Tel

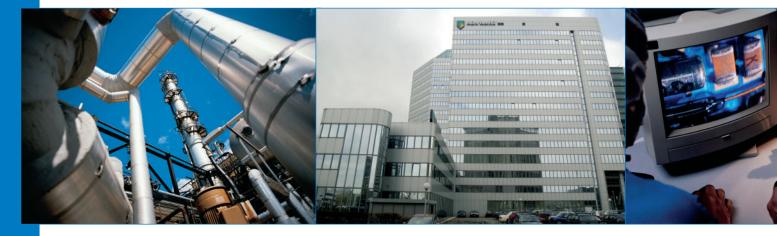
Full personal safety, optimum operational reliability and application flexibility, uniquely combined in standard design



Eaton's European Operations electrical business

Eaton's electrical business is a global leader in electrical control, power distribution, uninterruptible power supply and industrial automation products and services. Eaton's European brands including Holec, MEM, Powerware and Eaton, provide customer-driven PowerChain Management solutions to serve the power system needs of the industrial, institutional, government, utility, commercial, residential, IT, mission critical and OEM markets.

PowerChain management helps enterprises achieve a competitive advantage through proactive management of the power system as a strategic, integrated asset throughout its lifecycle. With Eaton's distribution, generation and power quality equipment: full scale engineering services; and information management systems, the power system is positioned to deliver powerful results; greater reliability, operating cost efficiencies, effective use of capital, enhanced safety, and risk mitigation. That's the value of PowerChain Management.







Capitole 40 assembly.

Increase of safety requirements

The economic importance of industrial process continuity in onshore and offshore projects has resulted in increasingly stringent project specifications focusing particularly on the safety and reliability of power distribution and motor control equipment. The demands of today's specifiers include increased device density per square metre of floor space, particularly in installations like on offshore platforms, compliance with the highest of international safety standards, guaranteed operational reliability and the demand for equipment requiring little or no maintenance.

Eaton's range of Capitole low voltage Systems have been specifically designed and developed to meet these requirements. The Capitole 40 Motor Control Center is valued internationally for it's applicationoriented characteristics, such as full compartmentation and highest form of separation, it's optional fault-free zone between incoming and outgoing feeders, as well as the system's flexibility, including the facility to quickly carry-out on-site changes, even under service conditions.

The optionally available Capitole 40 with fault free zones and insulated main busbar system is considered to be an **ArcFree** MCC. Precautions have been taken to limit possible causes of failures: **Increased safety by Design**.



Characteristics



Personal safety

- Full internal separation of all functional units.
- Enclosure protection IP41 minimum, higher ratings are available when required.
- Measures to limit the consequences of an internal fault in outgoing units.
- Internal protection, including for opened switchgear compartments, is IPXXB, (maintained even when drives removed).
- Automatic door interlocking of all outgoing feeder sections prevents access or removal when the switch is in the ON position.
- Fuse-links within motor starters can <u>only</u> be replaced when the drawout unit is fully removed.
- Access to cable termination of a drawout unit is <u>only</u> possible when the unit is removed from the cubicle.
- Optional shutters can be mounted to guard the distribution busbars when drawers are removed.
- Safe connection of outgoing cables is feasible under live conditions of the busbar.
- As a standard, the cable entry compartment is fully voltage free.



Operational reliability

- The design verification and the tests carried out (verification through testing) are performed under the guidance of an independent body (KEMA/DEKRA). The DEKRA EN-IEC-61439-2 Capitole 40 test certificate is available on request.
- Internal separation of all functional units is standard, complying with IEC 61439-2, NEN-EN-IEC 61439-2 and BS-EN-IEC 61439-2, Form 4a type 2, Form 4b types 3, 6 and 7.
- Vertical distribution busbars are completely enclosed by an insulated busbar chamber.
- Segregation is continued at the main contact pins of the drawout units, preventing phase-to-phase and phase-to-earth faults.
- Vertical distribution busbars feature two parallel conductors per phase for increased cooling and reliability.
- Unique main isolating scissor-shaped contacts between distribution busbars and drawout units prevent contact wear or welding to busbars and counteract the risk of contact repulsion under short-circuit conditions.
- The systematic use of torque wrenches during assembly guarantees reliable electrical connections.
- The design, engineering and assembly of the Capitole system is carried-out within an ISO 9001 and EN 29001 Quality Management System and a ISO 14001 Environmental Management System, both of which are Kema certified.











Fault-free zone

Additional options to comply with the requirement of a fault-free zone between incomer and outgoing protection are:

- Full insulation by epoxy powdercoating of main busbars.
- Epoxy powder insulated connection bars between main and distribution busbars.
- Epoxy powder insulated connection bars between incomer/buscoupler and main bars.
- Phase-to-phase, phase-to-neutral and phase-to-earth screened terminations at both busbar and cable side of incoming feeders.

System flexibility

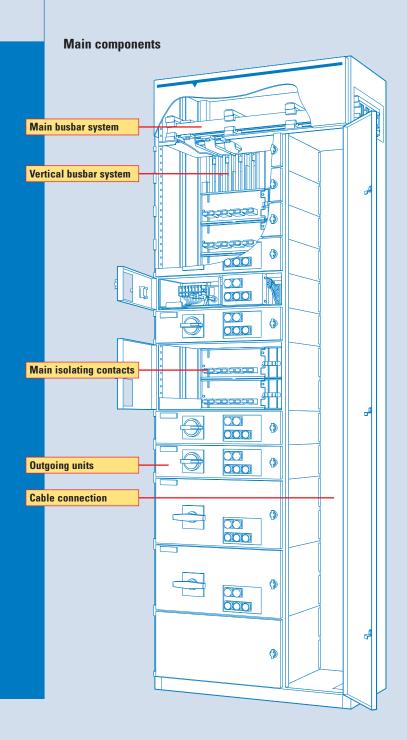
- Compartments for drawout units can be modified without process interruption.
- Cable connection to drawout units can be accomplished under live conditions.
- Standard range of cubicle sizes for front/rear connection, bottom or top entry of cables.
- Corner cubicle for angular mounting Cubicle design with a reduced height.
- Up to 32 outgoing units per cubicle.
- Wide range of options, such as soft starters, frequency converters, PLC-controlled synchronisation and changeover equipment, units for power factor improvement, harmonic filtration, etc.
- Assemblies with combined motor control and high current distribution functions.

Maintenance

- All parts are accessible from the front, optional cable connections are available at the rear.
- Scissor-shaped isolating contacts render maintenance on distribution busbars unnecessary.
- Contact cassettes can be quickly and easily changed if necessary.
- The use of high-grade materials and components, reduces maintenance to a minimum.
- Due to the systematic use of maintenance free joints, factory tightened to optimum torques, means that inspection and/or retightening of the electrical main connections is not required.
- Accessibility of vertical and horizontal insulated busbars in switched off position.

Capitole 40

Capitole 40 cubicles are of a self-supporting structure, consisting of profiles and sheet-steel side-walls. The outer side-walls and front covers are epoxy-coated. Corrosion-resistant zinc coated sheet-steel plates are used for the rear and inner walls and for compartment separation.





Cubicle arrangement

All cubicles are of modular design, comprising a top-mounted busbars enclosed within their own compartment and a switchgear or controlgear compartment. The vertical distribution busbars are accommodated in a glass-fibre reinforced polyester busbar duct with an adjacent, separate compartment for cable-entry to the withdrawable switchgear or controlgear compartments.

units by metallic or non metallic rigid barriers/partition

Functional units are separated from other

Terminals are external to functional units

Cables may be glanded elsewhere,

in a common cabling chamber Termination of each functional unit has its

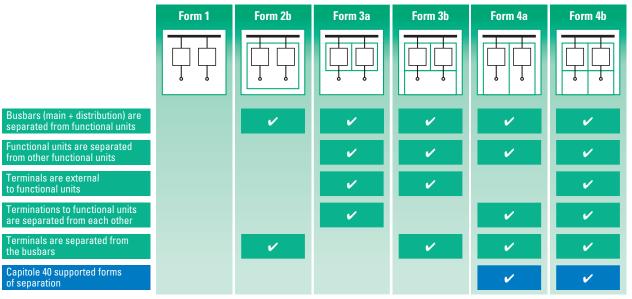
Capitole 40 supported forms of separation

functional units

own glanding facility

Forms of internal separation

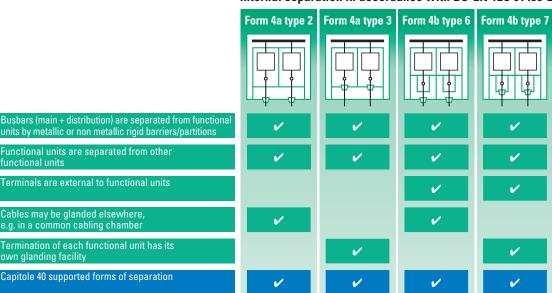
The IEC 61439-2 defines forms of internal separation. The form of separation determines how busbars, functional units and terminals are separated from eachother. BS-EN-IEC 61439-2 includes informative Annex AA, entitled "Forms of internal separations". This appendix provides additional information regarding different forms, based on typical practices in the United Kingdom.

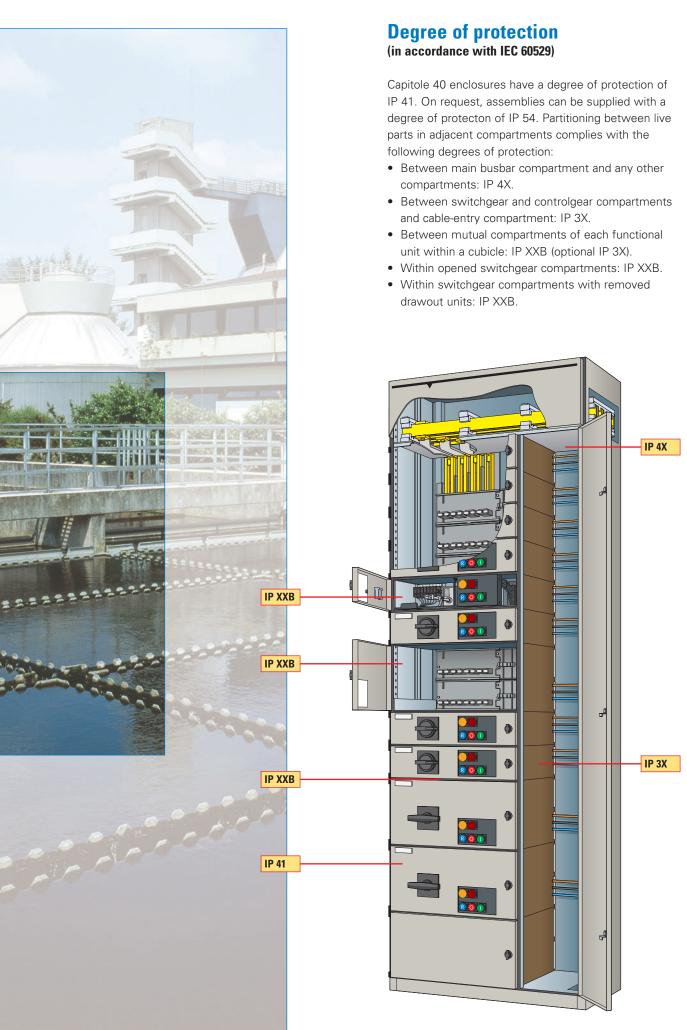


Internal separation in accordance with IEC 61439-2



Internal separation in accordance with BS-EN-IEC 61439-2



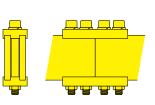


Main busbar system

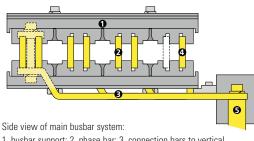
Main busbar system

The main busbars are located in a separate compartment at the top of the switchboard. The compartment has a degree of protection of IP 4X with respect to the lower situated switchgear and the vertical cable-entry compartment.

The busbars, phase bars and neutral bar, have a standard thickness of 10 mm and are available for current ratings from 800 up to 6300 A. They are secured by glass-fibre reinforced polyester busbar supports which allow easy, on-site changing of the busbars if uprating of the system is necessary. This can be done without having to alter the busbar supports. On-site extension of busbars can be easily and quickly accomplished with the appropriate busbar coupling clamps; no drilling is required. The bottom of the busbar compartment is sealed by a glass-fibre reinforced polyester plate.

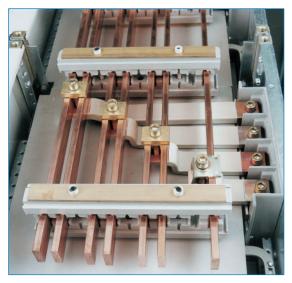


Busbar coupling clamp for extension of main busbars.



 busbar support; 2. phase bar; 3. connection bars to vertical distribution busbar system; 4. neutral bar; 5. distribution busbar.

Auxiliary supply system busbars are located in a separate compartment, mounted in front of the main busbar compartment. Up to 8 auxiliary bars with a current rating



Main busbar system with insulated connection bars to distribution busbars.

Auxiliary busbars in front of main busbar compartment.

Horizontal auxiliary supply system

of 50 A may be specified.

Maximum	Busbar cross-section (Cu)		Short-circuit capacity	
permissible load current (A)	Phase bar (mm)	Neutral bar (mm)	/ _{cw} kA-1 s	/ _{pk} kA
1000	1 x 35 x 10	1 x 35 x 10	35	73.5
1400	2 x 25 x 10	1 x 25 x 10	50	110
1700	2 x 35 x 10	1 x 35 x 10	63	140
2100	2 x 50 x 10	1 x 50 x 10	80	176
2600	2 x 75 x 10	1 x 75 x 10	100	220
2900	2 x 100 x 10	1 x 100 x 10	100	220
3200	2 x 120 x 10	1 x 120 x 10	100	220
3600 ¹⁾	2 x 120 x 10	1 x 120 x 10	100	220
4500 ²⁾	2 x 2 x 75 x 10	1 x 2 x 75 x 10	100	220
5000 ²⁾	2 x 2 x 100 x 10	1 x 2 x 100 x 10	100	220
6300 ²⁾	2 x 2 x 120 x 10	1 x 2 x 120 x 10	100	220

Ratings and cross-sections of main busbars

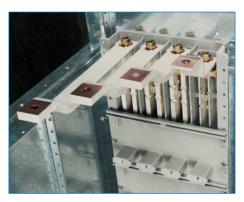
1) Natural ventilation. 2) Epoxy insulated busbars.

Vertical distribution busbar system

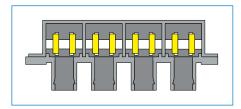
For cubicles with drawout outgoing units vertical busbars are branched from the main busbar system by means of insulated connection bars. The vertical busbars are located in a glass-fibre reinforced duct at the back of the cubicle. The busbar duct is partitioned into four sections, each section accommodating a phase or neutral busbar consisting of two silver-plated parallel conducts. The front of the duct is screened by glass fibre reinforced polyester plates, so that each pair of busbars is fully enclosed, thus preventing the occurrence of open arcs between busbars or between busbars and earth. The bus duct screening plates have a module height of 125 mm and are each provided with sockets for busbar branching.

Vertical auxiliary busbars

A duct for up to four auxiliary busbars can be located next to the vertical distribution busbar duct. Tee-off to each drawout unit is made via a 4-pole socket outlet per module height.



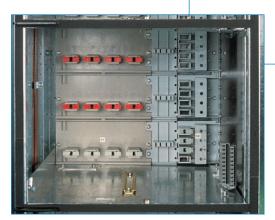
Distribution busbar duct with connection bars to main busbar system (upper sealing plate removed).



Top view of distribution busbar system in glass-fibre reinforced polyester duct.



Rear view of drawout unit showing segregation of main isolating contact pins.



Switchgear and controlgear compartments for drawout units, showing from left to right: scissor contacts to distribution busbars, sockets to auxiliary busbars, and cable terminal blocks.

Ratings and cross-sections of distribution busbars

Maximum	Busbar cross-section	Busbar cross-section (Cu)		Short-circuit capacity	
permissible	Phase	Neutral	I _{cw}	/ _{pk}	
load current (A)	bar (mm)	bar (mm)	kA-1 s	kA	
740	2 x 32 x 4	2 x 32 x 4	35	73.5	
985	2 x 25 x 10	2 x 25 x 10	50	105	
1420	2 x 50 x 10	2 x 50 x 10	80	176	

Branching

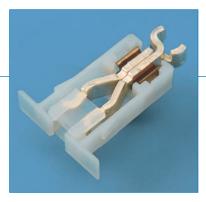
Draw-out units utilize scissor-shaped main isolating contacts. When a draw-out unit is fitted the power circuit contacts enter the jaws of the scissor contacts causing them to make contact with the parallel busbar conductors. When a drawout unit is being fully inserted, the power circuit contact pins enter the scissor contacts and slightly force apart the contact blades against the steel contact spring. As a result and excellent, low resistance, contact is obtained on both busbar and draw-out unit. The scissor contacts can be easily removed, and if required, quickly replaced, even under live conditions. Blanking plugs are available for unused busbar openings to provide IPXXB protection.

Main isolating contacts

The scissor-shaped contacts (patent granted) have a number of important advantages:

- They prevent wear on the vertical busbars, normally resulting from the in and outward movement of the drawout units.
- There is no risk of welding to the busbars in the event of high starting or short-circuit currents
- Due to the scissor-shaped construction¹⁾ increasing through-going currents cause increased contact pressure on the vertical busbars and on the tray's contact pin, consequently preventing contact repulsion under short-circuit conditions.

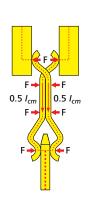
The scissor shaped contacts each have a maximum current rating of 160 A and have been proven to withstand a prospective short-circuit current of up to 100 kA.

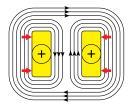


Typical main isolating

1) Taking advantage of the phenomenon of force of attraction exerted on parallel conductors carrying currents in the same direction.



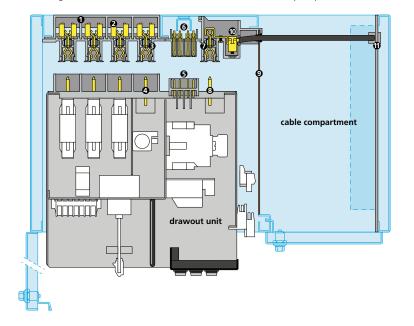




Increasing through-going (shortcircuit) currents cause increased contact pressure on the vertical busbars and on the trav's contact pins, consequently preventing contact repulsion under shortcircuit conditions.

Sectional drawing of Capitole 40 cubicle

Showing distribution busbars, drawout motor starter unit and cable-entry compartment.



- 1. Glass-fibre reinforced polyester busbar duct.
- 2. Parallel busbar conductors.
- 3. Main isolating scissor-shaped
- contact.
- 4. Main isolating contact pins with glass-fibre reinforced polyester phase segregation.
- 5. Auxiliary busbar connector.
- 6. Auxiliary busbars.
- 7. Cable isolating scissor contacts.
- 8. Cable-sided contact pins.
- 9. Screening plate with grommet for cable entry.
- 10. Cable terminal clamp.
- 11. Fixing strip for cable clamps.

Switchgear and control gear compartments

The standardised, modular Capitole 40 system offers practically unlimited possibilities to satisfy customers' demands for highgrade Motor Control Centers whilst providing optimum operational reliability, personal safety, flexibility and economy.

Incoming feeders and buscouplers

When a single device is mounted in one cubicle - for example an incoming feeder section - switchgear and space for cable connection are integrated in one compartment. However, associated measuring sections are housed in a separate compartment. As an option the busbar-sided and cable-sided incoming feeder terminations can be phase-to-phase, phase-to-neutral and phase-to-earth screened, whilst buscouplers have terminal screening on left and right sides. Standard available incoming feeders and buscouplers for Capitole 40 MCCs are switch-disconnectors type Dumeco up to 3150 A, or Air Circuit Breakers type Magnum¹⁾ up to 6300 A. The circuit breakers are withdrawable and can be provided with shutters (IP 20) of which cable and busbar sides are individually operable and padlockable (optional).



Capitole 40 assembly with outgoing switch-disconnector-fuse units.



Capitole 40 assembly with Magnum Air Circuit Breakers as incoming feeder and buscoupler.

 Magnum Air Circuit Breakers range from 800 A up to 6300 A. For detailed information ask for Magnum brochure.

Outgoing units

Outgoing feeders are available as:

- Switch-disconnector + fuse units up to 1000 A.
- Switch-disconnector-fuse units up to 500 A.
- MCCB units up to 1000 A.
- Withdrawable switch-disconnector + fuse units up to 400 A.
- Withdrawable motor starter units up to 132 kW.
- Withdrawable Air Circuit Breaker units up to 2900 A.



Close-up view of Magnum Air Circuit Breaker in Capitole 40 cubicle.

Outgoing withdrawable units

Drawout units are provided with contact pins connecting the unit to distribution busbars and cable via the corresponding scissor-shaped main isolating contacts. Since the full phase segregation of the busbar branching points is also continued at the contact pins, the possibility of phase-to-phase, phase-to-neutral and phase-to-earth faults are excluded. Each drawout unit comprises the following locking devices:

- An automatic door interlock, which prevents the door being opened when the switch is in the ON position.
- A locking device against insertion or removal when the switch is in the ON position.
- A latch, to prevent the unit from being dropped accidentally if removed too quickly.

A lever at the front of each drawout unit permits smooth insertion and removal, and, in addition, ensures a good end-stop.

Fuse-links (if present) are located in such a way, that they can only be replaced when the drawout unit is fully removed from the cubicle. For local signalling and operation, each drawout unit is provided with a frontmounted panel showing up to eight operating and signalling functions. A twenty-pole auxiliary isolating contact block has been incorporated to enable remote control and signalling.

On request, drawout units can be supplied with a fourpole plug connection to the vertical auxiliary busbars in the back of the cubicle.



Front view of motor starter tray with fuse/switch in line (module heigth 125 mm).



Rear view of motor starter tray (module height 125 mm).



Capitole 40 cubicle showing partly withdrawn motor starter tray.



Front view of motorstarter tray with fuse/switch combination (module heigth 125 mm).

Testing of secondary circuits

Drawout units can be supplied with a test position for secondary circuit testing.

Several options are available, e.g.:

- Removal of scissor-shaped contacts on the cable side.
- A test switch.
- Test unit for testing withdrawable motor/feeder units outside the MCC.



Motor starter with electrical test position.



Test unit for testing withdrawable motor/feeder units outside the MCC.

Application flexibility

Process changes, e.g. up rating of motor power, may require on-site modification of motor starter circuits and accordingly, enlargement of switchgear compartments. The Capitole 40 design is able to meet this requirement under live conditions. In cubicles with a vertical distribution busbar system,

provided with screening plates for insertion of main isolating scissor contacts along its entire length, changing of outgoing compartment sizes can be safely carried out under live conditions. For this purpose, the compartment separation plates, being secured by two bolts at the front of the cubicle, can be easily and quickly removed and secured at the desired height. In a similar way, a compartment can be divided along its width into two individual compartments by changing the compartment separation plate for a partitioned one. The appropriate connections to the distribution busbars are then realised via a contact adaptor unit, situated at the rear of the partitioned separation plate.



Changing of outgoing compartment sizes can be safely carried out even under live conditions.



Cable connection

With incoming feeder sections in excess of 1000 A (or outgoing feeders in excess of 630 A), cabling is integrated in the switchgear compartment. The main current cables are then directly connected to the incoming or outgoing unit. For parallel cables, a cable connector set is available.

Cable-entry compartment

If several incoming and outgoing feeder sections are mounted in one cubicle, and cable connection is made from the front, a separate, lockable cable-entry compartment, along the entire height of the switchgear compartment, is provided at the right-hand side. On the side wall, mounting strips are available for cable clamps or cable glands. Cable connections to drawout units are made in the switchgear compartment without the use of cable lugs. The terminals are fully enclosed in a cable connector block, together with the cablesided scissor-shaped isolating contacts. The cableentry compartment is isolated from the switchgear compartments by means of screening plates (IP 3X). The standard cable-entry compartment width is 250 mm (375 or 500 mm optional available). The compartment is provided with an undrilled, removable gland plate at the bottom of the cubicle. A vertical earth bar runs along the height of the cable-entry compartment and is connected to the earth bar of the main busbar system.

Earth bars

Capitole 40 switchboards are supplied with a horizontal earth bar 25×10 mm, located in the main busbar compartment. Vertical branches from the main earth bar, with a cross-section of 30×8 mm are fitted in the feeder and end cubicles; earth bars 20×4 mm in all other cubicles.



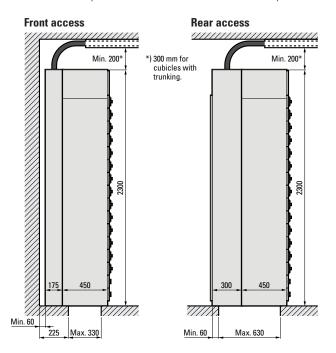
Safe connection of outgoing cables is possible under live busbar conditions.



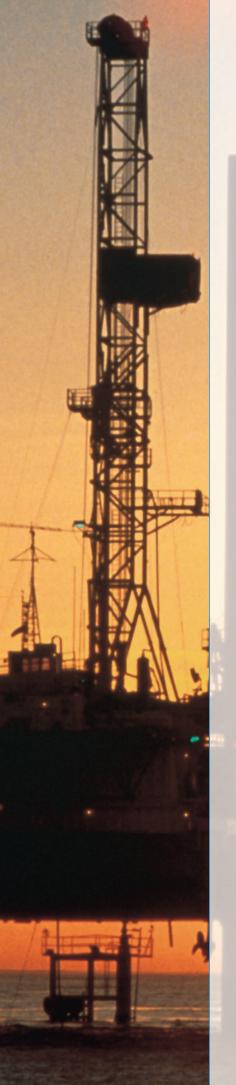
Cable-entry compartment. Left: cable entry through screening plates. Right: cables supported by strip-mounted cable clamps.

Top entry of cables

To enable top entry of cables an additional box of 175 mm deep needs to added to a front access panel.









Cubicles with reduced height.

Fields of application

- Petrochemical industries.
- Refineries.
- Gas & Oil exploration (on-shore and off-shore).
- Steelworks.
- Water treatment plants.
- Food industry.
- Sugar mills.
- Paper mills.
- Power stations.
- Cement works.
- Packaged substations.
- On board ships.

Lloyd's approval for marine use

By making a small number of modifications, the standard Capitole 40 version meets the requirements of Lloyd's Register of Shipping for application on board ships and on offshore platforms.

Lloyd's approval has been granted after the relevant tests with regard to degree of protection, vibration and shock resistance, etc.

A certificate is available on request.



Tool box.



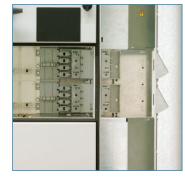
Shutters.



Back-to-back arrangement with interconnected busbar systems.

Options

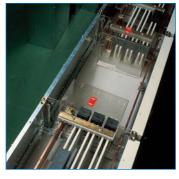
- Epoxy powder insulated main busbars.
- Mutual insulation of busbar sections (IP 40).
- Insulated connection bars between incomer/ buscoupler and main busbars.
- Phase-to-phase screened terminations at both busbar and cable side of incoming feeders.
- Automatic Transfer System: Otonet. PLC based system with optional sync check facilities for synchronised switching.
- Integrated electronic soft starters and static frequency converters.
- Integrated equipment for power factor improvement.
- Corner cubicles for erection against walls at right angles.
- Interconnection of main busbar systems, enabling back-to-back arrangements; space between assemblies 120 mm.
- Cubicles with reduced height for application in packaged substations, offshore and on board ships.
- Special locking facilities.
- Anti-condensation heating facility.
- Separate foundation frame (height 100 mm).
- Rear access.
- Forms of separation: Form 4b, Form 4a type 3, Form 4b type 6 or Form 4b type 7.
- Shutters.
- Motor starters with Fuse/Switch combination switches.
- BS-fuses.
- Tool box.



Form 4b type 7.



Form 4b type 7.



Mutually insulated busbar sections.



Fully insulated main busbar system.



Assembly arrangement with corner cubicle.



Automatic Transfer System, Otonet.

Clink Integrated Motor Control System

Clink is an automation system with individual control units for each motor and feeder circuit within a Capitole 40 switchboard. All units execute an extensive range of protection, monitoring and control functions. In addition, serial communication is possible between the Motor Control Center and other systems e.g. DCS, SCADA, applying various protocols i.e. **Modbus, Profibus, Control Net, Data Highway Plus**, etc.

Eaton's integrated Clink system provides plant managers with comprehensive data and opportunities to further optimize plant performance, efficiency and productivity.

Since 1993, the Clink system, successfully applied in Eaton's Capitole 40 Motor Control Center has been field-proven world-wide with full appreciation from customers in Europe, the Middle East, the Far East and South America.

Redundancy

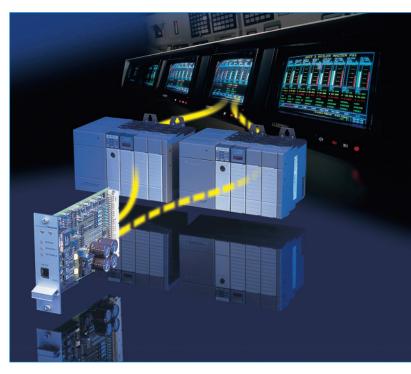
Due to growing safety requirements and the demand for increased system reliability and availability Clink, next to its simplex system design, is also available with a redundant communication link.

For internal communication the open network standard **DeviceNet** is used with the advantage that also frequency controllers, automatic transfer switching logic and other devices supporting DeviceNet can be simply implemented and configured via one and the same network.

Clink II in Capitole 40 offers the following benefits:

• Less downtime: Clink II is a reliable system with low MTTR and high MTBF and above all offers a very reliable motor protection.

- Reduced costs compared to conventional MCCs: The use of an intelligent MCC eliminates control cabling, DCS I/O, Interposing Relais Panels.
- Reduced design time: the engineer can use typical schematics and typical configuration settings.
- Reduced testing and commissioning: the engineers need less time for FAT, SAT and commissioning on site, Clink II allows easy fault finding.
- Standard a lot of functionality is available: If you need it in the future it is already there (e.g. kW or kWh).
- Comprehensive data for your process automation or maintenance systems: all relevant data is available.
- Advanced authorisation: instead of screwdrivers you need passwords to change protection settings.
- Proven technology: Clink has already been used since 1993, there is a large global installed base.





Detail of Capitole 40 cubicle with integrated Clink system. At right (mounted in cable-entry compartment), part of the cassette-mounted Starter Control Units which substitute the auxiliary protection and control devices of each motor starter.

For detailed information ask for brochure Clink II, Integrated Motor Control System, form no. 1993 155.

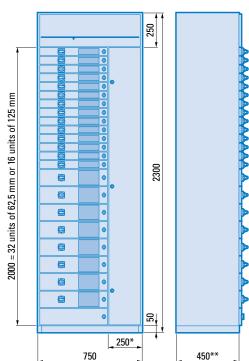
Technical data

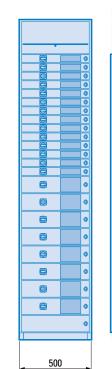
	Capitole 40
Electrical data	
Rated operational voltage	690 V
Rated frequency	50/60 Hz
Main busbar data	
Rated insulation voltage	1000 V
Rated impulse withstand voltage	12 kV
Rated current	6300 A
Rated short-time withstand current	100 kA 1 s
Rated peak withstand current	220 kA
Vertical distribution busbar data	
Rated insulation voltage	1000 V
Rated impulse withstand voltage	12 kV
Rated current	1420 A
Rated short-time withstand current	80 kA 1 s
Rated peak withstand current	176 kA
Enclosure data	
Degree of protection	IP41 (IP54 on request)
Form of separation in accordance with NEN-EN-IEC 61439-2	Form 4a (Form 4b optional)
Form of separation in accordance with BS-EN-IEC 61439-2	Form 4a types 2 and 3, Form 4b types 6 and 7
Entry of cables	Top and/or bottom
Access	Front or rear
Standard Colour	RAL 7035

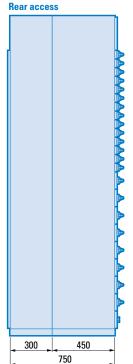
IEC 61439-1, NEN 61439-1 and BSEN 61439-1

Certifications

Lloyd's Register of shipping







Capitole 40 cubicles can be mounted back to wall, back-to back or freestanding. If required, Capitole 40 assemblies can be placed on a separate 100 mm mounting frame. Special cubicles are available for corner erection and for mounting in packaged substations (cubicles with reduced height).

*) Wire ways of 375 and 500 mm are available.

**) Extended depth (175 mm) when top entry.

Dimensions (mm)

Eaton's Electrical Sector is a global leader in power distribution, power quality, control and automation, and monitoring products. When combined with Eaton's full-scale engineering services, these products provide customerdriven PowerChain[™] solutions to serve the power system needs of the data center, industrial, institutional, public sector, utility, commercial, residential, IT, mission critical, alternative energy and OEM markets worldwide.

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Eaton Industries (Netherlands) B.V. P.O. Box 23 7550 AA Hengelo The Netherlands

Customer contact Tel.: +31 (0)74 - 246 40 10 Fax: +31 (0)74 - 246 40 25 info.electric@eaton.com www.eaton.eu/electrical Eaton Electric Limited Reddings Lane Birmingham B11 3EZ United Kingdom

Customer contact Tel.: +44 (0)8700 545 333 Fax: +44 (0)8700 540 333 ukcommorders@eaton.com Due to continuous research and development policy Eaton reserves the right to make changes in design and specifications of the products without prior written notice.

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Form. BR04300002U_v2/1991332G0102 November 2013

