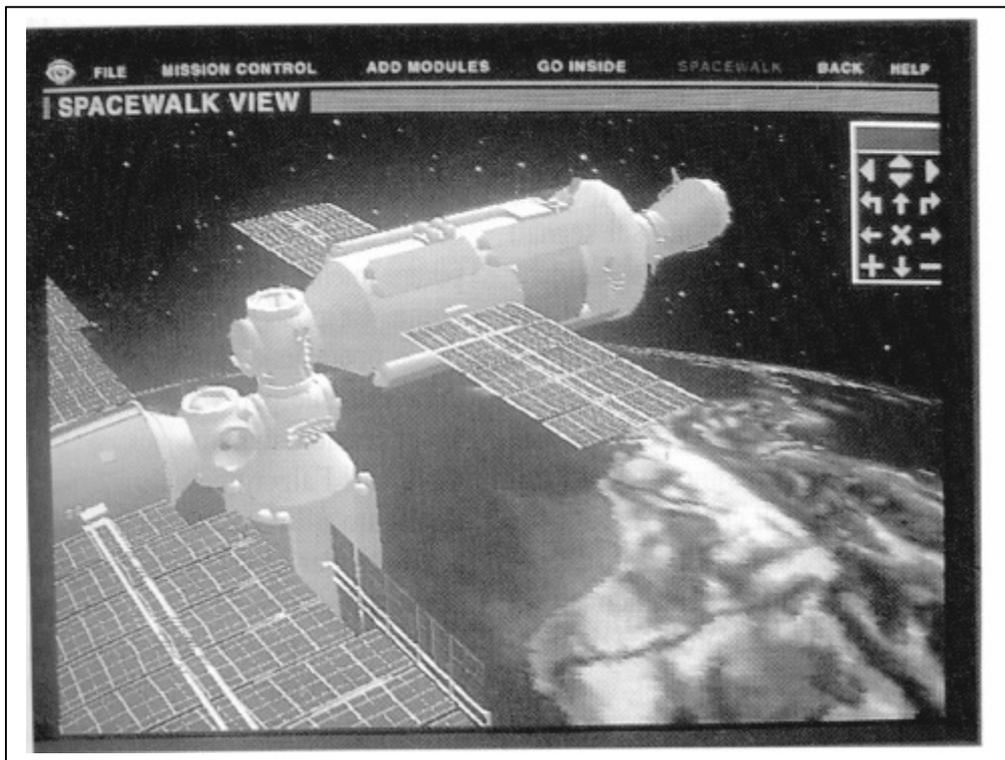


Electromagnetic Compatibility EMC



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1 Introduction

The industrial automation environments are every day more and more governed by microprocessor based units.

The capability of equipment to operate satisfactory in an electromagnetic environment without itself causes electromagnetic disturbances that would be unacceptable for other electrical equipment in this environment. This means that electrical devices should not interfere with each other. This is what is normally demanded for electronic products.

2 Noise emission and noise immunity

An electronic device can be considered a source of noise (transmitter) and a receptor of noise (receiver). EMC is respected if source of noise do not negative influence the function of the receptor of noise. Electrical device like thyristor unit can be source of noise and a receptor of noise at the same time. For example the power devices (thyristors) of one unit can be considered as a source of noise, and the electronic control board as a receptor of noise.

The European Standard EN 55011 covers noise emitted. The conducted noise at the supply connection point is measured under standardised conditions as mains terminal disturbance voltage. Electromagnetically emitted noise is measured as radiation disturbance. The standard defines limits "A1" and "B1".

When equipment is connected to a public utility supply line, the maximum harmonics specified by the local power utility must be observed.

The noise immunity of electrical equipment describes how it behaves when subject to electromagnetic disturbance. Standards EN 50082-2 and EN 50082-1 cover requirements and evaluation criteria for the behavior of electrical equipment.

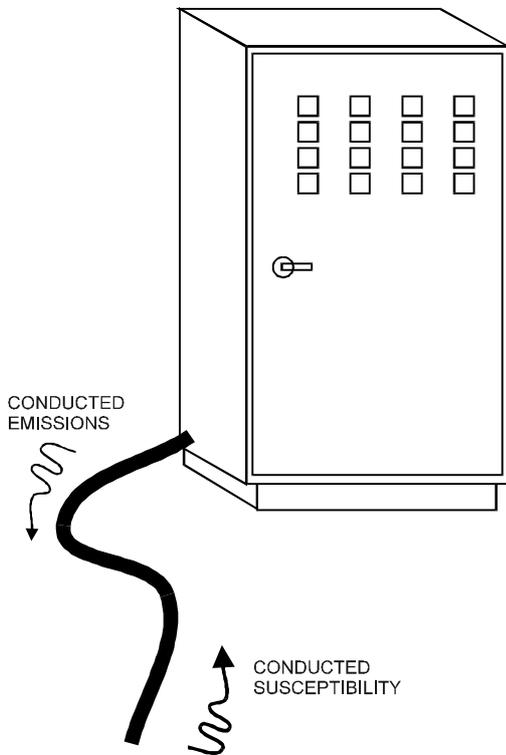
A Product Standard (prEN 61800-3: 1995) has been drawn up which defines all requirements regarding emitted noise and noise immunity.

3 Application in industrial environments

Limits for emitted noise and noise immunity is defined depending on the application for which the equipment is used. A differentiation is made between industrial- and domestic environments. In industrial environments, the noise immunity of electrical equipment must be extremely high, however lower demands are placed on the emitted noise.

If the thyristor unit is part of an installation, initially, it does not have to fulfill any requirements regarding emitted noise. However, the EMC Law specifies that the system as a whole must be electromagnetically compatible with its environment. The use will ensure electroimagnetic compatibility within the installation for his own benefits. Without a radio interference suppression filter, thyristor unit with wave form partialization emit noise which exceeds limit "A1", specified in EN 55011. However, its high noise immunity makes it insensitive to noise emitted from equipment in its vicinity. If all of the control components in the installation (e.g. automation units, PLCs) have a noise immunity for industrial environments, not every unit has to maintain limit "A1" for itself.

4 NOISE REPRESENTATION



4.1 Conducted emissions/susceptibility

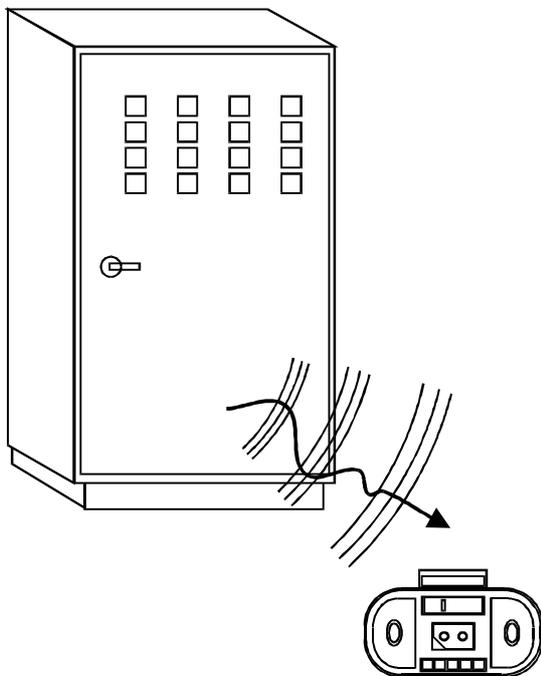
4.1.1 *Low frequency*

In general are noises on the voltage main supply like:

- voltage fluctuation
- holes in voltage supply waveform
- short voltage interruptions
- unbalance
- continuous components

4.1.2 *High frequency*

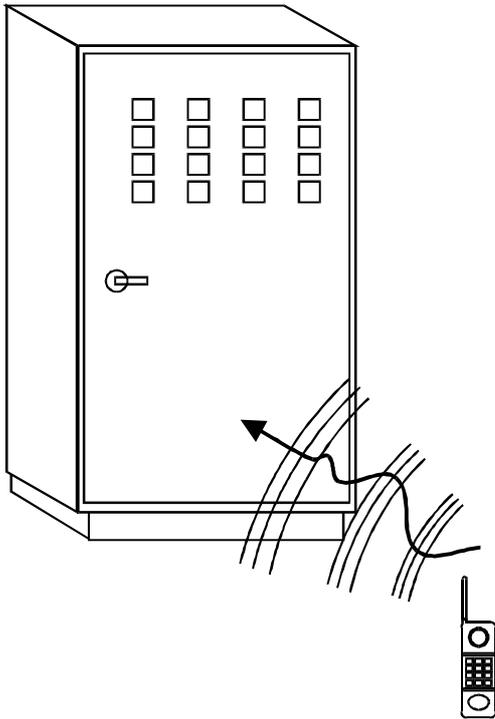
- fast transient
- waves 100/1300 μ s
- waves 1.2/50 μ s - /20 μ sec
- Oscillating waveform (0.5 μ sec/100KHz)



4.2 Radiated emissions

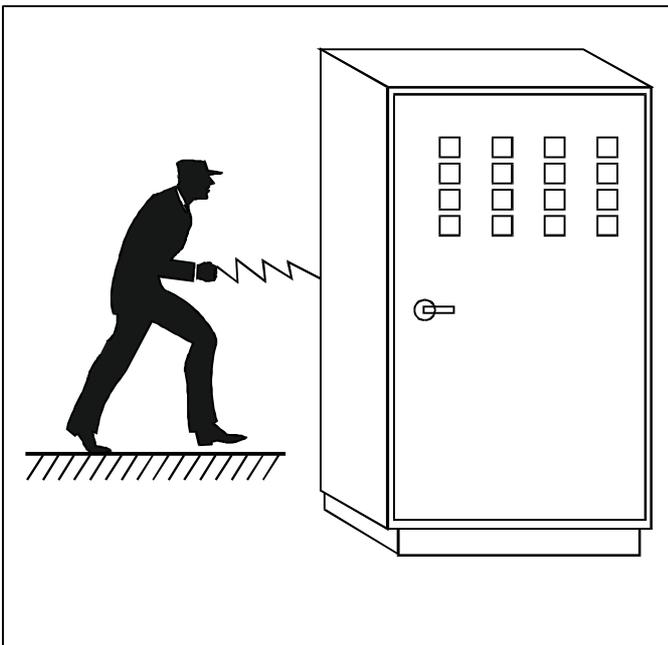
- Electromagnetic fields
- Single or repetitive transients

The noises above can be in low or high frequency.



4.3 Susceptibility to radiation

The electronic device must not be influenced by radiations emitted by portable phones, walky talky, etc.



4.4 Electrostatic discharge

The operators on the cabinet or directly on electronic devices can be charged at 2KV. This is due to insolated shoses and to synthetic wears. This voltage sometime can reach 6KV. When operator touches an electronic device can seriously damage it.

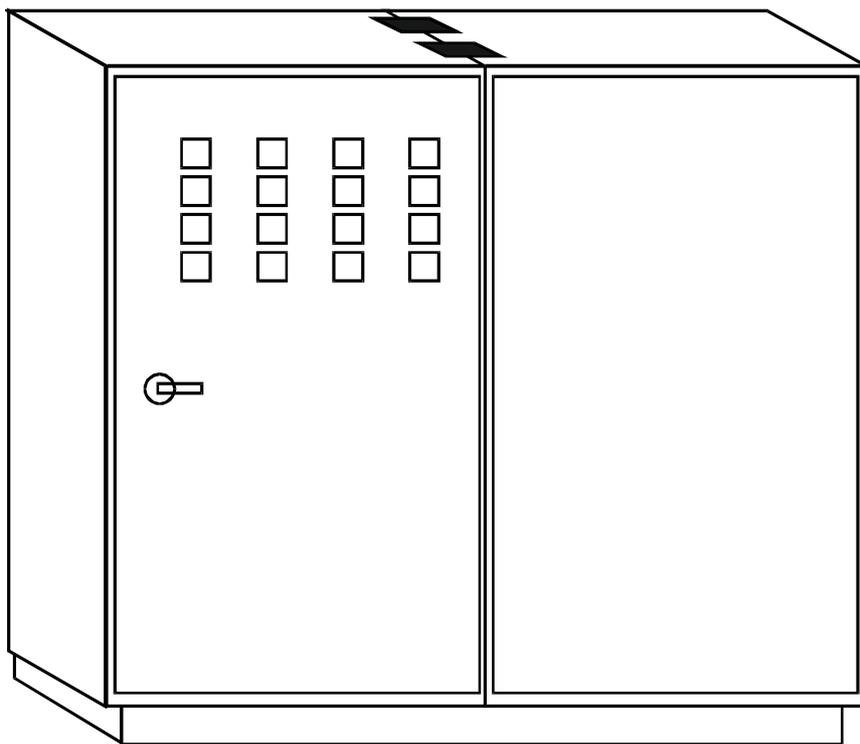
5 Mounting and wiring

To comply EMC is not enough to have in a cabinet all components EMC marked but must be the complete system in line with EMC rules. To obtain it is necessary to respect at list these rules.

5.1 Rule 1

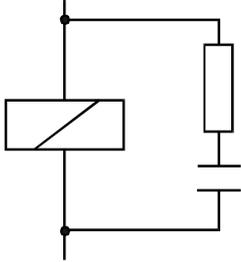
All the metallic parts of a cabinet must be connected together to maintain the complete cabinet at same ground potential.

All the doors must have rubber-conducting gasket and the door has to be grounded in upper medium and lower part.

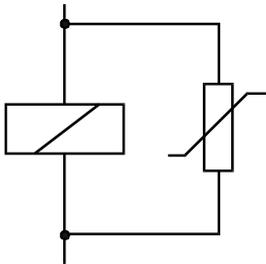


5.2 Rule 2

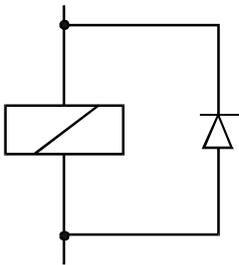
All contactors, relays etc. in the cabinet should provide RC filter, varistor and diode as represented on left side.



RC filters reduces consistently noise and are wired in parallel to the coil. The noises occurs when contactor's coil is switched ON-OFF



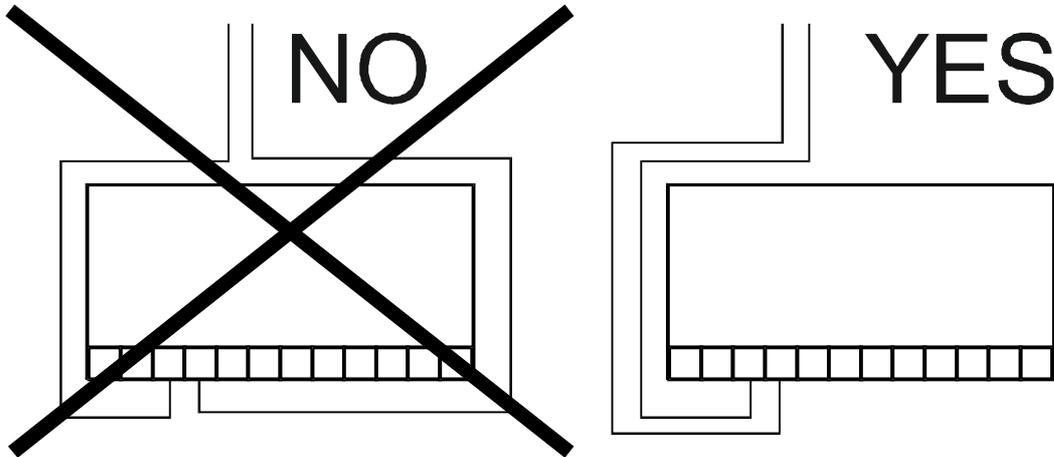
VDR (variable dependent resistor) are used for relay coils.



Diode is normally used on electromagnetic valve, solenoids etc. to reduce noises. A solenoid valve with nominal voltage of 24V when switched can generate 600V pick voltage. When the nominal voltage is 220V the pick voltage can be 2KV.

5.3 Rule 3

Attention should be given to the wiring. For analog and digital circuit the cables must be always routed in pairs.



In wiring done as on left drawing an antenna is formed to receive all noises. Another suggestion for analog and digital signal is to use screened cable or to twist the signal cables.

5.4 Rule 4

Cable lengths should be kept short to minimize coupling capacitances and inductances.

5.5 Rule 5

When are used multiple cables and on or more wires are not used ground spare conductors on both ends. This offers additional shielding.

5.6 Rule 6

Non-shielded cable pairs of the same supply and return circuit should be twisted, or the distance between the two conductors kept as low as possible in order to prevent antenna behaviour.

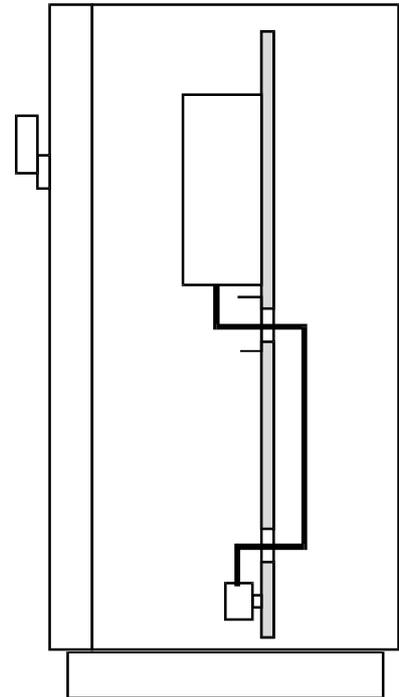
5.7 Rule 7

Noise coupling is reduced if cables are routed close to the grounded enclosure sheet metal. Wiring should therefore not be freely routed inside the enclosure, but as closely as possible to the enclosure frame and the mounting panels. This is also true for spare cables.

5.8 Rule 8

Power cables and signal cable must not route together and in particular they should not be parallel between them. When is not possible to avoid it the power cable should be routed in a metallic cable tray with a minimum distance of 20cm from signal cables. In the cabinet to reach a separation route the power cables behind the panel

Outside the panel is also an economic method to route the signal cable in a metallic pipe grounded on all the length.

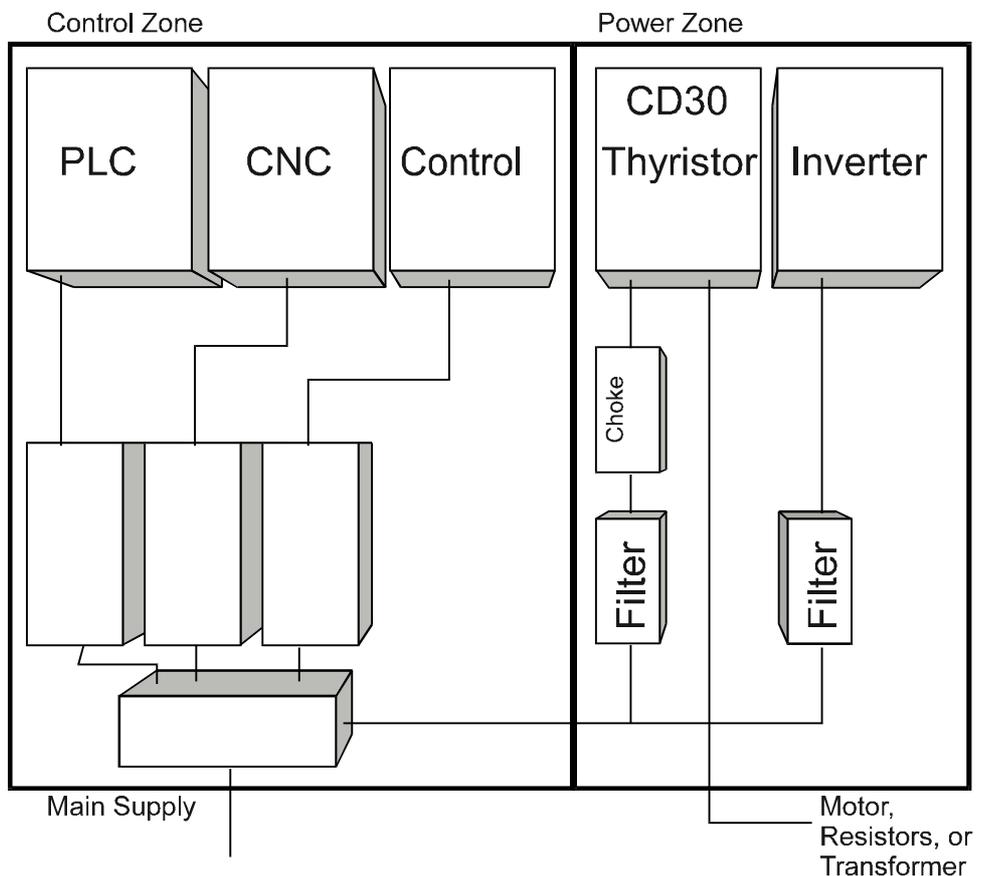


5.9 Rule 9

The internal panel of the cabinet should be divided in zones with relation to the capacity to generate noise. The normal division is between “zone of power” and “zone of electronic control”.

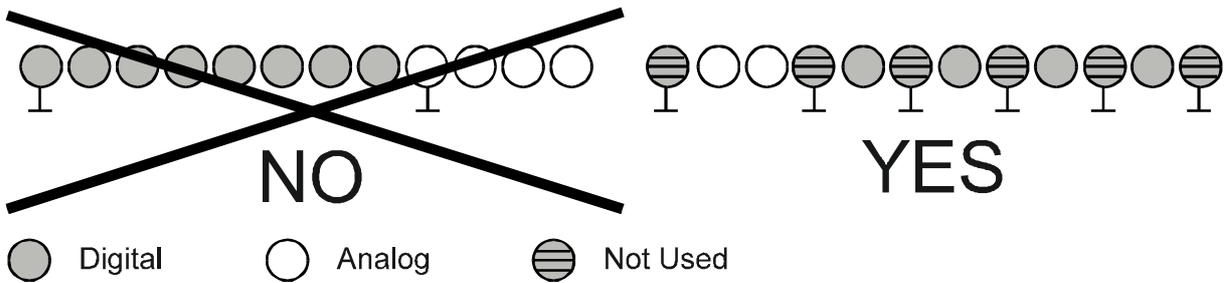
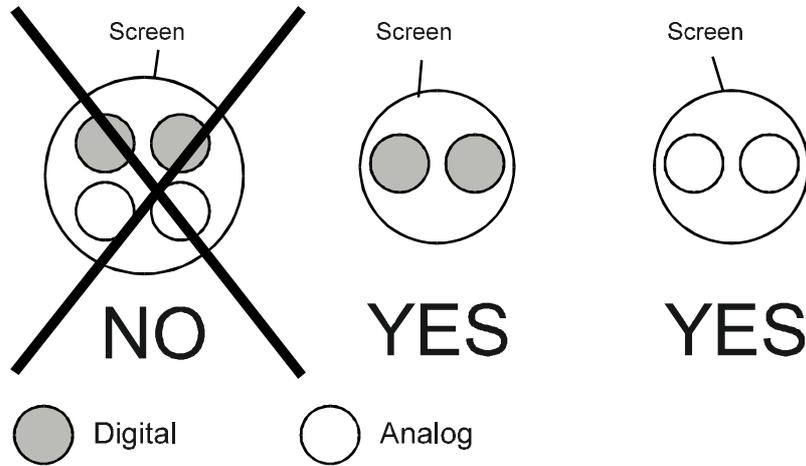
Between the two zones we suggest to have a still plate separation.

This is an example of installation structure with electronic controls, inverter and units with waveform parzialization

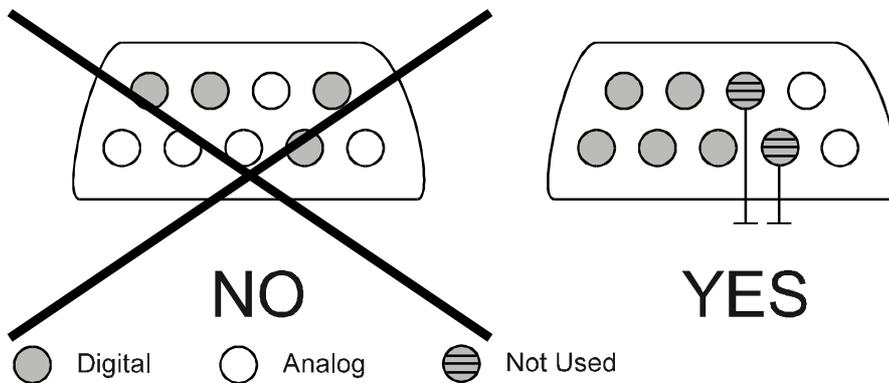


5.10 Rule 10: analog/digital signals

Only pairs of analog signals or only pairs of digital signals should be put side by side in the same cable tray or in the same multiway cable with unscreened pairs.



With flat ribbon cables a ground lead can be alternated with a signal lead. If in the same connector are used digital and analog the end connections must be separated by pins connected to 0V.



5.11 Rule 11

Electrical filter unit should be mounted as close as possible to the noise generator unit. This filter should be flat mounted on the panel. In this mode the still plate of the panel became a screen.

5.12 Rule 12

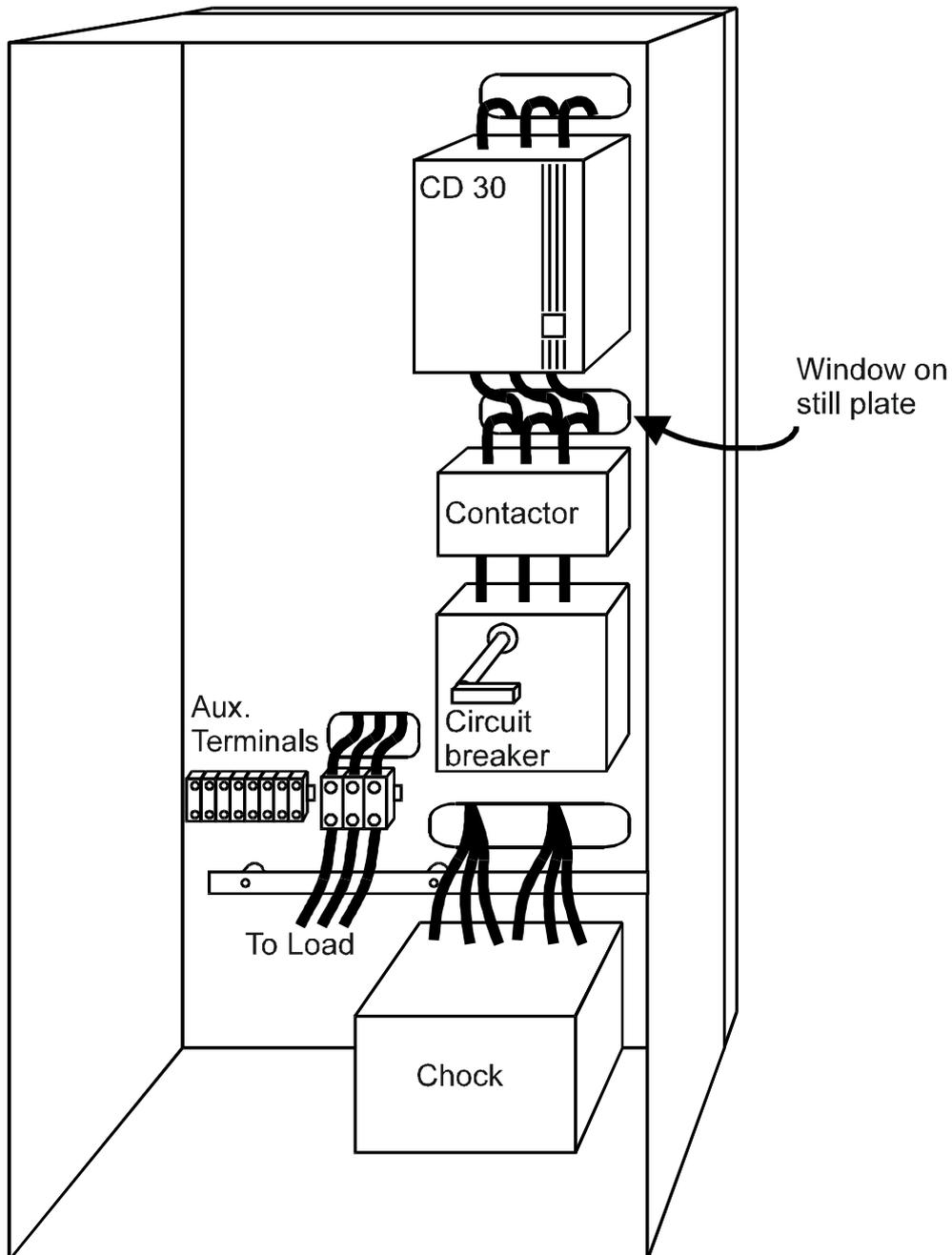
Electrical filter unit should be provided with following C.D. Automation thyristor units:

CD3000 15 to 800A	No filter
CD3000-2PH 15 to 800A	choches + parallel filter *
CD3000-3PH 15 to 800A	no filter
CD30	choches + parallel filter
CD2200	choches + parallel filter

Note: * when cabinet is wired with cure in respect to the rules above listed one parallel filter for the cabinet plus choches for each thyristor unit is normally enough.

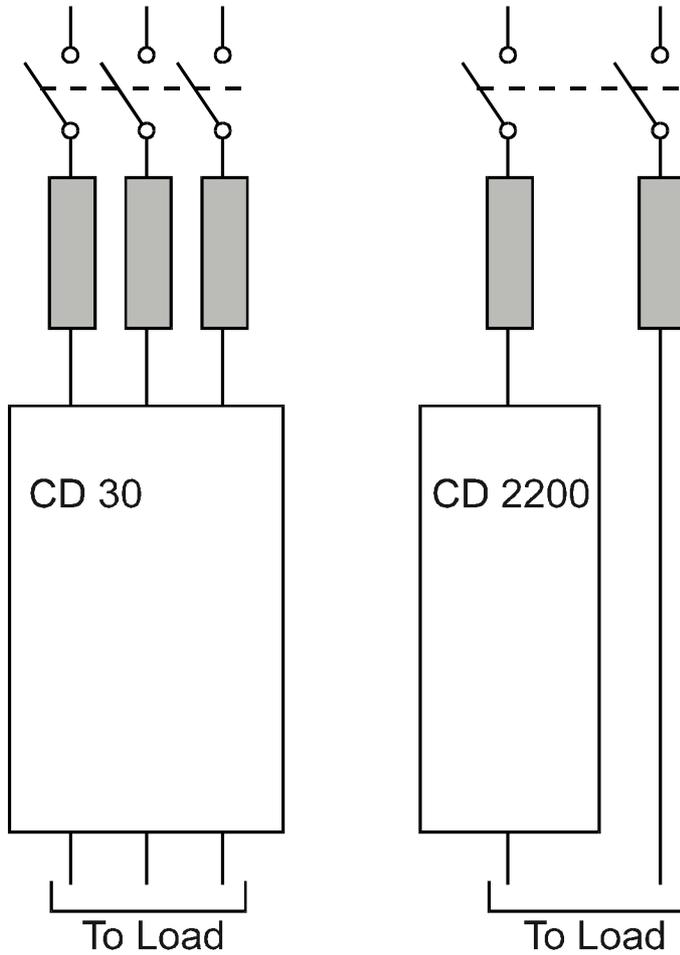
5.13 Rule 13

The construction of the cabinet should consider critical part for EMC effects. Below is given a CD30 mounting example



5.14 Rule 14

The sequence of the filter, choche contactor and C.D. Automation unit should be respected as represented below



One parallel filter only should be provided for each cabinet. This filter should be mounted as close as possible to the incoming line voltage supply.