

Ong Peck Seng LP Marketing, Singapore, 24/25th September 2014

How to Ride Through Voltage Dip

Power and productivity
for a better world™

Introduction

Voltage dip is one of the most troublesome power quality issue.
Remedy at the source is the most effective way but the reinforcement at the load side can be very much cost effective especially for small installation.
There are many ways to improve the entire electrical system immunity against volt-dip by improving the component selection and circuit design, we are going to touch on few components like:-

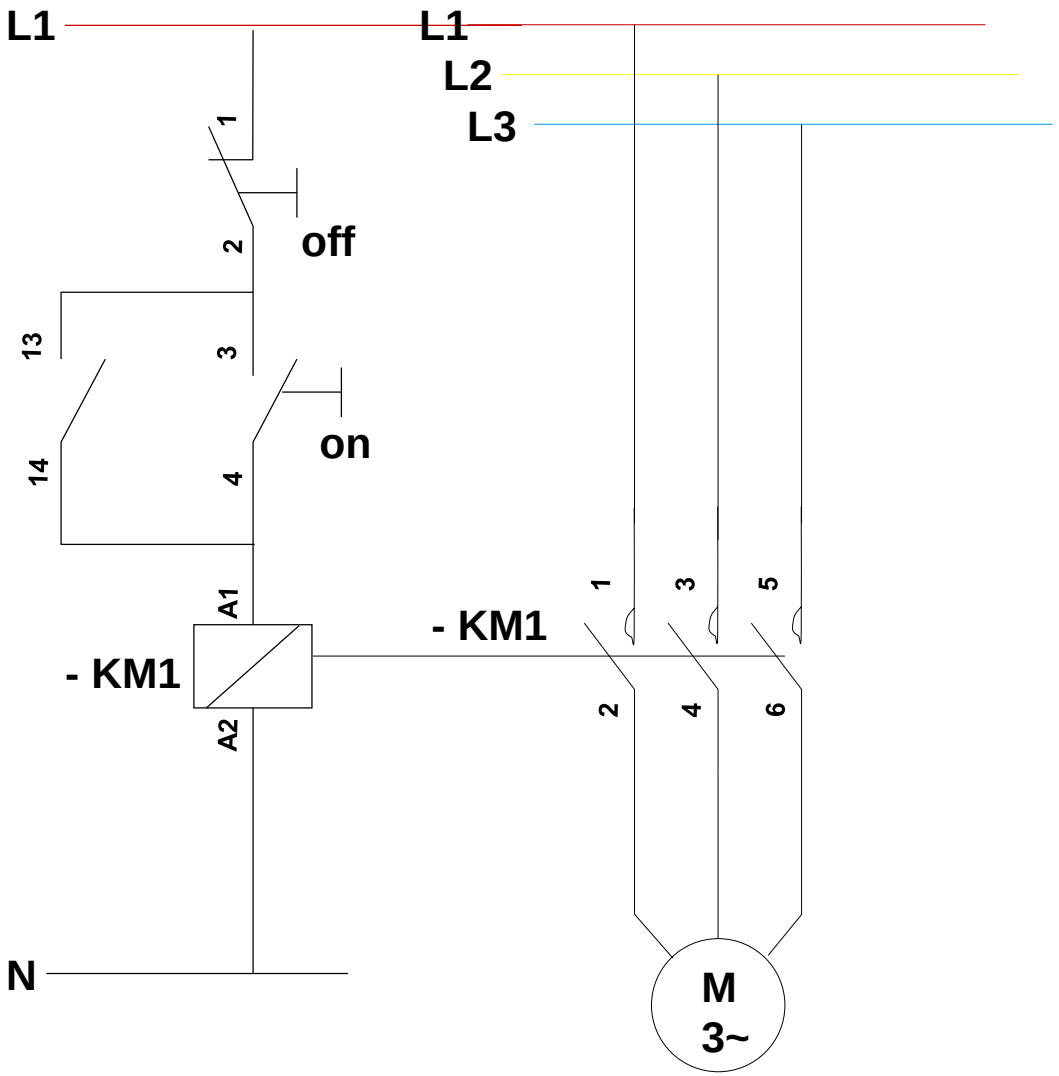
- Contactors
- VFD
- Relay etc.

Correct component selection and right way of implementation can safe the circuit from tripping during the dip.

The Problem

When voltage dip happens, the control device tripped off, motor stop and cause the interruption of process.

SEMI F47 standard define the pass fail criteria for the VDRT

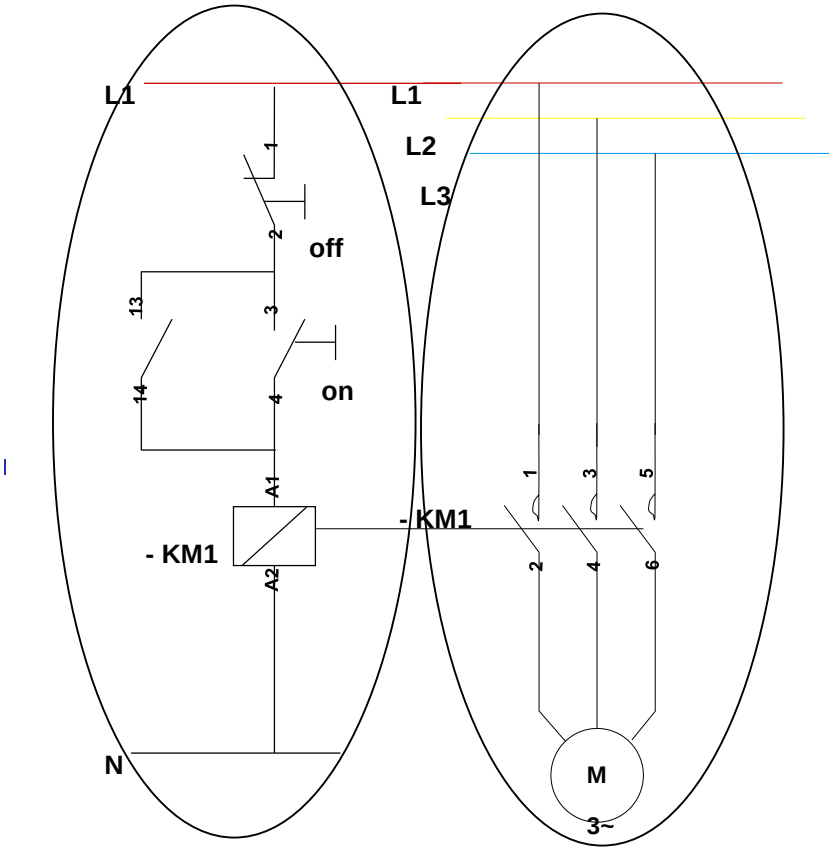


Two Main Area of Concerns

Two main criteria for electrical equipment to be able to perform “ride through” during volt-dip

1.) The control circuit
- Control and Protection Relay,
- Contactor
- DC power supply
- Auxiliary device
- Control transformer

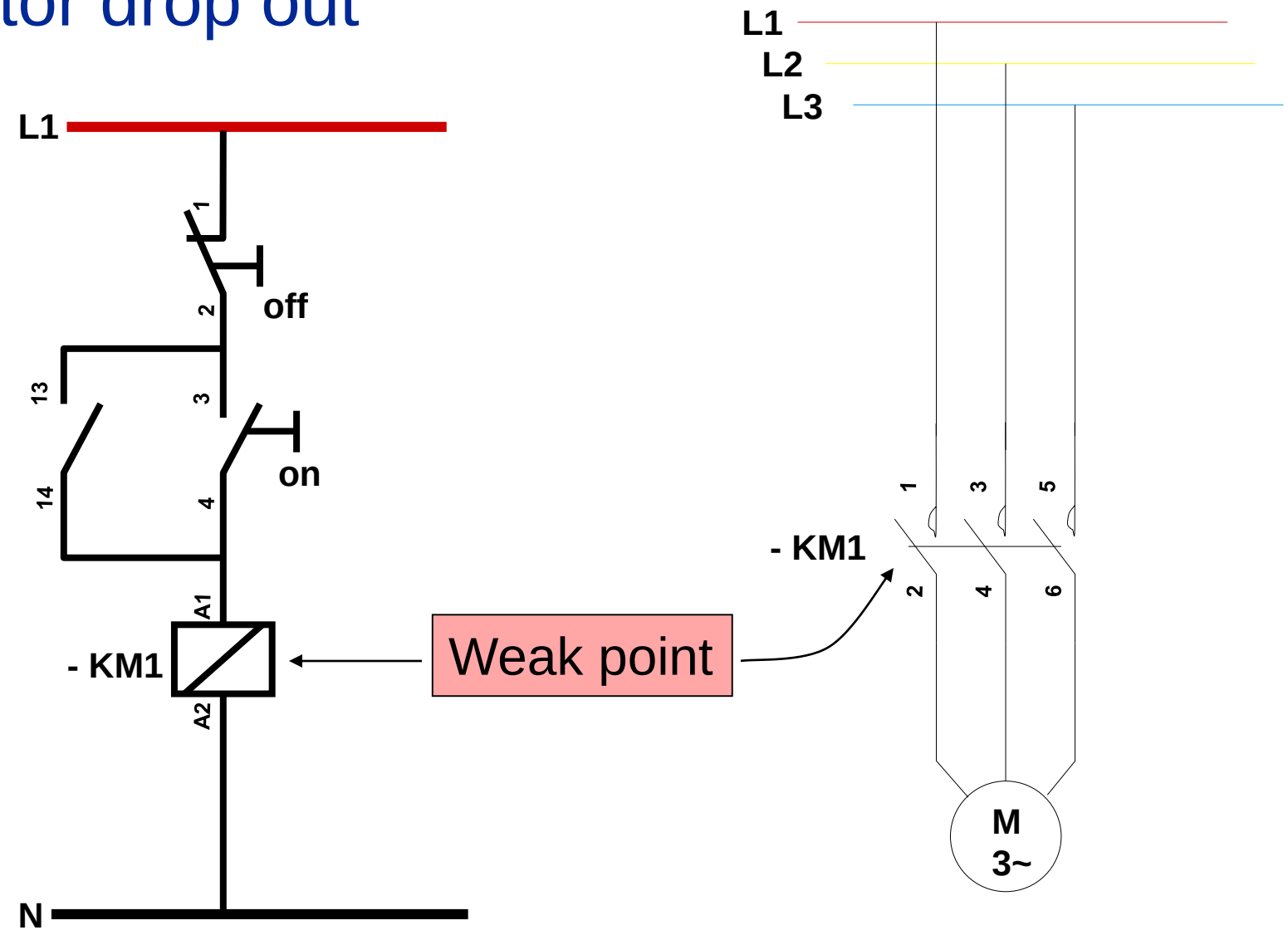
2.) The power circuit
- Motor behaviors
- Starter / Power electronics component
- Variable Speed Drive
- Load Shedding / MPR





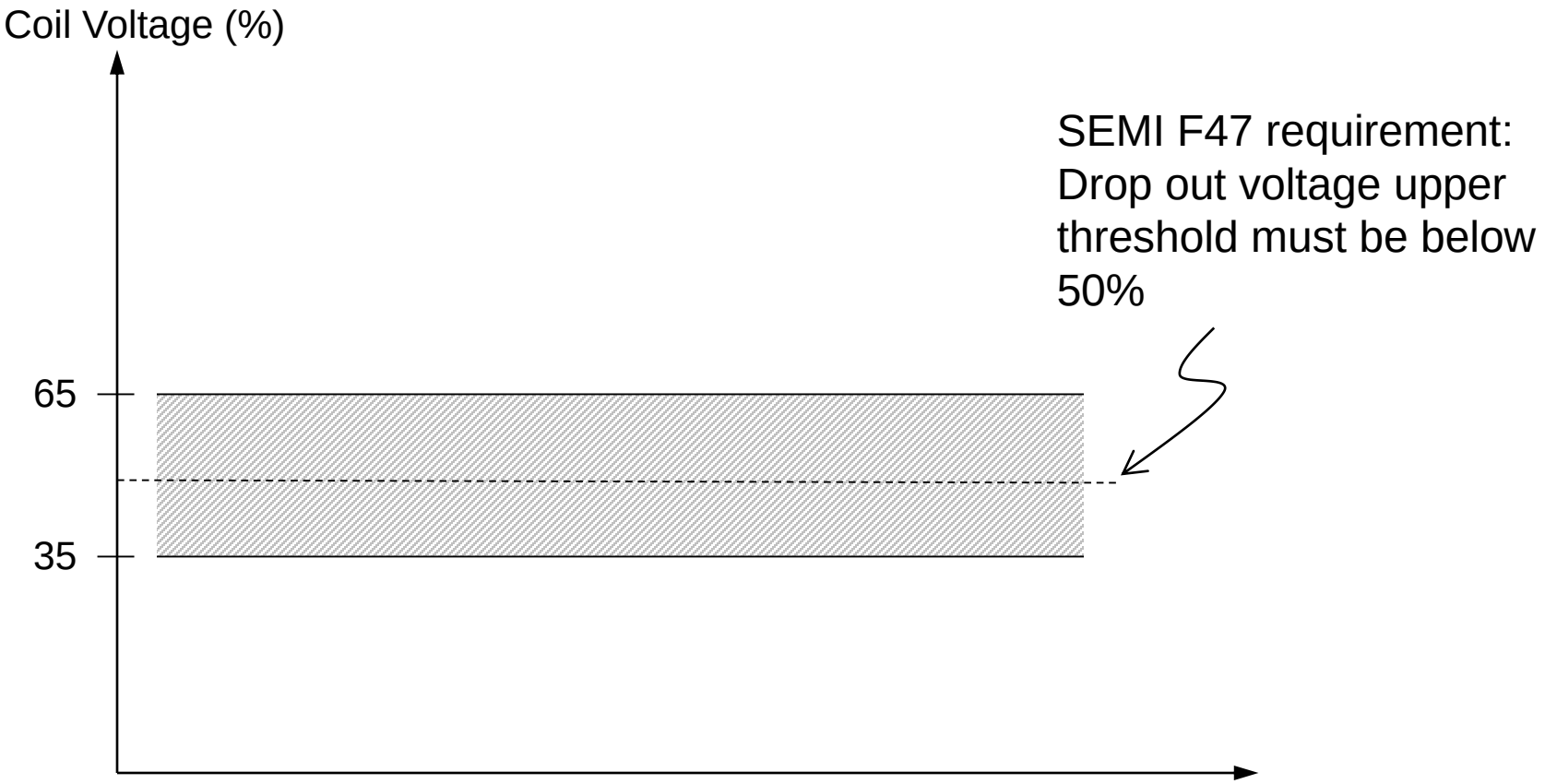
1. Control Circuit

Circuit weak point
Contactor drop out



Standard Contactor Characteristics

(AC contactor standard coil drop out voltage threshold)

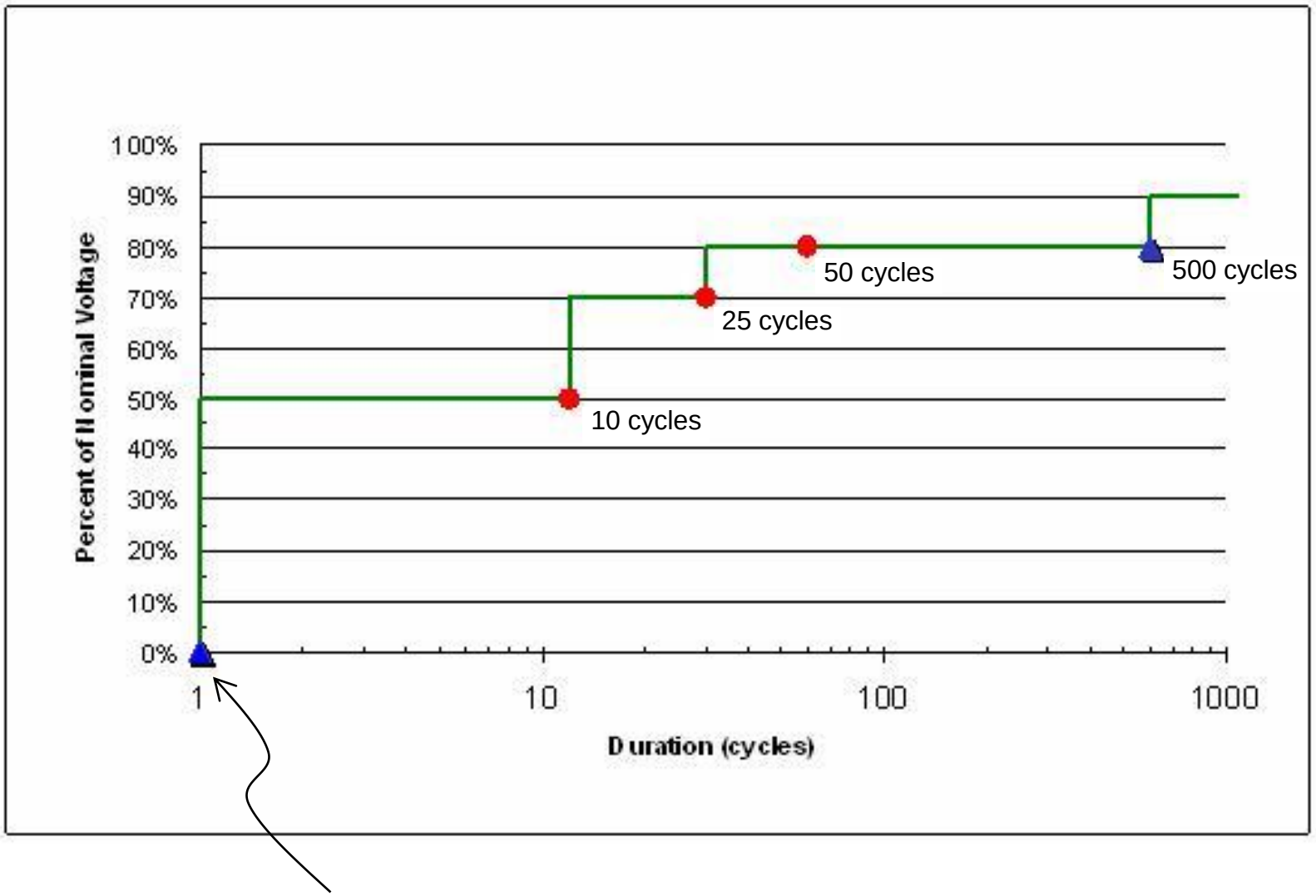


Ideal Contactor Characteristic

(Special contactor using “AF Coil” drop out voltage threshold)



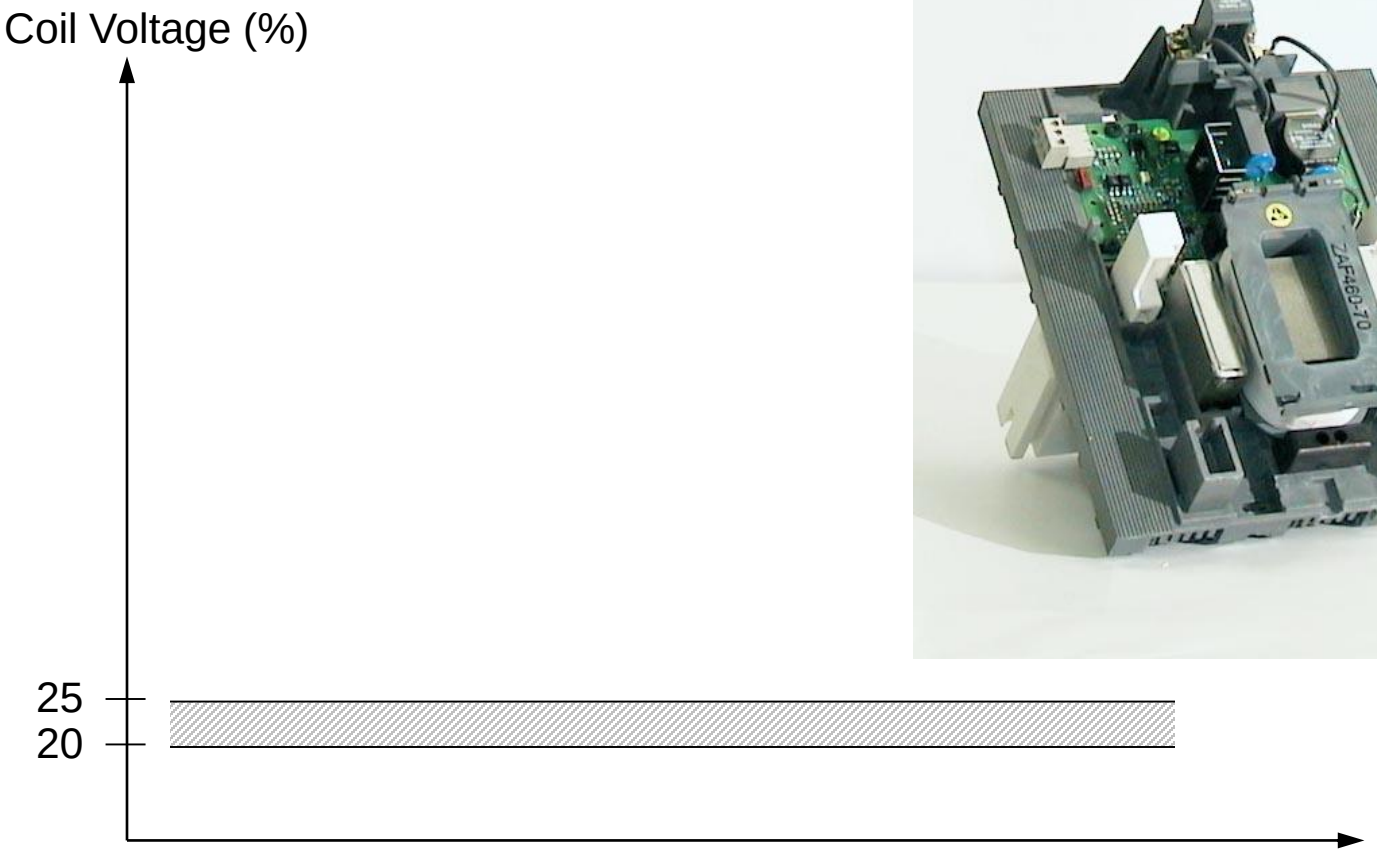
Visualizing the New F47-0706 Standard



Ride through for 1 cycle interruption

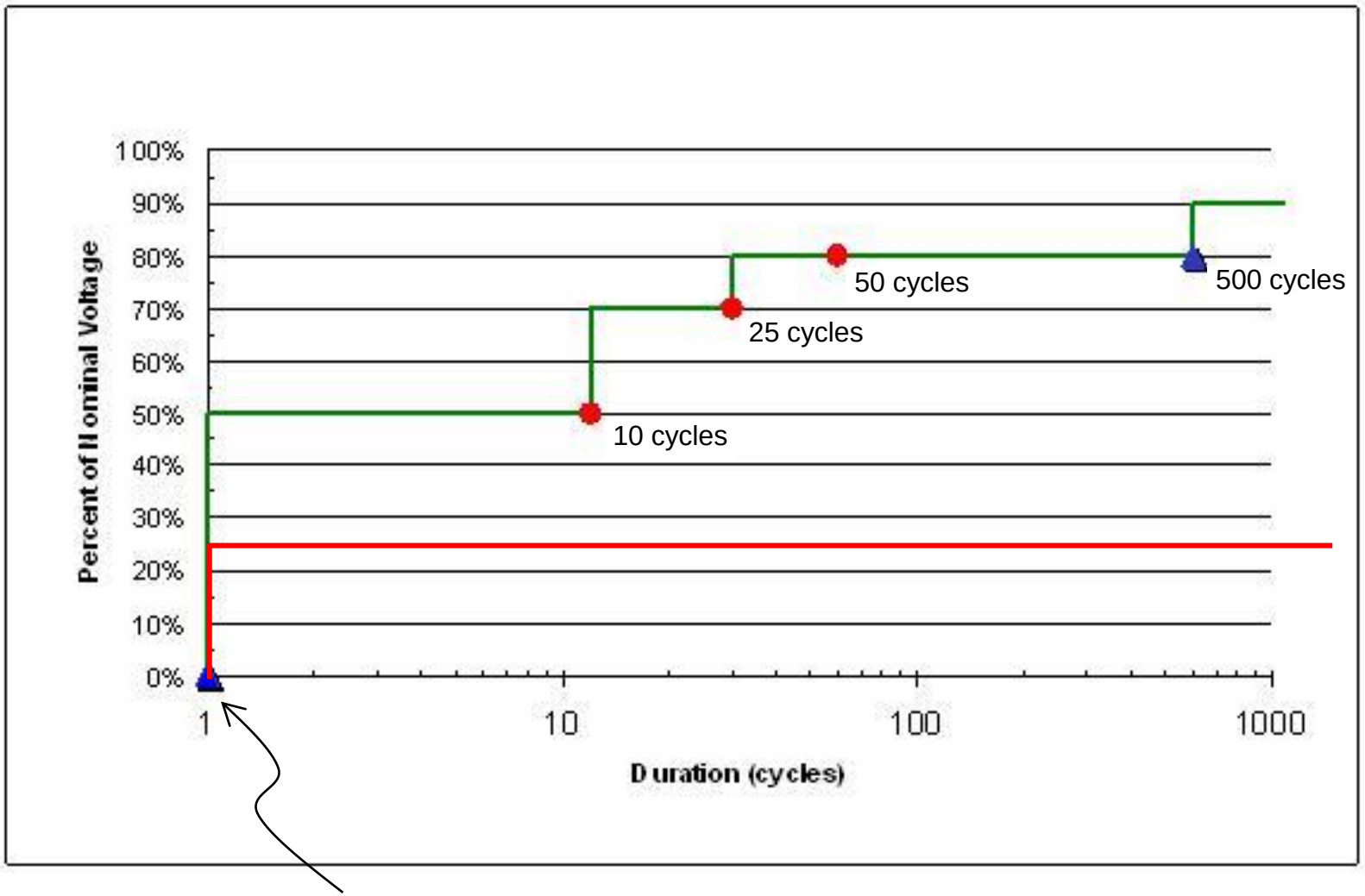
ABB Standard Contactor Characteristic

(ABB AF contactor drop out voltage threshold)



Can withstand voltage interruptions ≤ 20 ms

Visualizing the New F47-0706 Standard



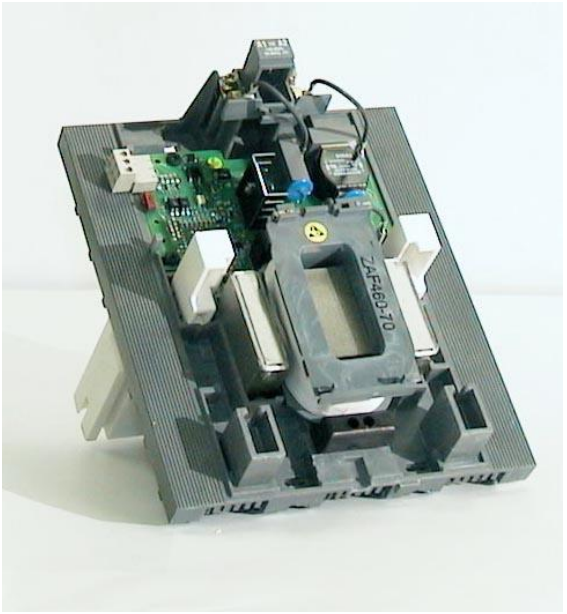
AF coil Contactor is fully comply with new SEMI F47 requirement

ABB AF Contactor Comply to SEMI F47



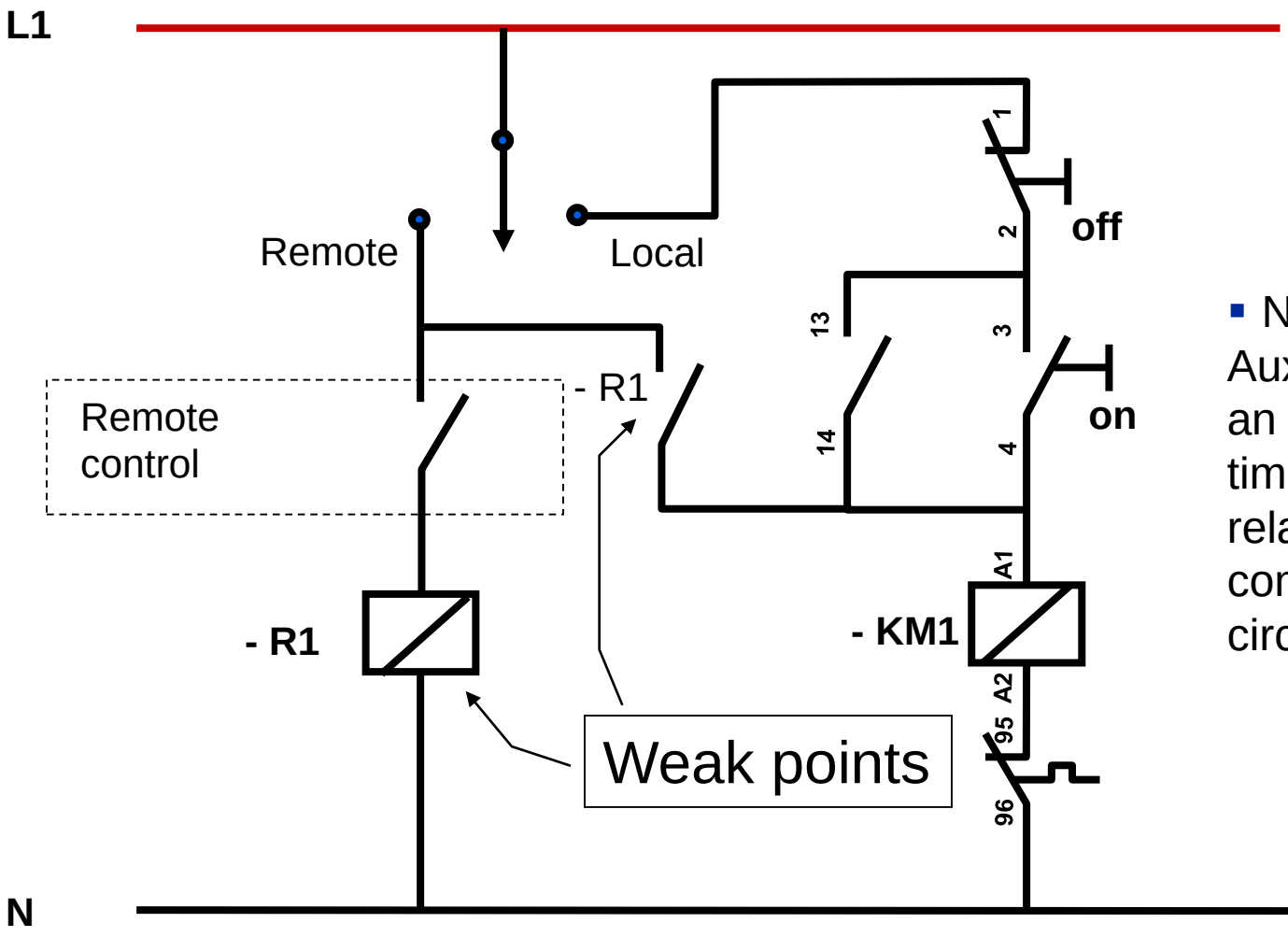
Wide range coils

- 24-60V AC/DC
- 48-130V AC/DC
- 100-250V AC/DC



Other weak point

aux. relay drop out

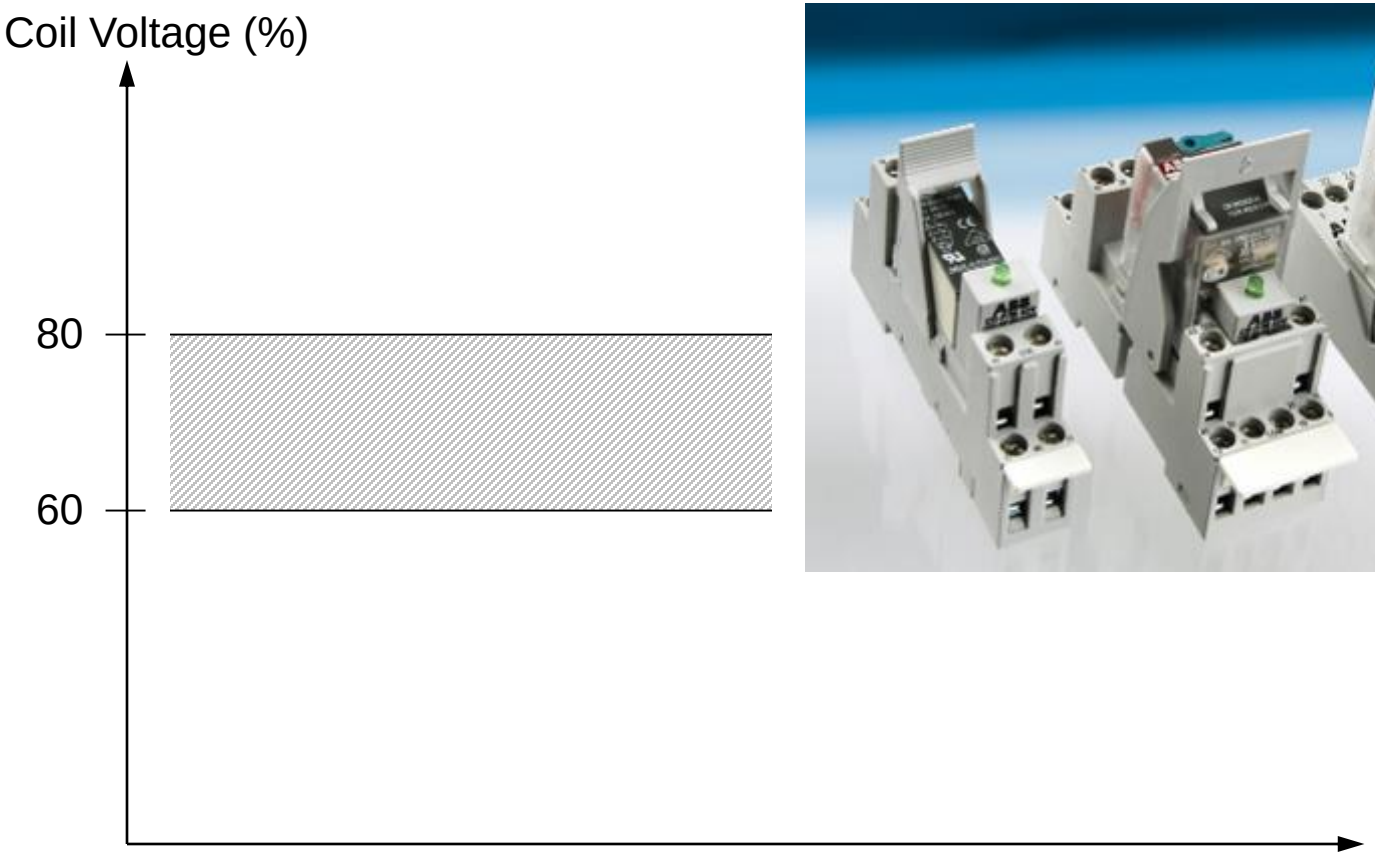


- Note:
Aux relay could be an EMO relay, timer, measurement relay or any component in the circuit.

Relay Characteristic

(AC Relay standard coil drop out voltage threshold)

(AC normal coil)

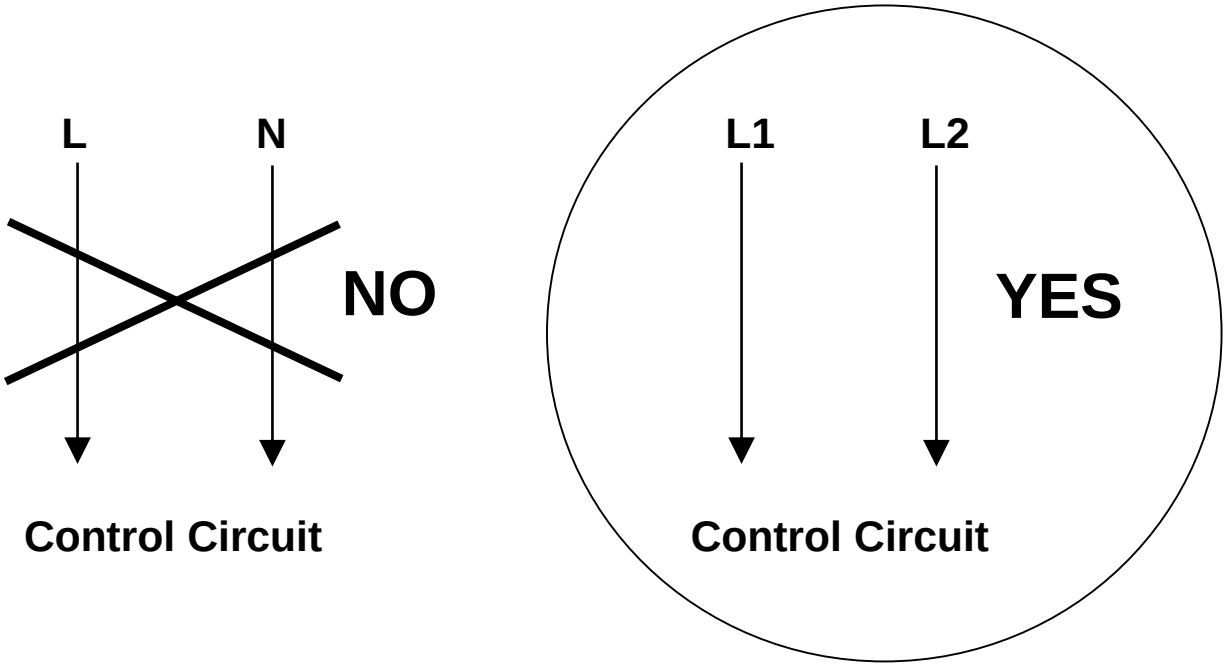


Control Circuit
Solution 1

- Ensure all control component comply to semi-F 47 standard.
- Contactor
- Relay
- Other auxiliary relay

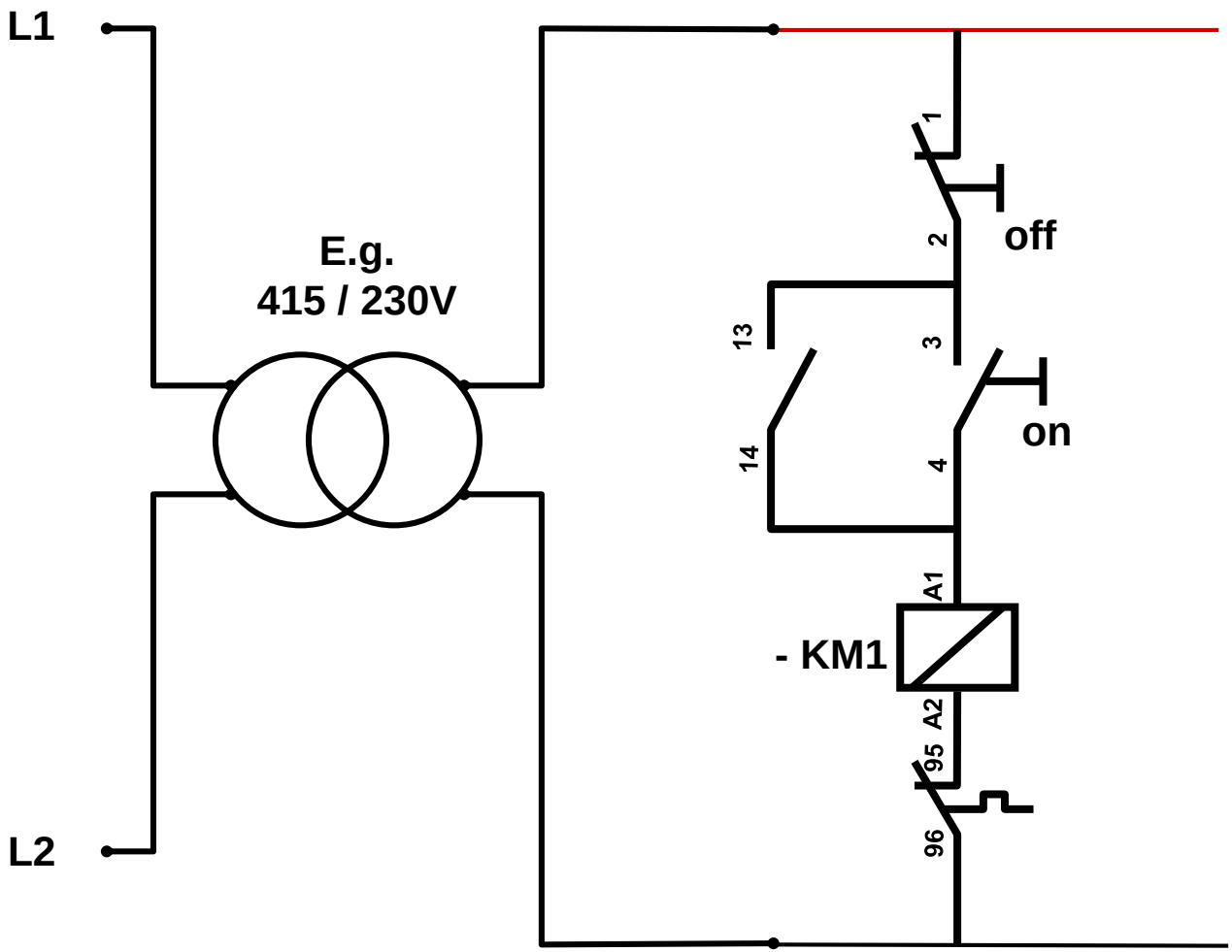
Control Circuit
Solution 2

- Taking control circuit source from two phases instead of one phase and neutral.

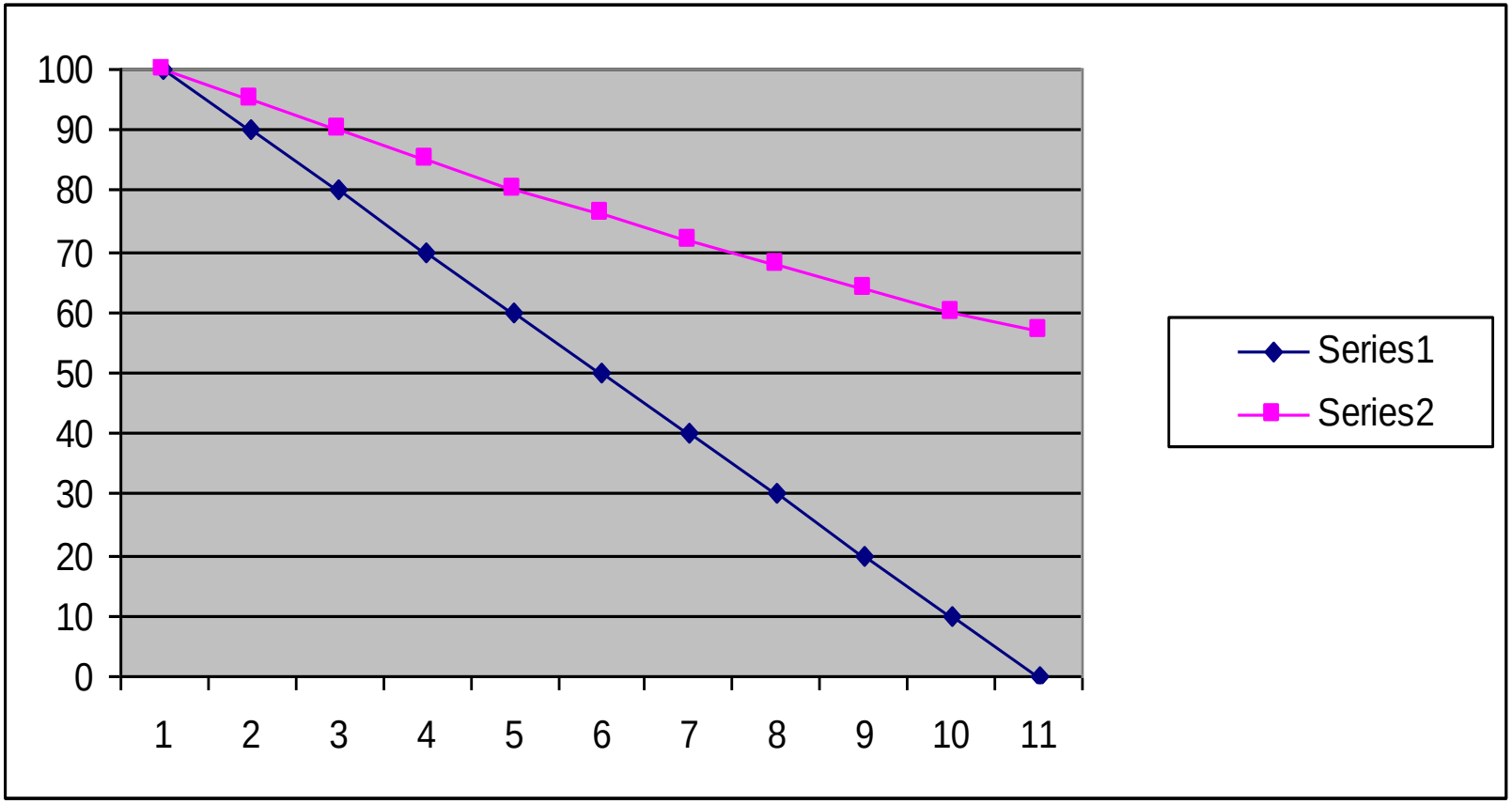


Two Phase Source

Improved Dip Immunity using control Transformer taking in source from 2 lines but not from Line and Neutral



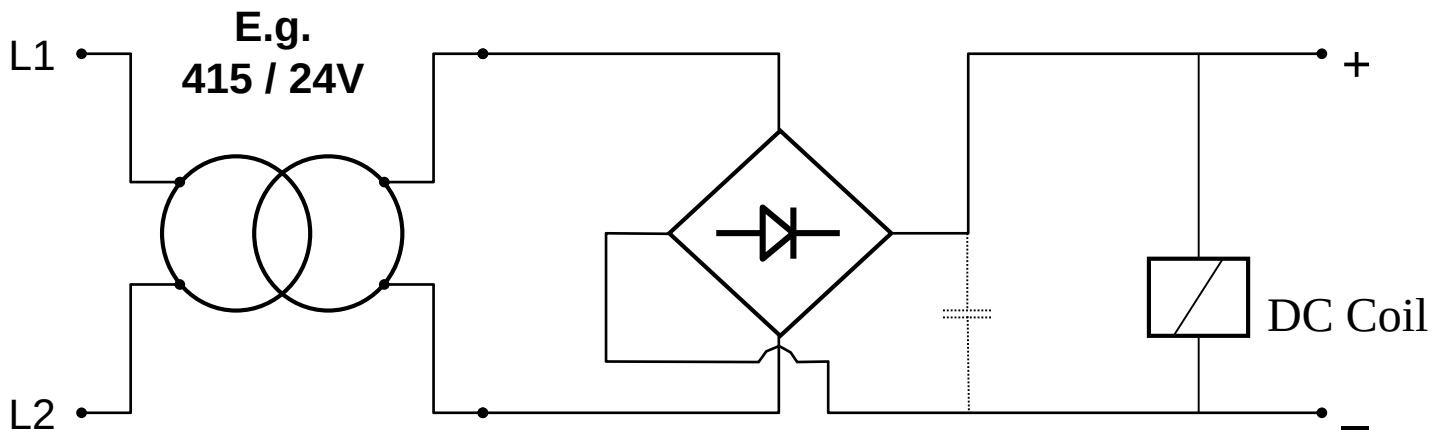
Two Phase Source



Series 1: Voltage dip at one phase of the control transformer.
Series 2: Output voltage of the control transformer during the dip.

Control Circuit
Solution 3

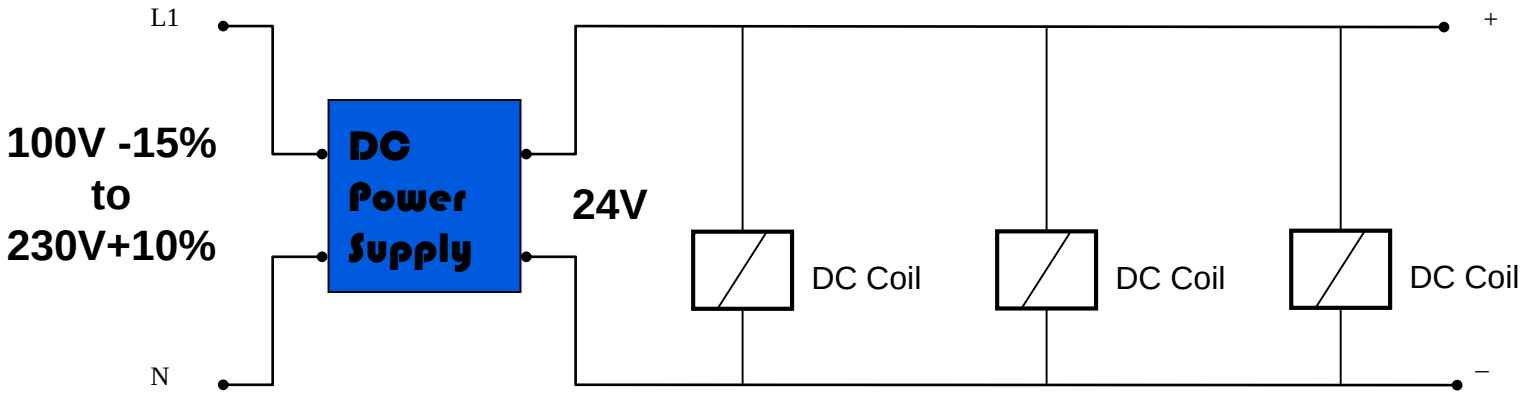
- Using DC power supply control system



Control Circuit Solution 3



- Using DC power supply control system



DC EMO Characteristic

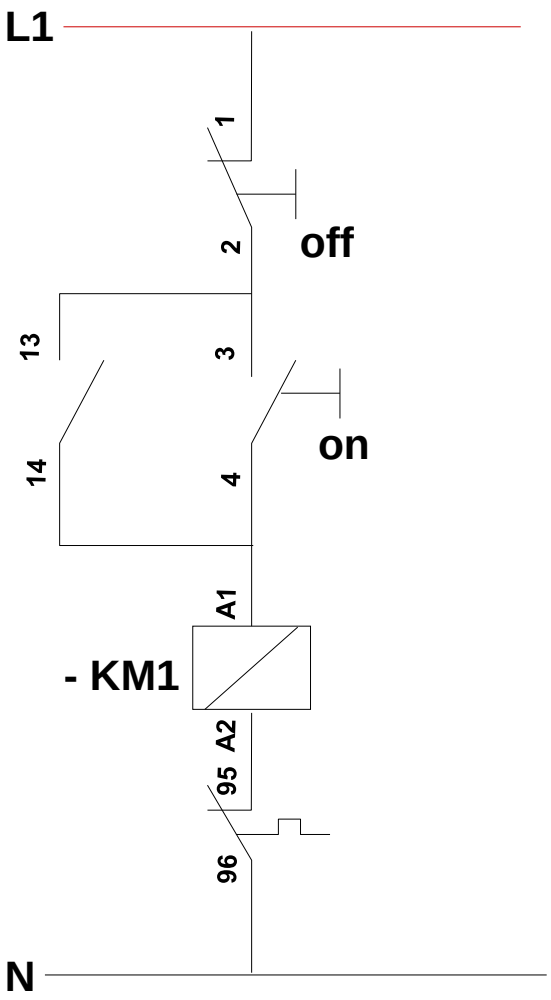
(DC Relay standard coil drop out voltage threshold)

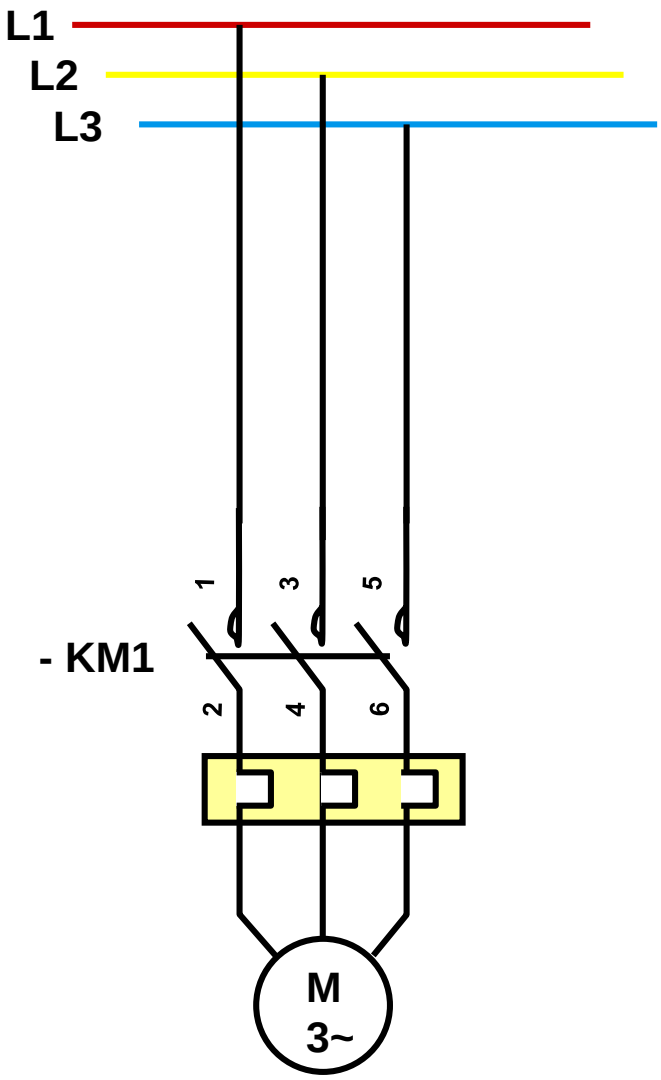




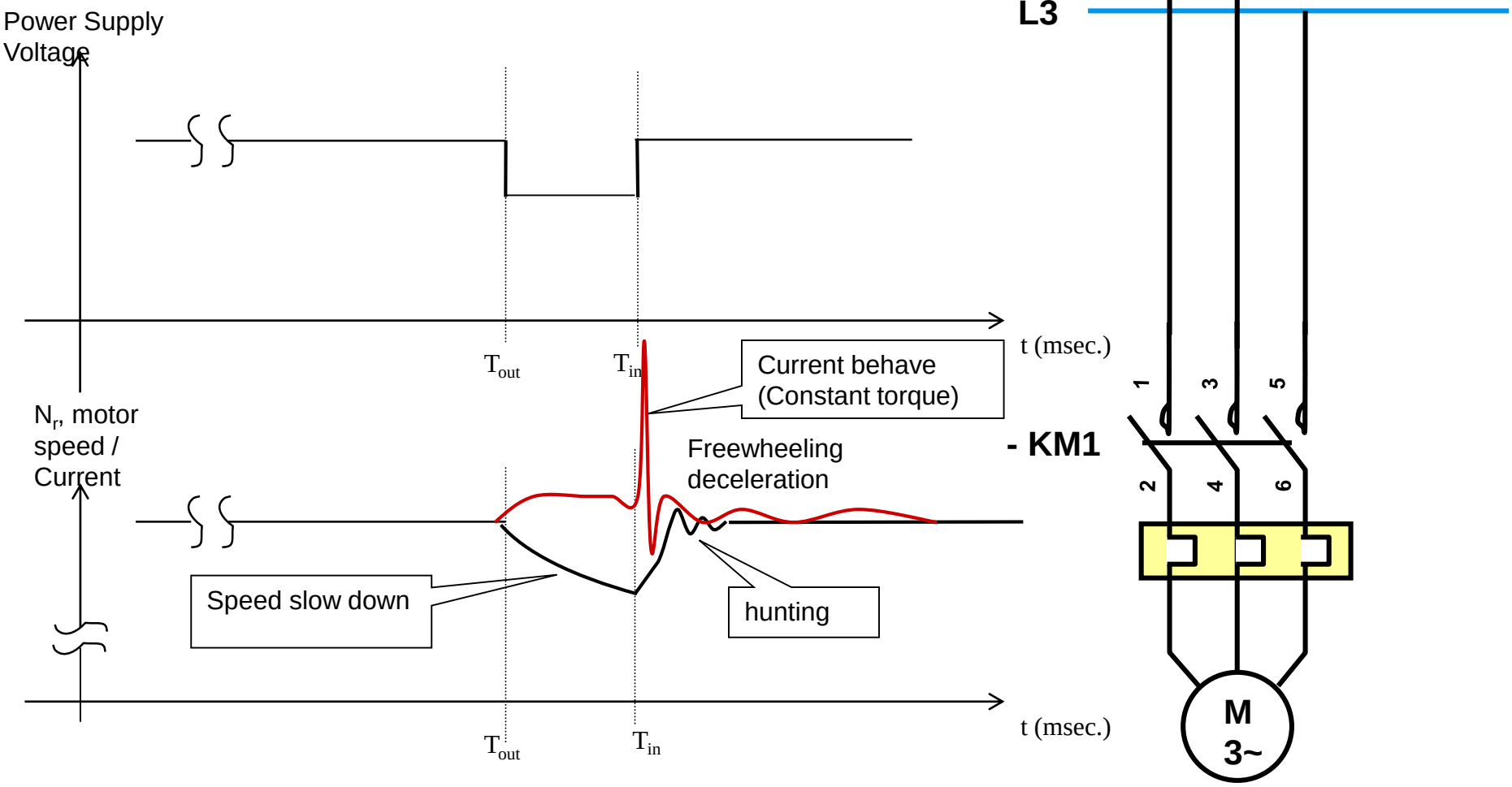
2. Power Circuit

Motor behaviors
Current variation on Dip



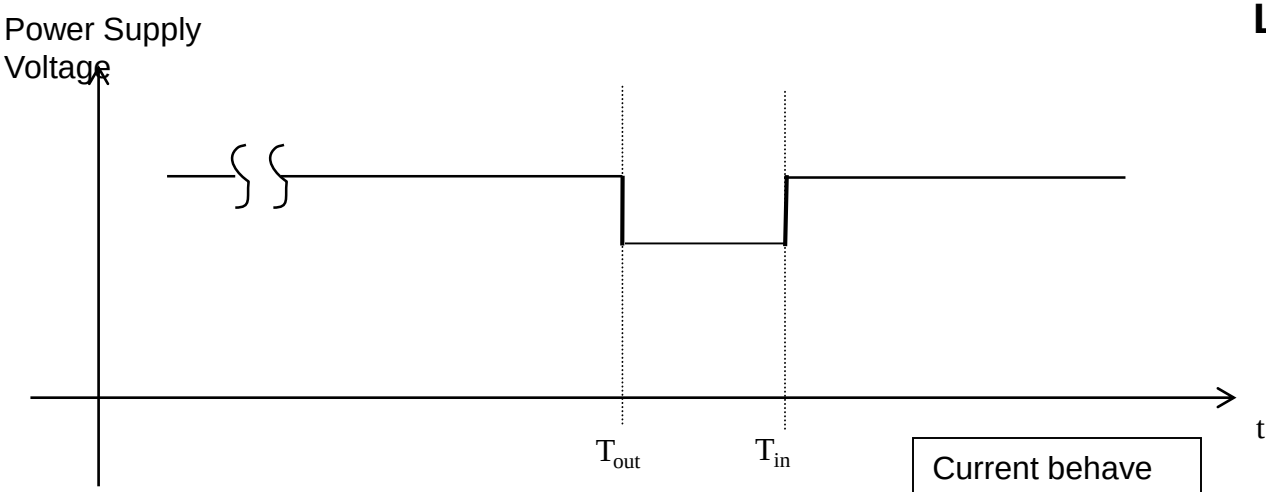


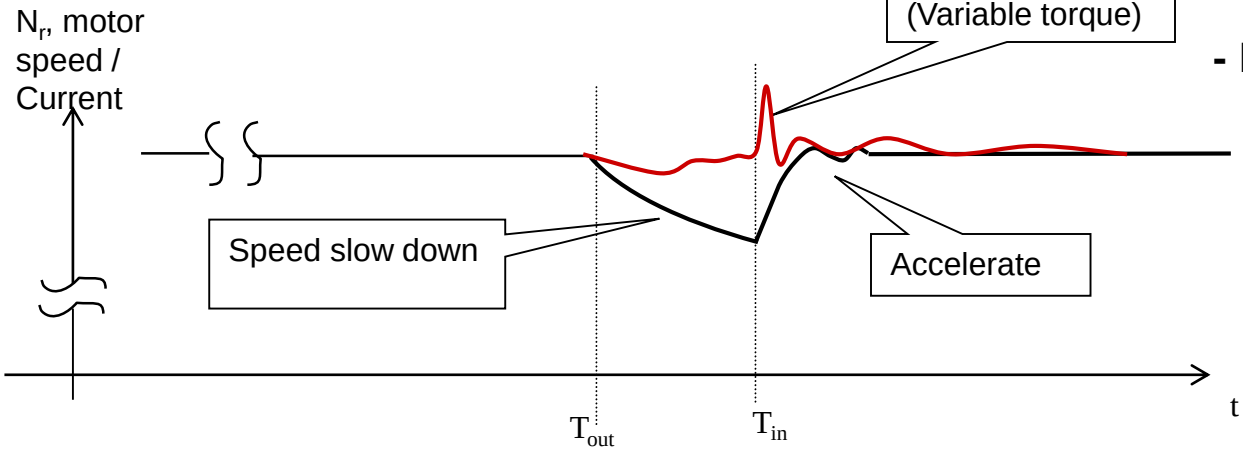
Motor behaviors
Current variation on Dip

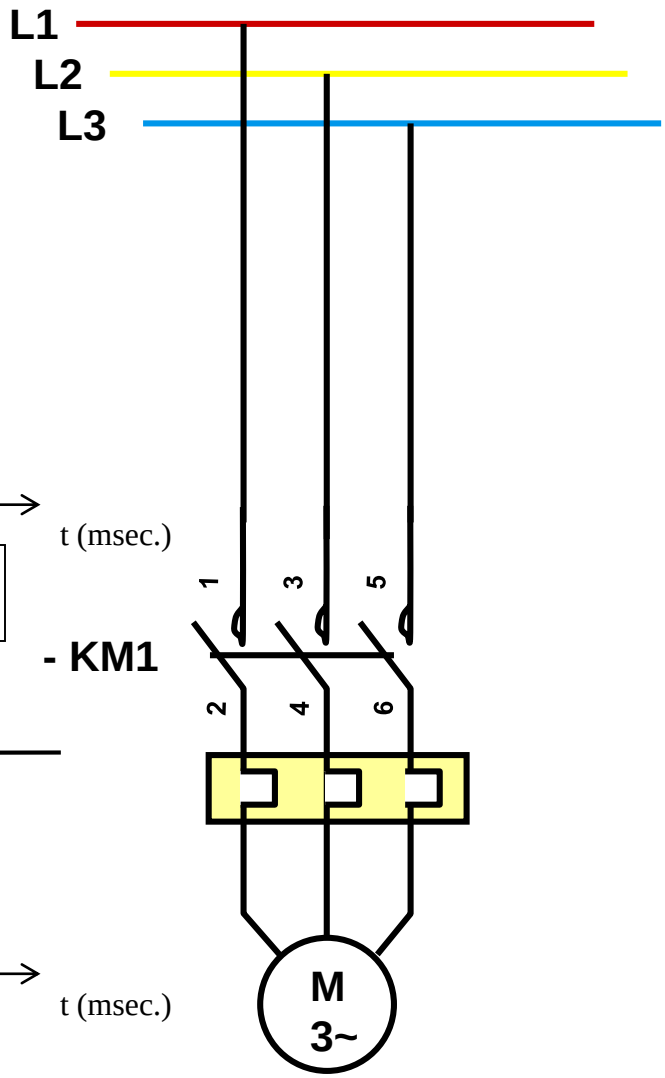


Motor behaviors

Current variation on Dip





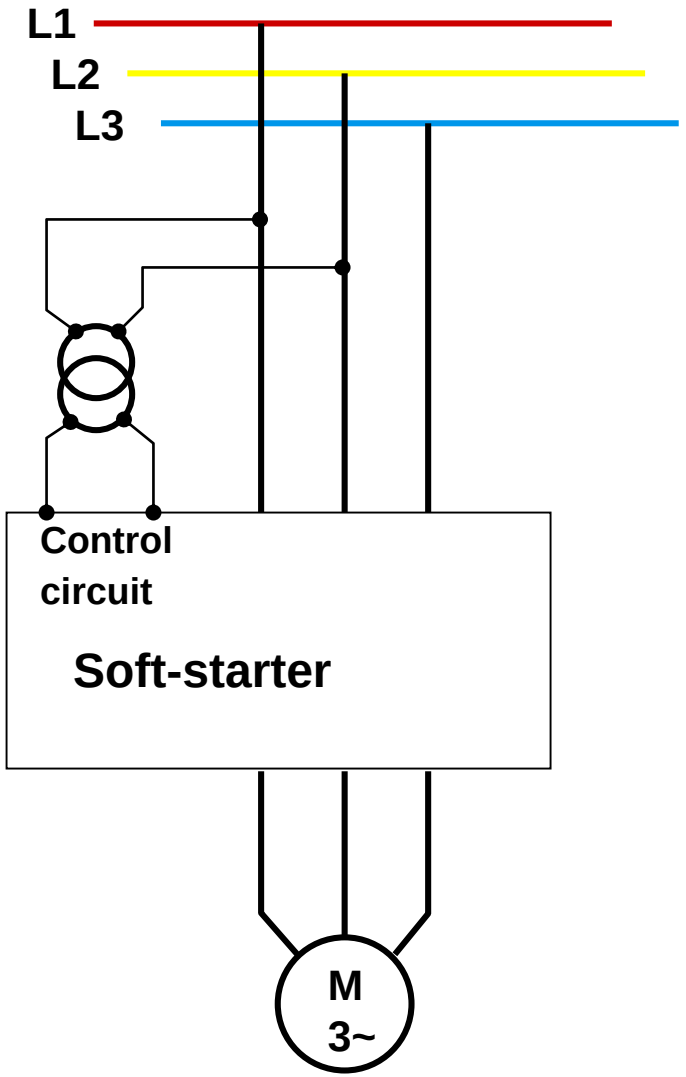


Soft-starter behaviors

VDRT using Soft-starter

Control Voltage range:
100 Volt -15%
230 Volt +10%





VDRT using VFD

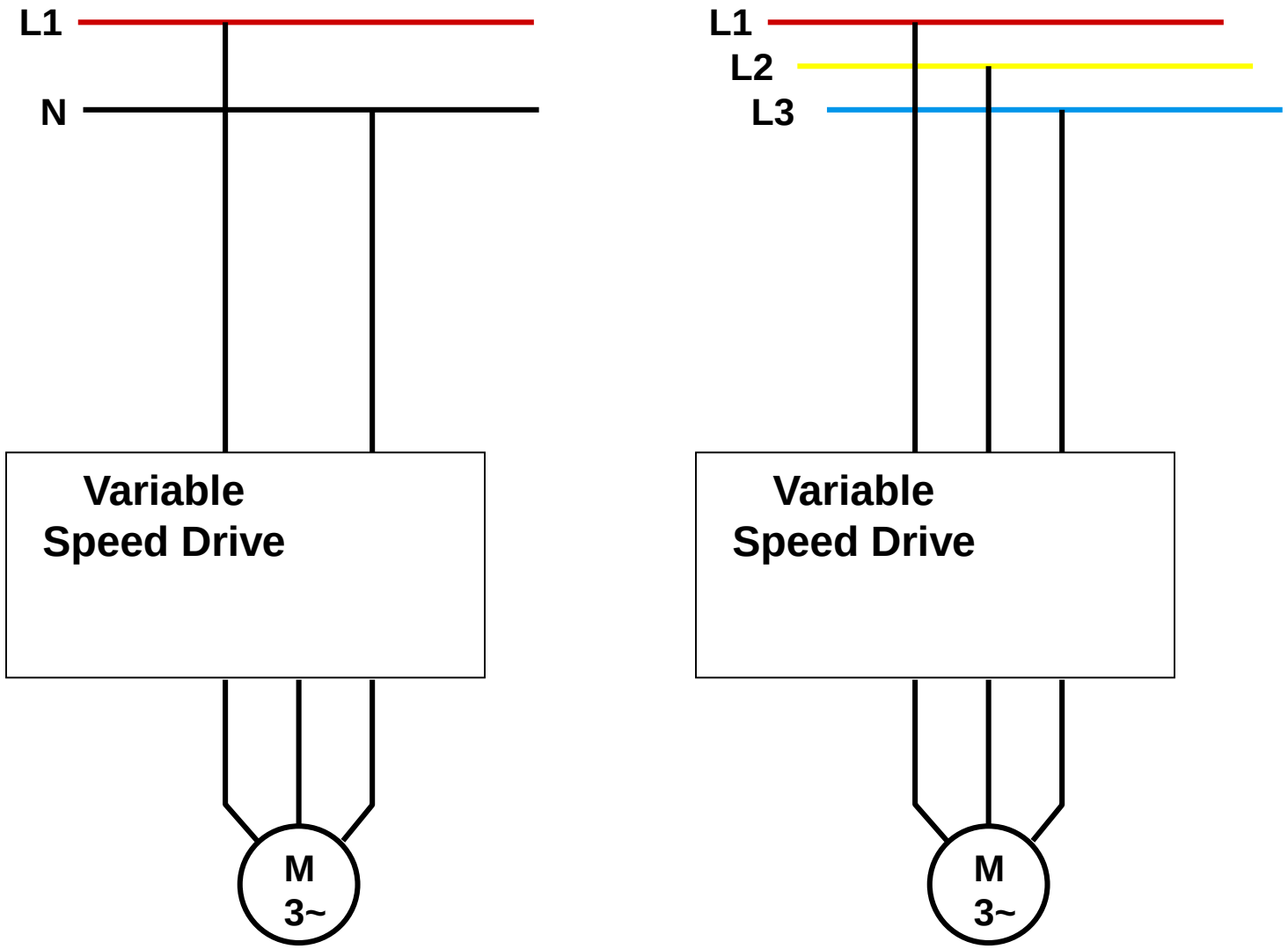
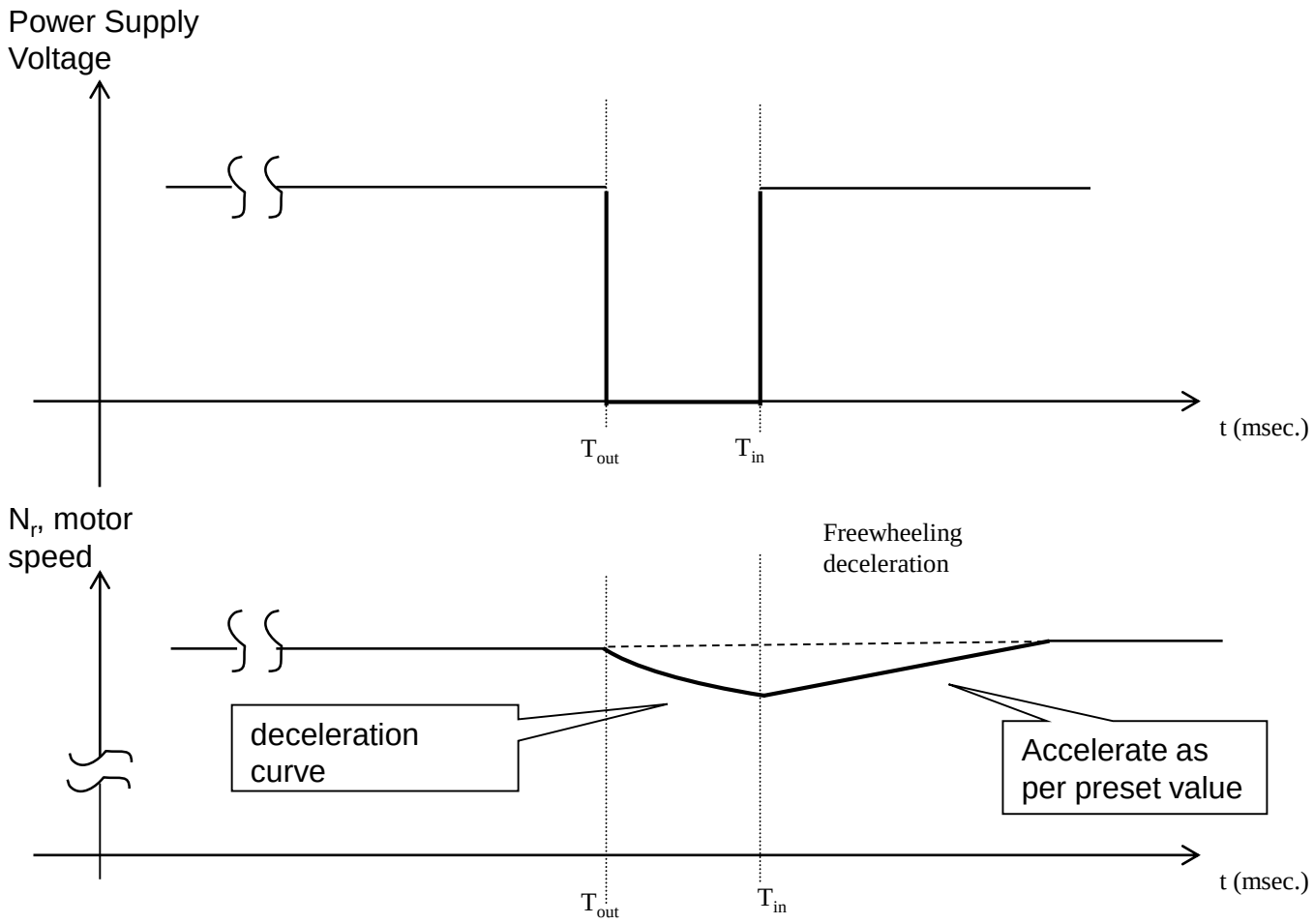


ABB Drive Tested and Pass with PG Lab

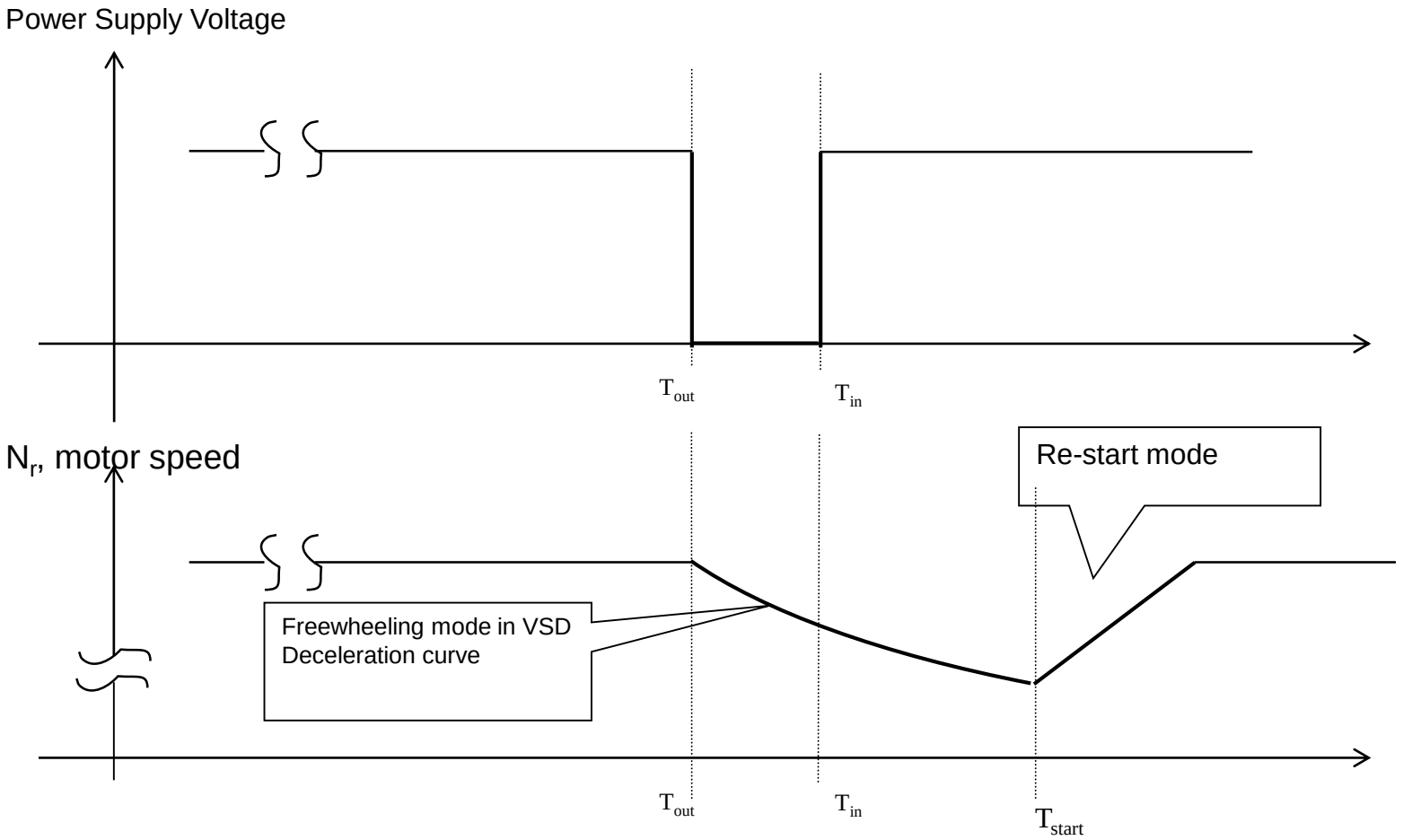


VDRT using VFD



"Control Board" powered by capacitor

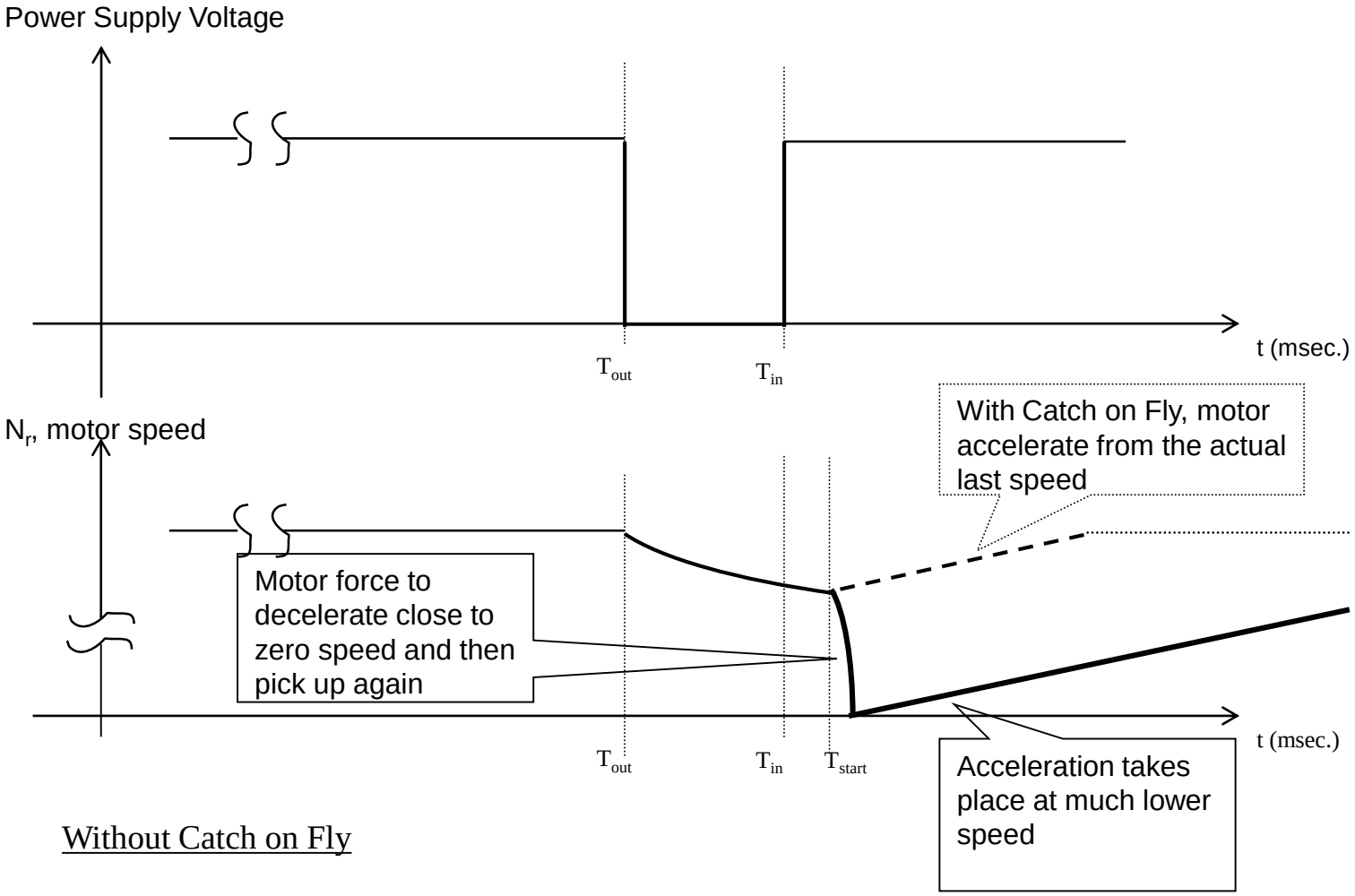
VDRT using VFD



Free Wheeling and Catch on Fly with re-starting Mode

VDRT using VFD

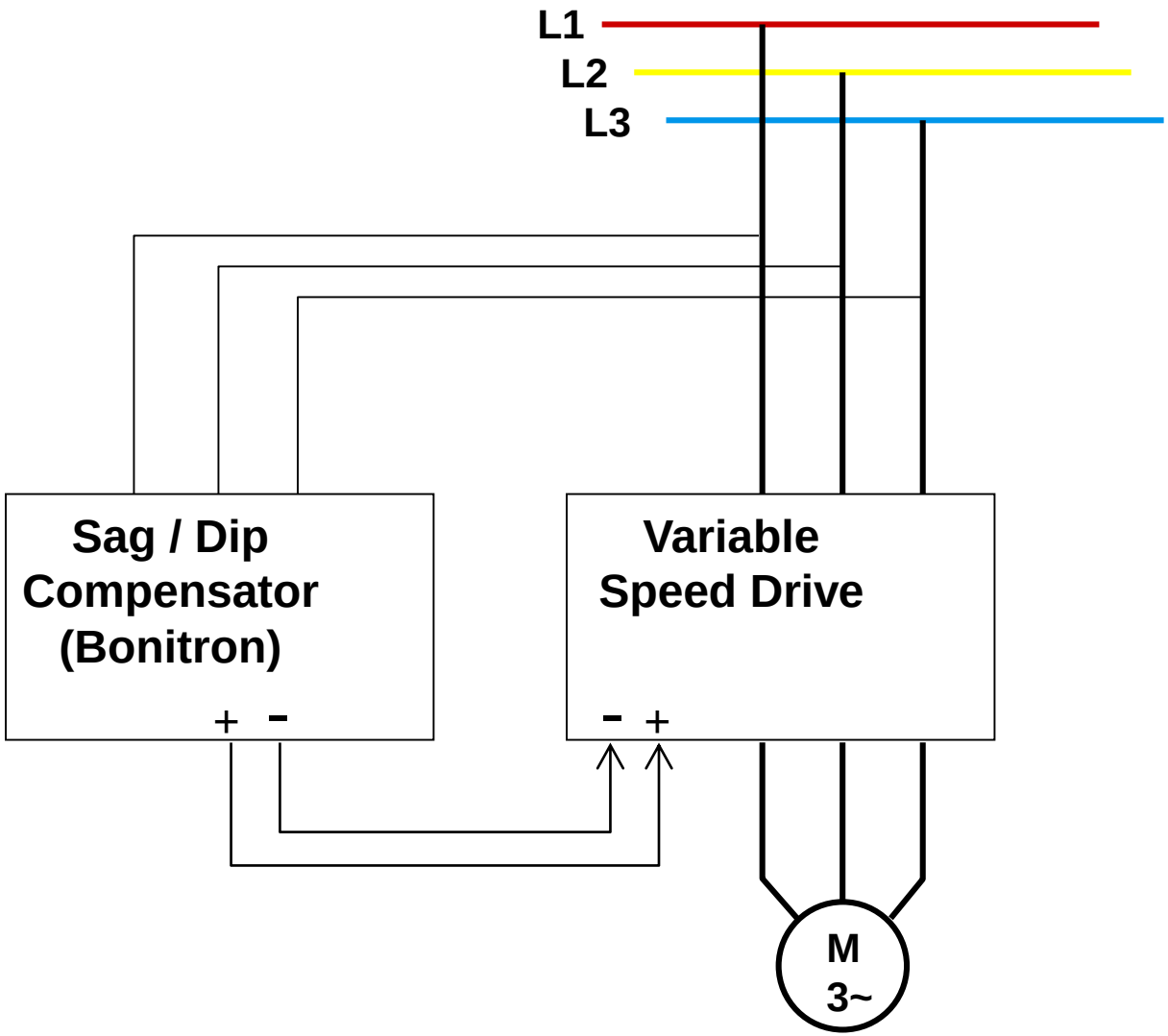
This is what we must avoid !!



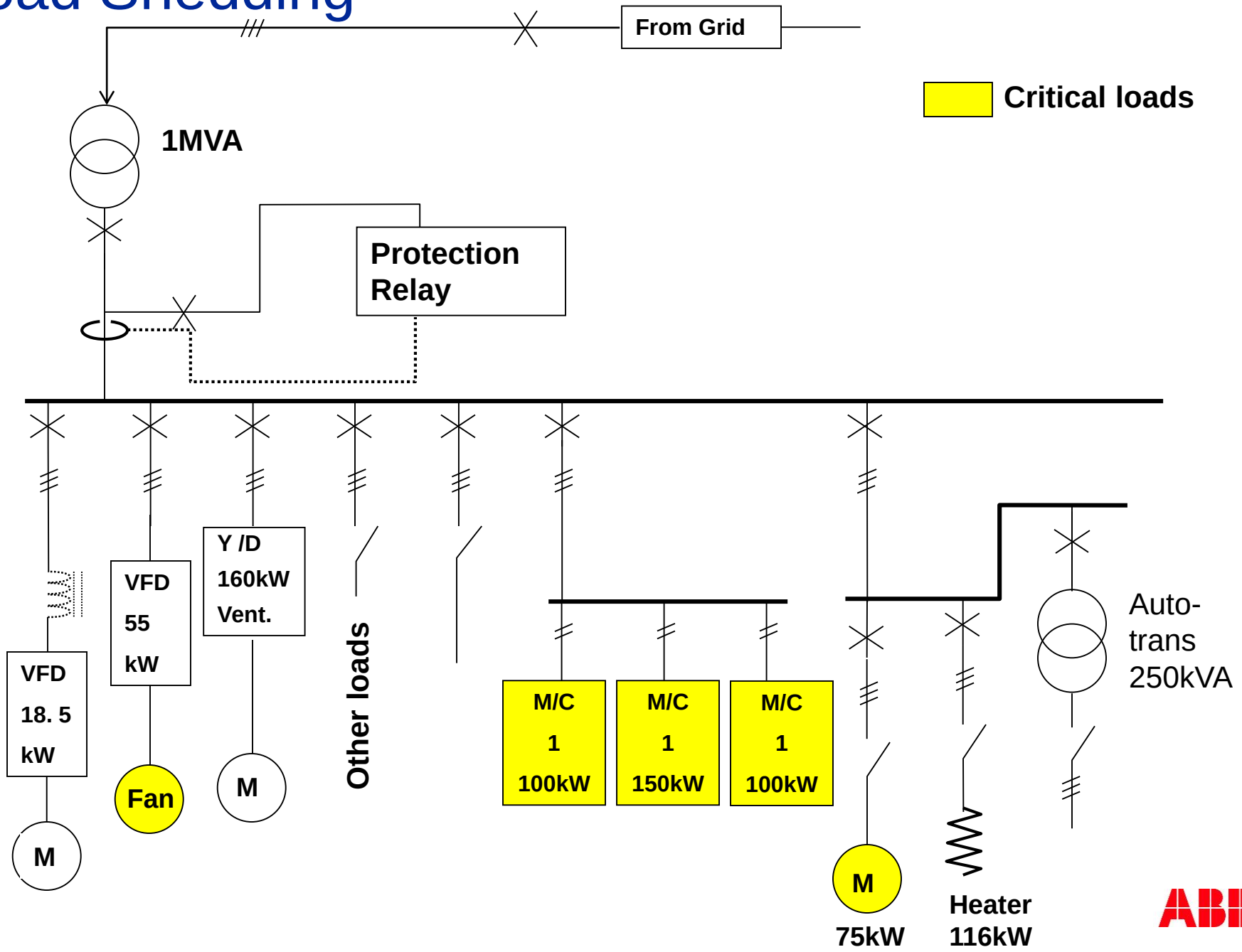
Without Catch on Fly

VDRT using VFD

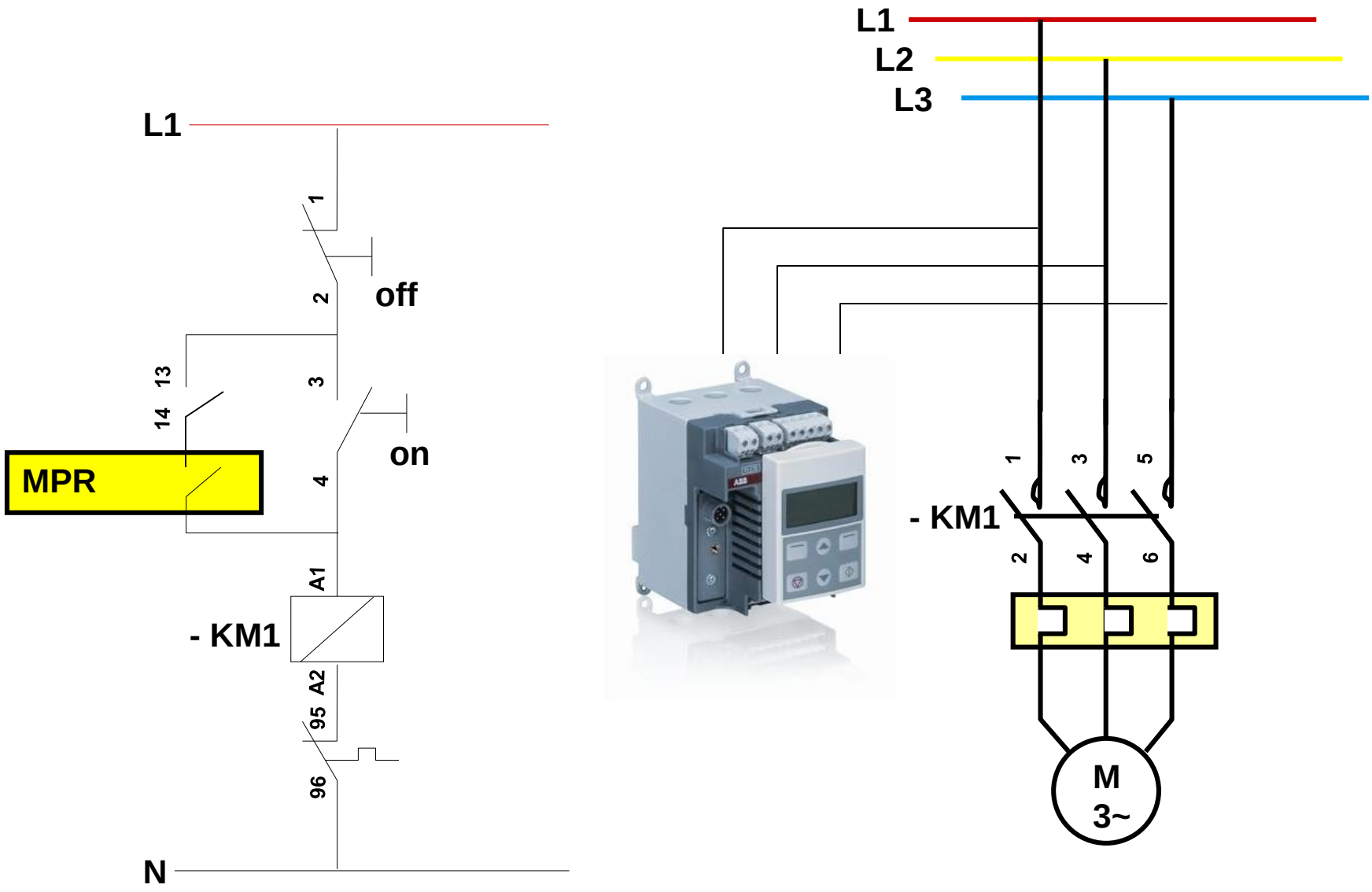
VSD plus Dip Compensator (e.g. Bonitron)



Load Shedding



Load Shedding using UMC 100



How to Ride Through Volt Dip
Summary

Volt dip could create huge destruction to any installation.

Remedy at the source is the most effective way but the reinforcement at the load side can be very much cost effective especially for small installation.

ABB have developed wide series of products and solution to tackle volt dip issue especially in the range of products:

- AF Contactor
- VFD
- Soft-starter
- Control relays etc.

We are ready to share our valued customers our experiences if any technical advise needed.

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