Hydraulics & Pneumatics

Chapter 3: Electro-fluids (Circuit Design

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Lesson Outcome

- By the end of this lecture, student should be able to:
  - Design and analyze advanced electro-hydraulic circuit with multiple actuators using solenoid valves.

Multi Actuator Circuit

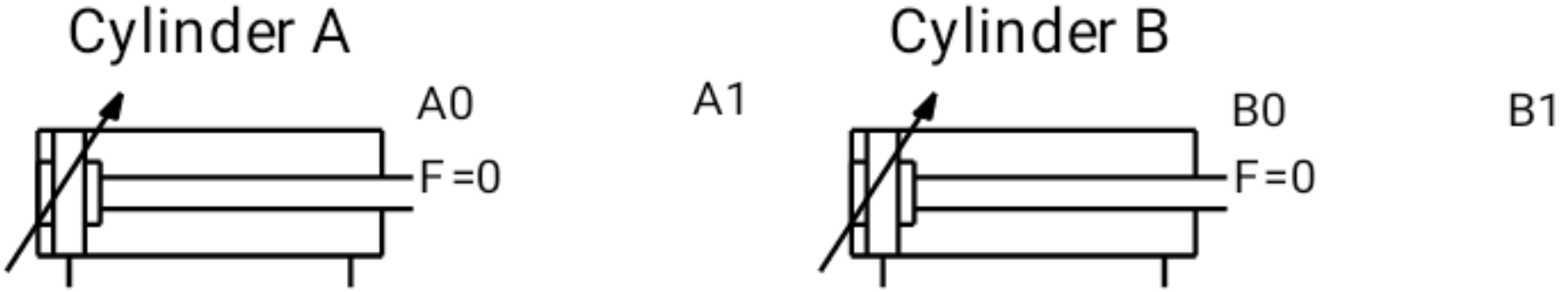
- More than 1 actuator
- 1 cylinder needs 1 valve
- Tips for circuit design:
  - Identify sequence of movement
  - Identify limit switch/sensor status

Multi Actuator Circuit

- Example:
  - A hydraulic actuated drilling machine contains two double acting cylinders (DACs). When the work piece is located at its position, cylinder A will clamp the work piece. Then, the drilling process starts, where the spindle is controlled by cylinder B. After completion of drilling, cylinder B will retract to the initial position, before the clamping cylinder retracts.
  - Sequence: A (extend) -> B (extend) -> B (retract) -> A (retract)

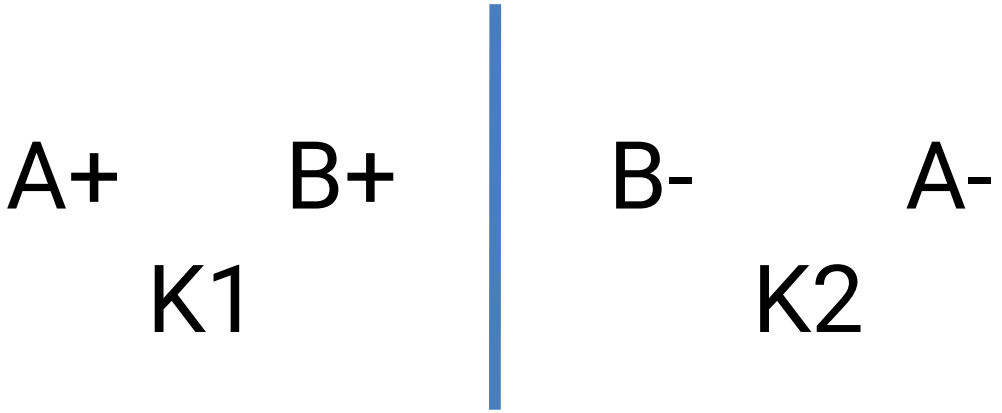
Step 1: Sequence

- Identify sequence of movement
  A+ B+ B- A-



Step 2: Grouping

- Make the group



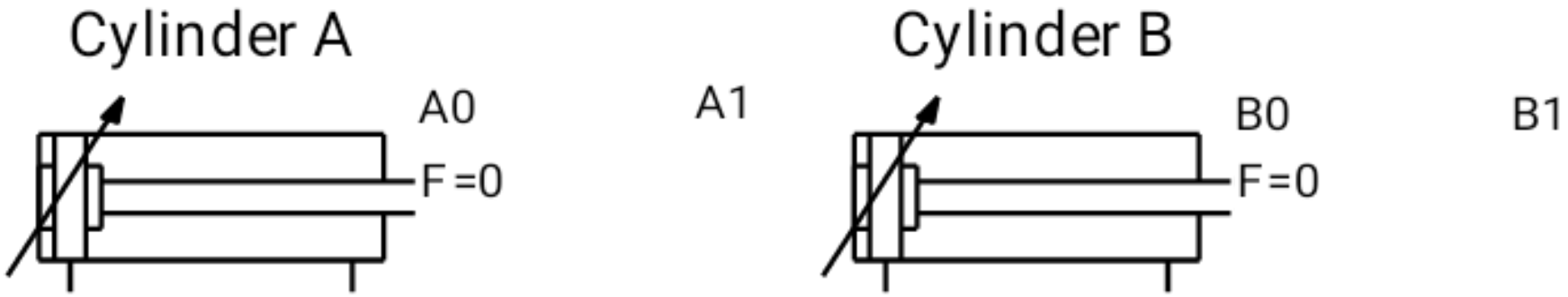
- A group must contain different elements
- 1 group represents 1 coil

Step 3: Limit switch/sensor status

- Identify limit switch/sensor status

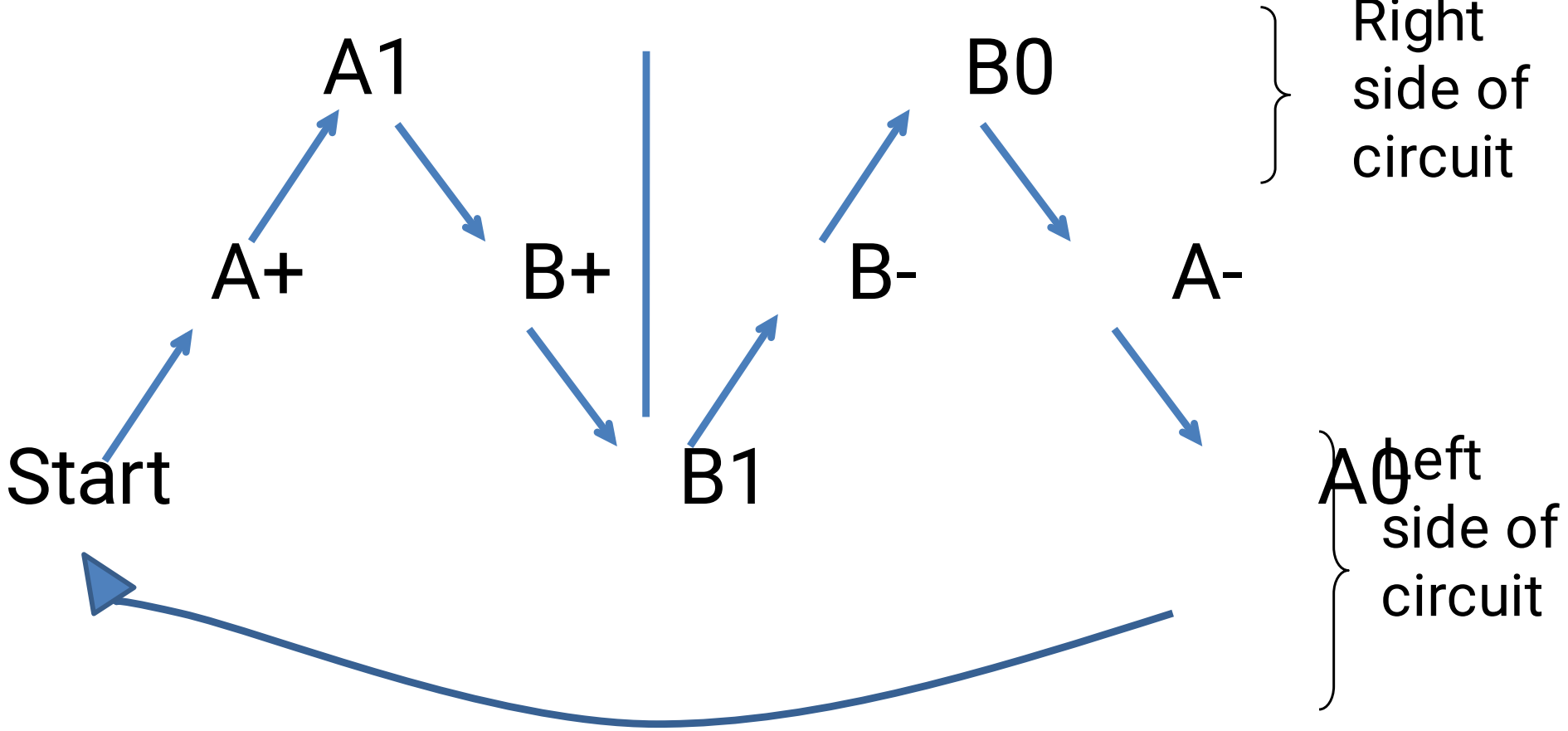
A+ B+ B- A- **<= Actions**

A1 B1 B0 A0 **<= Sensors**

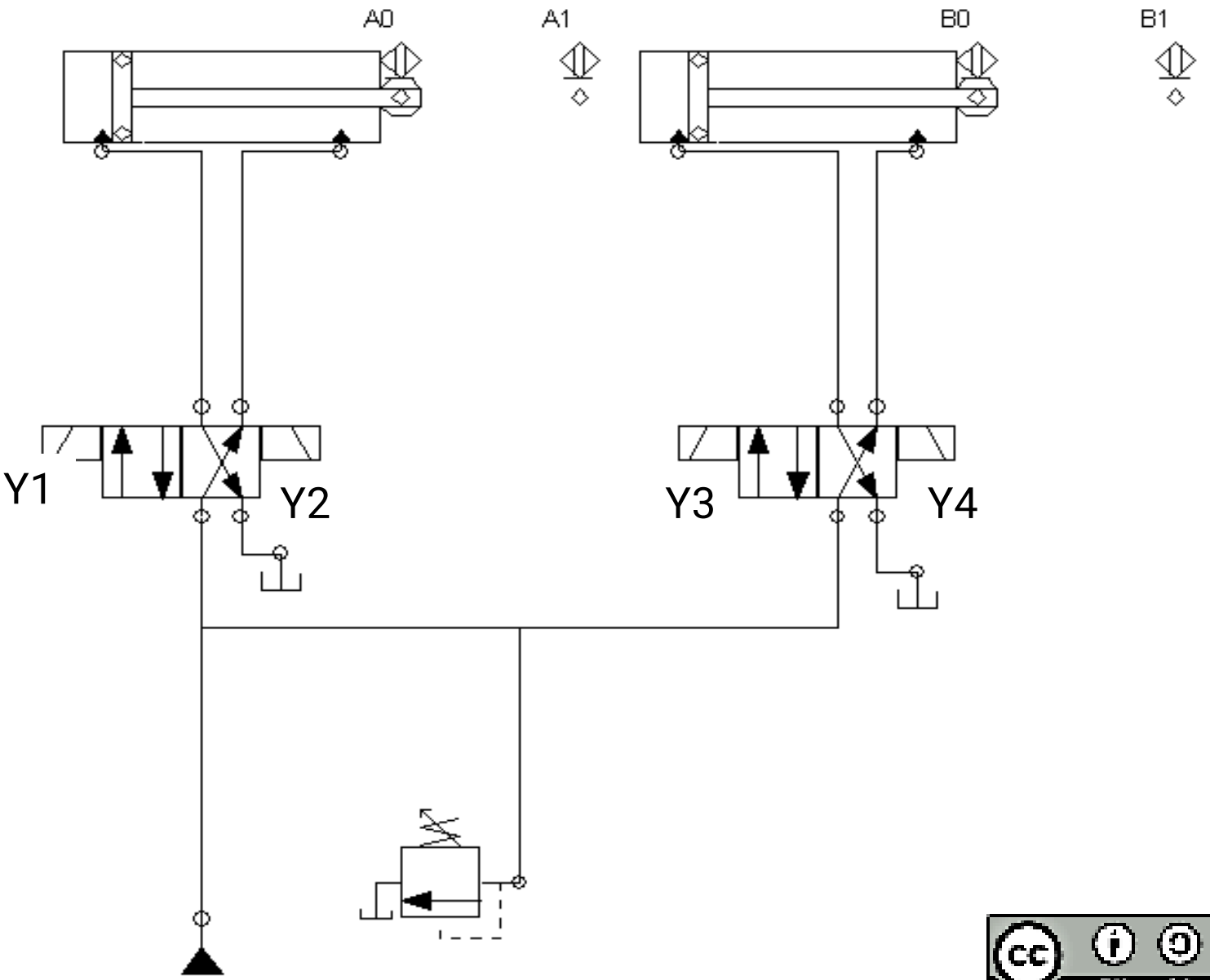


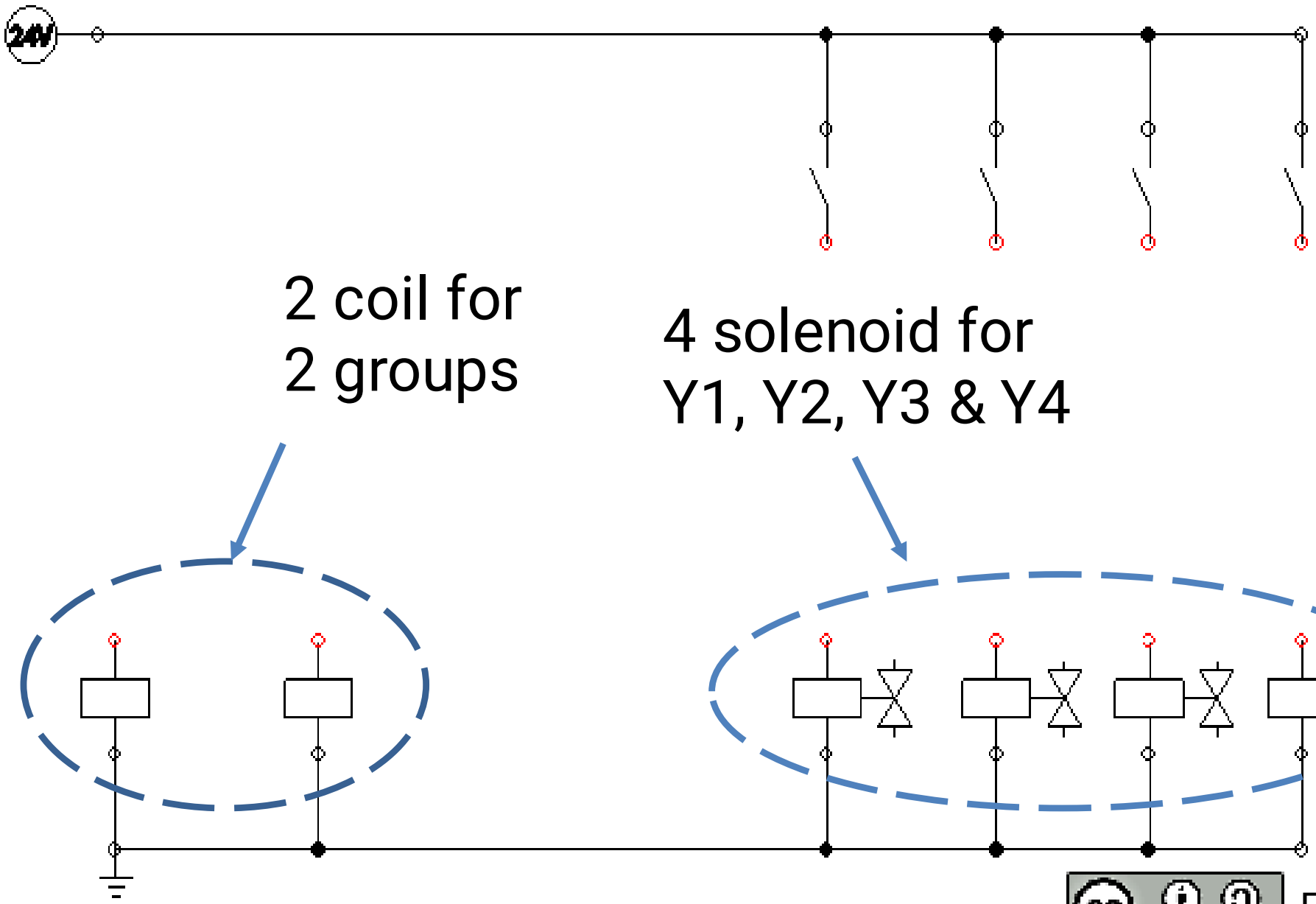
Step 4: Rephrase

- Rephrasing the sequence and limit switch/sensor status

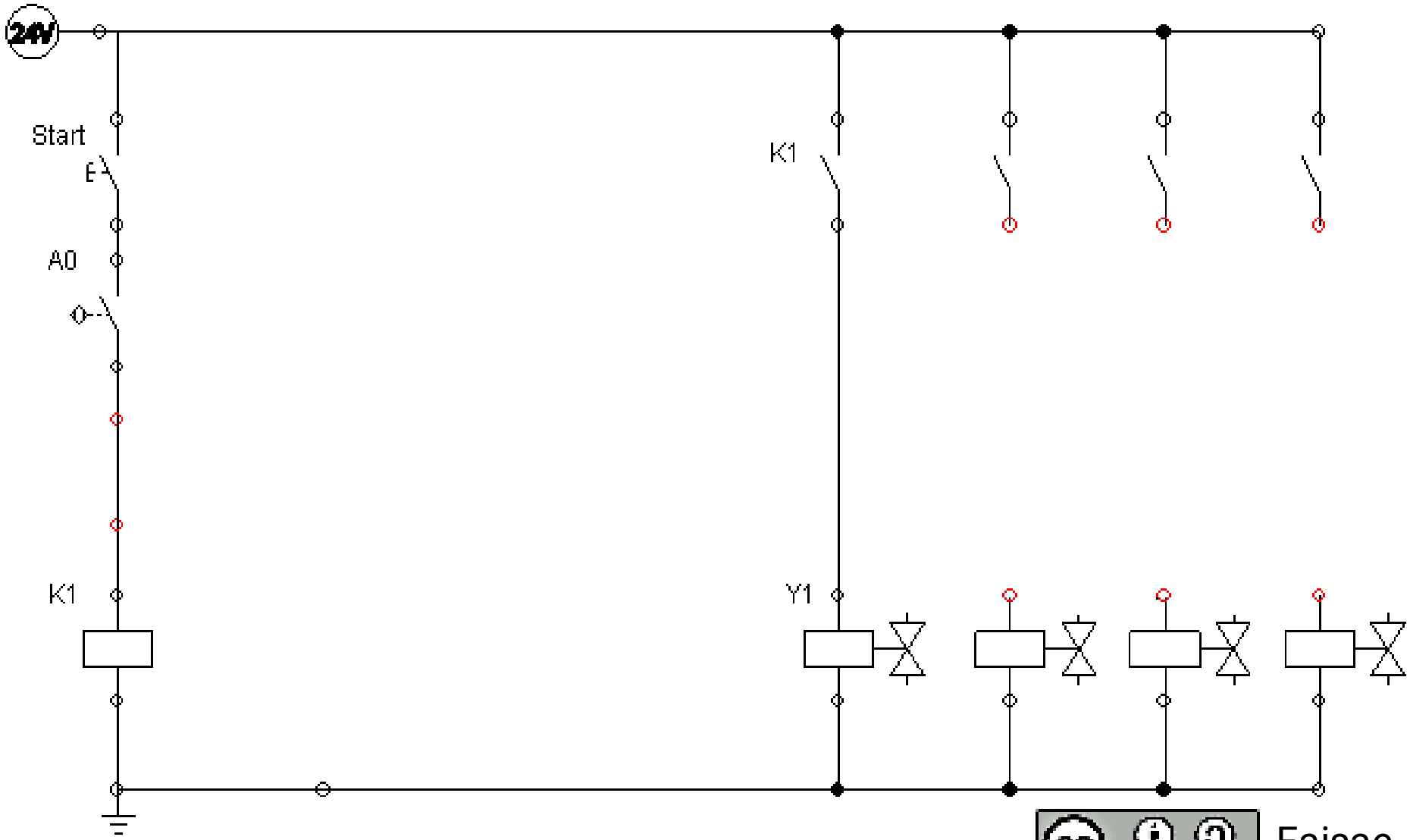


Designing of Hydraulic Circuit



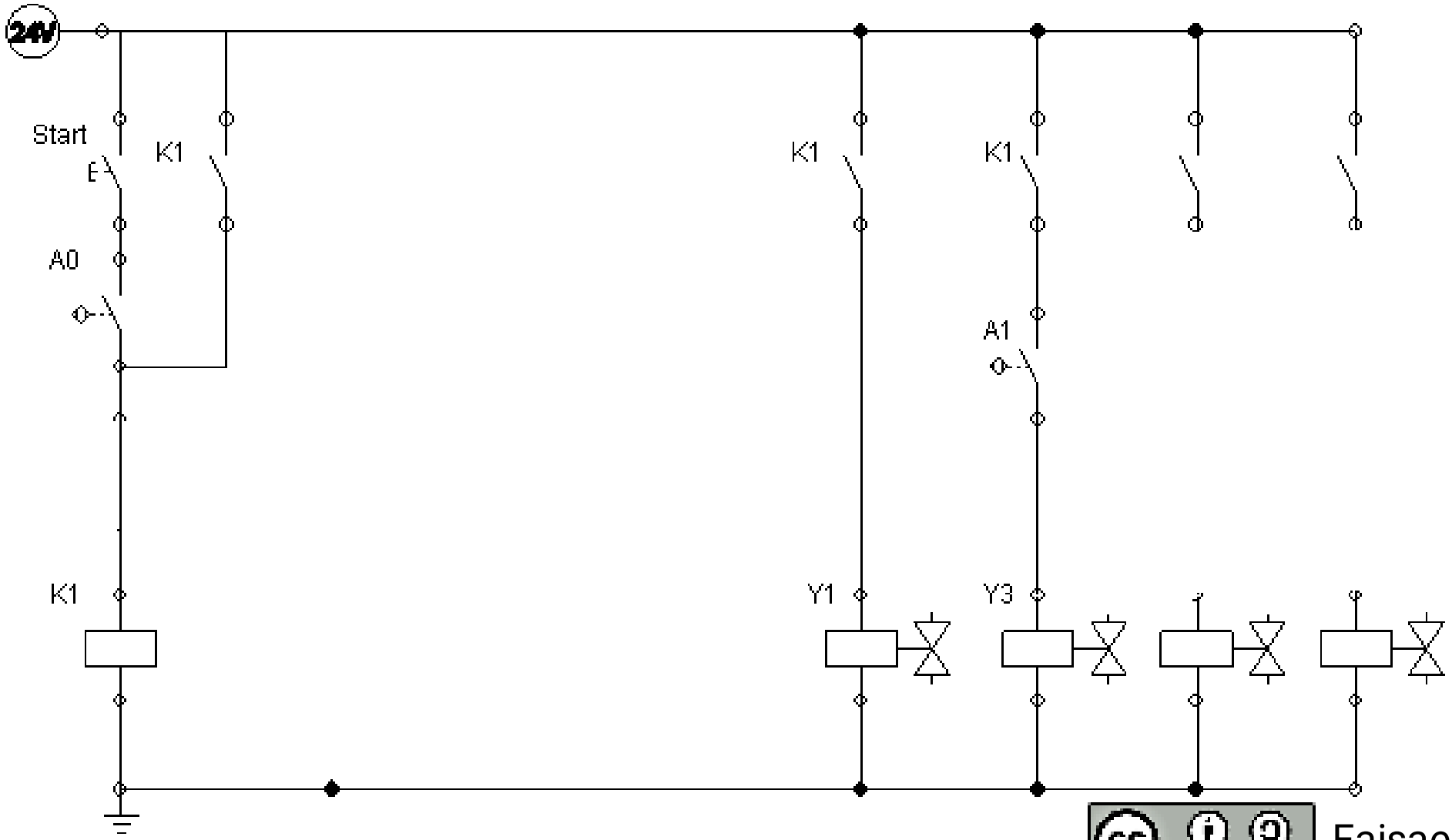


A+ → K1 ▭ Start ▭ A0

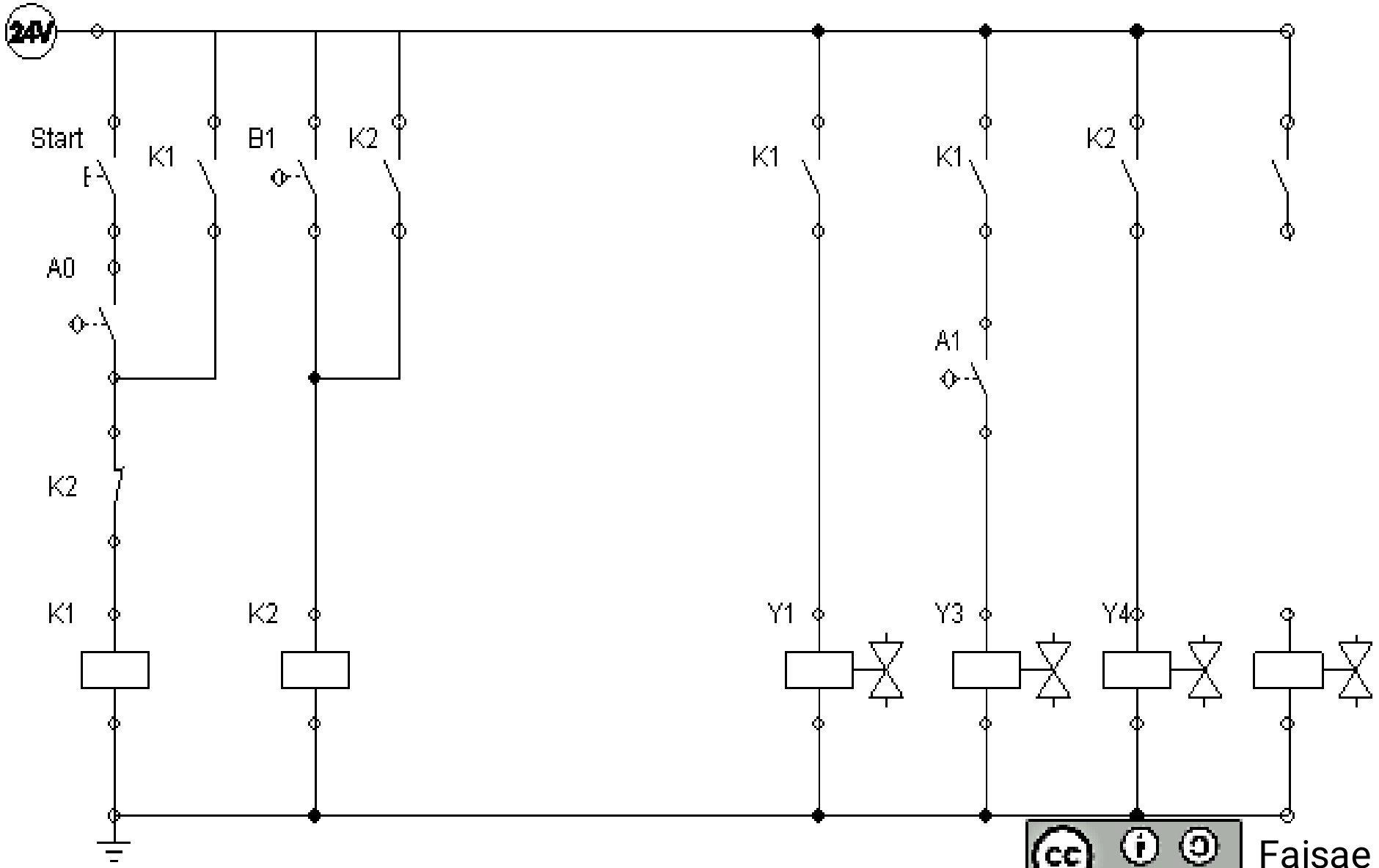


Latching

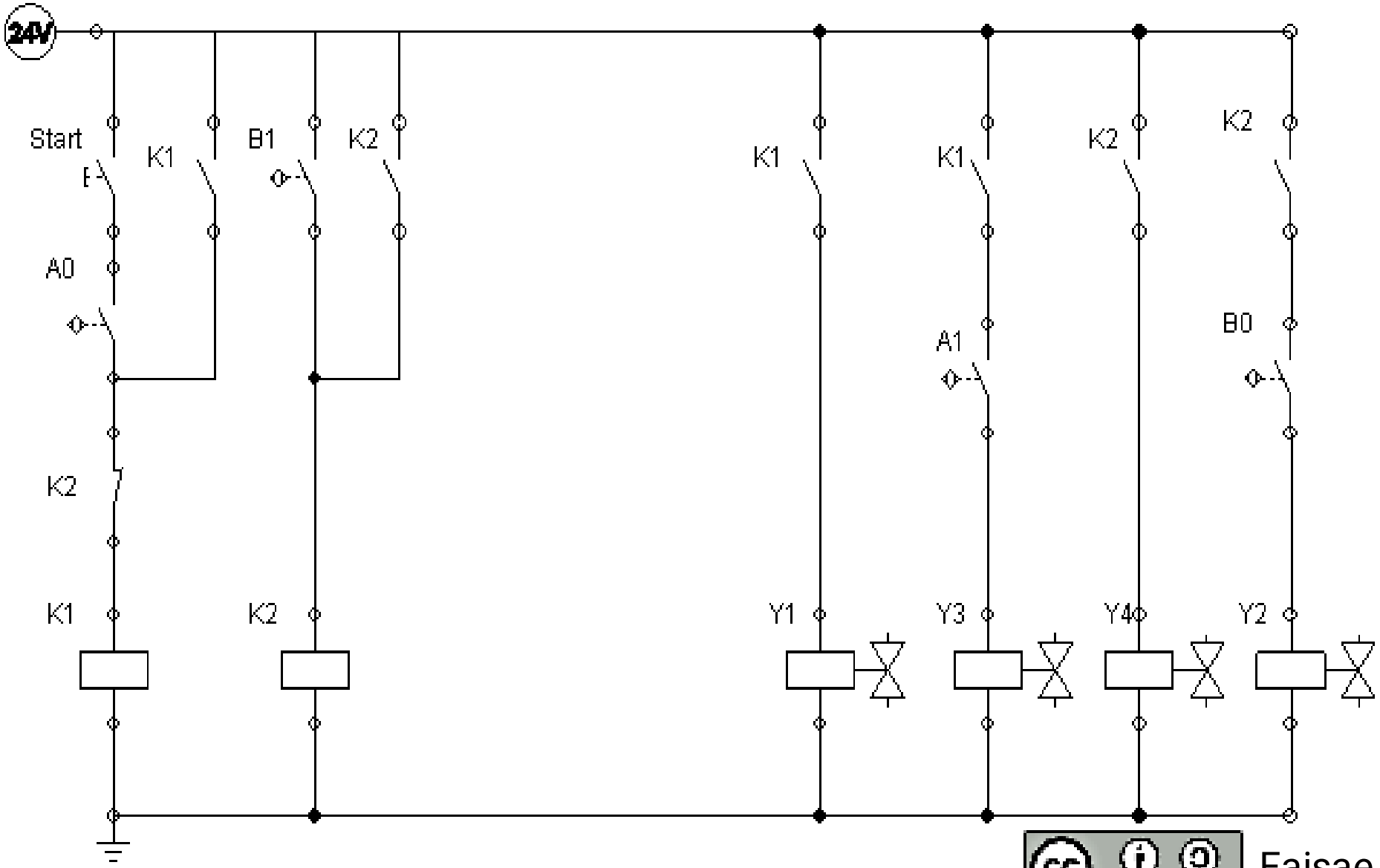
B → K1 A1



B- → K2 ▭ B1 K2 due to changing group



A- → K2 B0



Exercise

- Design an electro hydraulics to conduct this sequence:
  - Cylinder 1 & 3 extend simultaneously
  - Cylinder 2 extend
  - Cylinder 2 retract
  - Cylinder 1 & 3 retract simultaneously

Summary

- We have learn how to design an electro-hydraulics circuit with multiple actuators.