

# Mechatronics Technician

## Exam Preparation Documentation

### Part 2 Phase 1

# 2025

Test Taker first and last name:

Test Taker number:

Test Taker company:



German American  
Chambers of Commerce  
Deutsch-Amerikanische  
Handelskammern

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## General Note

In the final examination, part 2 the test taker must carry out the written and practical assignments as described on the next page.

The test equipment listed in this booklet must be provided by the training organization for the final examination work task/assignment.

Materials necessary for the final examination and this preparation booklet must be provided to the test taker prior to the final examination day so that the test taker can test the completeness and functionality of the examination material.

The mechatronics system described in this booklet must be designed and tested according to applicable rules and regulations.

The company's own tools and equipment may be used.

By his/her signature on the day of the examination, the test taker confirms that he/she has received safety training and will follow instructions.

### **IMPORTANT Examination preparation information:**

This booklet contains the technical documentation required to complete the preparation assignment. The documentation has been designed to be as neutral as possible and must, if necessary, be adapted to suit the operational components. **Note the highlighted items in the documentation. Be sure that the material you have meets these requirements or quantities as listed.**

On the first page of this booklet, be sure to enter your first and last name.

The standard provisioning documents and preparation material can be accessed and downloaded from the **ICATT or MAT2 apprentice resource pages**

Preparation consists of 2 parts/booklets – a Phase 1 and a Phase 2

1. PHASE 1: You will receive the Phase 1 yellow preparation documents approximately 3 months prior to exam day. All parts are to be procured, tested, assembled, programmed and prefabricated according to the Phase 1 preparation booklet as is. No modifications should be added. PLC program operands should be added for the identified inputs and outputs. Keep all notes to present in an organized folder.
2. PHASE 2: Distributed about 1 month after Phase 1. After completion of the PHASE 1 Yellow preparation booklet, **you will complete numbers/steps 1-6 as listed in the Phase 2 to modify your assembly from Phase 1. Only steps 6 as outlined on page 3 of your Phase 2 Yellow preparation booklet should be added to your current set up from Phase 1 Yellow preparation documents. Follow directions as given in 1-6. At this time, per step 6 instructions you should also modify or draw in changes to the Phase 1 diagrams, schematics, and blueprints according to steps 1-6. Keep updated and complete documentation in a binder to hand in to the exam board when you arrive at the exams.**

This Phase 1 booklet as well as any other material used in preparation of the practical assignment must be collected and brought to the examination on examination day and presented in an organized manner for evaluation by the exam board. All notes and documentation will be reviewed before the exam and the exam board reserves the right to remove items that conflict with examination preparation expectations prior to start of the examination. Please do not include photos in your folder.

## Final Examination Part 2, examination scope

## Work assignment outline – Model for Complete Action

Outline of action steps apprentices are expected to perform when starting any work project or system modification and therefore are also expected to perform both when preparing for the examination and during the examination.

1. Inform:
  - Analyze work assignments
  - Prepare information from the documents provided
  - Explain technical and organisational interfaces
  - Evaluate and select optional solutions based on technical, economic, and ecological considerations
2. Plan:
  - Plan and cross-check assignment procedures
  - Specify steps of assignment
  - Compile planning documentation
  - Take into consideration the work procedures and conditions at location
3. Make Decisions/Procure:
  - Resources, equipment, aids, test equipment, raw materials
  - Semi-finished products
  - Tools etc, to be selected, secured and prepared
  - Arrange for space and time
4. Implement:
  - Perform assignments
  - Check and document operation and safety
  - Follow standards and specifications for the system quality and safety
  - Systematically identify causes of errors and defects
5. Check:
  - Select and use test methods and equipment
  - Determine suitability of test equipment
  - Check and document results
  - Systematically identify, rectify and document quality defects
6. Assess/Handover:
  - Approve and hand over systems
  - Provide customer instructions
  - Prepare acceptance protocol
  - Document and evaluate results and performance
  - Record/save system data and documentation

On Exam Day, the test taker should in 6 hours prepare, perform, follow up and document the practical assignment using the documentation that is provided on the day of the exam. On exam day the exam board will observe the test taker's work and conduct an on-site technical discussion of a maximum of 20 minutes during the work assignment. The work assignment will be evaluated through observation of the test taker's process, documentation, and technical discussion.

Final Examination Overview - ICATT Mechatronics Technician			
Final examination: Part 1 Weighting: 40 %		Final examination: Part 2 Weighting: 60 %	
Areas of examination		Areas of examination	
<p><b>Practical task with professional, situation-based discussions</b></p> <p>Weighting: 50 % Total time permitted: 6.5 h</p>	<p><b>Written examination</b></p> <p>Weighting: 50 % Total time permitted: 1 h 30 min</p>	<p><b>Practical task with professional, situation-based discussions</b></p> <p>Weighting: 50 % Total time: 14 h</p>	<p><b>Written examination</b></p> <p>– Work planning – Functional analysis – OSHA and Workers Rights</p> <p>Weighting: 50 % Total time permitted: 4 h 15 min</p>
<p><b>– Planning*</b> Weighting: 20 % Time suggested: 30 min</p> <p><b>– Execution including tech discussion</b> Weighting: 40 % Time suggested: 4 h</p> <p><b>–Commissioning</b> Weighting: 35 % Time suggested: 2 h</p>	<p><b>– Part A (50%):</b> 23 multiple choice questions 3 of which can be deselected</p> <p><b>– Part B (50%):</b> 8 short answer questions No deselection possible</p>	<p><b>– Preparation for the practical task</b> Time allotted: 8 h In company</p> <p><b>– Execution of the practical task</b> Time allotted: 6 h At exam site</p> <p>Including <b>technical discussion</b> Time allotted: 20 min</p>	<p><b>– Work Planning</b> Time permitted: 105 min Weighting: 40 %</p> <p><b>Part A (50%):</b> 28 multiple choice questions – 3 of which can be deselected</p> <p><b>Part B (50%):</b> 8 short answer questions No deselection possible</p>
<p><b>Professional, situation-based discussions</b></p> <p>Weighting: 5 % Time permitted: 10 min</p> <p>– The duration of the discussions is included in the examination time. – The discussions can last up to 10 min within the scope of the examination and can be held continuously or in stages.</p>		<p>Phases:</p> <ul style="list-style-type: none"> <li>– Information</li> <li>– Planning</li> <li>– Execution</li> <li>– Review</li> </ul> <p>The practical task is assessed by means of:</p> <ul style="list-style-type: none"> <li>– Task-specific documents</li> <li>– Professional, situation-based discussions</li> <li>– Observations by the board of examiners</li> </ul>	<p><b>– Functional analysis</b> Time permitted: 105 min Weighting: 40 %</p> <p><b>Part A (50%):</b> 28 multiple choice questions 3 of which can be deselected</p> <p><b>Part B (50%):</b> 8 short answer questions No deselection possible</p>
<p>*The planning phase takes place after the written assignments. If the planning time is exceeded or not used in full, the relevant deviation is compensated for in the execution and review phases to ensure that the total permitted time of 6 h 30 min is not exceeded.</p>			<p><b>– OSHA and Workers Rights</b></p> <p>Time permitted: 45 min Weighting: 20 %</p> <p>20 multiple choice questions 5 of which can be deselected</p> <p>4 short answer questions 1 of which can be deselected</p>

# AHK-USA Chicago

Final Examination Part 2 - 2025

**General Information**

**Mechatronics Technician**

All of the information in this booklet is provided for you to prepare for the practical examination.

Use the documents in this booklet to gather information, plan the execution of the practical assignment, procure the necessary material, execute the work assignment, and check the execution.

The documents in this packet will assist you in set up and preparation.

Staging and preparation documents for setting up a mechatronics system in preparation for the exam:

- Standard material staging list for the training company (identical to Part 1 final examination)
- List of tools, materials, and test equipment (identical to Part 1 final examination)
- Information on the axis module require (sketches, drawing for the prefabrication of individual parts, etc.)
- Wiring diagram
- Electrical pneumatic diagram
- General information about the work assignment and procedure to follow
- Preparation description and assignment description (functioning level for exam start)
- Work schedule to complete
- Inputs/Outputs for PLC

The mechatronic subsystem to be completed on the day of the exam is to be prepared according to the specifications of this booklet, commissioned, and put into operation in compliance with the valid safety regulations.

The required control cabinet with the control unit is to be prewired according to the documents in this booklet and connected to the mechanical subassembly via the plug connector.

**208V – Connection to the main is made by a 208VAC cable with NEMA L21-20P plug 3-poles +N+PE (5 wires)**

**6mm outer diameter (OD) pneumatic push to connect hose fitting for the pressure regulator**

**This booklet lists additional testing equipment that is required for both the test preparation and the in-person testing. Bring everything listed to the examination even if it was not used during the preparation (unused material may be required to complete the in-person examination). Be sure that all equipment is functioning properly.**

<b>AHK-USA Chicago</b> Final Examination Part 2 – 2025	
<b>Standard Material Staging List for all Mechatronics examinations</b>	<b>Mechatronics Technician</b>

### General information

The components must comply with the accident prevention regulations. The required mounting materials must be provided for the components. Only where required must the connection diagrams and data sheets be supplied for the control components.

Before the test, check the components function properly.

- I Parts and equipment that must be brought to the exam by each test taker:**
1. **1** Mounting plate: groove profile plate approx. 700mm x 560mm, alternatively with perforated grid or similar
- II Parts and equipment that must be brought to the exam by each test taker:**
1. **2** Double-acting cylinder, piston diameter: 10mm, stroke: 40mm, threaded piston rod and lock nut, optionally with adjustable end-position damping on both ends, with magnetic ring, mounted on mounting base, with swivel head/fork head
  2. **1** double-acting cylinder, piston diameter: 10 mm, stroke: 25 mm, threaded piston rod and lock nut, optionally available with adjustable end-position damping on both ends, with magnetic ring, mounted on a base and with a swivel head/ fork head.
  3. **1** Valve terminal, compatible with Item No.4
  4. **3** 5/3-way valve (with manual overrides). Electrically actuated on both sides, with free-wheeling diode, with magnetic clutch sockets (24V DC), with part blocking setting and 1 meter long, preassembled connection line, nominal width: 4 to 5mm, incl. plug connection compatible with page 6 III/5
  5. **1** 3/2-way valve, with spring return, with neutral position locking, single-side electric control with manual override, lockable, incl. plug connection compatible with page 6 III/5
  6. **1** Pressure switch, up to 6 bar, 24V DC, 1 two-way contact or 1 NO-1NC (electronic 3-wire pressure sensor also possible), incl. plug connection compatible with page 6 III/5
  7. **1** Adjustable pressure regulator valve with constant output pressure, can be regulated from 1 bar, (with increase reverse ventilation with the integrated check valve) with pressure gauge.
  8. **6** One-way restrictor (exhaust throttle), can be adjusted and secured, with fastening on the cylinder or on the mounting plate, compatible with I/1
  9. **X** Sound absorber (silencer)
  10. **6** Proximity switch, operating voltage: 24V DC, actuated by magnetic ring, compatible with Item No. 1 and 2 with connected cable, 1 NO, 3-line connection incl. plug connection compatible with page 6 III/5
  11. **0.7m** wiring duct, slotted, at least approx. 80 x 80mm with snap on cover
  12. **10** Dummy plug with snap on cover for item no 13
  13. <sup>1)</sup>**X** Push-in fitting, straight, outlet for plastic tube, push-in connection
  14. <sup>1)</sup>**3** Push-in T-fitting, suitable for plastic tube

<sup>1)</sup> = compatible with plastic tube inner diameter 2 mm, outer diameter 4 mm or inner diameter 4 mm, outer diameter 6 mm

**X = number refers to number of components in use**

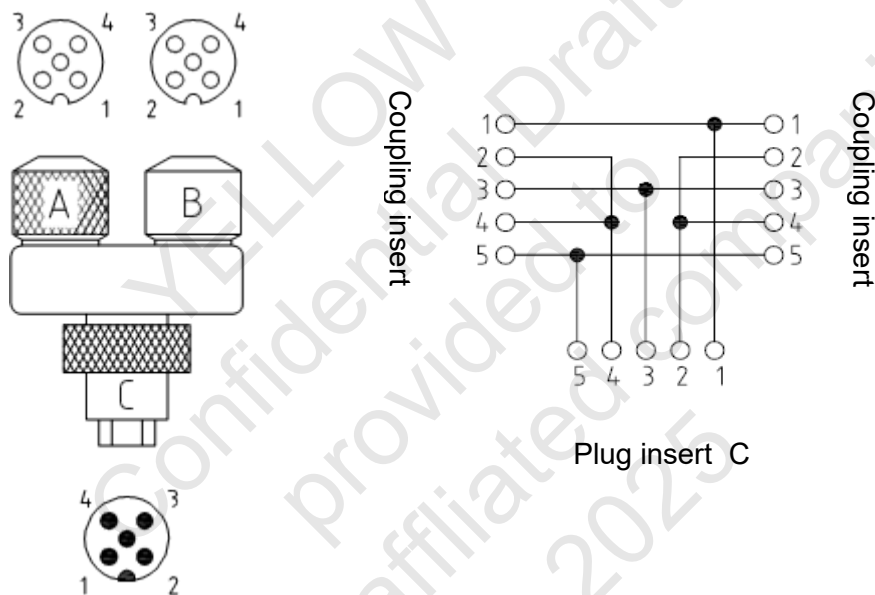
### NOTE:

- The connection points for the valves must be clearly identified (letters or numbers)
- The pneumatic and electro-pneumatic components must be provided equipped with push-in fittings on the pressure ports and silencers on the exhaust ports.
- Appropriate fasteners must be provided for the components (screws, nuts...)

### III Parts and equipment that must be brought to the exam by each test taker:

1. 1 Signal column lights 24 V DC (3 lights, red, green, white), incl. plug connection compatible with Item No. 5
2. 1 Capacitive proximity sensor, 3 line connection, 1 NO, PNP-output, operating voltage: 24V DC, metal housing with thread M12 x 1, usable thread length at least 30mm, with 2 securing nuts, flush mountable, operating distance: 4mm, with approx. 1.5m long preassembled connection line, incl. plugconnection compatible with Item No. 5
3. 1 Inductive proximity sensor, 3 line connection, 1 NO, PNP-output, operating voltage: 24V DC, metal housing with thread M12 x 1, usable thread length at least 30mm, with 2 securing nuts, flush mountable, rated operating distance: 4mm, with approx. 1.5m long preassembled connection line, incl. plug connection compatible with Item No. 5
4. 1 Evaluation unit for the fiber optics/fiber optic sensor, distance at least 0-50mm, operating voltage: 24V DC, PNP output, switching status display, connection line incl. Plug connection compatible with Item No. 5 (incl. Fiber optics, one-way-function, straight M4, length approx. 50cm)
5. 2 Actuator/sensor distribution system with M12 (or customary) I/O slots 4-pin + PE with master cable, 8 fold, 2 signals per socket
6. 10 T-distributor with two M12-couplings (or customary) compatible with Item No. 5

#### Possible connection of T-connector with partial drawing



### III Parts and equipment that must be brought to the exam by each test taker:

1. PLC-system programmable with at least the following performance characteristics
  - Voltage/power supply 24VDC/4 A (also see page 6 I/2)
  - 24 inputs
  - 24 outputs
  - Storage medium for uploading an alternative control program

**NOTE: The PLC can be installed in the control cabinet (internal) or externally, for example with additional plug connections.**

### I Additional parts and equipment that must be brought to the exam by each test taker:

1. 1 Control cabinet with (W x H x D) 600m x 800mm x at least 250mm, (size recommended) if necessary, secured from tipping with an additional supporting construction
2. 1 24 V power supply unit DC, 4 A, or alternative power supply appropriate for the PLC
3. 1 Mounting rail according to DIN EN 50022 (DIN rail), compatible with Item No. 6, length approx. 2m

4. 6 End bracket, compatible with Item No. 6
5. 6 End plate, compatible with Item No. 6 (for example 4 x grey, 2 x blue)
6. 90 Terminal block 2.5 mm<sup>2</sup>, compatible with Item No. 3 (for example, grey)
7. 5 Terminal block 2.5mm<sup>2</sup>, compatible with Item No. 3, blue
8. 6 PE terminal block 2.5mm<sup>2</sup>, compatible with Item No. 3
9. 3 PE terminal block 6.0mm<sup>2</sup>, compatible with Item No. 3
10. X Identification label/plate, compatible with Item No. 6
11. X Connecting bridge, compatible with Item No. 6
12. 1 EMERGENCY OFF switching device (safety relay), 24V DC, dual-channel operation with grounding, short circuit, and crosswire short detection in the input circuit, monitored start, feedback circuit to monitor external contractors (at least 2 x NO)
13. 1 Load break switch, 3-pin approx. 25 A for installation (extension) IP 40
14. 3 Contactor with suppressor 4kW, 24V DC; 3 H + 2 NC, 2 NO
15. 1 Motor protection switch/motor starter 3 x 0.25 to 0.40A Eaton # XTGRP40BC1, (with auxiliary contact, 1 NC, 1 NO) for 200V 3 phase motor used – if 400V 3 phase motor is used the appropriate motor protection switch must also be used
16. 1 Circuit breaker B 10 A, 1-pole
17. 1 Circuit breaker B 6 A, 1-pole
18. 1 Circuit breaker C 4 A, 1-pole
19. 1 Fault-current circuit breaker (RCD), 16 A/10mA, 2-pin, type A
20. 1 NEMA L21-20 flanged inlet three-phase plug, 5-pin, -X0
21. 1 NEMA 5-15R socket for DIN rail mounting, 125 V, 15 A, -X11
22. 2 Extension housing for 40-pin socket insert
23. 2 Socket insert, 40-pin (\*crimp, screw or screwless insert) \*observe the necessary cross section for the crimp contacts
24. 2 Sleeve housing for 40-pin male insert + PE, 1x with multiple screw connections adapted to the actuator sensor distribution system, compatible with page 6 III/5
25. 2 Pin insert, 40-pin (\*crimp, screw or screwless insert) \*observe the necessary cross section for the crimp contacts
26. 1 NEMA L21-20R three-phase receptacle, 5-pin, -X13
27. 4m Wiring duct, slotted, at least approx. 45 x 65mm
28. 95m Plastic cable H05V-K 0.5mm<sup>2</sup>, dark blue or customary (24 V control circuit)
29. 3.5m Plastic cable H07V-K 1.5mm<sup>2</sup>, light blue or customary (neutral conductor)
30. 3m Plastic cable H07V-K 1.5mm<sup>2</sup>, red or customary (230 V)
31. 5m Plastic cable H07V-K 1.5mm<sup>2</sup>, red or customary (protective conductor)
32. 12m Plastic cable H07V-K 1.5mm<sup>2</sup>, purple or customary (emergency off switching device)
33. 12m Plastic cable H07V-K 2.5mm<sup>2</sup>, black or customary (main power circuit)
34. 2m Plastic cable H07V-K 2.5mm<sup>2</sup>, orange or customary (feed in for load break switch)
35. 5m Plastic cable H07V-K 6mm<sup>2</sup>, green/yellow or customary (protective conductor)
36. X Insulated end sleeve (ferrules)
37. X Insulated ring cable terminal
38. Approx. 50 cable ties, approx. 100mm long
39. X Self-adhesive labels to identify the components

**X= based on the number of components used**

**NOTE: The Home structure of the control cabinet follows the layout diagram on Sheet 1 of 1 included at the start of the schematic diagrams. Any components that are not mounted are to be brought with to the examination.**

## II Control unit parts and equipment that are to be brought to the exam by each test taker:

1. 1 External display and control unit as a housing unit with 18 installation holes
2. 1 Built-in EMERGENCY STOP button insert, 2 channel, 2 NC, locking, fitting to Item no 1
3. 2 Built-in switch insert (toggle stitch, locking), 1 NO, 0-1 (off and on), fitting to Item No. 1
4. 1 Built-in illuminated push button insert with light fixture, 1 NO, red, 24V, fitting to Item No. 1
5. 7 Built-in illuminated push button insert with light fixture, 1 NO, white, 24 V, fitting to Item No. 1
6. 7 Built in indicator lamp with light fixture, 6x white, 1x green, 24V, fitting to Item No.1
7. 10 Dummy plugs for installation unused holes, fitting to Item No. 1
8. 1 Flexible control cable, length approx. 3m, for example, 0.75mm<sup>2</sup>, 40-pin + PE, inserted on the display and control unit with cable strain relief.

More test equipment is listed than is necessary in the initial set up and preparation for the examination. The differing amounts are therefore to be brought along by the test taker in a functioning state on the day of the examination.

## General

**In addition to the test material listed in the "Standard Material Staging List" the following material is also necessary for the examination:**

**The materials should be checked before the test to ensure proper functionality.**

### I Additional parts that must be brought to the exam by each test taker:

1. 5m plastic tube, preferably: inner diameter 2 mm, outer diameter 4 mm; optionally: inner diameter 4 mm, outer diameter 6 mm
2. 1 double-acting cylinder, piston diameter: 10 mm, stroke: 60 mm, piston rod with thread and lock nut, optionally available with adjustable end position damping on both ends, with magnetic ring, mounted on a base and with a swivel head/ fork head.
3. 2 throttle check valve (exhaust throttling), adjustable and securable, fastened to cylinder or mounting plate, compatible with item no 2
4. 2 proximity switch, operating voltage: 24 V DC, actuated via magnetic ring, compatible with item no 2 with connection cable connected. 1 NO. 3-wire connection. incl. push-in fitting compatible with page 6 III/5
5. 1 Axis model made according to the drawing provided in accordance with additional details
6. 3 **Contactors with suppressor 4 kW, 24 V DC; 3H + 2 NC, 2 NO**
7. 1 **Gear motor with releasable coupling, adapted to the spindle drive of the axis model: three-phase 208V, 25W, 60Hz, .24A approx. with connecting material** (400V is also possible with the appropriate motor protection switch)
8. 3m H07RN-F 4G1.5 mm<sup>2</sup>, black or customary, or S00W 12AWG 4-wire, **compatible with Item No.8 (-X13 wire)**
9. 1 **1 NEMA L21-20P for connection of Item No.7 (-X13 plug)**
10. 3 inductive proximity sensor, 3-wire connection, 1 NO, PNP output, operating voltage: 24 V DC, metal housing with thread of M12 x 1, minimum usable thread length of 30 mm, with 2 mounting nuts, suitable for flush installation, rated operating distance: 4 mm with approx. 1.5 m longer prefabricated connection cable incl. push-in fitting compatible with page 6 III/5
11. 1 light fixture, 1 x red, 24 V, compatible with page 7 II/6
12. 1 Integrated illuminated button with light source, 1 NO, white, 24V, compatible with page 7 II/1
13. 1 Fasteners for your collection containers, assemblies, and pneumatic components on the mounting plate
14. 1 Fuse socket (-F0) D01, 3 pin with suitable screw caps
15. 3 Adapter sleeve insert D01, 10 A, compatible with item no 14
16. 3 Neozed fuse link D01, 10 A, compatible with item no 14
17. 1 **Assembly fabricated and assembled according to the drawings provided in accordance with additional details in the mechanical drawings (see pages 24 and 55).**
18. X semi-finished product without assignment to drawing (see page 25)
19. 2 Cap screw M4 x 12 - 8.8 (DIN EN ISO 4762)
22. 1 **1 permanent electromagnet, diameter 20 mm, height 25 mm, thread 4 mm, operating voltage 24 V DC, holding force min. 45 N, currentless magnetic (e.g. Red Magnetics ITS-PE-2025)- with approx. 1.5m long prefabricated connection cable (correctly extended), incl. plug connector M12 compatible with actuator sensor distribution system components page 6 III/5**

# AHK-USA Chicago

Final Examination Part 2 – 2025

**Practical Task****Training tools, extras and  
Exam Day Equipment****Mechatronics Technician**

The following items are standard equipment that is required for the companies to properly train and prepare an apprentice for the examination. The following equipment must be accessible to each apprentice at his/her training facility and should therefore also be available for use in preparation of the equipment for a mechatronics examination. Not all items will be needed but should be provided whenever deemed necessary according to preparation material and assignment given.

**I Quality measuring equipment that must be provided by the training company for each test taker:**

1. 1 caliper	min. 135mm	DIN 862
2. 1 flat square	100x70mm	
3. 1 wide base square	100x70mm	
4. 1 straight edge square	100x70mm	
5. 1 two-pin voltage tester (optional)	according to VDE 0413	

**II Tools that must be provided by the training company for each test taker:**

1. 1 scribe		
2. 1 center punch		
3. 1 engineer's hammer	Approx. 300g	DIN 1041
4. 1 mallet		
5. 1 hacksaw for metal	300 mm	DIN 6473
6. 1 flat file	150-1 150-3 250-1	DIN 7261
7. 1 triangular file	150-1 150-3	DIN 7261
8. 1 round file	150-1 150-3	DIN 7261
9. 1 square file	150-1 150-3	DIN 7261
10. 1 semi-round file	150-1 150-3	DIN 7261
11. 1 needle file H3	flat, triangular, round rectangular	
12. 1 file brush		
13. 1 triangular scraper		
14. 1 pin punch	4 5mm	DIN 6450
15. 1 Allen wrench set	SW 2.5 3 4 5 mm	ISO 2936
16. 1 screwdriver for slotted screws	A 0.5x3.0 A0.8x4.0 A 1.0x5.5 A1.2x6.5	DIN 5265
17. 1 screwdriver each for Phillip's head screws	size 0 size 1 size 2	DIN 5262
18. 2 parallel C-clamps	40 to 100 mm span or similar	
19. 1 side cutter		
20. 1 combination pliers		
21. 1 angled telephone plier		DIN 5745 B
22. 1 wire stripper		
23. 1 cable tie pliers (if necessary)		
24. 1 crimper for wire-end ferrules	0.14-2.5 mm <sup>2</sup>	
25. 1 cable stripping knife		
26. 1 tubing cutter to shorten pneumatic hoses		
27. Open end wrench of appropriate sizes for mounting of push-in pneumatic fittings and silencers		
28. 1 external snap ring pliers	range approx. 3 to 10mm	DIN 5254

**III Measurement/testing equipment that must be provided by the training company for each test taker:**

1.	1 universal protractor		
2.	1 set of radius gauges	1-6 (concave and convex)	
3.	1 steel rule	300mm	
4.	1 set of feeler gauges	0.05 to 0.5mm	
5.	1 caliper	300mm	DIN 862
6.	1 plug gauge H7	4 5	
7.	1 outside micrometer	0-25mm 25-50mm	
8.	1 VDE-test device VDE 0413	to check protective measures according to VDE 0100-600 (insulation resistance, PE conductor resistance, etc.)	
9.	1 RCD-tester VDE 0413	if not included in Item No. 8	
10.	1 multi-meter with probes		
11.	1 watch/timer with seconds measurement		
12.	1 rotary field test instrument		
13.	1 wire terminal crimper	for wire terminals 1.5mm <sup>2</sup> to 4 mm <sup>2</sup> or crimp contacts	

**IV Tools and equipment that must be provided by the training company for each test taker:**

1.	1 divider/compass	150mm leg length	
2.	1 set of marking stamps (Arabic numbers)	3mm	
3.	Open ended wrench of each size	WAF 6x7 8x9 10x11 12x13 17x19 24x27mm	DIN 3110
4.	1 set of taps (with tap wrench) or machine taps	M3 M4 M5 M6 (standard pitch) M12x1	
5.	1 center drill of each size	Each A 1.6 A2.5	DIN 333
6.	1 twist drill of each size	Each Ø 2.5, 3.3, 3.8, 4.2, 4.5, 4.8, 5.0, 5.5, 5.8, 6.0, 6.6, 8.0, 10.5, 11.0, 12.0, 12.5	
7.	1 counter bore of each size	Each 6.5x3.4 8x4.5 10x5.5	DIN 373
8.	1 tapered countersink 90° of each size	Each 1-5 5-10 10-15	DIN 335
9.	1 machine reamer H7 of each size	4 5	DIN 212
10.	1 appropriate tool to assemble control panel and switches		
11.	1 H7 hand reamer of each size	4 5	

**V The following are provided during the examination in the testing center in collaboration with the Exam Board for 1 to 5 test takers:**

- 1 surface plate with general accessories such as height marker, prism, angle, layout fluid
- 1 floor drill press up to 13mm size drill bit with machine vice and general accessories

**VI Test equipment that the company must provide, and each test taker must bring to the examination:**

- 1 chalk
- 1 cleaning cloth
- 1 whisk broom
- 1 file cleaner
- 1 permanent pen/marker for labeling

**VII The following are provided during the examination in the testing center in collaboration with the Exam Board for 1 to 5 test takers:**

- Parallel vice (with protective jaws)
- 1 compressed air connection, with on/off switch, 6 bar and corresponding pneumatic hoses, T-couplings or air manifold, with appropriate air fitting/s (M6 push to connect)
- 1 three-phase socket 3P/N/PE L21-20/208V, 60hz

**VIII Equipment/Resources that the company must provide, and each test taker must bring to the examination:**

1. Mechanical and Metal Trades Handbook and Electrical Engineering Handbook
2. One sided 3x5 note card with a collection of quick reference formulas
3. 1 writing instrument with drawing tools
4. 1 NON-programmable, battery or solar powered calculator without third-party communication possibilities
5. 1 set of personal protection equipment
6. 1 appropriate voltage extension cable to connect the control cabinet at test facility
7. 1 binder/folder for your documents

**IX Programming device that the company must provide, and each test taker must bring to the examination:**

1. Programming device for the PLC system used

YELLOW  
Confidential Draft  
provided to  
ICATT affiliated companies  
2025



**AHK**

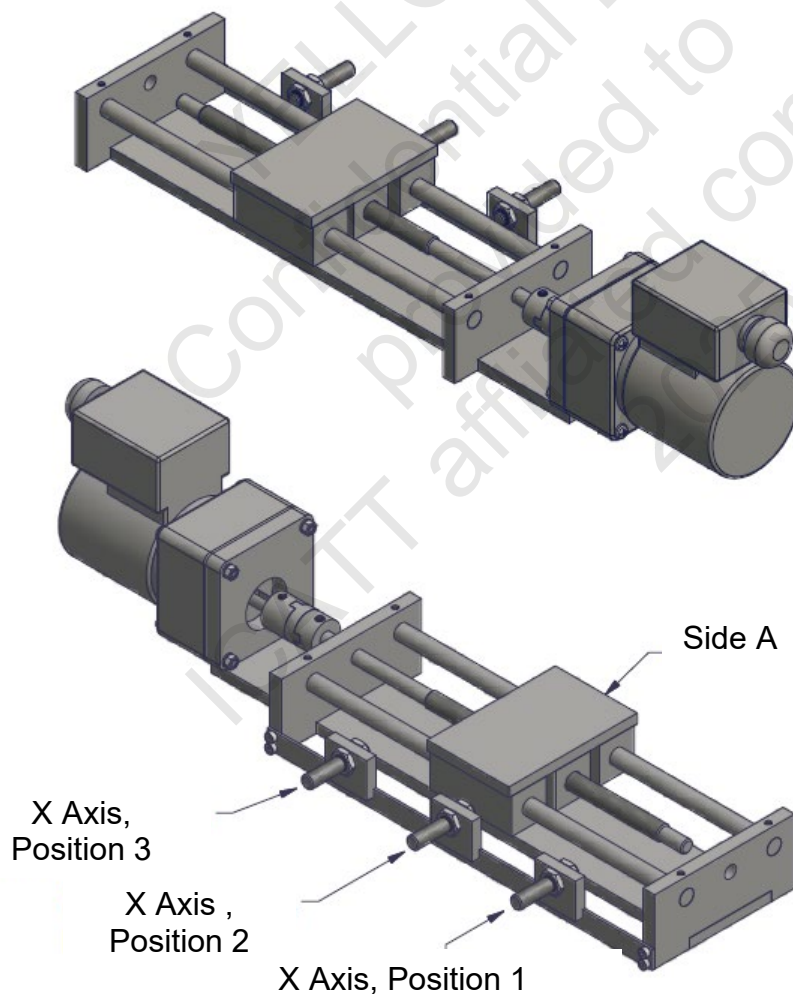
Final Examination Part 2 - 2025

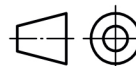
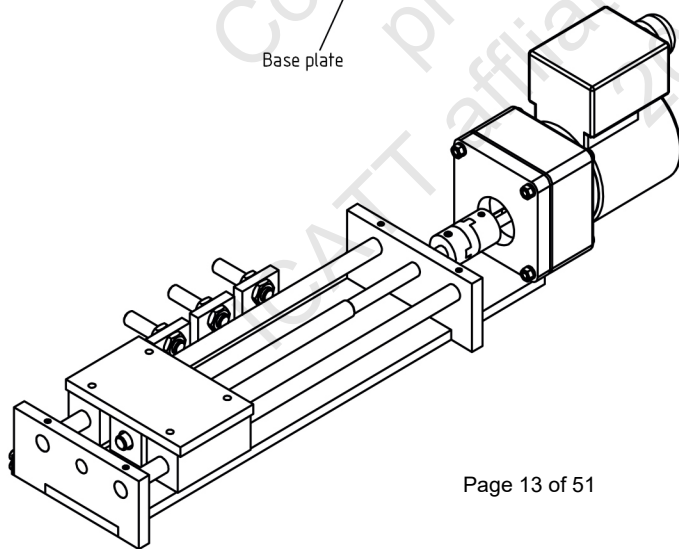
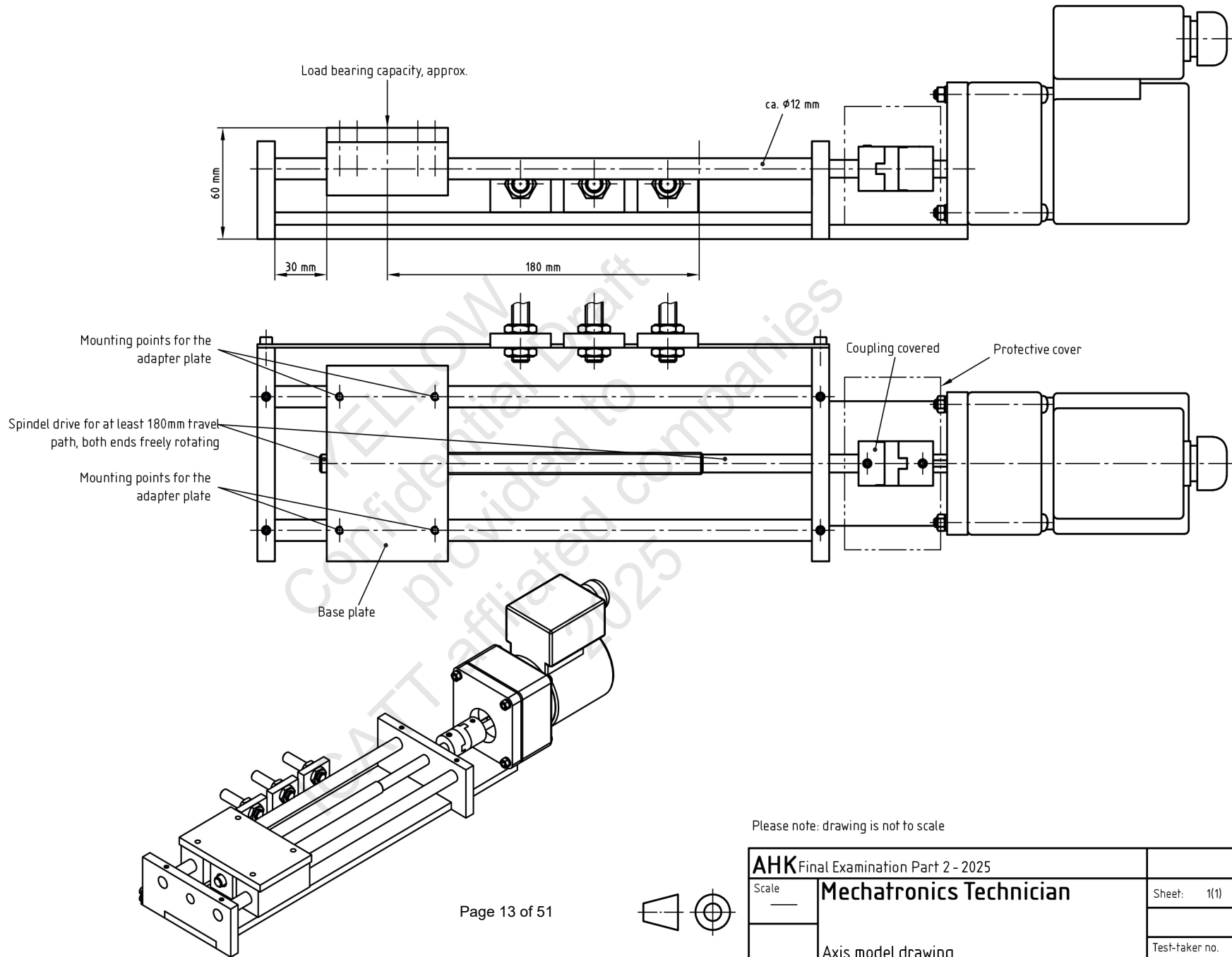
**Preparation of the Practical task:  
Axis Module****Mechatronics Technician**

If not already assembled in kit, you are to procure and fabricate the illustrated axis module (example) according to the following representations and additional information.

**Please note in particular:**

- Work height of the carriage slide – 60mm
- Capacity of the carriage slide at least 4kg
- Path of movement at least 180mm
- Free path of carriage slide on both sides at least 30mm
- Coupling covered
- The position of the sensor mount, for recording the carriage slide position, must be variable
- Powered by the gear motor
- Fastened to the mounting plate
- **Home position is position 3**



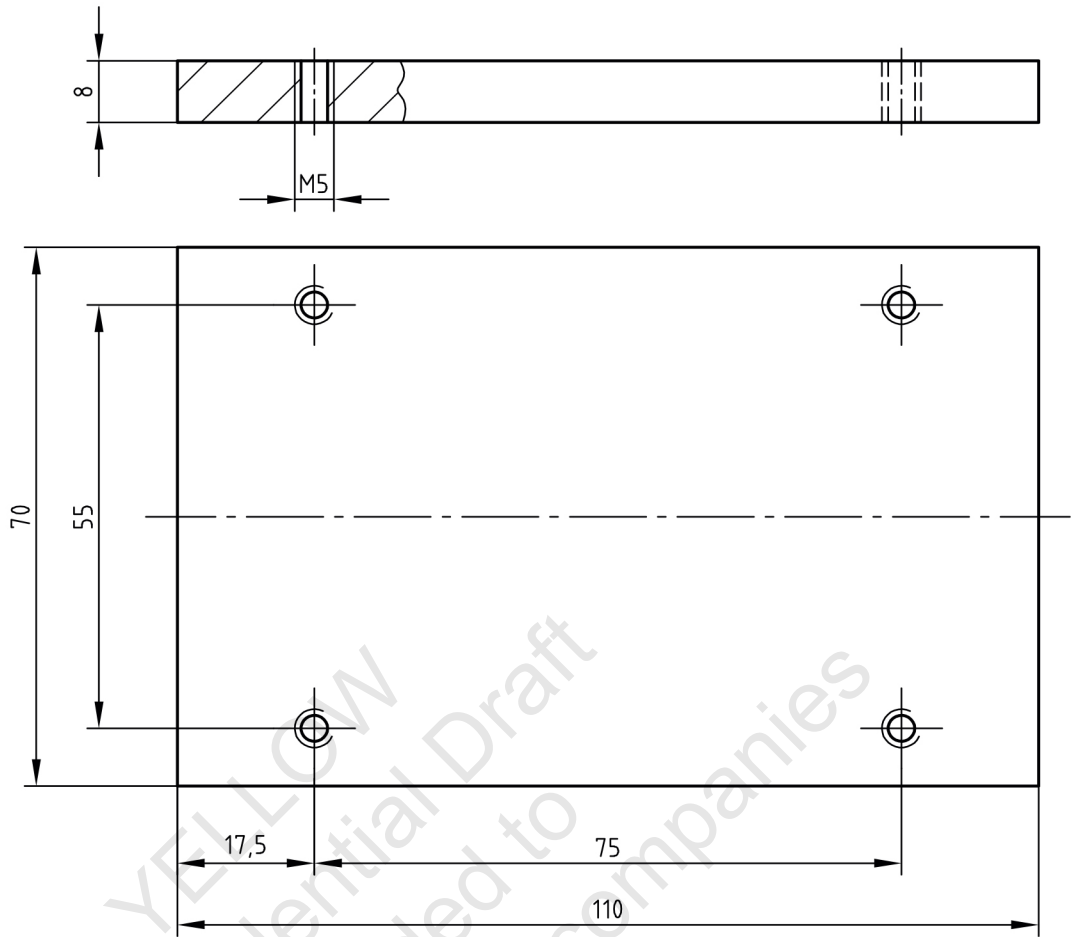


Please note: drawing is not to scale

<b>AHK</b> Final Examination Part 2 - 2025		
Scale	<b>Mechatronics Technician</b>	Sheet: 1(1)
	Axis model drawing	Test-taker no.

Base plate

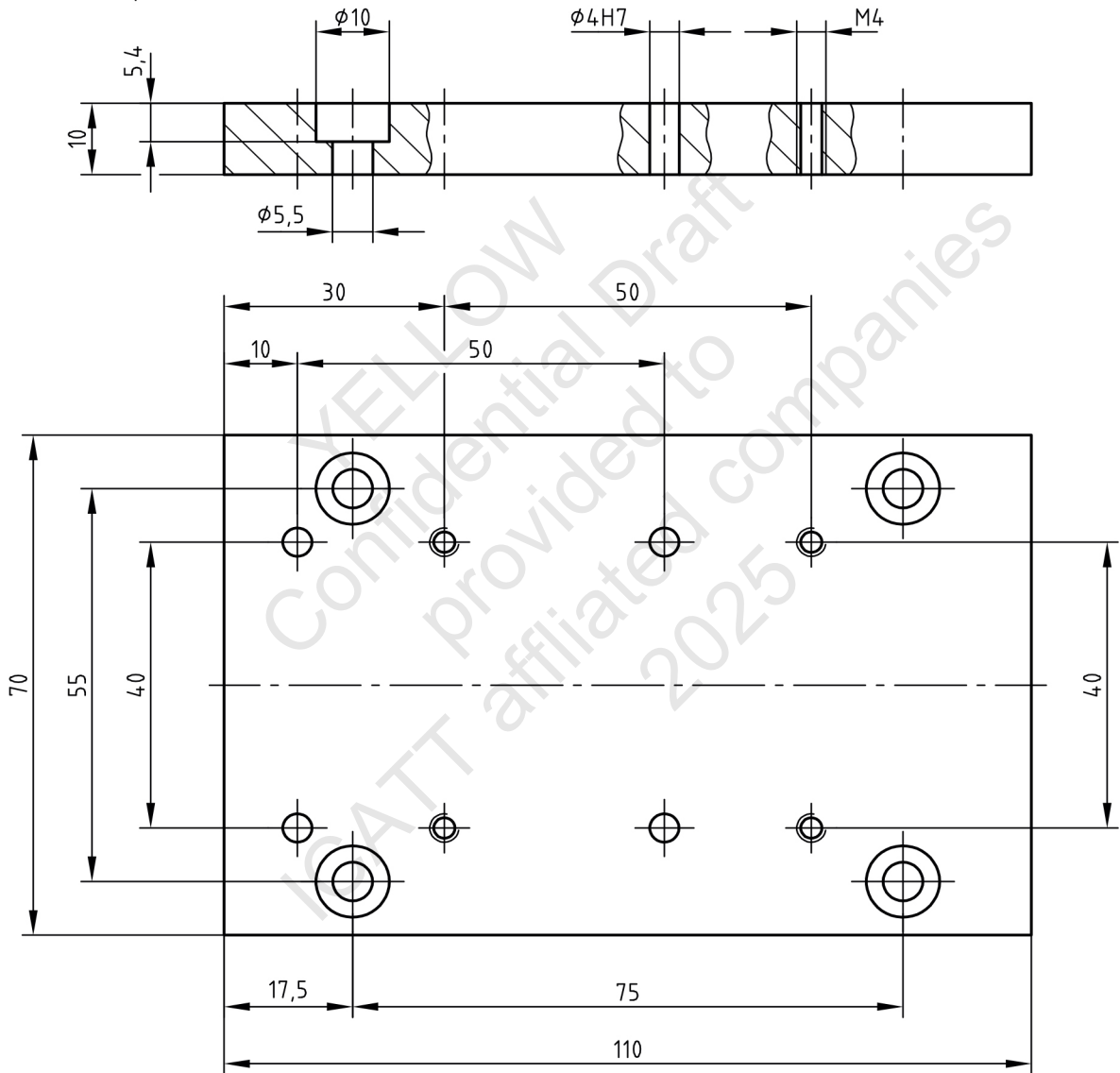
e.g. flat steel, S235JRC+C



You are to procure and fabricate the shown parts and assemble according to the drawings and additional information on the following pages:

## Adapter plate

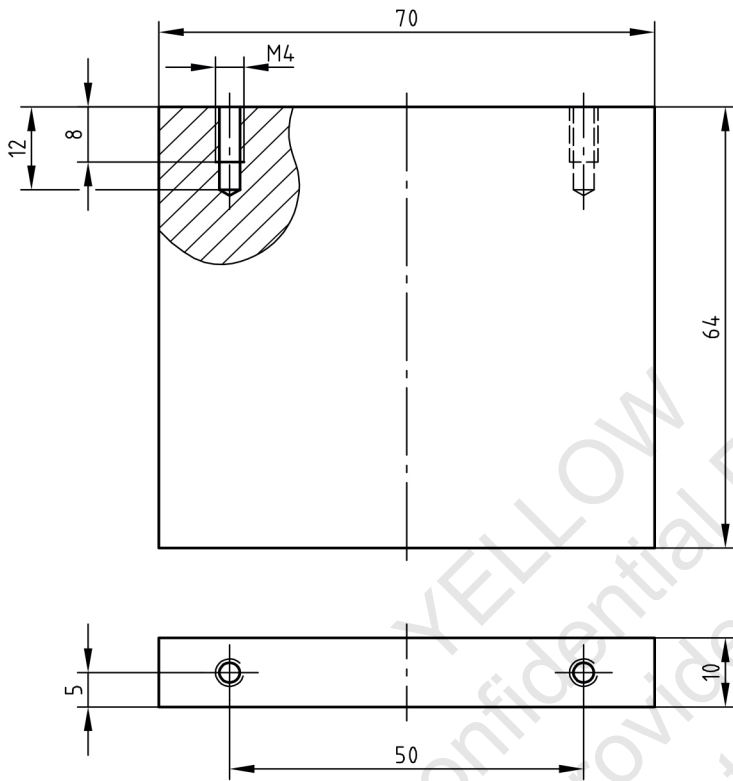
S235 JR+C  
(fitted to base plate)



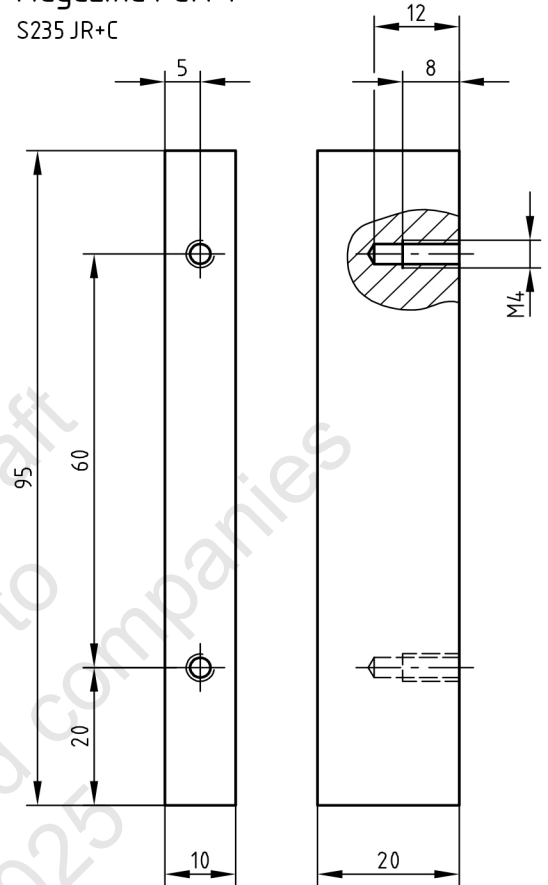
Task  
Semi-finished parts

Mechatronics Technician

Table leg  
S235 JR+C



Magazine Part 1  
S235 JR+C

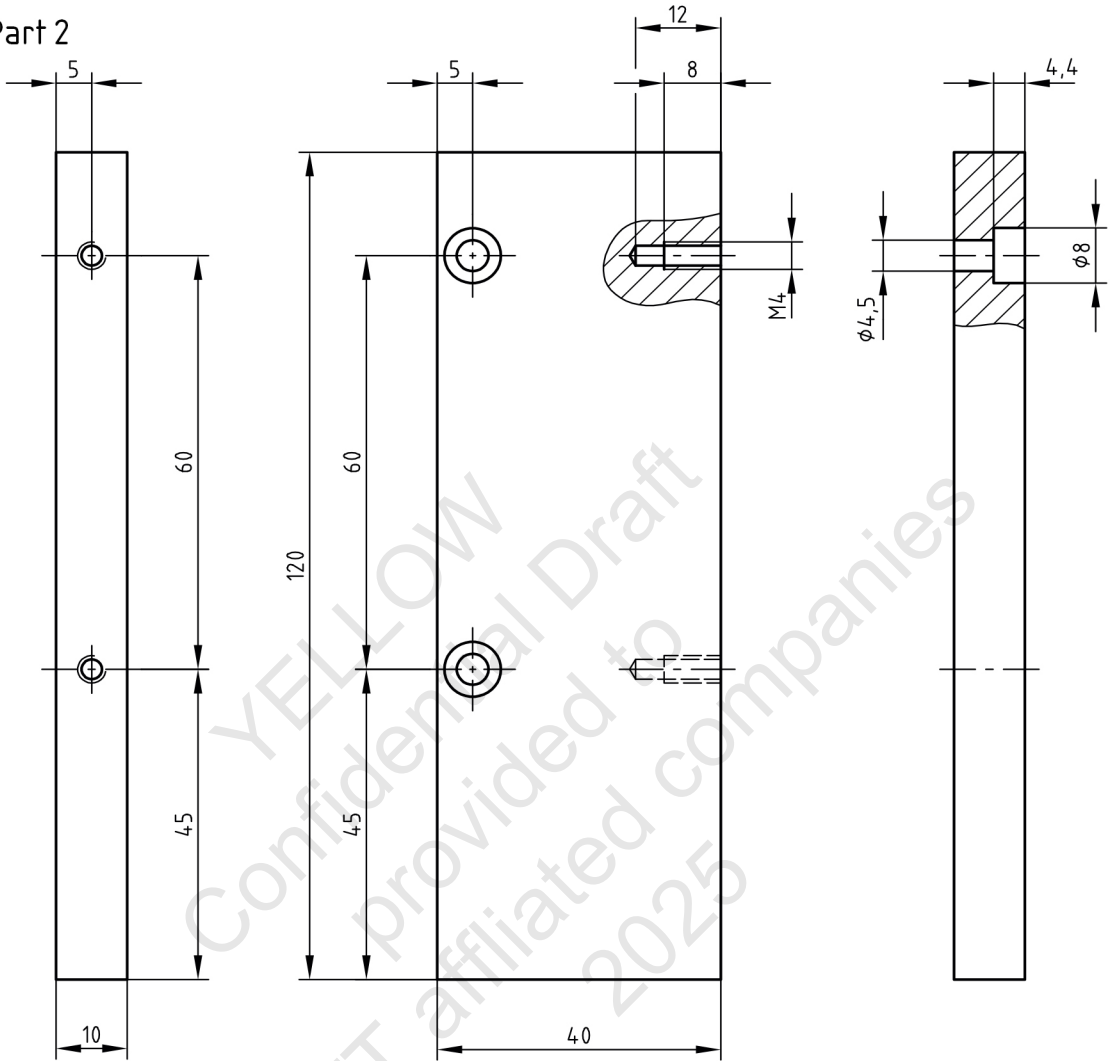


Task  
Semi-finished parts

Mechatronics Technician

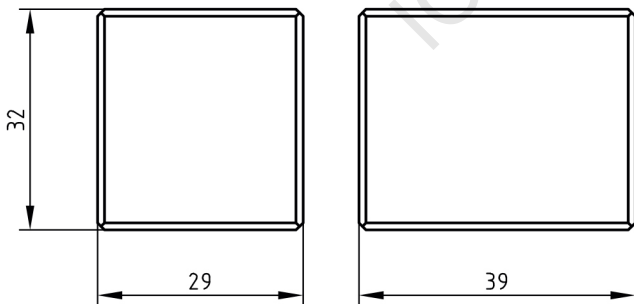
## Magazine Part 2

S235 JR+C



## Cube

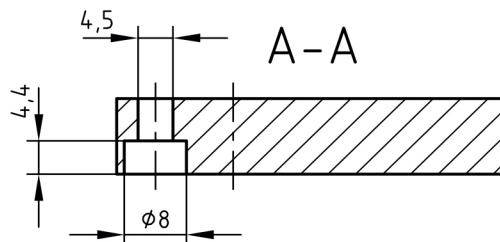
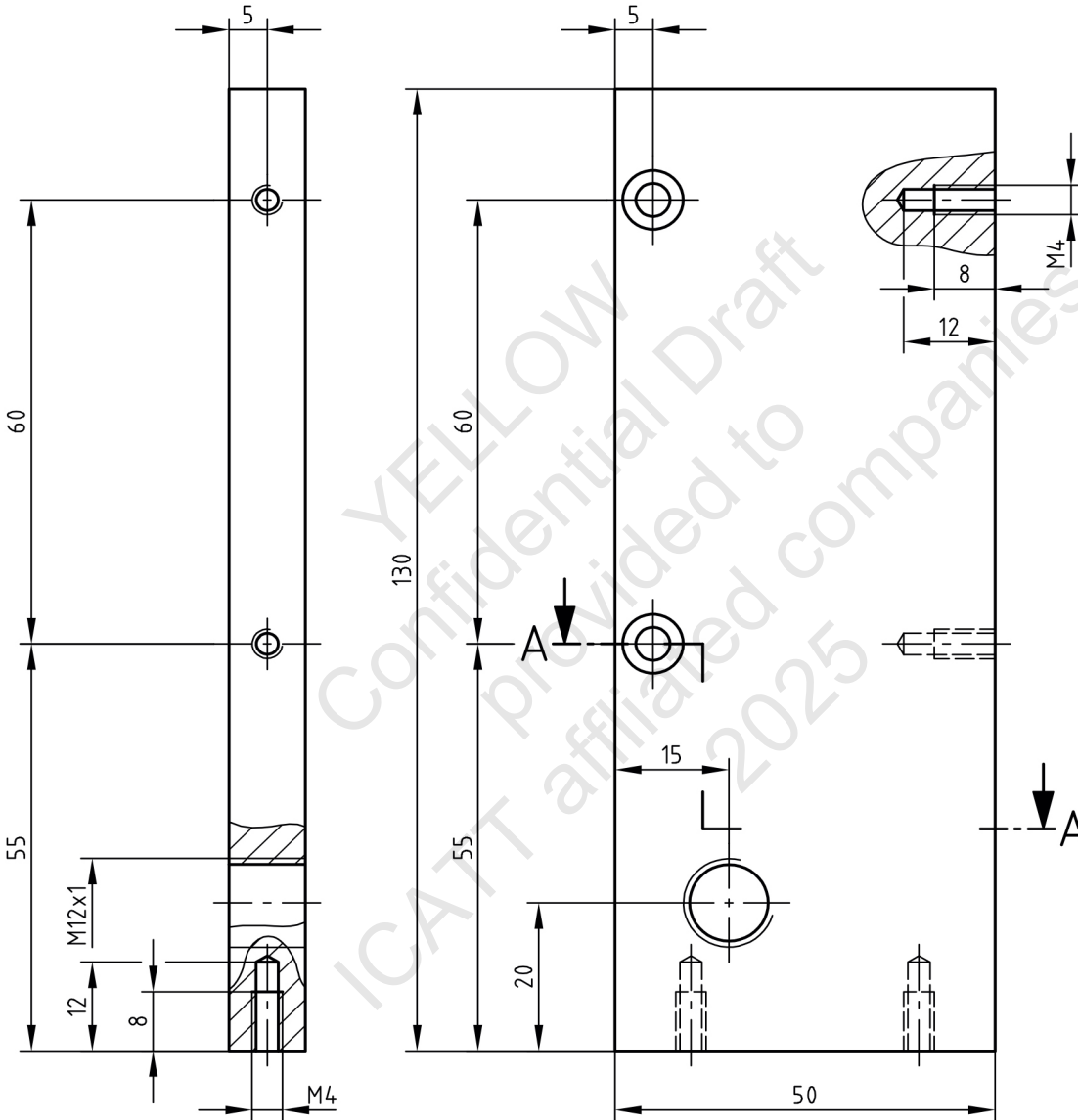
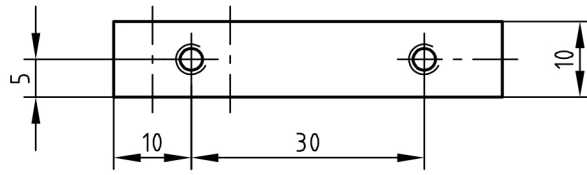
3 pieces, steel (e.g. S235 JR)



non-dimensioned chamfers 1x45°

## Magazine Part 3

S235 JR+C

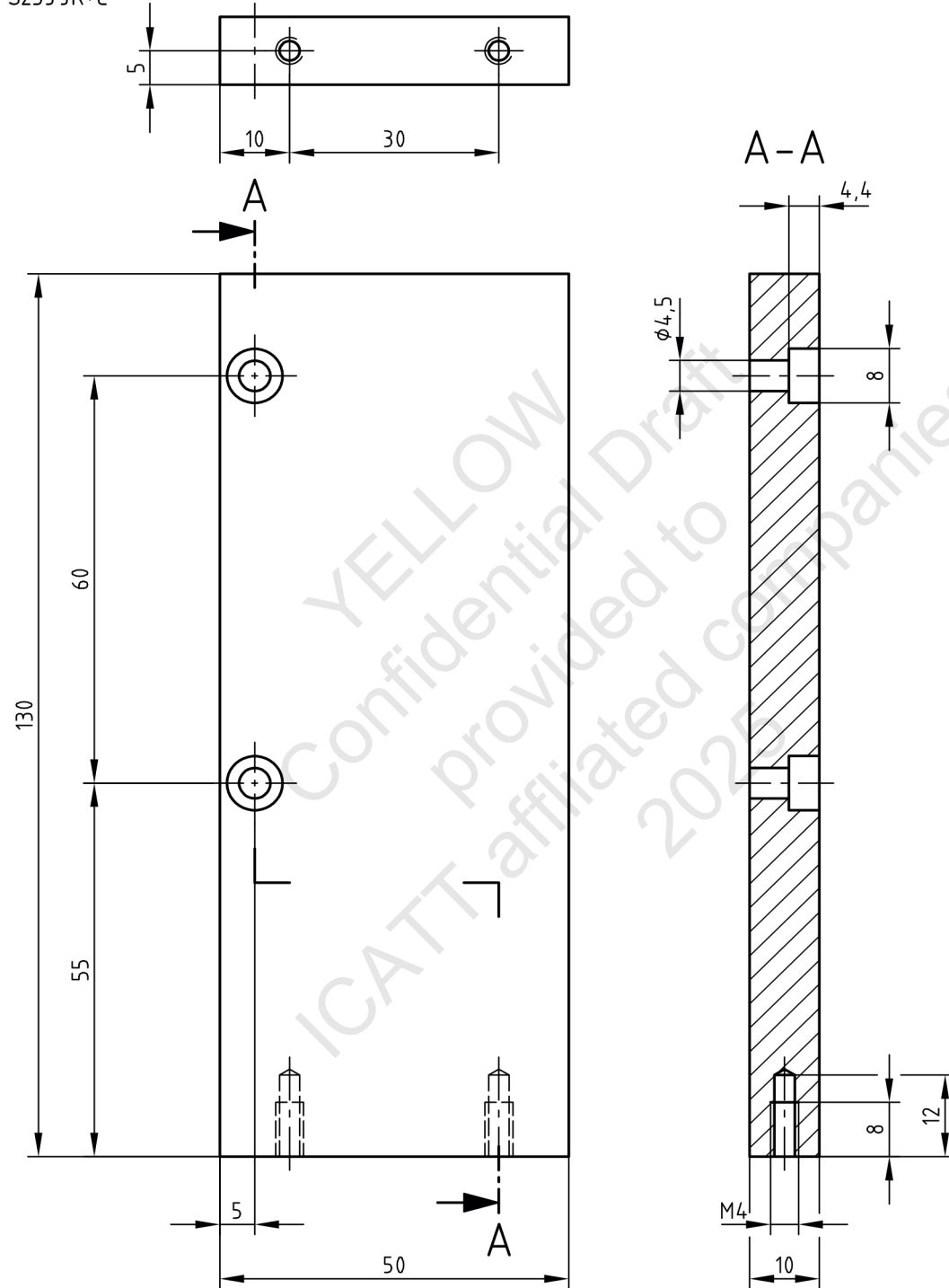


Task  
Semi-finished parts

Mechatronics Technician

## Magazine Part 4

S235 JR+C





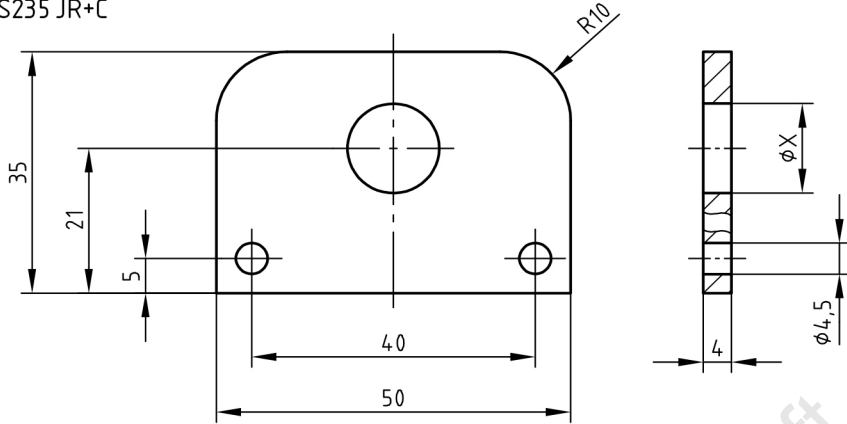


Task  
Semi-finished parts

Mechatronics Technician

## Cylinder holder 1

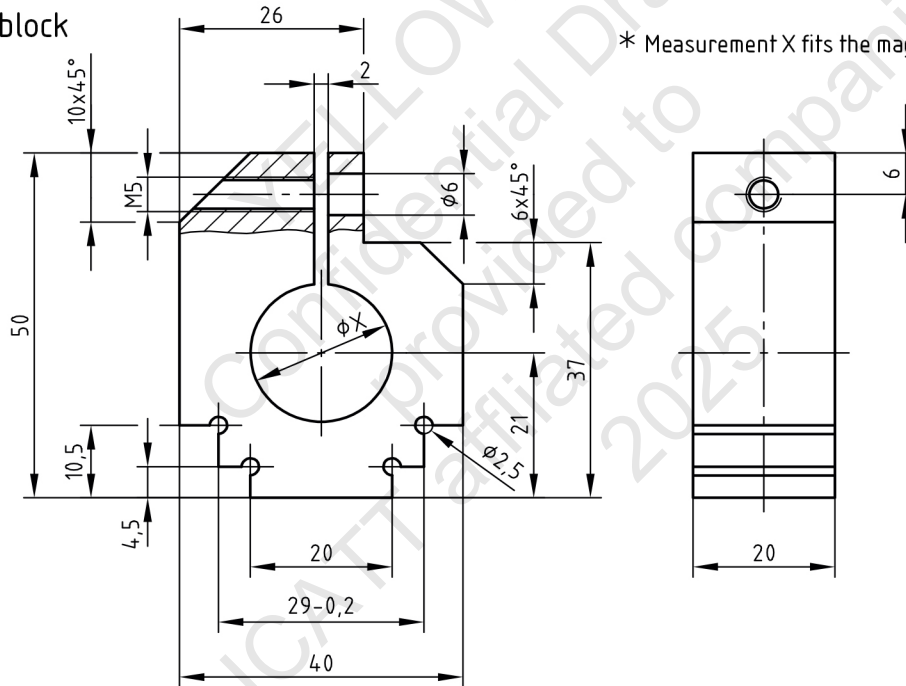
S235 JR+C



\* Measurement X fits the pneumatic cylinder used. ( $\phi 10$ , Stroke 60)

## Clamping block

PVC



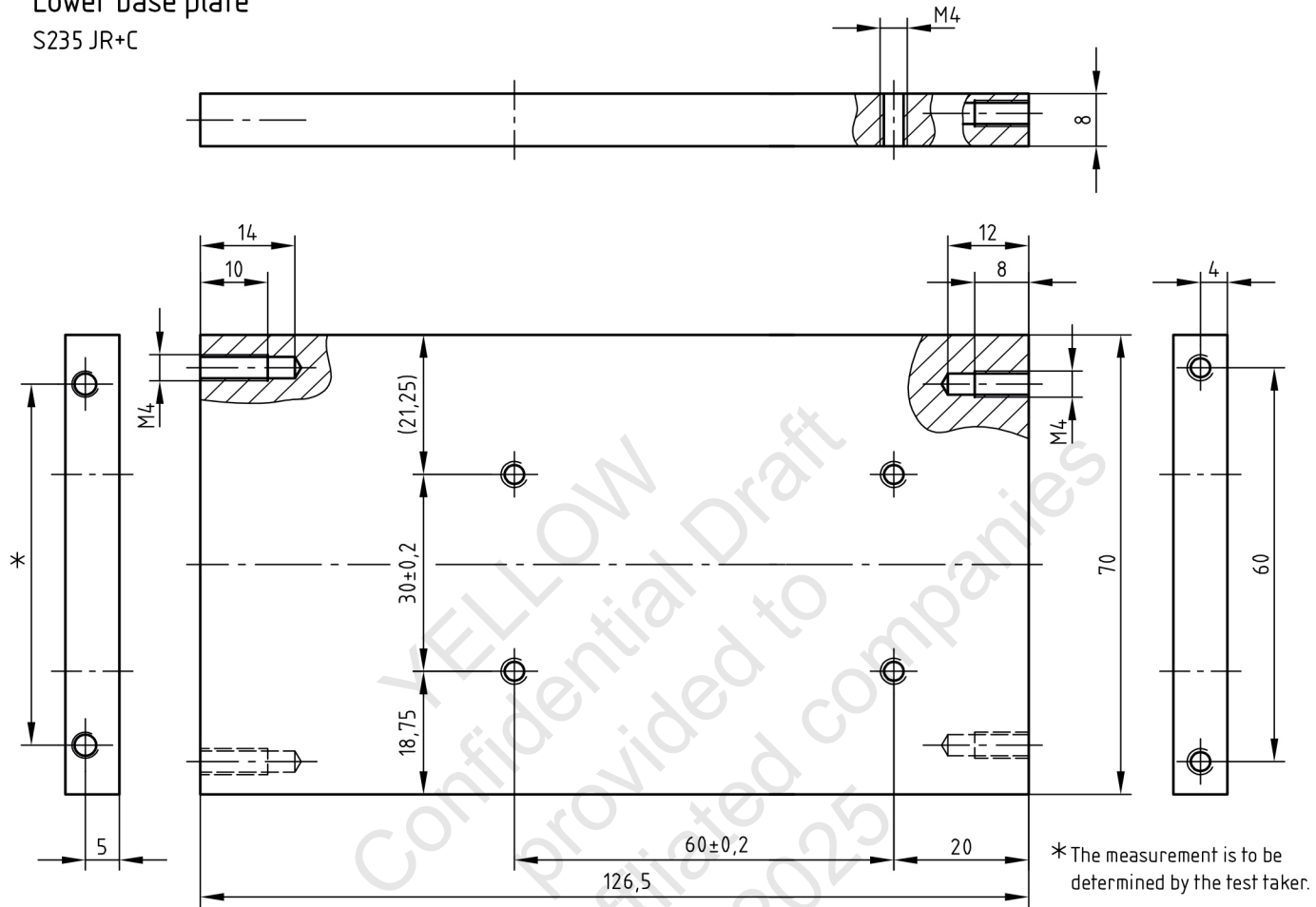
\* Measurement X fits the magnet used.

Task  
Semi-finished parts

Mechatronics Technician

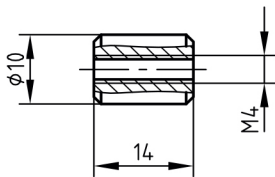
## Lower base plate

S235 JR+C



## Stamp

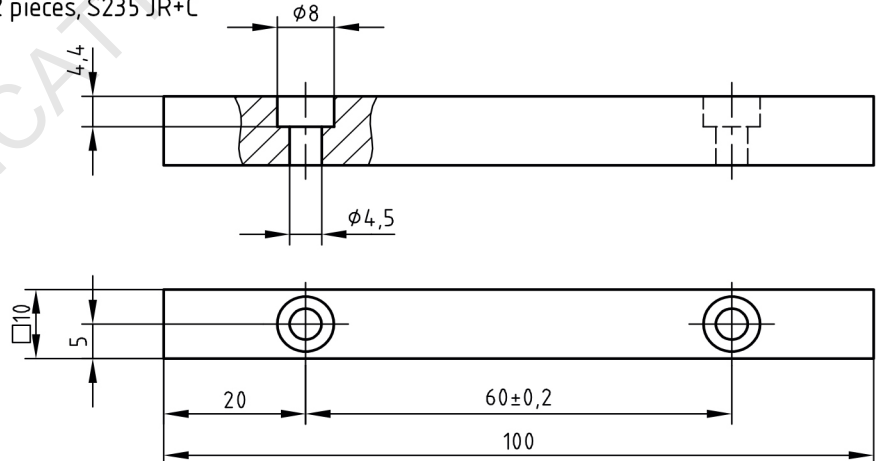
11SMn 30+C



non-dimensioned  
chamfers 1x45°

## Guide rail 3 and 4

2 pieces, S235 JR+C



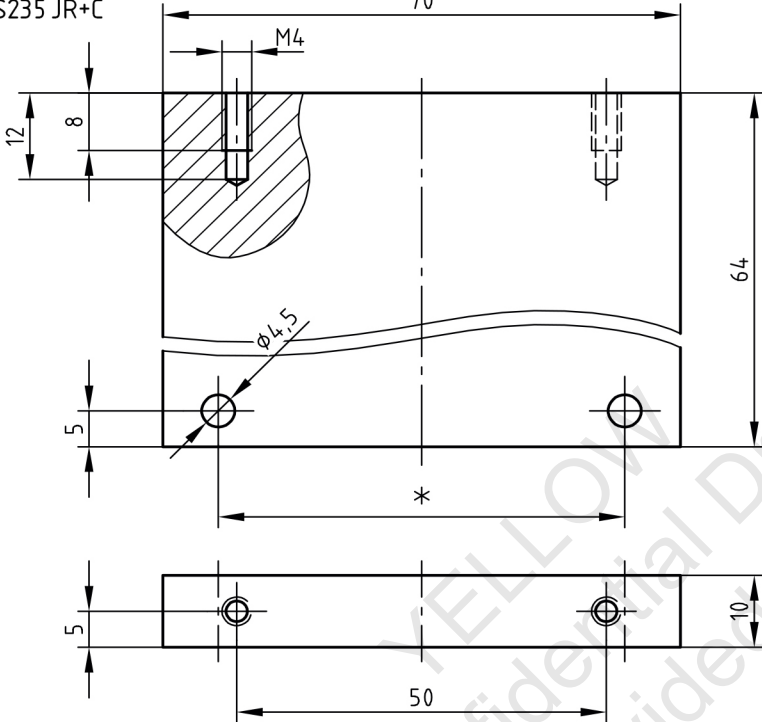
Task  
Semi-finished parts

Mechatronics Technician

Table leg 1

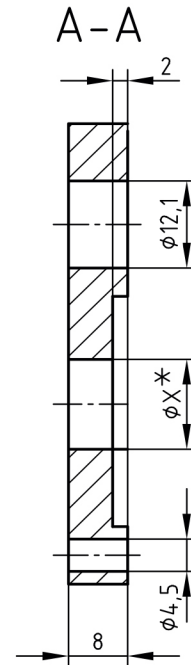
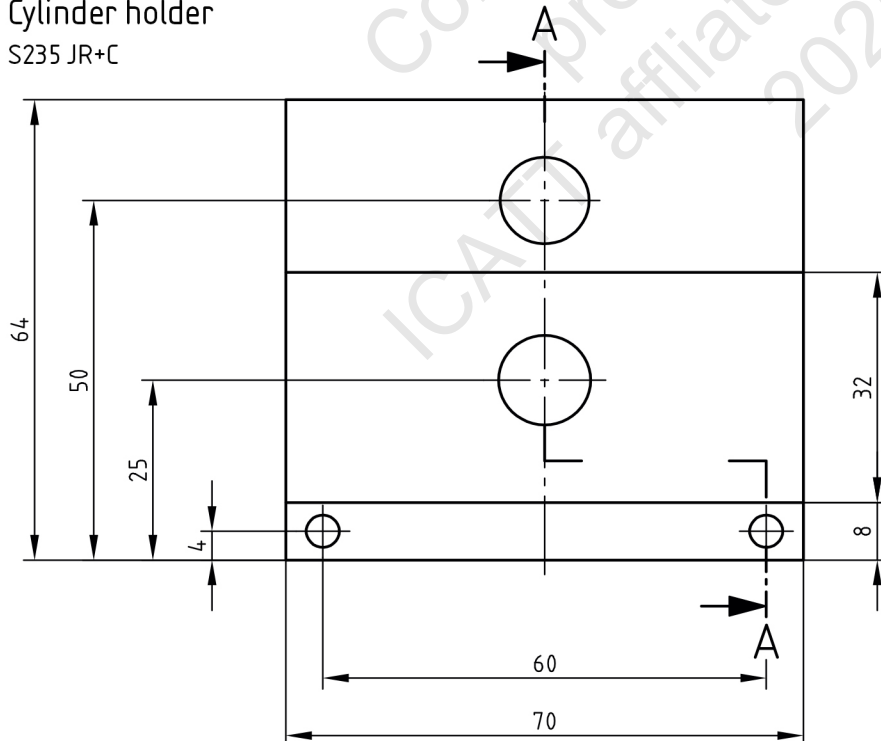
S235 JR+C

\* The measurement is to be determined by the test taker.  
70



Cylinder holder

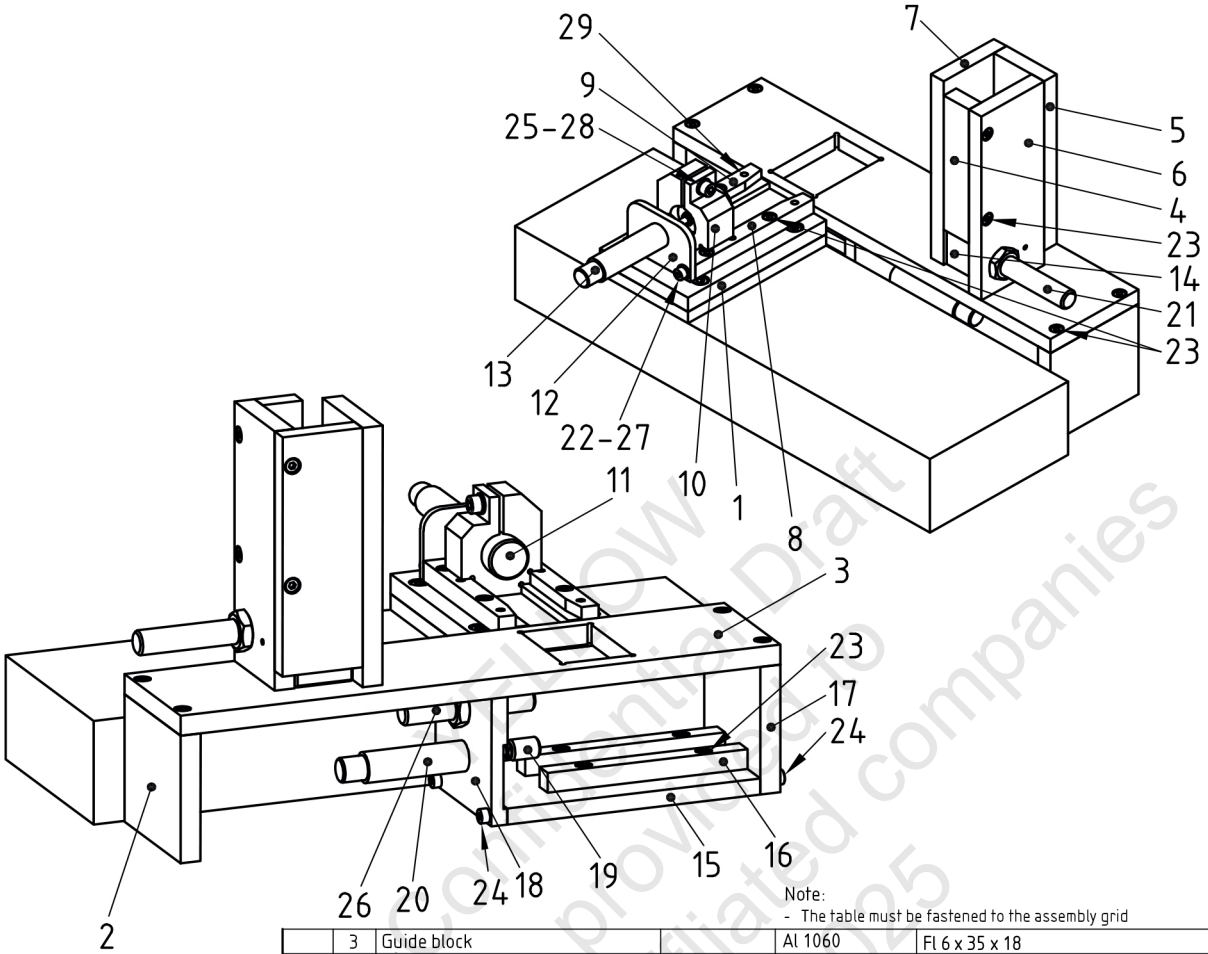
S235 JR+C



\* Measurement X fits the pneumatic cylinder used. ( $\phi 10$ , Stroke 40)

Task  
Complete Phase 1 assembly of the Unit with full BOM

Mechatronics Technician



Note:  
- The table must be fastened to the assembly grid

	3	Guide block		Al 1060	Fl 6 x 35 x 18
	3	Container		Al 1060	SM 2 x 107,2 x 113,2
	2	Guide rails 5 and 6		S235JR	Fl 10 x 10 x 175 EN 10278
	29	4 Dowel pin 4 x 18 - A	ISO 8734	St	
	28	1 Washer 5	ISO 7089	200 HV	
	27	2 Washer 4	ISO 7089	200 HV	
	26	1 Capacitive sensor			
	25	1 Socket Head Cap screw M5 x 16	ISO 4762	8.8	
	24	4 Socket Head Cap screw M4 x 16	ISO 4762	8.8	
	23	22 Socket Head Cap screw M4 x 12	ISO 4762	8.8	
	22	2 Socket Head Cap screw M4 x 10	ISO 4762	8.8	
	21	1 Inductive sensor			
	20	1 Pneumatic cylinder (ø10, stroke 40)			
	19	1 Stamp		11SMn30+C	Rd 10 x 14 EN 10278
	18	1 Cylinder holder		S235JR	Fl 70 x 8 x 64 EN 10278
	17	1 Table leg 1		S235JR	Fl 70 x 10 x 64 EN 10278
	16	2 Guide rails 3 and 4		S235JR	Fl 10 x 10 x 100 EN 10278
	15	1 Bottom base plate		S235JR	Fl 70 x 8 x 126,5 EN 10278
	14	3 Block		S235JR	29 x 32 x 39
	13	1 Pneumatic cylinder (ø10, stroke 60)			
	12	1 Cylinder holder 1		S235JR+C	Fl 35 x 4 x 50 EN 10278
	11	1 Permanent electromagnet			
	10	1 Clamping block		PVC	Fl 40 x 20 x 50
	9	1 Guide rail 2		S235JR+C	Fl 10 x 15 x 94 EN 10278
	8	1 Guide rail 1		S235JR+C	Fl 10 x 15 x 94 EN 10278
	7	1 Magazine part 4		S235JR+C	Fl 50 x 10 x 130 EN 10278
	6	1 Magazine part 3		S235JR+C	Fl 50 x 10 x 130 EN 10278
	5	1 Magazine part 2		S235JR+C	Fl 40 x 10 x 120 EN 10278
	4	1 Magazine part 1		S235JR+C	Fl 20 x 10 x 95 EN 10278
	3	1 Table top		S235JR+C	Fl 70 x 10 x 300 EN 10278
	2	1 Table leg		S235JR+C	Fl 70 x 10 x 64 EN 10278
	1	1 Adapter plate		S235JR+C	Fl 70 x 10 x 110 EN 10278
Item no.	Qty.	Designation		Material	Semi-finished product (according to materials provisioning list)

# AHK

Final Examination Part 2 - 2025

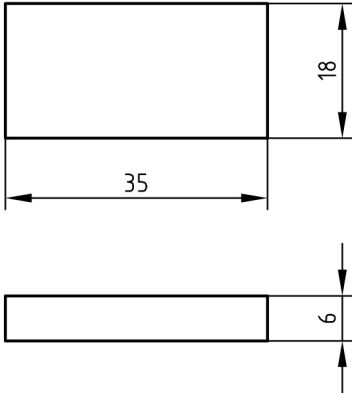
Task  
Semi-finished parts without allocation in Phase 1

Mechatronics Technician

Additional information will be provided in Phase 2 and /or on Exam Day.

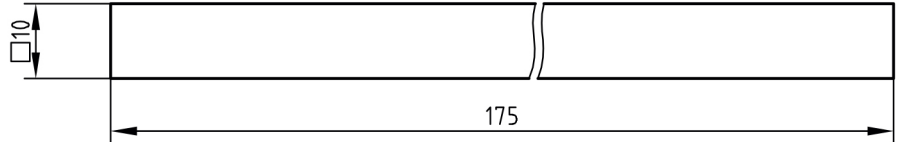
## Guide Block

3 pieces, aluminum, 1060



\*Guide rails 5 and 6\*  
2 pieces, S235 JR+C

\*All test takers must have their own pieces for Guide rails 5 and 6. They cannot be shared.



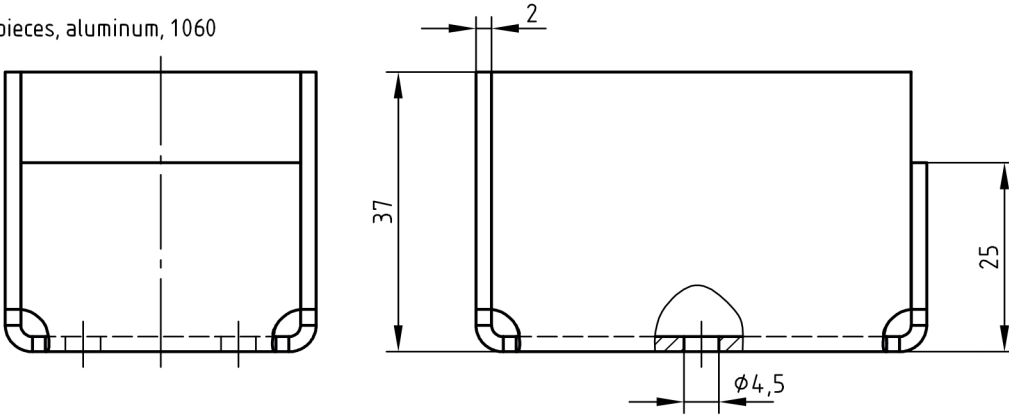
YELLOW  
Confidential Draft  
provided to  
ICATT affiliated companies  
2025

Task  
Semi-finished parts without allocation in Phase 1  
Additional information provided in Phase 2

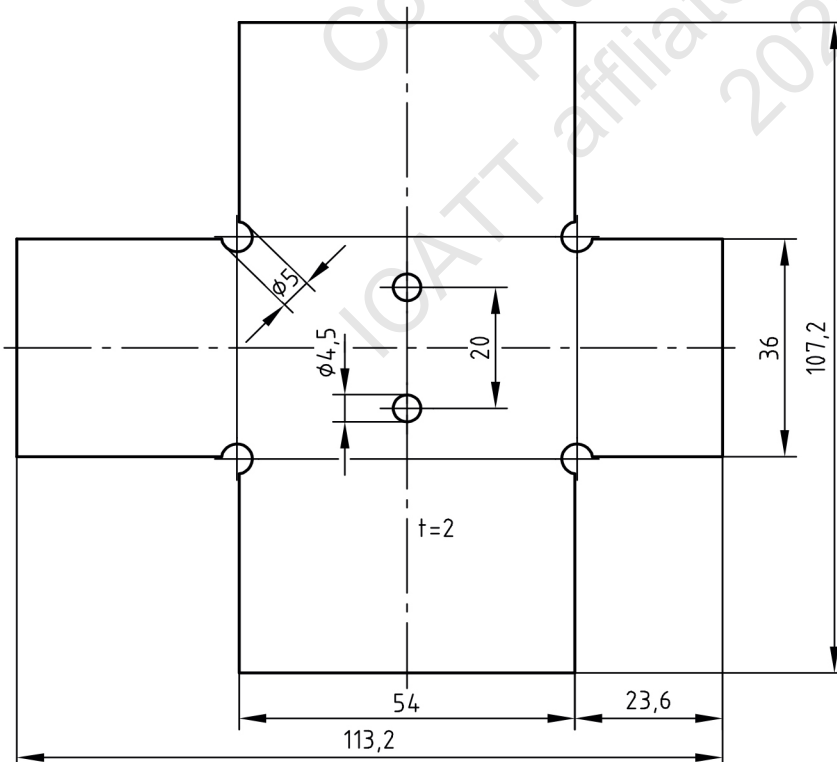
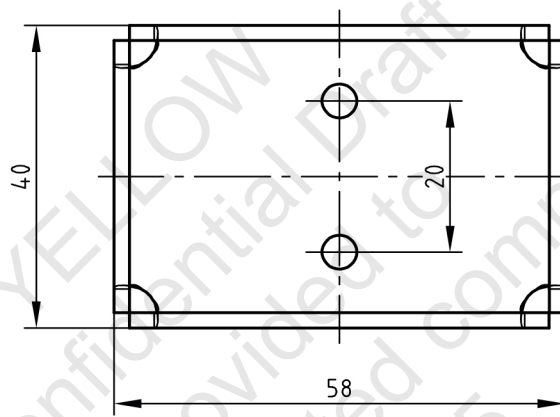
Mechatronics Technician

## Container

3 pieces, aluminum, 1060



Bending radius R1



# AHK

Final Examination Part 2 - 2025

**Practical Task overview**  
**Switch cabinet, control unit, wiring**  
**diagrams**

**Mechatronics Technician**

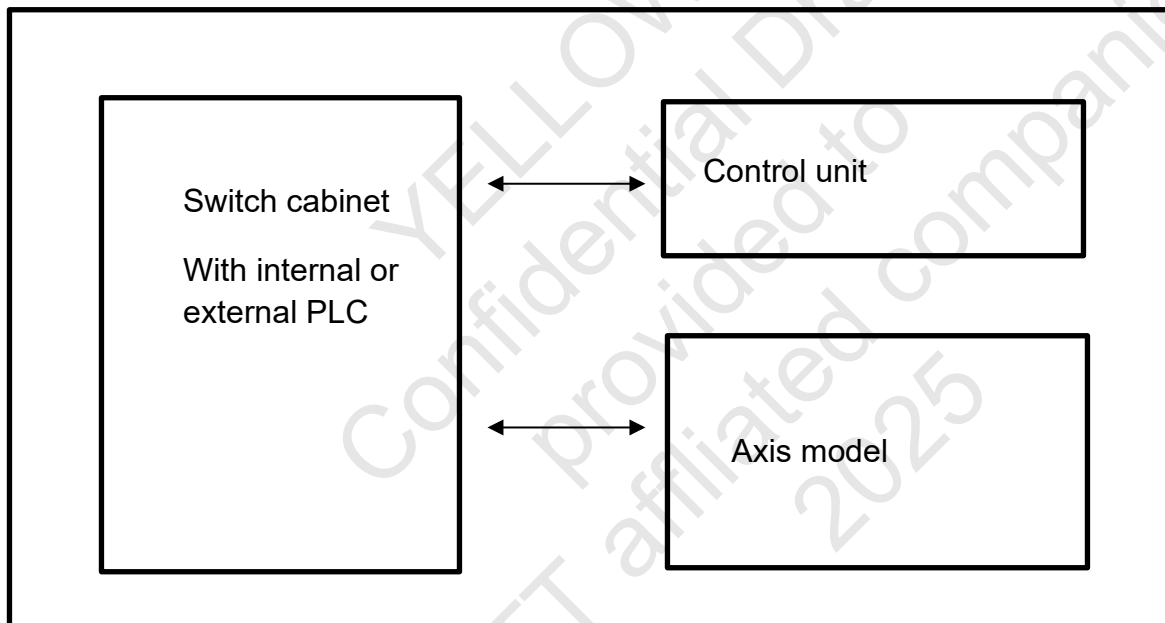
## General

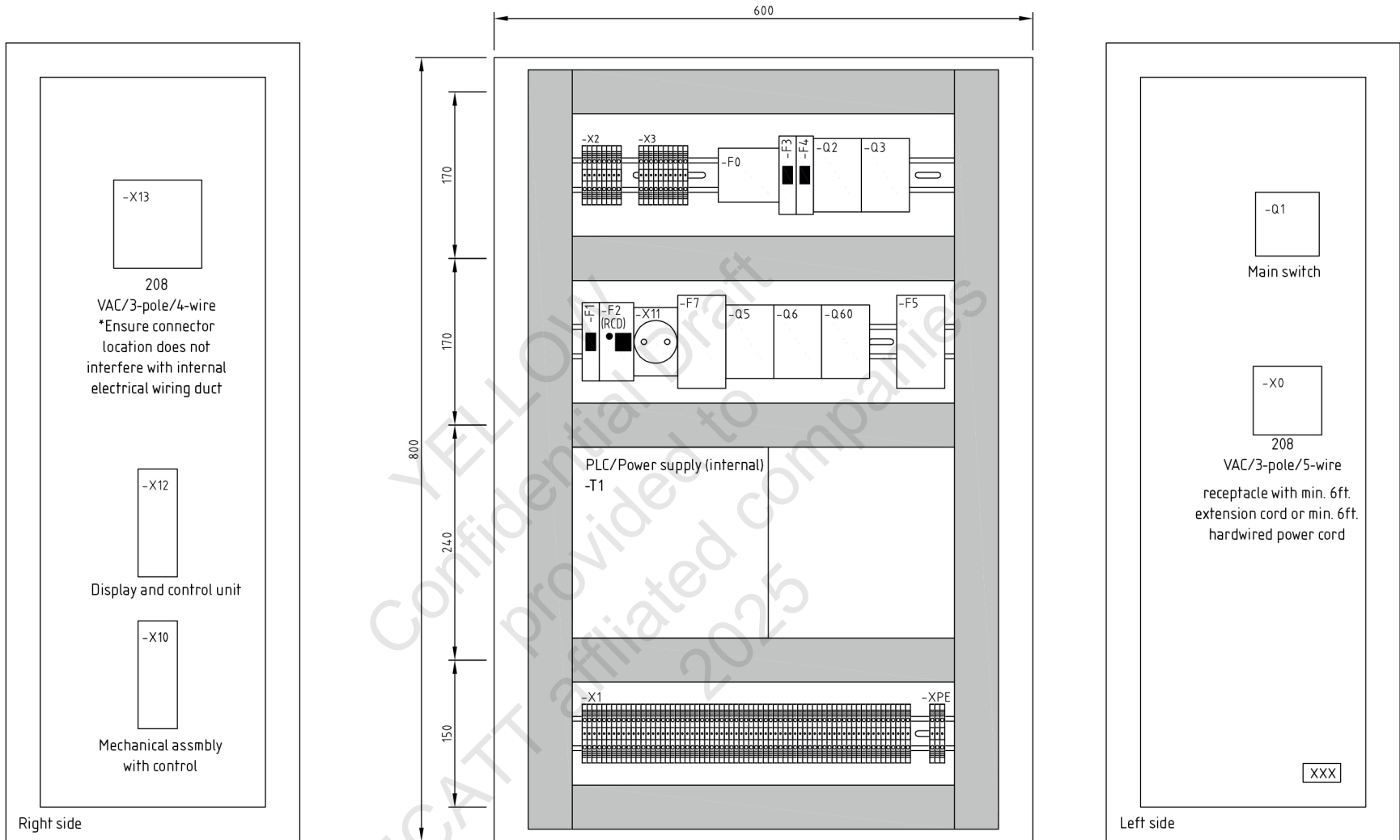
The switch cabinet and control unit are prewired as per the following documents and later attached to the axis module by connectors.

The next page shows a possible layout for the switch cabinet (wiring not shown). The position of the materials and components used can be changed if necessary; note changes on this yellow preparation documentation.

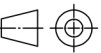
**The power is connected using an extension cable.**

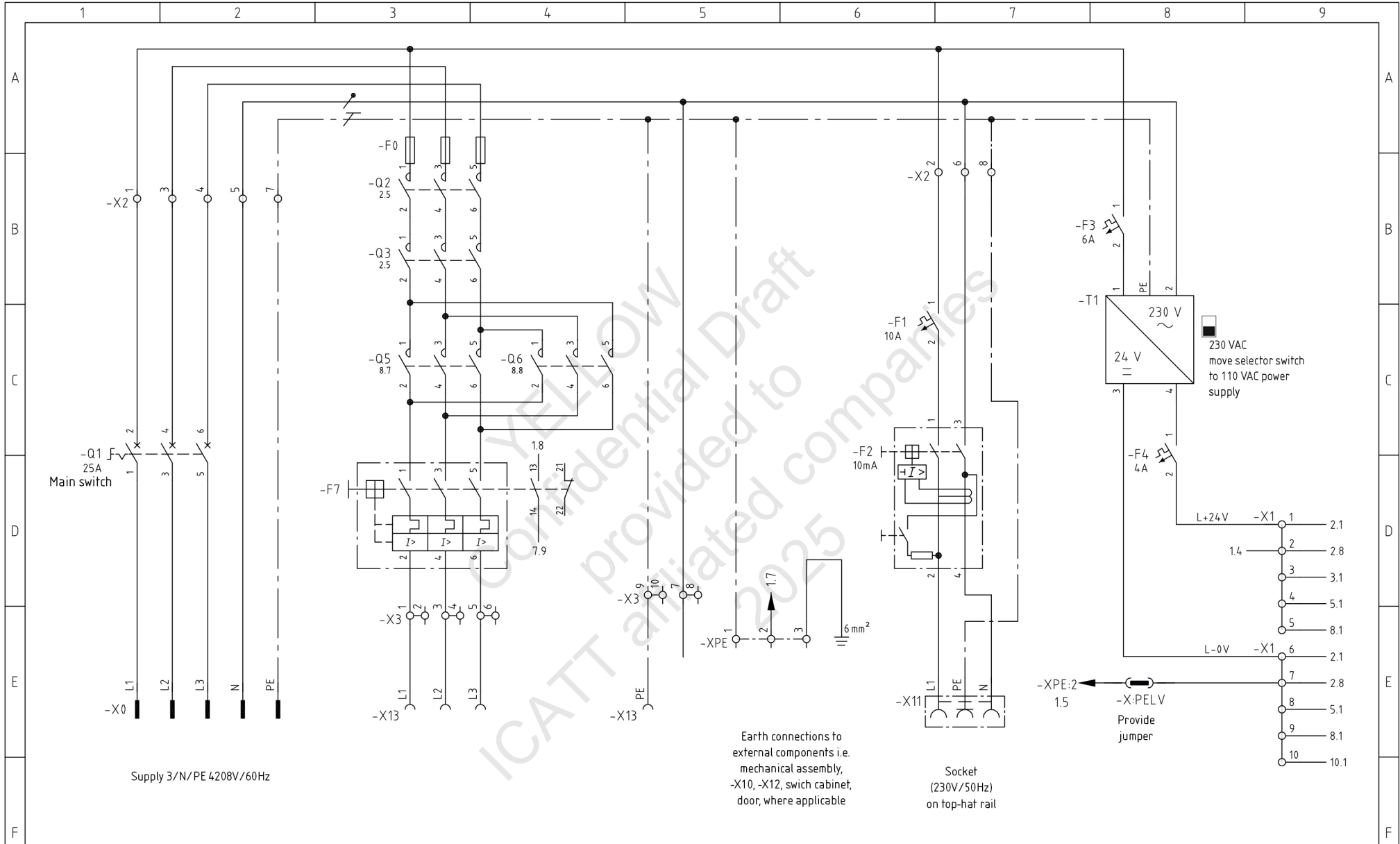
**The figure below shows the relationship between the different components.**





- ① plug connector - control/display unit (make sure not to mix these up)
- ② plug connector - mechanical assembly with control engineering function (make sure not to mix these up)





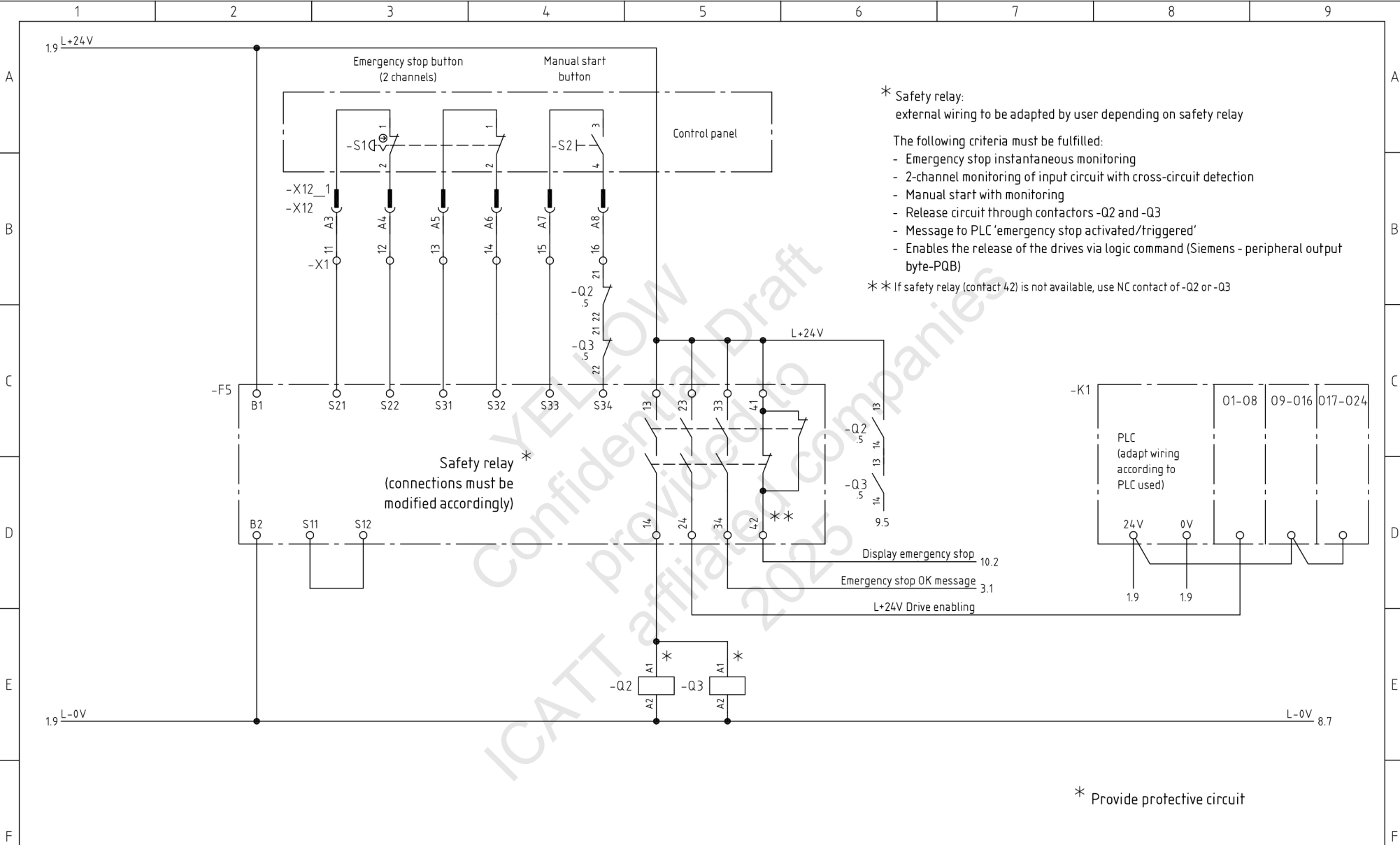
Earth connections to external components i.e. mechanical assembly, -X10, -X12, switch cabinet, door, where applicable

Socket (230V/50Hz) on top-hat rail

230 VAC move selector switch to 110 VAC power supply

-X:PELV Provide jumper

Supply 3/N/PE 4208V/60Hz



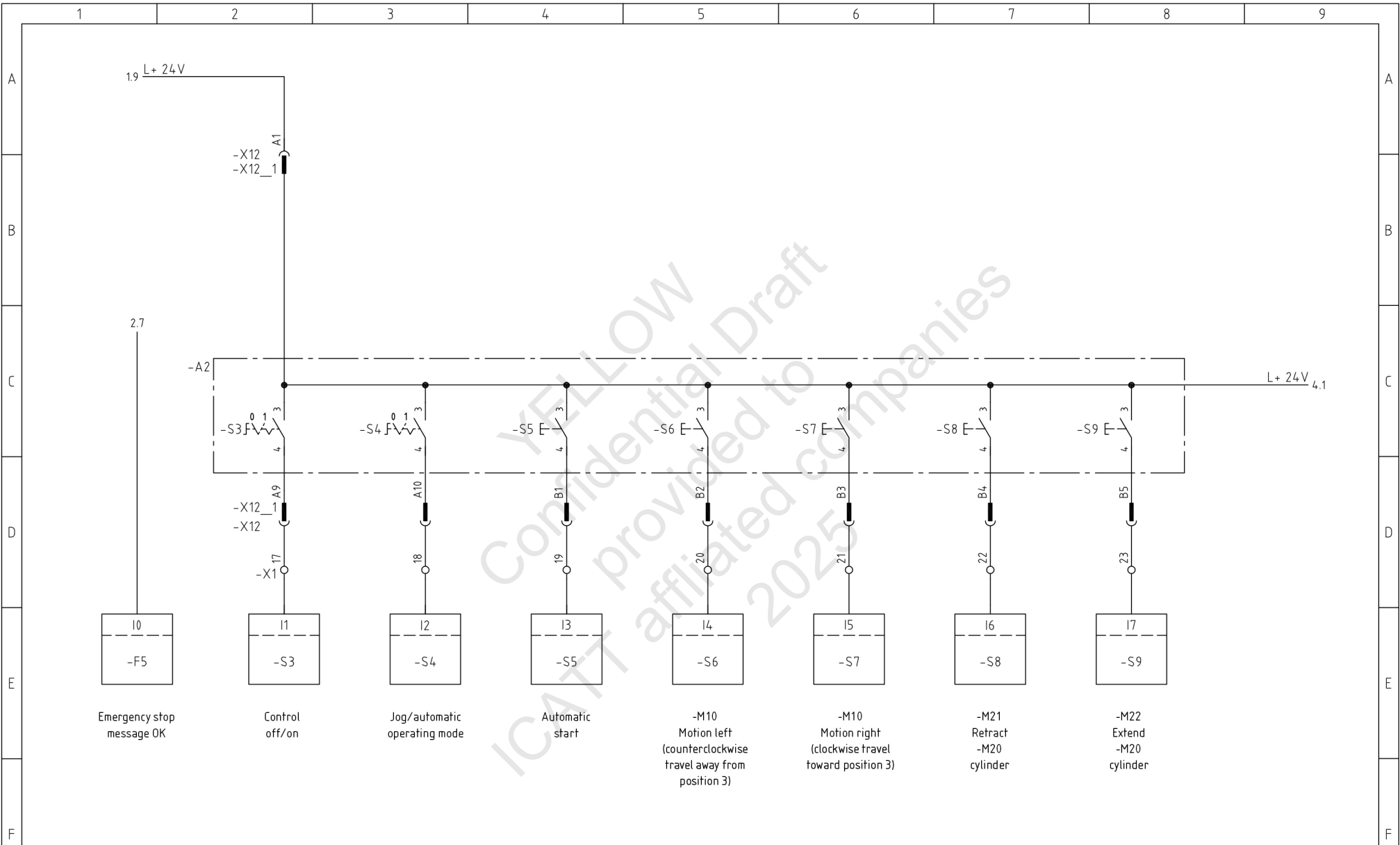
\* Safety relay:  
external wiring to be adapted by user depending on safety relay

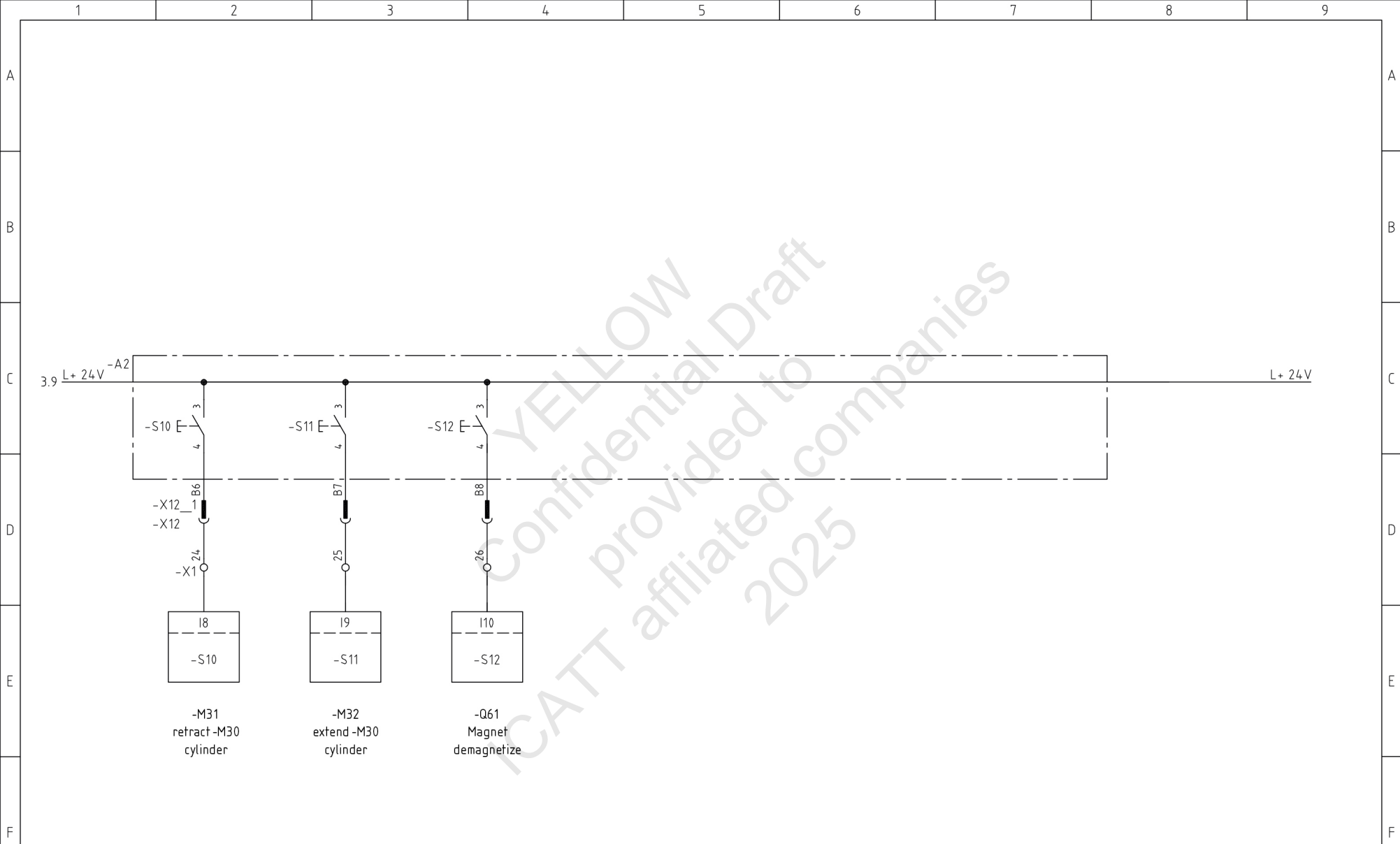
The following criteria must be fulfilled:

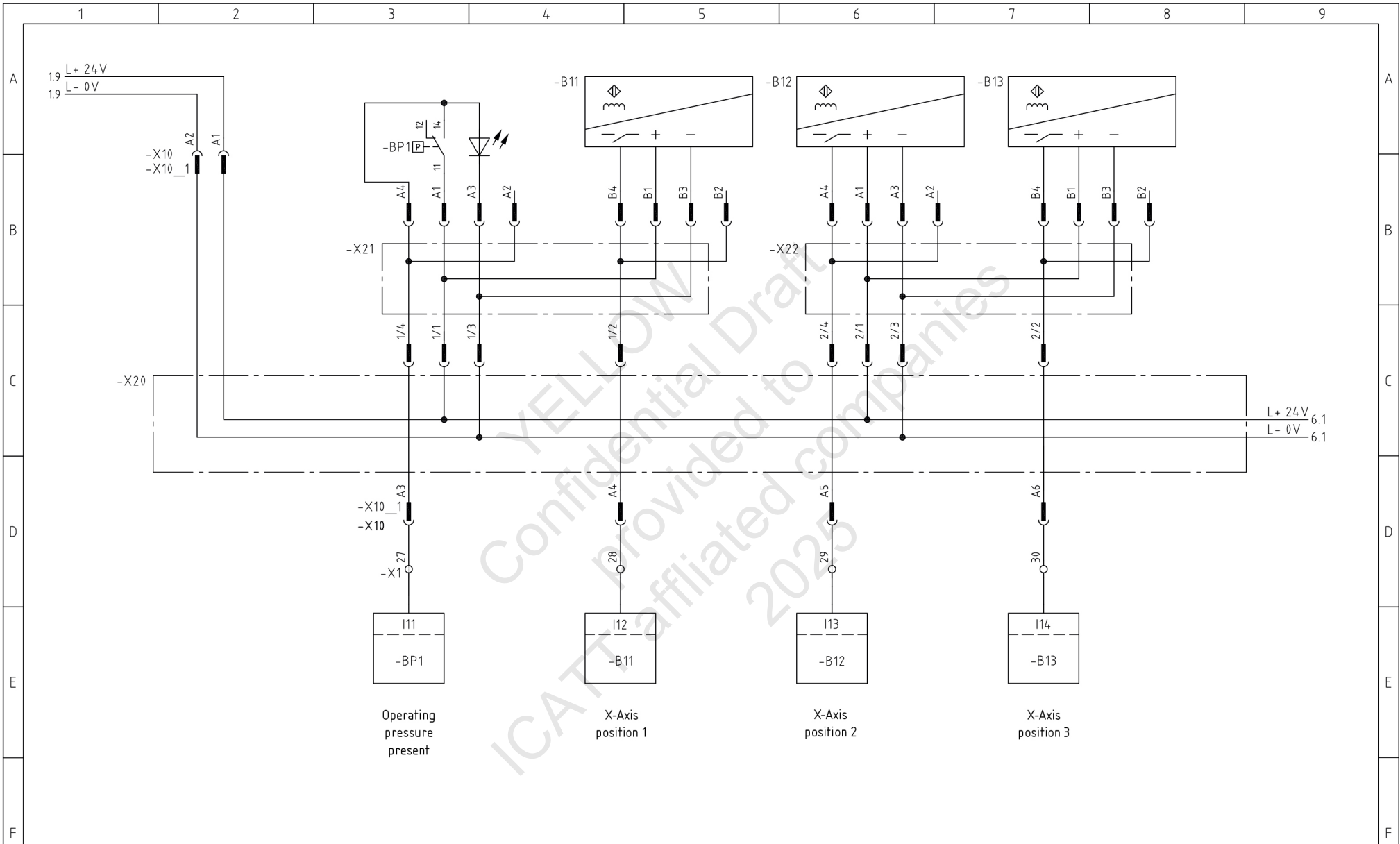
- Emergency stop instantaneous monitoring
- 2-channel monitoring of input circuit with cross-circuit detection
- Manual start with monitoring
- Release circuit through contactors -Q2 and -Q3
- Message to PLC 'emergency stop activated/triggered'
- Enables the release of the drives via logic command (Siemens - peripheral output byte-PQB)

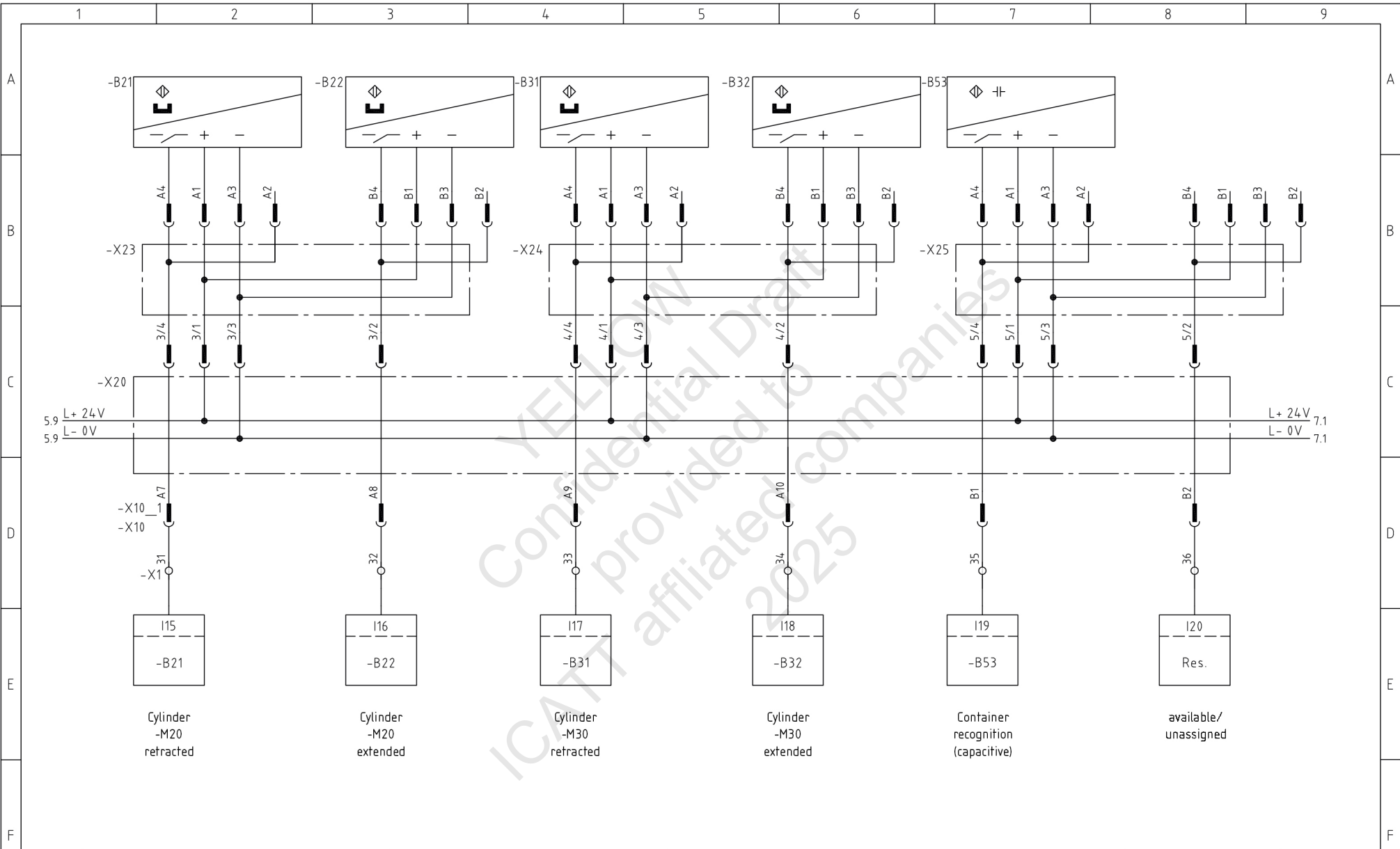
\*\* If safety relay (contact 42) is not available, use NC contact of -Q2 or -Q3

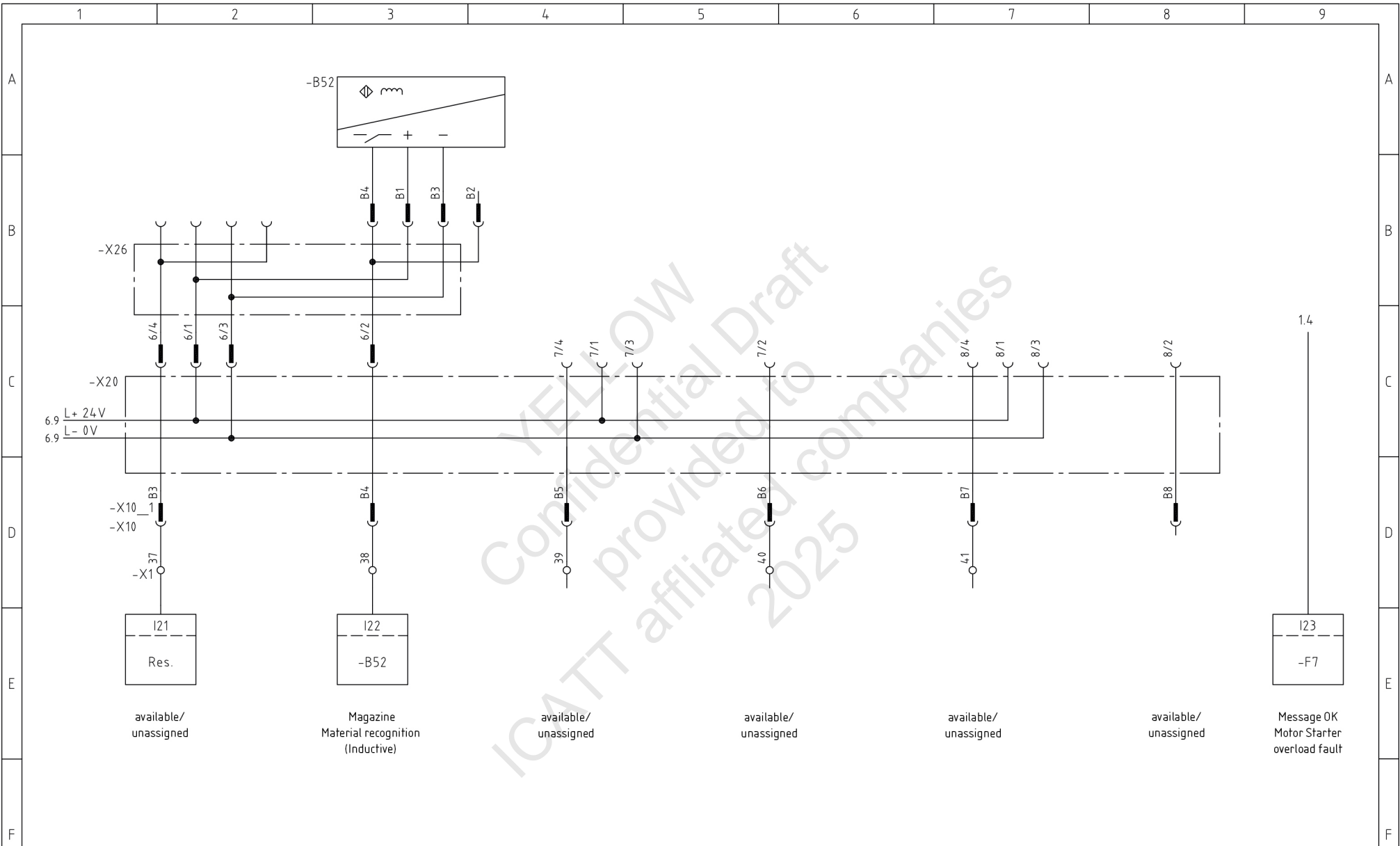
\* Provide protective circuit

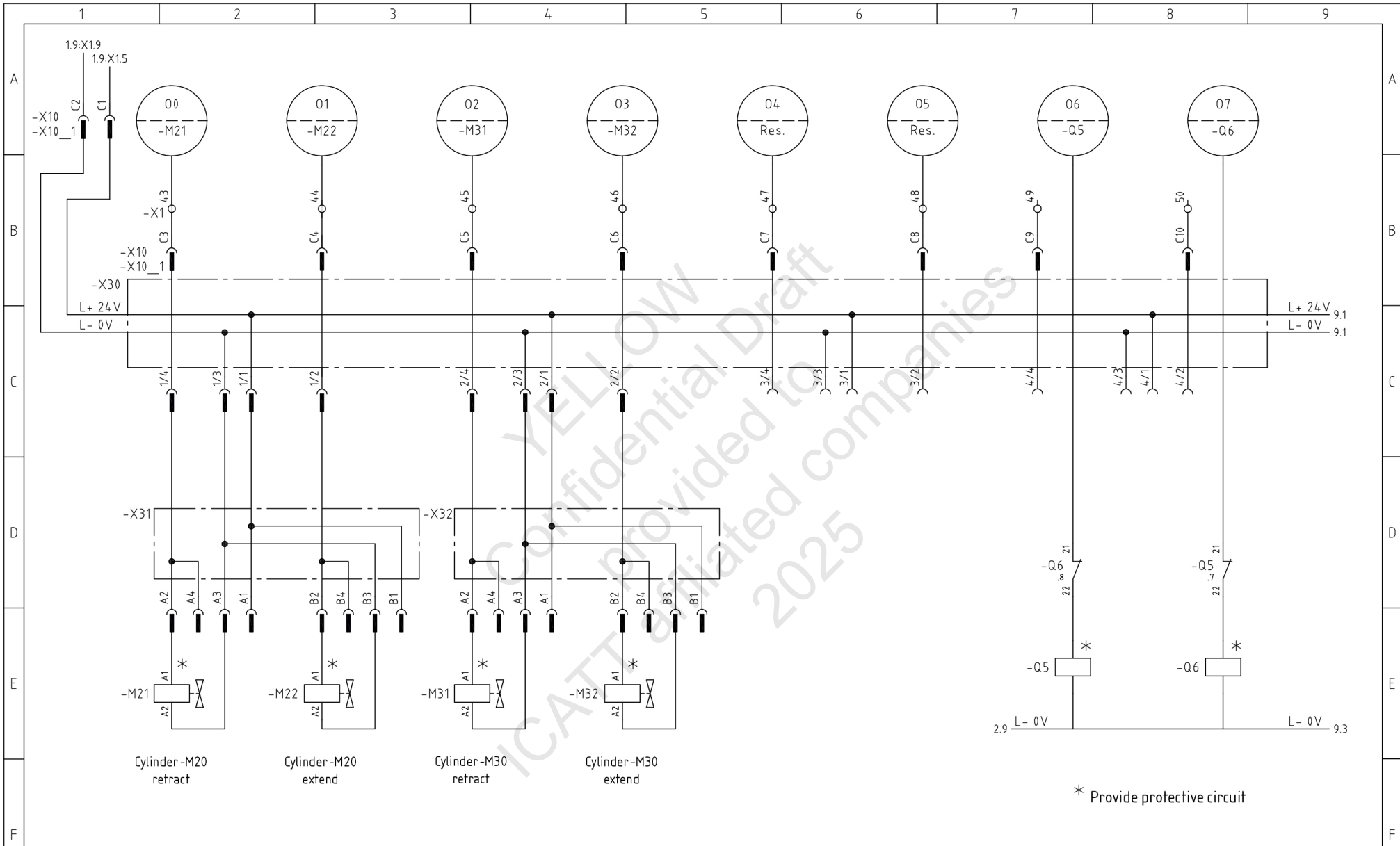




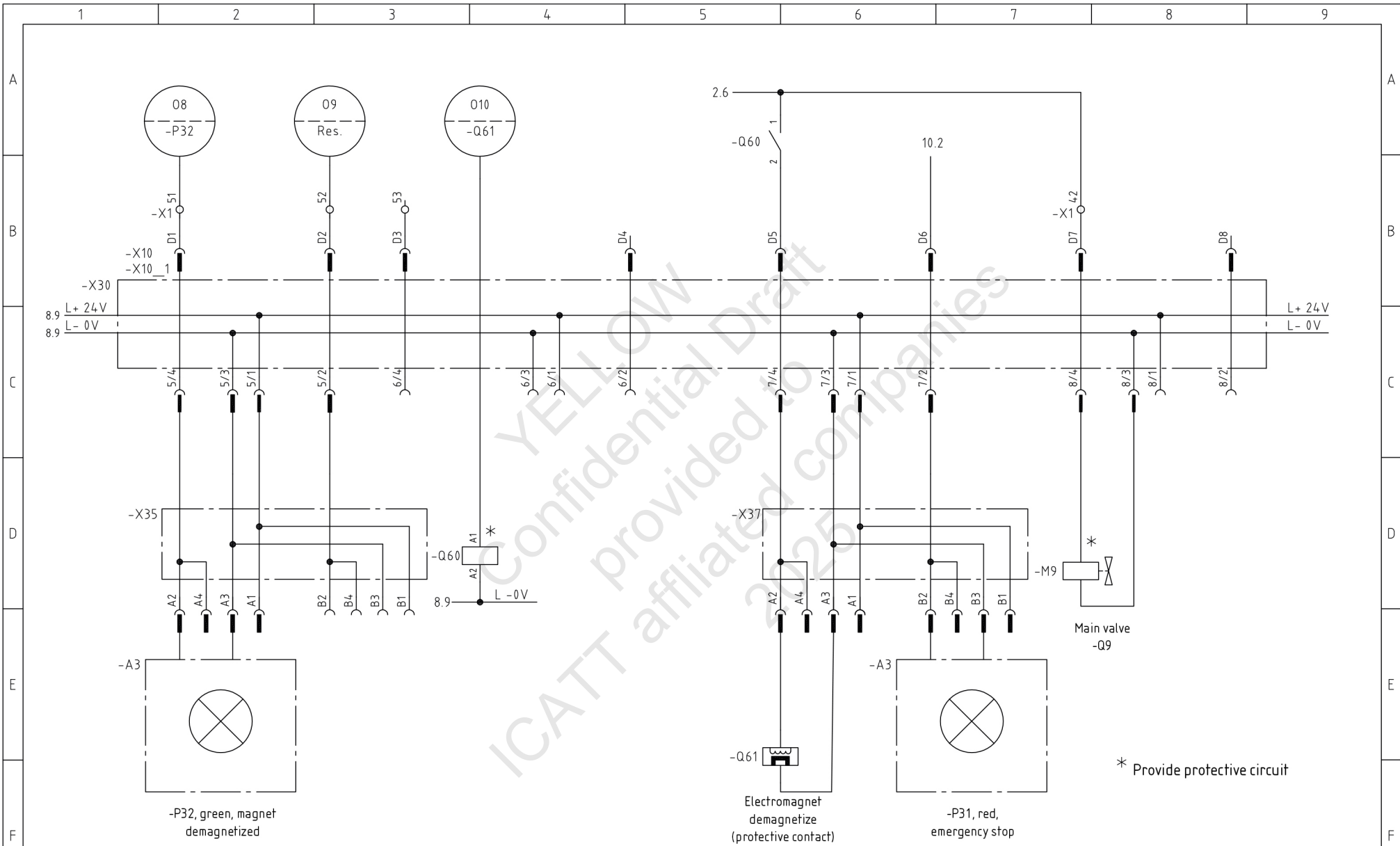


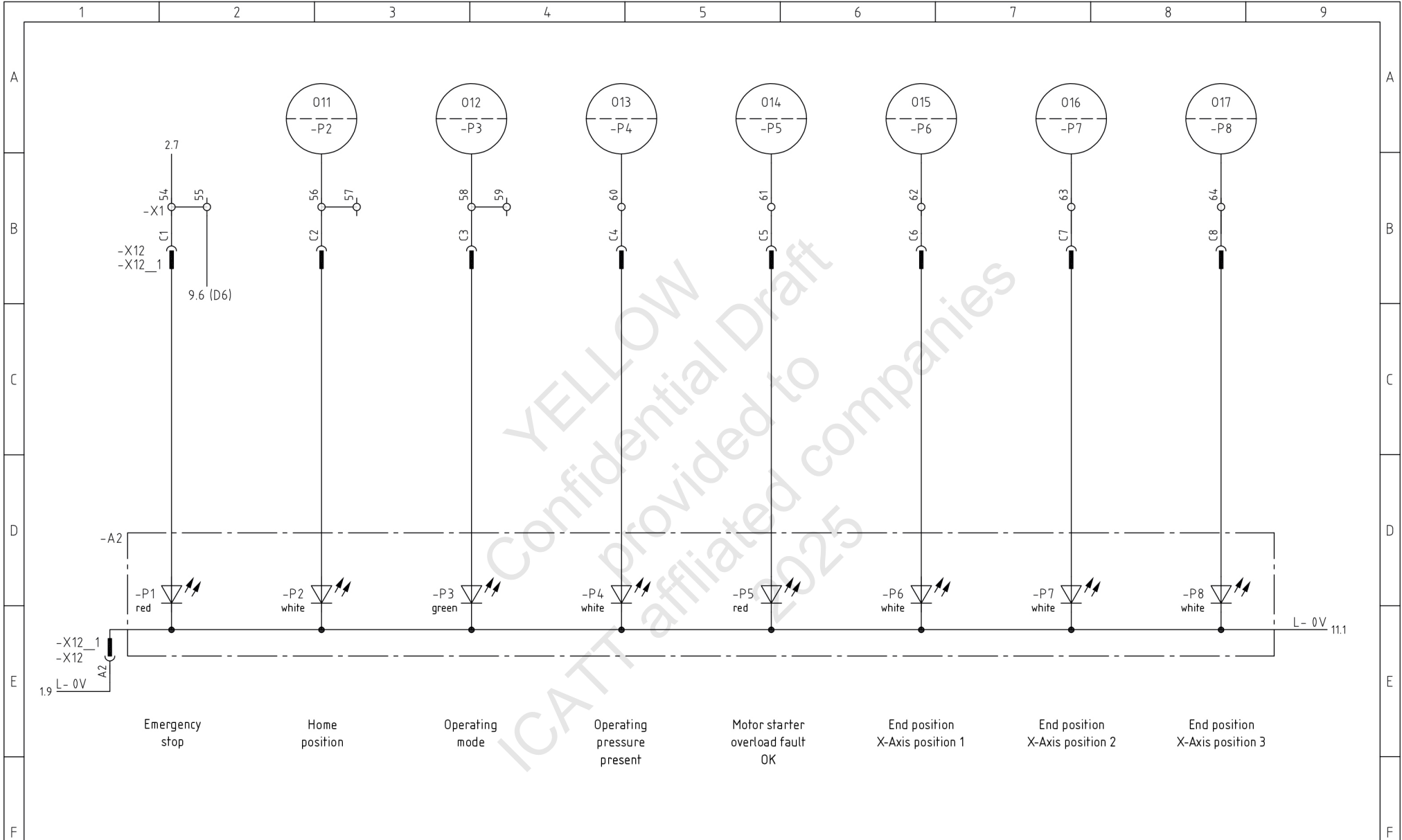






\* Provide protective circuit





Emergency stop

Home position

Operating mode

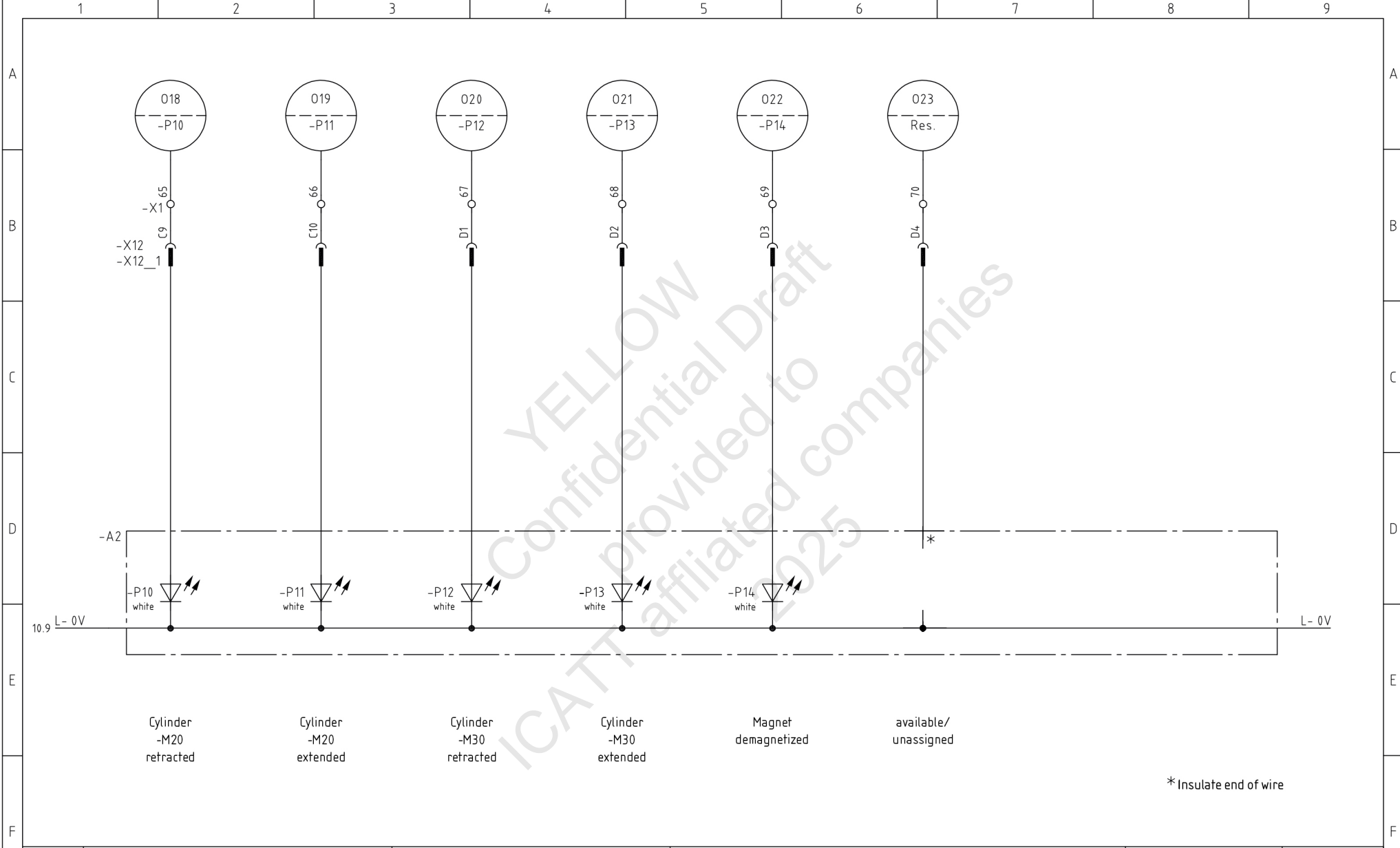
Operating pressure present

Motor starter overload fault OK

End position X-Axis position 1

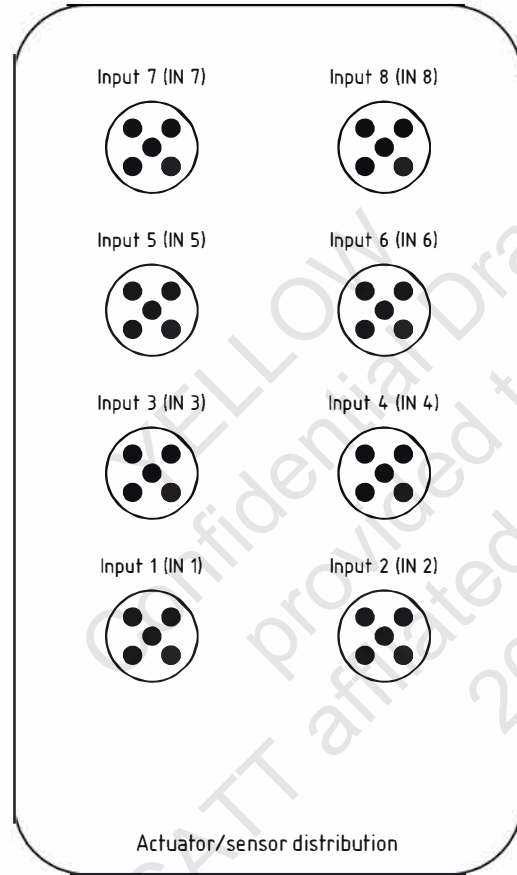
End position X-Axis position 2

End position X-Axis position 3



Sensors → mechanical subassembly

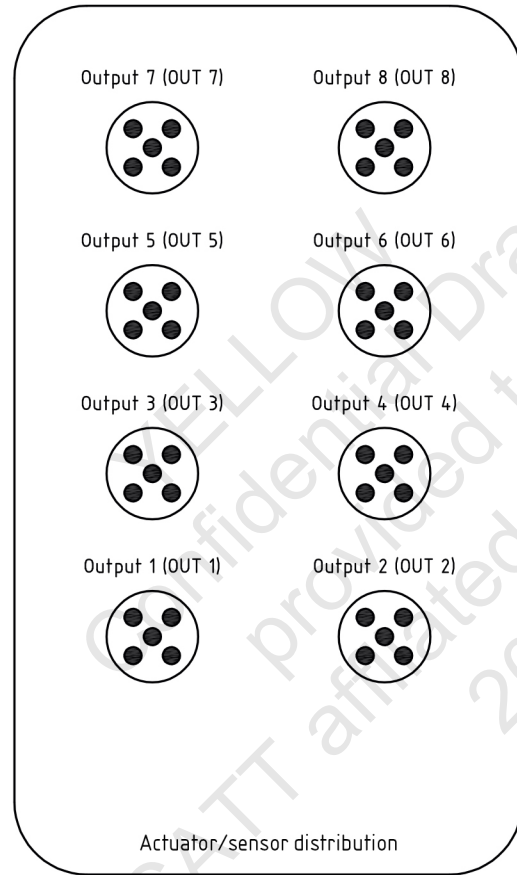
-X20



L+24V		A1	-X10__1
L-0V		A2	
IN1 (4)	- BP 1 Operating pressure present	A3	
IN1 (2)	- B11 X-Axis position 1	A4	
IN2 (4)	- B12 X-Axis position 2	A5	
IN2 (2)	- B13 X-Axis position 3	A6	
IN3 (4)	- B21 Cylinder -M20 retracted	A7	
IN3 (2)	- B22 Cylinder -M20 extended (inductive)	A8	
IN4 (4)	- B31 Cylinder -M30 retracted (inductive)	A9	
IN4 (2)	- B32 Cylinder -M30 extended (inductive)	A10	
IN5 (4)	- B53 Container recognition (capacitive)	B1	
IN5 (2)	- available/unassigned	B2	
IN6 (4)	- available/unassigned	B3	
IN6 (2)	- B52 Magazine material recognition (inductive)	B4	
IN7 (4)	- available/unassigned	B5	
IN7 (2)	- available/unassigned	B6	
IN8 (4)	- available/unassigned	B7	
IN8 (2)	- available/unassigned	B8	

Sensors → mechanical subassembly

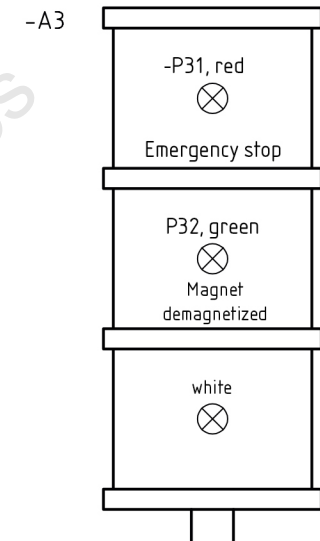
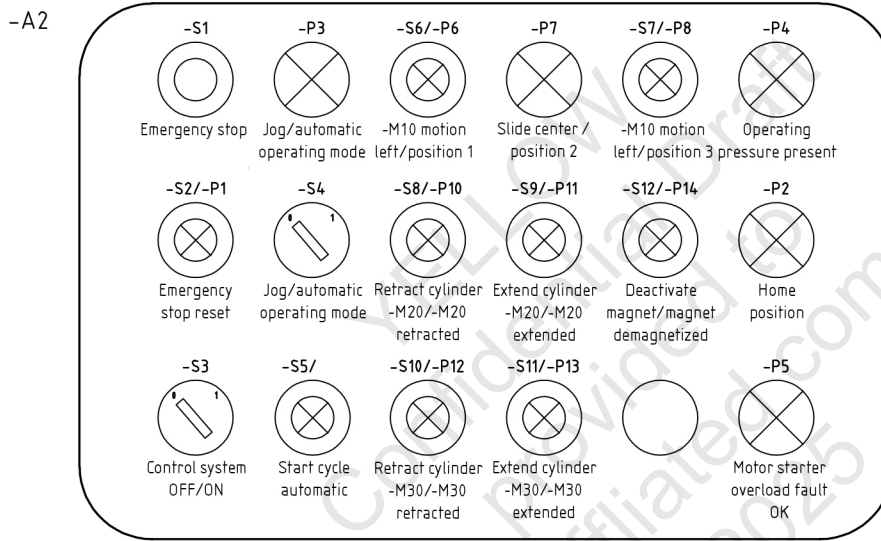
-X30



L+24V		C1	-X10_1
L-0V		C2	
OUT1 (4)	- Retract M21 cylinder -M20	C3	
OUT2 (2)	- Extend M22 cylinder -M20	C4	
OUT2 (4)	- Retract M31 cylinder -M30	C5	
OUT2 (2)	- Extend M32 cylinder -M30	C6	
OUT3 (4)	available/unassigned	C7	
OUT3 (2)	available/unassigned	C8	
OUT4 (4)	available/unassigned	C9	
OUT4 (2)	available/unassigned	C10	
OUT5 (4)	- P32 magnet demagnetized	D1	
OUT5 (2)	available/unassigned	D2	
OUT6 (4)	available/unassigned	D3	
OUT6 (2)	available/unassigned	D4	
OUT7 (4)	- Q61 demagnetize magnet	D5	
OUT7 (2)	- P31 Emergency stop	D6	
OUT8 (4)	- Q9 Main valve	D7	
OUT8 (2)	available/unassigned	D8	

# Display and control Panel

# Stack light



**Legend**

- Dummy plug
- Installation toggle
- Installation indicator lamp
- Installation illumination button
- Emergency stop

Note: Electrical wiring is not shown!

Note: The electrical connections are not shown!

**AHK**

Final Examination Part 2 - 2025

**Preparation of the Practical task:**  
**PLC**  
**Input assignment list**

**Mechatronics Technician**

System related operands are to be entered here.

Inputs	Operand	Equipment identifier	Function
I0		-F5	Emergency stop message ok
I1		-S3	Control system ON/OFF
I2		-S4	Mode: Jog/automatic mode
I3		-S5	Start automatic
I4		-S6	-M10 counterclockwise travel away from position 3
I5		-S7	-M10 clockwise travel toward position 3
I6		-S8	Cylinder -M20 retracts
I7		-S9	Cylinder -M20 extends
I8		-S10	Cylinder -M30 retracts
I9		-S11	Cylinder -M30 extends
I10		-S12	-Q61 magnet demagnetize
I11		-BP1	Operating pressure present
I12		-B11	X-axis, pos. 1 (inductive)
I13		-B12	X-axis, pos. 2 (inductive)
I14		-B13	X-axis, pos. 3 (inductive)
I15		-B21	Cylinder -M20 retracted
I16		-B22	Cylinder -M20 extended
I17		-B31	Cylinder -M30 retracted
I18		-B32	Cylinder -M30 extended
I19		-B53	Container recognition (capacitive)
I20		-	-
I21		-	-
I22		-B52	Material recognition Magazine (inductive)
I23		-F7	-Motor starter overload fault
I24		-	-
		-	-
		-	-
		-S1	Emergency stop
		-S2	Manual start, emergency stop reset

**AHK**

Final Examination Part 2 - 2025

**Preparation of the Practical task:**  
**PLC**  
**Output assignment list**

**Mechatronics Technician**

System related operands are to be entered here.

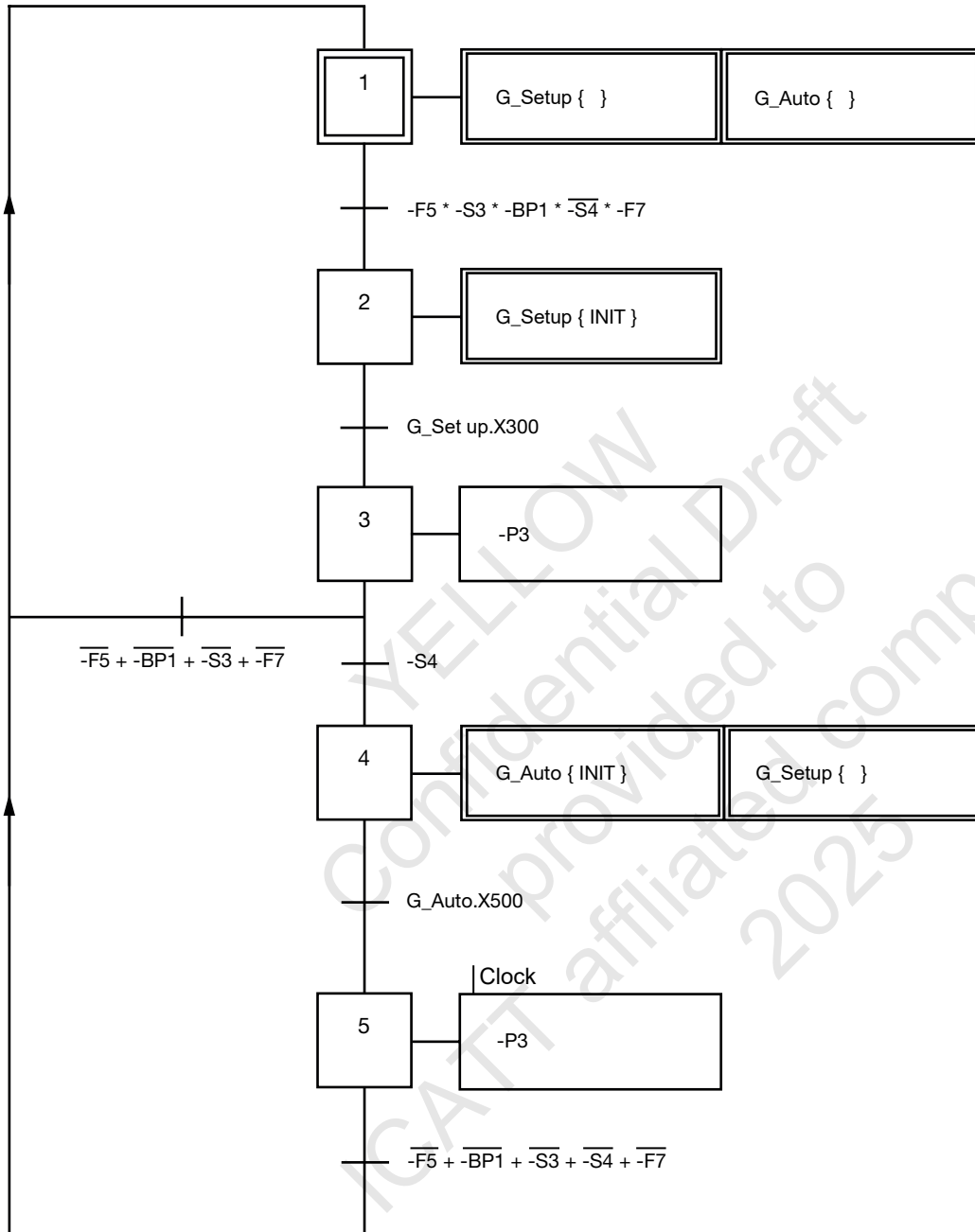
Outputs	Operand	Equipment identifier	Function
O0		-M21	Cylinder -M20 retracts
O1		-M22	Cylinder -M20 extends
O2		-M31	Cylinder -M30 retracts
O3		-M32	Cylinder -M30 extends
O4		-	-
O5		-	-
O6		-Q5	Carriage slide travel away from position 3
O7		-Q6	Carriage slide travel toward position 3
O8		-P32	Magnet demagnetized
O9		-	-
O10		-Q60	Protection on (Magnet -Q61 demagnetize)
O11		-P2	Home position
O12		-P3	Mode: Jog/automatic operating mode
O13		-P4	Operating pressure present
O14		-P5	Motor starter overload fault ok
O15		-P6	End position of X-axis, pos. 1 equipped accordingly
O16		-P7	End position of X-axis, pos. 2 equipped accordingly
O17		-P8	End position of X-axis, pos. 3 equipped accordingly
O18		-P10	Cylinder -M20 retracted
O19		-P11	Cylinder -M20 extended
O20		-P12	Cylinder -M30 retracted
O21		-P13	Cylinder -M30 extended
O22		-P14	Magnet demagnetized
O23		-	-
		-Q61	Magnet demagnetize (protective contact)
		-P31	Emergency stop
		-M9	Main valve -Q9

# AHK

## Final Examination Part 2 - 2025

Preparation Task  
Workflow according to Grafcet

Mechatronics Technician

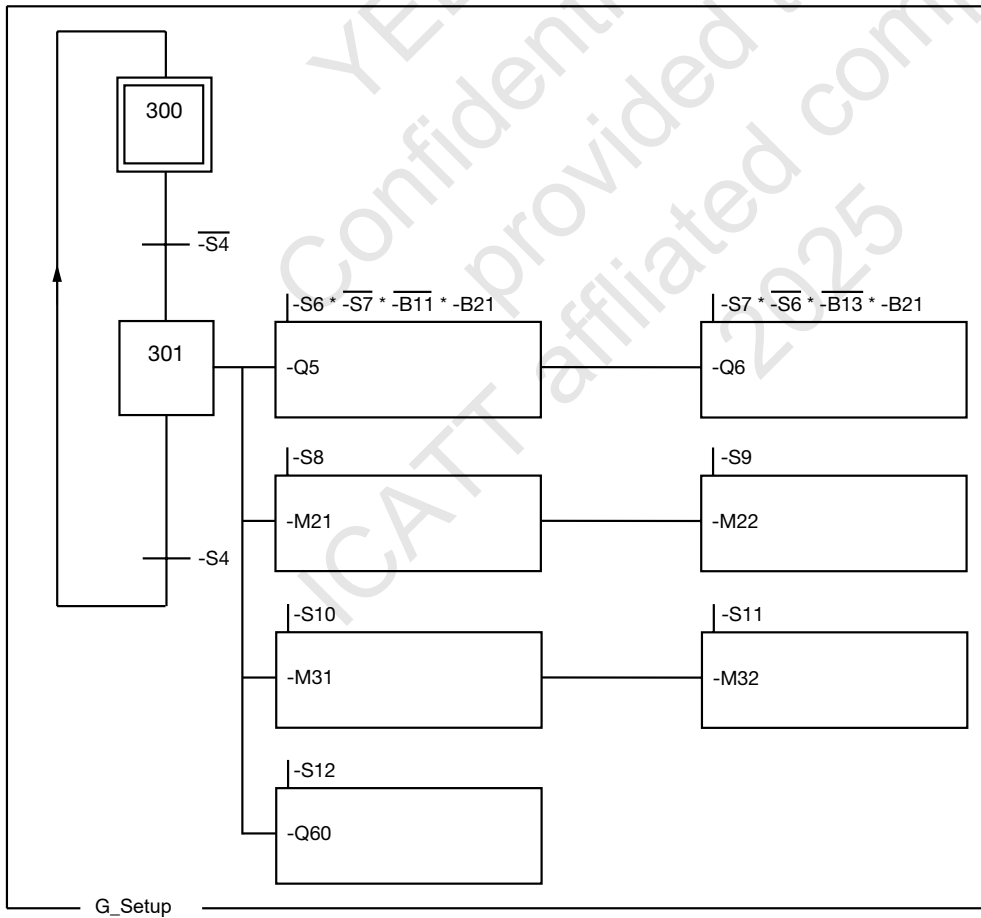
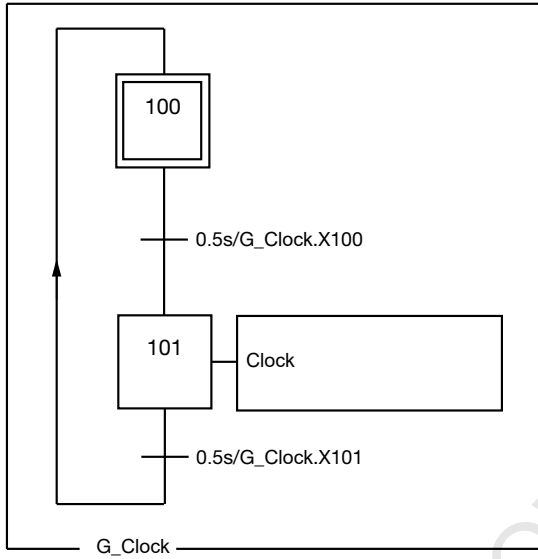


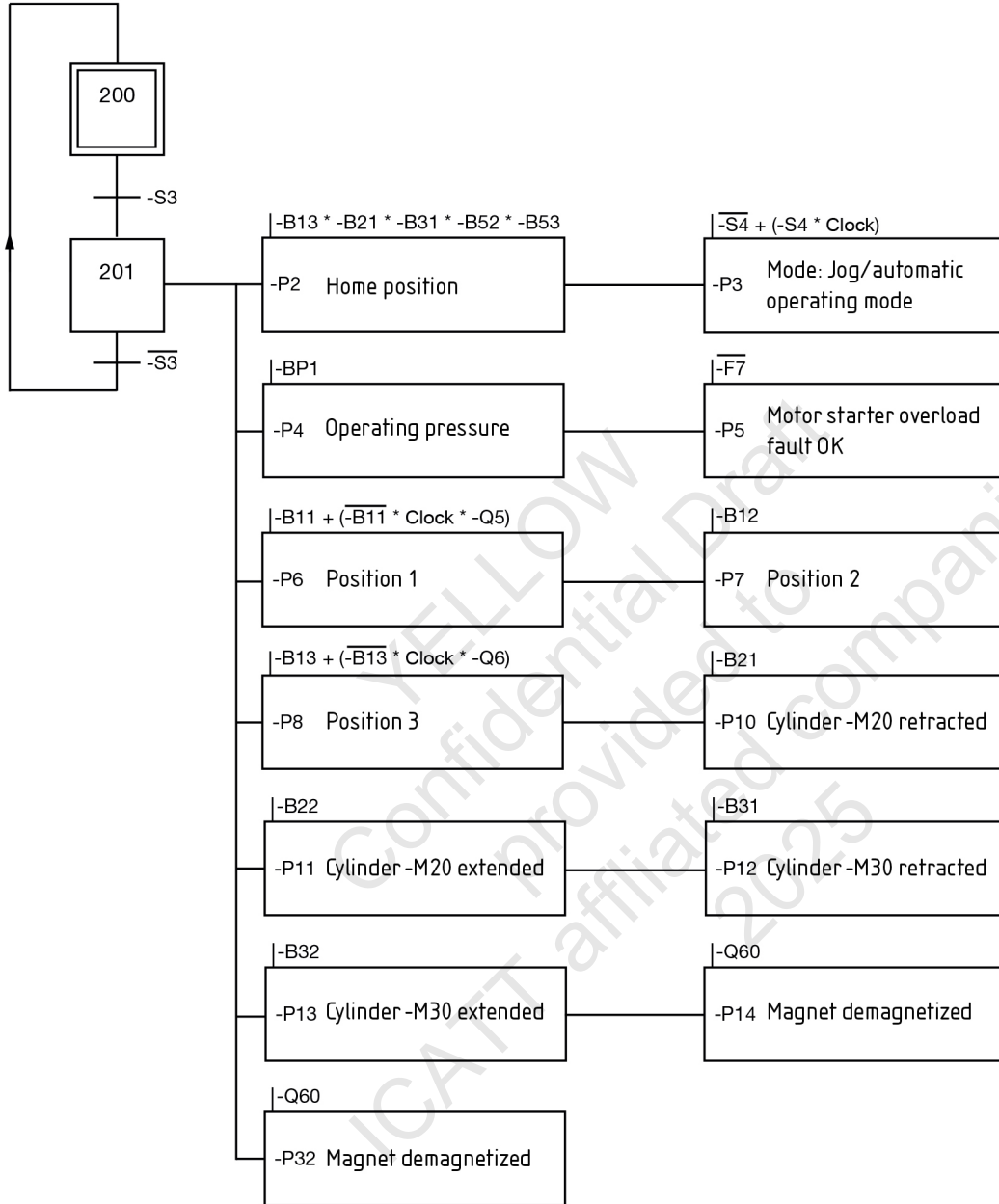
# AHK

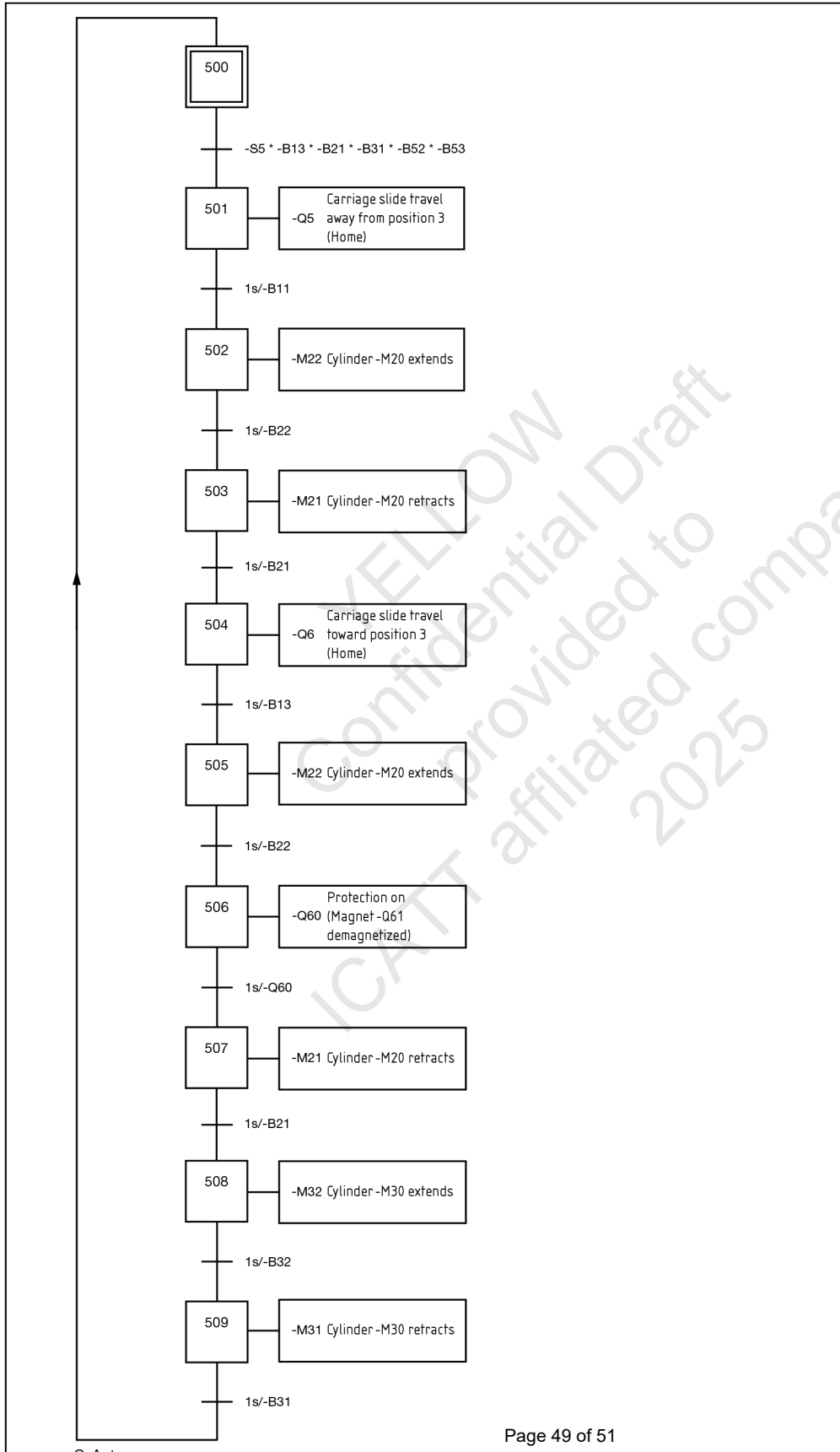
Final Examination Part 2 - 2025

Preparation Task  
Workflow according to Grafcet

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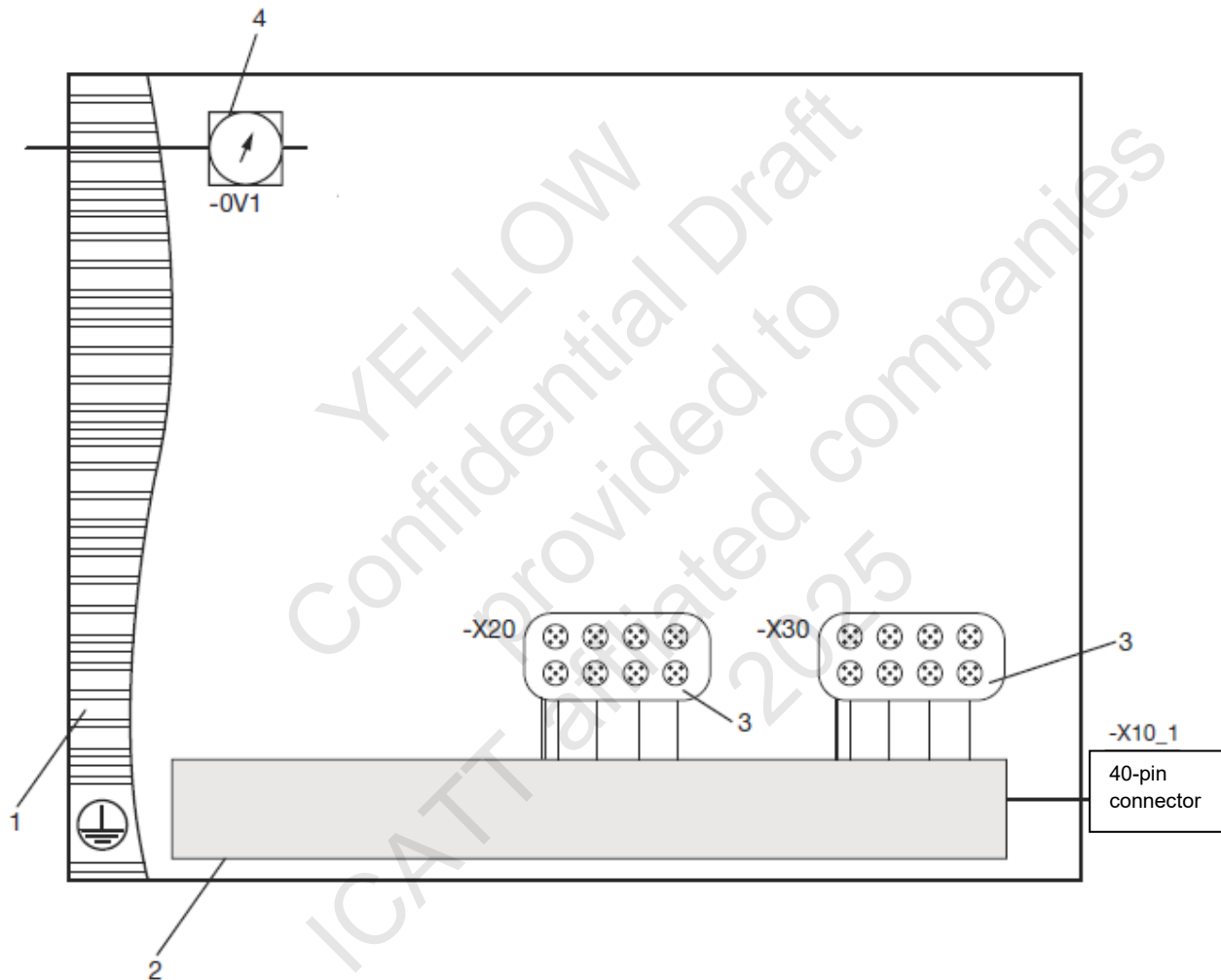


**AHK**

Final Examination Part 2 - 2025

**Preparation of the practical assignment  
Pre-assembly drawing****Mechatronics Technician**

4	1	-Q8	Pressure regulator with gage	Stand. Mat. List pages 5-8
3	2	-X20,-X30	Actuator/sensor distributor system	Stand. Mat. List pages 5-8
2	1		Wiring duct	Stand. Mat. List pages 5-8
1	1		Mounting plate	Stand. Mat. List pages 5-8
Item No.	Quantity	Identification	Description	Comments

Please note:

1. The drawing is a **diagram** and not to scale!
2. Stack light is not shown!
3. Pre-wiring and plumbing of hoses are in accordance with the diagrams/information in this booklet
4. **Modify diagram according to the "Preparation of the practical assignment –work order" showing only items connected in your PHASE 1 documentation and items added in steps 1-6 of your PHASE 2 documentation.**

# AHK

Final Examination Part 2 - 2025

**Preparation of the Practical task:  
Pneumatic diagram**

**Mechatronics Technician**

