User manual

DRIESCHER Medium voltage-Compact switchgear ECOS-C

Indoor
SF6-free
Rated voltage 24 kV



STROM • SICHER • SCHALTEN





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General instruction

Read this user manual before installing and commissioning the equipment. Keep this user manual available at the equipment.

The activities described in this user manual may be performed only by qualified electricians authorised by the operating company.

Scope of this manual

This user manual forms the basis for operating and using the ECOS-C medium-voltage switchgear.

Translation of the original German User Manual

1 Introduction

1.1 Copyright

The copyright, and all other protective rights to the contents of this manual, remain in their entirety with DRIESCHER GmbH (Elektrotechnische Werke Fritz Driescher & Söhne GmbH / Driescher GmbH Eisleben).

Printing and reproduction are permitted solely for personal use for your own information in performance of the work.

1.2 Hazard signs

Instructions that are important for safety or other reasons are marked in this manual with the following pictograms for "DANGER", "ATTENTION", "CAUTION", and "NOTICE". For hazards that arise from high voltages, the special pictogram for hazardous voltages is also used.



DANGER: Danger that can lead to personal injuries or death.



DANGER: High voltage, danger of death

Immediate danger of death or serious personal injury due to touching live high-voltage parts.



ATTENTION: Danger or unsafe procedure which may result in serious personal injuries or major damage to property.



CAUTION: Danger or unsafe procedure which may result in significant personal injuries or damage to property.



NOTICE: Additional information to make the subject matter easier to understand, and pointers to further sources of information or documentation.

1.3 Guarantee and indemnification

Without approval by DRIESCHER this document may not be changed during the warranty period. Any liability of DRIESCHER for damages, be they of a direct, immediate or remote nature, as direct or indirect consequence of changes to this document after expiry of the warranty period and/or of unauthorised changes to this document during the warranty period, is expressly excluded.

1.4 Basis of the user manual

This user manual is based on the following standards:

- EN 62271-1:2017 [IEC 62271-1], chapter 11
- EN 62271-100:2017 [IEC 62271-100], chapter 10
- EN 62271-200:2012 [IEC 62271-200], chapter 10

1.5 Associated documents

The following documents are associated with this manual: Job-specific electrical circuit diagram Manuals for optional protective relays and other additional components Factory instructions National regulations such as:

- Accident prevention regulations, DGUV V3 (Germany)
- 5 safety rules, and more ...



- During all operations, please comply with the instructions regarding
- Tightening torques
- · Erection of parts or assemblies
- Test and failure criteria

1.6 Quality Assurance

DRIESCHER GmbH is certified according to ISO 9001:2015.

1.7 Type testing

The ECOS-C medium-voltage switchgear unit has been type tested according to EN 62271-200 [IEC 62271-200]. The results of the tests are recorded in the test reports.

The type tests tested the operational capability and safety of the equipment in normal operation and under fault conditions. The test reports are available on request.

1.8 Manufacturing standards – conformity

DRIESCHER declares on its own responsibility that the ECOS-C product satisfies the specified standards and provisions. This declaration relates to all the product variants that are described in this document, and to the design and manufacturing drawings and images that have been prepared.

• EN 50110	Operation of electrical equipment Part 1:2013 General requirements Part 2:2010 National appendices
• EN 50180:2017 Ducts for voltages above 1 kV and up to 52 kV and currents from 250 A to kA for liquid-cooled transformers	
• EN 60529:2013	Types of protection through casings (IP code)
• EN 60721 Classification of environmental conditions part 3-3:1997 Classes of environmental impacts and their limit values; fixed installation, weather-pro-	
• EN 61243-5:2001	Working on live equipment - voltage testers part 5: Voltage test systems
• EN 61869	Instrument transformers Part 1:2016 General requirements Part 2:2012 Additional requirements for current transformers Part 3:2011 Additional requirements for inductive voltage transformers
• EN 61936-1:2014	Electrical power equipment with rated AC voltages above 1 kV
• EN 62271	High voltage switchgear and switching systems Part 1:2011 Common provisions Part 100:2017 High voltage AC circuit breakers Part 200:2012 Metal-clad AC switchgear for rated voltages above 1 kV and up to and including 52 kV
• ISO 9001:2015	Quality management systems

2 Safety

HIGH VOLTAGE, DANGER OF DEATH The ECOS-C medium-voltage switchgear unit is designed for rated voltages up to 24 kV and is subject to the applicable national and international regulations for high-voltage operations.

The switchgear can be operated only when it is in the enclosed condition. Safety devices may not be switched off or disabled. If the regulations in respect of safe working practices are disregarded, malfunctions and damage to the switchgear or parts thereof, together with injuries and impairment of health of personnel, may occur. Comply with the statutory and operational provisions for safe working practices!

2.1 General Safety Instructions

The ECOS-C medium-voltage switchgear unit is manufactured according to current technology and in compliance with recognised safety standards. Nevertheless hazards and effects on users and third parties may arise during operation.



High voltage, danger of death

During operation of the switchgear, parts of the equipment are live at high voltages.

- Do not remove any guards.
- Do not reach into any openings.
- Comply with the safety instructions listed in this manual, the applicable national and international regulations for accident prevention and the internal working instructions, operating instructions and safety instructions.
- · Faults which may affect safety must be rectified immediately.

2.1.1 Use for the intended purpose

The ECOS-C medium-voltage switchgear unit is intended exclusively for the distribution and switching of electrical energy. It may be operated only by competent persons authorised by the operating company, who are qualified in terms of the applicable statutory regulations and the applicable national and international standards and guidelines. Usage for any other purpose is deemed to be improper use and can give rise to risks to life and limb or personnel and risks of damage to property.

The ECOS-C medium-voltage switchgear unit may be used only when in a technically fault-free state. The instructions listed in this manual must be complied with.

The operating company bears sole liability for all injuries and damages arising from improper use of the equipment or parts thereof, or use of the equipment or parts thereof for purposes not approved by the manufacturer.

Any modifications to the product require approval in advance by the manufacturer and must be documented accordingly.

The applicable laws and other statutory ordinances, standards and regulations must be complied with in addition to the chapters of this manual.

2.2 Operational safety instructions

2.2.1 The 5 Safety rules

The following 5 safety rules must be complied with whenever work is being performed on the equipment:

1. Disconnect the equipment and isolate it in all respects

Before starting work, disconnect the electrical equipment by isolating the current-carrying parts at all phases.

Example: Switch off the equipment and remove the fuses.

2. Secure it against being switched on again

Prevent any possibility of accidentally switching on the equipment on which work is being done. Example: Keep the fuses in your personal possession, lock all switches, lock isolating switches and hang a prohibition notice

3. Check that the equipment is free of voltage

The person in charge of the work must use appropriate tools to check that the equipment is voltagefree. Prior to this the measurement tool must have been checked to demonstrate its working order. *Example: use suitable voltage testers to check all phases for phase-to-phase and phase-to earth voltages.*

4. Earthing and short circuiting

Earth all current-carrying parts with short circuit-proof earthing conductors and short-circuit devices. Take care in cases where downstream energy feeds may be present (e.g. solar power systems, ring mains and emergency back-up power systems).

5. Fit protection against touching adjacent live equipment

If live equipment adjacent to the hazard area cannot be switched off, these must be clearly indicated in the form of barriers and warning notices or other instructions.

DANGER:

Functional testing of the voltage tester

Before testing to establish that the switchgear is voltage-free, using the Horstmann Orion Compare voltage tester (see chapter 8.2.1 Special Tools) or using another type of voltage tester according to EN 61243-5 [IEC 61243-5], a functional test of the voltage tester is to be performed.



Earthing a live conductor creates a short circuit to earth, which will cause the protective devices to trip.

• Before connecting a conductor to earth, make sure it is voltage-free.

2.2.2 Duties of the operating company



DANGER: High voltage, danger of death

Defects or damage that affect the operational safety of the equipment must be reported to the manufacturer immediately and rectified without delay. Such equipment must not be operated.

Unauthorised modifications to the equipment cancel any liability of the manufacturer for direct and consequential damage arising.

No modifications that may affect safety may be made to the equipment without the manufacturer's authorisation.

Optional components of the equipment, such as protective relays and motorised charging of the spring drive, must satisfy the technical requirements specified by the manufacturer.

Only original spare parts from the manufacturer may be fitted.

The activities described in this user manual may be performed only by qualified electricians authorised by the operating company, who hold the statutorily required authorisation certificate for switching activities.

2.2.3 Qualification and requirements of personnel

Qualified personnel in the sense of this manual are persons engaged in the transportation, erection, commissioning and operation of the equipment, and who are appropriately qualified to perform such work.

The operating personnel must be competent. Competent personnel have appropriate training and experience, such that they are in the position to recognise and avoid hazards that can arise from electrical voltages.

Such personnel must be authorised to perform switching, i.e. they must be qualified as required by the national guidelines and the applicable statutory provisions.

The personnel must be instructed about all necessary accident prevention regulations and safety regulations.

The personnel must be instructed in the use of the necessary and reasonably expect safety equipment.

The personnel must be aware of the applicable national and factory regulations in respect of operation of high-voltage equipment.

The personnel must have read this user manual.

The person responsible for the equipment must be informed before any work is commenced.

No work on the equipment may be performed without the agreement of the person responsible for the equipment.

2.2.4 Fire prevention requirements

The relevant national and factory fire prevention regulations and guidelines must be complied with. In other countries the relevant national regulations must be complied with.



3 Technical description

3.1 Technical data switchgear

Switchgear ECOS-C 20 kA EN 62271-200					
Rated voltage			24 kV		
Rated short-time power frequency withstand voltage			50 kV		
Rated lightning impulse withstan	d voltage	Up	125 kV		
Rated frequency		f _r	50 Hz		
Rated short-time current		lk	20 kA		
Rated short-circuit duration		t k	3 s		
Rated surge current		I _p	50 kA		
Rated operating current			630 A		
Rated operating current, busbar			630 A		
Permissible ambient temperature	e in operation*	Т	-25° +40° C		
Max. permissible relative humidit	ty in operation	rH	< 90% non-condensing		
Fault arc qualification			IAC FL 20 kA 1s / IAE 0,5 kA 1 s		
Service continuity category			LSC 2		
Partition class			PM		
Index of protection of equipment enclosure			IP 2X		
Index of protection of switching and busbar unit			IP 63		
Installation height			no limit		
Pressure relief			downwards		
Insulating medium	nsulating medium Midel 7131 - synthetic, dielectric liquid based on ester, se chapter 8.3 Operating Materials and Consumables				
Dimensions of the equipment	see chapter 3.4 Dimensions and Floor Recesses				

*dependent on secondary equipment

3.2 Technical data of the circuit breaker

Circuit breaker EN 62271-100				
		ECOS-C 20 kA		
Rated voltage	U _r	24 kV		
Rated short-circuit duration	tĸ	3 s		
Rated short-time current	lk	20 kA		
Rated surge current	I _p	50 kA		
Rated short-circuit breaking current	lsc	20 kA		
Rated operating current	۱ _r	630 A		
Electrical working life		E1		
Mechanical working life		M2		
Rated switching sequence		O - 0,3s - CO - 180s - CO		
Extinguishing medium		Vacuum		
Actuation		Manual / motorised drive		

3.3 Function and design

3.3.1 Performance profile

The ECOS-C medium-voltage switchgear unit has been tested according to EN 62271-200 for its ability to withstand fault arcs.

All electrical conductive parts are single-phase insulated, field controlled, fully protected against being touched and metal-clad.

The electric arc is extinguished in a hermetically sealed vacuum interrupter.

Earthing is always performed via the circuit breaker.

The ECOS-C medium-voltage switchgear unit contains no SF6.

The external insulation of the vacuum interrupter and the busbar system is provided by "MIDEL 7131", an environmentally-friendly synthetic ester-based dielectric insulating fluid. MIDEL 7131 is characterised by the following advantages:

- environmentally-friendly
- easily biologically degradable
- does not pollute water
- non-toxic
- In conformity with RoHS
- high flashpoint of >300 °C (K3)
- stable even at extreme fluctuations in temperature.

3.3.2 Design features

Thanks to the single-phase metal-clad enclosure of the busbars and the circuit breakers, the risk of a three-phase short-circuits and resulting electric arcs is practically excluded.

If a fault arc occurs in the cable connection chamber, the pressure relief is downwards into the false floor.

Because of the offset arrangement of the externally tapered ducts, connecting up the medium-voltage cables from the front is very easy using simple-to-fit, angled plug-in cable connectors.

If required, additional surge arresters can be connected at the cable plug connectors.

The cable converter instrument transformers are located in the cable terminal compartment.

At the back of the equipment, underneath the phase tubes, there is space for installation of a limited number of voltage transformers for selective detection of short circuits to earth or auxiliary power supplies to various different consumers.

Switch bays can optionally be provided with motorised charging of the spring drive.

A secondary cabinet may be required depending on the protective relay.

3.3.3 Vacuum interrupter technology



Vacuum interrupter

The vacuum interrupter has been proven over decades in service. The excellent and sustainable switching behaviour and the outstanding dielectric characteristics are the advantages of this switching technology.

The vacuum interrupter is a self-contained hermetically sealed system that can be installed in any location.

The characteristics of the vacuum interrupter are small switching elements with a short stroke and high performance.

Neither gases nor electric arcs are released during the switching cycle.

The interrupter generates neither oxides nor extraneous substances.

When the contacts of the vacuum interrupter open to interrupt the current, an electric arc is formed (metal vapour carrying a high current density), which extinguishes itself at the next zero crossing. The separation distance is then filled with fluid at the dielectric strength.

The contact opening is only a few millimetres and thus permits a low-power drive mechanism with short intrinsic switching times.

Vacuum interrupters are maintenance-free throughout the entire working life.

3.3.4 Design of the switch unit

• The single-phase insulated switch unit and busbar system is installed in a corrosion-resistant stainless steel enclosure, which is filled with an environmentally-friendly synthetic esterbased dielectric insulating fluid.

• At the interface between the switch system and the mechanical drive there is a phase tube seal with an integral shaft bellows. This acts as a seal for the switching system.

• Several switching systems for a phase form a busbar unit.

• One switch system for the phases L1, L2 and L3 form a switch unit. The phases of a switch unit are linked to each other by the control mechanism.







3.3.5 Design of the switch system

- Cast resin duct with external taper for the cable connection using a plug connector system to DIN47636, current rating: 630 A, M16 screw thread
- 2. Power vacuum interrupter
- 3. Pre-selector switch for connection to either the busbar or earth
- 4. Busbar made of copper
- 5. Isolator for activating the vacuum interrupter
- 6. Phase tube made of stainless steel
- 7. Insulation material: Cast resin and hard dielectric: Insulating fluid
- 8. Isolator for activating the vacuum interrupter and the pre-selector switch busbar / earth
- 9. Earth contact
- 10. Phase tube termination



Functional features

a) The switching movement of the contacts within the vacuum interrupter (2) is performed axially by the drive lever (8).

b) The switching movement of the pre-selector switch (3) is performed radially by rotating the drive lever (8) through 180°.

c) Each switch unit incorporates a spring drive for the vacuum interrupter. This powers an actuation mechanism which mechanically links the three individual switch systems and moves them.

d) A phase tube termination with integral shaft bellows (10) is fitted to the switch system; this provides a seal for the switch system.

e) The volumetric balancing of the insulating fluid is performed by an equalising tank. The phase tube casing and equalising tank are linked by stainless steel pipework

3.3.6 Design of the switchgear

High voltage part

- 1. Three single-phase insulated switch systems are arranged one above the other.
- 2. Connection of the MS cable is performed at the front using angled cable plug connectors for external tapers to DIN 47636
- 3. Capacitive voltage display for the input cables
- 4. Transformer mounting plate for attaching the cable changeover instrument transformers.
- 5. Cable attachment using cable clamps (strain relief).
- 6. Insulating fluid level sight glass
- 7. Equipment earth

Mechanism and position displays

- 8. On and off buttons for the circuit breaker (CB).
- 9. Position display CB ON / OFF
- Pre-selector switch EARTH / BUSBARS.
 When the circuit breaker is switched on, the pre-selector switch is mechanically locked.
- 11. Position display pre-selector switch EARTH / BUSBARS
- 12. Actuation mechanism

Switch enclosure

- 13. Front fascia of the upper cable connection chamber.
- 14. Front fascia for the lower cable connection chamber / instrument transformer chamber.
- 15. Operating key with storage on the side wall of the enclosure.
- 16. Front cover plate of the top drive area.
- 17. Voltage transformer chamber







Side sectional view

3.3.7 Behaviour in the event of internal faults

The ECOS-C medium-voltage switchgear unit has been type tested according to EN 62271-200 for its behaviour in the event of internal faults. When a fault occurs, pressure relief is downwards. (see the diagram below).



The clear height of the exhaust opening in the cable duct under the ECOS medium-voltage switchgear unit must be at

- Floor opening
- Direction of pressure relief
- Expanded metal (provided on site)
- Exhaust pressure = 220 mbar

Erection in type-tested substations

Transformer substations and false floors according to EN 62271-202 must be tested as a whole for their behaviour in the event of internal faults. In this case buildings, doors and false floors amongst other features must be able to withstand the MS switchgear blow-out pressure



Test set-up for determining behaviour in the event of internal faults with a transformer substation according to EN 62271-202.

Internal area arrangement - site-mixed concrete

Transformer substations according to EN 61936-1 with site-mixed concrete are generally unique items and thus cannot be type tested.

For this purpose a calculation must be submitted to demonstrate that in the event of a fault the station and false floor can withstand the exhaust pressure of the switchgear.

- The size of the openings for pressure relief must correspond to the number of panels (see chapter 3.4 Dimensions and Floor Recesses).
- Refer to the manufacturer's data for the design of a suitable expanded metal plate.
- Please contact DRIESCHER to perform the calculation of the pressure in transformer substations with site-mixed concrete. The calculation must take into account amongst other things the other equipment that is installed, such as low-voltage switchgear combinations.

3.3.8 Option – motorised drive for the main spring



Operating voltage	Rated current
24 V DC	4 A
48 V DC	2 A
60 V DC	1,6 A
110 V DC	0,9 A
230 V DC	0,65 A

One motorised drive per switch panel.

Each switch panel of the ECOS-C medium-voltage switchgear unit can be fitted with a motorised drive, to enable remote operation. The motorised drive automatically charges the spring drive as required.

The manual drive (operating key) is unaffected by the motorised drive. (When using the manual drive, be sure to rotate the operating key fully to the stop.). The operating voltages 24, 48, 60, 110 V DC or 230 V AC are available for selection (other operating voltages on request).

3.3.9 Option - digital protective relay

Three types of digital protective relay (some in conjunction with manual drives) can be integrated directly into the ECOS-C medium-voltage switchgear unit. Use of these variants can obviate the need for an additional, secondary cabinet. In each case the feasibility must be checked in advance with the manufacturer.

Examples:



Digital protective relay DSZ 4 RN1



Digisave digital protective relay



Digital protective relay IKI30

3.3.10 Option - secondary cabinet

The ECOS-C medium-voltage switchgear unit can be fitted with a secondary cabinet for the installation of manufacturer-independent protection and measurement systems. The secondary cabinet can be removed for transportation and installation because the internal electrical connections are established with plug-in system.





Secondary cabinet

3.3.11 Option - Heater

The ECOS-C medium-voltage switchgear unit is intended for indoor use. A heater with integrated thermostat can be used where installation conditions have minimum temperatures below -5° C and down to -25° C, or extremely high atmospheric humidity (> rH 90%). An operating voltage of 230 V AC is required for this.



Heater with thermostat



3.3.12 Option - Measurement panel

A separate measurement panel suitable for the ECOS-C unit is available in a similar tested enclosure (air-insulated). The purpose of the measurement panel is to accommodate current transformers and voltage transformers that are used for measurement and protection.

3.3.13 Other options

Current converters (split core transformers) and surge arresters can be fitted in the cable connection chamber. The circuit breakers are available with a variety of electrical equipment. Auxiliary contacts with position displays rated 24, 48, 60, 110 and 220 V DC and also 230 V AC are available for switching the circuit breaker on and off electrically.

3.4 Dimensions and Floor Recesses



The medium-voltage switchgear ECOS-C can be supplied with 2 to 7 switch panel and a separate measurement panel.

A gap of at least 50 mm on the sides and 15 mm at the back must be left between the ECOS-C medium-voltage switchgear unit and the wall. For maintenance reasons, we recommend a distance of 100 mm from the switch panel to the building wall (at the sides as well as towards the rear).

NOTICE

Appropriate openings must be provided because pressure is relieved downwards from the ECOS-C when a fault occurs. Different floor openings must be created for the switchgear unit depending on the number of panels.

	2 panels	3 panels	4 panels	5 panels	6 panels	7 panels
Height (mm)	1400	1400	1400	1400	1400	1400
Width (mm)	650	890	1130	1370	1610	1850
Depth (mm)	1040	1040	1040	1040	1040	1040
Secondary cabinet Height (mm)	500	500	500	500	500	500
Secondary cabinet Depth (mm)	398	398	398	398	398	398
Overall height (mm)	1900	1900	1900	1900	1900	1900







A= Floor recess B= Floor attachment C= Wall of the building

* See note on the previous page.



3 panel







4 panel



Personal injury and damage to property

The floor recess (A) must not be sealed. The pressure relief of the switchgear is performed via this opening in the floor.

(347)

(022)

230

80

(130)

230

8

1040

(407)

1040

B ECOS-C







7 panel

DANGER Personal injury and dam

Personal injury and damage to property

The floor recess (A) must not be sealed. The pressure relief of the switchgear is performed via this opening in the floor.

1

3.5 Schematic diagram



Busbar connection T0



Legend	Circuit breaker / busbar connection
-QA1	Circuit breaker
-QZ1	Pre-selector switch
-PF1	Capacitive voltage display for the input or output cables
-BC1	Split-core type current transformer
-FA9	Surge arrester

acc. to IEC 81346

Measurement panel



Legend	Measurement panel
-PF1	Capacitive voltage display for the input or output cables
-BC11	Current transformer
-BA11	Voltage transformer

16566	Circuit breaker without secondary cabinet												
	Coil Auxiliary contacts					Coils				Message / motor			
	Coil off	Off	On	Off	O	Busbar	Earth	Wiper	Coil on	Coil off	Spring charged	Slide open	Motor drive



Variant					
10		•			
11	٠	•			
20	•	•			•
21		•	•	•	•
22	•	•	•	•	•
23					
24					•
25		•			•



4 Transportation and storage

4.1 Handling instructions

The following pictograms with their associated meanings apply to transportation and storage:

<u>††</u>	Тор
Ţ	Handle with care
$\overset{\bullet}{\Sigma}$	High centre of gravity
	Protect against heat
Ť	Protect against wet
ß	Do not step on the equipment
\bowtie	Do not stack
-34	Max. permissible tilt
Â	Refer to lifting instructions
-275-	Permissible temperature



4.2 Transport



DANGER

- Use the lifting points provided - Note the weight, dimensions, and centre of gravity.
- Do not tilt the equipment more than 30°.



DANGER

Protection of personnel

- Ensure that no personnel remain in the hazard area.
- The equipment may be suspended using transport slings only where the transport slings have a length (L_{min}) equal at least equal to the width of the equipment (Lb) times a factor of 1.1:
 → L_{min} ≥ 1,1 x L_b
- If this is not practical, a suitable lifting beam must be used.
- Equipment for transport and lifting must have a current safety test certificate for the required working load.



DANGER High voltage, danger of death

- If the switchgear is damaged in any way it must not be switched on.
- Inform the manufacturer.

Suspension using a lifting beam (not included in delivery)



Suspension using transport slings

Lmin \geq 1,1 x Lb

- Two transport eyes are provided for lifting by crane
- If the equipment is listed using transport slings the rule is: $L_{min} \ge 1,1 \times L_b$
- The sling length (L_{min}) must be at least equal to the width of the equipment (L_b) times a factor of 1.1 (*for the dimensions of the equipment see chapter 3.4 Dimensions and Floor Recesses*).

4.3 Storage

If the switchgear or parts of it or accessories to it are placed in storage, a suitable storage location must be selected or created.

Equipment should be stored dry and protected against the effects of weather, solar radiation and dust. Permissible storage temperature: -25° C to $+70^{\circ}$ C.

Max. permissible relative humidity < 90 % rH, non-condensing.

Store the equipment in an upright position so that the transport eyes are at the top of the equipment. During transportation, the equipment must not be tilted more than 30°.

The national and international standards must be complied with.

Maximum total weight						
Variant	without secondary cabinet	with secondary cabinet				
2-panel switchgear:	approx. 615 kg	approx. 675 kg				
3-panel switchgear:	approx. 790 kg	approx. 860 kg				
4-panel switchgear:	approx. 965 kg	approx. 1045 kg				
5-panel switchgear:	approx. 1140 kg	approx. 1230 kg				
6-panel switchgear:	approx. 1315 kg	approx. 1415 kg				
7-panel switchgear:	approx. 1490 kg	approx. 1600 kg				

Insulating fluid		
Quantity per switch panel	approx. 15 kg	approx. 15 kg

The data listed for the total weight represent the maximum expansion. Depending on the degree of expansion the total weight will be less.

5 Erection and installation

5.1 Safety instructions



DANGER Use the lifting points provided

- Note the weight, dimensions, and centre of gravity!



DANGER Protection of personnel

- Make sure that no personnel remain in the hazard area!



DANGER

High voltage, danger of death

- If the switchgear is damaged in any way it must not be switched on.
- Inform the manufacturer.

5.2 Erection

The ECOS-C medium-voltage switchgear unit is delivered ready for connection. Sufficient access space must be allowed around the location of the medium-voltage switchgear. (For the dimensions of the equipment see chapter 3.4 Dimensions and Floor Recesses)

5.3 Installation

1. Place the switch bays in their intended locations. The medium-voltage switchgear can be installed directly on the floor or on a prepared support fabrication (according to EN 62271-200).

2. Remove the front fascias at the top and bottom, the front frames at the top and bottom and also the service covers.

3. Attach with 10xM10 bolts. Tightening torque 32 Nm.

4. Refit the front fascias, front frames at the top and bottom and also the covers.

5.4 Installation and earthing the cable connections

Only plug-in cable connectors, Cellplux type (Company Cellpack) are to be used.



DANGER

High voltage, danger of death

Compliance with the 5 safety rules (see chapter 2.2.1 Five Safety Rules) is essential whenever work is being performed on the switchgear.
All open connection cones must be covered as protection against being touched.



Example with Cellplux CTS cable plug connections



Example with Cellplux CTKSA overvoltage surge arresters.

- Refer to and comply with the respective manufacturer's installation manual for end cap installation.

Schematic diagram:

- 1. Current transformer
- 2. Cable screen
- 3. Conductor

- The cable screen must be brought through the current transformer and earthed.

Cover open connection cones

The switchgear must not be operated using open connection cones; instead these must be fitted with screwon insulating caps of the correct voltage rating as protection against being touched. We recommend the use of Cellplux CIK 630 A 24 kV insulating caps. (Company Cellpack).

Recommended cross-section of the medium-voltage cables

To prevent excessive heating in the switchgear, the cross-section of the medium-voltage cables must be specified so that in normal operation the conductor temperature does not exceed 60 °C.



Refer to the manufacturer's data for the medium-voltage cables and the design and temperatures in operation.



6 Commissioning and operation

6.1 Safety instructions



DANGER High voltage, danger of death

Switching on may be performed only by authorised and competent personnel! When switching on the equipment, make sure that no personnel are working on it and that all the cladding elements on the equipment are closed and properly secured.



DANGER

Personal injury and damage to property

Switching on defective switchgear can lead to serious personal injuries and major damage to property.

In such cases the switchgear must on no account be switched on, instead the manufacturer must be informed.

6.2 Commissioning



DANGER

High voltage, danger of death

Compliance with the 5 safety rules (see chapter 2.2.1 Five Safety Rules) is essential whenever work is being performed on the switchgear.

- 1. Check the level of insulating fluid in the sight glass (the level must be above the "min" mark)
- 2. Check the switch position of the switch unit
- (Pre-selector switch to BUSBAR, switch position OFF).
- Connect the grid voltage and check the voltage using a VDS capacitive voltage display according to EN 61243-5 or another test device.
- 4. Charge the main spring to the stop.
- **5.** Press the ON button.
- 6. Once the main spring has been charged again, an ON/OFF/ON switching sequence is enabled.

Operations for connecting the infeed:

Check phase balance at the nearest infeed and switch on the infeed. Switch on a tested infeed.



DANGER

High voltage, danger of death

The pre-selector switch for the switch disconnector or circuit breaker for the branch that is switched off and is to be switched on must be set to "busbar" to permit subsequent switching on.

6.3 Operation

Operation of the switchgear is performed via the spring drive (6) and pre-selector switch (5) by turning the operating key supplied *(see chapter 8.2.1 Special Tools)* in the direction of rotation shown on the front fascia.



- 1. Position display LS ON/ OFF
- 2. Pre-selector safety valve (5) locked in Position ON
- 3. Circuit breaker (CB) ON/OFF button
- 4. Display of spring pre-charging drive
- 5. Pre-selector
- 6. Manual charging, main spring
- 7. Pre-selector switch position indicator Busbar or earthing
- 8. Optional: Electronic protective relay
- **9.** VDS capacitive voltage display according to EN 61243-5:2001 [IEC 61243-5] on the cable side
- 10. Mechanical cycle counter CB
- **11.** Insulating fluid level sight glass

The settings on the front fascia have the following meaning:



- Pre-selector switch (5) to busbar
- Circuit breaker (3) switched on
- Pre-selector switch (5) to busbar
- Circuit breaker (3) switched off
- Pre-selector switch (5) to earthing
- Circuit breaker (3) switched off, not earthed
- Pre-selector switch (5) to earthing
- Circuit breaker (3) switched on, earthed

If motorised charging is fitted, the spring drive (6) is charged automatically. The spring drive (6) can be charged again whilst the equipment is in operation, using the operating key (see chapter 8.3.2 Special Tools). It is then ready to perform an OFF-ON-OFF switching cycle.

6.4 Switching



• Each switch panel is provided with a drive system for manual operation. The operating key supplied *(see chapter 8.2.1 Special Tools)* allows all 3 phases of each switch panel to be switched. The spring elements fitted ensure correct fast switching, both ON and OFF.

• The circuit breaker can be switched only when the pre-selector switch has been correctly changed over through an angle of 180°.

6.5 Changing over the pre-selector switch

NOTICE

The pre-selector switch is changed over by turning it through 180° using the operating key.

Switch off the circuit breaker Change over the pre-selector switch (to "Earth" or "Busbar") Then close the circuit breaker by pressing the "ON" pushbutton

6.6 Voltage display

The capacitive voltage taps are fed to the front fascia and are displayed by the WEGA 1.2 voltage display in accordance with the VDS system to EN 61243-5:2001.

The display device has test sockets for connecting the Orion Compare (Company Horstmann) voltage test and phase balance device, or another suitable test device according to EN 61243-5 (see chapter 8.2.1 Special Tools, and also the separate user manual).





DANGER

High voltage, danger of death

Switching on may be performed only by authorised and competent personnel. When switching the equipment on, ensure that no personnel are working on it and that all the cladding elements on the equipment are closed and properly secured.



DANGER Bhasa imbalanasa wil

Phase imbalances will lead to short circuits When checking the phase sequence, use only phase comparison devices suitable for measurements on switchgear.

6.7 Earthing the input or output cables



DANGER High voltage, danger of death

Compliance with the 5 safety rules (see chapter 2.2.1 Five Safety Rules) is essential whenever work is being performed on the switchgear.

- 1. Press the OFF button to switch off the circuit breaker.
- 2. Switch off the grid voltage.
- **3.** Use a test device to check that the input and output cables are dead (see the safety provisions).
- 4. Open the safety flap, set the pre-selector switch to "Earth" and close the safety flap again.
- 5. Charge the main spring to the stop.
- 6. Push the "ON" pushbutton for the circuit breaker. This earths the output cable.

6.8 Testing the cables



High voltage, danger of death

- Compliance with the 5 safety rules (see chapter 2.2.1 Five Safety Rules) is essential for all work on the switchgear unit.
- Furthermore the following points must be complied with:
 - The installation and user manuals for the switchgear must be complied with
 - The standard EN 62271-200
 - The manufacturer's data on the cable plug connector
 - The type of the cable (paper-composition cable, PVC or VPE cable)
 - Comply with the conditions on the reverse of the MV cable.

To perform a cable test on the connected MV cables, contact the manufacturer. Unless advised to the contrary by the manufacturer, the MV cables should be disconnected by the operating company or the authority performing the work (*for disconnection and earthing of the cables see chapter 6.7 Earthing the Input and Output Cables*).

6.9 Insulating fluid level sight glass

A level sight glass is incorporated in the panel of the front fascia. This allows the current level of the insulating fluid to be read reliably at any time. The level is indicated by the green float sphere in the sight glass. The level of the insulating fluid changes depending on the operating ambient temperature. At very low operating ambient temperatures the level may fall significantly. As long as the float sphere is above the "Min" mark, reliable operation is assured.

In the event that the float sphere is at the minimum for equipment temperatures above 0° C , it is essential that the manufacturer is informed.





• Since the switch contacts are switched under vacuum, the circuit breaker can be switched on and off at any time, irrespective of the fluid level.

• In the event that with the temperature of the equipment above 0 °C the insulating fluid float sphere is at the minimum, the manufacturer must be informed.



DANGER

Changing over when the fluid level is at "Min"

• Changing over the pre-selector switch when the fluid level is at "Min" can lead to a short-circuit to earth or between phases, and is not permitted.

6.10 Mechanical switching cycle counter

Each switch panel is equipped with a mechanical switching cycle counter for the drive and the vacuum interrupter. This counter is mounted on the front fascia panel. When a certain switching cycle count is reached, an repair must be performed (see chapter 7 Repair).





7 Repair

The ECOS-C medium-voltage switchgear unit is a low-maintenance design. Regular checks and inspections must be performed and recorded in accordance with the applicable national regulations and customer-specific procedures. These checking and inspection records must also be stored safely. The period for which they must be stored is specified in the relevant national regulations.

7.1 Basis for repair

The following regulations are the basis for repair:

- The manufacturer's ECOS-C user manual
- For Switzerland the requirement is:
- Regulations for power electrical installations (Power Electrical Regulations) 734.2
- In other countries the relevant national regulations must be complied with
- EN 62271-1
- EN 62271-100
- EN 62271-200
- DIN 31051

7.2 Concept

The repair concept of the ECOS-C medium-voltage switchgear consists of the following operations five sub-groups:

- Visual check
- Inspection (functional check / identification of condition)
- Maintenance (certificate of good operating condition)
- Corrective maintenance (restoration of good operating condition)
- Improvement (increasing the operating condition)

For Switzerland the requirement is:

Periodic checks as specified by statute (Swiss Heavy Current Inspectorate, ESTI). The equipment operating company is responsible for determining the checking intervals for each item of equipment. However the checking intervals must not exceed 5 years.

In other countries the relevant national regulations must be complied with.

7.3 Visual check

Regular visual checking (at least once a year) by the operating company allows detection of evident defects and assessment of the overall condition of the equipment. Visual checking of the ECOS-C medium-voltage switchgear consists essentially of:

a) Checking the insulation system for leaks

When doing this, a check should be made that the level of insulating fluid in the sight glass is sufficiently high, and the floor of the switch bays should be visually checked for spots of insulating fluid. If when the temperature of the equipment is above 0 °C, the level in the sight glass has fallen to the minimum, contact DRIESCHER without delay. Never attempt to open the system and top it up.

b) Checking the desiccation cartridge

As soon as the colour of the silica gel granules changes from orange (active) to completely blue (saturated), the desiccation cartridge must be replaced. To do this, the front cover plate at the top of the equipment must be removed. The desiccation cartridge can then be unscrewed and replaced with a new one (for the part no. see chapter 8.2 Accessories and Spare Parts).









Desiccation cartridge

Active silica gel

Saturated silica gel

Contrast

c) The checking of the mechanical switching play of the drive

The counter reading must be recorded. Maintenance must be performed when the following number of switching cycles is reached:

—>After 2000 switching cycles (at ≤ rated operating current I_r)

d) Checking the overall condition

- Contamination by dust
- Effects of moisture
- Condition of the cable plug connectors. The condition must be checked, and any necessary work performed immediately.

Visual check

We recommend that a visual check is performed annually.

The manufacturer's instructions regarding installation of other companies' products (such as capacitive voltage displays, protective relays, cable plug connectors, etc.) must be complied with.



7.4 Inspection

Regular inspection by the operating company promotes higher availability and longer working life, and prevents standstill damage such as may be suffered by any equipment. Inspection of the ECOS-C medium-voltage switchgear consists essentially of:

- a) Visual check of all operating steps
- b) Check for correct operation (switching cycles)
- c) Checking of the earth connection

If any of the following events occurs, an inspection must be performed without delay:

- After a damage event
- Change to the external influences
- Change to the electrical demands



Inspection of the protective relay

For Switzerland the requirement is:

The equipment operating company has a statutory obligation to test the electronic protective relay at least every 5 years, including a trip test. We therefore recommend that a relay test is included in the inspection. DRIESCHER is the right service partner for all servicing work.

7.5 Maintenance

Regular on-site maintenance ensures continued safe operation of the equipment. For this purpose the entire medium-voltage switchgear unit is switched off and taken out of service. The maintenance work may only be performed by DRIESCHER.

This maintenance work must be carried out once the following numbers of switching cycles have been performed.

 \rightarrow After 2000 switching cycles (at \leq rated operating current I_r) and consists essentially of the following:

- a) All the work included in an inspection
- b) Repair all instances of damage.
- c) Lubricate the bearings and joints in the drive mechanism.
- d) Electrical and mechanical functional check of the drive system.
- e) Check the condition of the circuit breaker vacuum interrupter

This maintenance work may be performed only when the equipment is voltage-free.



Maintenance

- Maintenance work may only be performed by DRIESCHER or by specialist personnel authorised by us.
- Only original DRIESCHER parts and accessories may be fitted.

7.6 Corrective Maintenance

To enable us to ensure that the device will perform the specified functions and to avoid any grid failures, it is advisable in the sense of reliable power supply that the equipment is overhauled at a time depending on the age of the equipment, frequency of switching cycles and magnitude of the rated short-circuit current switching capability.

ECOS-C medium-voltage switchgear is subject to continuous development in the light of experience and technical developments. Therefore upgrades may also be performed in the course of an corrective maintenance. An corrective maintenance / upgrade ensures the operational capability and reliability of the equipment, and also extends the product's working life.

We recommend a corrective maintenance of the ECOS-C medium-voltage switchgear unit:

- After approx. 15 to 20 years, e.g. in conjunction with the renewal of the electronic protective relay / equipment
- However no later than achievement of the guaranteed number of 10000 switching cycles

An corrective maintenance consists essentially of:

- a) Fully dismantling the switchgear
- b) Replacing the electromechanical parts
- c) Checking the vacuum interrupter using a vacuum test device, and renewing it if necessary
- d) Replacing all seals
- e) Refilling with a biologically degradable insulating fluid
- f) Changing the desiccation cartridge
- g) Switching travel analysis (with travel-time diagram)
- h) Performing a partial discharge test at each phase
- i) Carrying out routine testing

Corrective maintenances may be performed only in the manufacturer's works, since some of the work requires technical infrastructure, facilities and test gear that is not available on-site (for instance refilling with insulating fluid and performing partial discharge tests).

NOTICE

Corrective maintenance

An corrective maintenance / upgrade ensures the operational capability and reliability of the equipment. It also extends the product working life.

7.7 End of the working life

As far as we are aware, the ECOS-C medium-voltage switchgear unit contains no raw materials or materials that are harmful to the environment. Therefore no additional charges for disposal of special waste are incurred when at the end of the product's working life the equipment is reprocessed into waste products. The materials used in the ECOS-C are largely suitable for reprocessing and can thus be sent for recycling.

Disposal must be by authorised contractors in accordance with the national regulations, or the equipment can be returned to the manufacturer.

If in doubt, ask the manufacturer.

8 Appendix

8.1 Nameplate

The nameplate can be found on the front of the equipment. A second nameplate is fitted inside the equipment on the right-hand side.



If you have questions about the product or wish to place an order, please state the highlighted nameplate data.

8.2 Accessories and spare parts

Use only original spare parts

For correct operation of the equipment we recommend that only original accessories and spare parts from the manufacturer are used.

8.2.1 Special tools

This chapter lists tools that may not be standard equipment in a workshop or are supplied with the switchgear or can be ordered at a later date as required.





8.2.2 Cellplux Cellpack plug-in cable connectors



Example: CTS 630 A 24 kV / EGA

Cellplux angled plug-in cable connectors are suitable for connecting all plastic-insulated infeed cables to switchgear and transformers, for grid voltages up to a maximum of 24 kV.

Main components:

- 1. Field control element of silicone
- 2. Bolted cable lug with shear bolt and integral restraint
- 3. Contact pin with M16 shear bolt
- 4. Inner electrode
- 5. Main insulation
- 6. Screen
- 7. Screwed insulation plug with capacitive measurement point
- 8. Protective cap



Cellplux Cellpack plug-in cable connectors



Cellplux CTS 630 A 24 kV / EGA Screw-on cable plug connectors for infeed cables



Cellplux CTKS 630 A 24 kV Screw-on coupling plug connectors for infeed cables (in conjunction with CTS 630 A)



Cellplux CTKSA 630 A 12 bis 24 kV Screw-on coupling plug surge arrestors for the incoming cables (in conjunction with CTS 630 A)



Cellplux CIK 630 A 24 kV

Screw-on insulating caps of the correct voltage rating to protect the open connectors on the equipment against being touched

8.2.3 Accessories and spare parts list

Accessories:

Part-no.	Designation
in process	Horstmann Orion Compare phase comparison device
in process	CTS 630 A 24 kV / EGA Cellplux cable plug connector
in process	CTKS 630 A 24 kV Cellplux coupling plug connector
in process	CIK 630 A 24 kV voltage-proof insulating caps
in process	CTKSA 12 kV-10 kA overvoltage surge arrestor
in process	CTKSA 17 kV-10 kA overvoltage surge arrestor
in process	CTKSA 19.5 kV-10 kA overvoltage surge arrestor
in process	CTKSA 24.0 kV-10 kA overvoltage surge arrestor
in process	CSA 24-5 overvoltage surge arrestor
in process	CSA 24-10 overvoltage surge arrestor
in process	CSA 21-10 overvoltage surge arrestor
in process	Earthing conductor set for the overvoltage surge arrestor

Recommended spare parts:

Part-no.	Designation	
2-90103126	Horstmann WEGA 1.2C 17.5-24 kV VDS capacitive voltage display	
2-90103127 Horstmann WEGA 1.2C 10-17,5 kV VDS capacitive voltage display		
2-90101004	Operating key for operating the spring and changing over the pre-selector switch	
2-90103021	Double-bit key for the secondary cabinets	
2-90103104 T30 Torx screwdriver with T-handle		
2-90101087 Desiccation cartridge 2.0 for the equalising tank		

Accessories and spare parts can be ordered from DRIESCHER. Necessary data for ordering component spare parts are as follows:

• The type, job number and schematic number of the switchgear (see nameplates)

8.3 Materials and consumables

DRIESCHER hereby confirms the conformity of our products with the REACH regulations 1907/2006 for registration, evaluation and approval of chemicals.

Our suppliers have committed to a declaration of conformity of their materials to the REACH regulations in the form of safety data sheets.

8.4 Troubleshooting / fault rectification

If the suggested actions fail to rectify the fault, inform the manufacturer without fail. No actions may be undertaken apart from those described in this manual.

No	Nature of the fault	Cause of the fault	Remedial action			
1	Capacitive voltage displays show no signal	a) Input or output cable is dead	a) Switch on the cable			
		b) Busbar is not under tension	b) Press the ON button			
		c) Check the voltage tester ar	nd if necessary use another one			
		d) Check the infeed voltage				
2	Pressing the ON button fails to switch the circuit breaker on	a) Pre-selector switch not fully engaged	 b) Use the operating key to turn the pre-selector switch to the stop 			
		b) Safety flap is open	b) Close the safety flap			
		c) Drive insufficiently pre- stressed	c) Wind up the drive to the stop using the crank			
3	The pre-selector switch cannot be activated	 a) The switch bay is still switched on 	a) Switch off the switch bay			
4	Insulating fluid present in the drip trays within the equipment (traces, drips,	a) Possible leaks in the system	 a) Inform the manufacturer without delay, do not switch the equipment. 			
	pools)	 b) sustained over- temperature (>40° C, overflow) 	 b) Inform the manufacturer. Under no circumstances top up the fluid after it has cooled down. 			
5	Float sphere of the level sight glass at "Min"	a) Minimum temperature of Significantly lower than - 5° C	a) Provide additional heating for the room or the equipment			
		b) Possible leaks in the system	b) Proceed as for fault type no.4			
6	Secondary protection fails to trip	a) Check the connections to the instrument transformers / protective relay				
		b) Check the settings				

Service address

Our specialist personnel can be contacted by telephone in the event of faults or to answer any questions you may have with regard to compatibility, assembly or maintenance. A member of our team is always contactable by telephone - also outside the normal office hours. Please have the technical data from the type labels to hand.

Phone: +49 (0) 87 61 6 81-0 E-Mail: service@driescher.de www.driescher.de

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