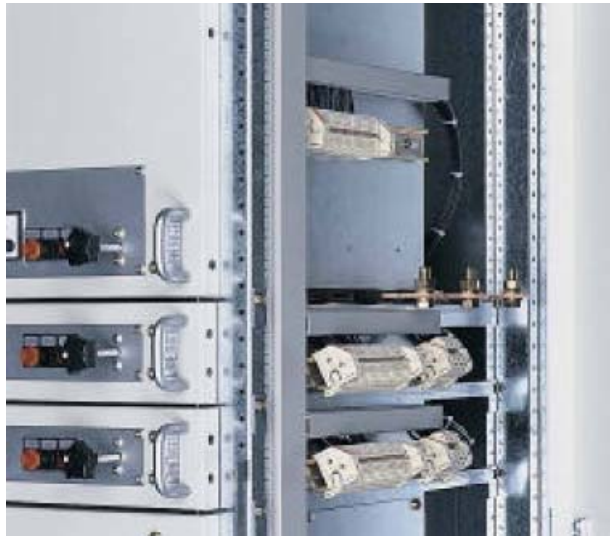


## **Session 10 – International Motor Controls Forms of Separation**



# Forms of Segregation



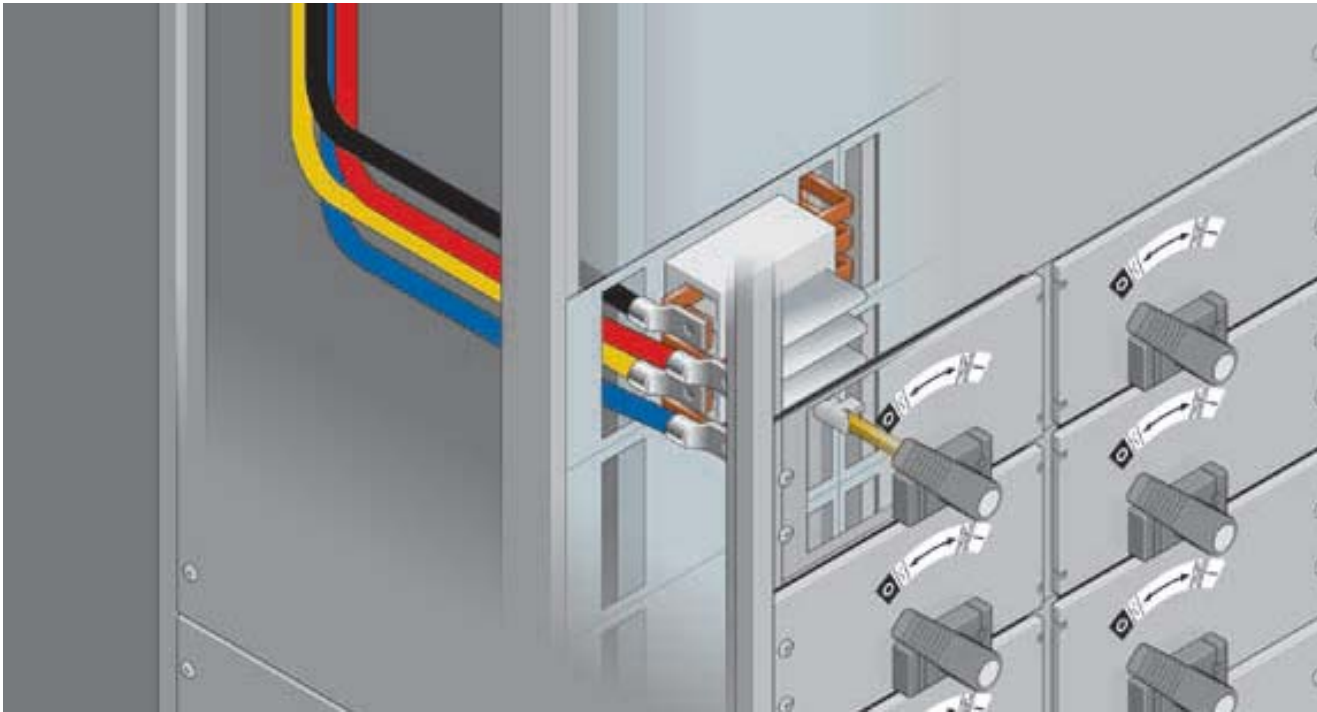
**Table NA.1** Forms of separation

Mains criteria	Sub-criteria	Form	Type of construction
No separation		Form 1	
Separation of busbars from the functional units.	Terminals for external conductors not separated from busbars	Form 2	Type 1 Busbar separation is achieved by insulated covering, e.g. sleeving, wrapping or coatings.
	Terminals for external conductors separated from busbars.		Type 2 Busbar separation is by metallic or non-metallic rigid barriers or partition.
Separation of busbars from the functional units and separation of all functional units from one another. Separation of the terminals for external conductors from the functional units, but not from each other.	Terminals for external conductors not separated from busbars	Form 3a	Type 1 Busbar separation is achieved by insulated covering, e.g. sleeving, wrapping or coatings <sup>(1)</sup>
	Terminals for external conductors separated from busbars.		Type 2 Busbar separation is by metallic or non-metallic rigid barriers or partitions.
Separation of busbars from the functional units and separation of all functional units from one another; including the terminals for external conductors which are an integral part of the functional unit.	Terminals for external conductors in same compartment as associated functional unit.	Form 4	Type 1 Busbar separation is achieved by insulated coverings, e.g. sleeving, wrapping or coatings <sup>(1)</sup> . Cables may be ganded elsewhere.
			Type 2 Busbar separation is by metallic or non-metallic rigid barriers or partitions. Cables may be ganded elsewhere <sup>(1)</sup>
			Type 3 Busbar separation is by metallic or non-metallic rigid barriers or partitions. The termination for each functional unit has its own integral glanding facility.
	Terminals for external conductors in same compartment as associated functional unit, but in individual, separate, enclosed protected spaces or compartments.		Type 4 Busbar separation is achieved by insulated coverings, e.g. sleeving, wrapping or coatings <sup>(1)</sup> . Cables may be ganded elsewhere.
	Type 5 Busbar separation is by metallic or non-metallic rigid barriers or partitions. Terminals may be separated by insulated coverings and ganded in common cabling chamber(s).		
	Type 6 All separation requirements are by metallic or non-metallic rigid barriers or partitions. Cables are ganded in common cabling chamber(s).		
	Type 7 All separation requirements are by metallic or non-metallic rigid barriers or partitions. The termination for each functional unit has its own integral glanding facility.		

<sup>1)</sup> See 7.4.2.1 in relation to protection against contact with live parts.

NOTE: Conductors which are connected to a functional unit but where are external to its compartment or enclosed protected space (e.g. control cables connected to a common marshalling compartment) are not considered to form part of the functional unit.

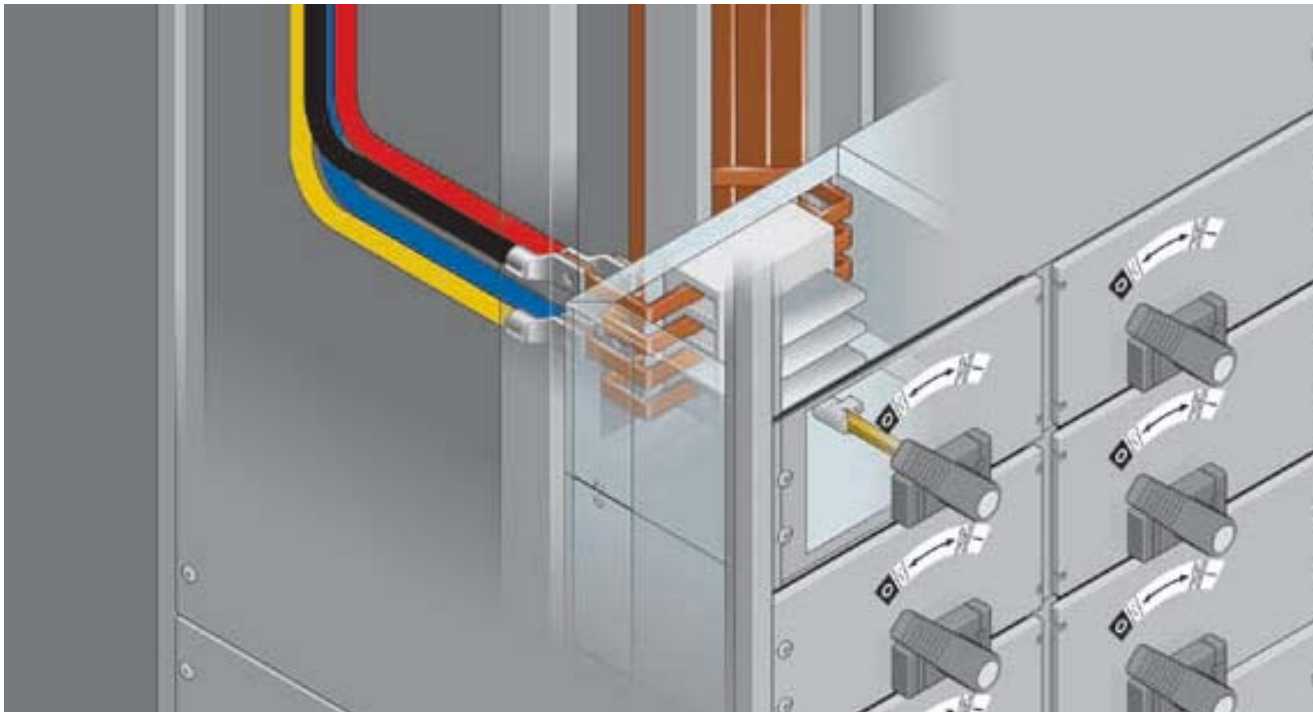
## Forms of Segregation Examples



### Form 2 Type 2 Construction:

- Separation of busbars from the functional units.
- Terminals for external conductors separated from busbars.
- Busbar separation is by metallic or non-metallic rigid barriers or partitions.

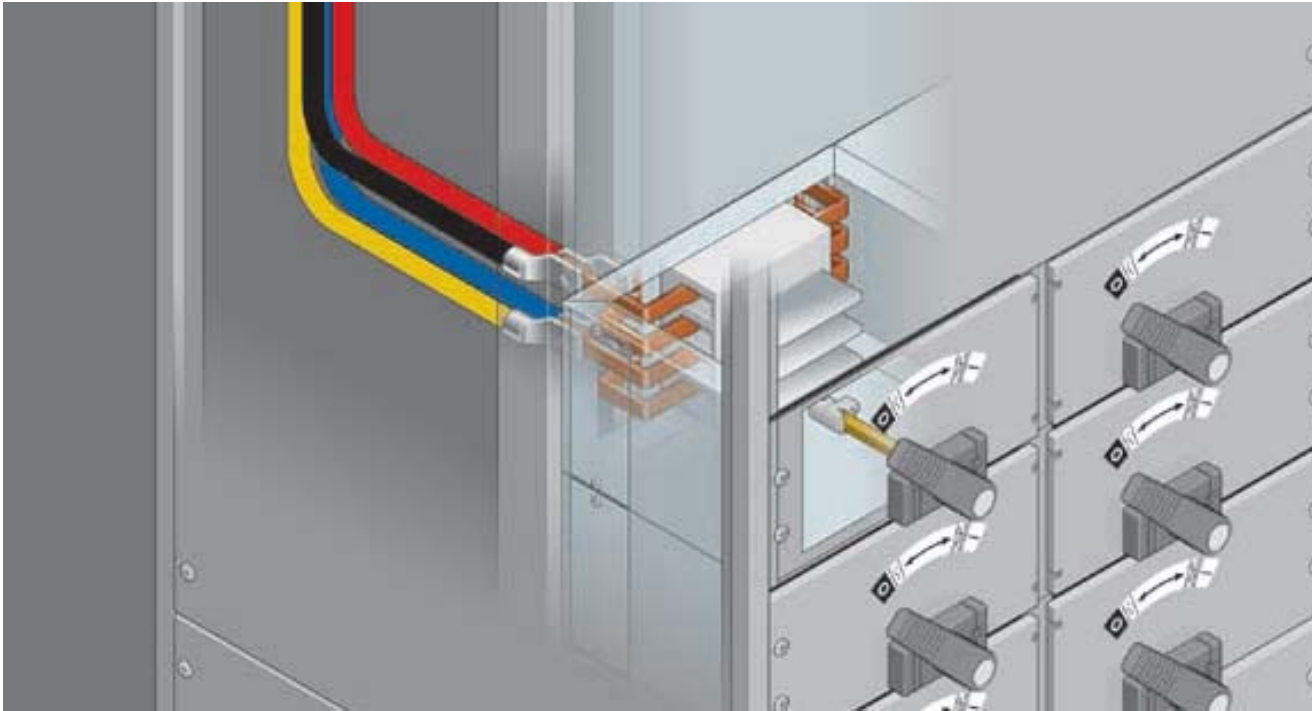
## Forms of Segregation Examples



### Form 3a Construction:

- Separation of busbars from the functional units and separation of all functional units from one another.
- Separation of the terminals for external conductors from the functional units, but not from each other.
- Terminals for external conductors not separated from busbars.
- Busbar separation is by metallic or non-metallic rigid barriers or partitions.

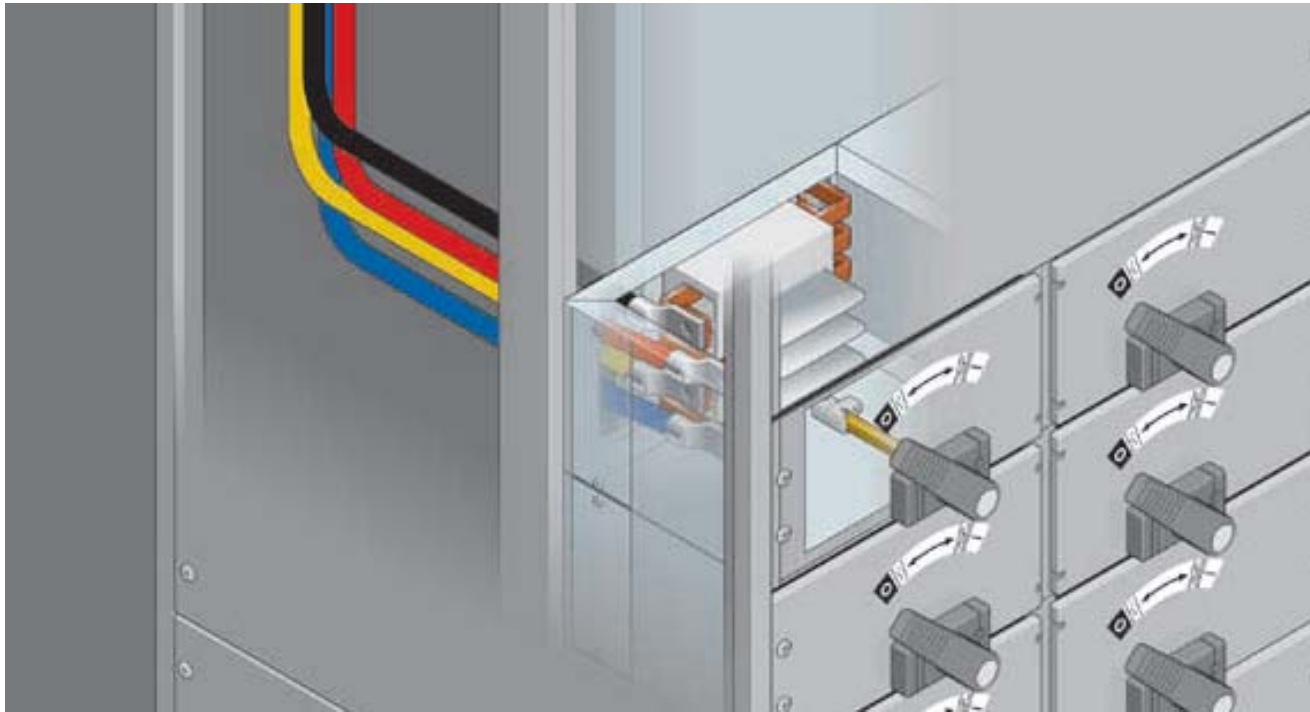
## Forms of Segregation Examples



### Form 3b Type 2 Construction:

- Separation of busbars from the functional units and separation of all functional units from one another.
- Separation of the terminals for external conductors from the functional units, but not from each other.
- Terminals for external conductors separated from busbars.
- Busbar separation is by metallic or non-metallic rigid barriers or partitions.

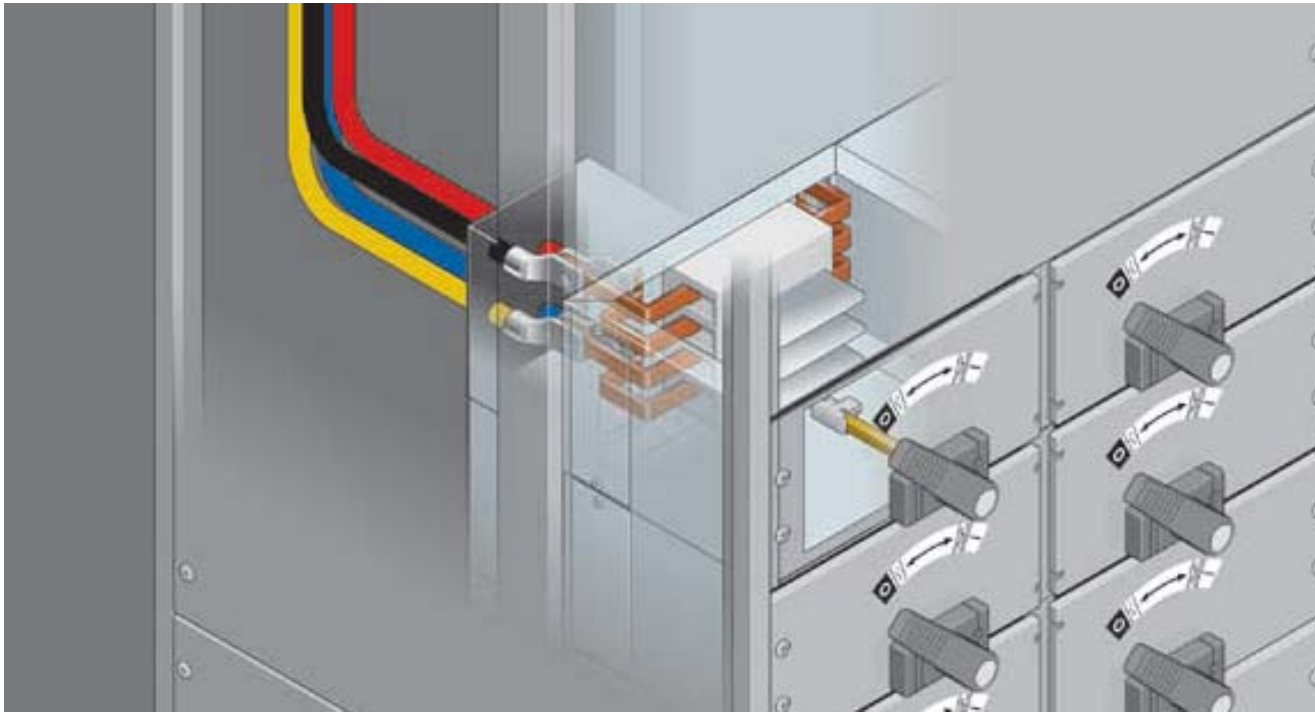
## Forms of Segregation Examples



### Form 4 Type 2 Construction:

- Separation of busbars from the functional units and separation of all functional units from one another, including the terminals for external conductors which are an integral part of the functional unit.
- Terminals for external conductors in the same compartment as the associated functional unit.
- Busbar separation is by metallic or non-metallic rigid barriers or partitions. Cables may be glanded elsewhere.

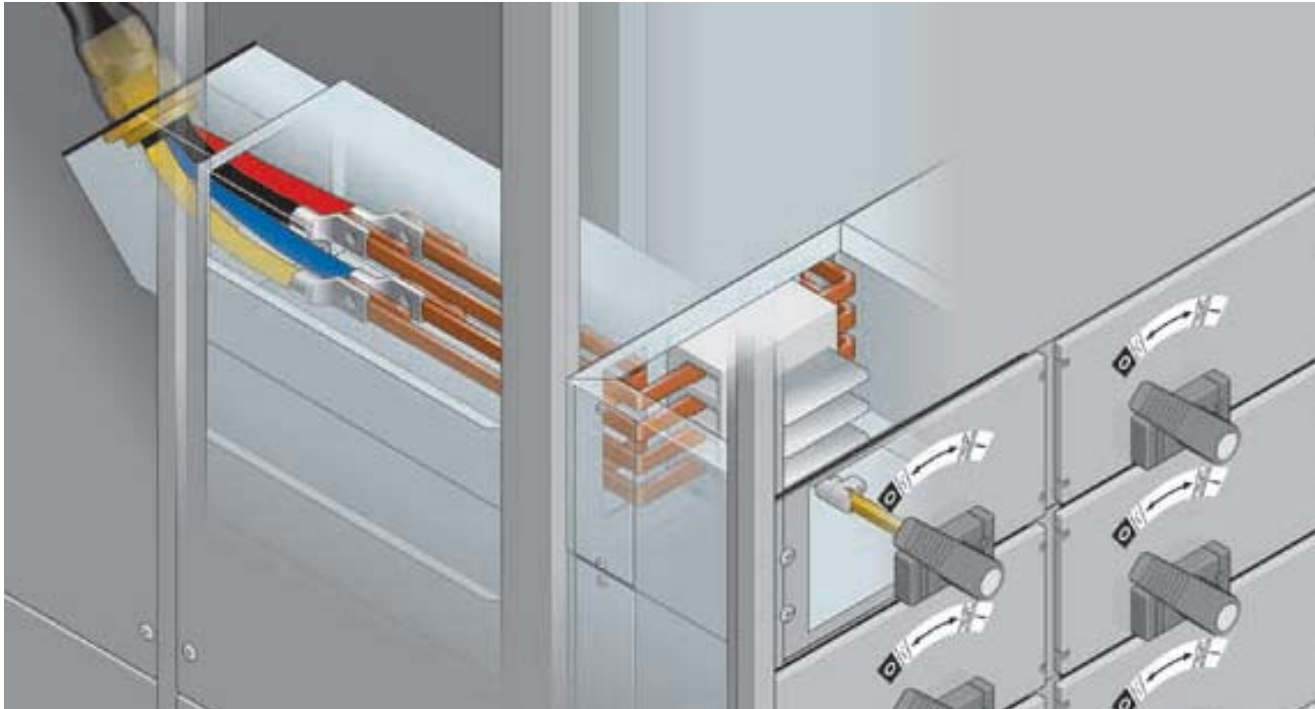
## Forms of Segregation Examples



### Form 4 Type 6 Construction:

- Separation of busbars from the functional units and separation of all functional units from one another, including the terminals for external conductors.
- Terminals for external conductors not in the same compartment as the associated functional unit, but in individual, separate, enclosed protected spaces or compartments.
- All separation requirements are by metallic or non-metallic rigid barriers or partitions.

## Forms of Segregation Examples



### Form 4 Type 7 Construction:

- Separation of busbars from the functional units and separation of all functional units from one another, including the terminals for external conductors.
- Terminals for external conductors not in the same compartment as the associated functional unit, but in individual, separate, enclosed protected spaces or compartments.
- All separation requirements are by metallic or non-metallic rigid barriers or partitions.



## Forms of Segregation Examples



Form 4 Type 7 Construction:

Form 4 Type 2 Construction:



## IEC MCC Oil & Gas Typical Designs with Forms of Separation

In general, the Oil & Gas industry has standardized on withdraw able Form 4 construction. Most of the other industrial markets for MCC's utilize the fixed pattern type design with variations of Form construction. The difference can be substantial with regards to cost and benefit. This can usually is the biggest determining factor in pricing on IEC LV motor control... It is a key point to review specifications to determine the appropriate design criteria for the project.

**Withdrawable Design** – Allows easier access to individual components without hot permits or de-energizing the balance of the MCC.

**Fixed pattern** – Electrical components are typically hard wired to the bus and do not allow easy maintenance without de-energizing the entire board.



**SOURCE** IEx

# IEC MCC Examples

