlled by wall mounted switches. The cable must be connected to the luminaire in a professional manner in accordance with the requirements for open installation. The lamp's IP degree must not be impaired during installation.

Thermal Management

The heating system includes a heater that is controlled by a plug-in thermostat.

Marking

All circuit breakers and cables must be marked in distribution GC and MC.

Group listing must be completed in distribution GC and MC

Documentation

Documents related to installation work such as drawings, installation instructions and measurement forms must

be handed over to judges.

The same goes for documentation of equipment and user manuals.

Inspection of the installation

Once the installation is completed and before the job is handed over to the judge, an inspection of the installation must be performed. During commissioning, continuity measurement of protective conductors and measurement of insulation resistance are performed. On the RCD's it is required to check trip time, trip current and test button. The results of the measurements must be recorded on the inspection form included in the documents following the task. The inspection form will be delivered to the referee.

Judge shall be present during completion of the inspection.

User Manual

After the job is completed, the installation will be handed over to the customer, which in this task is one of the judges. The handover should enable the customer to cope with basic usage and the most common errors that may occur in the installation. The customer must be able to disconnect the power supply in case of emergency. The customer must also be advised of the necessary maintenance of the installation.

Sustainable development, entrepreneurship and attitudes

In carrying out the installation work, the principles for sustainable development must be taken into account, insofar as they apply to this work. This means handling equipment, remains and waste. For work that affects work capacity, physically excess workload must be avoided.

Attitudes towards entrepreneurship and entrepreneurial spirit are reflected in; quality of work done, self-motivated work, skills for problem solving and ability to assess own work. The participant must be prepared to present to the judge his own assessment of whether the work is in a condition that can be handed over to the customer.

Equipment and tools that the participant must bring along

- Hand tools for electricians
- Cordless screwdriver with bit kit
- Multimeter
- Instrument for test of insulation resistance and continuity
- Instruments for testing earth fault switches/RCD's
- Workwear, protective clothing and personal protective equipment (gloves, safety goggles and hearing protection)

Evaluation of the competition task

The competition task is evaluated on a scale from 0 to 100 p.

- | | |
|--|------|
| • Work and electricity safety | 18 p |
| • Commissioning, testing and operation | 20 p |
| • Circuit design | 18 p |
| • Attachment of devices and conductors | 10 p |
| • Wiring and connections | 14 p |
| • Customer service and documentation | 10 p |
| • Sustainable development, entrepreneurship and attitude | 10 p |

In the evaluation process, all judges assess the following subjects: work and electrical safety, sustainable development, entrepreneurship and attitude. Other items of the evaluation will be divided so that the same judges will evaluate the same evaluation target from all the competitors.

If problems arise during work, it's allowed for participants to turn to the judges to go ahead with the task. The participant is not allowed to speak directly to the judge. Issues regarding arrangements, supply failures, or broken equipment do not affect the evaluation. Questions about the actual installation work and the requested advice will affect the evaluation.

The judges will only once point out breach of rules for HSE and electrical safety. If the participant repeatedly acts in violation of the rules for HSE and electrical safety, the referees will immediately interrupt the work and the assignment will be rejected.

Participants must wear work clothes and footwear in addition to personal protective equipment such as safety goggles and gloves throughout the competition. For safety reasons, gloves should not be used with cordless screwdriver. Hearing protection is used when needed. In order to safeguard electrical safety in all situations

during the competition, the participant must use personal measuring instruments that are suitable for measuring whether voltage is applied. In addition, the participant must bring his own personal hand tool.

The participant must also bring with him personal measuring instruments that are suitable and approved to perform measurements in connection with commissioning of the facility.

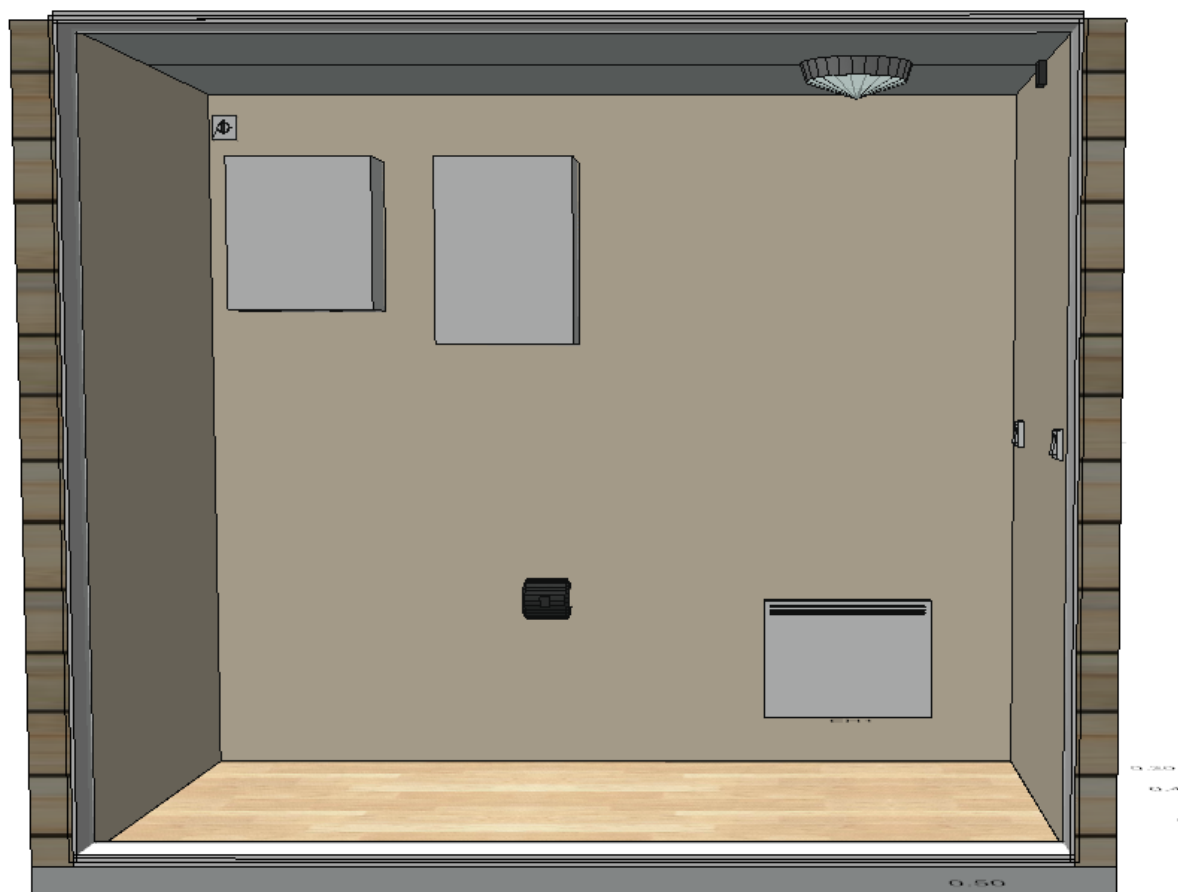
Time schedule

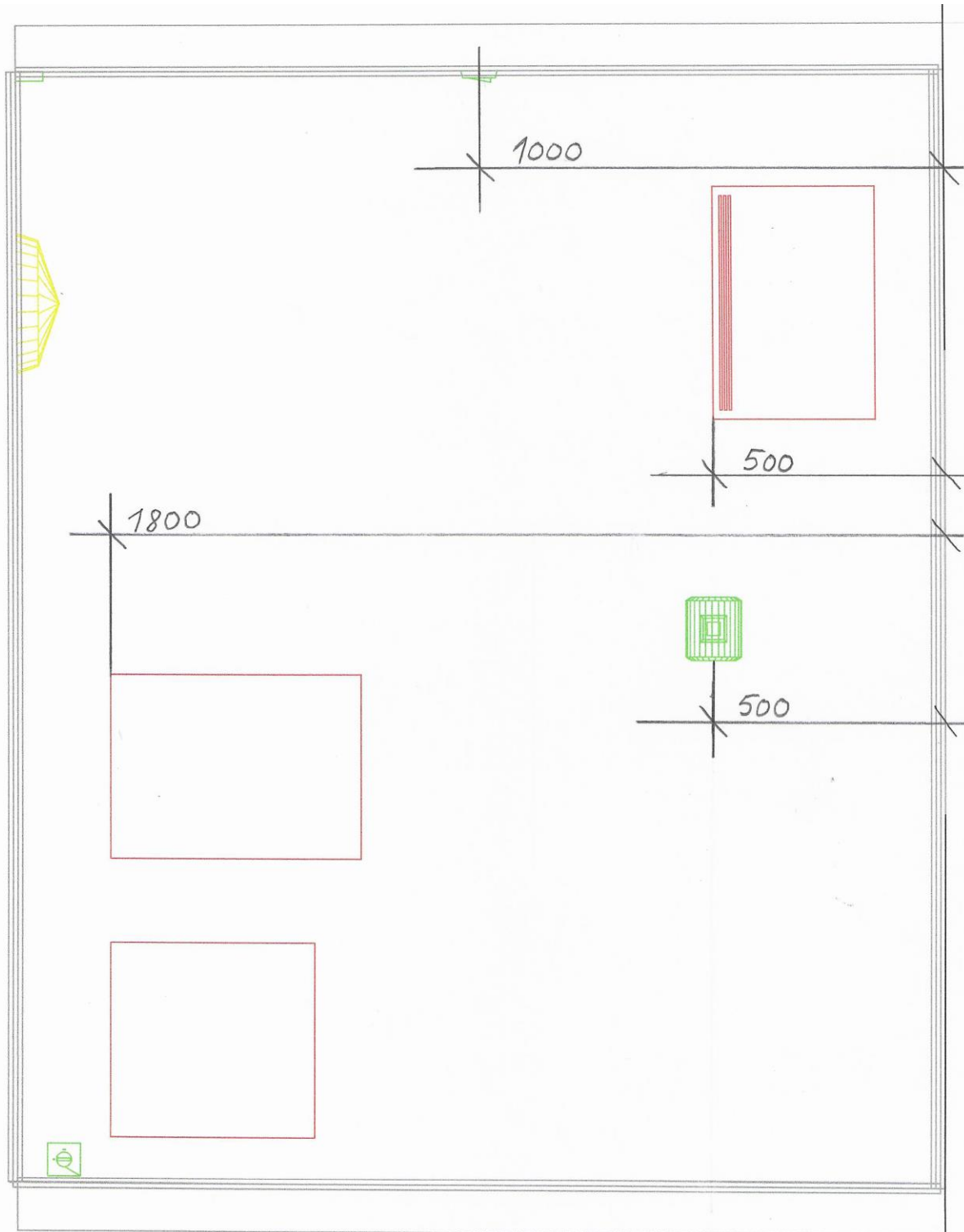
Arctic Skills 2019		
Monday 8 th of April		
1200-1600	Arrival of teams from Russia, Finland and Sweden	
1700-1900	Visit competition arenas	Kirkenes vocational school
1915-	Check in Thon Hotel	Thon Hotel
2000	Opening ceremony with dinner	
Tuesday 9 th of April		
0800	Arrival competition arena	Kirkenes vocational school
0830	Competition start	
1130-1230	Lunch	
1600	Competition end	
1800-2000	Prizing and closing ceremony with banquet	Thon Hotel
Wednesday 10 th of April		
0800-	Departure	

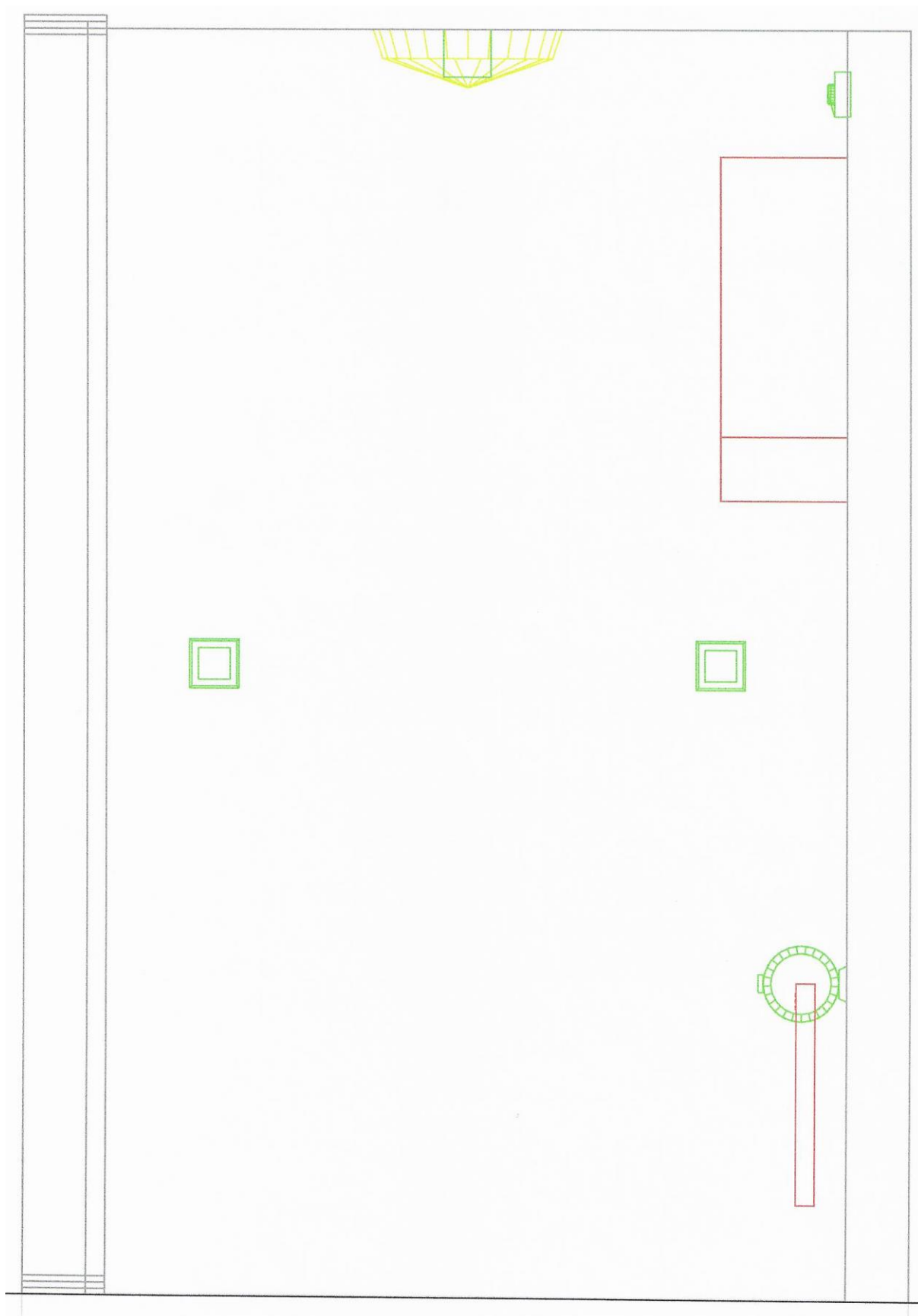
Overview over components in the installation

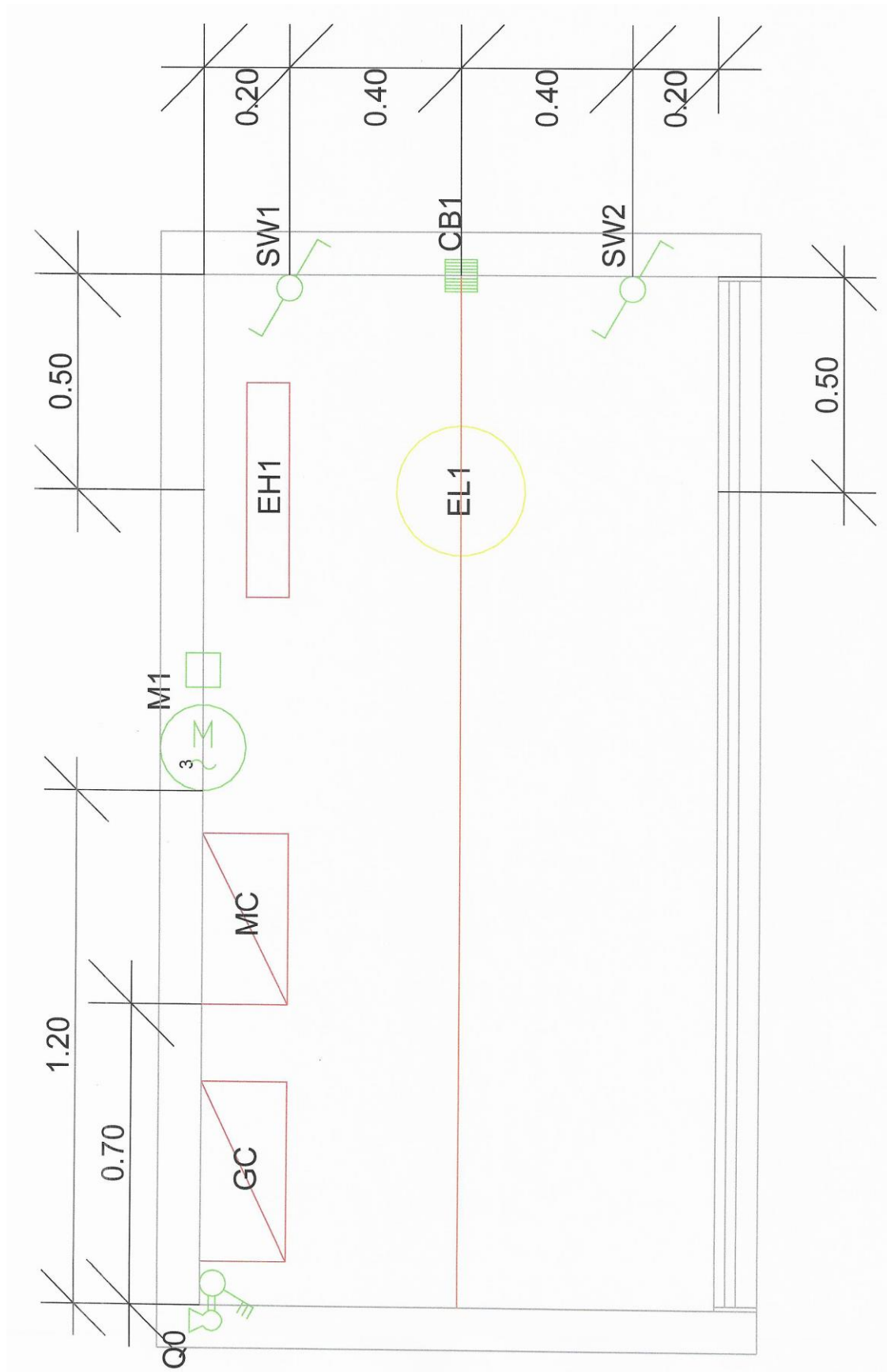
Component/object	Description/notes
-GC	Group Central
-MC	Motor Central
-M1	Three phase AC asynchronous induction motor
-EH1	Heater Nobø NTL4N 05 500W
-EL1	Electric lamp SG Enøk Led
-SW1/-SW2	Electric switches Elko model 6
-CB1	Connection box Elko model 76
-QO	Safety switch
-W1	Cable PFXP/NO5VV-R 5*2,5 mm ²
-W2	Cable PFXP/NO5VV-R 5*2,5 mm ²
-W3	Cable PFXP/NO5VV-R 3*1,5 mm ²
-W4	Cable PFXP/NO5VV-R 3*1,5 mm ²
-W5	Cable PFXP/NO5VV-R 5*2,5 mm ²
-W6	Cable PFXP/NO5VV-R 4*1,5 mm ²
-W7	Cable PFXP/NO5VV-R 3*1,5 mm ²
-W8	Cable PFXP/NO5VV-R 4*1,5 mm ²
-W9	Cable PFXP/NO5VV-R 4*1,5 mm ²

Plans over the installation











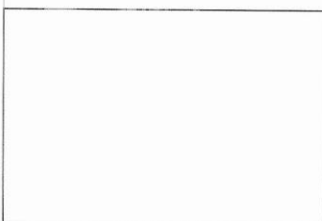
AS2019 GROUP CENTRAL

Prosjekt

Kunde

Sentral GROUP CENTRAL

Tegning



Rev.nr.	Revisjon	Dato	Navn

Prosjekt: Opprettet: 22.11.2018 2701h
Oppdatert: 21.12.2018

Tegning: AS206501

Tegning: Opprettet: 26.11.2018 2701h
Oppdatert: 26.11.2018

Antall blad: 7



DDS-CAD

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KURS		KABEL	LAST	TEKST	PROJEKTERINGSNIVÅ	BLAD	ANT. BL.
1	-F1 0V/40A	-W1 PFXP/ICU 5G2.5mm ²	28.7A 19.9kW	Main fuse	TEKNISSERIE	AS206501	7
2	-F2 30mA/B10A 3G2.5	-W2 PFXP/ICU 3G1.5mm ²	0.5A 0.1kW	Lighting	TEKNISSERIE	AS206501	7
3	-F3 30mA/B16A 3G2.5	-W3 PFXP/ICU 3G2.5mm ²	8.7A 2.0kW	Heating	TEKNISSERIE	AS206501	7
4	-F4 30mA/B16A 3G2.5		16A 3.7kW	RES	TEKNISSERIE	AS206501	7
5	-F5 30mA/B16A 3G2.5		16A 3.7kW	RES	TEKNISSERIE	AS206501	7
6	-F6 30mA/B16A 3G2.5		16A 3.7kW	RES	TEKNISSERIE	AS206501	7
7	-F7 30mA/B16A 3G2.5		16A 3.7kW	RES	TEKNISSERIE	AS206501	7
8	-8 C20A 3G2.5	-W8 PFXP/ICU 5G2.5mm ²	20A 13.9kW	Supply for Motor Central MC	TEKNISSERIE	AS206501	7



ERSATTET AV

ERSATTET AV

BLAD TYPE: Single line Group Central

UTTILBUDT

ODKJENT

NOVA

DATO SIGNATUR

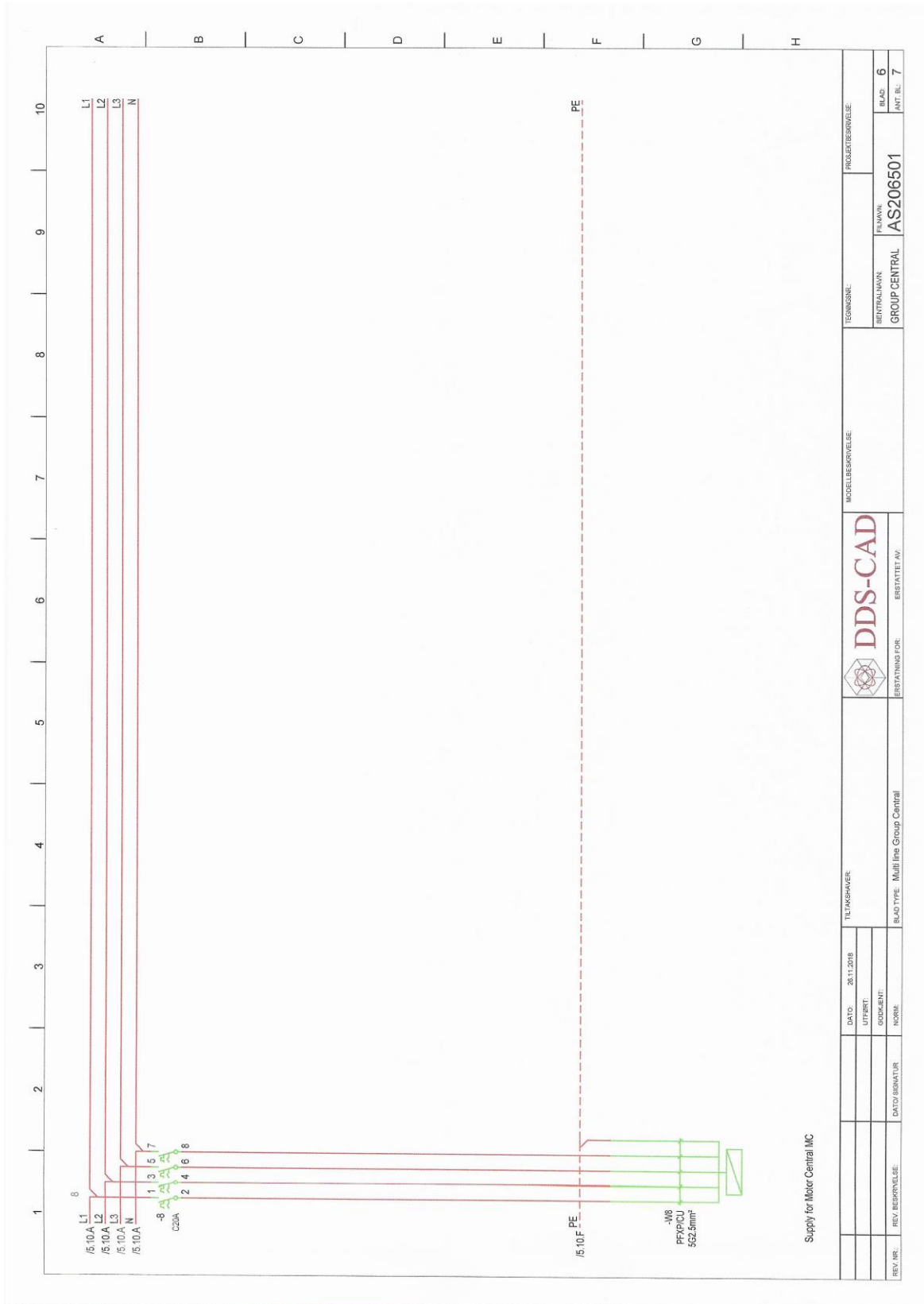
REV. REVISOR

REV. NR.

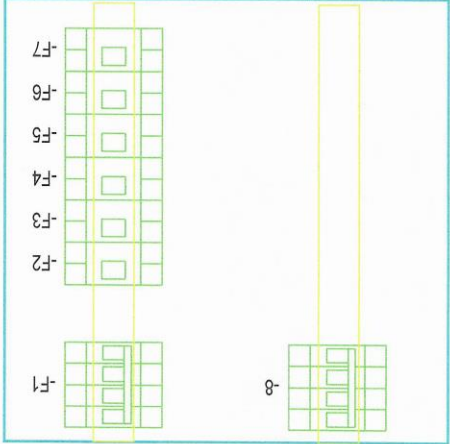


2019

Kirkenes videregående skole
Girkonjårgga joatkkaskuvla

FINNMARK FYLKESKOMMUNE
FINNMÁRKKU FYLKKAGIELDA



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AS2019 MOTOR CENTRAL

Prosjekt

Kunde

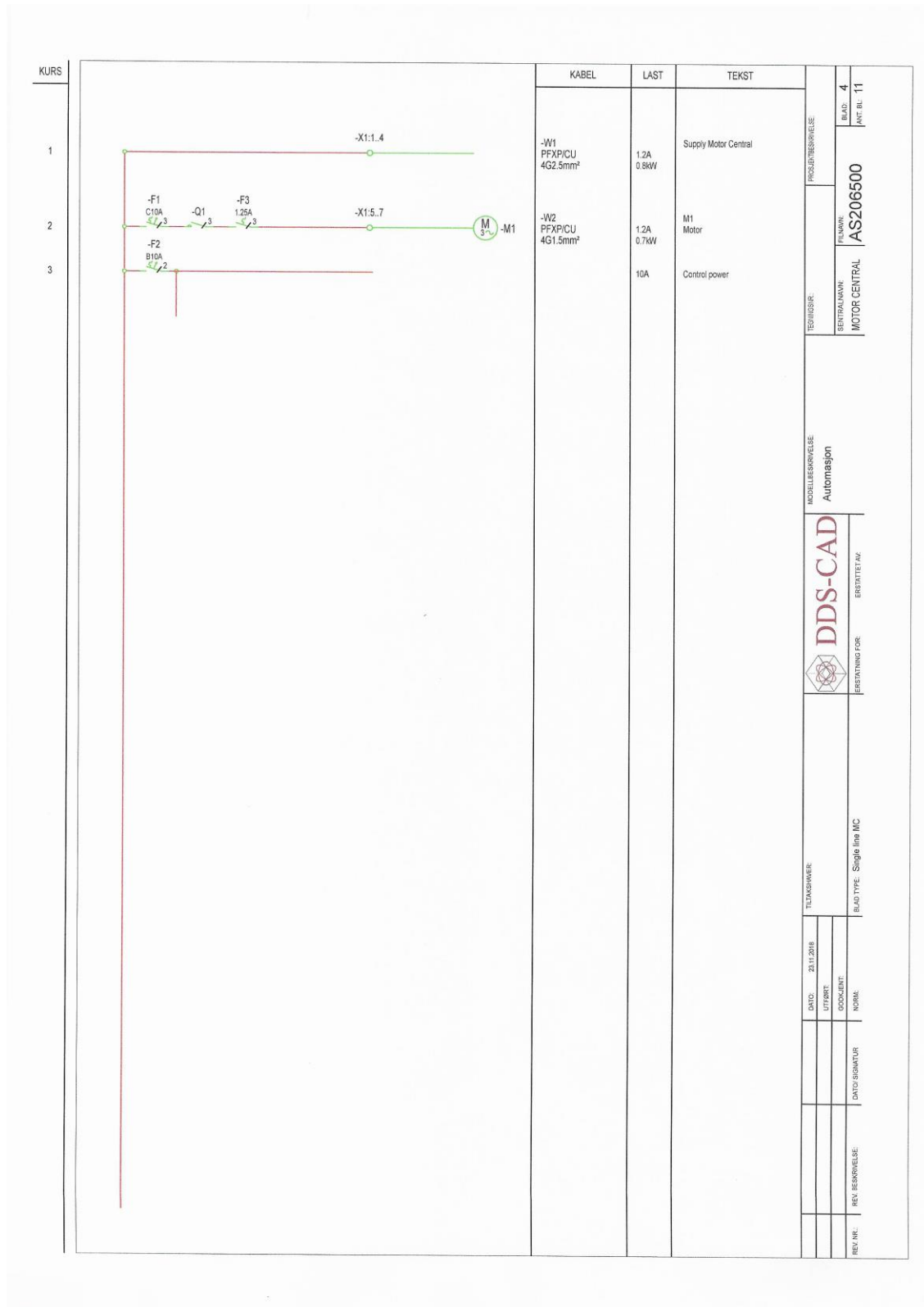
Sentral MOTOR CENTRAL

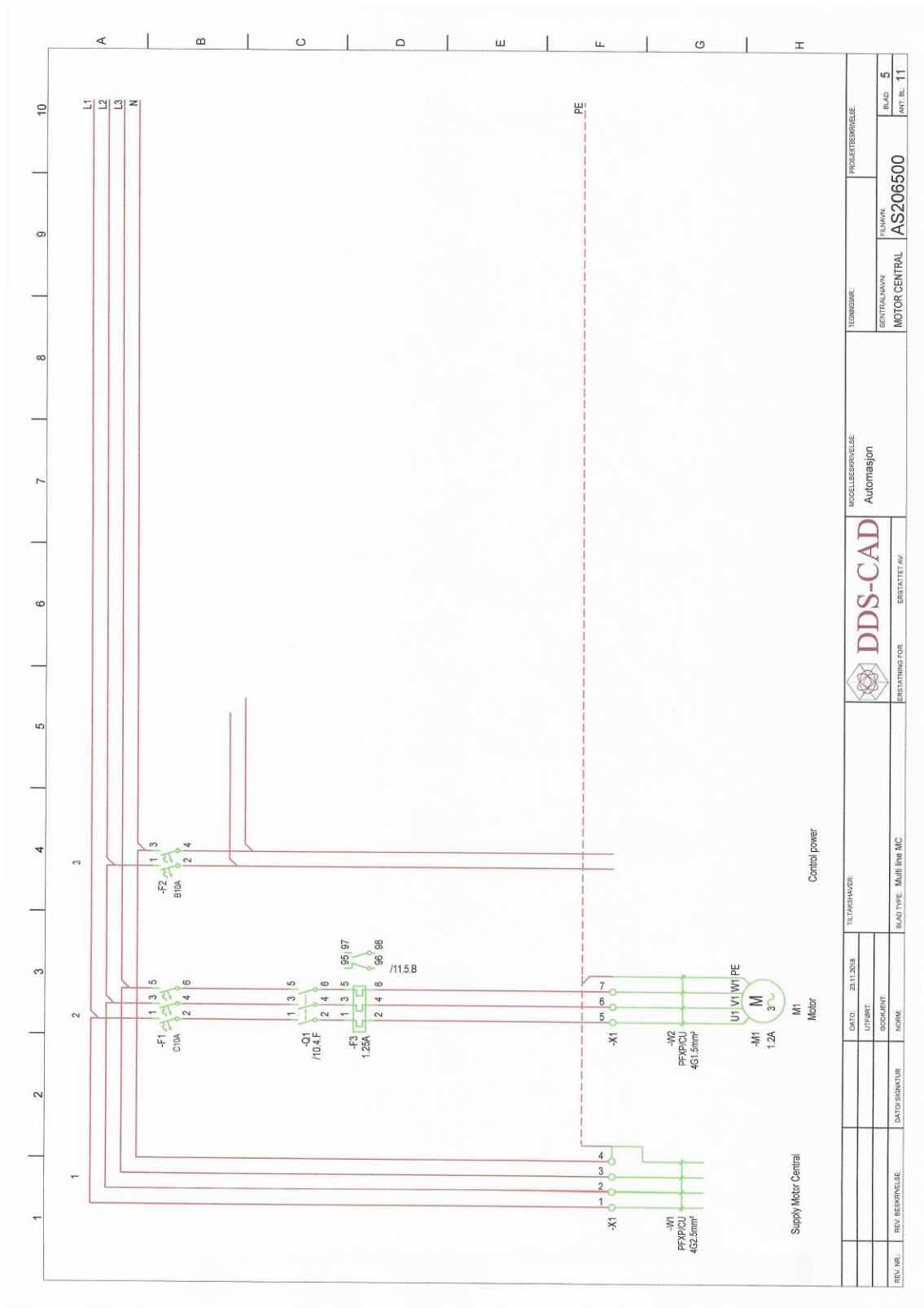
Tegning Automasjon

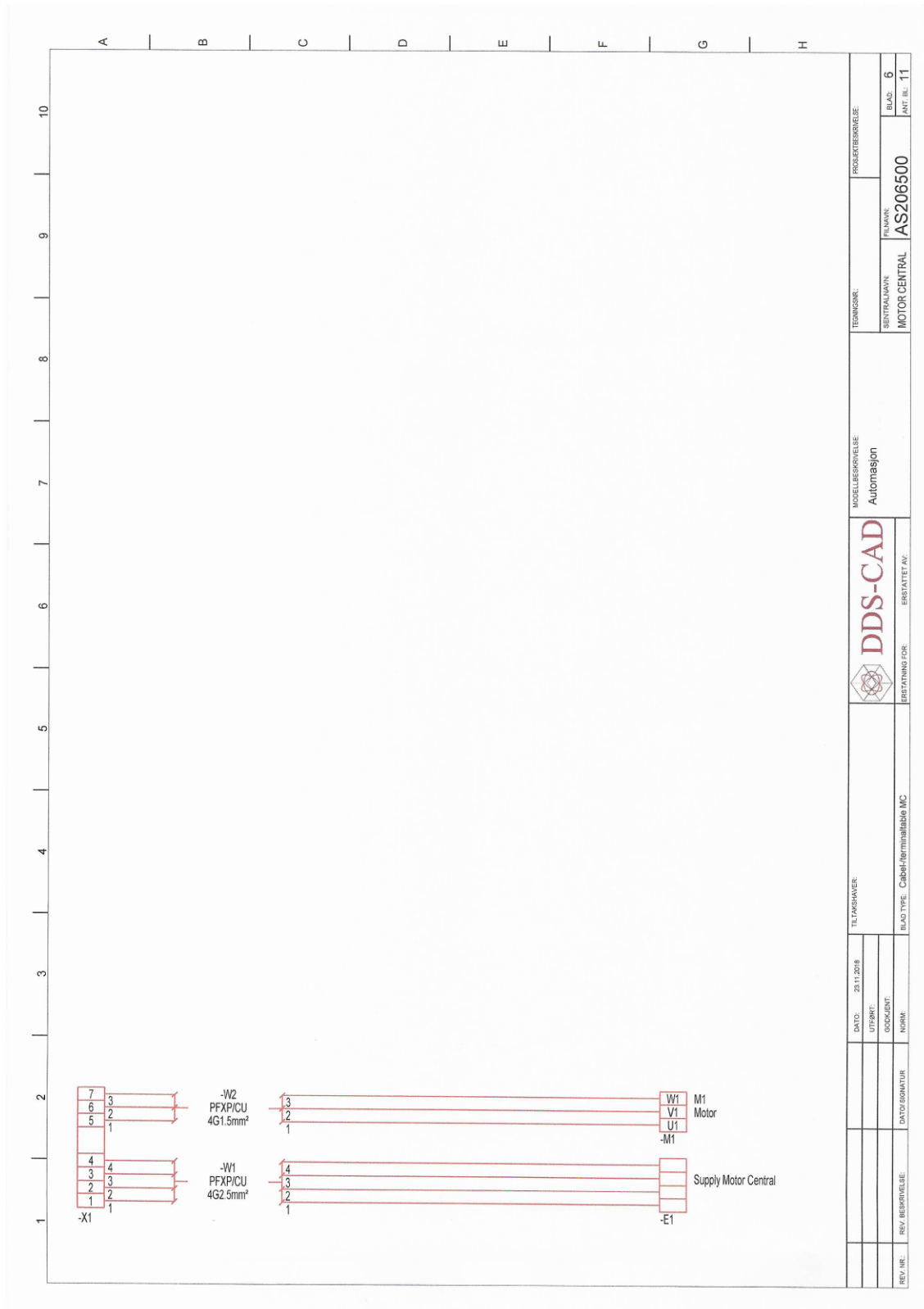


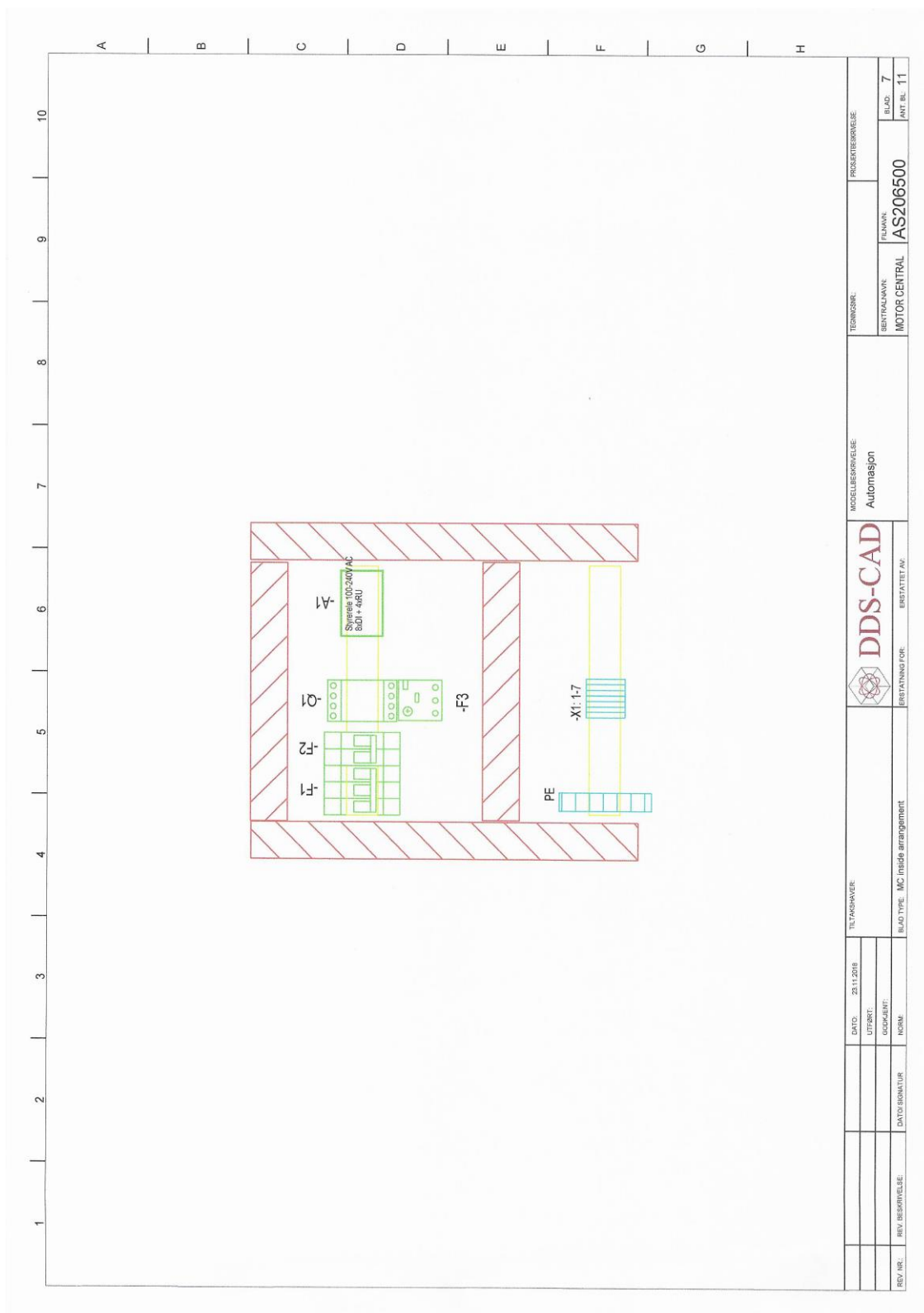
DDS-CAD

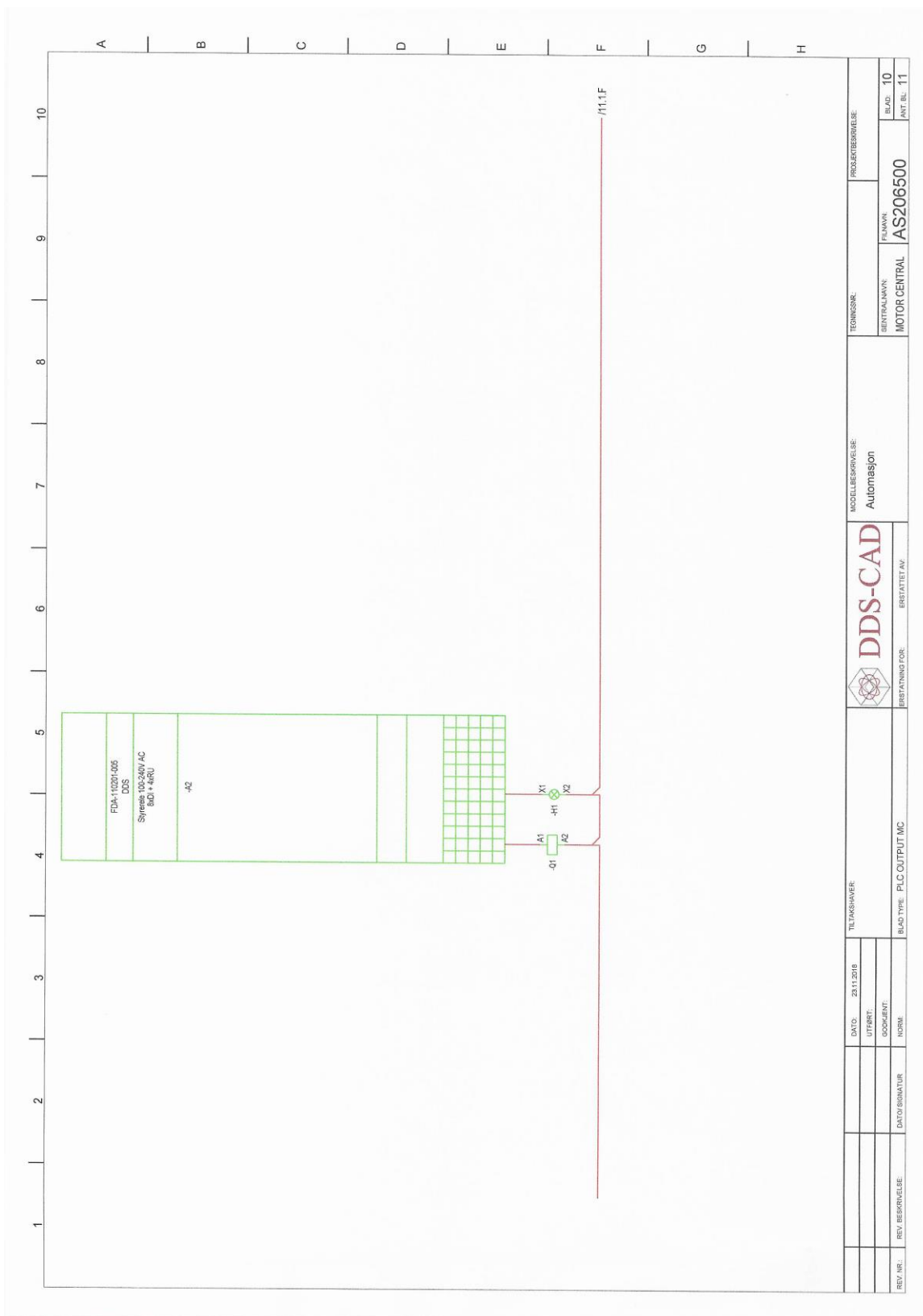
Rev.nr.	Revisjon	Dato	Navn
Prosjekt:	Opprettet: 22.11.2018 Oppdatert: 05.12.2018	2701h	Tegning: AS206500
Tegning:	Opprettet: 23.11.2018 Oppdatert: 23.11.2018	2701h	Antall blad: 11











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INSPECTION SCHEME

Measurement condition of motor:

Measured motor phase winding resistances:

U1-U2 =

V1-V2 =

W1-W2 =

Perform the required insulation resistance measurements with the meter you selected and record the measurement results:

Measuring voltage: _____ V

Insulation resistance results:

U1-PE =

V1-PE =

W1-PE =

U1-V1 =

V1-W1 =

W1-U1 =

Direction of rotation: _____ Counter-clockwise _____ Clockwise

Inspection of continuity in protective conductors in the installation:

The continuity of the protective conductor checked for each point _____ YES _____ NO

Maximum measured protective conductor resistance: _____ Ω Result was found in the group: _____

Inspection of insulation resistance in the installation:

Measuring voltage: _____ V Result of insulation resistance check: _____ M Ω

Inspection of RCD's:

Trip time: _____ / _____ ms Trip current: _____ / _____ mA

Check of function test button: _____ YES _____ NO

The inspection verifies the installation meet the required results and can be put into operation:

_____ YES _____ NO

Date _____ / _____ 2019

Signature participant: _____

Judge: _____

Subtasks / point distribution		Maximum points	Earned points
A	Work and electricity safety	18	
B	Commissioning, testing and function	20	
C	Circuit design	18	
D	Attachment of devices and conductors	10	
E	Wiring and connections	14	
F	Customer service and documentation	10	
G	Sustainable service, entrepreneurship and attitude	10	
Task Total		100	
Confirmed result			100
Signature of judges:			
Date and place:			

Participant's name	Nationality

	Description	Judging Criteria	Detracted Points	Max Points	Earned Points
A	Work and electricity safety				
1	Safe and orderly work environment checked every 1 h	No remarks 2 p 1 remark = 1 p 2 remarks = 0 p		2	
2	Use of personal protective equipment	Safety shoes and safety glasses all the time, ear protectors or ear plugs whenever you need it. 1 remark = 1 p 2 remarks = 0 p		2	
3	Load-tolerant working method (ergonomics, diligence)	Use of ladder when working with arms higher than head Avoids working with bent back Avoids unnecessary rotation of body 1 remark = 1 p 2 remarks = 0 p		2	
4	Use of cordless screwdriver	Uses cordless screwdriver for attaching equipment Avoid wearing gloves when using cordless screwdriver 1 remark = 1 p 2 remarks = 0 p		2	
5	Shut down of voltage before working	No remarks 2 p		2	
6	Use of lock or/and warning sign	Use of a warning sign and lock 2 p Uses warning sign or lock 1 p		2	
7	Operation testing of the voltage tester and insulation resistance tester before measuring	No remarks 2 p 1 remark = 1 p		2	
8	Measurement of no voltage before working	No remarks 2 p		2	
9	Working order. Connects power supplies to centrals after the other installation is completed	No remarks 2 p 1 remark = 1 p 2 remarks = 0 p		2	
Sub	Participants total points for Work and electricity safety		sum	18	

	Description	Judging Criteria	Detracted Points	Max Points	Earned Points
B	Commissioning, testing and function				
1	Continuity measurement of the protective conductor	Measured with continuity tester Zero-adjustment before measuring Measures all protective conductors 1 remark 2 p 2 remarks 1 p		3	
2	Insulation resistance measurement	All groups in GC measured All groups in MC measured Tested with 250V on groups with electronics in MC and GC 1 remarks 2 p 2 remark = 1 p		3	
3	RCD's: test of test button, test of trip time and trip current	No remarks 3 p 1 remark = 2 p 2 remarks = 0 p		3	
4	Measurement of the motor winding resistance before installation	No remarks 1 p		1	
5	Measuring the insulation resistance of the motor before installation	Measured windings against earth/frame 0,5 p Measured between windings 0,5 p		1	
6	Coupling of motor Y/D	Correct Y-coupling and supply on U1-V1-W1 2 p Correct Y-coupling and supply on U2-V2-W2 1 p		2	
7	Clockwise rotation	No remarks 1 p		1	
8	Motor overload protection correctly adjusted	No remarks 1 p		1	
9	Lighting control function	No remarks 3 p		3	
10	Thermal control	No remarks 2 p 1 remark = 1 p		2	
Sub	Participants total points for Work and electricity safety		sum	20	

	Description	Judging Criteria	Detracted Points	Max Points	Earned Points
C	Circuit design				
1	Height to top of MC– required 1800 mm	Tolerance +/- 3 mm No remarks 1 p		1	
2	Distance between left side of MC and end of left wall – required 700 mm	Tolerance +/- 3 mm No remarks 1 p		1	
3	Distance end of left wall to centre of motor – required 1000 mm Distance from floor to centre of motor – required 500 mm	Motor mounted horizontally Tolerance placement +/- 10 mm both directions No remarks 2 p 1 remark = 1 p		2	
4	Height to centre of switches – required 1000 mm Distance nearest wall to centre of switch – required 200 mm	Tolerance +/- 3 mm No remarks 2 p 1 remark = 1 p		2	
5	Connection box	Box in centre of wall - tolerance +/- 3 mm Box just below ceiling No remarks 1 p		1	
6	Distance nearest wall to centre of heater – required 500 mm	Tolerance +/- 3 mm No remarks 1 p		1	
7	Distance floor to top of heater – required 500 mm	Tolerance +/- 3 mm No remarks 1 p		1	
8	Distance wall to centre of lamp 500 mm and in accordance with connection box	No remarks 1 p		1	
9	Cables installed vertically and horizontally, and in straight lines	No remarks 2 p 1 remark = 1 p		2	
10	Subjective assessment of the entire installation	Evaluated the cleanliness of the installation design subjectively 1-6 p The judges will make a subjective assessment together		6	
Sub	Participants total points for Circuit design		sum	18	

	Description	Judging Criteria	Detracted Points	Max Points	Earned Points
D	Attachment of devices and conductors				
1	Cable for motor protected with tube	No remarks 1 p		1	
2	Cable glands is tight and the cable comes straight through	No remarks 1 p		1	
3	Equipment IP-classification Lamp, switches and connection box	Cut-outs in covers expertly performed No remarks 2 p 1 remark = 1 p		2	
4	Distance between TC brackets flat and required from 13 to 25 cm, from the devices from 5 to 7 cm	No remarks 2 p 1 remark = 1 p		2	
5	Equipment and cables installed horizontally and vertically orientated	No remarks 2 p 1 remark = 1 p		2	
6	The IP rating for the lamp remains unchanged after the installation	No remarks 1 p		1	
7	The bending of the tube for protection on motor cable is done according to a good installation method	No remarks 1 p		1	
Sub	Participants total points for Attachment of devices and conductors		sum	10	

	Description	Judging Criteria	Detracted Points	Max Points	Earned Points
E	Wiring and connections				
1	The tightness of the connections in GC is checked	No remarks 1 p		1	
2	Circuit breaker has been replaced	No remarks 1 p		2	
3	The group centre Cu is not perpendicularly visible and there are no conductors over the DIN rail	No Cu visible No conductors over the DIN-rail No remarks 2 p 1 remark = 1 p		2	
4	Insulation of cables inserted in the centrals within 10 – 30 mm	No remarks 1 p		1	
5	Insulation of cables inserted in connection box, switches, lamp and heater	Cables outer insulation inserted between 5-10mm inside equipment covers No remarks 1 p		1	
6	The tightness of connections in MC is checked OK and no Cu visible	No remarks 1 p		1	
7	Tightness of connections in motor	No remarks 1 p		1	
8	The tightness of connections in heater is checked OK and no Cu visible	No remarks 1 p		1	
9	Good order in connection box, no Cu visible and conductors well connected in Wago	No remarks 1 p		1	
10	The tightness of the connections in switches is checked OK and no Cu visible	No remarks 1 p		1	
11	Stripping of cables and conductors	Uses suitable tools for stripping of cables No damage on conductors from stripping No remarks 2 p 1 remark = 1 p		2	
Sub	Participants total points for Wiring and connections		sum	14	

	Description	Judging Criteria	Detracted Points	Max Points	Earned Points
F	Customer service and documentation	Customer service and documentation			
1	Inspection scheme	Recordings correctly noted Scheme signed and dated No remarks 1 p		1	
2	The documents are intact and neat	No remarks 1 p		1	
3	In guidance, s/ he makes his / her case clear, calm and customer-oriented	No remarks 2 p 1 remark = 1 p		2	
4	Telling about the function of the main switch and circuit breakers	No remarks 1 p		1	
5	Guidance on motor control functions and protective devices	No remarks 1 p		1	
6	Delivery of equipment installation / operating instructions to the customer	No remarks 1 p		1	
7	Reminding customers of the importance of operating the test button of the RCD's	No remarks 1 p		1	
8	Marking in GC and MC	Group chart for GC and MC filled in with correct data Cables and circuit breakers marked No remarks 2 p 1 remark = 1 p		2	
Sub	Participants total points for Customer service and documentation		sum	10	

	Description	Judging Criteria	Detracted Points	Max Points	Earned Points
G	Sustainable service, entrepreneurship and attitude	Sustainable service, entrepreneurship and attitude			
1	Economic use of equipment and materials	Small amount of waste 2 p Moderate amount of waste 1 p Large amount of waste 0 p		2	
2	Waste sorting Cu / mixed waste	No remarks 2 p		2	
3	Entrepreneurial finished work quality	Working purposefully Solves challenges and problems independently The judges will make a subjective assessment together No remarks 2 p 1 remark = 1 p		2	
4	Comprehensive evaluation skills of your own work quality	In condition to be handed over to the customer 2 p Estimates correctly work left to be done, and not in delivery condition 1 p		2	
5	Handling of tools and equipment	Avoids unnecessary wear and tear No remarks 2 p 1 remark = 1 p		2	
Sub	Participants total points for Sustainable service, entrepreneurship and attitude		sum	10	