# IMPROVING SAFETY IN HYDRAULIC LIFTS

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## ABSTRACT

The hydraulic lift is well known for the high degree of safety that it provides.

The safety philosophy of the lifts is based on two basic elements:

1. the components have to be designed according to rules, that take into consideration all the possible stress conditions
2. if the failure of a component causes a dangerous situation, the function acted on by this component will be driven by two components reciprocally controlled

Therefore we think that the safety in hydraulic lift can be improved by the use of an auto controlled double safety valve.

## THE "SAFETY" IN THE HYDRAULIC LIFTS

It is well-known that the safety of an elevator is based on two main aspects:

- the equipments, which are part of the lift, are manufactured taking into consideration all the acquired knowledge
- the equipments have to be provided with control devices, that highlight all the possible defects

The European safety rules, especially for the hydraulic lifts (EN 81.2), try to satisfy the two above mentioned aspects.

The electrical part of the rules takes into consideration the following points:

- the requirements of the power contactors (13.2.1) and how they have to stop the equipment (12.4)
- the electrical devices failures, that might cause a dangerous condition (14.1.1)

- the construction characteristics of the safety devices and their location in the movement control circuit (14.1.2.1)

while the hydraulic equipments, that are the basic part of the lift, require:

- the list of the assembling devices (valves) and their resistance characteristics
- the type of the device against free fall or descent with excessive speed

On the other hand the SAA Lift Code has been recently modified and it is now similar to the European Code but the request for a door lock valve (a second check valve) has been maintained.

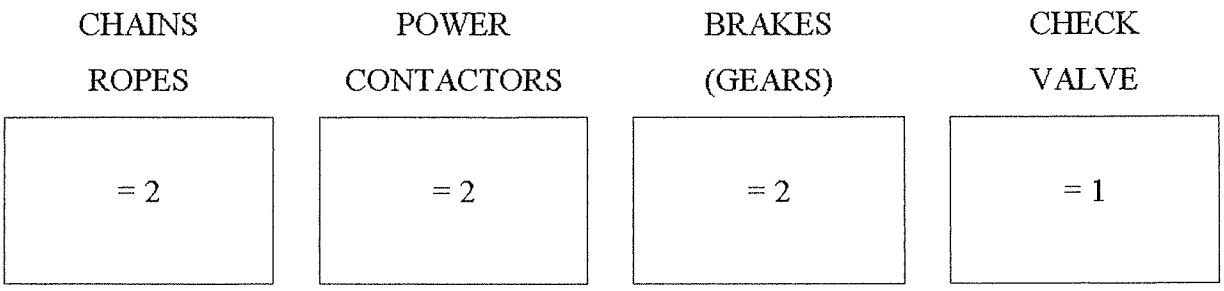



**Figure 1** Minumum number of components required by EN 81.2

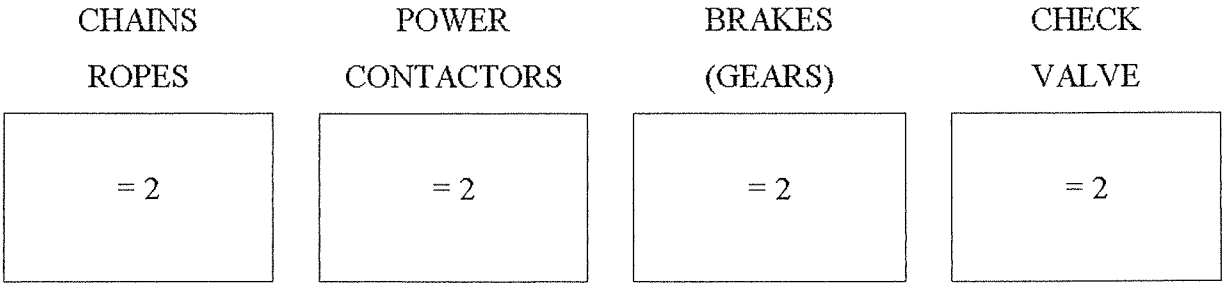
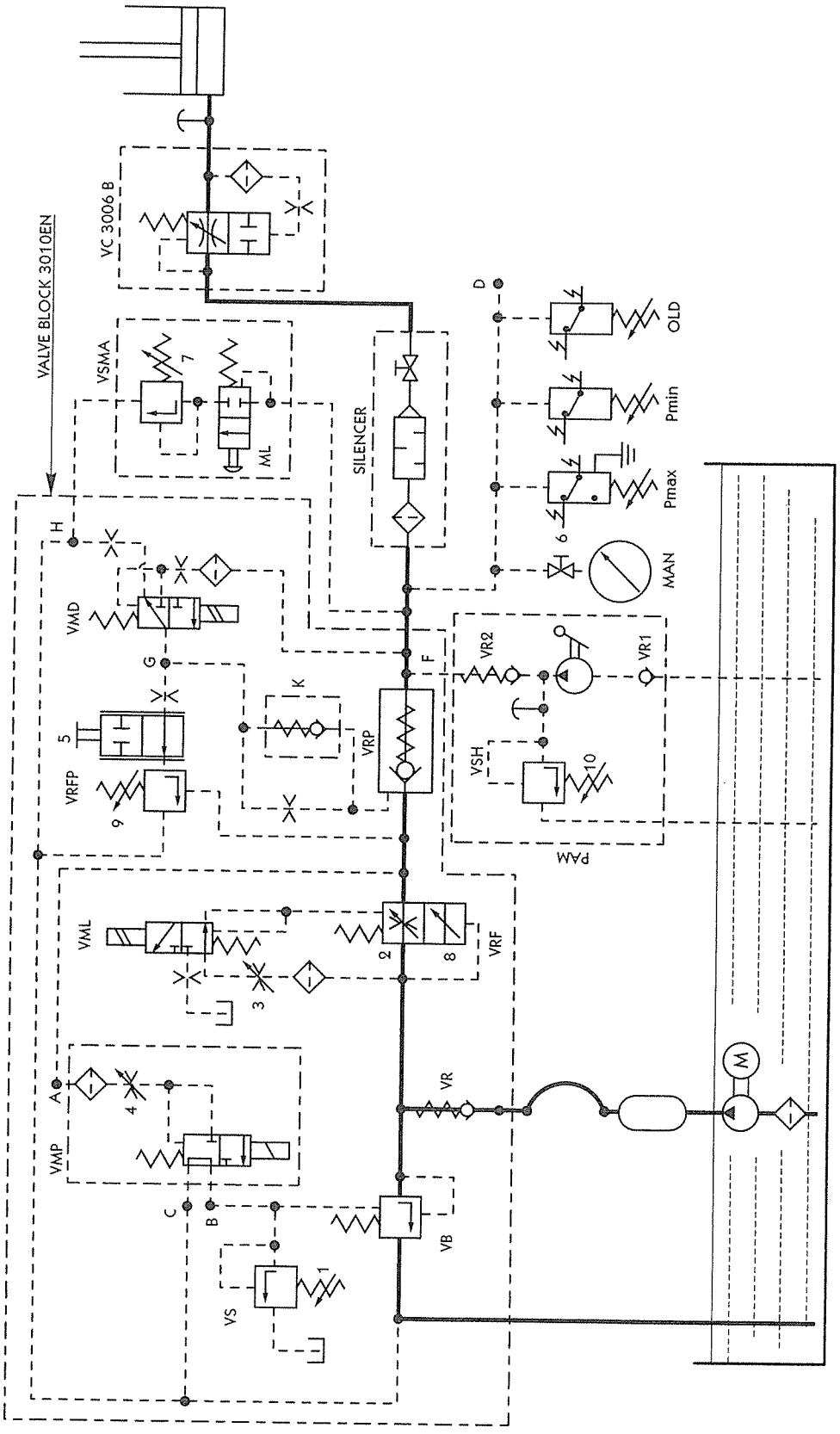



**Figure 2** Minumum number of components required by SAA Lift Code

It is well-known that one of the failures, that might cause the uncontrolled downward movement of the car is the incorrect working of the check valve. In order to prevent dangerous conditions due to this valve failure, we studied a solution for this problem. Our idea is not the addition of


VALVE BLOCK 3010EN
VC 3006 B
VSMA
7
ML
SILENCER
D
OLD
Pmin
Pmax
6
MAN
H
VMD
G
K
F
VR2
VR1
5
VRFP
9
VRP
VSH
10
PAM
VML
3
2
8
VRF
A
4
VMP
VR
C
B
VB
VS
1
M

further components in the circuit, because we think that "safety" does not necessarily mean "additional costs".

The control system we were speaking about, was the 3010-BASE circuit of GMV circuits (annex 1).

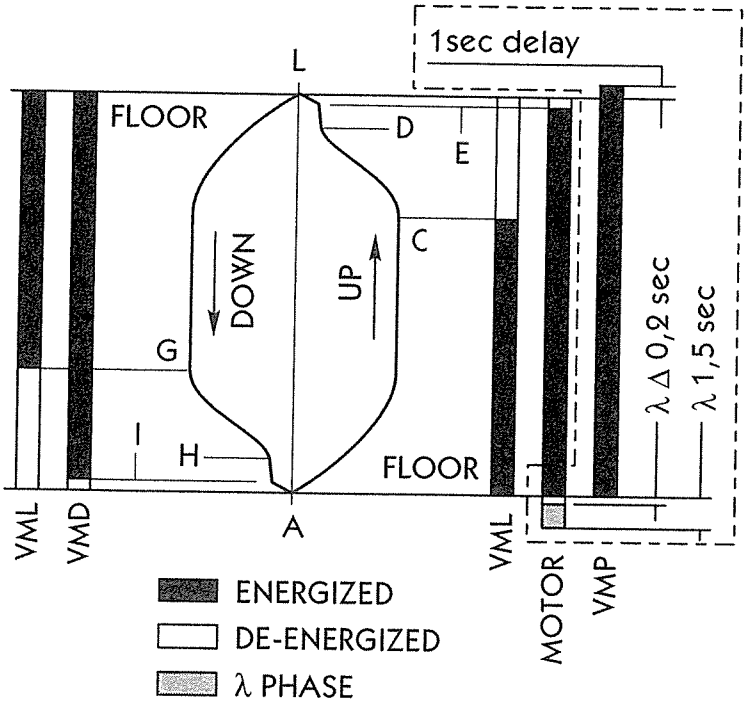
The control of the movement in the down direction is obtained through the VRP valve piloted by the VMD solenoid valve (annex 2).

By reversing the operation of VMP (by-pass control), it was possible to obtain a second check valve using the VB by-pass (annex 3/4).
It is necessary to remember that the VMD, VMP and VML energize during the travel in down direction. By energizing the VMD, the VRP valve opens and by energizing the VMP also the VB valve opens, allowing the lowering of the car. When the car is close to the floor, the VML is disenergized, the deceleration phase begins and the car reaches the floor at levelling speed. It has also been necessary to modify the control shutter of the VB valve, in order to allow the up direction with the same confort of the standard system (annex 5/6).

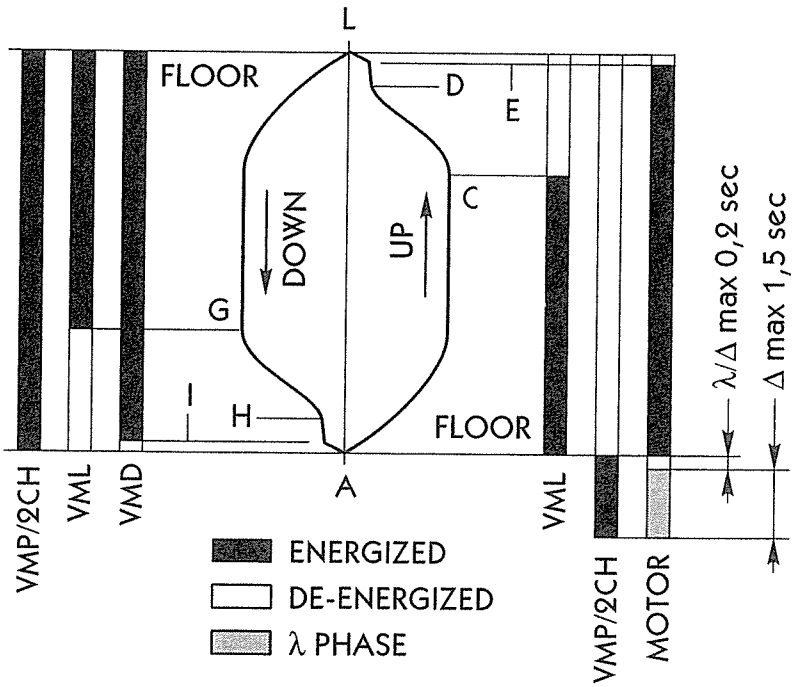
The simultaneous failure of two components is statistically improbable; so the circuit is designed with the following criteria. In case of failure of VRP, VMD or VML, the closing of the VB is ensured by the VMP disenergizing. The possible failure signal is given by the pressure switch PM. Moreover, in case of failure of VMP and/or VB, the upward travel of the lift is not possible because the VB will be open.

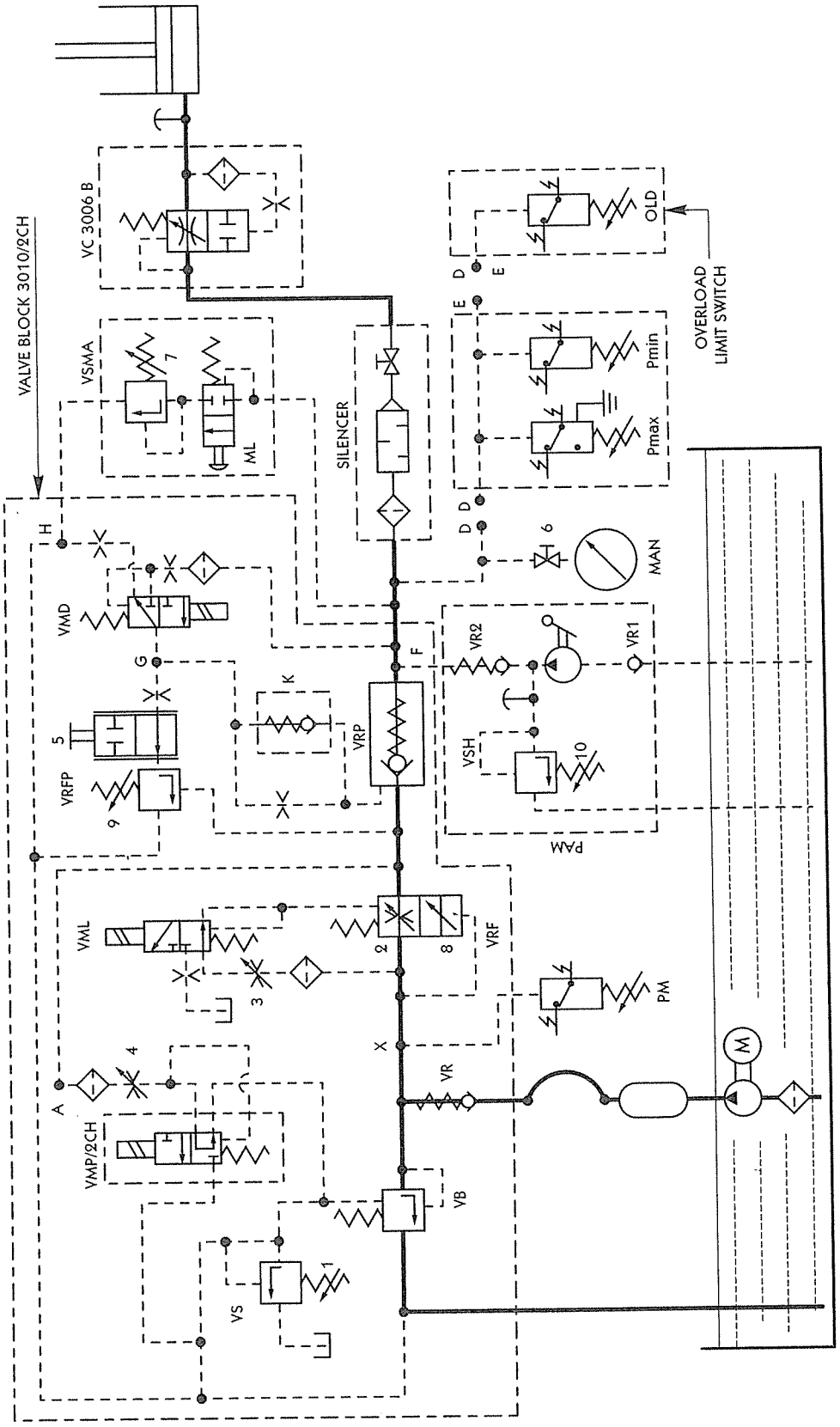
## CONCLUSIONS

Through this modification the number of components has not been changed.
On the contrary an in depth study of their position increased the safety standard requirements of the control valve to the same levels required by the rules concerning the other lift components.

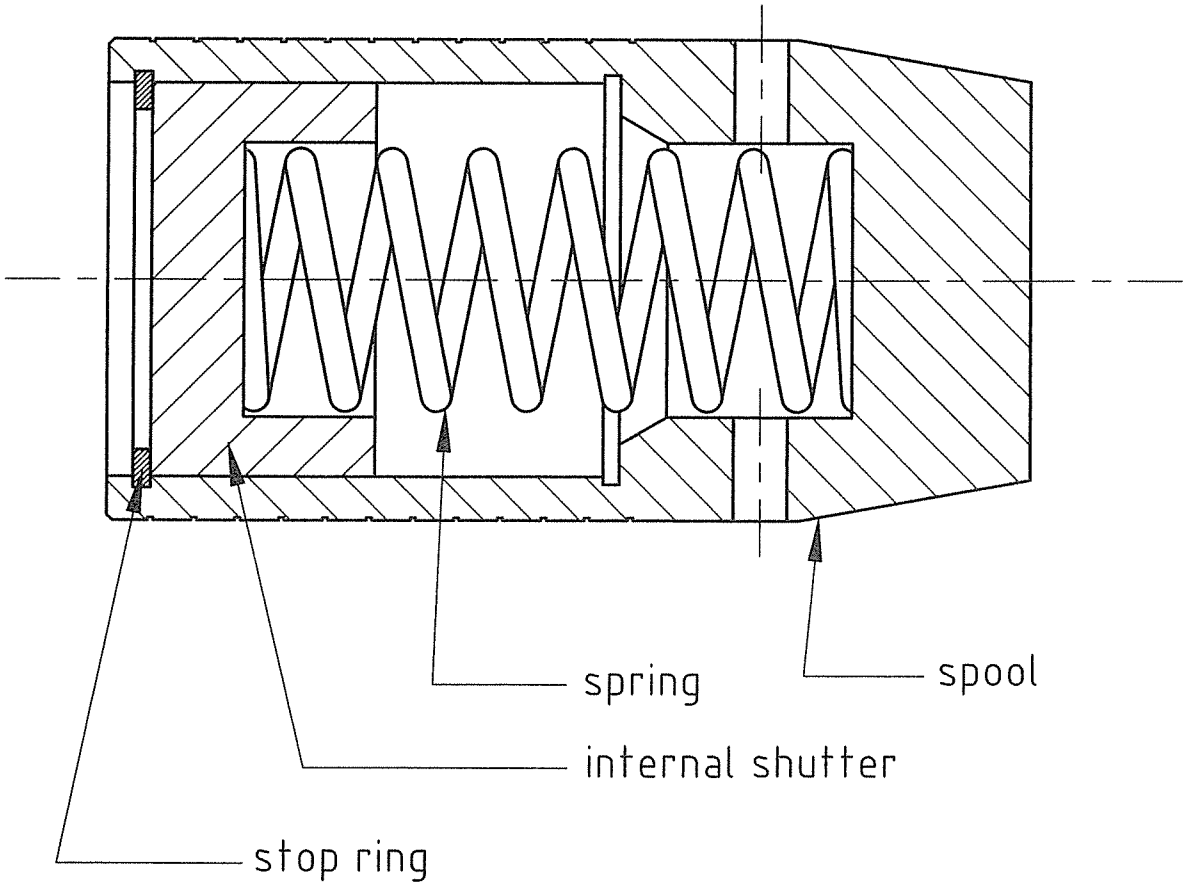

1sec delay
L
FLOOR
D
E
C
DOWN
UP
G
I
H
FLOOR
A
VML
VMD
VML
MOTOR
VMP
λ Δ 0,2 sec
λ 1,5 sec
ENERGIZED
DE-ENERGIZED
λ PHASE

Annex – 2 –

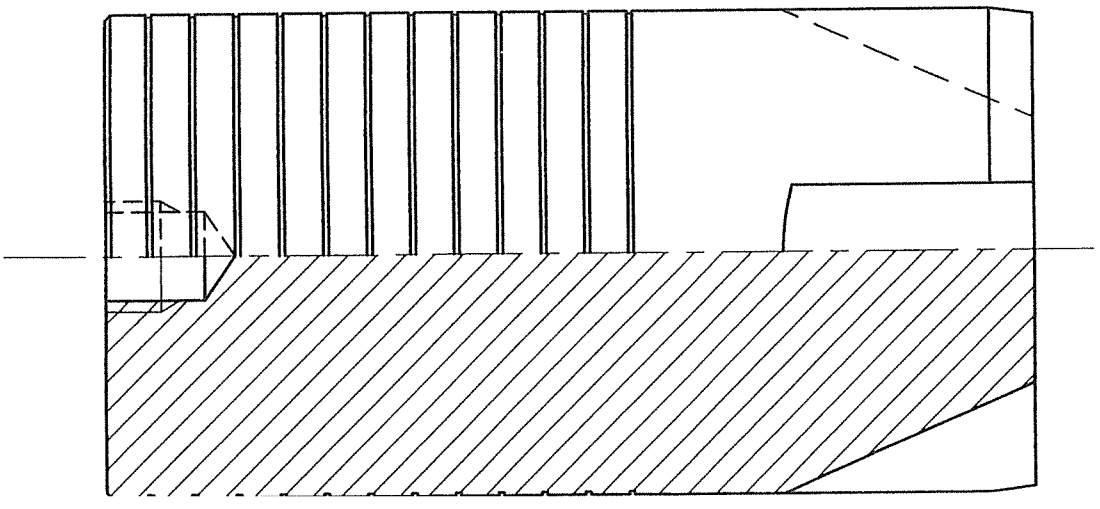

L
FLOOR
D
E
C
DOWN
UP
G
I
H
FLOOR
A
VMP/2CH
VML
VMD
VML
VMP/2CH
MOTOR
λ/Δ max 0,2 sec
Δ max 1,5 sec
ENERGIZED
DE-ENERGIZED
λ PHASE


VALVE BLOCK 3010/2CH
VC 3006 B
VSMA
7
ML
SILENCER
OLD
OVERLOAD
LIMIT SWITCH
Pmin
Pmax
D
E
H
VMD
G
K
VRP
F
VR2
VR1
MAN
6
5
VRFP
9
VSH
10
PAM
VML
3
2
8
VRF
PM
4
A
X
VR
VMP/2CH
VB
VS
1
M

Annex – 5 – VB SPOOL (differential)




Annex – 6 – VB SPOOL (standard)



| CHAINS ROPES | POWER CONTACTORS | BRAKES (GEARS) | CHECK VALVE |
|---|---|---|---|
| = 2 | = 2 | = 2 | = ~~1~~ = 2 |

BIOGRAPHY

Paolo Tagliabue obtained a higher technical education in all the hydraulic components for elevators. He is the Technical Director of GMV S.p.A., the major manufacturer of hydraulic components for passenger and freight elevators. He is also member of several technical committees (UNI, CEN/AH10).