

PARTNER FOR PROFESSIONALS

HOLEC 

CAPITOLE 40

Low voltage
Motor Control Centres
in sheet-steel enclosures



- FULL PERSONAL SAFETY,
OPTIMUM OPERATIONAL RELIABILITY
AND APPLICATION FLEXIBILITY,
UNIQUELY COMBINED IN STANDARD DESIGN

INTRODUCTION

TAKING CARE OF YOUR POWER

Holec Holland N.V. (1700 employees world-wide) is a leading Dutch manufacturer in the field of electric power engineering. Holec focuses on the distribution and control of electricity, supplying products to switch and safeguard electrical energy. The range of products comprises a wide variety of medium and low voltage switchgear systems and switchgear components.

The Holec Holland companies design and supply essential links in the chain of safe energy distribution and application. In product design Holec engineers focus on cast-resin insulation and vacuum interrupters for medium voltage switchgear. In low voltage engineering, major achievements can be found in motor control and monitoring, electronic earth leakage detection and load break switches. The control of electricity from the power source up to the end user requires specific solutions. Holec's engineers combine many years of experience with the latest technological advances and have added considerably to the company's reputation as international manufacturer of electric power engineering products in the energy distribution field.

Holec Holland is formed by three operating companies in the Netherlands; Holec Middenspanning B.V. (Holec Medium Voltage), Holec Laagspanning B.V. (Holec Low Voltage) and Holec Algemene Toelevering B.V. (Holec General Supplies). Holec's subsidiaries and joint-ventures in Western and Eastern Europe, Scandinavia, Australia and PR China report directly to the Dutch operating companies. In emerging markets where Holec Holland companies are not directly active, customers are served by local representatives, with the support of Holec product specialists.

Holec Holland is part of the Electrical Division of Delta plc. The division harnesses the strengths of well-established brand names, such as HOLEC, MEM, BILL and ELEK. They are synonymous with product quality and reliability for low and medium voltage applications. Strong decentralised management and a continuous policy of research and development has enabled the Electrical Division to maintain a comprehensive and international product range that is in line with the latest demands of the market place.

Delta PLC, based in London, Great Britain, is an international industrial group, comprising three divisions; Electrical, Industrial Services and Plumbing. Delta identified these activities as long-term growth businesses, since they offer superior growth opportunities. In each business area Delta companies have leading market positions.

Increase of safety requirements



Capitole 40 assembly.

The economic importance of industrial process continuity on and offshore, calls for increasingly stringent project specifications with regard to the safety and reliability of power distribution and motor control equipment. Growing current ratings per square metre floor space (e.g. on offshore platforms), yet fulfilling the highest international safety standards, guaranteed operational reliability and the demand for equipment requiring little or no maintenance, are just a few examples.

Holec's range of Capitole low voltage switchgear systems, developed and designed with unremitting attention for industrial progress, meet these requirements.

Of this range, the Capitole 40 Motor Control Centre is valued internationally because of its application-oriented characteristics, such as full compartmentation and highest form of separation, its fault-free zone between incoming and outgoing feeders (optional), as well as the system's modification flexibility, even under service conditions.

CHARACTERISTICS

Personal safety

- full internal separation of all functional units
- the degree of protection of the enclosure is IP 41 (higher on request)
- measures have been taken to limit the consequences of internal faults (IEC 60298, appendix AA)
- for all opened switchgear compartments the degree of protection is IP 20, which is maintained when the relevant drawout unit has been removed
- automatic door interlock of all outgoing feeder sections prevents access or removal when the switch is in the ON position
- fuse-links of motor starter and switch+fuse units can only be replaced when the drawout unit is fully removed
- access to cable termination of a drawout unit is only possible when the unit is removed from the cubicle
- safe connection of outgoing cables is feasible under live conditions
- the complete absence of non-insulated current-carrying parts renders safe access to the cable entry compartment.

Operational reliability

- KEMA certified (TTA)
- internal separation complies with IEC 60439-1, Form 4a
- the vertical distribution busbars are completely enclosed by an insulated busbar duct
- the distribution busbars' full segregation is continued at the main contact pins of drawout units, preventing phase-to-phase faults
- the distribution busbars are executed as parallel conductors for increased cooling surface
- unique main isolating scissor-shaped contacts between distribution busbars and drawout units prevent contact wear or welding to busbars and exclude the risk of contact repulsion under short-circuit conditions
- the systematic use of torque wrenches guarantees reliable tightening of all electrical main connections
- the design, engineering and assembly of the Capitole system complies with the requirements of ISO 9001 (EN 29001) Quality Management System, ISO 14001 Environmental Management System, certified by KEMA*.

*) Member of the European network for quality system assessment and certification EQNET.





Fault-free zone

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

- full insulation of main busbars;
- insulated connection bars between main and distribution busbars
- insulated connection bars between incomer/ buscoupler and main busbars
- phase-to-phase 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 reduced height
- up to 16 drawout units per cubicle; adaptor set for 32-drawer system available
- wide range of options, such as soft starters, frequency converters, PLC-controlled synchronisation and changeover equipment, units for power factor improvement, etc.
- for assemblies with combined motor control and high current distribution functions.

Maintenance

- all parts are accessible from the front
- scissor-shaped isolating contacts render maintenance on distribution busbars superfluous
- 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 set torques, retightening of the electrical main connections is not required.

THE PRODUCT

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 topsided compartment for the main busbars, 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. With regard to internal separation, the design complies with IEC 60439.1, Form 4a: the main and vertical busbars being accommodated in their own individual compartment. All functional units, inclusive of terminals for external conductors, are mutually separated and fully segregated from the main and vertical busbars.

Internal separation

(in accordance with IEC 60439-1)

IEC 60439-1 distinguishes so-called forms of internal separation (numbered 1 up to 4), of which the degree of reliability increases the higher the number. Seemingly little, but yet significant difference lies between forms 3b and 4a (shown above). The applied separation in Capitole 40 assemblies is in accordance with Form 4a.

Definitions:

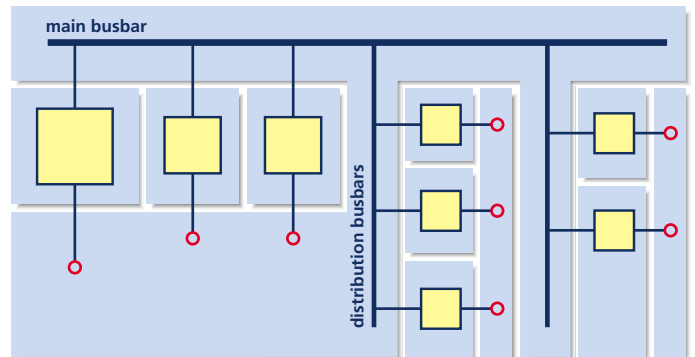
Form 3b

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.

Form 4a

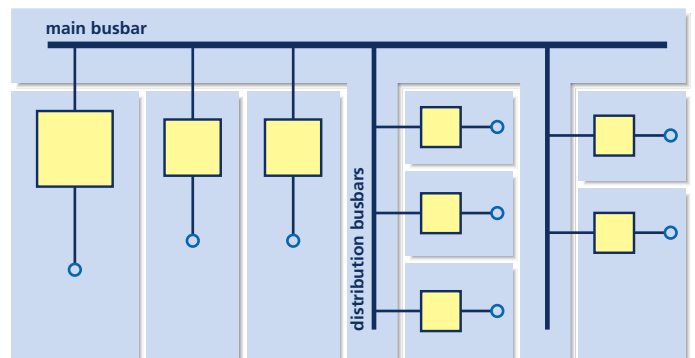
Separation of busbars from the functional units and separation of all functional units from one another, including the terminals for external conductors which are an integral part of the functional unit. Terminals for external conductors in the same compartment as the associated functional unit.

Internal separation Form 3b



- incoming and outgoing functional units
- terminals for external conductors in common cable compartment

Internal separation Form 4a



- incoming and outgoing functional units
- terminals for external conductors integrated in functional unit

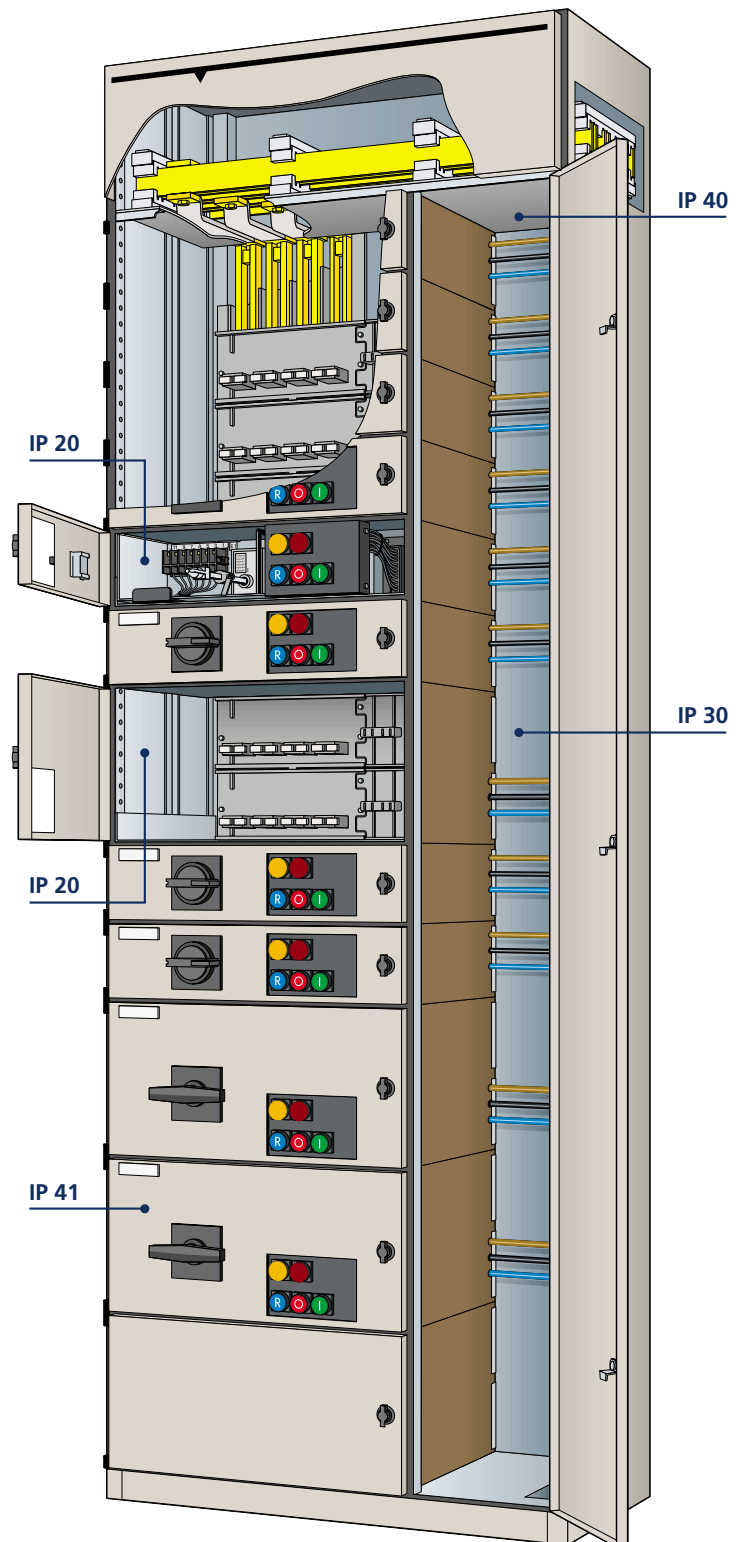
Degree of protection

(in accordance with IEC 60529)

Capitole 40 enclosures have a degree of protection of IP 41. On request, assemblies can be supplied with a degree of protection of IP 54.

Partitioning between live parts in adjacent compartments complies with the following degrees of protection:

- between main busbar compartment and any other compartments: IP 40
- between switchgear and controlgear compartments and cable-entry compartment: IP 30
- between mutual compartments of each functional unit within a cubicle: IP 20
- within opened switchgear compartments: IP 20
- within switchgear compartments with removed drawout units: IP 20.



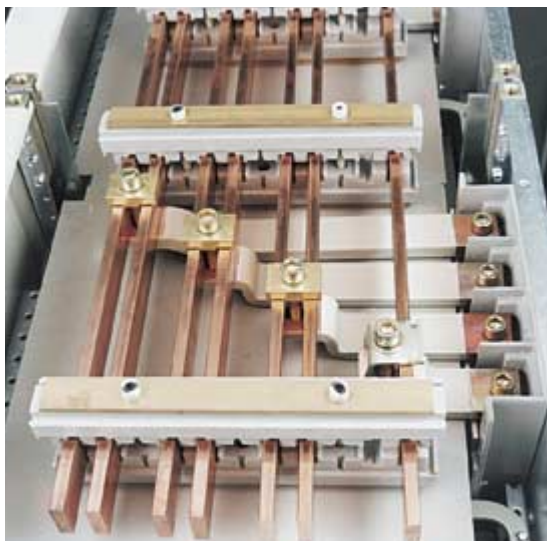
Main busbar system

The main busbars are located in a separate compartment at the top of the switchboard. The compartment has a degree of protection of IP 40 with respect to the lower situated switchgear and the vertical cable-entry compartment.

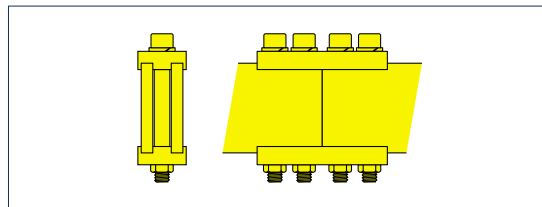
The busbars, phase bars and neutral bar, have a standard thickness of 10 mm and are available for current ratings from 800 up to 6300 A. They are secured by glass-fibre reinforced polyester busbar supports which allow easy, on-site changing of the busbars if uprating of the system current is necessary. 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.

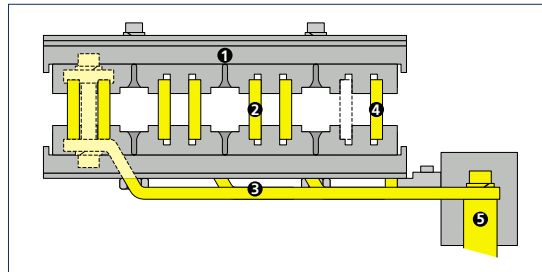
The bottom of the busbar compartment is sealed by a glass-fibre reinforced polyester plate.



Main busbar system with insulated connection bars to distribution busbars.



Busbar coupling clamp for extension of main busbars.



Side view of main busbar system:

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

Horizontal auxiliary supply system

Auxiliary supply system, e.g. busbars, are located in a separate compartment, mounted in front of the main busbar compartment. Max. 8 bars with a current rating of 50 A are available.



Auxiliary busbars in front of main busbar compartment.

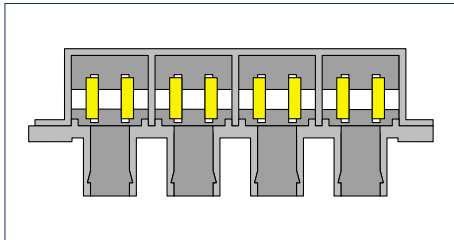
Ratings and cross-sections of main busbars

maximum permissible load current (A)	busbar cross-section (Cu)		short-circuit capacity		
	phase bar (mm)	neutral bar (mm)	I_{cw} kA-1 s	I_{cw} kA-3 s	I_{pk} kA
800	1 x 25 x 10	1 x 25 x 10	35	20	73.5
1000	1 x 35 x 10	1 x 35 x 10	35	20	73.5
1400	2 x 25 x 10	1 x 25 x 10	50	35	110
1700	2 x 35 x 10	1 x 35 x 10	63	50	140
2100	2 x 50 x 10	1 x 50 x 10	80	63	176
2600	2 x 75 x 10	1 x 75 x 10	100	63	220
2900	2 x 100 x 10	1 x 100 x 10	100	63	220
3200	2 x 120 x 10	1 x 120 x 10	100	63	220
3600*	2 x 120 x 10	1 x 120 x 10	100	63	220
4500 ¹⁾	2 x 2 x 75 x 10	1 x 2 x 75 x 10	100	63	220
5000 ¹⁾	2 x 2 x 100 x 10	1 x 2 x 100 x 10	100	63	220
6300 ¹⁾	2 x 2 x 120 x 10	1 x 2 x 120 x 10	100	63	220

*) Natural ventilation; ¹⁾ 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 busbar duct at the back of the cubicle. The busbar duct is partitioned into four sections, each section accommodating a dual busbar as parallel conductor, silverplated at drawout unit level. At the front side 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.



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



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



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



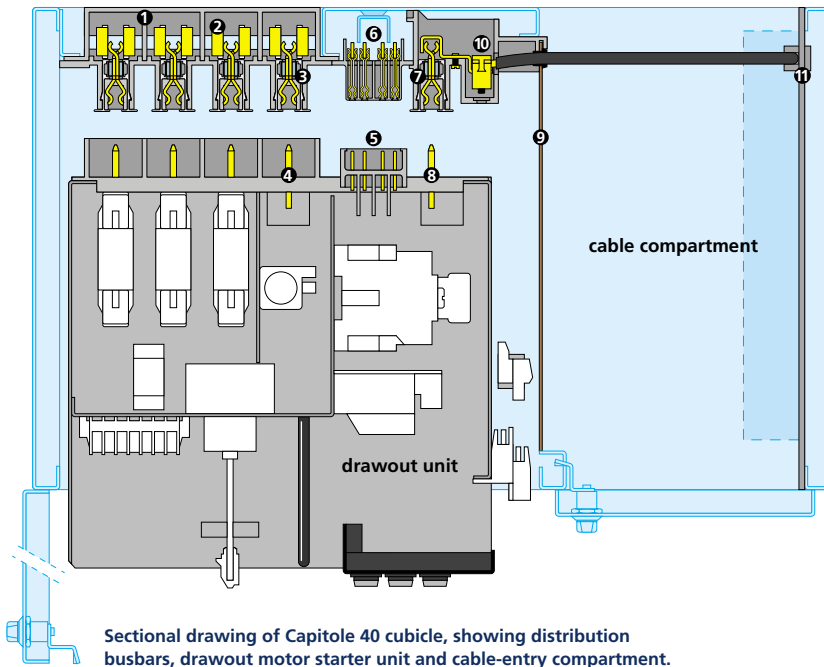
Switchgear and controlgear compartments for drawout units, showing from left to right: scissor contacts to distribution busbars, sockets to auxiliary busbars, and cable terminal blocks.

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.

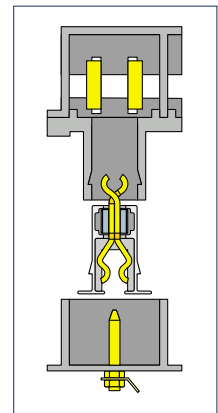
Ratings and cross-sections of distribution busbars

maximum permissible load current (A)	busbar cross-section (Cu)		short-circuit capacity		
	phase bar (mm)	neutral bar (mm)	I_{cw} kA-1 s	I_{cw} kA-3 s	I_{pk}
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

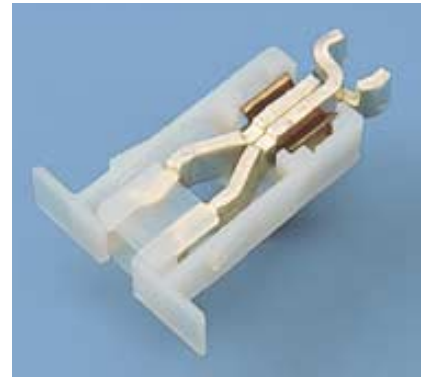


Sectional drawing of Capitole 40 cubicle, showing distribution busbars, drawout motor starter unit and cable-entry compartment.

- | | |
|---|--|
| 1. glass-fibre reinforced polyester busbar duct; | 5. auxiliary busbar connector; |
| 2. parallel busbar conductors; | 6. auxiliary busbars; |
| 3. main isolating scissor-shaped contact; | 7. cable isolating scissor contacts; |
| 4. main isolating contact pins with glass-fibre reinforced polyester phase segregation; | 8. cable-sided contact pins; |
| | 9. screening plate with grommet for cable entry; |
| | 10. cable terminal clamp; |
| | 11. fixing strip for cable clamps. |



Top view of main isolating contact parts.



Typical main isolating scissor-shaped contact.

Branching

Busbar tee-offs in compartments with drawout units are effected by special cassette-mounted (scissor-shaped) main isolating contacts, protected by fuses or MCCBs).

When being fitted into the openings of the busbar screening plates, the contact jaws of the scissor contacts slide between the parallel busbar conductors. When a drawout unit is being fully inserted, the main-current contact pins enter the scissor contacts and slightly force apart the contact blades against the steel contact spring. As a result, proper contact is obtained on both busbar and tray sides.

The scissor contacts can be easily removed, and if required, quickly replaced, even under live conditions.

Cassettes without scissor contacts can be fitted into non-used busduct openings for protection purposes (IP 20).

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 construction*) 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 can withstand a fuse protected short-circuit current of 100 kA.

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

Switchgear and controlgear compartments

Cubicle layout is performed on the basis of specific requirements for operational reliability, personal safety, flexibility and economy. The standardized, modular Capitole 40 system offers practically unlimited possibilities to satisfy customers' demands for high-grade Motor Control Centres.

Incoming feeders and buscouplers

When per cubicle a single section is built-in - 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 screened, whilst buscouplers have terminal screening on left and right sides. Standard available incoming feeders and buscouplers for Capitole 40 MCCs are proven type Dumeco switch-disconnectors up to 3150 A, or small-dimensioned type Aeromat* air circuit breakers 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 Aeromat air circuit breakers as incoming feeder and buscoupler.



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

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.



Close-up view of Aeromat air circuit breaker in Capitole 40 cubicle.

*) Aeromat air circuit breakers range from 1000 A up to 6300 A. For detailed information ask for brochure 1993.030

Outgoing withdrawable units

The 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 faults is 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 front-mounted 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 four-pole plug connection to the vertical auxiliary busbars in the back of the cubicle.



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



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



Capitole 40 cubicle showing partly withdrawn motor starter tray.

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
- a simulated compartment outside the installation.



Compartment separation plate with contact adaptor for two adjacent drawout switchgear units.

Multiple switchgear trays

For smaller motor ratings, an optimum filling factor can be obtained by using two drawout units, side by side, within the standard cubicle width. In that case the compartment separation plate is provided with an adaptation unit which provides the connection between the distribution busbars and the drawout units. Front covers are fixed to the units.



32-drawer system units with fixed front covers.

Application flexibility

Process changes, e.g. uprating 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 under live conditions.

Cable connection

With incoming feeder sections in excess of 1000 A (or outgoing feeders > 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 cable-sided scissor-shaped isolating contacts. The cable-entry compartment is isolated from the switchgear compartments by means of screening plates (IP 30). The standard cable-entry compartment width is 250 mm (375 or 500 mm optional). 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.



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.

Earth bars

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

THE APPLICATION



Cubicles with reduced height.

FIELDS OF APPLICATION

- (Petro)chemical industries
- Refineries
- Gas & oil exploration (on and off-shore)
- Steelworks
- Water treatment plants
- Food industry
- Sugar mills
- Paper mills
- Power stations
- Concrete 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.



Assembly arrangement with corner cubicle.

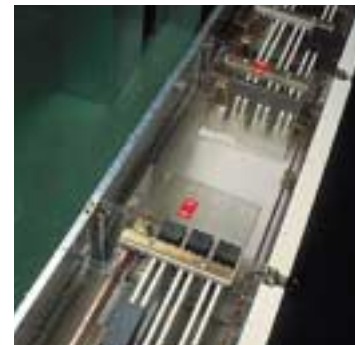


Back-to-back arrangement with interconnected busbar systems.

- Full insulation of main busbar system
- 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
- Integrated PLC-controlled synchronisation and changeover equipment (Otonet system)
- 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).



Fully insulated main busbar system.



Mutually insulated busbar sections.

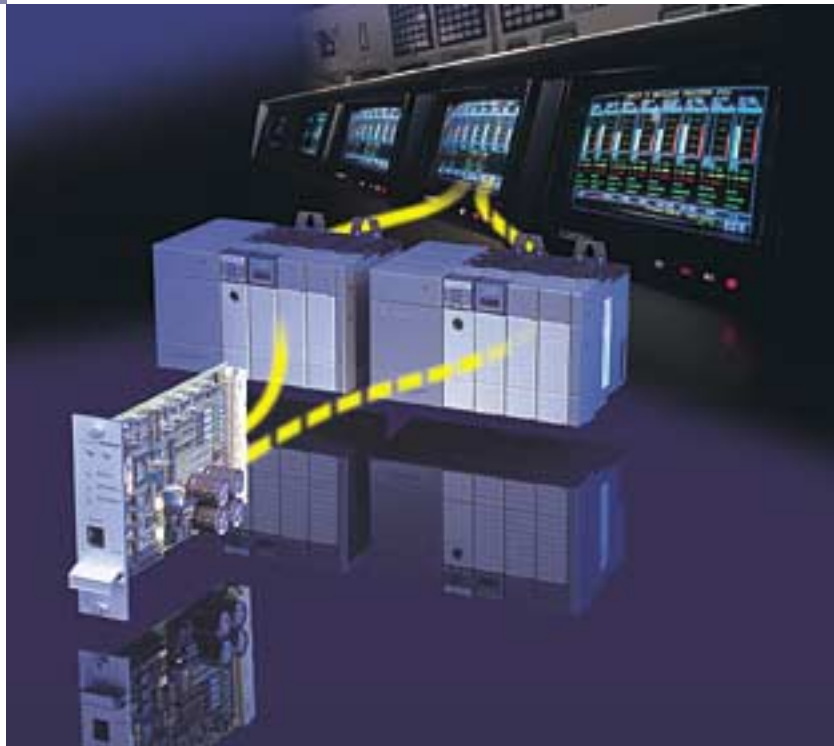


Integrated synchronisation and changeover system, Otonet.

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 Centre and other systems e.g. DCS, SCADA, applying various protocols i.e. Modbus, Profibus, Control Net, Data Highway Plus, etc.

Holec's integrated Clink system provides plant managers with comprehensive data and opportunities to further optimize plant performance, efficiency and productivity. Over the last decade, the Clink system, successfully applied in Holec's Capitole 40 Motor Control Centre has been field-proven world-wide with full appreciation from customers in Europe, the Middle East, the Far East and South America.



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.

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.

Technical data

	Capitole 40	Capitole 40* Main Distribution
rated operational voltage, max.	690 V	690 V
rated frequency	50/60 Hz	50/60 Hz
main busbar system:		
rated insulation voltage (max.)	1000 V	1000 V
rated impulse withstand voltage (max.)	12 kV	12 kV
rated current (max.)	6300 A	6300 A
rated short-time withstand current (max.)	100 kA-1 s	100 kA-1 s
rated peak withstand current (max.)	220 kA	220 kA
vertical distribution busbar system		
rated insulation voltage (max.)	1000 V	1000 V
rated impulse withstand voltage (max.)	12 kV	12 kV
rated current (max.)	1420 A	3550 A
rated short-time withstand current (max.)	80 kA-1 s	100 kA-1 s
rated peak withstand current (max.)	176 kA	220 kA
degree of protection (IEC 60529)	IP 41 (IP 54 on request)	IP 31
segregation (IEC 60439-1)	Form 4a (Form 4, type 5 on request)	Form 2, 3, 4
entry of cables	top & bottom	top & bottom
access	front	front
standard colour	RAL 7035**	RAL 7035**

*) Fixed PCC; combination with Capitole 40 possible. **) All colours can be delivered.

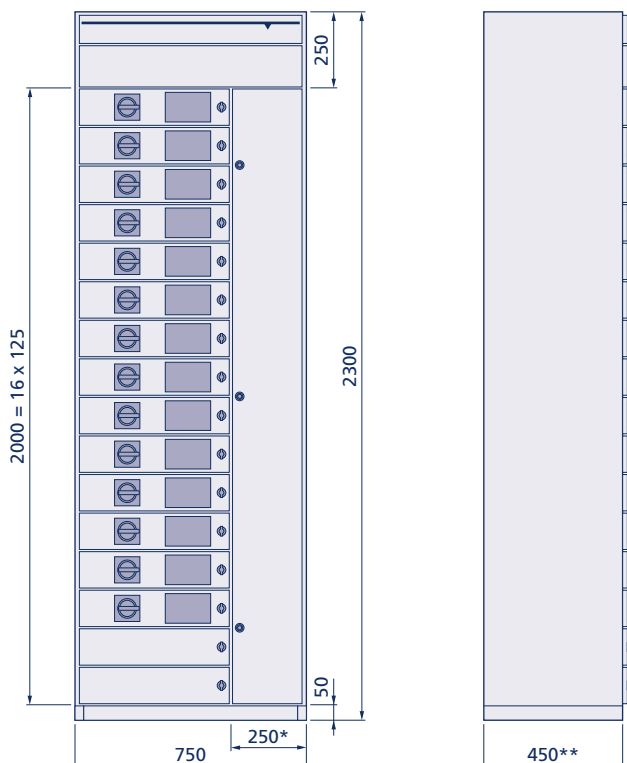
standards:

IEC 60439-1 / EN 60439-1 / NEN-EN-IEC 60439-1 / BS-EN 60439-1
NFC 63-410 / VDE 0660 Teil 500 / NBN C 63-439

certifications:

KEMA-Keur / Lloyd's Register of Shipping

Dimensions (mm)



Capitole 40 cubicles can be mounted back to wall, back-to-back or free-standing.

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.

HOLEC HOLLAND N.V.
ELECTRICAL POWER ENGINEERING

- medium voltage switchgear systems and components
- low voltage switchgear systems and components
- general supplies

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