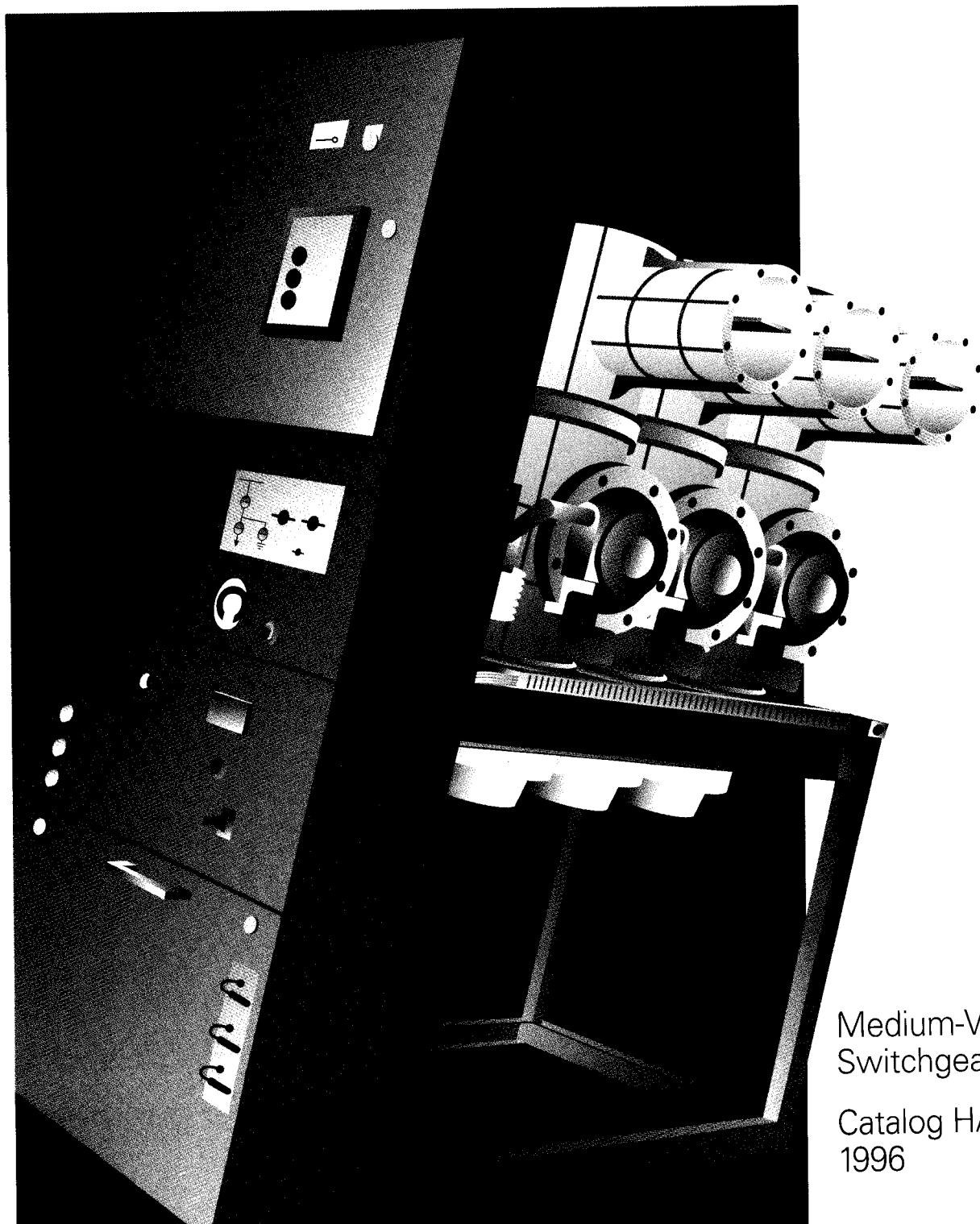


SIEMENS

Types 8DA10 and 8DB10 Panels up to 36 kV with Fixed-Mounted Circuit-Breakers, SF₆-Insulated



Medium-Voltage
Switchgear

Catalog HA 35.11
1996



CERTIFICATE

**DQS Deutsche Gesellschaft zur Zertifizierung
von Qualitätsmanagementsystemen mbH**
(German Association for the Certification of Quality Systems)

hereby certifies that the company

Siemens AG
Power Transmission and Distribution Group
Paul-Gossen-Strasse 100
D - 91050 Erlangen

Medium Voltage Division (EV M)
Sales and Manufacturing Plants
Erlangen, Berlin, Frankfurt/Main, Wattenscheid

has implemented and maintains a
quality system

A quality audit has verified that
this quality system fulfills the requirements
of the following standard:

DIN EN ISO 9001

Quality systems
Model for quality assurance
in design, development, production, installation and servicing
(issue August 1994)

This certificate is valid until
Certificate Registration No.:
Frankfurt am Main,

October 29, 1998
3473 - 01
October 30, 1995

This certificate is based on a quality audit in cooperation with
VDE Prüf- und Zertifizierungsinstitut - VDE Verband Deutscher Elektrotechniker e.V.

[Signature]
PRESIDENT
Dr.-Ing. W. Hansen

[Signature]
MANAGING DIRECTOR
Dipl.-Ing. J. Florschütz

[Signature]
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Offices:
D-60433 Frankfurt am Main, August-Schanz-Straße 21
D-10787 Berlin, Burggrafenstraße 6

Deutscher Akkreditierungsrat
DAR
TGA-ZQ-91003

This is to state that

Siemens AG
Power Transmission and Distribution Group
Paul-Gossen-Strasse 100
D - 91050 Erlangen
Medium Voltage Division (EV M)
Sales and Manufacturing Plants
Erlangen, Berlin, Frankfurt/Main, Wattenscheid

holds the
Quality System Certificate

ISO-Reg. No. 3473 - 01

for the standard from

ISO 9000

series, and for the scope, sp

Signed for and on behalf of E

**DQS Deutsche Gesellschaft zur
von Qualitätsmanagementsystemen**

Signature:

[Signature]
MANAGING DIRECTOR

Date:

October 30, 1995

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The issuing member indemnifies all other EQNet members from any claims arising from the existence of this document

Types 8DA10 and 8DB10
Panels up to 36 kV
with Fixed-Mounted
Circuit-Breakers,
SF₆-Insulated

Single-Pole Metal-Enclosed,
Metal-Clad
8DA10 Single-Busbar Switchgear
8DB10 Duplicate-Busbar Switchgear

Medium-Voltage
Switchgear

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A

The 8DA10/8DB10 switchgear panels with fixed-mounted circuit-breakers are designed for:

Rated voltages
from 7.2 kV to 40.5 kV

Rated short-circuit breaking currents
of up to 40 kA

Busbar rated currents
of up to 2500 A

Feeder rated currents
of up to 2500 A

Typical uses

Power stations, transformer stations and
distribution substations operated by power
supply utilities

Cement industry

Automobile industry

Iron and steel works

Rolling mills

Mining industry

Textile and paper industries, food industry

Chemical industry

Petroleum industry

Pipeline installations

Offshore installations

Electrochemical plants

Petrochemical plants

Traction power supplies

Shipbuilding industry

Diesel power plants

Emergency power supply installations

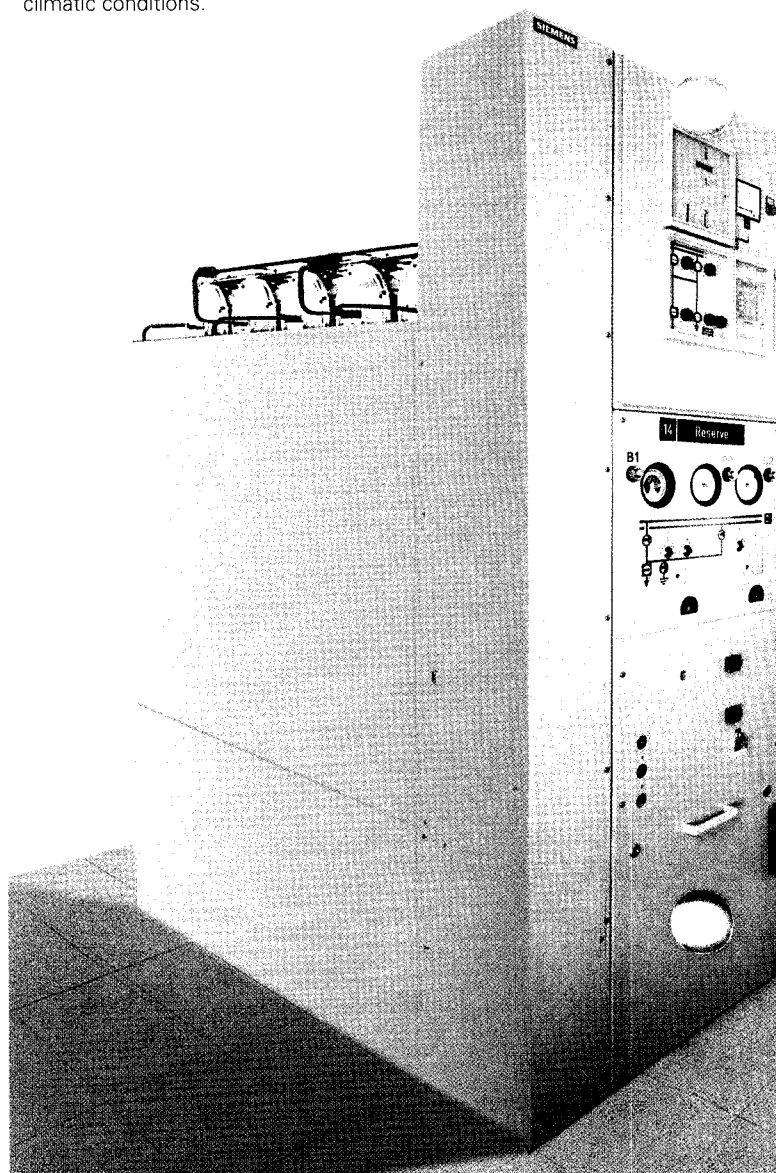
Lignite open-cast mines

Technical characteristics

- Panels with fixed-mounted circuit-breakers
- Available as single-busbar switchgear or duplicate-busbar switchgear
- Single-pole metal-enclosed
- Metal-clad
- SF₆-insulated
- Vacuum circuit-breaker
- Three-position switch as busbar disconnect and feeder earthing switch
- Make-proof earthing with circuit-breaker
- Panel width 600 mm for all versions
- Flexible configuration of panel options and additional assemblies thanks to modular design and standard enclosures
- Insulation properties not affected by site altitudes and climatic conditions.

Operator safety

- Safe-to-touch and hermetically sealed enclosure
- Safe-to-touch terminations and connections for cables, solid-insulated bar and SF₆ tubular gas bus trunking
- Capacitive voltage indication for checking for dead state
- Operating mechanisms and auxiliary switches safely accessible outside enclosure
- Protective system interlock to prevent operation when enclosure is open
- Enclosure tested to provide high degree of arcing protection.



Operational reliability

- Primary section hermetically sealed for protection against environmental influences (contamination, humidity and vermin)
- Single-pole enclosure excludes all fault types except earth faults
- Operating-mechanism components in enclosure maintenance-free
- Breaker operating mechanisms accessible outside enclosure
- Capacitive indication available, with no dielectrically stressed cast-resin parts
- Inductive voltage transformer in separate enclosure or metal-enclosed for plug-in mounting outside the main-circuit enclosure
- Toroidal-core current transformers located outside the enclosure
- Complete switchgear interlocking with interrogation interlocks
- Leakage rate < 1 % annually, topping up required in 10 years at the earliest
- Minimum fire load.

Electrical data

Operating voltage max. 40.5 kV

Rated power-frequency withstand voltage 80 kV

Rated lightning impulse withstand voltage 180 kV

Rated short-circuit breaking current and rated short-time current 3 s 40 kA (31.5 kA at 40.5 kV)

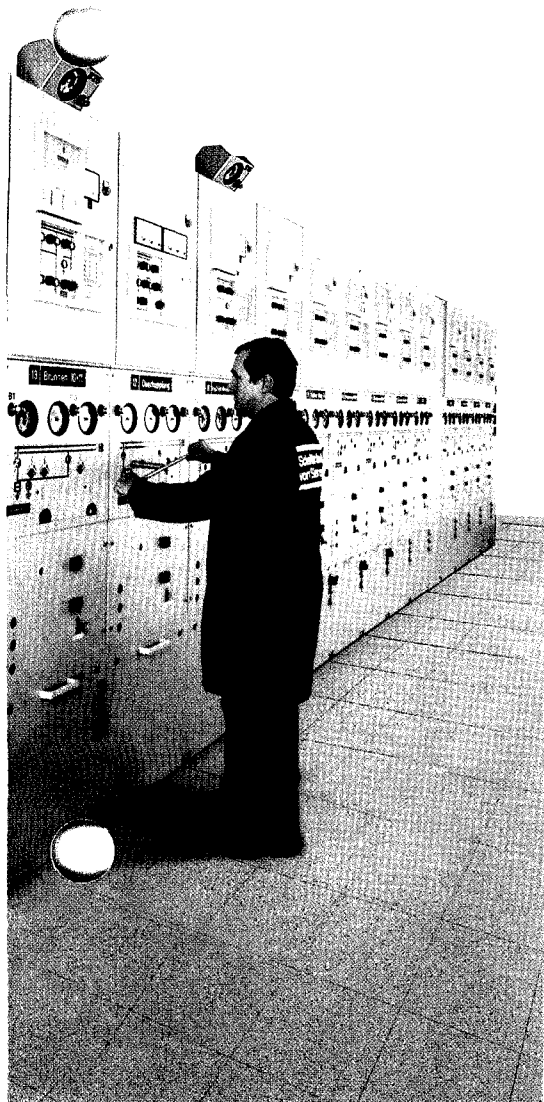
Rated short-circuit making current 110 kA (80 kA at 40.5 kV)

Busbar rated current 2500 A

Feeder rated current 2500 A

1

2



◀ Type 8DB10 panel with fixed-mounted circuit-breakers, 24 kV, 16 kA

Electrical data

Circuit-breaker data

Operating times

Closing time	Opening time		Arcing time	Break time		Dead time	CLOSE-OPEN operating time	
	1st release	2nd or 3rd release		1st release	2nd or 3rd release		1st release	2nd or 3rd release
ms	ms	ms	ms	ms	ms	ms	ms	ms
< 75	< 70	< 55	< 15	75	55	300	80	60

Power consumption of releases and solenoids

Release method	Release type	DC operation Approx. consumption in W	AC operation, 50/60 Hz Approx. consumption in VA
Shunt-opening release without energy store, closing solenoid	3AY15 10	100	100
Shunt-opening release with energy store	3AX11 01	60	100
Undervoltage release	3AX11 03	18	27

Max. power consumption and short-circuit protection of operating-mechanism motor

Rated voltage of mechanism	Operating voltage (rated voltage)		Inrush current	Power consumption	Rated currents for motor short-circuit protection		
	max. (+ 10% - 15%)	min. (+ 10% - 15%)			M.c.b. with G characteristics		
	V	V			Recommended values for uniform protection	Lowest possible value for circuit-breakers	
DC	24	26	20	500	16	16	
	48	53	41	500	8	8	
	60	66	51	500	8	6	
	110	121	93	500	6	3	
	220	242	187	500	3	1.6	
AC	110	121	93	—	6	3	
	220	242	187	—	700	1.6	

Voltage range limits within which the releases operate reliably

Release type	DC voltage	AC voltage, 50/60 Hz
3AY15 10 and 3AX11 01	70 to 110% <i>U</i>	85 to 110% <i>U</i>
3AX11 03	35 to 0% <i>U</i>	35 to 0% <i>U</i>

Maintenance and service life of the circuit-breaker

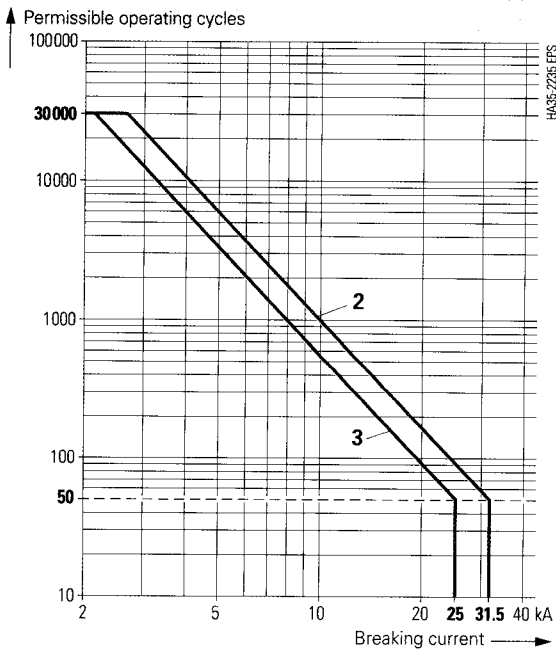
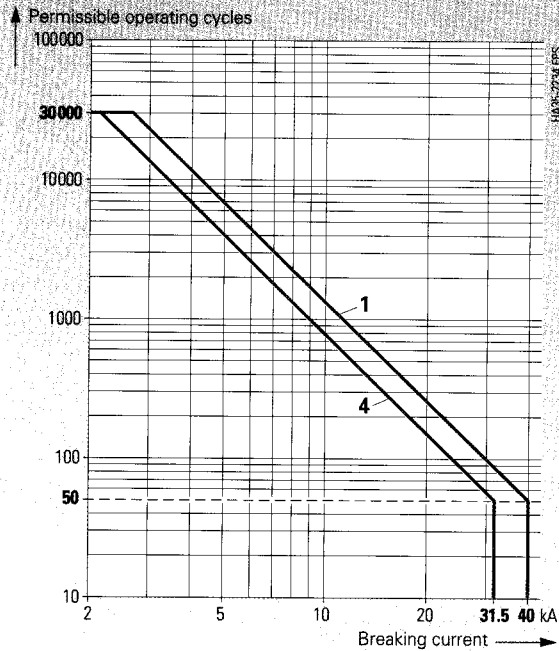
Operating mechanism

- Maintenance-free up to 10,000 operating cycles unrestricted time
- Service life 30,000 operating cycles

Vacuum interrupters

- Maintenance-free
- Mechanical service life 30,000 operating cycles
- Electrical service life as a function of breaking current (see following load characteristics)

**Electrical service life of circuit-breaker
as a function of breaking current**



Selection of the load characteristics

Load char.	Rated voltage	Rated short-circuit breaking current	Feeder current
1	12 kV	16/20/25/31.5/40 kA	up to 2500 A
2	12/17.5 kV	31.5 kA	up to 2500 A
3	12/17.5/24 kV	16/20/25 kA	up to 2500 A
4	36 kV	16/20/25/31.5 kA	up to 2500 A

**Data of
three-position switch or disconnecter**

Power consumption and
protection of operating-mechanism motor

Rated voltage	Power consumption	M.c.b. with G characteristics
	W	Rated current A
60 V DC	100	3
110 V	100	1.6
220 V	100	0.5
110 V AC	100	1.6
220 V	100	0.5

Rated power and duty cycle of
interlocking electromagnet

Rated voltage	Rated power	Duty cycle
	W	%
60/110/220 V DC	7.1	100
110/220 V AC	7.1	100

Installation details for 8DA10 single-busbar switchgear

Planning space

Space dimensions

Distance	Dimens. mm
----------	---------------

Height of switchroom

(dependent on highest switchgear component):

- High-voltage built-on access- A > 300 series up to switchroom ceiling
- Low-voltage compartment B > 200 or gas monitoring up to switchroom ceiling
- Busbar connections up to switchroom ceiling (to be planned depending on the space required for cable connectors, cable bending radii or installation room for solid-insulated bars)

Front operating aisle	C ≥ 1000
------------------------------	----------

Rear aisle width	D ≥ 50
-------------------------	--------

Height of cable basement	F –
---------------------------------	-----

(must be planned according to connection type and cable bending radius)

Side aisle width	G ≥ 400
-------------------------	---------

Door dimensions

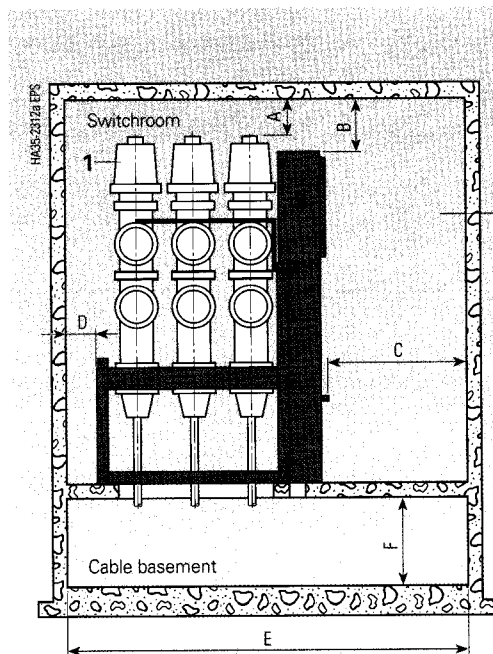
- Dependent on the number of panels per transport group and
- Dependent on the transport dimensions (see page 8 and dimension drawings, pages 27 to 29).

Mounting

- On the floor of the frame
- By bolting or welding.

Floor openings

- Foundation as
 - Steel-reinforced concrete or
 - Steel structure with adjustable support columns.
- Floor opening below each row of panels should be continuous.



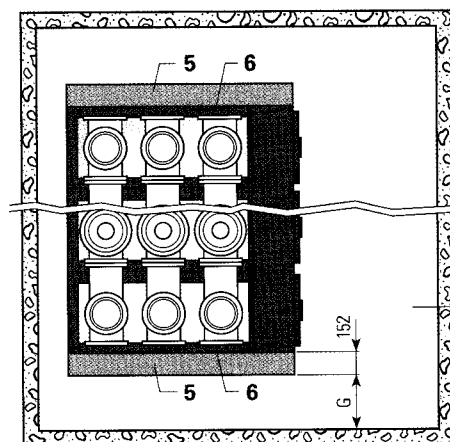
Net weight of a panel: about 580 kg.

Side view

- 1 Built-on accessories
- 2 Low-voltage compartment
- 5 End wall (end of installation)
- 6 End panel (frame)

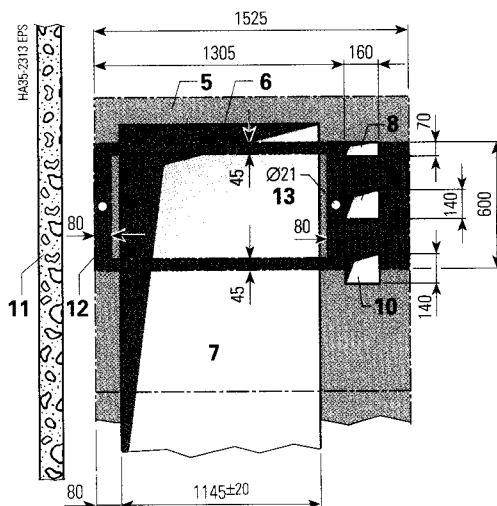
Floor openings for

- 7 – Panel terminations
- 8 – Control cables of end panels
- 9 – Control cables concentric to panel width (standard)
- 10 – Control cables, if there is a beam beneath the panel width
- 11 Wall of building
- 12 Rear edge of frame
- 13 Fastening hole in baseframe



Plan view

◀ **Switchgear installation**
(see below for floor openings)



◀ **Floor openings and fixing points**
(plan view)

Installation details for 8DB10 duplicate-busbar switchgear

Planning space

Space dimensions

Distance	Dimens. mm
----------	---------------

Height of switchroom

(Dependent on highest switchgear component):

- High-voltage built-on access- A > 300 series up to switchroom ceiling
- Low-voltage compartment B > 200 or gas monitoring up to switchroom ceiling
- Busbar connections up to switchroom ceiling (to be planned depending on the space required for cable connectors, cable bending radii or installation room for solid-insulated bars)

Front operating aisle	C ≥ 1000
------------------------------	----------

Rear aisle width

Rear edge of the frame up to rear wall of switchroom:

- With accessible cable basement and no rear operating mechanisms D ≥ 50 E ≥ 3750
- Without cable basement and with rear operating mechanisms D ≥ 1000 E ≥ 4700

Height of cable basement

(must be planned according to connection type, cable bending radius and frame height)

Side aisle width	G ≥ 400
-------------------------	---------

Door dimensions

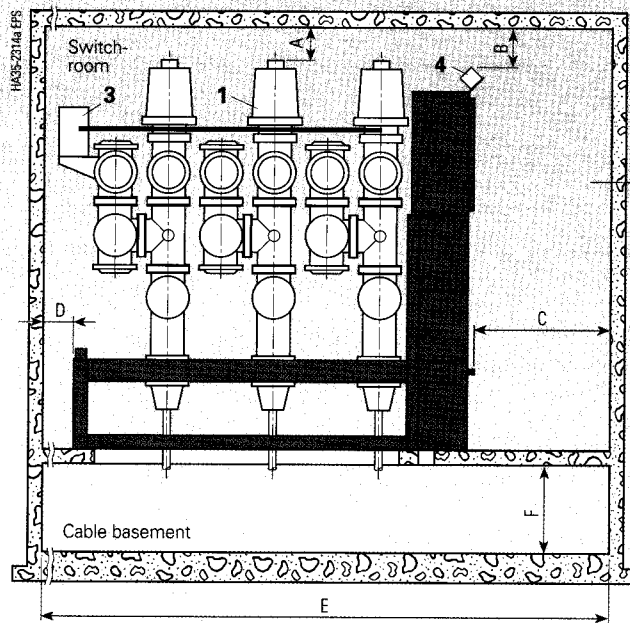
- Dependent on the number of panels per transport group and
- Dependent on the transport dimensions (see page 8 and dimension drawings, pages 30 to 33).

Mounting

- On the floor of the frame
- By bolting or welding.

Floor openings

- Foundation as
 - Steel-reinforced concrete or
 - Steel structure with adjustable support columns.
- Floor opening below each row of panels should be continuous.
- Size of floor opening (7) may be reduced, if the row of panels is configured without "busbar tie for connection in cable basement":
Change from
*80 mm to 440 mm,
2180 mm to 1820 mm.



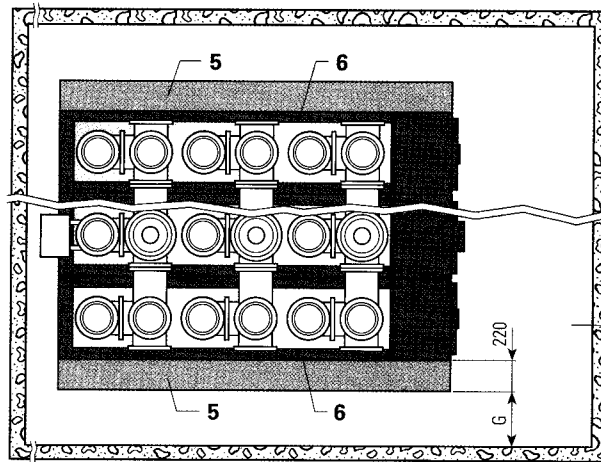
Net weight of a panel: about 1100 kg.

Side view

- 1 Built-on accessories
- 2 Low-voltage compartment
- 3 Rear operating mechanism
- 4 Gas monitoring
- 5 End wall (end of installation)
- 6 End panel (frame)

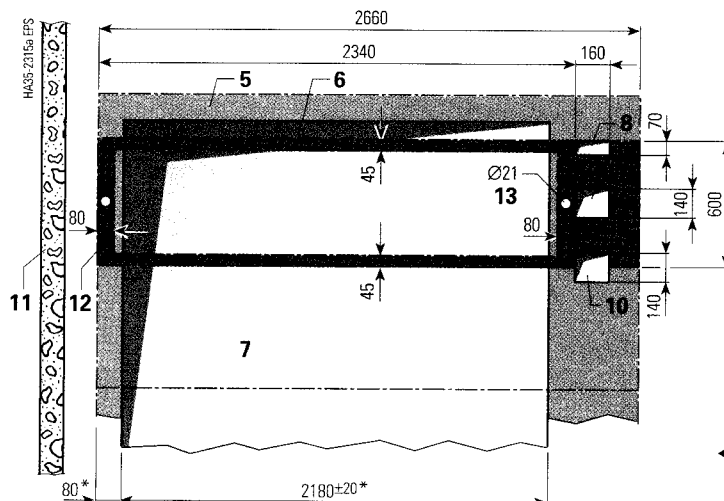
Floor openings for

- 7 – Panel terminations
- 8 – Control cables of end panels
- 9 – Control cables concentric to panel width (standard)
- 10 – Control cables, if there is a beam beneath the panel width
- 11 Wall of building
- 12 Rear edge of frame
- 13 Fastening hole in baseframe



Plan view

◀ **Switchgear installation**
(see below for floor openings)



◀ **Floor openings and fixing points**
(plan view)

Shipping data

Transport groups

The following must be noted when defining transport groups:

- Transport facilities on site
- Transport sizes and weights
- Size of door openings in building

Transport group	Number of panels
8DA10 single-busbar panel	Max. 5
8DB10 duplicate-busbar panel	Max. 3

Transport sizes and weights

Transport inside Germany or to other European countries

Switchgear type	Panel type	Number of panels	Sizes, volumes, weights						
			(Pallet height 220 mm)			Floor area	Volume	Weight Tare	approx. Gross
			Length	Width	Height				
			mm	mm	mm	m ²	m ³	kg	kg
8DA10 single-busbar switchgear	Non-end panels or end panels with end wall on right	1	1788	1488	2946	2.661	7.839	345	900
		2	1788	1638	2946	2.93	8.628	375	1500
		3	2388	1788	2946	4.270	12.578	470	2200
		4	2988	1788	2946	5.343	15.740	560	2900
		5	3588	1788	2946	6.415	18.899	650	3600
	End panels with end wall on left	1	1788	1488	2946	2.661	7.839	345	900
		2	1788	1788	2946	3.197	9.418	375	1500
		3	2388	1788	2946	4.270	12.579	470	2200
		4	2988	1788	2946	5.343	15.740	560	2900
		5	3588	1788	2946	6.415	18.899	650	3600
8DB10 duplicate-busbar switch-gear	with fully-insulated connections	1	3098	1488	3061	4.610	14.111	386	1500
		2	3098	1668	3061	5.167	15.818	411	2600
		3	3098	2268	3061	7.026	21.507	516	3900
	End panels with end wall on left	1	3098	1488	3061	4.610	14.111	386	1500
		2	3098	1862	3061	5.768	17.657	462	2700
		3	3098	2462	3061	7.627	23.347	542	3900
	for 36 kV, with air-insulated connections	1	3098	1488	3261	4.610	15.033	390	1500
		2	3098	1668	3261	5.167	16.851	415	2600
		3	3098	2268	3261	7.026	22.913	522	3900
	End panels with end wall on left	1	3098	1488	3261	4.610	15.033	390	1500
		2	3098	1862	3261	5.768	18.811	466	2700
		3	3098	2462	3261	7.627	24.873	545	3900

Packing

Destination inside Germany or other European countries

- Method of transport:
Rail and road
- Type of packing:
– Switchpanels on open pallets
– Panels protected by polyethylene sheet covering

Destination overseas

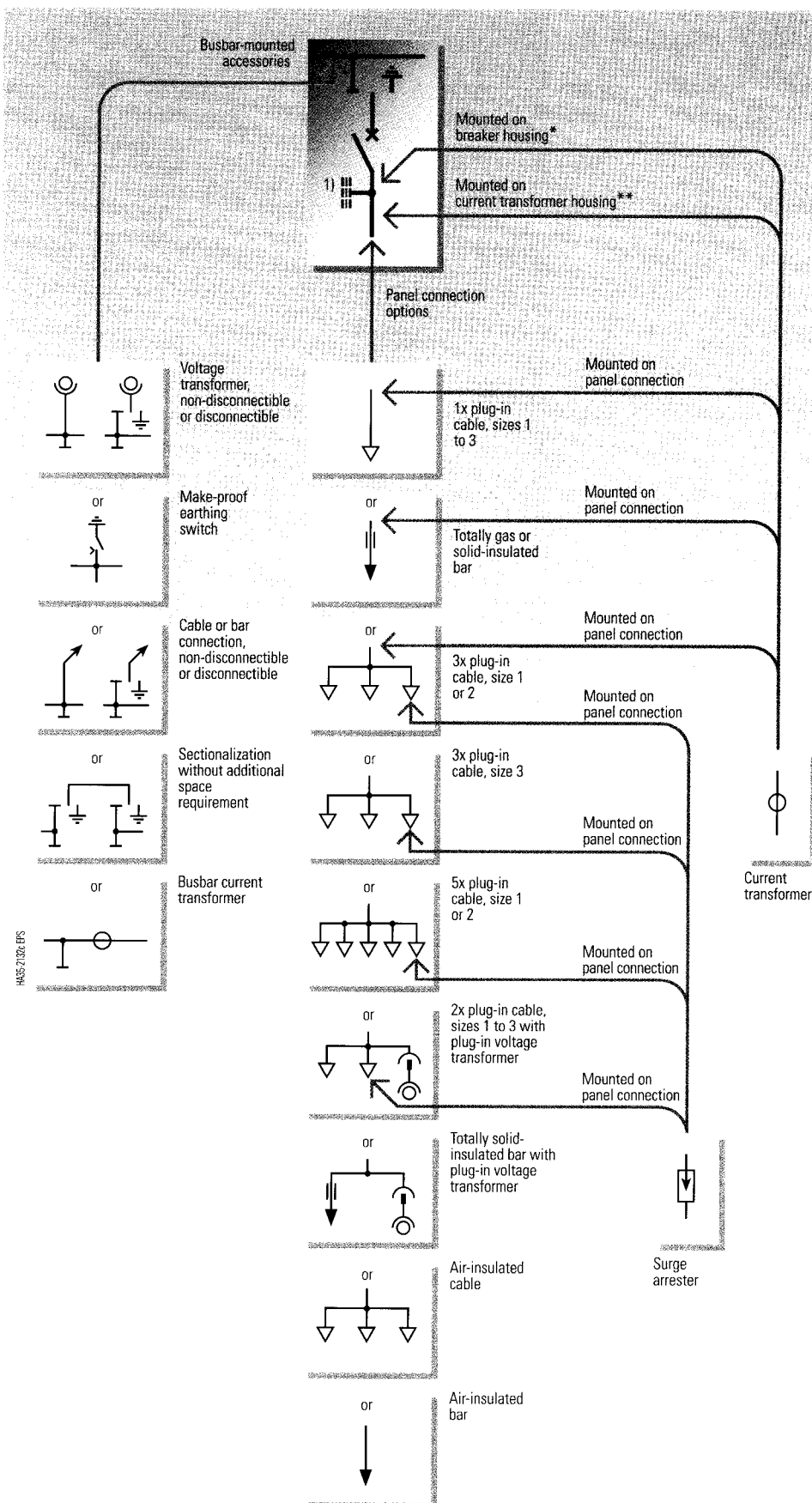
- Method of transport:
Ship
- Type of packing:
– Switchpanels on open pallets
– In sealed crates with upper and lower polyethylene sheets welded together
– With dessicant bags
– With sealed wooden floor
– Max. storage time: 6 months

Transport overseas

Switchgear type	Panel type	Number of panels	Sizes, volumes, weights						
			(Pallet height 220 mm)			Floor area	Volume	Weight Tare	approx. Gross
			Length	Width	Height				
			mm	mm	mm	m ²	m ³	kg	kg
8DA10 single-busbar switchgear	Non-end panels or end panels with end wall on right	1	1766	1466	2966	2.589	7.679	525	1100
		2	1766	1616	2966	2.854	8.465	555	1700
		3	2366	1766	2966	4.178	12.392	700	2500
		4	2966	1766	2966	5.238	15.536	825	3200
		5	3566	1766	2966	6.298	18.680	955	3900
	End panels with end wall on left	1	1766	1466	2966	2.589	7.679	525	1100
		2	1766	1766	2966	3.119	9.251	580	1800
		3	2366	1766	2966	4.178	12.392	700	2500
		4	2966	1766	2966	5.238	15.536	825	3200
		5	3566	1766	2966	6.298	18.680	955	3900
8DB10 duplicate-busbar switch-gear	with fully-insulated connections	1	3076	1466	3134	4.509	14.133	492	1600
		2	3076	1646	3134	5.063	15.868	554	2800
		3	3076	2246	3134	6.909	21.652	764	4100
	End panels with end wall on left	1	3076	1466	3134	4.509	14.133	492	1600
		2	3076	1840	3134	5.660	17.738	623	2800
		3	3076	2440	3134	7.505	23.522	804	4100
	for 36 kV, with air-insulated connections	1	3076	1466	3334	4.509	15.034	506	1600
		2	3076	1646	3334	5.063	16.880	568	2800
		3	3076	2246	3334	6.909	23.034	780	4100
	Left-hand end panels	1	3076	1466	3334	4.509	15.034	506	1600
		2	3076	1840	3334	5.660	18.870	638	2900
		3	3076	2440	3334	7.505	25.023	821	4100

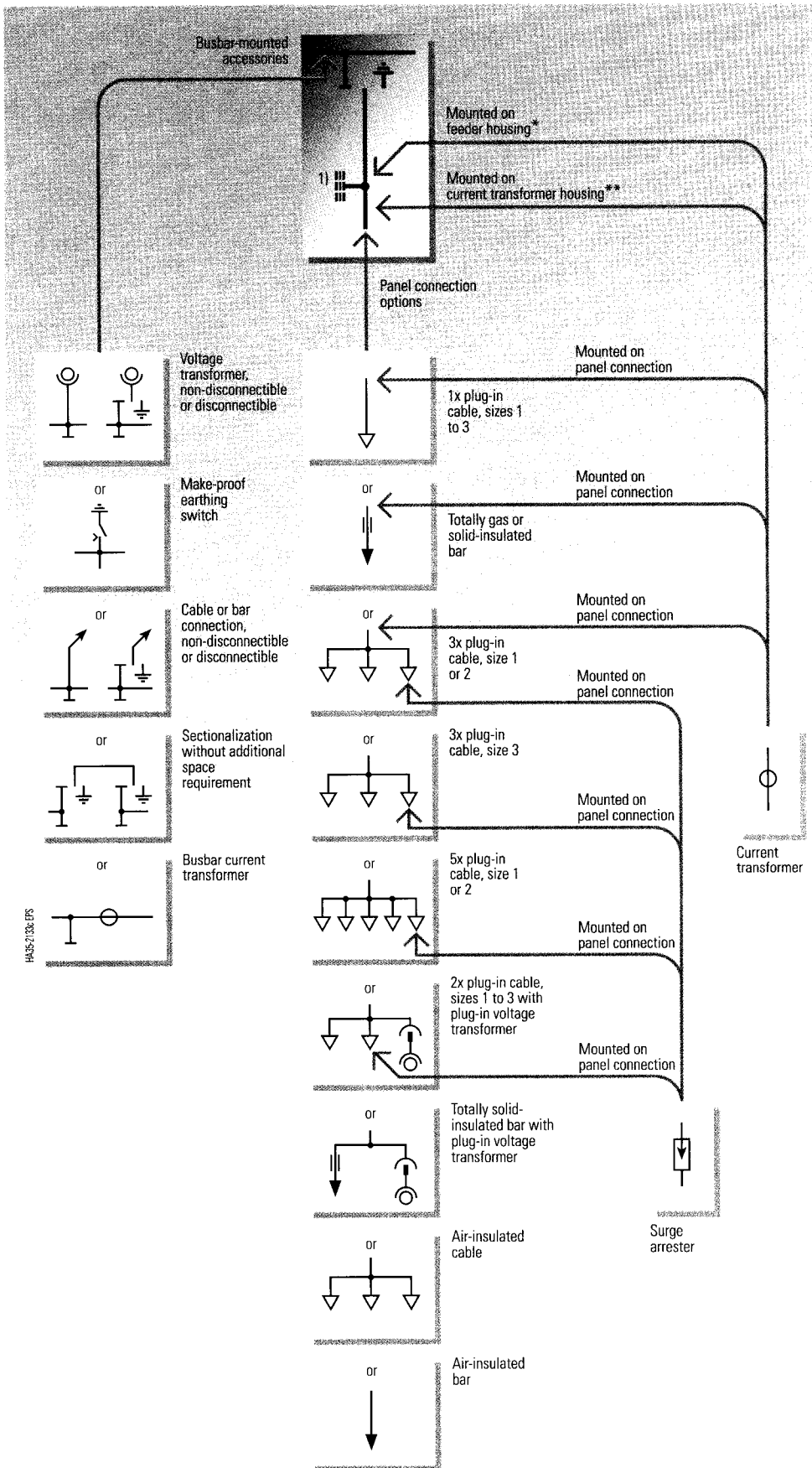
8DA10 single-busbar panels

Circuit-breaker panel



8DA10 single-busbar panels

Disconnecter panel



* For 12 kV, 2500 A and 36 kV.

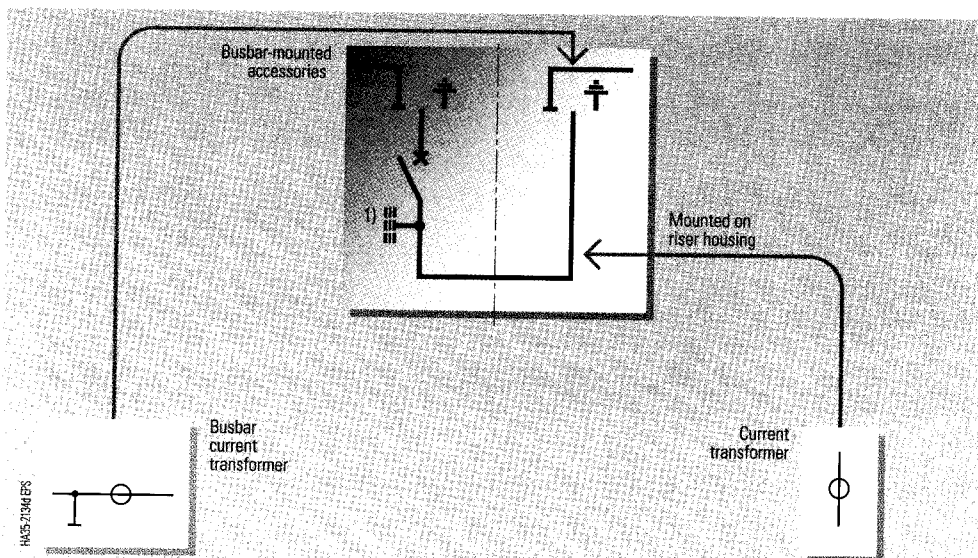
** Up to 24 kV.

1) Capacitive voltage indication acc. to the LRM system in the feeder housing (= standard).

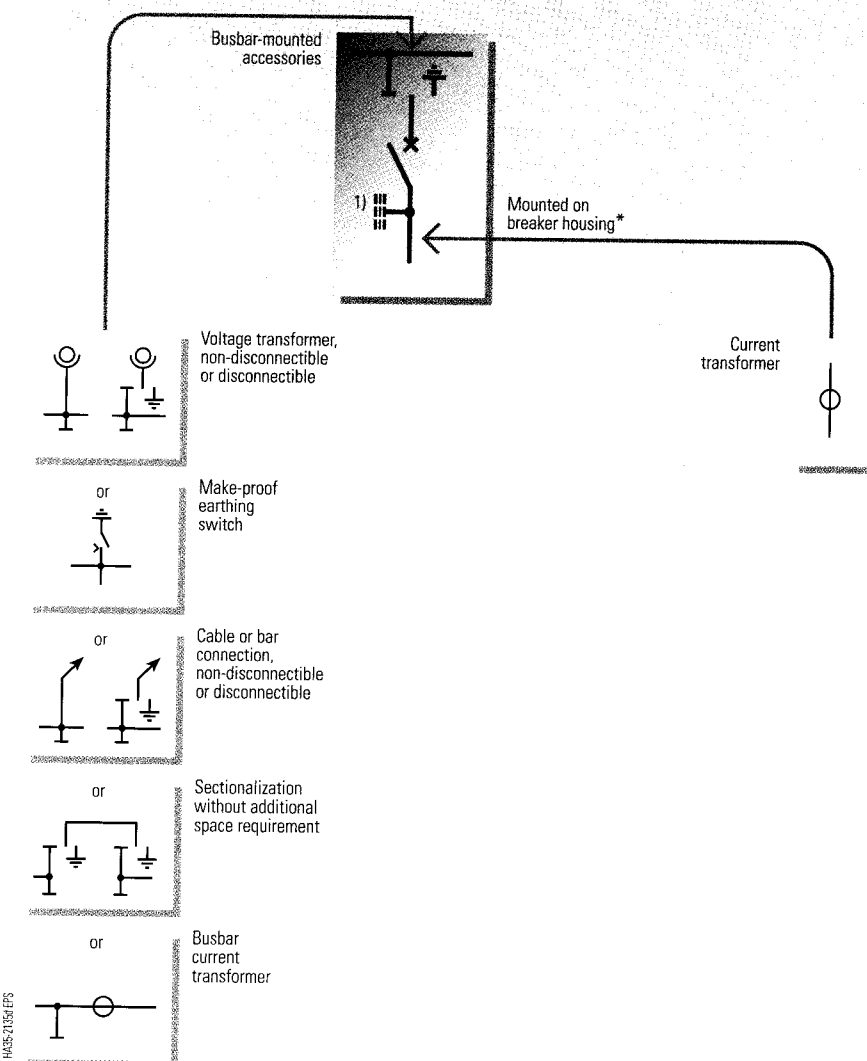
8DA10 single-busbar panels

Busbar tie

consisting of 2 panels
(circuit-breaker can be mounted in either left-hand or right-hand panel)



Spare panel

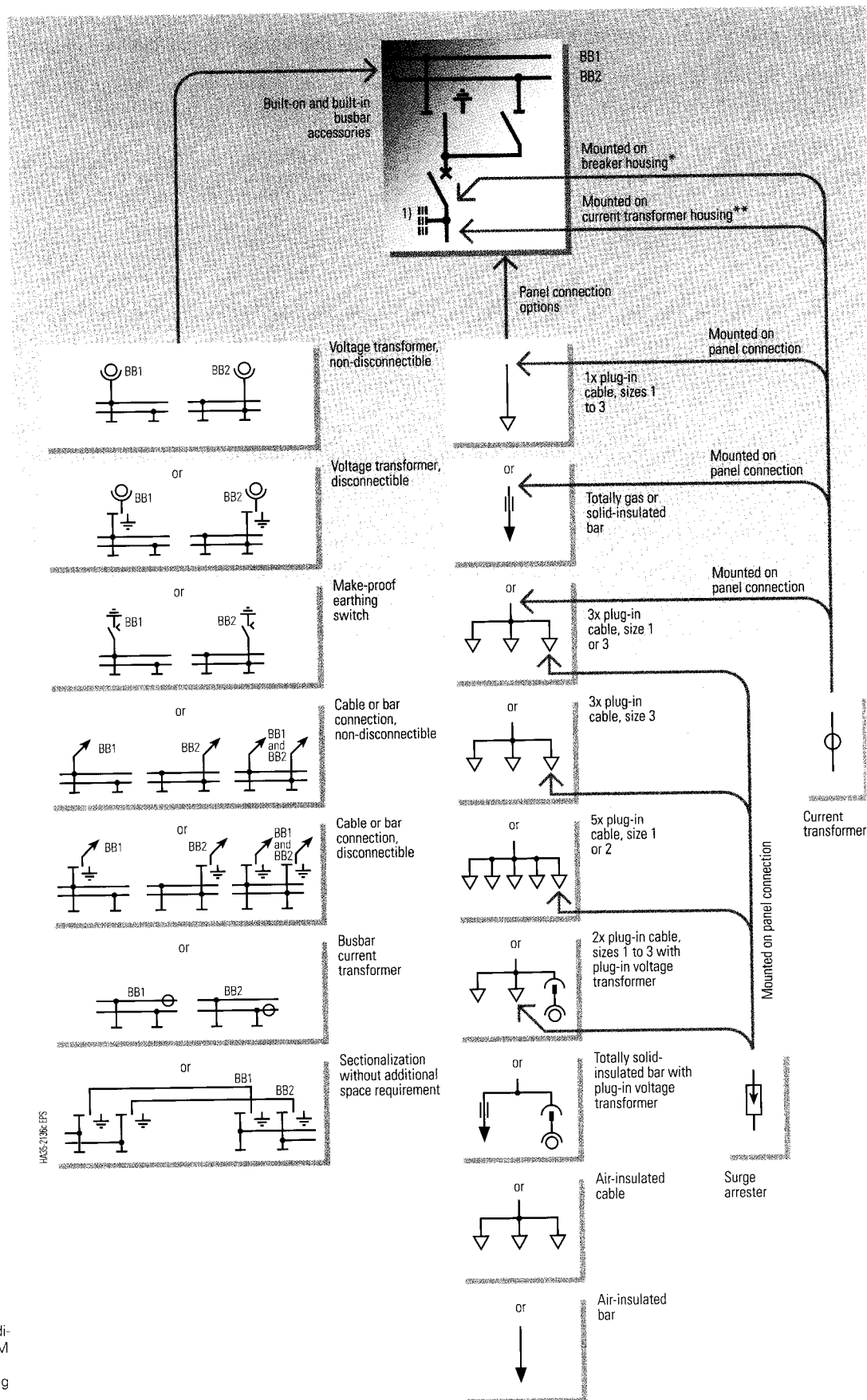


* For 12 kV, 2500 A
and 36 kV.

1) Capacitive voltage indication
acc. to the LRM system in the
circuit-breaker housing
(= standard).

8DB10 duplicate-busbar panels

Circuit-breaker panel



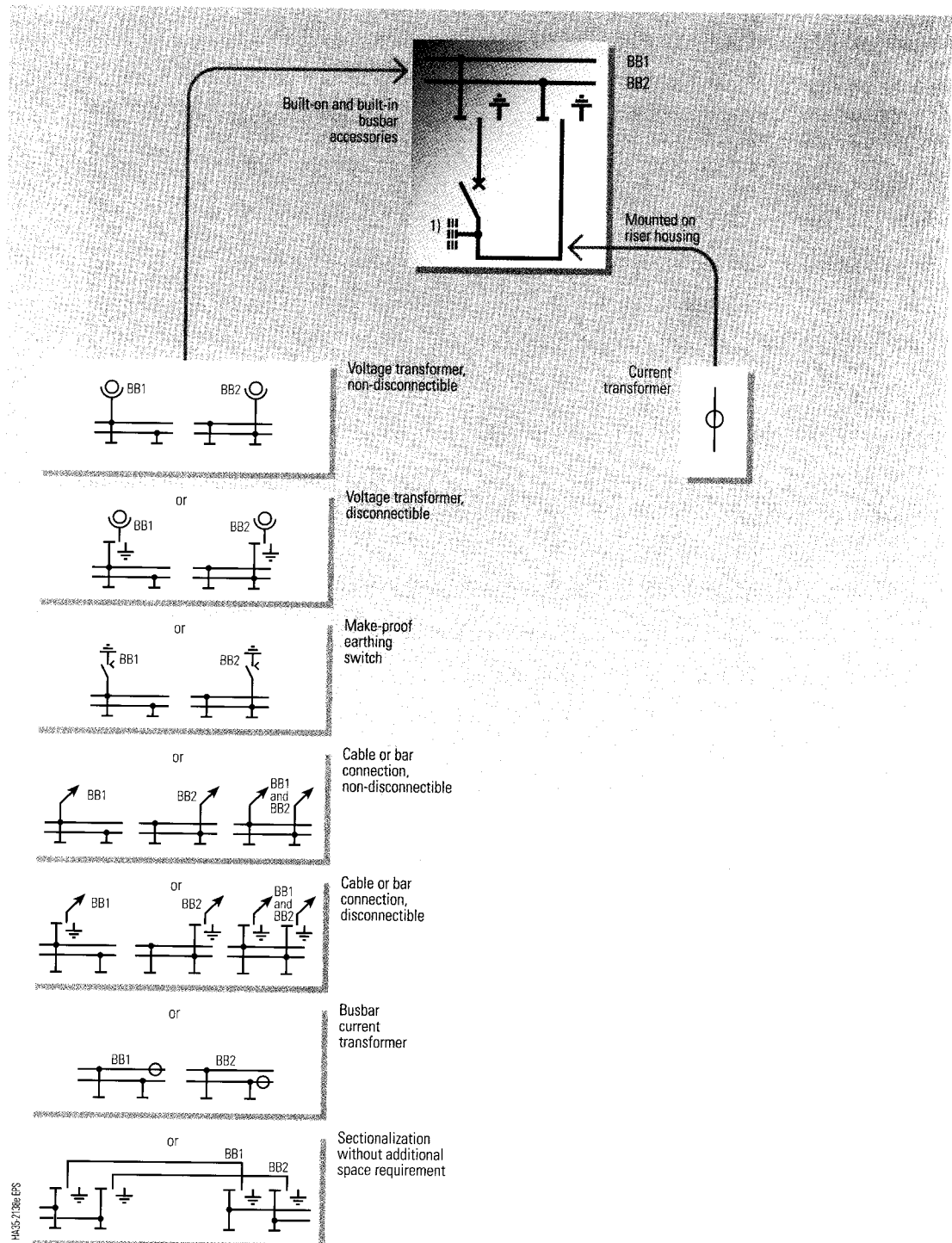
* For 12 kV, 2500 A and 36 kV.

** Up to 24 kV.

1) Capacitive voltage indication acc. to the LRM system in the circuit-breaker housing (= standard).

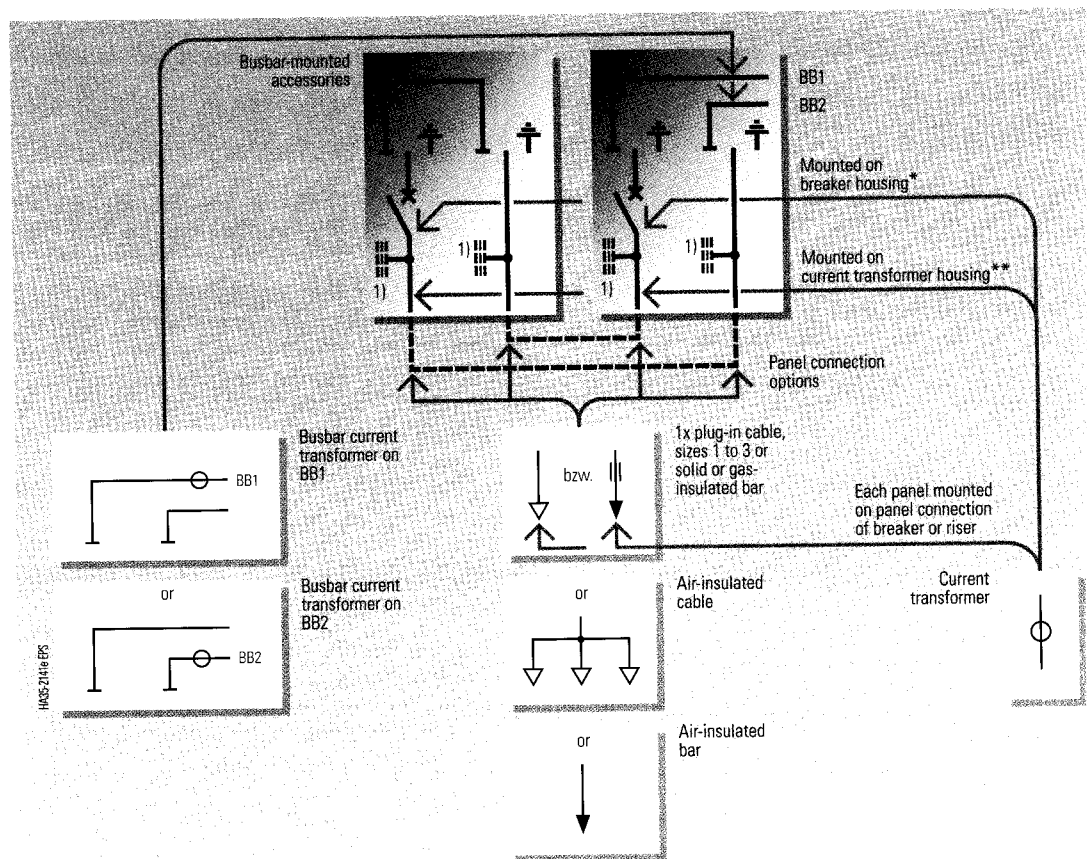
8DB10 duplicate-busbar panels

Busbar coupler



1) Capacitive voltage indication acc. to the LRM system in the circuit-breaker housing (= standard).

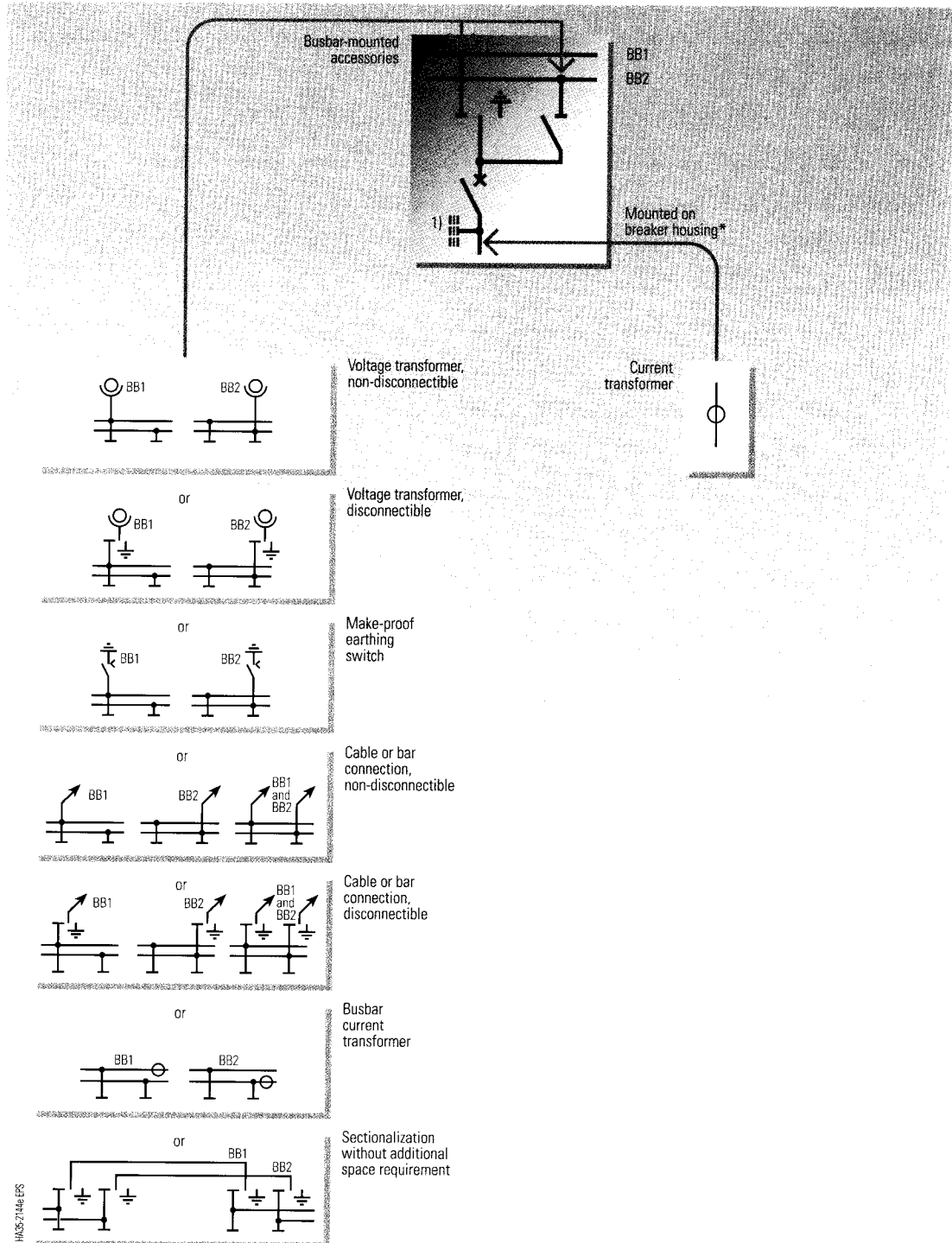
Busbar tie
for connection in
cable basement
consisting of 2
separate panels



- 1) Capacitive voltage indication acc. to the LRM system in the circuit-breaker housing (= standard).

8DB10 duplicate-busbar panels

Spare panel



3

* For 12 kV, 2500 A and 36 kV.

1) Capacitive voltage indication acc. to the LRM system in the circuit-breaker housing (= standard).

General

Switchpanel

- Totally insulated
- Single-pole, metal-enclosed
- Metal-clad
- Basic construction of cast-aluminium chambers (= enclosure for the three poles of a switchpanel).

Switchpanel pole assembly

- The three poles are arranged in tandem
- Comprising a vertical chamber containing a vacuum interrupter
- Arranged on the top
 - For single-busbar switchgear: Horizontally arranged chamber containing a three-position switch and busbars;
 - For duplicate-busbar switchgear: 2 vertical chambers with three-position switch for busbar system 1 and disconnector for busbar system 2 and, on top, 2 horizontally arranged chambers containing busbars
- Gas-tight barrier plates separate function compartments for
 - Circuit-breaker
 - Three-position switch
 - Disconnector
 - Busbars.

Frame

Frame of the switchpanel

- As support for the switchpanel poles and the switch-gear front
- Forms the cable termination compartment
- Holds glass-fibre-reinforced plastic partitions between the poles with air-insulated cable connections.

Low-voltage compartment

- For accommodating the devices for protection, control, measurement and counting
- With plug-in cables of the primary modules on terminal strips with screw connections for incoming and outgoing cables
- Can be either mounted on or in the door
- Door with or without inspection window
- Two standard heights available for duplicate-busbar switchgear.

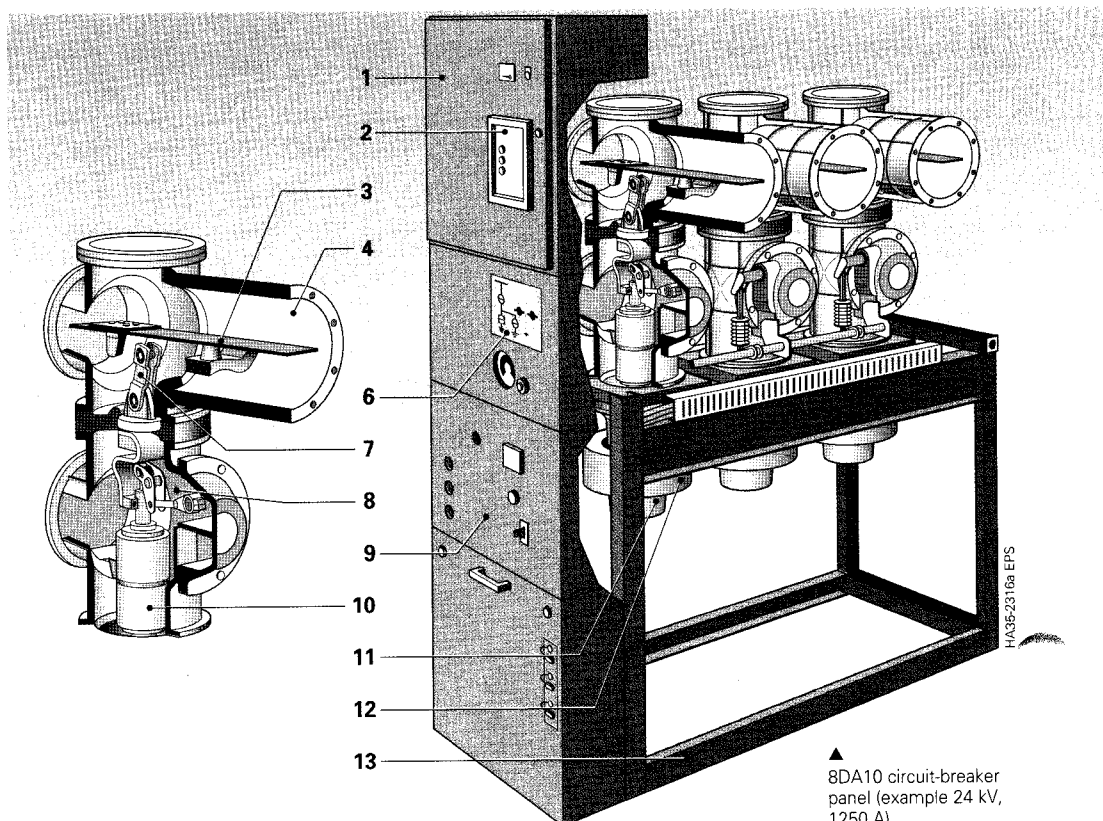
Insulation

- Switchpanel housing filled with SF₆ gas
- Features of the SF₆ gas:
 - Non-poisonous
 - Odourless and colourless
 - Non-inflammable
 - Inert
 - Heavier than air
 - Electronegative (good insulator)
- Overpressure of the SF₆ gas in the switchpanel housing:
 - Normally 0.5 bar or 1.0 bar (depending on insulation level and rated current) at 20 °C
 - Design pressure _____ 1.53 bar
 - Design temperature of the SF₆ gas _____ 80 °C
 - Operating pressure of the rupture diaphragm _____ 3.6 bar
 - Burst pressure _____ > 6.8 bar

4

Circuit-breaker panel

- 1 Low-voltage compartment
- 2 Secondary equipment
- 3 Busbar
- 4 Cast-aluminium chamber
- 5 Disconnector
- 6 Operating mechanism and interlock for three-position switch
- 7 Three-position switch
- 8 Circuit-breaker pole with upper and lower bushings
- 9 Circuit-breaker operating mechanism
- 10 Vacuum interrupter
- 11 Connection
- 12 Current transformer
- 13 Frame



▲
8DA10 circuit-breaker panel (example 24 kV, 1250 A)

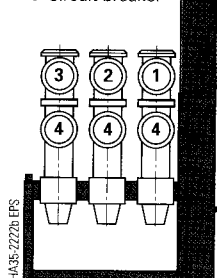
Gas compartments

The elementary requirements of a functional gas compartment design and monitoring system are as follows:

- A busbar section can only be operated if all busbar chambers involved are in good working order;
- Operation and monitoring of the entire busbar section as one gas compartment ;
- Lining up a number of individual panels to form a switchgear assembly forms one gas compartment per busbar phase
- Pressure indicator for monitoring mounted on a plate at the side.

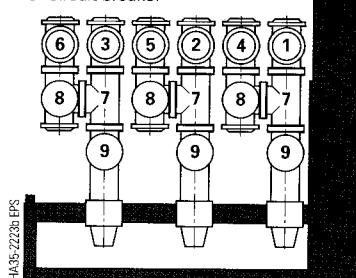
Gas compartments of the single-busbar switchgear

- 1 Busbar: L1
- 2 Busbar: L2
- 3 Busbar: L3
- 4 Circuit-breaker



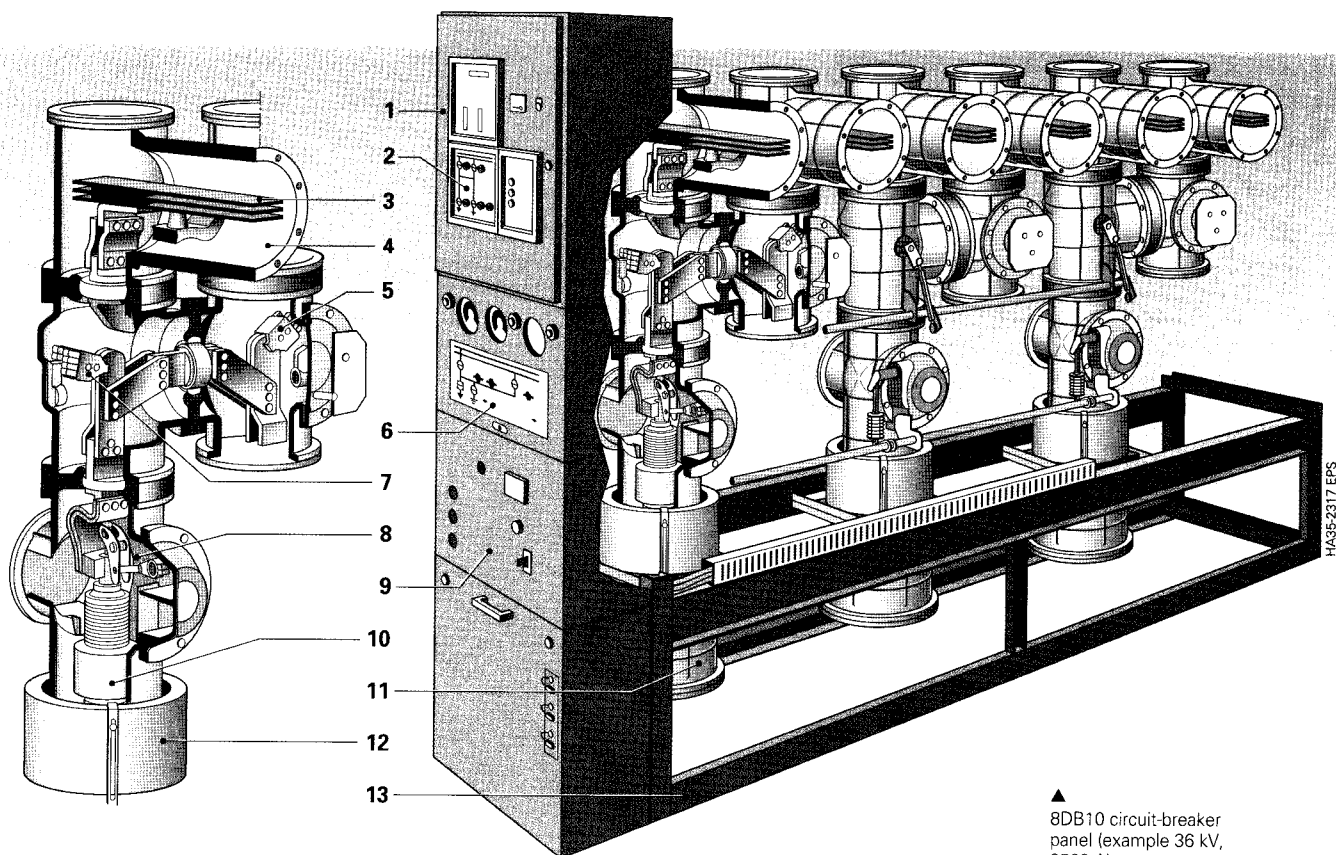
Gas compartments of the duplicate-busbar switchgear

- 1 Busbar 1: L1
- 2 Busbar 1: L2
- 3 Busbar 1: L3
- 4 Busbar 2: L1
- 5 Busbar 2: L2
- 6 Busbar 2: L3
- 7 Busbar 1: Three-position switch
- 8 Busbar 2: Disconnecter
- 9 Circuit-breaker



◀ Arrangement of gas compartments (example 36 kV switchgear)

- Operation and monitoring of a busbar section also possible in a single-busbar switchgear if a feeder is faulty:
 - “Feeder” gas compartment separated from “busbar” gas compartment;
 - 3 circuit-breaker housings interconnected by a pipe, resulting in individual gas monitoring for each panel;
 - For this purpose, a pressure indicator is installed in the front of each panel.
- Operation and monitoring of a duplicate-busbar switchgear is possible with faulty busbar or faulty disconnecter:
 - Gas compartments of both busbars have to be separated from the gas compartments of both disconnectors;
 - 1 gas compartment available for 3 circuit-breaker housings, disconnecter and three-position switch housings;
 - For this purpose, 3 pressure indicators are installed in the front of each panel to monitor the gas pressure.
- Own defined pressure relief facility per gas compartment;
- If voltage transformers are mounted on the busbar: SF₆ pressure is monitored by means of an indicator on the front of the switchpanel;
- Pressure monitoring by means of pressure gauges in conjunction with signalling contacts, to signal any increase or drop in pressure;
- Leakage rate per gas compartment < 1% per annum due to appropriately designed seals and gaskets:
 - Rated data as per DIN VDE 0670 part 6 or IEC 298 will still be valid even after 10 years of operation;
 - No topping up of the SF₆ gas is necessary.



▲ 8DB10 circuit-breaker panel (example 36 kV, 2500 A)

Modular assemblies

Switchpanel with circuit-breaker

- The pole housing contains:
 - Vacuum interrupters
- Flanges of pole housing:
 - The top flange connects the pole housing of the circuit-breaker with the busbar chamber via a bushing
 - The bottom flange is for mounting the feeder bushing plate with the coupling electrode for capacitive voltage indication
 - Side flange (at front of Fig.) for a cover with a rupture diaphragm
 - Side flange (at rear of Fig.) for a cover with an upper support and operating mechanism of the vacuum interrupter.

Vacuum circuit-breaker

- Contacts inside the vacuum interrupter perform the actual switching
- SF₆ gas in the outer area of the interrupter provides insulation to the earthed pole housing (SF₆ insulating properties are thus unaffected by switching processes)
- The 3 interrupters are operated from the front of the panel by means of a common shaft (fitted outside the housings).

Circuit-breaker operating mechanism

- The vacuum interrupters have the same operating mechanism as the type 3AH circuit-breaker.
- Arranged in the mechanism casing on the front of the switchpanel.
- The operating force is transmitted to the vacuum interrupters by means of the common shaft outside the housing.

Three-position switch

- Can be supplied for rated currents up to 2500 A
- Maintenance-free
- Compact design, as only short contact gaps needed in SF₆ gas
- Operating shaft at the pivot of the isolating blade contacts
- Operating shaft and isolating blade contacts coupled via an insulator without any additional guide linkage
 - Thus the position of the operating shaft reliably indicates the position of the three-position switch
- Three switch positions
 - **ON:** The blade contacts engage the busbar: circuit between busbar and circuit-breaker is closed
 - **OFF:** Circuit between busbar and circuit-breaker is opened: The contact gap is sufficiently large to withstand test voltages
 - **READY TO EARTH:** Blade contacts engage the earth contacts in the busbar chamber: Outgoing feeder is earthed and short-circuited by closing the circuit-breaker
- Gas-tight barrier plates separate the busbar chambers and the circuit-breaker housings from each other underneath the blade contacts
- Busbar chambers and circuit-breaker housings are bolted separately to their bushings:
 - One of the two housings can be removed without affecting the gas-tight seal of the other.

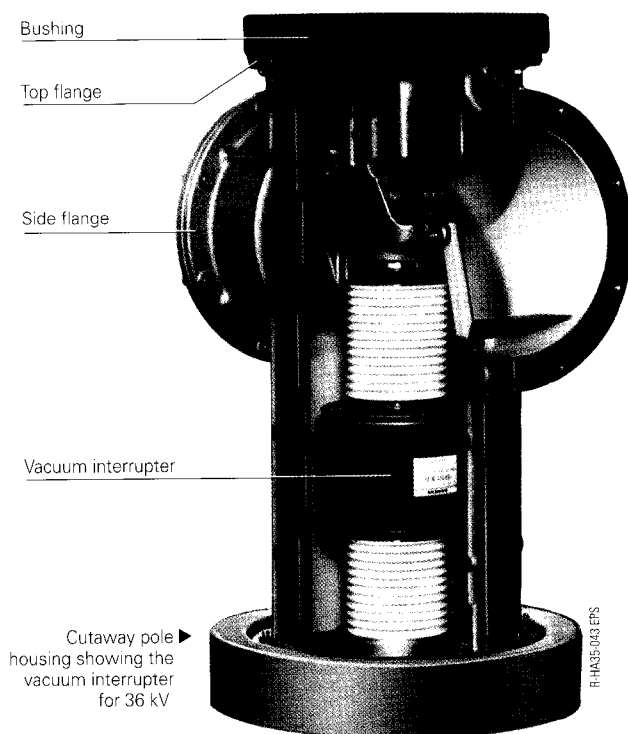
Operating mechanism of three-position switch

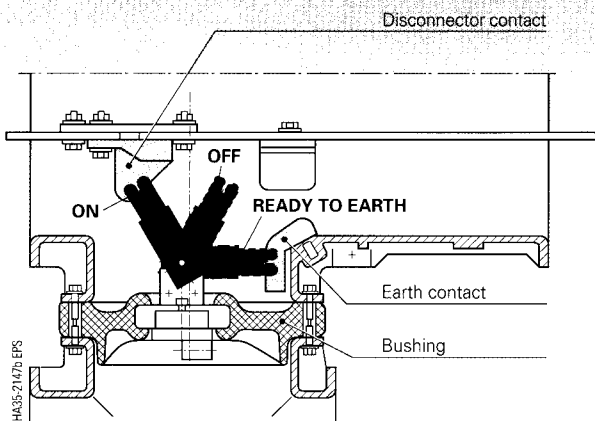
New operating mechanism for disconnector and earthing switch function as of January 1996.

Features

- Separate, lockable fitting openings for operating lever of the functions "Isolate" and "Earth"
- Selection of functions "Isolate" or "Earth" by means of a double-bit key (only possible for permitted switching operation as per the interrogation interlock)
- Same sense of rotation when operating the functions "On" or "OFF"
- Interlock interrogation for duplicate-busbar switchgear with the aid of a slide valve which selects the system disconnector to be operated (for busbar 1 or 2)
- Motor-operating mechanism can also be provided for the three-position switch, which means that the mechanical "outgoing feeder internal" interlock functions also remain with manual operation.

4

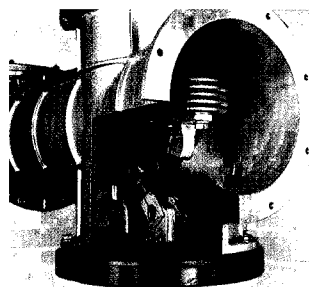




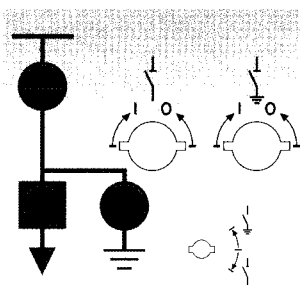
Three-position switch
with busbar and bushing

Switch positions

Switch position indication

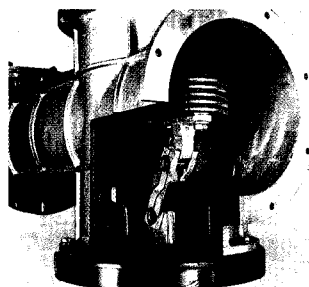
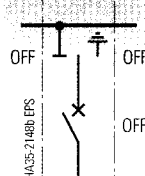


R-HA35-008 EPS

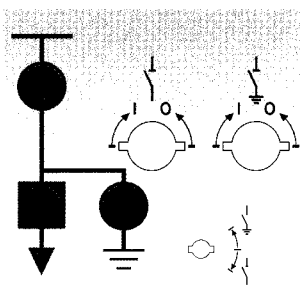


HA35-2301 EPS

Outgoing feeder off
Three-position switch OFF
Circuit-breaker OFF

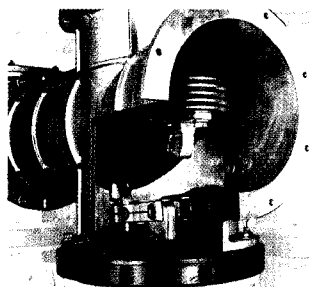
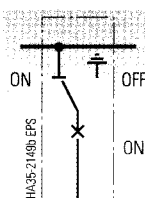


R-HA35-008 EPS

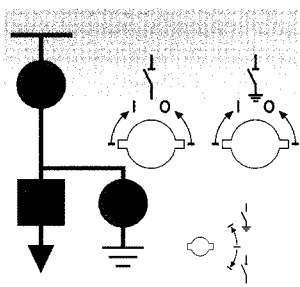


HA35-2331 EPS

Outgoing feeder on
Three-position switch ON
Circuit-breaker ON

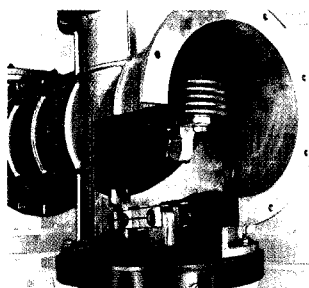
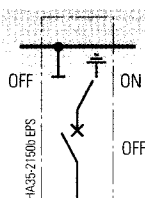


R-HA35-010 EPS

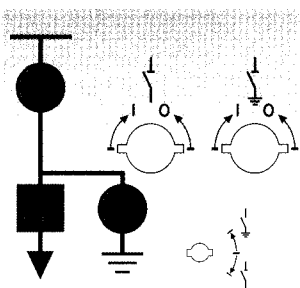


HA35-7332 EPS

Ready to earth
Three-position switch READY TO EARTH
Circuit-breaker OFF

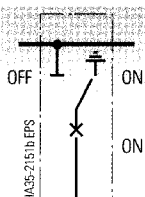


R-HA35-010 EPS



HA35-2333 EPS

Outgoing feeder earthed
Three-position switch EARTH
Circuit-breaker ON



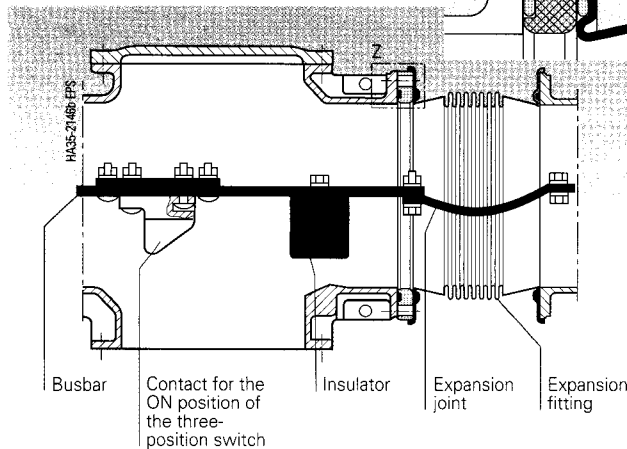
Modular assemblies

Busbars

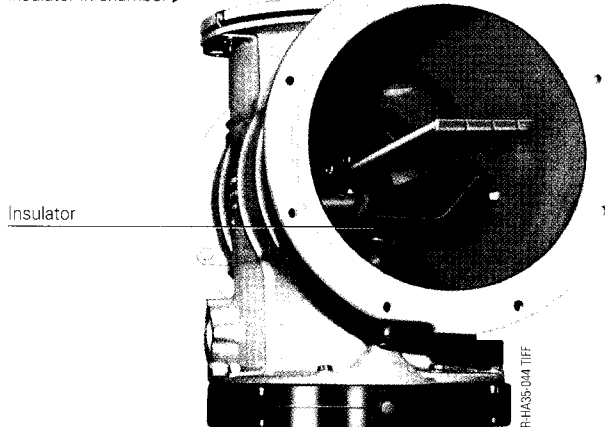
- Busbars of flat copper
- Mounted on insulators (see Fig.) in the chamber and secured once per busbar section in the longitudinal direction
- Insulators absorb transverse forces arising from short-circuits, still allowing movement in the longitudinal direction of the busbar
- Installation of the 3 busbar phases each in separate, continuous busbar compartments
- Each phase and each busbar compartment has its own gas monitor
- Mating contacts for the ON position of the three-position switch in single-busbar switchgear directly in the busbar (see Fig. below)
- Busbar connection to the gas-tight bushing of the disconnecter gas compartment by means of a flexible strap in the case of duplicate-busbar switchgear
- Linear compensation of the horizontal busbar chambers at approximately 10-panel intervals with the aid of expansion joints and fittings (see Fig.) with unaffected panel spacing. (The busbar chamber is appropriately shorter at the expansion fitting).

Detail Z:
Insulation between
expansion fitting and
chamber

Busbar with expansion joint and fitting,
mounted on the short busbar chamber



Busbar with
insulator in chamber



Capacitively coupled voltage indicator according to the LRM system

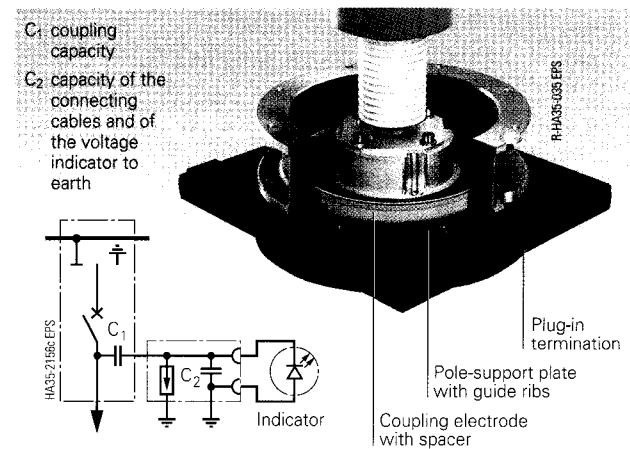
- For checking for dead state of each pole
- A plug-in voltage indicator flashes when high voltage is applied
- Phases can be compared at jack pairs
- Indicator designed for continuous duty (can remain plugged in)
- System permanently safe-to-touch
- System routine-tested at factory
- Easy indicator test facility.

The coupling capacitor C_1 is formed by a coupling electrode installed in the pole-support plate of the circuit-breaker.

The capacitive layers in the cable connector are thus made redundant and the device is calibrated with capacitor C_2 and the entire system is tested at the factory.

If, however, cable connectors with capacitive layers are used, these layers must be earthed or, alternatively, they can be used as an additional voltage indicator directly on the cable connector (= accessories made by Pfisterer).

Coupling capacitor C_1 and
capacitive voltage indicator
(schematic diagram)



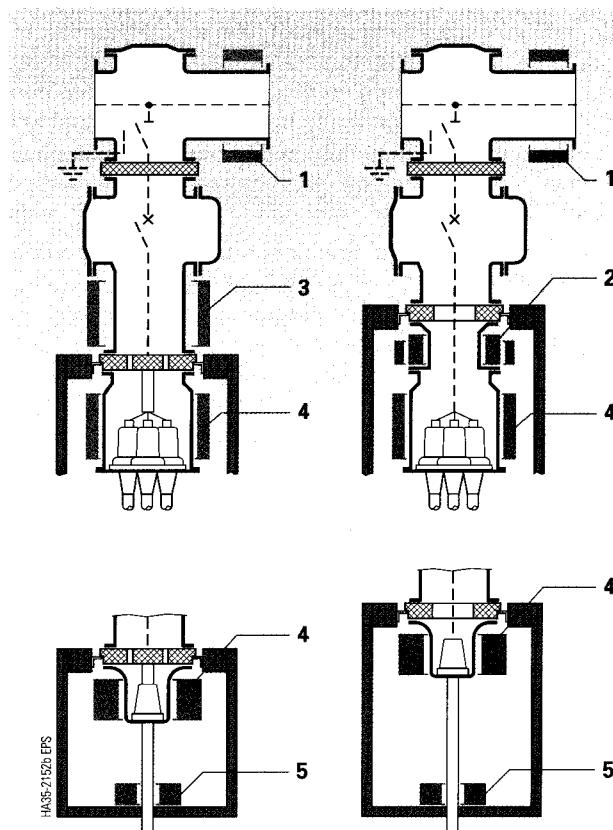
Toroidal-core current transformers

- For arrangement outside the housing due to single-pole enclosure of the toroidal cores
- The toroidal core accommodates the secondary winding and the current path forms the primary winding
- Free from dielectrically stressed cast-resin components
- Easily accessible outside the housing
- Dimensions of the current transformers are the same for all primary voltages.

Mounting locations

Up to 12 kV, 2500 A and 36 kV

- **On the busbar (1):**
CT inside diameter 300 mm, max. mounting height 160 mm
 - **On the circuit-breaker housing (3):**
CT inside diameter 300 mm, max. mounting height 214 mm (for 36 kV: max. 294 mm)
 - **At the panel connection (4):**
 - With single connection up to connector size 2:
CT inside diameter 180 mm and CT outside diameter 290 mm; max. mounting height 160 mm; CT inside diameter 180 mm and CT outside diameter 376 mm; max. mounting height 214 mm
 - With single connection for connector size 3:
CT inside diameter 300 mm, max. mounting height 160 mm
 - With multiple connection (2 or 3 cable connectors size 1 or 2) per phase:
CT inside diameter 300 mm, max. mounting height 214 mm
 - No CT installation possible with
 - a) 2 or 3 cables per phase, connector size 3
 - a) 4 or 5 cables per phase, connector size 1 or 2
 - c) Directly plugged-in voltage transformer
 - **In cable compartment (slip-on version) (5):**
CT inside diameter 140 mm.
- Up to 24 kV
- **On the busbar (1):**
CT inside diameter 300 mm, max. mounting height 160 mm
 - As a result of the compact design of the interrupters, and thus an appropriately shorter housing, mounting is not possible on the circuit-breaker housing. For this purpose, a special current transformer housing will be provided underneath the circuit-breaker housing in the case of single connections for connector size 3 and multiple connections.
In the case of single connections up to connector size 2, this CT housing will be formed by the housing of the socket contacts.
 - **On the CT housing (2):**
With panel connection with multiple connection or single connection with connector size 3:
CT inside diameter 180 mm and CT outside diameter 290 mm or 376 mm; max. mounting height 160 mm.
 - **At the panel connection (4):**
 - With single connection up to connector size 2:
CT inside diameter 180 mm and CT outside diameter 290 mm; max. mounting height 160 mm; CT inside diameter 180 mm and CT outside diameter 376 mm; max. mounting height 214 mm
 - With single connection for connector size 3:
CT inside diameter 300 mm; max. mounting height 160 mm
 - With multiple connection (2 or 3 cable connectors size 1 or 2) per phase:
CT inside diameter 300 mm, max. mounting height 214 mm
 - No CT installation possible with
 - a) 2 or 3 cables per phase, connector size 3
 - a) 4 or 5 cables per phase, connector size 1 or 2
 - c) Directly plugged-in voltage transformer
 - **In cable compartment (slip-on version) (5):**
CT inside diameter 140 mm.



Design for 12 kV, 2500 A and 36 kV

- 1 Mounting on the busbar
- 3 Mounting on the circuit-breaker housing
- 4 Mounting at the panel connection
- 5 Mounting in cable compartment

Design for up to 24 kV

- 1 Mounting on the busbar
- 2 Mounting on the CT housing
- 4 Mounting at the panel connection
- 5 Mounting in cable compartment

Mounting locations for toroidal-core current transformers

Technical data of the toroidal-core current transformers

Operating voltage	Max. 0.8 kV
Rated power-frequency withstand voltage	3 kV (high-voltage test)
Rated frequency	50/60 Hz
Rated continuous thermal current	Max. $1.2 \times I_n$
Rated short-time thermal current	40 kA, max. 3 s
Rated dynamic current	Unlimited
Rated primary current	40 to 2500 A
Reconnectible on secondary side	200 – 100 to 2500 – 1250 A
Rated secondary current	1 A or 5 A
Number of cores	Max. 3
Core data (depending on rated primary current):	Core for instrument duty Core for protective duty
Rating	2.5 to 10 VA 2.5 to 30 VA
Class/overcurrent factor	0.2 to 1 / M10 5 to 10 / P10 to P30
Permissible ambient temperature	Max. 60 °C
Insulation class	E
Standards	IEC 185, DIN VDE 0414

* Only possible with totally insulated connections.

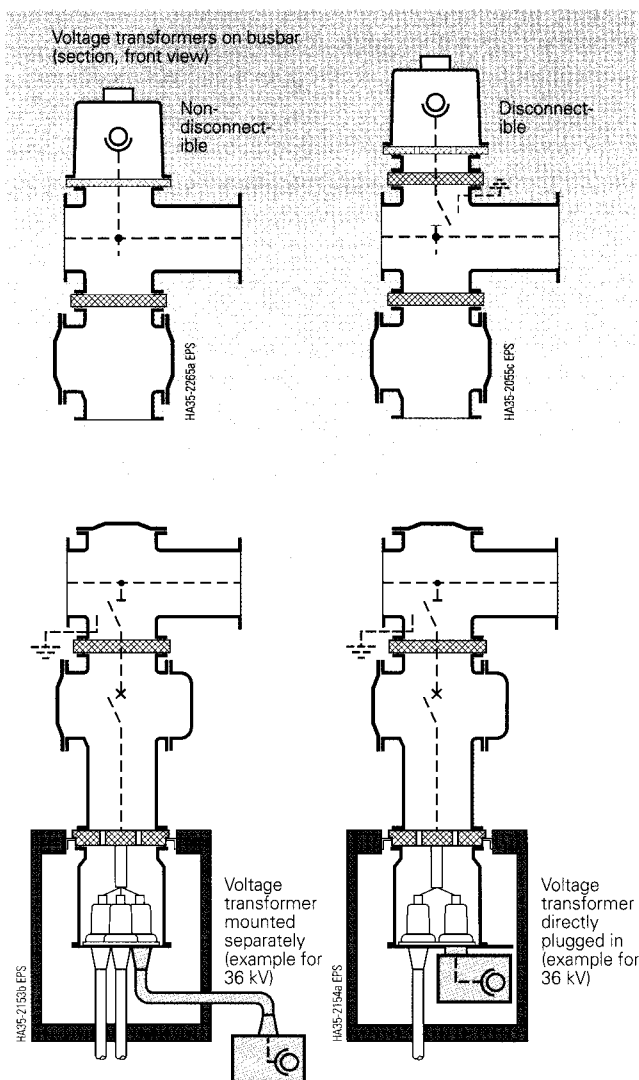
Modular assemblies

Inductive voltage transformer on busbar

- Can be mounted on any non-end panel (with the exception of the busbar tie)
- No additional panel spacing required
- Single-pole insulated
- Accommodated in a separate housing filled with SF₆ gas
- Also available as certified inductive voltage transformers (for billing purposes).

Versions

- Voltage transformer directly connected to the busbar via contact bushing
- Disconnectable voltage transformer linked to busbar via three-position switch. In the event of a voltage transformer defect, the busbar can remain in operation while the transformer is being replaced.



Inductive voltage transformer at panel connection

- Can be directly plugged in or
- Mounted separately and connected via a plug-in cable.

If the performance data of the direct plug-in voltage transformer are inadequate due to the restricted space available, a metal-enclosed voltage transformer with socket connection can be used, which is separately mounted and connected via cable. This option should also be employed if more than 2 additional cables have to be connected.

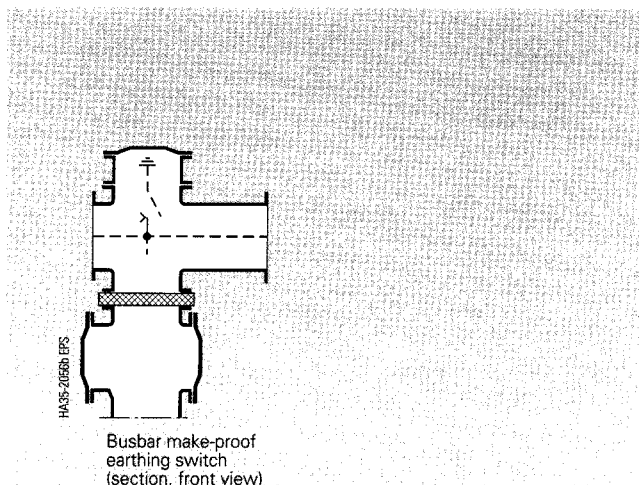
In addition to the direct plug-in transformer, a maximum of 2 cables per phase (up to connector size 3) or 1 totally-insulated bar can be connected at the panel connection.

Technical data		Voltage transformer on busbar			Voltage transformer mounted separately			Voltage transformer directly plugged in		
Type		4MT42	4MT44	4MT46	GBE12	GBE24	GBE36	4MT72	4MT74	4MT76
Operating voltage	max. kV	12	24	36	12	24	36	12	24	36
Primary voltage	kV	3.3/√3	13.8/√3	25.0/√3	3.3/√3	13.8/√3	25.0/√3	3.3/√3	13.8/√3	25.0/√3
		3.6/√3	15.0/√3	25.8/√3	3.6/√3	15.0/√3	25.8/√3	3.6/√3	15.0/√3	25.8/√3
		4.8/√3	17.5/√3	30.0/√3	4.8/√3	17.5/√3	30.0/√3	4.8/√3	17.5/√3	30.0/√3
		5.0/√3	20.0/√3	33.0/√3	5.0/√3	20.0/√3	33.0/√3	5.0/√3	20.0/√3	33.0/√3
		6.0/√3	22.0/√3	34.5/√3	6.0/√3	22.0/√3	34.5/√3	6.0/√3	22.0/√3	34.5/√3
		6.6/√3		35.0/√3	6.6/√3		35.0/√3	6.6/√3		35.0/√3
		7.2/√3			7.2/√3			7.2/√3		
		10.0/√3			10.0/√3			10.0/√3		
		11.0/√3			11.0/√3			11.0/√3		
Secondary voltage	V	100/√3 110/√3	100/√3 110/√3	100/√3 110/√3	100/√3 110/√3	100/√3 110/√3	100/√3 110/√3	100/√3 110/√3	100/√3 110/√3	100/√3 110/√3
Auxiliary winding for earth-fault detection	V	100/3 110/3	100/3 110/3	100/3 110/3	100/3 110/3	100/3 110/3	100/3 110/3	100/3 110/3	100/3 110/3	100/3 110/3
Secondary, thermal current limit of measuring winding	A	8 9 (on request)	8 9 (on request)	13	7 10 (on request)	7 10 (on request)	10	7	7	6
Rated voltage factor U _n /8 h		1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
Rated long-duration current / 8 h	A	5	5	11	6	6	6	6	6	6
Accuracy class		0.2-0.5-1	0.2-0.5-1	0.2-0.5-1	0.2-0.5-1	0.2-0.5-1	0.2-0.5-1	0.2-0.5-1	0.2-0.5-1	0.2-0.5-1
Output	VA	30-90-200	30-90-200	30-90-200	30-90-180	30-90-180	30-90-180	10-30-75	10-30-75	10-30-75
Standards		IEC 186, DIN VDE 0414			IEC 186, DIN VDE 0414			IEC 186, DIN VDE 0414		

Busbar make-proof earthing switch

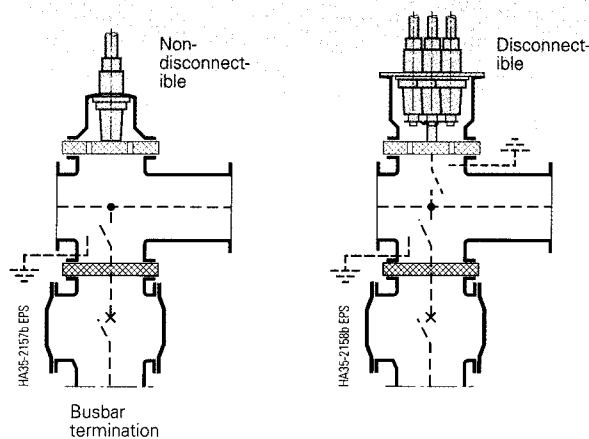
- For single-busbar switchgear without busbar ties
- For duplicate-busbar switchgear without busbar ties or busbar couplers
- Refer to pages 29 and 33 for arrangement of the operating mechanism.

If the switchgear includes a busbar tie or coupler, make-proof earthing is normally provided by means of the three-position switches and the circuit-breaker of one coupling feeder.



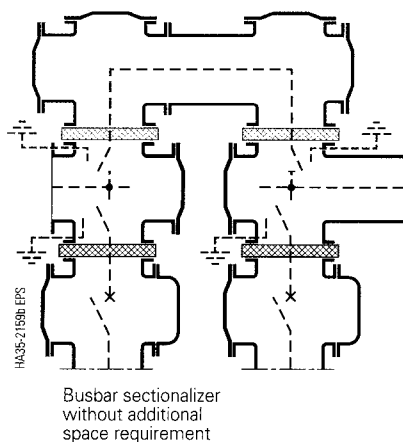
Busbar termination

- Direct connection can be made to the busbar with all variants of the totally-insulated panel terminations
- Can be supplied with or without disconnector
- Refer to pages 29 and 33 for arrangement of the operating mechanism.



Busbar sectionalizer without additional space requirement

- Allows two adjacent panels to be sectionalized
- No additional space required in the panel width
- Refer to pages 29 and 33 for arrangement of the operating mechanism.



Modular assemblies up to 24 kV

Totally-insulated panel terminations

The totally-insulated panel terminations can be supplied either for conical (inner cone) cable connectors or for solid or gas-insulated bars.

Cable cross-sections for plug-in cables

Con- nector size	For rated voltage 7.2/12/15 kV	17.5/24 kV
	Cable cross-section mm ²	mm ²
1	to 240	to 185
2	120 to 300	95 to 300
3	400 to 630	400 to 630

The multiple terminations can also be equipped with socket contacts for various connector sizes, e.g. when separately mounted voltage transformers or plug-in surge arresters are used.

Panel termination height a above the floor

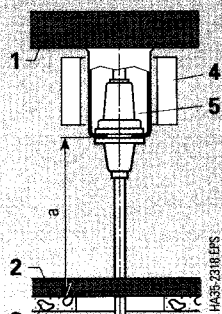
Fig.	For 8DA10 single- busbar switchgear	For 8DB10 duplicate- busbar switchgear
	Dimension a mm	Dimension a mm
A	670	470
B	470	270
C	760 ¹⁾ 790 ²⁾	560 ¹⁾ 590 ²⁾
D	400	200
E*	370	170
F*	370	170
G*	370	170
H*	320	120

1) With circuit-breaker panel.

2) With disconnector panel.

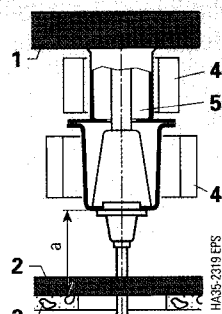
* No mounting possibility of current transformers at the panel termination.

Single terminations



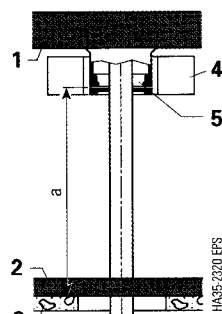
Plug-in cable termination
for 1 cable
per phase
with connector
size 1 or 2

Fig. A



Plug-in cable termination
for 1 cable
per phase
with connector
size 3

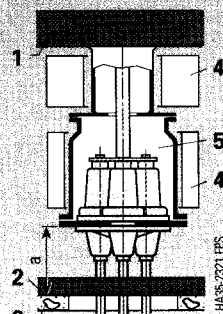
Fig. B



**Termination
for solid-insulated
bar**
up to 2500 A
rated current

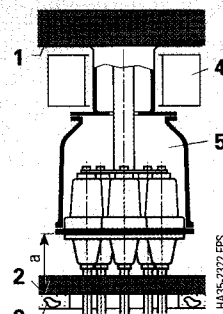
Fig. C

Multiple terminations



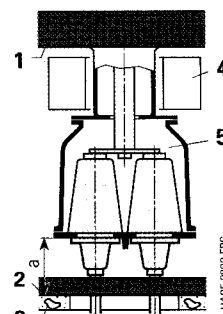
Plug-in cable termination
for 2 or 3 cables
per phase
with connector
size 1 or 2

Fig. D



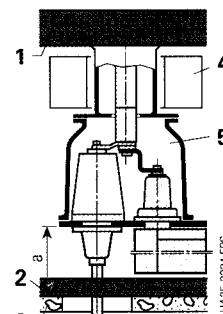
Plug-in cable termination
for 4 or 5 cables
per phase
with connector
size 1 or 2

Fig. E*



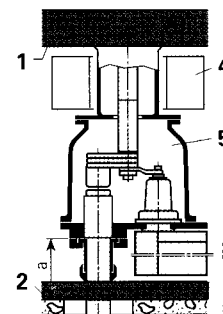
Plug-in cable termination
for 2 or 3 cables
per phase
with connector
size 3

Fig. F*



Plug-in cable termination
- for 1 or 2 cables
per phase
with connector
size 1, 2 or 3 and
- for plug-in voltage
transformer

Fig. G*



**Termination
for solid-insulated
bar
and
for plug-in voltage
transformer**

Fig. H*

- 1 Frame upper section
- 2 Frame lower section
- 3 Concrete floor (for example)
- 4 Mounted current transformer
- 5 SF₆ insulation

Modular assemblies 12 kV, 2500 A and 36 kV

Totally-insulated panel terminations

Totally-insulated panel terminations can be supplied either for conical (inner cone) plug connectors or for solid or gas-insulated bars.

Cable cross-sections for plug-in cables

Con- nector size	For rated voltage 12 kV	36 kV
	Cable cross-section mm ²	mm ²
1	to 240	–
2	120 to 300	to 185
3	400 to 630	240 to 500

The multiple terminations can also be equipped with socket contacts for various connector sizes, e.g. when separately mounted voltage transformers or plug-in surge arresters are used.

Panel termination height a above the floor

Fig.	For 8DA10 single- busbar switchgear	For 8DB10 duplicate- busbar switchgear
	Dimension a	Dimension a
	mm	mm

For switchpanels 12 kV, 2500 A

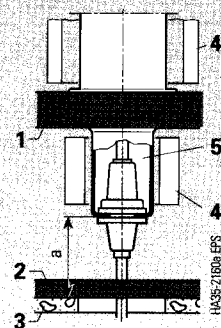
A	480	280
B	500	300
C	600	400
D	650	450
E	440	240
F*	400	200
G*	400	200
H*	400	200
J*	360	160

For switchpanels 36 kV

A	400	200
B	420	220
C	520	320
D	570	370
E	350	150
F*	320	120
G*	320	120
H*	320	120
J*	280	80

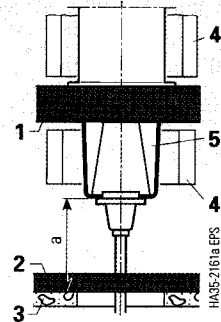
* No mounting possibility of current transformers at the panel termination.

Single terminations



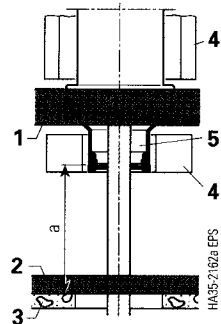
Plug-in cable termination for 1 cable per phase with connector size 1 or 2

Fig. A



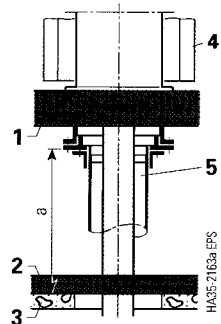
Plug-in cable termination for 1 cable per phase with connector size 3

Fig. B



Termination for solid-insulated bar up to 2500 A rated current

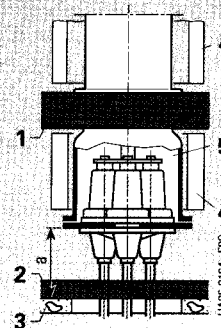
Fig. C



Termination for tubular gas bar up to 2500 A rated current

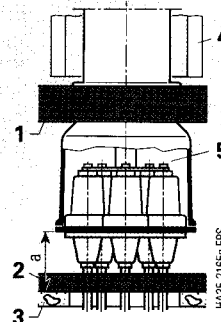
Fig. D

Multiple terminations



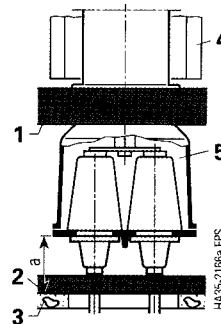
Plug-in cable termination for 2 or 3 cables per phase with connector size 1 or 2

Fig. E



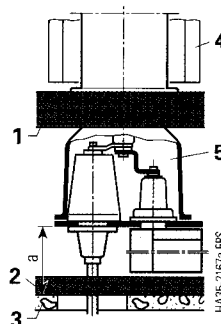
Plug-in cable termination for 4 or 5 cables per phase with connector size 1 or 2

Fig. F*



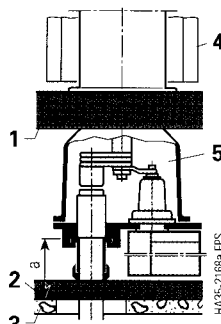
Plug-in cable termination for 2 or 3 cables per phase with connector size 3

Fig. G*



Plug-in cable termination for 1 or 2 cables per phase with connector size 1, 2 or 3 and for plug-in voltage transformer

Fig. H*



Termination for solid-insulated bar and for plug-in voltage transformer

Fig. J*

- 1 Frame upper section
- 2 Frame lower section
- 3 Concrete floor (for example)
- 4 Mounted current transformer
- 5 SF₆ insulation

Modular assemblies 36 kV

Air-insulated panel terminations (36 kV)

The air-insulated panel terminations of standard design are suitable for the cable sealing ends made by Siemens (type IAE) or for comparable sealing end types of other makes.

The complete immission protection of the primary section is not achievable in this area.

Toroidal-core current transformers at the panel termination are not possible with air-insulated panel terminations.

Cable cross-sections

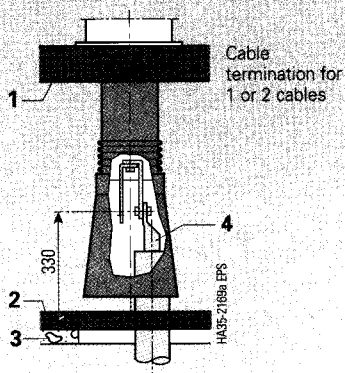
Termination type	Cable cross-section mm ²
1x	up to 600
2x	up to 500
3x	300

Terminations for paper-insulated mass-impregnated cables or for other types of sealing ends as specified can also be made for which, however, special measures may need to be taken.

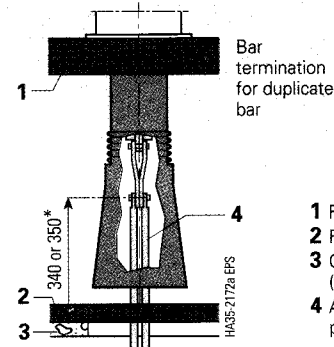
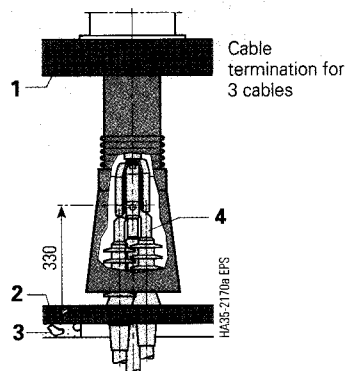
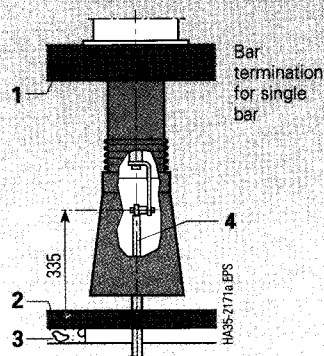
4

* 347 mm at ≤ 1600 A
357 mm at ≤ 2500 A

Cable terminations



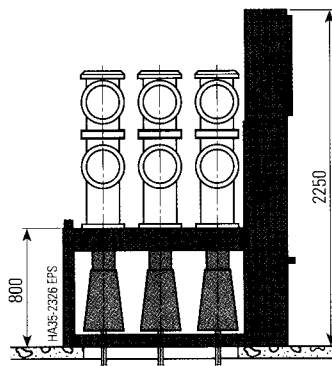
Bar terminations



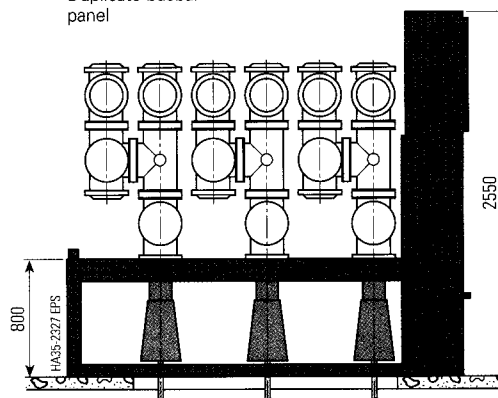
- 1 Frame upper section
- 2 Frame lower section
- 3 Concrete floor (for example)
- 4 Air-insulated panel termination

Arrangement of the air-insulated panel terminations in the frame

Single-busbar panel



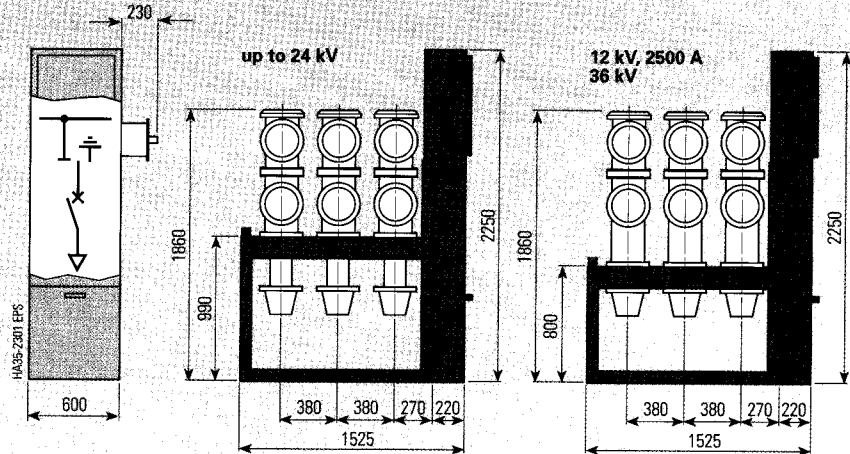
Duplicate-busbar panel



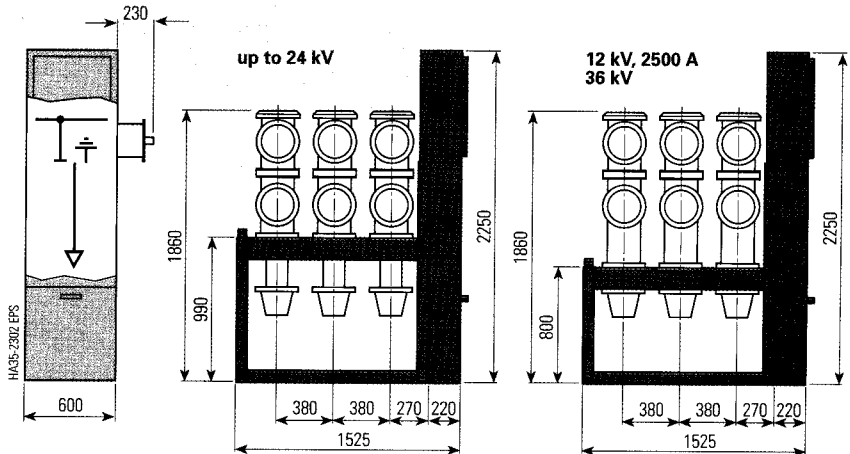
Switchpanel and frame heights for air-insulated terminations (36 kV)

Dimensions for 8DA10 single-busbar panels

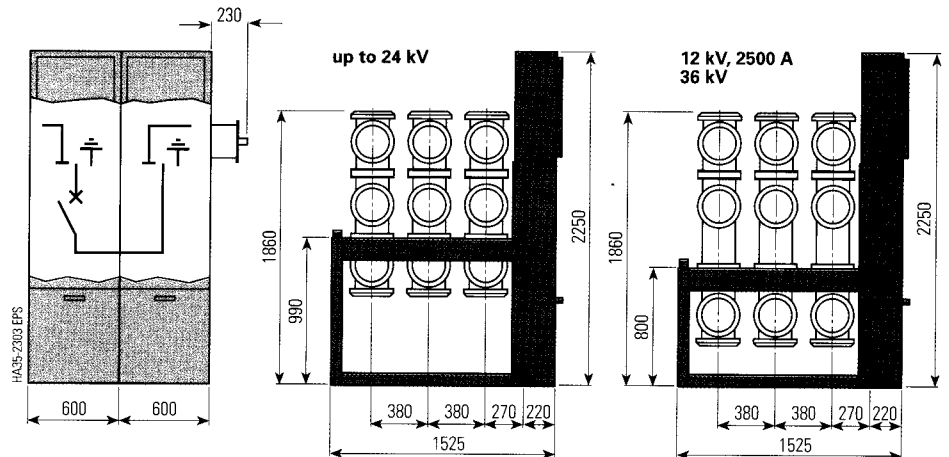
Circuit-breaker panel



Disconnecter panel



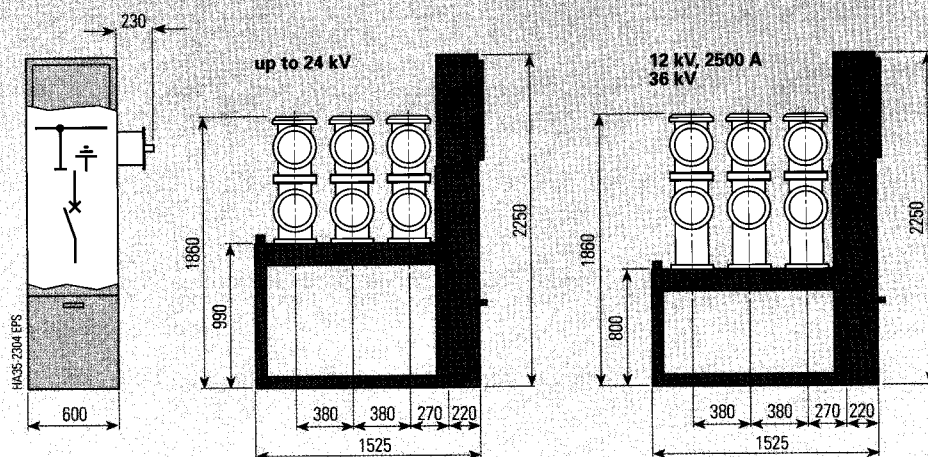
Busbar tie



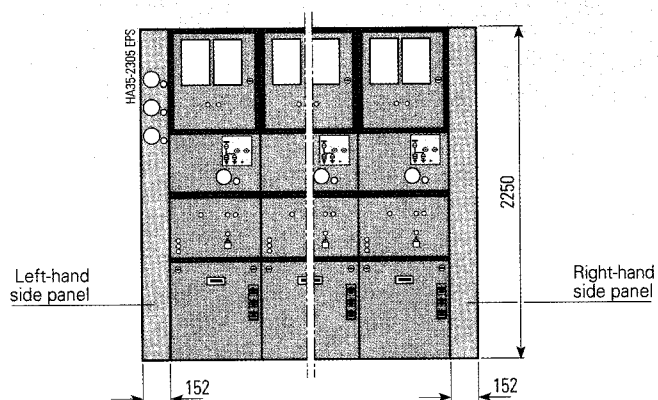
4

Dimensions for 8DA10 single-busbar panels

Spare panel

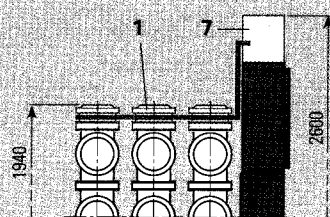


Switchgear end units



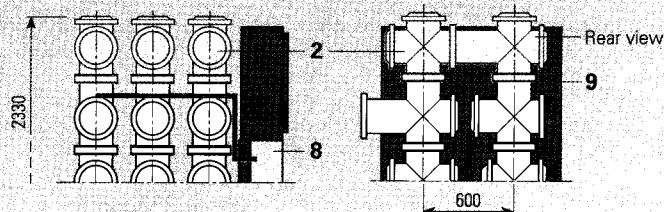
Dimensions for built-on accessories of the 8DA10 single-busbar panels

Busbar make-proof earthing switch (1)



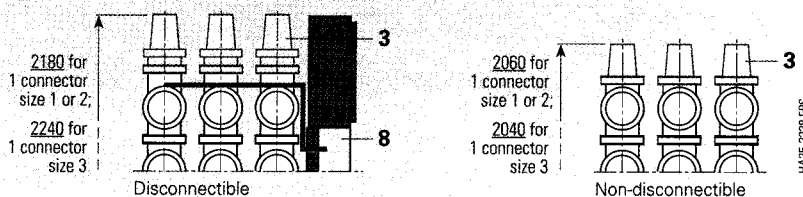
HA35-2338 EPS

Busbar sectionalizer (2) without additional space requirement



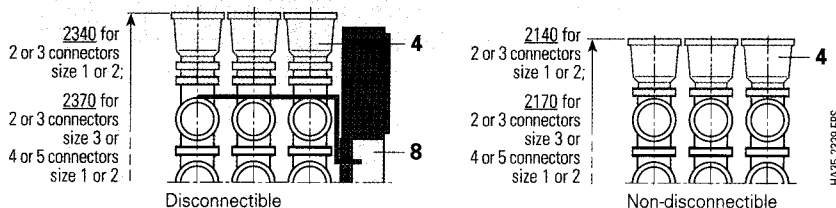
HA35-2337 EPS

Busbar termination (3) for single plug-in cable



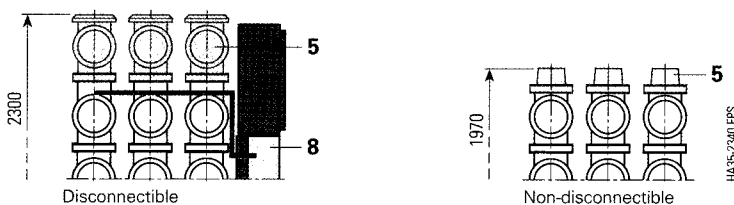
HA35-2338 EPS

Busbar termination (4) for multiple plug-in cable



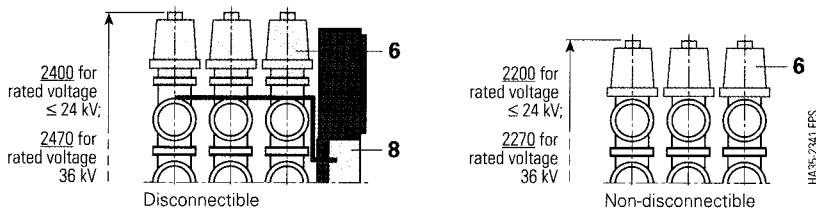
HA35-2339 EPS

Busbar termination (5) for totally-insulated bar



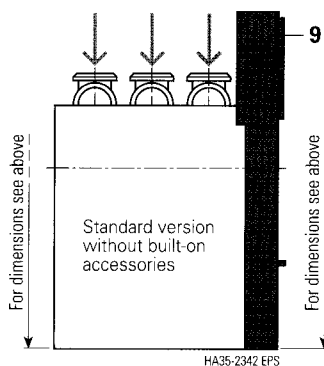
HA35-2340 EPS

Busbar voltage transformer (6)



HA35-2341 EPS

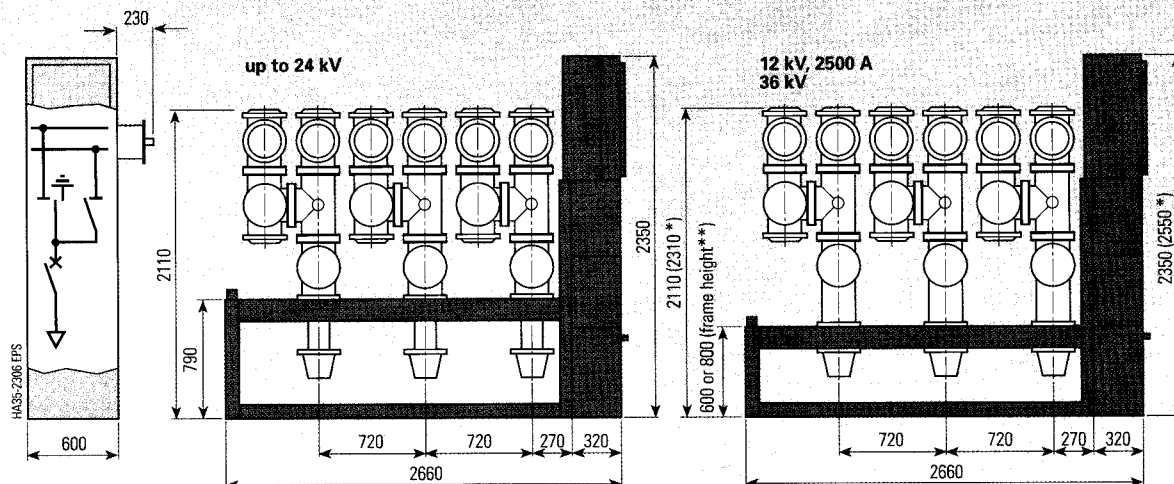
- 7 Operating mechanism for make-proof earthing switch
- 8 Operating mechanism for three-position switch
- 9 Low-voltage compartment



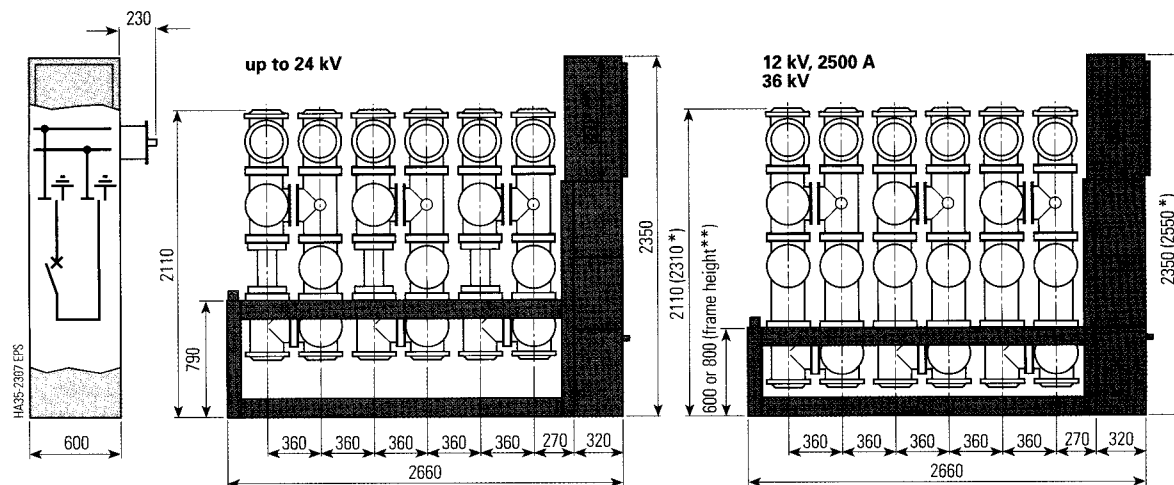
HA35-2342 EPS

Dimensions for 8DB10 duplicate-busbar panels

Circuit-breaker panel



Busbar coupler

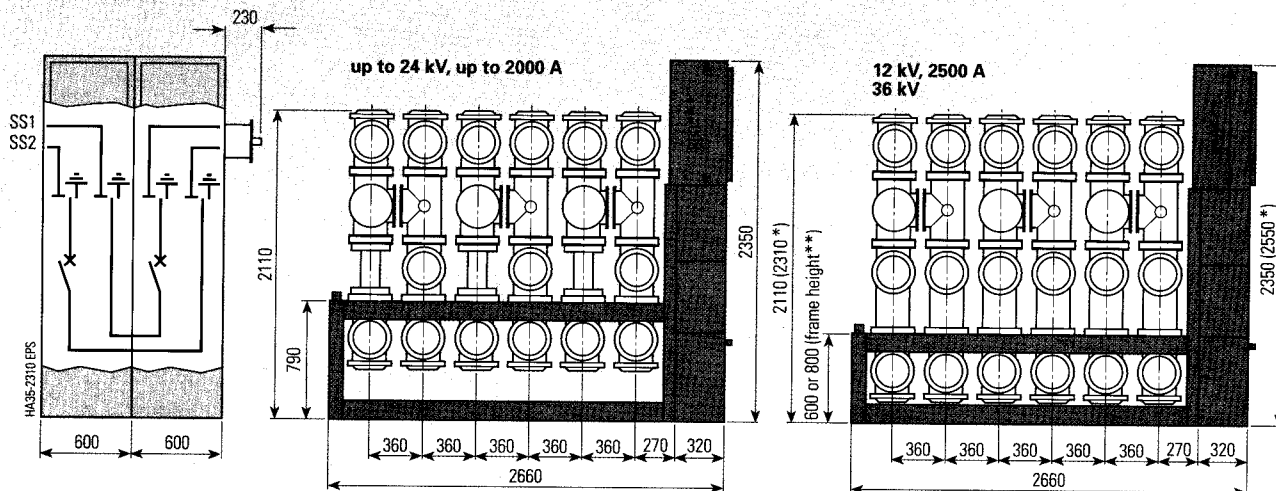


* Dimension for frame height of 800 mm.

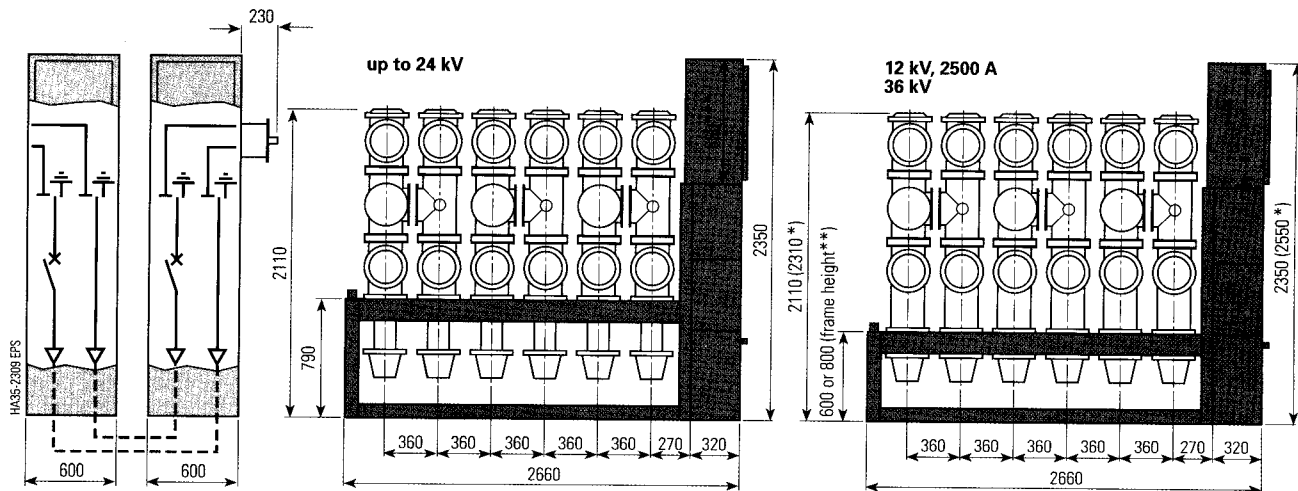
** Frame height of 800 mm only with 36 kV and air-insulated panel termination.

*** The low-voltage compartment can also be supplied with a height of 1000 mm. The total height of the switch gear front will increase accordingly.

Busbar tie for both busbar systems (BB1 and BB2)



Busbar tie for connection in cable basement



4

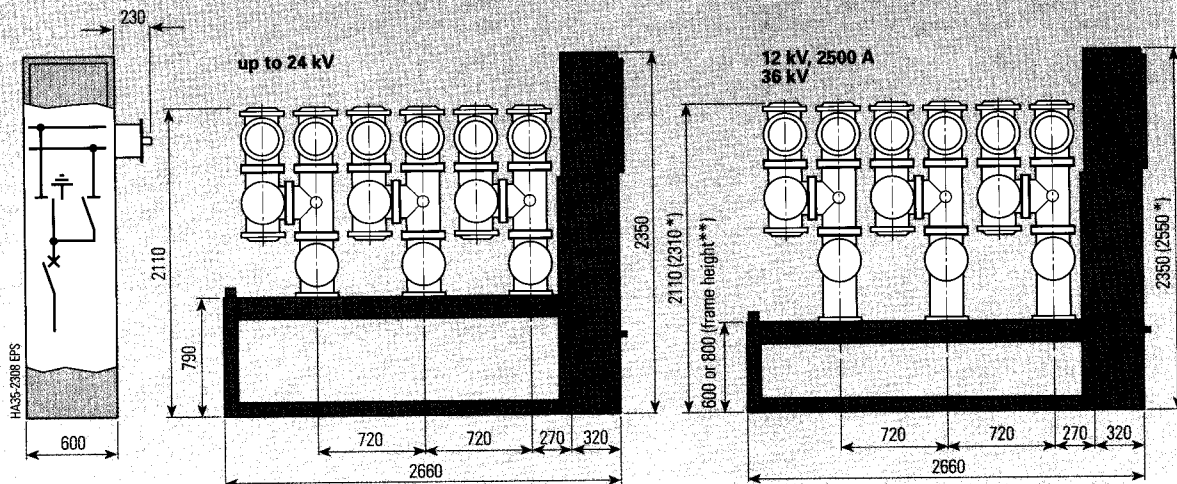
* Dimension for frame height of 800 mm.

** Frame height of 800 mm only with 36 kV and air-insulated panel termination.

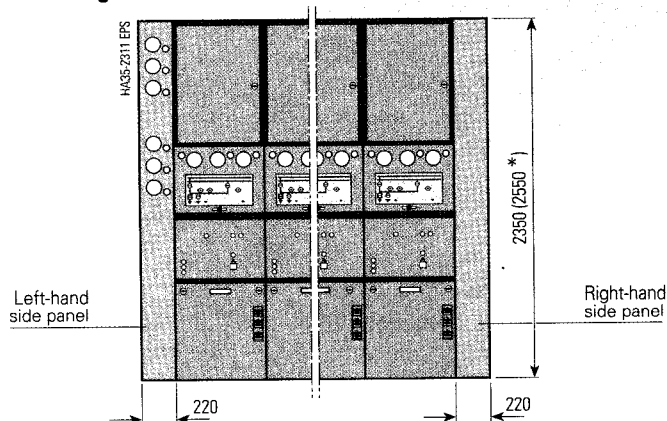
*** The low-voltage compartment can also be supplied with a height of 1000 mm. The total height of the switch-gear front will increase accordingly.

Dimensions for 8DB10 duplicate-busbar panels

Spare panel



Switchgear end units



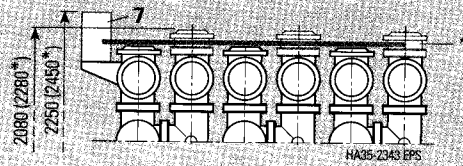
* Dimension for frame height of 800 mm.

** Frame height of 800 mm only with 36 kV and air-insulated panel termination.

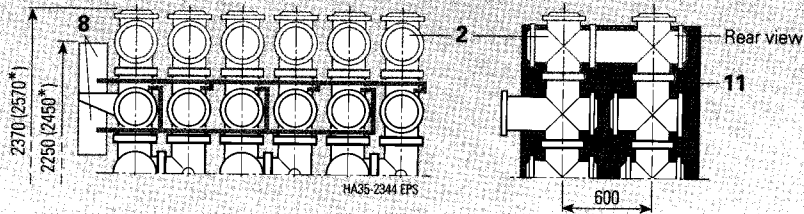
*** The low-voltage compartment can also be supplied with a height of 1000 mm. The total height of the switchgear front will increase accordingly.

Dimensions for built-on accessories of the 8DB10 duplicate-busbar panels

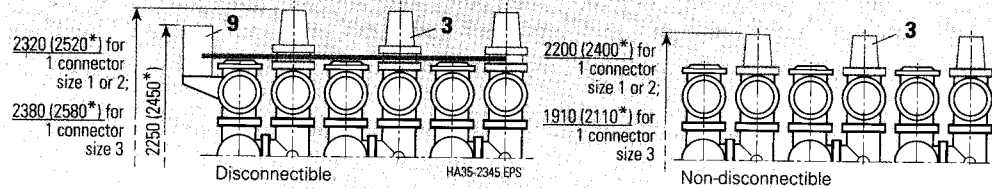
Busbar make-proof earthing switch (1)



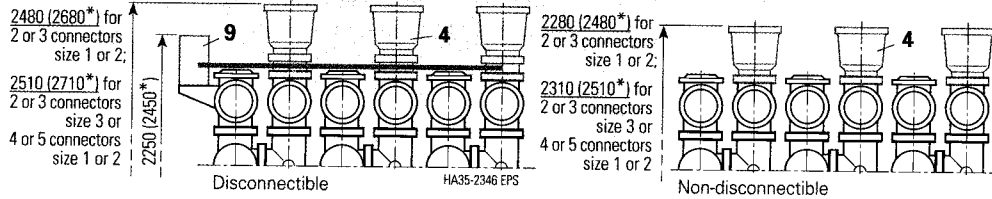
Busbar sectionalizer (2) without additional space requirement



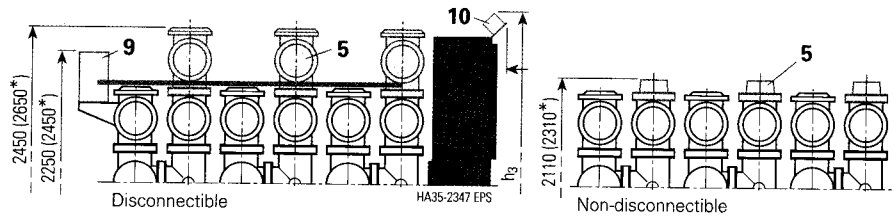
Busbar termination (3) for single plug-in cable



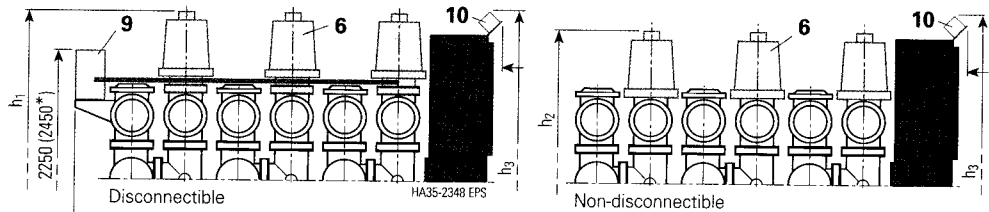
Busbar termination (4) for multiple plug-in cable



Busbar termination (5) for totally insulated bar



Busbar voltage transformer (6) (only 1 transformer for 1 BB system per panel)



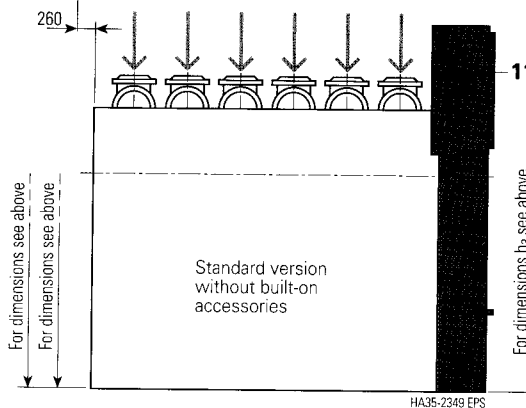
7 Operating mechanism for make-proof earthing switch

8 Operating mechanism for disconnecter

9 Operating mechanism for three-position switch

10 Gas monitor

11 Low-voltage compartment



Rated voltage	Dimension h ₁ mm	Dimension h ₂ mm
≤ 24 kV	2420	2220
36 kV	2490 (2690*)	2290 (2490*)

Rated voltage and rated feeder current	Height for LV compartment mm	Dimension h ₃ mm
up to 36 kV	850 1000	2520 (2720*) 2670 (2870*)

* Dimension for frame height of 800 mm

Standards, specifications, guidelines

Standards

The 8DA10 and 8DB10 switchgear for indoor installation comply with the relevant standards and specifications listed below:

- DIN VDE 0670 Part 6 and Part 1000
- IEC 298, 3rd edition with Appendix AA and IEC 694
- ANSI C37.20c 1974 (in essential points)

In accordance with the obligatory harmonization in the European Community, the national standards of the member countries conform to IEC 298.

Type of service location

Switchgear of type 8DA10 and 8DB10 can be used as an indoor installation in accordance with DIN VDE 0101:

- Outside closed electrical operating areas in locations not accessible to the general public. Tools are required to remove switchgear enclosures.
- In closed electrical operating areas. A closed electrical operating area is a room or area which is used solely for the operation of electrical installations. This type of area is locked at all times and accessible only to authorized, trained personnel and other skilled staff. Untrained or unskilled persons must be accompanied by authorized personnel.

Insulating property

The insulating property is verified by testing the switchgear at rated power-frequency withstand voltage and rated impulse withstand voltage in accordance with DIN VDE 0670 Part 1000 or IEC 694:

Rated voltage (r.m.s. value)	Rated power-frequency with- stand voltage (r.m.s. value)		Rated lightning impulse with- stand voltage (peak)	
	For isolating distances	Between phases and to earth	For isolating distances	Between phases and to earth
7.2 kV	23	20	70	60
12 kV	32	28	85	75
15 kV	40	36	105	95
17.5 kV	45	38	110	95
24 kV	60	50	145	125
36 kV	80	70	195	170

All high-voltage parts inside the switchgear are insulated from the earthed outer enclosure by SF₆ gas.

The use of a gas insulant at a pressure of 0.5 or 1 bar (gauge) allows the switchgear to be installed at any altitude above sea level without any adverse effect on the dielectric strength. This also applies to the cable terminations when using single-core thermoplastic-insulated cables

with metal-enclosed plug-in sealing ends, totally-insulated busbars and tubular gas busbars.

When cables with conventional sealing ends are used (outer connections in air), the conductors are brought out from the SF₆ space through the bottom bushing. If the switchgear is installed at an altitude higher than 1000 m above sea level, the reduction in insulation

capacity must be taken into account for the outer connections in air. With regard to the reduced insulation, this type of connection can be used up to the following altitudes:

7.2 to 12 kV	up to 5000 m
24 kV	up to 3500 m
36 kV	up to 1000 m

If the site is located at higher altitudes above sea level only totally-insulated connections may be used.

Arcing protection

Arcing between the phase conductors cannot occur because each conductor is contained in a single-pole metal enclosure.

The individual phase enclosures only allow arcing between the phase and the earthed metal enclosure.

The amperage of these earth faults is low in isolated-neutral systems and systems with arc-extinction coils and they are self-extinguishing in SF₆ gas within the first half-cycle. In this case, the insulation, conducting paths and metal enclosures do not sustain any damage.

In effectively-earthed or resistively-earthed systems, the partition bushings restrict the effects of internal arcing to the particular gas compartment affected. There is no adverse effect on the functioning of adjacent poles.

Any excess pressure is discharged through rupture diaphragms in order to prevent any damage to the aluminium chambers.

Moreover, the risk of internal arcing is considerably lower than with air-insulated switchgear for the following reasons:

- There are no external factors such as pollution deposits, moisture, vermin and foreign bodies.

- Maloperation is prevented by mechanical interlocks.

- The outgoing feeder is earthed short-circuit-proof by the circuit-breaker when "READY TO EARTH" is selected with the three-position switch

The 8DA10 and 8DB10 switchgear comply with the criteria according to DIN VDE 0670 Part 6 or IEC 298 concerning the behaviour in case of internal arcing and in case of corresponding adjustments in the switchgear room.

Current-carrying capacity

- In accordance with DIN VDE 0670 Part 6 or Part 1000, IEC 298 or IEC 694 current-carrying capacities are referred to the following ambient temperatures:
 - Maximum value + 35 °C (24-hour average)
 - Maximum value + 40 °C
- The current-carrying capacity of the switchpanels and busbars varies as a function of the ambient temperature outside the enclosure.

Definitions

"Make-proof earthing switches" are earthing switches with short-circuit making capacity (DIN VDE 0670 Part 2).

Protection against electric shock and water and ingress of solid foreign bodies

(Protection of equipment and persons)

The degrees of protection specified apply to the control front as well as the side panels of the switchgear.

There is no degree of protection against moving parts for the rear of the switchgear.

Definition of the equipment	Degrees of protection according to DIN VDE 0470 Part 1 and IEC 529	Degree of protection
Switchpanels at high voltage with safe-to-touch plug-in cable terminations	Basic version	I P 6 5 ▲▲
	Protection against electric shock Protected against access to dangerous components by wire (access probe of 1 mm diameter is not permitted to penetrate)	
	Protection against ingress of solid foreign bodies Protection against ingress of dust (dust-tight)	
	Protection against water Protected against jet-water (a jet of water directed at the housing coming from every direction must not cause any damage)	
Operating mechanisms for circuit-breakers and three-position switches; low-voltage compartment	Basic version	I P 3 X D ▲▲▲
	Protection against ingress of solid foreign bodies Protected against ingress of solid foreign bodies with a diameter ≥ 2.5 mm (the object probe, 2.5 mm diameter, must not be able to penetrate at all)	
	Protection against water No determination of the degree of protection against water	
	Protection against electric shock Protected against access by wire (the access probe, 1 mm diameter, 100 mm long, must be kept at an adequate distance away from dangerous parts)	
	Basic version with additional features	I P 3 1 D ▲▲▲
	Protection against ingress of solid foreign bodies Protected against ingress of solid foreign bodies, with a diameter ≥ 2.5 mm (the object probe, 2.5 mm diameter, must not be able to penetrate at all)	
	Protection against water Protected against dripping water (water dripping onto the switchgear must not cause any damage)	
	Protection against electric shock Protected against access by wire (the access probe, 1 mm diameter, 100 mm long, must be kept at an adequate distance away from dangerous parts)	

5

Climate and environmental effects

Conditions in switchgear room (see table)

Ambient temperature	Relative humidity	Condensation	Special environmental conditions	Additional measures required
+ 5 to + 40 °C	5 to 85 %	None	None	–
– 5 to + 55 °C	5 to 100 %	Occasionally, once a month for 2 hours	None	–
			Blow sand, dust, vermin	–
– 5 to + 70 °C	5 to 100 %	Frequently, once a day for 2 hours	Frequent condensation	Yes
			Blow sand, dust, vermin	–
			Dripping water caused by condensation on ceiling (not harmful) in accordance with DIN VDE 0470 Part 1 or IEC 529	–
Areas subject to emission of chemical pollution			Sulphur dioxide (SO ₂) ≥ 2 ppm	Yes
			Hydrogen sulphide (H ₂ S) ≥ 1 ppm	Yes
			Hydrogen chloride (HCl) ≥ 3 ppm	Yes
			Ammonia (NH ₃) ≥ 15 ppm	Yes
			Nitric oxide (NO ₂) ≥ 2 ppm	Yes
			Chloride deposits (Cl [–]) (saline fog) ≥ 2 mg/dm ²	Yes

Catalog Index of the Power Transmission and Distribution Group

Title	Designation	Order No.
High Voltage	High-Voltage Equipment (Above 52 kV)	
Type 3EM2 Surge Arresters with Current-Limiting Series Spark Gap for HV System Voltages up to 245 kV	HG 21.3.1	E86010-K1521-A311-A1-7600
Type 3EM3 Surge Arresters with Current-Limiting Series Spark Gap for HV System Voltages up to 525 kV	HG 21.3.2	E86010-K1521-A321-A1-7600
Type 3EP2 Surge Arresters without Gaps for HV System Voltages up to 362 kV	HG 21.3.4	E50001-K1521-A341-A1-7600
Type 3EP3 Surge Arresters without Gaps for HV System Voltages up to 525 kV	HG 21.3.5	E86010-K1521-A351-A1-7600
Surge Counting Devices for Surge Arresters	HG 21.4	E50001-K1521-A401-A1-7600
High-Voltage Porcelain Insulators	HG 23	E50001-K1523-A101-A2-7600
Medium Voltage	Medium-Voltage Switchgear (High-Voltage Indoor Distribution Switchgear)	
Metal-Enclosed Truck-Type Switchboards for Indoor Installation 8BC1, 8BD1	HA 21	E86010-K1421-A101-A3-7600
Type 8BK20 Switchgear up to 24 kV with Withdrawable Circuit-Breakers (Metal-Clad)	HA 25.21	E50001-K1425-A311-A5-7600
Type 8BK40 Switchgear up to 17.5 kV/63 kA with Withdrawable Circuit-Breakers	HA 25.31	E50001-K1425-A411-A2-7600
Generator Circuit-Breaker Units up to 17.5 kV/80 kA, Type 8BK41	HA 25.41	E50001-K1425-A511-A1-7600
Type 8BJ50 Switchgear up to 24 kV with Withdrawable Circuit-Breakers*	HA 25.61	E50001-K1425-A711-A2-7600
36/38 kV Switchgear with Withdrawable Vacuum Circuit-Breakers, Metal-Enclosed Compartmented Type 8BK20, Single Bus	HA 26.1	E50001-K1426-A101-A1-7600
Compartmented Type 8BM20, Duplicate Bus		
Type 8BK30 Switchgear up to 12 kV with Draw-Out Vacuum Contactors	HA 27.11	E50001-K1427-A111-A2-7600
Panels up to 36 kV with Fixed-Mounted Circuit-Breakers, SF ₆ -Insulated, Types 8DA10 and 8DB10		
Single-Pole, Metal-Enclosed, Metal-Clad		
Single-Busbar Switchgear	HA 35.11	E50001-K1435-A101-A6-7600
Duplicate-Busbar Switchgear		
Type 8DC11 Panels up to 24 kV, Fixed-Mounted Vacuum Circuit-Breaker Switchgear, SF ₆ -Insulated	HA 35.41	E50001-K1435-A401-A2-7600
Spline-Shaft Drive 8UG for Torque Transmission up to 200 Nm	HA 39.1	E86010-K1439-A111-A2-7600
Motor Drive 8UH for Torque Requirements up to 250 Nm	HA 39.3	E86010-K1439-A131-A1-7600
Fixed-Mounted Ring-Main Units up to 24 kV, SF ₆ -Insulated, Type 8DH10	HA 41.11	E50001-K1441-A101-A2-7600
Fixed-Mounted Ring-Main Units up to 24 kV, SF ₆ -Insulated, Type 8DJ10	HA 45.11	E50001-K1445-A111-A6-7600
Type 8FB1 Compact Transformer Substations up to 24 kV	HA 51.1	E50001-K1451-A111-A2-7600
Factory-Built Container Stations, Type 8FF1	HA 52.1	E50001-K1452-A111-A1-7600
Medium-Voltage Equipment (High-Voltage Equipment up to 52 kV)		
Circuit-Breakers, Disconnectors, (Make-Proof Earthing Switches), Vacuum Contactors	HG 11	E50001-K1511-A101-A4-7600
3AH Vacuum Circuit-Breakers	HG 11.11	E50001-K1511-A111-A2-7600
Vacuum Switches, Switch-Disconnectors, HV HRC Fuse	HG 12	E50001-K1512-A101-A4-7600
Switchgear Interlock Units, Control Valves, Compressed Air Systems	HG 13	E86010-K1513-A101-A1-7600
Overvoltage Protection	HG 21	E50001-K1521-A101-A1-7600
Insulators of Cast Resin (Excerpt)	HG 22	E50001-K1522-A111-A1-7600
Current and Voltage Transformers	HG 24	E50001-K1524-A101-A2-7600
Air-Cored Reactors, High-Voltage Capacitors	HG 25	E86010-K1525-A101-A4-7600
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Low-Voltage Power Capacitors and Power Factor Correction Units Selection and Ordering Data	K1.2	E50001-K1600-A121-A5-7600
Power Cables	Power Cables	
Flexible Electric Cables for Cranes and Material Handling Equipment	SK 1.12	E50001-K8112-A101-A1-7600
Special-Purpose Cables for Industrial Applications	SK 4.20	E50001-K8142-A101-A1-7600

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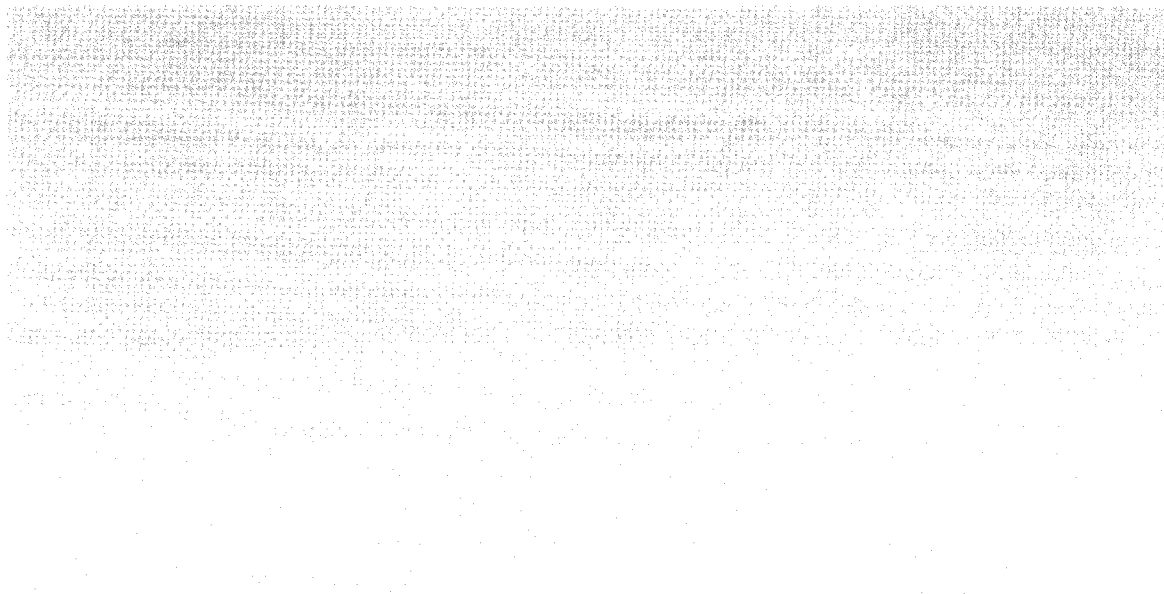
	Title	Designation	Order No.
Substation Secondary Equipment	Numerical Protective Relaying		
	Numerical Protection Devices	LSA 2.0.1	E50001-K5702-A011-A1-7600
	Operation and Evaluation Software for Numerical Protection Devices	LSA 2.0.2	E50001-K5702-A121-A1-7600
	Relay Selection Guide	LSA 2.0.3	E50001-K5702-A031-A1-7600
	7SJ600 SIPROTEC Overcurrent Protection	LSA 2.1.15	E50001-K5712-A251-A1-7600
	7SJ41 Definite-Time Overcurrent Protection Relay	LSA 2.1.10	E50001-K5712-A201-A1-7600
	7SJ511 Numerical Overcurrent-Time Protection Relay (Version V3)	LSA 2.1.3	E50001-K5712-A131-A1-7600
	7SJ512 Numerical Overcurrent-Time Protection Relay (Version V3)	LSA 2.1.4	E50001-K5712-A141-A1-7600
	7SJ531 Numerical Overcurrent Protection Relay	LSA 2.1.9	E50001-K5712-A191-A2-7600
	7SJ551 Multi-Function Protection Relay	LSA 2.4.2	E50001-K5742-A121-A2-7600
	7SA511 Line Protection Relay (Version V3)	LSA 2.1.11	E50001-K5712-A211-A1-7600
	7SA513 Line Protection Relay (Version V3)	LSA 2.1.12	E50001-K5712-A221-A1-7600
	3VU13 Miniature Circuit-Breaker	LSA 2.1.8	E50001-K5712-A181-A1-7600
	7SD502 Line Differential Protection with Two Pilot Wires	LSA 2.2.1	E50001-K5722-A111-A1-7600
	7SD503 Line Differential Protection with Three Pilot Wires	LSA 2.2.2	E50001-K5722-A121-A1-7600
	7SD511/512 Current Comparison Protection Relay (Version V3) for Overhead Lines and Cables	LSA 2.2.3	E50001-K5722-A131-A2-7600
	7UT512/513 Differential Protection Relay (Version V3) for Transformers, Generators and Motors	LSA 2.2.4	E50001-K5722-A141-A2-7600
	7SS5 Station Protection	LSA 2.2.5	E50001-K5722-A151-A1-7600
	Auxiliary Current Transformers 4AM50, 4AM51, 4AM52 and Isolating Transformers 7XR95	LSA 2.2.6	E50001-K5722-A161-A1-7600
	Introduction to Earth-Fault Detection	LSA 2.3.1	E50001-K5732-A111-A1-7600
	7SN71 Transient Earth-Fault Relay	LSA 2.3.2	E50001-K5732-A121-A1-7600
	7XR96 Toroidal Current Transformer	LSA 2.3.3	E50001-K5732-A131-A1-7600
	7VC1637 Earth-Leakage Monitor	LSA 2.3.4	E50001-K5732-A141-A1-7600
	7SK52 Motor Protection	LSA 2.4.1	E50001-K5742-A111-A1-7600
	7SJ551 Multi-Function Protection Relay	LSA 2.4.2	E50001-K5742-A121-A2-7600
	Introduction to Generator Protection	LSA 2.5.1	E50001-K5752-A111-A1-7600
	7UM511 Generator Protection Relay (Version V2)	LSA 2.5.2	E50001-K5752-A121-A1-7600
	7UM512 Generator Protection Relay (Version V2)	LSA 2.5.3	E50001-K5752-A131-A1-7600
	7UM515 Generator Protection Relay	LSA 2.5.4	E50001-K5752-A141-A1-7600
	7UM516 Generator Protection Relay (Version V3)	LSA 2.5.5	E50001-K5752-A151-A1-7600
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	7VP151 Three-Phase Portable Test Set (Omicron CMC56)	LSA 2.6.1	E50001-K5762-A111-A1-7600
	7SV50 Numerical Circuit-Breaker Failure Protection Relay	LSA 2.7.1	E50001-K5772-A111-A1-7600
	7SV512 Numerical Circuit-Breaker Failure Protection Relay	LSA 2.7.2	E50001-K5772-A121-A1-7600
	7VK512 Numerical Auto-Reclose/Check-Synchronism Relay	LSA 2.7.3	E50001-K5772-A131-A1-7600
	7SM70 Analog Output Unit	LSA 2.7.5	E50001-K5772-A151-A1-7600
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	TUMETIC and TUNORMA Oil-Immersed Distribution Transformers 50 to 2500 kVA	TV 2	E50001-K7102-A101-A1-7600
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	7EC48 Solid-State 3-Phase Meter with Drum-Type Registers	Z 9.1.1	E50001-K8991-A101-A1-7600
	7E.62/63 Static Multifunction Meters	Z 9.1.2	E50001-K8991-A111-A1-7600
	7EC49 Electronic 3-Phase Meter with Drum-Type Registers	Z 9.1.3	E50001-K8991-A121-A1-7600
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	Power System Quality Analysis OSCILLOSTORE	SR 10.2	E50001-K4020-A101-A1-7600
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	Static Analog Machine Protection Relays	R 1.2	E50001-K4501-A121-A1-7600
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	Hand and Electrical Reset Tripping Relay 7PA20	R (Extract)	E86010-K4500-A151-A1-7600
	Trip Circuit Supervision Relay 7PA21	R (Extract)	E86010-K4500-A161-A1-7600
	Pilot-Wire Differential Relay 7SD24	R (Extract)	E86010-K4500-A131-A1-7600
	Microprocessor Based Overcurrent Relay 7SJ55	R (Extract)	E50001-K4500-A361-A2-7600
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- Planning of switchgear
- Types of switchgear
- Switchgear accessories

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