1. Basic description of UCM protection means

Safety system for A3 consists of three units:

	Function	Unit	Function
1.	Detection	Dual door-zone monitoring unit	Detects the UCM with the doors open
2.	Activation	ARL-500 lift controller with integrated door-bridging circuit	Activates the stopping device in case of UCM
3.	Stopping	Hydronic HSV safety valve	Stops the car and keeps it stopped

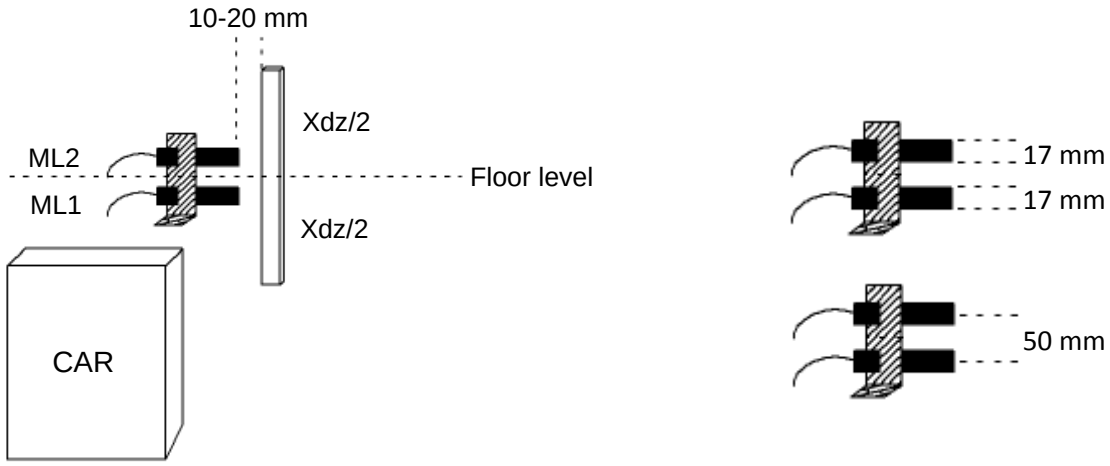
2. Basic description of UCM detection and activation

The door-bridging circuit is integrated in ARL-500 lift controller. The detection of the UCM away from the landing with landing door unlocked and car door open is done with dual door-zone monitoring that is cutting the safety circuit off when ever passed unintentionally.

In normal conditions but also in case of power failure, ARL-500 controller stores the information of UCM. The elevator is put and kept out of service until the memory is reset by a competent person. Reset of the memory is done from the menu of ARL-500.

3. Dual door-zone monitoring unit

When at least one of the door-zone signals goes off (ML1 signal in downward movement, ML2 signal in upward movement), it is detected that the car is outside the door-zone.



ML1 & ML2: Door-zone magnetic switches
Manufacturer / Model: ARKEL / MTM
Description: Electronic mono-stable magnetic switch
Pcb version: 1.2
Conformity: EN 81-1/2 clause 14.1.2.5 (tested according to EN 81-1/2 annex F.6.3.1)

Xdz (length of the door-zone magnet): 30cm.
This might be too much for the application and needs then to be shortened to fit into the total system and finally stop the lift within the required distances of A3.

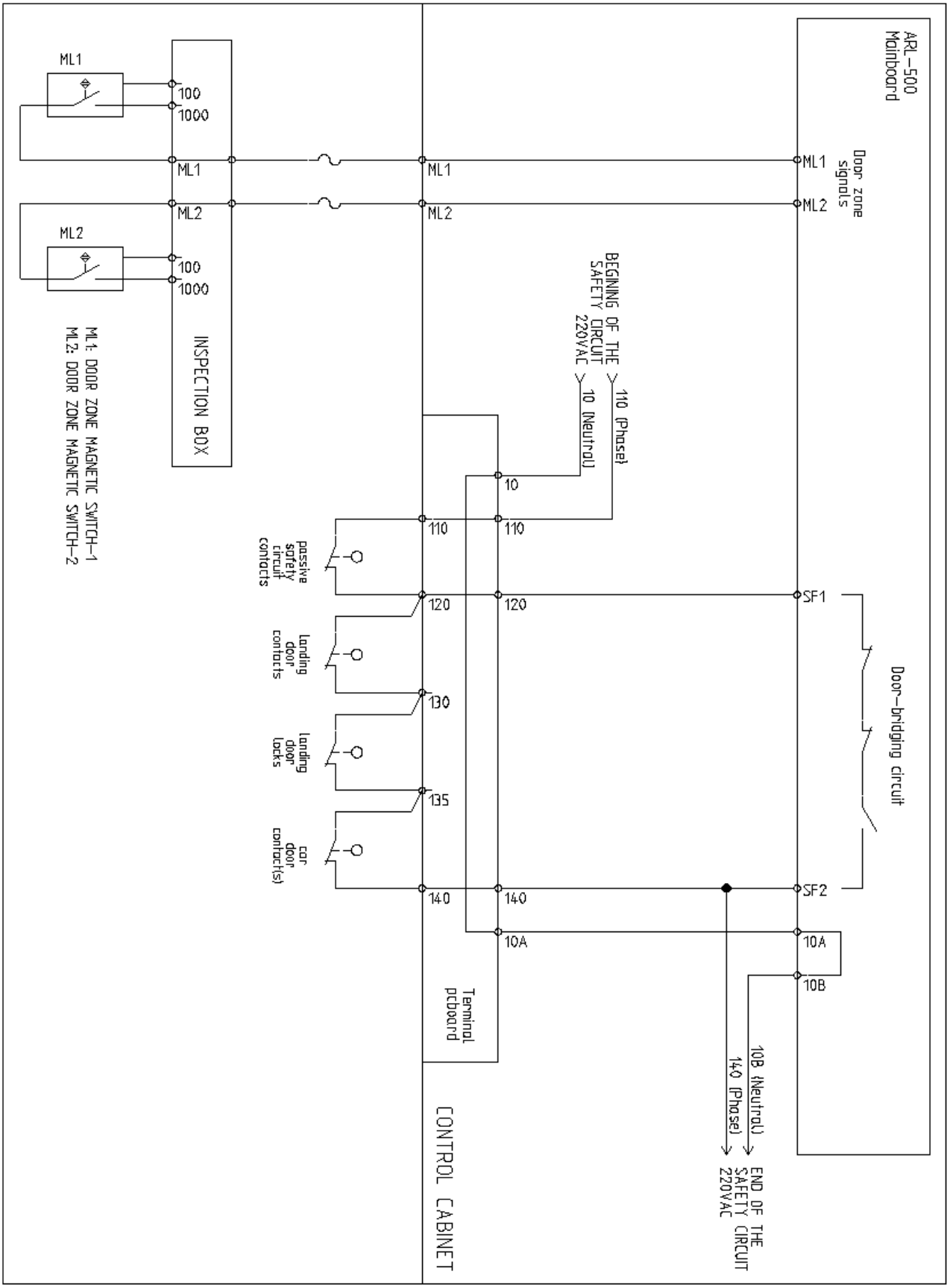
4. Door-bridging circuit integrated in ARL-500 controller

When at least one of the door-zone signals goes off (ML1 signal in downward movement, ML2 signal in upward movement), the related safety relay in the door-bridging circuit is released. The contact of this safety relay cuts the door-bridging circuit. If the doors are open at this time, because the door-bridging is removed, safety circuit will be cut off.

ARL-500 lift controller has a type-examination certificate given by Liftinstituut B.V. Therefore no detailed information about the door-bridging circuit is given in this document.

ARL-500 type-examination certificate no: NL 07-400-1002-048-04 rev. 2

5. Electrical drawing



6. Hydronic HSV safety valve as UCM stopping device

After UCM is detected and the safety circuit is cut off:

- Motor contactors are released: Upward movements are not permitted when the motors contactors are off. Therefore, the current application of two serial monitored contactors on the motor's power line is adopted as a solution for upward UCM.

- The power of the HSV safety valve is cut off: For the protection against downward UCM, HSV safety valve is used.

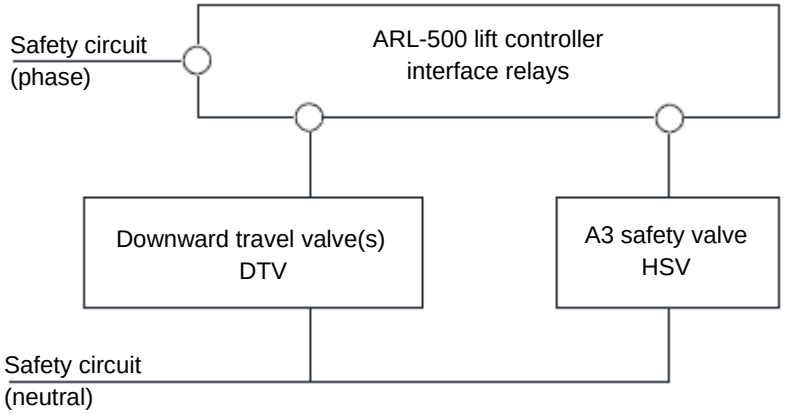
7. Operating the safety valve HSV from Hydronic Lift with ARL-500 lift controller

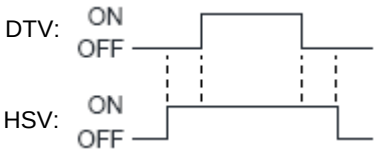
ARL-500 has 2 valve control options:

- with timing (without self-monitoring)
- with self-monitoring of the valves with periodic test

HSV safety valve is a pilot-operated non-return valve (one-way lock valve), therefore the first option can be applied for HSV safey valve.

The HSV safety valve, respect to the downward travel valve(s), is energized a time before and de-energized a time after the arrival at landing. In this way, the A3 safety valve is not considered as an element that works to control the normal operation of the lift and does not work as a redundant safety device (EN 81-2+A3 clause 9.13.3). Therefore, a self-monitoring is not required.



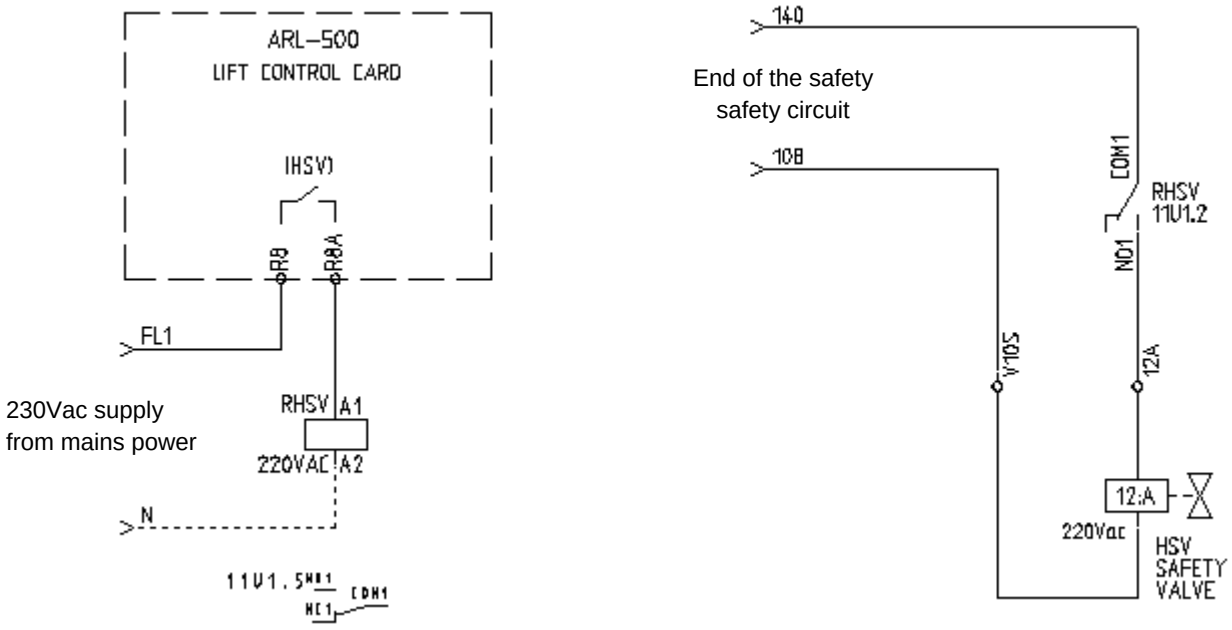


8. Required connection for HSV valve

The drawing shown below is for Hydronic HSV safety valve with 230Vac solenoid voltage. HSV valve is directly supplied from the safety circuit.

When the solenoid voltage of the safety valve is different, then a transformer according to EN 81-2 can be used to transform the voltage from 230Vac safety circuit to the solenoid voltage.

An additional interface relay (RHSV) according to EN 81-2 is necessary. Because the interface circuits of the programmable relay (R8) on ARL-500 does not fulfil the requirements of EN 81-2 for 230Vac safety circuit. This additional interface relay is also necessary when the solenoid voltage is a dc and higher than 48Vdc. Because the interface relays on ARL-500 are not suitable for switching the dc voltage higher than 48Vdc.



9. Required settings in ARL-500 menu

With the firmware version V20R132 or later, the functions for HSV safety valve are provided. The following settings are required in the menu of ARL-500:

- The output function for HSV valve must be assigned to the programmable relay PR8:
  Menu > Programmable outputs > ARL-500 relays > Relay (PR8): 94: (HSV) Hydraulic safety valve

- The type of the safety valve should be selected:
  Menu > Hydraulic lift settings > Hydraulic UCM valve type: Hydronic Lift HSV

- The time required for HSV valve should be set:
  Menu > Hydraulic lift settings > HSV Safety valve delay: 1.5 seconds

Note: According to the manual of the HSV valve, this time should be 1.5 second (see datasheet of the HSV valve)

10. Considerations before UCM test

10.1. Before starting the test, the required connections and settings described in the previous sections shall be checked

10.2. When power is switched on at door zone, ARL-500 controller does not activate door bridging function after one correct travel. After a travel, controller checks ML1-ML2 zone enable signals. If there is no fault and no short circuit at ML1-ML2 door zone signals then door bridging is activated.

10.3. With the firmware version V20R134 or later, a test function for UCM safety valve is provided in ARL-500 menu. This test function shall be used during the test operation.

10.3.1. To be able to use the UCM test function, the door pre-opening option shall be enabled as shown below:

- Menu > Door Timing Settings > Door preopening: Maximum

10.3.2. To enable the UCM test function, do the followings:

- Go to “Debug tools” screen by pressing the up button while the ARL-500 is in the main screen
- Set “UCM Test” parameter. It has 3 options:
    - Off: Disables the UCM Test function
    - Slow (V0): Enables the UCM Test function with slow test speed
    - Fast (V3): Enables the UCM Test function with high test speed. This option shall be selected

This setting is not stored in the memory. After the power is switched off or “Reset system !” is activated, it turns to “Off”.

10.3.3. When the UCM test function is set to “Fast (V3)”, ARL-500 does the followings:

- Closes the doors
- Disables landing calls and car commands
- Activates door bridging circuit (doors are bypassed)
- Works in “inspection mode only”. In this mode, lift can be moved by pressing the direction buttons (Up or Down) on the emergency electrical operation hand terminal in the control cabinet
- When down direction button is pressed lift moves with high speed in the down direction

10.3.4. The UCM test shall be done with doors closed for safety purposes. But in order to simulate an open door, the door safety circuit needs to be interrupted manually after door circuits are bridged (after UCM test function is enabled). To do this, remove the wire from terminal 130 on the KBK-9 board to open the door safety circuit

10.3.5. In case of UCM, ARL-500 gives “UCM detected” error. The lift is kept out of service, even if the main power is switched off and on. To reset this error:

- Go to “Debug tools” screen by pressing the up button while the ARL-500 is in the main screen
- Activate “Reset system !” option

10.4. The UCM test shall be made by moving the fully loaded car in down direction in the upper part of the well (top floor) to simulate the worst case load.

10.5. Only the HSV safety valve shall be used for the test for stopping the lift. Therefore, the normal downward travel valve(s) shall be remains energized even if the door safety circuit is interrupted after leaving the door zone. It is for simulating a failure of the normal downward travel valve(s) during the test.

11. UCM test procedure

a) Move the car to the top floor by giving a call

b) Load the car with the rated load

c) Enable the UCM test function (see 10.3.2)

d) Remove the wire from terminal 130 on the KBK-9 board (see 10.3.4)

e) Press the down direction button on the emergency electrical operation hand terminal. Drive accelerates to rated speed in the down direction (see 10.3.3)

f) After leaving the door zone, because door bridging is interrupted, the power of the HSV safety valve is also cut off. An emergency stop (UCM fall) occurs. ARL-500 gives “UCM detected” error.

g) Measure the stopping distance. Test is successful if the stopping distance is lower than the limit value.

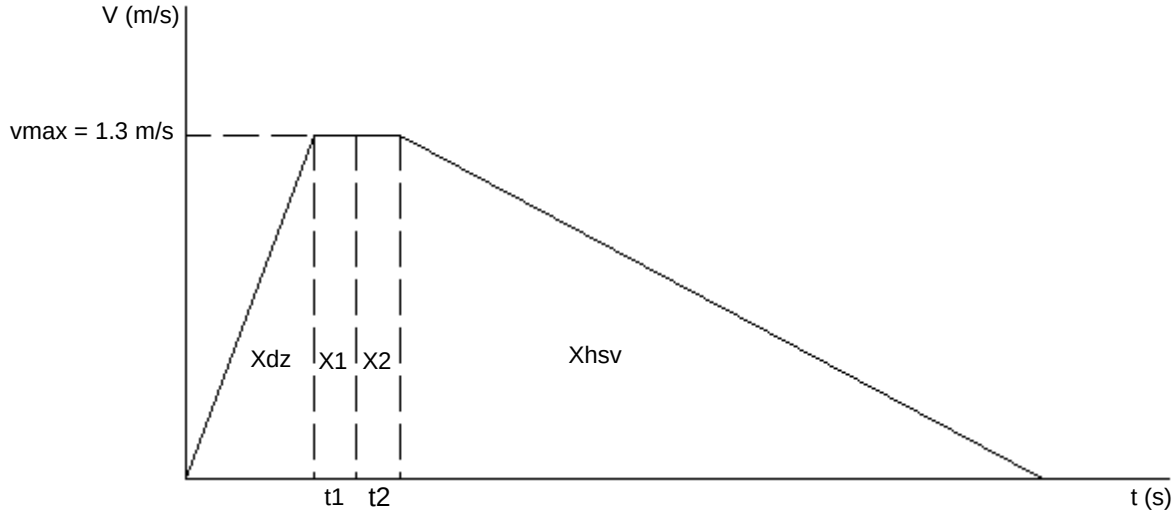
h) Reset the error (see 10.3.5)

12. Calculation of the stopping distance in case of UCM in downward direction

Response time of the components:

	Component	Response time (max.)
ARL-500 door-bridging circuit	Panasonic-NAIS SFS3-DC24V or Omron G7SA-3A1B DC24	10 ms
ML1 door-zone magnetic switch	ARKEL MTM	10 ms

The chart below shows the theoretical curve of the car in case of UCM in worst case:



Xdz: Max. door zone = 200 mm

t1: Max. response time of the ML1 magnetic switch = 10 ms
X1: Vmax * t1 = 1,3 m/s * 10 ms = 13 mm

t2: Max. response time of the door-bridging circuit = 10 ms
X2: Vmax * t1 = 1,3 m/s * 10 ms = 13 mm

Xhsv: Max. breaking distance of the HSV safety valve = 750 mm (see note 1)

vmax = Maximum speed of a hydraulic lift when leaving the door zone = 1,3 m/s (see note 1)

Maximum total stopping distance in the worst case can be calculated as follows:

X(total) = Xdz + X1 + X2 + Xhsv = 200 + 13 + 13 + 750 = 976 mm

Note 1: The worst case in with the HSV must stop the lift is max car speed plus 0,3 m/s. For higher speed the lift must be stopped by the pipe rupture valve. In the worst case this speed is 1,3 m/s. The Safety Valve HSV has been designed so that, considering a speed of vmax of 1,3 m/s, maximum load and unfavourable oil conditions, the lift will stop within 750 mm from the de-energising of the safety valve HSV solenoid 12:A.

13. Periodical test

Perform the UCM test described in section 11 during periodical tests/inspection.

14. Maintenance

This system requires no maintenance. See technical data of the manufacturer of the hydraulic valve.

15. Requirements for UCM test during examinations and tests before putting the lift into service

EN 81-2:1998+A3:2009 ANNEX D.zc

zc) Unintended car movement protection means (9.13).

The type-examination has demonstrated the functionality of the means. The aim of the test before putting into service is to check detection, and stopping elements.

Test-requirements

Only the stopping element of the means defined in 9.13 shall be used for the tests for stopping the lift.

The test shall:

- consist of verifying that the stopping element of the means is triggered as required by type examination;

- be made by moving the empty car in up direction in the upper part of the well (e.g. from one floor from top terminal) and fully loaded car in down direction in the lower part of the well (e.g. from one floor from bottom terminal) with a 'pre-set' speed, e.g. as defined during type testing, (inspection speed etc.);

The test, as defined by the type-examination, shall confirm that the unintended movement distance will not exceed the value given in 9.13.5.

If the means requires self-monitoring (9.13.3), its function shall be checked.

NOTE If the stopping element of the means involves elements present at landing floors, it could be necessary to repeat the test for each concerned landing.

NB-L POSITION PAPER NB-L/POS 1/007

Installation (includes Final Inspection) **/** Final tests

- Are the components supplied according to the scope of application and the conditions mentioned in the report.

- Does the “UCM”, which is used, fit to the lift system (parameters)?

- Supplementary, in case of combination of “UCM” partial systems: Are the “UCM” partial systems suitable for combination with one another and with the lift system? The lift installer has to provide the documentation (e.g. calculation of the combined systems including delays, distances, acceleration, retardation etc.) for the lift containing the proof of the correct combination of the applied partial systems with the lift system to fulfil the requirements of A3.

- Verification of reference number(s)

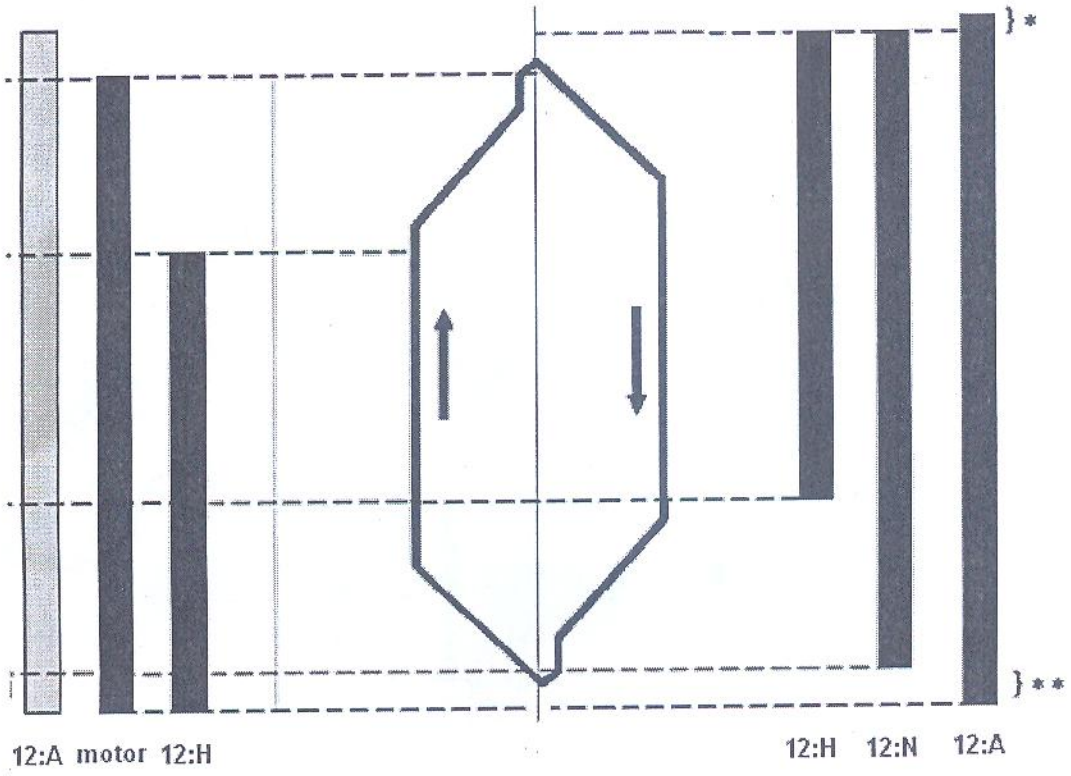
- Verification of implemented software

- Functional test, (as a minimum, the tests according to the instructions for examinations and tests)

- Verification of the test result with the acceptance limits given by the installer / manufacturer (e.g. distances).

2.4.1.2 Sequence of signals at normal operation

Example of signals sequence with Hydronic H300:



Legend:

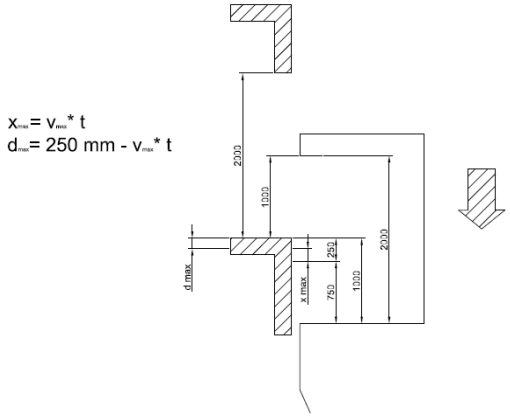
Phase	Description	Remark
UP	12:A	HSV solenoid 12:A can be energised
	Motor	Motor contactor ON
	12:H	High speed
DOWN	12:H	High speed
	12:N	Slow speed
	12:A	HSV solenoid 12:A must be energised
	*	300 ms before energize 12:H and 12:N solenoid valves
	**	1,5 s after de-energize 12: solenoid valve

NOTE: ***with this configuration the Safety Valve HSV does not work as a redundant safety device, therefore does NOT require monitoring.***

HYDRONIC LIFT

Detector

EN81-2:2010, paragraph 9.13.5 prescribes that the lift that moves unintentionally DOWN with open doors shall be stopped so that:



the distance between the floor of the car and the floor of the landing will not exceed 1200 mm.
The free distance between the car door lintel and the landing floor shall not be less than 1000 mm.

Both requirements must be fulfilled simultaneously. In order to exploit both these criteria simultaneously the clearance height of the open door must to be at minimum 2200 mm, but due to the fact that clearance height of many car doors is only 2000 mm, the maximum permitted distance between car floor and the floor landing is reduced to 1000 mm.

The worst case in with the HSV must stop the lift is max car speed plus 0,3 m/s. For higher speed the lift must be stopped by the pipe rupture valve. In the worst case this speed is 1,3 m/s.
The Safety Valve HSV has been designed so that, considering a speed of v_{max} of 1,3 m/s, maximum load and unfavourable oil conditions, the lift will stop within 750 mm from the de-energising of the safety valve HSV solenoid 12:A. That means that the safety valve HSV solenoid must be de-energized when the lift has travelled not more than:

$$1000\ mm - 750\ mm = 250\ mm$$

The signal processing time *t,* that it takes from the lift control to detect the travel with open door until the safety valve HSV solenoid is de-energized gives the distance travelled during signal processing x_{max} according to the formula:

$$x_{max} = v_{max} * t$$

The maximum permitted distance d_{max} between the shaft switch and the landing position is:

$$d_{max} = 250\ mm - v_{max} * t$$