ТЕХНИК ЕНЕРДЖИ ЕООД

ТОМ 1

Открита процедура с предмет: *„Доставка на модули за комплектни комутационни устройства“ реф. № PPD 14 -035*

Възложител: *"ЧЕЗ България" ЕАД*

Предложение за изпълнение на поръчката

ТЕХНИЧЕСКО ПРЕДЛОЖЕНИЕ
за открита процедура за възлагане на обществена поръчка с предмет:
„Доставка на модули за комплектни комутационни устройства",
реф № PPD 14 - 035

ДО „ЧЕЗ РАЗПРЕДЕЛЕНИЕ БЪЛГАРИЯ АД "– гр. София, ул. „Цар Симеон" № 330

ОТ : ***"Техник Енерджи" ЕООД – гр. Варна***
(участник)

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Представляван от *Яков Желязков Нанчев – Упълномощен представител*
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УВАЖАЕМИ ГОСПОДА,
След като закупихме документацията за провеждане на процедура за възлагане на обществена поръчка с наименование: *„Доставка на модули за комплектни комутационни устройства" реф № PPD 14 - 035*
и се запознахме подробно с дадените в нея указания, аз долуподписаният *Ива Стоянова*
, в качеството си на представляващ *"Техник Енерджи" ЕООД*,гр. *Варна* декларирам, че:

1. Представям техническите спецификации от глава IV на документацията с попълнени всички изисквани стойности от стоката по предмета на поръчката.
2. Представям всички изисквани документи, съгласно приложенията, към настоящото техническо предложение.
3. Потвърждаваме, че представяната от нас стока, описана в Техническото ни предложение ще отговаря на посочените от възложителя стандарти или на еквивалентни. В случай, че даден материал отговаря на стандарт, еквивалентен на посочения се задължаваме да го отразим в отделен документ и да представим доказателства за еквивалентността на дадения стандарта.
4. Всички стойности, попълнени в колона „Гарантирано предложение" на приложените таблици от Технически спецификации от глава IV от документацията за участие са точни и истински.
5. Предлагам гаранционен срок за предлаганата стока – 24- месеца *(не по-малко от 24 месеца)*, от датата на приемо – предавателен протокол за получаване на стоката от Възложителя.
6. Предлагам срокове за доставка на стоката съгласно Приложение 3 към настоящото техническо предложение.
7.Запознат съм, че представените от мен технически документи (протоколи от изпитания, каталози и др), са доказателство за декларираните от мен технически данни и параметри в техническите спецификации на стоката.
8. Техническите изисквания за капаци, лостове за управление, връзки шини, комплекти кабелни глави „Т" и „К" са част от изискванията за съответния модул. Те зависят от вида, типа и производителя на модулите.

Приложения:
1. Техническите спецификации – попълнени от глава IV на документацията;
2. Изисквани документи от Технически спецификации;
3. Срокове за доставка и опаковка.
4. Опаковка и маркировка на стоката

Дата *22.06.2014* г.

ПОДПИС и ПЕЧАТ:

"ТЕХНИК ЕНЕРДЖИ" ЕООД
ВАРНА

(име и фамилия)
Упълномощен представител
(длъжност на представляващия участника)
Приложение 3 към техн. предложение

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IV. ТЕХНИЧЕСКИ ИЗИСКВАНИЯ И СПЕЦИФИКАЦИИ ЗА ИЗПЪЛНЕНИЕ НА ПОРЪЧКАТА

Наименование на материала: Комплектни комутационни устройства в метални шкафове 12/24(25) kV, 630 A, 16 kA, с товарови прекъсвачи с SF_6 (или вакуум)

Съкратено наименование на материала: КРУ 12/24(25) kV, 630A, 16kA, с тов. прек. в SF_6

Област: Н – Електрически уредби СрН/НН **Категория:** 24 - Разпределителни уредби

Мерни единици: брой **Аварийни запаси:** Да

Характеристика на материала:

Триполюсни затворени в метален шкаф фабрично произведени за работа в закрити разпределителни уредби, въздушно изолирани комплектни комутационни устройства с обявено напрежение 24/25 kV, съоръжени с трипозиционен товаров прекъсвач [1] в изолационна среда от сярен хексафлуорид (SF_6) (или вакуум), комплектувани с отделни функционални единици съгласно функцията за която са предназначени, включително и необходимото допълнително оборъдване за управление, измерване, сигнализация и т.н.

Всички функционални отделения на комплектните комутационни устройства са фиксирани неподвижно към носеща конструкция, с недостъпно отделение на товаровия прекъсвач (достъпно с помощта на инструменти или чрез устройство за блокиране от механичен тип), с недостъпно или достъпно с помощта на инструменти отделение за събирателните шини и с механично блокиране с възможност за заключване на предпазните щитове (капаците) на отделенията на кабелите/предпазителите/шините съединения СрН.

Комплектните комутационни устройства съответстват на категория на непрекъснатост на работа LSC2A-PI/PM, с дефиниран клас на устойчивост на вътрешна електрическа дъга (IAC) съгласно БДС EN 62271-200.

Струята от горещи газове, пари и нагорещени частици в случаите на вътрешна електрическа дъга при късо съединение се отвежда в пространството под комплектното комутационно устройство.

Задвижването на контактната система, представлява самостоятелна или интегрирана конструктивна част, с ръчно управление, с импулсно действие, със сигурно блокиране/заключване (в положения „Заземено", „Включено" и „Изключено", изобразени еднозначно (по недвусмислен начин) на еднолинейната схема на челния панел за управление), и автоматично изключване на товаровия прекъсвач за трансформаторните присъединения с акумулирана в задвижващия механизъм енергия.

Главната и заземителната вериги на товаровите прекъсвачи са блокирани механично срещу едновременно включване. Предпазните щитове (капаците) на отделенията за кабелните присъединения са блокирани механично, в случаите когато заземителната верига е отворена.

Комплектните комутационни устройства позволяват възможност за замяна на ръчното задвижване с моторно задвижване в условията на експлоатация.

Комплектните комутационни устройства са съоръжени със светлинна индикация, захранвана от капацитивни делители на изводите, на всички присъединения на всички полюси (фази), включително гнезда (букси) за проверка за напрежение и за уеднакяване на фазовия ред (сфазировка) на присъединяваните кабелни линии. *В случай на използване на комплектните комутационни устройства в електроразпределителни мрежи с по-ниски напрежения системите за индикация на напрежението са приспособени за работа съобразно номиналното напрежение на електроразпределителната мрежа.*

Комплектните комутационни устройства позволяват присъединяване на кабелните линии посредством кабелни глави с кабелна обувка или стандартни прави или ъглови конусни конектори (адаптори), присъединяване на кабелните изводи за трансформаторите посредством кабелни глави с кабелна обувка или стандартни прави или ъглови конусни конектори (адаптори), с кабелни скоби,

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[1] БДС IEC 60050 (441) „Международен електротехническо речник Глава 441: Комутационни апарати за разпределение, комутационни апарати за управление и стопяеми предпазители"

Определение 441-14-10 Товаров прекъсвач - механичен комутационен апарат, способен да включва, проводи и изключва токове при нормални условия във веригата, които могат да включват и предписани условия с претоварване, а също така да проводи за определено време токове при предписани ненормални условия във веригата, такива като тези при късо съединение.

Забележка: Един прекъсвач може да е способен да включва ,но не и да изключва токове на късо съединения.

подходящи за кабелните линии с диаметър до 50 mm и за кабелните изводи за трансформаторите с диаметър до 40 mm.
Отделенията за присъединяване на кабелните линии позволяват да бъдат монтирани допълнително в експлоатационни условия металооксидни вентилни отводи с обявен разряден ток I_n = 10 kA, без необходимостта от замяна на предпазните щитове/капаци на отделенията.
Защитата от къси съединения на кабелния извод на трансформаторното присъединение CpH се осъществява посредством стопяеми предпазители високо напрежение 442 mm с диаметър на контактната част 45 ± 1 mm. При задействане на който и да е от ударните щифтове на предпазителите се изключват и трите полюса на товаровия прекъсвач.
Светлинната сигнализация, лостът или комплектът лостове за управление на комплектните комутационни устройства и шинните връзки са включени в доставката, както е посочено по-долу в таблиците за техническите параметри и други данни за отделните комплектните комутационни устройства и техните комбинации в т. 4 по-долу.
Всички комплектни комутационни устройства се доставят като отделно изпитани съгласно приложимите стандарти модули: модул кабелно присъединение - „К", модул трансформаторно присъединение - „Т" и модул шинен съединител - „ШС" или комбинации от тях в зависимост от конкретната заявка.

Използване:
Комплектните комутационни устройства в метален шкаф с обявено напрежение 24/25 kV с товарови прекъсвачи с SF_6 газ (или вакуум) са предназначени главно за съоръжаване на проходими (обслужвани отвътре) трансформаторни постове в електроразпределителни мрежи с номинални напрежение 20 kV и 10 kV, единствено в случаите когато не е възможно да се монтират компактни комплектни комутационни устройства с шинна система в изолационна среда от серен хексафлуорид (SF_6) . (Комплектните комутационни устройства се използват в електроразпределителни мрежи с номинално напрежение 10 kV, ако съответно системата за индикация на напрежението е преработена).

Съответствие на предложеното изпълнение със стандартизационните документи:
Комплектните комутационни устройства трябва да отговарят на приложимите български и международни стандарти или еквиваленти и на техните валидни изменения и поправки:

- БДС EN 60099-4:2006 „Вентилни отводи. Част 4: Метало-оксидни вентилни отводи без разрядници за електрически системи за променливо напрежение (IEC 60099-4:2004, с промени)";
- БДС EN 60265-1:2003 „Превключватели високо напрежение. Част 1: Превключватели за обявени напрежения над 1 kV и по-ниски от 52 kV (IEC 60265-1:1998)";
- БДС EN 60282-1:2010 „Предпазители за високо напрежение. Част 1: Токоограничаващи предпазители (IEC 60282-1:2009)";
- БДС EN 60529:1991/A1:2004 „Степени на защита, осигурени от обвивката (IP код) (IEC 60529:1989 + A1:1999)";
- БДС EN 62271-1:2008/A1:2011 „Комутационни апарати за високо напрежение. Част 1: Общи технически изисквания";
- БДС EN 62271-102:2007 „Комутационни апарати за високо напрежение. Част 102: Разединители и заземителни разединители за променлив ток (IEC 62271-102:2001 + поправка 1, април 2002 + поправка 2, май:2003)";
- БДС EN 62271-105:2012 „Комутационни апарати за високо напрежение. Част 105: Комутационни апарати за променливо напрежение, комбинирани с предпазител за обявено напрежение над 1 kV до 52 kV включително (IEC 62271-105:2012)";
- БДС EN 62271-200:2012 „Комутационни апарати за високо напрежение. Част 200: Променливотокови комутационни апарати в метална обвивка за обявени напрежения над 1 kV и до 52 kV включително (IEC 62271-200:2011)";
- БДС IEC 60050-441:2007 „Международен електротехнически речник Глава 441: Комутационни апарати за разпределение, комутационни апарати за управление и стопяеми предпазители".

Изисквания към документацията и изпитванията

№ по ред	Документ	Приложение № (или текст)
1.	Точно обозначение на типовете на комплектните комутационни устройства, производителя, страна на произход и последно издание на каталога на производителя	Приложение 1

№ по ред	Документ	Приложение № (или текст)
2.	Техническо описание на комплектните комутационни устройства, включително аксесоари и гарантирани параметри, пространствени чертежи, включително чертежи за минимално допустимите вертикални и хоризонтални разстояния съответно до тавана и до стените на закритата разпределителна уредба, гарантиращи сигурността на работа на комплектните комутационни устройства и тяхното обслужване, броя и размера на винтовете за фиксиране, размерите на отворите в пода и т.н.	Приложение 2
3.	Едноплинейни схеми на главните и заземителните вериги, вкл. капацитивните делители на отделните видове комплектни комутационни устройства	Приложение 3
4.	Дизайн на табелката за обявените данни на комплектното комутационно устройство на български език	Приложение 4
5.	Експлоатационна дълготрайност, години	30 години
6.	Инструкции за транспортиране, складиране, монтиране, наладка, обслужване и поддържане на комплектните комутационни устройства	Приложение 5
7.	Списък на проведените типови изпитвания на английски или на български език съгласно БДС EN 62271-200 с приложени резултати.	Приложение 7
8.	Протоколи от типови изпитвания на английски или на български език за устойчивост на вътрешна електрическа дъга за клас IAC – AB.	Приложение 7
9.	Препоръчан тип на устройство за уеднаквяване на фазовия ред (сфазиране) на присъединяваните кабелни линии за предложеното изпълнение на системата за индикация на напрежение на комплектните комутационни устройства	VPI62421 Фазов Компаратор
10.	Възможност за съоръжаване на комплектните комутационни устройства с моторно задвижване, изключвателни бобини и индикатори на къси и земни съединения и др.	Да
11.	Декларация за съответствие на предлаганото изпълнение с изискванията на стандартите, посочени по-горе в параграф „Съответствие на предложеното изпълнение със стандартизационните документи"	Приложение 6
12.	Препоръки от производителя за постигане на необходимата сеизмична устойчивост.	Приложение 8

Изисквания за допълнителна информация от производителя

№ по ред	Наименование	Гарантирано предложение
1.	Категория на непрекъснатост на работа LSC2A-PM / LSC2A-PI	LSC2A-PI
2.	Вътрешна електрическа дъга min 16 kA/1s за всички достъпни функционални отделения	IAC-ALFR 16kA/1s
3.	Товарови прекъсвачи и заземителни разединители – самостоятелни/интегрирани	Да
4.	Материал на контактната система на товаровите прекъсвачи	Електролитна мед
5.	Брой комутационни цикли в зависимост от комутирания ток	100 при номинален ток
6.	Обявена максимална сила, която е необходимо да се приложи от оператора върху лоста/лостовете на ръчното задвижване [N]	Не повече от 25daN
7.	Обявено съпротивление на главната верига на товаровите прекъсвачи в комплектните комутационни устройства за кабелни присъединения и допустим толеранс в експлоатационни условия [μΩ]	От 30 000 до 110 000 μΩ при 630A

№ по ред	Наименование	Гарантирано предложение
8.	Обявено съпротивление на главната верига на товаровите прекъсвачи в комплектните комутационни устройства за трансформаторни присъединения и допустим толеранс в експлоатационни условия [μΩ]	От 30 000 до 110 000 μΩ при 630А
9.	Функционална единица – Трансформаторно присъединение – товаров прекъсвач, комбиниран с предпазители (съгласно БДС EN 62271-105)	Да
10.	Обявен краткотраен издържан ток (с предпазители), Ik	20kA
11.	Обявен ток на включване при късо съединение (с предпазители) , Ima	50kA
12.	Обявен ток съгл. IEC 420 (реална стойност на тока ограничена от предпазител)	Приложение 9
13.	Заземяване на предпазителите – едностранно/ двустранно	двустранно
14.	Извеждане на предпазителите – хоризонтално/вертикално	вертикално
15.	Брой години без поддържане на комплектните комутационни устройства при нормални експлоатационни условия	30 години
16.	Необходимо свободно пространство за манипулиране с лоста/лостовете за управление, измерено от челния панел на комплектните комутационни устройства [mm]	135мм
17.	Възможност за визуален контрол на положението на контактите на заземителния разединител, Да/Не	Да
18.	Брой на лостовете за управление	1
19.	Обявено свръхналягане на газа в херметизираните товаровите прекъсвачи	0,4[bar] при 20°C
20.	Наличие на индикатор на контролния панел за състоянието на предпазителите –Да/Не	Да

Технически данни

1. Характеристики на работната среда

№ по ред	Характеристика	Стойност
1.1	Максимална околна температура	+ 45°C
1.2	Минимална околна температура	Минус 5°C
1.3	Максимална средна околна температура за период от 24 ч.	+ 35°C
1.4	Относителна влажност	До 95 %(2,2 kPa)
1.5	Надморска височина	До 1000 m
1.6	Земетръсна устойчивост	0,3 g

2. Параметри на електроразпределителната мрежа СрН

№ по ред	Параметър	Стойност	
2.1	Номинално напрежение	3~10 000 V	3~20 000 V
2.2	Най-високо напрежение на мрежата	12 000 V	24 000 V
2.3	Обявена честота	50 Hz	
2.4	Брой на фазите	3	
2.5	Заземяване на звездния център	през активно съпротивление; през дъгогасителна бобина; изолиран звезден център	

3. Общи технически параметри:

6

№ по ред	Параметър	Изискване	Гарантирано предложение
3.1	Степен на защита от проникване на твърди тела във вътрешността на комплектните комутационни устройства	min IP 3X	IP2X Опция IP3X
3.2	Херметичност на обвивката на товаровите прекъсвачи - максимално изтичане (загуба) на сярен хексафлуорид - SF_6	max 1% / год.	0,1% за година
3.3	Материал на обвивката на товаровия прекъсвач	PM или PI	Отливка от епоксидна смола
3.4	Възможност за допълнително монтиране на моторно задвижване и окомплектоване с изключвателна бобина при заявка	Да	Да
3.5	Възможност за допълнително монтиране на чалния панел на индикатори на къси и земни съединения по кабелните линии	Да	Да
3.6	Експлоатационна дълготрайност	min 30 години	min 30 години
3.7	Отделенията на кабелните изводи и защитните капаци/щитове позволяват допълнително монтиране на металооксиден вентилен отвод в експлоатационни условия	Да	Да
3.8	Изпълнение	За монтиране на закрито	За монтиране на закрито
3.9	Брой на полюсите (фазите)	3	3
3.10	Шинна система	Единична	Да
3.11	Обявено напрежение, U_r	24/25 kV	24 kV
3.12	Обявена честота, f_r	60 Hz	50 Hz
3.13	Обявен краткотраен издържан ток (1 s)	16 kA	16 kA
3.14	Обявен върхов издържан ток	40 kA	40 kA
3.15	Клас на устойчивост на вътрешна електрическа дъга (IAC) AFL	16 kA (1 s)	16 kA (1 s)
3.16	Обявено краткотрайно (1 min) издържано напрежение с промишлена честота (50 Hz), U_d (ефективна стойност): спрямо земя, между полюси и между отворени контакти	50 kV	50 kV
3.17	Обявено краткотрайно (1 min) издържано напрежение с промишлена честота (50 Hz) U_d (ефективна стойност): върху разделящо разстояние	60 kV	60 kV
3.18	Обявено издържано мълниево импулсно напрежение U_p (върхова стойност): спрямо земя, между полюси и между отворени контакти	125 kV	125 kV
3.19	Обявено издържано мълниево импулсно напрежение U_p (върхова стойност): върху разделящо разстояние	145 kV	145 kV
3.20	Обявен ток на шинната система	min 630 A	630 A
3.21	Обявен ток I_r на кабелните присъединения и шинния съединител	min 630 A	630 A
3.22	Обявен ток I_r на трансформаторното присъединение	min 200 A	200 A

№ по ред	Параметър	Изискване	Гарантирано предложение
3.23	Еднополюсна схема на челния панел, изобразяваща главните и заземителните вериги, в която са интегрирани устройствата за индициране на положението на контактните системи	Да	Да
Функционална единица - Товарен прекъсвач за комплектно комутационно устройство за кабелно присъединение (съгласно БДС EN 60265-1)			
3.24	Обявен краткотраен издържан ток, I_k (1 s)	16 kA	16 kA
3.25	Обявен ток на включване при късо съединение, I_{ma}	40 kA	40 kA
3.26	Обявен ток на изключване на преобладаващ активен товар, I_1	min 630 A	630 A
3.27	Обявен ток на изключване на затворена верига, I_{2a}	min 630 A	630 A
3.28	Обявен ток на изключване на работещ на празен ход трансформатор, I_3	min 16 A	16 A
3.29	Обявен ток на изключване на работеща без товар кабелна електропроводна линия, I_{4a}	min 25 A	31,5A
3.30	Обявен ток на изключване на земно съединение, I_{6a}	min 16 A	16A
3.31	Брой на комутационните цикли при изключване на преобладаващ активен товар I_1	min 100	100
3.32	Брой на комутационните цикли при включване на обявения ток на късо съединение I_{ma}	min 5	5
3.33	Брой на СО комутационни цикли – механична износоустойчивост	M1 (min 1000)	1000
3.34	Вид на задвижването	Ръчно, с мигновено действие	Да
3.35	Дъгогасяща камера	SF_6 или вакуум	SF6
Функционална единица - Товарен прекъсвач, комбиниран с предпазители за комплектно комутационно устройство за трансформаторно присъединение (съгласно БДС EN 62271-105)			
3.36	Обявен краткотраен издържан ток , I_k (с предпазители)	16 kA	16 kA
3.37	Обявен ток на включване при късо съединение, I_{ma} (с предпазители)	40 kA	40 kA
3.38	Брой на комутационните цикли при включване на обявения ток на късо съединение I_{ma}	min 5	5
3.39	Заземяване на контактните части на предпазителите	Да	Да
3.40	Брой на СО комутационни цикли – механична износоустойчивост	M1 (min 1000)	1000
3.41	Задвижване	Ръчно, с мигновено действие, с акумулирана енергия и автоматично изключване при наличие на изключвателна бобина	Да
3.42	Дъгогасяща камера	SF_6 или вакуум	SF6

№ по ред	Параметър	Изискване	Гарантирано предложение
Функционална единица - Товаров прекъсвач за комплектно комутационно устройство за шинно съединение (съгласно БДС EN 60265-1)			
3.43	Обявен краткотраен издържан ток, I_k (1 s)	16 kA	16 kA
3.44	Обявен ток на включване при късо съединение, I_{ma}	40 kA	40 kA
3.45	Обявен ток на изключване на затворена верига, I_{sa}	min 630 A	630 A
3.46	Обявен ток на изключване на работещ на празен ход трансформатор, I_3	min 16 A	16 A
3.47	Брой на комутационните цикли при изключване на преобладаващ активен товар I_1	min 100	100
3.48	Вид на задвижването	Ръчно, с мигновено действие	Да
3.49	Дъгогасяща камера	SF_6 или вакуум	SF6
Функционална единица - Заземителен разединител на товаровите прекъсвачи за комплектни комутационни устройства за кабелно и трансформаторно присъединение и за шинно съединение (съгласно БДС EN 62271-102)			
3.50	Обявен краткотраен издържан ток, I_k	16 kA	16 kA
3.51	Обявен ток на включване при късо съединение	40 kA	40 kA
3.52	Брой на комутационните цикли при включване на обявения ток на късо съединение	min 5	5
3.53	Брой на СО комутационни цикли – механична износоустойчивост	M1 (min 1000)	1000
3.54	Задвижване	Ръчно, с мигновено действие	Да
3.55	Дъгогасяща камера	SF6 или вакуум	SF6

4. Технически параметри и др. данни на комплектните комутационни устройства и комплектните разпределителни уредби 24/25 kV и 12 kV

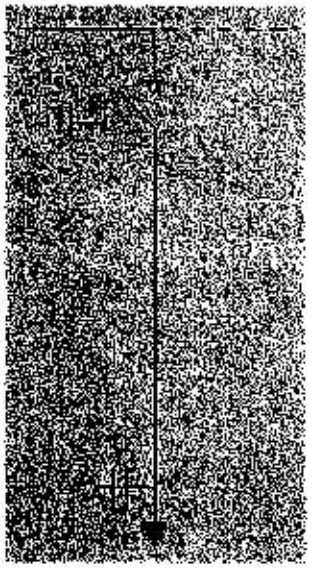
4.1 Комплектно комутационно устройство в метален шкаф 24/25 kV, 630 A, 16 kA с SF_6 товаров прекъсвач за кабелно присъединение

Номер на стандарта	Тип/референтен номер съгласно каталога на производителя
20 24 1201	Да се посочи
Наименование на материала	Комплектно комутационно устройство в метален шкаф 24/25 kV, 630 A, 16 kA с SF_6 товаров прекъсвач за кабелно присъединение
Съкратено наименование на материала	КРУ 24(25)/630/16, SF_6 тов. прекъсвач - К

№ по ред	Технически параметър	Изискване	Гарантирано предложение
4.1.1	Модул	1 x K (кабел)	IM
4.1.2	Обявено напрежение, U_r	24/25 kV	24 kV
4.1.3	Обявен ток, I_r	min 630 A	630 A
4.1.4	Височина	max 2000 mm	1600мм
4.1.5	Дълбочина	max 1100 mm	1030мм

4.1.6	Широчина	max 500 mm	375мм
4.1.7	Шинни връзки 630 А	3 бр.	3 бр.
4.1.8	Лост/комплект лостове за управление	1 бр.	1 бр.
4.1.9	Общо тегло, kg	Да се посочи	140кг.

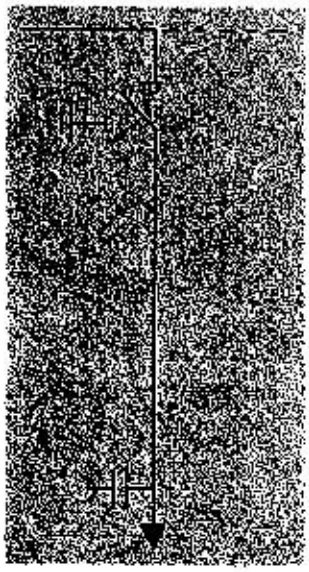
Фиг. 1 - Комплектно комутационно устройство с SF_6 товаров прекъсвач за кабелно присъединение – К



4.2 Комплектно комутационно устройство в метален шкаф 12 kV, 630 A, 16 kA с SF_6 товаров прекъсвач за кабелно присъединение

Номер на стандарта		Тип/референтен номер съгласно каталога на производителя	
20 24 1101		Да се посочи	
Наименование на материала		Комплектно комутационно устройство в метален шкаф 12 kV, 630 A, 16 kA с SF_6 товаров прекъсвач за кабелно присъединение	
Съкратено наименование на материала		КРУ 12/630/16, SF_6 тов. прекъсвач - К	
№ по ред	Технически параметър	Изискване	Гарантирано предложение
4.2.1	Модул	1 x K (кабел)	IM
4.2.2	Обявено напрежение, U_r	24/25 kV	24 kV
4.2.3	Обявен ток, I_r	min 630 A	630 A
4.2.4	Височина	max 2000 mm	1600мм
4.2.5	Дълбочина	max 1100 mm	1030мм
4.2.6	Широчина	max 500 mm	375мм
4.2.7	Система за индикация на напрежението	Приспособена за работа в ел. мрежи с номинално напрежение 10 kV	Да
4.2.8	Шинни връзки 630 А	3 бр.	3 бр.
4.2.9	Лост/комплект лостове за управление	1 бр.	1 бр.
4.2.10	Общо тегло, kg	Да се посочи	140кг.

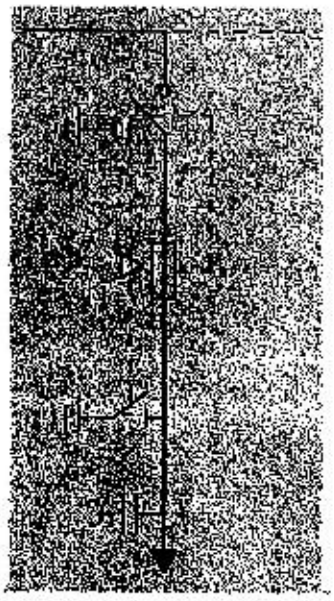
Фиг. 2- Комплектно комутационно устройство с SF_6 товаров прекъсвач за кабелно присъединение – К



4.3 Комплектно комутационно устройство в метален шкаф 24/25 kV, 630 A, 16 kA с SF_6 товаров прекъсвач за трансформаторно присъединение

Номер на стандарта		Тип/референтен номер съгласно каталога на производителя	
20 24 1202		Да се посочи	
Наименование на материала		Комплектно комутационно устройство в метален шкаф 24/25 kV, 630 A, 16 kA с SF_6 товаров прекъсвач за трансформаторно присъединение	
Съкратено наименование на материала		КРУ 24(25)/630/16, SF_6 тов. прекъсвач - Т	
№ по ред	Техническя параметър	Изискване	Гарантирано предложение
4.3.1	Модул	1 x T (трафо)	QM
4.3.2	Обявено напрежение, U_r	24/25 kV	24 kV
4.3.3	Обявен ток, I_r	min 200 A	200 A
4.3.4	Височина (включва и необходимото разстояние за манипулации със стопяемите предпазители)	max 2000 mm	1600мм
4.3.5	Дълбочина	max 1100 mm	1030мм
4.3.6	Широчина	max 600 mm	375мм
4.3.7	Шинни връзки 630 A	3 бр.	3 бр.
4.3.8	Лост комплект лостове за управление	1 бр.	1 бр.
4.3.9	Общо тегло, kg	Да се посочи	160кг.

Фиг. 3 - Комплектно комутационно устройство с SF_6 товаров прекъсвач за трансформаторно присъединение - Т

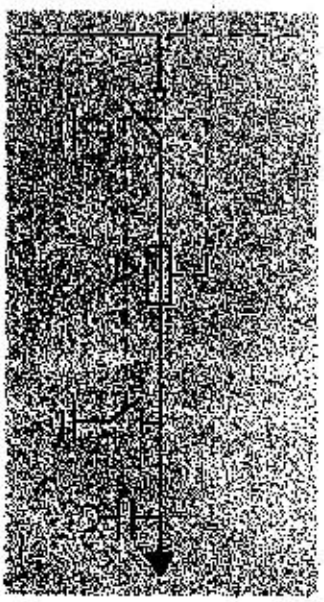


4.4 Комплектно комутационно устройство в метален шкаф 12 kV, 630 A, 16 kA с SF_6 товаров прекъсвач за трансформаторно присъединение

Номер на стандарта	Тип/референтен номер съгласно каталога на производителя
20 24 1102	Да се посочи
Наименование на материала	Комплектно комутационно устройство в метален шкаф 12 kV, 630 A, 16 kA с SF_6 товаров прекъсвач за трансформаторно присъединение
Съкратено наименование на материала	КРУ 12/630/16, SF_6 тов. прекъсвач - Т

№ по ред	Технически параметър	Изисквания	Гарантирано предложение
4.4.1	Модул	1 x T (трафо)	QM
4.4.2	Обявено напрежение, U_r	24/25 kV	24 kV
4.4.3	Обявен ток, I_r	min 200 A	200 A
4.4.4	Височина (включва и необходимото разстояние за манипулации със стопяемите предпазители)	max 2000 mm	1600мм
4.4.5	Дълбочина	max 1100 mm	1030мм
4.4.6	Широчина	max 500 mm	375мм
4.4.7	Система за индикация на напрежението	Приспособена за работа в ел. мрежи с номинално напрежение 10 kV	Да
4.4.8	Шинни връзки 630 A	3 бр.	3 бр.
4.4.9	Лост/комплект лостове за управление	1 бр.	1 бр.
4.4.10	Общо тегло, kg	Да се посочи	160кг.

Фиг. 4 - Комплектно комутационно устройство с SF_6 товаров прекъсвач за трансформаторно присъединение - Т



4.5 Комплектно комутационно устройство в метален шкаф 24/25 kV, 630 A, 16 kA с SF_6 товаров прекъсвач за шинно съединение

Номер на стандарта		Тип/референтен номер съгласно каталога на производителя	
20 24 1203		Да се посочи	
Наименование на материала		Комплектно комутационно устройство в метален шкаф 24/25 kV, 630 A, 16 kA с SF_6 товаров прекъсвач за шинно съединение	
Съкратено наименование на материала		КРУ 24(25)/630/16, SF_6 тов. прекъсвач - ШС	
№ по ред	Технически параметър	Изискване	Гарантирано предложение
4.5.1	Модул	1 x ШС (шиносъединител)	IMB+GBM
4.5.2	Обявено напрежение, U_r	24/25 kV	24kV
4.5.3	Обявен ток, I_r	min 630 A	630A
4.5.4	Височина	max 2000 mm	1800мм
4.5.5	Дълбочина	max 1100 mm	1030мм
4.5.6	Широчина: • моноблочно изпълнение; или • комбинация с вертикални шини	• max 750 mm • max 1000 mm	750мм
4.5.7	Шинни аръзки 630 A	3 бр.	1 бр.
4.5.8	Лост/комплект лостове за управление	1 бр.	270кг.
4.5.9	Общо тегло, kg	Да се посочи	1 бр.

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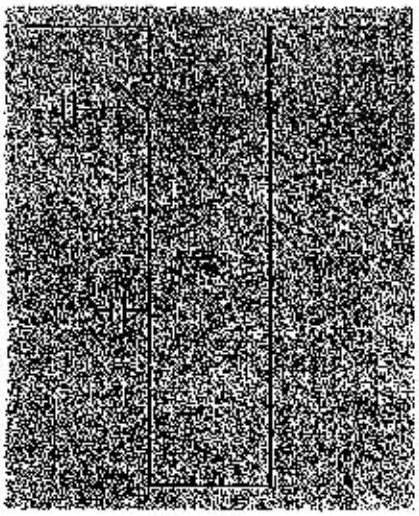
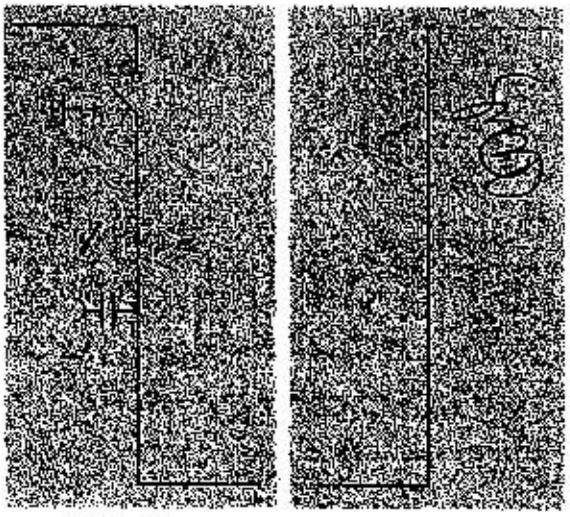
Фиг. 5 - Комплектно комутационно устройство с SF_6 товаров прекъсвач за шинно съединение – ШС



а) Моноблок

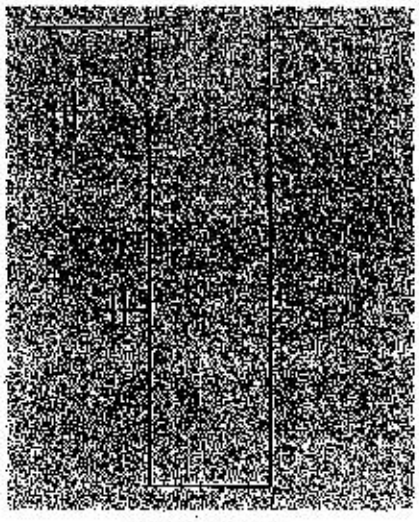


б) Комбинация с вертикални шини

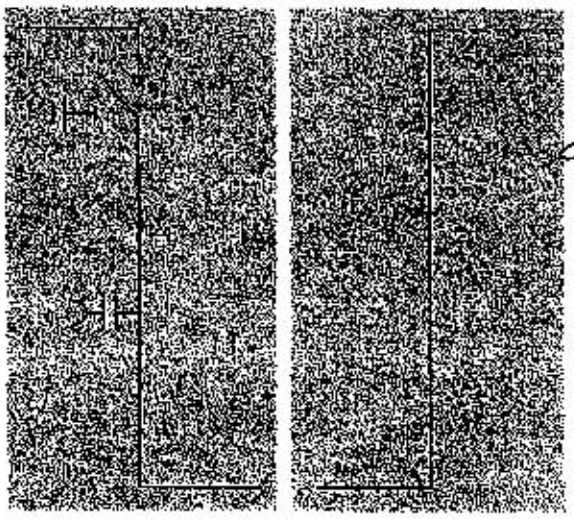
4.6 Комплектно комутационно устройство в метален шкаф 12 kV, 630 A, 16 kA с SF_6 товаров прекъсвач за шинно съединение

Номер на стандарта		Тип/референтен номер съгласно каталога на производителя	
20 24 1103		Да се посочи	
Наименование на материала		Комплектно комутационно устройство в метален шкаф 12 kV, 630 A, 16 kA с SF_6 товаров прекъсвач за шинно съединение	
Съкратено наименование на материала		КРУ 12/630/16, SF_6 тов. прекъсвач - ШС	
№ по ред	**Технически параметър**	**Изискване**	**Гарантирано предложение**
4.6.1	Модул	1 x ШС (шиносъединител)	IMB+GBM
4.6.2	Обявено напрежение, U_r	24/25 kV	24kV
4.6.3	Обявен ток, I_r	min 630 A	630A
4.6.4	Височина	max 2000 mm	1600мм
4.6.5	Дълбочина	max 1100 mm	1030мм
4.6.6	Широчина: • моноблочно изпълнение; или • комбинация с вертикални шини	• max 750 mm • max 1000 mm	750мм
4.6.7	Система за индикация на напрежението	Приспособена за работа в ел. мрежи с номинално напрежение 10 kV	да
4.6.8	Шинни връзки 630 A	3 бр.	3 бр.
4.6.9	Лост/комплект лостове за управление	1 бр.	1 бр.
4.6.10	Общо тегло, kg	Да се посочи	270кг.

Фиг. 5 - Комплектно комутационно устройство с SF_6 товарен прекъсвач за шинно съединение – ШС



а) Моноблок



б) Комбинация с вертикални шини

4.7 Комплектна разпределителна уредба в метални шкафове 24/25 kV, 630 A, 16 kA с SF_6 товарен прекъсвач – две кабелни присъединения и едно трансформаторно присъединение

Номер на стандарта		Тип/референтен номер съгласно каталога на производителя	
20 24 1204		Да се посочи	
Наименование на материала		Комплектна разпределителна уредба в метални шкафове 24/25 kV, 630 A, 16 kA с SF_6 товарен прекъсвач - ККТ	
Съкратено наименование на материала		КРУ 24(25)/630/16, SF_6 тов. прекъсвачи - ККТ	
№ по ред	Технически параметър	Изискване	Гарантирано предложение
4.7.1	Конфигурация	2 x K (кабел) + 1 x T (трафо)	1xQM+2xIM
4.7.2	Обявено напрежение, U_r	24/25 kV	24 kV
4.7.3	Височина (включва и необходимото разстояние за манипулации със стопяемите предпазители)	max 2000 mm	1800мм
4.7.4	Дълбочина	max 1100 mm	1030мм
4.7.5	Широчина	max 1500 mm	1125мм
4.7.6	Шинни връзки 630 A	Да	Да
4.7.7	Лост/комплект лостове за управление	1 бр.	1 бр.
4.7.8	Общо тегло, kg	Да се посочи	440кг.

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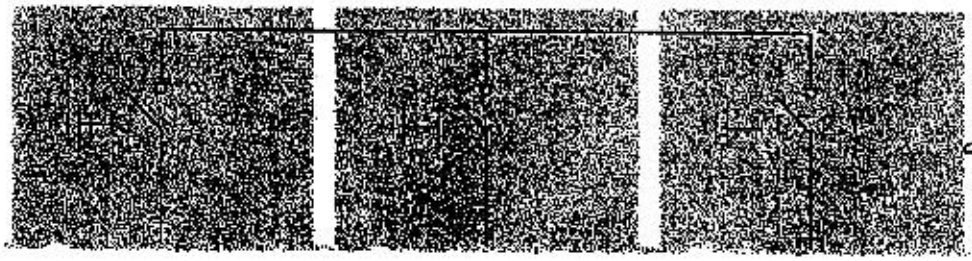
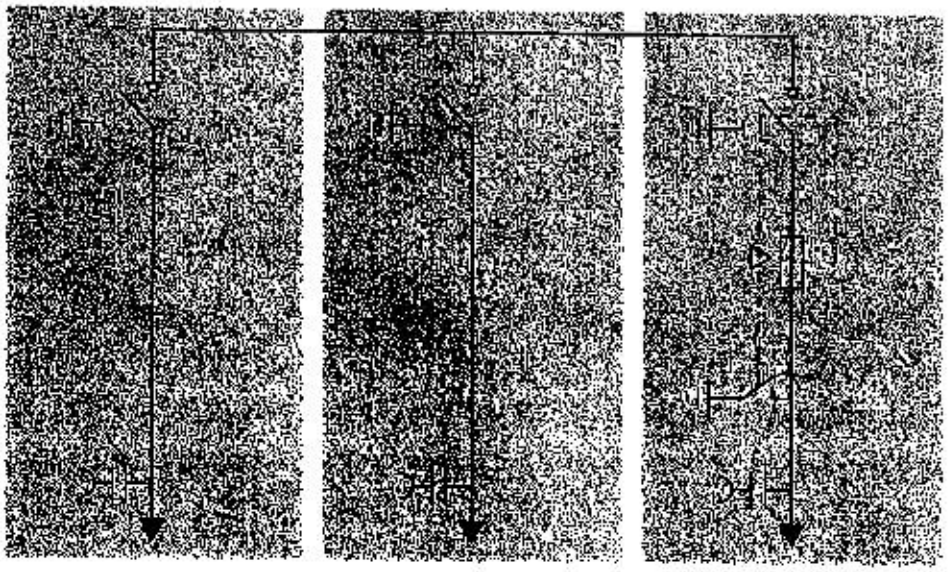
Фиг. 7 - Комплектна разпределителна уредба с SF_6 товарови прекъсвачи – две кабелни присъединения и едно трансформаторно присъединение – ККТ



4.8 Комплектна разпределителна уредба в метални шкафове 12 kV, 630 A, 16 kA с SF_6 товарови прекъсвачи – две кабелни присъединения и едно трансформаторно присъединение

Номер на стандарта		Тип/референтен номер съгласно каталога на производителя	
20 24 1104		Да се посочи	
Наименование на материала		Комплектна разпределителна уредба в метални шкафове 12 kV, 630 A, 16 kA с SF_6 товарови прекъсвачи - ККТ	
Съкратено наименование на материала		КРУ 12/630/16, SF_6 тов. прекъсвачи - ККТ	
№ по ред	Технически параметър	Изискване	Гарантирано предложение
4.8.1	Конфигурация	2 x K (кабел) + 1 x T (трафо)	1xQM+2xIM
4.8.2	Обявено напрежение, U_r	24/25 kV	24 kV
4.8.3	Височина (включва и необходимото разстояние за манипулации със стопяемите предпазители)	max 2000 mm	1800мм
4.8.4	Дълбочина	max 1100 mm	1030мм
4.8.5	Широчина	max 1500 mm	1125мм
4.8.6	Система за индикация на напрежението	Приспособена за работа в ел. мрежи с номинално напрежение 10 kV	Да
4.8.7	Шинни връзки 630 A	Да	Да
4.8.8	Лост/комплект лостове за управление	1 бр.	1 бр.
4.8.9	Общо тегло, kg	Да се посочи	440кг.

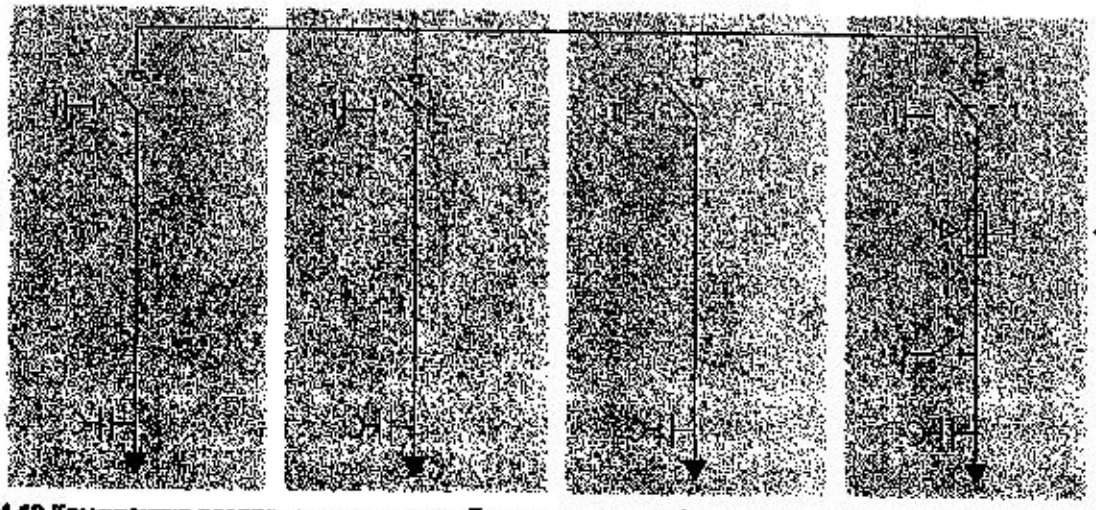
Фиг. 8 - Комплектна разпределителна уредба с SF_6 товарови прекъсвачи – две кабелни присъединения и едно трансформаторно присъединение - ККТ



4.9 Комплектна разпределителна уредба в метални шкафове 24/25 kV, 630 A, 16 kA с SF_6 товарови прекъсвачи – три кабелни присъединения и едно трансформаторно присъединение

Номер на стандарта		Тип/референтен номер съгласно каталога на производителя	
20 24 1205		Да се посочи	
Наименование на материала		Комплектна разпределителна уредба в метални шкафове 24/25 kV, 630 A, 16 kA с SF_6 товарови прекъсвачи - ККТ	
Съкратено наименование на материала		КРУ 24(25)/630/16, SF_6 тов. прекъсвачи - ККТ	
№ по ред	**Технически параметър**	**Изискване**	**Гарантирано предложение**
4.9.1	Конфигурация	3 x K (кабел) + 1 x T (трафо)	1xQM+3xIM
4.9.2	Обявено напрежение, U_r	24/25 kV	24 kV
4.9.3	Височина (включва и необходимото разстояние за манипулации със стопяемите предпазители)	max 2000 mm	1600мм
4.9.4	Дълбочина	max 1100 mm	1030мм
4.9.5	Широчина	max 2000 mm	1500мм
4.9.6	Шинни връзки 630 A	Да	Да
4.9.7	Люст/комплект лостове за управление	1 бр.	1 бр.
4.9.8	Общо тегло, kg	Да се посочи	580кг.

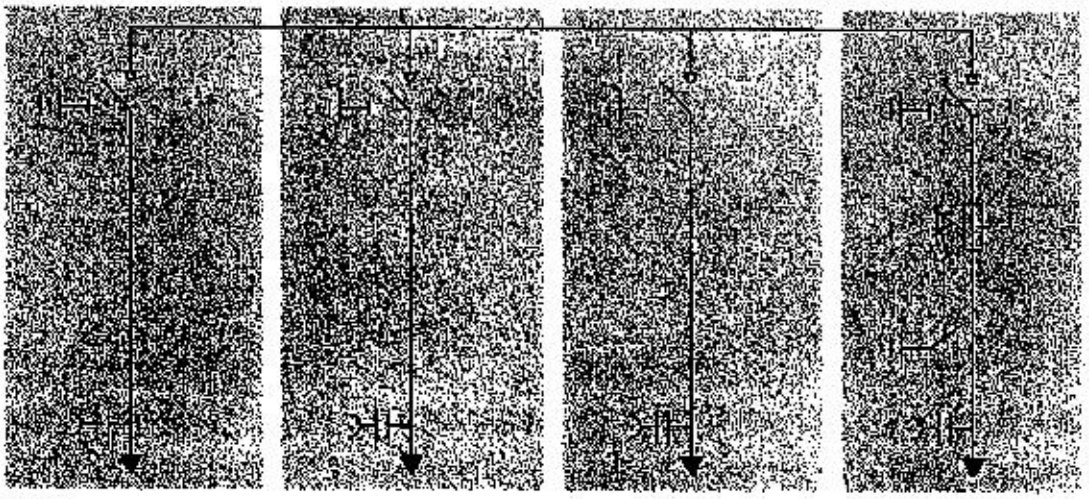
Фиг. 9 - Комплектна разпределителна уредба с SF_6 товарови прекъсвачи – три кабелни присъединения и едно трансформаторно присъединение - КККТ



4.10 Комплектна разпределителна уредба в метални шкафове 12 kV, 630 A, 16 кA с SF_6 товарови прекъсвачи – три кабелни присъединения и едно трансформаторно присъединение

Номер на стандарта		Тип/референтен номер съгласно каталога на производителя	
20 24 1106		Да се посочи	
Наименование на материала		Комплектна разпределителна уредба в метални шкафове 12 kV, 630 A, 16 кA с SF_6 товарови прекъсвачи - КККТ	
Съкратено наименование на материала		КРУ 12/630/16, SF_6 тов. прекъсвачи - КККТ	
№ по ред	Технически параметър	Изискване	Гарантирано предложение
4.10.1	Конфигурация	3 x K (кабел) + 1 x T (трафо)	1xQM+3xIM
4.10.2	Обявено напрежение, U_r	24/25 kV	24 kV
4.10.3	Височина (включва и необходимото разстояние за манипулации със стоящемите предпазители)	max 2000 mm	1600мм
4.10.4	Дълбочина	max 1100 mm	1030мм
4.10.5	Широчина	max 2000 mm	1500мм
4.10.6	Система за индикация на напрежението	Приспособена за работа в ел. мрежи с номинално напрежение 10 kV	Да
4.10.7	Шинни връзки 630 A	Да	Да
4.10.8	Лост/комплект лостове за управление	1 бр.	1 бр.
4.10.9	Общо тегло, kg	Да се посочи	580кг.

Фиг. 10 - Комплектна разпределителна уредба с SF_6 товарови прекъсвачи – три кабелни присъединения и едно трансформаторно присъединение - КККТ

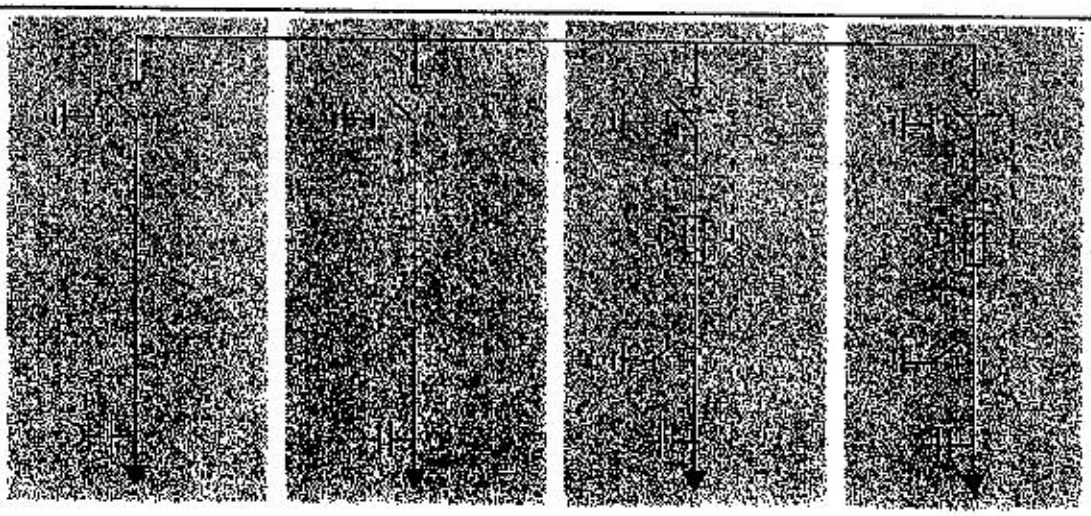


4.11 Комплектна разпределителна уредба в метални шкафове 24/25 kV, 630 A, 16 kA с SF_6 товарови прекъсвачи – две кабелни присъединения и две трансформаторни присъединения

Номер на стандарта	Тип/референтен номер съгласно каталога на производителя
20 24 1206	Да се посочи
Наименование на материала	Комплектна разпределителна уредба в метални шкафове 24/25 kV, 630 A, 16 kA с SF_6 товарови прекъсвачи - ККТТ
Съкратено наименование на материала	КРУ 24(25)/630/16, SF_6 тов. прекъсвачи - ККТТ

№ по ред	Технически параметър	Изискване	Гарантирано предложение
4.11.1	Конфигурация	2 x K (кабел) + 2 x T (трафо)	2xQM+2xIM
4.11.2	Обявено напрежение, U_r	24/25 kV	24 kV
4.11.3	Височина (включва и необходимото разстояние за манипулации със стопяемите предпазители)	max 2000 mm	1600мм
4.11.4	Дълбочина	max 1100 mm	1030мм
4.11.5	Широчина	max 2000 mm	1500мм
4.11.6	Шинни връзки 630 A	Да	Да
4.11.7	Лост/комплект лостове за управление	1 бр.	1 бр.
4.11.8	Общо тегло, kg	Да се посочи	600кг.

Фиг. 11 - Комплектна разпределителна уредба с SF_6 товарови прекъсвачи – две кабелни присъединения и две трансформаторни присъединения - ККТТ

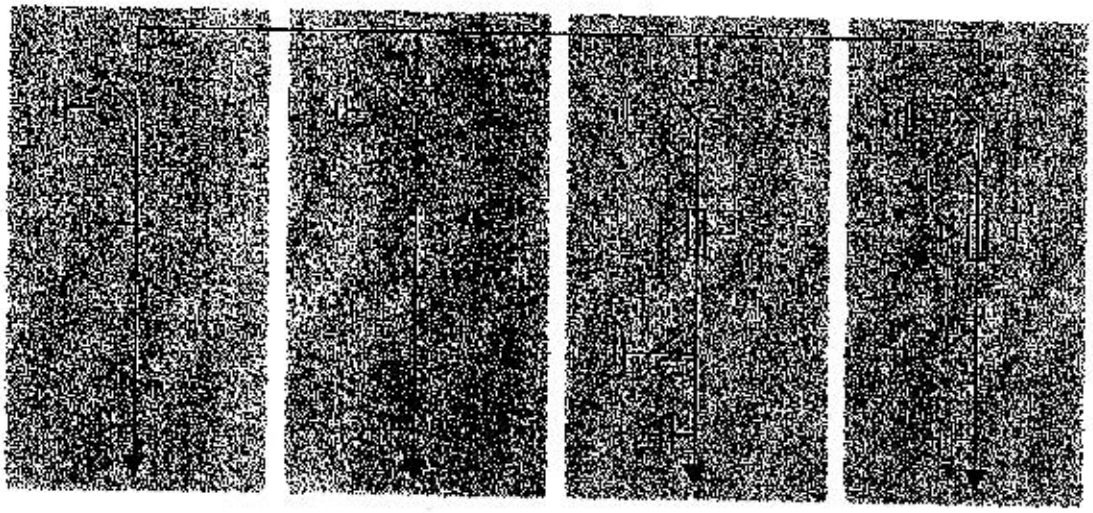


4.12 Комплектна разпределителна уредба в метални шкафове 12 kV, 630 A, 16 kA с SF_6 товарови прекъсвачи – две кабелни присъединения и два трансформаторни присъединения

Номер на стандарта	Тип/референтен номер съгласно каталога на производителя
20 24 1108	Да се посочи
Наименование на материала	Комплектна разпределителна уредба в метални шкафове 12 kV, 630 A, 16 kA с SF_6 товарови прекъсвачи - ККТТ
Съкратено наименование на материала	КРУ 12/630/16, SF_6 тов. прекъсвачи - ККТТ

№ по ред	Технически параметър	Изискване	Гарантирано предложение
4.12.1	Конфигурация	2 x K (кабел) + 2 x T (трафо)	2xQM+2xdM
4.12.2	Обявено напрежение, U_r	24/25 kV	24 kV
4.12.3	Височина (включва и необходимото разстояние за манипулации със стопяемите предпазители)	max 2000 mm	1600мм
4.12.4	Дълбочина	max 1100 mm	1030мм
4.12.5	Широчина	max 2000 mm	1500мм
4.12.6	Система за индикация на напрежението	Приспособена за работа в ел. мрежи с номинално напрежение 10 kV	Да
4.12.7	Шинни връзки 630 A	Да	Да
4.12.8	Лост/комплект лостове за управление	1 бр.	1 бр.
4.12.9	Общо тегло, kg	Да се посочи	600кг.

Фиг. 4.12 - Комплектна разпределителна уредба с SF_6 товарови прекъсвачи – две кабелни присъединения и два трансформаторни присъединения - ККТТ



СРОКОВЕ ЗА ДОСТАВКА

1.	Капак краен /или ляв или десен/	бр.	1	3	...5..... (да се посочи)	6	...6... (да се посочи)
2.	КРУ 24/630/16, SF_6 тов. прекъсвач - К	бр.	1	6	.....6..... (да се посочи)	12	... 12... (да се посочи)
3.	КРУ 24/630/16, SF_6 тов. прекъсвач - Т	бр.	1	3	...3... (да се посочи)	6	...6..... (да се посочи)
4.	Модул секциониране,КРУ,24kV	бр.	1	1	.....1..... (да се посочи)	1	.....1..... (да се посочи)
5.	Лост за управление,КРУ24kV SF6	бр.	1	3	...2..... (да се посочи)	5	...5... (да се посочи)
6.	Връзки шинни 630А,компл.за КРУ	бр.	1	2	.....2..... (да се посочи)	3	...3... (да се посочи)
7.	Комплект кабелни глави за КРУ, приложими за модул"К",20kV,185mm²	бр.	1	6	...6..... (да се посочи)	12	...12... (да се посочи)
8.	Комплект кабелни глави за КРУ, приложими за модул "Т", 20kV, 95 mm²	бр.	1	3	.....3..... (да се посочи)	6	.....6..... (да се посочи)
9	Изключвателна бобина за КРУ 24/630/16, SF_6 тов. прекъсвач - Т	бр.	1	3	.....3..... (да се посочи)	6	.....6..... (да се посочи)

Поръчка със срок на доставка до 7 календарни дни, може да бъде направена от Възложителя след извършена доставка на стоката, фигурираща в първата поръчка със срок на доставка до 30 кал. дни след сключване на договора.

Забележки:

1/ Срокът на доставките започва да тече от датата на изпращане на поръчката

2/ В колона 6 и 8 Участникът попълва количества със срок за доставка, съответно до 7 и 30 дни, които са равни или по-големи от количествата, определени от Възложителя в колони 5 и 7.

3/ Количествата в колона 6, със срок на доставка до 7 /седем/ календарни дни, се доставят след поръчка до посочените в обявлението складове на Възложителя за покриване на спешни нужди на Възложителя.

Възложителят може до поръчва посоченото спешно количество веднъж месечно.

4/ В случай, че крайният срок на доставката съвпада с празничен или неработен ден, то доставката се извършва на по-късно от първия работен ден след изтичането на срока.

5/ При поръчки на Възложителя на количества в рамките на потвърдените от Участника и недоставени в посочените срокове, ще бъдат налагани неустойки, съгласно условията на договора.

6/ Възложителят може да поръчва количества по-малки от посочените в колони 6 и 8, но не по-малки от минималния размер на партидата, посочен в колона 4 за съответния вид стока.

7/ Купувачът може да поръчва количества по-високи от посочените в колони 6 и 8, като това обстоятелство ще бъде посочено текстово в съответната поръчка изпратена към Изпълнителя. С потвърждението на поръчката, Изпълнителят вписва в същата очаквана дата за доставка на количествата стока, надвишаващи посочените в колони 6 и 8.

8/ Количествата за доставка в колони 6 и 8 са отделни и независими едно от друго.

9/ Количествата за доставка в колона 8 не включват в себе си количествата за доставка в колона 6.

10/ Възложителят има право да направи едновременно поръчки за доставка на количества от колони 6 и 8.

Дата 22.08.2014 г.

ПОДПИС и ПЕЧАТ:
Явор Ненчев – Упълномощен представител
(име и фамилия)
(длъжност на представляващото участника)

Приложение 4 към техническо предложение

22

ОПАКОВКА

1	Капак краен /или ляв или десен/	1	Дървени палета,стреч фолио и стиропор	1400x800x150mm	13кг е теглото на опаковката
2	КРУ 24/630/16, SF_6 тов. прекъсвач - К	1	Дървени палета,стреч фолио и стиропор	1400x800x150mm	13кг е теглото на опаковката
3	КРУ 24/630/16, SF_6 тов. прекъсвач - Т	1	Дървени палета,стреч фолио и стиропор	1400x800x150mm	13кг е теглото на опаковката
4	Модул секционирана,КРУ,24kV	1	Дървени палета,стреч фолио и стиропор	1400x800x150mm	13кг е теглото на опаковката
5	Лост за управление,КРУ24kV SF6	1	Дървени палета,стреч фолио и стиропор	1400x800x150mm	13кг е теглото на опаковката
6	Връзки шини 630А,компл.за КРУ	1	Дървени палета,стреч фолио и стиропор	1400x800x150mm	13кг е теглото на опаковката
7	Комплект кабелни глави за КРУ, приложими за модул"К",20kV,185mm²	1	Дървени палета,стреч фолио и стиропор	1400x800x150mm	13кг е теглото на опаковката
8	Комплект кабелни глави за КРУ, приложими за модул "Т", 20kV, 95 mm²	1	Дървени палета,стреч фолио и стиропор	1400x800x150mm	13кг е теглото на опаковката
9	Изключвателна бобина за КРУ 24/630/16, SF_6 тов. прекъсвач - Т	1	Дървени палета,стреч фолио и стиропор	1400x800x150mm	13кг е теглото на опаковката

Дата 22.08.2014 г.

ПОДПИС и ПЕЧАТ:
Явор Нанчев – Упълномощен представител
(име и фамилия)
(длъжност на представляващия участника

23

ТЕХНИК ЕНЕРДЖИ ЕООД
Адрес: гр.Варна, 9000 бул."Янош Хунияди" №6

ПРИЛОЖЕНИЕ 1

гр.Варна, бул.Янош Хунияди 6, тел.:052/801946; факс: 052/ 801 955, е- mail: office@tehen.bg;

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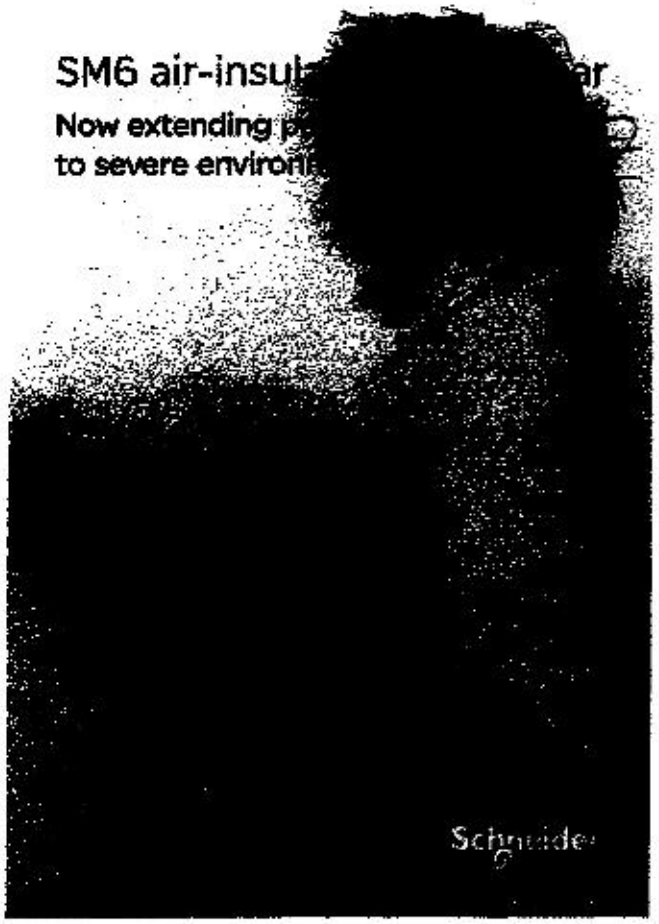

ВЯРНО С ОРИГИНАЛА!

ЕНЕРГИЕ ЕНЕРГИ" ЕООД

Answers to the severe environment questions

A two-step approach to protecting your switchgear

The ideal modular equipment for severe environments worldwide

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3,890 years

Severe environment product evolution:

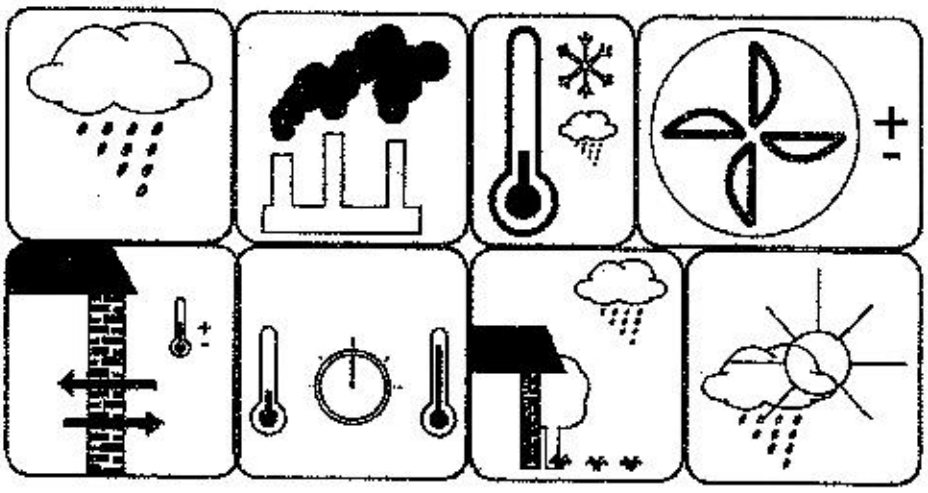
1 Innovation at the busbar

2 Replacing aluminum with silicon

Instruction guide

Medium Voltage equipment on sites exposed to high humidity and/or heavy pollution

Recommendations for installation and use



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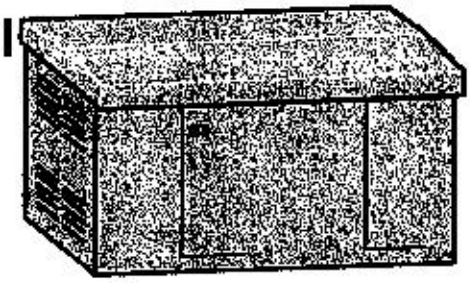
Contents

Use of MV equipment



MV switchboards fulfil safety functions and must therefore be installed in line with certain profession practices.

The purpose of this documentation is provide general guidelines on how to avoid or greatly reduce MV equipment degradation as since exposed to high humidity and heavy pollution.

Normal service conditions for indoor MV equipment

MV equipment consists of modular MV cubicles or compact Ring Main units generally installed in prefabricated substations along with transformers and LV switchgear.

All MV equipments comply with specific standards and with the IEC 62271-1 High-voltage switchgear and controlgear - part 1 (common specification). The latter defines the normal conditions for the installation and use of such equipment.

For instance, regarding humidity, the standard mentions :
2.1 Normal service conditions
2.1.1 Indoor switchgear and controlgear
a) The conditions of humidity are as follows :
- the average value of the relative humidity, measured over a period of 24 h does not exceed 90 %;
- the average value of the water vapour pressure, over a period of 24 h does not exceed 2.2 kPa;
- the average value of the relative humidity, over a period one month does not exceed 90 %;
- the average value of water vapour pressure, over a period one month does not exceed 1.8 kPa;
For these conditions, condensation may occasionally occur.

NOTE 1 - Condensation can be expected where sudden temperature changes occur in period of high humidity.
NOTE 2 - To withstand the effects of high humidity and condensation, such as a breakdown of insulation or corrosion of metallic parts, switchgear designed for such conditions and tested accordingly shoul be used.
NOTE 3 - Condensation may be prevented by special design of the building or housing, by suitable ventilation and heating of the station or by use of dehumifying equipment.

As indicated in the standard, condensation may occasionally occur even under normal conditions. The standard goes on to indicate special measures concerning the substation premises that can be implemented to prevent condensation (Note 3).

Use under severe conditions

Under certain severe conditions concerning humidity and pollution, largely beyond the normal conditions of use mentioned above, correctly designed electrical equipment can be subject to damage by rapid corrosion of metal parts and surface degradation of insulating parts.

Guidelines

Remedial measures for condensation problems

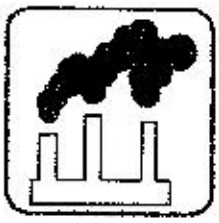
Carefully design or adapt substation ventilation
- Keep substation ventilation to the minimum required for evacuation of transformer heat to reduce temperature variations.
- Use natural ventilation rather than forced ventilation whenever possible.
- If forced ventilation is required, run fans continuously.
- Locate the substation ventilation openings as far as possible from the MV cubicle.
- Never add ventilation openings to MV cubicles.

Avoid temperature variations
- Install anti-condensation heaters inside MV cubicles and let them run continuously, i.e. without automatic or manual control.
- Improve the thermal insulation of the substation.
- Avoid substation heating if possible.
- If heating is required, make sure the temperature regulation system avoids large temperature swings or leave heating on continuously.
- Eliminate cold air drafts from cable trenches, under doors, etc.

Eliminate sources of humidity in the substation environment
- Avoid excessive plant growth around the substation.
- Repair any leaks in the substation roof.
- Prevent humidity from cable trenches from entering MV cubicles.

Install an air conditioning system
- Air conditioning is the surest way of controlling humidity and temperature.
- Always use a reputed supplier.
- Clearly define your needs.

Make sure cabling is in accordance with applicable rules
- Pay special attention to the positioning of earthing screens, stress control screens and semiconductor screens).
- Use cold-shrink cable terminations is possible, but make sure they are properly installed.



Remedial measures for pollution problems

- Equip substation ventilation openings with chevron-type baffles to reduce entry of dust and pollution.
- Keep substation ventilation to the minimum required for evacuation of transformer heat to reduce entry of pollution and dust.
- Use MV cubicles with a sufficiently high degree of protection (IP).
- Use air conditioning systems with filters to restrict entry of pollution and dust.
- Regularly clean all traces of pollution from metal and insulating parts.

Condensation

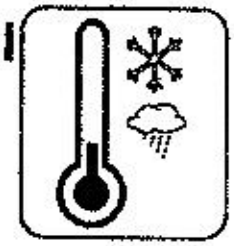
How condensation occurs

Condensation is the transformation of a gas or vapour into a liquid. It takes place in air when the air becomes saturated with water vapour and results in the formation of liquid water.

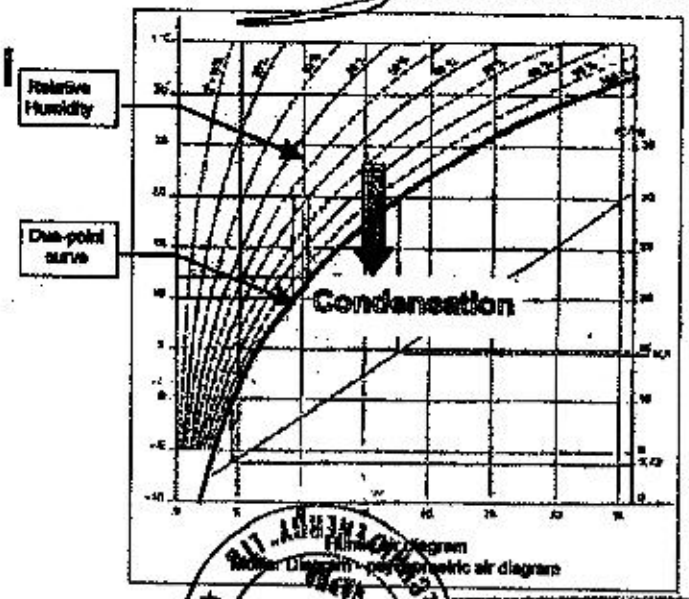
Two processes can lead to the saturation of air with water vapour and subsequent condensation:

- An increase in humidity at constant temperature

- A drop in temperature at constant humidity



The relationship between temperature, humidity and condensation is described by the «dew point» curve. The dew point is the temperature to which a parcel of air at a given level of humidity and a given barometric pressure must be cooled to condense into water.



Condensation (cont'd)

Sources of humidity

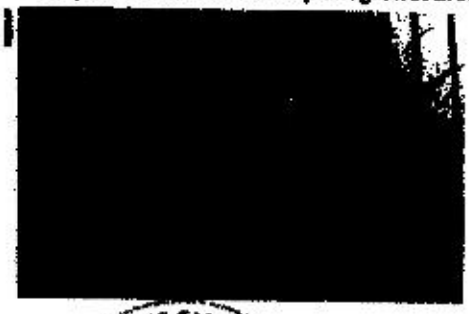
The humidity causing condensation in MV cubicles can come from four different sources:

- The atmosphere

- Water leaks in the building or substation

- The presence of water in cable trenches

- The presence of excessive plant growth around the substation

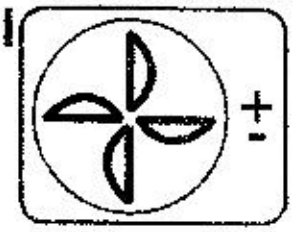


Condensation (cont'd)

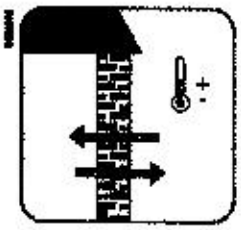
Sources of temperature variation

Temperature variation causing condensation in MV cubicles may result from:

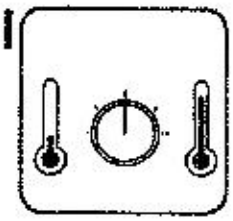
- Excessive or discontinuous ventilation



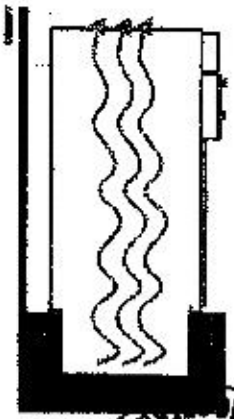
- Insufficient thermal insulation of the substation



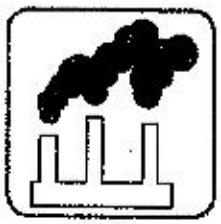
- Substation heating control systems



- Cold air drafts from cable trenches or other openings (under doors, etc.)

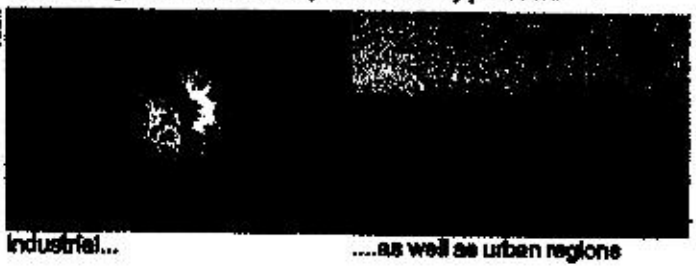


Pollution



General

Certain regions or sites are exposed to heavy pollution.



Industrial... ....as well as urban regions

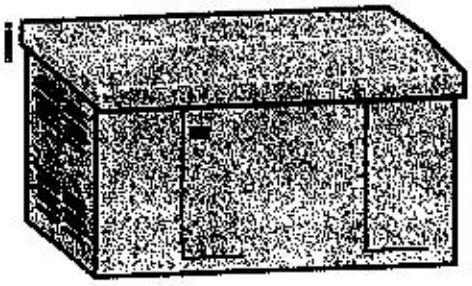
Related problems

If no precautions are taken, pollution will be deposited on:

- Insulating components, leading to degradation by corona and tracking
- Metal parts, leading to corrosion.

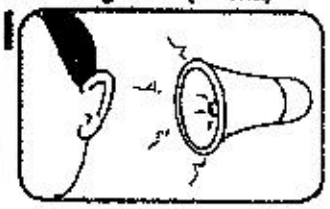
Site inspection and diagnosis

The presence of the following phenomena can be used to detect MV equipment degradation problems related to condensation and pollution.

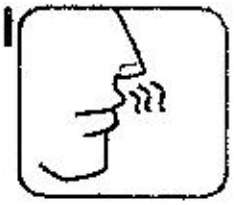


Inside the substation

- Condensation
- Accumulation of dust or contamination from pollution
- Buzzing sound (corona)



- Ozone smell.



Inside the cubicle

- Condensation
- Accumulation of dust or contamination from pollution
- Corrosion of metal components (e.g. voltage divider, cable lugs, connection terminals)
- Visible discharges around the cable terminations (switchgear insulation, capacitive dividers, cable ends).
- Chalking (white tracks) on the insulation (switchgear insulation, capacitive dividers, cable ends).
- Erosion and tracking (black tracks) on the insulation.

[illegible] contact your Schneider Electric correspondent.

Conclusions

When site inspection reveals problems related to condensation and pollution, remedial measures can be implemented to avoid degradation of MV equipment.

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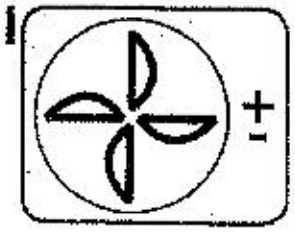
Ventilation

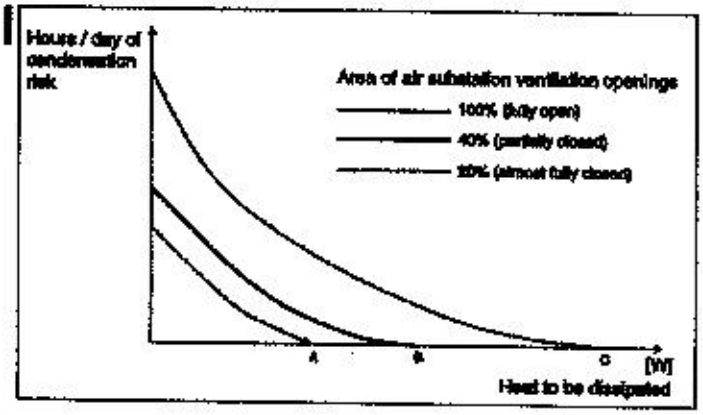


General

Substation ventilation is generally required to dissipate the heat produced by transformers and to allow drying after particularly wet or humid periods.

However, a number of studies have shown that excessive ventilation can drastically increase condensation.

For instance, the following graph shows the risk of condensation in an MV substation cooled by natural ventilation with the ventilation openings opened and with the ventilation openings blocked to 40 % and 20 % of their initial area.



Note that if, for instance, the heat to be evacuated from the substation is less than A, the red and blue curves reflect greatly overdesigned ventilation, corresponding to a far higher risk of condensation in the substation.

Ventilation should therefore be kept to the minimum level required.

Furthermore, ventilation should never generate sudden temperature variations that can cause the dew point to be reached.
For this reason:

Natural ventilation should be used whenever possible. If forced ventilation is necessary, the fans should operate continuously to avoid temperature fluctuations.

Note that excessive ventilation will also increase the ingress of dust and pollution.

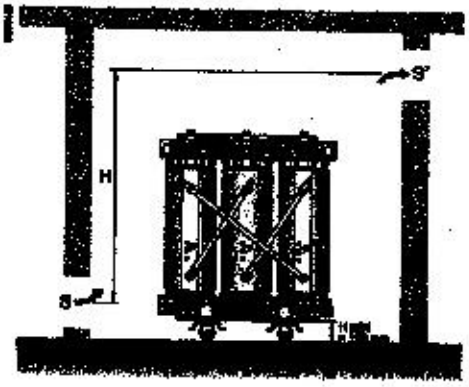
Guidelines for sizing the air entry and exit openings of substations are presented hereafter.

Sizing the ventilation openings

Calculation methods

A number of calculation methods are available to estimate the required size of substation ven tilation openings, either for the design of new substations or the adaptation of existing substations for which condensation problems have occurred.

• Basic method



This method is based on transformer dissipation.

- The required ventilation opening surface areas S and S' can be estimated using the following formulas

$$S = \frac{1.8 \times 10^{-4} P}{\sqrt{H}} \quad \text{and} \quad S' = 1.10 \times S$$

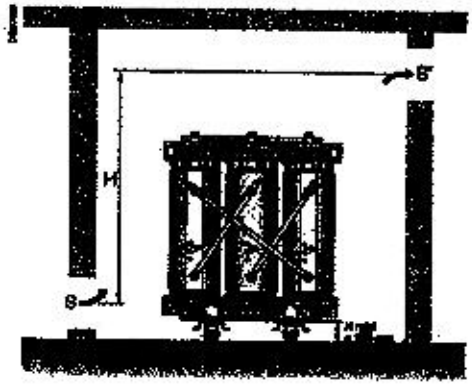
where:
S = Lower (air entry) ventilation opening area [m²] (grid surface deducted)
S' = Upper (air exit) ventilation opening area [m²] (grid surface deducted)
P = Total dissipated power [W]
P is the sum of the power dissipated by:
– the transformer (dissipation at no load and due to load)
– the LV switchgear
– the MV switchgear
H = Height between ventilation opening mid-points [m]

Note:
This formula is valid for a yearly average temperature of 20 °C and a maximum altitude of 1000 m.

- Example:
Transformer dissipation = 7 970 W
LV switchgear dissipation = 750 W
MV switchgear dissipation = 300 W
The height between ventilation opening mid-points is 1.5 m.

Calculation:
Dissipated Power P = 7970 + 750 + 300 = 9020 W

$$S = \frac{1.8 \times 10^{-4} P}{\sqrt{1.5}} = 1.32\ m^2 \quad \text{and} \quad S' = 1.1 \times 1.32 = 1.46\ m^2$$



Sizing the ventilation openings (cont'd)

• More complete method

- Another possibility is the following formula based on various aspects of substation design.

$$S = \frac{(P - 2.4 * \Sigma(K_i * S_i) * T)}{(417 * G * \sqrt{H} * T^{1.5})} \quad \text{and} \quad S' = 1.10 * S$$

where:
S = Lower (air entry) ventilation opening area [m²]
S' = Upper (air exit) ventilation opening area [m²]
P = Total dissipated power [W]
P is the sum of the power dissipated by:
- the transformer (dissipation at no load and due to load)
- the LV switchgear
- the MV switchgear
Si = Area of enclosure surface i [m²]
Ki = Transmission coefficient of surface i [W/m²K]
- K = 7 for steel sheets
- K = 3 for 10 cm and 2.5 for 20 cm of concrete
- K = 0 for the ground (no heat transmission through the ground)
T = Class of enclosure (transformer temperature rise) [K]
G = Grid coefficient
- G = 0.26 to 0.77 for chevron blade louvers (0.38 for 90° simple chevrons)
- G < 0.2 for more complex types such as overlapped C beams
- G around 0.6 for punched sheet with rectangular holes
H = Height between ventilation opening mid-points [m]

Note:
This gives smaller ventilation opening areas than the previous method because it takes dissipation through the walls, roof and doors into account.

- Example:
Transformer dissipation = 7 970 W
LV switchgear dissipation = 750 W
MV switchgear dissipation = 300 W
The substation area is made up of:
– 14.6 m² of concrete walls (10 cm thick)
– 7.0 m² of concrete roof (10 cm thick)
– 6.2 m² of metallic doors
The enclosure class is 10 K
The ventilation grid is of the chevron louver type (G = 0.4).
The height between ventilation opening mid-points is 1.5 m.

Calculation :
$P = 7970 + 750 + 300 = 9020$ W

$\sum_i (K_i * S_i) = 14.6 * 3 + 7.0 * 3 + 6.2 * 7 = 108.2$ W/K

$$S = \frac{(9020 - 2.4 * 108.2 * 10)}{417 * 0.4 * \sqrt{1.5} * 10^{1.5}} = 0.99 \text{ m}^2 \text{ and } S' = 1.1 * 0.99 = 1.09 \text{ m}^2$$

Sizing the ventilation openings (cont'd)

• Testing

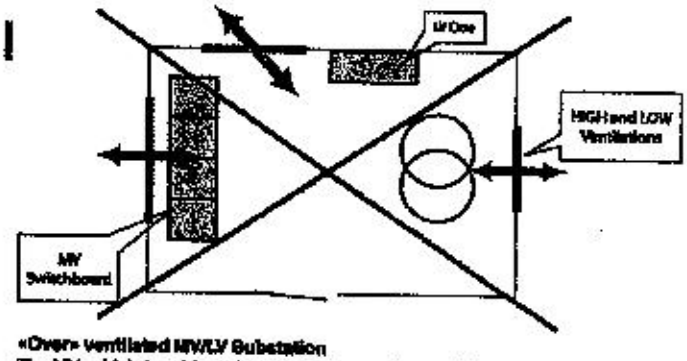
The above methods can be used to estimate the required size of substation ventilation openings, however the best results are obtained by testing.

- For new substations, tests should be carried out by the substation supplier to ensure that the provided ventilation system is not oversized.
- For existing substations presenting condensation, tests can be carried out to determine whether ventilation opening areas can be reduced without exceeding the maximum temperature rise limits of the transformer under the worst possible conditions.

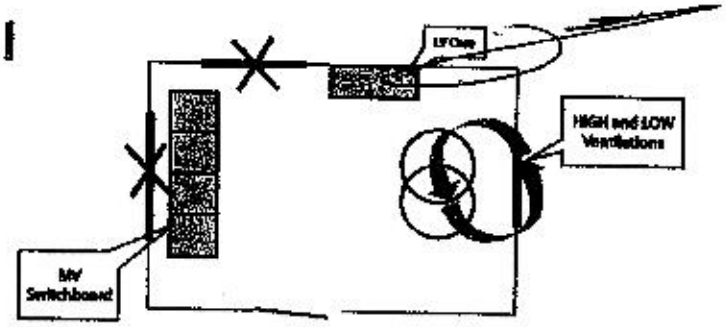
Ventilation opening locations

To favour evacuation of the heat produced by the transformer via natural convection, ventilation openings should be located at the top and bottom of the wall near the transformer.

The heat dissipated by the MV switchboard is negligible. To avoid condensation problems, the substation ventilation openings should be located as far as possible from the switchboard.



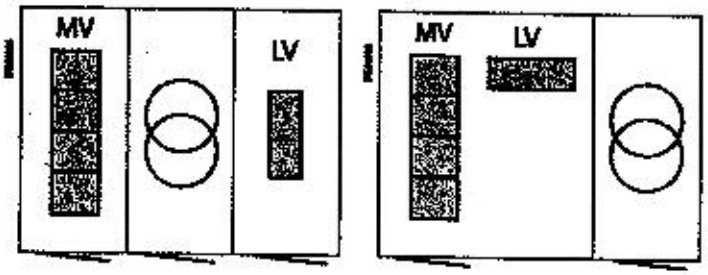
«Oven» ventilated MV/LV Substation
The MV-cubicle is subjected to sudden temperature variations.



Substation with adapted ventilation
The MV cubicle is no longer subjected to sudden temperature variations.

Ventilation opening locations (cont'd)

If the MV switchboard is separated from the transformer, the room selected for the switchboard requires only natural ventilation to allow drying of any humidity that may enter the room.



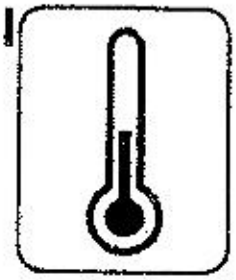
Type of ventilation openings

To reduce the entry of dust, pollution, mist, etc., the substation ventilation openings should be equipped with chevron-blade baffles. Always make sure the baffles are oriented in the right direction.

MV cubicle ventilation

As a rule, natural ventilation is taken into account by the manufacturer in the design of the cubicle. Ventilation openings should then be added to the original design.

Temperature



General

As already mentioned, temperature variations lead to condensation under high humidity conditions.

Temperature variations inside cubicles

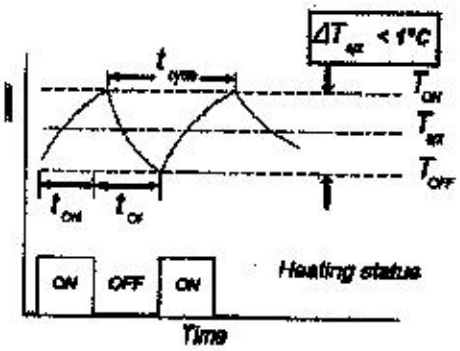
To reduce temperature variations, always install anti-condensation heaters inside MV cubicles if the average relative humidity can remain high over a long period of time.
The heaters must operate continuously, 24 hours a day all year long.

Never connect them to a temperature control or regulation system as this could lead to temperature variations and condensation as well as a shorter service life for the heating elements.
Make sure the heaters offer an adequate service life (standard versions are generally sufficient).

Temperature variations inside the substation

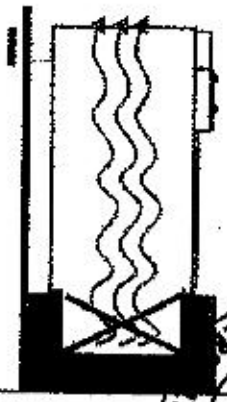
The following measures can be taken to reduce temperature variations inside the substation:

- Implement the measures described in the previous section concerning ventilation.
- Improve the thermal insulation of the substation to reduce the effects of outdoor temperature variations on the temperature inside the substation.
- Avoid substation heating if possible. If heating is required, make sure the regulation system and/or thermostat are sufficiently accurate and designed to avoid excessive temperature swings (e.g. no greater than 1 °C).

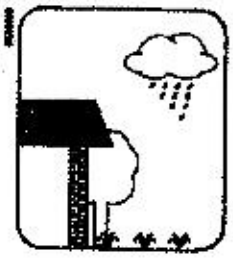


Example of an acceptable thermostat regulation curve.

- If an inadequately accurate temperature regulation system is not available, keep the heaters on continuously, 24 hours a day all year long.
- Eliminate cold air drafts from cable trenches under cubicles or from openings in the substation (under doors, roof joints, etc.).



Substation environment and humidity



General

Various factors outside the substation can affect the humidity inside.

Plants

Avoid excessive plant growth around the substation.

Substation waterproofing

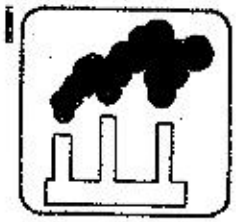
The substation roof must not leak. Avoid flat roofs for which waterproofing is difficult to implement and maintain.

Humidity from cable trenches

Make sure cable trenches are dry under all conditions.
A partial solution is to add sand to the bottom of the cable trench.

Studies have shown that this reduces corrosion inside the cubicle, however if internal arc protection is required, this solution requires careful investigation as to how it is implemented.

Pollution protection and cleaning



General

Excessive pollution favours leakage current, tracking and flashover on insulators. To prevent MV equipment degradation by pollution, it is possible to either protect the equipment against pollution or regularly clean the resulting contamination.

Protection

Indoor MV switchgear can be protected by enclosures providing a sufficiently high degree of protection (IP)

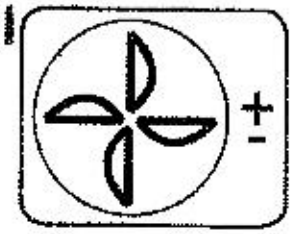
Cleaning

If not fully protected, MV equipment must be cleaned regularly to prevent degradation by contamination from pollution.

Cleaning is a critical process. The use of unsuitable products can irreversibly damage the equipment.

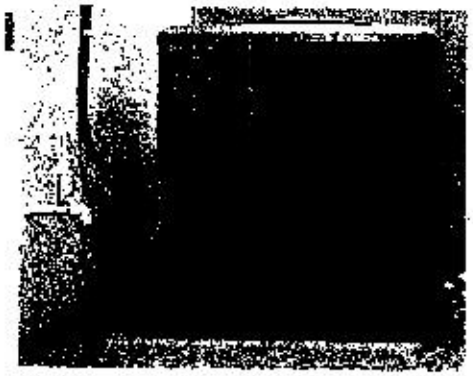
For cleaning procedures, please contact your Schneider Electric correspondent.

Air conditioning



General

Air conditioning is the ideal way to control temperature and humidity in a substation.
A number of efficient systems are now available on the market.



Some are equipped with filters to reduce the entry of pollution and dust.

Recommendations

If you are considering this type of system:

- Contact a reputed air conditioning manufacturer or specialist.

Cabling

General

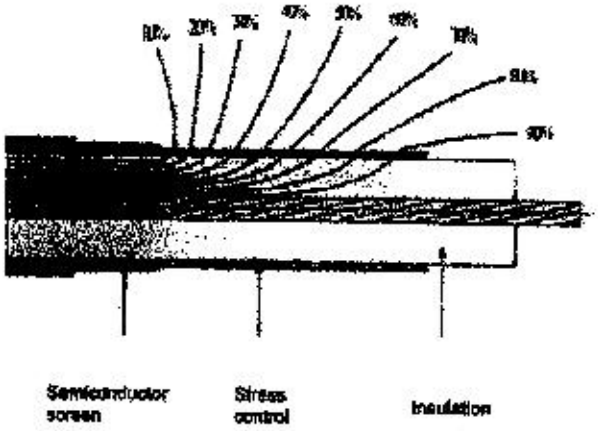
The MV equipment must be cabled in accordance with applicable rules and regulations. Some cabling rules are described in the installation manuals.

Incorrect cabling can cause partial discharges that produce ozone.

Ozone is an aggressive gas that attacks the chemical bonds of insulation materials, especially in the presence of condensation or pollution.

Recommendations

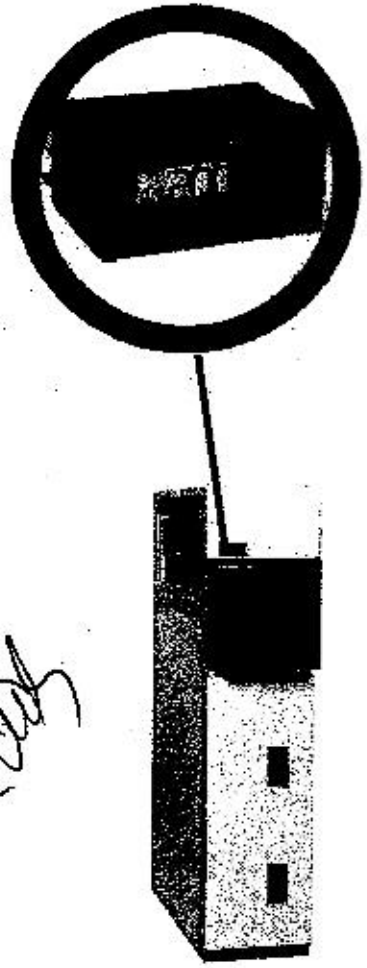
- Pay special attention to the positioning of earthing screens, stress control screens and semiconductor screens.



- Cable terminations:
  - As cable terminations differ from one range to another, consult the respective catalogue for the most suitable solution.

Fault Passage Indicators: Embedded

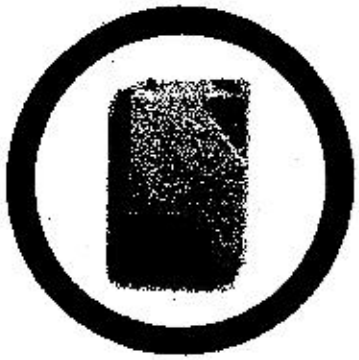
- Increase the reliability of your network and application thanks to the self-powered and hi-performance indicator
  - Fault current passage indicators are adapted product to all neutral earthing system: insulation, impedant and direct earthing.

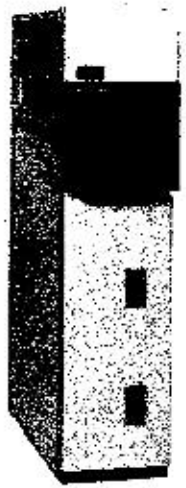


- Self-powered with a liquid crystal display
- Clear and comprehensive display
- Maintenance free

Fault Passage Indicators: Stand alone

- Communicating fault passage indicator for underground applications

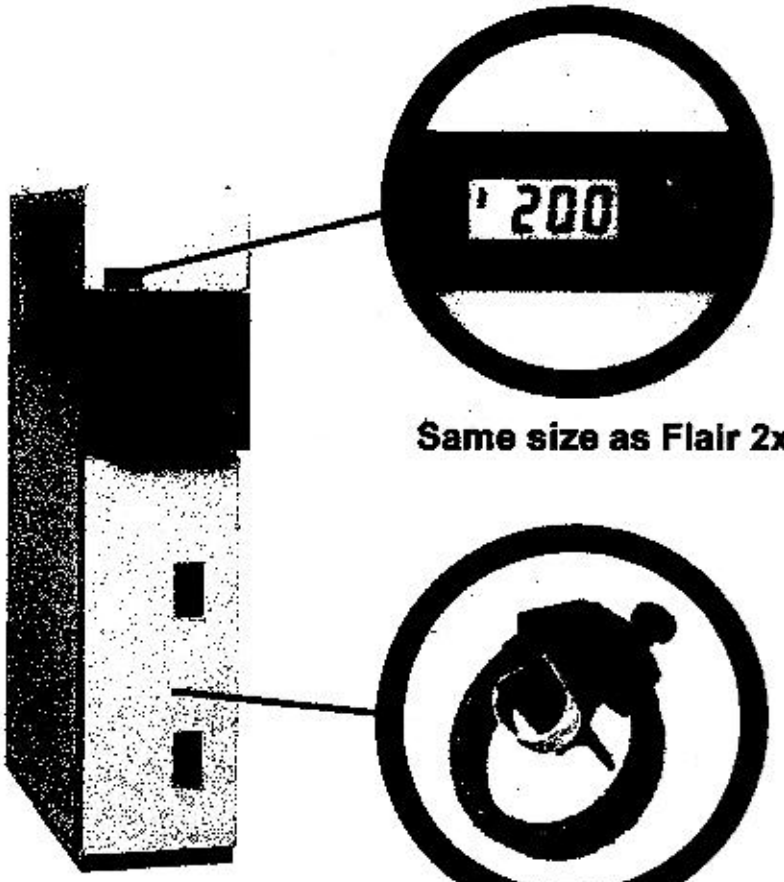




- Local fault indicator for underground applications

Ammeter

- No power supply
- Digital display
- 3 phase current indication
- Maximeter
- Accuracy : ~5%
- 1A resolution

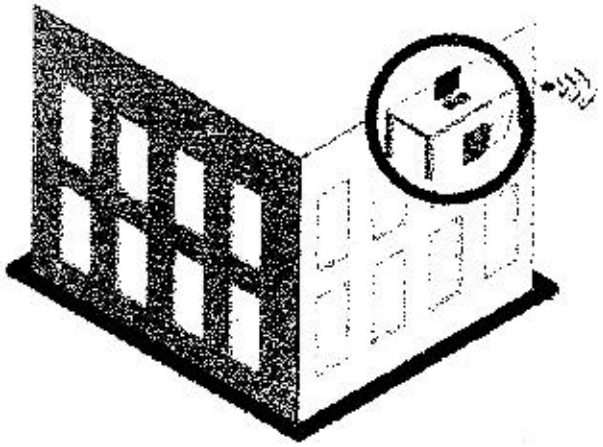


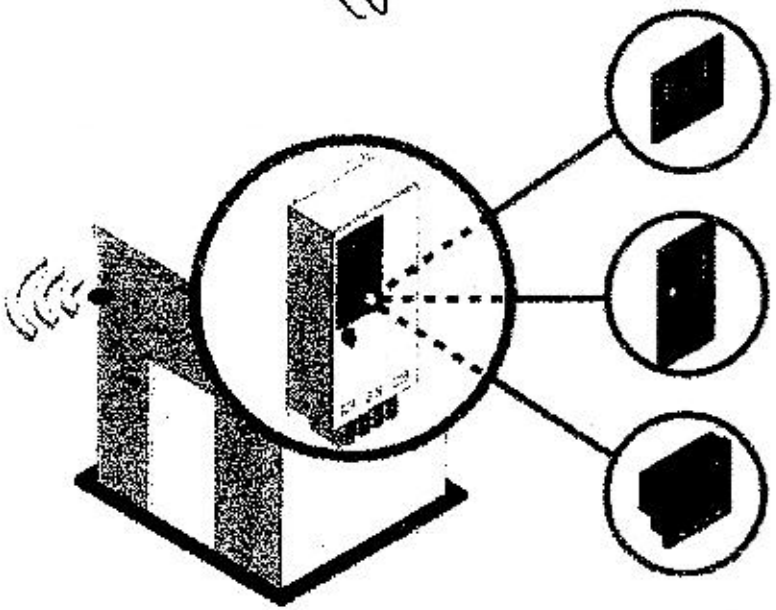
Same size as Flair 2xD

Flair 2xD low cost
Split core CTs

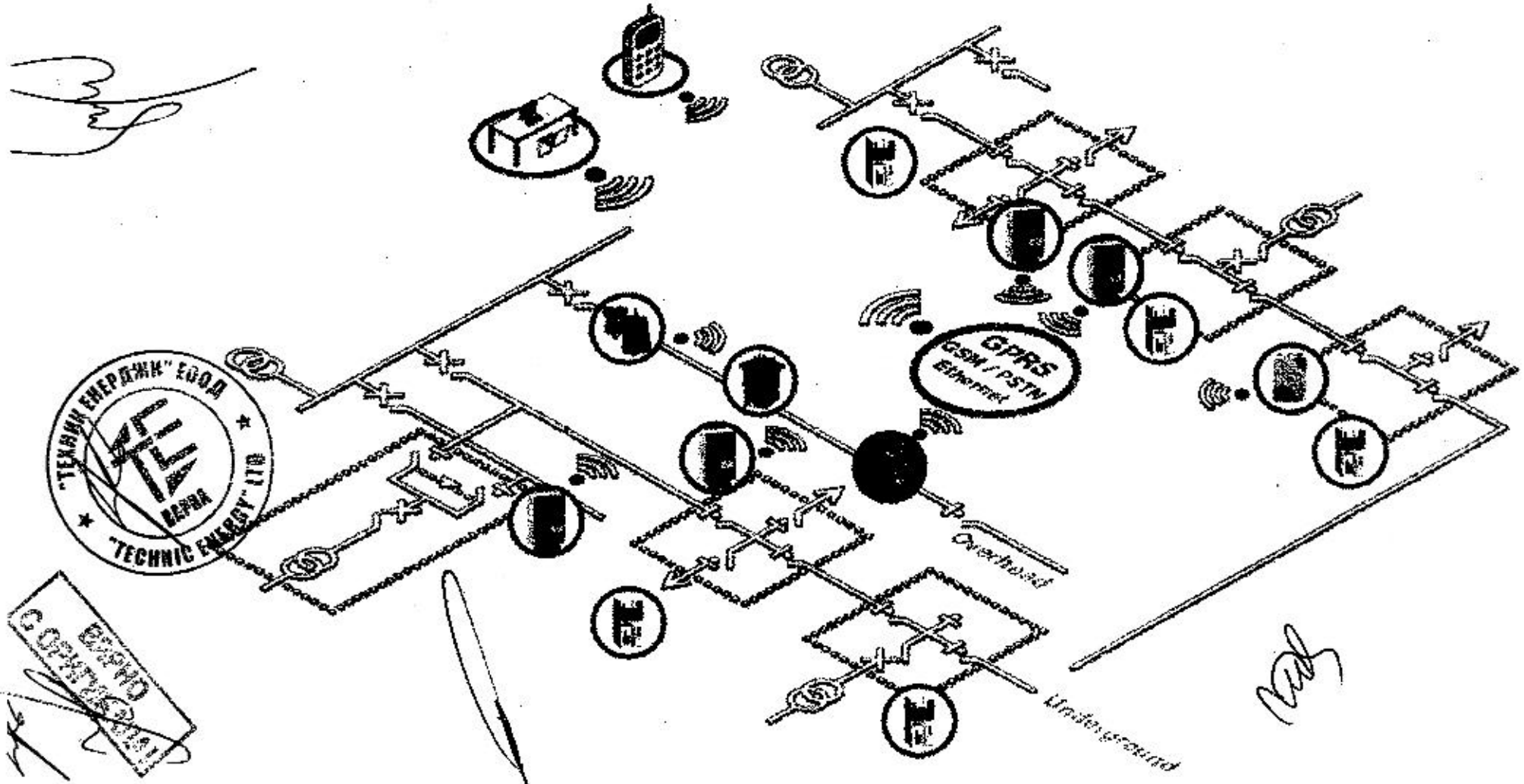
Hi-reliability: guaranteeing continuity of service

- T200 is a simplified MV substation control unit for secondary distribution network enabling remote control of one or two substation switches.
  - Multifunctional "plug & play" interface which integrates all functions required for remote monitoring and control.
  - Compatible with all SCADA remote control system.

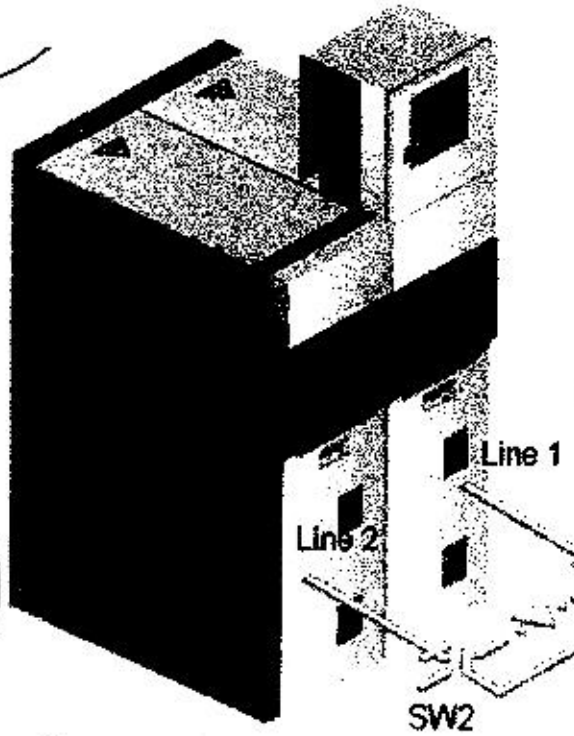




Guaranteeing continuity of service with control and monitoring



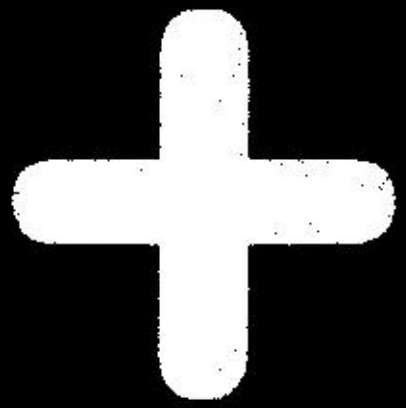
Guaranteeing continuity of service through hi-reliability



- Because continuity of service is one major stake, the change-over function gives automatic control and let you free from cut-off.
- Switching time : Less than 0.4'

Making the most of our energy

Continuity of service

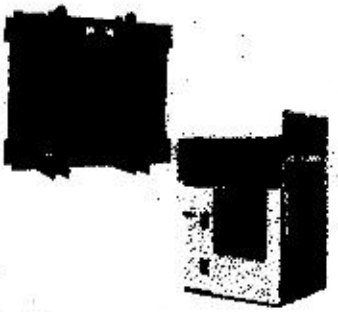


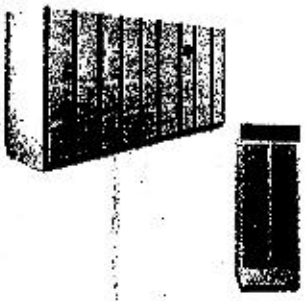
Easy upgradeability

Monitoring and protection of your network

Експертна гриж а

Schneider





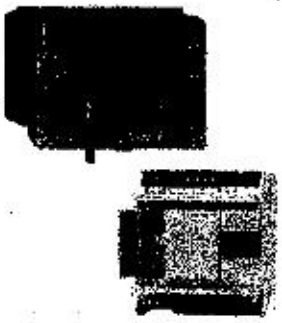
	Средно напрежение	Ниско напрежение	UPS оборудване
	Предпазители, прекъсвачи, контактори, КРУ за вторично и първично електроразпределение, въздушни и маслени трансформатори, устройства за корекция фактора на мощността и потискане на хармоници	Прекъсвачи, АВР табла, устройства за корекция фактора на мощността и потискане на хармоници	Трифазни UPS устройства, статични превключватели, активни филтри за хармоници
Шеф монтаж и въвеждане в експлоатация		стр. 4	стр. 4
Диагностика и одит	стр. 5	стр. 5	стр. 5
Модернизация и ретрофит на оборудване	стр. 6	стр. 6	
Ремонтна дейност	стр. 7	стр. 7	стр. 7
Доставка на резервни части	стр. 8	стр. 8	стр. 8
[illegible]	стр. 9	стр. 9	
Договори за системна поддръжка на оборудване	стр. 10	стр.10	стр. 10
Лизинг на оборудване	стр. 11	стр. 11	стр. 11

ТЕХНИК ЕНЕРДЖИ" ЕООД ВАРНА

ВЯРНО С ОРИГИНАЛА

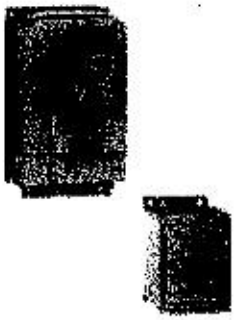
Системи за мониторинг

Измерватели, електронни защити, устройства за комуникация



Автоматизация и управление

Програмируеми контролери, релета, устройства за комуникация и софтуерни продукти



Драйвери и моторни задвижвания

Пускатели, защитни компоненти, устройства за плавен пуск, честотни регулатори.

Сградна автоматизация

Аварийно и евакуационно осветление, структурно окабеляване, управление на осветлението, видеонаблюдение, управление на сградни системи.

стр. 4 стр. 4 стр. 4

стр. 5 стр. 5 стр.5

стр. 6

стр. 7 стр. 7

стр. 8 стр. 8 стр. 8 стр. 8

стр. 9 стр. 9 стр. 9

стр. 10 стр. 10 стр. 10 стр. 10

стр. 11 стр. 11 стр. 11 стр. 11

ШЕФ-МОНТАЖ И ВЪВЕЖДАНЕ В ЕКСПЛОАТАЦИЯ

Цел: Въвеждане в експлоатация и безопасно включване на оборудването, надеждна работа и минимизиране на отказите в захранването при експлоатацията, обезпечаване на непрекъснатост в електрозахранването.

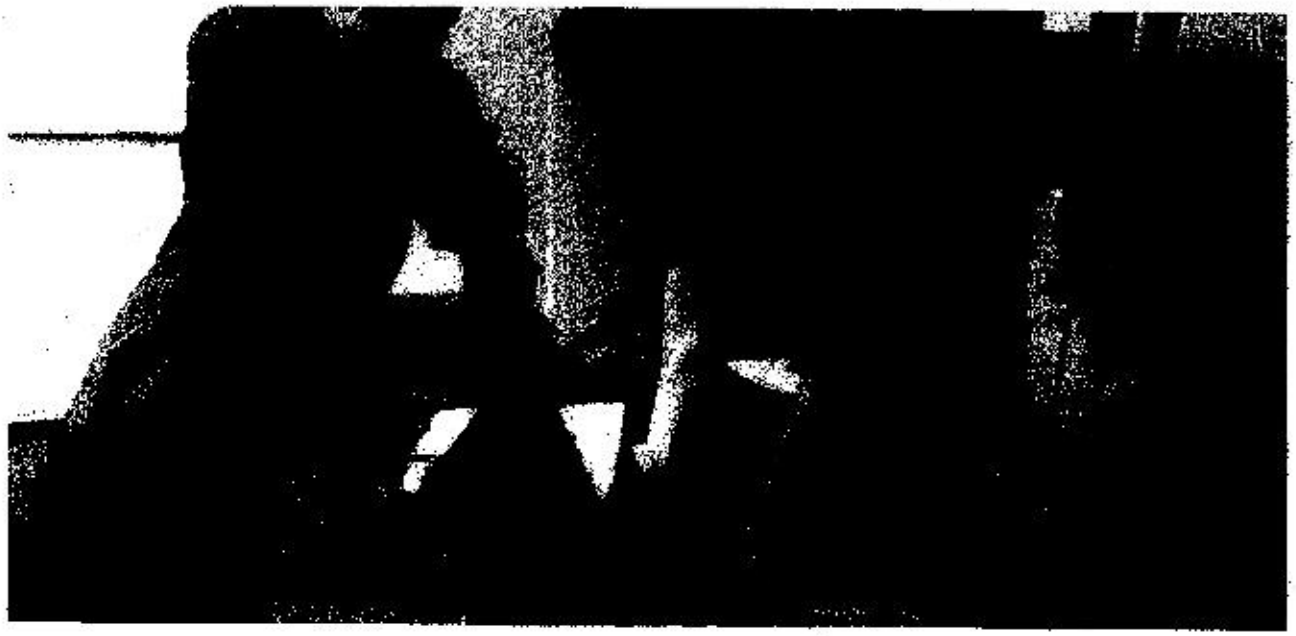
Услугата включва:

- Пълно изследване на помещението на оборудването /температура, влажност, вентилация/
- Разопаковане и обследване за механични дефекти, проверка за съответствие със спецификацията
- Общ контрол за изпълнение на монтажните работи
- Проверка на отделните възли на оборудването, кабелни и шинни присъединения
- Извършване на всички необходими измервания
- Тестове за функционалност под напрежение
- Обучение на обслужващия персонал; изготвяне на необходимите документи /протоколи, гаранционни карти/
- Настройки и програмиране на оборудването

Предимства

- Незабавно инсталиране след доставката
- Обезпечаване на необходимата последователност и качество на монтажни дейности
- Увеличаване на надеждността на електрозахранването и повишаване на електробезопасността на инсталационните дейности
- Извършване на монтаж, измерване, настройки и тестове от висококвалифициран и обучен персонал
- Оптимална последователност при въвеждането в експлоатация и намаляване на рисковете от дефекти при включване към напрежение
- Увеличаване на срока на експлоатация на оборудването
- Повишаване на квалификацията на обслужващия персонал

ДИАГНОСТИКА И ОДИТ



Цел: Комплексна проверка на състоянието на електроразпределителната система на клиента с изготвяне на препоръки за модернизация на съществуващото оборудване и повишаване на енергийната ефективност.

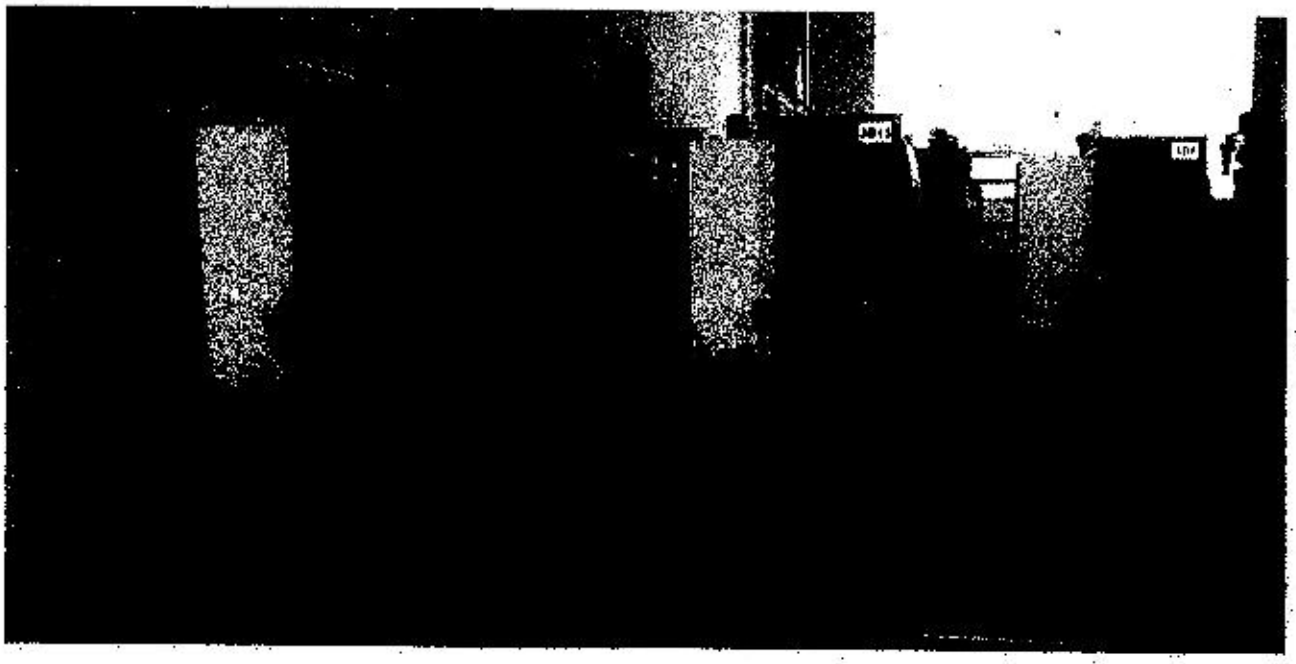
Услугата включва:

- Оглед на обектите и запознаване с оборудването и неговата документация; провеждане на измервания, както и запис на данните при реално работещи системи и консуматори /напрежения, токове, честота, фактор на мощността, консумирана активна и реактивна енергия, хармонични изкривявания, пикова, нисковолтрия/
- Извършване на термографско заснемане с инфрачервена камера; измерване на съпротивление на заземителните контури
- Проверка изправността на електронни и цифрови защити в прекъсвачи ниско напрежение
- Изготвяне на протоколи и доклади с анализ на резултатите от реално записаните данни и препоръки към клиента

Предимства

- Повишаване на безопасността и увеличаване на срока на експлоатация на оборудването
- Натрупване на данни с прецизна апаратура и ползуването им като база за бъдещо развитие и усъвършенстване
- Получаване на реална оценка за състоянието на всички отделни възли на електроразпределителната система и възможност за избор на варианти за оптимизация
- Възможност за повишаване на ефективността на базата на анализ на записаните данни и следване на препоръките от изготвения доклад
- Съкращаване на времето на принудителен престой на работещото оборудване

МОДЕРНИЗАЦИЯ И РЕТРОФИТ НА ОБОРУДВАНЕ



Цел: Повишаване на надеждността, безопасността и ефективността на оборудването, усъвършенстване и опростяване на техническото обслужване и удължаване срока на експлоатация.

Услугата включва:

- Изследване на съществуващото оборудване за електроразпределение и определяне конфигурацията на новото
- Подбор на оборудването като реконструкция, съставяне на спецификация на отделните компоненти и принадлежности, разработване на адаптационните устройства
- Изработване и доставка на готово за монтаж ново оборудване
- Адаптация и модернизация на съществуващата част с новото оборудване

Предимства

[illegible]

РЕМОНТНА ДЕЙНОСТ

Цел: Ремонт, профилактика и тест на цялата гама оборудване Schneider Electric на място и в сервизни условия.

Услугата включва:

- Диагностика при спазване на инструкциите на производителя; провеждане на ремонт в съответствие с процедурите на клиента за извеждане и въвеждане в експлоатация без влияние върху работата на консуматорите
- Възможност за предоставяне на оборотно оборудване през времето на ремонта в сервизни условия
- Изготвяне на Протокол за състоянието на оборудването
- Изготвяне на Ремонтен протокол за извършената дейност
- Издаване на Гаранционна карта след приключване на ремонтната дейност.

Предимства

- Повишаване на безопасността и увеличаване срока на експлоатация на ремонтираното оборудване
- Намаляване на времето и разходите при възстановяване след евентуално прекратяване на работата
- Предоставяна на гаранция за всички ремонтни дейности и вложени нови компоненти
- Извършване на ремонтната дейност от обучени и квалифицирани специалисти

Notes

Notes

Schneider Electric Industries SAS

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35, rue Joseph Monier
CS 30323
92506 Rueil-Malmaison
www.schneider-electric.com

As standards, specifications and designs change from time to time, please ask for confirmation of the information given in this publication.

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Photos: Schneider Electric
Printing:

09/2010

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SM6-24 range

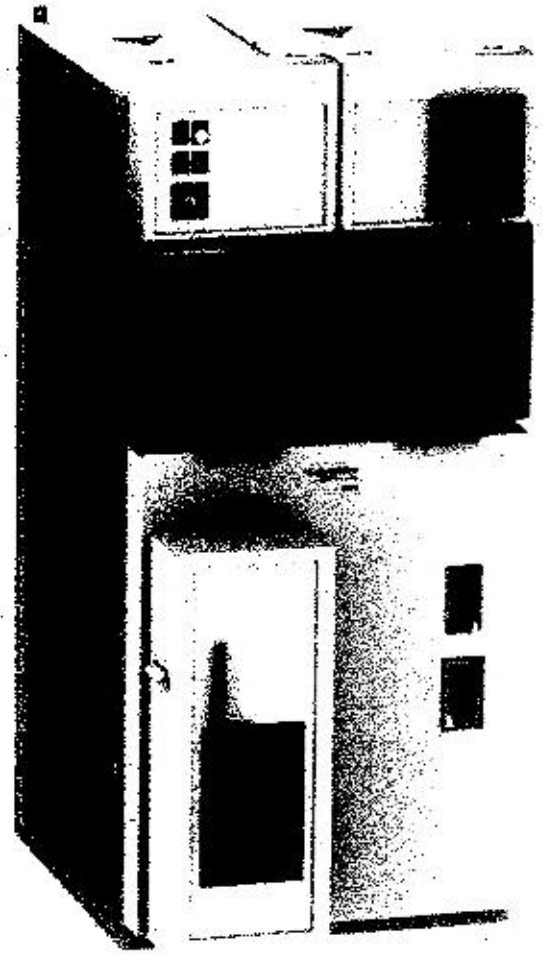
Schneider Electric

Quantity 1 100,000

What is SM6-24?

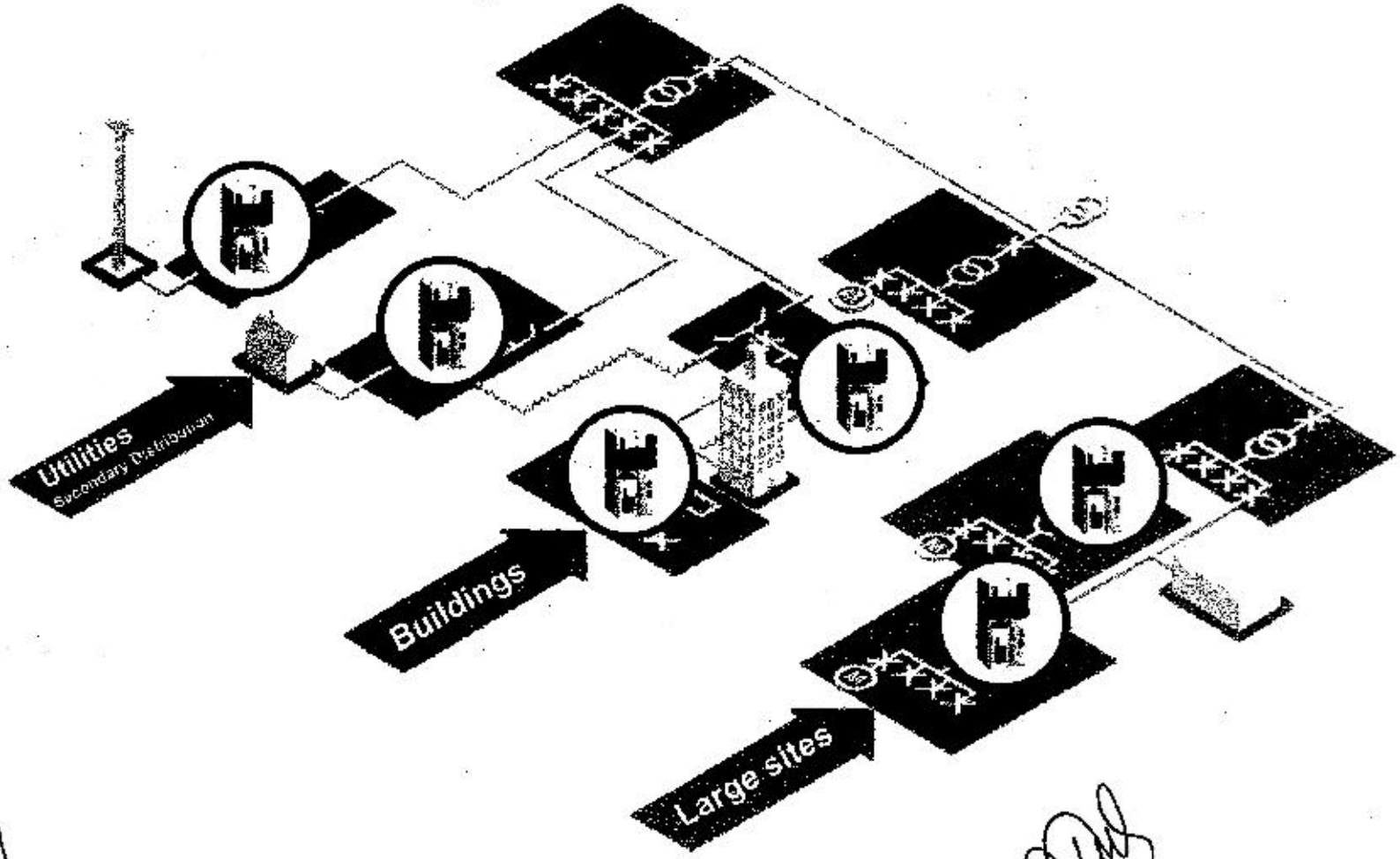
It is an Air Insulated Modular Switchgear that guarantees hi-reliability for your underground secondary distribution applications.

SM6-24 units are used for the medium voltage section in MV/LV transformer substations in public distribution systems and MV consumer or distribution substations up to 24kV and 1250A.



Market

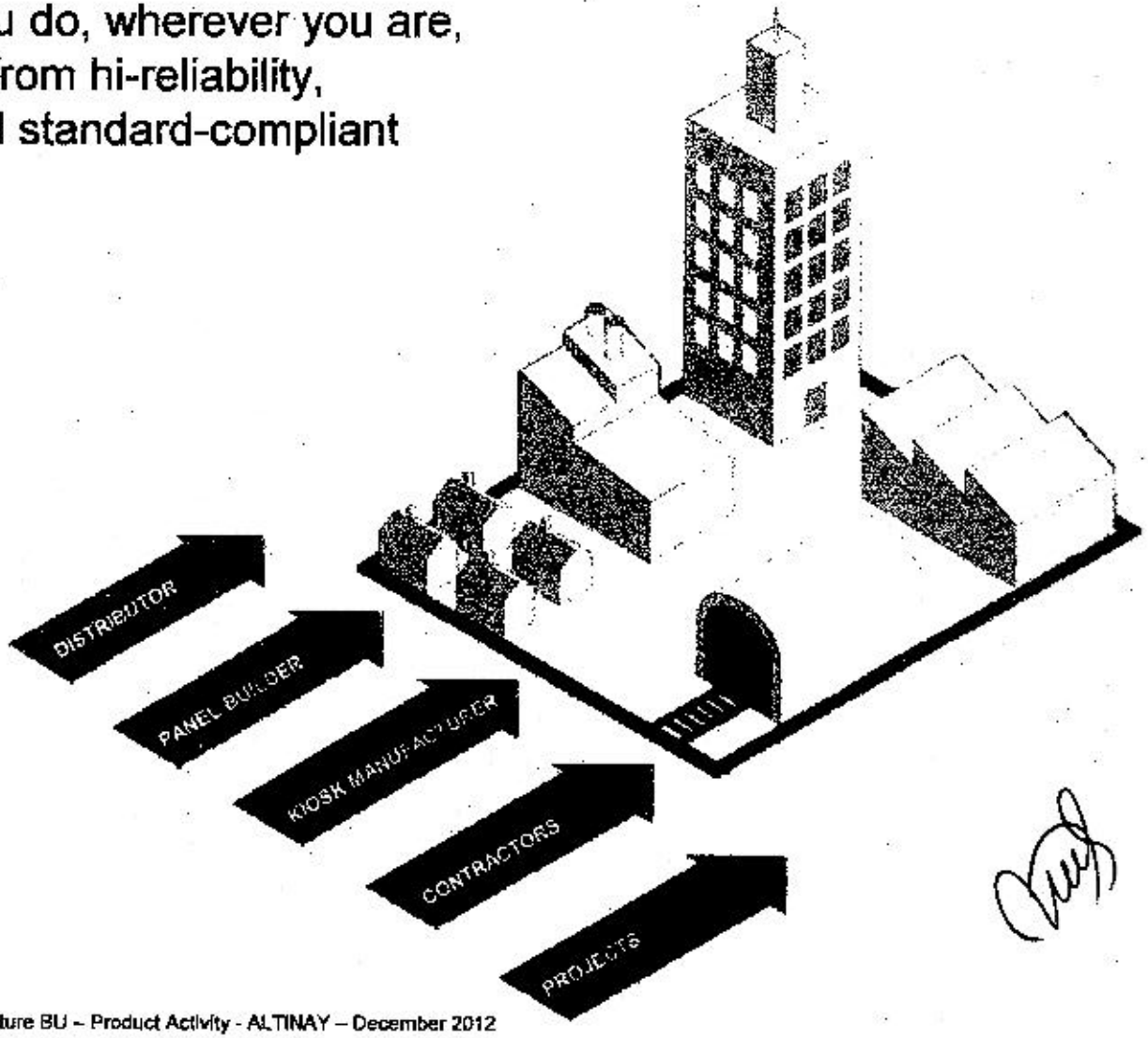
- MV Switchboard in electrical grid



Major applications

Helping you access hi-reliability

Whatever you do, wherever you are, your benefit from hi-reliability, hi-quality and standard-compliant products.



"In Medium Voltage, risk must be avoided at all. That's why we always recommend hi-reliability. With a quantity 1,100,000 functions installed-base, SM6 is our reference"

Taking advantage of the reference

1975

innovation

- Sulphur hexafluoride (SF6) is first used in a MV switchboard for an MV/LV transformer substation, with the hi-reliable VM6

1991

innovation and experience

- Cumulated with second generation of SM6-24 modular SF6 range

2012

the widest installed-base in the world

- With over quantity 1,100,000 SM6 functions installed all around the world, you avoid any risk by recommending and using the reference in the Medium Voltage field

They already benefit from hi-reliability

Because hi-reliability is a matter of quality

- A functional organization is integrated into each manufacturing unit
- The quality system for design, and manufacturing plants have been certified in conformity with the requirements of ISO 9001 : 2000 quality assurance model
- The environmental management system adopted on manufacturing units have been certified with requirements in the ISO 14001 standard.

Mean Operating Time to Failure (MTTF)

- MTTF : 3890 years (2010)

Environment: our real concern

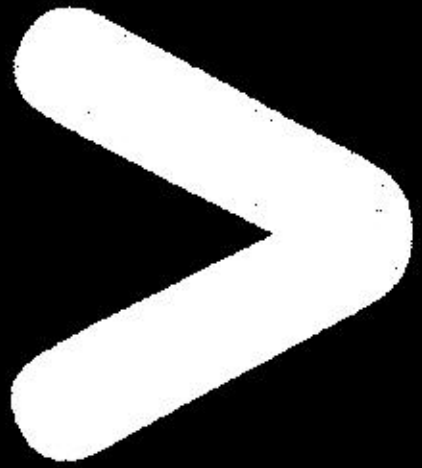
- SM6-24 has been designed to be environmentally friendly
  - The material used, both conductors and insulators are identified, and easily separable
  - At the end of its life, SM6-24 is recycled and its materials recovered in conformity with the European regulations
  - This process runs without any gas being released to the atmosphere nor any polluting fluids being discharged

	Switch unit	Circuit breaker unit
Ferrous metal	84%	65%
Non-ferrous metal	4%	10.6%
Thermohardening	9.5%	22%
Thermoplastics	2.35%	2.3%
Fluid	0.15%	0.1%

A full range of services to make the most of your energy

- Helping you improve the quality of your electrical distribution
  - Network analyzing, harmonics, etc…
- Accompanying the purchase and installation of your SM6-24
  - Adaptation of product to offer response to your requirements
  - On site installation, testing & commissioning
- Accompanying your installation throughout its life and upgrading
  - Upgrading your existing SM6-24 equipments: functional adaptation, telecontrol, renovation of protection units, etc…

Features that help you do more



Standard compliance - IEC 62271-200

- Metal Enclosed Switchgear
- Partition class: PI
- Service continuity: LSC2A
- People protection indexes:
  - IP3X for enclosure,
  - IP2X between compartments
- Equipment protection index: IK08
- Internal Arc withstand

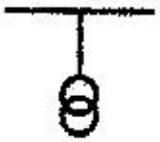
Benefit from modular functions

Network connection

Protection by fuse-switch

Protection by SF6 / vacuum type circuit breaker

Motor control by contactor



MV metering

Casing

Auxiliary source

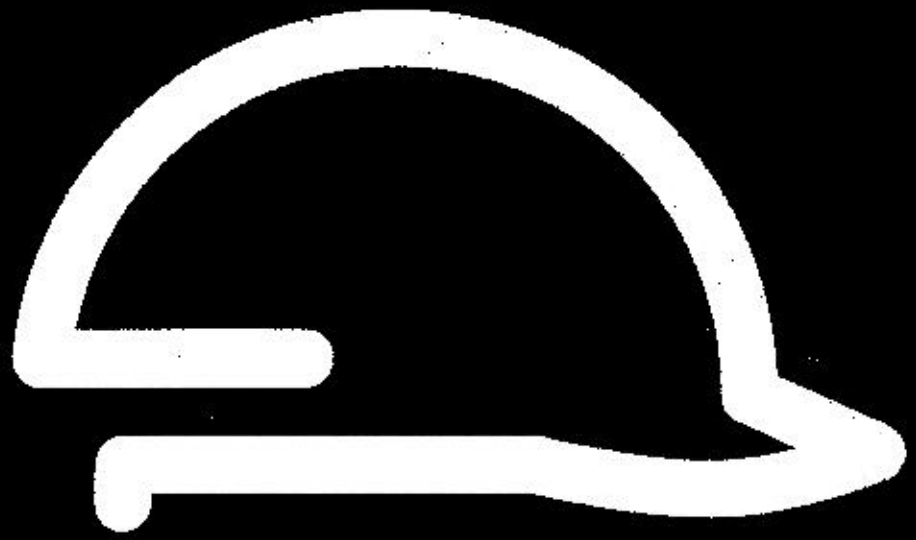
Specific cubicles

Other functions e.g. standby ...

Extending your possibilities

- SM6-24 is a modular and adaptable range that:
  - Ensures service continuity
  - Guarantees power's quality
  - Evolves with your needs
  - Helps you make your energy always available

Ensuring hi-safety



SM6-24 hi-safety offer

- PI (Partition material class)
- LSC2A (Loss of service continuity class)
- IK08 (Mechanical impact withstand for functional kinematics parts)
- IP3X (Degree of protection)
- Visibility of main contact (on LBS)
- Internal Arc withstand (12,5kA/1s & 16kA/1s and 20kA/1s)
- Manometer (on LBS)
- Pressure switch (on LBS)

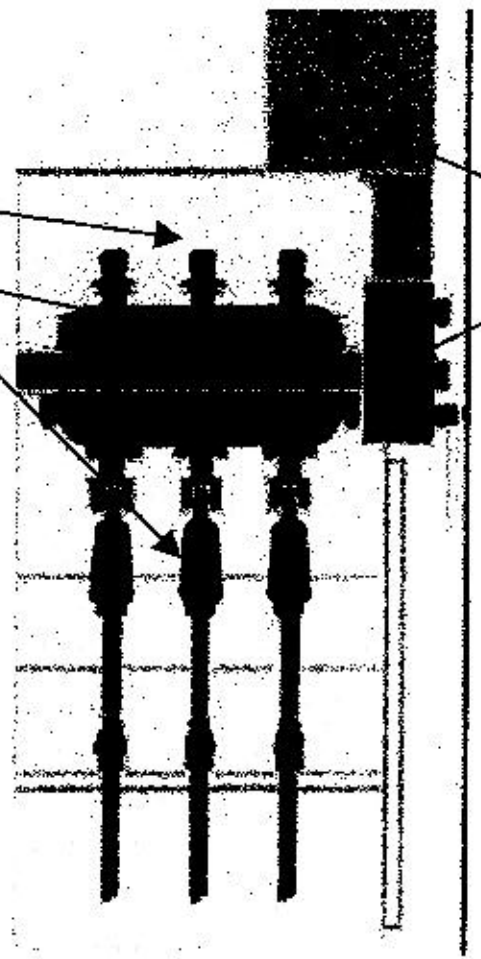
Ensuring hi-safety with an optimized architecture
PI & LSC2A

SM6-24 has 3 compartments

1.Busbar

2.Switch (LBS)

3.Cable or CB connection



SM6-24 has 2 cabinets

1. LV

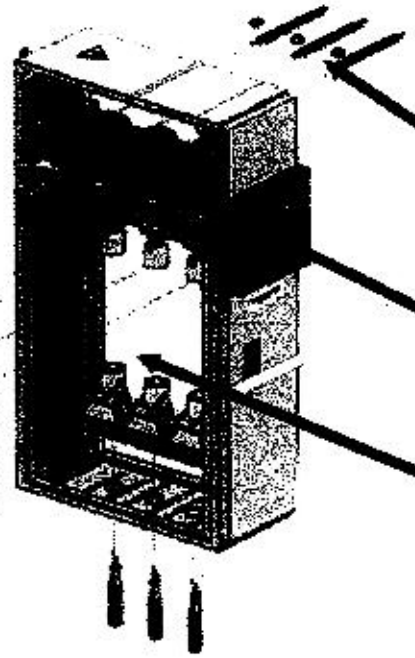
2. Mechanism

- Thanks to isolated (PI) compartments
  - No risk to access live parts while realizing any operation in one of compartment (ex: cable or CB)

- Thanks to LSC2A
  - No need to cut-off energy of switchboard while realizing any operation in one of compartments or cabinets (ex: cable or CB)

Compartments

AIS & Modular: compartmented (PI & LSC2A)



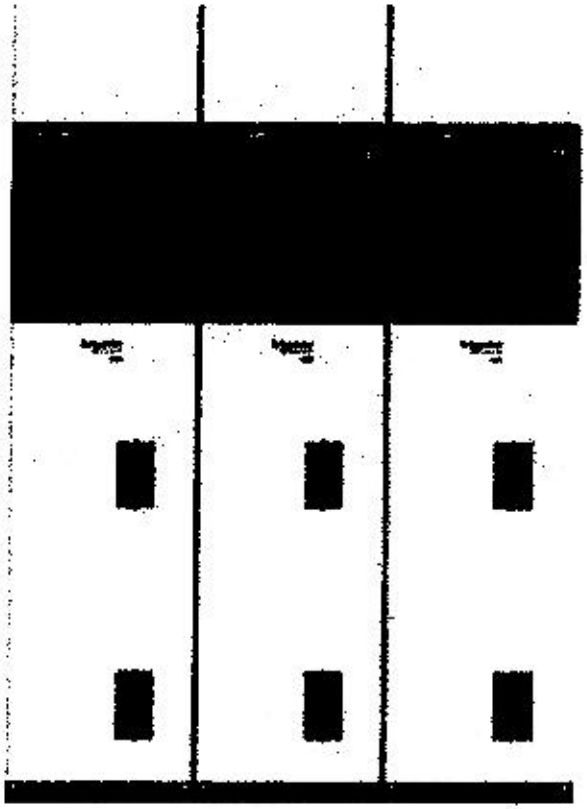
compartments	insulation	type of enclosure
busbars	air	metal
switching parts	SF6	metal & insulating
Cable connection	air	Metal

***AIS:** Air insulated switchgear*

Ensuring hi-safety with an optimised architecture IK08 & IP3X

- Thanks to IK08*
  - Protection of functional kinematics parts against mechanical impact under normal service condition that is 5J. (ex: functional key interlocks)

*Minimum requested value is IK07 for indoor switchboard

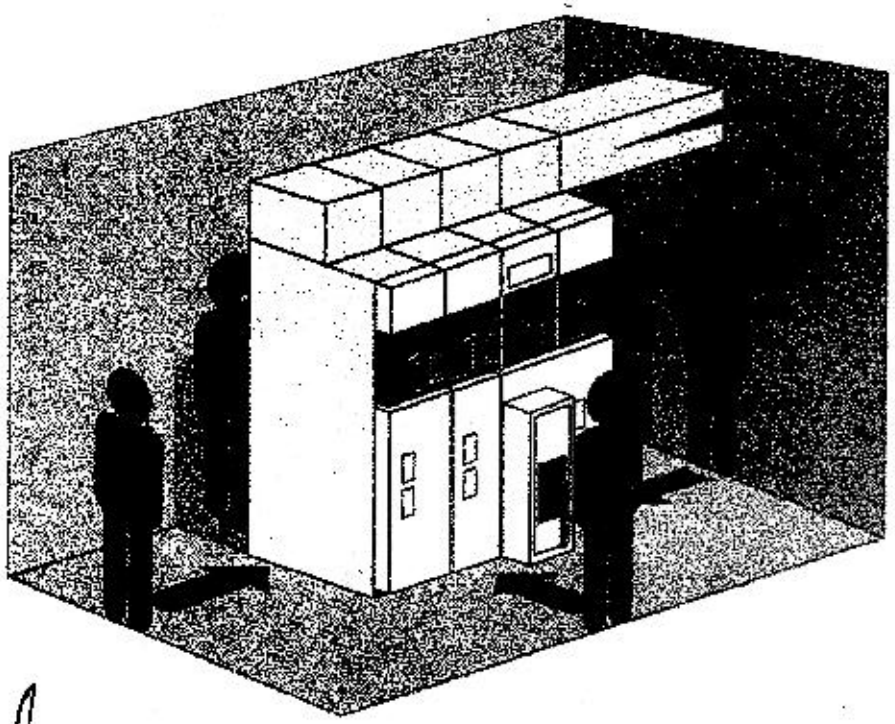


- Thanks to IP3X
  - Protection of person provided by an enclosure against access to hazardous parts with using tools which is less than Ø: 2,5mm that is represented by "3".
  - No protection against ingress of water that is represented by "X".

People's safety: a major commitment

- To enhance the safety of people, we provide a hi-degree of protection at

  3 compartments by evacuating the effects of Standalone Internal Arc
  - Evacuation systems which direct gases towards the top or the bottom of the switchboard
  - Use of non-flammables materials in the cubicles
  - Reinforced panels
- 5 versions are available (exhaust)
- 12,5kA/1s, IAC: A-FL downstream
- 12,5kA/1s, IAC: A-FLR downstream
- 16kA/1s, IAC: A-FLR or A-FL downstream
- 16kA/1s, IAC: A-FLR or A-FL upstream
- 20kA/1s, IAC: A-FLR or A-FL upstream



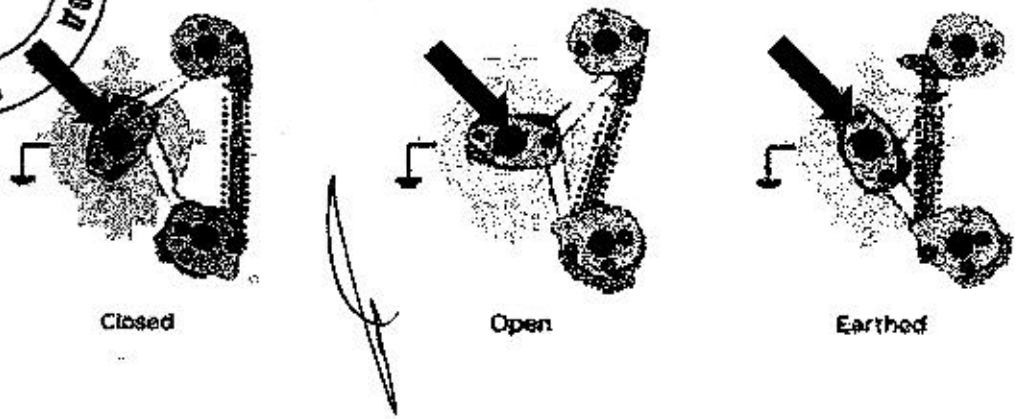
Ensuring hi-safety with an optimised architecture
Visibility of main contact

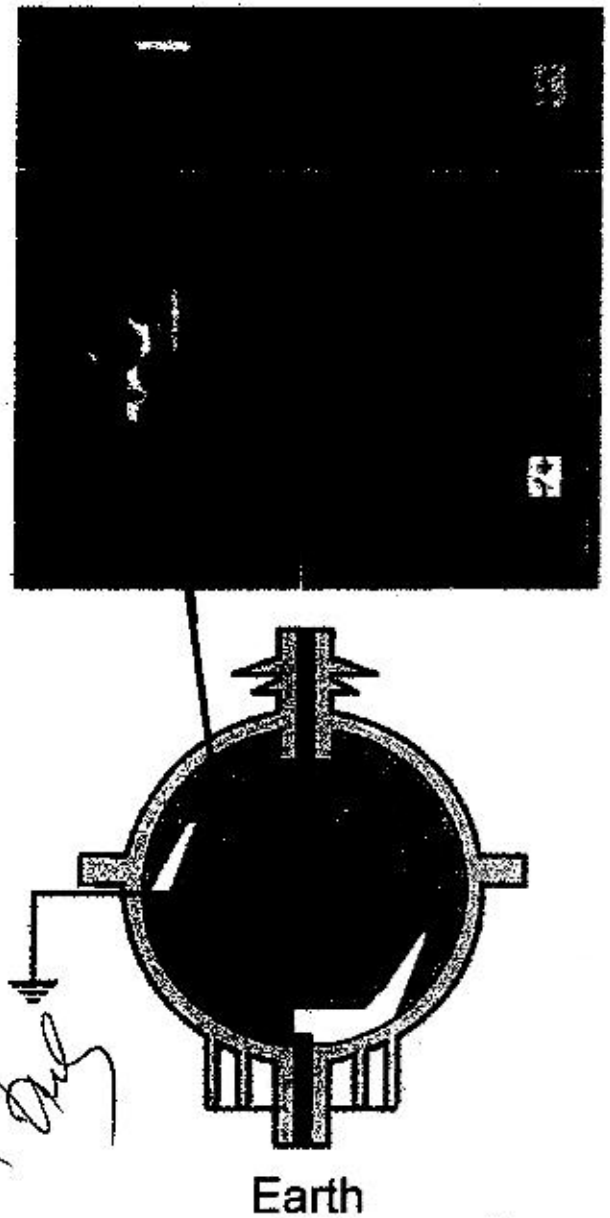
- 3 position LBS with unique rotated shaft mechanism
  - Provides visibility of main contact at;

    "open" position

    "earth" position

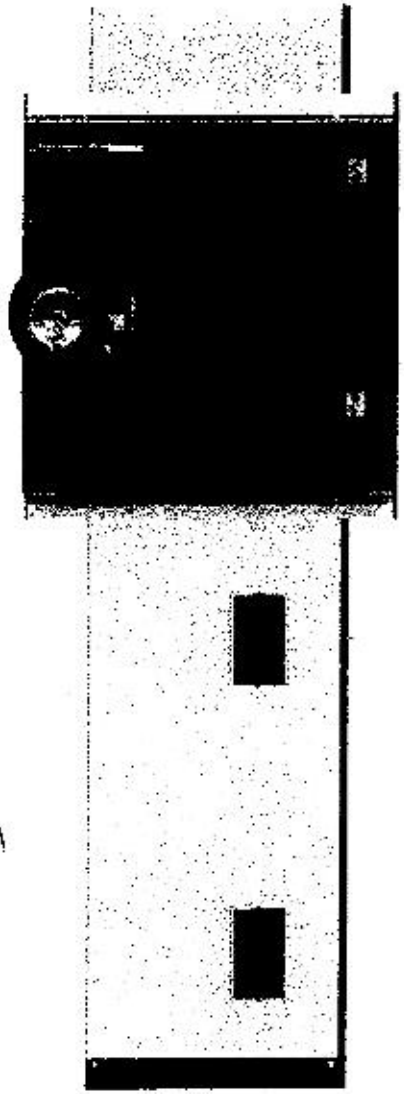
- Thanks to inspection windows to ensure the operation and position of main contact by visually, in addition to position indicator and optimsed breaking at rated current, making capacity of earthing





Manometer

- What is it?
  - An analog pressure indicator that shows the SF6 tank pressure.
  - Temperature compensated on analog screen
  - Operating temperature: -5°C to +40°C
- Application can be done on site as **"quick connection ®"** (plug & play) for all without any leakage test repetition.
- 2 versions available
  - No-visibility of main contact
  - Visibility of main contact



Manometer

- If indication on **green**
  - SM6-24 unit is completely in normal conditions.
- If indication is just on border between **green** and **red**
  - SM6-24 unit OK
  - Unit may remain energised
  - Unit **can** be operated (open or close) while energized
- If indication is on **red**
  - SM6-24 unit must be replaced, immediately
  - Unit may remain energized until replacement
  - Unit can be operated (open) for **once** while energized
  - For replacement, the unit has to be switched off through the adjacent units.

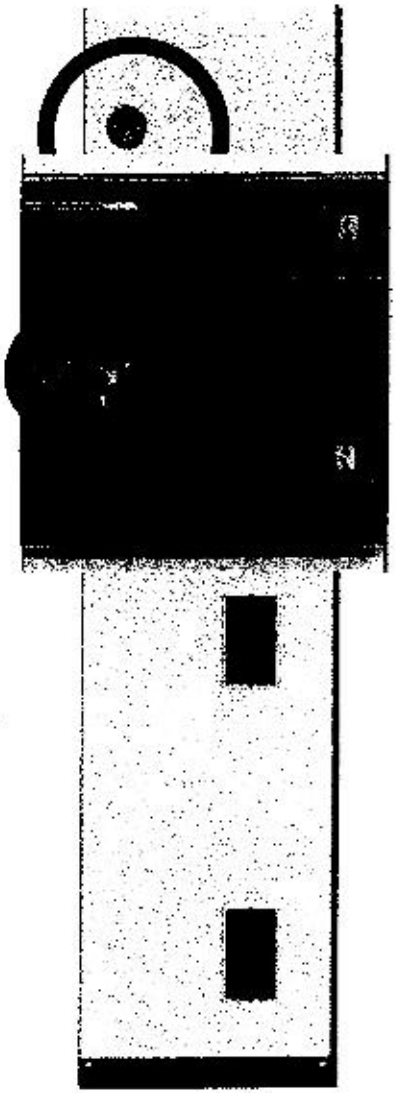
DANGER

Pressure switch

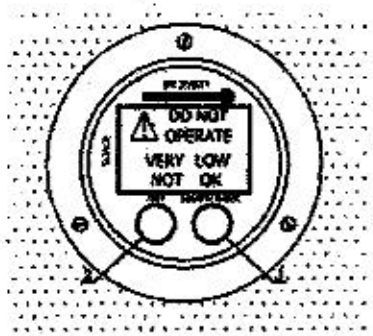
- What is it?
  - A density switch to monitor SF6 tank pressure with auxiliary contact for remote indication or local electrical interlocking,
  - Local indication of pressure (LCD display)
  - No need of auxiliary supply
  - Temperature compensated
  - Operating temperature: -5°C to +40°C

- Application can be done on site as "**quick connection®**" (plug & play) for all without any leakage test repetition.

- 2 versions available
  - No-visibility of main contact
  - Visibility of main contact



Pressure switch

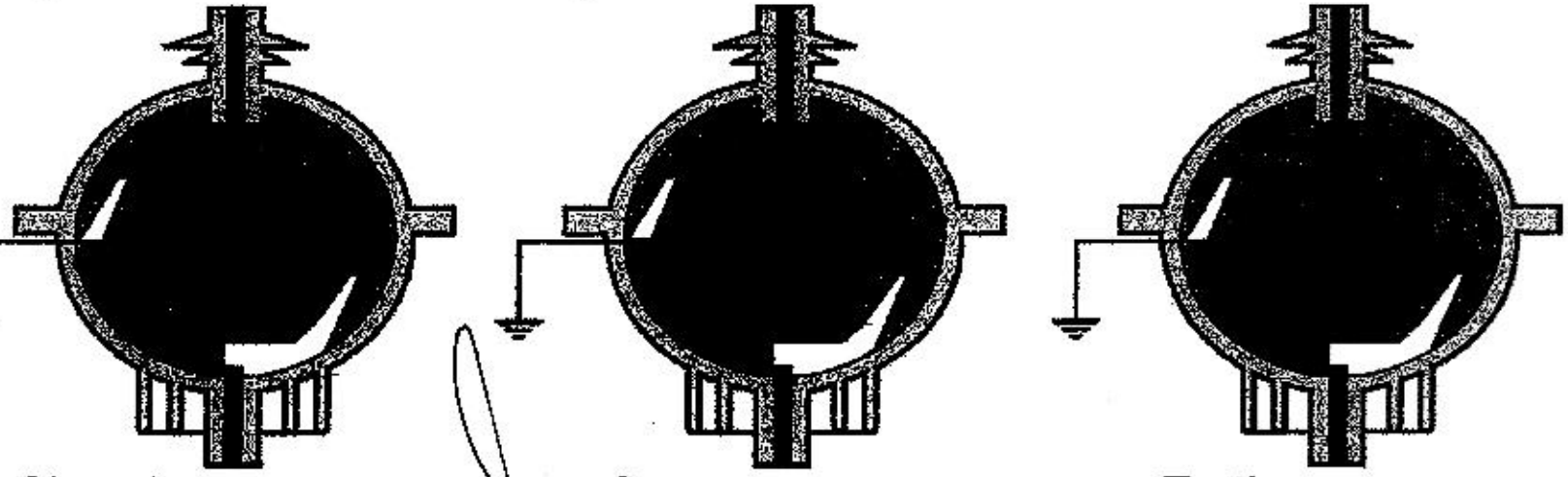


- If SF6 density control result is "OK"
  - SM6-24 unit is completely in normal conditions.
- If SF6 density control result is "LOW/ OK"
  - SM6-24 unit OK
  - Unit may remain energized
  - Unit **can** be operated (open or close) while energized
- If SF6 density control result is "VERY LOW/ NOT OK" :
  - SM6-24 unit shall be replaced immediately
  - Unit may remain energized until replacement
  - Unit can be operated (open) for **ones** while energized
  - For replacement, the unit has to be switched off through the adjacent units.

DANGER

Operating safely

- Load Break Switch (LBS)
  - 3 positions
  - Making capacity at earthing
  - Optimised breaking at rated current



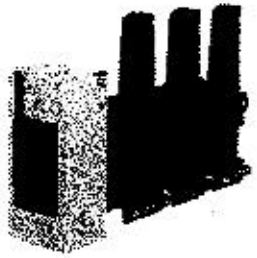
People's safety: a major commitment

- Safe and easy operation (total confidence)
  - 3 positioned **L**oad **B**reak **S**witch (LBS) / Disconnector
  - Natural interlocking mechanism
  - Clear symbols and animated mimic diagram
  - Anti-reflex lever
  - Making capacity at earthing switch
  - Compartmented function
  - Internal arc (safety membrane on the LBS/Disconnector)

The best technologies for hi-protection

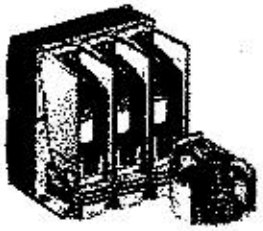
- You can choose the best technologies for your protection chains

  - SF6 CB range (lateral disconnectable / withdrawable)
    630A & 1250A, 25kA/1s, 24kV



  - Vacuum CB range (lateral disconnectable)
    630A, 25kA/1s, 24kV

  - Vacuum CB range (frontal fix)
    630A & 1250A, 25kA/1s, 17.5kV



Summary of performances

- Electrical characteristics (1)

Rated voltage	Ur	kV		7.2	12	17.5	24
Insulation	Ud	50/60 Hz, 1 min (kV rms)		20	28	38	50
Isolation	Ud	50/60 Hz, 1 min (kV rms)		23	32	45	60
Insulation	Up	1.2/50 µs (kV peak)		60	75 (1)	95	125
Isolation	Up	1.2/50 µs (kV peak)		70	85	110	145
Transformer off load		A		16			
Cables off load		A		31.5			
Rated current	Ir	A		400 - 630 - 1250			
Short-time withstand current	Ik/tk (4)	kA/1 s	25	630 - 1250			
			20	630 - 1250			
			16	630 - 1250			
			12.5	400 - 630 - 1250			
Making capacity	Ima	kA	62.5	630			
			50	630			
			40	630			
			31.25	400 - 630			

Summary of performances

- Electrical characteristics (2)

Rated voltage	Ur	kV	7.2	12	17.5	24
Insulation	Ud	50/60 Hz, 1 min (kV rms)	20	28	38	50
Isolation	Ud	50/60 Hz, 1 min (kV rms)	23	32	45	60
Insulation	Up	1.2/50 µs (kV peak)	60	75 (1)	95	125
Isolation	Up	1.2/50 µs (kV peak)	70	85	110	145
Units IM, IMC, IMB, NSM-cables, NSM-busbars		A	630 - 800 (2)			
QM, QMC, QMB		kA	25		20	
PM		kA	25			
CRM		kA	10	8		
CRM with fuses		kA	25			
CVM		kA	6.3			
CVM with fuses		kA	25			
SF6 circuit breaker range						
DM1-A, DM1-D, DM1-W DM1-Z, DM1-S, DM2		kA	25			
Vacuum circuit breaker range						
DMV-A, DMV-D, DMV-S		kA	25			
DMVL-A		kA	20			

Monitoring and protecting your network

Protection Type

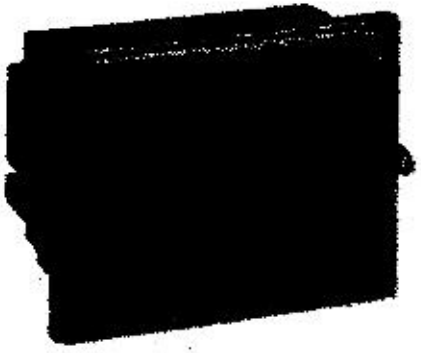
Protection Type	Code	Relays		
		VIP 300	Sepam 10	Sepam 20
Three-phase overcurrent	50 - 51	☑	☑	☑
Zero-sequence overcurrent	50N - 51N	☑	☑	☑
Very sensitive Zero-sequence overcurrent	50N - 51N		☑	☑
* Thermal image	49		☑	☑
Communication			☑	☑
Negative seq. overcurrent	46			☑
Single-phase undercurrent	37			☑
Long start-up	51LR			☑
Self powered		☑	☑	☑

Protecting your network Self powered relay

- VIP range, a cost-effective solution

  - Transformer protection
    VIP35 : Overcurrent & Earth fault

  - Network protection
    - VIP300 : Overcurrent & Earth fault



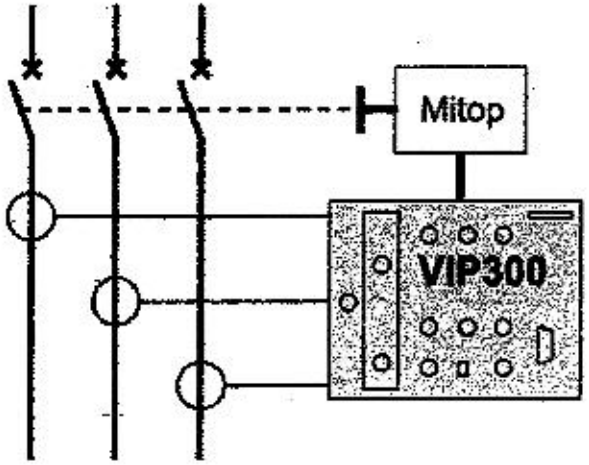
VIP application

- Self-powered protection relay
  - Designed for use in power distribution systems that may be used to protect MV/LV transformer, incoming points of industrial installations or branch feeders.

- Type of Sensor

Sensor's type	Current operating range
CRa/CRb/CRc	10A – 1250A

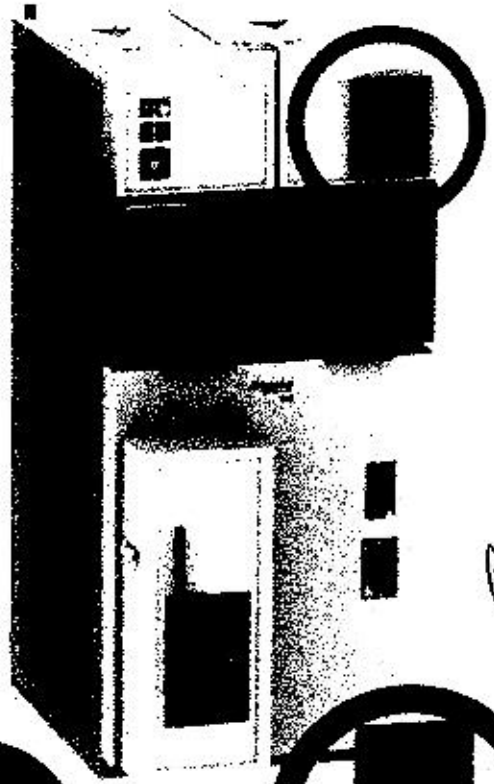
- Reducing your acquisition & operation costs
  - Simplified solution
  - No auxiliary power supply necessary



Simplified wiring diagram

Monitoring and protecting your network: Auxiliary powered relay

- Sepam range
  - Protection
  - Monitoring
  - Control



Sepam 10
The "just enough" protection

Sepam 20
For basic loads

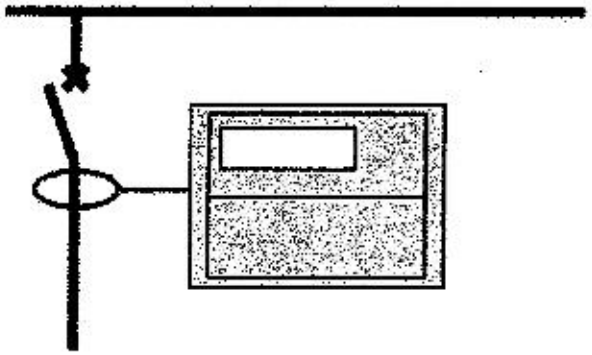
Sepam 40
For important source and loads

Sepam 80
For critical source and loads

Sepam 10 application

- Sepam range offers you especially cost-effective & just enough, essential protection relay reliability.

  Designed for use in power distribution systems that may be used to protect MV/MV branch feeders, MV/LV transformer, incoming points of industrial installations.



- Type of Sensor

Sensor's type	Current operating range
CRa/CRb	20A – 1250A

- Reducing your acquisition & operation costs
  - Simplified solution with communication
  - No need computer assistance

Sepam 20/40/80 with LPCT application

- LPCT is a Low Power Current Transformer
- Type of Sensor

Sensor's type	Current operating range
TLP130	5A – 1250A

- Reducing your acquisition & operation costs
  - Cost effective even though as sensitive as traditional CTs
  - Simplified solution with advantage of Sepam 20/40/80
- Innovative and unique

ДОСТАВКА НА РЕЗЕРВНИ ЧАСТИ

Цел: Обезпечаване с резервни части за ново и снето от производство оборудване по спецификация на клиента.

Услугата включва:

- Снабдяване с резервни части по желание на клиента без влагане на труд в съответствие със стандартните срокове на доставка
- Влагане на резервни части като замяна на дефектни такива при ремонтна дейност
- Поддържане на складови наличности при предварително заплащане от страна на клиента
- Подбор на оптимални комплекти от резервни части при оперативни ремонти

Предимства

- Готовност за осъществяване на планови и непланови ремонти
- Минимален престой на оборудването

> ОБУЧЕНИЕ

Цел: Запознаване с новите тенденции, технологии и решения при проектиране, изпълнение и експлоатация на електрически инсталации. Разучаване на съвременните решения и средства за автоматизация и енергийна ефективност. Усвояване на най-добрите практики и опит на Schneider Electric за повишаване компетентността и експертизата на клиентите в тяхната ежедневна дейност.

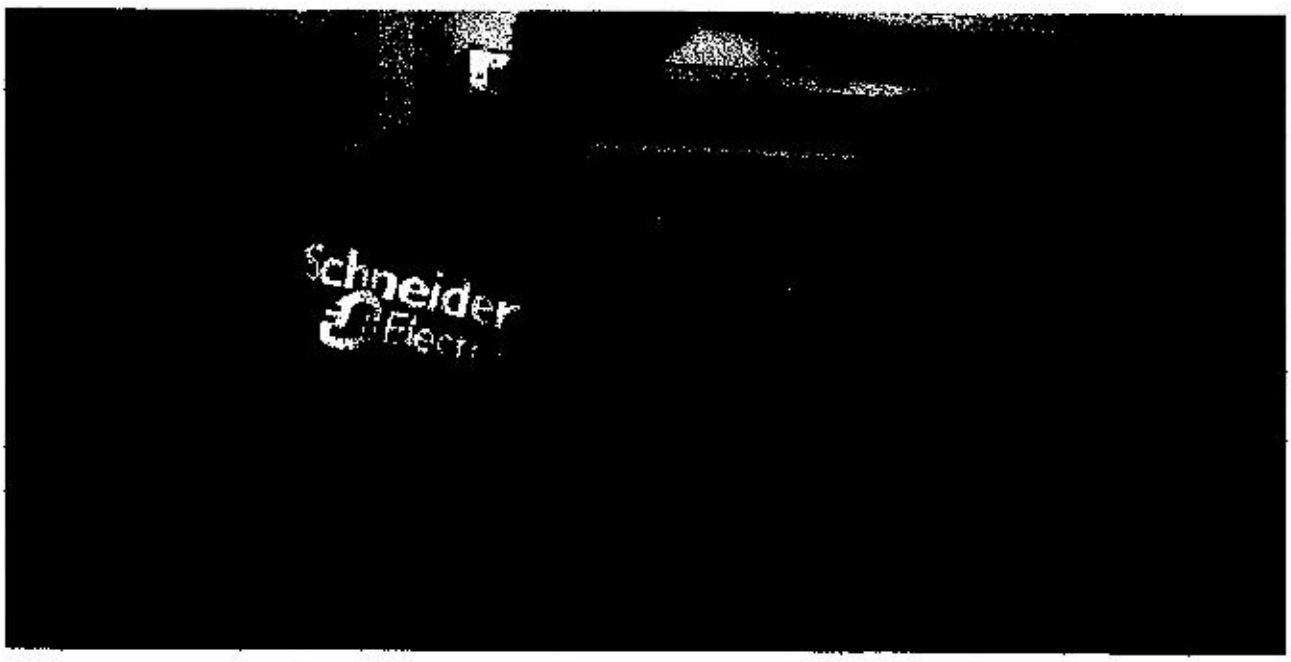
Услугата включва:

- Обучения в локални учебни центрове – технически лаборатории на територията на технически университети в градовете София, Пловдив и Русе
- Обучение по заявка на клиентите съобразно техните нужди от повишаване на степента на техническата компетентност на персонала относно експлоатацията и поддръжката на инсталираното оборудване
- Обучения в международни тренировъчни центрове на Schneider Electric

Предимства

- Обученията се провеждат от висококвалифицирани преподаватели и експерти
- Обученията са съобразени със съвременните изисквания и стандарти
- Практически лабораторни занимания и симулации, доближаващи се до реални ситуации
- Снабдяване със специализирани учебни и каталожни продукти

ДОГОВОРИ ЗА СИСТЕМНА ПОДДРЪЖКА НА ОБОРУДВАНЕ



Цел: Регулярно профилактично техническо обслужване за удължаване срока на експлоатация и поддържане на висока надеждност при работата на оборудването

Услугата включва:

- Оглед и проверки на механичното състояние на оборудването
- Тестове и проверка на електрическите характеристики
- Гореща телефонна линия 24 часа в денонощието с възможност за консултации или предаване на информация при аварийни ситуации
- Снабдяване с резервни части по фиксирани срокове за доставка
- Документиране на профилактичните дейности и протоколиране на реалното състояние на оборудването

Предимства

- Изключване на разходи и отпадане на необходимостта от обучение на собствен персонал за поддръжка
- Договори взаимоотношения с фиксирани правила и отговорности
  Незабавна реакция в случай на необходимост от коригиращи действия
- Безаварийно и икономичност работен процес на оборудването
- Системна поддръжка от високоспециализиран сервизен персонал

ВЯРНО С ОРИГИНАЛА

ЛИЗИНГ НА ОБОРУДВАНЕ

Цел: Оборудване, предлагано на лизинг: Трансформаторни уредби, Комплектни разпределителни уредби, Честотни регулатори, Софстартери, Системи за сграден и енергиен мениджмънт, Системи за резервиране на захранването.....

Услугата включва:

- **Финансиране на проекти с минимална стойност 15 000 Евро**
- **Авансово плащане от 20%**
- **Период на лизинга от 6 до 48 месеца**

Предимства

- Дълъг период на изплащане по удобна схема и план на клиента
- Разсрочване на ДДС
- Атрактивен данъчен ефект
- Финансова ликвидност

ТЕХНИКА ЕНЕРГИЯ" ЕООД ВАРНА ТЕХНИКА ЕНЕРГИЯ ЛИЗИНГ ЕООД

ВЯРНО С ОРИГИНАЛА!

Инжинер електрик България
София 1766, Младост 4
Бизнес парк София
Сграда Шипка 1
тел.: 02/932 93 00, факс: 02/932 93 93

Център „Обслужване на клиенти"
тел.: 0700 11 10 10, 02/932 93 33
факс: 02/932 93 94
e-mail: customerservice@ie-electric.bg

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Бизнес Парк Варна
Сграда 1, ет. 1
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факс: 052/730 146

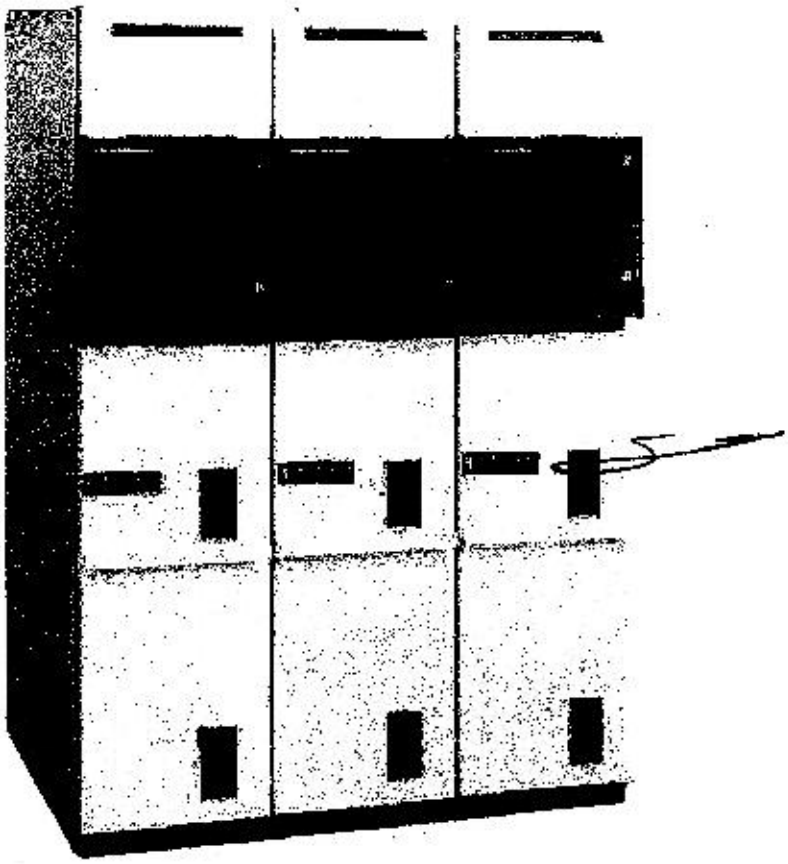
Бургас 8000
ул. „Александровска" 87
ет. 4
тел./факс: 056/ [illegible]

Електроразпределение

Средно напрежение

Комплектни Разпределителни Устройства

Гама SM6



Merlin Gerin
Modicon
Square D
Telemecanique

Schneider Electric

Области на приложение

Определения

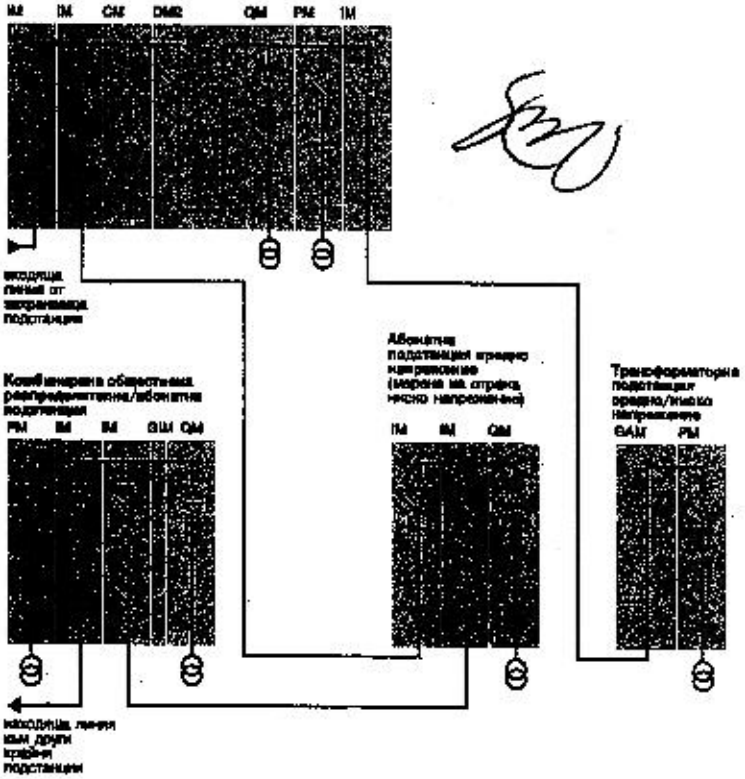
Следва списък на шкафовете от гамата SM6, които се използват в трансформаторните подстанции за средно напрежение/ниско напрежение и в промишлените разпределителни уредби.

- **IM, IMC, IMB:** входен или изходен шкаф
- **PM:** мощностен разединител със стопяеми предпазители
- **QM, QMC, QMB:** комбинация мощностен разединител - предпазители
- **CRM:** контактор и контактор с предпазители
- **DM1-A, DM1-D:** един разединител и прекъсвач
- **DM1-W, DM1-Z:** извеждаем единичен прекъсвач
- **DM2:** два разединителя и прекъсвач
- **CM, CM2:** напрежителни трансформатори
- **GBC-A, GBC-B:** измервания на ток и/или напрежение
- **NSM-кабели:** главни входящи и резервни
- **NS-шини:** за главните входящи кабели и за резервните кабели
- **GBM:** шкодинен шинен шкаф
- **GEM:** преходен шкаф VM6/SM6
- **GBM:** свързващ шкаф
- **GAM2, GAM:** свързващ шкаф за входящия кабел
- **SM:** разединител
- **TM:** трансформаторен шкаф средно напрежение/ниско напрежение за "собствени нужди"
- **други шкафове:** консултирайте се с Merlin Gerin.

Трансформаторни подстанции за средно/ниско напрежение

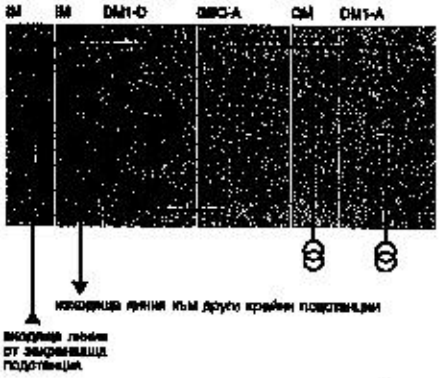
UTE стандарти

абонатна подстанция средно напрежение (мерене на страна средно напрежение)



други стандарти

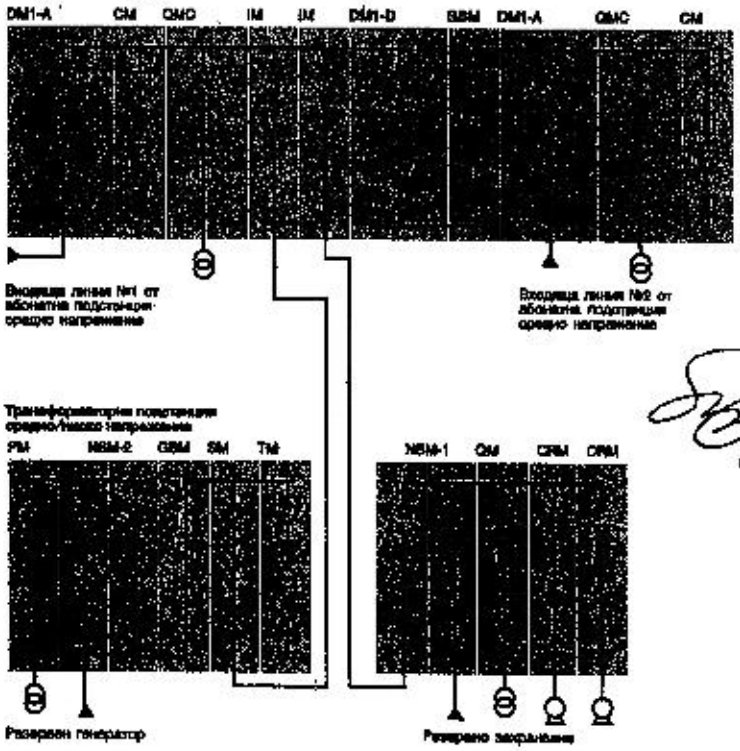
абонатна подстанция средно напрежение (мерене на страна средно напрежение)



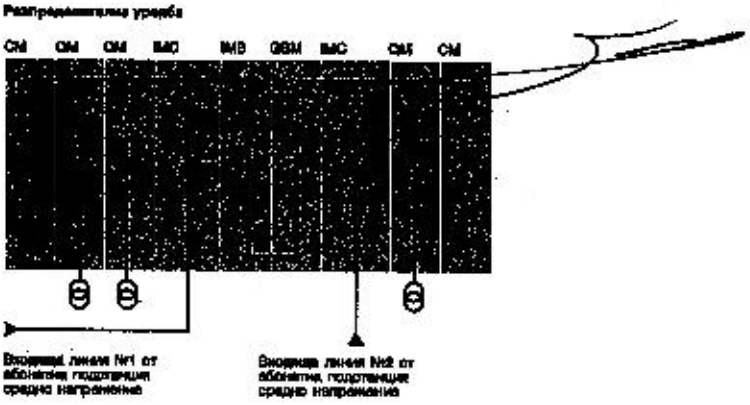
Области на приложение
(продължение)

Промишлени разпределителни уредби

Разпределителна уредба



Разпределителна уредба



Общо представяне

Въведение

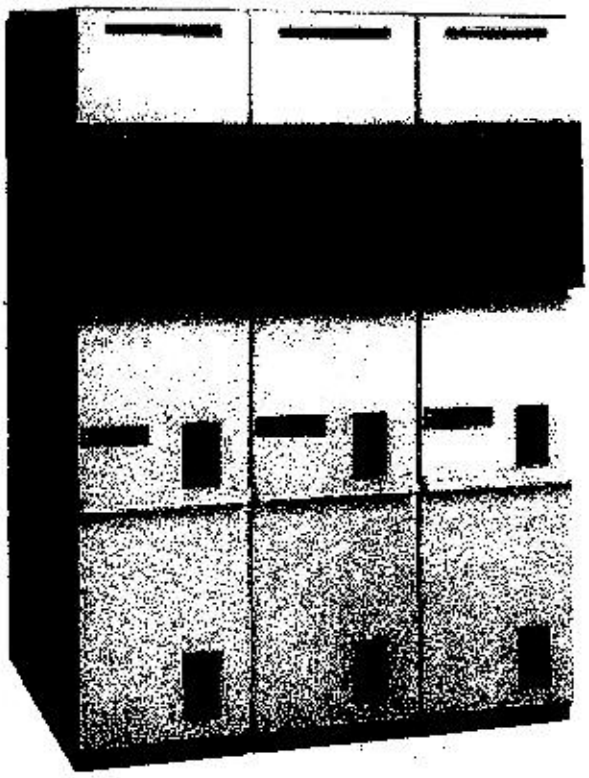
Гамата SM6 се състои от модулни метални шкафове, които съдържат фиксирани или изваждаеми комплектни комутационни устройства с изолация от елегаз (SF6), включващи
- мощностни разединители;
- прекъсвачи Fluarc SF1 или SF set;
- контактори Rollarc 400 или 400D;
- разединители.

Шкафовете SM6 се използват в секциите средно напрежение на подстанциите средно напрежение/ниско напрежение в обществените разпределителни системи и в абонатните или разпределителни подстанции средно напрежение до 24 kV.

В допълнение на техническите си характеристики, SM6 отговаря на изискванията за защита на живота и собствеността. Шкафовете SM6 са лесни за монтаж и за експлоатация.

Шкафовете SM6 са предназначени за закрити уредби (IP2XC). Размерите им са компактни:
- широчина 375 до 750 mm
- височина 1600 mm
- дълбочина 840 mm

Това улеснява монтажа в малки помещения или в сглобяеми подстанции. Кабелите се свързват през предната част.
Всички функции на управление са централизирани на лицевата плоча, което улеснява работата.
Блоковете могат да се съоръжат с различни допълнителни устройства (релета, тороиди, измервателни трансформатори и др.)



Стандарти

Шкафовете SM6 отговарят на следните препоръки, стандарти и спецификации:
- препоръки IEC 265, 265, 129, 694, 420, 56;
- UTE стандарти:NFC 13.100, 13.200, 64.130, 64.160;
- EDF спецификации: HN 64-S-41, 64-S-43.

Означение

Шкафовете SM6 се идентифицират по код, който включва:
- индикация на функцията, т.е. кода на електрическата схема:
IM - QM - DM1 - CM - DM2 - и т.н.;
- номинален ток:
400 - 630 - 1250 A;
- номиналното напрежение:
7.2 - 12 - 17.5 - 24 kV;
- максималните кратковременни стойности на тока:
12.5 - 16 - 20 - 25 kA/1s

Пример
При шкаф означен като IM 400 - 24 - 12.5
- IM означава входен или изходен шкаф;
- 400 означава, че номиналният ток е 400 A;
- 24 означава, че номиналното напрежение е 24 kV;
- 12.5 означава, че максималният кратковременен ток е 12.5 kA/1s.

Общо представяне
(продължение)

Основни електрически характеристики

Стойностите дадени по-долу са за работни температури от -5° C до +40° C и за монтаж при надморска височина под 1000 m.

ном. напрежение (kV)		7.2	12	17.5	24
изолационно ниво					
50 Hz / 1 min (kV rms)	към земя	20	28	38	50
	м/у отворени контакти	23	32	45	60
1,2 / 50 µs (kV пик)	изолация	60	75*	95	125
	м/у отворени контакти	70	85	110	145
изключателен ток					
трансформатори на празен ход (A)		16			
кабели без товар (A)		25			
максимален кратко-временен ток (kA / 1 s)	25	630 - 1250 A			
	20	630 - 1250 A			
	16	630 - 1250 A			
	12.5	400 - 630 - 1250 A			

Токът на включване е равен на 2.5 пъти максималния краткотраен ток.
* 60 kV пик за шкафа CRM.

Общи характеристики

Максимални изключателна способност

ном. напрежение (kV)	7.2	12	17.5	24
шкафове				
IM, IMC, IMB, NSM-кабели, NSM-шини	630 A			
PM, QM, QMC, QMB	25 kA		20 kA	
CRM	10 kA	8 kA		
CRM с предпазители	25 kA	12.5 kA		
DM1-A, DM1-D, DM1-W, DM1-Z	25 kA		20 kA	
DM2	20 kA			16 kA

устойчивост

шкафове	механична устойчивост	електрическа устойчивост
IM, IMC, IMB PM QM*, QMC*, QMB* NSM-кабели, NSM-шини	IEC 265 1000 операции	IEC 265 100 изключвания при In, coеф = 0.7
CRM	IEC 56 300 000 операции	IEC 56 100000 изключвания при 320 A 300000 изключвания при 250 A
DM1-A, DM1-D, DM1-W, DM1-Z DM2	IEC 56 10 000 операции	IEC 56 40 изключвания при 12.5 kA 10000 изключвания при In, coеф = 0.7

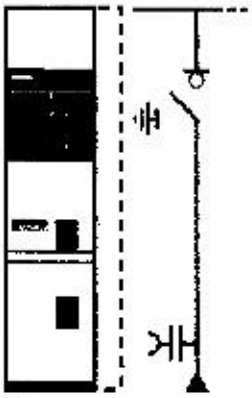
*спорад Препоръката IEC 420, три изключвания при coеф=0.2
■ 1730 A / 12 kV
■ 1400 A / 24 kV

Устойчивост на електромагнитни смущения
■ релета: издържат 4 kV спорад Препоръката IEC 80.4;
■ отделения:
□ електрическо поле:
– затихване 40 dB при 100 MHz;
– затихване 20 dB при 200 MHz;
□ магнитно поле: затихване 20 dB под 30 Mhz

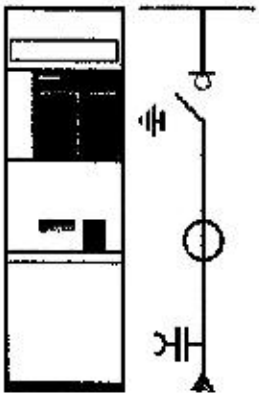
Температури:
■ на съхранение: от -40°C до +70°C
■ работни: от - 5°C до +40°C
■ за други температури се обърнете към нас.

Описание на функциите

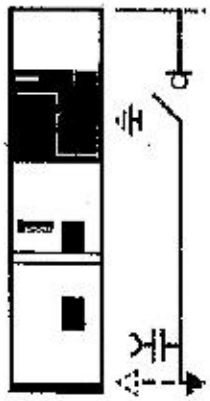
шкафове за всички функции: свързване към мрежите



Входен или изходен шкаф
IM (375 or 500 mm)

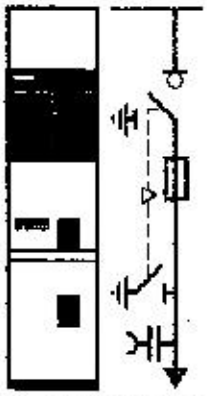


Входен или изходен шкаф
IMC (500 mm)

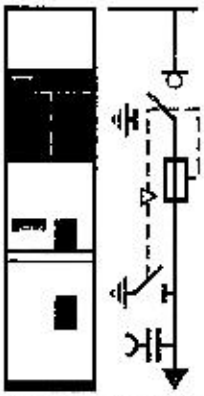


Изходен шкаф, десен или ляв
IMB (375 mm)

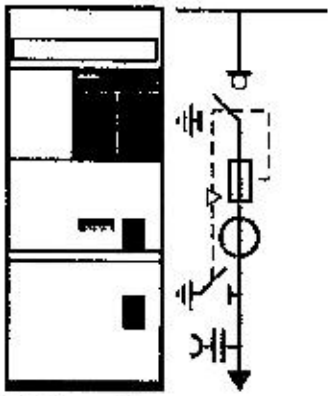
защита



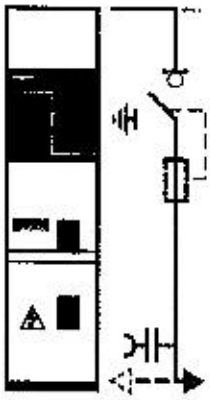
Шкаф с мощностен разединител с предпазител
PM (375 mm)



Шкаф с комбинация предпазител и мощностен разединител
QM (375 mm)



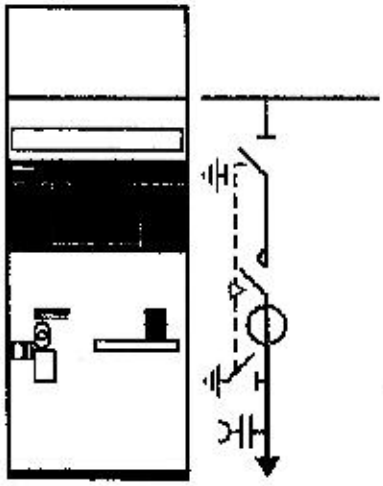
Шкаф с комбинация предпазител и мощностен разединител
QMC (625 mm)



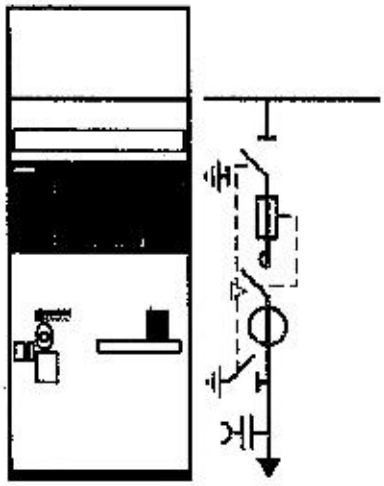
Шкаф с комбинация предпазител и мощностен разединител, дясна или лява изходна линия
QMB (375 mm)

Описание на функциите
(продължение)

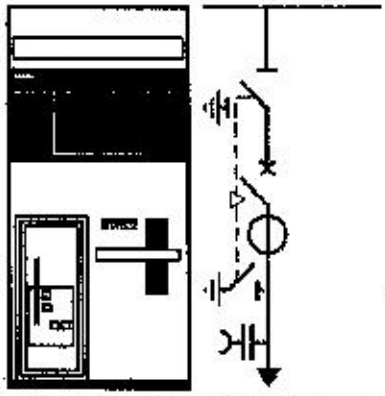
защита (продължение)



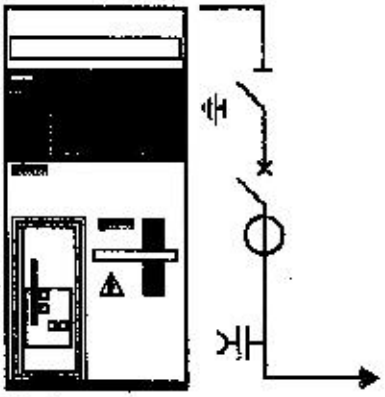
Шкаф с контактор
CRM (750 mm)



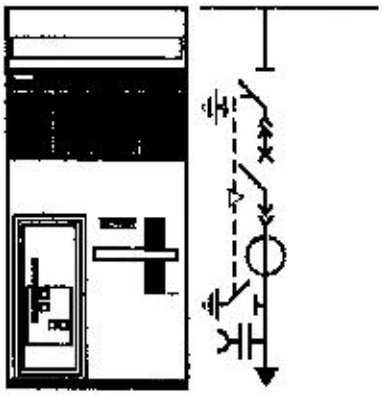
Шкаф с контактор с предпазител
CRM (750 mm)



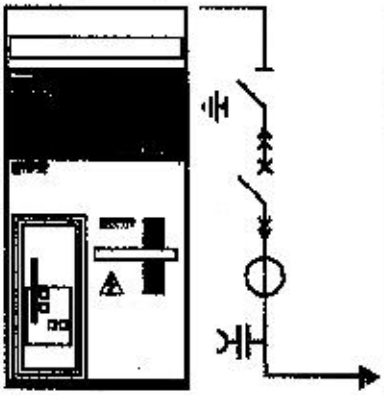
Шкаф с един разединител и прекъсвач
DM1-A (750 mm)



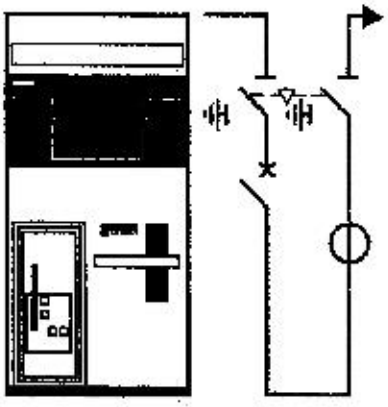
Шкаф с един разединител и прекъсвач, дясна или лява изходна линия
DM1-D (750 mm)



Шкаф с изнесдаем единичен прекъсвач
DM1-W (750 mm)



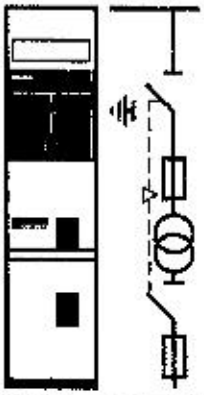
Шкаф с изнесдаем единичен прекъсвач, дясна или лява изходна линия
DM1-Z (750 mm)



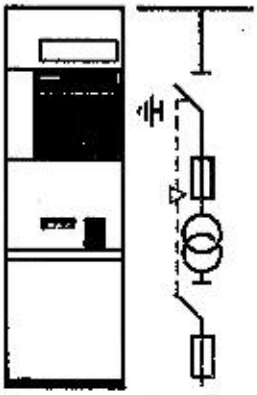
Шкаф с два разединителя и прекъсвач, дясна или лява изходна линия
DM2 (750 mm)

Описание на функциите
(продължение)

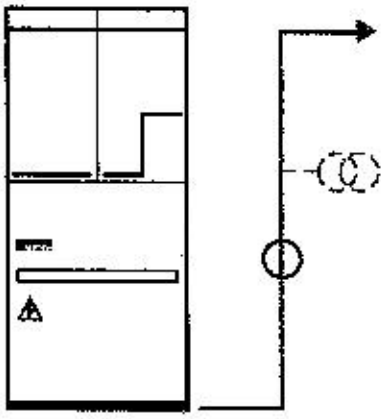
шкафове за всички функции: измерване на средни напрежения



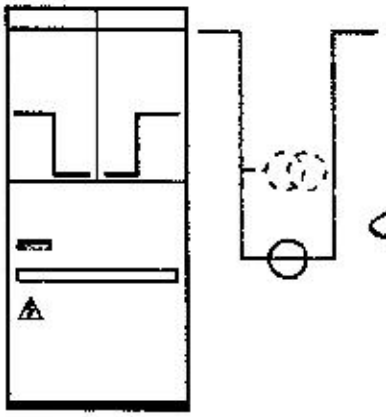
Напрежителни трансформатори за мрежа със система заземена неутрала
CM (375 mm)



Напрежителни трансформатори за мрежа със система изолирана неутрала
CM2 (500 mm)



Токов и/или напрежителен измервателен шкаф, дясна или лява изходна линия
GBC-A (750 mm)

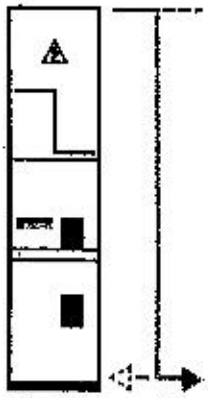


Токов и/или напрежителен измервателен шкаф
GBC-B (750 mm)

функции, изисквани от частни мрежи

Междинен шинен шкаф
GIM (125 mm)

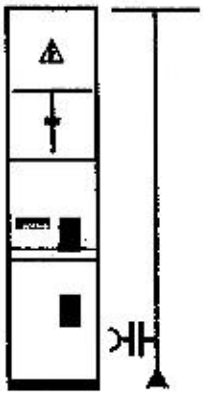
Проходен шкаф VM6/SM6
GEM (125 mm)



Свързващ шкаф, дясна или лява изходна линия
GBM (375 mm)

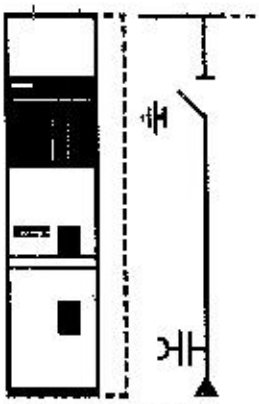
Описание на функциите
(продължение)

функции, изисквани от частни мрежи (продължение)

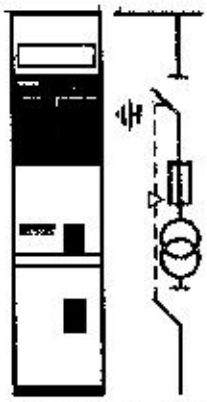


Свързващ шкаф за входния кабел
GAM2 (375 mm)

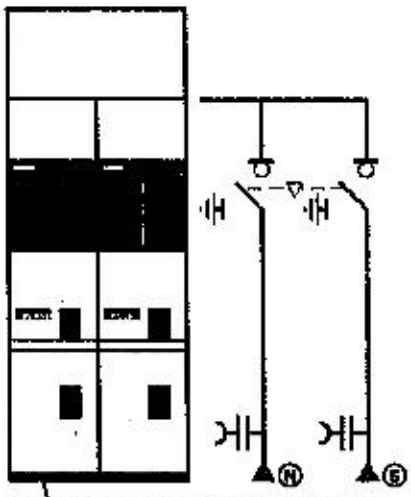
Свързващ шкаф за входния кабел
GAM (500 mm)



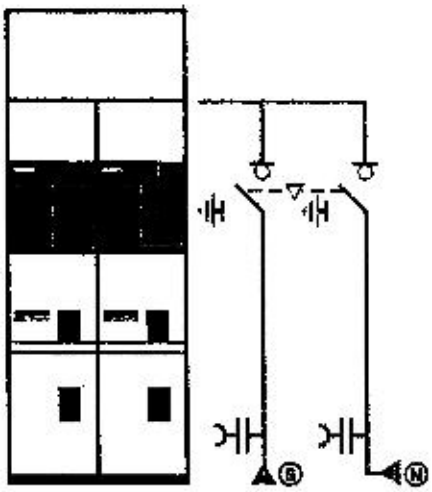
Разединителен шкаф
SM (375 или 500 mm)



Трансформаторен шкаф средно/ниско напрежения за собствения нужди
TM (375 mm)



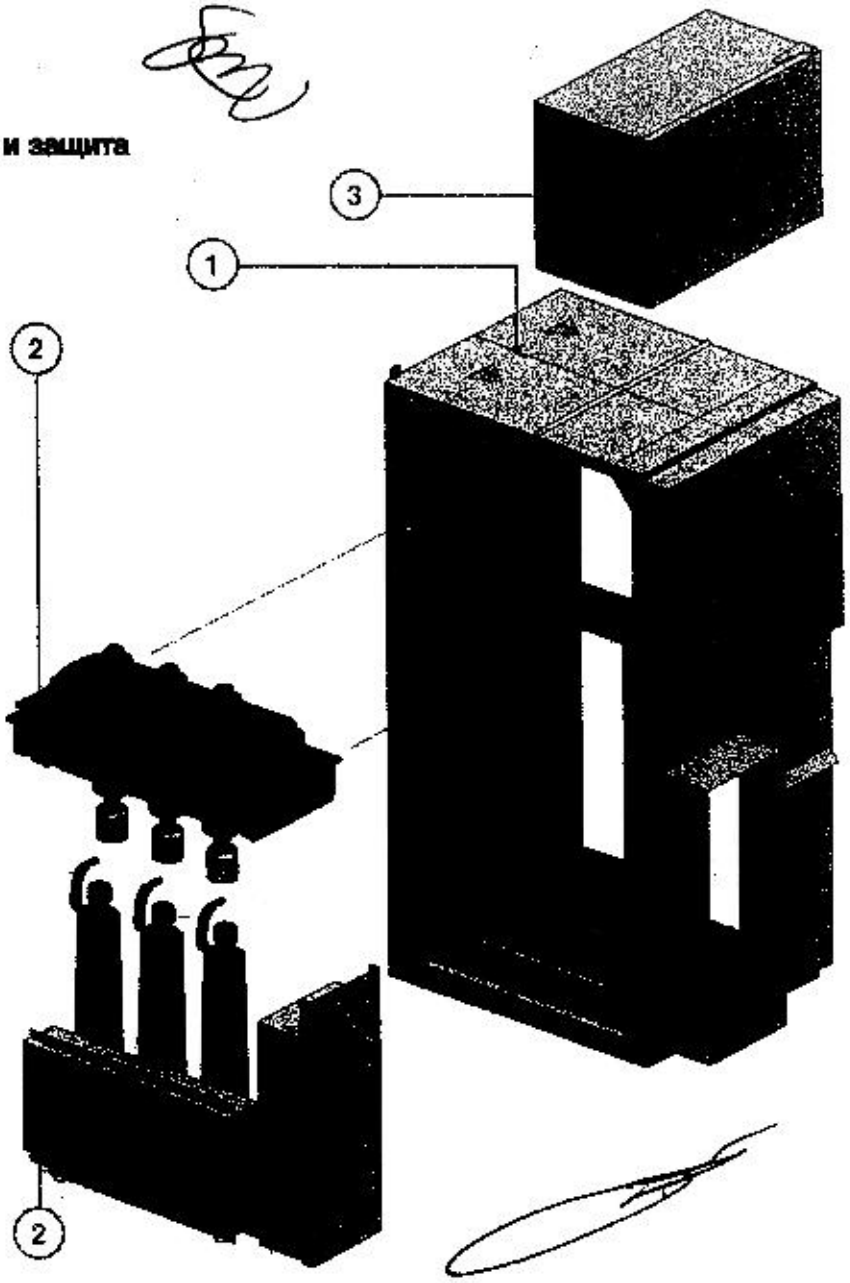
Токозахранване на кабели за главната входна линия и за резервната линия
NSM-кабели (750 mm)



Токозахранване на шини за главната входна линия от дясно или от ляво и на кабели за резервната линия
NSM-шини (750 mm)

Три-компонентен шкаф

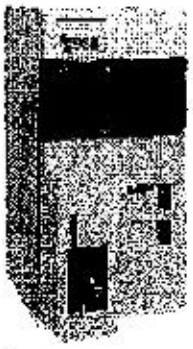
1. шкаф
2. комутационни апарати
3. управление/мониторинг и защита



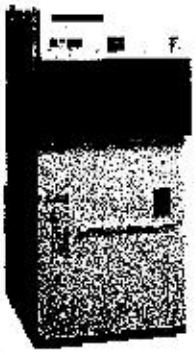
Три-компонентен шкаф

Фабрично изработени шкафове

Шкаф с мощностен разединител



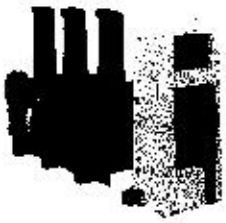
Шкаф прекъсвач



Контакторен шкаф

с вградена комутационни апарати SF6

Мощностен разединител със заземител



Fluarc SF-комплект или прекъсвач SF1

Контактор Rollarc 400 или 400D

и функции за управление/мониторинг и защита

Sepam
Гама от цифрови многофункционални системи за защита

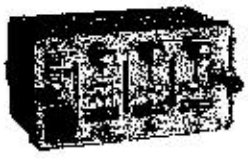
Гамата Sepam представлява комплект блокове за защита и управление с възможности за много видове приложения:
- подстанции
- трансформатор
- двигател
- кондензатор
- генератор

Всеки модел Sepam представлява оптимизирано решение по отношение на функции, работни характеристики и цена. Всеки модел Sepam включва всички функции на защита, измерване, управление, мониторинг и сигнализация, изисквани за определеното приложение. Функциите са с широк обхват на зададените стойности, всякакъв вид криви и могат да се включат към всяка система на защита.

VIP
Автономна с обратнозависимо закъснение по време

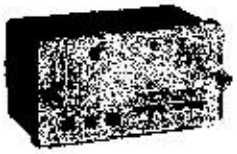
Интегрирана защита за SFset прекъсвачи, без оперативно напрежение. Използва се за защита на трансформатори. Това реле осигурява и висока степен на селективност.

Statimax
Автономна с определено закъснение по време



Обща защита на абонатни подстанции за средно напрежение (мерене на отрана средно напрежение) Statimax осигурява, без да е необходимо оперативно напрежение защита след определено закъснение по време в случаи на междуфазни и земни съединения.

ABP
непрекъснатост на токозахранването

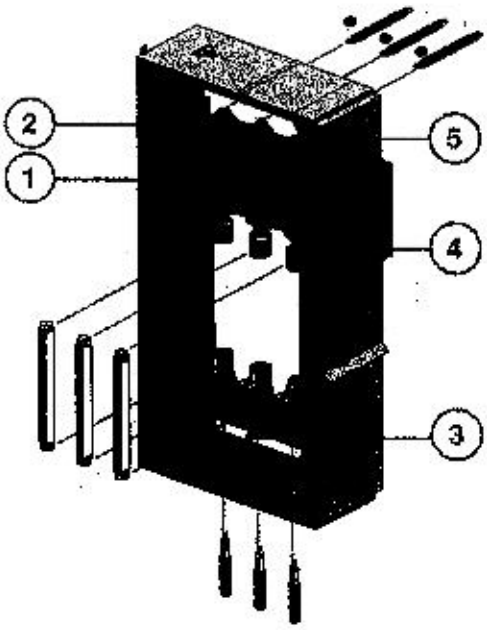


Тези електронни блокове са проектирани за енергиен мениджмънт и електро разпределение. Блоковете превключват автоматично и безопасно между два отделни източника на средно напрежение.

Забележка:
Апаратурите (с изключение на VIP и Statimax) са разположени в нисковолтовото отделение на съответния шкаф.

Описание
Фабрично изработени шкафове

комутационен шкаф



5 отделения:

① **комутационни апарати:** мощностен разединител и разединител със заземител в корпус запълнен с SF6 и спазени изисквания за херметично затворена система под налягане.

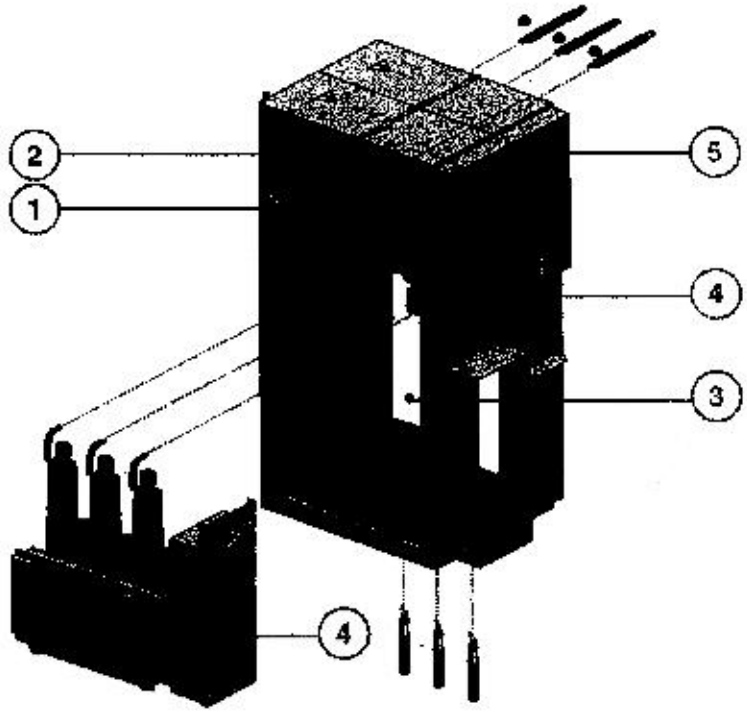
② **шини:** разположени в една и съща хоризонтална равнина, което позволява допълнително разширение на разпределителната уредба и свързване към съществуваща апаратура с помощта на адапторни комплекти (за VM6 има 125 mm канал).

③ **свързване:** достъп отпред, свързване към клемите на долния мощностен разединител и разединител със заземител (M шкафовете) или долните изолационни втулки за предпазители (шкафовете PM и QM). Това отделение е снабдено също така и разединител със заземител надолу по линията след предпазителите за шкафовете за защита на трансформатори (шкафовете PM и QM).

④ **задвижващ механизъм:** съдържа елементите, които се използват за задействане на мощностния разединител със заземител, както и за задействане на съответните индикации (извършено разединяване). Задействащите функции могат да бъдат моторизирани (опция).

⑤ **ниско напрежение:** монтаж на клемен блок (ако е монтирана опцията моторно задвижване), предпазители за ниско напрежение и компактни релейни устройства. При необходимост от повече място може да се добави допълнителна кутия отгоре на шкафа.

шкаф прекъсвач



5 отделения:

① **комутационни апарати:** разединител(и) и заземяващ(и) комутатор(и) в корпус запълнен с SF6 и спазени изисквания за херметично затворена система под налягане.

② **шини:** разположени в една и съща хоризонтална равнина, което позволява допълнително разширение на разпределителната уредба и свързване към съществуваща апаратура с помощта на адапторни комплекти (за VM6 има 125 mm канал).

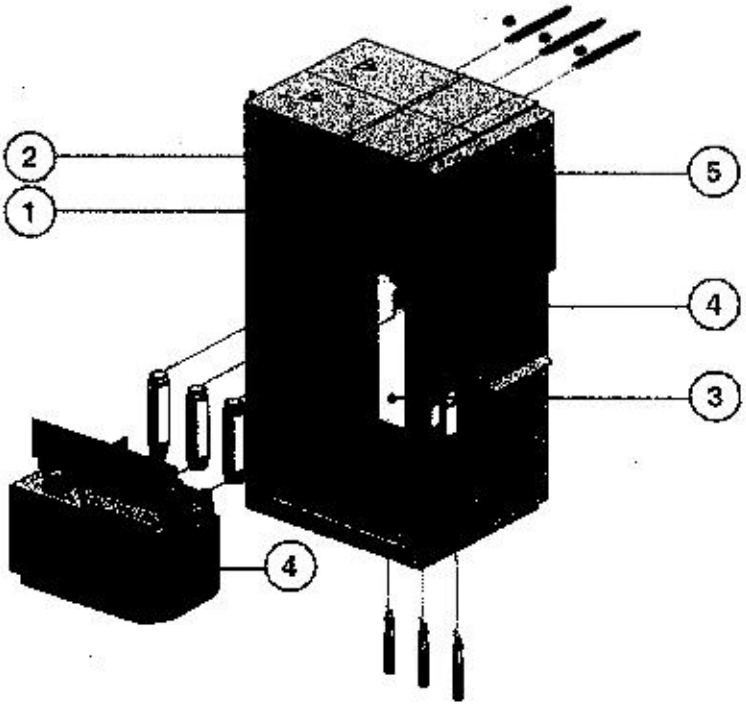
③ **свързване и комутационни апарати:** достъп отпред, свързване към долните клеми на прекъсвача. При необходимост могат да се монтират токови и напрежителни трансформатори. Могат да се използват два типа Rsarc прекъсвачи:
- SFset: автономен комплект, съоръжен с електронна система за защита и специални сензори (не изискват оперативно напрежение).
- SF1 комбиниран с електронно реле и стандартни сензори (с или без оперативно напрежение).

④ **задвижващ механизъм:** съдържа елементите, които се използват за задействане на разединителя(телите), прекъсвача и заземителя, както и за задействане на съответните индикации. Функциите за задействане на прекъсвача могат да бъдат моторизирани (опция).

⑤ **ниско напрежение:** монтаж на компактни релейни устройства (Statimax) и кутии за тест клеми. При необходимост от повече място може да се добави допълнителна кутия отгоре на шкафа.

Описание (продължение)
Фабрично изработени шкафове

контакторен шкаф



5 отделения:

① **комутационни апарати:** разединител със заземител в корпус запълнен с SF6 и спазени изисквания за херметично затворена система под налягане.

② **шини:** разположени в една и съща хоризонтална равнина, което позволява допълнително разширение на разпределителната уредба и свързване към съществуваща апаратура с помощта на адапторни комплекти (за VM6 има 125 mm канал).

③ **свързване и комутационни апарати:** достъп отпред. Това отделение също така е съоръжено със заземител надолу по линията и при необходимост могат да се монтират токови и напрежителни трансформатори. Контакторът Rollarc може да се снабди с предпазители Могат да се използват два типа:
- Rollarc 400 с магнитно задържане;
- Rollarc 400D с механично задържане.

④ **задействащ механизъм:** съдържа елементите, които се използват за задействане на разединителя(телите), контактора 400 или 400D и заземителя и съответните индикации.

⑤ **ниско напрежение:** монтаж на компактни релейни устройства и кутии за тест клеми. При основна конфигурация на апаратурата се добавя допълнителна кутия отгоре на шкафа.

Безопасност при работа с мощностни разединители, прекъсвачи и контактори

Целостната безопасност при работа с Гамата SM6 се гарантира от разделянето на шкафовете на пет обособени отделения и от опростените операции на превключване с подобрени функционални системи на блокировка.

Простота на действията
- Целият механизъм на действия е централизиран в отделението на работния механизъм;
- Системите за работа и за защита са монтирани в отделението на работните механизми на Fluarc SF6 прекъсвачи;
- Лостовете се задействат с много малко усилие;
- Действията от отваряне и затваряне се извършват с лостове, бутони и изключвателни устройства (принадлежности);
- Положението на разединителя(телите) или на мощностните разединители се показва на табло с разширена мнемосхема;
- Наличието на напрежение се следи от неонови индикатори, свързани към капацитивни делители на кабелните глави.

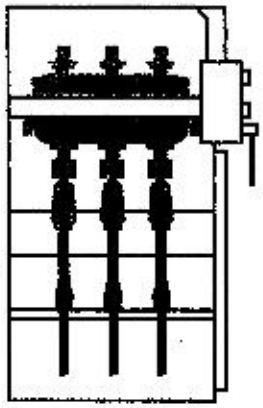
Индикация на разединяване и положително прекъсване

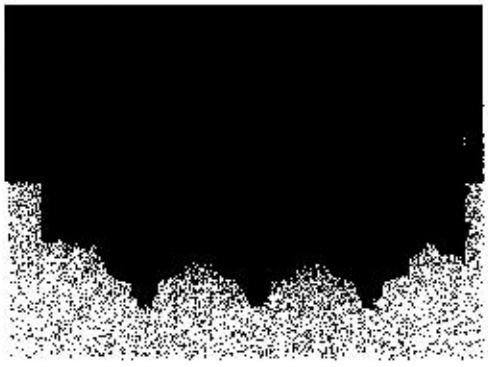
Позиционният индикатор, който е поставен пряко на лостта на задействащия вал дава сигурна индикация за положението на контактите, благодарение на пряка и надеждна система от механични предавки. Местоположението на контролните прозорчета върху глючите на шкафа може да се различава в зависимост от бъдещите модификации в спецификациите и стандартите.

Описание
(продължение)

Шкафовете имат по пет отделения, преградени с метал или изолационен материал.

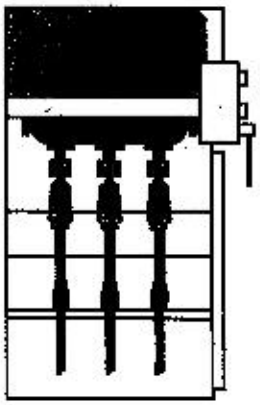
Отделение за комутационни апарати (мощностен разединител или разединител)

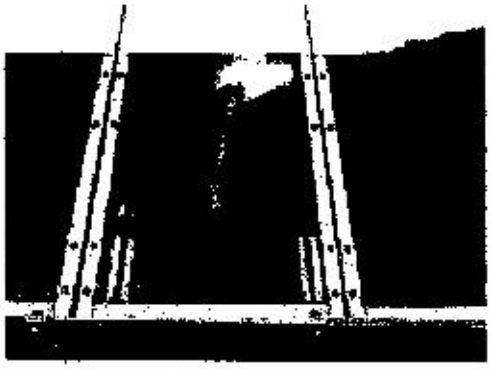




Това отделение е отделено от шиното отделение и отделението за свързване от корпуса на мощностния разединител, разединителя и заземяващия комутатор.

Шинно отделение

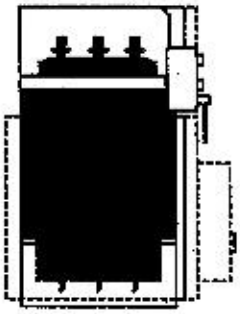




Трите изолирани шини са монтирани паралелно. Свързването се извършва от горните клеми на корпуса с помощта на разпределителя на полето с вградени винтове с глави за ключ.
Номинални стойности 400 - 630 - 1250 A.

Описание
(продължение)

Отделение за свързване и за комутационни апарати (прекъсвач)

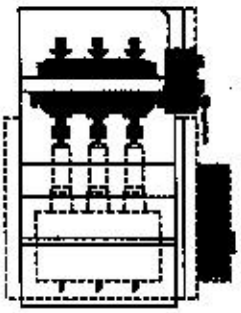


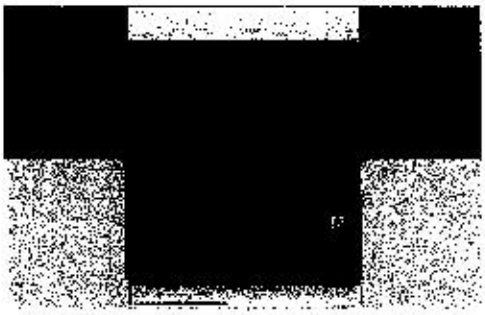
Мрежовите кабели се свързват към клемите на мощностния разединител и на заземителя.
Трансформаторните кабели се свързват към долния държач на предпазителите или към изходните клеми на прекъсвача. Кабелите могат да бъдат с:
- конвенционални клемни глави за тези с въздушна изолация (сухи кабели) или за триполните кабели;
- термосвиваеми глави за кабелите с въздушна (сухи) или хартиена изолация.

При основна конфигурация от съоръжения, максималното допустимо сечение на кабелите е:
- 630 mm2 за 1250 A входни или изходни шкафове
- 240 mm2 за 400-630 A входни или изходни шкафове.
- 95 mm2 за трансформаторни защитни шкафове с вградени предпазители.

Заземителят трябва да бъде затворен преди да може да се осигури достъп до шкафа. Намалената дълбочина на шкафа улеснява свързването на фазите. Вграденият шкаф в полевия разпределител улеснява разположението и свързването на кабелната обувка с една ръка.

Отделение за работния механизъм

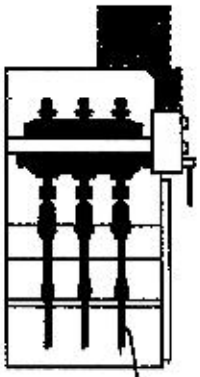


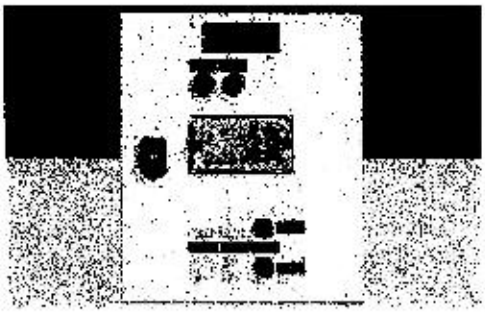


Това отделение съдържа различните работни функции за:
- мощностния разединител и заземителя;
- разделителя(ите);
- прекъсвача;
- контактора;

и индикаторите за напрежение.
Отделението на работния механизъм за мощностния разединител, заземителя и разединителя(ите) е достъпно и когато кабелите и сборните шини са под напрежение, без да се изолира подстанцията.
Улеснено е също така монтирането на катинари, ключалки и стандартни никоволтови спомагателни съоръжения (допълнителни контакти, изключвателни устройства, двигатели и др.)

Отделение за ниско напрежение

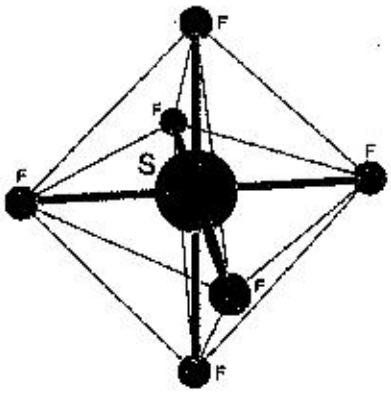




Когато механизмът за задвижване на комутатора е моторизиран, това отделение е съоръжено с клемен блок и никоволтови предпазители.
Отделението може да се разшири като се добави кутия с врата отгоре на шкафа.
Тези отделения са достъпни и когато кабелите и сборните шини са под напрежение, без да се изолира подстанцията.

ВЯРНО С ОРИГИНАЛА!

SF6, изолационна среда за комутационните апарати



Мощностните разединители и заземителите SM6 и прекъсвачите SF-sat и SF-1 използват за изолация и дъгогасене газ сярен хексафлуорид.
Активните части са разположени в изолационен корпус в съответствие с дефиницията на IEC 56/ Приложение EE (Издание 1967 г.) за херметизирани системи под налягане.
Устройствата SM6 имат забележителни характеристики:
- дълъг срок на експлоатация;
- активни части, които не се нуждаят от обслужване;
- висока електрическа издръжливост;
- много ниско ниво на пренапрежение;
- безопасност при експлоатация.

Описание (продължение)
SF6

Мощностен разединител или разединител със заземител

Трите въртящи се контакта са разположени в газонапълнен корпус под относително налягане от 0.4 bara (400 hp). Системата осигурява максимална надеждност при работа.

■ газова непроницаемост

Напълненият с SF6 газ корпус отговаря на изискванията за "херметизирани системи под налягане" и непроницаемостта на херметизацията винаги се проверява в завода производител.

■ безопасност при работа

□ разединителят може да бъде в едно от трите положения "затворен", "отворен" или "заземен". Това е една естествена взаимноблокираща се система, която предотвратява неправилната работа. Въртенето на подвижните контакти се осъществява от бързодействащ механизъм, който е независим от действията на оператора.

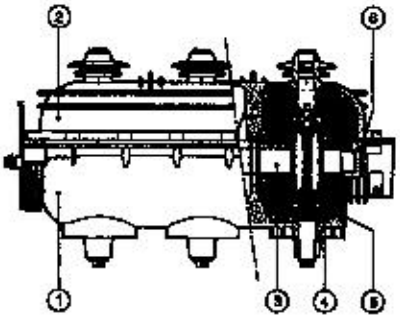
□ Устройството комбинира функциите изключване и разединяване.

□ Заземителят, монтиран в SF6 е с включвателна способност на късо съединение в съответствие със стандартите.

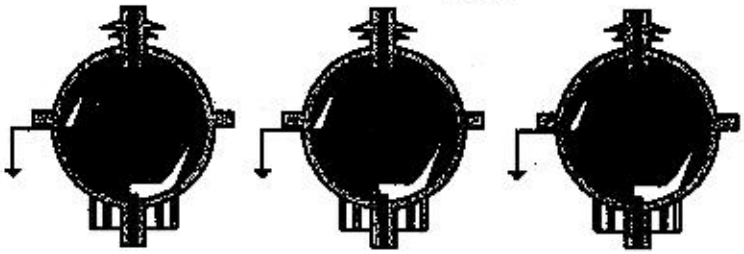
□ Всички случайни овръхналягания се елиминират с отварянето на предпазна мембрана в резултат на което газовете се насочват към задната страна на шкафа, като по този начин се избягват издутини или други подобни явления отпред.

■ принцип на прекъсването

Изключителите качества на газа SF6 се използват за гасене на електрическата дъга. За увеличено охлаждане на дъгата се създава относително денонение между дъгата и газа. Дъга се появява когато се отделят подвижните от фиксираните контакти. Комбинацията от ток и магнитно поле, обусловено от постоянен магнит предизвиква завъртане на дъгата около неподвижния контакт, което води до разтягането, охлаждането и изгасянето при преминаване на тока през нулевата стойност.
Разстоянието между неподвижните и подвижните контакти тогава е достатъчно да издържи на възстановяващото се напрежения.
Тази система е както проста, така и сигурна и осигурява подобрена електрическа издръжливост поради много ниското износване на контактите.

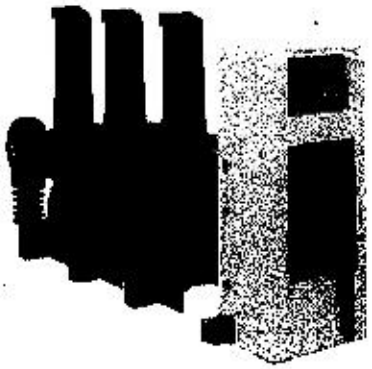


① корпус
② капак
③ задвижващ вал
④ неподвижен контакт
⑤ подвижен контакт
⑥ уплътнение

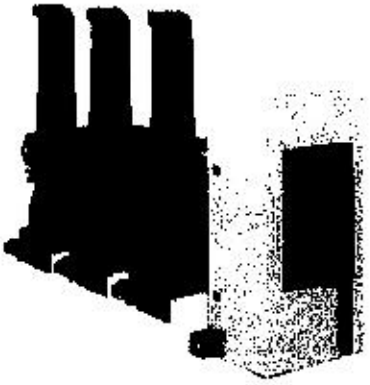


затворени контакти | отворени контакти | заземени контакти

Прекъсвач SF1 или Fluarc SF-set



Прекъсвач SF-set с интегрирано защитно реле и токови сензори



Прекъсвач SF1

Описание (продължение)
SF6

Прекъсвачът Fluarc SF-set или SF1 се състои от три отделни полюса, монтирани на конструкция, поддържаща работния механизъм. Всеки полюс съдържа всички активни елементи затворени в изолационен корпус, напълнен с газ до относително налягане от 0.5 bars (500 hp). Тази система предлага максимална надеждност при работа.

■ Газонепроницаемост

Полюсите, напълнени с SF6 газ удовлетворяват изискванията за "херметизирани системи под налягане" и непроницаемостта на херметизациите винаги се проверява в завода производител.

■ безопасност при работа

Както и при разединителните модули, случайните свръхналягания се елиминират с отварянето на предпазна мембрана.

■ принцип на прекъсването

Прекъсвачът се основава на принципа на автокомпресия на газа SF6. Присъщите качества на газа SF6 и мекото прекъсване, резултат на тази техника, намаляват пренапреженията при изключване.

□ предварителна компресия

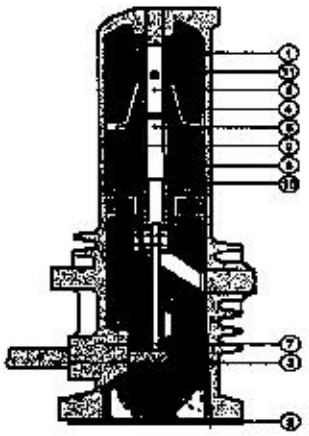
Когато контактите започват да се отварят, буталото леко компресира газа SF6 в-съда под налягане

□ дъгогасене

След това се оформя дъга между дъгогасителните контактите и буталото продължава движението си надолу. Малко количество газ, насочено от изолационната дюза се инжектира в дъгата.

Така се постига охлаждане на дъгата посредством принудителна конвекция за прекъсването на ток с ниски стойности. Когато обаче се прекъсва ток с високи стойности имаме пренасяне на горещ газ към студените части на стълба, обусловено от топлинното разширение. Когато стойностите на тока се приближават към нула, разстоянието между двата дъгогасящи контакта е достатъчно, поради диелектричните свойства на газа SF6 за окончателното прекъсване на тока.

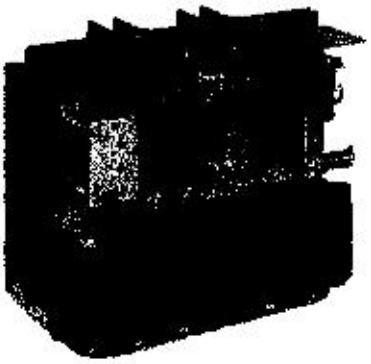
□ Подвижните части завършват своя ход докато инжектирането на студен газ продължава до пълното отваряне на контактите.



① корпус
② долен капак
③ задвижващ вал
④ главен подвижен контакт
⑤ подвижен дъгогасящ контакт
⑥ неподвижен дъгогасящ контакт
⑦ херметизираща система
⑧ компресионна камера
⑨ подвижно бутало
⑩ клапани
⑪ изолационна дюза

затворени контакти | предварителна компресия | дъгогасене | отворени контакти

Контактор Rollarc 400 или 400 D



Описание (продължение)
SF6

Трите фази се поставят в корпус, напълнен с SF6 газ до относително налягане от 2.5 bars (2500 hp)
Тази система осигурява максимална надеждност при работа.

■ газова непроницаемост

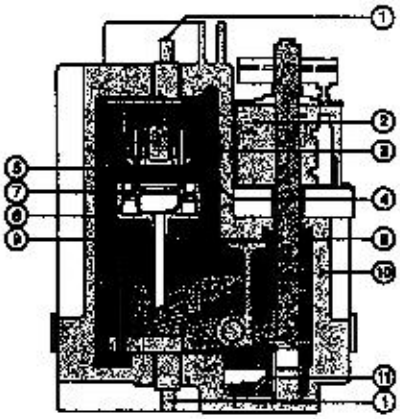
Корпусът отговаря на изискванията за "херметизирани системи под налягане" и непроницаемостта винаги се проверява в завода производител.

■ безопасност при работа

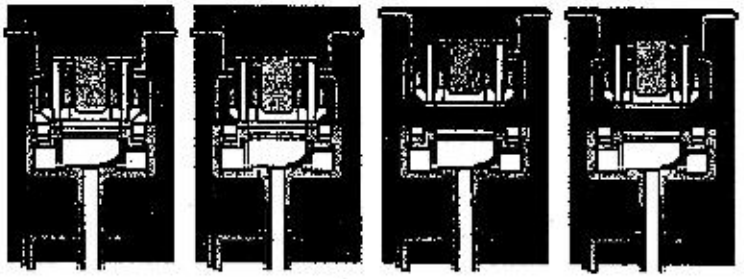
Случайни свръхналягания се елиминират с отварянето на предпазната мембрана.

■ Принцип на прекъсването

Контакторът работи на принципа на въртящата се дъга, като се използва SF6.
Завъртането на дъгата между кръговите дъгогасящи контакти се осигурява от електромагнитно поле.
Полето се обуславя от соленоид през който тече в момента на отварянето токът, който трябва да се прекъсна. Въртеливото движение охлажда дъгата с принудителна конвекция.
В началото на действието отваряне, главните контакти и дъгогасящите контакти са затворени.
Главната верига е прекъсната с отделянето на главните контакти.
Дъгогасящите контакти са все още затворени.
Отделянето на дъгогасящите контакти непосредствено следва отделянето на главните контакти.
Дъгата е подложена на електромагнитното поле, обусловено от дъгогасителната бобина. Полето съответства на тока, който трябва да се прекъсна.
Дъгата, под влияние на електромагнитните сили, се завърта бързо и така се охлажда от принудителна конвекция.
Поради фазовото отместване между тока и магнитното поле, тази сила е все още съществена при нулев ток.
При нулев ток, междината между двата контакта възстановява началната си диелектрична якост, поради присъщите свойства на SF6.



① токова клема
② електромагнит
③ дъгогасителна бобина
④ фиксиран главен контакт
⑤ фикс. дъгогасящ контакт
⑥ подвижен главен контакт
⑦ подв. дъгогасящ контакт
⑧ херметизираща система
⑨ гъвкав съединитал
⑩ корпус
⑪ -молекулно сито-



затворени контакти | главните контакти са разделени | период на дъгата | отворени контакти

Описание (продължение)
Управляващи/мониторни и защитни функции

Sepam

Гамата Sepam се състои от цифрови управляващи/мониторни и защитни блокове за разпределителни мрежи средно напрежение. Като се започне от серията 1000, създадена за защита на мрежи, двигатели или трансформатори и измерване на ток и на напрежение...и се стигне до серията 2000, която е с вградени функции за управление/мониторинг и защита с управляваща логика и комуникационни възможности и функции, се вижда че Sepam е една пълна гама с цифрова индикация, която задоволява всички нужди.

- широк обхват на динамична настройка;
- съвместимост с всички типове сензори;
- лесно за работа при запис на токовете на изключване за всяка фаза и индикация на реални измерени стойности, без необходимост от коефициенти;
- надеждност при работа със самодиагностираща се система за непрекъснат мониторинг и висока степен на защита от електромагнитни смущения.

VIP

VIP защитните системи за Fluarc SF-set прекъсвачите защитават от междуфазни и земни съединения и не изискват допълнително оперативно напрежение. Има два типа защита: VIP 13 само с "контрол на фазите" и блоковете VIP200/201, които контролират нулевата последователност на фазите и осигуряват защита на микропроцесорна основа. Всички системи са с широк обхват на настройка на тока на изключване и всички настройки и работни характеристики са подбрани за продължителна работа без дрейф.

- защита от електромагнитни смущения;
- пролове и закъснения по време с висока точност отсъстват отлична избирателност по мрежата;
- лесни за работа и поддръжка, като релето е интегрирано в прекъсвача със сензорите си.

Statimax

Защита с определено закъснение по време без оперативно напрежение от фазни и земни съединения. Statimax се състои от електронно устройство за настройка/задаване на стойности, три тороидални съгласуващи по напрежение трансформатора, трансформатор за токове нулева последователност на фазите и регулационно устройство което осигурява захранването за електрониката и изключвателната бобина Mitop с ниска консумация.

таблица за избор

защита	ANSI код	типични приложения: мрежа: входен	мрежа: изходен	свързване: автоуправление: да	свързване: автоуправление: не	траноформ. P < 3MV	двигател	[illegible]	[illegible]	[illegible]
3-фазна максималнотокова	50 - 51	■	■	■	■	■	■	■	■	■
земна максималнотокова	50N - 51N	■	■	□	□	□	■	■	■	■
посочна земна	67N		Δ					■		
минималнонапреженова	27			■				■		
максималнонапреженова	59			■				■		
термоизображение	49					■	■	■	■	
максималнонапреженова със земна	59N					Δ		■		
максималнотокова с обратна последоват.	46						■	■	■	
дълъг пуск и блокаж на ротора	51LR						■	■	■	
максимален брой пускови операции	66						■	■	■	
едно-фазна минималнотокова	37						■	■	■	

■ за всички системи на заземяване
□ за всички импедансни системи на заземяване
Δ за изолирани системи на заземяване

Забележка: Блоковете за АВР са описани със съответните шкафове на страница 33. Тази апаратура (с изключение на VIP и Statimax) е разположена в нисковолтовото отделение.

Избор на модули за свързване към мрежата

IM (375 или 500 mm)

Входен или изходен модул

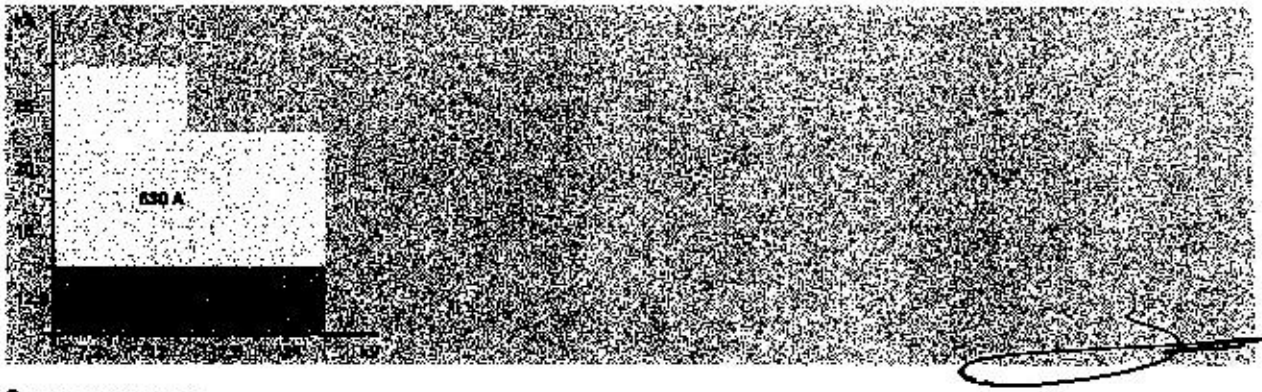
IMC (500 mm)

Входен или изходен модул

IMB (375 mm)

Изходен модул (десен или ляв)

Електрически характеристики



Основна апаратура

- [redacted]

[redacted]

[redacted]

[redacted]

- разширено нисковолтово отделение с 1 до 4 СТ.

Варианти

- [redacted]

- 630 A или 1250 A трифазни шини.

Спомагателни съоръжения предлагани като опции

- двигател за работния механизъм,
- спомагателни контакти,
- допълнителна кутия или свързваща кутия за кабелно свързване отгоре,
- блокировки с ключ,
- 50 W отоплителен елемент,
- основи.

- фазов компаратор,
- индикатори за повреда,
- съоръжение за "двойно свързване" за едножилни кабели с въздушна изолация,
- разширено нисковолтово отделение.

- разширено нисковолтово отделение.

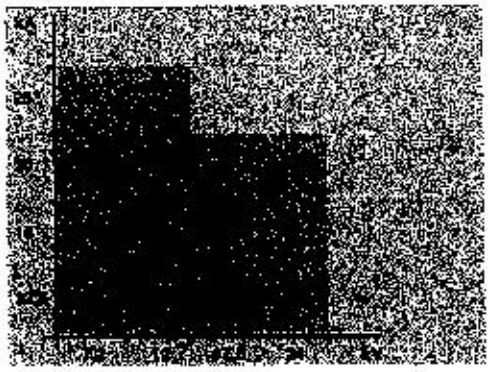
Избор на модули за защита

PM (375 mm)

Модул с разединител с предпазител

[redacted]

Електрическа характеристики



Основна апаратура

[redacted]

Варианти

[redacted]

Допълнителни принадлежности

- двигател за работния механизъм,
- спомагателни контакти,
- разширено, високоволтово отделение,
- допълнителна кутия или свързваща кутия за съединяване на кабелни отпори,
- блокировки с ключ,
- основи,
- 50 W отоплителен елемент,
- механична индикаторна система за стопяеми предпазители,
- UTE или DIN предпазители.

Избор на модули за защита

(продължение)

QM (375 mm)	QMC (625 mm)	QMB (375 mm)
Комбинация мощностен разединител-предпазител	Комбинация мощностен разединител-предпазител	Комбинация мощностен разединител-предпазител
[redacted]	[redacted]	[redacted]

Електрическо характеристики

[redacted]

Основна апаратура

[redacted]

Варианти

[redacted]

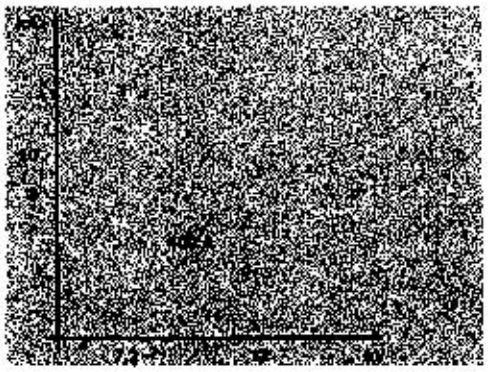
Допълнителни принадлежности

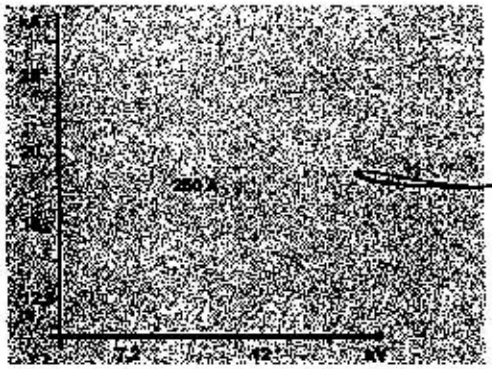
- двигател за работния механизъм с изключвателна бобина,
- спомагателни контакти,
- блокировки с ключ,
- 50 W отоплителен елемент,
- основи,
- индикаторен контакт за отопени предпазители,
- UTE или DIN ударни предпазители,
- изключвателна бобина или минималнонапреженова бобина.

- разширено нисковолтово отделение
- допълнителна кутия или свързваща кутия за св. на кабели отгоре.

- допълнителна кутия.

- разширено нисковолтово отделение
- допълнителна кутия или свързваща кутия за св. на кабели отгоре.





Избор на модули за защита

(продължение)

CRM (750 mm)

Контактор

CRM (750 mm)

Контактор с предпазители

Електрически характеристики

Основна апаратура

[illegible]

■ апаратура за три предпазителя DIN

Варианти

[illegible]

Незадължителни принадлежности

■ шкаф :
☐ спомагателни контакти на разединителя,
☐ защита с програмируем електронен блок Sepam,
☐ един до три напрежителни трансформатора,
☐ блокировки с ключ,
☐ 50 W стоплителен елемент,
☐ основи,
☐ съоръжения за "двойно свързване" за едножилни кабели със суха изолация.

■ контактор:
☐ механична блокировка.

■ DIN предпазители.

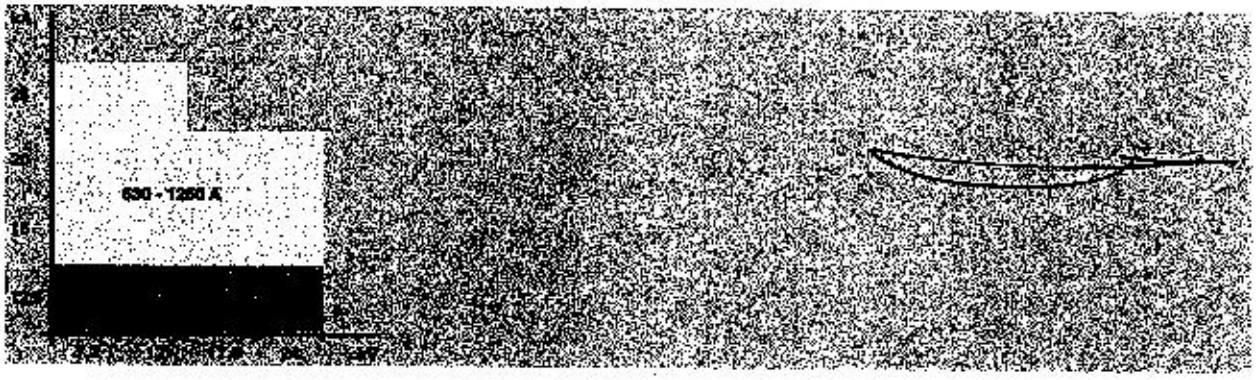
ВЯРНО С ОРИГИНАЛА

Избор на модули за защита

(продължение)

DM1-A (750 mm)	DM1-D (750mm)	DM1-D (750mm)
Един разединител и прекъсвач	Един разединител и прекъсвач с дясна изходяща линия	Един разединител и прекъсвач с лява изходяща линия
[redacted]	[redacted]	[redacted]

Електрически характеристики



Основна апаратура

[redacted]

Варианти

[redacted]

Незадължителни принадлежности

■ шкаф :
□ спомагателни контакти на разединителя,
□ допълнителна кутия или кутия за свързване отпоре,
□ защита с релета Sepam или програмируем електронен блок Sepam за прекъсвач Rlarc SF1,
□ три напрежителни трансформатора за прекъсвач Rlarc SF1,
□ блокировки с ключ,
□ 50 W отоплителен елемент,
□ основи.

■ прекъсвач:
□ двигател за задвижващия механизъм,
□ изключвателна бобина с ниска консумация Mitop или минимално напреженова,
□ изключвателни и включвателни бобини,
□ брояч на операциите при механизма за ръчно задвижване.

* само за работа при 400 - 630 A

Избор на модули за защита

(продължение)

DM1-W (750 mm)*

Извеждаем прекъсвач с единичен разединител

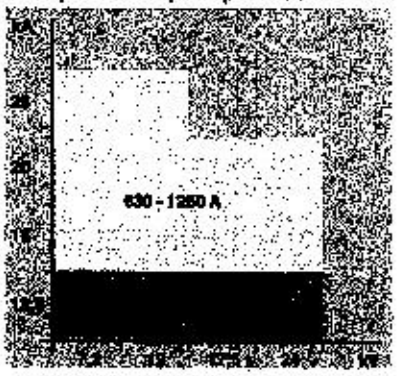
[redacted]

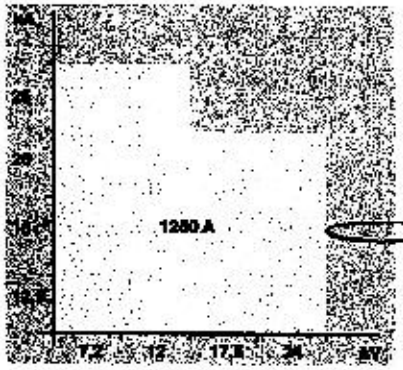
DM1-Z (750 mm)*

Извеждаем прекъсвач с единичен разединител дясна изходна линия

[redacted]

Електрически характеристики





Основна апаратура

[redacted]

[redacted]

[redacted]

Варианти

[redacted]

Незадължителни принадлежности

В шкаф :
- □ спомагателни контакти на разединителя,
- □ допълнителна кутия или кутия за свързване отгоре,
- □ защита с релета Statitrax или програмируем електронен блок Sepam за прекъсвач Fluarc SF1,
- □ три напрежителни трансформатора за прекъсвач Fluarc SF1,
- □ блокировки с ключ,
- □ 50 W отоплителен елемент,
- □ основи.

В прекъсвач:
- □ двигател за задвижващия механизъм,
- □ изключителна бобина с ниска консумация Mitop или минимално напреженова,
- □ изключвателни и включвателни бобини,
- □ брояч на операциите при механизма за ръчно задвижване.

* моля, консултирайте се с нас относно работата при 1250 A.

Избор на модули за защита

(продължение)

DM2 (750 mm)

Два разединителя и прекъсвач с дясна **изходна линия**

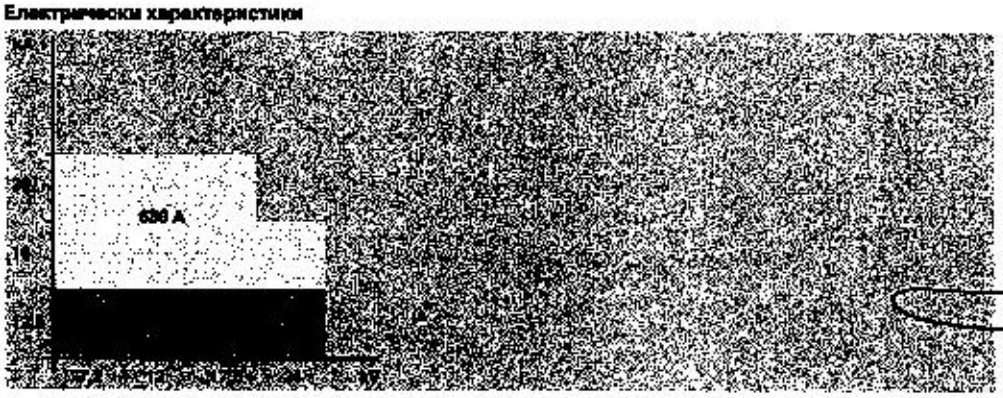
[redacted]

DM2 (750 mm)

Два разединителя и прекъсвач с лява **изходна линия**

[redacted]

Електрически характеристики



Основна апаратура

[redacted]

Незадължителни принадлежности

■ шкаф :
- □ спомагателни контакти на разединителя,
- □ допълнителна кутия или кутия за свързване отгора,
- □ защита с релета Statimax или програмируем електронен блок Sepam за прекъсвач Fluairo SF1,
- □ три напрежителни трансформатора за прекъсвач Fluairo SF1,
- □ блокировки с ключ,
- □ 50 W отоплителен елемент,
- □ основи.

■ прекъсвач:
- □ двигател за задвижващия механизъм,
- □ изключвателна бобина с ниска консумация Mitop или минимално напрежение,
- □ изключвателни и включвателни бобини,
- □ брояч на операциите при механизма за ръчно задвижване.

Избор на модули за измерване на средни напрежения (продължение)

CM (375 mm)

Напрежителни трансформатори за мрежи със заземена неутрала

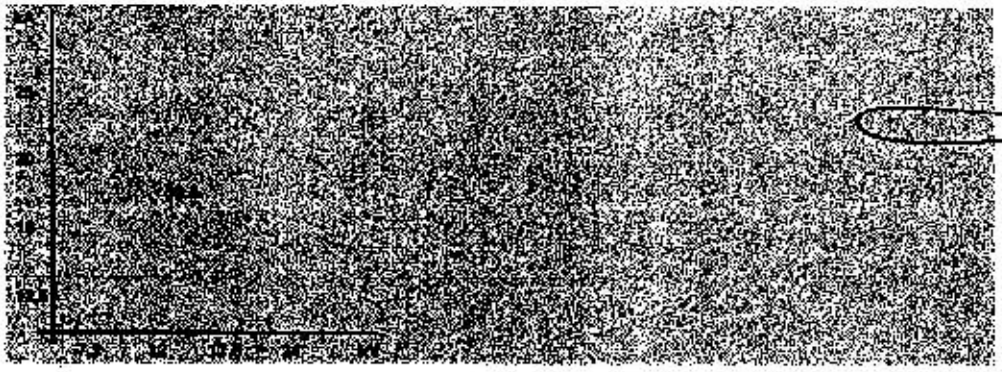
[redacted]

CM2 (500 mm)

Напрежителни трансформатори за мрежи с изолирана неутрала

[redacted]

Електрически характеристики



Основна апаратура

[redacted]

Варианти

[redacted]

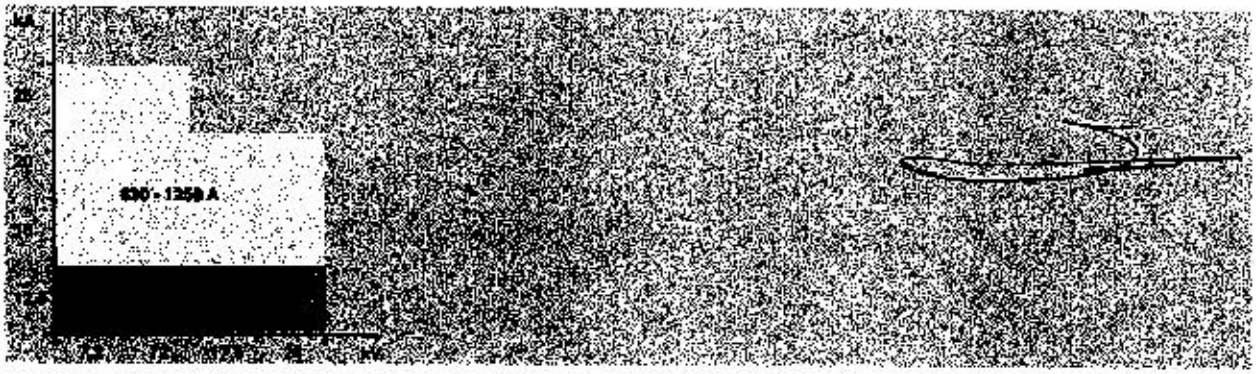
Незадължителни принадлежности

- допълнителни контакти,
- допълнителен шкаф за ниско напрежение,
- 50 W отоплителен елемент,
- основи на отвора,
- индикаторен контакт за отопени предпазители.

Избор на модули за измерване на средни напрежения (продължение)

GBC-A (750 mm)	GBC-A (750 mm)	GBC-B (750 mm)
Измерване на ток и напрежение - дясна изходна линия	**Измерване на ток и напрежение** - лява изходна линия	**Измерване на ток и напрежение**
[redacted]	[redacted]	[redacted]

Електрически характеристики



Основна апаратура

- [redacted]

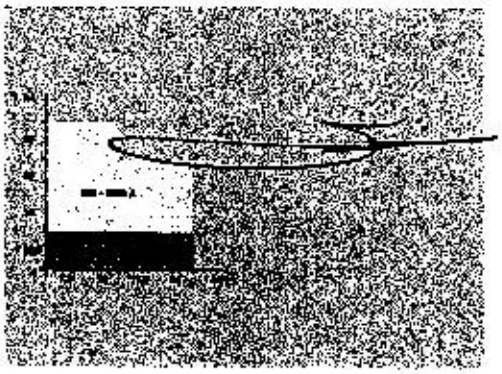
Незадължителни принадлежности

- допълнителен шкаф,
- три напрежителни трансформатора (фаза-земя),
- или два напрежителни трансформатора (фаза-фаза).

Избор на модули за функции изисквани при абонатни мрежи

GIM (125 mm)	GEM (125 mm)	GBM (375 mm)
Междинен шинен шкаф	Разширителен шкаф VM6/SM6	Свързващ шкаф дясна или лява изходна линия
[redacted]	[redacted]	[redacted]

Електрически характеристики



Основна апаратура

- [redacted]

- [redacted]

Незадължителни принадлежности

- основен

- допълнителен шкаф

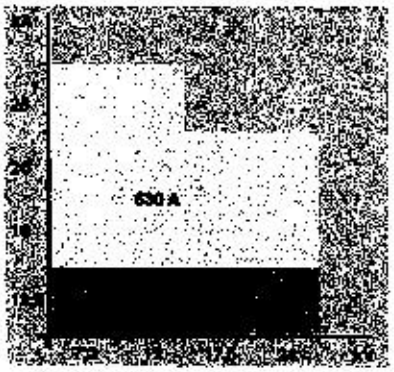
Избор на модули за функции изисквани при абонатни мрежи (прод.)

GAM2 (375 mm)

Свързващ шкаф за входящ кабел

[redacted]

Електрически характеристики



Основна апаратура

[redacted]

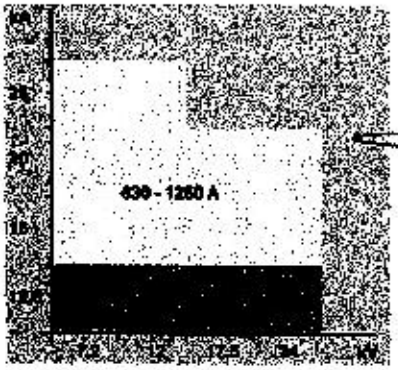
Незадължителни принадлежности

- спомагателни контакти,
- разширено нисковолтово отделение,
- блокировки с ключ.

GAM (500 mm)

Свързващ шкаф за входящ кабел

[redacted]



Избор на модули за функции изисквани при абонатни мрежи (прод.)

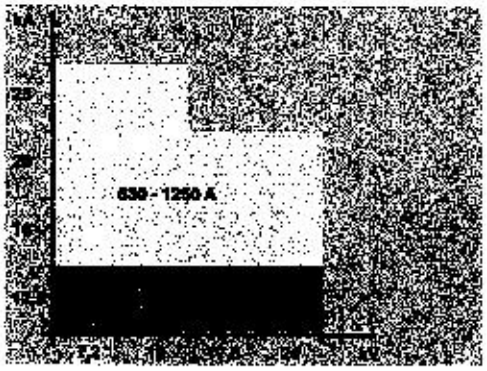
SM (375 до 500 mm*)

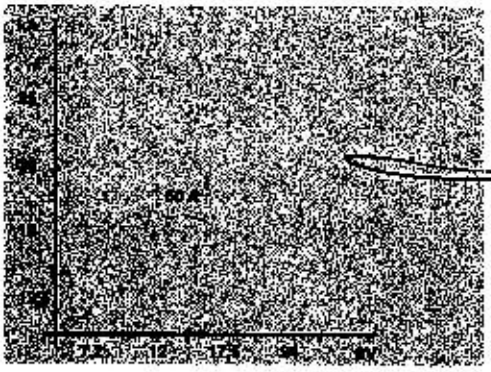
Разединител

TM (375 mm)

Трансформаторен шкаф средно/ниско напрежение

Електрически характеристики





Основна апаратура

- [redacted]

[redacted]

[redacted]

Варианти

- [redacted]

Незадължителни принадлежности

- спомагателни контакти,
- нисковолтово отделение,
- блокировки с ключ,
- основи,
- 50 W отоплителен елемент.

- разширено нисковолтово отделение,
- допълнителен шкаф за свързване на кабели отгоре,
- съоръжения за "двойно свързване" на едножилни кабели със суха изолация за 400 - 630 A шкафове.

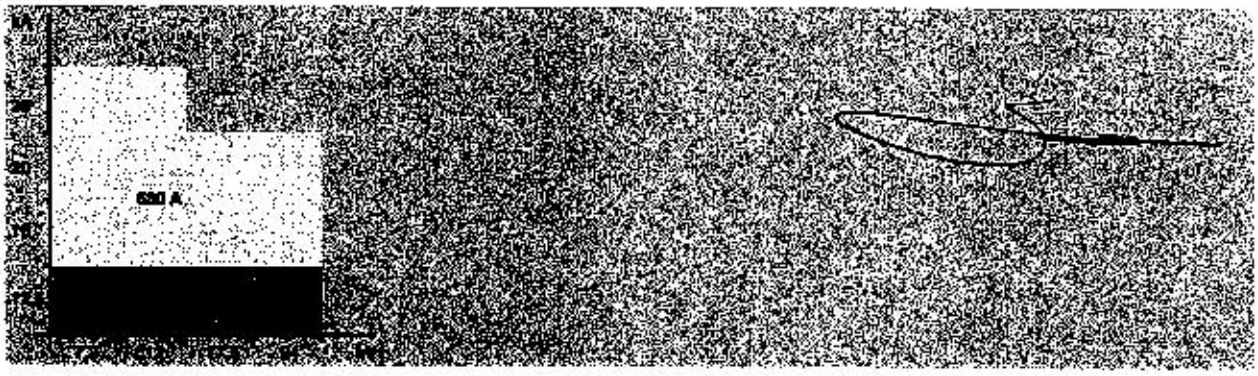
- механична индикаторна система за стопяеми предпазители

* ширина 500 mm за 1250 A разединител.

Избор на модули за функции изисквани при абонатни мрежи (прод.)

NSM - кабели (750 mm)	NSM - шини (750 mm)	NSM - шини (750 mm)
Кабелно токозахранване за главна входна линия и за резервна линия	**Шинно токозахранване за главна входна линия от дясно и кабели за резервна линия**	**Шинно токозахранване за главна входна линия от ляво и кабели за резервна линия**

Електрически характеристики



Основна апаратура

[illegible]

■ [illegible] задействан вариант
[illegible]
☐ [illegible] за автоматично управление.

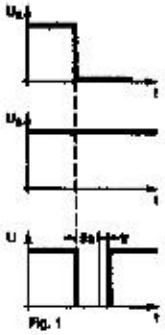
Незадължителни принадлежности

■ ръчно задействан вариант
☐ двигател за работния механизъм с 24V постояннотокови включвателни и изключвателни бобини,
☐ спомагателни контакти,
☐ разширено нисковолтово отделение,
☐ допълнителна кутия,
☐ блокировки с ключ,
☐ 50 W отоплителен елемент,
☐ цокли,
☐ "съоръжения за двойно свързване" на едножилни кабели със суха изолация.

■ автоматично задействан вариант
☐ спомагателни контакти,
☐ блокировки със заключване,
☐ 50 W отоплителен елемент,
☐ цокли,
☐ "съоръжения за двойно свързване" на едножилни кабели със суха изолация.

Избор на модули за функции изисквани при абонатни мрежи (прод.)

Уреди за автоматичен контрол



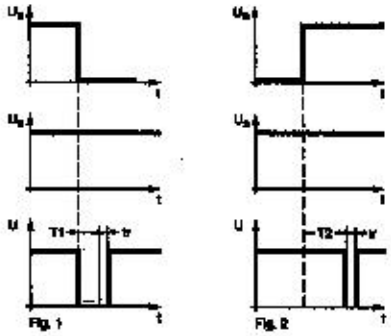
tr - време на задействане на АВР (70 до 80 ms)

АВР тип RVH 215 I
- възможност за паралелна работа
- автономно постояннотоково 24 V захранване за изключователни бобини и моторен тип:
  - -10°C < T < +40°C или
  - 0°C < T < +60°C,
- без токов трансформатор за затваряне в случай на повреди надолу по линията;
- с шест токови трансформатора от тороиден тип с изправители за откриване на повреди надолу по линията за предотвратяване на прехвърляне в следните случаи:
  - 80 A ±10% ток на земно съединение;
  - 1200 A междуфазово съединение;
  - 450 A симетрично три-фазово съединение.

Последователност на операциите
- прехвърляне (фигура 1)

Четири условия трябва да бъдат изпълнени за прехвърляне към резервен източник:
- загуба на напрежение на главната захранваща линия (Ua);
- наличие на напрежение на резервната захранваща линия (Us);
- липса на авария надолу по линията (опция);
- горните състояния се поддържат 5 секунди.
- връщане към начално състояние.

Връщането не е автоматично, но може да се предприеме, ако няма повреда.



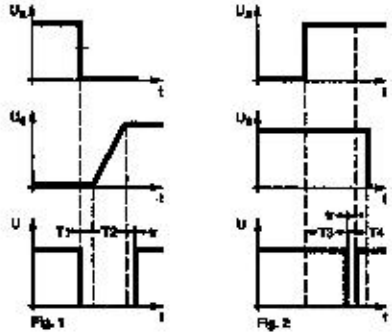
tr - време на задействане на АВР (70 до 80 ms)

АВР тип RCV 420
- блокираща функция в случай на повреда,
- възможност за паралелна работа,
- автономно постояннотоково 24 V захранване за изключователни бобини и моторен тип:
  - -10°C < T < +40°C или
  - 0°C < T < +60°C,
- клемен блок за външни команди за блокиране на прехвърлянето.

Последователност на операциите
- прехвърляне към резервен източник (фигура 1)

1. загуба на напрежение на главната захранваща линия (Ua), което продължава зададено време: 0.1 - 0.2 - 0.4 - 0.6 - 0.8 -1 - 1.5 - 2 s (T1) и наличие на напрежение на резервната захранваща линия (Us).
2. прехвърляне
- прехвърляне обратно към главния източник (фигура 2)

1. наличие на напрежение на главната захранваща линия (Ua), което продължава зададено време 5 - 10 - 20 - 40 - 60 - 100 - 120 s (T2).
2. обратно прехвърляне.



tr - време на задействане на АВР (70 до 80 ms)

АВР тип RNS 11
- блокираща функция в случай на повреда,
- възможност за паралелна работа,

автономно постояннотоково 24 V захранване за изключователни бобини и моторен тип:
- -10°C < T < +40°C или
- 0°C < T < +60°C,
- клемен блок за външни команди за блокиране на прехвърлянето.

Последователност на операциите
- прехвърляне към резервен генератор (фигура 1)

1. загуба на напрежение на главната захранваща линия (Ua), което продължава време зададено от 1 до 15 s (T1 се задава в завода).
2. пуск на генератора (T2).
3. прехвърляне, когато е налично напрежение на генератора (Us) (външно реле).
- прехвърляне обратно към главния източник (фигура 2)

1. наличие на напрежение на главната захранваща линя (Ua), което продължава време зададено от 60 до 120 s (T3 се задава в завода)
2. обратно прехвърляне.
3. спиране на генератора 8 секунди след обратното прехвърляне (T4).

Предпазители

защита на трансформатори

Номиналните стойности на предпазителите за шкафове SM6 от типа PM, CM, QMB и QMC зависят и от следните критерии:
- работно напрежение,
- номинални параметри на трансформатора,
- технология (производител) на предпазителя.

Могат да се монтират различни типове предпазители със средно натоварен ударен механизъм.
- Предпазители Solfuse по стандарт UTE NFC 64.210
- Предпазители Fusarc CF по IEC препоръка 282.1 и DIN размери 43.625.

Пример: За защита на 400 kVA трансформатор при 10 kV изберете или предпазители Solfuse с номинален ток 43 A или предпазители Fusarc CF с номинален ток 50 a.

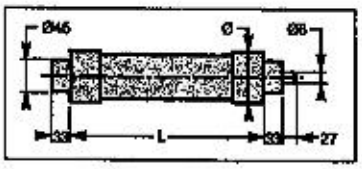
[illegible]

размери на предпазителя

Solefuse (UTE стандарт)

ном. напр. (kV)	ном.ток (A)	L (mm)	Ø (mm)	тегло (kg)
7,2	6.3 до 125	450	55	2
12	100			
17.5	80			
24	6.3 до 63			

Fusarc (DIN стандарт)



ном. напр. (kV)	ном.ток (A)	L (mm)	Ø (mm)	тегло (kg)
7,2	125	292	88	3.3
12	6.3 до 63	292	55	1.4
	80 до 100	292	88	3.3
24	6.3 до 40	442	55	1.4
	50 до 80	442	88	5

таблица за избор (номинални стойности в A, без претоварване, - 5° C < θ < 40° C).

Моля, консултирайте се с нас за претоварване и работа над 40° C.

тип предп.	работно напр. (kV)	номинални мощности на трансформатора (kVA) 25	50	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	ном. напр. (kV)
стандарти UTE NFC: 13.100, 64.210																			
Solefuse																			
	5,5	6.3	16	31.5	31.5	63	63	63	63	63									7.2
	10	[illegible]																	
	16	[illegible]																	
	20	[illegible]																	
Общ случай, стандарт UTE NFC 13.200																			
Solefuse																			
	3,3	16	16	31.5	31.5	31.5	63	63	100	100									7,2
	5,5	6.3	16	16	31.5	31.5	63	63	63	80	80	100	125						
	6,6	6.3	16	16	16	31.5	31.5	43	43	63	80	100	125	125					
	10	[illegible]																	12
	13,8	[illegible]																	17.4
	15	[illegible]																	
	20	[illegible]																	
	22	[illegible]																	
Fusarc																			
	3,3	16	25	40	50	50	63	80	80	125*	160*	200*							7.2
	5,5	10	16	25	31.5	31.5	40	50	63	80	80	100	125	160*					
	6,6	10	16	25	31.5	31.5	40	50	50	63	80	80	100	125	160*				
	10	6.3	6.3	16	16	25	25	31.5	40	50	50	63	80	80	100	160*	160*		12
	13,8	[illegible]																	
	15	[illegible]																	
	20	[illegible]																	
	22	[illegible]																	

* моля, консултирайте се с нас.

Предпазители
(продължение)

защита на двигатели с шкафове CRM
избор на предпазители

Номиналната стойност на тока на предпазители монтирани в CRM (контактор и контактор с предпазители) зависи от:
- номиналната стойност на тока на двигателя Inq
- пусковия ток Id,
- честота на пусковите.

Номиналният ток на предпазителя се изчислява така, че при ток равен на два пъти пусковия ток, предпазителят да не изгаря в рамките на необходимото време за пуск.
Таблицата от дясно показва кои номинални стойности следва да се използват на базата на следните предположения:
- директен пуск
- Id/In 6,
- pf = 0.8 (P < 500 kW) или 0.9 (P > 500 kW),
- η = 0.9 (P < 500 kW) или 0.94 (P > 500 kW),

Дадените стойности се отнасят за предпазителите Fusarc (по DIN стандарт 43-625).
Например:
Да вземем 950 kW двигател при 5 kV

$$In = \frac{P}{\sqrt{3} \cdot U \cdot \eta \cdot pf} = 130\ A$$

d = 6 x In = 780 A
След това изберете следващата по голямина стойност, т.е. 790 A.
При шест 5 секундни пуска на час изберете предпазители с номинална стойност 200 A.
Забележка:
Същият двигател не може да бъде защитен за 12 пуска на час защото максималното работно напрежение за необходимите предпазители с номинал 250 A е 3.3 kV.

пусков ток (A)	време на пуск (s) / брой пуска на час	5 / 6	5 / 12	10 / 6	10 / 12	20 / 6	20 / 12	макс. раб. напр. (kV)
1410		250						
1290		250	250	250				
1140		250	250	250	250	250		
1030		250	250	250	250	250	250	3.3kV
890		250	250	250	250	250	250	
790		200	250	250	250	250	250	
710		200	200	200	250	250	250	
640		200	200	200	200	200	250	
610		200	200	200	200	200	200	6.6 kV
540		160	200	200	200	200	200	
480		160	160	160	200	200	200	
440		160	160	160	160	160	200	
310		160	160	160	160	160	160	
280		125	160	160	160	160	160	
250		125	125	125	160	160	160	
240		125	125	125	125	125	160	
230		125	125	125	125	125	125	
210		100	125	125	125	125	125	
190		100	100	100	100	100	125	
170		100	100	100	100	100	100	11 kV

Максимална превключвана мощност (kW)
(директен пуск, шест петсекундни пуска на час)

раб. напр. (kV)		3.3	4.16	5	5.5	6	6.6	10	11
без предп.	1550	1960	2360	2590	2830	3110	4710	5180	
с предп.	100 A	140	180	215	240	260	285	435	480
	200 A	525	800	980	1060	1155	1270		
	250 A	1135							

Достъп до предпазителите
Достъп е осигурен отпред при свалена предна лицева плоча. Предпазителите могат да се извадят без специални приспособления като просто се изтеглят напред. Изравнителят на полето се заключва и автоматично се заключва на мястото.

Подмяна на предпазители
Когато при отстраняване на повреда имат един или два изгорели предпазителя, обичайната практика е да се сменят само изгорялите предпазители.
Въпреки че останалите предпазители (останалият предпазител) могат видимо да бъдат в добро състояние , тяхните работни характеристики в общия случай са влошени поради настъпилото къс съединение.
Когато неизгорели предпазители останат в гнездата си, те могат да изгорят бързо и при много ниско превишаване на стойностите на тока. В системи при които непрекъснатата работа е от особена важност, се препоръчва да се сменят всичките предпазители в съответствие с препоръката на IEC 282.1.

Блокировки

функционални блокировки

блокировките са в съответствие с IEC препоръка 298 и EDF спецификация HN 64-S-41.

Шкафове с мощностни разединители
- мощностният разединител може да бъде затворен само когато заземителят е отворен и капакът за достъп е на място.
- заземителят може да бъде затворен само когато мощностният разединител е отворен.
- капакът за достъп при свързване може да се свали/отвори само когато заземителят е затворен.
- мощностният разединител е блокиран в отворено положение когато капакът за достъп е свален. Заземителят може да се задейства за изпитания.

шкафове с прекъсвачи
- разединителят(ите) може (могат) да се затворе(ят) само когато прекъсвачът е отворен и капакът за достъп е на място.
- заземителят(ите) може (могат) да се затворят само когато разединителят(ите) е(са) отворени.
- капакът за достъп при свързване може да се свали/отвори само когато:
  - прекъсвачът е блокиран в отворено положение
  - разединителят(ите) е(са) отворени
  - заземителят е затворен.

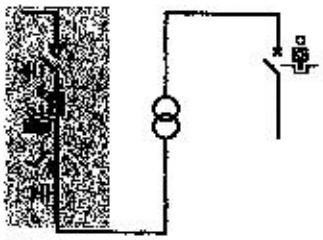
Забележка: Възможно е разединителя (ите) да се остави(ят) в отворено положение за работа без товар с прекъсвача.

в допълнение на функционалните блокировки към всеки разединител и мощностен разединител са включени:
- възможности за заключване с катинар (катинарите не се доставят)
- четири избивки които могат да се използват за заключалки с ключ (доставят се при поискване) за заключващи функции на механизма.

Блокировка на шкафовете

шкафове	блокировка								
	A1	A3	A4	C1	C4	P1	P2	P3	P5
IM, IMB, IMC		■	■			■			
PM, QM, QMB, QMC, DM1-A, DM1-D, DM1-W, DM1-Z	■			■	■				
CRM				■					
NSM		■				■			
GAM									■
SM							■	■	

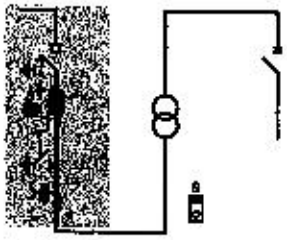
блокировки със заключване



type A1

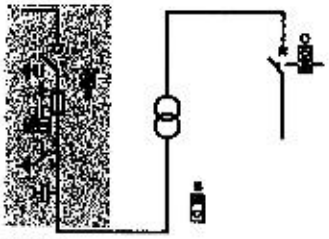
изходни шкафове

Цел:
- да се предотврати затварянето на заземителя в трансформаторен защитен шкаф освен когато нисковолтовият прекъсвач е блокиран в положение "отворено" или "разединено".



type C1

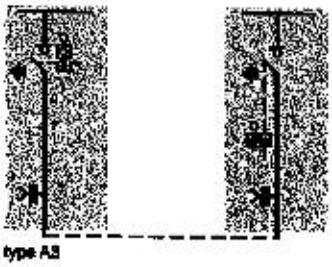
- да се предотврати достъп до трансформатора преди заземителят на шкафа за защита на трансформатора да е затворен.



type C4

- да се предотврати затварянето на заземителя в шкафа за защита на трансформатора освен когато нисковолтовият прекъсвач е блокиран в положение "отворено" или "разединено".
- да се предотврати достъп до трансформатора преди заземителят на шкафа за защита на трансформатора да е затворен.

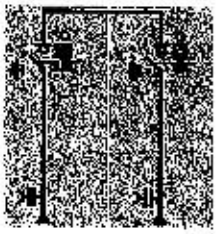
Блокировки
(продължение)



type A3

шкафове за пръстеновидни мрежи

Цел:
- да се предотврати затварянето на заземителя в шкаф към товара освен когато мощностният разединител на линията е блокиран в положение "отворено".

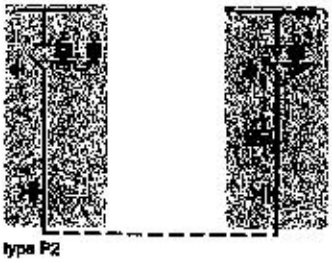


type A4

- да се предотврати едновременното включване на два мощностни разединителя.

type P1

- да се предотврати затварянето на заземителя когато мощностният разединител на другия шкаф е блокиран в положение отворено.

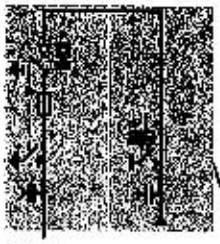


type P2

- да се предотврати задействане при товар на разединителя, освен когато мощностният разединител е блокиран в положение "отворено".
- да се предотврати затварянето на заземителя освен когато разединителят и мощностният разединител са блокирани в положение "отворено".

type P3

- да се предотврати задействане при товар на разединителя, освен когато мощностният разединител е блокиран в положение "отворено".
- да се предотврати затварянето на заземителя когато шкафът е под напрежение, когато разединителят и мощностният разединител са блокирани в положение "отворено".
- да не се допусне задействане на мощностният разединител когато няма товар.



type P5

- да се предотврати затварянето на заземителя във входния шкаф освен когато резединителят и мощностният разединител са блокирани в положение "отворено".

легенда за блокировките със заключване

- без ключ
- свободен ключ
- задържащ ключ
- плоча или врата

Свързване

свързване с кабели с въздушна изолация

Кабелите със суха изолация се свързват през къси конвенционални кабелни глави (EUIC):
■ с изравнител на полето или линеен разпределител на напрежение за медни или алуминиеви едножилни кабели тип HN 33-S-22;
■ с линеен разпределител на напрежение за едножилни или три-жилни* кабели тип HN 33-S-23.
Кабелната обувка трябва да се свърже към вградения болт на екрана с динамометричен гаечен ключ нагласен на 50 mN.

кабелиране отдолу

■ всички шкафове
■ през канали
Дълбочината на канала P за често използваните типове кабели е даден на таблицата в дясно.
■ със стойки
P се намалява или каналите се елиминират изцяло когато шкафовете се поставят на 400 mm опори.
■ с двоен под
Дълбочината на канала P за често използваните типове кабели е даден на таблицата в дясно.

кабелиране отгоре

Свързването за всички шкафове от гамата с изключение на тези с включено разширено нисковолтово отделение се извършва с едножилни кабели със суха изолация (1 или 2 кабела на фаза до 240 mm²[1]). Разширеното нисковолтово отделение може да бъде съоръжено с неонови индикатори за кабелната глава.

кабелиране отдолу за 400 - 630 - 1250 A шкафове

едножилни кабели сечение на кабела (mm²)	радиусна огъване (mm)	шкафове до 630 A IM[2], SM[2] NSM-кабели, NSM-шини	IMC[2], CRM, DM1-A, DM1-W, QAM	PM, QM, QMC [3]	1250 A шкафове SM, QAM	DM1-A [3] DM1-W[3]
		дълбочина P (mm) всички ориентации				
		P1	P2	P3	P4	P5
50	370	140	400	350		
70	400	150	430	350		
95	440	160	470	350		
120	470	200	500			
150	500	220	550			
185	540	270	670			
240	590	330	730			
400	800				1000	1350
630	940				1000	1350

[1] възможности за съоръжения с двойно свързване до 240 mm².
[2] трябва да се монтира с корито дълбоко 100 mm.
[3] трябва да се монтира с корито дълбоко 350 mm в двоен под.

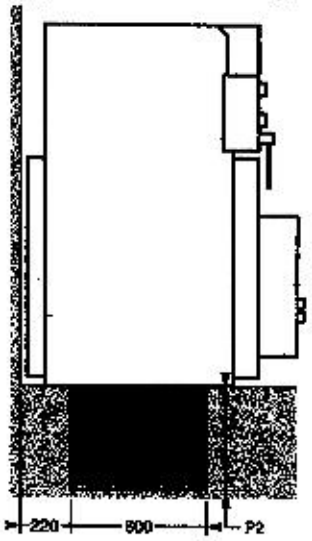
Забележка: Когато се определя дълбочината P за едноканален монтаж следва да се вземе под внимание шкафа и кабелите, които изискват най-голяма дълбочина.
При дву-канален монтаж следва да се вземе под внимание дълбочината P за всеки тип шкаф и ориентация на кабелите.

* само за 400 - 630 A шкафове.

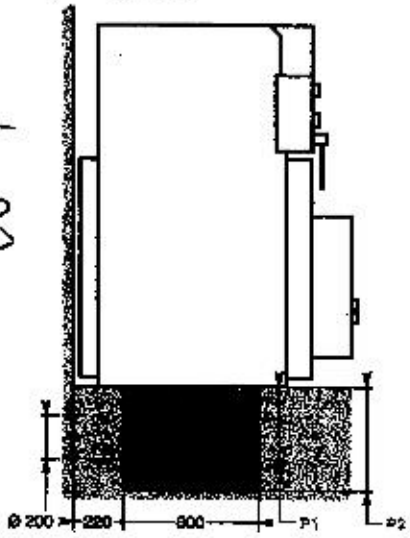
Свързване
(продължение)

примерни схеми на каналите

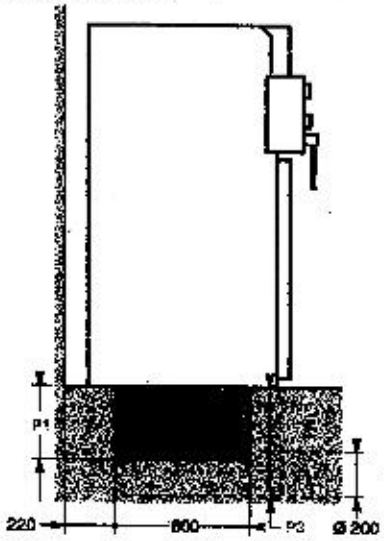
Кабелът влиза или излиза от дясната или от лявата страна

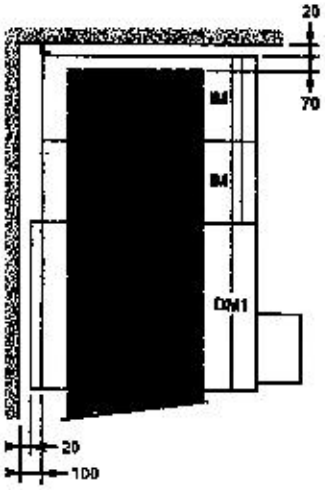


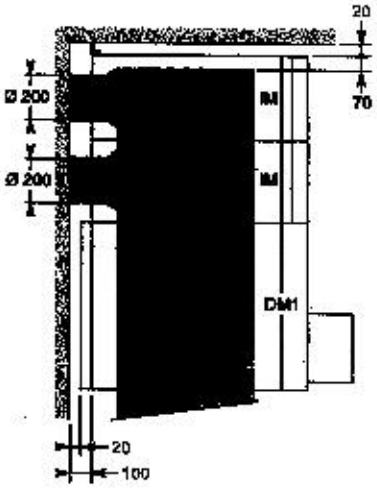
Вход отзад или изход със свързващи тръби

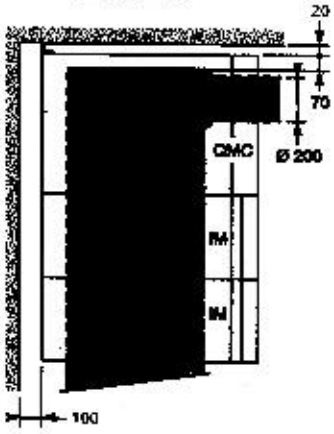


Вход отпред или изход със свързващи тръби









необходими размери (mm)

Забележка: при свързване с тръби, скосяването трябва да отговаря на следните размерности на канала: P1 = 75 mm или P2/P3 = 150 mm.

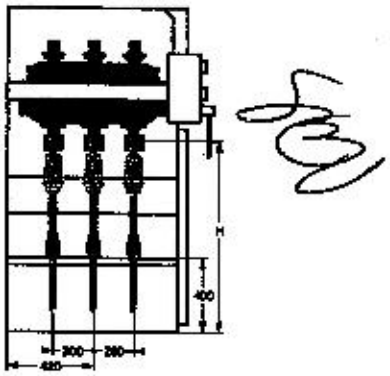
Свързване
(продължение)

височина на свързване на кабелите
измерена от пода (mm)

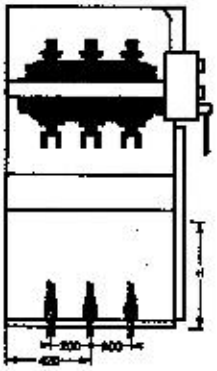
IM, NSM-кабели, NSM-шини, SM [1]	950
IMC	450
PM, QM	430
QMC	340
CRM	430

DM1-A SF1	430 или 650 [2]
DM1-A SFset	370
DM1-W	360 или 650 [2]
GAM2	760
GAM	470 или 620 [2]

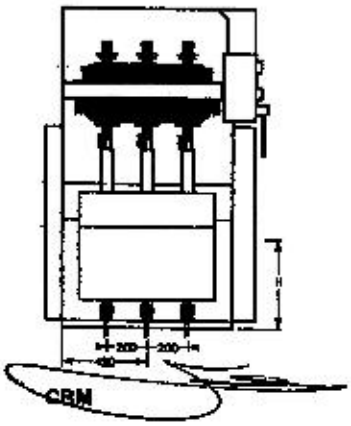
[1] 870 mm за 1250 A SM шкаф с 2 кабела на фаза.
[2] за 1250 A шкафове.



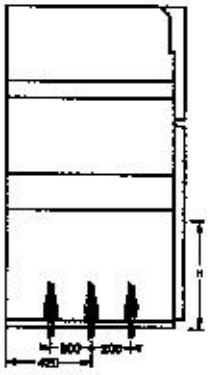
IM, NSM кабели, NSM шини, SM



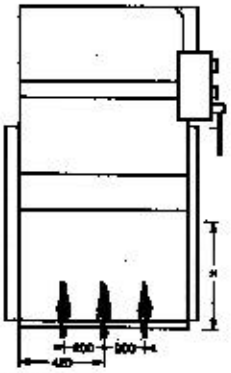
IMC, PM, QM, QMC



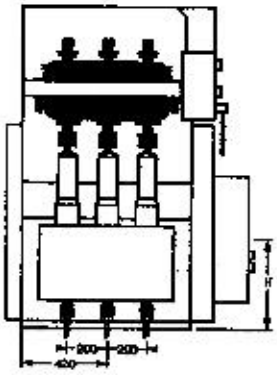
CRM



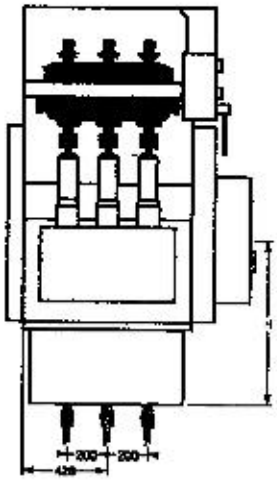
GAM2



GAM



DM1-A, DM1-W 400 - 630 A



DM1-A, DM1-W 1250 A

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Монтаж

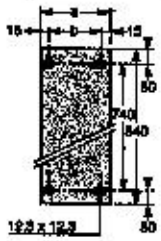
подготовка на пода

Шкафовете могат да се поставят на обикновени бетонни подове с или без канали в зависимост от типа и сечението на кабелите.
Едни и същи строителни дебелини са необходими за всички шкафове 400 - 630 A.
За да се намали дълбочината на каналите с 400 mm (за 400 - 630 A шкафове), като в много случаи каналите въобще могат да се елиминират, шкафовете се монтират на бетонни основи, подготвени при изливане на пода.
Монтажът на 400 - 630 A шкафовете на основа:
- осигурява инсталация в помещения, където не е възможно прокарването на канали;
- по никакъв начин не влияе на комутационните действия в подстанцията.

За 1250 A шкафове DM1-A и DM1-W може да се предвиди двоен под.

фиксиране на шкафовете

Един към друг
Шкафовете просто се свързват един към друг с болтове за да се образува разпределителна уредба за средно напрежение (болтовете се доставени). Шинните връзки се осъществяват с помощта на динамометричен гаечен ключ наложен на 28 mN.
На пода
- При разпределителни табла, които се състоят от един до три шкафа, четирите ъгъла на разпределителното табло трябва да бъдат закрепени към пода с:
  - болтове M8 (не са доставени), които се завинтват в гайки, заложени в пода със завиждащ пистолет;
  - шпилки с резба, заляти в пода;
- При разпределителни табла, които се състоят от повече от три шкафа, броят и разположението на точките на фиксиране зависи от местните условия (заземрьсна устойчивост и т.н.). Ако е необходимо може да се фиксира всеки един шкаф.
- позицията на фиксиращите отвори b зависи от ширината на шкафовете:



a (mm)	125	375	500	625	750
b (mm)	95	345	470	595	720

Забележка: В контакторни или разединителни шкафове фиксиращите приспособления се монтират на отворената страна от комутационните устройства.

размери и тегла

тип шкаф	вис. (mm)	шир. (mm)	дълб. (mm)	тегло (kg)
IM, IMB	1600 [1]	375	940	120
IMC	1600 [1]	500	940	200
PM, QM, QMB	1600 [1]	375	940	130
QMC	1600 [1]	625	940	230
CRM	2050	750	940	390
DM1-A, DM1-D, DM1-W, DM1-Z, DM2	1600 [1]	750	1220	400
CM	1600 [1]	375	940	190
CM2	1600 [1]	500	940	210
GBC-A, GBC-B	1600	750	1020	260
NSM-кабели, NSM-шини	2050	750	940	260
GIM	1600	125	840	30
GEM[2]	1600	125	920 или 1060	30 или 35
GBM	1600	375	870	120
GAM2	1600	375	870	120
GAM	1600	500	1020	120
SM	1600 [1]	375/500 [3]	940	120
TM	1600	375	940	190

Добавете към височината:
[1] 450 mm за нисковолтово отделения за управляващи/монитори и защитни функции.
За осигуряване на равномерна фасада, всички шкафове (с изключение на GIM и GEM) могат да бъдат съоръжени с нисковолтови отделения.
[2] В зависимост от конфигурацията на шините в шкафа VM6 могат да се използват два типа разширения:
- за разширение на шкаф VM6 DM12 или DM 23 се използва разширение с сдълбочина 1060 mm]
- за други шкафове VM6 е необходима дълбочина от 920 mm.
[3] за 1250 A шкаф.

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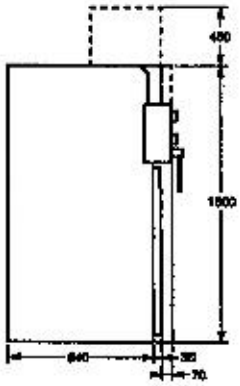
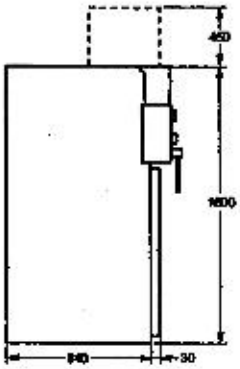
Монтаж
(продължение)

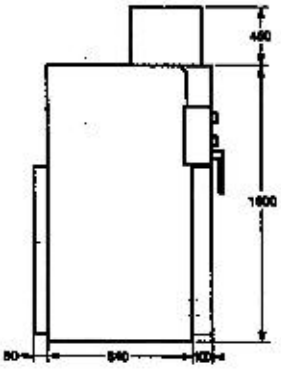
размери



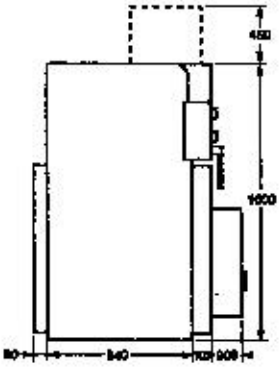
IM, IMB, PM, QM, QMB, SM



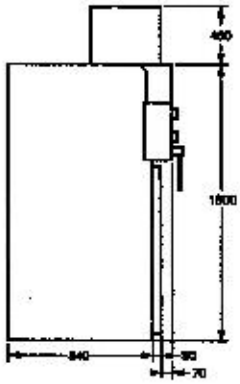
IMC, QMC, CM, CM2



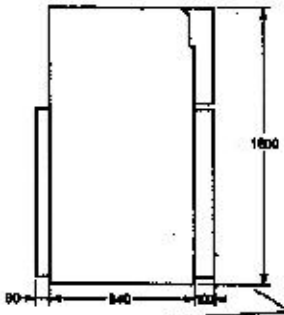
CRM



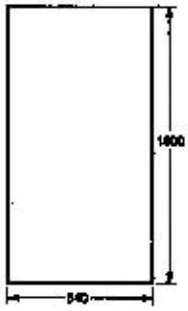
DM1-A, DM1- D, DM1- W, DM1-Z, DM2



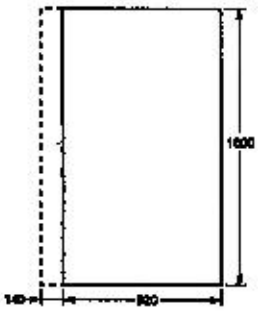
NSM-кабели, NSM-шини



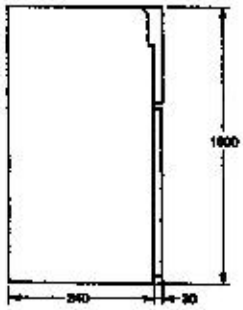
GBC-A, GBC-B



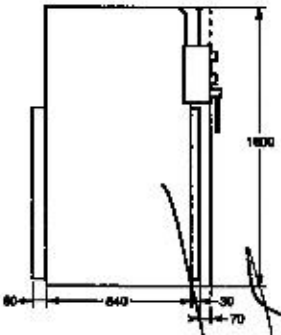
GIM



GEM



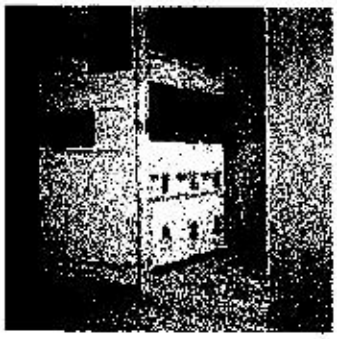
GBM, GAM2



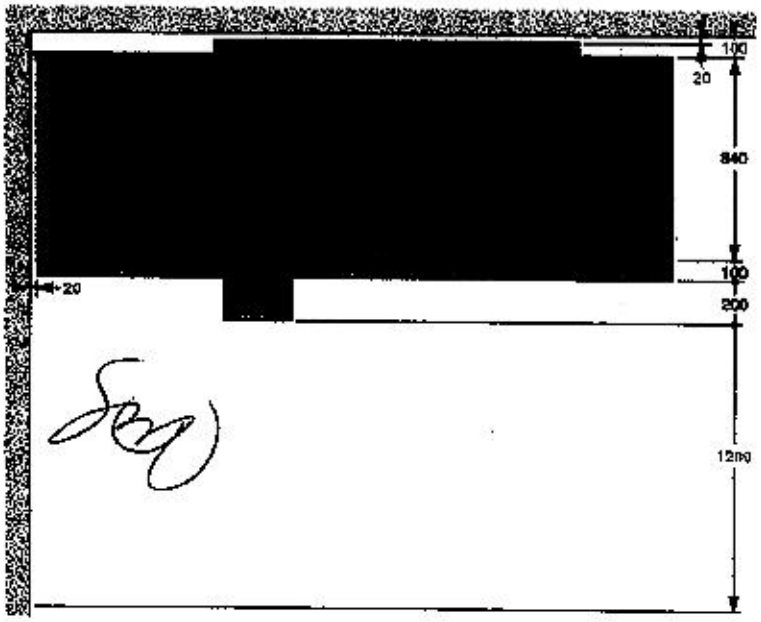
GAM

Примери на разширения и разположения VM6

Фабрично изработена подстанция Bocage



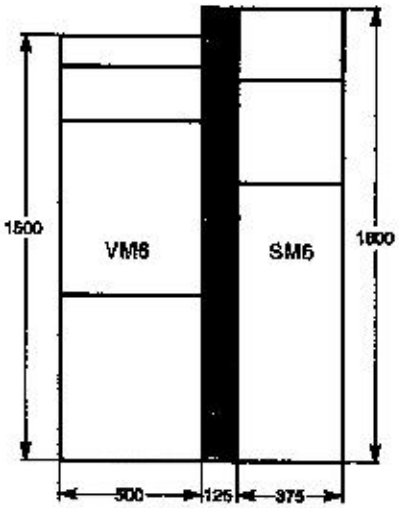
конвенционална тухлена подстанция



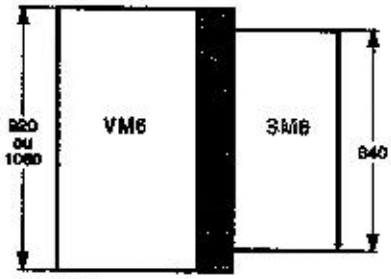
минимални необходими размери (mm)

примерно разширение на разпределително табло VM6

Размери при изглед отпред



Размери при изглед отдолу



разпределително табло - поглед отпред

14

SM6

MV distribution
factory built assemblies
at your service

Anglais

civil engineering guide

for 400–630A cubicles

MERLIN GERIN
mastering electrical power
GROUPE SCHNEIDER

contents

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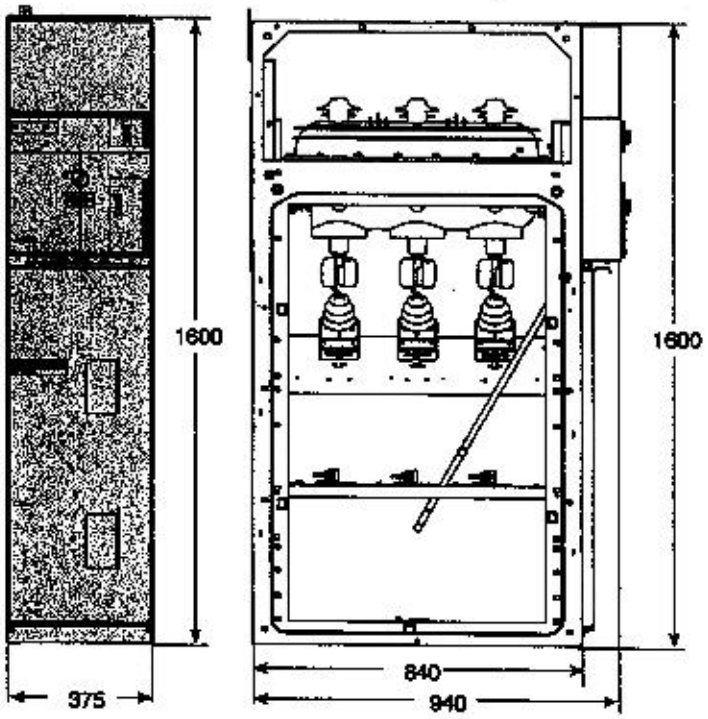
375 mm wide cubicles

IM



type of cubicle	height (mm) (1)	width (mm)	depth (mm)	weight (kg)
IM, IMB	1600	375	940	120
PM,QM, QMB	1600	375	940	130
CM	1600	375	940	190
GBM	1600	375	940	120
GAM2	1600	375	940	120
SM	1600	375	940	120
TM	1600	375	940	190

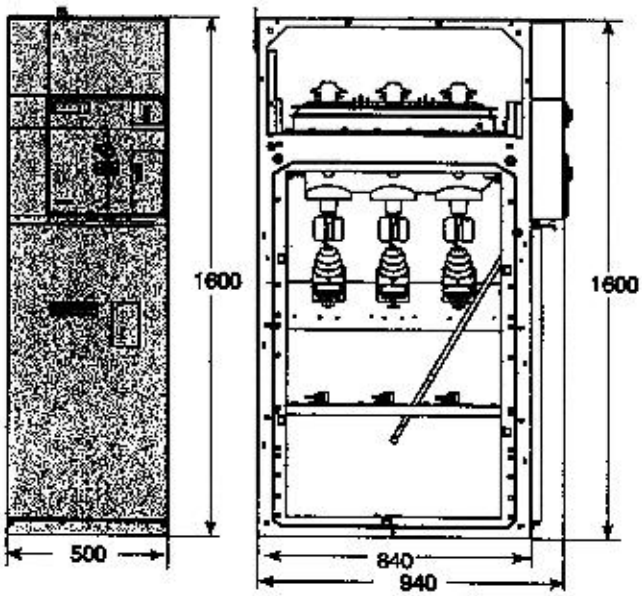
Add to height:
(1) 450 mm, if low voltage case for protection and control/monitoring.

To obtain a homogeneous switchboard, all the cubicles (except for GIM and GEM) can accommodate a LV case.

153

500 mm wide cubicles

IM



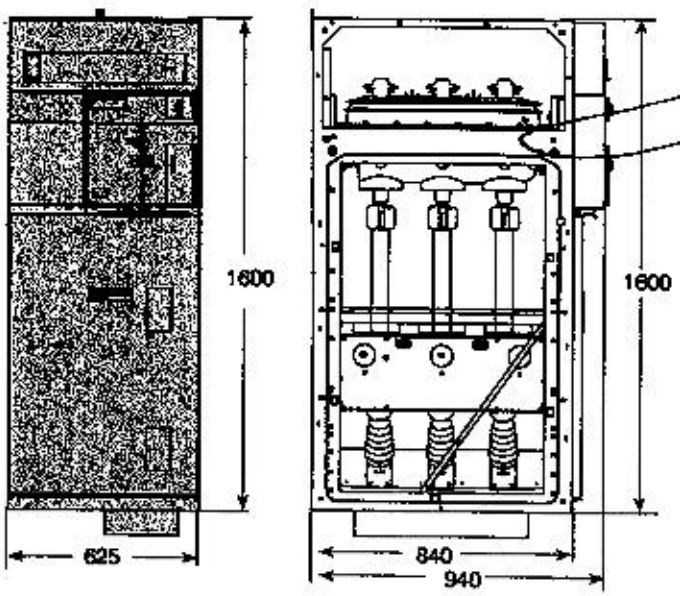
type of cubicle	height (mm) (1)	width (mm)	depth in (mm)	weight (kg)
IM, IMB	1600	500	940	200
QM	1600	500	940	150
CM2	1600	500	940	210
GAM	1600	500	1020	120
SM	1600	500	940	120

Add to height:
(1) 450 mm, if LV case for protection and control/monitoring.

To obtain a homogeneous switchboard, all the cubicles (except for **QIM** and **GEM**) can accommodate a LV case.

625 mm wide cubicles

QMC

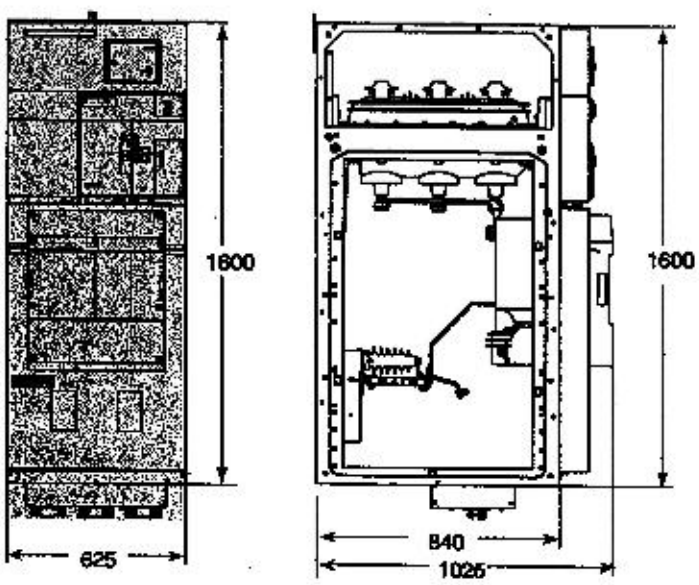


type of cubicle	height (mm) (1)	width (mm)	depth in (mm)	weight (kg)
QMC	1600	625		230

154

625 mm wide cubicles

DMV–S



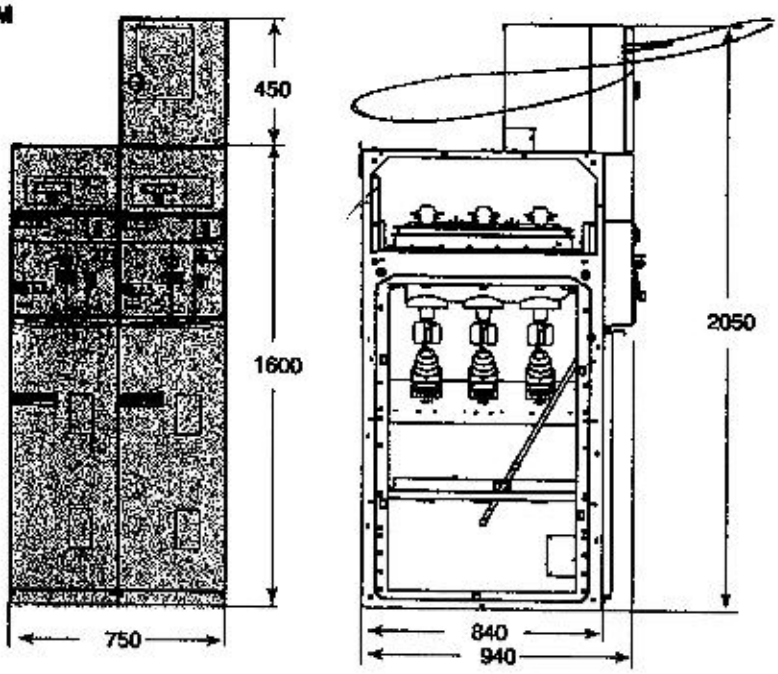
type of cubicle	height (mm) (1)	width (mm)	depth in (mm)	weight (kg)
DMV–S	1600	625	1025	260
DMV–A, DMV–D	1680	625	1025	340

Add to height:
(1) 450 mm, if LV case for protection and control/monitoring.

To obtain a homogeneous switchboard, all the cubicles (except for **GIM** and **GEM**) can accommodate a LV case.

750 mm wide cubicles

NSM

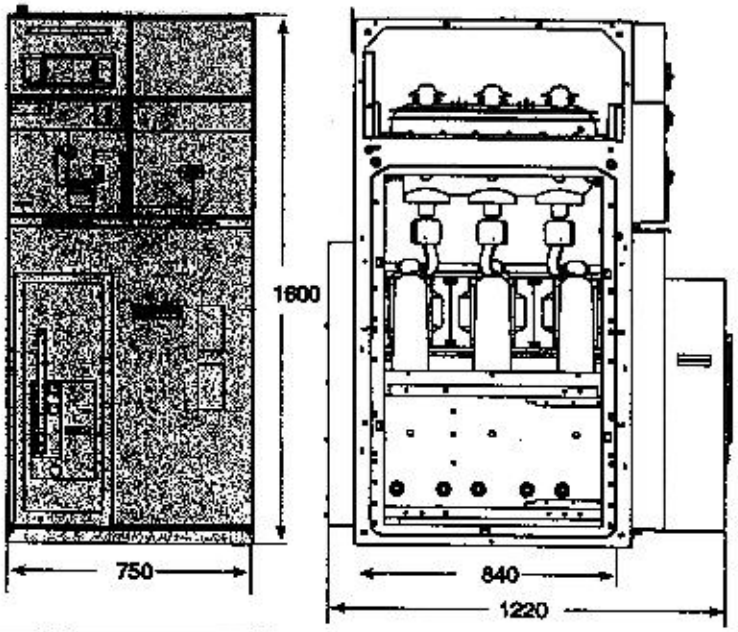


type of cubicle	height (mm) (1)	width (mm)	depth in (mm)	weight (kg)
NSM–cables/ NSM–bars	2050	750	940	260

155

750 mm wide cubicles

DM1–A



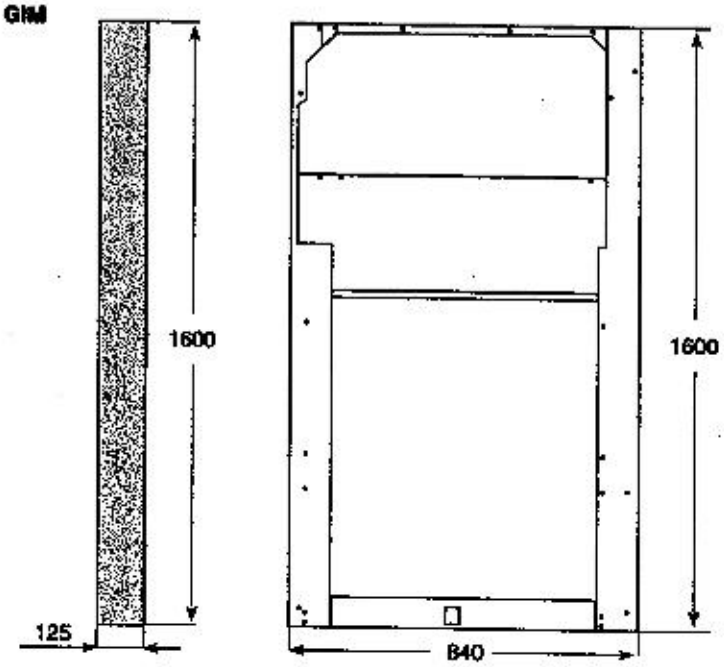
type of cubicle	height (mm) (1)	width (mm)	depth in (mm)	weight (kg)
CRM	2050	750	940	390
DM1–A,DM1–D DM1–W,DM1–Z,DM2	1600 (1)	750	1220	400
DM1–S	1600 (1)	750	1220	260
GBC–A, GBC–B	1600 (1)	750	1020	290

Add to height:
(1) 450 mm, if LV case for protection and control/monitoring.

To obtain a homogeneous switchboard, all the cubicles (except for **GIM** and **GEM**) can accommodate a LV case.

125 mm wide cubicles

GIM

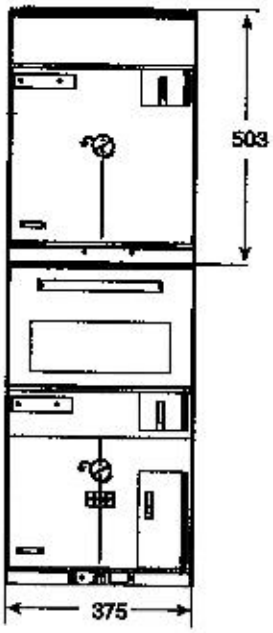


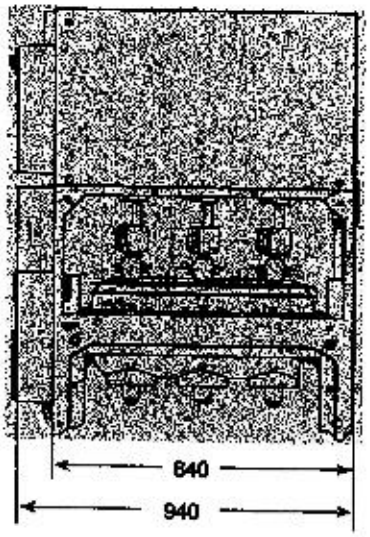
type of cubicle	height (mm) (1)	width (mm)	depth in (mm)	weight (kg)
GIM	1600	125	840	30
GEM	1600	125	920/1060*	30/35*

*for VM6 extension/1060 mm depth, 35 kg circuit-breaker

EMB function

Installed on 630A cubicles.
IM 375mm or DM1-A
(except if LV case
or compartment with top cable
connection is already installed).





type of cubicle	height (mm) (1)	width (mm)	depth in (mm)	weight (kg)
EMB	503	375	940	70

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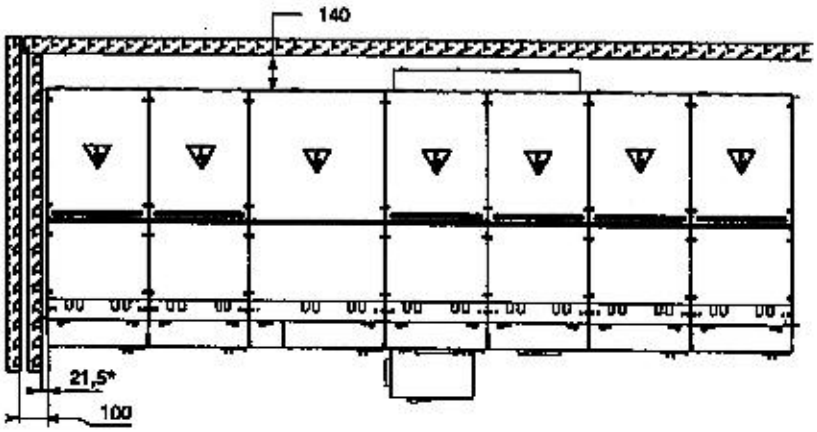
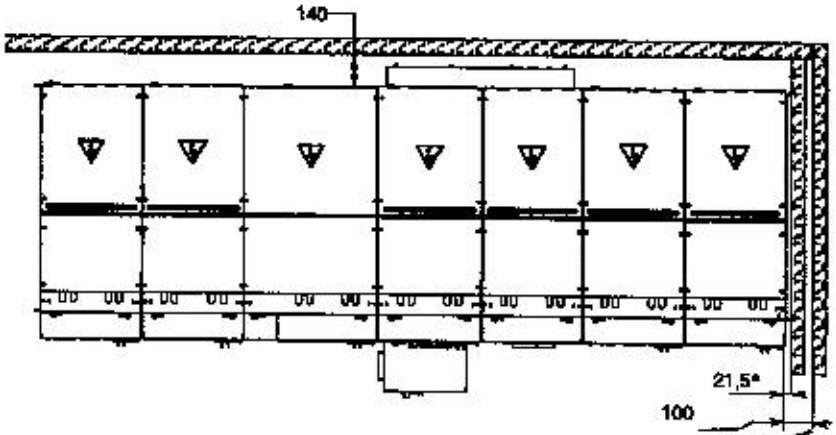
layout in the substation



Installation of switchboard to the right of the wall.
(*) minimum dimension to ensure proper operation of device.



Installation of switchboard to the left of the wall.
(*) minimum dimension to ensure proper operation of device.

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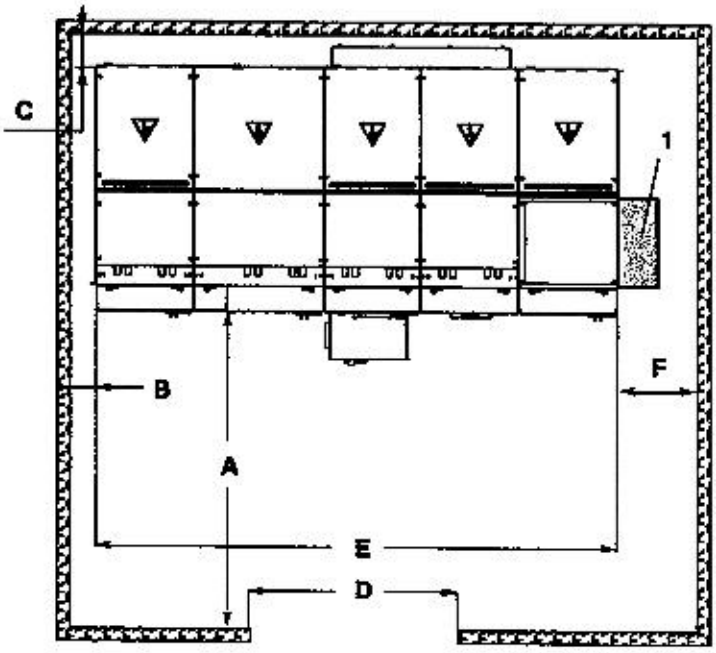
surface required for operation and maintenance

1 : wiring riser trunking option



A : this dimension must be equal to 1200mm for the **Circuit-breaker** extraction operation.

B : this dimension varies from 21.5 to 100 mm

C : the minimum dimension is 140 mm

D : access to substation: this dimension varies according to switchboard composition: 750 mm wide circuit-breaker cubicle

E : this dimension depends on the functional units making up the switchboard

F : dimension identical to **B** except if wiring riser trunking option.

In this case F=300 mm.

standard cubicle

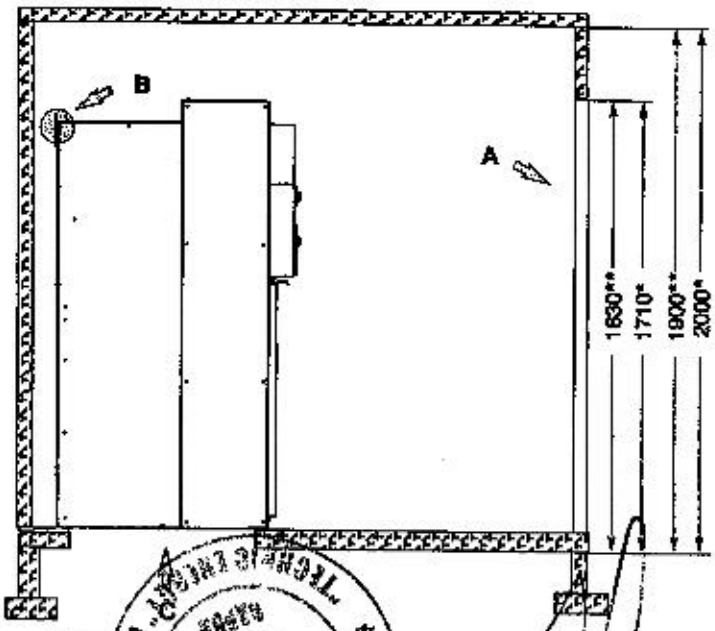
A ; access to substation

B : earth busbar

C : reserved space for MV cable insertion

Recommendation:
*minimum dimension (in mm) with the wiring
or Sepam trunking option (series 20)** minimum dimension without option

NB: these dimensions must be increased by 350 mm with base option!



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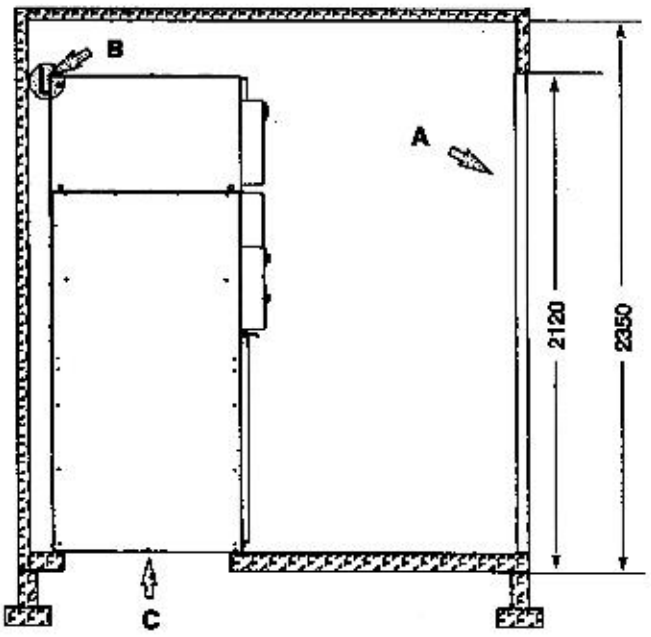
cubicle with EMB

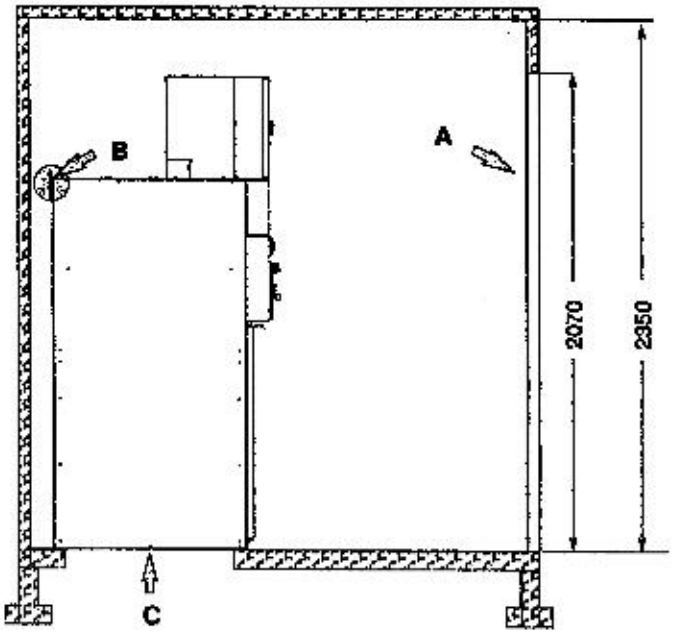
A ; access to substation
B : earth busbar
C : reserved space for MV cable insertion

NB: these dimensions must be increased by 350 mm with base option.



cubicle with LV case

(e.g.: NSM type)
A : access to substation
B : earth busbar
C : reserved space for MV cable insertion
NB: these dimensions must be increased by 350 mm with base option.



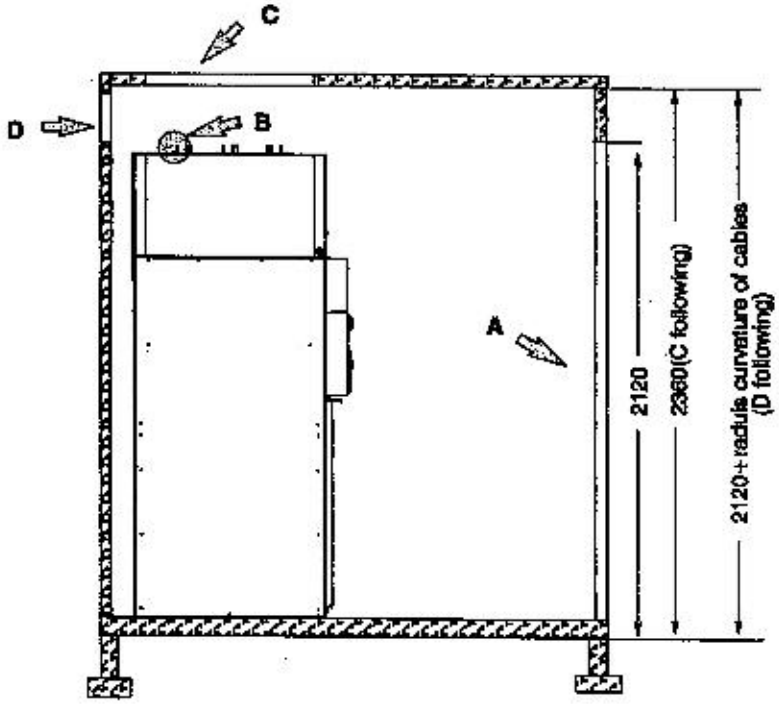
top cable connection of compartment

A : access to substation
B : earth busbar
C : insertion of cables by the top
D : insertion of cables by the rear or side

Height of substation must allow for the radius of curvature of cable cross–section.

see paragraph:
Civil engineering with duct

NB: these dimensions must be increased by 350 mm with base option.



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reminder

Recommendation for environmental withstand.

Under certain climatic conditions, the condensation phenomenon may occur.

By simple means it is possible to enhance the behaviour of MV substations and to minimise the risk of appearance of condensation and thus of corona discharge phenomena.

- main factors may be responsible for this phenomenon:

1 substation architecture (dimension and replacement of ventilation systems, type of materials used).

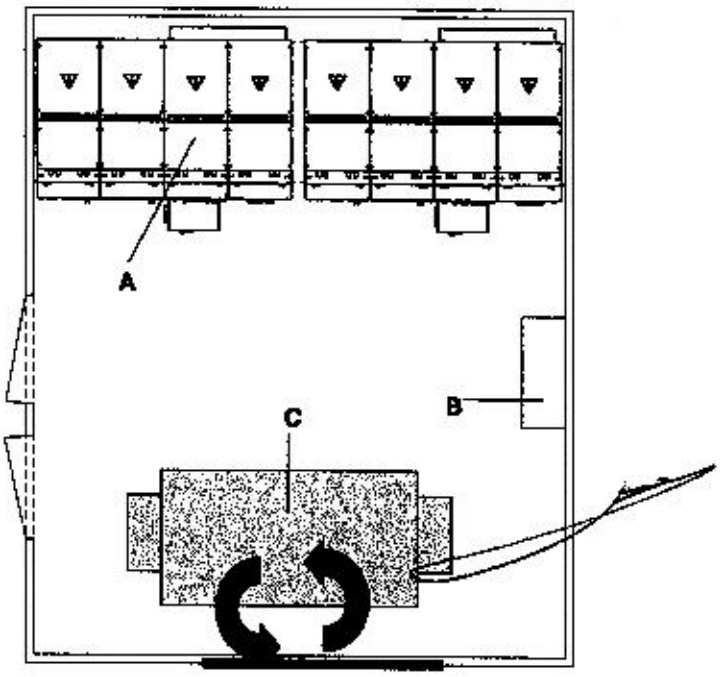
2 climatic environment of MV/LV (very damp area, fog, precipitation, orientation and pollution)

3 technology and/or implementation of cable ends

environmental details

A : MV switchboard
B : LV enclosure
C : transformer

ventilation area
Top and Bottom



solutions

1 substation architecture:

adapt ventilation cross-section to power loss in the substation to minimise temperature differences.

Eliminate ventilation in the environment in the immediate vicinity of the MV modular switchboard.

Encourage suitable ventilation (top and bottom) by convection around the transformer.

2 the HV/LV substation environment:

guarantee tightness of the substation and of the cable pits.

Provide baffle type ventilation systems to limit direct penetration.

Install anti-condensation resistances in the cubicles

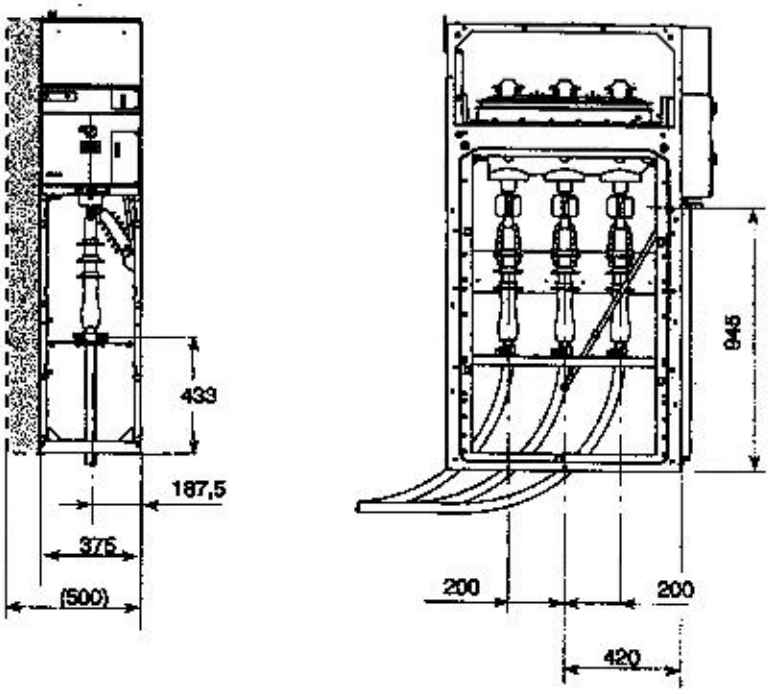
Cable ends:

incorrect implementation of cold technology cable ends will result in dielectric stresses that will also generate the corona discharge phenomenon in harsh conditions.

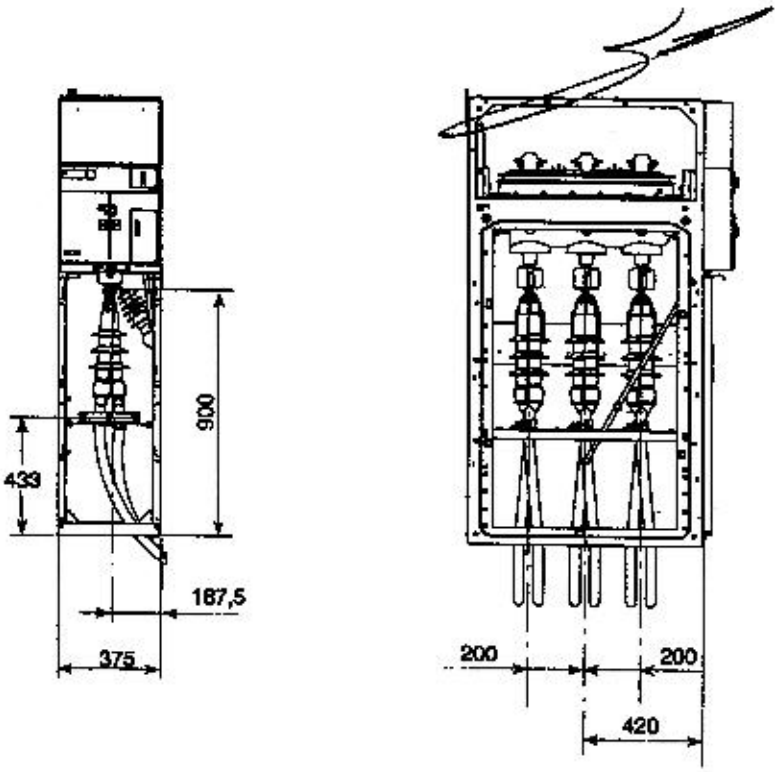
switch cubicle

IM, IM(500), SM, NSM

single–core dry cables with short ends

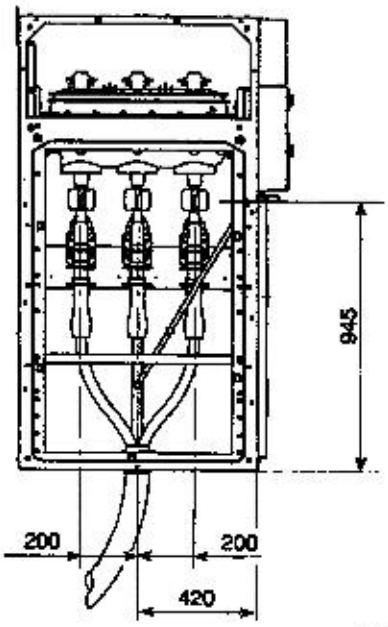


2 single–core dry cables per phase



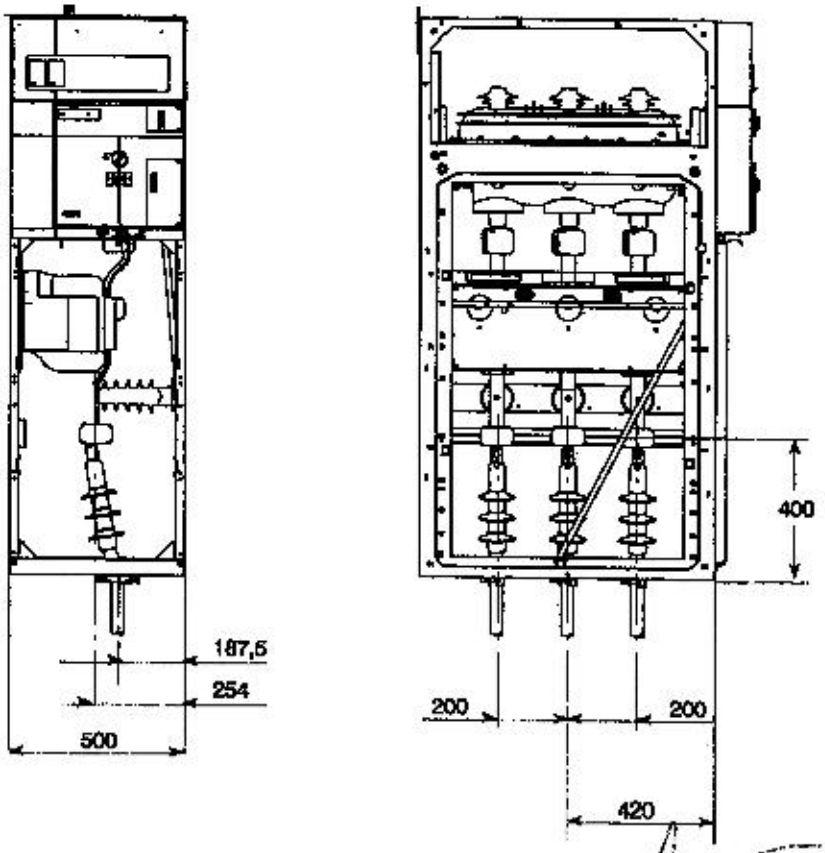
switch cubicle
IM, IM(500), SM, NSM

three–core dry cables with short ends



switch cubicle with CT
IMC cubicle

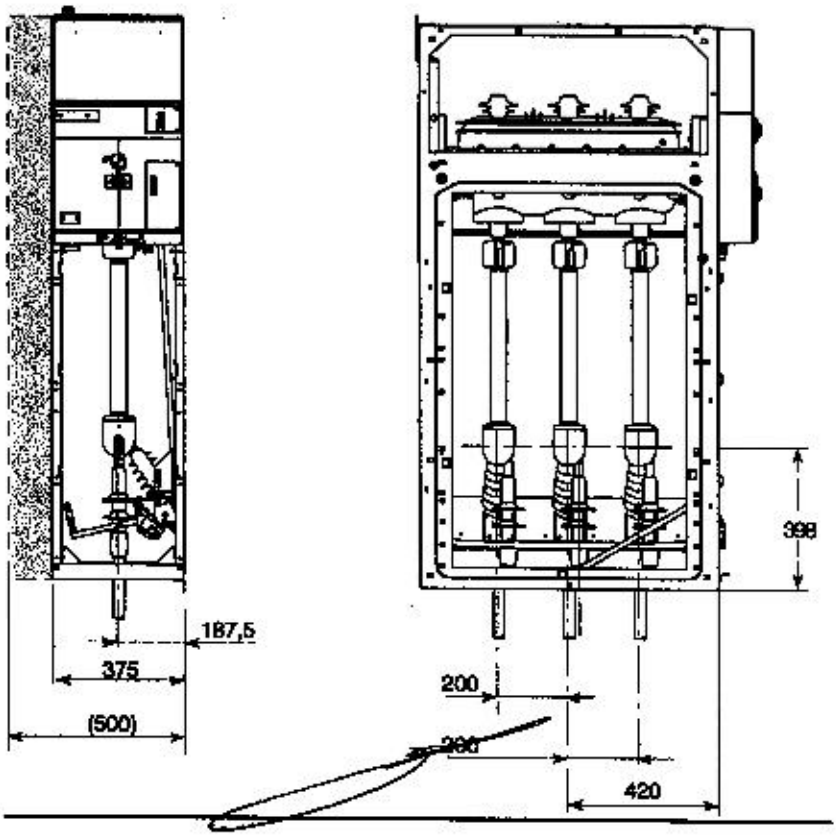
single–core dry cables with short ends



fuse–switch cubicles

PM, QM, QM(500) cubicle

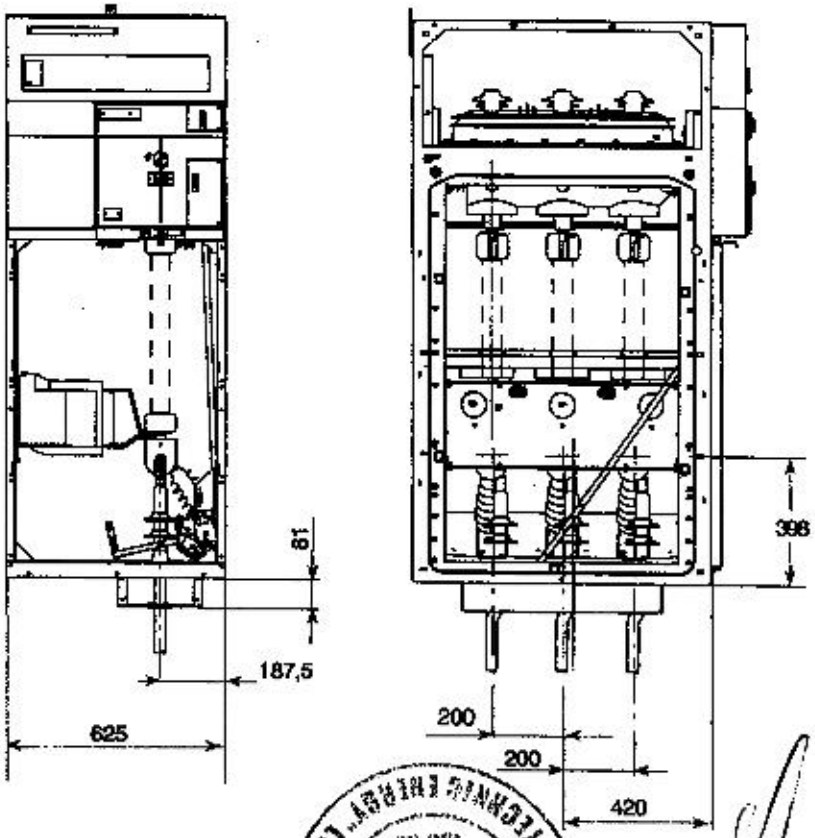
single–core dry cables with short ends



transformer protection with CT

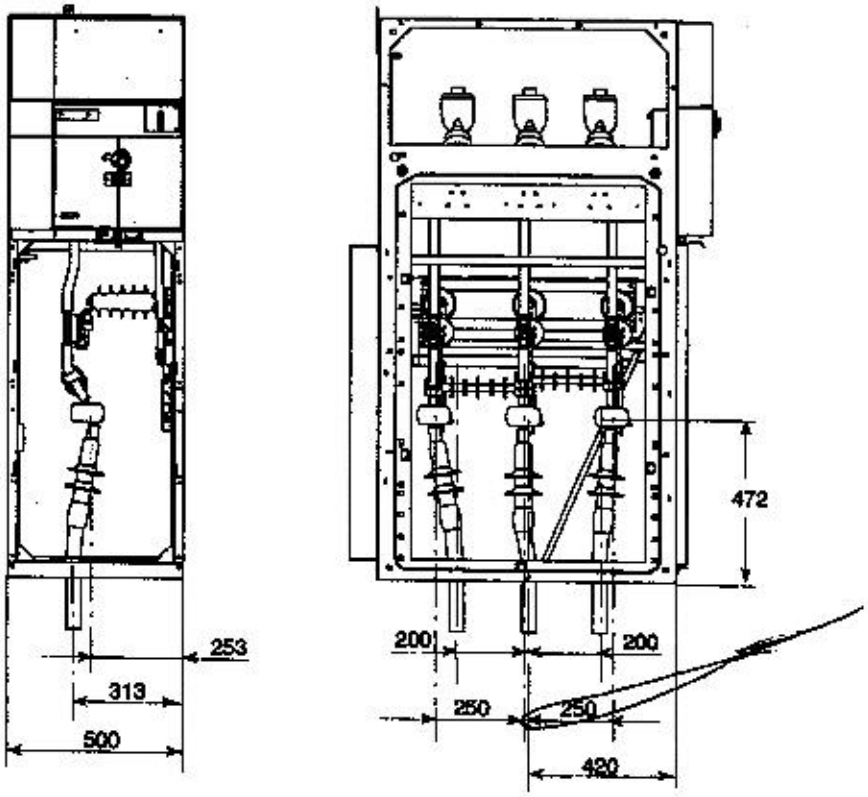
QMC cubicle

single–core dry cables



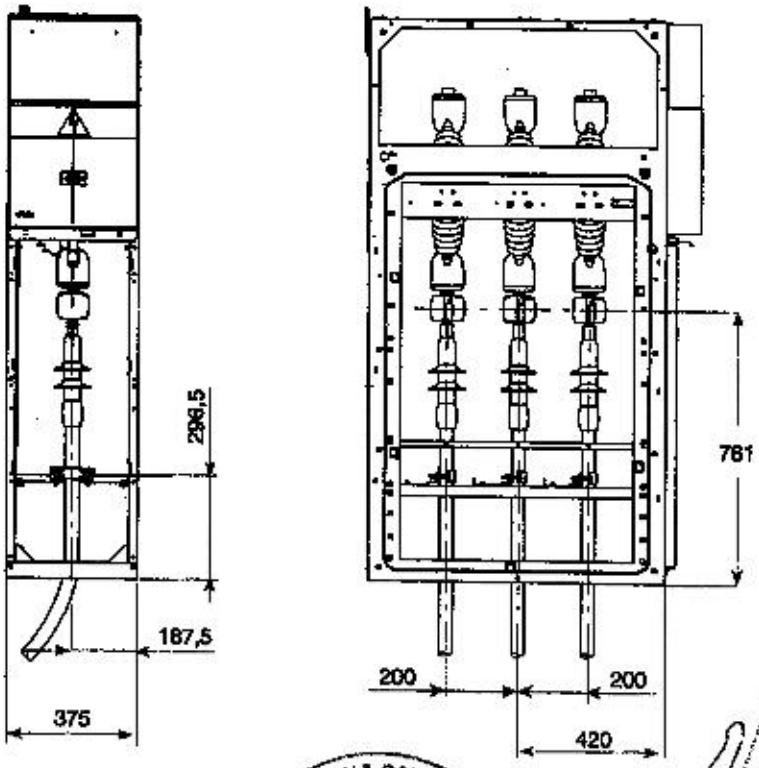
GAM cubicles

single–core dry cables
with short ends



GAM2 cubicles

single–core dry cables
with short ends



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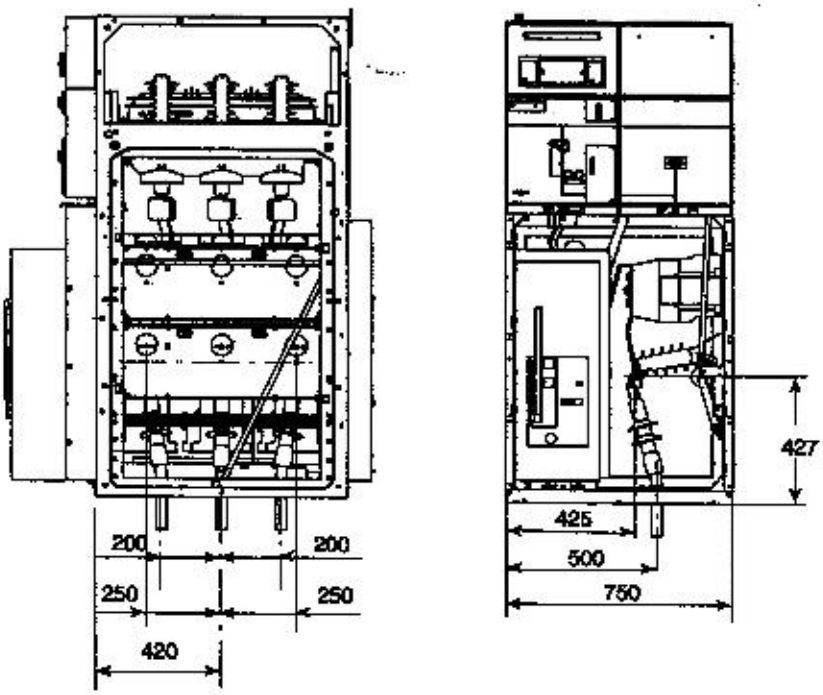
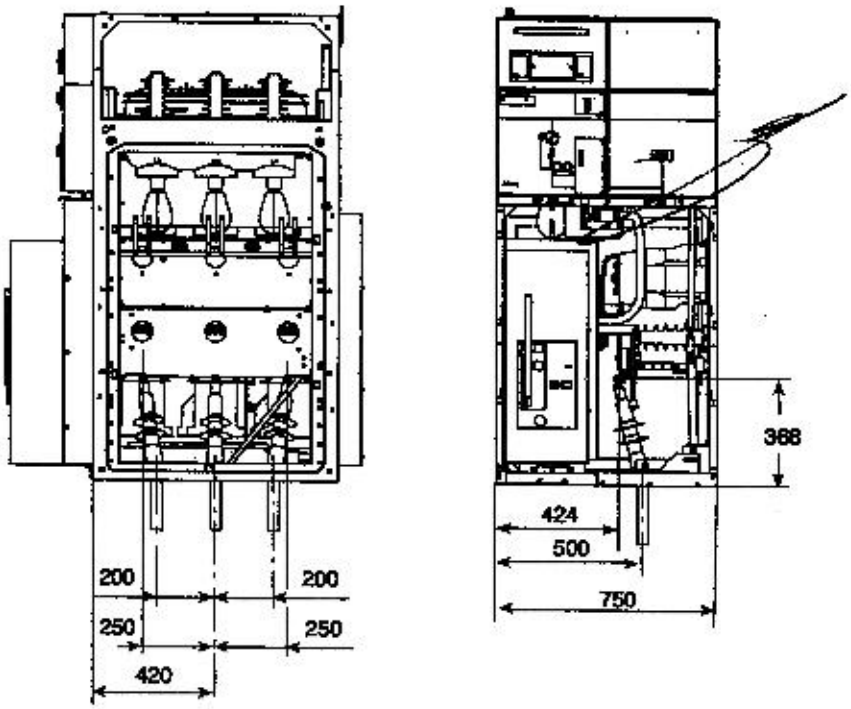
DM1 – A circuit–breaker cubicles

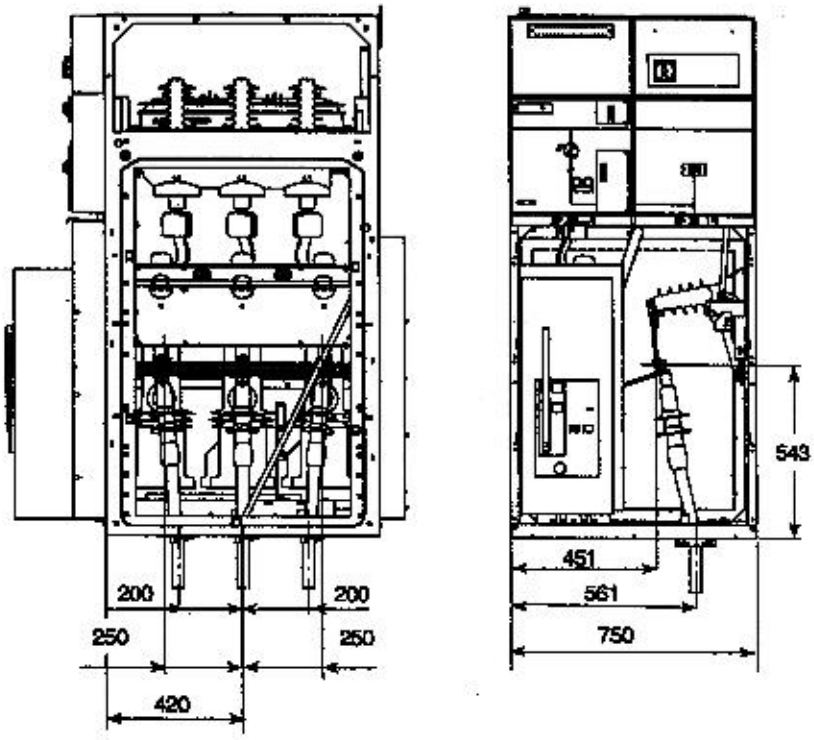
single–core dry cables with short ends



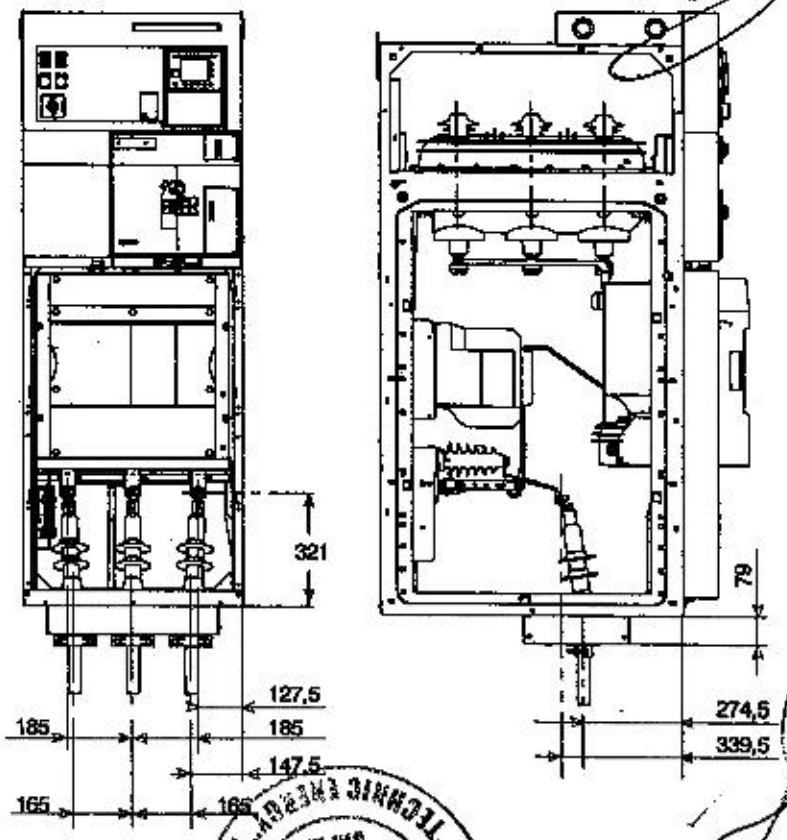
DM1 – W circuit–breaker cubicles



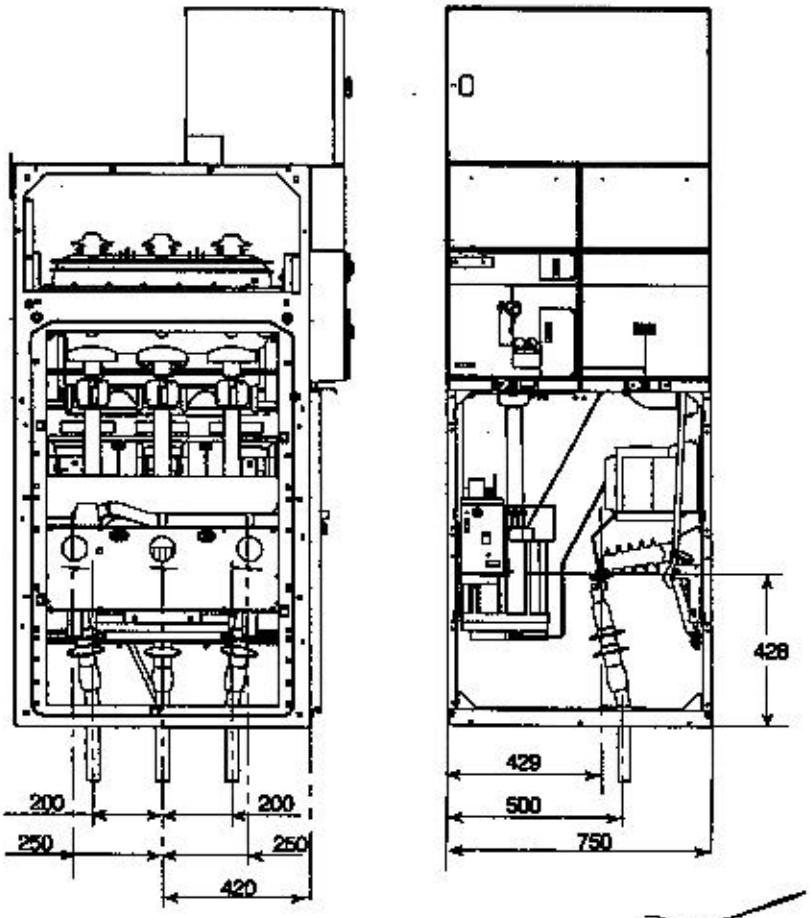
DM1 – S circuit – breaker cubicles



DMV – A, DMV – S circuit – breaker cubicles



CRM circuit–breaker cubicles



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bottom connection of cables

depth of ducts according to cables

400–630A cubicles

cablecross–section (mm²)	radius of curvature	IM, SM, NSM–cables NSM–bars	IMC, CRM, DM1–A, DM1–W, GAM, DM1–S	PM, QM, QMC (1)
		depth D (mm) all directions		
		P1	P2	P3
50	370	140	400	350
75	400	150	430	350
95	440	160	470	350
120	470	200	500	
150	500	220	550	
185	540	270	670	
240	590	330	730	
300	692	430	830	

(1) for QMC: D3=450 mm

NB: to determine the depth D of a simple switchboard duct, you need to consider the cubicle and the cables that call for maximum depth.

For a double duct, you must allow for each depth D by type of cubicle and orientation of cables.

bottom connection

All cubicles:

- **with duct**

The depth D of ducts is given opposite for standard cables of the single–pole dry type (for three–pole cables, **consult us**).

- **with raising**

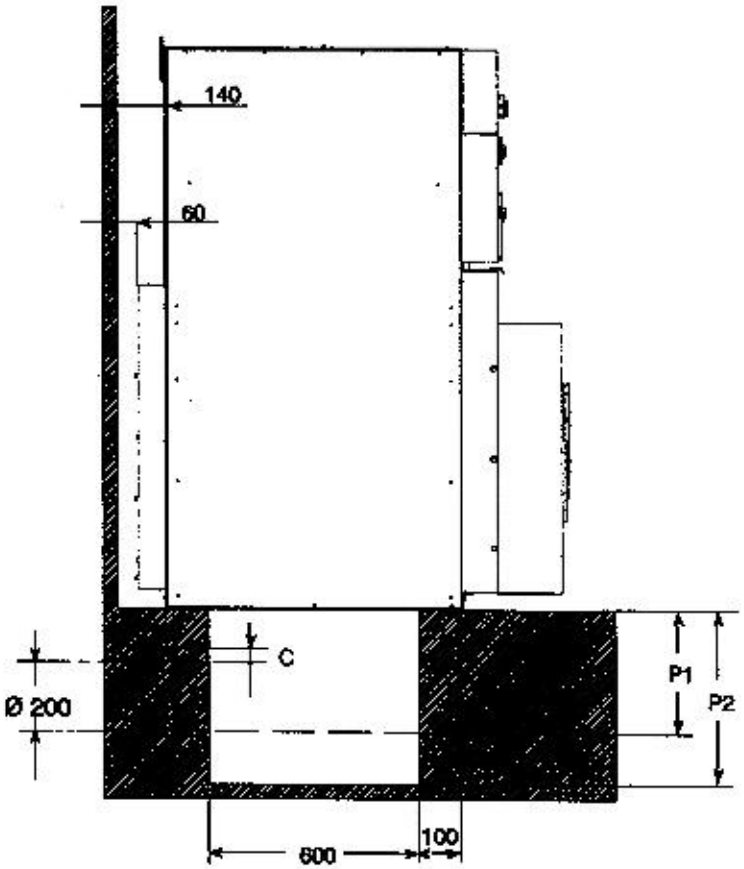
Elimination or reduction of the duct is achieved either by installing a raiser (supplied as an option) or by placing cubicles on a 350 mm concrete base.

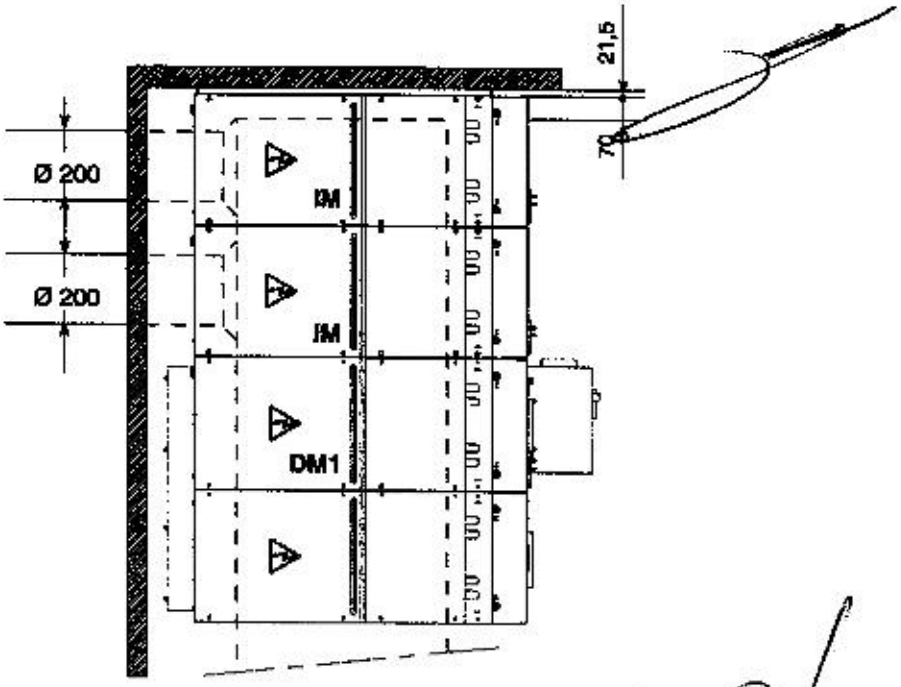
Caution: if the switchboard has a **DM1–W** cubicle, provide a circuit–breaker extraction truck (option).

NB: for connection with nozzles, the chamfer **C** must comply with the following dimensions:
D1 = 375 mm or **D2/D3**=150 mm

duct drawing

Incomer or feeder via the rear with nozzles.





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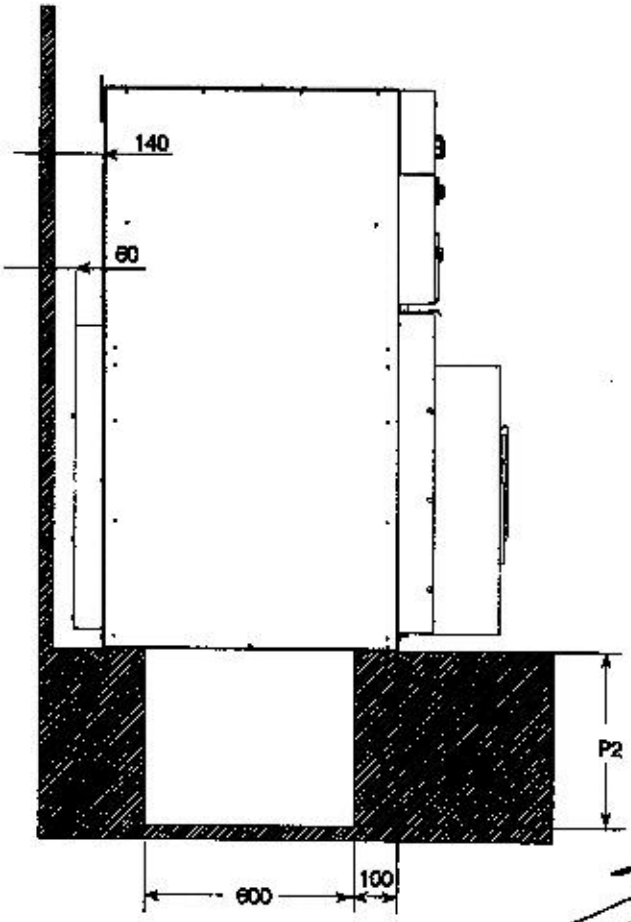
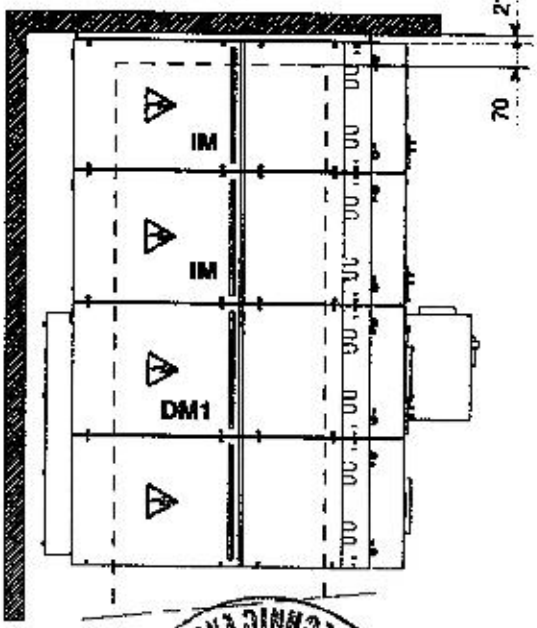
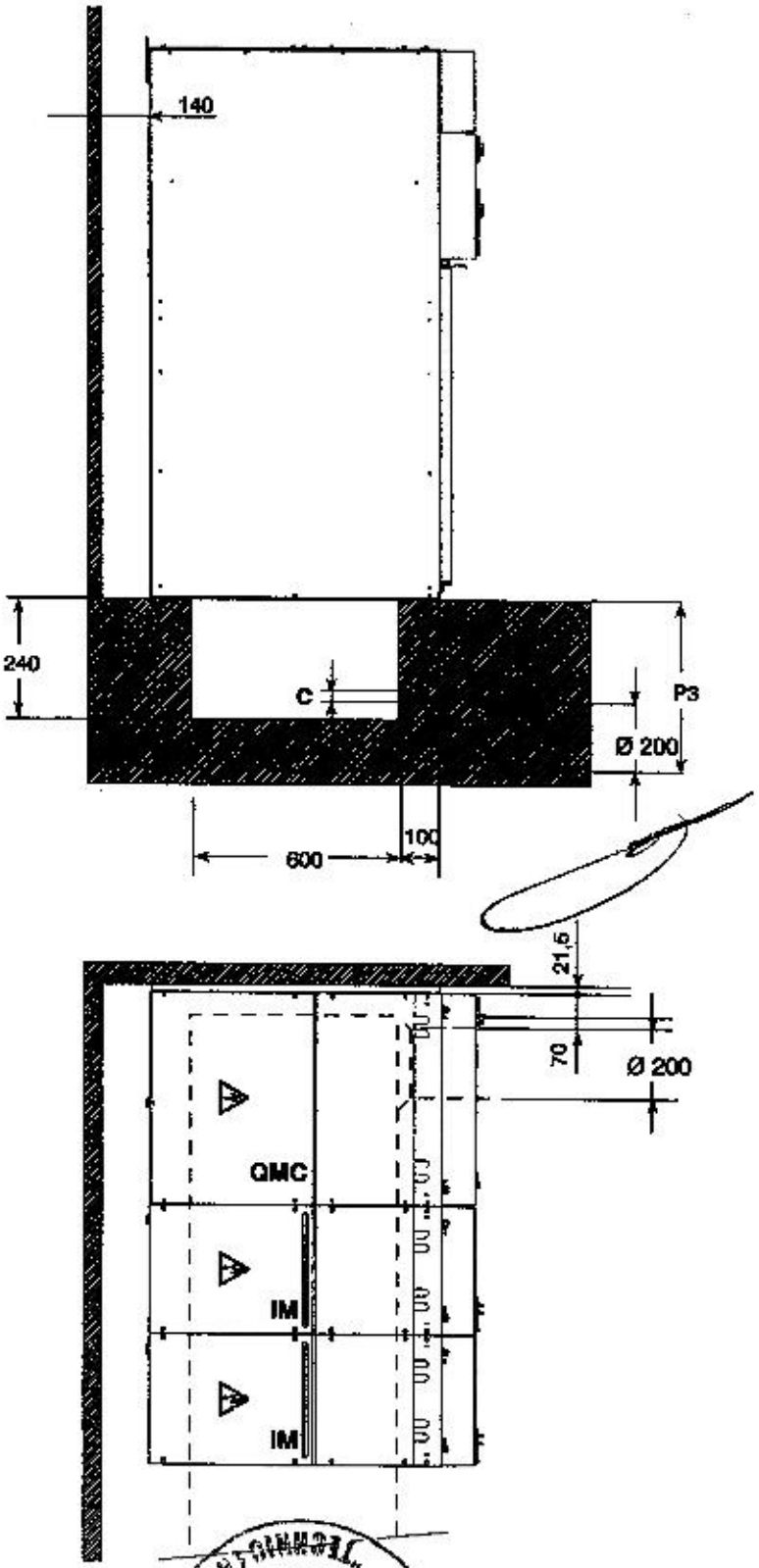
Side left or right incomer or feeder.





Front incomer or feeder with nozzles.



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preparing the floor

The cubicles are placed on a standard quality concrete floor, with or without duct, as per cable cross-section and type.

Civil engineering is the same for all 400–630A cubicles.

To reduce by 350 mm the depth of the ducts of 400–630A cubicles (thus enabling their elimination in many cases), you can raise cubicles by placing them on a concrete base produced by civil engineering.

Cubicle raising:

- used to install cubicles in premises where ducts cannot be dug
- does not obstruct substation operations

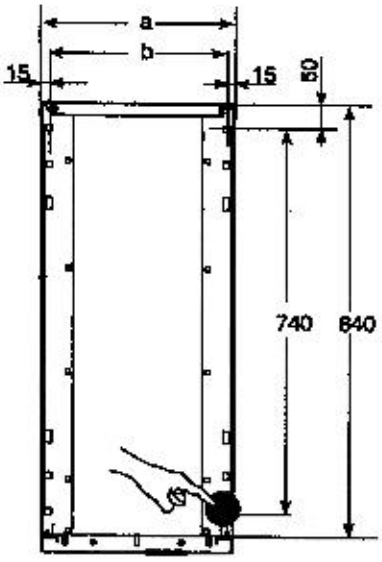
cubicle fastening

with one another

The cubicles making up the substation are secured to one another by bolts (screws delivered with the cubicles).

fastening the cubicles to the floor

4 holes 12.5x12.5 per cubicle



NB: for circuit-breaker and contactor cubicles, fastening is on the side opposite the switchgear.

a (mm)	125	375	500	625	750
b (mm)	95	345	470	595	720

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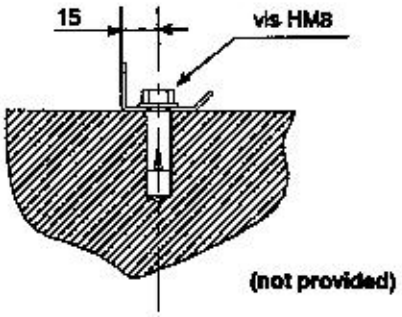
- for a switchboard of 3 cubicles or less, the 4 corners of the switchboard are fastened by:
  - M8 screws (not supplied) that are fastened in a nut fitted using a striking device,
- or a floor threaded rod

- for a switchboard with more than 3 cubicles, the fastening points must be determined according to installation requirements (earthquake withstand, etc.),each cubicle can be fastened to the floor.
- position of fastening holes (b) as per cubicle width (a).

fastening example



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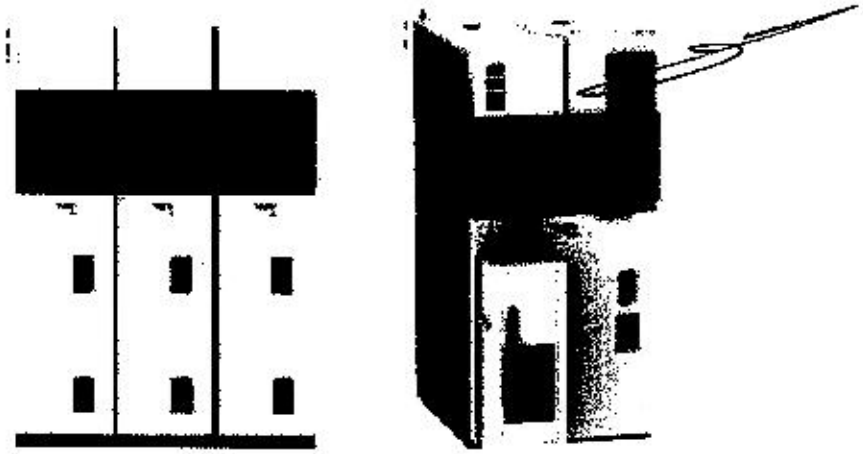
КЛИЕНТ: ЧЕЗ България

ПРОЕКТ: УЧАСТИЕ В ТЪРГ С ПРЕДМЕТ – ДОСТАВКА НА МОДУЛИ ЗА КРУ

ЧАСТ: ЕЛЕКТРО



Доставка на електрооборудване Ср.Н. тип **SM6**

Техническо описание

Schneider Electric

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ОБЩА ЧАСТ

Настоящата оферта е разработена на база на Идеен проект за изграждане Завод за механично и биологично третиране на битови отпадъци в София.

Офертата включва:

Доставката на КРУ 20kV

1. КОМПЛЕКТНА РАЗПРЕДЕЛИТЕЛНА УРЕДБА 20 KV ТИП SM6

Общи характеристики

Предлаганите КРУ са от типа SM6.

SM6 е модулно комплектно разпределително устройство за закрит монтаж с метален корпус предназначено за изграждане на разпределителни уредби СН.

Конструкцията на SM6 отчита трите категории изисквания на потребителите:

- Надеждност необходима за обезпечаване на непрекъснатост на захранването
- Простота на монтаж, експлоатация и поддръжка,
- Безопасност на обслужващия персонал

За уредбите са използвани следните типове шкафове от гамата SM6:

КРУ *20kV:*

- **QM 375** шкаф с SF6 разединител и предпазители – приложение: защита на трансформатор
- **IM 375** шкаф с SF6 разединител – приложение: свързване към мрежата с кабели средно напрежение.

Гамата SM6 обхваща функционални модули състоящи се от:

- Метален шкаф с въздушна изолация,
- Фиксирана или изваждаема апаратура с SF6 като дъгогасяща среда (мощностни разединители, прекъсвачи, контактори)

SM6 предлага редица съществени предимства при удовлетворяването дори на най-строгите изисквания :

- Всички дейности по монтажа и пускането в експлоатация могат да се осъществят от предната страна на всеки шкаф, което позволява монтажът на уредбата до стена
- Лесно разширение на уредбата и повишена надеждност поради използването на заводски изготвени функционални модули предназначени за съвместна работа,

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- Много ниски разходи по подръжка и обслужване.
- Проста и сигурна работа посредством цветни мнемо-схеми и вградени защитни функции и блокировки.

Стандарти

Предлаганото оборудване е проектирано и произведено в съответствие със следните стандарти на IEC:

• Общи изисквания за оборудване високо напрежение	IEC 60694
• КРУ за високо напрежение с метален корпус	IEC 62271-200
• Прекъсвачи за високо напрежение	IEC 62271-100
• Токови трансформатори	IEC 60044-1
• Напреженови трансформатори	IEC 60044-2
• Защитни релета	IEC 60255
• Разединители и заземители	IEC 62271-102
• Индикатори за наличие на напрежение	IEC 60598

Заземяване

Заземяване на кабелите :

Заземяването на кабелите се осъществява посредством заземител снабден с блокировки разположен в кабелния отсек и задвижван от лицевия панел на шкафа. Възможността за задвижването му зависи от положението на силовия апарат или изваждаемата част.
За конкретни случаи се прилагат блокировки с ключове.

Изпитания

Гамата SM6 е преминала следните типови изпитания съгласно IEC 298:

- Диелектрични изпитания
- Загряване
- Механична устойчивост
- Електродинамична и термична устойчивост на к.с.
- Работа в среда с повишена влажност

Предимства

Всички шкафове имат единична дълбочина. Те могат да се монтират до стена върху проста строителна конструкция.

За ръчно задвижване на апаратите са необходими малки усилия.

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Последователността на операциите е илюстрирана със символи върху лицевия панел.

Блокировки и възможности за заключване предпазват оператора от погрешни манипулации.

Подръжката се свежда до прости проверки, почистване и смазване на всеки 5 до 10 години.

Безопасност

Всички операции се извършват от предната страна на шкафа.
Няколко допълнителни нива на защита предпазват оператора:

- Ефективни механични и електрически блокировки предотвратяващи погрешни операции.
- Индикаторите са положението са разположени на лицевия панел до задвижващия механизъм на заземителя
- Заземителят се задвижва от анти-рефлексен механизъм и е с възможност за включване на к.с.

Антикорозионни покрития и боядисване

За обезпечаване на работата на оборудването при тежки климатични условия са предвидени следните мерки:

- Видимите външни части на са направени от поцинкована стоманена ламарина (дебелина на покритието : 3 µm)
- Боядисаните части предварително се почистват и преминават фосфатна обработка. Самото боядисване прахово с полимерна епоксидно-полиестерен прах (средната дебелина на покритието е 50 µm). Цветът е **RAL 9002** (бял)
- За всички останали повърхности се използва горещо поцинкована ламарина (средна дебелина на покритието 20 µm) преминала пасивиране с хром.

Нормални работни работни условия

Нормалните работни условия в съответствие с IEC 694 за оборудване за монтаж на закрито са:

Архитектура	В метален корпус, с въздушна изолация
Степен на защита	IP2X
Нормални работни условия:	За монтаж на закрито

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• Температура:	
- минимална	- 5°C
- максимална	+40°C
- средна за 24 часа	+35°C
• Надморска височина	> 1000 m
• Атмосфера:	С малко прах, дим, агресивни или запалими газове, пари или сол
• Влажност	
-за 24 часа	< 95 %
- за 1 месец	< 90 %

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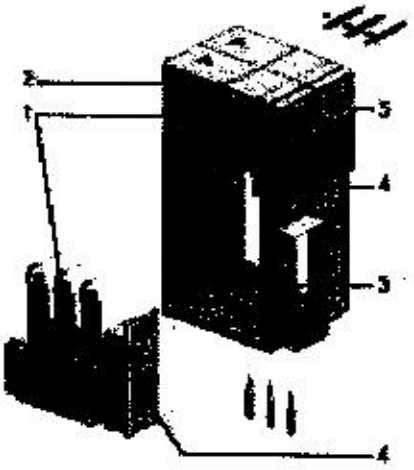
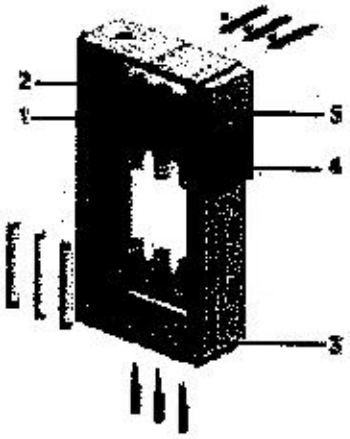
Шкафове

Шкафовете SM6 са с метален заземен корпус в съответствие с дефиницията на IEC 298 за тип "metal enclosed"

Те имат 3 функционални отсека :





Отсек за апаратура и кабелни присъединения

Този отсек съдържа следното::

- Комутационния апарат
- Механизмаза задвижване
- Куплунг за оперативните вериги
- Планките за свързване на кабелите или долни изходни шини
- Капацитивни делители на напрежение за индикаторите за наличие на напрежение
- Заземителя
- Токовите трансформатори / токови сензори за защити VIP

Отсек за сборни шини

- Сборните шини
- Шинния разединител в корпус от епоксидна смола запълнен с елегаз (той разделя шинния отсек от отсека за силовата апаратура и кабелните присъединения). Разединителят служи и за основа за закрепване на сборните шини

Релеен отсек

- Мнемо-схема

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- Оперативна апаратура
- Цифрова защита SEPAM

Заводски изпитания

Заводските изпитания в съответствие с изискванията на IEC включват следното:

- Проверка на съответствието с чертежите и схемите на свързване,
- Проверка на механичната функционалност и блокировките,
- Проверка на взаимозаменяемоста на изваждаемите части,
- Диелектрични изпитания с повишено напрежение с промишлена честота. След монтаж на площадката в съответствие с изискванията на IEC сборните шини се изпитват с 80% от номиналното изпитателно напрежение
- Диелектрични изпитания на оперативните вериги,
- Електрическа функционалност на оперативните вериги.

Сертификати

SCHNEIDER ELECTRIC има изградена система за управление на качеството в съответствие с изискванията на ISO 9001:2000

Характеристики на шкафовете

ЕЛЕКТРИЧЕСКИ ХАРАКТЕРИСТИКИ КРУ - 20 kV :

Работно напрежение	kV	20
Изолационно ниво :		
Номинално напрежение	kV	24
Приложено напрежение с промишлена честота	kV rms	50
Импулсно изпитателно напрежение (1,2 / 50 µs)	kV peak	125
Оперативни вериги и клеми	kV/1min.	2
Номинална честота :	Hz	50
Краткотраен ток :		

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За оборудването:	kA	16/1s
За прекъсвача	kA	16/1s
Ударен ток	kA peak	40
Номинален ток на шините	A	630

Шини

Материал: Изолирани медни тръбни

Размер: 630A

Кабелни присъединения

На въводи: 1-жилен кабел ≤ 240 mm ²

На изводи: 1-жилен кабел ≤ 240 mm ²

Материал на кабела: Мед или Алуминий

Описание на уредбата

ШКАФ №	ГАМА	ШКАФ ТИП	КОЛИЧЕСТВО
КРУ 20 kV			
Шкаф 1	SM6	QM	1
Шкаф 2	SM6	IM	1
ОБЩО ЗА УРЕДБАТА			2

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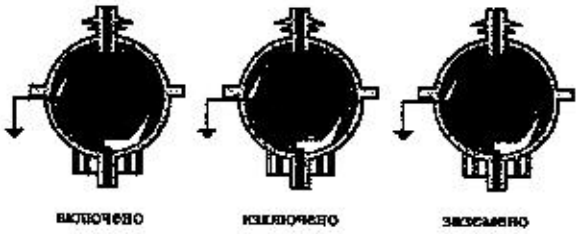
АПАРАТУРА:

Мощностни разединители



Шкафовете с разединител са с три-позиционен елегазов мощностен разединител с "включено" "изключено" и "заземено" положение.

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Подробно описание на шкафовете

Едноолосна схема		
Шкаф тип	IM	CM
Номинално напрежение	24 kV	24 kV
Работно напрежение	20 kV	20 kV
Номинален ток на к.с.	16 kA	16 kA
Ном. ток на шини	630A	630A
Заземител на шини	-	-
Три-позиционен мощностен разединител – заземител	630A	630A
Три-позиционен разединител – заземител	-	-
Задвижващ механизъм	CIT	CIT
Помощни контакти	-	-
Моторно задвижване	-	-
Прекъсвач	-	-
Задвижващ	-	-

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Едноконтактна схема		
механизъм		
Оперативно напрежение	-	-
Помощни контакти	-	-
Изключвателна бобина	-	-
Включвателна бобина	-	-
Предпазители	-	-
Токови трансформатори	-	-
Напреженови трансформатори	-	-
Реле за наличие на напр.	-	-
Заземител на кабелите	Да	Да
Индикатори за напрежение	Да	Да
Отсек НН	-	-
Защита	-	-
Тип	-	-
Защитни функции	-	-
Мерене	-	-

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Еднополюсна схема		
Комуникация	-	-
Блокировки	-	CT
Размери	-	-
Ширина, mm	375	375
Дълбочина mm	940	940
Височина, mm	1600	1600
Тегло, kg	140	160

Процедура номер : PPD 14-035
Обект : Доставка на модули за КРУ
Част : Доставка на електрооборудване
Дата : 21.8.2014г.

Приложения

Чертежи на фасади и еднолинейни схеми.

Павел Павлов

Инженер отдел оферти и комплексни решения

Иван Лесишки

Ръководител офертен отдел

Васил Ников

Мениджър отдел Инфраструктура

Шнайдер Електрик България ЕООД

Schneider Electric Bulgaria
BID Team

Schneider Electric

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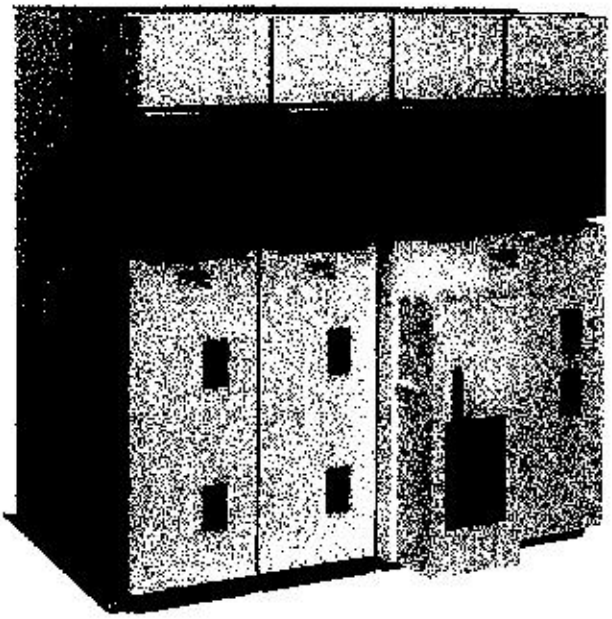
Medium Voltage Distribution
Catalogue | 2012

SM6

Modular units

Air insulated switchgear up to 36 kV



Make the most of your energy

Schneider Electric

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Medium Voltage
Distribution

Your requirements...

Continuity of Service & Complete Safety

- [illegible] protection against electrical [illegible] of a fault observation of each [illegible]
- [illegible] front door closed
- [illegible] housing on the front panel
- [illegible] physical position
- [illegible] earthing
- [illegible]
- [illegible]

- [illegible] with the IEC 60282/1-2002 [illegible]
- [illegible] disc [illegible] compound [illegible]
- [illegible] according to ISO 9001:2000 [illegible]

- [illegible] with the same engineering [illegible]
- [illegible]
- [illegible]
- [illegible] UL/CSA [illegible] sample
- [illegible] parts
- [illegible]

[illegible] Simplicity = Cost optimization!

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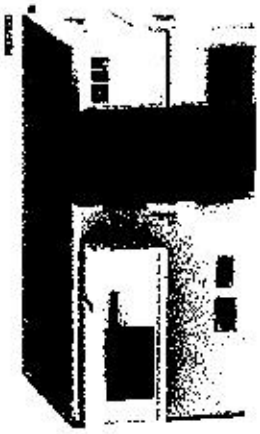
Medium Voltage Distribution
SM6
Air insulated switchgear
1 to 36 kV

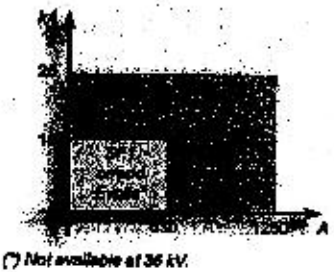
Our solutions

Schneider Electric has developed protection, monitoring and control solutions specifically dedicated to Medium Voltage networks for over 40 years.
SM6 switchgear has been specifically designed on the basis of that extensive experience.
It also incorporates some very new solutions, giving the best in terms of continuity of service and operators' safety.



SM6, a truly professional solution! More than 1,100,000 cubicles installed world-wide.

High-performance breaking devices



(*) Not available at 36 kV.

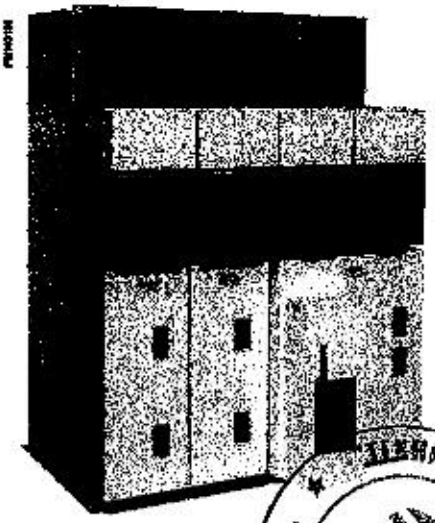
A comprehensive solution

SM6 switchgear is fully compatible with
- **PowerMeter metering units.**
- **Sepam multi-function protection relays**
  - **Protection**
  - **Measurements and diagnosis.**
- **VIP protection self powered relay for protection.**

SM6 swithchboards can thus be easily integrated into any monitoring and control system.
- **Local & remote indication and operation.**

Enclosures able to withstand internal arcing

Internal Arc Classification: A-FL and A-FLR.
- **3-sides internal arc protection IAC: A-FL,**
  12,5 kA 1 s and 16 kA 1 s for 24 kV and 16 kA 1 s for 36 kV.
- **4-sides internal arc protection IAC: A-FLR,**
  16 kA 1 s and 20 kA 1 s for 24 kV.
- **Choice of exhaust:**
  - **downwards exhaust**
  - **upwards exhaust for 24 kV.**



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General contents

"ТЕХНИЧЕСКИ ЕНЕРГИИ" ЕООД
TECHNIC ENERGY
БЪЛГАРИЯ

БЕЛЕЖКИ
С ОРИГИНАЛА

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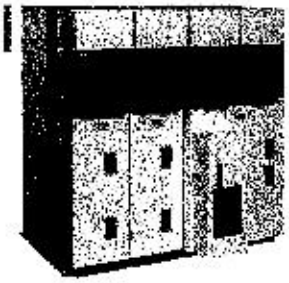
The experience of a world leader



The Schneider Electric experience's extends over forty years in factory-built cubicles and over thirty years in SF6 breaking technology for Medium Voltage switchgear.

This experience means that today Schneider Electric can propose a complementary range: vacuum type circuit breaker cubicles up to 24 kV and standard or enhanced internal arc withstand cubicles to reinforce the safety of people according to the IEC standard.

This gives you the advantage of unique experience, that of a world leader, with over 2,500 000 SF6 Medium Voltage units installed throughout the world.

Putting this experience at your service and remaining attentive to your requirements is the spirit of active partnership that we want to develop in offering you the SM6.

The modular SM6 is a range of harmonised cubicles equipped with SF6 or vacuum breaking technology switchgear with 30 years life span.

These cubicles allow you to produce all your Medium Voltage substation requirements up to 36 kV by superposing their various functions. The result of in-depth analysis of your requirements, both now and in the future, SM6 cubicles mean that you can take advantage of all the features of both a modern and proven technology.

1975: innovation
Sulphur hexafluoride (SF6) is first used in an MV switch for an MV/LV transformer substation, with the VM6.

1989: experience
Over 300,000 VM6 cubicles equipped networks throughout the world.

1991: innovation and experience
Cumulated with the second generation of SM6 modular SF6 cubicles.

2012: a leading position
With over 1,100,000 SM6 cubicles installed around the world, Schneider Electric consolidates its position as uncontested leader in the Medium Voltage field.

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The range's advantages

Upgradability

SM6, a comprehensive range

- A comprehensive offer covering your present and future requirements
- A design adapted to the extension of your installations
- A catalogue of functions for all your applications
- A product designed to be in compliance with standards constraints
- Options to anticipate the control and monitoring of your installations.

Compactness

SM6, an optimised range

- Compact units, with low increment cubicles
- Rationalised space requirement for switchboard installation
- Reduction of civil works costs
- Easy integration in factory-built outdoor substations for which the SM6 is particularly well designed.

Maintenance

SM6, a range with reduced maintenance

- The active parts (breaking and earthing) are integrated in an SF6-filled, "sealed for life" unit
- The control mechanisms, are intented to function with reduced maintenance under normal operating conditions
- Enhanced electrical endurance when breaking.

Ease of installation

SM6, a simple range to incorporate

- Reduced dimensions and weights
- Only one civil works layout
- A solution adapted to cable connection
- Simplified switchboard busbar design.

Ease and safe to operate

SM6, a proven range

- A three position switch to block incorrect switching
- The earthing disconnector has full closing capacity
- Positive breaking of position indicators
- Internal arc withstand in the cable and switchgear compartments
- Clear and animated display diagrams
- Switching lever with an "anti-reflex" function
- Compartmented cubicles.

SM6: a range designed with control and monitoring in mind

SM6 switchgear is perfectly adapted to control and monitoring applications. Motorised, either when installed or at a later date on-site without any interruption in service, SM6 combines with the Easergy T200 remote control interface. You therefore benefit from a ready-to connect unit that is easy to incorporate providing guaranteed switchgear operation.

SM6: a range with adapted protection devices

With the SM6, Schneider Electric proposes solutions for network management; the Sepam and VIP or relay ranges protect installations, providing continuity of electrical supply and reducing downtime.

Protecting the environment

Product environmental profile & recycling service

Schneider Electric's recycling service for SF6 products is part of a rigorous management process.

Schneider Electric is committed to a long term environmental approach. As part of this, the SM6 has been designed to be environmentally friendly, notably in terms of the product's recycleability.

The materials used, both conductors and insulators, are identified in product environmental profile analysis and easily separable.
It was performed in conformity with ISO 14040 "Environmental management: life cycle assessment - principle and framework".

At the end of its life, SM6 can be processed, recycled and its materials recovered in conformity with the draft European regulations on the end-of-life of electronic and electrical products, and in particular withoutany gas being released to the atmosphere nor any polluting fluids being discharged.

SM6 is compliant with the RoHS directive.
RoHS restricts the use of six hazardous materials in the manufacture of various types of electronic and electrical equipment.

	Switch unit	Circuit breaker unit	Switch unit
Ferrous metal	84%	66%	74%
Non-ferrous metal	4%	10.6%	8%
Thermohardening	9.6%	22%	18%
Thermoplastics	2.35%	2.3%	2%
Fluid	0.16%	0.1%	1%

The environmental management system adopted by Schneider Electric production sites that produce the SM6 have been assessed and judged to be in conformity with requirements in the ISO 14001 standard.

A full range of services

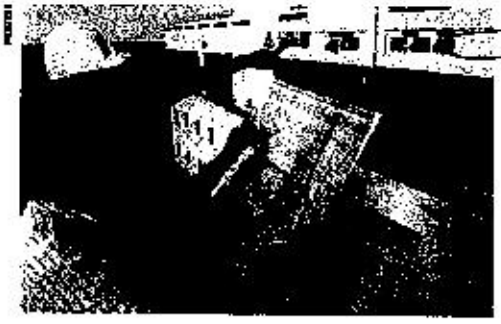
Schneider Electric is capable of offering a full range of services either associated or not with the supply of the SM6 unit.

To improve the quality of your electrical power:
- Network study, harmonics study, etc.
- Reactive energy compensation
- Consumption monitoring
- Optimisation of your electrical power supply contracts.

To accompany the purchase and installation of your SM6 equipment:
- Adaptation of our equipment to provide a better response to your requirements
- On site assembly, testing and commissioning of your equipment
- Customised financing solutions
- Warranty extension
- Operator training.

To accompany your installation throughout its life and upgrading your equipment:
- Upgrading your existing equipment: functional adaptation, control motorisation, renovation of protections units, etc.
- On site work
- Supply of replacement parts
- Maintenance contracts
- End of life recycling.

Fore more information on all the services proposed by Schneider Electric, please contact your Schneider Electric Sales Office.



The references of a leader
SM6, a world-wide product

Asia/Middle East
- Canal Electrical Distribution Company, Egypt
- General Motors Holden, Australia
- Pasteur Institute, Cambodia
- Tian he City, China
- Sanya Airport, China
- Bank of China, Beijing, Jv Yanta, China
- Plaza Hotel, Jakarta, Indonesia
- Bali Airport, Indonesia
- Wakasa Control Center, Japan
- Otaru Shopping center, Japan
- New City of Muang, Thong Than, Kanjanapas, Thailand
- Danang and Quinhon Airport, Vanad, Vietnam
- British Embassy, Oman
- KBF Palace Riyadh, Saudi Arabia
- Raka Stadium, Saudi Arabia
- Bilkent University, Turkey
- TADCO, BABOR development, United Arab Emirates
- Melbourne Tunnel City Link, Australia
- Campus KSU Qassim Riyad, Saudi Arabia

Africa
- ONAFEX, Hilton Hotel, Algeria
- Yaounde University, Cameroon
- Karoua Airport, Cameroon
- Libreville Airport, Gabon
- Ivarto Hospital, CORIF, Madagascar
- Central Bank of Abuja, ADEFEMI, Nigeria
- OCI Dakar, Oger international, CGE, Senegal
- Bamburi cement Ltd, Kenya
- Ivory Electricity Company, Ivory Coast
- Exxon, New Headquarters, Angola

South America/Pacific
- Lamentin Airport, CCIM, Martinique
- Space Centre, Kourou, Guyana
- Mexico City Underground System, Mexico
- Santiago Underground System, Chile
- Cohiba Hotel, Havana, Cuba
- Ibarostar Hotel, Bavaro, Dominican Republic
- Aluminio Argentino Saic SA, Argentina
- Michelin Campo Grande, Rio de Janeiro, Brazil
- TIM Data Center, São Paulo, Brazil
- Light Rio de Janeiro, Brazil
- Hospital Oswaldo Cruz, São Paulo, Brazil

Europe
- Stade de France, Paris, France
- EDF, France
- Eurotunnel, France
- Nestlé company headquarters, France
- TLM Terminal , Folkestone, Great Britain
- Zaventem Airport, Belgium
- Kredietbank Computer Centre, Belgium
- Bucarest Pumping station, Romania
- Prague Airport, Czech Republic
- Philipp Morris St Petersburg, Russia
- Kremlin Moscow, Russia
- Madrid airport, Spain
- Dacia Renault, Romania
- Lafarge cement Cirkovic, Czech Republic
- Caterpillar St Petersburg, Russia
- Ikea Kazan, Russia
- Barajas airport, Spain
- Coca-cola Zurich, Switzerland

Quality assurance
Quality certified to ISO 9001

A major advantage

Schneider Electric has integrated a functional organisation into each of its units. The main mission of this organisation is to check the quality and the compliance with standards.
This procedure is:

- Uniform throughout all departments
- Recognised by many customers and approved organisations.

But it is above all its strict application that has enabled recognition to be obtained by an independent organisation:
The French Quality Assurance Association (FQAA).

The quality system for the design and manufacture of SM6 units has been certified in conformity with the requirements of the ISO 9001: 2000 quality assurance model.

Meticulous and systematic controls

During manufacture, each SM6 is subject to systematic routine testing which aims to check the quality and conformity:

- Sealing testing
- Filling pressure testing
- Opening and closing rate testing
- Switching torque measurement
- Dielectric testing
- Conformity with drawings and plans.

The results obtained are written and reported on the test certificate for each device by the quality control department.

Mean Operating Time To Failure (MTTF)

As result of Schneider Electric quality assurance system, SM6 has negligible "Mean Down Time (MDT)" in comparison to the "Mean Up Time (MUT)", thus "Mean Operating Time Between Failures (MTBF)" is as similar as to the MTTF.

- MTTF (cumulative) = 3890 years for 24 kV *
- MTTF (cumulative) = 6259 years for 36 kV *.

(*) Year 2010.

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Contents

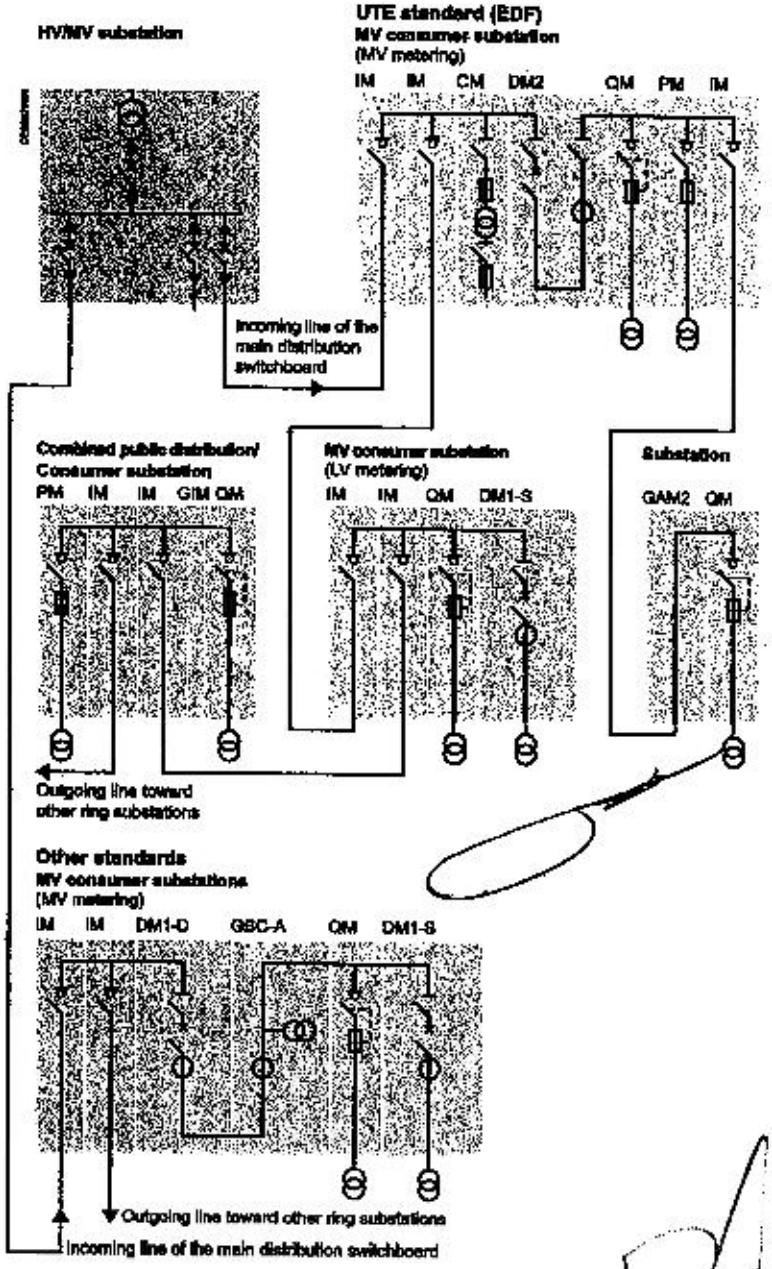
Field of application

The SM6 is made up of modular units containing fixed, disconnectable or withdrawable metal-enclosed switchgear, using sulphur hexafluoride (SF6) or vacuum:

- Switch-disconnector
- SF1, SFset or Evolis circuit breaker
- Rollarc 400 or 400 D contactor, or vacuum contactor
- Disconnector.

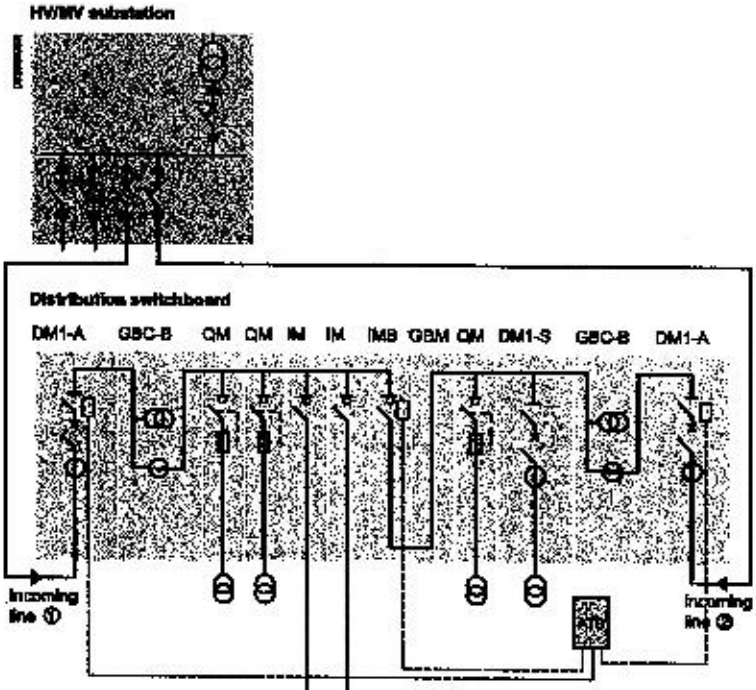
SM6 units are used for the MV section in MV/LV transformer substations in public distribution systems and MV consumer or distribution substations up to 36 kV.

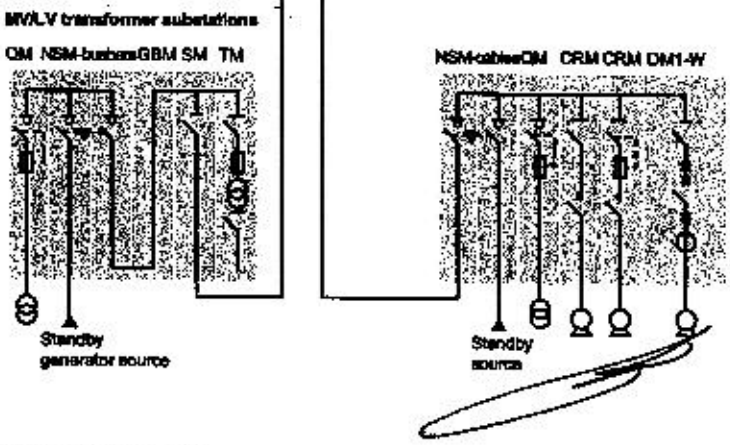
MV/LV transformer substations

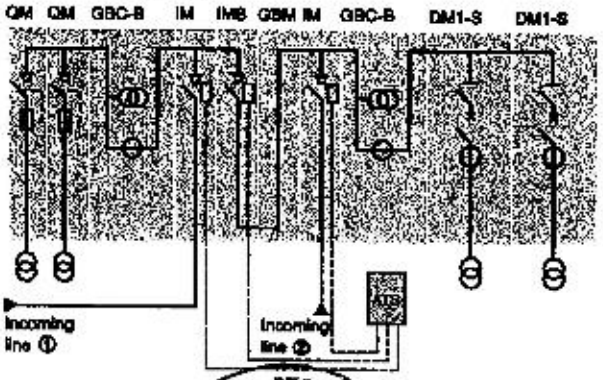


Field of application

Industrial distribution substations







ATS: Automatic Transfer System

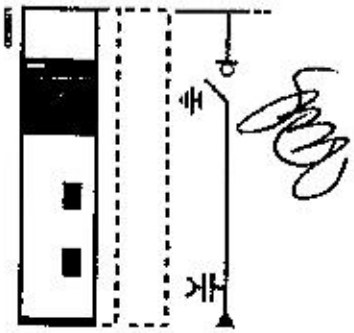
Unit definitions

Below is the list of SM6 units used in MV/LV transformer substations and industrial distribution substations:

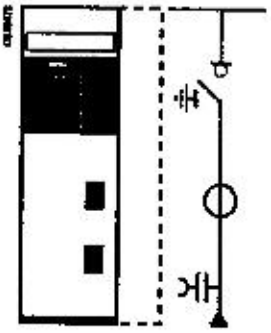
- **IM, IMC, IMB** switch
- **PM** fused switch
- **QM, QMC, QMB** fuse-switch combination
- **CRM, CVM** contactor and contactor with fuses
- **DM1-A, DM1-D, DM1-S** single-isolation disconnectable SF6 type circuit breaker
- **DMV-A, DMV-D, DMV-S** single-isolation vacuum type circuit breaker frontal
- **DMVL-A, DMVL-D** single-isolation disconnectable vacuum type circuit breaker lateral
- **DM1-W, DM1-Z** withdrawable single-isolation SF6 type circuit breaker
- **DM2** double-isolation disconnectable SF6 type circuit breaker
- **DM2-W** withdrawable double-isolation SF6 type circuit breaker only for 36 kV
- **CM, CM2** voltage transformers
- **GBC-A, GBC-B** current and/or voltage measurements
- **NSM-cables** for main incoming and standby
- **NSM-busbars** for main incoming and cables for standby
- **GIM** intermediate bus unit
- **GEM** extension unit
- **GBM** connection unit
- **GAM2, GAM** incoming cable connection unit
- **SM** disconnector
- **TM** MV/LV transformer unit for auxiliaries
- Other units, consult us
- Special function **EMB** busbar earthing only for 24 kV.

Units for switching function

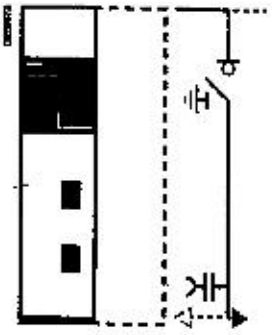
Switching



IM
Switch unit
24 kV: 375 or 500 mm
36 kV: 750 mm

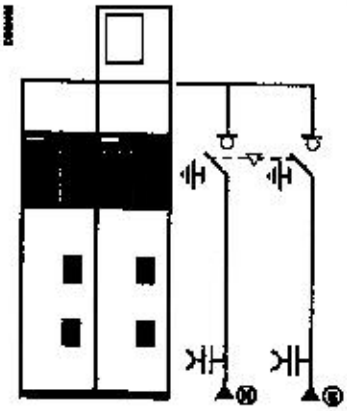


IMC
Switch unit
24 kV: 500 mm
36 kV: 750 mm

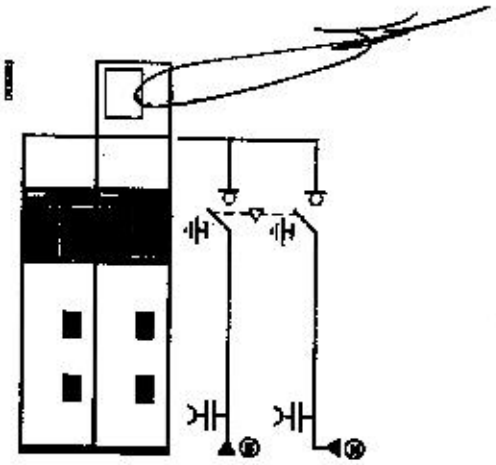


IMB
Switch unit
with earthing disconnector
right or left outgoing line
24 kV: 375 mm
36 kV: 750 mm

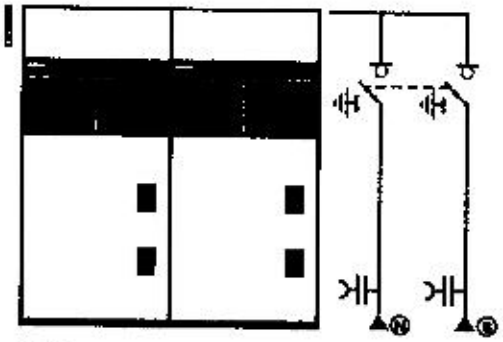
Automatic transfer system



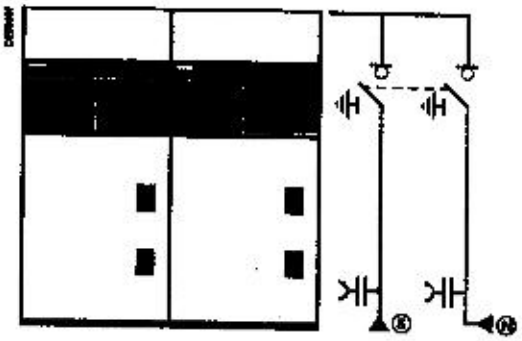
NSM-cables
Cables power supply
for main incoming line
and standby line
24 kV: 750 mm



NSM-busbars
Busbars power supply
for main incoming line on right or left
and cables for standby line
24 kV: 750 mm



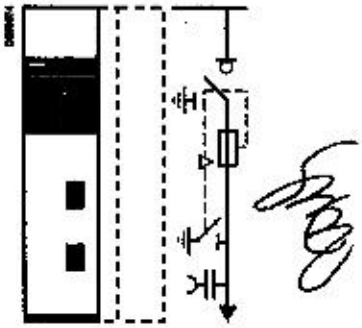
NSM-cables
Cables power supply
for main incoming line
and standby line
36 kV: 1500 mm



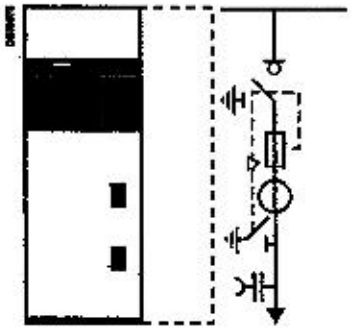
NSM-busbars
Busbars power supply
for main incoming line on right or left
and cables for standby line
36 kV: 1500 mm

Units for protection function

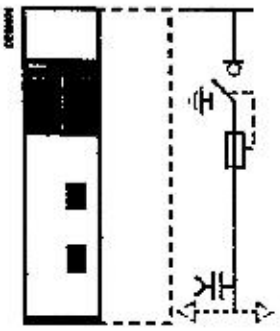
Fuse-switch



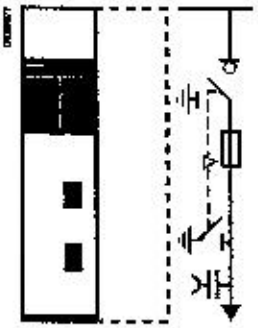
QM
Fuse-switch combination unit
24 kV: 375 or 500 mm
36 kV: 750 mm



QMC
Fuse-switch combination unit
24 kV: 625 mm
36 kV: 1000 mm

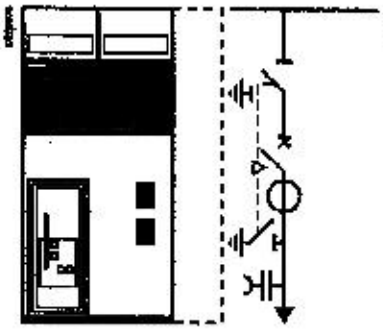


QMB
Fuse-switch combination unit right or left outgoing line
24 kV: 375 mm
36 kV: 750 mm

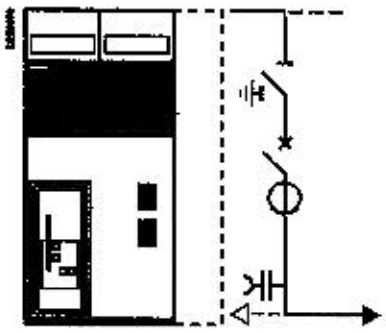


PM
Fuse-switch unit
24 kV: 375 mm
36 kV: 750 mm

SF6 circuit-breaker



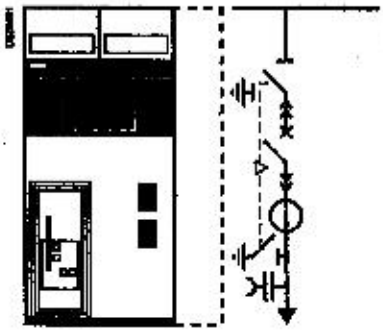
DM1-A
Single-isolation, disconnectable circuit breaker unit
24 kV: 750 mm
36 kV: 1000 mm



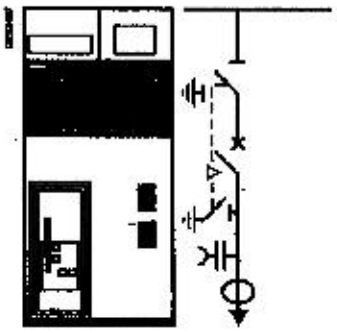
DM1-D
Single-isolation, disconnectable circuit breaker unit right or left outgoing line
24 kV: 750 mm
36 kV: 1000 mm

Units for protection function

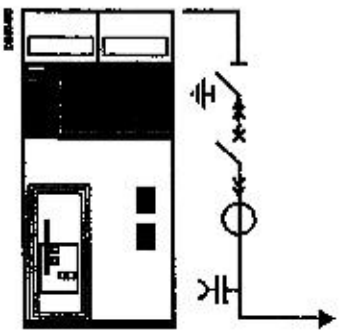
SF6 circuit-breaker



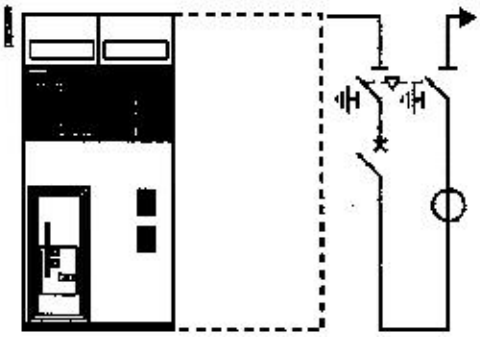
DM1-W
Withdrawable single-isolation circuit breaker unit
24 kV: 750 mm
36 kV: 1000 mm



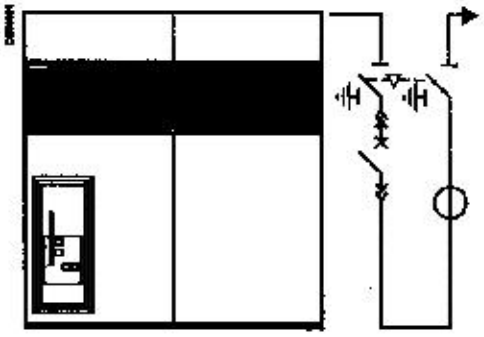
DM1-S
Single-isolation, disconnectable circuit breaker unit with autonomous protection
24 kV: 750 mm



DM1-Z
Withdrawable single-isolation circuit breaker unit right outgoing line
24 kV: 750 mm

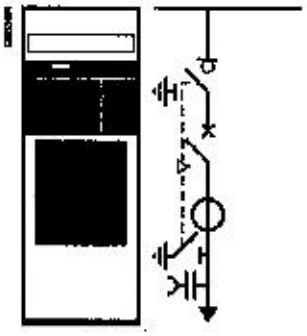


DM2
Double-isolation, disconnectable circuit breaker unit right or left outgoing line
24 kV: 750 mm
36 kV: 1500 mm

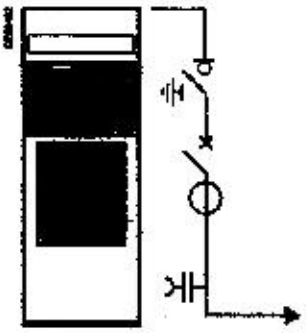


DM2-W
Withdrawable double-isolation circuit breaker unit right outgoing line
36 kV: 1500 mm

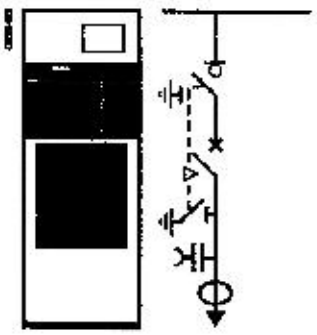
Vacuum circuit-breaker



DMV-A
Single-isolation circuit breaker unit
24 kV: 625 mm



DMV-D
Single-isolation circuit breaker unit right outgoing line
24 kV: 625 mm



DMV-S
Single-isolation circuit breaker unit with autonomous protection
24 kV: 625 mm

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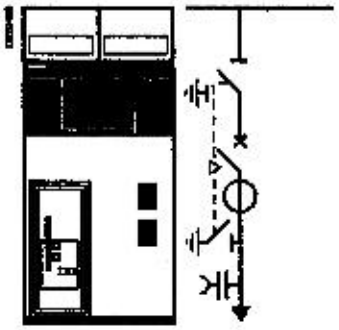
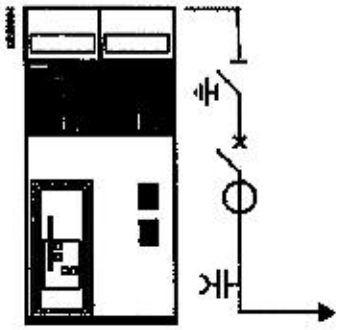
Units for protection function

Vacuum circuit-breaker

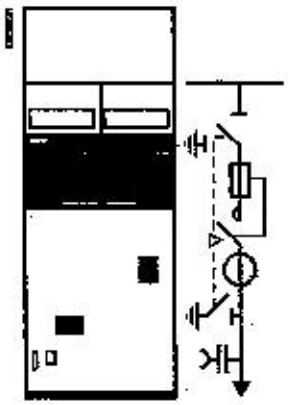


DMVL-A
Single-isolation, disconnectable circuit breaker unit
24 kV: 750 mm

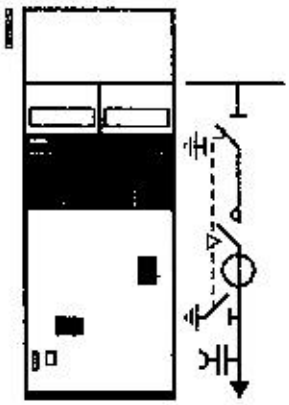


DMVL-D
Single-isolation, disconnectable circuit breaker unit right outgoing line
24 kV: 750 mm

Vacuum contactor (Direct Motor Starter)

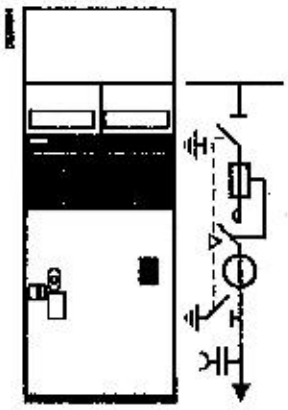


CVM
Fuse-contactor unit
24 kV: 750 mm

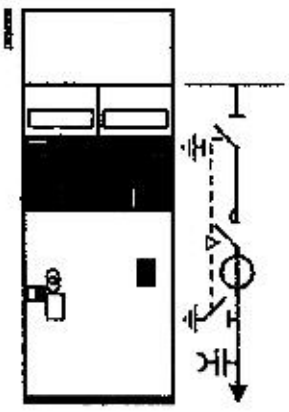


CVM
Contactor unit
24 kV: 750 mm

SF6 contactor (Direct Motor Starter)

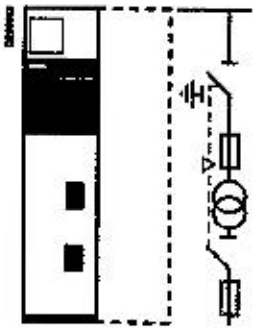


CRM
Fuse-contactor unit
24 kV: 750 mm

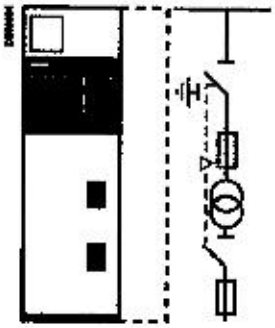


CRM
Contactor unit
24 kV: 750 mm

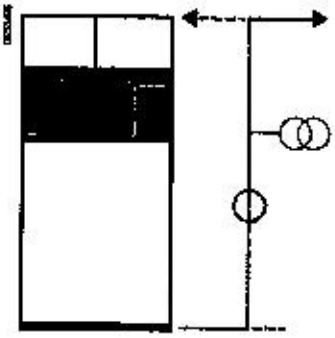
Units for metering function



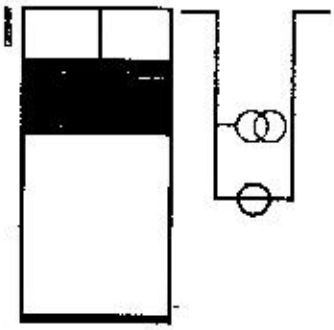
CM
Voltage transformers for mains with earthed neutral system
24 kV: 375 mm
36 kV: 750 mm



CM2
Voltage transformers for mains with insulated neutral system
24 kV: 500 mm
36 kV: 750 mm



GBC-A
Current and/or voltage measurement unit right or left outgoing line
24 and 36 kV: 750 mm



GBC-B
Current and/or voltage measurement unit
24 and 36 kV: 750 mm

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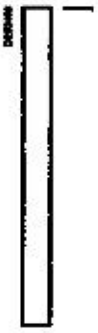
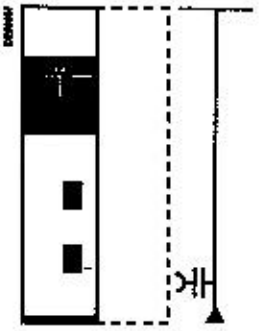
Units for other functions

GBM
Connection unit
right or left outgoing line
24 kV: 375 mm
36 kV: 750 mm

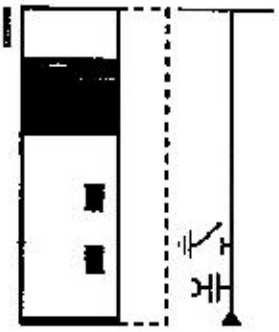


GEM
Extension unit VM6/SM6
24 kV: 125 mm

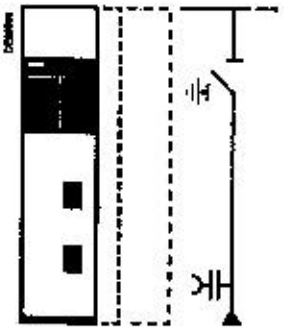
GIM
Intermediate bus unit
24 kV: 125 mm
36 kV: 250 mm



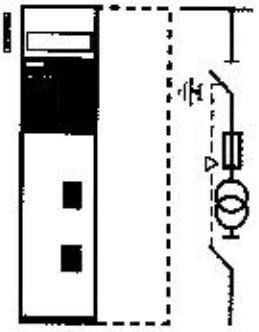
GAM2
Incoming cable-connection unit
24 kV: 375 mm
36 kV: 750 mm



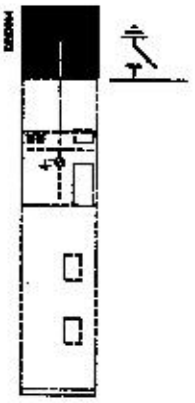
GAM
Incoming cable-connection unit
with earthing
24 kV: 500 mm
36 kV: 750 mm



SM
Disconnector unit
24 kV: 375 mm or 500 [1] mm
36 kV: 750 mm
(1) only for 1250 A units.



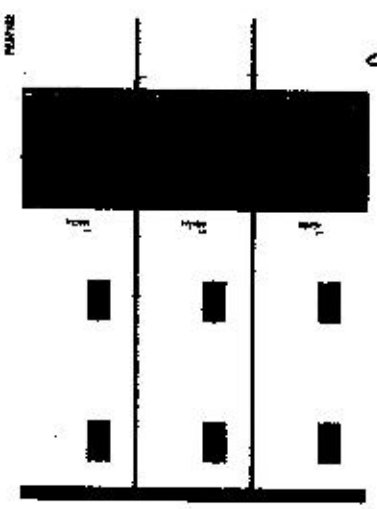
TM
MV/LV transformer unit
for auxiliaries
24 kV: 375 mm
36 kV: 750 mm



EMB
Busbar earthing compartment
24 kV: 375 mm

Operating conditions

In addition to its technical characteristics, SM6 meets requirements concerning safety of life and property as well as ease of installation, operation and protecting the environment.



SM6 units are designed for indoor installations.
Their compact dimensions are:
- 375 to 1500 mm width
- 1600 to 2250 mm height
- 840 to 1400 mm depth...

... this makes for easy installation in small rooms or prefabricated substations.
Cables are connected via the front.
All control functions are centralised on a front plate, thus simplifying operation.
The units may be equipped with a number of accessories (relays, toroids, instrument transformers, surge arrester, control and monitoring, etc.).

Normal operating conditions

- **Ambient air temperature:**

1) less than or equal to 40°C
2) less than or equal to 35°C on average over 24 hours
3) greater or equal to –5°C.

- **Altitude**

1) less than or equal to 1000 m
2) above 1000 m, a derating coefficient is applied (please consult us).

- **Solar radiation**

1) no solar radiation influence is permitted.

- **Ambient air pollution**

1) no significant pollution by dust, smoke, corrosive and/or flammable gases, vapours or salt.

- **Humidity**

1) average relative humidity over a 24 hour period, less than or equal to 95%
2) average relative humidity over a 1 month period, less than or equal to 90%
3) average vapor pressure over a 24 hour period, less than or equal to 2.2 kPa
4) average vapor pressure over a 1 month period, less than or equal to 1.8 kPa.

For these conditions, condensation may occasionally occur. Condensation can be expected where sudden temperature changes occur in periods of high humidity.

To withstand the effects of high humidity and condensation, such as breakdown of insulation, please pay attention on Civil Engineering recommendations for design of the building or housing, by suitable ventilation and installation.

Severe operating conditions (please consult us).

Standards

SM6 units meet all the following standards and specifications:

- IEC standards
- UTE standards for 24 kV
- EDF specifications for 24 kV.

■ IEC standards

62271-200	High-voltage switchgear and controlgear - Part 200: A.C. metal-enclosed switchgear and controlgear for rated voltage above 1 kV and up to and including 52 kV.
62271-1	High-voltage switchgear and controlgear - Part 1: Common specifications.
62271-103	High voltage switches - Part 1: switches for rated voltages above 1 kV and less or equal to 52 kV.
62271-105	High-voltage switchgear and controlgear - Part 105: High voltage alternating current switch-fuse combinations.
60255	Electrical relays.
62271-100	High-voltage switchgear and controlgear - Part 100: High-voltage alternating current circuit breakers.
62271-102	High-voltage switchgear and controlgear - Part 102: High-voltage alternating current disconnectors and earthing switches.
60044-1	Instrument transformers - Part 1: Current transformers.
60044-2	Instrument transformers - Part 2: Voltage transformers.
60044-8	Instrument transformers - Part 8: Low Power Current Transducers.
61958	High-voltage prefabricated switchgear and controlgear assemblies - Voltage presence indicating systems.
62271-206	High-voltage prefabricated switchgear and controlgear assemblies - Voltage presence indicating systems.

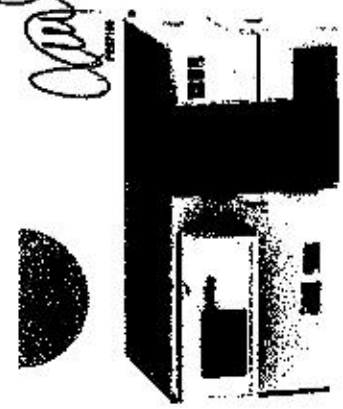
■ UTE standards for 24 kV

NFC 13.100	Consumer substation installed inside a building and fed by a second category voltage public distribution system.
NFC 13.200	High voltage electrical installations requirements.
NFC 64.130	High voltage switches for rated voltage above 1 kV and less than 52 kV.
NFC 64.160.	Alternating current disconnectors and earthing switches

EDF specifications for 24 kV

HN 64-S-41	A.C. metal-enclosed switchgear and controlgear for rated voltages above 1 kV and up to and including 24 kV.
HN 64-S-43	Electrical independent-operating mechanism for switch 24 kV - 400 A.

Main characteristics



The hereunder values are for working temperatures from -5°C up to +40°C and for a setting up at an altitude below 1000 m.

Electrical characteristics

Rated voltage	Ur	kV		7.2	12	17.5	24	36
[illegible]								
Insulation	Ud	50/60 Hz, 1 min (kV rms)		20	28	38	50	70
Isolation	Ud	50/60 Hz, 1 min (kV rms)		23	32	45	60	80
Insulation	Up	1.2/50 µs (kV peak)		60	75 (1)	95	125	170
Isolation	Up	1.2/50 µs (kV peak)		70	85	110	145	195
[illegible]								
Transformer off load		A		16				
Cables off load		A		31.5				50
Rated current	Ir	A		400 - 630 -1250				630-1250
Short-time withstand current	Ik/tk (2)	kA/1 s	25	630 - 1250				1250
			20 (3)	630 - 1250				
			16	630 - 1250				
			12.5	400 - 630 - 1250				630-1250
Making capacity (50 Hz)	Ima	kA	62.5	630		NA		
			50	630				
			40	630				
			31.25	400 - 630				630
[illegible]								
Units IM, IMC, IMB, NSM-cables, NSM-bus-bars		A		630 - 800 (4)				630
QM, QMC, QMB		kA		25		20		20
PM		kA		25				20
CRM		kA		10	NA			
CRM with fuses		kA		25	NA			
CVM		kA		6.3	NA			
CVM with fuses		kA		25	NA			
[illegible]								
DM1-A, DM1-D, DM1-W		kA	25	630-1250				1250
			20	630-1250				
DM1-S		kA	25	630				NA
DM1-Z			25	1250				NA
DM2		kA	20	630				
			25	630				1250
DM2-W		kA	25	NA				1250
[illegible]								
DMV-A, DMV-D, DMV-S		kA	25	630-1250			NA	
DMVL-A		kA	20	630				NA
DMVL-D		kA	25	630				NA

NA: Non Available
(1) 60 kV peak for the CRM unit
(2) 3 phases
(3) In 20 kA/3 s, consult us
(4) In 800 A, consult us.

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Main characteristics

Endurance

Units IM, IMC, IMB, PM, QM (5), QMC (5), QMB (5), NSM-cables, NSM-busbars		IEC 62271-103 1 000 operations class M1	IEC 62271-103 100 breaks at Ir, p.f. = 0.7, class E3
CRM	Disconnector	IEC 62271-102 1 000 operations	
	Rollarc 400	IEC 60470 300 000 operations	IEC 60470 100 000 breaks at 320 A 300 000 breaks at 250 A
	Rollarc 400D	100 000 operations	100 000 breaks at 200 A
CVM	Disconnector	IEC 62271-102 1 000 operations	
	Vacuum contactor	IEC 60470 2 500 000 operations 250 000 with mechanical latching	IEC 60470 250 000 breaks at Ir
SF6 circuit breaker range			
DM1-A, DM1-D, DM1-W, DM1-Z, DM1-S, DM2 DM2-W	Disconnector	IEC 62271-102 1 000 operations	
	SF circuit breaker	IEC 62271-100 10 000 operations class M2	IEC 62271-100 30 breaks at 12.5 kA for 24 kV 25 breaks at 25 kA for 24 kV 40 breaks at 16 kA for 36 kV 15 breaks at 25 kA for 36 kV 10 000 breaks at Ir, p.f. = 0.7, class E2
Vacuum circuit breaker range			
DMV-A, DMV-D, DMV-S	Switch	IEC 62271-103 1 000 operations class M1	IEC 62271-103 100 breaks at Ir, p.f. = 0.7, class E3
	Evolis circuit breaker	IEC 62271-100 10 000 operations class M2	IEC 62271-100 10 000 breaks at Ir, p.f. = 0.7, class E2
DMVL-A DMVL-D	Disconnector	IEC 62271-102 1 000 operations	
	Evolis circuit breaker	IEC 62271-100 10 000 operations class M2	IEC 62271-100 10 000 breaks at Ir, p.f. = 0.7, class E2

(5) As per recommendation IEC 62271-105, three breakings at p.f. = 0.2
800 A under 36 kV; 1400 A under 24 kV; 1730 A under 12 kV; 2600 A under 5.5 kV.

Internal arc withstand (in accordance with IEC 62271-200):
- SM6 24 kV:
  - 12.5 kA 1 s, IAC: A-FL
  - 16 kA 1 s, IAC: A-FLR & IAC: A-FL
  - 20 kA 1 s, IAC: A-FLR & IAC: A-FL
- SM6 36 kV:
  - 16 kA 1 s, IAC: A-FL.

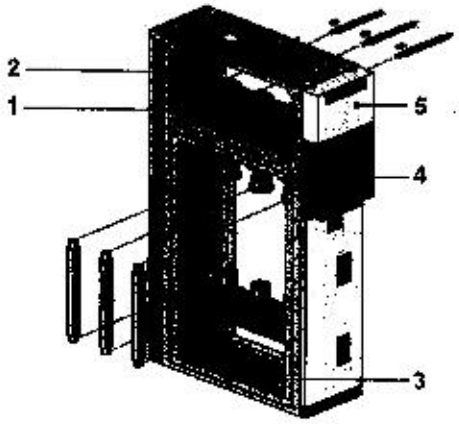
Protection index:
- Classes: PI (insulating partition)
- Loss of service continuity classes: LSC2A
- Units in switchboard: IP3X
- Between compartments: IP2X for 24 kV, IP2XC for 36 kV
- Cubicle: IK08 for 24 kV, IK07 for 36 kV.

Electro-magnetic compatibility:
- Relays: 4 kV withstand capacity, as per recommendation IEC 60801.4
- Compartments:
  - electrical field:
    - 40 dB attenuation at 100 MHz
    - 20 dB attenuation at 200 MHz
  - magnetic field: 20 dB attenuation below 30 MHz.

Temperatures:
The cubicles must be stored and installed in a dry area free from dust and with limited temperature variations.
- For storing: from –40°C to +70°C
- For working: from –5°C to +40°C
- Other temperatures, consult us.

Factory-built cubicles description

Cubicles are made up of 3 (*) compartments and 2 cabinets that are separated by metal or insulating partitions.



Switch and fuse protection cubicles

1 **switchgear**: switch-disconnector and earthing switch in an enclosure filled with SF6 and satisfying "sealed pressure system" requirements.

2 **busbars**: all in the same horizontal plane, thus enabling later switchboard extensions and connection to existing equipment.

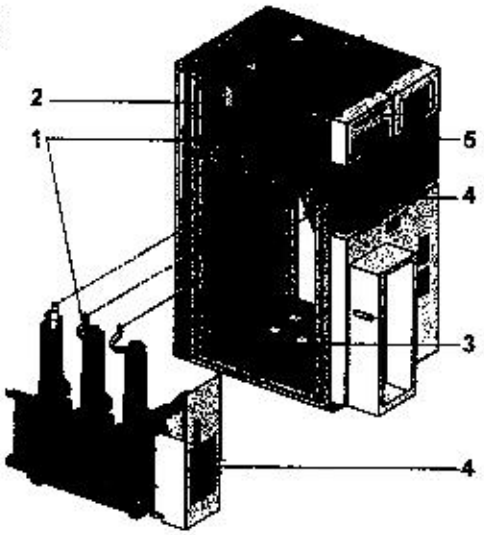
3 **connection**: accessible through front, connection to the lower switch-disconnector and earthing switch terminals (IM cubicles) or the lower fuse-holders (PM and QM cubicles). This compartment is also equipped with an earthing switch downstream from the MV fuses for the protection units.

4 **operating mechanism**: contains the elements used to operate the switch-disconnector and earthing switch and actuate the corresponding indications (positive break).

5 **low voltage**: installation of a terminal block (if motor option installed), LV fuses and compact relay devices.
If more space is required, an additional enclosure may be added on top of the cubicle.

Options: please, refer to the chapter "Characteristics of the functional units".

(*) 2 compartments for 36 kV



SF6 circuit breaker cubicles

1 **switchgear**: disconnector(s) and earthing switch(es), in enclosures filled with SF6 and satisfying "sealed pressure system" requirements.

2 **busbars**: all in the same horizontal plane, thus enabling later switchboard extensions and connection to existing equipment.

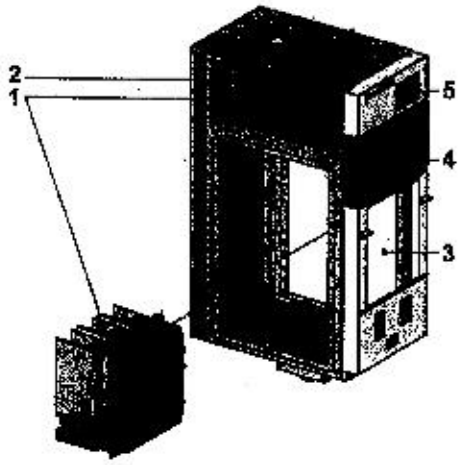
3 **connection and switchgear**: accessible through front, connection to the downstream terminals of the circuit breaker.
Two circuit breaker offers are possible:
- SF1: combined with an electronic relay and standard sensors (with or without an auxiliary power supply
- SFset: autonomous set equipped with an electronic protection system and special sensors (requiring no auxiliary power supply).

4 **operating mechanism**: contains the elements used to operate the disconnector(s), the circuit breaker and the earthing switch and actuate the corresponding indications.

5 **low voltage**: installation of compact relay devices (Statimax) and test terminal boxes. If more space is required, an additional enclosure may be added on top of the cubicle.

Options: please, refer to the chapter "Characteristics of the functional units".

Factory-built cubicles description



Frontal vacuum type circuit breaker cubicles

1 switchgear: load break switch and earthing switch(es), in enclosure filled with SF6 and satisfying and one vacuum circuit breaker, "sealed pressure system" requirements.

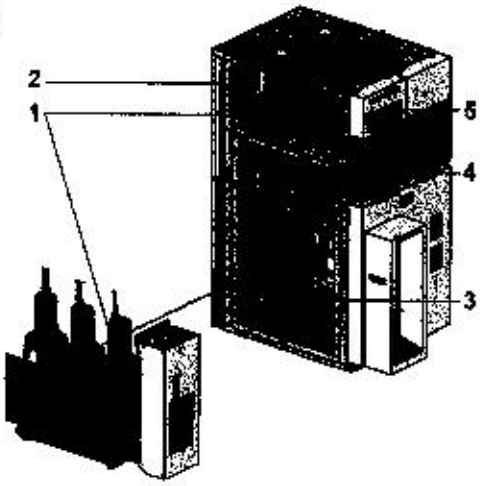
2 busbars: all in the same horizontal plane, thus enabling later switchboard extensions and connection to existing equipment.

3 connection and switchgear: accessible through front, connection to the downstream terminals of the circuit breaker.
- **Evolis:** device associated with an electronic relay and standard sensors (with or without auxiliary source).

4 operating mechanism: contains the elements used to operate the disconnector(s), the circuit breaker and the earthing switch and actuate the corresponding indications.

5 low voltage: installation of compact relay devices (VIP) and test terminal boxes. If more space is required, an additional enclosure may be added on top of the cubicle.

Options: please, refer to the chapter "Characteristics of the functional units".



Lateral vacuum type circuit breaker cubicles

1 switchgear: disconnector(s) and earthing switch(es), in enclosure filled with SF6 and satisfying and one vacuum circuit breaker, "sealed pressure system" requirements.

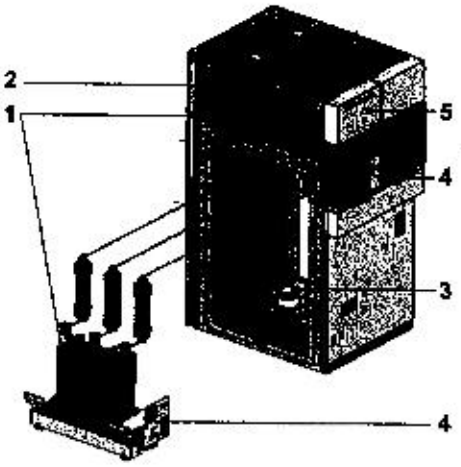
2 busbars: all in the same horizontal plane, thus enabling later switchboard extensions and connection to existing equipment.

3 connection and switchgear: accessible through front, connection to the downstream terminals of the circuit breaker.
- **Evolis:** device associated with an electronic relay and standard sensors (with or without auxiliary source).

4 operating mechanism: contains the elements used to operate the disconnector(s), the circuit breaker and the earthing switch and actuate the corresponding indications.

5 low voltage: installation of compact relay devices (VIP) and test terminal boxes. If more space is required, an additional enclosure may be added on top of the cubicle.

Options: please, refer to the chapter "Characteristics of the functional units".



Contactor cubicles

1 switchgear: disconnector and earthing switch and contactor in enclosures filled with SF6 and satisfying "sealed pressure system" requirements.

2 busbars: all in the same horizontal plane, thus enabling later switchboard extensions and connection to existing equipment.

3 connection and switchgear: accessible through front.
This compartment is also equipped with an earthing switch downstream.
The contactor may be equipped with fuses.
4 types may be used:
- R400 with magnetic holding
- R400D with mechanical latching
- Vacuum with magnetic holding
- Vacuum with mechanical latching.

4 operating mechanism: contains the elements used to operate the disconnector(s), the contactor and the earthing switch and actuate the corresponding indications.

5 low voltage: installation of compact relay devices and test terminal boxes. With basic equipment, an additional enclosure is added on top of the cubicle.

Options: please, refer to the chapter "Characteristics of the functional units".

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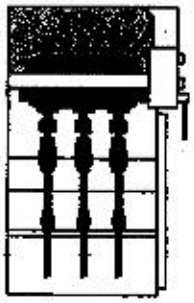
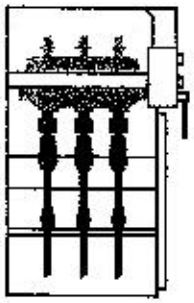
Compartments description



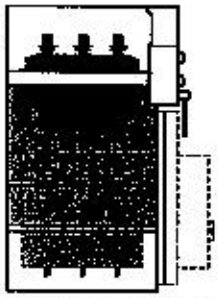
Busbar compartment

The three insulated busbars are parallel-mounted. Connection is made to the upper pads of the enclosure using a field distributor with integrated captive screws.
Ratings 400 (for 24 kV only) - 630 - 1250 A.

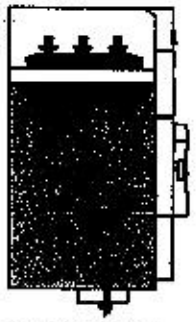


Switch compartment

This compartment is separated from the busbar compartment and the connection compartment by the enclosure surrounding the switch, the disconnector and the earthing switch.



SF6 and vacuum lateral type circuit breaker



Frontal vacuum type circuit breaker

Connection and switch compartment

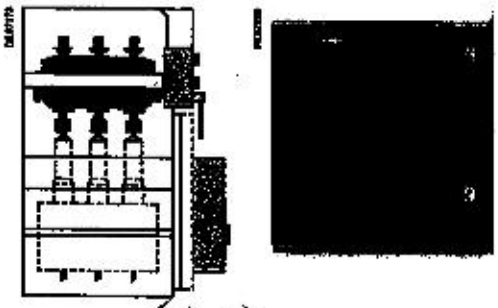
The network cables are connected:
- To the terminals of the switch
- To the lower fuse holders
- Or to the connection pads of the circuit breaker.

Cables may have either:
- Cold fitted cable end for dry-type

With basic equipment, the maximum allowable cross-section for cable is:
- 630 mm² or 2 x 400 mm² for 1250 A incoming or outgoing units
- 240 mm² or 2 x 240 mm² for incoming or outgoing units 400 - 630 A
- 95 mm² for transformer protection cubicles incorporating fuses.

See in fonctional units characteristics chapter for each unit allowable section.
The earthing switch must be closed before the cubicle may be accessed.
The reduced depth of the cubicle makes for easy connection of all phases.
A stud incorporated in the field distributor makes it possible to position and secure the cable-end lug with a single hand.

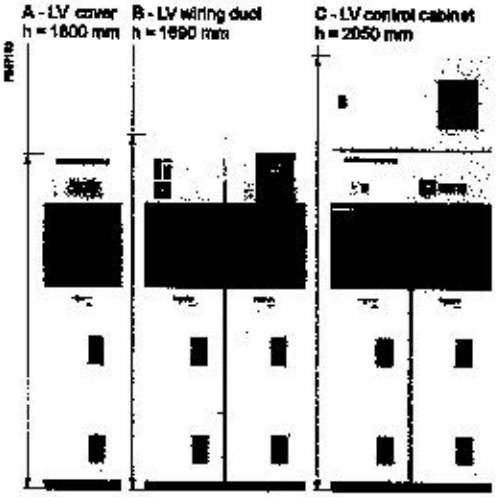
Compartments description



Operating-mechanism cover

These covers contain the various operating functions for the:
- switch and earthing switch
- disconnector(s)
- circuit breaker
- contactor

and the voltage presence indicator.
The operating-mechanism cover may be accessed with the cables and busbars energised and without isolating the substation.
It also enables easy installation of padlocks, locks and standard LV accessories (auxiliary contacts, trip units, motors, etc.).



Low-voltage monitoring control cabinet for 24 kV

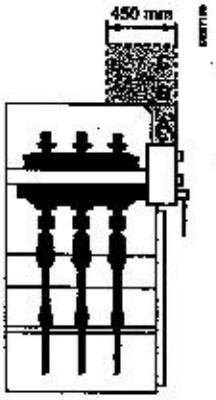
It enables the cubicle to be equipped with low voltage switchgear providing protection, control, status indication and data transmission.
According to the volume, it is available in 3 versions: cover, wiring duct and cabinet.

A - LV cover: enables a very simple low voltage section to be installed such as indication buttons, push buttons or protection relays.
The total height of the cubicle is then 1600 mm.

B - LV wiring duct and cabinet: enables a large majority of low voltage configurations to be installed.
It also takes the Sepam series 20 or series 40.
The total cubicle height is then 1690 mm.

C - LV control cabinet: this is only used for larger low voltage accessories or those with a depth greater than 100 mm or complex equipment, such as Sepam series 60 or series 80, converters, control and monitoring units, regulating transformers or dual secondary transformers.
The total height of the cubicle then becomes 2050 mm.

In all cases, these volumes are accessible, with cables and busbars energised, without de-energising the substation.

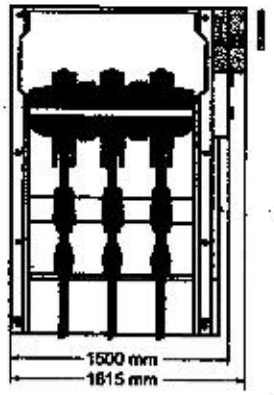


Low-voltage monitoring control cabinet for 36 kV

A - LV cover: enables a very simple low voltage section to be installed such as indication buttons, push buttons or protection relays.
The total height of the cubicle is then 2250 mm.

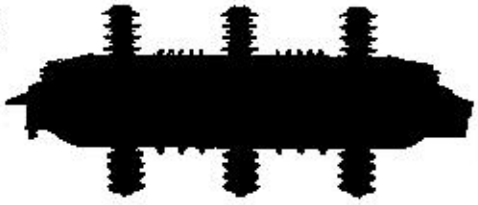
B - LV control cabinet: this is only used for larger low voltage accessories or those with a depth greater than 100 mm or complex equipment, such as Sepam series 50 or series 80, converters, control and monitoring units, regulating transformers or dual secondary transformers.

In all cases, these volumes are accessible, with cables and busbars energised, without de-energising the substation.



Safety of people
By switchgear

Switch-disconnector for 24 kV

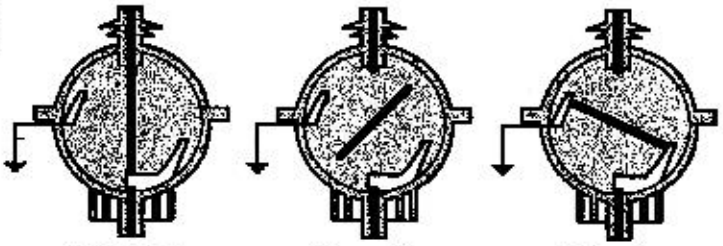


Switch-disconnector for 36 kV

Switch or disconnector and earthing switch

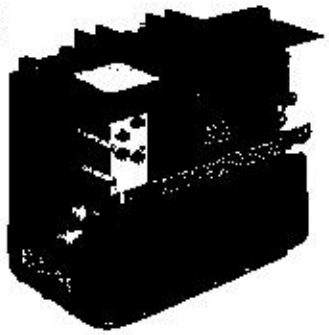
■ **Gas tightness**
The three rotating contacts are placed in an enclosure filled with gas to a relative pressure of 0.4 bar (400 hPa) for 24 kV and 1 bar (1000 hPa) for 36 kV. It satisfies "sealed pressure system" requirements and seal tightness is always factory checked, and leakage rate is less than 0.1% for 30 years life span.

■ **Operating safety**
□ the switch may be in one of three positions: "closed", "open", or "earthed", representing a natural interlocking system that prevents incorrect operation. Moving-contact rotation is driven by a fast-acting mechanism that is independent of the action of the operator.
□ the device combines the breaking and disconnection functions.
□ the earthing switch placed in the SF6 has a short-circuit making capacity, in compliance with standards.
□ any accidental over-pressures are eliminated by the opening of the safety membrane, in which case the gas is directed toward the back of the unit, away from the operator.



Closed position — Open position — Earth position

■ **Insensitivity to the environment**
□ parts are designed in order to obtain optimum electrical field distribution.
□ the metallic structure of cubicles is designed to withstand and aggressive environment and to make it impossible to access any energised part when in operation.

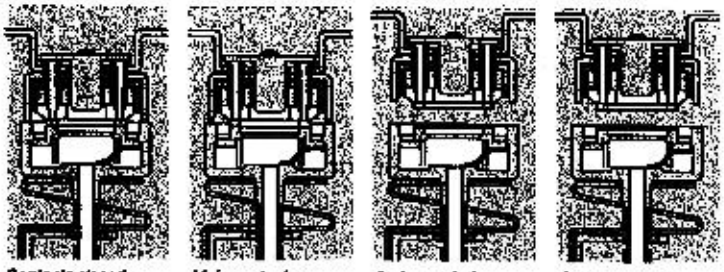


Rollarc contactor

Rollarc 400 and 400D contactor

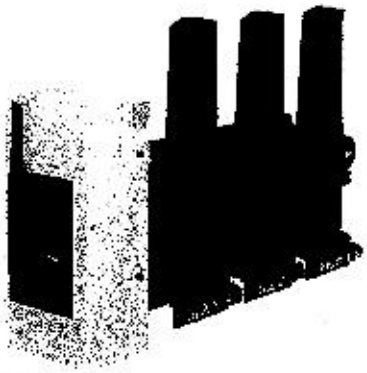
■ **Gas tightness**
The three phases are placed in an enclosure filled with SF6 gas to a relative pressure of 2.5 bars (2500 hPa). It satisfies "sealed pressure system" requirements and seal tightness is always checked in the factory.

■ **Operating safety**
Accidental over-pressures are eliminated by the opening of the safety membrane.



Contacts closed — Main contacts separated — Arcing period — Contacts open

Safety of people
By switchgear

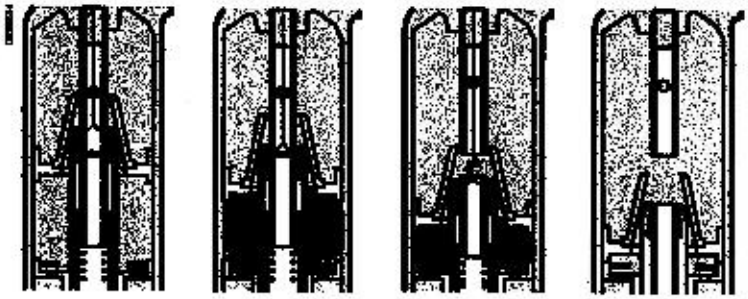


SF1 circuit breaker

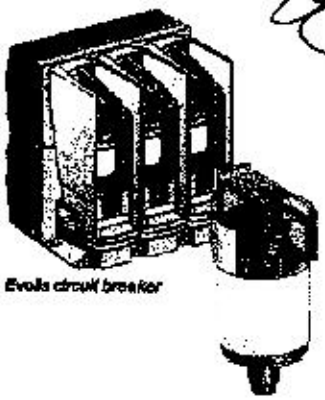
SF6 circuit breaker: SF1

■ **Gas tightness**
The SF1 circuit breaker is made up of three separate poles mounted on a structure supporting the operating mechanism. Each pole-unit houses all the active elements in an insulating enclosure filled with gas to a relative pressure of 0.5 bar (500 hPa) for 24 kV and 2 bar (2000 hPa) for 36 kV. It satisfies "sealed pressure system" requirements and seal tightness is always checked in the factory.

■ **Operating safety**
Accidental over-pressures are eliminated by the opening of the safety membrane.



Contacts closed *Precompression* *Arcing period* *Contacts open*

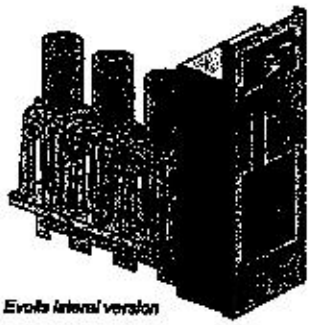


Evolis circuit breaker

Vacuum type circuit breaker: Evolis

■ **Vacuum tightness**
The Evolis circuit breaker comprises three separate pole units fixed on a structure supporting the control mechanism. Each pole encloses all of the active parts in an insulating enclosure, under vacuum, and its vacuum tightness is systematically checked in the factory.

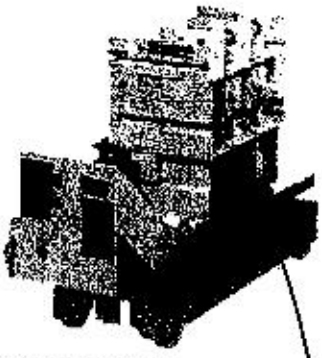
■ **Operating safety**
The magnetic field is applied along the contact axis of the vacuum type circuit breaker. This process diffuses the arc in a regular manner with high currents.
It ensures optimum distribution of the energy along the compact surface so as to avoid local hot spots.
The advantages of this technique:
- a simplified vacuum type circuit breaker which is consequently very reliable,
- low dissipation of arcing energy in the circuit breaker,
- highly efficient contacts which do not distort during repeated breaking,
- significant reduction in control energy.



Evolis lateral version

Vacuum type contactor

■ **Vacuum tightness**
Vacuum contactor comprises three separate poles fixed on a structure supporting the control mechanism. Each pole encloses all of the active parts in an insulating enclosure under vacuum and its vacuum tightness is checked in the factory.



Vacuum type contactor

2.30

Safety of people
By operating mechanism safety

Reliable operating mechanism

■ **Switchgear status indicator:**
Fitted directly to the drive shaft, these give a definite indication of the contact's position. (appendix A of standard IEC 62271-102).
■ **Operating lever:**
This is designed with an anti-reflex device that stops any attempt to re-open the device immediately after closing the switch or the earthing disconnector.
■ **Locking device:**
Between one and three padlocks enable the following to be locked:
□ access to the switching shaft of the switch or the circuit breaker,
□ access to the switching shaft of the earthing disconnector,
□ operating of the opening release push-button.

Simple and effortless switching

Mechanical and electrical controls are side by side on the front fascia, on a panel including the schematic diagram indicating the device's status (closed, open, earthed):
■ **Closed:** the drive shaft is operated via a quick acting mechanism, independent of the operator. No energy is stored in the switch, apart from when switching operations are taking place.
For combined switch fuses, the opening mechanism is armed at the same time as the contacts are closed.
■ **Opening:** the switch is opened using the same quick acting mechanism, operated in the opposite direction.
For circuit breakers and the combined switch fuses, opening is controlled by:
□ a push-button,
□ a fault.
■ **Earthing:** a specific control shaft enables the opening or closing of the earthing contacts. Access to this shaft is blocked by a cover that can be slid back if the switch is open but which remains locked in place if it is closed.

Visibility of main contacts

Visibility of main contacts (option)

The position of main contacts is clearly visible from the front of the cubicle through the window.

Gas pressure indicator (option)

Despite SM6 switch is sealed pressure system and has open and close capacity on rated current at 0 bar relative pressure SF6, to insure you about the internal pressure, we propose on request before sale or on site by after-sales either a pressure switch or an analog manometer on the switch.
These devices are both fitted without any alteration on the switch, they are temperature compensated and compatible with visibility of main contacts if requested.

Voltage Presence Indicating System

VPIS complies with IEC 61958 and 62271-206 standard allowing to indicate the voltage presence on each phase with LEDs. Designed for harsh environments so that to guarantee high reliability in MV/LV substations worldwide.
Exits in Voltage Output version to provide voltage presence information to VD23 voltage presence relay.

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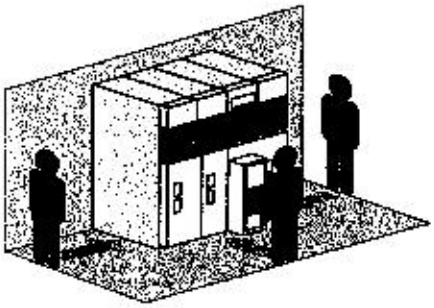
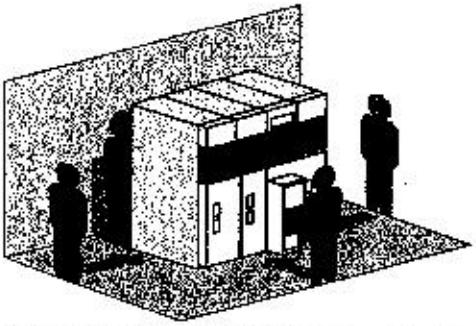
Safety of people
By internal arc protection

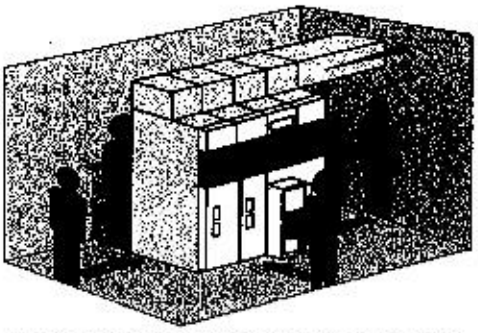
Standard IEC 62271-200 appendix A indicates a method for testing switchgear in metal enclosures under internal arc conditions. The aim of this test is to show that an operator situated in front of a switchboard would be protected against the effects of an internal fault.



Example of installation of an SM6 switchboard installed against the wall downwards exhaust 12,5 kA 1 s and 16 kA 1 s, IAC: A-FL: 3-sides internal arc protection



Example of installation of an SM6 24 kV switchboard installed in the middle of a room downwards exhaust 16 kA 1 s, IAC: A-FLR: 4-sides internal arc protection



Example of installation of an SM6 24 kV switchboard installed in the middle of a room upwards exhaust 16 kA 1 s and 20 kA 1 s, IAC: A-FLR: 4-sides internal arc protection

To enhance the safety of people, it is desirable to provide as high a degree of protection as possible by evacuating the effects of internal arc using:
- Evacuation systems which direct gases towards the top or the bottom of the switchboard enabling over pressure to be limited in the case of an internal fault in the compartments
- Channelling and evacuating hot gases towards an external area, which is not hazardous for the operator
- Materials which are non-inflammable in the cubicles
- Reinforced panels.

Consequently:

The SM6 is designed to offer a good level of safety

- **Control of the architecture:**
  - compartment type enclosure.
- **Technological control:**
  - electrotechnical: modelling of electrical fields,
  - mechanical: parts produced using CAD systems.
- **Use of reliable components:**
  - choice of materials,
  - earthing switch with closing capacity.
- **Devices for total operating safety:**
  - voltage presence indicator on the front face,
  - natural reliable interlocking,
  - locking using keys or padlocks.

Internal arc withstand (in conformity with IEC 62271-200)

- **3 versions are available for SM6 24 kV:**
  - 12.5 kA 1 s, IAC: A-FL
  - 16 kA 1 s, IAC: A-FLR & IAC: A-FL
  - 20 kA 1 s, IAC: A-FLR & IAC: A-FL
- **1 version is available for SM6 36 kV:**
  - 16 kA 1 s, IAC: A-FL

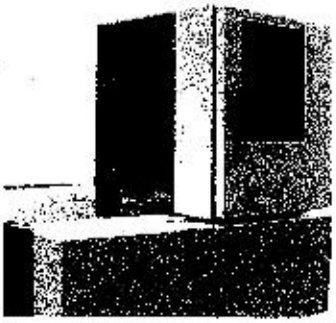
SM6 internal arc (in conformity with IEC 62271-200 appendix A)

In all internal arc versions, the SM6 has successfully passed all of the type testing relative to standard IEC 62271-200 (5 acceptance criteria).
The materials used meet the constraints for which the SM6 is designed.
The thermal and mechanical forces that an internal arc can produce are perfectly absorbed by the enclosure.
An operator situated in front of the SM6 switchboard during an internal fault will not be exposed to the effects of arcing.

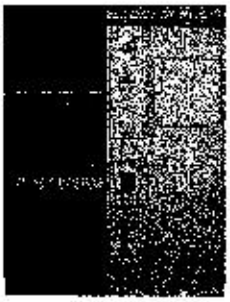
SM6 proposes several options to install a standard internal arc withstand switchboard

- **3-sides internal arc protection IAC: A-FL,**
  12,5 kA 1 s and 16 kA 1 s for 24 kV and 16 kA 1 s for 36 kV.
  SM6 switchboard positioned against the wall, access to the rear of the cubicles is impossible, internal arc protection on three sides is sufficient.
- **4-sides internal arc protection IAC: A-FLR,**
  16 kA 1 s and 20 kA 1 s for 24 kV.
  For SM6 switchboards installed in the middle of a room, 4-sides internal arc protection is necessary in order to protect an operator moving around the switchboard.
- **Choice of exhaust:**
  (installation requirements manual to be considered)
  - **downwards exhaust**
    Civil engineering with an adequate volume is necessary.
  - **upwards exhaust for 24 kV**
    A ceiling height greater or equal than 2 150 mm is necessary, duct at the right or left side of the cubicle (not supplied).

MV electrical network management
Easergy T200 S for 24 kV



Easergy T200 S for 24 kV: remote control interface in LV control cabinet



Control command

Back up power supply

Split core CTs

Easergy T200 S for NSM cubicle

Easergy T200 S is a simplified MV substation control unit for secondary distribution networks enabling remote control of one or two MV substation switches.
T200 S, a version of the T200 unit, is integrated in the SM6 cubicle LV control cabinet.
It is limited to control 2 switches. It is intended for remote control applications for source transfer switching and back up generator set switching in NSM cubicle.

Easergy T200 S a multifunctional "plug and play" interface which integrates all functions required for remote monitoring and control of MV substations:
- Acquisition of various data types: switch position, fault detectors, current values, etc.
- Transmission of opening and closing orders to the switches
- Exchange with the control center.

Particularly used during network incidents, Easergy T200 S has proven its reliability and availability to be able to operate the switchgear at all times. It is easy to implement and operate.

Functional unit dedicated to Medium Voltage applications

Easergy T200 S is installed in the low voltage control cabinet of NSM cubicles for remote control of one or two switches.
Easergy notably enables source transfer switching between two switches.
It has a simple panel for local operation to manage electrical controls (local/remote switch) and to display switchgear status information.
It integrates a fault current detector (overcurrent and zero sequence current) with detection thresholds configurable channel by channel (threshold and fault duration).

"Plug and play" and secure

Integrated in the low voltage control cabinet of an MV-equipped cubicle, it is ready to connect to the data transmission system.
Easergy T200 S has been subject to severe tests on its resistance to MV electrical constraints. A back-up power supply guarantees several hours continuity of service for the electronic devices, motorization and MV switchgear.
Current transformers are of split core type for easier installation.

Compatible with all SCADA remote control systems

Easergy T200 S supplies the following standard protocols:
- Modbus serial and IP
- DPN3 serial and IP
- IEC 870-5-101/104.

Data transmission system standards are: RS232, RS485, PSTN, FSK, FFSK, GSM/GPRS.
Other systems are available on request, the radio frequency emitter/receiver is not supplied.

MV electrical network management
Easergy T200 I

Local information and control

Monitoring and control

Back up power supply

Polarized connectors

Easergy T200 I: an interface designed for control and monitoring of MV networks

Easergy T200 I is a "plug and play" or multifunction interface that integrates all the functional units necessary for remote supervision and control of the SM6:
- Acquisition of the different types of information: switch position, fault detectors, current values...
- Transmission of switch open/close orders
- Exchanges with the control center.

Required particularly during outages in the network, Easergy T200 I is of proven reliability and availability, being able to ensure switchgear operation at any moment. It is simple to set up and to operate.

Functional unit designed for the Medium Voltage network

- Easergy T200 I is designed to be connected directly to the MV switchgear, without requiring a special converter.
- It has a simple front plate for local operation, which allows management of electrical rating mechanisms (local/remote switch) and display of information concerning switchgear status.
- It has an integrated MV network fault current detection system (overcurrent and zero sequence) with detection set points that can be configured channel by channel (current value and fault current duration).

Medium Voltage switchgear operating guarantee

- Easergy T200 I has undergone severe MV electrical stress withstand tests.
- It is a backed up power supply which guarantees continuity of service for several hours in case of loss of the auxiliary source, and supplies power to the Easergy T200 I and the MV switchgear motor mechanisms.
- Ready to plug
  - Easergy T200 I is delivered with a kit that makes it easy to connect the motor mechanisms and collect measurements.
  - the connectors are polarized to avoid any errors during installation or maintenance interventions.
  - current measurement acquisition sensors are of the split type, to facilitate their installation.
  - works with 24 Vdc and 48 Vdc motor units.

Compatible with all SCADA remote control systems

Easergy T200 I supplies the following standard protocols:
- Modbus serial and IP
- DPN3 serial and IP
- IEC 870-5-101/104.

Data transmission system standards are: RS232, RS485, PSTN, FSK, FFSK, GSM/GPRS.

Other systems are available on request, the radio frequency emitter/receiver is not supplied.

VD23

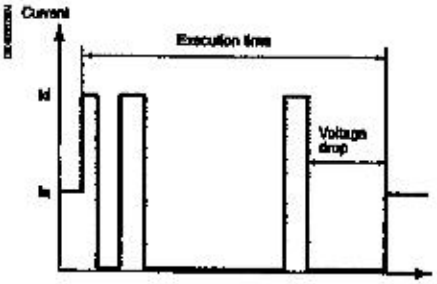
Voltage detection relay

VD23 provides accurate information of presence or absence of voltage. Associated with VPIS-Voltage Output, VD23 is typically used in critical power and safety applications.

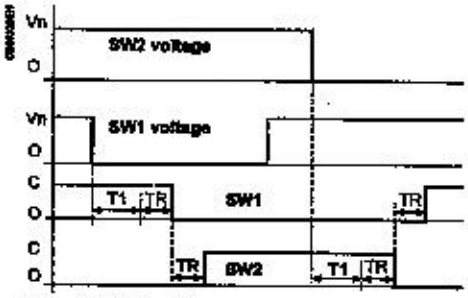
Various combinations of voltage detection are possible:
- 3 Ph-N and residual voltage: V1 + V2 + V3 + V0
- 3 Ph-N or Ph-Ph voltage: V1 + V2 + V3 or U12 + U13 + U23
- 1 Ph-N or Ph-Ph or residual voltage: V1, V2, V3, U12, U13, U23, V0.

VD23 can display the MV network voltage (in % of service voltage), activate the relay output R1 to monitor a loss of voltage on 1 phase at least and active the relay output R2 to monitor a presence of voltage on 1 phase at least.
- Auxiliary power supply: from 24 to 48 Vdc
- Assembly: compact DIN format, mounted in the same place as fault passage indicator (format DIN, integrated in switchgear), terminal connexion fitted with VPIS-Voltage Output
- Compatible with all neutral earthing systems.

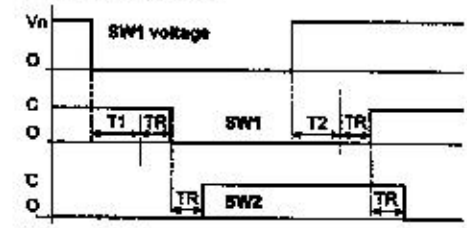
MV electrical network management
Automation systems



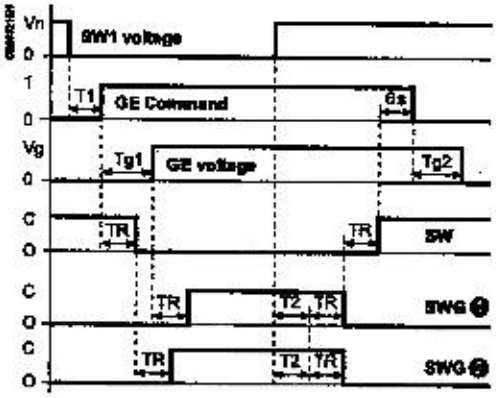
■ Configurable parameters:
□ Number of faults: from 1 to 4
□ Execution time: from 20 s to 4 mins configurable in 5 s steps
□ Automation system valid/invalid.



Network ATS - Semi-Auto Mode
(Without paralleling upon automatic return)
TR: switch response time



Network ATS - Auto Mode SW1
(with paralleling upon automatic return)
TR: switch response time



Generator ATS - Auto SW mode
(Without paralleling upon Auto return)
TR: Switch response time
Tg1: Generator starting time (maximum 60 s)
Tg2: Generator stopping time
Case ❶: Generator channel closing after Generator power on (configurable option)
Case ❷: Generator channel closing after Generator start-up command (configurable option)

Easergy T200 automation systems are factory predefined. No on-site programming is required.

■ The automation systems can be switched on and off from the local operator panel and disabled using the configurator.

■ Switches can be controlled manually in the following circumstances:
□ automation system switched off
□ switch in local mode.

Sectionaliser (SEC)

The sectionaliser automation system opens the switch after a predefined number of faults (1 to 4) during the voltage dip in the reclosing cycle of the top circuit breaker.

■ The automation system counts the number of times a fault current followed by a voltage loss is detected. It sends an open order if:
□ the switch is closed
□ the fault has disappeared
□ the MV supply is absent.

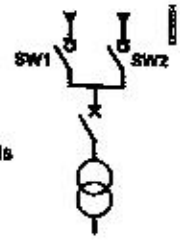
■ The automation system is reset at the end of the execution time delay.

ATS automatic transfer system (source changeover)

The automatic transfer system performs automatic control and management of sources in the MV secondary distribution network.

Two possible versions for ATS:

Network ATS version: control of two MV network channels. The network ATS automatic transfer system requires use of the VD23 relay for detection of voltage presence/absence.



Generator ATS version: control of one network channel and one generating set channel (not available on T200 E).

Note: ATS automatic transfer system is available only on channels 1 and 2 of each CONTROL module. Generator ATS automatic transfer system is available only on the first CONTROL module (channels 1 to 4).

Operating modes

The operating mode is selected from the T200 Web server.

Mode SW1→SW2 or SW2→SW1 (or SW→SWG if Generator ATS):
Automatic transfer system executes only one changeover from the priority channel to the backup channel. Automatic transfer system then remains on that channel.

Semi-Auto mode SW1←→SW2 (or SW←→SWG if Generator ATS):
In the event of a voltage loss on the active channel, automatic transfer system switches to the other channel after a time delay T1. Automatic transfer system executes no return, except in case of voltage loss on the new active channel.

Auto SW1 or Auto SW2 mode (or Auto SW if Generator ATS):
After a changeover, return to the priority channel occurs if the MV voltage on that channel is restored. The channel that has priority can be defined according to the state of a dedicated digital input.

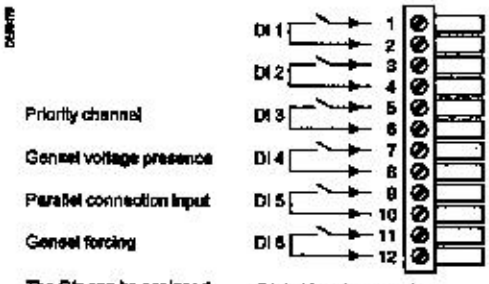
Changeover sequences:

Network ATS: In the event of voltage loss on the normal channel, changeover involves opening the normal channel after time delay T1 and then closing the backup channel.
Note: in "Auto" mode, the sequence of return to the normal channel depends on configuration of the "Paralleling upon auto return" option (see below).

Generator ATS: In the event of voltage loss on the network channel, changeover involves sending the order for opening the network channel and at the same time the Generator start-up order, after time delay T1.
The remainder of the changeover sequence depends on the management of Generator channel closing (configurable option):
■ Case of Generator channel closing after start-up order:
After the Generator start-up order, the closing order is given to the Generator channel, without waiting until the Generator is actually started.
■ Case of Generator closing after Generator power on:
The Generator channel closing order is sent only when Generator voltage is detected.

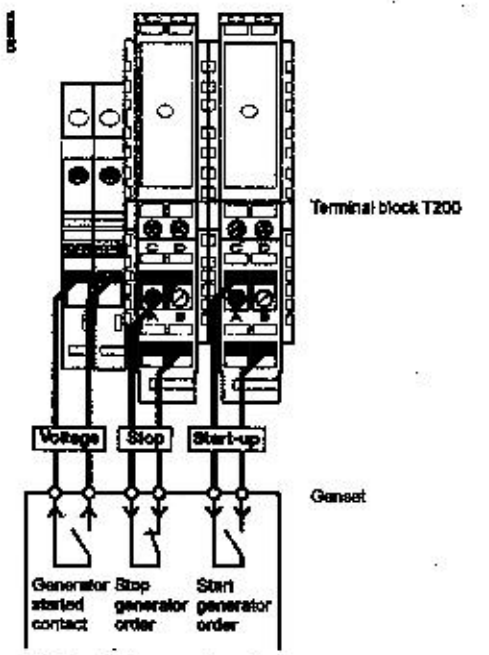
MV electrical network management
Automation systems

Configurable parameters:
- Automatic transfer system ON/OFF
- Operating mode: Semi-Auto, Auto SW1, Auto SW2, SW1 –> SW2, SW2 –> SW1
- T1: 0 ms to 2 min. in increments of 100 ms
- T2: 0 s to 30 min. in increments of 5 s
- Disabling/enabling transfer upon fault detection:
- Choice of voltage presence detection: DI4 or VD23
- Channel connected to generator: SW1 or SW2
- Type of automatic transfer system: Network ATS or Generator ATS
- Manual control enabled/disabled if ATS in operation
- Paralleling enabled/disabled in auto and/or manual mode
- Choice of type of changeover to Generator: immediately or after detection of Generator power on

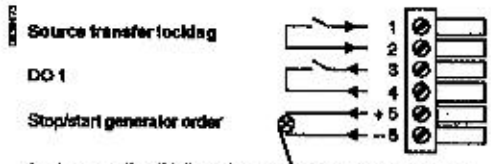


The DIs can be assigned for ATS automation (configurable options)

Digital input connection ("J2" or "J10" terminal block)



Interface with the generating set



Lock connection ("J1" terminal block on the 4-ways interface or "J9" on the 2-ways interface)

Paralleling upon Auto return
A software-configurable option allows the automatic transfer system to disable or enable paralleling of the channels upon automatic return to the main channel (in "Auto" mode).
Enabling of paralleling must be confirmed by the activation of a dedicated digital input.

Paralleling disabled: Auto return to the priority channel involves opening the backup channel and, when it is open, closing the priority channel.

Paralleling enabled: Auto return to the priority channel involves first closing the priority channel and, when it is closed, opening the backup channel.

Changeover conditions
Changeover takes place if the following conditions are met:
- Automatic transfer system in operation
- SW1 open and SW2 closed or SW1 closed and SW2 open
- Absence of fault current on the two channels (only if locking by fault detection option activated)
- "Transfer locking" absent
- "Earthing switch" absent on the two channels
- MV voltage absent on the active channel
- MV voltage present on the other channel.

Return to the main channel for the "Auto" modes occurs if:
- The priority channel is open
- The MV voltage on the priority channel is present during time delay T2.

Generating set connections
Relays are installed in factory in the T200 enclosure to provide interfacing with the generating set (Generator ATS version only). Connection should be performed as follows (see diagram opposite):
- **Voltage:** contact closed if Generator started, to be wired on the two available terminals (do not wire if detection of power on is performed by a relay VD23)
- **Start-up:** Generator start-up order, to be wired on terminals C and B
- **Stop:** Generator stoppage order, to be wired on terminals D and B.

Detection of voltage presence
Voltage presence on a channel managing the Generator can be executed by two processes:
- Either by a dedicated "Voltage" digital input
- Or by voltage relay VD23 (via cubicle cable).

Override setting on generator (Generator ATS only)
For routine test or reduced pricing requirements, it is possible to perform override setting of operation on the generator manually, remotely (from the supervisor) or locally (activation by a dedicated digital input).
When the override setting is terminated, the automatic transfer system places itself back in the initial mode, i.e. in the mode that was active before the override setting (ON or OFF). During override setting, the automatic transfer system is set to "ON" for channels 1 and 2.

Source transfer locking
A dedicated digital input allows changeover to be locked if a problem occurs on one of the devices related to the changeover. This input is generally connected to the downstream circuit breaker. Local and remote controls are no longer possible in this case.

Specific Generator-related management
- Upon transfer to the Generator, if the latter doesn't start, the automatic transfer system waits for a period of 60 s at most before stopping changeover, then:
  - in SW –> SWG mode: the automatic transfer system is locked and must be reset (on the Control panel) to restart the device.
  - In SW <–> SWG mode or in Auto mode: the automatic transfer system remains operational.

  If voltage returns to the network channel, the automatic transfer system requests return to the network channel.
- When the automatic transfer system is configured with auto return on the network channel, Generator stoppage is requested 6 s after the changeover sequence is completed.

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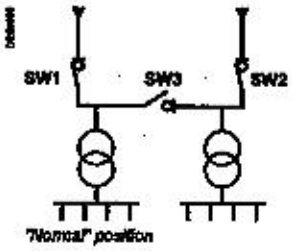
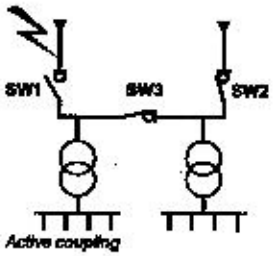
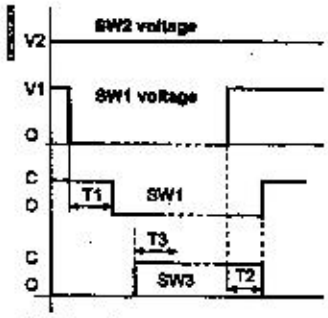
MV electrical network management
Automation systems



"Normal" position



Active coupling



Configurable parameters:
- Operating mode:
Standard/locking upon voltage loss
- Automatic return: SW1/SW2
- Automation system: on/off
- Delay before switching
T1: 100 ms to 60 s in 100 ms steps
- Delay before return
T2: 5 s to 300 s in 1 s steps
- Interlock delay on voltage loss
T3: 100 ms to 3 s in 100 ms steps
- Motorisation type: command time
- Manual control: enabled/disabled in local and remote modes if automation system in operation
- Paralleling: enabled/disabled in auto and (or) manual modes
- Transfer locking upon fault detection.

Bus tie coupling (BTA) with T200 I

The BTA (Bus Tie Automatism) is an automation system for switching sources between two incoming lines (SW1 and SW2) and a busbar coupling switch (SW3). It must be used in conjunction with VD23 type voltage presence detectors and the fault current detection function on the busbar incoming lines.

Operating mode

Two operating modes can be configured:
- Standard mode:
If the voltage is lost on one busbar, the automation system opens the incoming line (SW1 or SW2) and closes the coupling switch SW3. Coupling is conditional upon the absence of a fault current on the main source.
- Interlock on loss of voltage after switching mode:
After execution of the automation system in standard mode, the voltage presence is checked for a configurable period. If the voltage is lost during this period, the coupling switch SW3 is opened and the automation system interlocked.

Coupling sequence

- Coupling takes place if the following conditions are met:
  - the automation system is switched on
  - the switches on incoming channels SW1 and SW2 are closed
  - the earthing switches SW1, SW2 and SW3 are open
  - there is no voltage on an incoming line SW1 or SW2
  - there is no fault current detection on SW1 and SW2
  - there is no transfer interlock
  - voltage is present on the other incoming line.
- The coupling sequence in standard mode is as follows:
  - opening of the de-energised incoming line switch after a delay T1
  - closing of the coupling switch SW3.
- The coupling sequence in "Interlock on loss of voltage after coupling" mode is completed as follows:
  - monitoring of the voltage stability for a delay T3
  - opening of the coupling switch SW3 if this condition is not met
  - locking of BTA automation system.
- The system returns to standard mode after coupling if:
  - the "return to SW1 or SW2" option is activated
  - voltage on the channel has been normal for a delay T2
  - the automation system is activated
  - the automation system is not locked
  - there is no coupling interlock.

Coupling interlock

A dedicated digital input allows changeover to be locked if a problem occurs on one of the devices related to the changeover. This input is generally connected to the downstream circuit breaker. Local and remote controls are no longer possible in this case.

Locking the automation system

The BTA automation system is locked if one of the following conditions is met during the coupling process:
- Failure of a command to open or close a switch
- Indication that an earthing switch has closed
- Appearance of a fault current
- Switch power supply fault
- Appearance of the coupling interlock
- Manual or remote ON/OFF command from the automation system.

Paralleling upon Auto return

A software-configurable option allows the automation system to disable or enable paralleling of the channels upon automatic return to the main channel (in "Auto" mode). Enabling of paralleling must be confirmed by the activation of a dedicated digital input.

If paralleling is disabled: Auto return to the normal channel involves opening the coupling channel (SW3) and, when it is open, closing the normal channel.

If paralleling is enabled: Auto return to the normal channel involves first closing the normal channel and, when it is closed, opening the coupling channel (SW3).

Fault indicators

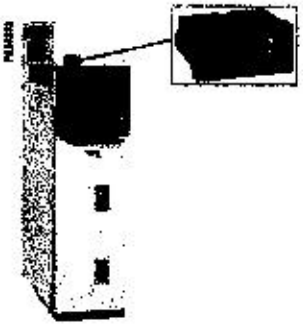
Easergy Flair is a comprehensive range of underground network fault current indicators

Easergy MV underground network fault current passage indicators are a range of products adapted to all neutral earthing systems: insulated, impedant and direct earthing.

- Easergy Flair 21D-22D-23DV, are self-powered with a liquid crystal display, with DIN dimensions for MV cubicle installation.
- Easergy Flair 279 and 219, have a wall-mounted case for the MV cubicles substation or LV compartment and an external power supply which can be backed up (Li battery or LV supply + Li battery in LV compartment).
- Easergy Flair 200C is a communicating Fault passage indicator with advanced measurement functions and Modbus master port for data concentration.



Application	Underground MV networks, isolated, impedant and solidly earthed + compensated		
Installation	Flush mounted	Wall-mounted	Wall-mounted
Power supply	Self-powered or dual power	230 Vac and/or Li battery	230 Vac and rechargeable battery
Fault detection	Phase-phase and phase-earth for all 3 ranges		
Indication	Led and LCD display + optional external light indicator	External light indicator	External light indicator (option)
Measurement	Current, frequency		Current, voltage, power
Communication	Dry output contact	Dry output contact	Modbus, DNP3, IEC101&104, GMS, GPRS and others



Easergy Flair 21D - 22D - 23DV

SM6 can integrate Flair 21D, Flair 22D and Flair 23DV on every incoming cubicles.

- **High performance indicators**
  - indication of phase-phase and phase-earth faults,
  - faulty phase indication,
  - compatible with HV/MV substation protection devices.
- **Clear and comprehensive display**
  - displaying the faulty phase for earth fault,
  - displaying settings,
  - displaying the load current including peak demand and frequency meter.
- **Maintenance free.**

Automatic fault detection calibration mode	■	■	■
Short-circuit fault thresholds	■	■	■
Earth fault thresholds	■	■	■
Fault acknowledge time	■	■	■
Type of CT (CT1 or CT2)	■	■	■
Time delay for resetting upon current return (or voltage return on Flair 22D and Flair 23DV)		■	■
Time delay for fault resetting		■	■
Time delay for fault confirmation		■	■
Inrush time delay		■	■
Phase at fault	L1-L2-L3	L1-L2-L3	L1-L2-L3
Load current	■	■	■
MV network frequency	50/60 Hz	50/60 Hz	50/60 Hz
Current madmeter	■	■	■
Residual current	■	■	■

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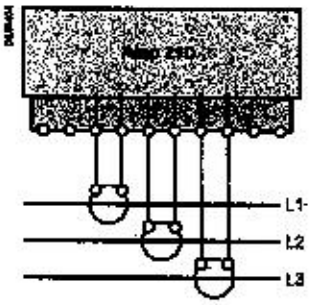
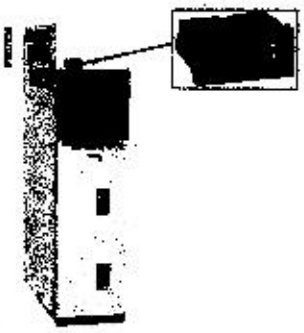
Ammeter

■ **At the leading edge of technology,** Amp 21D is suitable for Medium Voltage network load management.
■ **Self-powered,** it ensures a permanent display of currents.
■ **Compact and in DIN format,** it fits naturally into MV cubicles.
■ **Cost efficient,** it uses the CT optimised for Fault Passage Indicator.
■ **Performant,** it displays phase current and maximum of current.





The SM6 can integrate ammeter Amp 21D on all incoming cubicles and the fuse-switch cubicles

Functions

■ Display of 3 phase current: I1 , I2 , I3. Range: 3 A to 630 A
■ Display of 3 phase current maximeter: I1 , I2 , I3. Range: 3 to 630 A.

Display principle

■ Load currents are permanently displayed
□ continuous scrolling of L1, then L2, then L3.
■ Maximeter
□ access to maximeter display by pressing a dedicated push button
□ continuous scrolling of M1, then M2, then M3
□ reset of all maximeter by pressing a combination of two push buttons.

Connections, assembly

Small size enclosure
■ DIN format: 93 x 45 mm
■ Secured, extraction-proff mounting
■ Terminal connections.

Current sensors
■ Split core CT for mounting on MV cables.

Frequency		50 Hz and 60 Hz
Load current	Minimum current	≥ 3 A
Range	Phase current	3 to 630 A (resolution 1 A)
	Accuracy (I < 630 A)	± (2% + 2 digit)
Reset of maximeter	Manual from device	Yes
Self power	From the current sensors	I load ≥ 3 A
Battery		No
Auxiliary supply		No
	Display	4 digits LCD
	Current per phase	Yes (resolution 1A)
	Maximeter per phase	Yes
	Phase CTs	3 split core CT
	Test	Yes

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Protection and control monitoring
Sepam selection guide for all applications

The Sepam range of protection and metering is designed for the operation of machines and electrical distribution networks of industrial installations and utility substations for all levels of voltage.

It consists of complete, simple and reliable solutions, suited to following five families: Sepam series 10, 20, 40, 60 and 80.

A range adapted at your application

- Protection of substation (incoming, outgoing line and busbars).
- Protection of transformers.
- Protection of motors, and generators.

Simplicity

Easy to install

- Light, compact base unit.
- Optional modules fitted on a DIN rail, connected using prefabricated cords.
- User friendly and powerful PC parameter and protection setting software to utilize all of Sepam's possibilities.

User-friendly

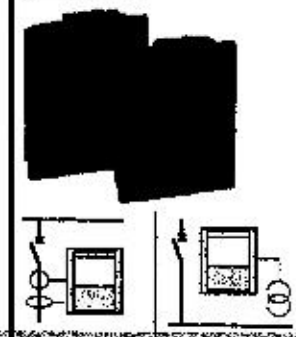
- Intuitive User Machine Interface, with direct data access.
- Local operating data in the user's language.

Accurate measurement and detailed diagnosis

- Measuring all necessary electrical values.
- Monitoring switchgear status: sensors and trip circuit, mechanical switchgear status.
- Disturbance recording.
- Sepam self-diagnosis and watchdog.

Flexibility and evolutivity

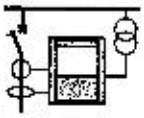
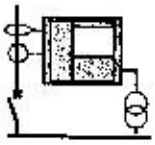
- Enhanced by optional modules to evolve in step with your installation.
- Possible to add optional modules at any time.
- Simple to connect and commission via a parameter setting procedure.



	Series 10	Series 20			
Protections					
Current	■	■	■		
Voltage				■	■
Frequency				■	■
Specifics	Phase and earth fault overcurrent		Breaker failure		Disconnection by rate of change of frequency
Applications					
Substation	10A, 10B	S20	S24		
Busbar				B21	B22
Transformer	10A, 10B	T20	T24		
Motor		M20			
Generator					
Capacitor					
Characteristics					
Logic inputs	4	0 to 10		0 to 10	
Logic outputs	7	4 to 8		4 to 8	
Temperature sensors		0 to 8		0 to 8	
Channel					
Current	3I + Io	3I + Io			
Voltage				3V + Vo	
LPCT (1)		■			
Communication ports	1	1 to 2		1 to 2	
IEC61850 Protocol		■		■	
Control					
Matrix (2)		■		■	
Logic equation editor					
Logipam (3)					
Other					
Backup battery	Lithium battery (4)				
Front memory cartridge with settings					

(1) LPCT: low-power current transformer complying with standard IEC 60044-8.
(2) Control matrix for simple assignment of information from the protection, control and monitoring functions.
(3) Logipam ladder language (PC programming environment) to make full use of Sepam series 80 functions.
(4) Standard lithium battery 1/2 AA format, 3.6 V, front face exchangeable.

Protection and control monitoring
Sepam selection guide for all applications

	Series 40			Series 60		
						
						
Protections						
Current	■	■	■	■	■	■
Voltage	■	■	■	■	■	■
Frequency	■	■	■	■	■	■
Specifics		Directional earth fault	Directional earth fault and phase overcurrent		Directional earth fault	Directional earth fault and phase overcurrent
Applications						
Substation	S40	S41, S43	S42	S80		S82
Busbar						
Transformer	T40		T42	T80		T82
Motor		M41			M81	
Generator	G40			G80		G82
Capacitor				C80		
Connection capacity						
Logic inputs	0 to 10			0 to 28		
Logic outputs	4 to 8			4 to 16		
Temperature sensors	0 to 16			0 to 16		
Channel						
Current	3 I + Io			3 I + Io		
Voltage	3V, 2U + Vo			3V, 2U + Vo or Vnt		
LPCT [1]	■			■		
Communication ports	1 to 2			1 to 2		
IEC61850 Protocol	■			■		
Control						
Matrix [2]	■			■		
Logic equation editor	■			■		
Logipam [3]						
Other						
Backup battery	48 hours			Lithium battery [4]		
Front memory cartridge with settings				■		

(1) LPCT: low-power current transformer complying with standard IEC 60044-8.
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Protection and control monitoring
Sepam selection guide for all applications

Series 80

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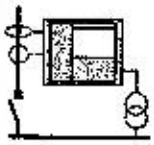
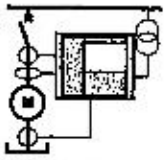
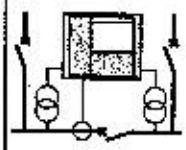
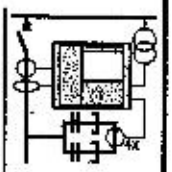

Protections								
Current	■	■	■	■	■	■	■	■
Voltage	■	■	■	■	■	■	■	■
Frequency	■	■	■	■	■	■	■	■
Specifics		Directional earth fault	Directional earth fault and phase overcurrent	Disconnection by rate of change of frequency	Transformer & transformer-machine unit differential	Machine differential	Voltage and frequency protection for 2 sets of busbars	Capacitor-bank unbalance
Applications								
Substation	S80	S81	S82	S84				
Busbar	B80						B83	
Transformer		T81	T82		T87			
Motor		M81			M88	M87		
Generator			G82		G88	G87		
Capacitor								C86
Characteristics								
Logic inputs	0 to 42				0 to 42		0 to 42	0 to 42
Logic outputs	5 to 23				5 to 23		5 to 23	5 to 23
Temperature sensors	0 to 16				0 to 16		0 to 16	0 to 16
Channel								
Current	3I + 2 x Io				2 x 3I + 2 x Io		3I + Io	2 x 3I + 2 x Io
Voltage	3V + Vo				3V + Vo		2 x 3V + 2 x Vo	3V + Vo
LPCT [1]	■				■		■	■
Communication ports	2 to 4				2 to 4		2 to 4	2 to 4
IEC61850 Protocol	■				■		■	■
Control								
Matrix [2]	■				■		■	■
Logic equation editor	■				■		■	■
Logipam [3]	■				■		■	■
Other								
Backup battery	Lithium battery [4]				Lithium battery [4]		Lithium battery [4]	Lithium battery [4]
Front memory cartridge with settings	■				■		■	■

(1) LPCT: low-power current transformer complying with standard IEC 60044-8.
(2) Control matrix for simple assignment of information from the protection, control and monitoring functions.
(3) Logipam ladder language (PC programming environment) to make full use of Sepam series 80 functions.
(4) Standard lithium battery 1/2 AA format, 3.6 V, front face exchangeable.

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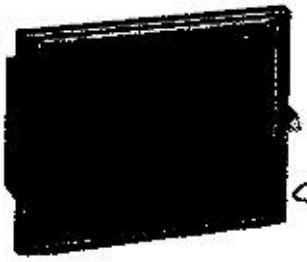
Protection and control monitoring
VIP 35 protection relay
VIP 300 LL protection relay



VIP 35

VIP 35 relay for transformer protection

Integrated in the DM1-S and DMV-S cubicles for SM6 24 kV
The VIP 35 is an independent relay without an auxiliary power supply, powered by the current sensors, and actuating a Mitop release unit.
VIP 35 provides protection against phase-to-phase faults and against earthing faults.

Phase protection
■ phase protection is achieved by a definite time threshold which functions from 1.2 times the operating current (Is).

Earthing protection
■ earthing fault protection functions with the residual current measurement taken from the sum of the secondary currents in the sensors. This is taken via a CRc, 8 A to 80 A gauge.
■ earthing protection is inverse definite time: its threshold and time delay can be set.

Setting the VIP 35 relays
Is: the phase operating current is adjusted directly in accordance with the transformer rating and the operating voltage.
Io: the earth current threshold is adjusted according to the network characteristics.

Setting values of the Is phase operating current for VIP 35

[illegible]																						
[illegible]	10	15	20	25	36	45	55	68	80	115	140	170	200									
[illegible]	10	15	18	22	28	36	45	58	70	90	115	140	200									
[illegible]	8	12	15	18	22	28	36	48	55	70	90	115	140	200								
[illegible]	8*	8	12	15	18	22	28	35	45	55	68	90	115	140	170							
[illegible]	8*	8*	10	12	18	20	25	36	45	55	68	80	115	140	170	200						
[illegible]	8*	8*	10	12	15	18	22	28	36	45	58	70	90	115	140	200						
[illegible]	8*	8*	8*	8	10	12	15	20	25	30	37	55	68	80	115	140	170	200				
[illegible]	8*	8*	8*	8*	10	12	15	18	22	28	36	45	55	68	90	115	140	170				
[illegible]	8*	8*	8*	8*	8	10	12	15	18	22	28	36	45	55	68	90	115	140	170			
[illegible]	8*	8*	8*	8*	8*	8	10	15	18	20	25	36	45	55	68	80	115	140	170	200		
[illegible]	8*	8*	8*	8*	8*	8*	8	10	12	15	20	25	30	37	55	68	80	115	140	170	200	
[illegible]	8*	8*	8*	8*	8*	8*	8	10	12	15	18	22	28	36	45	55	68	90	115	140	170	

** Short-circuit protection, no over-load protection*

VIP 300 LL

VIP 300 LL protection relay

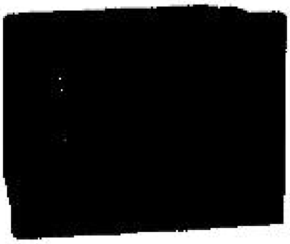
Integrated in the DM1-S and DMV-S cubicles for SM6 24 kV
VIP 300 provides protection against phase-to-phase and phase-to-earth faults.
A choice of trip curves and the large number of possible settings mean that it can be used in a large variety of selectivity layouts.
VIP 300 is an independent relay powered by the current sensors; it does not require an auxiliary power supply. It actuates a release unit.

Phase protection
■ phase protection is via two independently adjustable thresholds:
□ the lower threshold can be chosen to be inverse definite time or definite time.
The definite time curves are in conformity with IEC standard 60255-3.
They are either of inverse, very inverse or extremely inverse type.
□ the upper threshold is inverse definite time.

Earthing protection
■ protection against phase-to-earth faults uses the residual current measurement, taken from the sum of the secondary currents in the sensors. This is taken via a CRa X1 gauge: 10 to 50 A and X4: 40 to 200 A or via a CRb X1 gauge: 63 to 312 A and X4: 250 A to 1250 A.
■ as for phase protection, phase-to-earth protection had two thresholds that can be independently set.

Signalling
■ two indicators show the origin of the trip operation (phase or earth). They remain in position after the relay power supply has been cut.
two led indicators (phase and earth) show that the lower threshold has been exceeded and that its time delay is currently in progress.

Protection and control monitoring
Sepam series 10 with CRa/CRb sensors



Sepam series 10

Sepam series 10 with CRa/CRb sensors for transformer protection

Integrated in the DM1-S cubicle for SM6 24 kV with CRa and CRb sensors and DM1-A cubicle for SM6 36 kV with normal CT's

Sepam series 10 monitors phase and/or earth-fault currents.
Two models meet a wide range of different needs:

- **10B**: Sepam series 10B protects against overloads, phase-to-phase faults and earth faults.
- **10A**: Sepam series 10A provides the same functions as model B, but with a communication port, more inputs and outputs, and additional protection and monitoring functions.

Setting of Sepam series 10 for DM1-S 24 kV
Is: the phase operating current is adjusted directly in accordance with the transformer rating and the operating voltage.
Io: the earth current threshold is adjusted according to the network characteristics.

Setting values of the Is phase operating current

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	19	24	31	39	49	61	77	98	121	154	192	■	■	■	■	■	
[illegible]		22	28	35	44	56	70	87	110	140	175	■	■	■	■	■	
[illegible]			22	27	34	43	55	69	87	110	137	172	■	■	■	■	■
[illegible]				21	26	33	42	52	66	84	105	131	165	■	■	■	■
[illegible]				19	24	30	38	48	61	77	96	120	154	192	■	■	■
[illegible]					22	28	35	44	56	70	87	109	140	175	■	■	■
[illegible]							23	29	36	46	58	72	92	115	144	173	■
[illegible]							21	26	33	42	52	66	84	105	131	157	184
[illegible]								21	26	33	42	52	67	84	105	126	146
[illegible]								19	24	31	38	48	62	77	96	115	135
[illegible]										23	29	36	46	58	72	87	101
[illegible]										21	26	33	42	52	66	79	92

Sensors types legend
▨ CRa 200/1 ■ CRb 1250/1

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Protection and control monitoring
Protection and sensor selection table

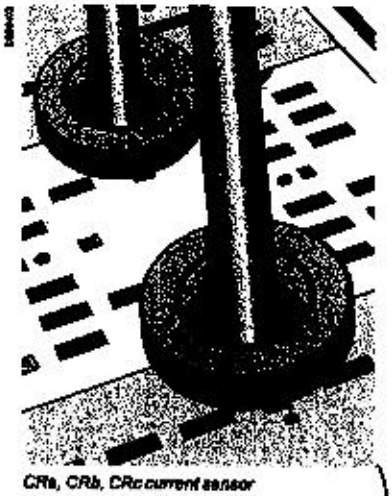
General common selection of protection units

Protection type	Code	Protection units						
Three-phase overcurrent	50 - 51	■	■	■	■	■	■ (2)	■ (1)
Zero-sequence overcurrent	50N - 51N	■	■	■	■	■	■ (3)	■ (1)
Directional zero-sequence current	67N			■	■	■		
Undervoltage	27			■	■	■		
Overvoltage	59			■	■	■		
Thermal image	49	■	■	■	■	■		
Zero-sequence overvoltage	59N			■	■	■		
Negative sequence overcurrent	46		■	■	■	■		
Long start-up and rotor blocking	51LR		■	■	■	■		
Maximum number of start-ups	66		■	■	■	■		
Single-phase undercurrent	37		■	■	■	■		
Communication		■	■	■	■	■		

(1) DT, EI, SI, VI and RI trip curves.
(2) Inverse curve suited to transformer protection.
(3) DT trip curve.

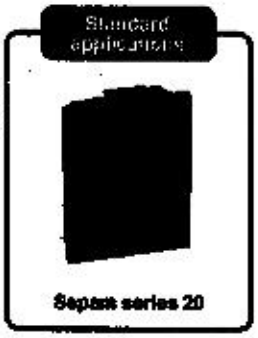
Current sensor for VIP 35 and VIP 300LL and Sepam series 10 for 24 kV

CRa	143.5	81	37.5	2.16	1/200	± 2% from 10 A to 100 A ± 1% from 100 A to 1600 A	On load 5.7 Ω (cal. x 1)		■	■
						± 1% from 10 A to 10 kA	On load 0.67 Ω (cal. x 4)			
CRb	143.5	81	37.5	1.26	1/1250	± 1% from 10 A to 11 kA	On load 5.7 Ω (cal. x 1)		■	■
						± 1 % from 10 A to 25 kA	On load 0.67 Ω (cal. x 4)			
CRc	143.5	81	37.5	2	S1-S2: 1/200 S1-S3: 1/500	S1-S2: ± 5% from 10 A to 60 A ± 2.5 % from 60 A to 600 A S1-S3: ± 2% from 20 A to 2200 A	On load 0.5 Ω	■		



CRa, CRb, CRc current sensor

Protection and control monitoring
LPCT protection chain



Sepam series 20

Sepam series 40

Sepam series 60 and 80

TLP130, TLP160, TLP190, CLP2 sensors for Sepam series 20, 40, 60, 80 protection units

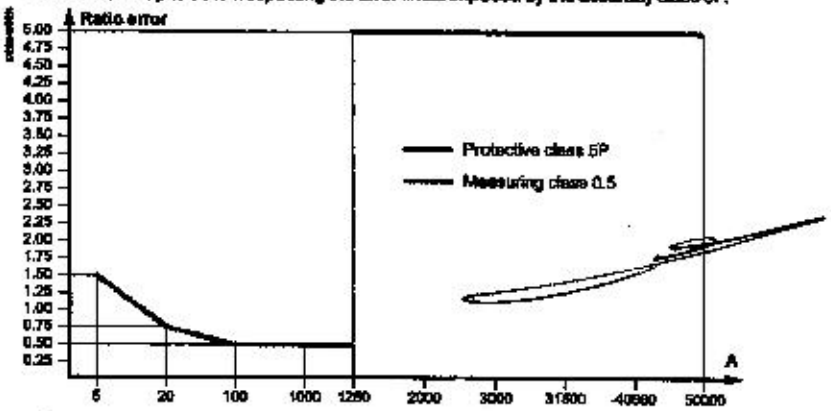
LPCT sensors are voltage-output current sensors (Low Power Current Transformer) compliant with the IEC 60044-8 standard.
These sensors are designed to measure rated current between 5 A and 630 A, with a ratio of 100 A / 22.5 mV.

Sepam series 20, 40, 60 and 80 protection units are at the heart of the LPCT protection chain.
Sepam series 20, 40, 60 and 80 performs the following functions:
- acquisition of phase currents measured by the LPCT sensors
- utilization of measurements by the protection functions
- tripping of the breaking device in case of fault detection.

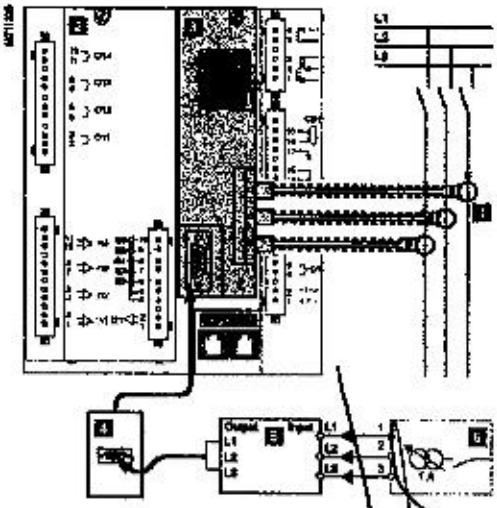
Advantages

- **Consistent protection chain with the same sensor measures phase currents from 5 A to 630 A**
- Simple to install and implement:
  - Installation of LPCT sensors
  - TLP130, TLP160 and TLP190 are installed around MV cable
  - CLP2 is installed on the MV circuit
  - LPCT connected directly to Sepam series 20, 40, 60 and 80
  - accessories available to test the LPCT protection chain by secondary current injection.
- LPCTs range of use

LPCT measuring and protection function guaranteeing the accuracy up to the short-time current.
Following the range of use of LPCT:
- from 5 A up to 1250 A respecting the error limits imposed by the accuracy class 0,5
- from 1250 A up to 50 kA respecting the error limits imposed by the accuracy class 5P.



- **Optimized integration of functions:**
  - measurement of phase rated currents as of 25 A that is set by micro-switch
  - monitoring of LPCT sensor by Sepam series 20, 40, 60 and 80 (detection of phase loss).



Connections

1 **LPCT sensor**, equipped with a shielded cable fitted with an RJ45 connector to be connected directly to the card **3**

2 **Sepam series 20, 40, 60 and 80 protection unit**

3 **Card interface** that adapts the voltage delivered by the LPCT sensors, with microswitch setting of rated current.
- CCA671 card for series 60 and 80
- CCA670 card for series 20 and 40.

Testing and injection

4 **CCA613 remote test plug**, flush-mounted in front panel of cubicle, equipped with a 3-m cord to be connected to the CCA670 connector test socket (9-pin Sub D)

5 **ACE917 injection interface**, used to test the LPCT protection chain with a standard injection box

6 **Standard 1A injection box**

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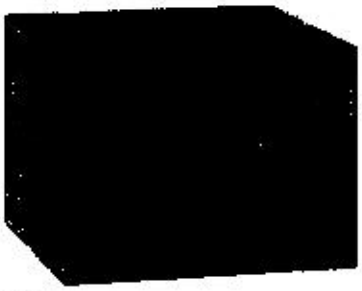
PS100 high-availability power supply

Backup solution for MV switchgear power needs in the event of micro outages and power interruptions.

- Easy maintenance with only one battery
- Remote battery monitoring
- High level of insulation to protect the electronic devices in harsh MV environments
- End-of-life alarm possible via Modbus communication
- Compliant with standards IEC 60 255-5 (10 kV level).



PS100

PS100 backup power supply for MV substations

Applications

The power supply unit supplies backup operating power for:
- MV switchgear motor mechanisms and circuit breaker coils
- Transmission equipment (e.g. radio)
- Control units such as RTU or Automatic Transfer System
- Protection relays, Fault Passage Indicators and others electronic devices.

High availability power supply

A battery ensures uninterrupted operation of the whole substation in the event of loss of the main supply. The backup power supply unit:
- Includes a regulated and temperature-compensated charger
- Stops the battery before deep discharge
- Carries out a battery check every 12 hours
- Measures battery ageing
- Forwards monitoring information via a Modbus communication port and output relays.

PS100 benefits

Only one battery

Traditional backup power supplies require a set of 2 or 4 batteries to produce 24 V or 48 V, with complicated replacement and adjustment of the battery pack.

The PS100 needs only one battery, simplifying replacement.

The battery is a standard sealed lead-acid 12 V battery with a 10-year service. It can be purchased easily, anywhere in the world.

Improved availability of MV/LV substations

The PS100 is designed to ride through power network interruptions of up to 48 hours. It is associated with a battery selected to meet the required backup time.

The PS100 protects and optimises the battery with state-of-the-art monitoring. A Modbus communication port forwards monitoring data to allow optimised maintenance operations. Perfect integration with the Easergy range to control and monitor your distribution network.

Additional energy backup

The PS100 stops supplying power and reserves an "additional energy backup" to restart the installation after an extended power interruption.

The "additional energy backup" can be enabled with a local pushbutton to provide energy for restarting the protection relays and operating the MV switchgear.

Withstands severe substation environments

The PS100 includes 10 kV insulation, electronic protection against overvoltage and overloads, and automatic restart after a fault.

Main features

- DIN rail mounting for easy integration in any LV cabinet or MV/LV substation
- 2 power supply outputs:
  - 12 Vdc - 18 W continuous - 100 W 20 s (for modem, radio, RTU, etc.)
  - 48 Vdc or 24 Vdc - 300 W/1 minute (for switchgear operating mechanism motors) and 90 W/ continuous for protection relays, electronic devices, etc.
- RJ45 Modbus communication port
- 2 output relays (AC supply ON, Battery ON)
- Diagnosis with LEDs
- 1 sealed lead-acid 12 V battery with a 10-year service life (from 7 Ah to 40 Ah)
- Power supply paralleling available with a 2nd PS100
- -40°C to +70°C operating temperature.

Range

PS100-48V	48 Vdc power supply and battery charger
PS100-24V	24 Vdc power supply and battery charger
Bat24AH	24 Ah long life battery
Bat38AH	38 Ah long life battery

Contents

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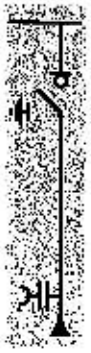
Functional units selection
Switching

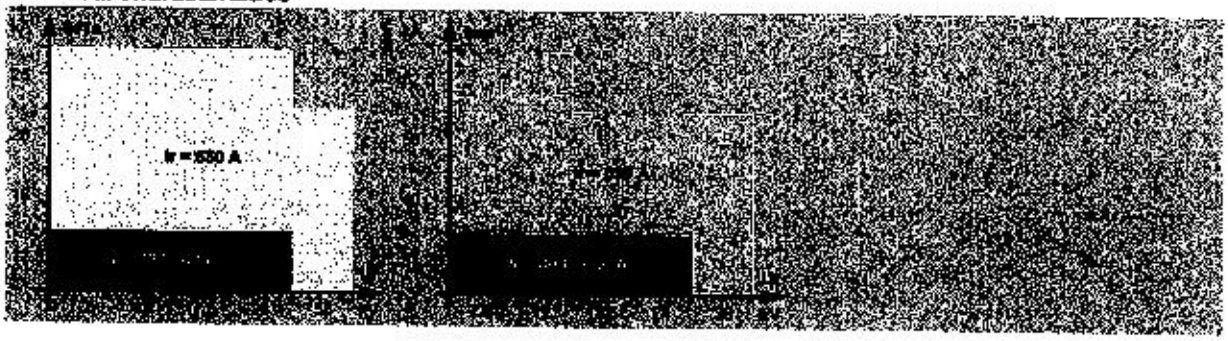
IM
Switch unit



IMC
Switch unit

IMB
Switch unit with earthing switch
Right or left outgoing

Electrical characteristics



Basic equipment:

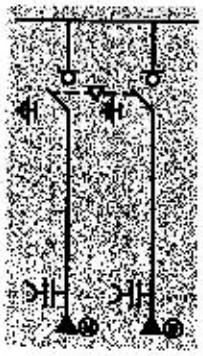
Versions:

Optional accessories:

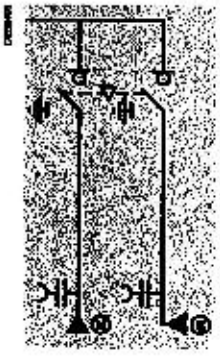
- motor for operating mechanism
- auxiliary contacts
- key-type interlocks
- release units (coil)
- operation counter
- 1250 A three-phase upper busbars
- 630 A three-phase upper busbars for severe operating conditions for 24 kV
- visibility of main contacts
- pressure indicator device
- enlarged low-voltage control cabinet for 24 kV
- 50 W heating element for 24 kV
- cable connection by the top (no internal arc withstand if selected)
- fault indicators
- Connection pads for two dry-type single-core cables for 36 kV
- digital ammeter
- surge arresters (for 36 kV and for 24 kV in 500 mm width cubicle)
- 630 A busbars earthing switch cabinet for 24 kV (not available for internal arc IEC62271-200)

Functional units selection
Switching
Automatic Transfer System for 24 kV

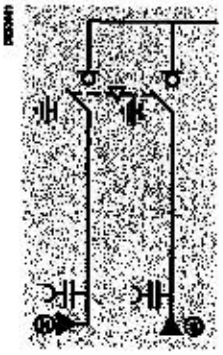
NSM-cables
Cables power supply for main incoming line (N) and standby line (S)



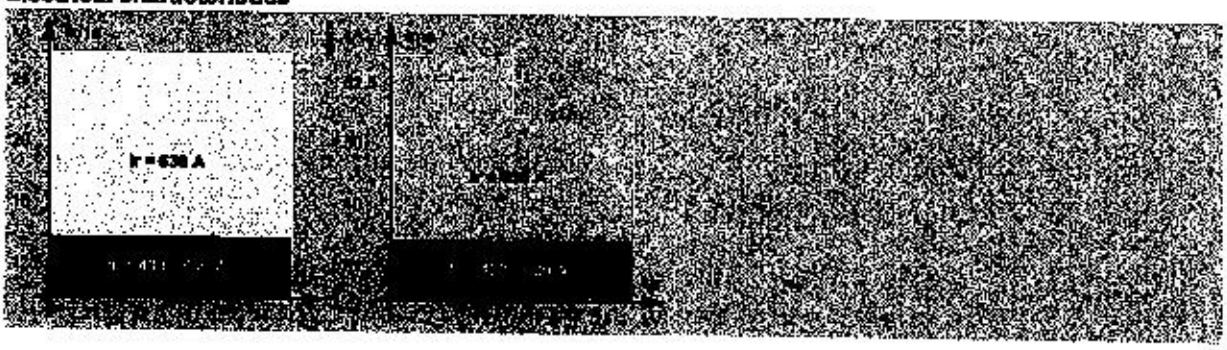
NSM-busbars
Cables power supply for main incoming line on left (N) and **busbars** for standby line (S) on right



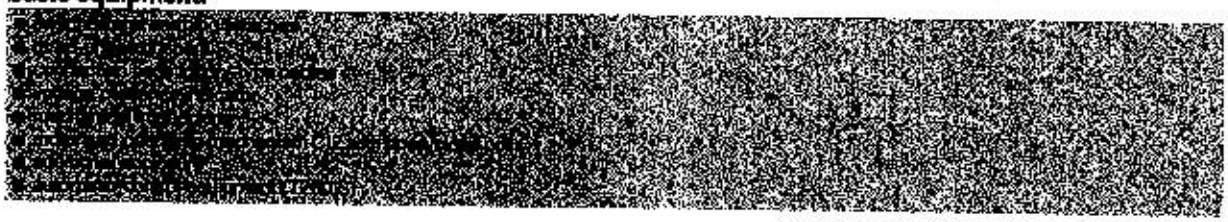
NSM-busbars
Busbars power supply for main incoming line on left (N) and **cables** for standby line (S) on right



Electrical characteristics



Basic equipment:



Optional accessories:

- auxiliary contacts
- key-type interlocks
- 50 W heating element
- control and monitoring
- visibility of main contacts
- pressure indicator device
- 1250 A three-phase upper busbars
- 630 A three-phase upper busbars for severe operating conditions

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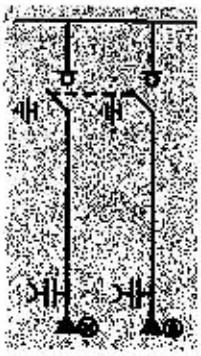
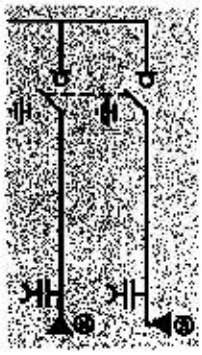
Functional units selection
Switching
Automatic Transfer System for 36 kV

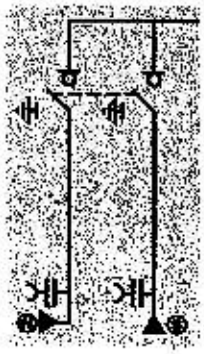
NSM-cables
Cables power supply for main incoming line (N) and standby line (S)



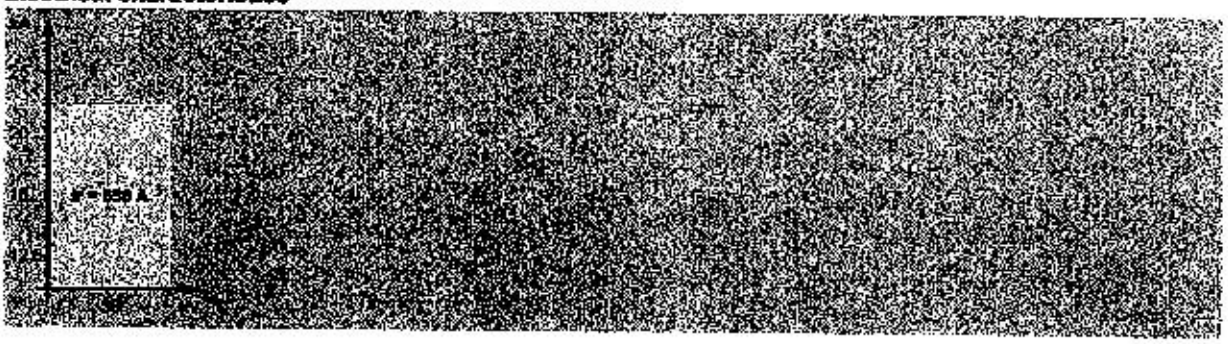
NSM-busbars
Cables power supply for main incoming line on left (N) and busbars for standby line (S) on right



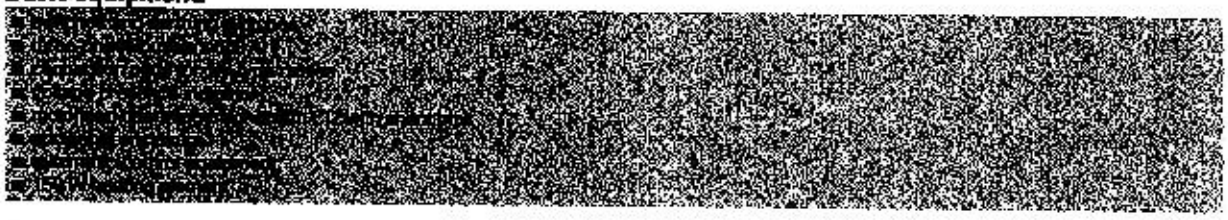
NSM-busbars
Busbars power supply for main incoming line on left (N) and cables for standby line (S) on right



Electrical characteristics



Basic equipment:



Optional accessories:
- auxiliary contacts
- key-type interlocks
- control and monitoring

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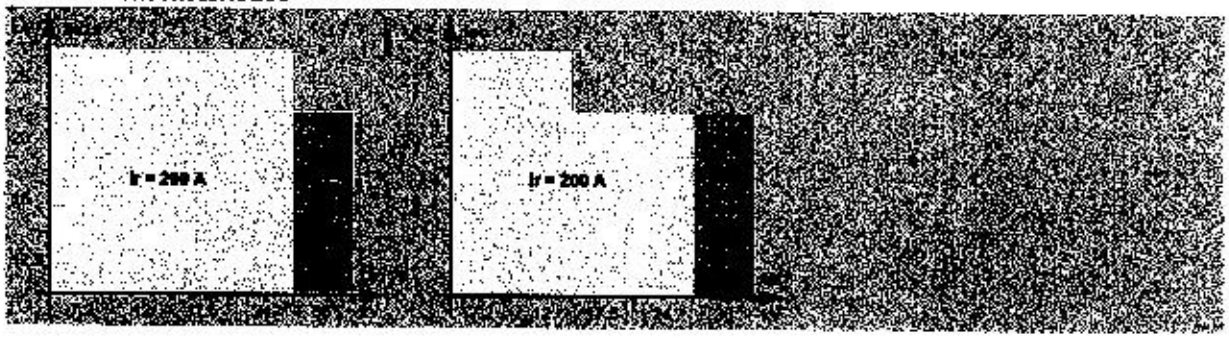
Functional units selection
Protection
Fuse-switch

QM
Fuse-switch combination unit

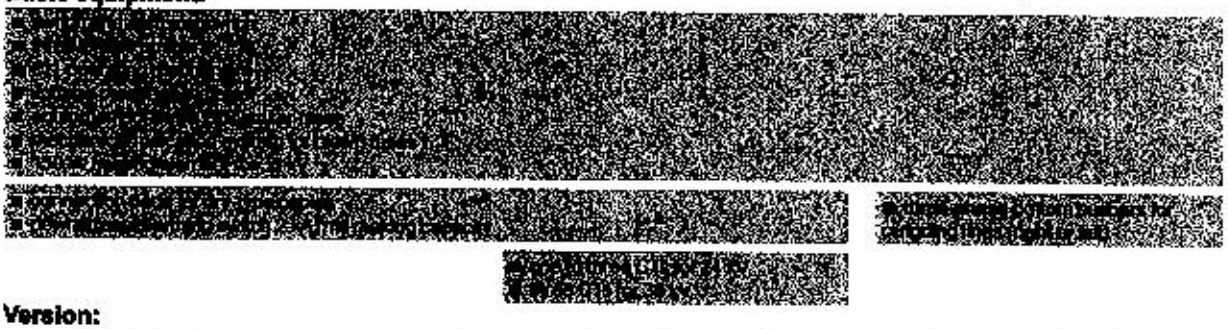
QMC
Fuse-switch combination unit

QMB
Fuse-switch combination unit
Outgoing line right or left

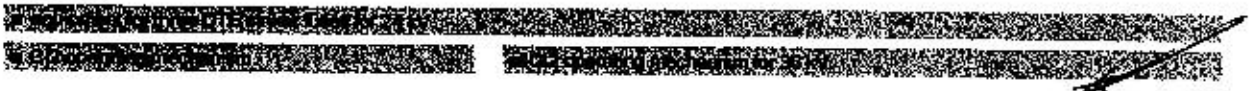
Electrical characteristics



Basic equipment:



Version:



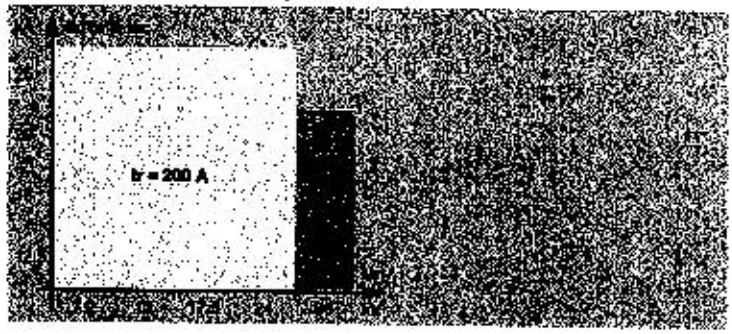
Optional accessories:

- motor for operating mechanism
- auxiliary contacts
- key-type interlocks
- auxiliary contact for blown fuses
- DIN striker fuses
- release units (coil)
- digital ammeter
- 1250 A three-phase upper busbars
- cable connection by the top (no internal arc withstand if selected)
- visibility of main contacts
- pressure indicator device
- 630 A three-phase upper busbars for severe operating conditions for 24 kV
- enlarged low-voltage control cabinet for 24 kV
- 50 W heating element for 24 kV

Functional units selection
Protection
Fuse-switch

PM
Fused-switch unit

Electrical characteristics



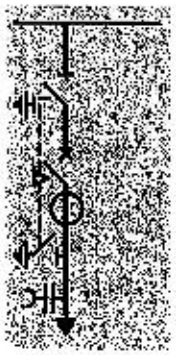
Basic equipment:

Version:

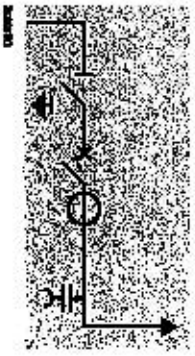
Optional accessories:
- motor for operating mechanism
- auxiliary contacts
- digital ammeter
- key type interlocks
- mechanical indication system for blown fuses
- 1250 A three-phase upper busbars
- cable connection by the top (no internal arc withstand if selected)
- UTE (for 24 kV) or DIN striker fuses
- visibility of main contacts
- pressure indicator device
- 630 A three-phase upper busbars for severe operating conditions for 24 kV
- enlarged low-voltage control cabinet for 24 kV
- 50 W heating element for 24 kV
- Release units for 36 kV

Functional units selection
Protection
SF6 type circuit breaker

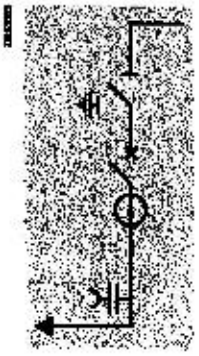
DM1-A
Single-isolation
disconnectable CB unit



DM1-D
Single-isolation
disconnectable CB unit
Outgoing line on right



DM1-D
Single-isolation
disconnectable CB unit
Outgoing line on left



Electrical characteristics

[redacted]

Ir = 630 - 1250 A

[redacted]

Basic equipment:

[redacted]

Version:

[redacted]

Optional accessories:

- cubicle:
- auxiliary contacts on the disconnector
- protection using Sepam programmable electronic unit
- three voltage transformers
- key-type interlocks
- 1250 A three-phase upper busbars at Ir 630 A
- cable connection by the top (no internal arc withstand if selected)
- surge arresters
- 630 A busbars earthing switch cabinet for 24 kV (not available for internal arc IEC62271-200)
- 630 A three-phase upper busbars for severe operating conditions for 24 kV
- enlarged low-voltage control cabinet for 24 kV
- 50 W heating element for 24 kV
- connection pads for two dry-type single-core cables for 36 kV

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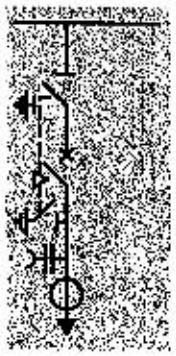
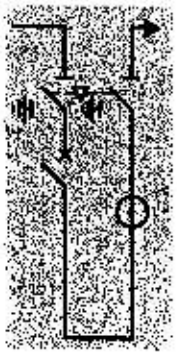
Functional units selection
Protection
SF6 type circuit breaker

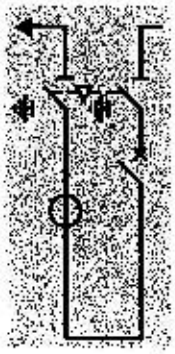
DM1-S
Single-isolation
disconnectable CB unit
with independent protection



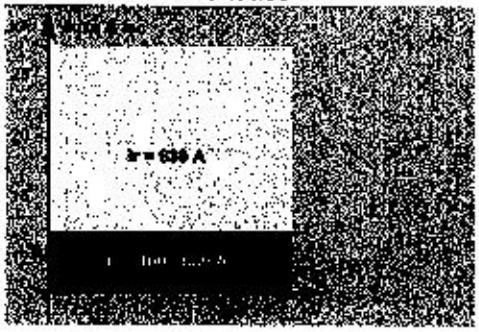
DM2
Double-isolation
disconnectable CB unit
Outgoing line on right

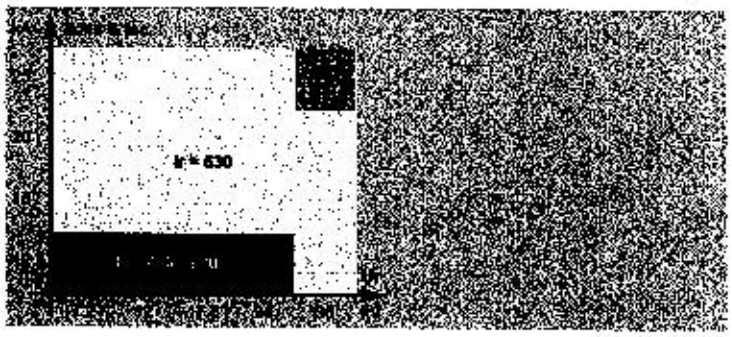


DM2
Double-isolation
disconnectable CB unit
Outgoing line on left



Electrical characteristics





Basic equipment:

Version:

Optional accessories:

■ cubicle:
- ☐ three voltage transformers
- ☐ key-type interlocks

- ☐ 1250 A three-phase upper busbars at Ir 630 A
- ☐ 630 A three-phase upper busbars for severe operating conditions for 24 kV
- ☐ enlarged low-voltage control cabinet for 24 kV

■ circuit breaker:
- ☐ motor for operating mechanism
- ☐ release units (coil)
- ☐ operation counter on manual operating mechanism

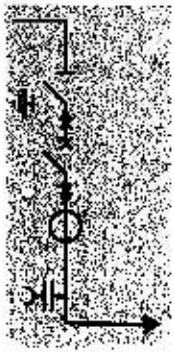
■ cubicle:
- ☐ protection using Sepam programmable electronic unit
- ☐ auxiliary contacts on disconnectors
- ☐ 2 voltage transformers phase-to-phase or 3 voltage transformers phase-to-earth

- ☐ cable connection by the top
- ☐ 50 W heating element for 24 kV

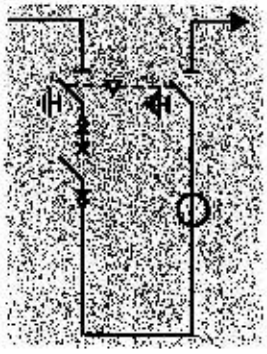
Functional units selection
Protection
SF6 type circuit breaker

DM1-W
Withdrawable single-isolation circuit breaker unit

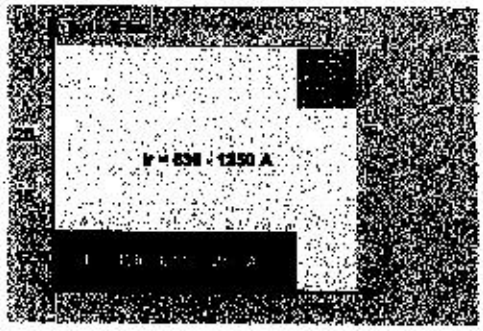
DM1-Z
Withdrawable single-isolation CB unit
Outgoing line on right

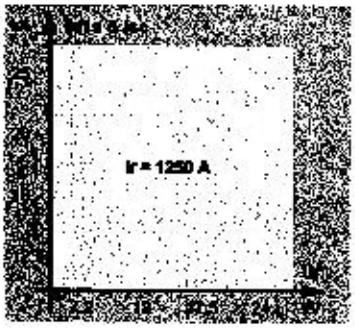


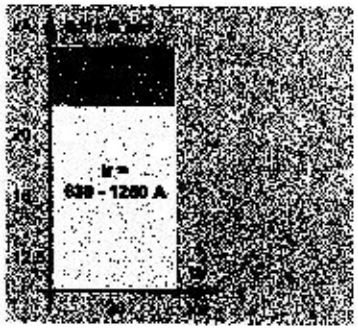
DM2-W
Withdrawable double-isolation CB unit
Outgoing line on right



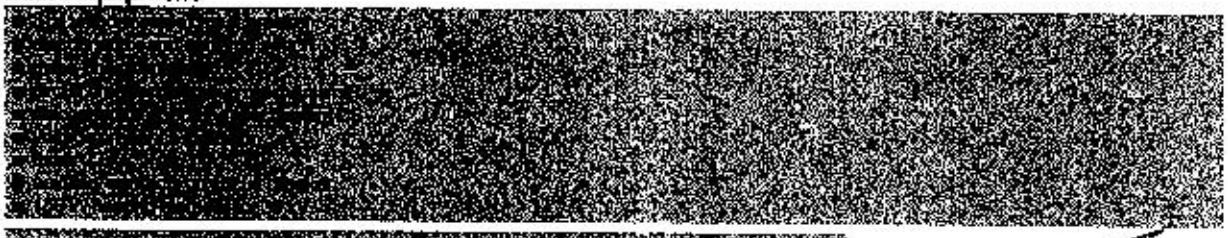
Electrical characteristics







Basic equipment:



Version:

Optional accessories:

■ cubicle:
- □ auxiliary contacts on the disconnector
- □ protection using Sepam programmable electronic unit
- □ key-type interlocks
- □ three voltage transformers for 24 kV
- □ connection enclosure for cabling from above for 24 kV
- □ 50 W heating element for 24 kV
- □ enlarged low-voltage control cabinet for 24 kV

- □ 1250 A three-phase upper busbars at Ir 630 A
- □ 630 A three-phase upper busbars for severe operating conditions for 24 kV
- □ surge arresters (only for 630 A and 24 kV)

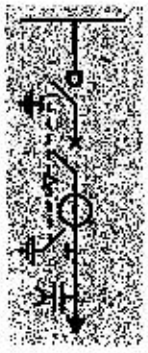
■ circuit breaker:
- □ motor for operating mechanism
- □ release units (coil)
- □ operation counter on manual operating mechanism

■ cubicle:
- □ auxiliary contacts on the disconnector
- □ key-type interlocks
- □ protection using Sepam programmable electronic unit

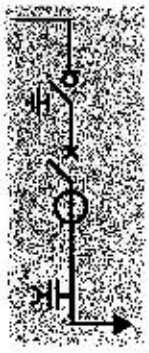
■ circuit breaker:
- □ motor for operating mechanism
- □ operation counter on manual operating mechanism
- □ opening and closing shunt trips

Functional units selection
Protection
Vacuum type circuit breaker

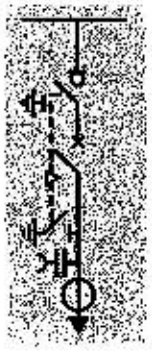
DMV-A
Single-isolation
circuit breaker unit



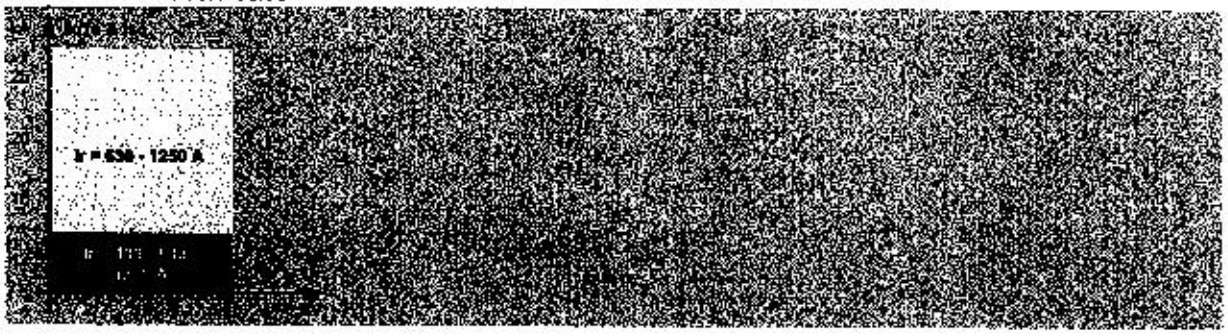
DMV-D
Single-isolation circuit breaker unit
Outgoing line on right



DMV-S
Single-isolation circuit breaker unit
with independent protection



Electrical characteristics



Basic equipment:

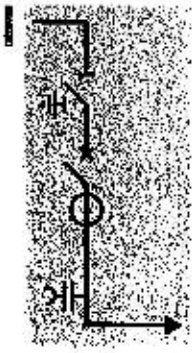
Optional accessories:

- **cubicle:**
  - auxiliary contacts on the disconnector
  - three voltage transformers
  - key-type interlocks
  - 50 W heating element
  - connection enclosure for cabling from above
  - 1250 A three-phase upper busbars at Ir 630 A
  - 630 A three-phase upper busbars for severe operating conditions
  - enlarged low-voltage control cabinet
- **circuit breaker:**
  - motor for operating mechanism
  - release units (coil)
  - operation counter on manual operating mechanism

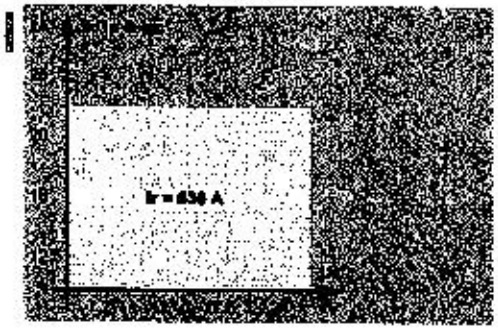
Functional units selection
Protection
Vacuum type circuit breaker

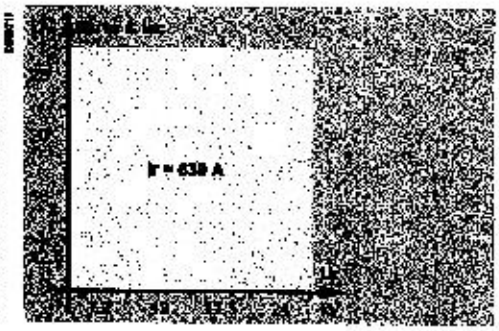
DMVL-A
Single-isolation disconnectable circuit breaker unit

DMVL-D
Single-isolation disconnectable circuit breaker unit
Outgoing line on right



Electrical characteristics





Basic equipment:

Optional accessories:

- cubicle:
  - auxiliary contacts on the disconnector
  - three voltage transformers
  - key-type interlocks
  - 50 W heating element
  - connection enclosure for cabling from above
  - 1250 A three-phase upper busbars at Ir 630 A
  - 630 A three-phase upper busbars for severe operating conditions
  - enlarged low-voltage control cabinet
  - Sepam relay protection
  - surge arresters
- circuit breaker:
  - motor for operating mechanism
  - release units (coil)
  - operation counter on manual operating mechanism

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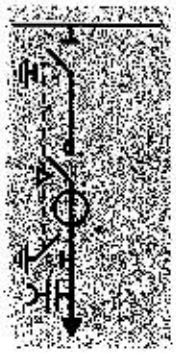
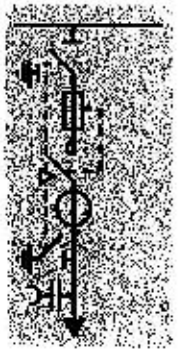
Functional units selection
Protection
Contactor (Direct Motor Starter) for 24 kV

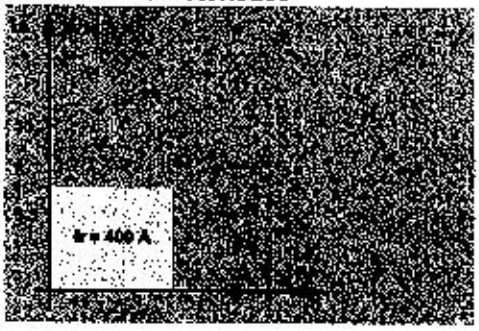
CVM
Disconnectable contactor unit

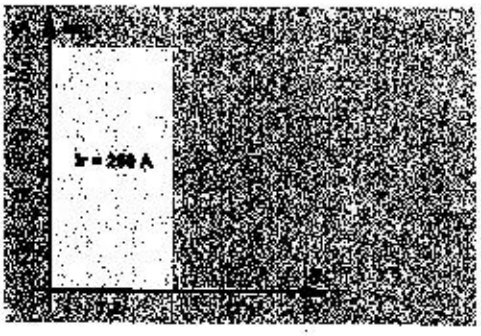


CVM
Disconnectable contactor unit with fuses

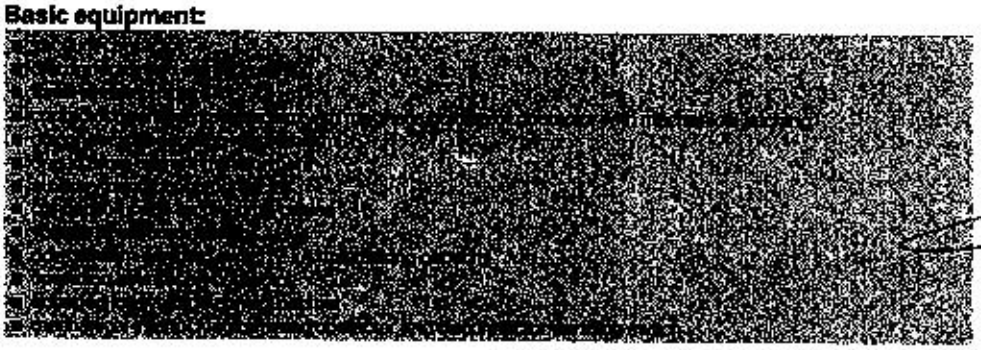


Electrical characteristics





Basic equipment:



Version:

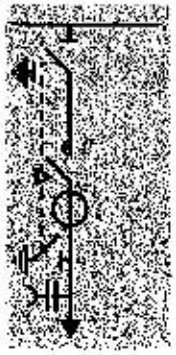
Optional accessories:

- cubicle:
  - auxiliary contacts on the disconnector
  - protection using Sepam programmable electronic unit
  - one to three voltage transformers
  - key-type interlocks
  - 50 W heating element
  - 1250 A three-phase upper busbars
  - 630 A three-phase upper busbars for severe operating conditions
- contactor:
  - mechanical interlocking
- DIN striker fuses

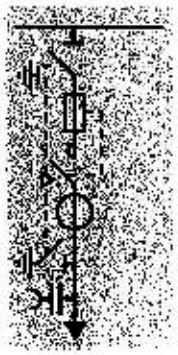
259

Functional units selection
Protection
Contactor (Direct Motor Starter) for 24 kV

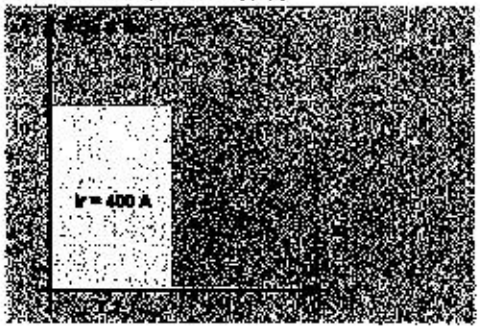
CRM
Contactor unit

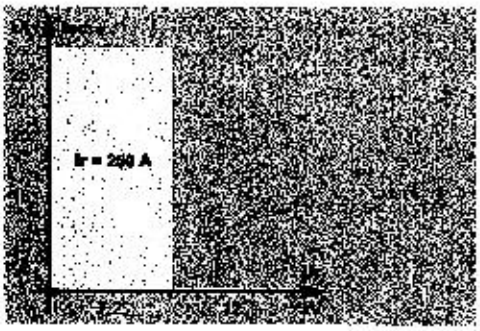


CRM
Contactor unit with fuses

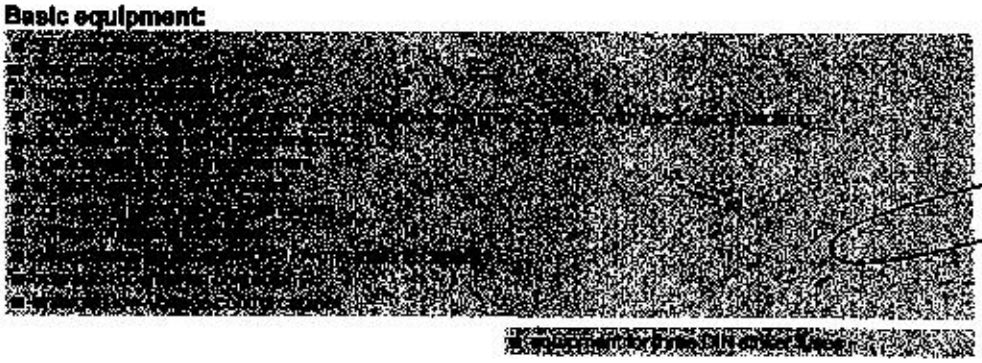


Electrical characteristics





Basic equipment:



■ equipment for three DIN striker fuses

Optional accessories:

■ cubicle:
□ auxiliary contacts on the disconnector
□ protection using Sepam programmable electronic unit
□ one to three voltage transformers
□ key-type interlocks
□ 50 W heating element
□ 1250 A three-phase upper busbars
□ 630 A three-phase upper busbars for severe operating conditions
■ contactor:
□ mechanical interlocking

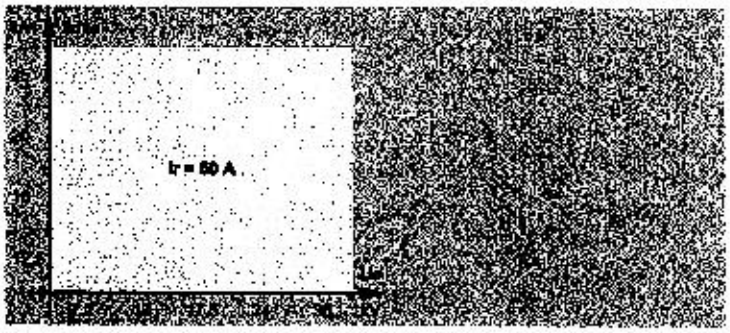
■ DIN striker fuses

Functional units selection
Metering

CM
Voltage transformers unit for network with earthed neutral system

CM2
Voltage transformers unit for network with insulated neutral system

Electrical characteristics



Basic equipment:

Optional accessories:

- auxiliary contacts
- mechanical signalling and auxiliary contact for blown fuses
- 1250 A three-phase upper busbars
- cable connection by the top (no internal arc withstand if selected)
- 50 W heating element for 24 kV
- 630 A three-phase upper busbars for severe operating conditions for 24 kV
- enlarged low-voltage control cabinet for 24 kV

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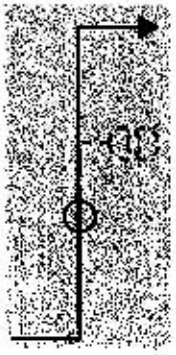
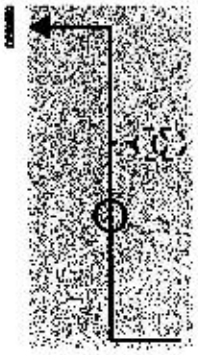
Functional units selection
Metering

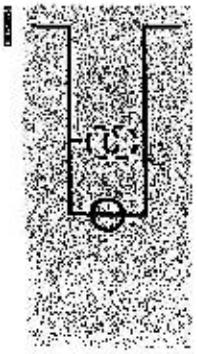
GBC-A
Current and/or voltage measurements unit
Outgoing line on right



GBC-A
Current and/or voltage measurements unit
Outgoing line on left



GBC-B
Current and/or voltage measurements unit



Electrical characteristics

Ir = 630 - 1250 A	[redacted]
[redacted]	

Basic equipment:

[redacted]

Optional accessories:

- 1250 A three-phase upper busbars at Ir 630 A for 24 kV
- enlarged low-voltage control cabinet for 24 kV
- three voltage transformers (phase-to-earth) or two voltage transformers (phase-to-phase) for 24 kV
- 50 W heating element for 24 kV
- cable connection by the top for 36 kV (no internal arc withstand if selected)

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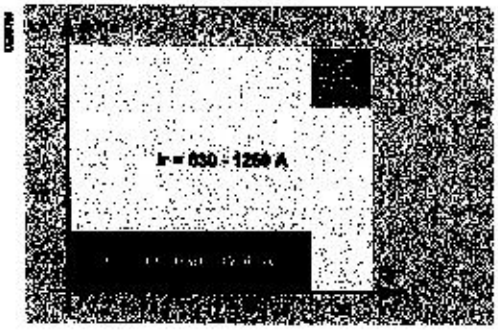
Functional units selection
Other functions

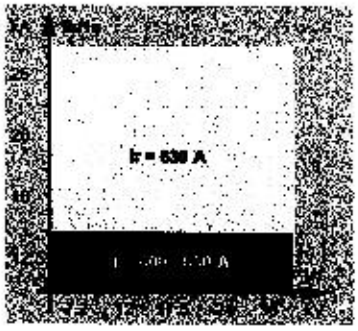
GBM
Connection unit
Outgoing line right or left

GEM
Extension unit VM6/SM6

GIM
Intermediate bus unit

Electrical characteristics





Basic equipment:

Optional accessories:

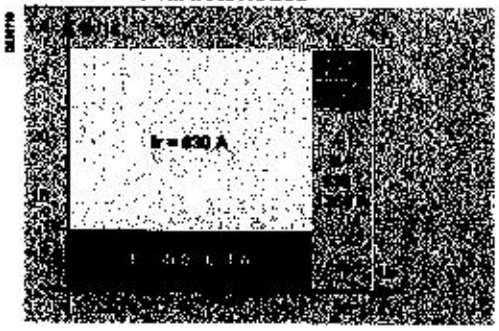
- 1250 A three-phase upper busbars at Ir 630 A
- enlarged low-voltage control cabinet for 24 kV
- cable connection by the top for 36 kV (no internal arc withstand if selected)

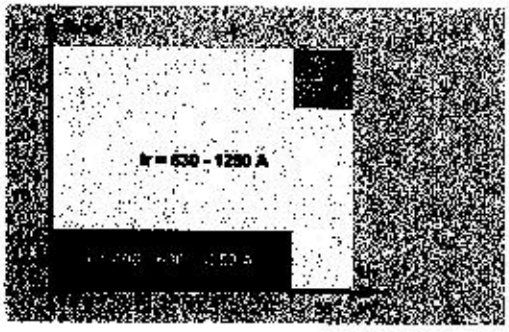
Functional units selection
Other functions

GAM2
Incoming-cable-connection unit

GAM
Incoming-cable-connection unit

Electrical characteristics





Basic equipment:

Optional accessories:

- fault indicator
- digital ammeter
- 1250 A three-phase upper busbars at Ir 630 A
- enlarged low-voltage control cabinet for 24 kV
- cable connection by the top (no internal arc withstand if selected)
- 50 W heating element for 24 kV
- surge arresters for 36 kV
- auxiliary contacts
- key-type interlocks
- surge arresters for 24 kV

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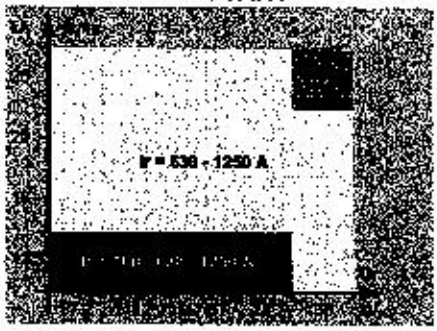
Functional units selection
Other functions

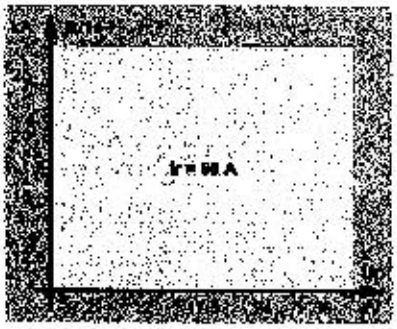
SM
Disconnector unit

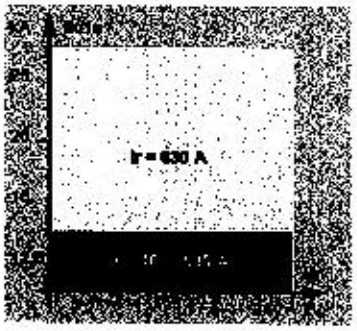
TM
MV/LV transformer unit
for auxiliaries

EMB
Busbars earthing switch
cabinet

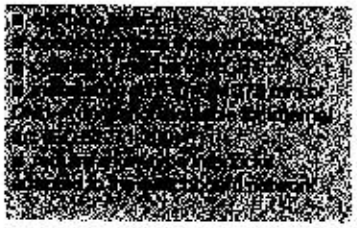
Electrical characteristics







Basic equipment:



Optional accessories:

- auxiliary contacts
- key-type interlocks
- 1250 A three-phase upper busbars at Ir 630 A
- cable connection by the top (no internal arc withstand if selected)
- enlarged low-voltage control cabinet for 24 kV
- 50 W heating element for 24 kV
- 630 A three-phase upper busbars for severe operating conditions for 24 kV
- digital ammeter for 24 kV
- surge arrester for 36 kV
- mechanical indication system and auxiliary contacts for blown fuses

- auxiliary contacts

Operating mechanisms

The control devices required for the unit operating mechanisms are centralised on the front panel. The different types of operating mechanism are presented in the table opposite.
Operating speeds do not depend on the operator, except for the CS.

	Switch/disconnector					Circuit breaker	
	CIT	CI1	CI2	CS	CC	RI	P2
IM, IMB	■	□	□				
IMC	■	□	□				
PM	■	□	□(1)				
QM		■	□				
QMC, QMB		■	□				
CM, CM2, CRM, CVM				■			
DM1-A, DM1-D, DM1-S, DM1-Z, DM2, DMVL-A, DMVL-D				■		■	
DM1-A (2), DM1-W, DM2-W				■	■	■	
DMV-A, DMV-D, DMV-S	■						■
NSM-cables, NSM-busbars			■				
GAM 24 kV					■		
SM, TM, GAM 36 kV				■			
EMB	■						

■ Provided as standard
□ Other possibility
(1) Only 36 kV
(2) 1250 A version

Unit applications	Load-break switch Fused switch		Load-break switch Fuse switch combination		Load-break switch Fuse switch combination			Disconnector	
Main circuit switch	Closing	Opening	Closing	Opening	Mechanism charging	Closing	Opening	Closing	Opening
Manual operating mode	Hand lever	Hand lever	Hand lever	Push button	Hand lever	Push button	Push button	Hand lever	Hand lever
Electrical operating mode (option)	Motor	Motor	Motor	Coil	Motor	Coil	Coil	N/A	N/A
Speed of operation	1 to 2 s	1 to 2 s	4 to 7 s	35 ms	4 to 7 s	55 ms	35 ms	N/A	N/A
Network applications	Remote control network management		Remote control transformer protection		Remote control network management, need of quick reconfiguration (generator source, loop)			N/A	
Earthing switch	Closing	Opening	Closing	Opening	N/A	Closing	Opening	Closing	Opening
Manual operating mode	Hand lever	Hand lever	Hand lever	Hand lever	Hand lever	Hand lever	Hand lever	Hand lever	Hand lever

Double-function operating mechanism CIT

■ **Switch function**
Independent-operation opening or closing by lever or motor.
■ **Earthing-switch function**
Independent-operation opening or closing by lever.
Operating energy is provided by a compressed spring which, when released, causes the contacts to open or close.
■ **Auxiliary contacts**
□ switch (2 O + 2 C) *,
□ switch (2 O + 3 C) and earthing switch (1 O + 1 C),
□ switch (1 C) and earthing switch (1 O + 1 C) if motor option.
■ **Mechanical indications**
Fuses blown in unit PM.
■ **Motor option**

(*) Included with the motor option

Operating mechanisms

Double-function operating mechanism CI1

■ **Switch function**
□ independent-operation closing by lever or motor.
Operating energy is provided by a compressed spring which, when released, causes the contacts to open or close.
□ independent-operation opening by push-button (O) or trip units.
■ **Earthing-switch function**
Independent-operation closing and opening by lever.
Operating energy is provided by a compressed spring which, when released, causes the contacts to open or close.
■ **Auxiliary contacts**
□ switch (2 O + 2 C)*,
□ switch (2 O + 3 C) and earthing switch (1 O + 1 C),
□ switch (1 C) and earthing switch (1 O + 1 C) if motor option,
□ fuses blown (1 C).
■ **Mechanical indications**
Fuses blown in units QM.
■ **Opening releases**
□ shunt trip,
□ undervoltage for unit QM.
■ **Motor option**

(*) Included with the motor option.

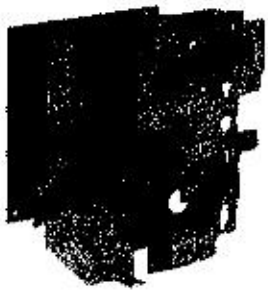
Double-function operating mechanism CI2

■ **Switch function**
□ independent-operation closing in two steps:
1 - operating mechanism recharging by lever or motor,
2 - stored energy released by push-button (I) or trip unit.
□ independant-operation opening by push-button (O) or trip unit.
■ **Earthing-switch function**
Independent-operation closing and opening by lever.
Operating energy is provided by a compressed spring which, when released, causes the contacts to open or close.
■ **Auxiliary contacts**
□ switch (2 O + 2 C)*,
□ switch (2 O + 3 C) and earthing switch (1 O + 1 C),
□ switch (1 C) and earthing switch (1 O + 1 C) if motor option.
■ **Opening release shunt trip**
■ **Closing release shunt trip**
■ **Motor option**

(*) Included with the motor option.

Double-function operating mechanism CS

■ **Disconnector and earth switch functions**
Dependent-operation opening and closing by lever.
■ **Auxiliary contacts**
□ disconnector (2 O + 2 C) for units DM1-A, DM1-D, DM1-W, DM2, DMVL-A, DMVL-D, CVM and CRM without VT,
□ disconnector (2 O + 3 C) and earthing switch (1 O + 1 C) for units DM1-A, DM1-D, DM1-W, DM2, DMVL-A, DMVL-D, CVM and CRM without VT,
□ disconnector (1 O + 2 C) for units CM, CM2, TM, DM1-A, DM1-D, DM2, DMVL-A, DMVL-D, CVM and CRM with VT.
■ **Mechanical indications**
Fuses blown in units CM, CM2 and TM.



Single-function operating mechanism CC

■ **Earthing switch function**
Independent-operation opening and closing by lever.
Operating energy is provided by a compressed spring which, when released, provokes opening or closing of the contacts.
■ **Auxiliary contacts**
Earthing switch (1 O + 1 C).

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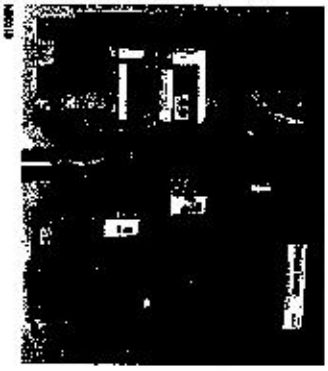
Operating mechanisms

Single-function operating mechanism for the SF circuit breakers 24 kV and 36 kV and Evolis 24 kV lateral

■ **Circuit-breaker function**
□ Independent-operation closing in two steps.
First operating mechanism recharge by motor or lever, then release of the stored energy by push-button (I) or trip unit.
□ Independent-operation opening by push-button (O) or trip units.
■ **Auxiliary contacts**
□ circuit breaker (4 O + 4 C),
□ mechanism charged (1 C).
■ **Mechanical indications**
Operation counter.
■ **Opening releases**
□ Mitop (low energy),
□ shunt trip,
□ undervoltage.
■ **Closing release**
□ shunt trip
■ **Motor option** (option and installation at a later date possible).

Release type	SF1						SFset			
	Combinations						Combinations			
	1	2	3	4	5	6	1	2	3	4
Mitop (low energy)	■	■	■				■	■	■	
Shunt trip		■		■	■			■		
Undervoltage			■		■	■				■



P2 stored energy operating mechanism for the Evolis circuit breaker 17.5 kV frontal

■ **Circuit-breaker function**
□ Independent-switching operating closing in two steps.
First operating mechanism recharge by motor or lever, then release of the stored energy by push-button (I) or trip unit.
□ Independent-operation opening by push-button (O) or trip units.
□ spring energy release.
■ **Auxiliary contacts**
□ circuit breaker (4 O + 4 C),
□ mechanism charged (1 C).
■ **Mechanical indications**
Operation counter.
■ **Opening releases**
□ Mitop (low energy),
□ shunt trip,
□ undervoltage.
■ **Closing release**
□ shunt trip
■ **Motor option** (option and installation at a later date possible).

Motor option and releases for switch-units

The operating mechanisms CIT, CI1 and CI2 may be motorised.

Power supply	(V)	24	48	110	125	220	120	230
Motor option								
	(W)	200						
	(VA)						200	
Operating time for CIT		1 to 2 (s)					1 to 2 (s)	
Charging time for CI1, CI2		4 to 7 (s)					4 to 7 (s)	
Shunt trip								
Shunt trip	(W)	200	250	300	300	300		
	(VA)						400	750
Response time	(ms)	35					35	
Undervoltage								
Pick-up	(W)	160						
	(VA)						280	550
Hold	(W)	4						
	(VA)						50	40
Response time	(ms)	45					45	
Closing release								
Shunt trip	(W)	200	250	300	300	300		
	(VA)						400	750
Response time	(ms)	55					55	

** Please consult us for other frequencies.*

Motor option and releases for SF6 type circuit breakers and Evolis 24 kV lateral

Operating mechanism RI may be equipped with the motor option for the recharging function.

Power supply	(V)	24	48	110	125	220	120	230
Motor option								
	(W)	300						
	(VA)							380
Charging time	(s)	15					15	
Shunt trip								
Mitop (low energy)	(W)	3						
Response time	(ms)	30					30	
Shunt trip	(W)	85						
	(VA)							160
Response time	(ms)	45					45	
Undervoltage								
Pick-up	(W)	160						
	(VA)						280	550
Hold	(W)	10						
	(VA)						50	40
Response time	(ms)	55					55	
Closing release								
Shunt trip	(W)	85						
	(VA)							160
Response time	(ms)	65					65	

** Please consult us for other frequencies.*

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Motor option and releases for Evolis circuit breakers 17.5 kV frontal

Power supply	(Vac 50/60 Hz)		48/60	100/130	200/240
	(Vdc)	24/30	48/60	100/125	200/250
Threshold		0.85 to 1.1 Ur			
Consumption	(VA or W)	180			
Motor overcurrent		2 to 3 Ir during 0.1 s			
Charging time		6 s max.			
Switching rate		3 cycles per minute max.			
CH contact		10 A 240 V			

Power supply	Direct current
Threshold	0.6 A < i < 3 A
Response time to the circuit breaker at Ur	50 ms (protection relay setting)

Power supply	(Vac 50/60 Hz)	24	48	100/130	200/250
	(Vdc)	24/30	48/60	100/130	200/250
Threshold		0.7 to 1.1 Ur			
Consumption	(VA or W)	Pick-up: 200 (during 200 ms)			
		Hold: 4.5			
Response time to the circuit breaker at Ur		50 ms ± 10			

Power supply	(Vac 50/60 Hz)	24	48	100/130	200/250
	(Vdc)	24/30	48/60	100/130	200/250
Threshold		0.85 to 1.1 Ur			
Consumption	(VA or W)	Pick-up: 200 (during 200 ms)			
		Hold: 4.5			

Auxiliary contacts for vacuum contactor

The auxiliary contacts are of the changeover-type with a common point.
The following are available:
- 3 NO + 3 NC for the electrically held version (optional 3 NO & 3 NC additional auxiliary contacts),
- 5 NO + 6 NC for the mechanically latched version as standard.

Operating voltage	Minimum	48 V
	Maximum	480 V
Rated current		10 A
Breaking capacity	Vdc	60 W (L/R 150 ms)
	Vac	700 VA (power factor 0.35)

Power supply (Vdc)	48	125	250
Consumption (W)	470	680	640
Response time (ms)	20-40	20-41	20-40

Current transformers for 24 kV

Synthesis table by unit

TC															
ARJP1	■	■	■												
ARM3				■	■	■	■	■	■						
ARJP2										■	■				
ARJP3												■	■	■	■
CLP2					■										
TLP130			■	■		■									

Transformer ARJP1/N2F
- characteristics according to IEC standard 60044-1
- single primary winding
- double secondary winding for measurement and protection.

Short-time withstand current Ith (kA)

I1n (A)		10	20	30	50	75	100	150	200
Ith (kA)		1.2	2.4	3.6	6	10	10	10	10
t (s)		1							
Measurement and protection	5 A	15 VA - class 0.5							
	5 A	2.5 VA - 5P20							

Transformer ARJP1/N2F
- characteristics according to IEC standard 60044-1
- single primary winding
- double secondary winding for measurement and protection.

Short-time withstand current Ith (kA)

I1n (A)		50	100	150	200
Ith (kA)		6	10		
t (s)		1			
Measurement and protection	5 A	15 VA - class 0.5			
	5 A	2.5 VA - 5P20			

Note: please consult us for other characteristics.

Transformer ARM3/N2F
- characteristics according to IEC standard 60044-1
- double primary winding
- single secondary winding for measurement and protection.

Short-time withstand current Ith (kA)

I1n (A)		10/20	20/40	50/100	100/200	200/400	300/600
Ith (kA)		5	12.5	12.5/21*	12.5/25*	12.5/25*	25
t (s)		1	0.8	1			
Measurement and protection	5 A	7.5 VA - class 0.5					
	1 A	1 VA - 10P30					
	5 A	5 VA - 5P10		5 VA - 5P15			

** For 5 A protection*

- characteristics according to IEC standard 60044-1
- double primary winding
- double secondary winding for measurement and protection.

Short-time withstand current Ith (kA)

I1n (A)		50/100	100/200	200/400	300/600
Ith (kA)		14.5	25	25	25
t (s)		1			
Measurement and protection	5 A	30 VA - class 0.5			
	5 A	5 VA - 5P15	7.5 VA - 5P15		
	5 A	7.5 VA - 5P10	15 VA - 5P10		

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Current transformers for 24 kV

Transformer ARJP2/N2F
- characteristics according to IEC standard 60044-1
- single primary winding
- double secondary winding for measurement and protection.

Short-time withstand current Ith (kA)

I1n (A)		50	100	200	400	600
Ith (kA)		25				
t (s)		1				
Measurement and protection	5 A	10 VA class 0.5	15 VA class 0.5	15 VA class 0.5	15 VA class 0.5	20 VA class 0.5
	5 A	2.5 VA 5P20	2.5 VA 5P20	5 VA 5P20	5 VA 5P20	7.5 VA 5P20

Transformer ARJP3/N2F
- characteristics according to IEC standard 60044-1
- single primary winding
- double secondary winding for measurement and protection.

Short-time withstand current Ith (kA)

I1n (A)		1000	1250
Ith (kA)		25	
t (s)		1	
Measurement and protection	1 A	30 VA - class 0.5	
	1 A	10 VA - 5P20	
Measurement and protection	5 A	30 VA - class 0.5	
	5 A	10 VA - 5P20	

Low Power Current Transformer (LPCT) CLP2
- characteristics according to IEC standard 60044-8
- large primary current range
- direct output voltage for measurement and protection
- RJ45-8 pts secondary connector
- insulation level 24 kV.

Minimum rated primary current	5 A
Rated nominal primary current	100 A
Rated extended primary current	1250 A
Rated nominal secondary output	22.5 mV
Accuracy class for measurement	0.5
Accuracy class for protection	5P
Accuracy limit factor	400
Rated short time thermal current	40 kA 1 s
Highest voltage (Um)	24 kV
Rated power-frequency withstand	50 kV

Low Power Current Transformer (LPCT) TLP130
- characteristics according to IEC standard 60044-8
- large primary current range
- direct output voltage for measurement and protection
- RJ45-8 pts secondary connector
- insulation level 0.72 kV
- internal diameter 130 mm.

Minimum rated primary current	5 A
Rated nominal primary current	100 A
Rated extended primary current	1250 A
Rated nominal secondary output	22.5 mV
Accuracy class for measurement	0.5
Accuracy class for protection	5P
Accuracy limit factor	250
Rated short time thermal current	25 kA 1 s
Highest voltage (Um)	0.72 kV
Rated power-frequency withstand	3 kV

Current transformers for 36 kV

Current transformer ARM6T

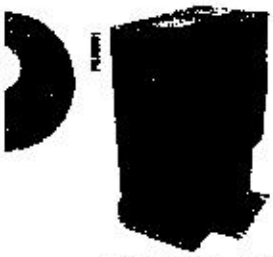
For units DM1-A, DM1-D, DM1-W, DM2, DM2-W, IMC, GBC-A, GBC-B

Transformer ARM6T/N1 or N2

- characteristics according to IEC standard 60044-1
- double primary winding
- double secondary winding for measurement and protection.

Short-time withstand current Ith (kA)

In (A)		50-100	75-150	100-200	150-300	200-400	300/600	1000/1250
Ith (kA)		16 - 20 -						25
t (s)		1						1
Measurement and protection	5 A	7.5 VA - 15 VA - class 0.5						30 VA - class 0.5
	5 A	2.5 VA - 5 VA - 5P20						10 VA - 5P20



Current transformer ARM9T

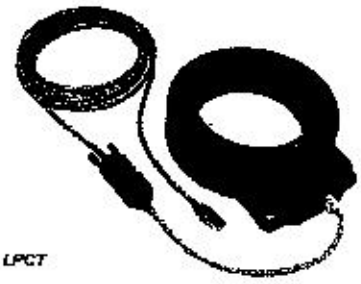
For units DM1-A, DM1-D, DM2, DM2-W

Transformer ARM9T

- characteristics according to IEC standard 60044-1
- double primary winding
- double secondary winding for measurement and protection.

Short-time withstand current Ith (kA)

In (A)		1000/1250
Ith (kA)		40
t (s)		1
Measurement and protection	5 A	30 VA - class 0.5 - Fs < 10
	5 A	10 VA - 5P20



LPCT

Low Power Current Transformer (LPCT) for units DM1-A, DM1-W

Transformer TLP 130, TLP 190

- characteristics according to IEC standard 60044-8
- large primary current range
- direct output voltage for measurement and protection
- RJ45-8 pts secondary connector
- insulation level 0.72 kV
- internal diameter 130 or 190 mm
- in SM6-36, TLP 130 can be used for 630 A, TLP 190 can be used up to 1250 A.

	TLP 130	TLP 190
Minimum rated primary current	5 A	5 A
Rated extended primary current	1250 A	2500 A
Secondary output	22.5 mV - 100 A	22.5 mV - 100 A
Accuracy class for measurement	0.5	0.5
Accuracy class for protection	5P	5P
Accuracy limit factor	250	400
Rated short time thermal current	25 kA 1 s	40 kA 1 s
Highest voltage (Um)	0.72 kV	0.72 kV
Rated power-frequency withstand	3 kV	3 kV

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Voltage transformers for 24 kV

Synthesis table by unit

VRQ2-n/S1	■		■	■	■	■	■	■	■				
VRFR-n/S1		■								■	■		
VRC2/S1							■	■				■	
VRM3-n/S2							■	■					
VCT24													■
VRC1/S1		■											

Transformer VRQ2-n/S1 (phase-to-earth) 50 or 60 Hz
■ characteristics according to IEC standard 60044-2.

Rated voltage (kV)	24			
Primary voltage (kV)	10/√3	15/√3	15-20/√3	20/√3
Secondary voltage (V)	100/√3			
Thermal power (VA)	250			
Accuracy class	0.5			
Rated output for single primary winding (VA)	30	30		30
Rated output for double primary winding (VA)			30-50	

Transformer VRFR-n/S1 (phase-to-earth) 50 or 60 Hz
■ characteristics according to IEC standard 60044-2.

Rated voltage (kV)	17.5	
Primary voltage (kV)	10/√3	15/√3
Secondary voltage (V)	100/√3	
Thermal power (VA)	250	
Accuracy class	0.5	
Rated output for single primary winding (VA)	30	

Transformer VRC2/S1 (phase-to-phase) 50 or 60 Hz
■ characteristics according to IEC standard 60044-2.

Rated voltage (kV)	24		
Primary voltage (kV)	10	15	20
Secondary voltage (V)	100		
Thermal power (VA)	500		
Accuracy class	0.5		
Rated output for single primary winding (VA)	50		

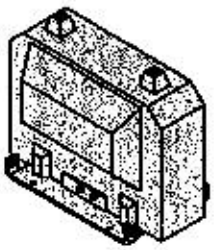
Transformer VRM3-n/S2 (phase-to-earth and protected by fuses 0.3 A) 50 or 60 Hz
■ characteristics according to IEC standard 60044-2.

	Rated voltage (kV)	12	17.5	24
	Primary voltage (kV)	10/√3	15/√3	20/√3
	Secondary voltage (V)	100/√3 - 100/3		
First secondary	Thermal power (VA)	200		
	Accuracy class	0.5		
	Rated output for single primary (VA)	30-50		
Second secondary	Thermal power (VA)	100		
	Accuracy class	3P		
	Rated output	50		

Voltage transformers for 24 kV

Transformer VRC1/S1 (phase-to-phase) 50 or 60 Hz
■ characteristics according to IEC standard 60044-2.

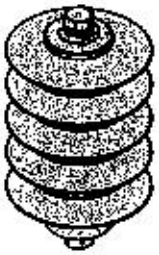
Rated voltage (kV)	7.2				
Primary voltage (kV)	3.3	5	5.5	6	6.6
Secondary voltage (V)	110	100	110	100	110
Thermal power (VA)	300				
Accuracy class	0.5				
Rated output for single primary winding (VA)	100				



Transformer VCT24 (phase-to-phase) 50 or 60 Hz

Rated voltage (kV)	24		
Primary voltage (kV)	10	15	20
Secondary voltage (V)	220		
Output (VA)	2500	2500	2500
		4000	4000

Note: the above mentioned voltage transformers are grounded neutral.
For other characteristics, please consult us.



Surge arresters

For units IM500, DM1-A, DM1-W, GAM, DMV-A*, DMVL-A

In (A)	400/630				
Un (kV)	7.2	10	12	17.5	24

Note: the rated voltage of the surge arrester is according to unit's rated voltage.
(*) limited up to 17.5 kV for DMV-A circuit breaker cubicles.

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Voltage transformers for 36 kV

Voltage transformer VRF3

For units CM, GBC-A, GBC-B

Transformer VRF3n/S2 (phase-to-earth)
- single primary winding
- single secondary

Rated voltage (kV)	36	
Primary voltage (kV)	30/√3	33/√3
Secondary voltage (V)	100/√3	100/√3 or 110/√3
Thermal power (VA)	450	
Accuracy class	0.5	3P
Rated output for single primary winding (VA)	30-50	30

Voltage transformer VRC3

For units CM2

Transformer VRC3/S1 (phase-to-phase)
- single primary winding
- single secondary

Rated voltage (kV)	36	
Primary voltage (kV)	30	33
Secondary voltage (V)	100	100 or 110
Thermal power (VA)	700	
Accuracy class	0.5	
Rated output for single primary winding (VA)	50-100	

For units TM

Transformer VRC3/S1 (phase-to-phase)
- single primary winding
- single secondary

Rated voltage (kV)	36
Primary voltage (kV)	30
Secondary voltage (V)	220
Thermal power (VA)	1000

Surge arresters

For units IM, DM1-A, SM, GAM2

In (A)	630
Un (kV)	36

276

Motors protection units

The current rating of fuses installed in units depends on:
- motor current rating In
- starting current Id
- frequency of starts.

The fuses rating is calculated such that a current equal to twice the starting current does not blow the fuse within period equal to the starting time.
The adjacent table indicated the ratings which should be used, based on the following assumptions:
- direct on-line startup
- Id/In ≤ 6
- pf = 0.8 (P ≤ 500 kW) or 0.9 (P > 500 kW)
- η = 0.9 (P ≤ 500 kW) or 0.94 (P > 500 kW).

The indicated values are for Fusarc fuses (to DIN standard 43-625).

Example:
Consider a 950 kW motor at 5 kV.

$$In = \frac{P}{\sqrt{3} \cdot U \cdot \eta \cdot pf} = 130\ A$$

Id = 6 x In = 780 A

Then select the next higher value, i.e. 790 A.
For six 5-second starts per hour, select fuses rated 200 A.

Note: the same motor could not be protected for 12 starts per hour since the maximum service voltage for the required 250 A rated fuses is 3.3 kV.

Selection of fuses for CRM units

The color code is linked to the rated voltage of the fuse.

	Number of starts per hour						
	6	12	6	12	6	12	
1410	250						
1290	250	250	250				
1140	250	250	250	250	250		
1030	250	250	250	250	250	250	3.3
890	250	250	250	250	250	250	
790	200	250	250	250	250	250	
710	200	200	200	250	250	250	
640	200	200	200	200	200	250	
610	200	200	200	200	200	200	6.6
540	160	200	200	200	200	200	
450	160	160	160	200	200	200	
440	160	160	160	160	160	200	
310	160	160	160	160	160	160	
280	125	160	160	160	160	160	
250	125	125	125	160	160	160	
240	125	125	125	125	125	160	
230	125	125	125	125	125	125	
210	100	125	125	125	125	125	
180	100	100	100	100	100	125	
170	100	100	100	100	100	100	11

Selection of fuses for CVM units

3.3	1100	183	250	250	250			
	942	157	250	250	250	250	250	250
	785	131	200	200	200	200	200	250
6.6	628	105	160	160	160	200	200	200
	565	94	160	160	160	160	160	160
	502	84	125	160	160	160	160	160
	439	73	125	125	125	160	160	160
	377	63	100	125	100	125	125	160
	314	52	100	100	100	100	100	125
	251	42	100	100	100	100	100	100
	188	31	50	100	100	100	100	100
	126	21	50	50	63	80	80	80

Fuse selection method:
- If Id ≥ 6 x Ie, use Id to select the fuses
- if Id < 6 x Ie, use Ie to select the fuses.

Note:
Fuses are 292 mm long (Fusarc fuses).
Fuses are only for short circuit protection.
For 250 A fuses, it is necessary to delay the opening of the contactor.

Protection of transformers

Fuse ratings for SM6 protection units such as PM, QM, QMB and QMC depend, among other things, on the following criteria:
- service voltage
- transformer rating
- fuse technology (manufacturer)

Different types of fuses with medium loaded striker may be installed:
- Solefuse fuses as per standard UTE NCF 64.210
- Fusarc CF fuses as per IEC 60.282.1 recommendation and dimensions are related to DIN 43.625 standard.

For fuse-switch combination unit type QM, QMB, QMC, refer only to the selection table and reference list of fuses. For all other type of fuses, consult us.

Example: for the protection of a 400 kVA transformer at 10 kV, select either Solefuse fuses rated 43 A or Fusarc CF fuses rated 50 A.

Fuse selection table

The color code is linked to the rated voltage of the fuse
Rating in A - no overload at –5°C < t < 40°C.

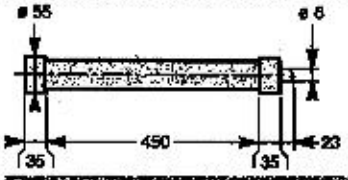
⚠ Please consult us for overloads and operation over 40°C for France Transfo oil immersed type transformers.

Type of fuse	Service voltage (kV)	Transformer rating (kVA) 25	50	100	125	150	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	Rated voltage (kV)
	5.5	6.3	16	31.5	31.5	63	63	63	63	63									7.2
	10	6.3	6.3	16	16	31.5	31.5	31.5	63	63	63	63							
	15	6.3	6.3	16	16	16	16	16	16	43	43	43	43	63					
	20	6.3	6.3	6.3	6.3	16	16	16	16	43	43	43	43	43	63				24
	3.3	16	16	31.5	31.5	31.5	63	63	100	100									7.2
	5.5	6.3	16	16	31.5	31.5	63	63	63	80	80	100	125						
	6.6	6.3	16	16	16	31.5	31.5	43	43	63	80	100	125	125					
	10	6.3	6.3	16	16	16	31.5	31.5	31.5	43	43	63	80	80	100				12
	13.8	6.3	6.3	6.3	16	16	16	16	31.5	31.5	31.5	43	63	63	80	100			17.5
	15	6.3	6.3	16	16	16	16	16	31.5	31.5	31.5	43	43	63	80				
	20	6.3	6.3	6.3	6.3	16	16	16	16	31.5	31.5	31.5	43	43	63				24
	22	6.3	6.3	6.3	6.3	16	16	16	16	16	31.5	31.5	31.5	43	43	63			
	3.3	16	25	40	50	50	80	80	100	125	125	160(1)	200(1)						7.2
	5	10	16	31.5	40	40	50	63	80	80	125	125	160(1)						
	5.5	10	16	31.5	31.5	40	50	50	63	80	100	125	125	160(1)	160(1)				
	6	10	16	25	31.5	40	50	50	63	80	80	125	125	160(1)	160(1)				
	6.6	10	16	25	31.5	40	50	50	63	80	80	100	125	125	160(1)				
	10	6.3	10	16	20	25	31.5	40	50	50	63	80	80	100	100	125(1)	200(1)		12
	11	6.3	10	16	20	25	25	31.5	40	50	50	63	80	100	100	125(1)	160(1)		
	13.8	6.3	10	16	16	20	25	31.5	31.5	40	50	50	63	80	80	100(1)	125(1)	125(1)	17.5
	15	6.3	10	10	16	16	20	25	31.5	40	50	50	63	80	80	100(1)	125(1)	125(1)	
	20	6.3	6.3	10	10	16	16	25	25	31.5	40	40	50	50	63	80	100(1)	125(1)	24
	22	6.3	6.3	10	10	16	16	20	25	25	31.5	40	40	50	50	80	80	100(1)	
	30					10		10	16	20	25	31.5	31.5	50	50	63	63		36
	31.5					10		10	16	20	25	25	31.5	50	50	63	63		
	33					6.3		10	16	20	25	25	31.5	40	50	50	63		
	34.5					6.3		10	16	20	25	25	31.5	40	50	50	63		
	30					10		10	16	20	25	31.5	31.5	40	40	50	63		36
	31.5					10		10	16	20	25	31.5	31.5	40	40	50	63		
	33					10		10	16	20	25	25	31.5	31.5	40	40	50		
	34.5					10		10	16	20	25	25	31.5	31.5	40	40	50		

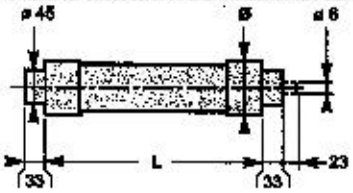
(1) SIBA fuses

(2) This selection table has been prepared according to the technical characteristics of France Transfo oil immersed type transformers. The characteristics of transformers and fuses may change according to manufacturers and standards.

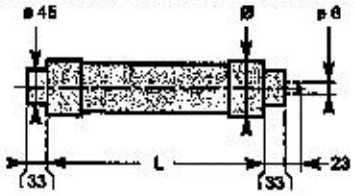
Fuses dimensions



Ur (kV)	Ir (A)	L (mm)	Ø (mm)	Weight (kg)
7.2	6.3 to 125	450	55	2
12	100	450	55	2
17.5	80	450	55	2
24	6.3 to 63	450	55	2



Ur (kV)	Ir (A)	L (mm)	Ø (mm)	Weight (kg)
7.2	125	292	88	3.3
12	6.3	292	50.5	1.2
	10	292	50.5	1.2
	16	292	50.5	1.2
	20	292	50.5	1.2
	25	292	57	1.5
	31.5	292	57	1.5
	40	292	57	1.5
	50	292	78.5	2.8
	63	292	78.5	2.8
	80	292	78.5	2.8
	100	292	78.5	2.8
24	6.3	442	50.5	1.6
	10	442	50.5	1.6
	16	442	50.5	1.6
	20	442	50.5	1.6
	25	442	57	2.2
	31.5	442	57	2.2
	40	442	57	2.2
	50	442	78.5	4.1
	63	442	78.5	4.1
	80	442	88	5.3
36	10	537	50.5	1.8
	16	537	50.5	1.8
	25	537	57	2.6
	31.5	537	78.5	4.7
	40	537	78.5	4.7
	50	537	88	6.4
	63	537	88	[illegible]



Ur (kV)	Ir (A)	L (mm)	Ø (mm)	Weight (kg)
7.2	160	292	85	3.8
	200	292	88	5.4
12	125	292	87	2
	160	292	85	3.8
	200	292	88	3.8
17.5	125	442	85	5.4
24	100	442	88	5.4
	125	442	85	5.4

Interlocks

Switch units

- **the switch can be closed** only if the earthing switch is open and the access panel is in position.
- **the earthing switch can be closed** only if the switch is open.
- **the access panel for connections can be opened** only if the earthing switch is closed.
- **the switch is locked** in the open position when the access panel is removed. The earthing switch may be operated for tests.

Circuit-breaker units

- **the disconnector(s) can be closed** only if the circuit breaker is open and the front panel is locked (interlock type 50).
- **the earth switch(es) can be closed** only if the disconnector(s) is/are open.
- **the access panel for connections can be opened** only if:
  - ☐ the circuit breaker is locked open,
  - ☐ the disconnector(s) is/are open,
  - ☐ the earth switch(es) is/are closed.

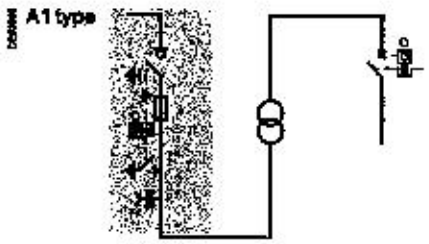
Note: it is possible to lock the disconnector(s) in the open position for no-load operations with the circuit breaker.

Functional interlocks

These comply with IEC recommendation 62271-200 and EDF specification HN 64-S-41 (for 24 kV).
In addition to the functional interlocks, each disconnector and switch include:
- **built-in padlocking capacities** (padlocks not supplied)
- **four knock-outs** that may be used for keylocks (supplied on request) for mechanism locking functions.

Interlocks

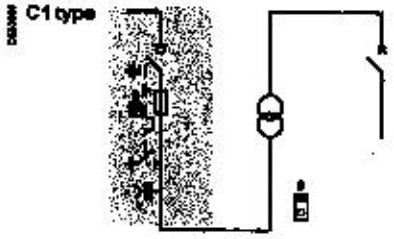
Units	Interlock											
	A1	C1	C4	A3	A4	A5	50	52	P1	P2	P3	P5
IM, IMB, IMC				■	■				■			
PM, QM, QMB, QMC, DM1-A, DM1-D, DM1-W, DM1-Z, DM1-S, DMV-A, DMV-D, DMV-S, DMVL-A, DMVL-D	■	■	■				■					
CRM, CVM		■						■				
NSM				■					■			
GAM				■		■						■
SM										■	■	
DM2, DM2-W							■					



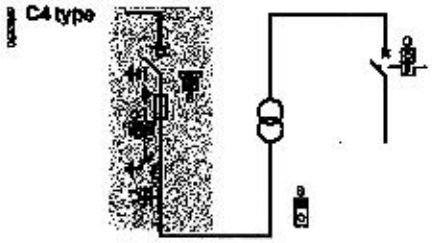
Key-type interlocks

Outgoing units

Aim:
- to prevent the closing of the earthing switch on a transformer protection unit unless the LV circuit breaker is locked in "open" or "disconnected" position.



- to prevent the access to the transformer if the earthing switch for transformer protection has not first been closed.

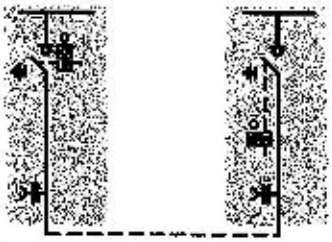


- to prevent the closing of the earthing switch on a transformer protection unit unless the LV circuit breaker is locked in "open" or "disconnected" position.
- to prevent the access to the transformer if the earthing switch for transformer protection has not first been closed.

Legend for key-type interlocks:
☐ ☐ ☐ = no key ■ = captive key — panel or door

Interlocks

A3 type

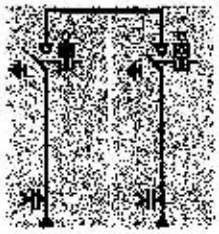


Ring units

Aim:

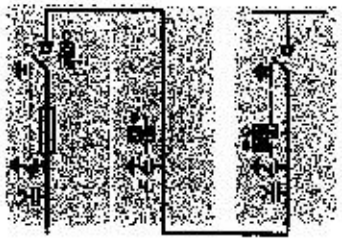
- to prevent the closing of the earthing switch of a load-side cubicle unless the line-side switch is locked "open".

A4 type



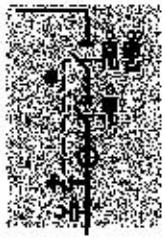
- to prevent the simultaneous closing of two switches.

A5 type



- to prevent the closing of the earthing switch of the casing unit unless the downstream and the upstream switches are locked in the "open" position.

50 type



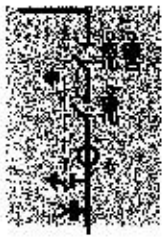
Prevents

- on-load switching of the disconnectors.

Allows

- off-load operation of the circuit breaker with the disconnectors open (double isolation).
- off-load operation of the circuit breaker with the disconnector open (single isolation).

Type 52



Prevents

- on-load switching of the disconnectors.

Allows

- off-load operation of the contactor with the disconnectors open (double isolation).
- off-load operation of the contactor with the disconnector open (single isolation).

Legend for key-type interlocks:

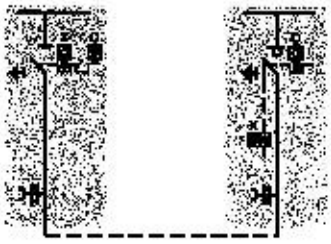
no key — captive key — panel or door

Interlocks

P1 type

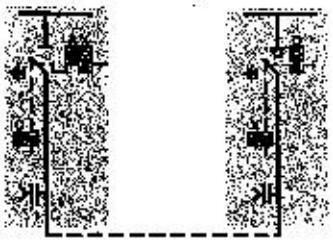
- to prevent the closing of an earthing switch if the switch of the other unit has not been locked in the "open" position.

P2 type



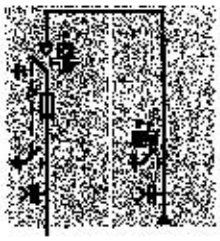
- to prevent on-load operation of the disconnector unless the switch is locked "open"
- to prevent the closing of the earthing switches unless the disconnector and the switch are locked "open".

P3 type



- to prevent on-load operation of the disconnector unless the switch is locked "open"
- to prevent the closing of the earthing switches with the unit energised, unless the disconnector and the switch are locked "open"
- to allow off-load operation of the switch.

P5 type



- to prevent the closing of the earthing switch of the incoming unit unless the disconnector and the switch is locked "open".

Legend for key-type interlocks:

no key — captive key — panel or door

Contents

Connections with dry-type cables for 24 kV
Selection table

The ageing resistance of the equipment in an MV/LV substation depends on three key factors:

- **the need to make connections correctly**
New cold fitted connection technologies offer ease of installation that favours resistance over time. Their design enables operation in polluted environments under severe conditions.
- **the impact of the relative humidity factor**
The inclusion of a heating element is essential in climates with high humidity levels and with high temperature differentials.
- **ventilation control**
The dimension of the grills must be appropriate for the power dissipated in the substation. They must only traverse the transformer area.

Round connector

Square connector

Network cables are connected:
- on the switch terminals
- on the lower fuse holders
- on the circuit breaker's connectors.

The bimetallic cable end terminals are:
- round connection and shank for cables ≤ 240 mm²
- square connection round shank for cables > 240 mm² only.

Crimping of cable and terminals to cables must be carried out by stamping.

The end connectors are of cold fitted type
Schneider Electric's experience has led it to favour this technology wherever possible for better resistance over time.

The maximum admissible cable cross section:
- 630 mm² for 1250 A incomer and feeder cubicles
- 240 mm² for 400-630 A incomer and feeder cubicles
- 120 mm² for contactor cubicles
- 95 mm² for transformer protection cubicles with fuses.

Access to the compartment is interlocked with the closing of the earthing disconnector.
The reduced cubicle depth makes it easier to connect all phases.
A 12 mm Ø pin integrated with the field distributor enables the cable end terminal to be positioned and attached with one hand. Use a torque wrench set to 50 mN.

Dry-type single-core cable

Short inner end, cold fitted

3 to 24 kV 400 A - 630 A	Round connector	50 to 240 mm²	All cold fitted cable end suppliers: Silec, 3M, Pirelli, Raychem, etc.	1 or 2 per phase	For larger x-sections, more cables and other types of cable end terminals, please consult us
3 to 24 kV 1250 A	Round connector Square connector	50 to 630 mm² > 300 mm² admissible	All cold fitted cable end suppliers: Silec, 3M, Pirelli, Raychem, etc.	1 or 2 per phase ≤ 400 mm² 400 < 1 ≤ 630 mm² per phase	For larger x-sections, more cables and other types of cable end terminals, please consult us

Three core, dry cable

Short inner end, cold fitted

3 to 24 kV 400 A - 630 A	Round connector	50 to 240 mm²	All cold fitted cable end suppliers: Silec, 3M, Pirelli, Raychem, etc.	1 per phase	For larger x-sections, more cables and other types of cable end terminals, please consult us
3 to 24 kV 1250 A	Round connector	50 to 630 mm²	All cold fitted cable end suppliers: Silec, 3M, Pirelli, Raychem, etc.	1 per phase	For larger x-sections, more cables and other types of cable end terminals, please consult us

Note:
- *The cable end terminals, covered by a field distributor, can be square.*
- *PM/QM type cubicle, round end connections Ø 30 mm max.*

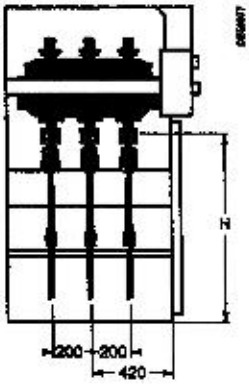
Cable-connection from below for 24 kV

Cable positions

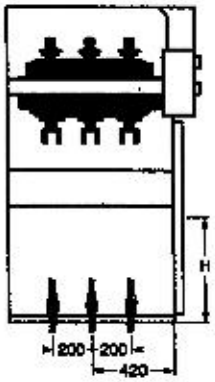
Cable-connection height H measured from floor (mm)

IM, NSM-cables, NSM-busbars	945	
SM	945	945
IMC	400	
PM, QM	400	
QMC	400	
CRM, CVM	430	
DM1-A	430	320
DMVL-A	430	
DMV-S	320	
DM1-W	370	320
GAM2	760	
GAM	470	620
DMV-A	320	313
DM1-S	543	

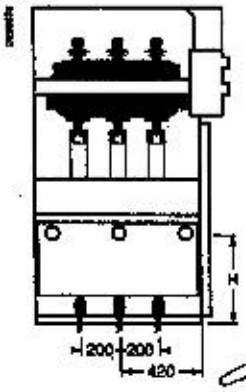
IM, NSM-cables, NSM-busbars, SM



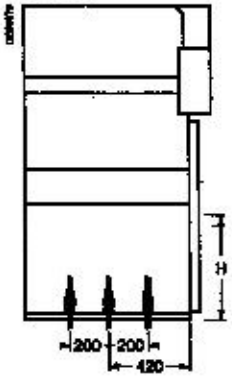
IMC, PM, QM, QMC



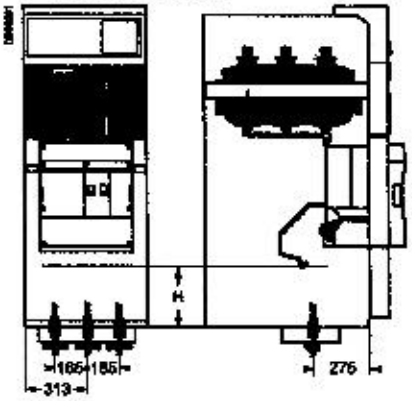
CRM, CVM



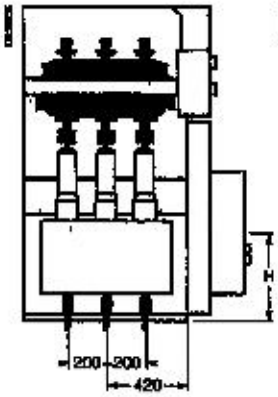
GAM, GAM2



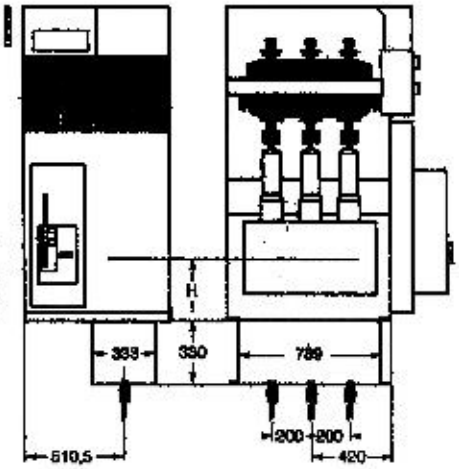
DMV-A, DMV-S (630 A)



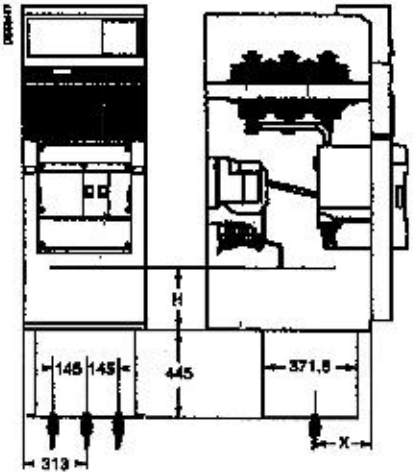
DM1-A, DM1-S, DMVL-A
DM1-W (630 A)



DM1-A, DM1-W (1250 A)



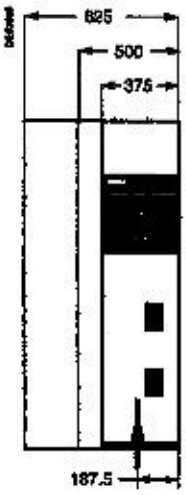
DMV-A (1250 A)



X = 330 : 1 single-core cable
X = 288 : 2 single-core cables
X = 299 : Three core cable

Cable-connection from below for 24 kV

Trenches depth



Cabling from below (all units)

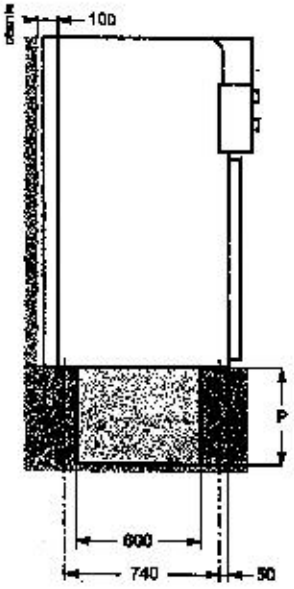
- **Through trenches:** the trench depth P is given in the following table for usual dry single-core cables type (for tri-core cables consult us).
- **With stands:** to reduce depth P or avoid trenches, by placing the units on 400 mm concrete footings.
- **With floor void:** the trench depth is given in the following table for usual types of cables.

[illegible]	[illegible]		[illegible]			[illegible]				
	12.5 kA/1s	16 kA/1s	12-16 kA/1s	12.5 kA/1s	16 kA/1s	12.5 kA/1s		16 kA/1s	12-16 kA/1s	12-16 kA/1s
	Depth P (mm)									
S < 120	330	550	550	330	550	330		550	–	–
120 < S < 240	330	550	800	–	–	Opposite to circuit breaker: 330	Under the circuit breaker: 450	550	–	–
S > 400	–	–	–	–	–	–	–	–	1000	1400

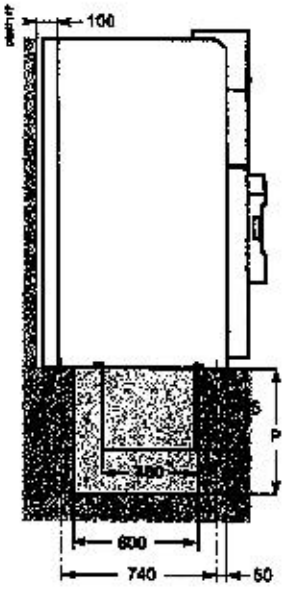
Cable trench drawings

1250 A units (provided with [illegible])

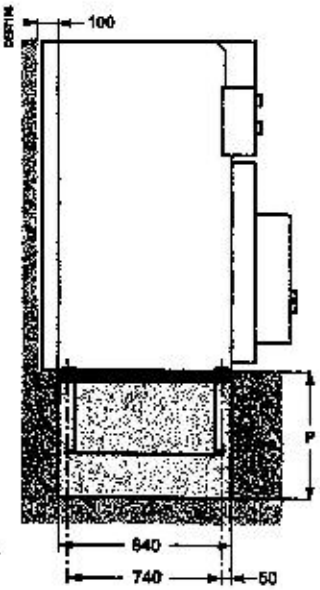
SM, GAM
For single and tri-core cables



DMV-A
For single and tri-core cables

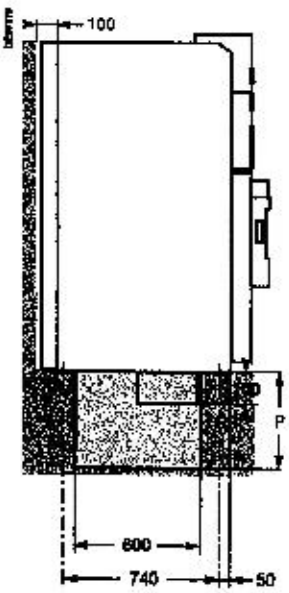


DM1-A, DM1-W
For single-core cables



630 A units

DMV-A, DMV-S
For single cables

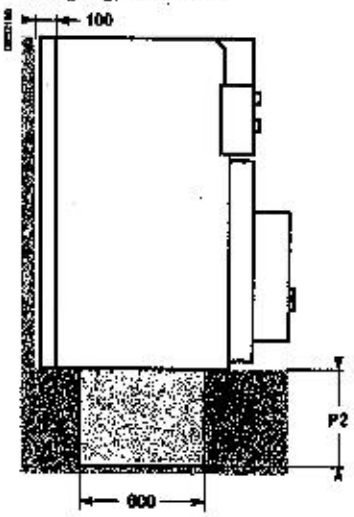


Cable-connection from below for 24 kV

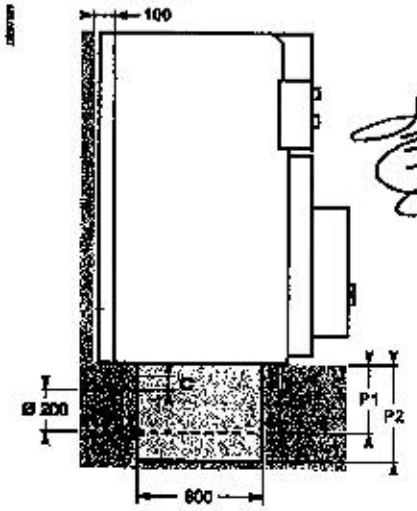
Trench diagrams example for installation IAC: A-FL classified

Units represented without switchboard side panels

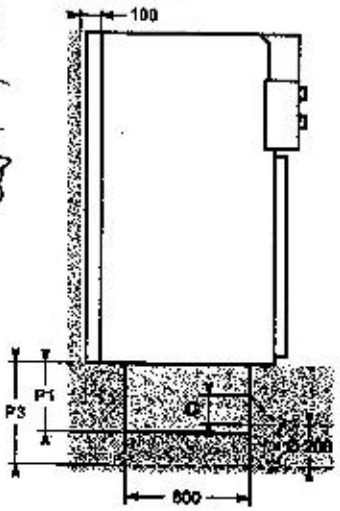
630 A units
Cable entry or exit through right or left side

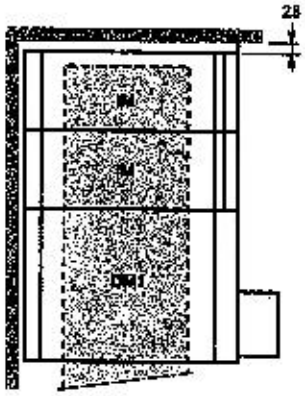


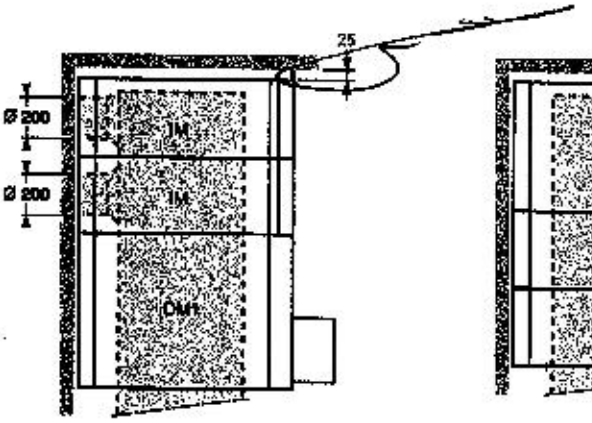
630 A units
Rear entry or exit with conduits

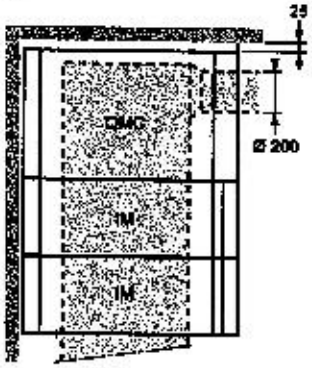


630 A units
Front entry or exit with conduits



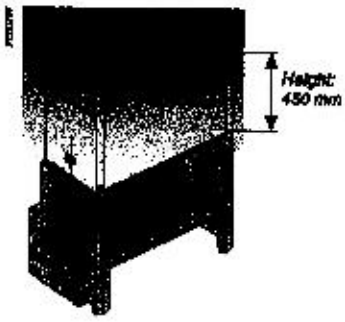






Required dimensions (mm)

Note 1: for connection with conduits, the bevel (C) must correspond to the following trench dimensions: P1 = 75 mm or P2/P3 = 150 mm.
Note 2: please refer to chapter "Layout examples" for a site application.



Cabling from above

On each 630 A unit of the range, except those including a low-voltage control cabinet and EMB compartment, the connection is made with dry-type and single-core cables.

Remarks:
- *Not available for internal arc IEC 62271-200 in busbar compartment.*
- *Not available in 1250 A.*

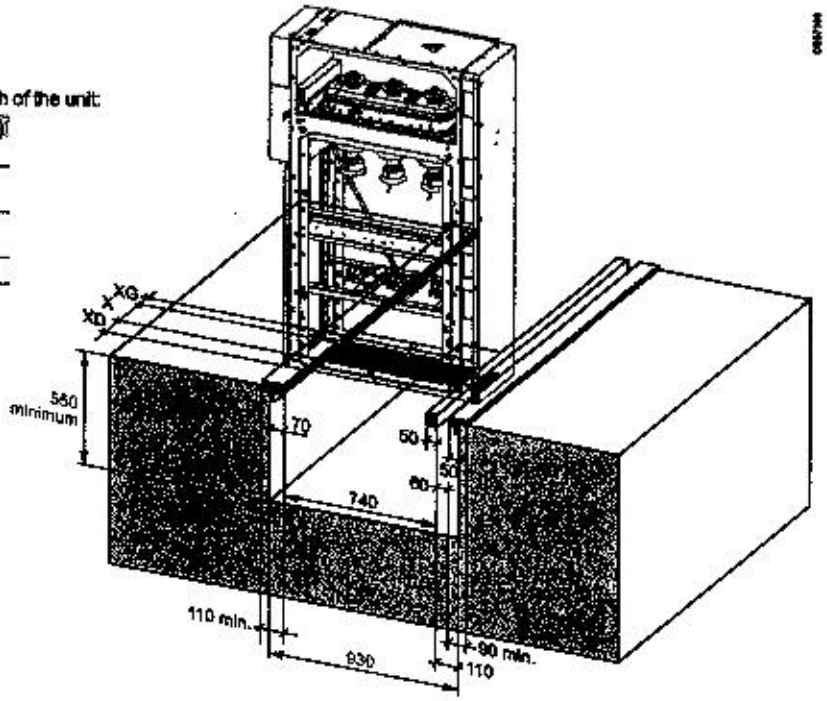
Cable-connection from below for 24 kV

Trench diagrams and floor void drawings example

Installation with floor void for 16 kA 1 s downwards exhaust

■ Position of fixing holes depends on the width of the unit:

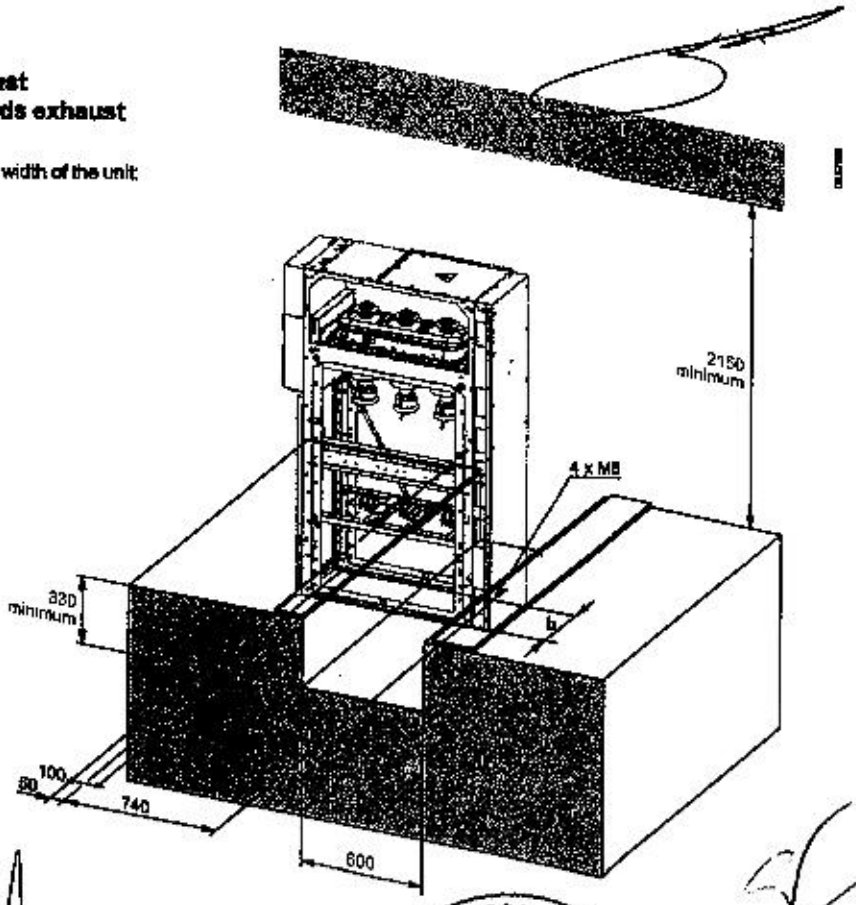
Width	Cubicle	X (mm)	Y (mm)	Z (mm)
375	All	57.5	260	57.5
500	GAM	57.5	260	182.5
	Other	182.5	260	57.5
625	QMC	307.5	260	57.5
	Other	57.5	510	57.5
750	All	432.5	260	57.5



Installation with cable trench for 12.5 kA 1 s downwards exhaust for 16 kA 1 s and 20 kA 1 s upwards exhaust

■ Position of fixing holes is depends on the width of the unit:

Width (mm)	X (mm)
125	95
375	345
500	470
625	595
750	720



Connections with dry-type cables for 36 kV
Selection table

Cable-section (mm^2)	Bending radius (mm)	IM, IMC, QM, CM, CM2, PM, DM1-A, DM1-W, GAM, GAM2, SM, TM, NSM	
		Depth P (mm)	
		P1	P2
1 x 35	525	350	550
1 x 50	555	380	580
1 x 70	585	410	610
1 x 95	600	425	625
1 x 120	630	455	655
1 x 150	645	470	670
1 x 185	675	500	700
1 x 240	705	530	730

Note: the unit and the cables requiring the greatest depth must be taken into account when determining the depth P for single-trench installations. In double-trench installations must be taken into account to each type of unit and cable orientations.

The ageing resistance of the equipment in an MV/LV substation depends on three key factors:

■ **the need to make connections correctly**
New cold fitted connection technologies offer ease of installation that favours resistance over time. Their design enables operation in polluted environments under severe conditions.

■ **the impact of the relative humidity factor**
The inclusion of a heating element is essential in climates with high humidity levels and with high temperature differentials.

■ **ventilation control**
The dimension of the grille must be appropriate for the power dissipated in the substation. They must only traverse the transformer area.

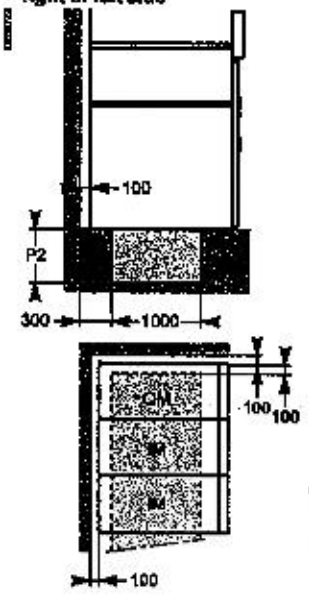
Network cables are connected:
■ on the switch terminals
■ on the lower fuse holders
■ on the circuit breaker's connectors.
The bimetallic cable end terminals are:
■ round connection and shank for cables ≤ 240 mm^2.
Crimping of cable lugs to cables must be carried out by stamping.
The end connectors are of cold fitted type
Schneider Electric's experience has led it to favour this technology wherever possible for better resistance over time.
The maximum admissible copper(*) cable cross section:
■ 2 x (1 x 240 mm^2 per phase) for 1250 A incomer and feeder cubicles
■ 240 mm^2 for 400-630 A incomer and feeder cubicles
■ 95 mm^2 for transformer protection cubicles with fuses.
Access to the compartment is interlocked with the closing of the earthing disconnector.
The reduced cubicle depth makes it easier to connect all phases.
A 12 mm Ø pin integrated with the field distributor enables the cable end terminal to be positioned and attached with one hand. Use a torque wrench set to 50 mN.
(*) Consult us for alu cable cross sections

Cabling from below

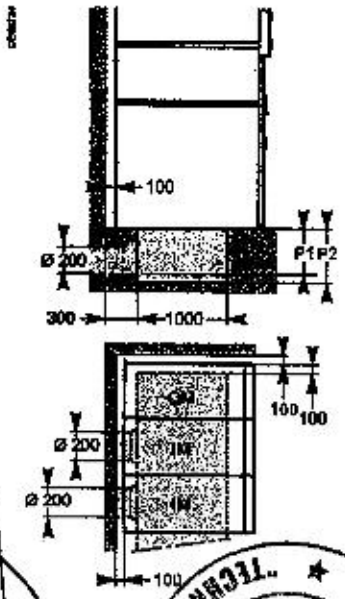
All units through trenches
■ the trench depth P is given in the table opposite for commonly used types of cables.

Trench diagrams

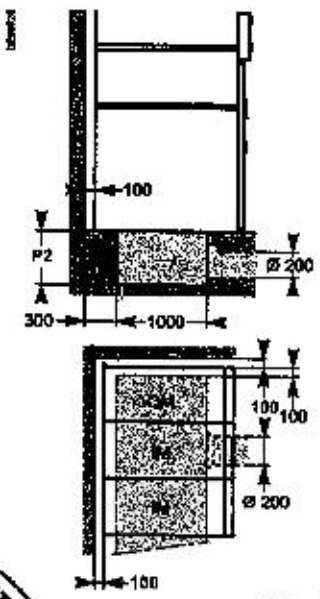
Cable entry or exit through right or left side



Rear entry or exit with conduits



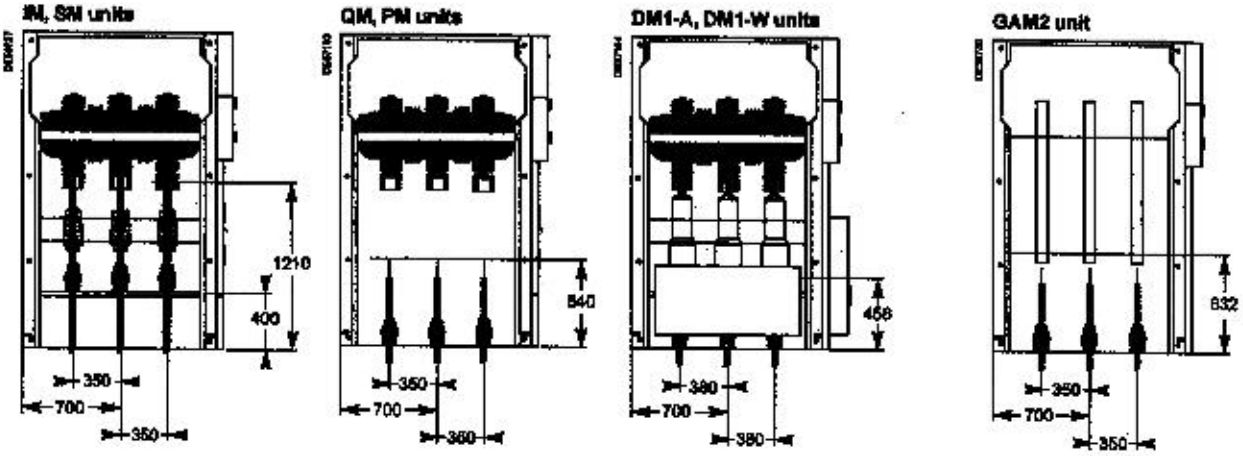
Front entry or exit with conduits



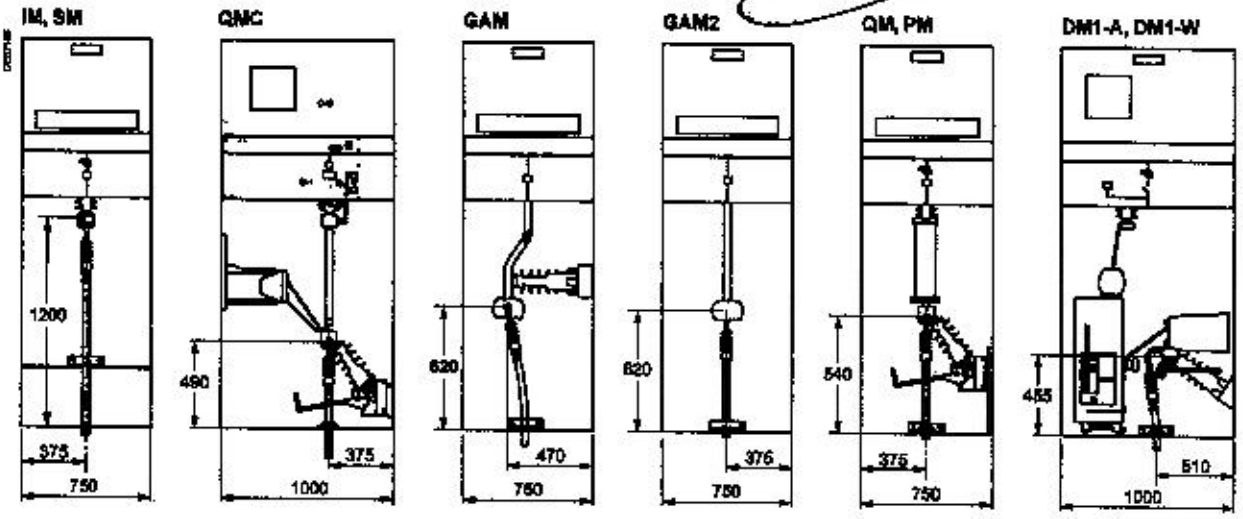
Cable-connection from below for 36 kV

Cable positions

Side view

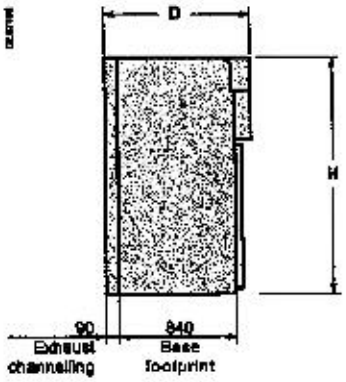


Front view



Contents

Dimensions and weights for 24 kV



Dimensions and weights

Unit type	Height H (mm)	Width D (mm)	Depth (mm)	Weight (kg)
IM, IMB	1600 (1)	375/500	1030	130/140
IMC	1600 (1)	500	1030	210
PM, QM, QMB	1600 (1)	375/500	1030	140/160
QMC	1600 (1)	625	1030	190
CVM, CRM	2050	750	1030	400
DM1-A, DM1-D, DM1-W, DM2, DMVL-A, DMVL-D	1600 (1)	750	1230	410
DM1-S	1600 (1)	750	1230	350
DMV-A, DMV-D	1695 (1)	625	1115	350
DMV-S	1600 (1)	625	1115	270
CM	1600 (1)	375	1030	200
CM2	1600 (1)	500	1030	220
GBC-A, GBC-B	1600 (1)	750	1030	300
NSM-cables, NSM-busbars	2050	750	1030	270
GIM	1600	125	930	40
GEM (2)	1600	125	930/1060 (2)	40/45
GBM	1600	375	1030	130
GAM2	1600	375	1030	130
GAM	1600	500	1030	170
SM	1600 (1)	375/500 (3)	1030	130/160
TM	1600	375	1030	210
DM1-A, DM1-D, DM1-W, DM1-Z (1250 A)	1600 (1)	750	1230	430

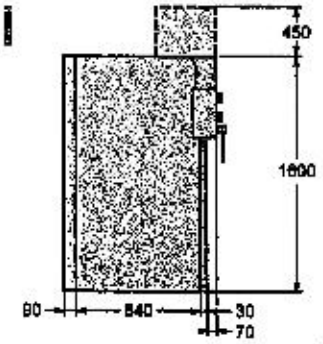
(1) Add to height 450 mm for low-voltage enclosures for control/monitoring and protection functions. To ensure uniform presentation, all units (except QM and GEM) may be equipped with low-voltage enclosures.

(2) Depending on the busbar configuration in the VM6 unit, two types of extension units may be used:
■ to extend a VM6 DM12 or DM23 unit, use an extension unit with a depth of 1060 mm
■ for all other VM6 units, a depth of 930 mm is required.

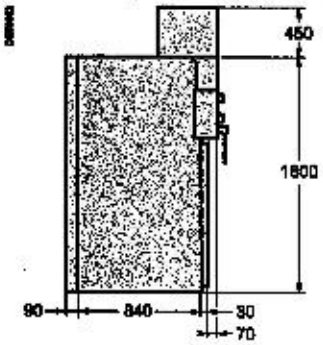
(3) For the 1250 A unit.

Units dimensions for 24 kV

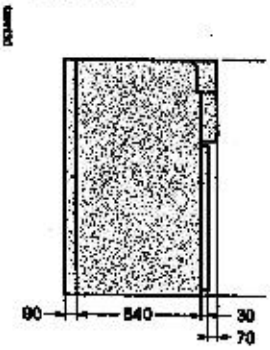
IM, IMB, PM, QM, QMB, SM, IMC, QMC, CM, CM2



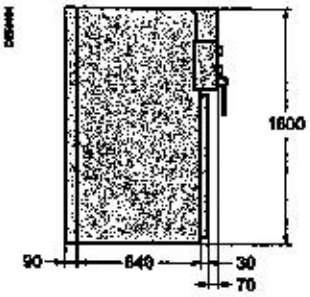
NSM-cables, NSM-busbars, CRM, CVM



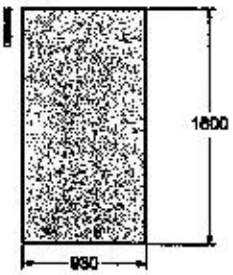
GBM, GAM2



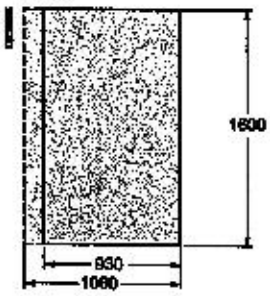
GAM



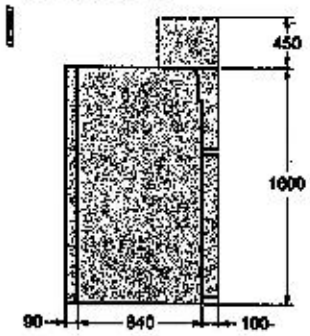
GIM



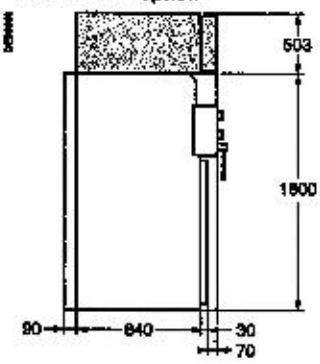
GEM



GBC-A, GBC-B

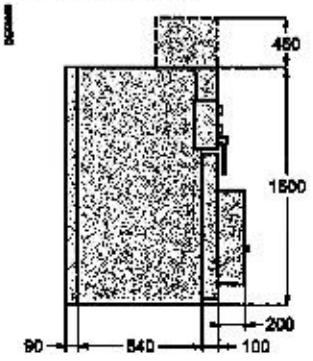


IM with EMB option

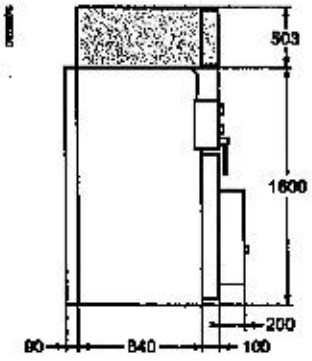


Units dimensions for 24 kV

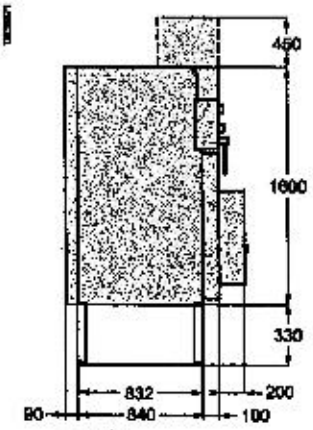
DMVL-A, DMVL-D, DM1-A, DM1-D, DM1-W, DM1-Z, DM1-S, DM2 630 A



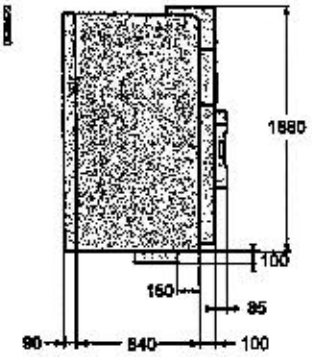
DM1-A 630 A with EMB option



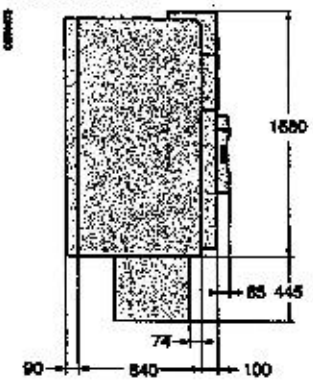
DM1-A, DM1-W 1250 A



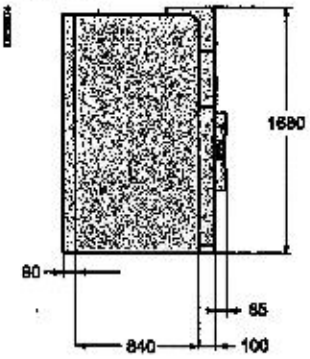
DMV-A 630 A



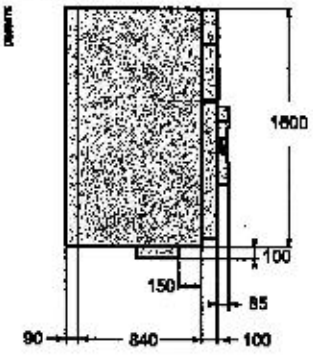
DMV-A 1250 A



DMV-D



DMV-S



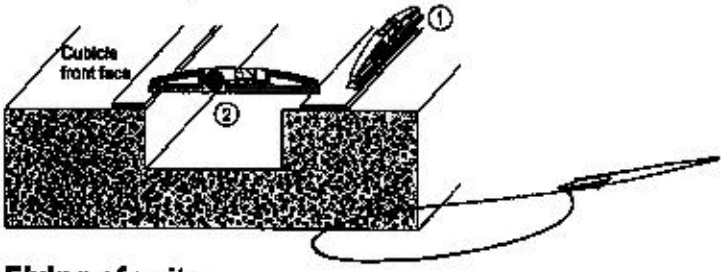
Civil engineering for 24 kV

Ground preparation

To obtain the internal arc performance, ground implementation must comply with the following requirements:

- Straightness: 2 mm / 3 m (Rep.1)
- Flatness: 3 mm maximum (Rep.2)

All the elements allowing the evacuation of the gas (duct, casing, etc.) must be able to bear a load of 250 kg/m².



Fixing of units

With each other

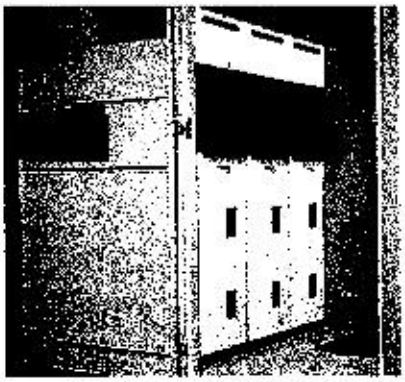
The units are simply bolted together to form the MV switchboard (bolts supplied). Busbar connections are made using a torque wrench set to 28 mN.

On the ground

- For switchboards comprising up to three units, the four corners of the switchboard must be secured to the ground with using:
  - M8 bolts (not supplied) screwed into nuts set into the ground using a sealing pistol
  - screw rods grouted into the ground.
- For switchboards comprising more than three units, each unit may be fixed to the ground
- In circuit-breaker or contactor units, fixing devices are installed on the opposite side of the switchgear.

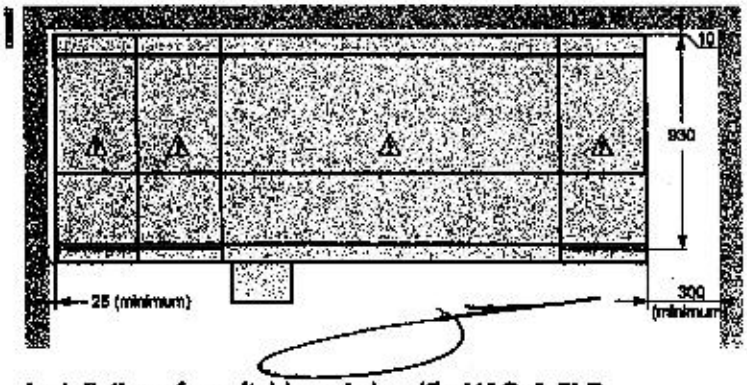
Layout examples for 24 kV

Prefabricated substation (Kiosk)

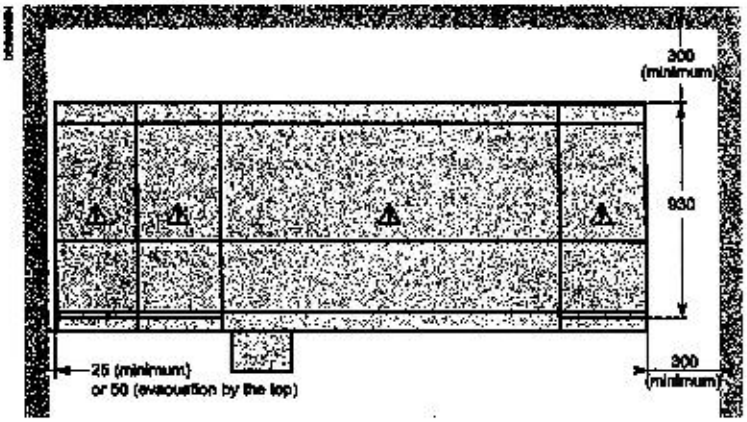


Position of cubicles in a substation

Installation of a switchboard classified IAC: A-FL

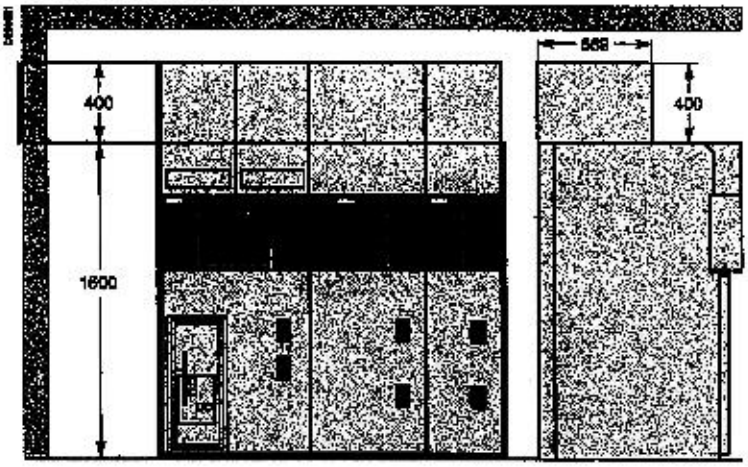


Installation of a switchboard classified IAC: A-FLR



With upwards exhaust left side

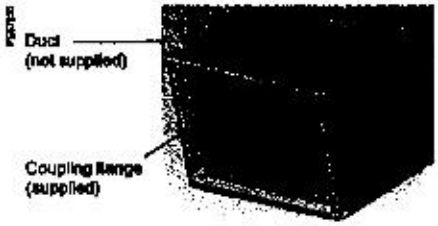
(ceiling height ≥ 2150 mm)



Evacuation duct

To enable the evacuation of gases by the top, users must install a conduit fixed to the coupling flange at right or left of the switchboard.
The end of the duct must block water, dust, moisture, animals, etc. from entering and at the same time enable the evacuation of gases into a dedicated area through a device situated at the outer end of the duct (not supplied).

Evacuation duct example
The evacuation duct must be made of metal sheet of sufficient thickness to withstand pressure and hot gases.



Dimensions and weights for 36 kV

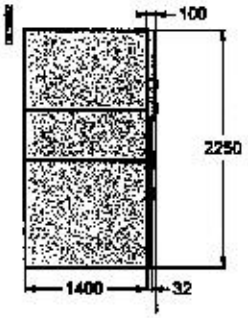
Dimensions and weights

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
IM, SM	2250	750	1400 [3]	310
IMC, IMB	2250	750	1400 [3]	420
QM, PM, QMB	2250	750	1400 [3]	330
QMC	2250	1000	1400 [3]	420
DM1-A	2250	1000	1400 [3]	500
DM1-D	2250	1000	1400 [2]	580
DM1-W	2250	1000	1400 [2]	580
NSM	2250	1500	1400 [2]	620
GIM	2250	250	1400	90
DM2	2250	1500	1400 [2]	900
DM2-W	2250	1500	1400 [2]	920
CM, CM2	2250	750	1400 [2]	480
GBC-A, GBC-B	2250	750	1400 [3]	420
GBM	2250	750	1400 [3]	260
GAM2	2250	750	1400 [3]	250
GAM	2250	750	1400 [3]	295

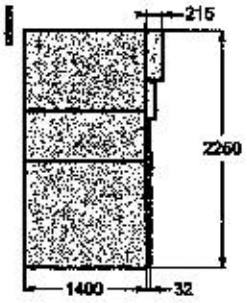
(1) The depth measures are given for the floor surface.
(2) The depth in these units are 1615 mm with the enlarged low voltage compartment.
(3) The depth in these units are 1800 mm with the standard low voltage compartment.

Dimensions

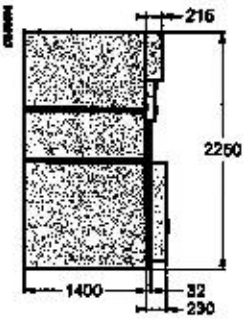
IM, SM, IMC, QM, PM, IMB, GBM, GAM, GAM2, GBC-A, GBC-B QMB, QMC units



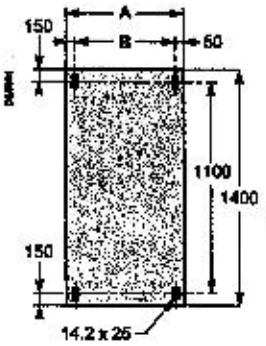
CM, CM2, NSM units



DM1-A, DM1-D, DM2, DM1-W, DM2-W units



Civil engineering for 36 kV



Ground preparation

Units may be installed on ordinary concrete grounds, with or without trenches depending on the type and cross-section of cables.
Required civil works are identical for all units.

Fixing of units

With each other

The units are simply bolted together to form the MV switchboard (bolts supplied).
Busbar connections are made using a torque wrench set to 28 mN.

On the ground

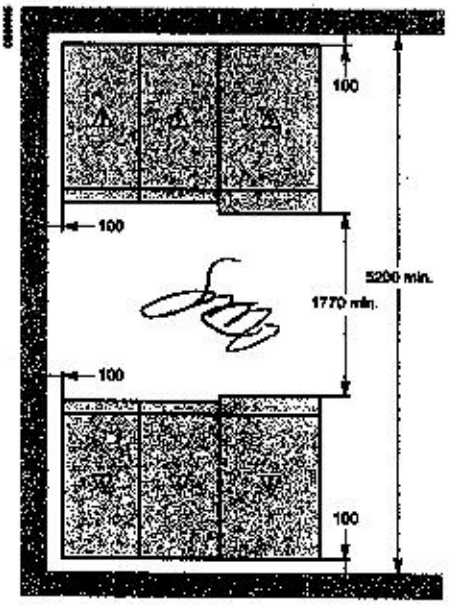
- for switchboards comprising up to three units, the four corners of the switchboard must be secured to the ground using:
  - bolts (not supplied) screwed into nuts set into the ground using a sealing pistol
  - screw rods grouted into the ground
- for switchboards comprising more than three units, the number and position of fixing points depends on local criteria (earthquake withstand capacities, etc.)
- position of fixing holes depends on the width of units.

IM, IMC, IMB, QM, PM, SM, CM, CM2, TM GBC-A, GBC-B, GBM, GAM2, IMB, GAM, QMB	750	650
DM1-A, DM1-D, DM1-W, QMC	1000	900
DM2, NSM, DM2-W	1500	1400
GIM	250	150

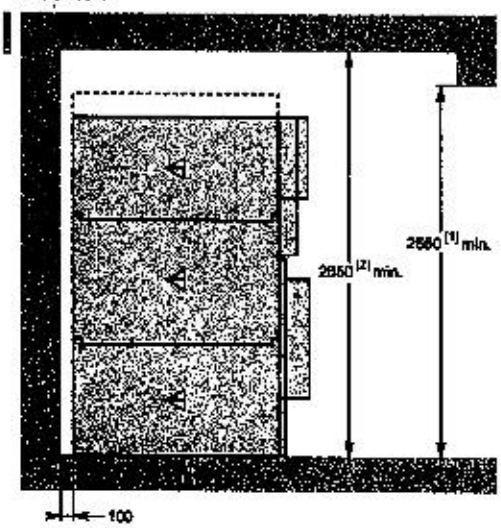
Layout examples for 36 kV

Conventional substation (Masonery)

Top view

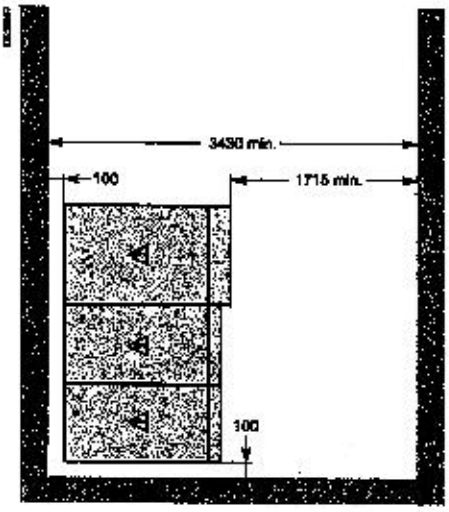


Side view



Minimum required dimensions (mm)
(1) In case of upper incoming option: It must be 2730 mm (no internal arc withstand if selected)
(2) In case of upper incoming option: It must be 2830 mm (no internal arc withstand if selected)

Top view



ВЯРНО С ОРИГИНАЛА

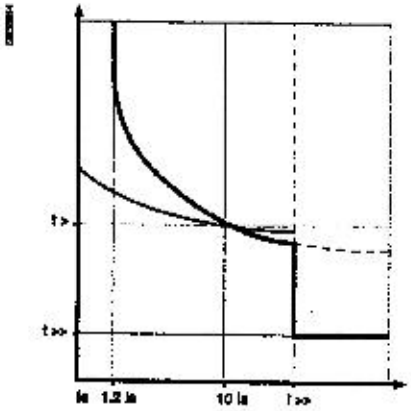
301

Contents

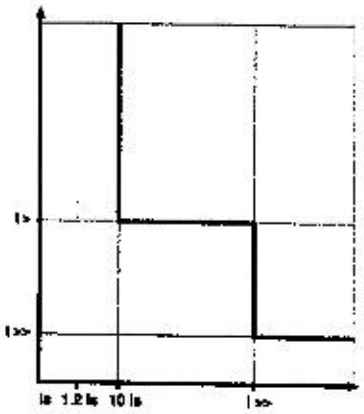
Appendices

Order form

Trip curves for VIP 300 LL or LH relays



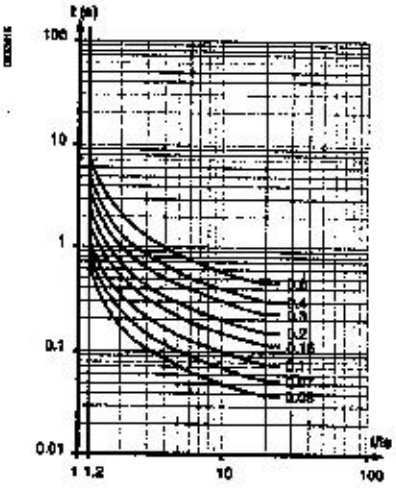
With lower definite time threshold



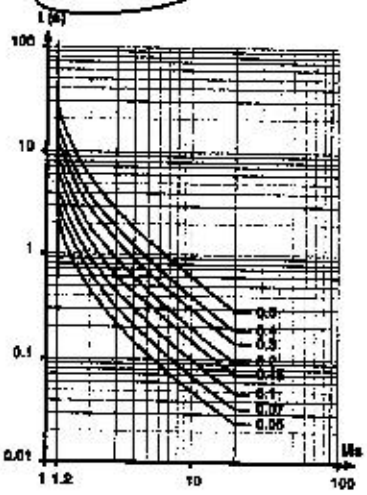
With lower inverse definite time threshold

Definite time tripping curves

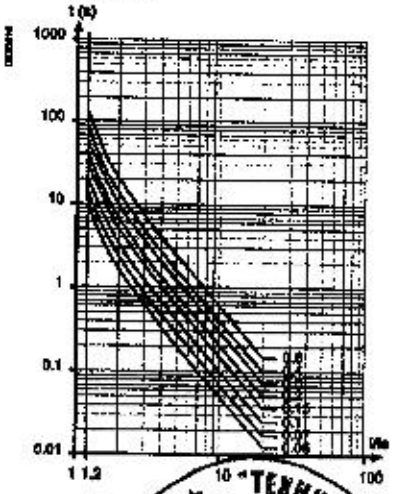
SI curve



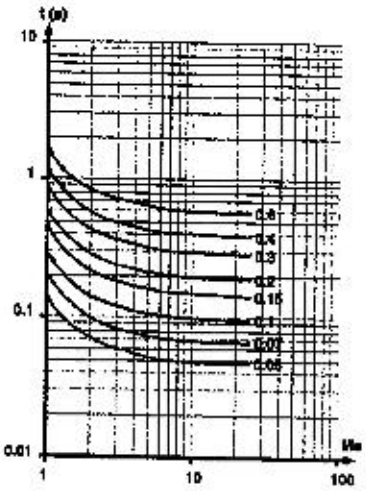
VI curve



EI curve

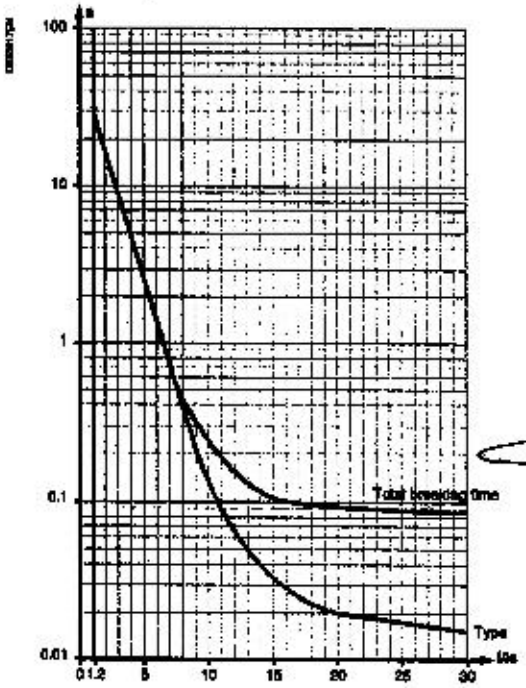


RI curve



Trip curves for VIP 35 relays

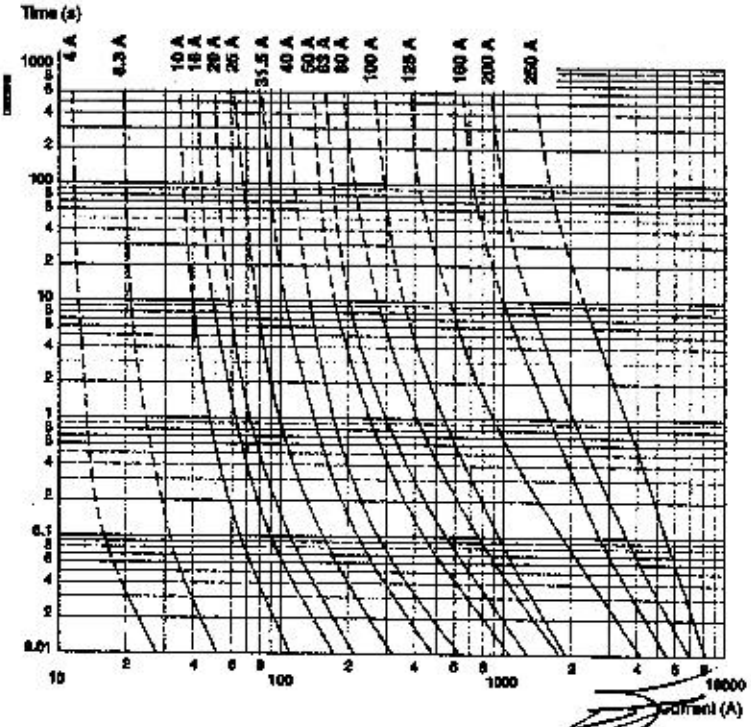
Phase protection curve



The trip curve shows the time before the relay acts, to which must be added 70 ms to obtain the breaking time.

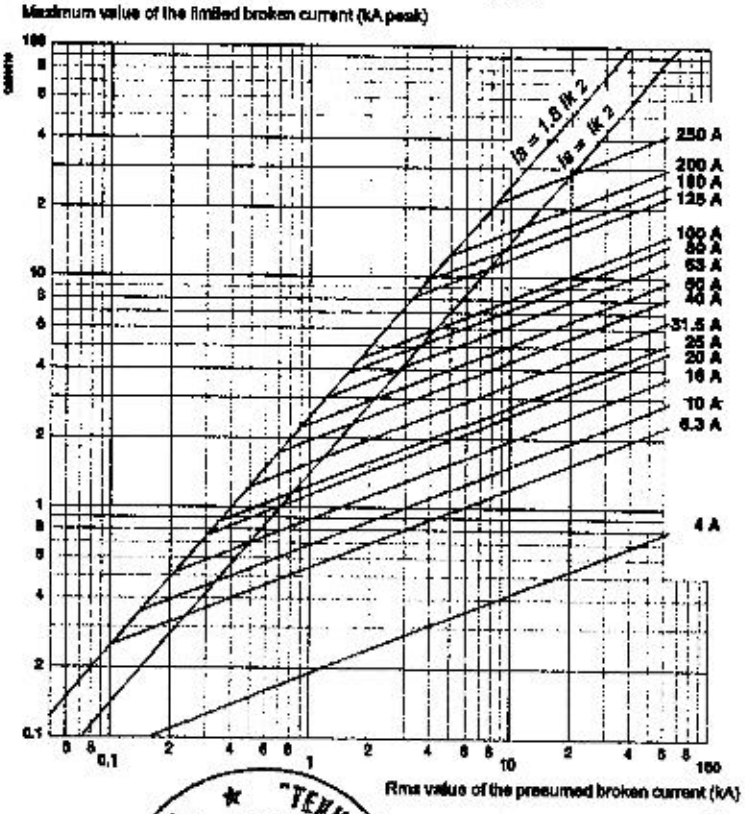
Fusarc CF fuses
Fuse and limitation curves

Fuse curve 3.6 - 7.2 - 12 - 17.5 - 24 - 36 kV



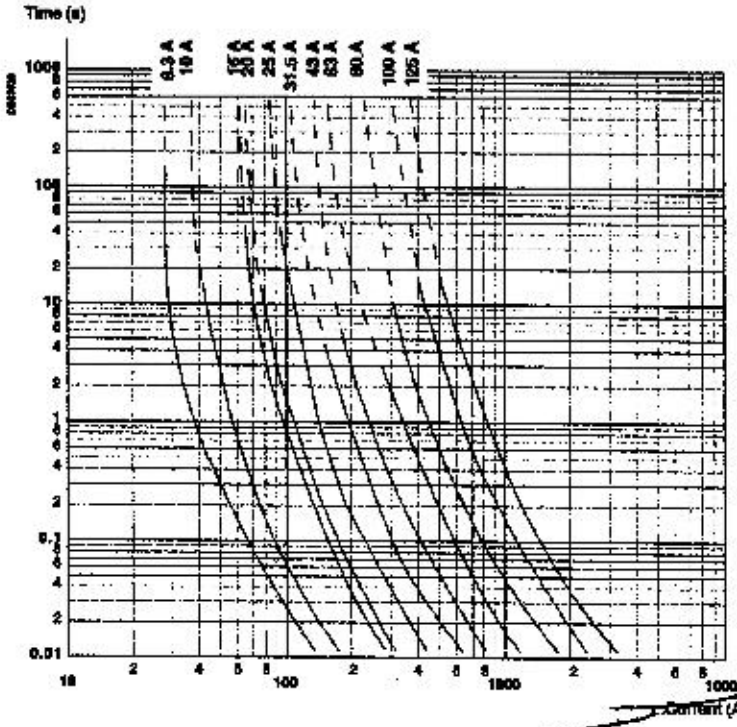
Limitation curve 3.6 - 7.2 - 12 - 17.5 - 24 - 36 kV

The diagram shows the maximum limited broken current value as a function of the rms current value which could have occured in the absence of a fuse.



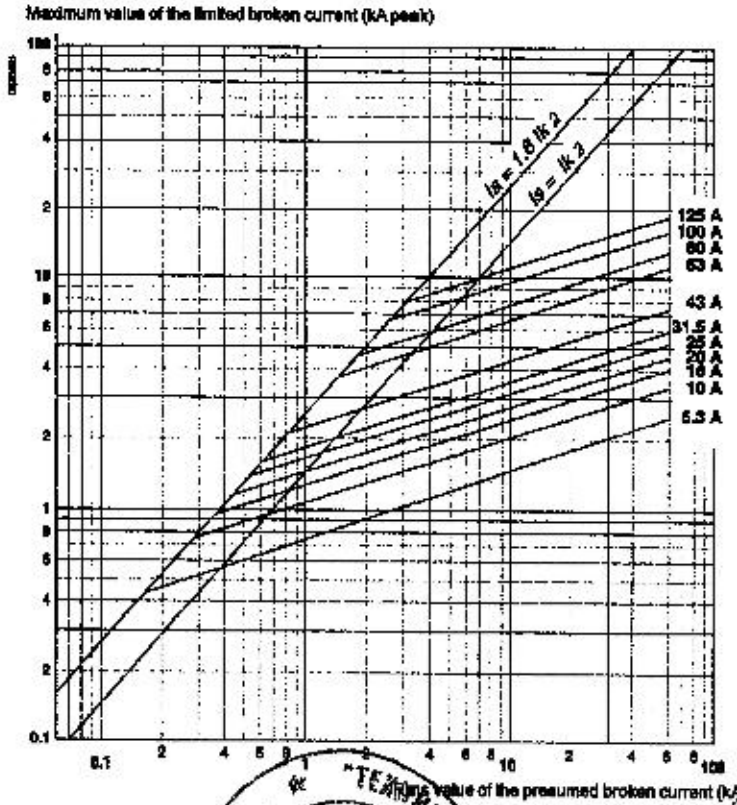
Solefuse fuses
Fuse and limitation curves

Fuse curve 7.2 - 12 - 17.5 - 24 kV



Limitation curve 7.2 - 12 - 17.5 - 24 kV

The diagram shows the maximum limited broken current value as a function of the rms current value which could have occured in the absence of a fuse.



SM6
Switching

Only one of the boxes (ticked [X] or filled [ ] by the needed value) have to be considered between each horizontal line.
Green box [X] corresponds to none priced functions.

Basic cubicle

Order no.

Rated voltage Ur (kV)

Service voltage (kV)

Short-circuit current Isc (kA)

Rated current Ir (A)

Internal arc withstand: 12.5 kA 1s for 24 kV [ ] | 16 kA 1s for 36 kV [ ]

Type of cubicle

24 kV: SM 375 [ ] | IM 375 [ ] | IMC 500 [ ] | IMB 375 [ ]
SM 500 (for 1250 A) [ ] | IM 500 [ ]

36 kV: SM 750 [ ] | IM 750 [ ] | IMC 750 [ ] | IMB 750 [ ]

Position in the switchboard: First on left [ ] | Middle [ ] | Last on right [ ]

Direction of lower busbars for IMB
Left (impossible as first cubicle of switchboard) [ ] | Right [ ]

Options

Common options

Replacement of CIT by: CI1 [ ] | CI2 [ ]

Electrical driving motorization and/or coil voltage (not applicable on SM cubicle)

24 Vdc [ ]	110 Vdc [ ]	120/127 Vac (50 Hz) [ ]
32 Vdc [ ]	120-125 Vdc [ ]	220/230 Vac (50 Hz) [ ]
48 Vdc [ ]	137 Vdc [ ]	120/127 Vac (60 Hz) [ ]
60 Vdc [ ]	220 Vdc [ ]	220/230 Vac (60 Hz) [ ]

Signalling contact: 1 C on SW and 1 O & 1 C on ES (not applicable on SM cubicle) [ ]
2 O & 2 C on SW [ ] | 2 O & 3 C on SW and 1 O & 1 C on ES [ ]

Interlocking: Tubular key type [ ] | Flat key type [ ]

For all cubicle (except SM): A4 [ ] | A3 SM6-SM6 [ ] | P1 SM6-SM6 [ ]
Localisation of 2nd lock for A3: On switch [ ] | On earthing switch [ ]
Localisation of 2nd lock for A4: Cubicle no. [ ]
SM cubicle only: P2 SM6-SM6 [ ] | P3 SM6-SM6 [ ]

Replacement of 630 A upper busbar by 1250 A (not possible for IMB) [ ]

Digital ammeter or fault current indicator: AMP 21D [ ] | Flair 23DV zero sequence [ ]
Flair 21D [ ] | Flair 22D [ ] | Flair 23DV [ ]

24 kV options

Remote control signalling
2 lights [ ] | 2 lights and 2 PB [ ] | 2 lights and 2 PB + 1 switch [ ]

Voltage of the lights (must be the same than electrical driving mechanism)
24 V [ ] | 48 V [ ] | 110/125 V [ ] | 220 V [ ]

Roof configuration (A, B or C only one choice possible)
A - Cable connection by the top (cable max 240 mm² with VPIS)
Single core [ ] | 2 x single core [ ]
B - Low voltage control cabinet (h = 450 mm) With unpunched door [ ]
C - Wiring duct [ ]

Cable connection by the bottom (not applicable on IMB, cable max 240 mm²)
Three-core [ ] | Single-core [ ] | 2 x single core [ ]

50 W heating element [ ]

Surge arresters for IM 500
7.2 kV [ ] | 10 kV [ ] | 12 kV [ ] | 17.5 kV [ ] | 24 kV [ ]

Operation counter [ ]

CTs for IMC (quantity): 1 [ ] | 2 [ ] | 3 [ ]

Visibility of main contacts [ ]

Pressure indicator device: Analogic manometer without visibility of main contacts [ ]
Pressure switch [ ] | Analogic manometer with visibility of main contacts [ ]

Busbar field distributors for severe conditions (only for 630 A) [ ]

Internal arc version (not possible with "top incomer" option): 16 kA 1 s [ ] | 20 kA 1 s [ ]
Gaz exhaust direction: Downwards (only for 16 kA 1s) [ ] | Upwards [ ]

36 kV options

Electrical driving mechanism (with O/C coils and AC contacts) [ ]

O/C coils without electrical driving mechanism [ ]

Cable connection by the top (single core cable max 240 mm² with VPIS) [ ]

Cable connection by the bottom (2 x single core cable max 240 mm², not applicable on IMC) [ ]

Surge arresters (not applicable on IMB, IMC cubicles): 36 kV [ ]

"ABGAS" LTD

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Order form

SM6
Switching
Automatic Transfer System

Only one of the boxes (ticked [X] or filled [ ] by the needed value) have to be considered between each horizontal line.
Green box [X] corresponds to none priced functions.

Basic cubicle

Rated voltage Ur			(kV)
Service voltage			(kV)
Short-circuit current Isc			(kA)
Rated current Ir			(A)
Internal arc withstand	12.5 kA 1s for 24 kV		16 kA 1s for 36 kV
Type of cubicle/upper busbar for 24 kV			
Ir = 630 A, Ir busbar = 400 A	NSM busbar		NSM cable
Ir = 630 A, Ir busbar = 630 A	NSM busbar		NSM cable
Ir = 630 A, Ir busbar = 1250 A			NSM cable
Type of cubicle for 36 kV	NSM busbar		NSM cable
Position in the switchboard	First on left	Middle	Last on right
Incoming bottom busbar for NSM busbar	Left		Right
Cable connection by the bottom (cable max 240 mm²) for NSM cable	Three core on both	Single core on both	2 x single core on both
Stand by source	Utility with paralleling		Generator without paralleling / Utility without paralleling
Control unit HMI language	French / English / Spanish / Portuguese		Chinese

Options

Common options

Signalling contact			1 C on SW and 1 O & 1C on ES
Operation counter			
Interlocking SM6-SM6	Tubular key type		Flat key type
	1 x P1	Right cubicle	Left cubicle
	2 x P1		Right and left cubicle
	1 kA3	Right cubicle	Left cubicle
		On switch	On earthing switch
	2 xA3 Right cubicle	On switch	On earthing switch
	Left cubicle	On switch	On earthing switch
Control and monitoring			
Protocol type	DNP3	IEC 101/204	Modbus (by default)
Modem type	FFSK	RS485	RS232 (by default)
	PSTN	GSM	FSK

24 kV options

2 heating elements			
Busbar field distributors for severe conditions (only for 630 A)			
Internal arc version (not possible with "top incomer" option)		16 kA 1 s	20 kA 1 s
Gaz exhaust direction	Downwards (only for 16 kA 1s)		Upwards

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ЕВРО
С ОРИГИНАЛА

SM6
Protection
Circuit breaker

Only one of the boxes (ticked [X] or filled [ ] by the needed value) have to be considered between each horizontal line.
Green box [X] corresponds to none priced functions.

Basic cubicle

Common 24/36 kV

Rated voltage Ur			(kV)
Service voltage			(kV)
Short-circuit current Isc			(kA)
Rated current Ir			(A)
Internal arc withstand		12.5 kA 1s for 24 kV [ ]	16 kA 1s for 36 kV [ ]
24 kV For SF1 circuit breaker	DM1-A 750 [ ]	DM1-D left 750 [ ]	DM1-D right 750 [ ]
	DM1-S 750 [ ]	DM1-Z 750 [ ]	DM1-W 750 [ ]
		DM2 left 750 [ ]	DM2 right 750 [ ]
For SFset circuit breaker		DM1-D left 750 [ ]	DM1-D right 750 [ ]
For Evolis frontal 630 A CB	DMV-A [ ]	DMV-S [ ]	DMV-D right [ ]
For Evolis lateral 630 A CB		DMVL-A [ ]	DMVL-D [ ]
36 kV For SF1 circuit breaker	DM1-A 1000 [ ]	DM1-D left 1000 [ ]	DM1-D right 1000 [ ]
	DM1-W 1000 [ ]	DM2 left 1500 [ ]	DM2 right 1500 [ ]
			DM2-W right 1500 [ ]
Position in the switchboard	First on left [ ]	Middle [ ]	Last on right [ ]
Circuit breaker			See specific order form
Current transformers (CT) and LPCTs			See specific order form

Basic 24 kV

Busbar (Ir > Ir cubicle)

For DM1-A, DM1-S, DM1-W, DMVL-A, DMVL-D, DM1-D, DM2	400 A [ ]	630 A [ ]	1250 A [ ]
For DM1-A, DM1-D, DM1-W, DM1-Z			1250 A [ ]
For DMV-A, DMV-D		630 A [ ]	1250 A [ ]
For DMV-S		630 A [ ]	

Protection

For DM1-S, DMV-S	VIP35 with CRc [ ]		VIP300LL with CRa [ ]
			VIP300LL with CRb [ ]
For DM1-S	Sepam series 10 with CRa [ ]		Sepam series 10 with CRb [ ]
For DMV-A, DMV-D			Sepam series 20/40 [ ]
For DM2, DM1-Z, DM1-W		Statimax 5A, 2s [ ]	Statimax 1A, 2s [ ]

Control for DMV-A and DMV-D

Local (shunt trip coil compulsory)			[ ]
Remote (opening coil and closing coil compulsory)			[ ]
Local and remote (opening coil and closing compulsory)			[ ]
Voltage of the auxiliaries	48/60 Vdc [ ]		110/125 or 220/250 Vdc [ ]
			110/130 or 220/240 Vac (50 Hz) [ ]
Voltage of signalling	48/60 Vdc [ ]	110/125 Vdc [ ]	220/250 Vdc [ ]
	110/130 Vac (50 Hz) [ ]		220/240 Vac (50 Hz) [ ]

Cable connection by the bottom

For DM1-A, DM1-W, DMVL-A

3 x single core cable maxi 240 mm² [ ]		6 x single core cable maxi 240 mm² [ ]
Current sensors	MV type CT [ ]	LPCT ring type for DM1-A 630 A [ ]
		LPCT MV type for DM1-D, DM1-W 630 A [ ]

Basic 36 kV

Voltage of the auxiliaries	48/60 Vdc [ ]		110/125 or 220/250 Vdc [ ]
			110/130 or 220/240 Vac (50 Hz) [ ]
Voltage of signalling	48/60 Vdc [ ]	110/125 Vdc [ ]	220/250 Vdc [ ]
	110/130 Vac (50 Hz) [ ]		220/240 Vac (50 Hz) [ ]

Options

SM6
Protection
Circuit breaker

Only one of the boxes (ticked [X] or filled [ ] by the needed value) have to be considered between each horizontal line.
Green box [X] corresponds to none priced functions.

Options

Common options

Interlocking

	Tubular key type		Flat key type	
Not applicable on DM2	A1		C1	
			C4	

Signalling contact

2 O & 2 C on SW (not applicable with VTs)	
2 O & 3 C on SW and 1 O & 1 C on ES (not applicable with VTs)	
1 O & 2 C on SW (available only on cubicle with VTs)	

VTs (not applicable for DM1-S, DMV-S)	See specific order form

24 kV options

Roof configuration (not applicable on DMV-A, DMV-S, DMV-D)
(A, B or C only one choice possible)

A - Cable connection by the top (cable max 240 mm² with VPIS)

		Single core	2 x single core
	DM2	1 set	2 sets

B - Low voltage control cabinet

		1 cabinet	2 cabinets
	DM2		

C - Wiring duct

	DM2	1 set	2 sets
	Other cubicles	1 set	

Surge arrester		
50 W heating element		
Replacement of 630 A upper busbars 400-630 A by 1250 A		
Busbar field distributors for severe conditions (only for 630 A)		
Internal arc version (not possible with "top incomer" option)	16 kA 1 s	20 kA 1 s
Gaz exhaust direction	Downwards (only for 16 kA 1s)	Upwards

36 kV options

Cable connection by the top (single core cable max 240 mm² with VPIS)	
Cable connection by the bottom (for DM1-A and DM1-W only)	
	3 x 2 x single core cable max 240 mm²
Surge arrester	36 kV
Sepam relay protection	See specific order form

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БРОЙ
ВЕРНО С ОРИГИНАЛА

300

SM6
Protection
Fuse switch

Only one of the boxes (ticked [X] or filled [ ] by the needed value) have to be considered between each horizontal line.
Green box [X] corresponds to none priced functions.

Basic cubicle

Rated voltage Ur (kV) [ ]

Service voltage (kV) [ ]

Short-circuit current Isc (kA) [ ]

Rated current Ir (A) [ ]

Internal arc withstand: 12,5 kA 1s for 24 kV [ ] | 16 kA 1s for 36 kV [ ]

Type of cubicle

24 kV	QM 375 [ ]	QMB 375 [ ]	QMC 625 [ ]	PM 375 [ ]
	QM 500 [ ]			
36 kV	QM 750 [ ]	QMB 750 [ ]	QMC 1000 [ ]	PM 750 [ ]

Position in the switchboard: First on left [ ] | Middle [ ] | Last on right [ ]

Current transformers for QMC 24 kV (to see price structure)
Quantity of CTs: 1 [ ] | 2 [ ] | 3 [ ]

Direction of lower busbars for QMB: Left [ ] | Right [ ]

Options

Common options

Fuses (see fuse price structure) — service voltage ≤ 12 kV [ ]

Replacement of mechanism — CIT by CI1 (only for PM) [ ]

Electrical driving motorization

24 Vdc [ ]	110 Vdc [ ]	120/127 Vac (50 Hz) [ ]
32 Vdc [ ]	120-125 Vdc [ ]	220/230 Vac (50 Hz) [ ]
48 Vdc [ ]	137 Vdc [ ]	120/127 Vac (60 Hz) [ ]
60 Vdc [ ]	220 Vdc [ ]	220/230 Vac (60 Hz) [ ]

Shunt trip: Opening (on CI1) [ ] | Closing and opening (on CI2) [ ]

24 Vdc [ ]	110 Vdc [ ]	120/127 Vac (50 Hz) [ ]
32 Vdc [ ]	120-125 Vdc [ ]	220/230 Vac (50 Hz) [ ]
48 Vdc [ ]	137 Vdc [ ]	120/127 Vac (60 Hz) [ ]
60 Vdc [ ]	220 Vdc [ ]	220/230 Vac (60 Hz) [ ]
		380 Vac (50/60 Hz) [ ]

Auxiliary contact signalling: 1 C on SW and 1 O & 1 C on ES [ ]
2 O & 2 C on SW [ ] | 2 O & 3 C on SW and 1 O & 1 C on ES [ ]

Interlocking: A1 [ ] C1 [ ] C4 [ ] — Tubular key type [ ] | Flat key type [ ]

Replacement of 630 A upper busbar by 1250 A (not possible for QMB) [ ]

Blown fuse signalling contact (for QM, QMB, QMC) [ ]

24 kV options

Replacement of mechanism — CI1 by CI2 (only for QM) [ ]

Remote control signalling (for QM only): 2 lights [ ] | 2 lights and 2 PB [ ] | 2 lights and 2 PB + 1 switch [ ]

Voltage of the lights (must be the same than electrical driving mechanism): 24 V [ ] | 48 V [ ] | 110/125 V [ ] | 220 V [ ]

Blown fuse signalling contact (mechanical indication PM, electrical for the other cubicles) [ ]

Roof configuration (A, B or C only one choice possible)

A - Cable connection by the top (cable max 240 mm² with VPIS): Single core [ ] | 2 x single core [ ]

B - Low voltage control cabinet (h = 450 mm) — With unpunched door [ ]

C - Wiring duct [ ]

50 W heating element [ ]

Operation counter [ ]

Digital ammeter (not applicable for QMB) — AMP21D [ ]

Visibility of main contacts [ ]

Pressure indicator device: Analogic manometer without visibility of main contacts [ ]
Pressure switch [ ] — Analogic manometer with visibility of main contacts [ ]

Busbar field distributors for severe conditions (only for 630 A) [ ]

Internal arc version (not possible with "arc-resistant" option): 16 kA 1 s [ ] | 20 kA 1 s [ ]

Gas exhaust direction: Downwards (only for 16 kA 1s) [ ] | Upwards [ ]

36 kV options

Replacement of mechanism — CIT by CI2 (only for PM) [ ]

Cable connection by the top (single core cable max 240 mm² with VPIS) [ ]

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Order form

SM6
Protection
Vacuum contactor (Direct Motor Starter) for 24 kV

Only one of the boxes (ticked [X] or filled [ ] by the needed value) have to be considered between each horizontal line.
Green box [X] corresponds to none priced functions.

Basic cubicle						
Rated voltage Ur					(kV)	7.2
Service voltage					(kV)	
Short-circuit current Isc (6.3 kA without fuse)					(kA)	
Rated current Ir (max. 400 A without fuse)					(A)	
Internal arc withstand						12.5 kA 1s
Position in the switchboard	First on left [X]		Middle [X]		Last on right [X]	
Busbar Ir	400 A		630 A		1250 A	
Phase current sensors	1 CT		2 CT		3 CT	
					3 LPCT ring type	
Key interlockings for 62 type	Tubular key type				Flat key type	
Options						
MV fuses	25 A		31.5 A		40 A	
50 A		63 A		80 A		100 A
125 A		160 A		200 A		250 A
Busbar field distributors for severe conditions (only for 630 A)						
Key interlockings for C1 type	Tubular key type				Flat key type	
Voltage transformer (quantity)	1		2		3	
Internal arc version (not possible with "top incomer" option)			16 kA 1 s		20 kA 1 s	
Gaz exhaust direction	Downwards (only for 16 kA 1s)				Upwards	

Contactor						
Vacuum contactor	Magnetic hold				Mechanical latching	
Open release	48 Vdc		125 Vdc		250 Vdc	
Closing coil	110 Vac/dc		120 Vac/dc		125 Vac/dc	
	220 Vac/dc		240 Vac/dc		250 Vac/dc	

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БЕЛПРО С ОРИГИНАЛ

312

SM6
Metering

Only one of the boxes (ticked [X] or filled [ ] by the needed value) have to be considered between each horizontal line.
Green box [X] corresponds to none priced functions.

Basic cubicle

Common on 24/36 kV

Rated voltage Ur					(kV)
Service voltage					(kV)
Short-circuit current Isc					(kA)
Rated current Ir					(A)
Internal arc withstand	12.5 kA 1 s for 24 kV			16 kA 1 s for 36 kV	
Type of cubicle/upper busbar for 24 kV					
Ir = 630 A, Ir busbar = 400 A	CM	CM2	TM	GBC-A	GBC-B
Ir = 630 A, Ir busbar = 630 A	CM	CM2	TM	GBC-A	GBC-B
Ir = 630 A, Ir busbar = 1250 A	CM	CM2	TM	GBC-A	GBC-B
Ir = 1250 A, Ir busbar = 1250 A				GBC-A	GBC-B
Type of cubicle for 36 kV	CM 750	CM2 750	TM 750	GBC-A 750	GBC-B 750
Position in the switchboard	First on left	Middle		Last on right	
Direction of lower busbars for GBC-A	Left			Right	
Signalling contact (for CM, CM2 and TM only)				1 O and 1 C on SW	
Fuses (for CM, CM2 and TM only)				See fuse price structure	

Basic 24 kV

VTs for GBC (to see price structure)	Phase/phase		Phase/earth	
CTs for GBC (to see price structure)	Quantity 1	2	3	
Ratio choice for GBC				
Protections	1 secondary		1 high secondary	
	2 secondaries		1 low secondary	

Basic 36 kV

Voltage transformers	See specific order form

Options

24 kV options

Roof configuration (A, B or C only one choice possible)

A - Cable connection by the top (cable max 240 mm² with VPIS) — Single core / 2 x single core

B - Low voltage control cabinet (h = 450 mm) — With unpunched door

C - Wiring duct

60 W heating element for CM, CM2, TM

Busbar field distributors for severe conditions (only for 630 A and CM, CM2 and TM cubicles)

Blown fuse auxiliary contact (for CM, CM2 and TM only) — 1 O and 1 C

Internal arc version (not possible with "top incomer" option) — 16 kA 1 s / 20 kA 1 s

Gaz exhaust direction — Downwards (only for 16 kA 1 s) / Upwards

36 kV options

Current transformers and voltage transformers for GBC	See specific order form
Cable connection by the top (single core cable max 240 mm² with VPIS)	
Replacement of 630 A busbar by 1250 A (for CM, CM2 and TM only)	

SM6
Other functions

Only one of the boxes (ticked [X] or filled [ ] by the needed value) have to be considered between each horizontal line.
Green box [X] corresponds to none priced functions.

Basic cubicle

Rated voltage Ur			(kV)
Service voltage			(kV)
Short-circuit current Isc			(kA)
Rated current Ir			(A)
Internal arc withstand	12.5 kA 1s for 24 kV		16 kA 1s for 36 kV
Type of cubicle/upper busbar for 24 kV			
Ir = 630 A, Ir busbar = 400 A	GAM 500	GAM2 375	GBM 375
Ir = 630 A, Ir busbar = 630 A	GAM 500	GAM2 375	GBM 375
Ir = 1250 A, Ir busbar = 1250 A	GAM 500		GBM 375
Type of cubicle for 36 kV	GAM 750	GAM2 750	GBM 750
Position in the switchboard	First on left	Middle	Last on right
Direction of lower busbars for GBM			
	Left (impossible on the first cubicle of the switchboard)		Right

Options

24 kV options

Roof configuration (A, B or C only one choice possible)

A - Cable connection by the top (cable max 240 mm² with VPIS)

	Single core	2 x single core
B - Low voltage control cabinet (h = 450 mm)		With unpunched door
C - Wiring duct		

Wiring duct for GBM	
ES auxiliary contact (only on GAM 500)	1 O and 1 C

Surge arresters for GAM 500, 630 A

7.2 kV	10 kV	12 kV	17.5 kV	24 kV

Interlocking on GAM 500

	Tubular key type		Flat-key type
	A3 SM6-SM6		P5 SM6-SM6
Localisation of 2nd lock for P5			Cubicle no.

Heating element (on GAM 500 630 A and on GAM2)			
Digital ammeter or Fault current indicator	AMP 21D (except GBM)		Flair 23DV zero sequence
	Flair 21D	Flair 22D	Flair 23DV
Internal arc version (not possible with "top incomer" option)	16 kA 1 s		20 kA 1 s
Gaz exhaust direction	Downwards (only for 16 kA 1s)		Upwards

36 kV options

Cable connection by the top (single core cable max 240 mm² with VPIS)	
Replacement of 630 A busbar by 1250 A (for GAM2 only)	
Surge arresters for GAM2	

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ВЯРНО С ОРИГИНАЛА

SF1
Lateral disconnectable or withdrawable

Only one of the boxes (ticked [X] or filled [ ] by the needed value) have to be considered between each horizontal line.
Green box [X] corresponds to none priced functions.

Basic circuit breaker

Rated voltage Ur		(kV)	
Service voltage		(kV)	
Impulse voltage Up		(kVbil)	
Short-circuit current Icc		(kA)	
Rated current Ir		(A)	
Frequency	60 Hz	50 Hz	
Mechanism position	Disconnectable A1	B1	
	Withdrawable	B1	

Colour for push buttons and indicators
Push buttons open/close: Red/black
Indicator open/close: Black/white
Operating mechanism charged/discharged: White/yellow

Circuit breaker options

1st opening release (see possible choices combination table below)

Shunt opening release YO1

24 Vdc	60 Vdc	220 Vdc	220 Vac (50 Hz)
30 Vdc	110 Vdc	48 Vac (50 Hz)	120 Vac (60 Hz)
48 Vdc	125 Vdc	110 Vac (50 Hz)	240 Vac (60 Hz)

Undervoltage release YM

24 Vdc	60 Vdc	220 Vdc	220 Vac (50 Hz)
30 Vdc	110 Vdc	48 Vac (50 Hz)	120 Vac (60 Hz)
48 Vdc	125 Vdc	110 Vac (50 Hz)	240 Vac (60 Hz)

Mitop: Without contact / With contact

2nd opening release (see possible choices combination table below)

Shunt opening release YO2

24 Vdc	60 Vdc	220 Vdc	220 Vac (50 Hz)
30 Vdc	110 Vdc	48 Vac (50 Hz)	120 Vac (60 Hz)
48 Vdc	125 Vdc	110 Vac (50 Hz)	240 Vac (60 Hz)

Undervoltage release YM

24 Vdc	60 Vdc	220 Vdc	220 Vac (50 Hz)
30 Vdc	110 Vdc	48 Vac (50 Hz)	120 Vac (60 Hz)
48 Vdc	125 Vdc	110 Vac (50 Hz)	240 Vac (60 Hz)

Mitop: Without contact / With contact

Remote control

Electrical motor M: 24...32 Vdc / 110...127 Vdc/ac; 48...60 Vdc/ac / 220...250 Vdc/ac

Shunt closing release YF

24 Vdc	60 Vdc	220 Vdc	220 Vac (50 Hz)
30 Vdc	110 Vdc	48 Vac (50 Hz)	120 Vac (60 Hz)
48 Vdc	125 Vdc	110 Vac (50 Hz)	240 Vac (60 Hz)

Leaflets language: French / English

Different releases combinations

Shunt opening releases YO1/YO2	1			2	1	1	
Undervoltage release YM			1		1		1
Mitop		1				1	1

"TECHNIC ENERGY" LTD

ВЯРНО С ОРИГИНАЛА

Order form

SFset
Lateral disconnectable for SM6 24 kV

Only one of the boxes (ticked [X] or filled [ ] by the needed value) have to be considered between each horizontal line.
Green box [X] corresponds to none priced functions.

Basic circuit breaker			
Rated voltage Ur		(kV)	
Service voltage		(kV)	
Impulse voltage Up		(kV/kV)	
Short-circuit current Isc		(kA)	
Rated current Ir		630 A maximum	
Frequency	60 Hz		50 Hz
Mechanism position	A1		B1

Colour for push buttons and indicators
Push buttons open/close: Red/black
Indicator open/close: Black/white
Operating mechanism charged/discharged: White/yellow

Control unit and sensors			
VIP 300P (not available for all electrical characteristics)	CSa 200/1	Is = 10 to 50 A	Is = 40 to 200 A
	CSb 1250/1	Is = 63 to 312 A	Is = 250 to 1250 A
VIP 300LL	CSa 200/1	Is = 10 to 50 A	Is = 40 to 200 A
	CSb 1250/1	Is = 63 to 312 A	Is = 250 to 1250 A

Circuit breaker options

Shunt opening release (see possible choices combination table below)

Shunt opening release YO2

24 Vdc	60 Vdc	220 Vdc	220 Vac (50 Hz)
30 Vdc	110 Vdc	48 Vac (50 Hz)	120 Vac (60 Hz)
48 Vdc	125 Vdc	110 Vac (50 Hz)	240 Vac (60 Hz)

Undervoltage release YM

24 Vdc	60 Vdc	220 Vdc	220 Vac (50 Hz)
30 Vdc	110 Vdc	48 Vac (50 Hz)	120 Vac (60 Hz)
48 Vdc	125 Vdc	110 Vac (50 Hz)	240 Vac (60 Hz)

Remote control

Electrical motor M

24...32 Vdc	110...127 Vdc/ac
48...60 Vdc/ac	220...250 Vdc/ac

Shunt closing release YF

24 Vdc	60 Vdc	220 Vdc	220 Vac (50 Hz)
30 Vdc	110 Vdc	48 Vac (50 Hz)	120 Vac (60 Hz)
48 Vdc	125 Vdc	110 Vac (50 Hz)	240 Vac (60 Hz)

Test box (VAP 6)		
Leaflets language	French	English

Different releases combinations

Mitop	1	1	1
Shunt opening release YO2		1	
Undervoltage release YM			1

"TECHNIC ENERGY" LTD

ВЯРНО С ОРИГИНАЛА

3/6

Evolis
Frontal fixed version for SM6 24 kV (up to 17.5 kV)

Only one of the boxes (licked [X] or filled [ ] by the needed value) have to be considered between each horizontal line.
Green box [X] corresponds to none priced functions.

Basic fixed circuit breaker

Rated voltage Ur (kV)	12 [ ]	17.5 [ ]
Service voltage		(kV) [ ]
Short-circuit current Isc		25 kA
Rated normal current Ir (A)	630 [ ]	1250 [ ]
Phase distance		185 mm

Circuit breaker options

Opening releases (see possible choices in combination table below)

Shunt opening release MX

24 Vac [ ]	24...30 Vdc [ ]	100...130 Vdc/ac [ ]
48 Vac [ ]	48...60 Vdc [ ]	200...250 Vdc/ac [ ]

Low energy release Mitop

1 AC fault signalling SDE and reset. 200...250 Vac are included [ ]

Remote control (operation counter already included)

Electrical motor MCH

24...30 Vdc [ ]	100...125 Vdc [ ]	200...250 Vdc [ ]
48...60 Vdc/ac [ ]	100...130 Vac [ ]	200...240 Vac [ ]

Shunt closing release XF

24 Vac [ ]	24...30 Vdc [ ]	100...130 Vdc/ac [ ]
48 Vac [ ]	48...60 Vdc [ ]	200...250 Vdc/ac [ ]

Operation counter CDM		[ ]
Additional auxiliary contacts OF (4 AC)	1 [ ]	2 [ ]
Ready to close contact PF (1 AC)		[ ]

Locking of the circuit breaker in the open position

By padlock [ ]

or by locks and keys — Tubular key type [ ] — Flat key type [ ]

If locks	1 lock [ ]	2 identical locks [ ]	2 different locks [ ]

Disabling of O/C circuit breaker push-buttons	[ ]

Different releases combinations

Shunt opening release MX		1	1
Mitop	★	1	1

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ВЯРНО С ОРИГИНАЛА

317

Order form

Evolis
Lateral disconnectable version for SM6 24 kV (up to 24 kV)

Only one of the boxes (ticked [X] or filled [ ] by the needed value) have to be considered between each horizontal line.
Green box [X] corresponds to none priced functions.

Basic circuit breaker

Rated voltage Ur	24 (kV)
Service voltage	(kV) [ ]
Impulse voltage Up	(kVbil) [ ]
Rated normal current Ir	630 A maximum
Phase distance	250 mm
Mechanism position	-B1

Colour for push buttons and indicators
Push buttons open/close: Red/black
Indicator open/close: Black/white
Operating mechanism charged/discharged: White/yellow

Circuit breaker options

1st opening release (see possible choices combination table below)

Shunt opening release YO1

24 Vdc [ ]	110 Vdc [ ]	110 Vac (50 Hz) [ ]
48 Vdc [ ]	125-127 Vdc [ ]	220-230 Vac (50 Hz) [ ]
	220 Vdc [ ]	120 Vac (60 Hz) [ ]

Undervoltage release YM

24 Vdc [ ]	110 Vdc [ ]	110 Vac (50 Hz) [ ]
48 Vdc [ ]	125-127 Vdc [ ]	220-230 Vac (50 Hz) [ ]
	220 Vdc [ ]	120 Vac (60 Hz) [ ]

2nd opening release (see possible choices combination table below)

Shunt opening release YO2

24 Vdc [ ]	110 Vdc [ ]	110 Vac (50 Hz) [ ]
48 Vdc [ ]	125-127 Vdc [ ]	220-230 Vac (50 Hz) [ ]
	220 Vdc [ ]	120 Vac (60 Hz) [ ]

Undervoltage release YM

24 Vdc [ ]	110 Vdc [ ]	110 Vac (50 Hz) [ ]
48 Vdc [ ]	125-127 Vdc [ ]	220-230 Vac (50 Hz) [ ]
	220 Vdc [ ]	120 Vac (60 Hz) [ ]

Low energy release Mitop [ ]

Remote control (operation counter already included)

Electrical motor M

	24...32 Vdc [ ]	110...127 Vdc/ac [ ]
	48...60 Vdc/ac [ ]	220...250 Vdc/ac [ ]

Shunt closing release YF

24 Vdc [ ]	110 Vdc [ ]	110 Vac (50 Hz) [ ]
48 Vdc [ ]	125-127 Vdc [ ]	220-230 Vac (50 Hz) [ ]
	220 Vdc [ ]	120 Vac (60 Hz) [ ]

Operation counter (already included if remote control supplied) [ ]

Different releases combinations

Shunt opening releases YO1	1		1	1	1	
Shunt opening releases YO2			1			
Undervoltage release YM		1		1		1
Mitop				1	1	1

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Notes

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ВЯРНО С ОРИГИНАЛА

Distribution Moyenne Tension
Medium Voltage Distribution

SM6-24

Cellules modulaires
Modular cubicles

Conditions d'installation
Installation requirements

[redacted]

Schneider Electric

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Performance arc interne
Internal arc performance

Introduction

Un arc interne est une forme de court-circuit très sévère qui peut survenir dans une installation électrique.
Contrairement à un court-circuit dit « boulonné » où le courant de défaut circule dans des conducteurs solides, un arc interne fait cheminer le courant dans l'air (devenant plasma) entre deux conducteurs.
En plus des effets classiques d'un court-circuit (échauffement des conducteurs, efforts électromagnétiques), l'arc interne se caractérise donc par une quantité d'énergie énorme transmise au fluide.
L'énergie dissipée, allant jusqu'à plusieurs dizaines de mégajoules sur une seconde, provoque des effets de pression et thermiques.
Le défaut d'arc interne est rare, mais sa criticité impose d'en maîtriser les effets.

Introduction

The internal arc fault is a very severe short-circuit that can occur in electrical equipment.
Whereas a conventional bolted short circuit fault makes the current flow in solid conductors, the internal arc fault makes the current flow in the air (which becomes also plasma) between two conductors.
In addition to the usual consequences of a short-circuit fault (conductors overheating, electromagnetic stresses), the internal arc transmits a huge energy amount to the fluid. The dissipated energy, which reaches more than 10 megajoules over one second, provokes hazardous pressure effects and thermal effects.
The internal arc fault is rare, but it is so critical that we must manage its effects.

Causes

L'arc interne est causé par la rupture de rigidité diélectrique entre deux parties au potentiel différent.
Un arc survient entre deux phases ou entre une phase et la masse. Il dégénère alors souvent en défaut triphasé.
L'amorçage initial peut être créé par :
- La vieillissement des isolants solides que constituent les gaines de câbles, les résines Epoxy (fissures).
- L'intrusion d'un animal entre les parties conductrices, soit créant directement un pont conducteur entre 2 phases, soit dégradant l'isolation des câbles (rongeurs).
- L'introduction d'un objet entre les phases lors d'une opération de maintenance, comme une clé mettant en court-circuit le jeu de barres.
- Une fuite de gaz isolant (pour les appareils fonctionnant dans le SF6) ou une perte de vide (pour les appareils fonctionnant dans le vide).

Causes

The internal arc fault starts when the dielectric strength is lost between two parts at a different voltage. An arc appears between two phases or between one phase and earth. It often degenerates into a three-phases fault.
The original arc can be the result of:
- *Insulating parts ageing (damaged cables sheath, cracked Epoxy resin).*
- *The intrusion of an animal, thus directly creating a short-circuit between conductors, or damaging the insulation (rodents).*
- *The introduction of an object between the phases during a maintenance work, typically a wrench in the busbar.*
- *A insulating fluid leakage (for the SF6 insulated devices) or a vacuum loss (for the vacuum devices).*

Conséquences

L'arc interne se manifeste par des effets de pression, sollicitation mécanique importante de l'appareil puis par des effets thermiques, expulsion abondante de gaz chauds à maîtriser.
L'arc interne se découpe en 3 phases génériques :
- **La phase onde de choc : 0-5ms**
- **La phase montée en pression : 5-30ms.**
- **La phase expulsion et thermique : 30ms- ...**

Les gaz chauds créés sont évacués en continu, ils doivent être correctement canalisés, non seulement pour que la pression tende vers zéro, mais aussi pour maîtriser leur direction de sortie.

Consequences

The consequences of internal arc are pressure effects, severe mechanical stress of the device and thermal effects (heavy expulsion of hot gases that is to be managed).

The internal arc fault divides into 3 phases:
- ***The shock wave phase: 0-5ms***
- ***The pressure rise phase: 5-30ms***
- ***The expulsion and thermal phase: 30ms***

The generated hot gases are expulsed in a continuous way. They must be correctly canalized in order that the pressure falls to zero, but also to manage their exhaust direction.

Performance arc interne
Internal arc performance

Conséquences (suite)

A ces phases génériques peut s'ajouter une phase d'éclatement de membrane, lorsque la surpression dans un compartiment hermétique est libérée vers les autres compartiments par l'ouverture d'une membrane calibrée.
Elle est caractérisée par une deuxième onde de choc et un transfert de la surpression aux autres compartiments.
Outre ses effets mécaniques et thermiques, l'arc interne est dangereux pour :
- sa toxicité : l'air expulsé est chargé de vapeurs plastiques et métalliques irrespirables,
- son bruit : l'onde de choc initiale est une onde acoustique dangereuse (160dB),
- son rayonnement transmis : sans obstacle intermédiaire, le rayonnement émis est capable de brûler la peau au second degré en 100 ms.

Consequences (continued)

In addition to these three generic phases, a valve opening phase can take place, when the overpressure in a hermetic compartment is released to the other compartments by the way of a calibrated valve opening.
This phase is characterized by a second pressure wave and a pressure transfer to the other compartments.
As well as its mechanical and thermal effects, the internal arc fault is hazardous because of:
- *Its toxicity: the released gases are loaded with toxic plastic and metal vapors.*
- *Its noise: the original pressure wave is a hazardous acoustic wave (160 dB).*
- *Its transmitted radiation: without any obstacle, the emitted radiation can burn the skin (second degree level) in 100 ms.*

DANGER

RISQUES D'ÉLECTROCUTION, D'ARC ÉLECTRIQUE OU DE BRÛLURES
- L'installation de cet équipement doit être confiée exclusivement à des personnes qualifiées, qui ont pris connaissance de toutes les notices d'installation et contrôlé les caractéristiques techniques de l'équipement.
- Ne travaillez JAMAIS seul.
- Coupez toute alimentation avant de travailler sur cet équipement. Tenez compte de toutes les sources d'alimentation et en particulier des possibilités d'alimentation extérieure à la cellule où est installé l'équipement.
- Portez des gants isolants pour éviter tout contact avec un conducteur accidentellement mis sous tension.

Le non-respect de ces instructions provoquera la mort ou des blessures graves.

DANGER

HAZARD OF ELECTRIC SHOCK, ELECTRIC ARC OR BURNS
- *Only qualified personnel should install this equipment. Such work should be performed only after reading this entire set of instructions and checking the technical characteristics of the device.*
- *NEVER work alone.*
- *Turn off all power supplying this equipment before working on or inside it. Consider all sources of power, including the possibility of backfeeding.*
- *Wear insulating gloves to avoid any contact with a conductor that has accidentally been energized.*

Failure to follow these instructions will result in death or serious injury.

Les différentes perfomances arc interne

The different internal arc performances

12,5 kA 1s	X		X	
16 kA 1s	X		X	
		X	X	X
20 kA 1s	X	X		X

Installation sans la performance arc interne

ATTENTION

Dans certaines conditions d'installation, la performance arc interne n'est pas garantie dans le cadre d'un raccordement des câbles par le haut.

Installation without internal arc performance

CAUTION

In certain installation conditions, internal arc performance is not guaranteed when cables are connected by the top.

Conditions pour obtenir la performance arc interne
Conditions to obtain the internal arc performance

La norme CEI 62271-200 annexe A impose un niveau de protection testé pour les personne se trouvant au voisinage de l'appareillage sous enveloppe métallique dans des conditions d'arc interne.

IEC 62271-200 standard appendix A imposes a tested level of protection to persons in the vicinity the switchgear in metal enclosures under internal arc conditions.

Classes accessibilité

2 versions de classes d'accessibilité sont disponibles :
- IAC : A-FL,
- IAC : A-FLR.

IAC : A-FL

A : Type A, limité au personnel autorisé seulement
F : accès par la Face avant
L : accès par les faces Latérales

Lorsqu'un tableau classifié IAC : A-FL est adossé à un mur, ce mur ne participe pas à la performance arc interne.

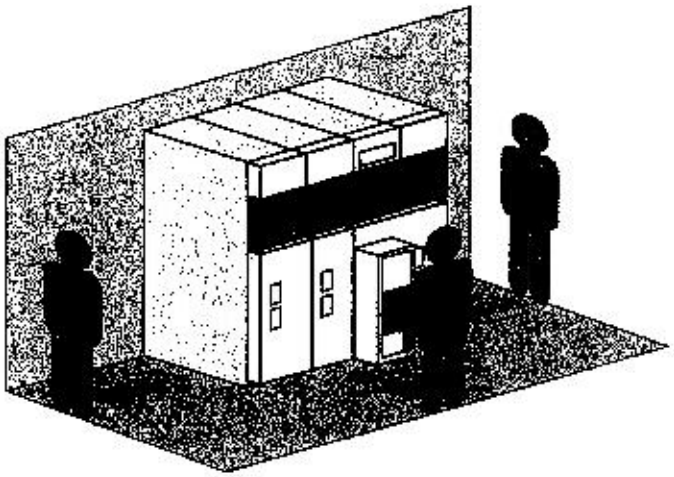
Accessibility classes

2 versions of accessibility classes are available:
- *IAC: A-FL,*
- *IAC: A-FLR.*

IAC: A-FL

A: Type A, restricted to authorized personnel only
F: access by Front side
L: access by Lateral sides

When a switchboard is classified IAC: A-FL wall-mounted, this wall does not contribute to the internal arc performance.

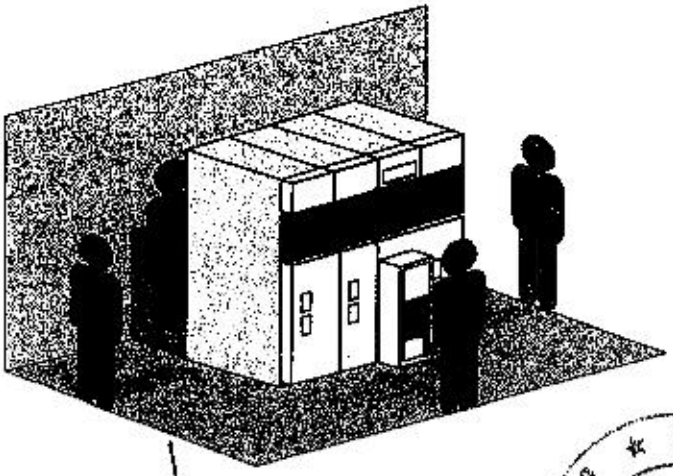


IAC : A-FLR

A : Type A, limité au personnel autorisé seulement
F : accès par la Face avant
L : accès par les faces Latérales
R : accès par la face Arrière

IAC: A-FLR

A: Type A, restricted to authorized personnel only
F: access by Front side
L: access by Lateral side
R: access by Rear side



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Conditions pour obtenir la performance arc interne
Conditions to obtain the internal arc performance

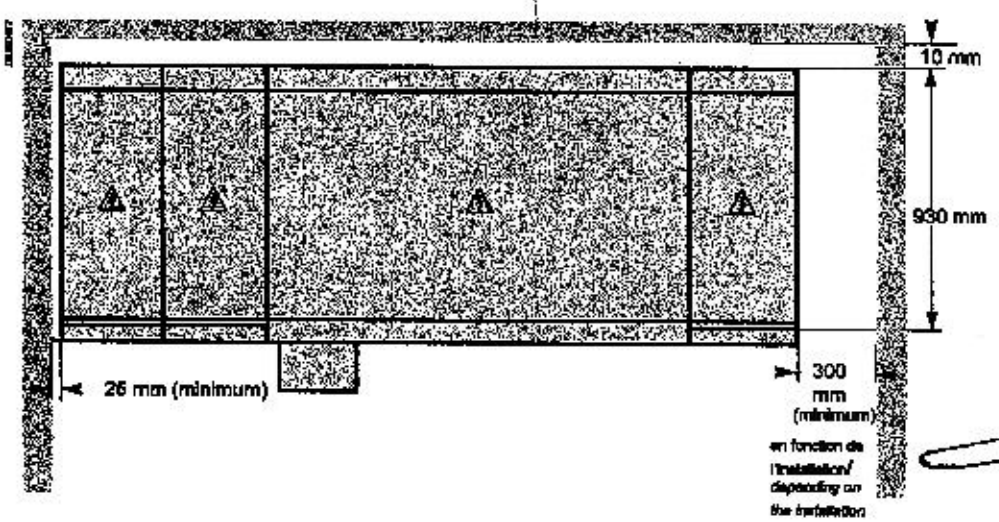
Position des cellules dans le poste

Installation du tableau classifié IAC A-FL par rapport au bâtiment

Position of cubicles in the substation

Installation of the switchboard IAC: A-FL classified relative to building

La hauteur sous plafond doit être de 2150 mm minimum.
The ceiling height must be 2150 mm minimum.



Implantation (vue de dessus).

Implantation (top view).

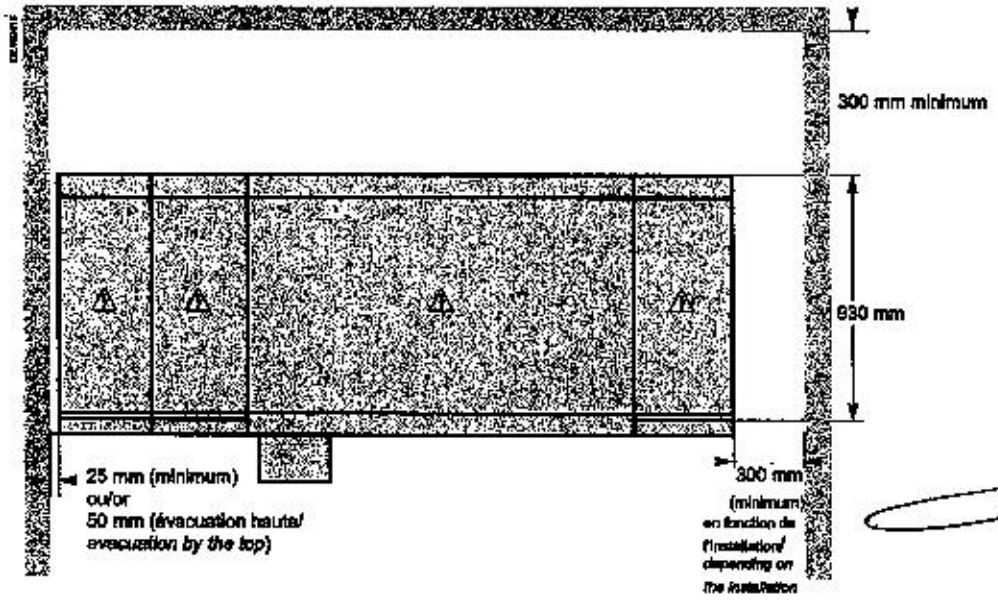
L'implantation du tableau est aussi possible accolé au mur de droite avec les mêmes conditions.
The implantation of the switchboard is also possible for a wall to the left.

Conditions pour obtenir la performance arc interne
Conditions to obtain the internal arc performance

Installation du tableau classifié IAC A-FLR par rapport au bâtiment

Installation of the switchboard IAC: A-FLR classified relative to building

La hauteur sous plafond doit être de 2150 mm minimum.
The ceiling height must be 2150 mm minimum.



Implantation (vue de dessus).

Implantation (top view).

L'implantation du tableau est aussi possible accolé au mur de droite avec les mêmes conditions.
The implantation of the switchboard is also possible for a wall to the left.

Conditions pour obtenir la performance arc interne
Conditions to obtain the internal arc performance

Mode d'évacuation

2 modes d'évacuation sont disponibles :
- l'évacuation basse par caniveau,
- l'évacuation haute par conduit.

Evacuation basse

Ce mode permet l'évacuationdes gaz dans le caniveau par l'intermédiaire d'un «flap» intégré dans le fond de la cellule. La surface sous les «flaps» doit être libre de tout obstacle (voir plan ci-dessous). Afin d'évacuer les gaz, une des extrémités du caniveau doit déboucher librement dans un espace aéré et ventilé.

Evacuation types

2 evacuation modes are available:
- *evacuation by the bottom via a trench,*
- *evacuation by the top via a duct.*

Evacuation by the bottom

This mode enables gases to be evacuated in a duct via a flap situated underneath the cubicle. The area under the «flaps» must be free of obstacle (see layout below) To enable the evacuation of gases, one of the ends of the duct must open into a well-ventilated area.

AVERTISSEMENT

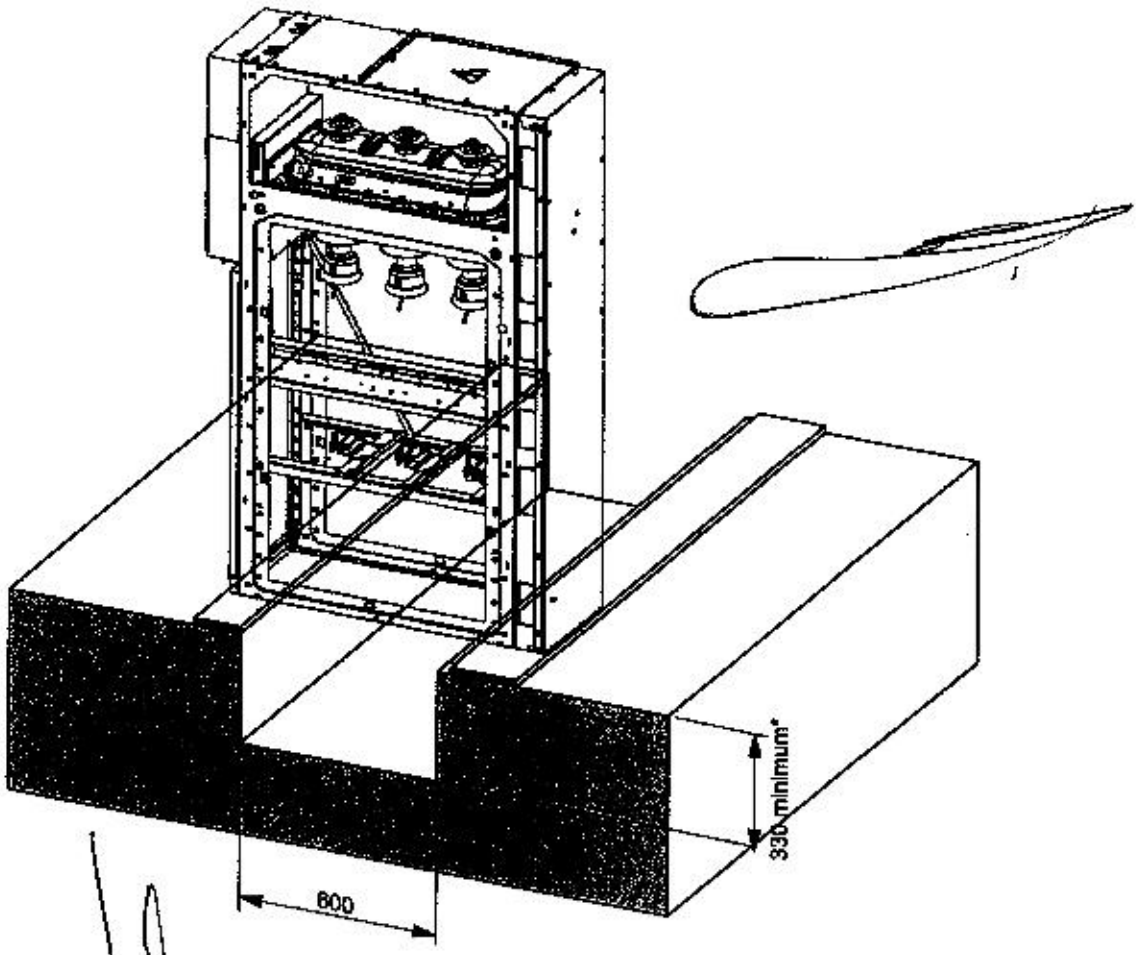
La non-respect de ces instructions provoquera la mort ou des blessures graves.

WARNING

Failure to follow these instructions will result in death or serious injury.

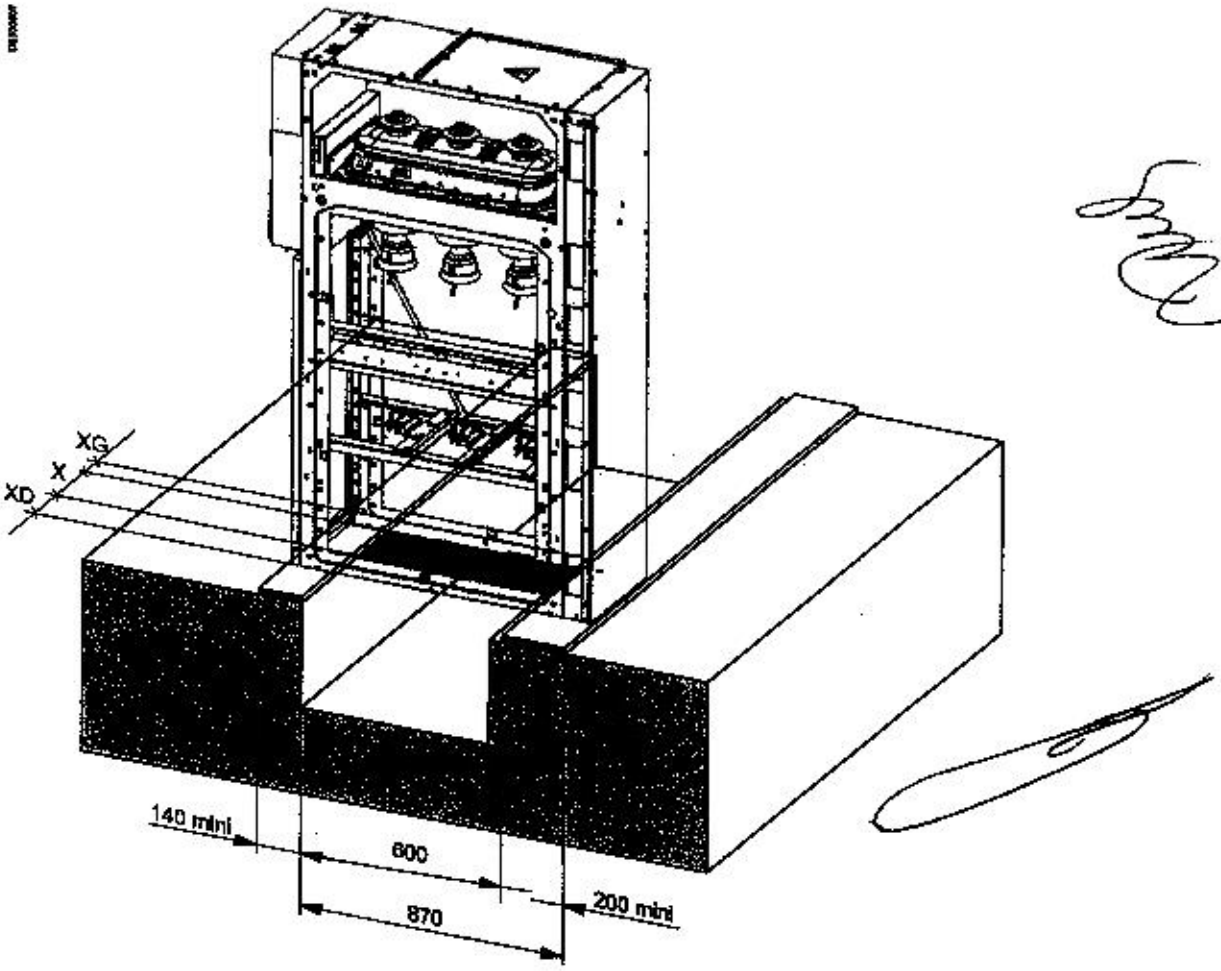
Dimensions des caniveaux pour performance 12,5 kA/1 s (en mm)

Dimensions of ducts for 12,5 kA/1 s performance (in mm)



Conditions pour obtenir la performance arc interne
Conditions to obtain the internal arc performance

Plan de la zone libre de tout obstacle (in mm) ***Area map free of obstructions (in mm)***



375	Toutes / *All*	57,5	260	57,5
500	GAM Autres / *Other*	57,5 182,5	260 260	182,5 57,5
625	QMC Autres / *Other*	307,5 57,5	260 510	57,5 57,5
750	Toutes / *All*	432,5	260	57,5

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Conditions pour obtenir la performance arc interne
Conditions to obtain the internal arc performance

Préparation du sol pour la performance arc interne 12,5 kA/ 1 s

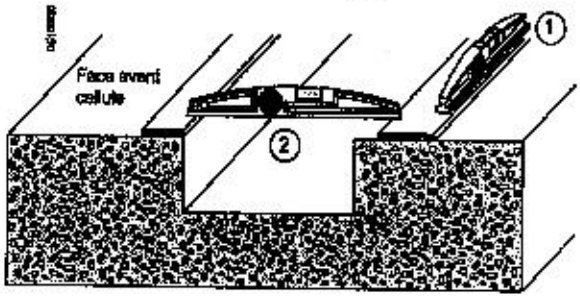
Afin d'obtenir la performance arc interne, la réalisation des sols doit être conforme aux exigences de rectitude et de planéités imposées.
L'utilisation de profils métalliques est conseillée:
- rectitude : 2 mm/ 3 m (Rep.1),
- planéité : 3 mm maximun (Rep.2).

Tous les éléments permettant l'évacuation des gaz (caniveau, cuvelage, etc ...) doivent supporter une pression de 250 Kg/m².

Preparing the floor for the internal arc performance12,5 kA/ 1 s

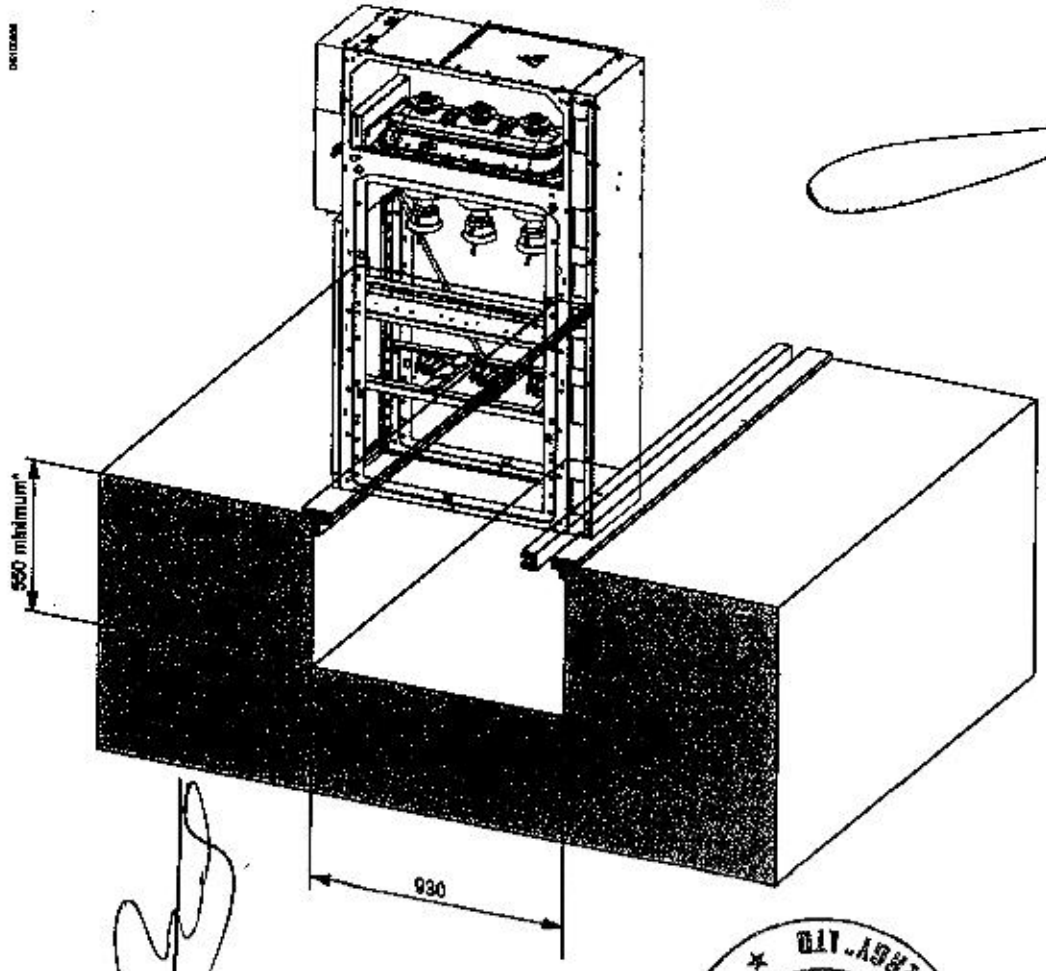
To obtain the performance arc, implementation of grounds must comply with the requirements of straightness and flatness imposed.
The use of metal angles brackets is recommended:
- *straightness: 2 mm/ 3 m (Rep. 1),*
- *flatness: 3 mm maximun (Rep.2).*

All the elements allowing the evacuation of the gas (duct, casing, etc ...) must be able to bear a load of 250 Kg/m².



Dimensions des caniveaux pour la performance arc interne 16 kA/1 s (en mm)

Dimensions of ducts for 16 kA/1 internal arc performance (in mm)



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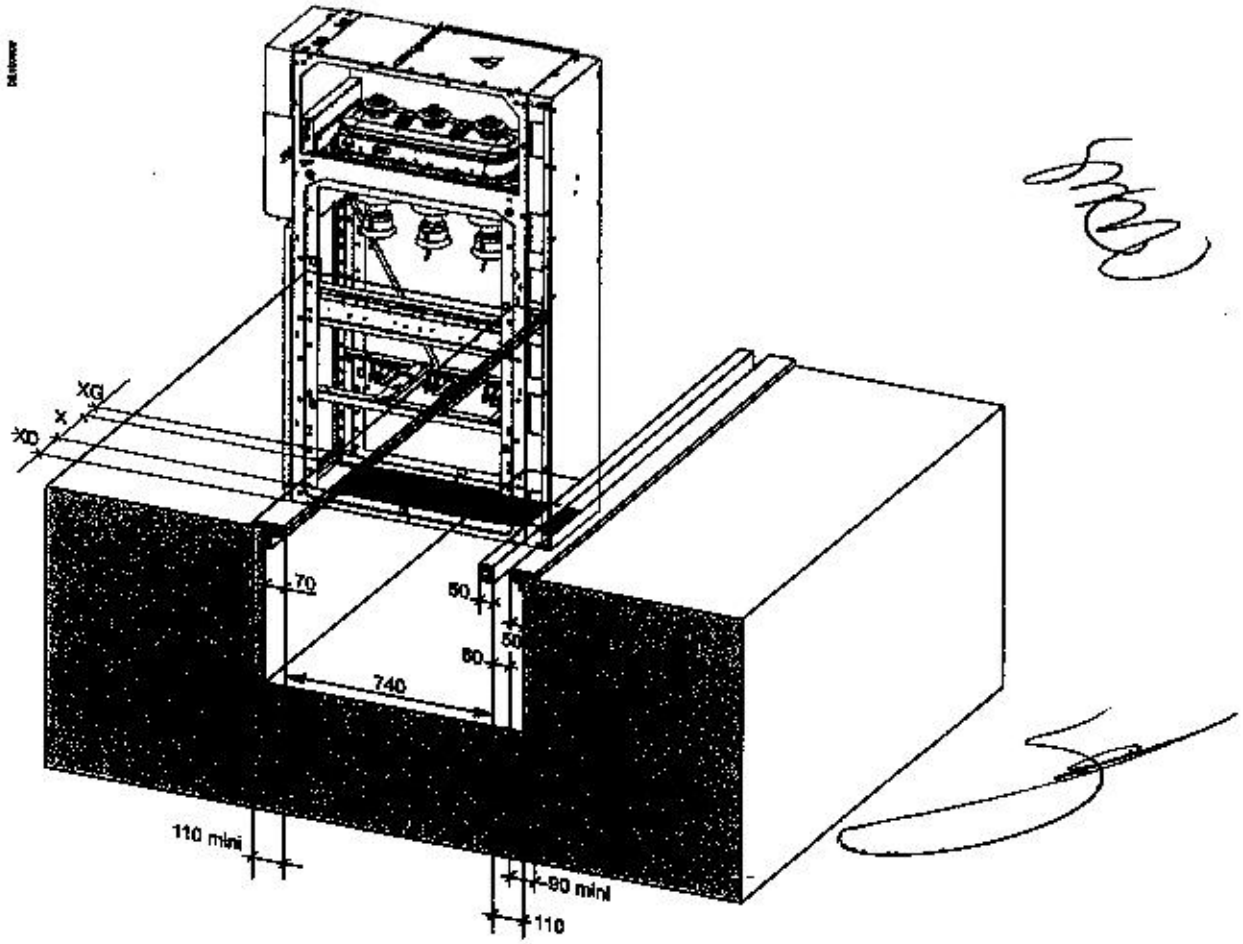
Conditions pour obtenir la performance arc interne
Conditions to obtain the internal arc performance

Plan de la zone libre de tout obstacle (en mm) ***Area map free of obstructions (in mm)***



375	Toutes / *All*	57,5	260	57,5
500	GAM Autres / *Other*	57,5 182,5	260 260	182,5 57,5
625	QMC Autres / *Other*	307,5 57,5	260 510	57,5 57,5
750	Toutes / *All*	432,5	260	57,5

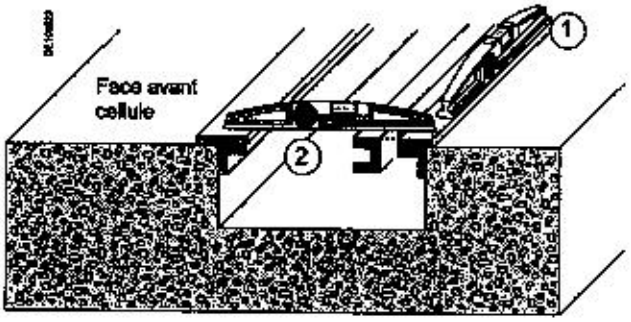
Conditions pour obtenir la performance arc interne
Conditions to obtain the internal arc performance

Préparation du sol en 16 kA/1 s
Afin d'obtenir la performance arc interne, la réalisation des sols doit être conforme aux exigences de rectitude et de planéités imposées.
L'utilisation de profils métalliques est conseillée:
- rectitude : 2 mm/ 3 m (Rep.1),
- planéité : 3 mm maximun (Rep.2).

Tous les éléments permettant l'évacuation des gaz (caniveau, cuvelage, etc ...) doivent supporter une pression de 250 Kg/m².

Preparing the floor for 16 kA/ 1 s
To obtain the performance arc, implementation of grounds must comply with the requirements of straightness and flatness imposed.
The use of metal angles brackets is recommended:
- *straightness: 2 mm/ 3 m (Rep.1),*
- *flatness: 3 mm maximun (Rep.2).*

All the elements allowing the evacuation of the gas (duct, casing, etc ...) must be able to bear a load of 250 Kg/m².



Dimensionnement de la profondeur des caniveaux en fonction de la section des câbles et de la performance 12 kA/1s ou 16 kA/1s en évacuation basse (cf illustrations p9,11,14) (en mm)

Sizing the depth of duct according to the cable section 12 kA/1s or 16 kA/1s performance in evacuation by the bottom *(cf drawings p9,11,14) (in mm)*

[redacted]

S<120	330	550	550	330	550	330		550	–	–
120<S<240	330	550	800	–	–	Opposé au disjoncteur / opposite to circuit breaker: 330	Sous le disjoncteur / under the circuit breaker: 450	550	–	–
S>400	–	–	–	–	–	–		–	1000	1400

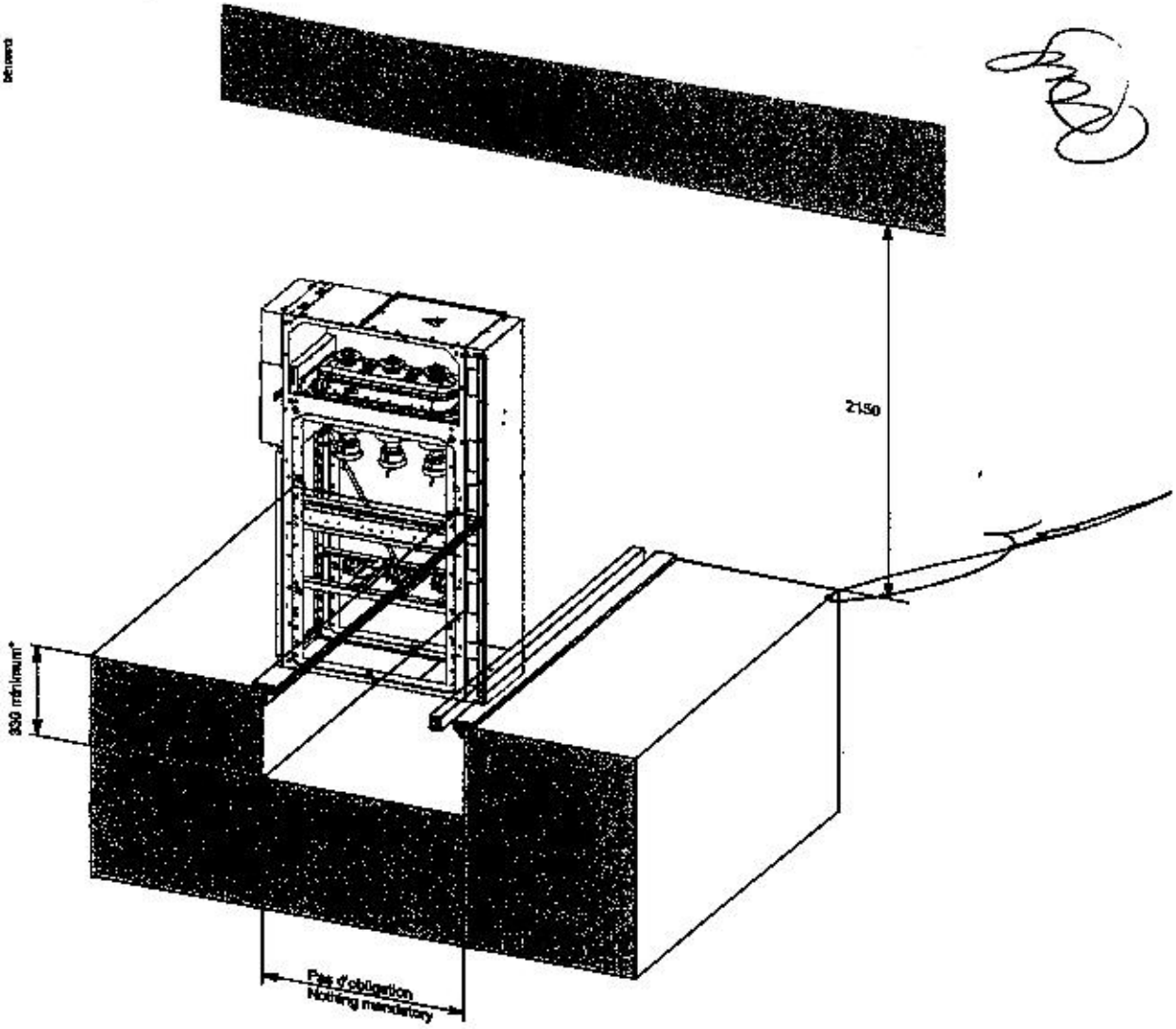
Conditions pour obtenir la performance arc interne
Conditions to obtain the internal arc performance

Evacuation haute

Dimension des caniveaux pour performance 16 kA/1s et 20 kA/1 s (en mm)

Evacuation by the top

Dimension of ducts for 16 kA/1 s and 20 kA/1 s performance (in mm)



Ce mode permet l'évacuation des gaz et nécessite l'utilisation d'un conduit placé sur le dessus de la cellule. Pour permettre l'évacuation des gaz, l'extrémité du tableau doit être équipé d'une bride d'interface (fournit avec l'équipement), sur laquelle est fixée le conduit d'évacuation (voir le plan de la bride en annexe 1).

This mode enables gases to be ejected and requires the use of a duct situated above the cubicle. To enable the evacuation of gases, the end of the switchboard must be equipped with a coupling flange (supplied by schneider Electric), on wich is fixed on the evacuation duct (see the coupling flange layout in Appendix 1).

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Conditions pour obtenir la performance arc interne
Conditions to obtain the internal arc performance

Fixation des cellules

Fixing of cubicles

Fixation des cellules entre elles

Les cellules qui composent le poste sont maintenues entre elles par simple boulonnage (visserie livrée avec les cellules). Les vis du jeux de barre doivent être serrées au couple à l'aide d'une clé dynamométrique

Fixing of cubicles to each other

The units are simply bolted together to built the MV switchboard (bolts supplied). Screws of busbars must be tightened with a torque wrench.

Fixation des cellules au sol

Toutes les cellules doivent être fixées avec 4 vis M8, ou des tiges filetées fixées au sol.

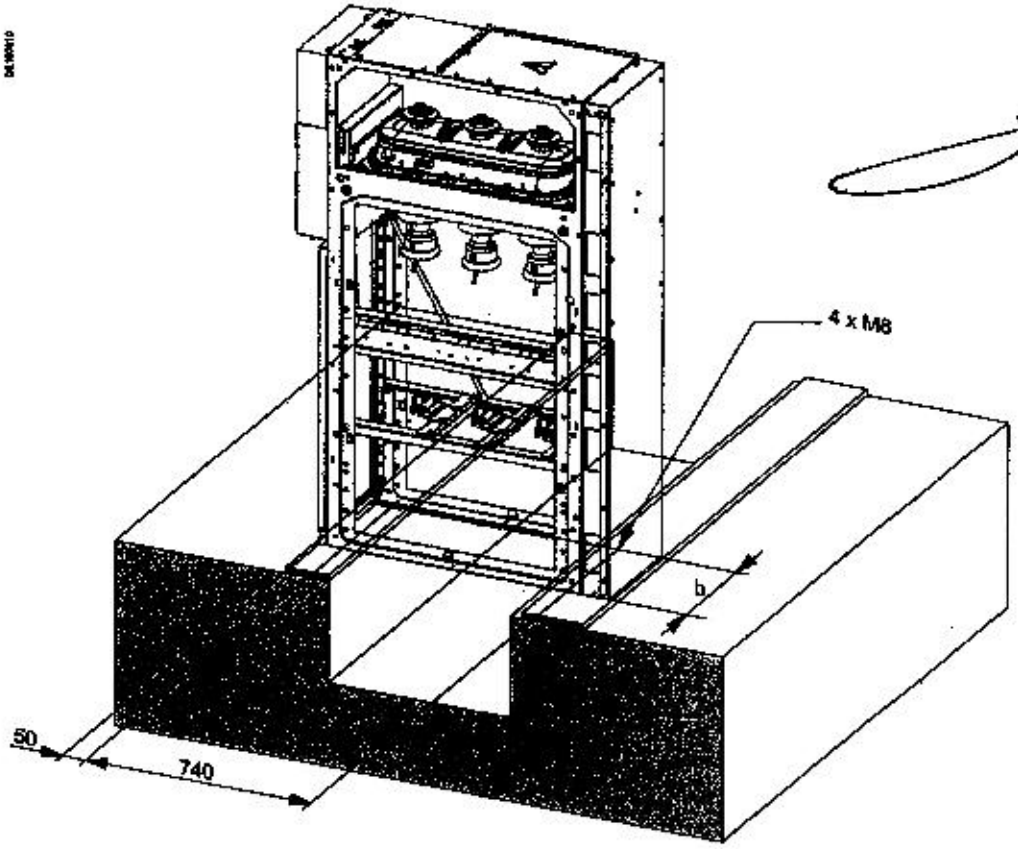
Fixation des cellules *on the ground*

All cubicles must be secured to the ground with using M8 bolts or screw rods grouted into the ground.

largeur de cellule (mm)	125	375	500	625	750
b (mm)	95	345	470	565	720

Fixation des cellules pour performance 12,5 kA/1 s (in mm)

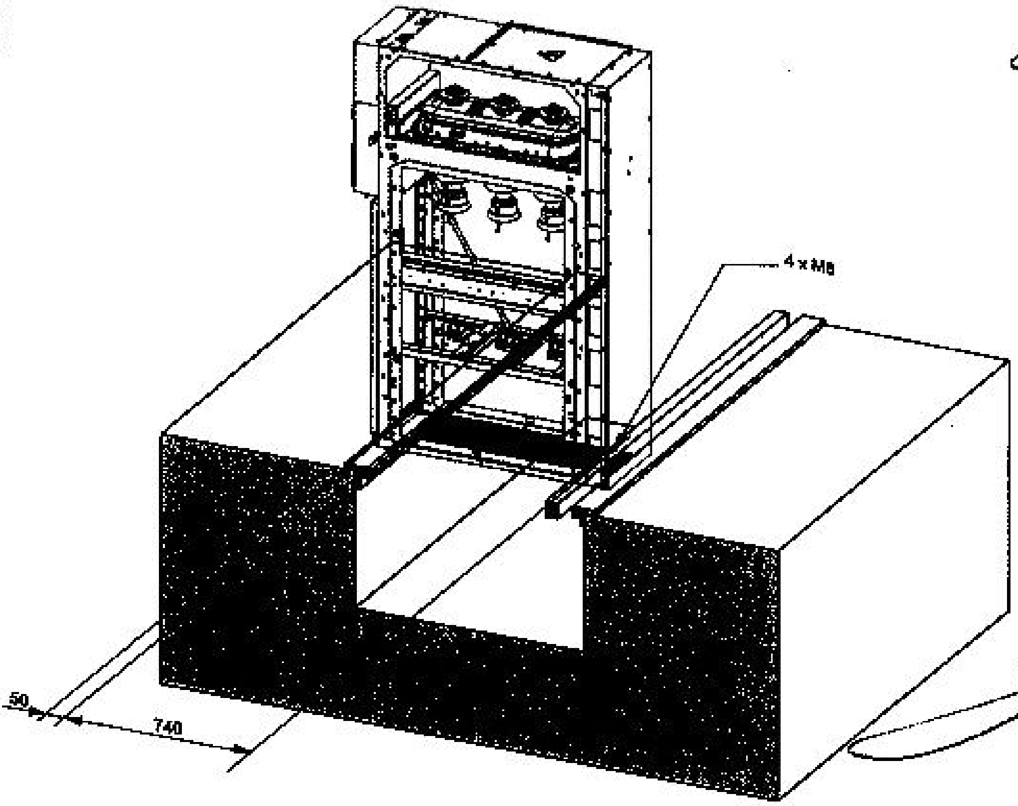
Fixing of cubicles for 12,5 kA/1 s performance *(in mm)*



Conditions pour obtenir la performance arc interne
Conditions to obtain the internal arc performance

Fixation des cellules pour performance 16 kA/1 s et 20 kA/ 1 s (en mm)

Fixing of cubicles for 16 kA/1 s and 20 kA/ 1 s performance *(in mm)*



Conduit d'évacuation

Pour permettre l'évacuation des gaz en évacuation haute, les utilisateurs devront installer un conduit à fixer à la bride d'interface.

L'extrémité de ce conduit doit interdire les entrées d'eau, de poussières, d'humidité, d'animaux, etc, tout en permettant l'évacuation des gaz dans une zone dédiée par l'intermédiaire d'un dispositif placé à l'extrémité extérieure du conduit (non fourni).

Evacuation duct

To enable the evacuation of gases by the top, users must install a conduit fixed to the coupling flange.

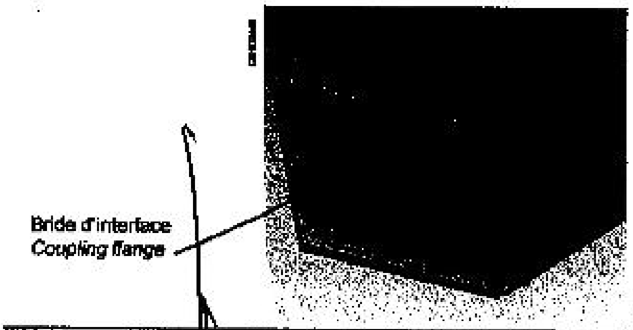
The end of the duct must block water, dust, moisture, animals, etc. from entering and at the same time enable the evacuation of gases into a dedicated area through a device situated at the outer end of the duct (not supplied).

Suggestion de conduit d'évacuation

Le conduit d'évacuation doit être en tôle d'épaisseur suffisante pour résister aux pressions et gaz chauds.

Evacuation duct example

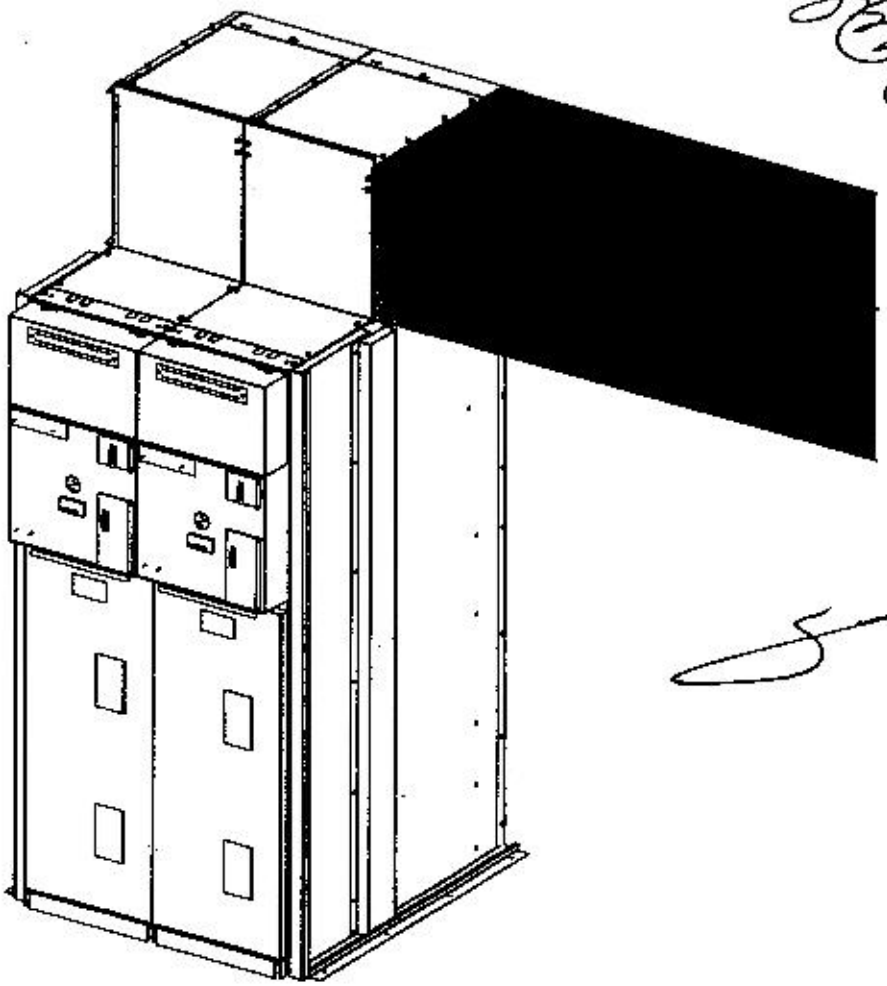
The evacuation duct must be made of metal sheet of sufficient thickness to withstand pressure and hot gases.



Conditions pour obtenir la performance arc interne
Conditions to obtain the internal arc performance

Exemple en évacuation haute

Top evacuation example



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Conditions sévères d'humidité et/ ou pollution du matériel MT
Harsh conditions of moisture and / or pollution of the MV equipment

Les tableaux MT remplissent des fonctions de sécurité et doivent donc être installés conformément à certaines pratiques professionnelles.

MV switchboards fulfil safety functions and must therefore be installed in line with certain profession practices.

Ce document a pour objectif de fournir des consignes d'ordre général afin d'éviter ou de réduire considérablement la dégradation du matériel sur les sites exposés à une forte humidité ou à une pollution importante.

The purpose of this document is to provided general guidelines on how to avoid or greatly reduce MV equipment degradation on sites exposed to high humidity and heavy pollution.

Conditions de service normales pour le matériel MT intérieur

Le matériel MT intérieur comprend des cellules MT modulaires ou des Ring Main Units compactes généralement installées dans des postes préfabriqués avec les transformateurs et l'appareillage BT.

Tous les matériels MT sont conformes aux normes spécifiques et à la norme internationale CEI 62271-1 Appareillage à haute tension - Partie 1 (clauses communes). Cette dernière définit les conditions normales d'installation et d'utilisation d'un tel matériel.

Normal service conditions for indoor MV equipment

MV equipment consists of modular MV cubicles or compact Ring Main units generally installed in prefabricated substations along with transformers and LV switchgear.

All MV equipment comply with specific standards and with the IEC 60694 «Common specifications for high-voltage switchgear and controlgear». The latter defines the normal conditions for the installation and use of such equipment.

Par exemple, concernant l'humidité, la norme mentionne :

Les conditions d'humidité sont les suivantes :
- la valeur moyenne d'humidité relative mesurée sur une période de 24 h n'excède pas 90 %,
- la valeur moyenne de la pression de la vapeur d'eau mesurée sur une période de 24 h n'excède pas 2,2 kPa,
- la valeur moyenne d'humidité relative mesurée sur une période d'un mois n'excède pas 90 %,
- la valeur moyenne de la pression de la vapeur d'eau mesurée sur une période d'un mois n'excède pas 1,8 kPa.

Occasionnellement, ces conditions peuvent provoquer de la condensation.

Note 1 : La condensation peut survenir dans le cas de variations soudaines de température en période de forte humidité.
Note 2 : Pour supporter les effets d'une forte humidité et de la condensation, tels qu'une interruption de l'isolation ou la corrosion des parties métalliques, il convient d'utiliser l'appareillage spécialement conçu pour de telles conditions et testé en conséquence.
Note 3 : Il est possible de prévenir la condensation en concevant un bâtiment ou une enveloppe spécial, une ventilation et un chauffage adaptés au poste, ou en utilisant un dispositif de déshumidification.

Comme l'indique la norme, la condensation peut aussi survenir occasionnellement dans des conditions normales. La norme poursuit en mentionnant les mesures spéciales susceptibles d'être appliquées aux locaux pour prévenir la condensation (Note 3).

For instance, regarding humidity, the standard mentions:

The conditions of humidity are as follows:
- *the average value of the relative humidity, measured over a period of 24 h does not exceed 90 %*
- *the average value of the water vapour pressure, over a period of 24 h does not exceed 2, kPa*
- *the average value of the relative humidity, over a period one month does not exceed 90 %*
- *the average value of water vapour pressure, over a period one month does not exceed 1,8 k Pa*

For these conditions, condensation may occasionally occur.

Note 1: condensation can be expected where sudden temperature changes occur in period of high humidity.
Note 2: to withstand the effects of high humidity and condensation, such as a breakdown of insulation or corrosion of metallic parts, switchgear designated for such conditions and tested accordingly should be used.
Note 3: Condensation may be prevented by special design of the building or housing, by suitable ventilation and heating of the station or by use of dehumidifying equipment.

As indicated in the standard, condensation may occasionally occur even under normal conditions. The standard goes on to indicate special measures concerning the substation premises that can be implemented to prevent condensation (Note 3).

Utilisation dans des conditions critiques

Dans des conditions critiques d'humidité et de pollution, qui dépassent largement les conditions d'utilisation normales mentionnées ci-dessus, le matériel électrique normalement conçu peut subir des dommages à cause de la corrosion rapide des parties métalliques et de la dégradation superficielle des parties isolantes.

Use under severe conditions

Under certain severe conditions concerning humidity and pollution, largely beyond the normal conditions of use mentioned above, correctly designed electrical equipment can be subject to damage by rapid corrosions of metal parts and surface degradation of insulating parts.

ВЯРНО С ОРИГИНАЛА

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Consignes en conditions sévères d'humidité et/ou pollution
Guidelines in harsh conditions of moisture and / or pollution

Mesures préventives pour limiter les effets de la condensation

Concevez et adapter les ventilations du poste avec précaution

- Pour réduire les variations de température, maintenez la ventilation du poste au niveau minimum requis afin d'évacuer la chaleur générée par le transformateur.
- Quand cela est possible, utilisez de la ventilation naturelle plutôt que de la ventilation forcée.
- Si la ventilation forcée est nécessaire, faites fonctionner les ventilateurs en continu.
- Si dans le poste, seule la ventilation forcée est possible, alors faites le fonctionner en continu.
- Placez les ouvertures de ventilation du poste le plus loin possible de la cellule MT.
- N'ajoutez jamais d'ouvertures de ventilation aux cellules MT.

Évitez les variations de température

- Installez des résistances anti-condensation à l'intérieur des cellules MT et faites-les fonctionner en continu, i.e. sans commande manuelle ou automatique.
- Améliorez l'isolation thermique du poste.
- Evitez que le transformateur soit dans le même local que l'appareillage MT.
- S'il est nécessaire de chauffer le poste, assurez-vous que le système de régulation de la température empêche les variations brusques de température ou bien laissez fonctionner le chauffage en continu.
- Éliminez les courants d'air froids provenant des caniveaux pour câbles, des dessous de portes, etc..

Éliminez les sources d'humidité dans le voisinage du poste

- Empêchez la prolifération des plantes autour du poste.
- Réparez les fuites dans le toit du poste.
- Empêchez l'humidité provenant des caniveaux pour câbles de pénétrer dans les cellules MT.

Installez un système de climatisation

- La climatisation est le moyen le plus sûr pour maîtriser l'humidité et la température.

Assurez-vous que le câblage est conforme aux règles applicables

- Prêtez une attention particulière au positionnement des blindages, des écrans de répartition de champs et des écrans semi-conducteurs.
- Dans la mesure du possible, utiliser des extrémités de câbles de technologie à froid, mais il faut s'assurer qu'elles sont correctement installées.

Preventive measures to limit the effects of condensation

Carefully design or adapt substation ventilation:

- *Keep substation ventilation to the minimum required for evacuation of transformer heat to reduce temperature variations.*
- *Use natural ventilation rather than forced ventilation whenever possible.*
- *If forced ventilation is required, run fans continuously.*
- *If there is only and forced ventilation mode switch in on continuously.*
- *Locate the substation ventilation openings as far as possible from the MV cubicle.*
- *Never add ventilation openings to MV cubicles.*

Avoid temperature variations

- *Install anti-condensation heaters inside MV cubicles and let them run continuously, i.e. without automatic or manual control.*
- *Improve the temal insulation of the substation.*
- *Avoid the transformer is in the same location as the MV switchgear.*
- *If heating is required, make sure the temperature regulation system avoids large temperature swings or leave heating on continuously.*
- *Eliminate cold air drafts cable tranches, under doors, etc..*

Eliminate sources of humidity in the substation environment

- *Avoid excessive plant growth around the substation.*
- *Repair any leaks in the substation roof.*
- *Prevent humidity from cable tranches from entering MV cubicles.*

Install an air conditioning system

- *Air conditioning is the sureet way of controlling humidity and temperature.*

Make sure cabling is in accordance with applicable rules

- *Pay special attention to the positioning of earthing screens, stress control screens and semiconductor screens.*
- *Use cold-shrink cable terminations is possible, but make sure they are properly installed.*

Mesures préventives pour limiter les effets de pollution

- Équipez les ouvertures de ventilation du poste de grilles de type chevron pour limiter la pénétration de la poussière et de la pollution.
- Maintenez la ventilation du poste au niveau minimum requis pour que l'évacuation de la chaleur générée par le transformateur limite la pénétration de poussière et de pollution.
- Utilisez des cellules MT avec un degré de protection (IP) suffisamment élevé.
- Utilisez des systèmes de climatisation avec filtres pour limiter la pénétration de la poussière et de la pollution.
- Nettoyez régulièrement toutes les traces de pollution des parties métalliques et des parties isolantes.

Preventive measures to limit the effects of pollution

- *Equip substation ventilation openings with chevron-type baffles to reduce entry of dust and pollution*
- *Keep substation ventilation to the minimum required for evacuation of transformer heat to reduce entry of pollution and dust.*
- *Use MV cubicles with a sufficiently high degree of protection (IP).*
- *Use air conditioning systems with filters to restrict entry of pollution and dust.*
- *Regularly clean all traces of pollution from metal and insulating parts.*

Dimensionner les ouvertures de ventilation

Méthode de calcul

Il existe un certain nombre de méthodes pour estimer la taille requise des ouvertures de ventilation des postes, soit pour la conception de nouveaux postes, soit pour l'adaptation de postes existants qui ont connu des problèmes de condensation.

Méthode de base

Cette méthode est fondée sur la dissipation de puissance du transformateur (effet de joule).
Les surfaces requises pour les ouvertures de ventilations S et S' peuvent être estimées en utilisant les formules suivantes :

$$S = \frac{1,8 \times 10^{-4} P}{\sqrt{H}} \quad \text{et} \quad S' = 1,1 \times S$$

Où :
S = surface de l'ouverture de ventilation inférieure (entrée d'air) [m²] (surface de la grille déduite).
S' = surface de l'ouverture de ventilation supérieure (sortie d'air) [m²] (surface de la grille déduite).
P = puissance dissipée totale [W], P est la somme de la puissance dissipée par :
- le transformateur (à vide et à cause de la charge),
- l'appareillage BT,
- l'appareillage MT.

H = hauteur entre les points du milieu des ouvertures de ventilations [m].

Sizing the ventilation openings

Calculation methods

A number of calculation methods are available to estimate the required size of substation ventilation openings, either for the design of new substations or the adaptation of existing substations for which condensation problems have occured.

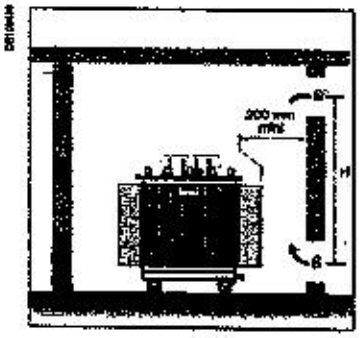
Basic method

This method is based on transformer dissipation.
The required ventilation opening surface areas S and S' can be estimated using the following formulas.

$$S = \frac{1,8 \times 10^{-4} P}{\sqrt{H}} \quad \text{and} \quad S' = 1.1 \times S$$

Where :
S= lower (air entry) ventilation opening area [m²] (grid surface deducted).
S'= upper (air exit) ventilation opening area [m²] (grid surface deducted).
P= total dissiped power [W], P is the sum of the power dissipated by:
- *the transformer (dissipation at no load and due to load)*
- *the LV switchgear*
- *the MV switchgear.*

H= height between ventilation opening mid–points [m].



Note : Cette formule est valable pour une température moyenne annuelle de 20 °C et une altitude maximum de 1000 m.

Exemple :
Dissipation de puissance du transformateur = 7970 W
Dissipation de puissance de l'appareillage BT = 750 W
Dissipation de puissance de l'appareillage MT = 300 W
La hauteur entre les points du milieu des ouvertures de ventilation est égale à 1,5 m.

Calcul :
Puissance dissipée
P = 7970 + 750 + 300 = 9020 W

$$S = \frac{1,8 \times 10^{-4} P}{\sqrt{1,5}} = 1,32 \text{ m}^2$$

et
S' = 1,1 x 1,32 = 1,46 m²

Note: *This formula is valid for a yearly average temperature of 20 °C and a maximum altitude of 1000 m.*

Example:
Transformer dissipation= 7970 W.
Lv switchgear dissipation= 750 W
MV switchgear dissipation= 300 W
The height between ventilation opening mid– points is 1,5 m.

Calculation:
Dissipated Power
P = 7970 + 750 + 300 = 9020 W

$$S = \frac{1,8 \times 10^{-4} P}{\sqrt{1.5}} = 1.32 \text{ m}^2$$

and
S'= 1.1 x 1.32= 1.46 m²

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Ventilation
Ventilation

Méthode plus complète

Une autre possibilité est la formule suivante basée sur divers aspects de la conception du poste.

$$S = \frac{(P - 2{,}4 * \Sigma(K_i * S_i) * T}{417 * G * \sqrt{H} * T^{1{,}5}} \quad \text{et} \quad S' = 1{,}1 \times S$$

Où :

S = surface de l'ouverture de ventilation inférieure (entrée d'air) [m²].

S' = surface de l'ouverture de ventilation supérieure (sortie d'air) [m²] (surface de la grille déduite).

P = puissance dissipée totale [W], P est la somme de la puissance dissipée par :

- le transformateur (à vide et à cause de la charge),
- l'appareillage BT,
- l'appareillage MT.

Si = surface de l'enveloppe i [m²].

Ki = coefficient de transmission de la surface i [W/m2K].

- k = 7 pour la tôle acier,
- k = 3 pour 10 cm de béton et 2,5 pour 20 cm,
- k = 0 pour le sol (pas de transmission de chaleur par le sol),

T = type d'enveloppe (hausse de la température du transformateur) [k].

G = coefficient de la grille

- G = 0,28 à 0,77 pour les grilles de type chevron (0,38 pour des chevrons simples à 90 °C)
- G < 0,2 pour les types les plus complexes comme les grilles à chicanes profilées.
- G autour de 0,6 pour la tôle perforée de trous rectangulaires

H = hauteur entre les points du milieu des ouvertures de ventilations [m].

More complete method

Another possibility is the following formula based on various aspects of substation design.

$$S = \frac{(P - 2.4 * \Sigma(K_i * S_i) * T}{417 * G * \sqrt{H} * T^{1.5}} \quad \textit{and } S' = 1.10 * S$$

Where:

S=lower (air entry) ventilation opening area [m²].

S'= upper (air exit) ventilation opening area [m²].

P= total dissiped power [W], P is the sum of the power dissipated by:

- *the transformer (dissipation at no load and due to load)*
- *the LV switchgear*
- *the MV switchgear.*

Si= area of enclosure surface i [m²].

Ki= transmission coefficient of surface [W/m2K].

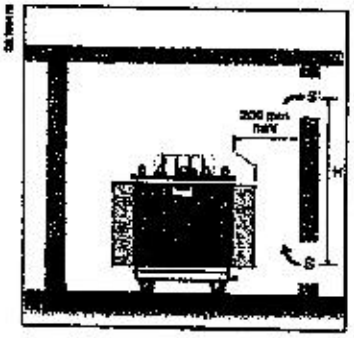
- *k= 7 for steel sheets*
- *k= 3 for 10 cm and 2,5for 20 cm of concrete,*
- *k= 0 for the ground (no heat transmission throught the ground)*

T= class of enclosure (transformer temperature rise) [K].

G= grid coefficient

- *G= 0.28 to 0.77 for chevron blade louvers (0.38 for 90 °simple chevron)*
- *G < 0.2 for more complex types such as overlapped C beams*
- *G around 0.6 for punched sheet with rectangular holes*

H= height between ventilation opening mid-points [m].



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Д/ 340

Méthode plus complète (suite)

Note : Cette méthode donne des surfaces des ouvertures de ventilation plus petite que celles obtenues avec la méthode de base car elle prend en compte la dissipation qui passe par les murs, le toit et les portes.

Exemple :
Dissipation de puissance du transformateur = 7970 W
Dissipation de puissance de l'appareillage BT = 750 W
Dissipation de puissance de l'appareillage MT = 300 W
La surface du poste se décompose comme suit :
- 14,6 m² de murs en béton (10 cm d'épaisseur),
- 7 m² de toit en béton (10 cm d'épaisseur),
- 6 m² de portes métalliques.

L'enveloppe est de catégorie 10 K.
La grille de ventilation est de type grille en chevron (G = 0,4).
La hauteur entre les points du milieu des ouvertures de ventilation est égale à 1,5 m.

Calcul :
Puissance dissipée
P = 7970 + 750 + 300 = 9020 W

$\sum_i (K_i * S_i) = 14{,}6*3+7{,}0*3+6{,}2*7 = 108{,}2$ W/K

$$S = \frac{(9020 - 2{,}4*108{,}2*10)}{417*0{,}4*\sqrt{1{,}5*10^{1{,}5}}} = 0{,}99 \text{ m}^2$$

et S' = 1,1 x 0,99 = 1,09 m²

More complete method (continued)

Note: *This gives smaller ventilation opening areas than the previous method beacause it takes dissipation through the walls, roof and doors into account.*

Example:
Transformer dissipation= 7970 W
Lv switchgear dissipation= 750 W
MV switchgear dissipation= 300 W
The substation area is made up of:
- *14.6 m² of concrete walls (10 cm thick)*
- *7.0 m² of concrete roof (10 cm thick)*
- *6.2 m² of metallic doors*

The enclosure class is 10 K.
The ventilation grid is of the chevron louver type (G= 0.4).
The height between ventilation opening mid– points is 1,5 m.

Calculation:
Dissipated Power
P = 7970 + 750 + 300 = 9020 W

$\sum_i (K_i * S_i) = 14{,}6*3+7{,}0*3+6{,}2*7 = 108{,}2$ W/K

$$S = \frac{(9020 - 2{,}4*108{,}2*10)}{417*0{,}4*\sqrt{1{,}5*10^{1{,}5}}} = 0{,}99 \text{ m}^2$$

and S' = 1.1 x 0.99 = 1.09 m²

Essai

Les méthodes énoncées ci-dessus peuvent être utilisées pour estimer la taille requise des ouvertures de ventilation du poste, toutefois les meilleurs résultats sont obtenus en procédant à des essais.

Pour les nouveaux postes, les essais doivent être effectués par le fabricant du poste afin de s'assurer que le système de ventilation fourni n'est pas surdimensionné.

Pour les nouveaux postes existant sujets à des problèmes de condensation, les essais servent à déterminer s'il est possible de réduire les surfaces des ouvertures de ventilation sans excéder les limites maximum de hausse de température du transformateur dans les pires conditions possibles.

Testing

The above methods can be used to estimate the required size of substation ventilation openings, however the best results are obtained by testing.

For new substation, tests should be carried out by the substation supplier to ensure that the provided ventilation system is not oversized.

For existing substations presenting condensation, tests can be carried out to determine whether ventilation opening areas can be reduced without exceeding the maximum temperature rise limits of the transformer under the worst possible conditions.

Ventilation
Ventilation

Emplacement des ouvertures de ventilation

Ventilation opening locations

Pour favoriser l'évacuation de la chaleur générée par le transformateur via la convection naturelle, les ouvertures doivent être placées en haut et en bas du mur près du transformateur.
La chaleur dissipée par le tableau MT est négligeable.
Pour éviter les problèmes de condensation, les ouvertures de ventilation du poste doivent être situées le plus loin possible du tableau.

To facilitate evacuation of the heat produced by the transformer via natural convection, ventilation openings should be located at the top and bottom of the wall near the transformer.
The heat dissipated by the MV switchboards is negligible.
To avoid condensation problems, the substation ventilation openings should be located as far as possible from the switchboard.

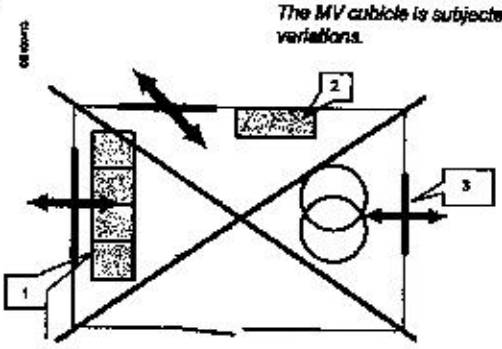
Poste MT/BT «sur-ventilé»

La cellule MT est soumise à des variations de températures soudaines.

«Over» ventilated MV/LV substation

The MV cubicle is subjected to sudden temperature variations.

1 : tableau MT
2 : tableau BT
3 : ventilation Haute et Basse



1: MV switchboard
2: LV switchboard
3: Upper and Lower ventilations

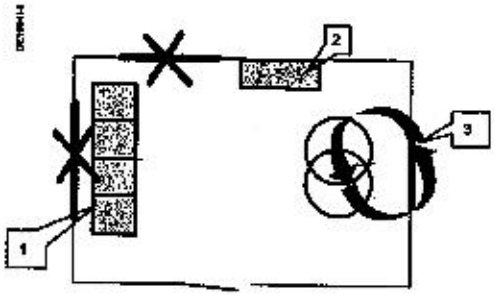
Poste avec ventilation adaptée

La cellule MT n'est plus soumise à des variations de températures soudaines.

Substation with adapted ventilation

The MV cubicle is no longer subjected to sudden temperature variations.

1 : tableau MT
2 : coffret BT
3 : ventilation Haute et Basse



1: MV switchboard
2: LV enclosure
3: High and Low ventilations

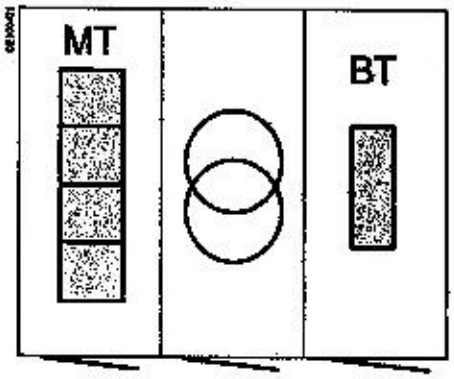
Ventilation
Ventilation

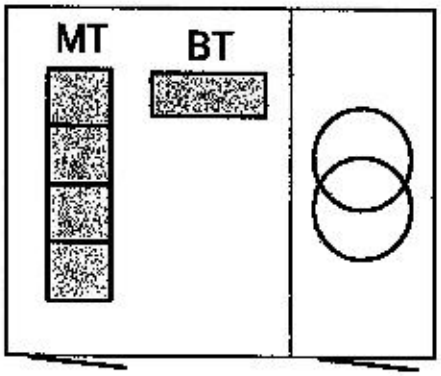
Poste avec ventilation adaptée (suite)

Si le tableau MT est séparé du transformateur, la pièce où se trouve le tableau requiert une ventilation minimale pour assécher l'humidité susceptible de pénétrer.

Substation with adapted ventilation (continued)

If the MV switchboard is separated fron the transformer, the room containing the switchboard requires only minimal ventilation to allow drying of any humidity that may enter the room.



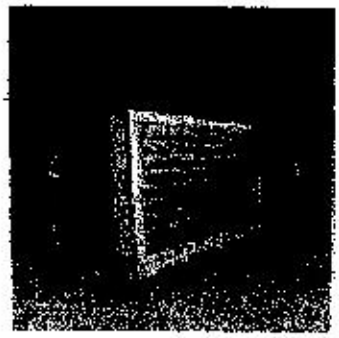


Type d'ouvertures de ventilation

Pour limiter l'entrée de poussières, de pollution, d'embruns, etc ... les ouvertures de ventilation du poste doivent être équipées de grilles de type chevron.
Vérifiez toujours que les grilles sont orientées dans la bonne direction.

Type of ventilation openings

To reduce the entry of dust, pollution, mist, etc ..., the substation ventilation openings should be equipped with chevron-blade baffles.
Always make sure the baffles are oriented in the right direction.



Ventilation de la cellule MT

Tout besoin de ventilation naturelle est pris en compte par le fabricant au moment de la conception des cellules MT. Il ne faut jamais ajouter les ouvertures de ventilation au modèle d'origine.

MV cubicles ventilation

Any need for natural ventilation is taken into account by the manufacturer in the design of MV cubicles.
Ventilation openings should never be added to the original design.

Température
Temperature

Généralités

General

Les variations de températures dans des conditions de fortes humidités sont sources de condensation.
The temperature variations lead to condensation under high humidity conditions.

Variations de température à l'intérieur des cellules

Pour limiter les variations de températures, installez toujours des résistances anti-condensations à l'intérieure des cellules MT si l'humidité relative moyenne reste élevée pendant un laps de temps important.
Les résistances doivent fonctionner sans interruption, 24 heures sur 24 pendant toute l'année.

Temperature variations inside cubicles

To reduce temperature variations, always install anti-condensation heaters inside MV cubicles if the average relative humidity can remain high over a long period of time.
The heaters must operate continuously, 24 hours a day all year long.

ATTENTION

RISQUE DE DETERIORATION DES CELLULES
- Ne connectez JAMAIS les résistances à un système de régulation de température.
- Assurez-vous que les résistances offrent une durée de service adéquate (en général les versions standard suffisent).

Le non-respect de ces instructions peut provoquer des blessures ou des dommages matériels.

CAUTION

HAZARD OF DAMAGE TO CUBICLES
- *NEVER connect the resistance to a temperature control or regulation system.*
- *Make sure the heaters offer an adequate service life (standard version are generally sufficient).*

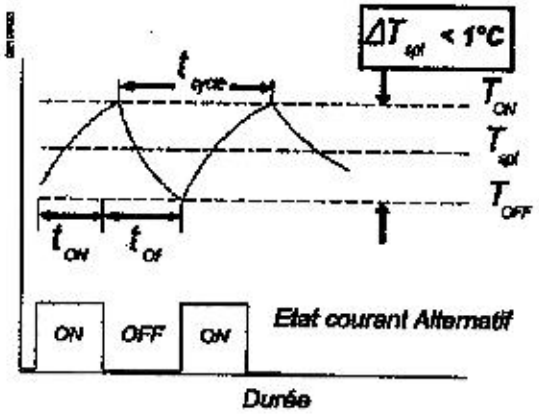
Failure to follow these instructions can result in injury or equipment damage.

Variations de température à l'intérieur du poste

Pour limiter les variations de température à l'intérieur du poste, il est possible de prendre les mesures suivantes :
- Appliquez les mesures décrites dans le chapitre Ventilation.
- Améliorez l'isolation thermique du poste pour réduire les effets des variations de la température extérieure sur la température à l'intérieure du poste.
- Si possible, évitez de chauffer le poste. Toutefois, s'il est nécessaire de le chauffer, assurez-vous que le système de régulation et/ou le thermostat sont suffisament précis, et conçus pour éviter les variations brutales de températures (i.e pas supérieures à 1 °C).

Temperature variations inside the substation

The following measures can be taken to reduce temperature variations inside the substation:
- *Implement the measures described in the previous section concerning ventilation.*
- *Improve the thermal insulation of the substation to reduce the effects of outdoors temperature variations on the temperature inside the substation.*
- *Avoid substation heating if possible. If heating is required make sure the regulation system and/or thermostat are sufficiently accurate and designed to avoid excessive temperature swings (e.g no greater than 1 °C).*



Si un système de régulation de température précis n'est pas disponible, laissez fonctionner le chauffage en permanence, 24 heures sur 24 pendant toute l'année.
If a sufficiently accurate temperature regulation system is not available, leave the heating on continuously, 24 hours a day all year long.

Température
Temperature

Rappel

Recommandation tenue à l'environnement.
Sous certaines conditions climatiques, le phénomène de condensation peut se produire.
Il est possible par des moyens simples d'améliorer le comportement des postes MT et de minimiser le risque d'apparition de condensation et par conséquent de phénomènes d'effluves.
Trois facteurs principaux peuvent être à l'origine du phénomène :
- l'architecture du poste (dimension et remplacement des ventilations, la nature des matériaux utilisés),
- l'environnement climatique du MT/BT (zone très humide, brouillard, précipitation, orientation et pollution),
- la technologie et/ou mise en oeuvre des extrémités des câbles.

Reminder

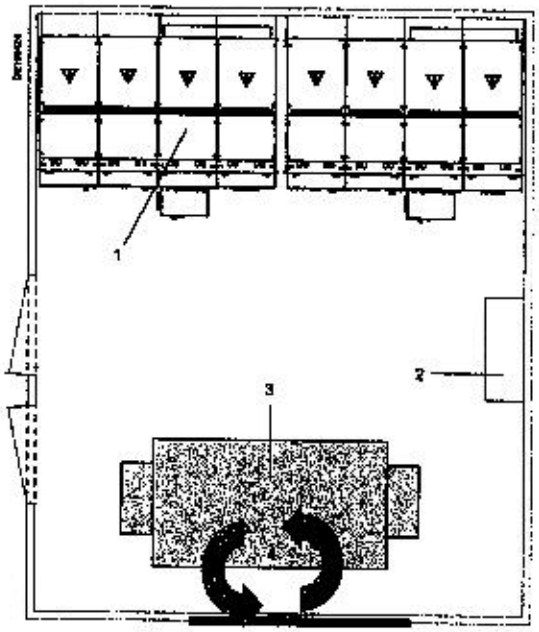
Recommendation for environmental withstand.
Under certain climatic conditions, the condensation phenomenon may occur.
By simple means it is possible to enhance the behavior of MV substations and to minimise the risk of appearance of condensation and thus of corona discharge phenomena.
Three main factors may be responsible for this phenomenon:
- *substation architecture (dimension and replacement of ventilation systems, type of materials used)*
- *climatic environment of MV/LV (very damp area, fog, precipitation, orientation and pollution)*
- *technology and/or implementation of cable ends.*

Détail de l'environnement

Environnemental details

1 : tableau MT
2 : coffret BT
3 : transformateur
4 : zone de ventilation haute et basse

1: MV switchboard
2: LV enclosure
3: transformer
4: ventilation area top and bottom



Remèdes

Architecture du poste

Adapter la section des ventilations à la puissance dissipée dans le poste pour minimiser les écarts de température.
Supprimer les ventilations dans l'environnement proche du tableau modulaire MT.
Favoriser une ventilation adaptée (hautes et basses) par convection autour du transformateur.

Environnement du poste HT/BT

Procéder à l'étanchéité du poste et des fosses à câbles.
Prévoir des ventilations de type chicane pour limiter les pénétrations directes.
Installer des résistances anti-condensation dans les cellules.

Extrémités des câbles

La mauvaise mise en oeuvre d'une extrémité des câbles de technologie à froid entrainera des contraintes diélectriques qui géneront aussi le phénomène d'effluves dans des conditions sévères.

Solutions

Substation architecture

Adapat ventilation cross-section to power loss in the substation to minimise temperature differences.
Eliminate ventilation in the environment in the immediate vicinity of the MV modular switchboard.
Provide suitable ventilation (top and bottom) by convection around the transformer.

The HV/LV substation environment

Guarantee tightness of the substation and of the cable pits.
Provide baffle type ventilation systems to limit direct penetration.
Install anti-condensation resistances in the cubicles.

Cables ends

Incorrect implementation of cold technology cable ends will result in dielectric stresses that will also generate the corona discharge phenomenon in harsh conditions.

Encombrements et masses
Overall dimensions and weights

IM,IMB	1600 (1)	375/500	1030	130/140
IMC	1600 (1)	500	1030	210
PM, QM, QMB	1600 (1)	375/500	1030	140/160
QMC	1600 (1)	625	1030	190
CVM	2050	750	1030	400
DM1-A, DM1-D, DM1-W, DM2, DMVL-A, DMVL-D	1600 (1)	750	1310	410
DM1-S	1600 (1)	750	1310	350
DMV-A, DMV-D	1695 (1)	625	1030	350
DMV-S	1600 (1)	625	1030	270
CM	1600 (1)	375	1030	200
CM2	1600 (1)	500	1030	220
GBC-A, GBC-B	1600	750	1110	300
NSM-cables, NSM-busbars	2050	750	1030	270
GIM	1600	125	930	40
GEM (2)	1600	125	1010/1150 (3)	40/45
GBM	1600	375	1030	130
GAM2	1600	375	1030	130
GAM	1600	500	1110	170
SM	1600 (1)	375/500 (2)	1030	130/160
TM	1600	375	1030	210
DM1-A, DM1-D, DM1-W, DM1-Z (1250 A)	1600	750	1310	430

Ajouter à la hauteur :

(1) 450 mm, si caisson contrôle pour protection et contrôle-commande. Pour avoir un tableau homogène, toutes les cellules (excepté GIM et GEM) peuvent recevoir un caisson contrôle.
(2) suivant la configuration des jeux de barres de la cellule VM6, deux types de gaines d'extension sont possibles :
- *si extension d'une cellule VM6 DM12 ou DM23, prendre la gaine de profondeur 1060 mm*
- *pour toutes les autres cellules VM6, prendre la profondeur de 920 mm.*

(3) pour la cellule 1250 A.

Add to height:

(1) 450 mm for low-voltage enclosures for control/monitoring and protection functions. To ensure uniform presentation, all units (except GIM and GEM) may be equipped with low-voltage enclosures.
(2) depending on the busbar configuration in the VM6 unit, two types of extension units may be used:
- *to extend a VM6 DM12 or DM23 unit, use an extension unit with a depth of 1060 mm*
- *for all other VM6 units, a depth of 920 mm is required.*

(3) for the 1250 A unit.

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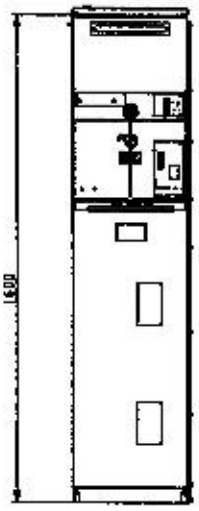
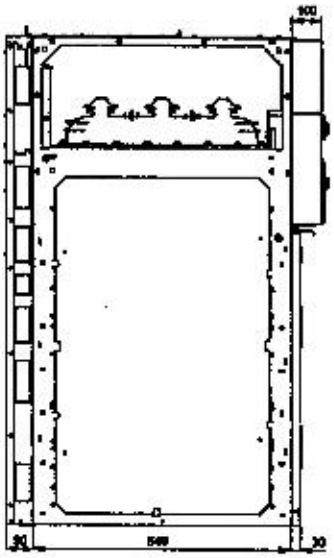
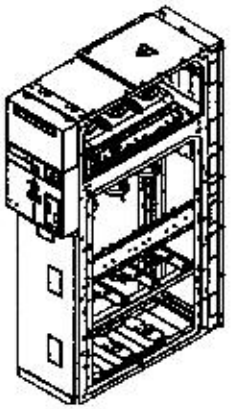
Dimensions des cellules
Cubicles dimensions

Cellule de largeur 375 — *Cubicle width 375*

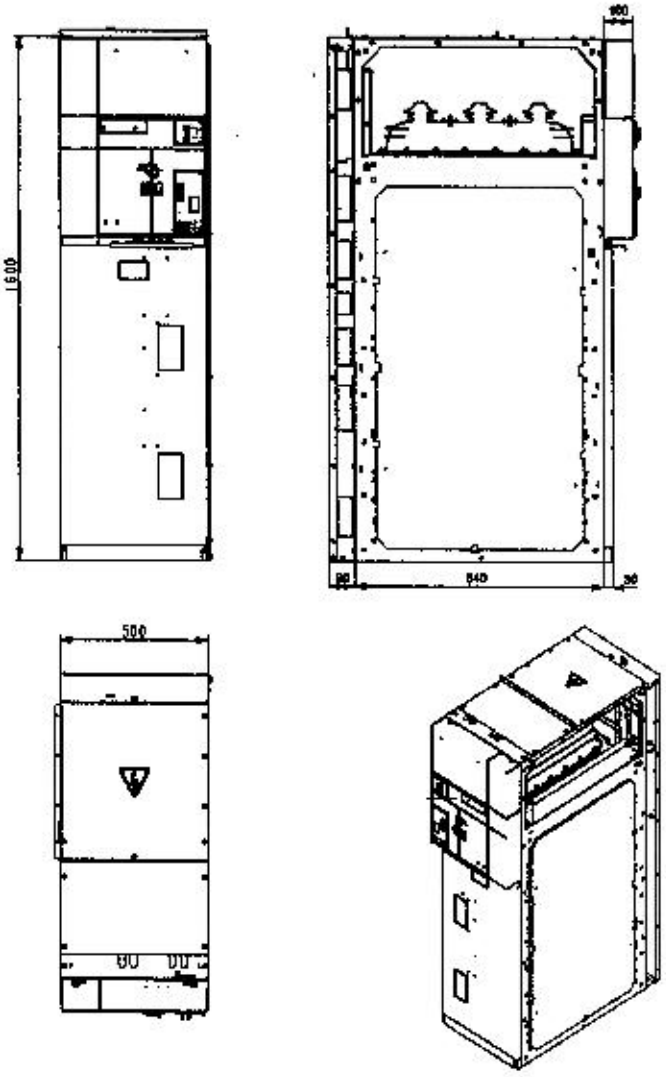






Dimensions des cellules
Cubicles dimensions

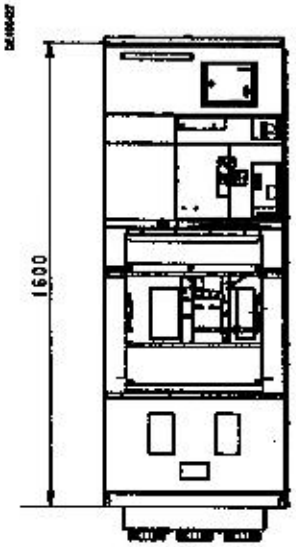
Cellule de largeur 500 — *Cubicle width 500*

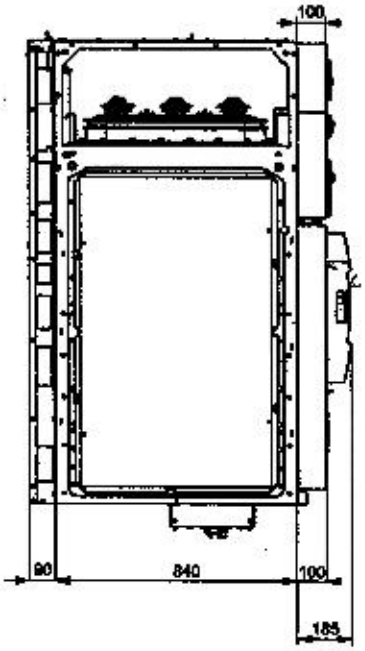


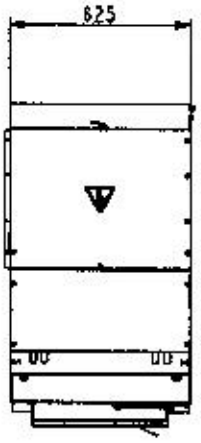
Dimensions des cellules
Cubicles dimensions

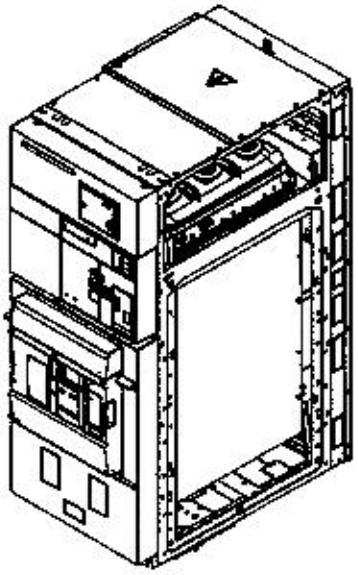
Cellule de largeur 625

Cubicle width 625



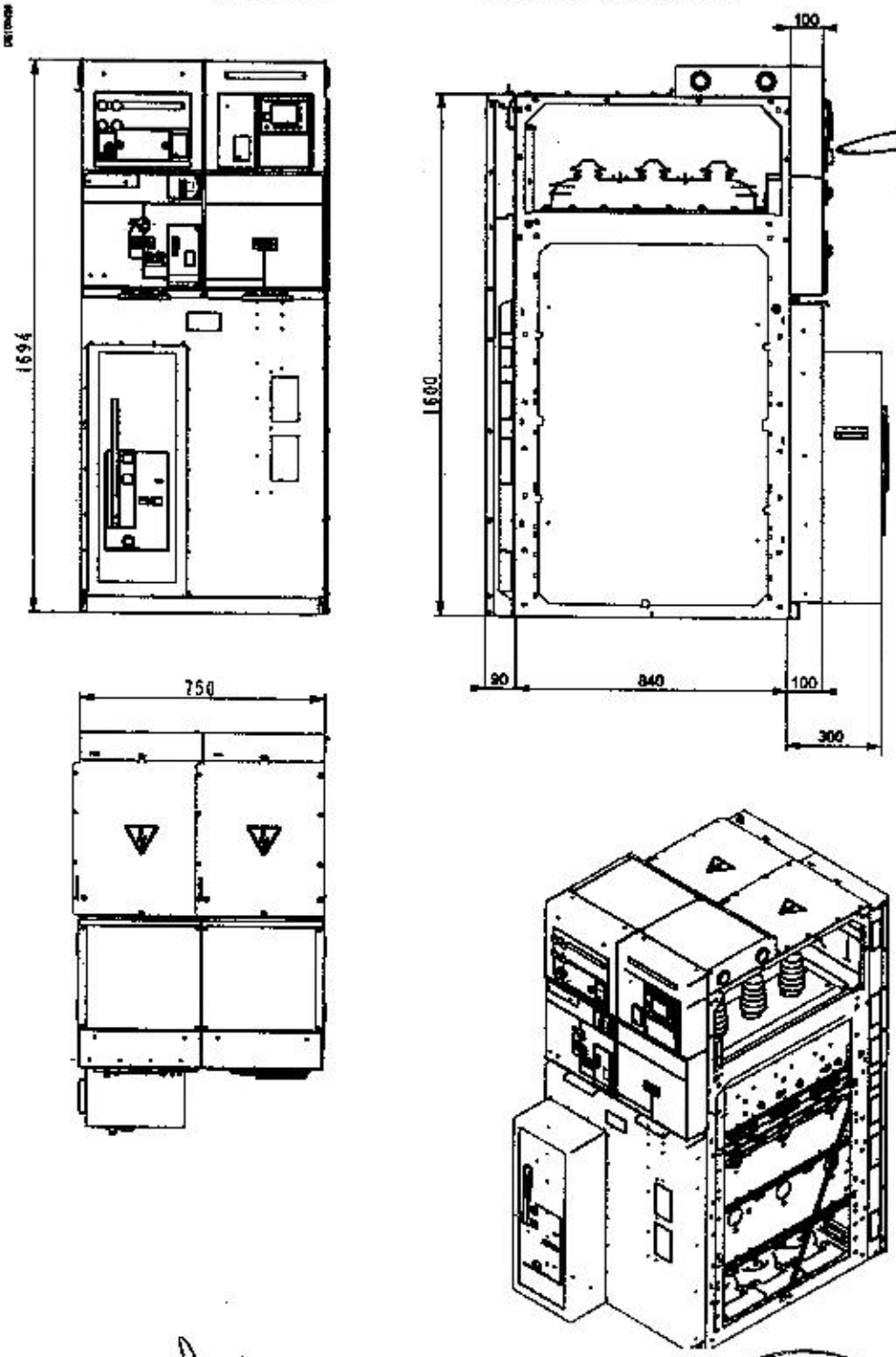






Dimensions des cellules
Cubicles dimensions

Cellule de largeur 750 | ***Cubicle width 750***



Fin de vie et préservation environnementale

End of life and environmental conservation

Préservation environnementale
Environmental conservation

Présentation du produit

La gamme **SM6-24** a pour principale fonction la commutation et la coupure des réseaux de 1 kV à 24 kV.
Détail de la gamme : jusqu'à 24 kV (Ur), 630/1250 A (Ir) 25 kA/1 s (Ik/tk), et tenue à l'arc interne à 50/60 Hz de 12,5 kA/1 s, 16 kA/1 s et 20 kA/1 s.
Les produits représentatifs utilisés pour l'analyse sont : IM & QM (sans fusibles), DM1-A et DMV-A.
Les impacts environnementaux des produits référencés sont représentatifs des impacts des autres produits de la gamme qui sont développés avec la même technologie.
L'analyse environnementale a été effectuée en conformité avec la norme ISO 14040 «Management environnemental : Analyse du cycle de vie - Principes et cadre".
Cette analyse prend en compte les étapes du cycle de vie du produit.

Product overview

*The main function of the **SM6-24** range is to switching and breaking from 1kV to 24kV.*

This range consists of: up to 24kV (Ur), 630/1250A (Ir) 25kA/1s (Ik/tk), and 12,5 kA/1s, 16 kA/1s and 20 kA/1 s Internal Arc Withstand at 50/60 Hz
The representative product used for the analysis are: IM & QM (without fuses), DM1-A, and DMV-A.
The environmental impacts of this referenced product are representative of the impacts of the other products of the range which are developed with the same technology.
The environmental analysis was performed in conformity with ISO 14040 "Environmental management: Life cycle assessment – Principle and framework".
This analysis takes the stages in the life cycle of the product into account.

Fabrication

La gamme **SM6-24** est fabriquée sur un site de production Schneider Electric bénéficiant d'un système de management environnemental certifié ISO 14001.

Manufacturing

*The **SM6-24** range is manufactured at a Schneider Electric production site on which an ISO 14001 certified environmental management system has been established.*

Distribution

Le poids et le volume des emballages ont été réduits, conformément à la directive de l'Union Européenne sur les emballages.
L'emballage IM & QM pèse 7 kg. Il est constitué d'une palette en bois (4,8 kg), de carton (1,5 kg), de clous (0,4 kg), de polystyrène (0,1 kg), d'un cerclage (0,1 kg).
L'emballage DMV-A pèse 12 kg. Il est constitué d'une palette en bois (8,6 kg), de carton (2 kg), de clous (0,8 kg), de polystyrène (0,2 kg), d'un cerclage (0,4 kg).
L'emballage DM1-A pèse 12,5 kg. Il est constitué d'une palette en bois (8,7 kg), de carton (2,2 kg), de clous (0,8 kg), de polystyrène (0,4 kg), d'un cerclage (0,4 kg).
Les flux de distribution du produit ont été optimisés par l'implantation de centres de distributions locaux proches des zones de marché.

Distribution

The weight and volume of the packaging have been reduced, in compliance with the European Union's packaging directive.
The IM & QM packaging weight is 7-kg. It consists of wooden pallet (4,8kg), carton (1,5kg), nails (0,4kg), polystyrene (0,1kg), band strapping (0,1kg).
The DMV-A packaging weight is 12-kg. It consists of wooden pallet (8,6kg), carton (2kg), nails (0,8kg), polystyrene (0,2kg), band strapping (0,4kg).
The DM1-A packaging weight is 12,5-kg. It consists of wooden pallet (8,7kg), carton (2,2kg), nails (0,8kg), polystyrene (0,4kg), band strapping (0,4kg).
The product distribution flows have been optimised by setting up local distribution centres close to the market areas.

Fin de vie et préservation environnementale

End of life and environmental conservation

Préservation environnementale
Environmental conservation

Utilisation

Les produits de la gamme SM6-24 ne génèrent pas de pollution environnementale réclamant des mesures de protection spéciales (bruit, émissions, etc.).
Pour les produits consommant de l'énergie, indiquer la mention suivante : la puissance dissipée dépend des conditions de mise en œuvre et d'utilisation du produit.
La puissance électrique consommée par la gamme SM6-24 va de 8,6 W à 78,2 W :
- Elle est de 8,6 W en mode actif et de 0 % en mode veille pour IM & QM référencé.
- Elle est de 38,6 W en mode actif et de 0 % en mode veille pour DMV-A référencé.
- Elle est de 78,2 W en mode actif et de 0 % en mode veille pour DM1-A référencé.

Cette puissance consommée représente moins de 30% de la puissance totale qui circule à travers le produit.

Pour les produits dissipant de l'énergie, indiquer la mention suivante : la puissance dissipée dépend des conditions de mise en œuvre et d'utilisation du produit.
La puissance dissipée va de 100 W à 850 W, pour la gamme de produits SM6-24.
Pour un taux d'utilisation de 100 % :
- Elle est de 100 W pour IM & QM référencé.
- Elle est de 440 W pour DMV-A référencé.
- Elle est de 850 W pour DM1-A référencé.

Cette dissipation thermique représente moins de $0,2.10^{-3}$ % pour IM & QM, $1,6.10^{-3}$ % pour DMV-A et $3,3.10^{-3}$ % pour DM1-A, de la puissance qui circule à travers le produit.

Utilisation

The products of the SM6-24 range do not generate environmental pollution requiring special precautionary measures (noise, emissions, and so on).
For consuming products, indicate following mention: the dissipated power depends on the conditions under which the product is implemented and used.
The electrical power consumed by the SM6-24 range spreads out between 8,6 W and 78,2 W:
- *It is 8.6 W in active mode and 0 % in standby mode for the referenced IM & QM.*
- *It is 38.6 W in active mode and 0 % in standby mode for the referenced DMV-A.*
- *It is 78.2 W in active mode and 0% in standby mode for the referenced DM1-A.*

This consumed power represents less than 30 % of the total power which passes through this product.

For dissipating products, indicate following mention The dissipated power depends on the conditions under which the product is implemented and used. This dissipated power spreads out between 100 W and 850 W, for the SM6-24 product range.
For a utilisation rate of 100 %:
- *It is 100 W for the referenced IM & QM.*
- *It is 440 W for the referenced DMV-A.*
- *It is 850 W for the referenced DM1-A.*

This thermal dissipation represents less than $0,2.10^{-3}$ % for IM&QM, $1,6.10^{-3}$ % for DMV-A, $3,3.10^{-3}$ % for DM1-A of the power which passes through the product.

Impacts environnementaux

L'Analyse du Cycle de Vie (ACV) a été réalisée à l'aide du logiciel EIME (Environmental Impact and Management Explorer) version V3 et de sa base de données version 5.4.
La durée de vie estimée du produit est de 30 ans avec un taux d'utilisation de l'installation de 100 %, le modèle de puissance électrique utilisée est européen.
L'étendue de l'analyse a été limitée à IM & QM, DMV-A et DM1-A.
Les impacts environnementaux ont été analysés pour les phases de fabrication (F), y compris le traitement des matières premières, et pour les phases de distribution (D) et d'utilisation (U).
Présentation des impacts environnementaux du produit

Environmental impacts

The EIME (Environmental Impact and Management Explorer) software, version V3, and its database, version 5.4 were used for the life cycle assessment (LCA).
The assumed service life of the product is 30 years with an utilisation rate of the installation of 100 % and the electrical power model used is European.
The scope of the analysis was limited to a IM & QM, DMV-A, and DM1-A.
The environmental impacts were analysed for the Manufacturing (M) phases, including the processing of raw materials, and for the Distribution (D) and Utilisation (U) phases.
Presentation of the product environmental impacts

Approche système

La gamme est conforme à ROHS : les produits de la gamme étant conçus conformément à la directive ROHS (directive européenne 2002/95/EC du 27 janvier 2003), ils peuvent être incorporés sans restrictions dans un assemblage ou une installation soumis à cette directive.

Product Overview

The range is RoHS compliant: as the product of the range are designed in accordance with the RoHS Directive (European Directive 2002/95/EC of 27 January 2003), they can be incorporated without any restriction within an assembly or an installation submitted to this Directive.

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Fin de vie et préservation environnementale

End of life and environmental conservation

Fin de vie et recyclage
End of life and recycling

Fin de vie

En fin de vie, les produits de la gamme SM6-24 doivent être démontéspour faciliter la récupération des différents matériaux constitutifs.
Si le poids du matériau (individuellement) représente plus de 15 % du poids total en fonctionnement, il est considéré comme un matériau recyclable.
La proportion de matière recyclable est supérieure à 85 %.
Ce pourcentage comprend les matériaux suivants : acier et cuivre.

End of life

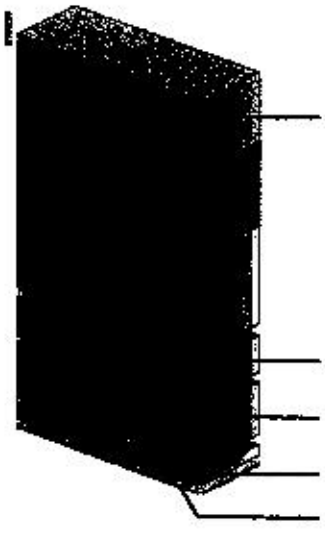
At end of life, the products of the SM6-24 must be dismantled to facilitate the recovery of the various constituent materials.
If weight of the material (individually) is more than 15 % of total function's weight that is considered as recyclable material.
The proportion of recyclable material is higher than 85 %.
This percentage includes the following materials: steel, and copper.

Recyclage

Schneider Electric est engagé dans une démarche environnementale inscrite dans le long terme.
Dans ce cadre, SM6 a été conçu dans le souci du respect de l'environnement et notamment en prenant en compte les aptitudes au recyclage du produit.
Les matériaux utilisés, isolants et conducteurs, sont identifiés, facilement séparables, dans l'analyse profil environnement produit qui a été élaboré en conformité avec l'ISO 14040.
En fin de vie, SM6 pourra être traité, recyclé et valorisé conformément au projet de réglementation européenne sur la fin de vie des produits électriques et électroniques,et en particulier sans émission de gaz dans l'atmosphèreni rejet de fluides polluants.
SM6 est conforme à la directive RoHS qui restreint l'utilisation de six substances dangereuses pour la fabrication de divers types d'équipements électroniques et électriques.

Recycling

Schneider Electric is committed to a long term environmental approach.
As part of this, the SM6 has been designed to be environmentally friendly, notably in terms of the product's recyclability.
The materials used, both conductors and insulators, are identified in product environmental profile analysis and easily separable. It was performed in conformity with ISO 14040 "Environmental management life cycle assessment - principle and framework".
At the end of its life, SM6 can be processed, recycled and its materials recovered in conformity with the draft European regulations on the end-of-life of electronic and electrical products, and in particular without any gas being released to the atmosphere nor any polluting fluids being discharged.
SM6 is compliant with the RoHS directive. RoHS restricts the use of six hazardous materials in the manufacture of various types of electronic and electrical equipment.



Métaux ferreux / *Ferrous metal*	84 %	65 %
Métaux non ferreux / *Non-ferrous metal*	4 %	10,6 %
Thermodurcissables / *Thermosetting*	9,5 %	22%
Thermoplastiques / *Thermoplastics*	2,35 %	2,3 %
Fluides / *Fluid*	0.15%	0,1 %

Fin de vie et préservation environnementale

End of life and environmental conservation

Récupération du gaz SF6 en fin de vie

Recovery of SF6 gas at end of life

Le SF6 doit être retiré avant toute opération de démantèlement selon les procédures décrites dans le document CEI-61634.

Le gaz doit être traité conformément au document CEI-60480.

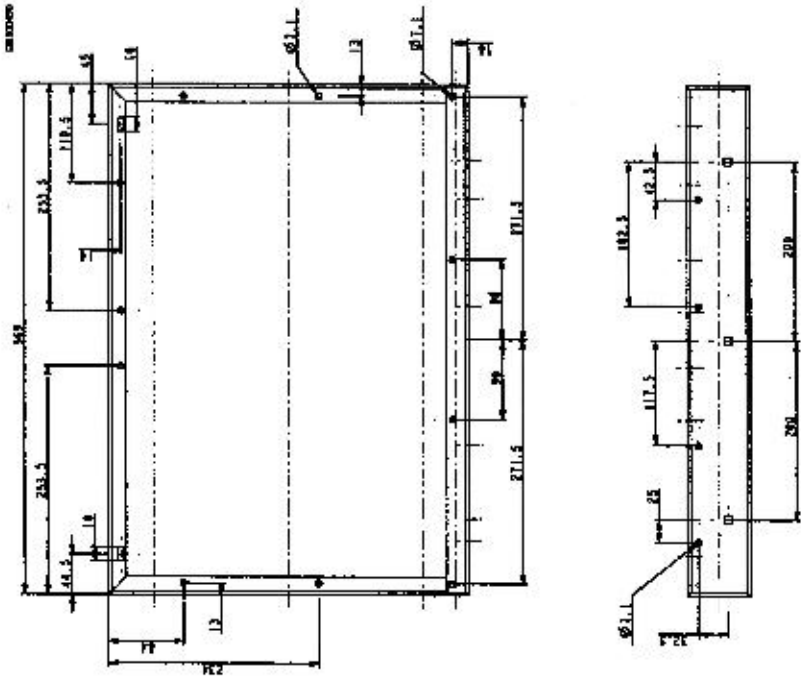
- volume de gaz à récupérer : 35litres par interrupteur,
- pression interne relative : 40kPa.

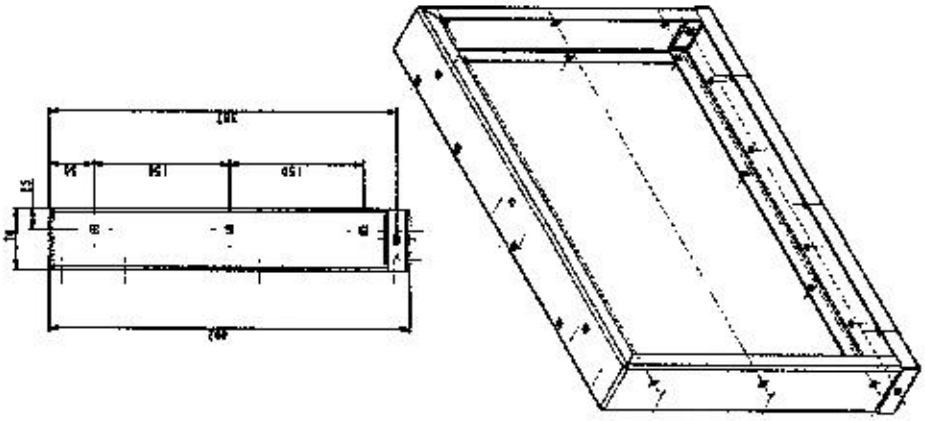
The SF6 must be removed before any dismantling operation can be carried out in compliance with the procedures describedin IEC-61634.

The gas must be treated in compliance with IEC-60480.

- *volume of gas to be recovered: 35litres per switch,*
- *internal gauge pressure: 40kPa.*

Plan de la bride d'interface
Coupling flange layout





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As standards, specifications and designs change from time to time, please ask for confirmation of the information given in this publication.

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02-2012

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SM6
Заводски стлобени шкафове за разпределителни уредби СН

Български

ИНСТРУКЦИЯ ЗА ЕКСПЛОАТАЦИЯ

Шкафове тип IM-PM-QM

MERLIN GERIN
mastering electrical power
GROUPE SCHNEIDER

"TECHNIC ENERGY" LTD

СЪДЪРЖАНИЕ

"ТЕХНИК ЕНЕРДЖИ" ЕООД "TECHNIC ENERGY" LTD ВАРНА

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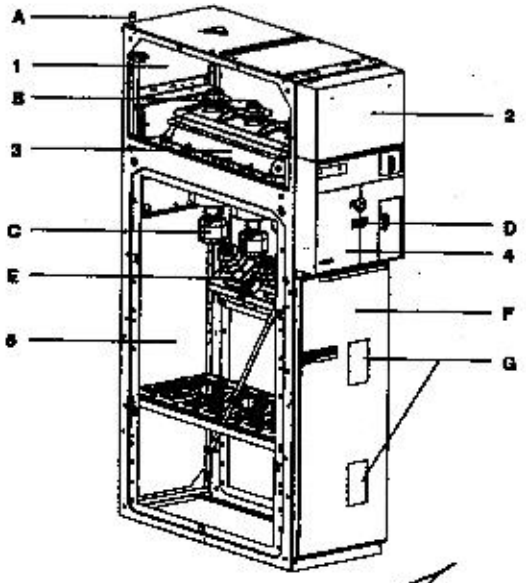
IM : Шкаф с мощностен разединител

1 Отделение за сборни шини
2 Отделение ниско напрежение
3 Отделение на разединителя и заземителя
4 Отделение на задвижващия механизъм
5 Отделение за свързване на кабелите

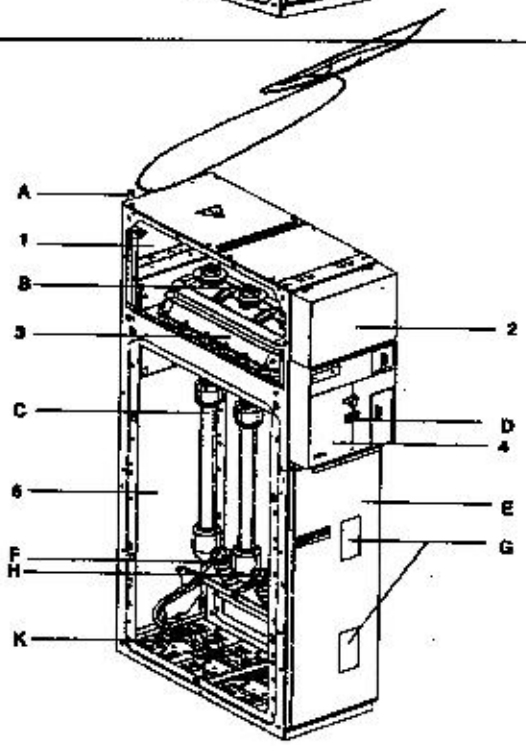
A Планка за свързване на заземителната шина
B Места за свързване на шините
C Долен екран и място за свързване на кабел
D Индикатор на напрежение
E Капацитивен делител
F Преден панел
G Прозорчета за наблюдение на кабелните връзки



PM : Шкаф с мощностен разединител и предпазители

1 Отделение за сборни шини
2 Отделение ниско напрежение
3 Отделение на разединителя и заземителя
4 Отделение на задвижващия механизъм
5 Отделение за предпазители и свързване на кабелите

A Планка за свързване на заземителната шина
B Места за свързване на шините
C Предпазители
D Индикатор на напрежение
E Преден панел
F Долен екран и място за свързване на кабел
G Прозорчета за наблюдение на предпазителите и положението на заземителя на извода
H Капацитивен делител
K Заземител на извода



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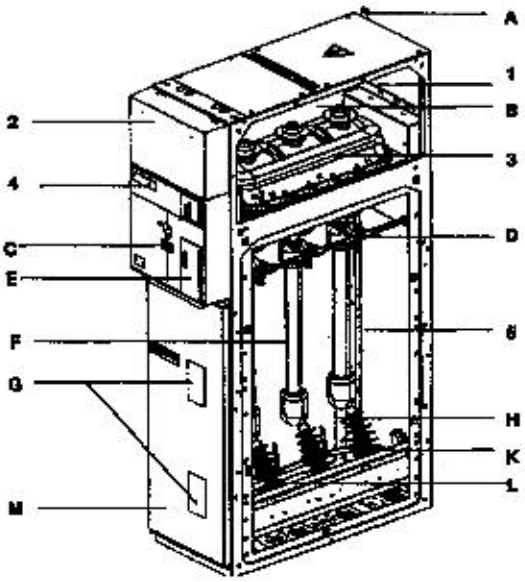
QM : Шкаф комбинация от мощностен разединител и предпазители

1 Отделение за сборни шини
2 Отделение ниско напрежение
3 Отделение на разединителя и заземителя
4 Отделение на задвижващия механизъм
5 Отделение за предпазители и свързване на кабелите

A Планка за свързване на заземителната шина
B Места за свързване на шините
C Индикатор на напрежение
D Механизъм за изключване на мощностния разединител при стопяване на предпазител (QM)
E Индикация за изключване на разединителя от стопен предпазител (QM)
F Предпазители
G Прозорчета за наблюдение на предпазителите и положението на заземителя на извода
H Долен екран и място за свързване на кабел
K Капацитивен делител
L Заземител на извода
M Преден панел



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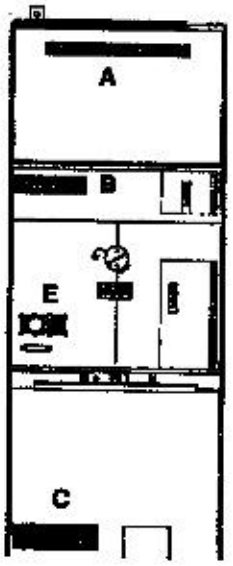
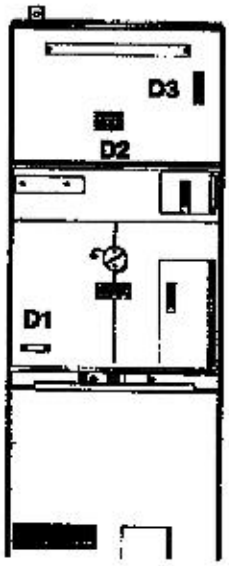
Идентификация на шкафа





A: Табелка с означение (опция)
B: Характеристики и означение
C: Фирмена табелка
E: Моторно задвижване (опция)

Сериен номер
D1: Занитен на капака на отделението за задвижващия механизъм
D2: Залепен на гърба на капака на отделението за управление
D3: Залепен на вертикалното ребро на рамката

Списък на окомплектовката

Шина вариант 400 – 630 A и свързване на едножилни сухи кабели. За други варианти виж специфичните инструкции.

Доставяни с шкафа

Окомплектовка за уредбата: (може да бъде различна в зависимост от шкафовете съставящи уредбата)

1 Задвижващ лост
2 Крайни капака
1 Плик с болтове и гайки за крайните капаци

Окомплектовка за IM:

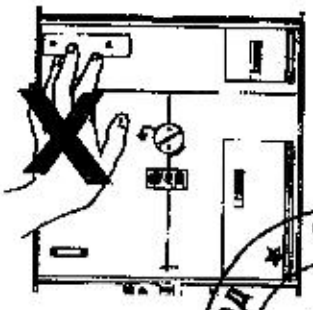
1 плик с окомплектовка за връзка между шкафовете **(плик S1 : 372945)**
1 плик с изравнители на полето за шините – при напрежение >12 kV **(плик S2 : 3729742)**
1 плик с принадлежности за закрепване на шините – при напрежение < 12 kV **(плик S6 : 3729746)**
4 дънни плочи
3 уплътнителя за кабели
3 планки за закрепване на кабелите + скоби
1 комплект шини
1 заземителна шина

Окомплектовка за PM и QM:

1 плик с изравнители на полето за шините – при напрежение >12 kV **(плик S2 : 3729742)**
1 плик с принадлежности за закрепване на шините – при напрежение < 12 kV **(плик S6 : 3729746)**
1 плик с принадлежности за монтаж на дънните плочи **(плик S5 : 3729743)**
4 дънни плочи
3 уплътнителя за кабели

Тегло

IM : 120 kg
PM2 : 130 kg
QM : 130 kg



Никога не се опитвайте да местите шкафа прилагайки усилие върху панела за управление

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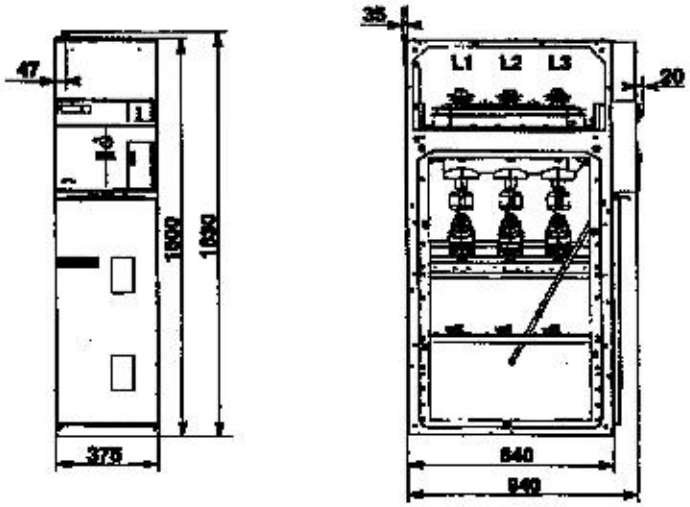
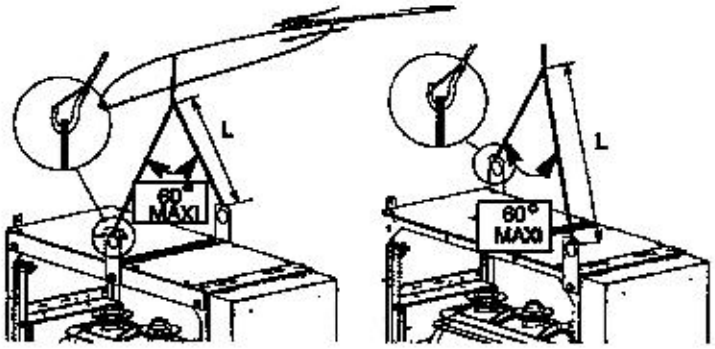
Размери



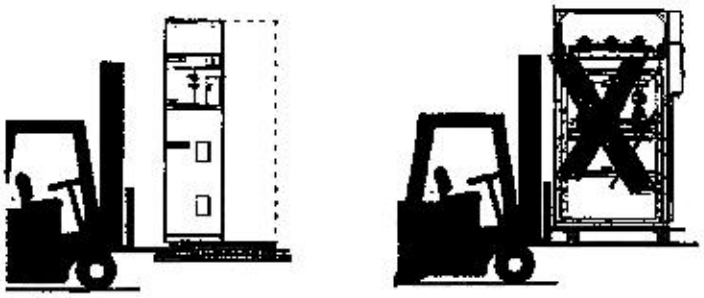
Преместване с повдигане



L = 375 mm минимум
С допълнителен шкаф НН

L = 920 mm минимум
Без допълнителен шкаф НН

Преместване с повдигач



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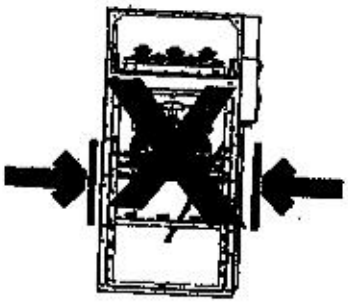
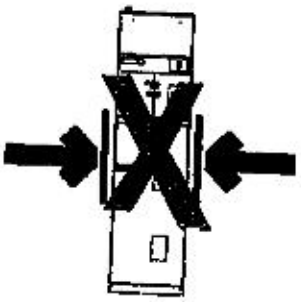
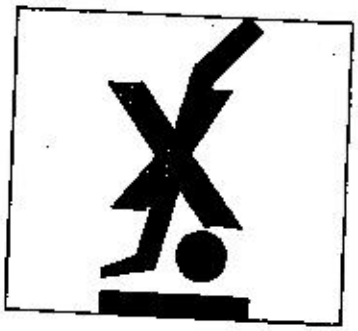
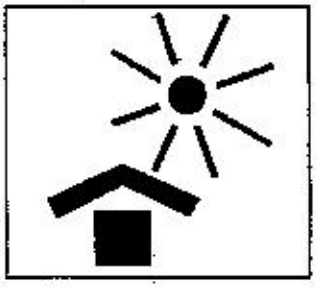
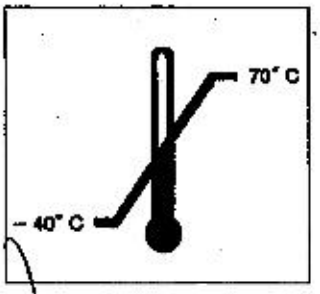






Съхранение





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Устойчивостта на стареене в подстанцията СН зависи от 3 основни фактора

- **Необходимост от правилното прилагане на присъединяването:**

Новите технологии дават възможност за лесен монтаж и повишават устойчивостта във времето.
Конструкциите позволяват работа в условия на замърсявания и трудни атмосферни условия

- **Влияние на фактора относителна влажност:**

Монтирането на нагреватели е особено важно при климатични условия с висока относителна влажност и големи температурни разлики

- **Вентилация:**

Вентилационните решетки трябва да бъдат оразмерени съобразно отделяната в подстанцията топлина.
Тези решетки трябва да се разполагат близо до трансформаторите за да се предотврати циркулация на топъл въздух около разпределителната уредба

Експлоатация

Ние препоръчваме през равни интервали от време (най-малко на всеки две години) да се извършват по няколко работни цикъла на апаратите.

В случай на работа при условия извън нормалните работни (между –5 и +40 C, липса на прах, агресивна среда и т.н.), препоръчваме да се обърнете към Сервизния център на Шнайдер Електрик, за да се проверят работните условия и да се вземат мерки за обезпечаване на нормална работа

Нашият сервизен център е на Ваше разположение по всяко време, за да :

- направи диагностика на уредбата
- препоръча необходимите мерки за подръжка
- предложи договор за сервизно обслужване
- препоръча адаптации на уредбата

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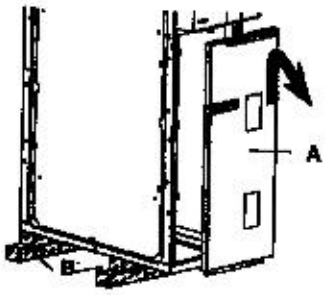
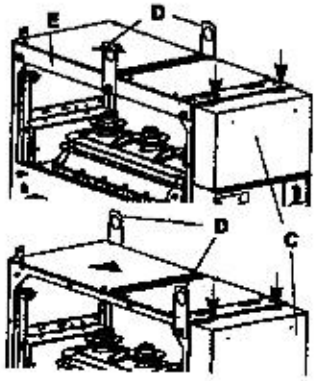
Подготовка на шкафовете уредбата за монтаж на уредбата

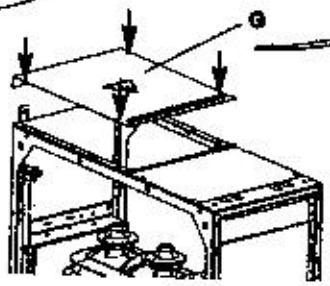
Състояние при доставка:
Заземител в заземено положение.
: болт + шайба
: болт + шайба + гайка с найлоново фиксиране



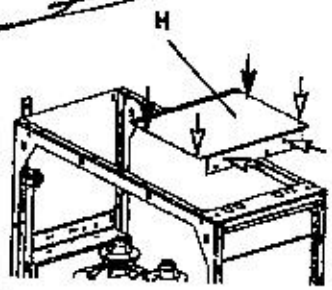
Свалете предния панел A и след това отстранете палета B. (болтовете не могат да се използват повторно)



Свалете капака на отделението НН C и планките за повдигане D и E



Свалете горната плоча G. (4 болта НН)

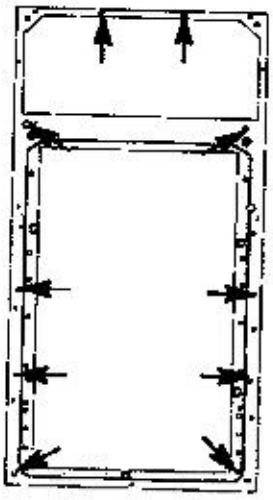


Свалете горната плоча H. (Шкаф без допълнителна надстройка НН)

Монтаж на страничните капаци

Подготовка

(само ако шкафа е в края на уредбата)
Плик с болтове и гайки
S4 : 3729744
(само болтове НМ 6 x 12)



Поставете 10 фиксиращи се гайки на стената на шкафа (виж указанията по-долу)

В случай на разширение на уредба с оборудване производство преди февруари 1995 г., крайният капак на съществуващата уредба трябва да бъде подменен.

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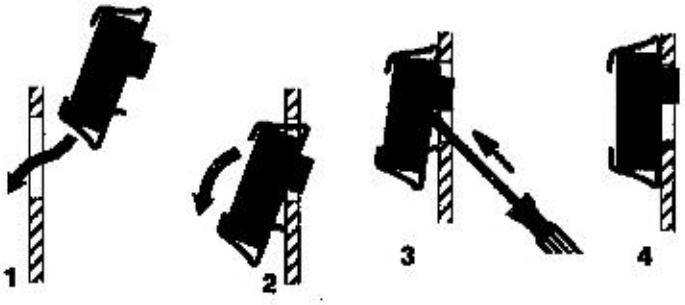
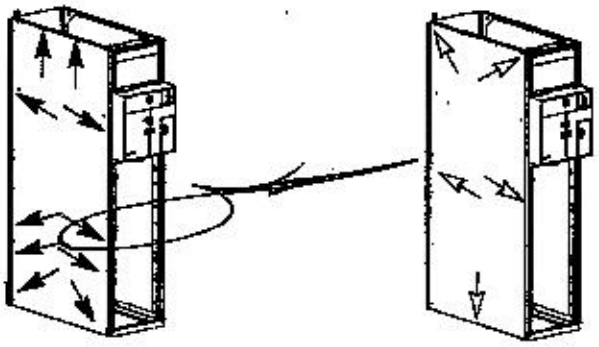


1 : Вкарайте самофиксиращата се гайка в квадратния отвор от външната страна на шкафа
2 : Завъртете кайката така че фиксиращата пластина да е в почти вертикално положение
3 : Натиснете гайката в показаната посока така че горния край на фиксиращата пластина да защипе панела
4 : Гайката е поставена правилно

Закрепване на страничните капаци

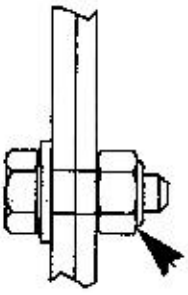
Обяснението е дадено за крайния ляв край на ередбата. Направете същото за отсрещния край.

: болт + шайба
: болт + шайба + гайка с найлоново фиксиране

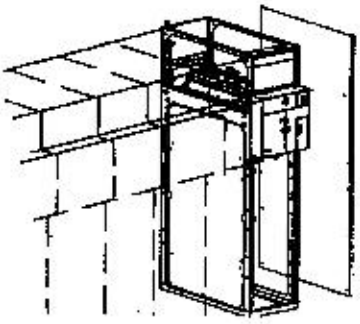


Поставете крайния капак. Сложете болтовете в самофиксиращите гайки

Поставете болтовете с гайките с найлоново фиксиране



Посока на монтажа на болта и гайката с найлоново фиксиране (гайката е от вътрешната страна на шкафа)



Монтирайте другия страничен капак по същия начин

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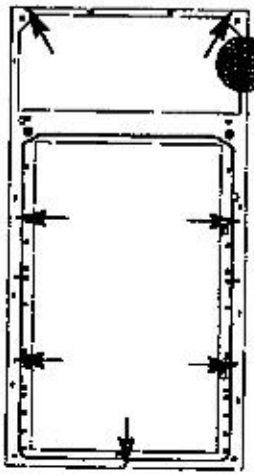
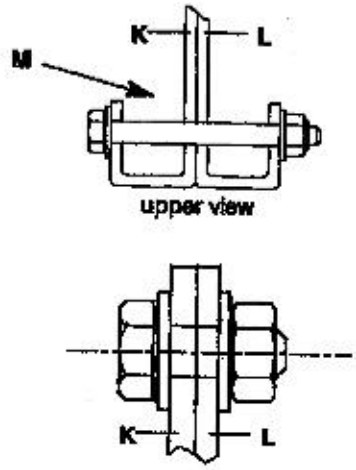
Сглобяване на уредбата

Плик с болтове и гайки
S1 : 3729745
(само болтове HM 6 x 16)
болт + шайба + гайка



Изглед отгоре

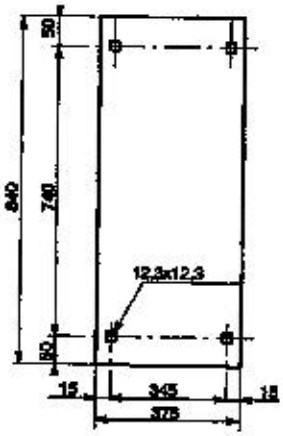


Свържете отделните шкафове. (оставащите болтове са за заземителните шини)

Посока на монтаж на болта
K : ляв шкаф
L : десен шкаф
M : за свързване на два шкафа
Болт HM 6 x 60 с умерено затягане
Усилие на затягане : 6 Nm

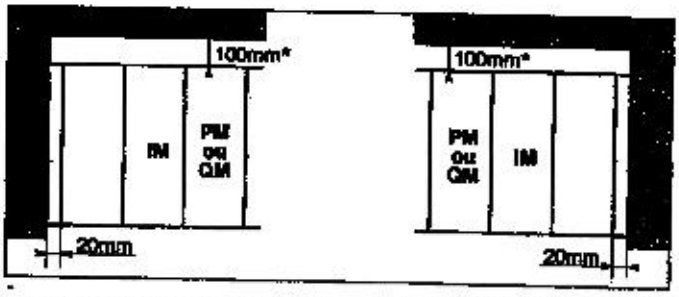
Закрепване към пода

(болтовете и гайките не са включени в доставката)



Разположение в подстанцията

(*) минимално отстояние за нормална работа



Уредба монтирана вдясно от стена

Уредба монтирана вляво от стена

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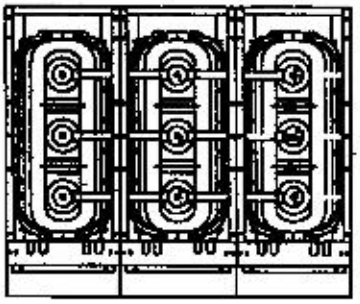
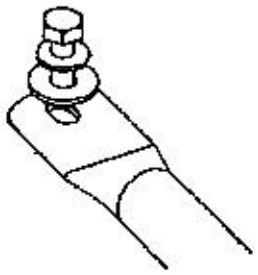
Поставяне на шините

след монтажа на шкафовете в работното им положение

Принадлежности:
Вариант > 12 kV
Плик S2 : 3729742
Вариант < 12 kV
Плик S6: 3729746

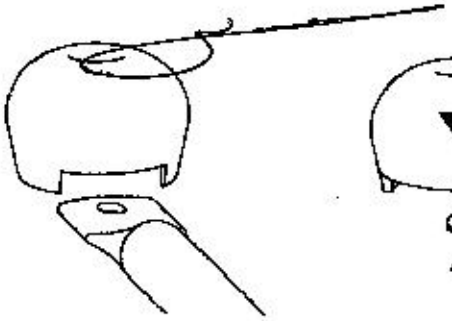
Инструменти:
1 : динамометричен ключ (1 до 50 Nm)
1 : адаптор 1/4 - 3/8
1 : удължение 6 mm
1 : 6 mm мъжки шестогран
1 : 6 mm женско гнездо

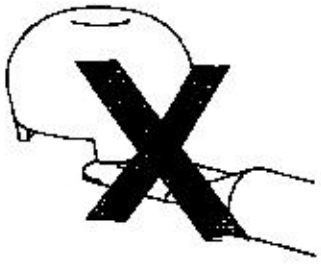




Свързване на шините
Усилие на затягане : 28 Nm

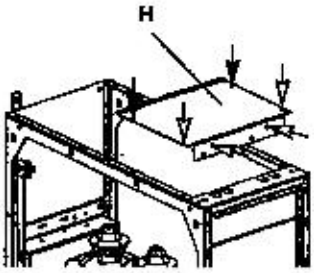
Вариант < 12 kV
(Плик S6 : 3729746)
Монтаж без изравнители на полето

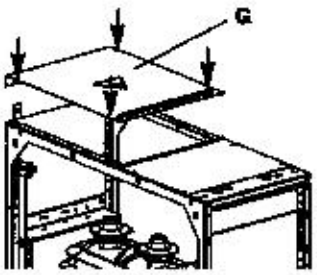




Вариант > 12 kV
(плик S2 : 3729742)
Правилно разположен изравнител на полето

Неправилно разположен изравнител на полето
(риск за повреда)



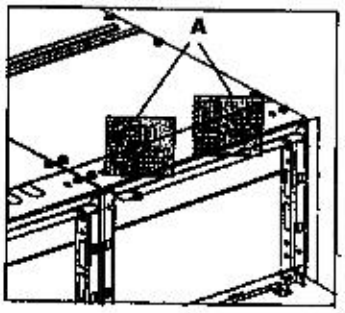


Монтирайте обратно горната плоча **H** (гайките от вътрешната страна на шкафа)

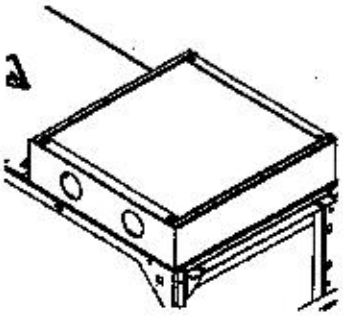
Монтирайте обратно горната плоча **G**

Подвеждане на кабелите НН за оперативни вериги

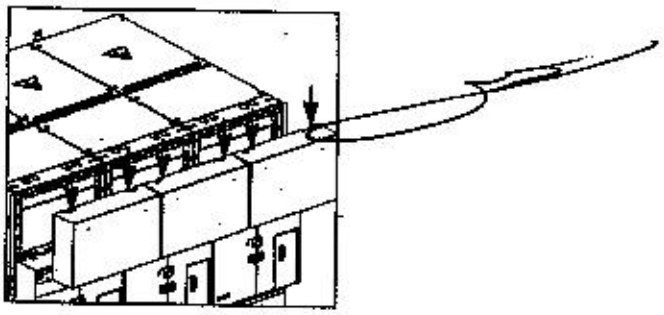
Забележка: схемите на свързване на оперативните вериги са залепени от вътрешната страна на отделението НН



Входът за кабелите към клеморедa за оперативните вериги е през двата отвора **A** отгоре



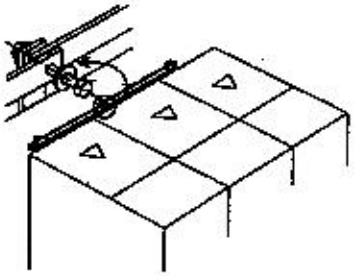
Шкаф оборудван с проходна кутия за кабелите НН. Следвайте същата процедура след като свалите проходната плоча



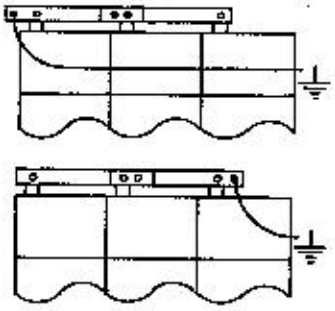
Поставете обратно предния капак на отделението НН като сглазвате индикациите

Монтаж на заземителните шини

Болтове и гайки в
Плик S1 : 3729745



Свържете заземителните шини (като използвате болтовете HM 6 x 30)



Свържете към заземителната уредба на подстанцията по един от двата начина

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Съхранение на задвижващия лост

Поставете скобата за закрепване на задвижващия лост на удобно място на стената. (винтът не се доставя)

Свързване на кабел СН при шкаф IM

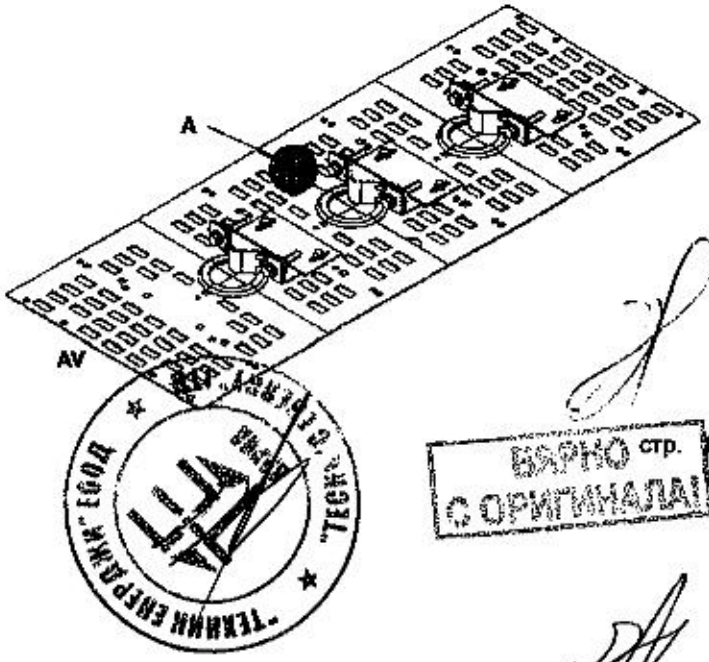
За да се намалят усилията върху кабелната връзка, трябва да се съобрази дължината и радиусът на огъване на кабела

Ухо за свързване при изпитване

Кабелните глави трябва да бъдат изпълнени съгласно **HN 68 S 06**
(медно/алуминиеви кръгли уши в съответствие с **HN 68 S 90**)

Поставете планките на скобинте за закрепване на кабелите.
Болтове и гайки в плик **S3 : 3729741** (болтове HM8x16)
Оставащите болтове и гайки са за закрепване на кабелите

2 възможности за монтаж:
А – без тороиди



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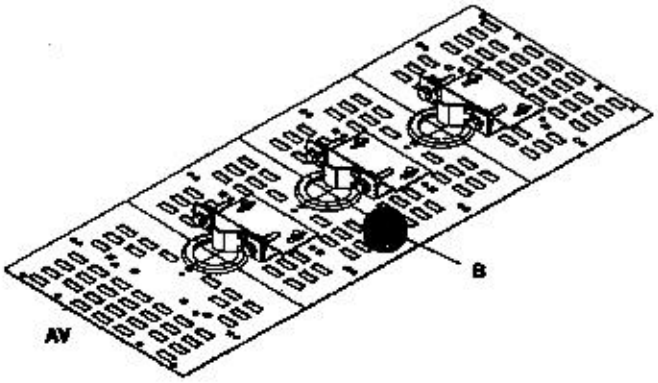
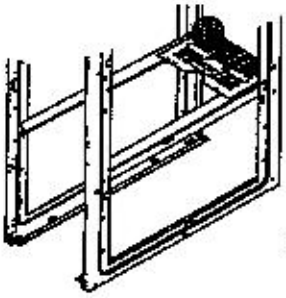
B – с тороиди

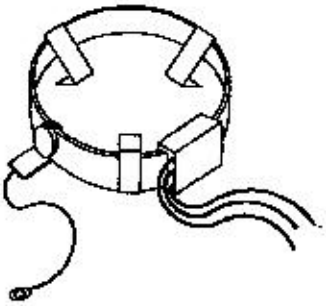




Поставете първата дънна плоча

Поставяне на тороидите за регистриране на авария

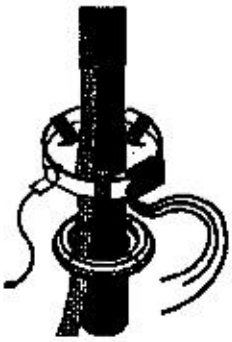
(инструкция предлагана от **Шнайдер Електрик**)
Само за шкафове IM.
Следвайте инструкциите за монтаж на производителя на тороида .



Подгответе тороидите извън шкафа

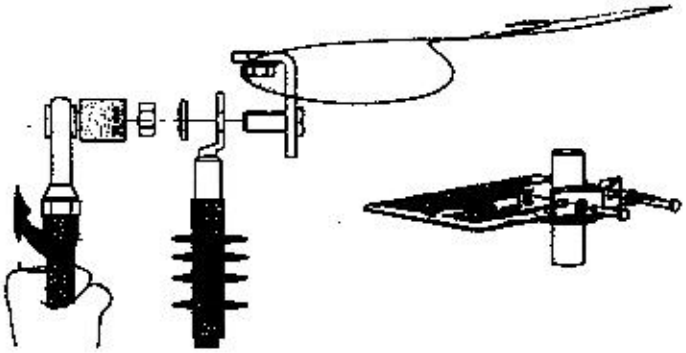
Поставете уплътнителя на кабела

37.



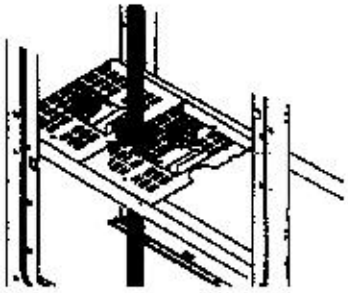
Разположете тороида върху кабела и го закрепете
Направете връзката НН.
Удължете трите заземителни оплетки с изолиран кабел и го прекарайте през тороида преди да го свържете със заземителната шина

Свържете кабела към болта на съединителя за фаза **L1.**



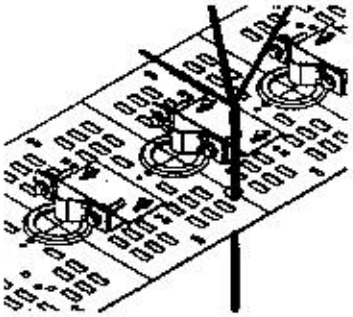
Използвайте динамометричен ключ и гнездо 19 mm за затягането на кабела към болта
Усилие на затягане : 50 Nm

Закрепете кабела към планката за закрепване на дънната плоча. (болтове HMx50)



Поставете **втората** дънна плоча

- Монтирайте фази **L2** и **L3** като спазвате същата последователност както при фаза L1.



Пример за отвеждане на кабелите НН:
Кабелите преминават през отвора.

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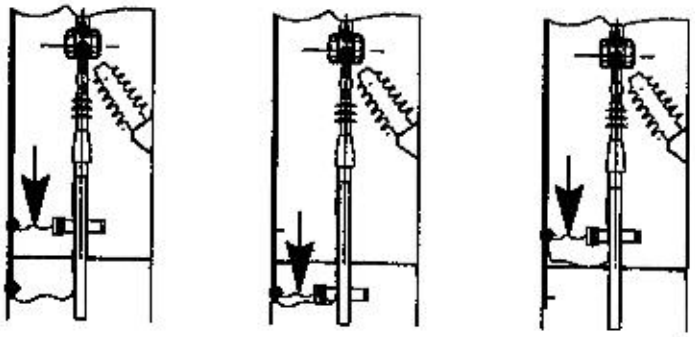
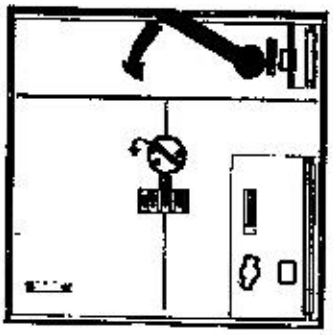


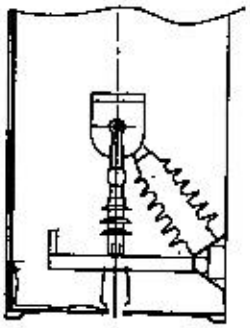
Свържете кабела и заземителните оплетки на тороида по един от тези 3 начина
(болтовете са вече монтирани)

Свързване на кабелите СН при шкафове PM и QM

Не използвайте скобите за закрепване на кабелите.

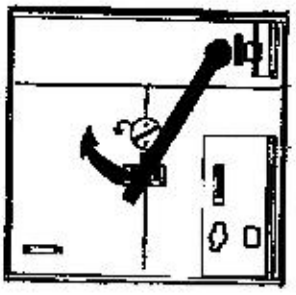
Болтове и гайки в плик S5 : 3729743





Отворете заземителя като използвате задвижващия лост

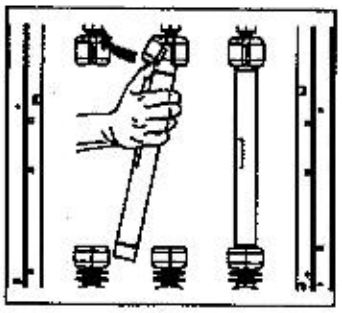
Свържете кабелите в същия ред както при шкаф **IM**. Използвайте динамометричен ключ и гнездо 16 mm за затягане на болтовете.
Усилие на затягане : 50 Nm



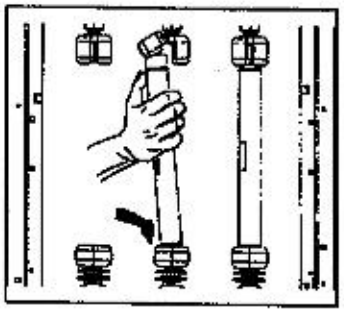
Затворете заземителя

Поставяне на предпазителите в шкафове PM и QM

Внимание:
Проверете състоянието на предпазителите преди да ги поставите



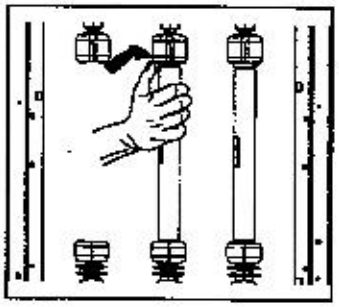
Повдигнете капачката на горния екран с горния край на предпазителя

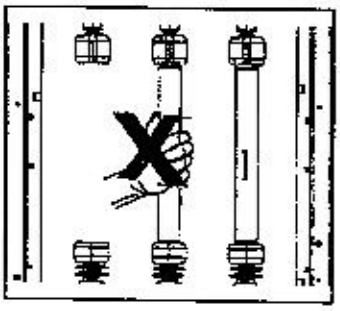


Вкарайте долния край на предпазителя изцяло в долната контактна розетка

Внимание:
Когато подменяте предпазители, сменете всичките три предпазителя

Не използвайте отново вече употребявани предпазители



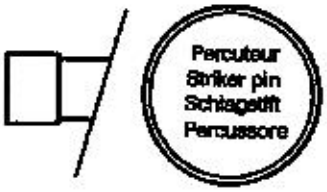


След това поставете горния край на предпазителя в горната контактна розетка и проверете дали капачката на екрана е правилно затворена Завъртете предпазителя така, че етикетът му да застане отпред

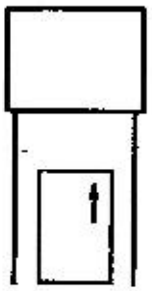
Препоръчваме предпазителят да не се държи в средата

В шкаф QM

Използвайте предпазители с ударник, който да задейства изключването на мощностния разединител при стопяване на предпазителя



Краят на предпазителя с ударник е маркиран



Характеристиките на предпазителя и посоката на монтаж са отпечатани на етикета Завъртете предпазителя така, че етикетът да застане отпред (ударникът отгоре)

ВЯРНО С ОРИГИНАЛА!

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Защита на трансформатори

Изборът на стойностите за предпазителите за шкафовете SM6 за защита на трансформатори като PM и QM зависи от следните критерии:

- Работното напрежение
- Номиналната мощност на трансформатора
- Технологията на предпазителя (производител)

- Могат да се използват различни типове предпазители със средно натоварване на ударника:
  - Предпазители Solefuse по стандарта **UTE NFC 64.210**
  - Предпазители CF Fusarc по препоръките на **IEC 282.1** и размери по **DIN 43.625**

Размери на предпазителите

Пример: За защита на трансформатор 400 kVA при напрежение 10 kV изберете или предпазители Solefuse за ток 40 A, или CF Fusarc за ток 50 A

Моля консултирайте се с нас за монтажа

Solefuse (Стандарт UTE)

Номин. Напреж. (kV)	Номин. Ток (A)	Тегло (kg)
7,2	6,3 à 125	2
12	100	2
17,5	80	2
24	6,3 à 63	2

CF Fusarc (Стандарт DIN)

Номин. Напреж. (kV)	Номин. Ток (A)	L mm	Ø mm	Тегло (kg)
7,2	125	292	88	3,5
12	6,3 à 63	292	55	1,4
	80 à 100	292	88	3,3
24	6,3 à 40	442	55	1,4
	50 à 80	442	88	6

Таблица за избор

(номинални стойности в A, без претоварване, -5°C < θ < 40°C)

Моля, консултирайте се с нас за претоварвания и работа при температури над 40°C

(*) моля, консултирайте се с нас

Тип Напр.	Работно Напреж. (kV)	Номинална мощност на трансформатора (kVA) 25	50	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	Ном. Напреж. (kV)
UTE NFC standards: 13.100, 64.210																			
Solefuse																			
	5,5																		
	10	6,3	6,3	16	16	31,5	31,5	31,5	63	63	63	63							24
	15	6,3	6,3	16	16	16	16	16	43	43	43	43	43	63					
	20	6,3	6,3	6,3	6,3	16	16	16	16	43	43	43	43	43	63				
General case, UTE NFC standard 13.500																			
Solefuse																			
	3,3																		
	5,5									80	80								
	6,6										80								
	10	6,3	6,3	16	16	16	31,5	31,5	31,5	43	43	63	80	80					
	13,8	6,3	6,3	6,3	16	16	16	16	31,5	31,5	31,5	43	63	63	80				17,5
	15	6,3	6,3	6,3	16	16	16	16	31,5	31,5	31,5	43	43	63	80				
	20	6,3	6,3	6,3	6,3	16	16	16	16	31,5	31,5	31,5	43	43	63				24
	22	6,3	6,3	6,3	6,3	16	16	16	16	16	31,5	31,5	31,5	43	63	63			
CF Fusarc																			
	3,3																		
	5,5																		
	6,6																		
	10																		
	13,8	6,3	10	16	16	20	25	31,5	31,5	40	50	50	63	80	80	100*	125*		17,5
	15	6,3	10	10	16	16	20	25	31,5	40	50	50	63	80	80	100	125*	125*	
	20	6,3	6,3	10	10	16	16	25	25	31,5	40	40	50	50	63	80	100*	125*	24
	22	6,3	6,3	10	10	10	16	20	25	25	31,5	40	40	50	50	80	80	100*	

ВЯРНО С ОРИГИНАЛА

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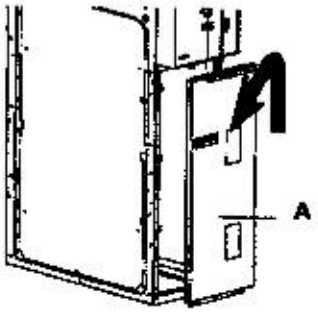
Проверка на работата преди подаване на напрежение

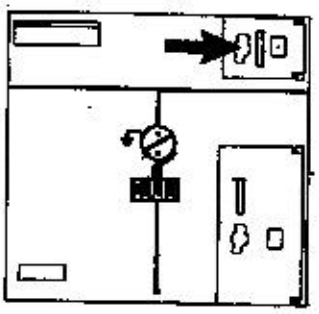
Проверете дали нещо не е забравено в отделението за свързване.
За всички фази:

- Проверете дали всички предпазители са правилно поставени
- Проверете дари капачките на екраните са правилно затворени
- Проверете дали тороида за регистрация на авария е правилно свързан

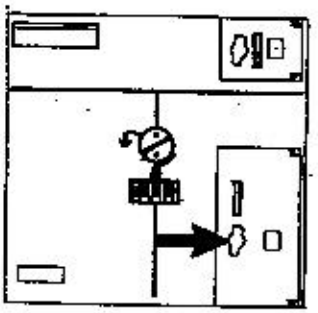


Поставете обратно предния панел

Функционални изпитвания преди подаване на напрежение

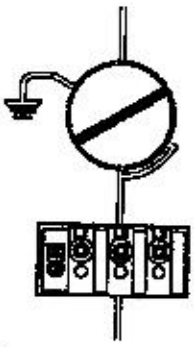


Превключете мощностния разединител няколко пъти



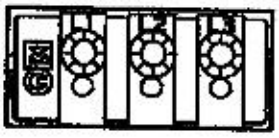
Превключете заземителя няколко пъти

Подаване на напрежение на захранващите кабели СН



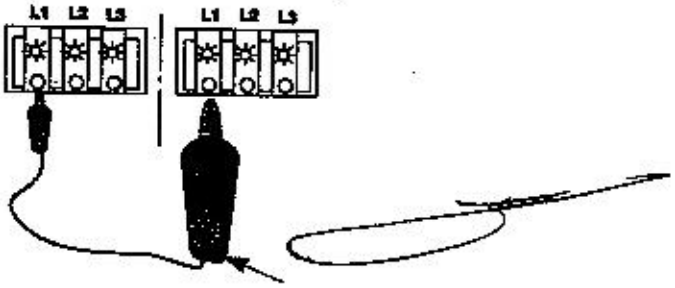
Мощностният разединител трябва да бъде в отворено положение
(виж : инструкции за работа)

Индикатори на напрежение



Веднага след подаване на напрежение на кабелите, лампите на индикаторите на напрежение трябва да светнат

Проверка за съответствие на фазите

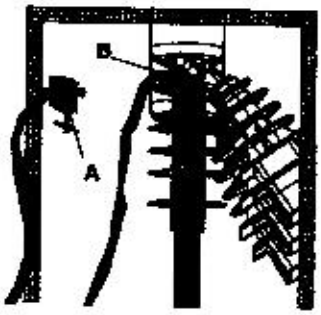


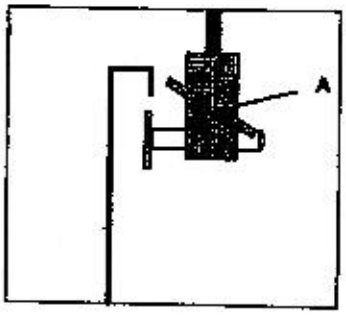
Ако фазите си съответстват, лампата не свети.
Ако фазите не съответстват, лампата светва

Изпитване на кабелите

Свързване за определяне на повреден кабел или подаване на токови импулси за локализиране на кабелната повреда.

- Включете заземителя
- Отворете предния капак
- Поставете заземителното устройство





Затегнете скобата **A** върху зъземителния щифт и свържете заземителните клеми **B** към трите отвора на кабелните накрайници

Поглед отгоре на свързването на скобата **A**
Правилно свързване

"ТЕХНИК ЕНЕРДЖИ" ЕООД "TECHNIC ENERGY" LTD ВАРНА

РЕГИО С ОРИГИНАЛА

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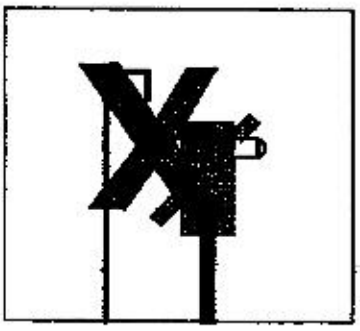
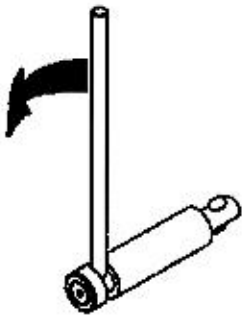


Неправилно свързване

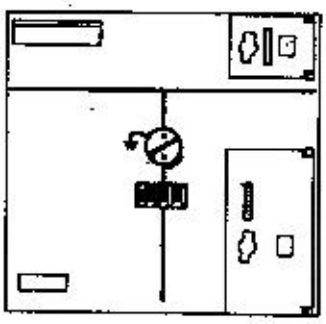
Отворете заземителя, за да позволите достъп до проводниците

Работа с шкафа IM, PM и QM и индикатори на положенията

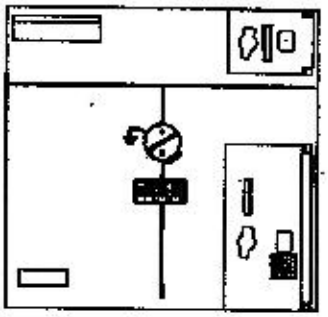


Поставете лоста, както е показано, за задвижване надолу (отваряне)

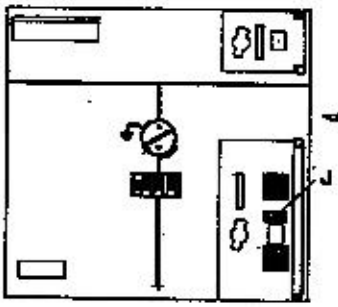
Поставете лоста, както е показано, за задвижване нагоре (затваряне)



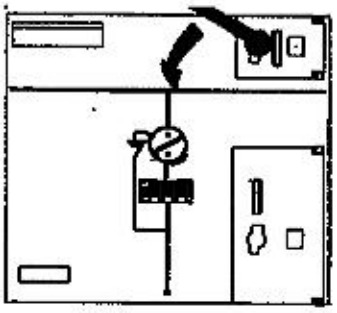
Лицева плоча на задвижващ механизъм CIT



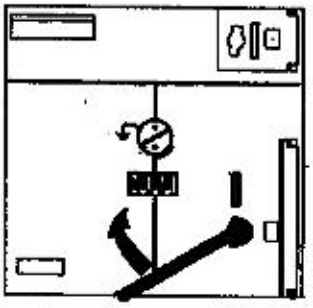
Лицева плоча на задвижващ механизъм CI1



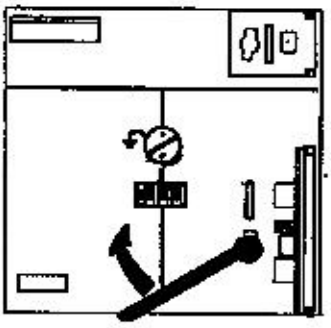
Лицева плоча на задвижващ механизъм CI2
J : индикация на заредено/незаредено положение



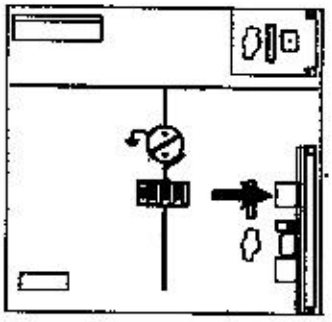
Отваряне на заземителя
(задвижващи механизми CIT, CI1 и CI2)



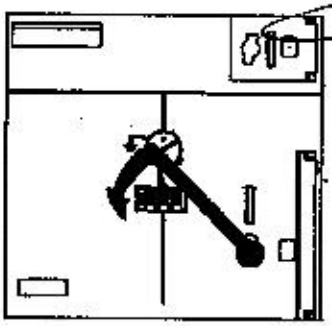
Затваряне на разединителя
(задвижващи механизми CIT, CI1 и CI2



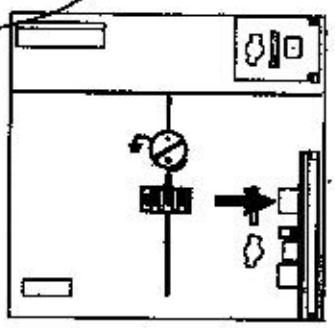
Зареждане на пружината
(задвижващ механизъм CI2)



Затваряне на мощностния разединител
(задвижващ механизъм CI2)



Отваряне на мощностния разединител
(задвижващ механизъм CIT)



Отваряне на мощностния разединител
(задвижващ механизъм CI1 и CI2)

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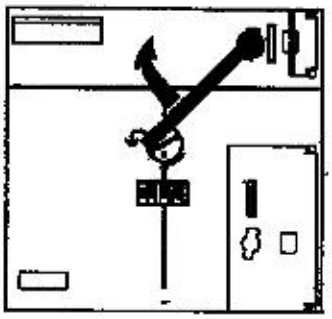
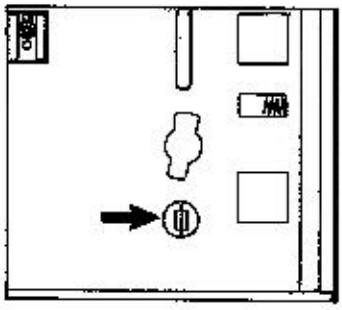
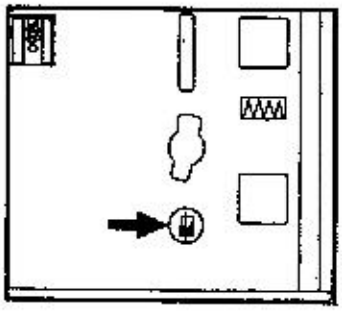


Затваряне на заземителя
(за задвижващи механизми CIT, CI1 и CI2) след проверка на състоянието на напрежението.
(виж индикатори на напрежение)

Индикация на предпазителите

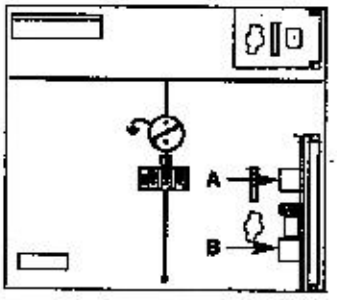


Предпазителите са изправни
(бял индикатор)

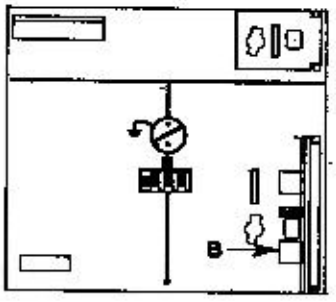


Един или повече предпазители са стопени
(червен индикатор)

Разреждане на задвижващ механизъм CI2

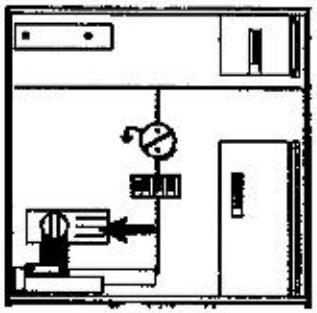


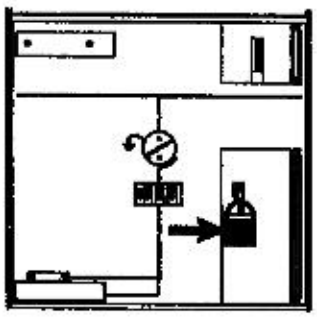
Шкафът е без напрежение:
Затворете мощностния разединител: бутон **A**, след това го отворете : бутон B



Шкафът е под напрежение:
Натиснете бутона за отваряне **B**.
ВНИМАНИЕ : тази операция може да повреди задвижващия механизъм.
Извършвайте само при необходимост

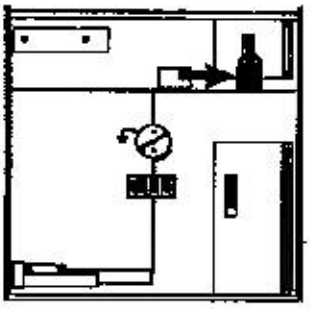
Заключване с катинари

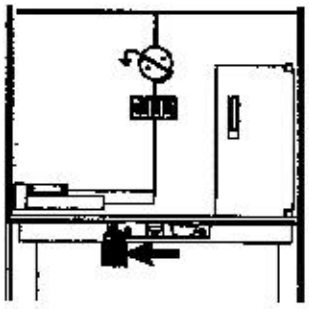




Заключване на моторното задвижване (опция)
Заключете моторното задвижване с катинар преди да отворите мощностния разединител.
Моторното задвижване може да бъде отключвано или заключвано с катинарите

Заключете мощностния разединител в отворено или затворено положение с 1, 2 или 3 катинара (диаметър 8 mm)



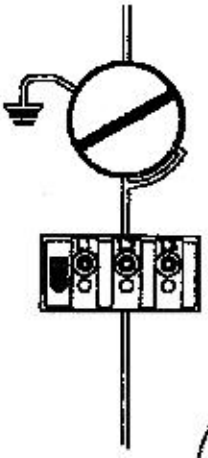


Заключете заземителя в отворено или затворено положение с 1, 2 или 3 катинара (диаметър 8 mm)

Заключване на предния капак

Безопасност при работа

Предният панел може да бъде свален или поставен обратно само при затворено положение на заземителя



Текуща подръжка

Ако имате проблеми : Виж Сервизния център на Шнайдер Електрик

Никога не смазвайте задвижващите механизми на разединителите

Не се изисква никакво специално обслужване при нормални работни условия **(температури между -5°C и +40°C)**

За тежки работни условия (агресивна среда, запрашеност, температури под -5°C и над +40°C) се обърнете към Сервизния център на Шнайдер

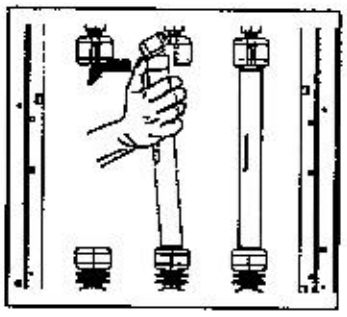
Подръжка

Подмяна на предпазителите CH

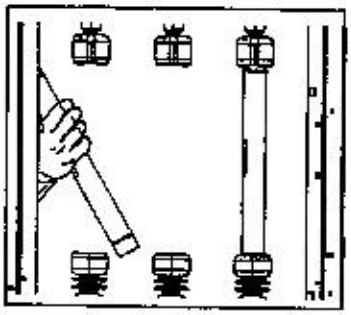
- Шкафът трябва да остане без напрежение
- Разединителят трябва да се отвори
- Заземителят трябва да се отвори

Отворете предния панел за достъп до предпазителите.

ВАЖНО:
Стандартът IEC 282.1 §23.2 посочва, че при стопяване на който и да е предпазител, трябва да бъдат подменени и трите предпазителя

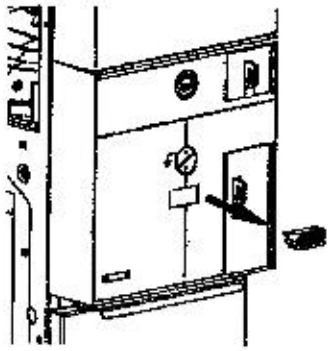


Най-напред откачете предпазителя от горната розетка



След това го повдигнете нагоре от долната розетка и го извадете изцяло
За поставянето на новите предпазители виж главата: **Поставяне на предпазителите**

Подмяна на блока индикатори на напрежение



Изтеглете блока индикатори на напрежение
(уредбата може да остане под напрежение)

Проблеми при работа
Шкафове IM, PM и QM

• Индикаторите на напрежение не светят	• Проверете дали захранващите кабели са под напрежение • Проверете индикаторния блок • Проверете дали мощностният разединител (за шкаф PM) е затворен • Проверете дали предпазителите са поставени • Проверете дали предпазителите са здрави
• Предният панел не може да бъде отворен или затворен	• Проверете дали заземителят е в заземено положение
• Заземителят не не може да бъде задвижен	• Проверете дали мощностният разединител е в отворено положение
• Мощностният Разединител не може да бъде задвижен	• Проверете дали заземителят е в отворено положение

Моторно задвижване (опция)

• Електрическото задвижване не е възможно S13 = вкарване на лоста за мощностния разединител S14 = вкарване на лоста за заземителя	• Проверете предпазителите HH (CIP2) • Проверете електрическите блокировки S13-S14 (вкарване на лоста за задвижване) • Проверете дали задвижващият вал на заземителя е достигнал крайното си положение • Проверете дали S14 не е предизвикала прекъсване на захранването и регулирайте положението • Проверете конфигурацията на-възела CIP1 (виж схемата
• (*) ръчното задвижване е невъзможно след електрически цикъл на включване при напрежение по-малко от –15% от номиналното	• Използвайте задвижващия лост за създаване на момент в в посока затваряне до достигане на крайното положение. Сега ръчното задвижване трябва да е възможно
• (*) вкарването на лоста за задвижване е невъзможно след електрически цикъл на включване при напрежение по-високо от +15% от номиналното	• Ако е възможно, извършете електрическо задвижване, като използвате резервен източник на захранване, ако това е възможно • За да направите възможно вкарването на лоста за задвижване, завъртете задния края на вала на мощностния разединител в посока затваряне с помощта на голяма отвертка. (За по-сигурно не забравяйте най-напред да изведете електрическия задвижващ механизъм. Ако е необходимо натиснете нагоре и задръжте блокиращото перо, което задейства контакт S13)
• (*) Работата е гарантирана при номинално напрежение ±15%	

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Резервни части	• Предпазители UTE или DIN • Индикатори на напрежение	За други резервни части, моля обърнете се към нас: **Виж най-близкия Сервизен център на Шнайдер Електрик**
Опции (Моля консултирайте се с нас)	• Блокировки с ключове • Нагреватели	
За шкафове IM	• Моторно задвижване • Помощни контакти • Тестер за проверка съответствието на фазите • Блокировки с ключове • Разширено отделение НН • Нагревател 50 W • Надстройка НН или шкаф за кабелен вход отгоре • Цокъл с по-голяма височина • Комплект за свързване на два кабела на фаза	
За шкафове QM	• Моторно задвижване с изключвателна бобина • Помощни контакти • Блокировки с ключове • Нагревател 50 W • Цокъл с по-голяма височина • Контакт за индикация "стопен предпазител" • Минимално-напреженова или шунтова изключвателна бобина • Разширено отделение НН • Надстройка НН или шкаф за кабелен вход отгоре	
За шкафове PM	• Моторно задвижване • Помощни контакти • Разширено отделение НН • Надстройка НН или шкаф за кабелен вход отгоре • Блокировки с ключове • Нагревател 50 W • Цокъл с по-голяма височина • Механична сигнализация "стопен предпазител"	

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Сервизните центрове на Шнайдер Електрик
са на Ваше разположение за:

инженеринг и техническа помощ,
пускане в експлоатация,
обучение,
текуща и друга подръжка,
адаптации,
резервни части

Обърнете се към Вашия търговски представител, който ще Ви свърже с най-близкия Сервизен център на Шнайдер Електрик, или се обадете направо в Гренобъл, Франция
(33) 04 76 57 60 60

Schneider Electric SA

Merlin Gerin
F-38050, Grenoble cedex 9

Тел. (33) 04 76 57 60 60

Тъй като стандартите и конструкциите се променят с течение на времето, моля искайте потвърждение на информацията дадена в тази публикация

Съставител, редакция : Сервизна документация

Издадено на 13-12-1999

Отпечатано на български език - БУЛПАК

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Distribution Moyenne Tension
Medium Voltage Distribution

SM6-24

Cellules modulaires
Modular cubicles

Exploitation et maintenance
Operating and maintenance

[redacted]

Schneider Electric

Table des matières
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Consignes de sécurité

Informations importantes

AVIS

Lisez attentivement ces instructions et examinez le matériel pour vous familiariser avec l'appareil avant de tenter de l'installer, et de le mettre en service. Les messages spéciaux suivants que vous trouverez dans cette documentation ou sur l'appareil ont pour but de vous mettre en garde contre des risques potentiels ou d'attirer votre attention sur des informations qui clarifient ou simplifient une procédure.

L'apposition de ce symbole à un panneau de sécurité Danger ou Avertissement signale un risque électrique pouvant entraîner des lésions corporelles en cas de non-respect des consignes.

Ceci est le symbole d'une alerte de sécurité. Il vous avertit d'un risque de blessures corporelles. Respectez scrupuleusement les consignes de sécurité associées à ce symbole pour éviter de vous blesser ou de mettre votre vie en danger.

DANGER

DANGER indique une situation immédiatement dangereuse qui, si elle n'est pas évitée, entraînera la mort ou des blessures graves.

AVERTISSEMENT

L'indication **AVERTISSEMENT** signale une situation potentiellement dangereuse et susceptible d'entraîner la mort ou des blessures graves.

ATTENTION

L'indication **ATTENTION** signale une situation potentiellement dangereuse et susceptible d'entraîner des blessures d'ampleur mineure à modérée.

ATTENTION

L'indication **ATTENTION**, utilisée sans le symbol d'alerte de sécurité, signale une situation potentiellement dangereuse et susceptible d'entraîner des dommages aux équipements.

Safety informations

Important information

NOTICE

Read these instructions carefully, and look at the equipment to become familiar with the device before trying to install, operate, or maintain it. The following special messages may appear throughout this documentation or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

The addition of this symbol to a Danger or Warning safety label indicates that an electrical hazard exists, which will result in personal injury if the instructions are not followed.

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

DANGER

***DANGER** indicates an imminently hazardous situation which, if not avoid will result in death or serious injury.*

WARNING

***WARNING** indicates a potentially hazardous situation which, if not avoided can result in death or serious injury.*

CAUTION

***CAUTION** indicates a potentially hazardous situation which, if not avoided, can result in minor or moderate injury.*

CAUTION

***CAUTION**, used without the safety alert symbol, indicates a potentially hazardous situation which, if not avoided, can result in equipment damage.*

Sécurité
Safety

Remarques importantes

L'installation, l'utilisation, la réparation et la maintenance des équipements électriques doivent être assurées par du personnel qualifié uniquement. Schneider Electric décline toute responsabilité quant aux conséquences de l'utilisation de cet appareil. Une personne qualifiée est une personne disposant de compétences et de connaissances dans le domaine de la construction et du fonctionnement des équipements électriques et installations et ayant bénéficié d'une formation de sécurité afin de reconnaître et d'éviter les risques encourus.

Please note

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material. A qualified person is one who has skills and knowledge related to the construction and operation of electrical equipment and its installation, and has received safety training to recognize and avoid the hazards involved.

Règles de sécurité

Equipement de Protection Individuel

E.P.I. ou Equipement de Protection Individuel obligatoire lors des interventions sur les cellules.

Toutes les opérations décrites ci-après doivent être effectuées en respectant les normes de sécurité en vigueur, sous la responsabilité d'une autorité compétente.

N'entreprenez le travail qu'après avoir lu et compris toutes les explications contenues dans ce document.

Si la moindre difficulté à respecter ces règles se présentait, veuillez vous adresser à Schneider Electric.

Le compartiment raccordement de la cellule sur laquelle il est prévu d'intervenir sera hors tension, et le sectionneur de ligne en position terre.

L'installateur doit être habilité et autorisé pour intervenir et manipuler le matériel SM6.

Safety rules

Personnal Protective Equipment

P.P.E. Personal Protective Equipment required during cells interventions.

All the operations described below must be performed in compliance with applicable safety standards, under the responsibility of a competent authority.

Only undertake the work after having read and understood all the explanations given in this document.

If you have any difficulty complying with these rules, please contact Schneider Electric.

The connection compartment of the cubicle, which is to be serviced, should be power-off and feeder and the disconnector in the earth position.

The contractor must be certified and authorised to manipulate and perform work on the SM6 unit.

Protection obligatoire de la vue
Eye protection must be worn

Protection obligatoire du corps
Safety overalls must be worn

Protection obligatoire des pieds
Safety boots must be worn

Protection obligatoire des mains
Safety gloves must be worn

Protection obligatoire de la tête
Safety helmet must be worn

Protection obligatoire de l'ouïe
Ear protection must be worn

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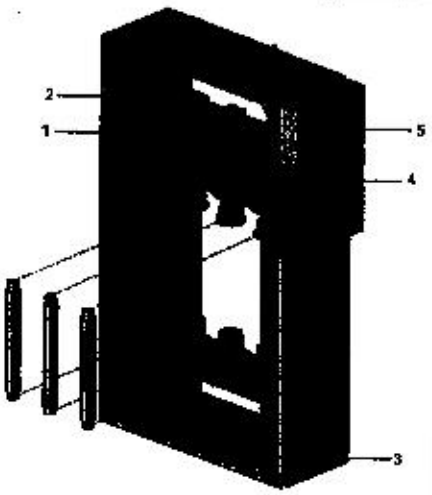
Description des cellules
Cubicles description

Cellules interrupteurs et protection par fusibles

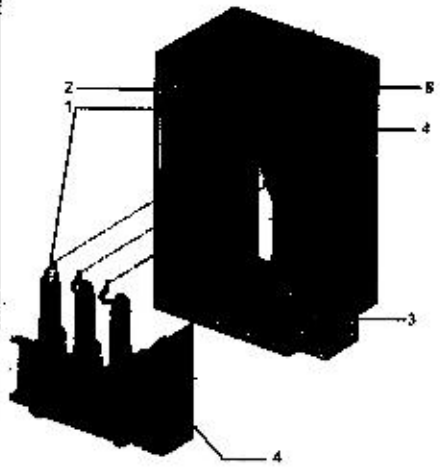
Switch and fuse protection cubicles



1 appareillage : interrupteur-sectionneur et sectionneur de terre dans une enveloppe remplie de SF6 et répondant au "système à pression scellé".	*1 **switchgear:** switch-disconnector and earthing switch in an enclosure filled with SF6 and satisfying "sealed pressure system" requirements.*
2 jeu de barres : en nappe permettant une extension à volonté des tableaux et un raccordement à des matériels existants.	*2 **busbars:** all in the same horizontal plane, thus enabling later switchboard extensions and connection to existing equipment.*
3 raccordement : accessibilité par face avant, sur les bornes inférieures de l'interrupteur (cellule IM) ou sur les porte-fusibles inférieurs (cellules PM et QM). Ce compartiment est également équipé d'un sectionneur de terre en aval des fusibles MT pour les cellules de protection.	*3 **connection:** accessible through front, connection to the lower switch-disconnector and earthing switch terminals (IM cubicles) or the lower fuse-holders (PM and QM cubicles). This compartment is also equipped with an earthing switch downstream from the MV fuses for the protection units.*
4 commande : comporte les éléments permettant de manoeuvrer l'interrupteur et le sectionneur de terre ainsi que la signalisation correspondante (coupure certaine).	*4 **operating mechanism:** contains the elements used to operate the switchdisconnector and earthing switch and actuate the corresponding indications (positive break).*
5 contrôle : pour l'installation d'un bornier (option motorisation), de fusibles BT et de relayage de faible encombrement. Un caisson complémentaire peut être ajouté si nécessaire à la partie supérieure de la cellule.	*5 **low voltage:** installation of a terminal block (if motor option installed), LV fuses and compact relay devices. If more space is required, an additional enclosure may be added on top of the cubicle.*

Cellules protection par disjoncteurs à coupure dans le SF6

SF6 circuit breaker protection cubicles



1 appareillage : sectionneur(s) et sectionneur(s) de terre et disjoncteur dans des enveloppes remplies de SF6 et répondant au "système à pression scellé". Deux offres de disjoncteurs sont envisageables : ■ SF1 : appareil associé à un relais électronique et à des capteurs standard (avec ou sans source auxiliaire) ■ SFset : ensemble autonome équipé d'une protection électronique et de capteurs spécifiques (sans source auxiliaire).	*1 **switchgear:** disconnector(s) and earthing switch(es), in enclosures filled with SF6 and satisfying "sealed pressure system" requirements. Two circuit breaker offers are possible: ■ SF1: combined with an electronic relay and standard sensors (with or without an auxiliary power supply ■ SFset: autonomous set equipped with an electronic protection system and special sensors (requiring no auxiliary power supply).*
2 jeu de barres : en nappe permettant une extension à volonté des tableaux et un raccordement à des matériels existants.	*2 **busbars:** all in the same horizontal plane, thus enabling later switchboard extensions and connection to existing equipment.*
3 raccordement : accessibilité par face avant, sur les bornes aval du disjoncteur.	*3 **connection:** accessible through front, connection to the downstream terminals of the circuit breaker.*
4 commande : comportent les éléments permettant de manoeuvrer le(s) sectionneur(s), le disjoncteur et le sectionneur de terre, ainsi que la signalisation correspondante.	*4 **operating mechanism:** contains the elements used to operate the disconnector(s), the circuit breaker and the earthing switch and actuate the corresponding indications.*
5 contrôle : pour l'installation de relayage de faible encombrement et de boîtes à bornes d'essais. Un caisson complémentaire peut être ajouté si nécessaire à la partie supérieure de la cellule.	*5 **low voltage:** installation of compact relay devices and test terminal boxes. If more space is required, an additional enclosure may be added on top of the cubicle.*

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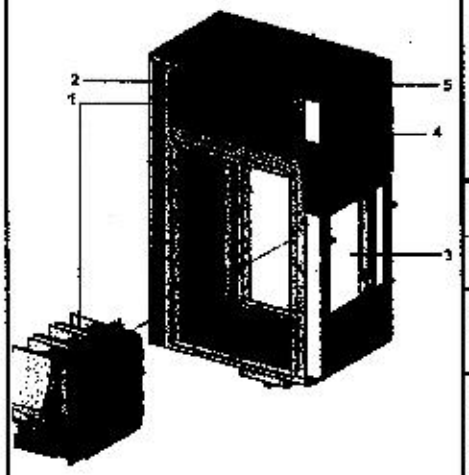
Description des cellules
Cubicles description

Cellules protection par disjoncteurs frontal à coupure dans le vide

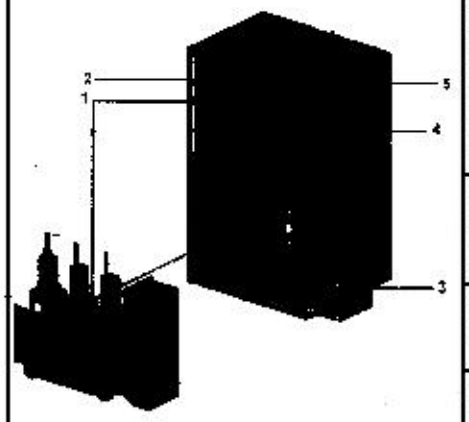
Frontal vacuum type circuit breaker protection cubicles



1 appareillage : interrupteur/sectionneur et sectionneur(s) de terre dans une enveloppe remplie de SF6 et un disjoncteur à coupure dans le vide, répondant au "système à pression scellé". ■ Evolis : appareil associé à un relais électronique et à des capteurs standard (avec ou sans source auxiliaire).	*1 **switchgear:** load break switch and earthing switch(es), in enclosure fi lled with SF6 and satisfying and one vacuum circuit breaker, "sealed pressure system" requirements. ■ Evolis: device associated with an electronic relay and standard sensors (with or without auxiliary source).*
2 jeu de barres : en nappe permettant une extension à volonté des tableaux et un raccordement à des matériels existants.	*2 **busbars:** all in the same horizontal plane, thus enabling later switchboard extensions and connection to existing equipment.*
3 raccordement : accessibilité par face avant, sur les bornes aval du disjoncteur.	*3 **connection:** accessible through front, connection to the downstream terminals of the circuit breaker.*
4 commande : comportant les éléments permettant de manoeuvrer le(s) sectionneur(s), le disjoncteur et le sectionneur de terre, ainsi que la signalisation correspondante.	*4 **operating mechanism:** contains the elements used to operate the disconnector(s), the circuit breaker and the earthing switch and actuate the corresponding indications.*
5 contrôle : pour l'installation de relayage de faible encombrement (VIP) et de boîtes à bornes d'essais. Un caisson complémentaire peut être ajouté si nécessaire à la partie supérieure de la cellule.	*5 **low voltage:** installation of compact relay devices (VIP) and test terminal boxes. If more space is required, an additional enclosure may be added on top of the cubicle.*

Cellules protection par disjoncteurs latéral à coupure dans le vide

Lateral vacuum type circuit breaker protection cubicles

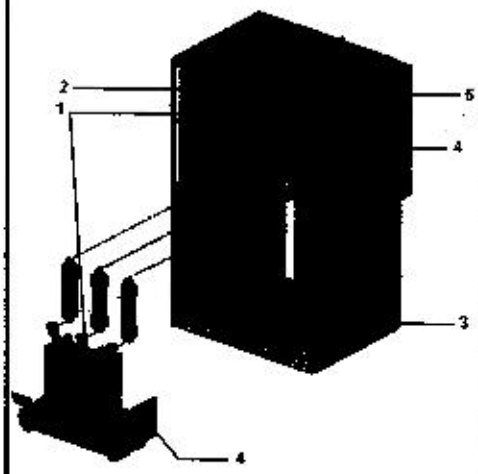


1 appareillage : sectionneur(s) et sectionneur(s) de terre dans une enveloppe remplie de SF6 et un disjoncteur à coupure dans le vide, répondant au "système à pression scellé". ■ Evolis : appareil associé à un relais électronique et à des capteurs standard (avec ou sans source auxiliaire).	*1 **switchgear:** disconnector(s) and earthing switch(es), in enclosure fi lled with SF6 and satisfying and one vacuum circuit breaker, "sealed pressure system" requirements. ■ Evolis: device associated with an electronic relay and standard sensors (with or without auxiliary source).*
2 jeu de barres : en nappe permettant une extension à volonté des tableaux et un raccordement à des matériels existants.	*2 **busbars:** all in the same horizontal plane, thus enabling later switchboard extensions and connection to existing equipment.*
3 raccordement : accessibilité par face avant, sur les bornes aval du disjoncteur.	*3 **connection:** accessible through front, connection to the downstream terminals of the circuit breaker.*
4 commande : comportant les éléments permettant de manoeuvrer le(s) sectionneur(s), le disjoncteur et le sectionneur de terre, ainsi que la signalisation correspondante.	*4 **operating mechanism:** contains the elements used to operate the disconnector(s), the circuit breaker and the earthing switch and actuate the corresponding indications.*
5 contrôle : pour l'installation de relayage de faible encombrement et de boîtes à bornes d'essais. Un caisson complémentaire peut être ajouté si nécessaire à la partie supérieure de la cellule.	*5 **low voltage:** installation of compact relay devices and test terminal boxes. If more space is required, an additional enclosure may be added on top of the cubicle.*

Description des cellules
Cubicles description

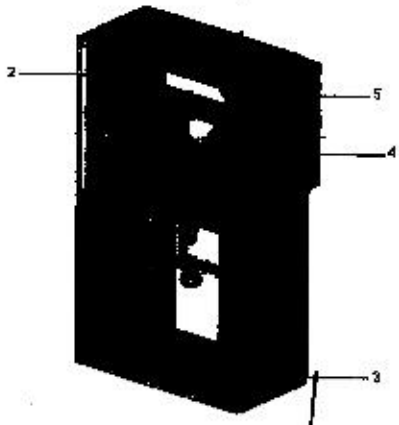
Cellule contacteur

Contactor cubicle

	**1 appareillage** : sectionneur et sectionneur de terre dans des enveloppes remplies de SF6 et répondant au "système à pression scellé". Deux offres sont envisageables pour le contacteur : ■ A coupure dans le vide avec maintien magnétique ■ A coupure dans le vide avec accrochage mécanique.	*1 **switchgear:** disconnector and earthing switch in enclosures filled with SF6 and satisfying "sealed pressure system" requirements. 2 types may be used for the contactor: ■ Vacuum with magnetic holding ■ Vacuum with mechanical latching.*
	2 jeu de barres : en nappe permettant une extension à volonté des tableaux et un raccordement à des matériels existants.	*2 **busbars:** all in the same horizontal plane, thus enabling later switchboard extensions and connection to existing equipment.*
	3 raccordement : accessibilité par face avant, sur des bornes prévues à cet effet. Ce compartiment est également équipé d'un sectionneur de terre aval. Le contacteur est installé avec ou sans fusibles.	*3 **connection:** accessible through front. This compartment is also equipped with an earthing switch downstream. The contactor may be equipped with or without fuses.*
	4 commande : comportant les éléments permettant de manoeuvrer le sectionneur, le contacteur et le sectionneur de terre ainsi que la signalisation correspondante	*4 **operating mechanism:** contains the elements used to operate the disconnector(s), the contactor and the earthing switch and actuate the corresponding indications.*
	5 contrôle : pour l'installation de relayage de faible encombrement et de boîtes à bornes d'essais. Un caisson complémentaire est ajouté en standard à la partie supérieure de la cellule.	*5 **low voltage:** Installation of compact relay devices and test terminal boxes. With basic equipment, an additional enclosure is added on top of the cubicle.*

Cellules gaines

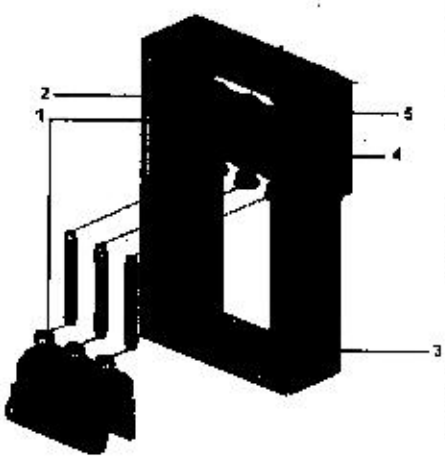
Casings cubicles

	**1 appareillage** : pas d'équipement	*1 **switchgear:** no equipment*
	2 jeu de barres : en nappe permettant une extension à volonté des tableaux et un raccordement à des matériels existants.	*2 **busbars:** all in the same horizontal plane, thus enabling later switchboard extensions and connection to existing equipment.*
	3 raccordement : accessibilité par face avant, sur le jeux de barre ou les câbles. Ce compartiment peut être équipé d'un sectionneur de terre aval.	*3 **connection:** accessible through front, on the busbars or cables. This compartment may be equipped with an earthing switch downstream*
	4 commande : pas d'équipement	*4 **operating mechanism:** no equipment*
	5 contrôle : pas d'équipement	*5 **low voltage:** no equipment*

Description des cellules
Cubicles description

Cellules comptage

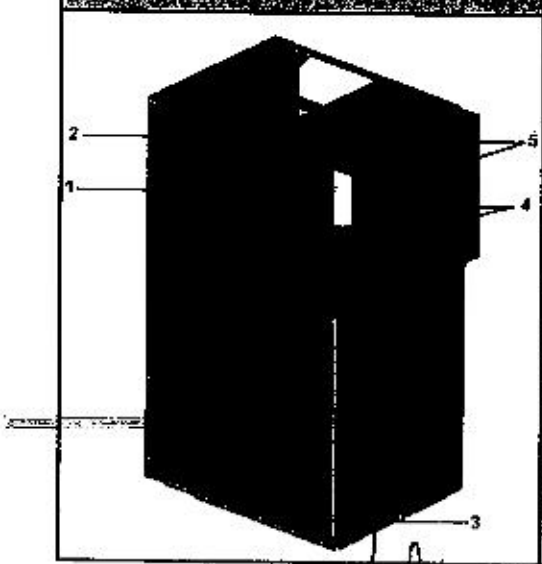
Metering cubicles



1 **appareillage CM-CM2-TM:** sectionneur(s) et sectionneur(s) de terre et disjoncteur dans des enveloppes remplies de SF6 et répondant au "système à pression scellé". 1 **appareillage GBC-A/GBC-B:** pas d'équipement	*1 **CM-CM2-TM switchgear:** switch-disconnector and earthing switch in an enclosure fi lled with SF6 and satisfying "sealed pressure system" requirements.* *1 **GBC-A/GBC-B switchgear:** no equipment*
2 **jeu de barres** : en nappe permettant une extension à volonté des tableaux et un raccordement à des matériels existants.	*2 **busbars:** all in the same horizontal plane, thus enabling later switchboard extensions and connection to existing equipment.*
3 **raccordement CM-CM2-TM:** accessibilité par face avant, sur les fusibles, sur les porte-fusibles inférieurs ou sur les capteurs de mesures. 3 **raccordement GBC-A/GBC-B:** accessibilité par face avant, sur les capteurs de mesures.	*3 **CM-CM2-TM connection:** accessible through front, connection to the lower-fuses, the lower fuse-holders or the sensor measures.* *3 **GBC-A/GBC-B connection:** accessible through front, connection to the sensor measures.*
4 **commande CM-CM2-TM:** comportant les éléments permettant de manoeuvrer le(s) sectionneur(s), le disjoncteur et le sectionneur de terre, ainsi que la signalisation correspondante. 4 **commande GBC-A/GBC-B:** pas d'équipement	*4 **CM-CM2-TM operating mechanism:** contains the elements used to operate the disconnector(s), the circuit breaker and the earthing switch and actuate the corresponding indications.* *4 **GBCA-GBCB operating mechanism:** no equipment*
5 **contrôle CM-CM2-TM:** pour l'installation de relayage de faible encombrement et de boîtes à bornes d'essais. Un caisson complémentaire peut être ajouté si nécessaire à la partie supérieure de la cellule. 5 **contrôle GBC-A/GBC-B:** pas d'équipement	*5 **CM-CM2-TM low voltage:** installation of compact relay devices and test terminal boxes.* *If more space is required, an additional enclosure may be added on top of the cubicle.* *5 **GBC-A/GBC-B low voltage:** no equipment*

Autres Cellules

Other cubicles



1 **appareillage** : interrupteur-sectionneur et sectionneur de terre dans une enveloppe remplie de SF6 et répondant au "système à pression scellé".	*1 **switchgear:** switch-disconnector and earthing switch in an enclosure fi lled with SF6 and satisfying "sealed pressure system" requirements.*
2 **jeu de barres** : en nappe permettant une extension à volonté des tableaux et un raccordement à des matériels existants.	*2 **busbars:** all in the same horizontal plane, thus enabling later switchboard extensions and connection to existing equipment.*
3 **raccordement** : accessibilité par face avant, sur le jeux de barre ou les câbles.	*3 **connection:** accessible through front, on the busbars or cables.*
4 **commande** : comporte les éléments permettant de manoeuvrer l'interrupteur et le sectionneur de terre ainsi que la signalisation correspondante (coupure certaine).	*4 **operating mechanism:** contains the elements used to operate the switchdisconnector and earthing switch and actuate the corresponding indications (positive break).*
5 **contrôle** : contient l'appareil de détection de tension VD23. Un caisson complémentaire est ajouté à la partie supérieure de la cellule et contient l'unité de contrôle T200S et sa batterie.	*5 **low voltage:** contains the device rated voltage sensing VD23. A space is required, an additional enclosure may be added on top of the cubicle and contains the control unit T200S and its battery.*

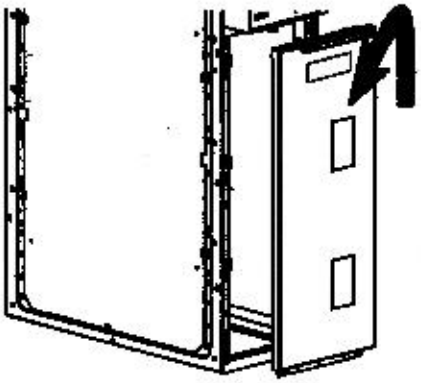
Vérification avant mise sous tension
Checking prior to energisation

Vérification pour les cellules IMB/GAM/IM/PM/QM/SM/IMC

■ Ne rien laisser dans le compartiment raccordement.

Checking for IMB/GAM/IM/PM/QM/SM/IMC cubicles

■ *Check that nothing has been left inadvertently in the connection cabinet.*



■ Remettre le panneau avant en place.

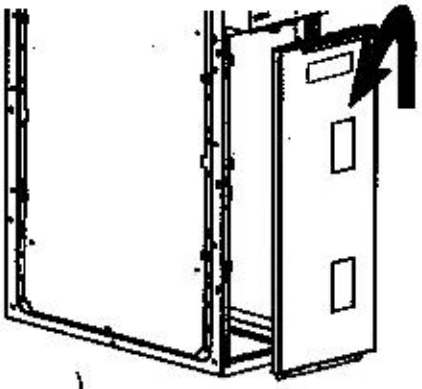
■ *Refit the front panel.*

Vérification pour les cellules QMC-CM-CM2-TM

■ Ne rien laisser dans le compartiment raccordement.
■ Vérifier sur toutes les phases que :
□ le fusible est positionné correctement,
□ le répartiteur de champ est correctement positionné.

Checking for QMC-CM-CM2-TM cubicles

■ *Check that nothing has been left inadvertently in the connection cabinet.*
■ *Check for all phases:*
□ *that the fuse has been properly fitted,*
□ *that the field distributor have been properly positioned on all phases.*



■ Remettre le panneau avant en place.

■ *Refit the front panel.*

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Vérification avant mise sous tension
Checking prior to energisation

Vérification pour les cellules DMV-A/DMV-D/DMV-S

■ Ne rien laisser dans le compartiment raccordement.

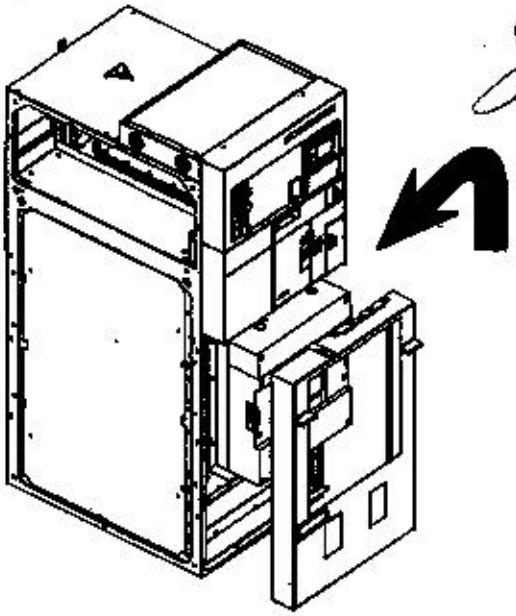
■ Remettre le panneau avant A en place.

Pour les cellules DM1-D remettre les 2 vis A.

Checking for DMV-A/DMV-D/ DMV-S cubicles

■ *Check that nothing has been left inadvertently in the connection cabinet.*
■ *Refit the front panel A in place.*

For the DM1-D refit the 2 bolts A.

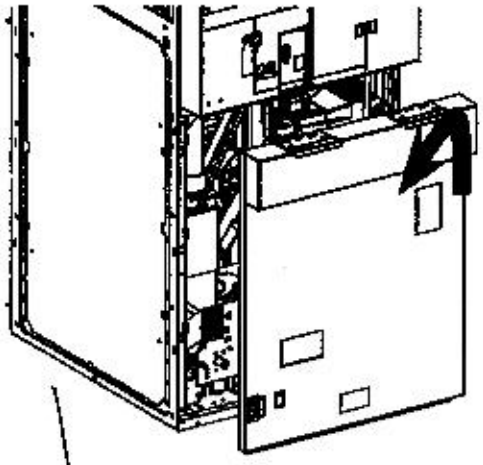


Vérification pour les cellules CVM

■ Ne rien laisser dans le compartiment raccordement.
■ Vérifier sur toutes les phases que le fusible est positionné correctement (si version avec fusibles).

Checking for CVM cubicles

■ *Check that nothing has been left inadvertently in the connection cabinet.*
■ *For fuse versions, check that the fuses are correctly fitted on all phases.*



■ Remettre le panneau avant en place.

■ *Refit the front panel.*

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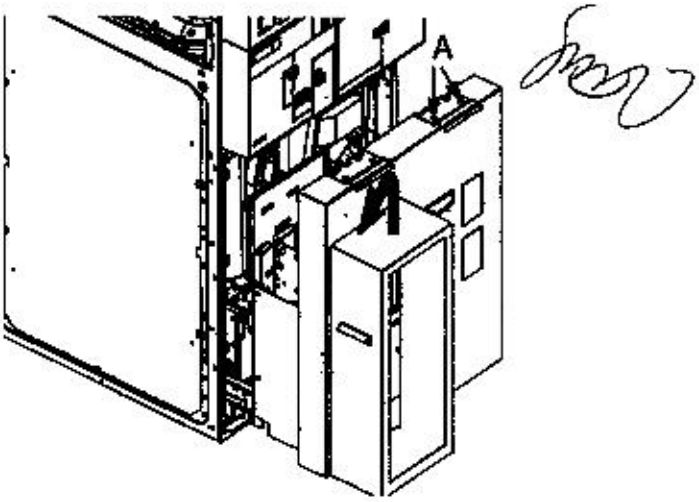
Vérification avant mise sous tension
Checking prior to energisation

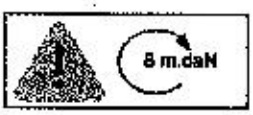
Vérification pour les cellules DM1/DM2/DMVL

- Ne rien laisser dans le compartiment raccordement.

Checking for DM1/DM2/DMVL cubicles

- *Check that nothing has been left inadvertently in the connection cabinet.*





Vérification pour les cellules NSM

- Ne rien laisser dans le compartiment raccordement.
- Remettre le panneau avant en place.
- Vérifier que le relais de permutation soit opérationnel.

Checking for NSM cubicles

- *Check that nothing has been left inadvertently in the connection cabinet.*
- *Refit the front panel in place.*
- *Check that the changeover relay is operational.*

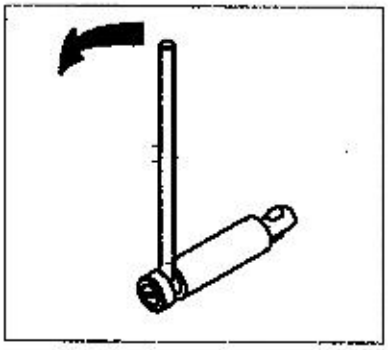
Manoeuvre de l'appareil hors tension
Operating the equipment when de-energised

Position du levier de manoeuvre du sectionneur de ligne

Line disconnector operating lever positions

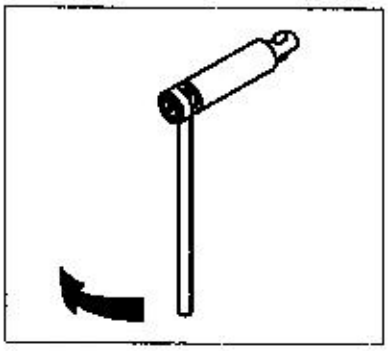
Positionner le levier comme indiqué, pour les manoeuvres vers le bas.

Position the lever as indicated for downward operations.



Positionner le levier comme indiqué, pour les manoeuvres vers le haut.

Position the lever as indicated for upward operations.



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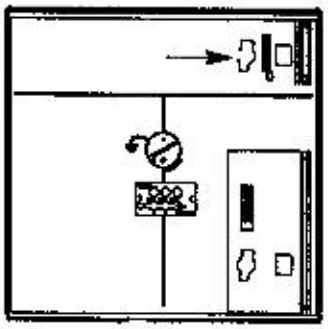
Manoeuvre de l'appareil hors tension
Operating the equipment when de-energised

Cellule IMC/QMC

IMC/QMC cubicle

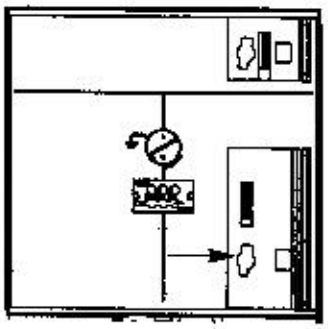
■ Effectuer quelques manoeuvres du sectionneur de terre.

■ *Operate the earthing switch several times.*



■ Effectuer quelques manoeuvre de l'interrupteur.

■ *Operate the switch several times.*

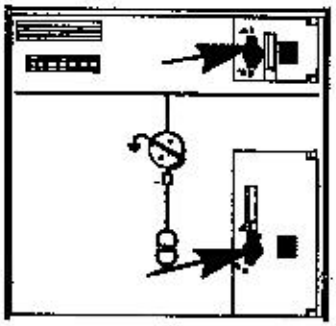


Cellule CM/CM2/TM

CM/CM2/TM cubicle

■ Effectuer quelques manoeuvres du sectionneur et du sectionneur de terre.

■ *Operate the disconnector and the earthing switch several times.*



Manoeuvres d'exploitation
Operating instructions

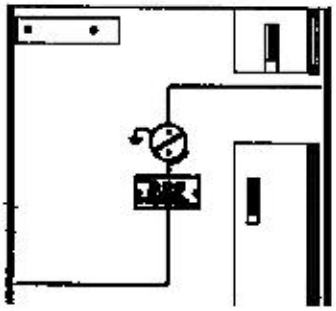
Manoeuvre de l'appareil hors tension
Operating the equipment when de-energised

Cellule IMB

■ Effectuer quelques manoeuvres du sectionneur de terre et de l'interrupteur.

IMB cubicle

■ *Operate the switch and the earthing switch several times.*

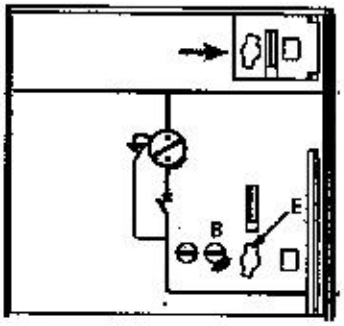


Cellule DM1-DMVL

■ Effectuer quelques manoeuvres du sectionneur de terre.

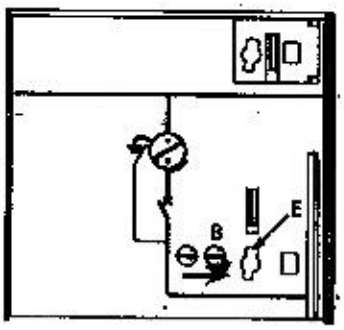
DM1-DMVL cubicle

■ *Operate the earthing switch several times.*



■ Effectuer quelques manoeuvre de l'interrupteur.

■ *Operate the switch several times.*



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ТЕХНИК ЕНЕРДЖИ ЕООД

Manoeuvres d'exploitation
Operating instructions

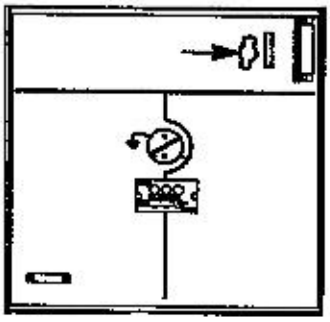
Manoeuvre de l'appareil hors tension
Operating the equipment when de-energised

Cellule GAM

■ Effectuer quelques manoeuvres du sectionneur de terre.

GAM cubicle

■ *Operate the earthing switch several times.*

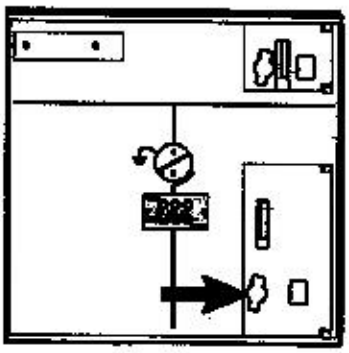


Cellule IM

■ Effectuer quelques manoeuvres du sectionneur de terre.

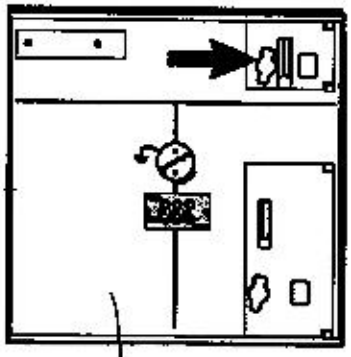
IM cubicle

■ *Operate the earthing switch several times.*



■ Effectuer quelques manoeuvre de l'interrupteur.

■ *Operate the switch several times.*



ВЯРНО С ОРИГИНАЛА!

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Manoeuvres d'exploitation
Operating instructions

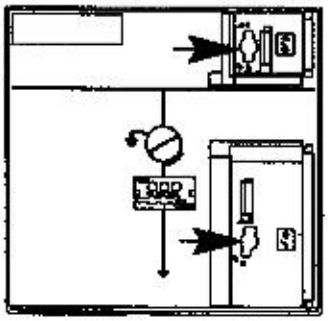
Manoeuvre de l'appareil hors tension
Operating the equipment when de-energised

Cellule SM

■ Effectuer quelques manoeuvres du sectionneur et du sectionneur de terre.

SM cubicle

■ *Operate the disconnector and the earthing switch several times*

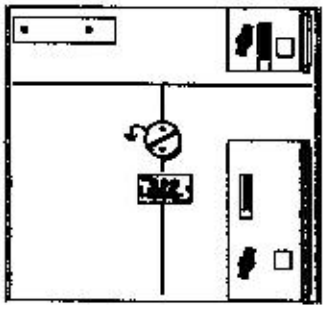


Cellules IM/PM/QM

■ Face avant commande CIT.

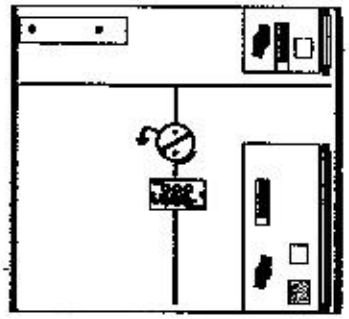
IM/PM/QM cubicles

■ *CIT operating mechanism front plate.*



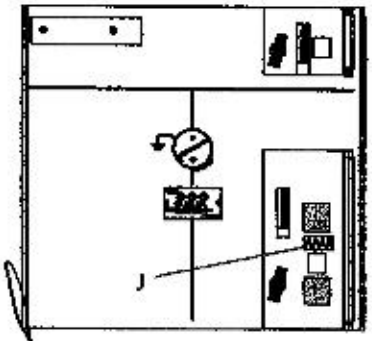
■ Face avant commande CI1.

■ *CI1 operating mechanism front plate.*



■ Face avant commande CI2.
J : identification de l'état d'armement.

■ *CI2 operating mechanism front plate...*



Schneider Electric

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Manoeuvres d'exploitation
Operating instructions

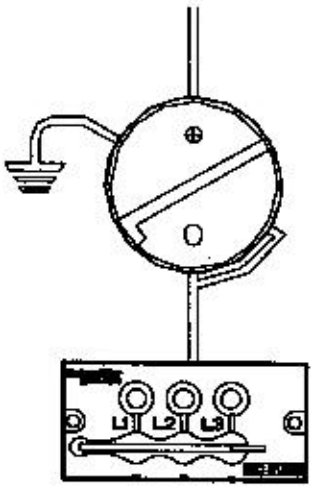
Manoeuvre de l'appareil hors tension
Operating the equipment when de-energised

Mise sous tension des câbles arrivée en MT

Energising the MV incoming cables

Les appareils doivent être en position ouvert.

The devices must be in the open position times.



ВЯРНО С ОРИГИНАЛА

"TECHNIC ENERGY" LTD

Manoeuvres d'exploitation **VPIS**
Operating instructions ***VPIS***

Présentation du VPIS-V2

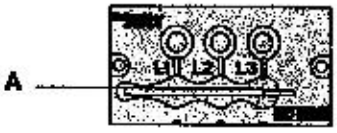
VPIS : Voltage Presence Indicating System, boîtier comprenant 3 lampes intégrées.

A : VPIS-V2

Presentation of VPIS-V2

VPIS: Voltage Presence Indicating System, a case with 3 built -in lights.

A : VPIS-V2



Caractéristiques
Conforme à la norme CEI 61958, relative à la présence de tension.

Characteristics
Conforming to IEC 61958, relative to voltage presence.

Instruction d'emploi

DANGER

L'indication d'un VPIS-V2, à elle seule, est insuffisante pour s'assurer que le système est hors tension.

Operating instructions

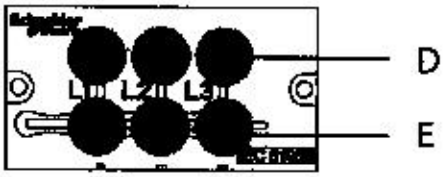
DANGER

The indication provided by a VPIS-V2 alone is not sufficient to ensure that the systemis de-energised.

En présence d'un éclairage ambiant extrêmement brillant, il peut être nécessaire d'améliorer la visibilité en protégeant l'indication.
When the ambient lighting is particularly bright, it may be necessary to improve visibility by protecting the indication

D : lampe indicateur présence de tension (une pour chaque phase);.
E : point de connexions permettant de connecter un comparateur de phase (un pour chaque phase).

D : voltage presence indicator light (one for each phase).
E : connection point designed for the connection of a phase concordance unit (one for each phase).



ВЯРНО С ОРИГИНАЛА!

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Manoeuvres d'exploitation
Operating instructions

Règles d'utilisation des comparateurs de phases
Rules for the use of phase concordance unit

Test de concordance de phases

Les 3 voyants du VPIS étant allumés et le comparateur étant adapté, l'opération de contrôle de concordance de phases peut être réalisée.

Phase concordance test

The 3 indicator lights of the VPIS are lit and the phase concordance unit is correct, meaning that the phase concordance test can be performed.

Lexique

Glossary

LED du comparateur allumée / *phase concordance unit LED lit*

LED éteinte/ *LED unlit*

	L1	L2	L3	
L1	○	☀	☀	Le raccordement est satisfaisant / *Connection is satisfactory*
L2	☀	○	☀	
L3	☀	☀	○	
L1	☀	○	☀	Il faut inverser les câbles MT raccordés sur L1 et L2 de l'une des 2 unités fonctionnelles / *Reverse the MV cables connected to L1 and L2 on one of the 2 functional units.*
L2	○	☀	☀	
L3	☀	☀	○	
L1	○	☀	☀	Il faut inverser les câbles MT raccordés sur L2 et L3 de l'une des 2 unités fonctionnelles / *Reverse the MV cables connected to L2 and L3 on one of the 2 functional units*
L2	☀	☀	○	
L3	☀	○	☀	
L1	☀	☀	○	Il faut inverser les câbles MT raccordés sur L1 et L3 de l'une des 2 unités fonctionnelles / *Reverse the MV cables connected to L1 and L3 on one of the 2 functional units*
L2	☀	○	☀	
L3	○	☀	☀	
L1	☀	○	☀	Il faut changer la place de chaque câble MT sur l'une des 2 unités fonctionnelles / *Change the position of each MV cable on one of the 2 functional units*
L2	☀	☀	○	
L3	○	☀	☀	
L1	☀	☀	○	Il faut changer la place de chaque câble MT sur l'une des 2 unités fonctionnelles / *Change the position of each MV cable on one of the 2 functional units*
L2	○	☀	☀	
L3	☀	○	☀	

Manoeuvres d'exploitation
Operating instructions

Manoeuvres à vide
Off–load operations

Manoeuvres à vide du disjoncteur pour les cellules DMV-L/DM1/DM2/ DMV-A/DMV-D/DMV-S/DM1-W/DM1-S

Circuit-breaker off-load operations for DMV-L/DM1/DM2/DMV-A/DMV-D/ DMV-S/DM1-W/DM1-S cubicles

Etat de départ :

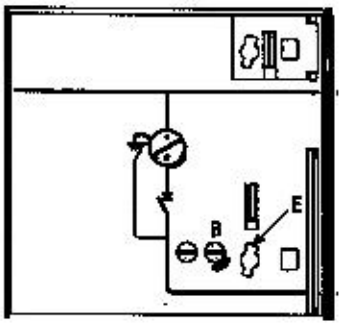
Initial conditions:

Le sectionneur de ligne est en position ouvert ou terre.
Le disjoncteur est verrouillé ouvert.

Line disconnector in closed position.
Circuit breaker in closed position.

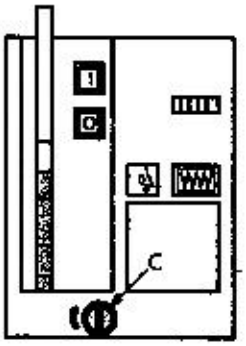
■ Verrouiller l'entrée de levier E du sectionneur de ligne avec la clé en B.

■ *Lock the lever entry E of the line disconnector with the wrench in B.*



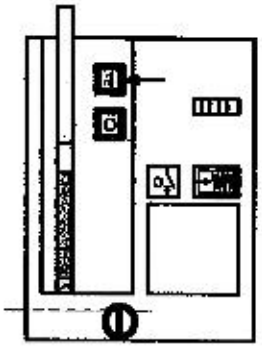
■ Retirer le clé en B puis la placer en C.
■ Déverrouiller puis armer le disjoncteur.

■ *Remove the wrench in B then place it in C.*
■ *Release then charge the circuit –breaker.*



■ Fermer le disjoncteur en appuyant sur la bouton poussoir I.

■ *Close the circuit -breaker by pressing the pushbutton I.*



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ВЯРНО С ОРИГИНАЛА

"ТЕХНИК ЕНЕРДЖИ" ЕООД БУРГАС

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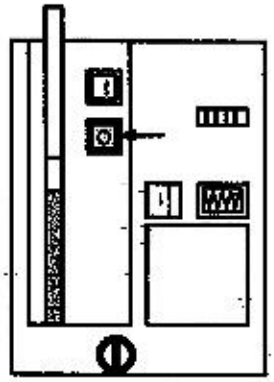
Manoeuvres à vide
Off–load operations

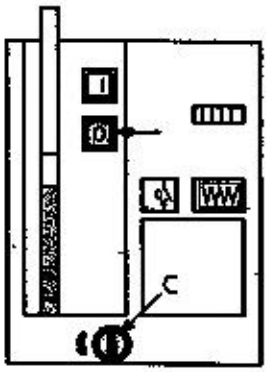
■ Ouvrir le disjoncteur en appuyant sur le bouton poussoir O.

■ *Open the circuit -breaker by pressing the pushbutton O.*



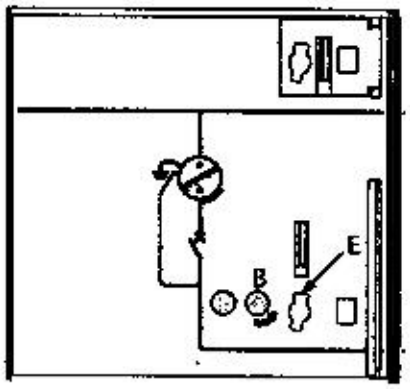
■ Verrouiller le disjoncteur ouvert avec la clé en C en appuyant sur le bouton poussoir O.

■ *Lock the circuit –breaker in the open position in C by pressing the pushbutton O.*



■ Retirer la clé en C puis la placer en B.
■ Déverrouiller l'entrée de levier E du sectionneur de ligne.

■ *Remove the key in C and place it in B.*
■ *Release the lever entry E of the line disconnector.*



Mise sous tension
Energisation

Mise sous tension de la partie aval de l'installation pour les cellules DMV-L/DM1/DM2/DMV-A/DMV-D/DMV-S/DM1-W/DM1-S

Energisation of the downstream part of the installation for DMV-L/DM1/DM2/DMV-A/DMV-D/DMV-S/DM1-W/DM1-S cubicles

Etat de départ :

Initial conditions:

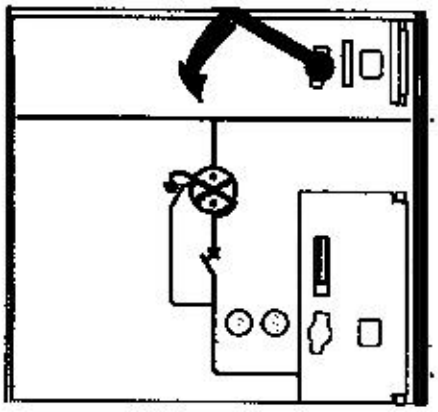
Le sectionneur de ligne est en position terre / *Line disconnector in closed position.*
Le disjoncteur est verrouillé ouvert / *Circuit breaker in closed position.*
Le panneau avant est en place / *The front panel is in place.*

- Passer le sectionneur de ligne en position ouvert à l'aide du levier de manoeuvre.

- *Move the line disconnector to the open position using the operating lever.*

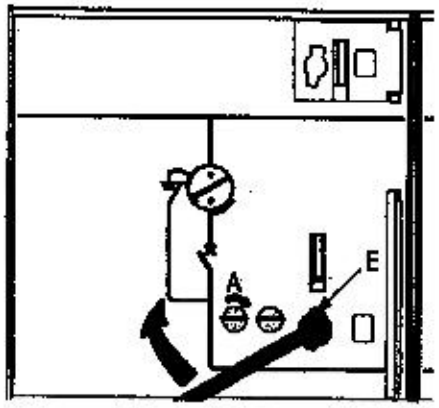
Le sectionneur de terre aval s'ouvre simultanément sauf pour les cellules DMVL-D, DM1-D et DM2.

The downstream earthing switch opens simultaneously expect DMVL-D, DM1-D and DM2 cubicles



- Passer le sectionneur de ligne en position fermé puis, verrouiller l'entrée E du sectionneur de ligne avec la clé en A.

- *Move the line disconnector to the closed position then lock the entry E of the line disconnector with the wrench in A.*

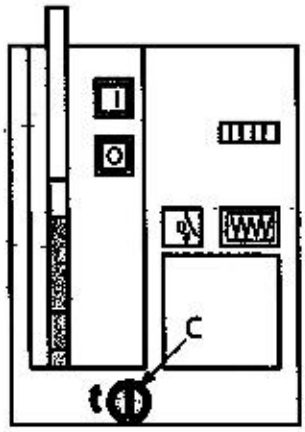


Manoeuvres d'exploitation
Operating instructions

Mise sous tension
Energisation

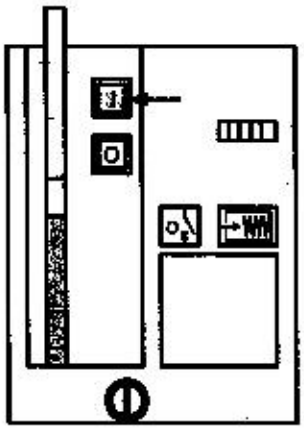
■ Retirer la clé en A, la placer en C puis déverrouiller le disjoncteur.
■ Armer ce dernier.

■ *Remove the wrench in A, place it in C and release the circuit -breaker.*
■ *Charge the latter.*



■ Fermer le disjoncteur en appuyant sur le bouton poussoir I.
■ La partie aval de l'installation est sous tension.

■ *Close the circuit -breaker by pressing on pushbutton I.*
■ *The downstream part of the installation is energised.*



Manoeuvres d'exploitation
Operating instructions

Mise hors tension
De–energisation

Mise hors tension de la partie aval de l'installation pour les cellules DMV-L/DM1/DM2/DMV-A/DMV-D/DMV-S/DM1-W/DM1-S

De-energisation of the downstream part of the installation for DMV-L/DM1/DM2/DMV-A/DMV-D/DMV-S/DM1-W/DM1-S cubicles

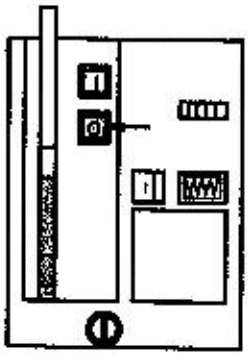
Etat de départ :

Initial conditions:

Le sectionneur de ligne est en position fermé. / *The line disconnector is in the closed position.*
Le disjoncteur est fermé. / *The circuit-breaker is closed.*

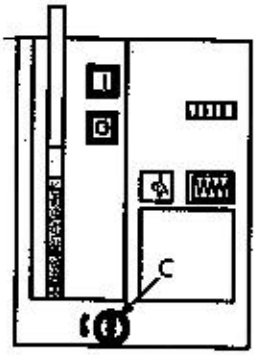
■ Ouvrir le disjoncteur en appuyant sur le bouton poussoir O.

■ *Open the circuit–breaker by pressing the pushbutton O.*



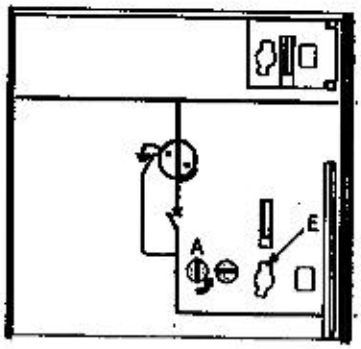
■ Verrouiller le disjoncteur ouvert avec la clé en C en appuyant sur le bouton poussoir O.

■ *Lock the circuit–breaker in the open position with the key in C by pressing the pushbutton O.*



■ Retirer la clé en C puis la placer en A.
■ Déverrouiller l'entrée de levier E du sectionneur de ligne.

■ *Remove the wrench in C and place it in A.*
■ *Release the lever entry E of the line disconnector.*



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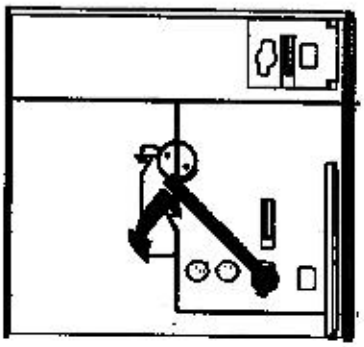
Manoeuvres d'exploitation
Operating instructions

Mise hors tension
De–energisation

■ Passer le sectionneur de ligne en position ouvert.

■ *Move the line disconnector to the open position.*

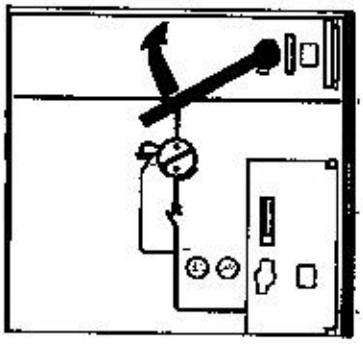


■ Passer le sectionneur de ligne en position terre.
■ Le panneau avant peut être retiré.

■ *Move the line disconnector to the earth position.*
■ *The front panel can be removed.*

Le sectionneur de terre aval se ferme simultanément sauf pour les cellules DMVL-D, DM1-D et DM2.

The downstream earthing switch closes simultaneously expect DMVL-D, DM1-D and DM2 cubicles



ВЯРНО С ОРИГИНАЛА!

Manoeuvres d'exploitation
Operating instructions

Désarmement d'une commande CI2
Discharging a CI2 operation mechanism

Désarmement d'une commande CI2 pour les cellules IMC/QMC/IMB/IM/PM/QM

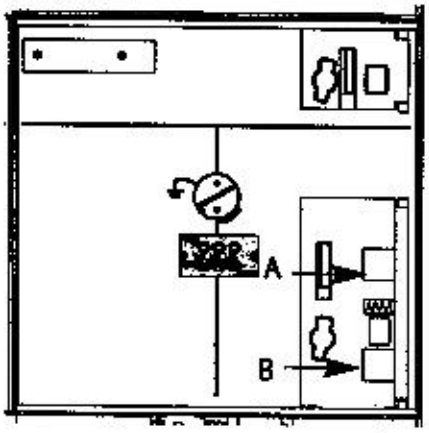
Discharging a CI2 operating mechanism for IMC/QMC/IMB/IM/PM/QM cubicles

Cellule hors tension :

■ Effectuer une fermeture de l'interrupteur : bouton A puis une ouverture : bouton B.

Cubicle de-energised:

■ *Close the switch: button A then open: button B.*



Cellule sous tension :

■ Appuyer sur le bouton B d'ouverture.

Cubicle energised:

■ *Press the open button B.*

ATTENTION

RISQUE DE DETERIORATION DE LA COMMANDE
■ Limiter au strict nécessaire cette manoeuvre.

Le non-respect de ces instructions peut provoquer des blessures ou des dommages matériels.

CAUTION

HAZARD OF DAMAGE TO OPERATING MECHANISM
■ *Perform only when strictly necessary this operation*

Failure to follow these instructions can result in injury or equipment damage.

Manoeuvres d'exploitation
Operating instructions

Manoeuvres manuelles
Manual operations

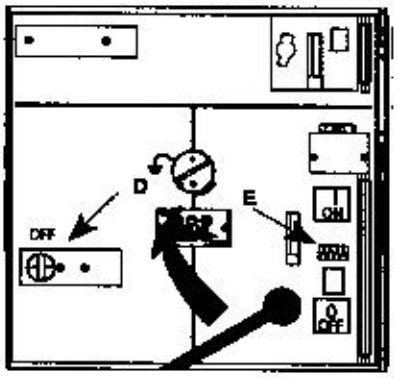
Manoeuvre manuelle des interrupteurs pour les cellules NSM

Manual switch operations for NSM cubicles

Mettre l'automatisme HORS SERVICE avant les manoeuvres manuelles.(agir sur l'automatismes on/off du T200S,voir le manuel de l'utilisateur du T200S n° NT00044 et N° T00045 en Anglais).Sectionneur de terre en position OUVERT / Place the automation OUT OF OPERATION before performing the manual operations (use the switch on the front panel of the relay). Earthing switch in the OPEN position.

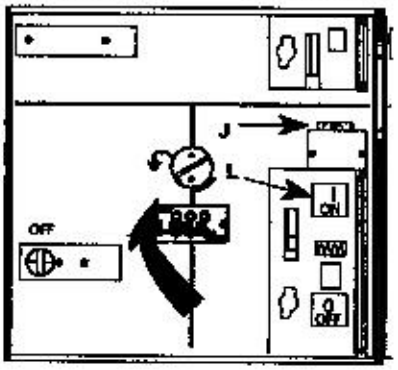
- Armement manuel d'une commande.
- Bouton D en position OFF.
- Armement du ressort.
- La signalisation E change d'état.

- *Manual charging of an operating mechanism.*
- *Button D in the OFF Position.*
- *Charging the spring.*
- *The indicating device E changes status.*



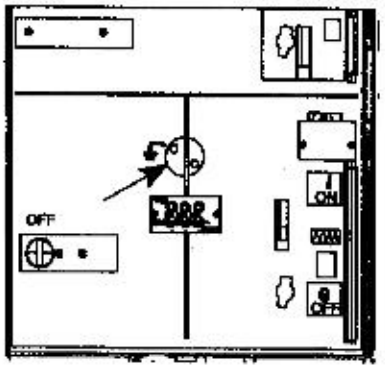
- Fermeture d'un interrupteur après armement de la commande.
- Sélectionner à l'aide du doigt J l'interrupteur à manoeuvrer (côté droit ou gauche).
- Appuyer sur le bouton L de l'interrupteur choisi.

- *Closing a switch after charging the operating mechanism.*
- *Select the switch to be operated using finger J (right or left side).*
- *Press button L of the chosen switch.*



Visualisation : interrupteur fermé.

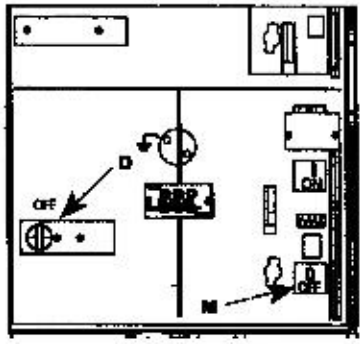
Visualisation: switch closed.



Manoeuvres manuelles
Manual operations

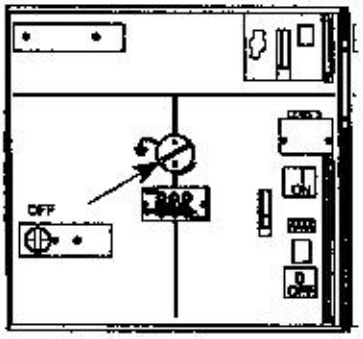
- Ouverture manuelle d'un interrupteur.
- Bouton D en position OFF.
- Appuyer sur le bouton M.

- *Manual opening of a switch.*
- *Button D in the OFF position.*
- *Press button M.*



Visualisation : Interrupteur ouvert.

Visualisation: switch open.



Désarmement d'une commande CI2 pour les cellules NSM

Discharging a CI2 operating mechanism for NSM cubicles

Première méthode : désarmement

ATTENTION

RISQUE DE DETERIORATION DE LA COMMANDE
- Limiter au strict nécessaire cette manoeuvre.

Le non-respect de ces instructions peut provoquer des blessures ou des dommages matériels.

First method: direct uncharging:

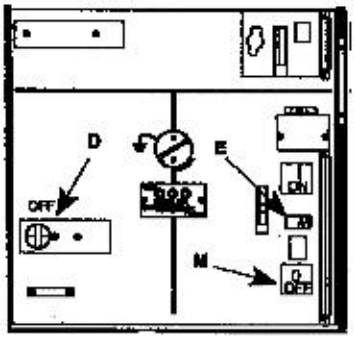
CAUTION

HAZARD OF DAMAGE TO OPERATING MECHANISM
- *Perform only when strictly necessary this operation*

Failure to follow these instructions can result in injury or equipment damage.

- Bouton D en position OFF.
- Appuyer sur le bouton M.
- La signalisation E change d'état.

- *Button D in the OFF position.*
- *Press button M.*
- *The indicating device E changes status.*



Dans le cas de manoeuvres avec cellule hors tension préférer la deuxième méthode.
When operating with cubicle off power, the second method should be preferred.

ВЯРНО С ОРИГИНАЛА!

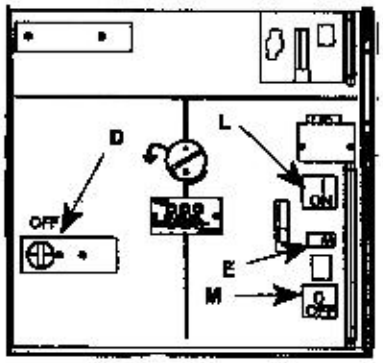
Manoeuvres manuelles
Manual operations

Deuxième méthode : désarmement après cycle fermeture/ouverture de l'interrupteur

- Bouton D en position OFF.
- Sélectionner l'interrupteur et appuyer sur le bouton L (fermeture de l'interrupteur).
- Appuyer sur le bouton M (ouverture de l'interrupteur).
- La signalisation E change d'état.

Second method: uncharging after switch opening/closing cycle.

- *Button D in the OFFposition.*
- *Select the switch and press button L (switch closes).*
- *Press button M (switch opens).*
- *The indicating device E changes status.*



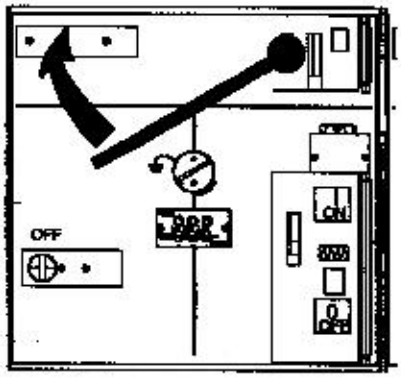
Manoeuvres du sectionneur de mise à la terre pour les cellules NSM

Operating the earthing switch for NSM cubicles

Les manoeuvres ne peuvent s'effectuer que si la commande de l'interrupteur est en position ouvert désarmé / *The operations can only be performed if the switch operating mechanism is in the open uncharged position*

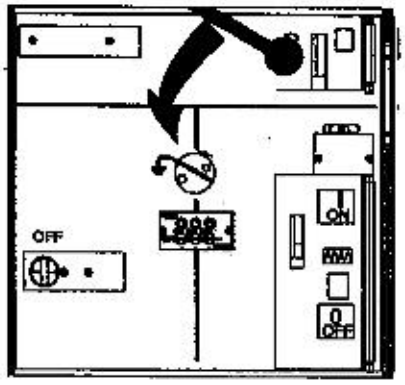
- Fermeture du sectionneur de mise à la terre, après vérification de l'absence de tension. (voir chapitre présence de tension).

- *Closing the earthing switch after checking voltage absence (see voltage presence chapter).*



- Ouverture du sectionneur de mise à la terre.

- *Opening the earthing switch.*



Manoeuvres manuelles
Manual operations

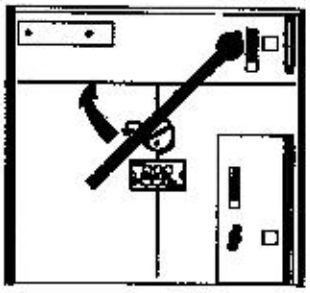
Manoeuvres du sectionneur de mise à la terre pour les cellules IMC/QMC

Operating the earthing switch for IMC/QMC cubicles

Les manoeuvres ne peuvent s'effectuer que si la commande de l'interrupteur est en position ouvert désarmé / The operations can only be performed if the switch operating mechanism is in the open uncharged position.

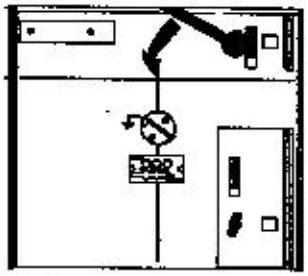
■ Fermeture du sectionneur de mise à la terre (pour commandes CIT / CI1 / CI2) après vérification de l'absence de tension. (voir présence de tension)

■ *Close the earthing switch (for CIT / CI1 / CI2 operating mechanisms) after verifying that there is no voltage present (see presence of voltage)*



■ Ouverture du sectionneur de mise à la terre.

■ *Opening the earthing switch.*

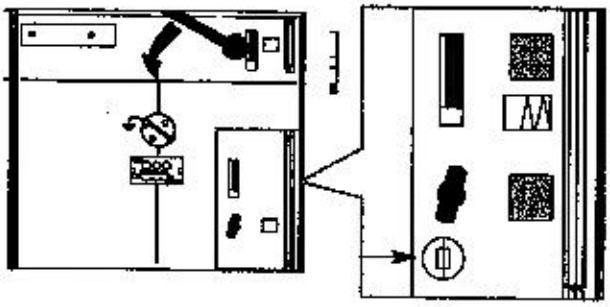


Visualisation de l'état des fusibles pour les cellules QMC/CM/CM2/TM

QMC/CM/CM2/TM cubicles fuse status indication

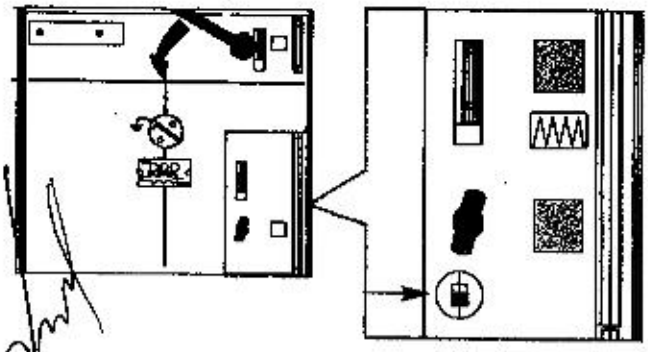
■ Fusibles en état de marche (voyant blanc)

■ *Fuses serviceable (white indicator)*



■ Un ou plusieurs fusibles hors services (voyant rouge)

■ *At least one fuse unserviceable (red indicator)*



Extraction du disjoncteur
Withdrawing the circuit-breaker

Extraction du disjoncteur pour la cellule DM1-W

Etat de départ :

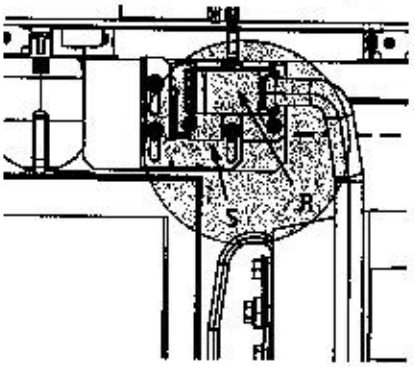
Withdrawing the circuit-breaker for DM1-W cubicle

Initial conditions:

Le sectionneur de ligne est en position terre / *The line disconnector is in the earthed position.*
Panneau avant enlevé. Vis de maintien du disjoncteur pour le transport enlevée (voir sous chapitre vérification avant mise sous tension) / *Front panel removed. Bolt securing the circuit breaker for transport removed. (see section on checks before energising)*

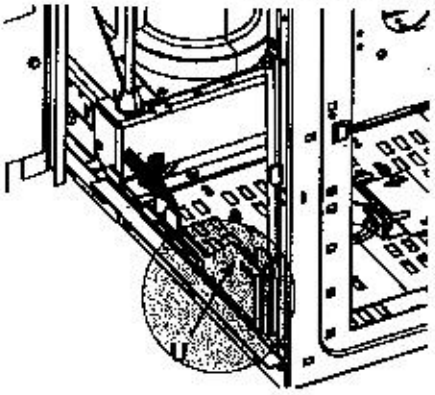
■ Retirer la prise R de raccordement des auxiliaires basse tension du disjoncteur.
■ Le verrou S remonte et vient empêcher la remise en place du panneau avant.

■ *Unplug the circuit breaker low voltage auxiliaries connector R.*
■ *The lock S move upwards to prevent the refitting of the front panel.*



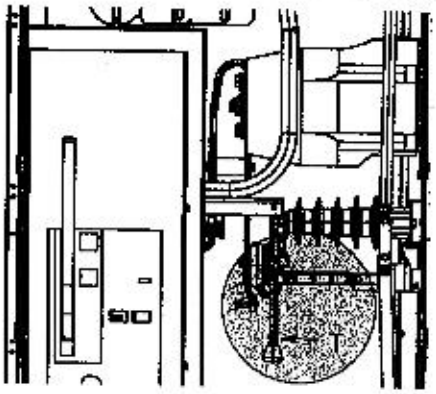
■ Effacer le verrou U.

■ *Disengage the lock U.*



■ Tirer sur le levier T pour dégager le disjoncteur des pinces d'embrochage puis le sortir manuellement.

■ *Pull on lever T to disconnect the circuit breaker and then withdraw it manually.*



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Mise en place du disjoncteur
Circuit-breaker installation

Mise en place du disjoncteur pour la cellule DM1-W

Circuit-breaker installation for DM1-W cubicle

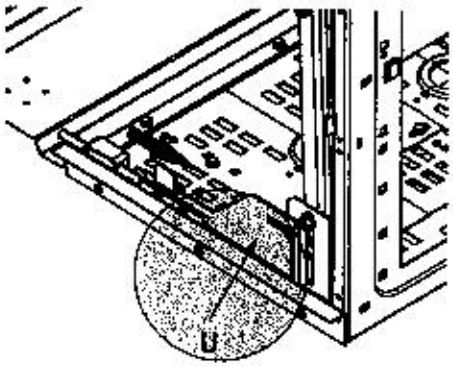
Etat de départ :

Initial conditions:

Le sectionneur de ligne est en position terre / *The line disconnector is in the earthed position.*
Panneau avant enlevé/ *Front panel removed.*

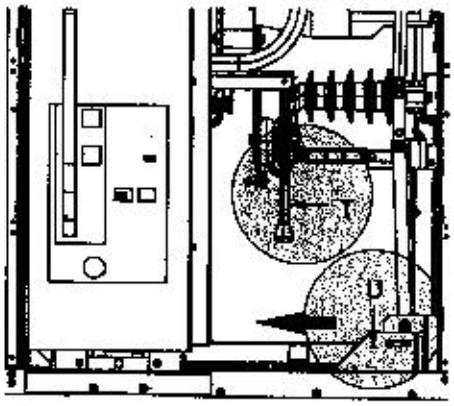
- Effacer le verrou U puis introduire manuellement de disjoncteur jusqu'en butée.

- *Disengage lock U and insert the circuit breaker manually until it is blocked.*



- Pousser le levier T pour embrocher le disjoncteur.
- Activer le verrou U.

- *Push on lever T to connect the circuit breaker.*
- *Reactivate lock U.*

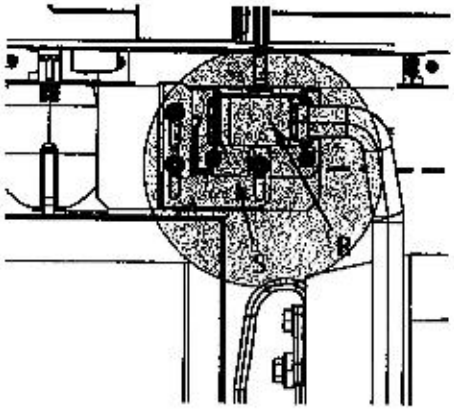


- Relever le verrou S qui empêche la mise en place de la prise de raccordement des auxiliaires basse tension vers le bas.
- Embrocher la prise R.

Remarque : le panneau avant peut être remis en place.

- *Disengage lock S, by moving it downwards, so that the low voltage auxiliaries connector can be plugged in.*
- *Plug-in connector R.*

Note: the front panel can be refitted.



Schneider Electric

Manoeuvres d'exploitation
Operating instructions

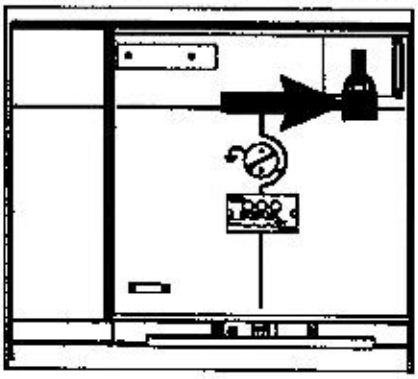
Condamnation par cadenas
Padlocking

Pour les cellules GAM

■ Cadenasser le sectionneur de terre en position ouvert ou fermé par 1, 2 ou 3 cadenas Ø 8 mm.

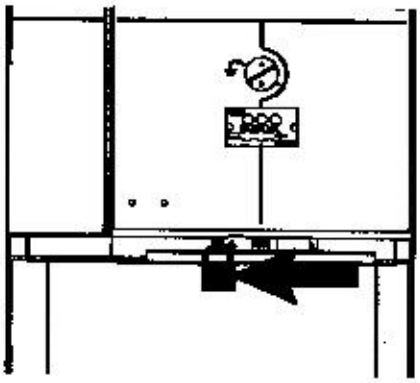
For GAM cubicles

■ *Padlock the earthing switch in open or closed position using 1, 2 or 3 padlocks. (dia. 8 mm).*



■ Condamnation par cadenas du panneau avant.

■ *Padlocking the front panel.*

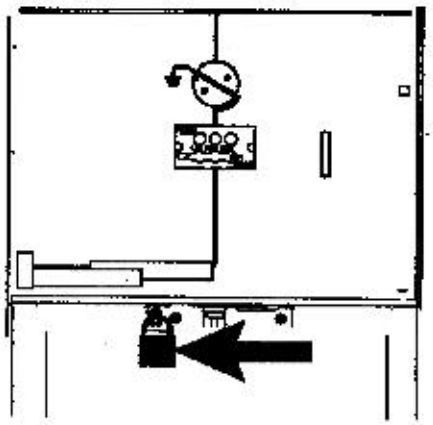


Pour les cellules SM

■ Cadenasser l'interrupteur en position ouvert ou fermé par 1,2 ou 3 cadenas Ø 8 mm.

For SM cubicles

■ *Padlock the switch in open or closed position using 1, 2 or 3 padlocks. (dia. 8 mm).*



Manoeuvres d'exploitation
Operating instructions

Condamnation par cadenas
Padlocking

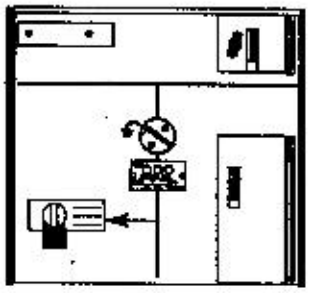
Pour les cellules IMC/QMC/IMB/IM500/IM/PM/QM

For IMC/QMC/IMB/IM500/IM/PM/QM cubicles

Lorsque la cellule est équipée d'une commande CI2, il est possible si nécessaire de désarmer cette dernière (voir chapitres précédents) / If the cubicle is fitted with a CI2 operating mechanism, the latter can be discharged if necessary (see previous sections)

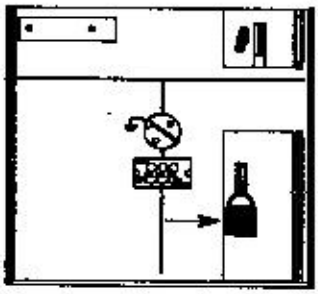
- Cadenassage motorisation (option)
- Cadenasser la motorisation hors service avant ouverture de l'interrupteur.
- Condamnation possible en ou hors service.

- *Padlocking the motor drive (option)*
- *Padlock the motor drive out of service before opening the switch.*
- *It can be padlocked in service or out of service.*



- Cadenasser l'interrupteur en position ouvert ou fermé par 1, 2 ou 3 cadenas Ø 8 mm.

- *Padlock the switch open or closed using 1, 2 or 3–8 mm dia. padlocks.*

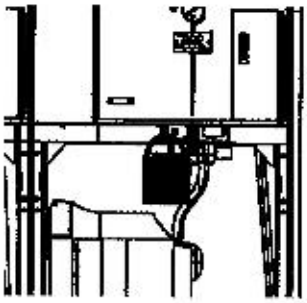


- Cadenasser l'interrupteur en position ouvert ou fermé par 1, 2 ou 3 cadenas Ø 8 mm.

- *Padlock the switch open or closed using 1, 2 or 3–8 mm dia. padlocks.*

- Condamnation par cadenas du panneau avant.

- *Padlocking the front panel.*



Manoeuvres d'exploitation
Operating instructions

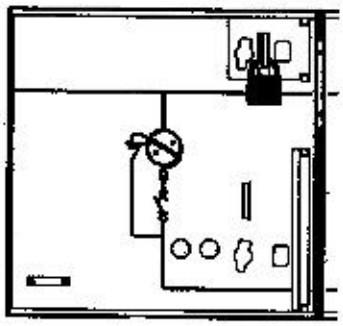
Condamnation par cadenas
Padlocking

Pour les cellules DM1-W/DMV-L/CVM/DM1/DM2/CM/CM2/TM/DMV-S/DMV-A/DMV-D/DM1-S

■ Cadenasser le sectionneur de ligne en position terre, par 1, 2 ou 3 cadenas Ø 8 mm.

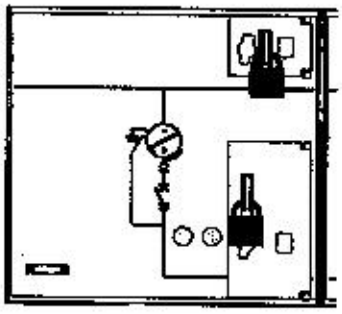
For DM1-W/DMV-L/CVM/DM1/DM2/CM/CM2/TM/DMV-S/DMV-A/DMV-D/DM1-S cubicles

■ *Padlock the line disconnector in earthed position 1, 2 or 3 padlocks. (dia. 8 mm).*



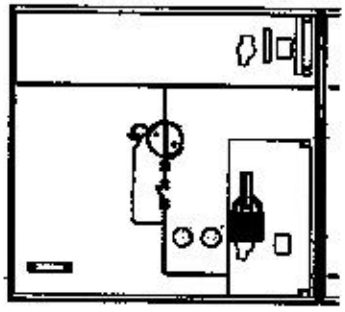
■ Cadenasser le sectionneur de ligne en position ouvert par 1, 2 ou 3 cadenas Ø 8 mm.

■ *Padlock tthe line disconnector in open position. using 1, 2 or 3–8 mm dia. padlocks.*



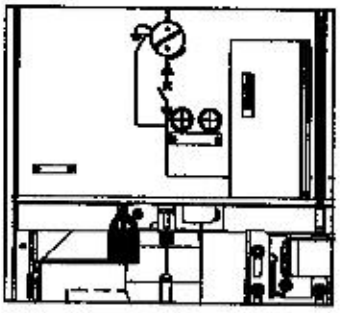
■ Cadenasser le sectionneur de ligne en position fermé par 1, 2 ou 3 cadenas Ø 8 mm.

■ *Padlock tthe line disconnector in closed position. using 1, 2 or 3–8 mm dia. padlocks.*



■ Condamnation par cadenas du panneau avant.

■ *Padlocking the front panel.*



ВЯРНО С ОРИГИНАЛА!

Schneider Electric

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42.3

Manoeuvres d'exploitation
Operating instructions

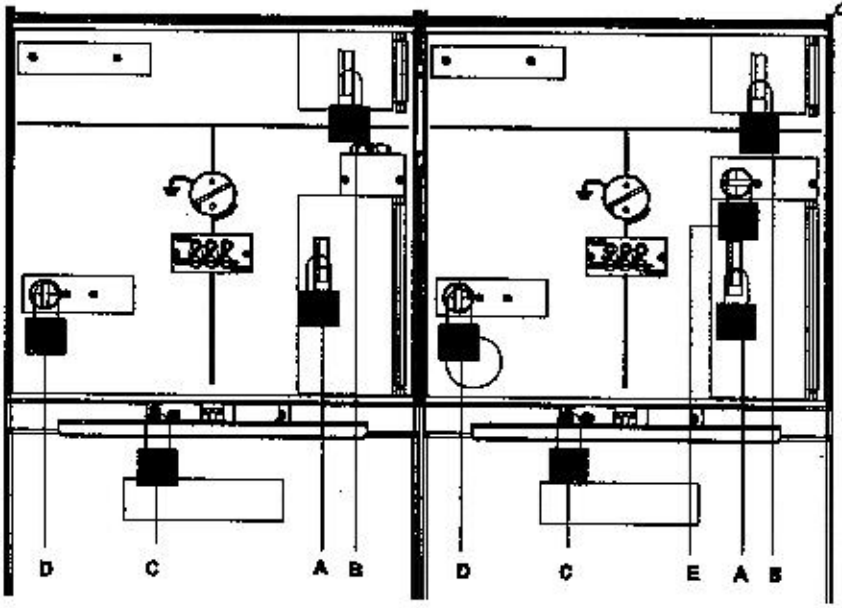
Condamnation par cadenas
Padlocking

Pour les cellules NSM

- Cadenas A : condamne les manoeuvres de l'interrupteur.
- Cadenas B : condamne les manoeuvres du sectionneur de terre.
- Cadenas C : condamne le panneau d'accès au compartiment câbles.
- Cadenas D : condamne l'armement électrique
- de la commande
- Cadenas E : Interdit la mise en parallèle des deux interrupteurs.

For NSM cubicles

- *Padlock A: blocks switch operations.*
- *Padlock B: blocks earthing switch operations.*
- *Padlock C: blocks cable cabinet access panel.*
- *Padlock D: blocks operating mechanism electrical charging.*
- *Padlock E: disables parallel–connection of the two switches.*



ВЯРНО С ОРИГИНАЛА!

Manoeuvres d'exploitation
Operating instructions

Verrouillage par serrures
Keylocks

Voir la notice d'installation et d'exploitation des verrouillages par serrures No 7896785.

See the keyed interlock installation and operating instructions No 7896785.

Pour les cellules DM1-W/DMV-L/DM1/DM2/DMV-S/DMV-A/DMV-D/DM1-S

Pour l'installation d'une serrure sur le disjoncteur, voir la notice de l'appareil concerné.
dans le cas où l'option serrure n'a pas été prévue à la commande faire appel au centre de services du groupe Schneider Electric.

For DM1-W/DMV-L/DM1/DM2/DMV-S/DMV-A/DMV-D/DM1-S cubicles

To install a keylock on the circuit breaker, see the instruction manual for the unit concerned.
If the keylock option was not specified with the order, call the Groupe Schneider Electric service centre

ВЯРНО С ОРИГИНАЛА

Manoeuvres d'exploitation
Operating instructions

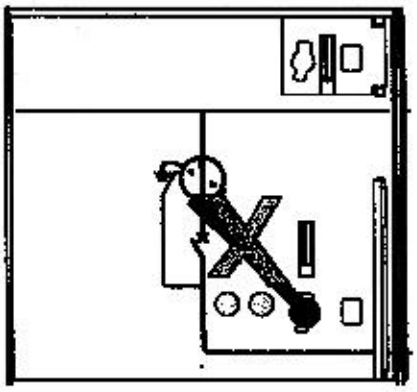
Sécurité d'exploitation
Operating safety

Sécurité d'exploitation DMVL-DM1-DM2-DMVA-DMVD-DMVS-DM1W-DM1S

Operating safety for DMVL-DM1-DM2-DMVA-DMVD-DMVS-DM1W-DM1S cubicles

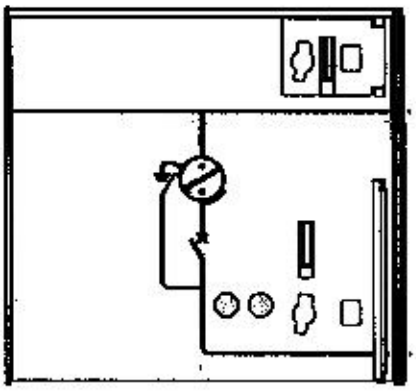
■ Manoeuvre impossible lorsque le disjoncteur est fermé.

■ *Operation impossible when the circuit-breaker is closed.*



■ Sectionneur de ligne en position ouvert ou fermé, il est impossible de retirer le panneau avant.

■ *Line disconnector in the open or closed position. It is impossible to remove the front panel.*



Le panneau avant ne peut être retiré ou mis en place lorsque le sectionneur de ligne en position terre / *The front panel can only be removed or fitted when the line disconnector is in the earth position.*

Panneau avant retiré, il est possible de passer le sectionneur de ligne en position ouvert. Par contre, il est impossible de le passer en position fermé. / *Once the front panel has been removed, you can move the line disconnector to the open position. However, you cannot move it to the closed position.*

ВЯРНО С ОРИГИНАЛА!

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Maintenance corrective
Corrective maintenance

Remplacement des fusibles MT

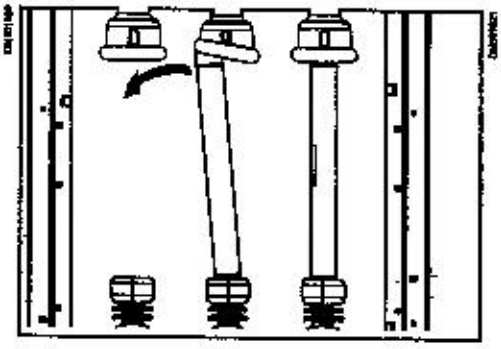
Pour cellules CM, CM2, TM, QMC, PM, QM, CVM

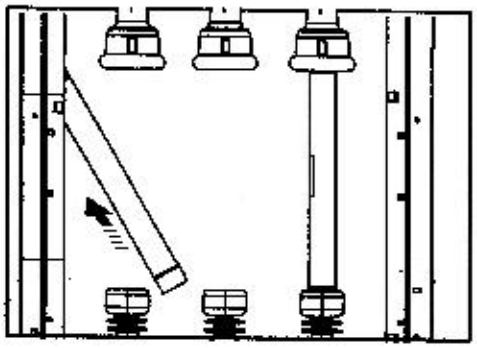
DANGER

- La cellule doit être hors tension
- Sectionneur ouvert
- Sectionneur de terre fermé. Ouvrir le panneau avant pour accès aux fusibles

La norme CEI 282.1 § 23.2 préconise de procéder à l'échange de tous les fusibles MT après fusion de l'un d'entre eux.

Standard IEC 282.1 § 23.2 states that all three of the MV fuses should be changed whenever one of them blows.





- Déboîter le fusible par la partie supérieure.
- Ensuite enlever complètement le fusible par le haut pour la mise en place des nouveaux fusibles.

Replacing the MV fuses

Pour cellules CM, CM2, TM, QMC, PM, QM, CVM

DANGER

- *The cubicle must be de-energized.*
- *The disconnector must be open.*
- *The earthing switch must be closed. Open the front panel for access to the fuses.*

- *First remove the top of the fuse. Then lift the fuse out of its bottom*
- *Support and remove it completely.*

ВЯРНО С ОРИГИНАЛА!

Maintenance corrective
Corrective maintenance

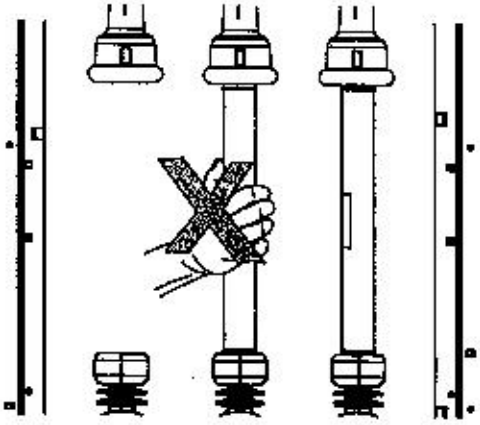
Mise en place des fusibles pour les cellules CM/CM2/TM/QMC/CVM/PM/QM/QMB

Assembly the fuses for CM/CM2/TM/QMC/CVM/PM/QM/QMB

ATTENTION / *CAUTION*

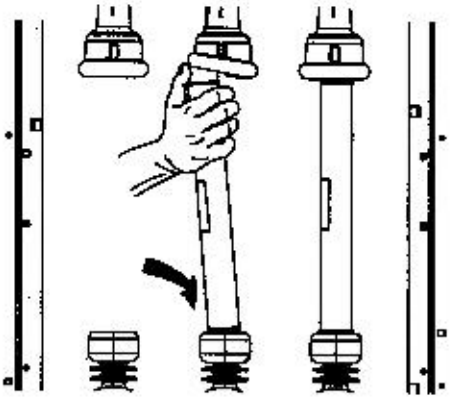
En cas de remplacement d'un fusible, veuillez changer les 3 fusibles à la fois / *When changing a fuse, change all 3 fuses.*
Ne pas réutiliser des fusibles déjà utilisés / *Do not re-used fuses that have already been used.*

La main au milieu du fusible est déconseillée / *We advise against holding the fuse in the middle.*



■ Emboîter la partie inférieure du fusible en butée dans le contact à tulipe inférieur.

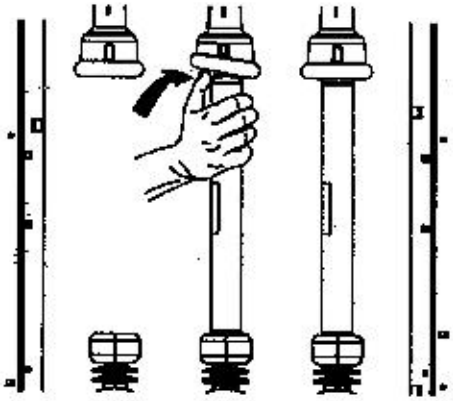
■ Insert the bottom of the fuse all the way into the lower annular contact.



Maintenance corrective
Corrective maintenance

■ Ensuite emboîter la partie supérieure du fusible dans le contact supérieur
■ Vérifier que le répartiteur de champ est correctement replacé.
■ Orienter l'étiquette vers la face avant.

■ Then put the top of the fuse in the upper contact
■ Check that the upper field repartitor is properly placed.
■ Turn the fuse so that the label appears in front.



Sens de montage des fusibles à percuteur

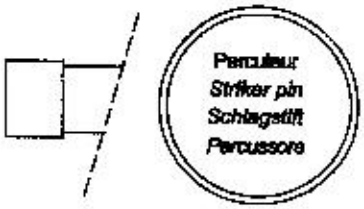
Installer les fusibles à percuteur, dont la fusion provoque le déclenchement de l'interrupteur.

L'extrémité du fusible équipée du percuteur est repérée.

Stricker Fuse mounting direction

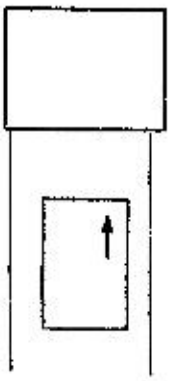
Install the striker fuses which trip the switch when they blow.

The end of the fuse with the striker pin is marked as shown above.



Les caractéristiques et les sens de montage du fusible sont imprimés sur le corps.
Orienter l'étiquette en face avant (percuteur en haut).

The specifications and the mounting orientation of the fuse are printed on the fuse body.
Turn the label to face the front (striker pin at the top).



Maintenance corrective
Corrective maintenance

Pour cellules GBC-A et GBC-B

DANGER

Pour effectuer ce changement, il est impératif avant toute opération de mettre la totalité du tableau MT **hors tension.**

Matériel nécessaire :
- 1 clé de 10.
- 1 perche présence de tension.

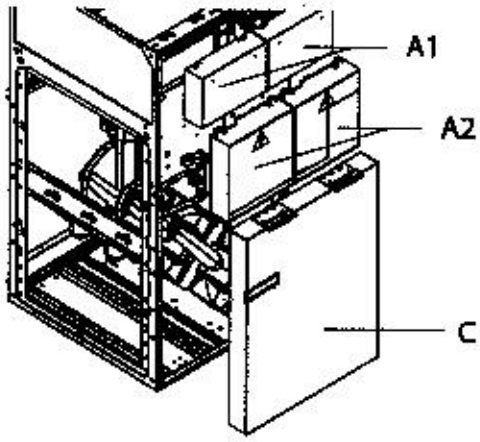
For GBC-A and GBC-B cubicles

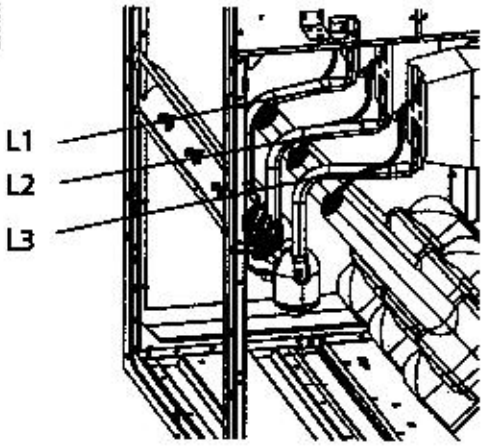
DANGER

To make this change it is imperative to de-energise the entire MV switchboard before any operation.

Equipment required :
- *10 mm wrench*
- *Voltage check rod.*

La norme CEI 282.1 § 23.2 préconise de procéder à l'échange de tous les fusibles MT après fusion de l'un d'entre eux.
Standard IEC 282.1 § 23.2 states that all three of the MV fuses should be changed whenever one of them blows.

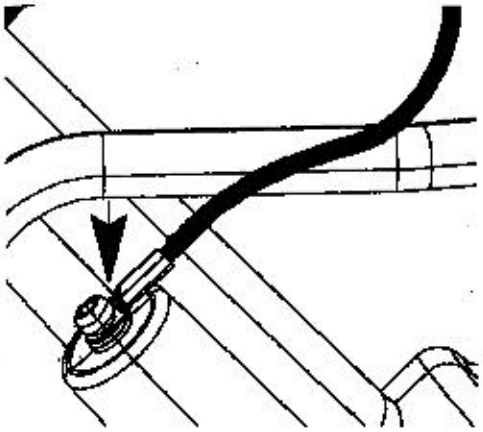


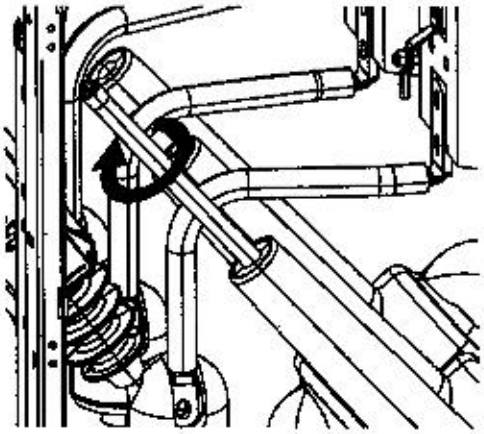


- Déposer les capots A1 et A2 puis le panneau avant C.
- Avant d'accéder à l'intérieur de la cellule, vérifier pour chacune des phases, grâce à la perche présence de tension, l'absence de tension.

- *Remove the covers A1 and A2 then front panel C.*
- *Before accessing the cubicle, check the absence of voltage for each of the phases, using the voltage check rod.*

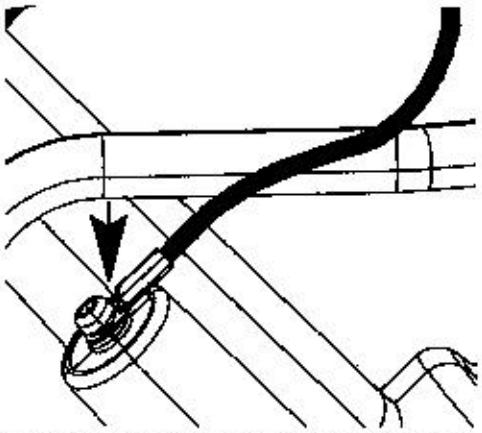
Maintenance corrective
Corrective maintenance

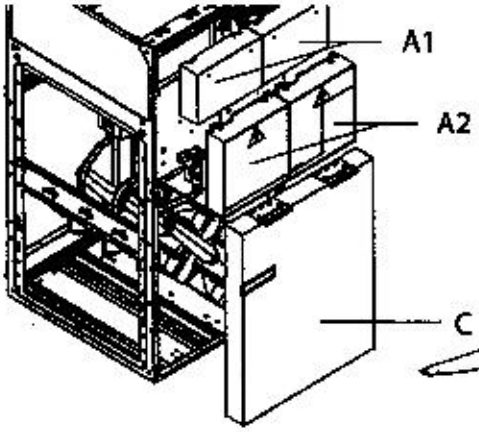




■ Dévisser l'écrou spécial et le fusible à changer.
■ Visser le nouveau fusible dans le puits.

■ *Unscrew the special nut and the fuse to be changed.*
■ *Screw the new fuse into its compartment.*





■ Raccorder le fil venant du transformateur de tension.
■ Visser et serrer modérément l'écrou spécial à la main.

■ *Connect the wire from the voltage transformer.*
■ *Screw and moderately tighten the special nut by hand.*

ATTENTION

Ne rien laisser dans le compartiment jeu de barres.

CAUTION

Do not leave anything in the busbar compartment.

■ Remonter le panneau avant C puis les capots A2 et A1.

■ *Reassemble the front panel C and then the covers A1 and A2.*

Maintenance corrective
Corrective maintenance

Remplacement d'un VPIS-V1 par VPIS-V2

Consignes à respecter

Dans le cas d'une extension tableau équipé poste de boîtier de présence de tension VPIS-V1 : le remplacement doit être effectué pour l'ensemble des VPIS-V1 présents sur le poste afin de conserver la possibilité de comparer les phases sur l'ensemble des cellules du tableau.

Replacing the VPIS-V1 by VPIS-V2

Instructions to be respected

For extension of switchboard equipped with a VPIS-V1 voltage presence unit: all the VPIS-V1 in the cubicle must be replaced in order to be able to compare the phases for all the cubicles in the switchboard.

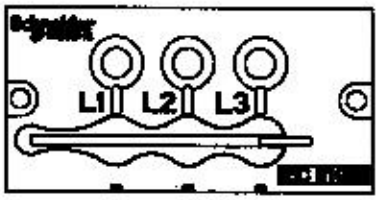
Constitution du kit VPIS-V2

1 : Boîtier indicateur
2 : Joints passe fils
3 : Protection VPIS-V2
4 : Vis (x 4)

Contents of the kit VPIS-V2

1 : Indicator unit
2 : Cable gland seals
3 : VPIS-V2 safety
4 : Screws (x4)

1



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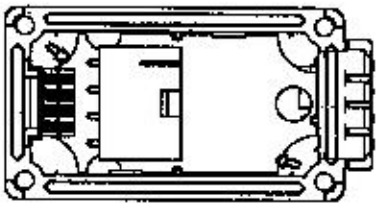
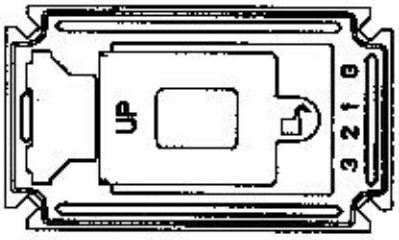


3



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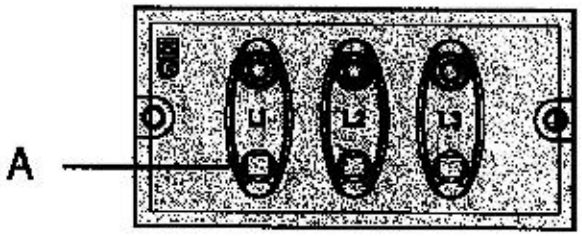
[redacted]

1 La visserie est récupérée sur la première dépose. (2 vis auto-taraudeuses).
The screws removed earlier are reused. (2 self-tapping screws).

Maintenance corrective
Corrective maintenance

Dépose du boîtier présence de tension VPIS-V1

Removing the VPIS-V1 voltage presence unit



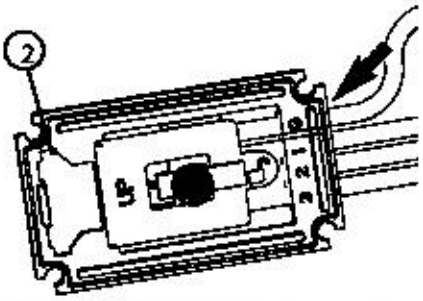
■ Déposer les 2 vis en face avant

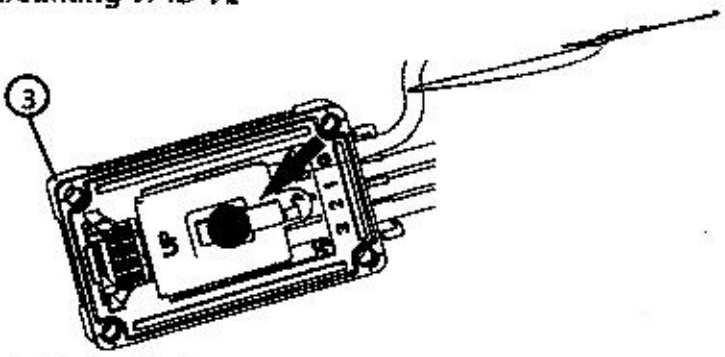
■ *Remove the 2 screws from the front panel.*

La visserie est récupérée sur la première dépose.
The screws removed earlier are reused.

Montage du VPIS-V2

Mounting VPIS-V2





■ Positionner le joint passe fils (2) sur la connexion de la présence de tension (5).
■ Cliper le connecteur du faisceau (5) sur la protection (3) VPIS-V2, en mettant le joint en place.

■ *Position the cable gland seal (2) on the voltage presence connection (5).*
■ *Clip the cable harness connector (5) onto the VPIS-V2 safety (3) and fit the seal.*

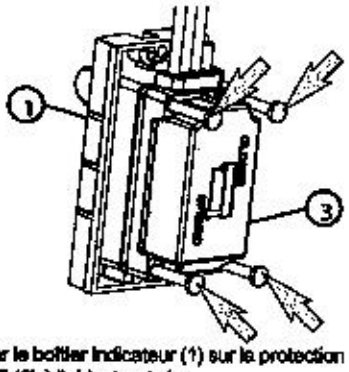
A vérifier avant de continuer l'intervention

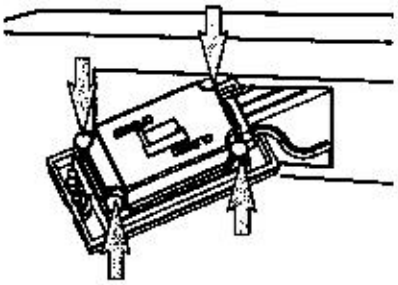
Vérifier l'état du faisceau (5) et le calibre du VPIS-V2 en utilisant l'outil diagnostic (VPI62420) optionnel (non livré dans le kit) ou voir tableau de correspondance ci-dessous.

Checks to be made before continuing with the operation

Check the condition of the wiring harness (5) and the VPIS-V2 rating using the optional diagnostic tool (VPI62420) (not included in the kit) or see correspondence table below.

	VPI62403 VPI62413		VPI62404 VPI62414		VPI62405 VPI62415		VPI62407 VPI62417		VPI62408 VPI62418	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
	2 kV	3 kV	3,1 kV	5,9 kV	6 kV	8,9 kV	9 kV	17,9 kV	18 kV	25 kV
	Tension de service mini et maxi pour utilisation en 50Hz et 60Hz. / *Minimum and maximum operating voltage for usage in 50Hz and 60Hz.*									





■ Visser le boîtier indicateur (1) sur la protection VPIS-V2 (3) à l'aide des 4 vis.

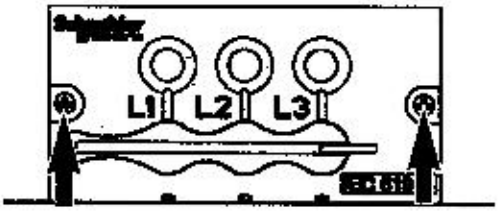
■ *Screw the indicator unit (1) onto the VPIS-V2 safety (3) using the 4 screws.*

ATTENTION

Serrer les vis jusqu'à exercer une légère pression sur le joint passe fils, sans que ce dernier soit déformé.

CAUTION

Tighten the screws to exert slight pressure on the cable gland seal without distorting it.



■ Positionner le boîtier présence de tension en lieu et place, utiliser les 2 vis auto-taraudeuses du démontage précédent.

■ *Install the voltage presence unit in the correct position using the 2 self-tapping screws removed earlier.*

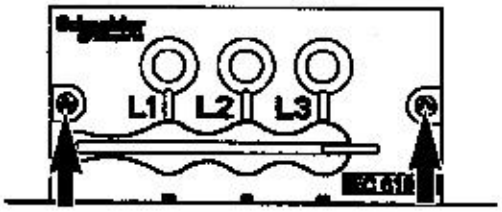
Maintenance corrective
Corrective maintenance

Remplacement du VPIS-V2 par un VPIS-V2

Replacement of VPIS-V2 by VPIS-V2

Dépose du boîtier présence de tension VPIS-V2

Removing the VPIS-V2 voltage presence unit

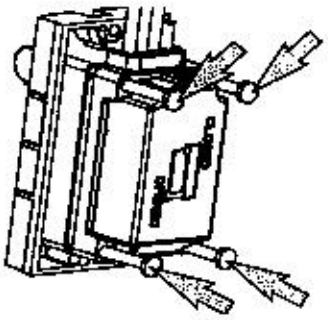


- Déposer les 2 vis en face avant
- *Remove the 2 screws from the front panel.*

La visserie est récupérée sur la première dépose.
The screws removed earlier are reused.

Montage du boîtier présence de tension VPIS-V2

Mounting the VPIS-V2 voltage presence unit



- Extraire le boîtier.
- Enlever les 4 vis du boîtier indicateur.
- Jeter le boîtier HS. Laisser en place la protection et le joint existant.

- *Remove the unit.*
- *Remove the 4 screws from the indicator unit.*
- *Discard the faulty indicator unit. Leave the existing safety and seal.*

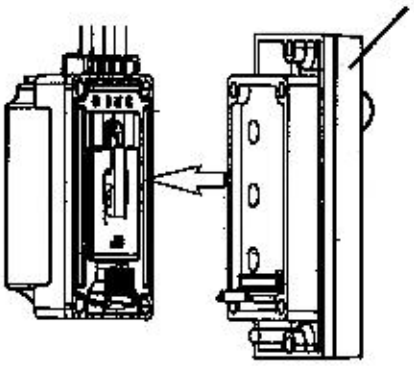
Maintenance corrective
Corrective maintenance

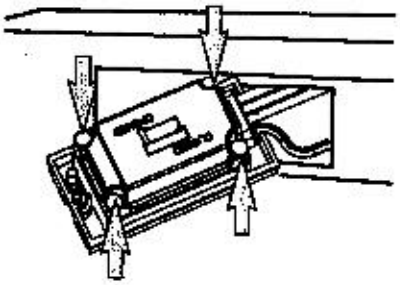
ATTENTION

Seul le boîtier indicateur (1) est à changer. Pour le recyclage des produits en fin de vie, contacter la filière de Schneider Electric.

CAUTION

Only the indicator unit (1) is to be changed. Contact the Schneider Electric administration for recycling products at the end of their service life.





- Mettre en place le nouveau boîtier indicateur présence de tension.
- Revisser les 4 vis.

- *Install the new voltage presence indicator unit.*
- *Screw up the 4 screws.*

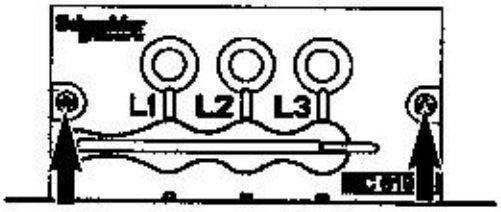
ATTENTION

Serrer les vis jusqu'à exercer une légère pression sur le joint passe fils, sans que ce dernier soit déformé.

CAUTION

Tighten the screws to exert slight pressure on the cable gland seal without distorting it.

La visserie est récupérée sur la première dépose.
The screws removed earlier are reused.



- Positionner la présence de tension en lieu et place, utiliser les 2 vis auto-taraudeuses du démontage précédent.

- *Install the voltage presence unit in the correct position using the 2 self-tapping screws removed earlier.*

Tableau des anomalies / remèdes - éléments de rechange - options

Anomalies / solutions table - spare parts - options

Pour cellules IM, PM, QM, SM, IMC, IMB, QMC, QMB, CVM, CM, CM2, TM, GAM et GAM2

For IM, PM, QM, SM, IMC, IMB, QMC, QMB, CVM, CM, CM2, TM, GAM and GAM2 cubicles

Tableau des anomalies et remèdes / *Anomalies and solutions Table*

Anomalies / *Disfonctions*	**Remèdes** / *Solutions*
■ L'indicateur de présence de tension ne s'éclaire pas / *Voltage indicator not illuminated*	■ Les câbles d'arrivée sont hors tension / *Check that the incoming cables are live* ■ Vérifier que les barres inférieures sont sous tension (uniquement IMB) / *Check that the incoming cables are live (Only for IMB cubicle)* ■ Vérifier l'indicateur présence de tension / *Check the voltage indicator block* ■ Vérifier que l'interrupteur est fermé (pour cellules IMC ; QMC ; IM ; PM ; QM uniquement) / *Check that the switch is closed (only for IMC ; QMC ; IM ; PM ; QM cubicles)* ■ Vérifier la présence des fusibles (pour cellules IMC ; QMC ; IM ; PM ; QM uniquement) / *Check that the fuses are present (only for IMC ; QMC ; IM ; PM ; QM cubicles)* ■ Vérifier le bon état des fusibles (pour cellules IMC ; QMC ; IM ; PM ; QM uniquement) / *Check the condition of the fuses (only for IMC ; QMC ; IM ; PM ; QM cubicles)* ■ Vérifier que le sectionneur est fermé (uniquement pour cellule SM) / *Check that the disconnector is closed (only for SM cubicle)* ■ Vérifier que le sectionneur de ligne et le contacteur sont fermés (uniquement pour cellule CVM) / *Check that the line disconnector and the contactor are closed (only for CVM cubicle)* ■ Vérifier que le jeu de barres est sous tension (uniquement pour cellule CVM) / *Check that the busbars are live (only for CVM cubicle)*
■ Le panneau avant ne s'ouvre pas ou ne peut être mis en place / *Front panel cannot be opened or closed*	■ Vérifier que le sectionneur de terre est fermé / *Check that the earthing switch is closed* ■ Vérifier que le sectionneur de ligne soit en position terre (uniquement pour cellule CVM) / *Check that the disconnector is in earthed position (only for CVM cubicle)* ■ Vérifier que la prise est embrochée (uniquement pour cellule CVM) / *Check the LV connection (only for CVM cubicle)*
■ Manœuvre du sectionneur de terre impossible / *Earthing switch cannot be operated*	■ Vérifier que l'interrupteur est ouvert / *Check that the switch is open* ■ Vérifier que le sectionneur est ouvert (uniquement pour cellule SM) / *Check that the disconnector is open (only for SM cubicle)*
■ Passage du sectionneur de ligne en position terre impossible (uniquement pour cellule CVM) / *Line disconnector cannot be set to earthed position (only for CVM cubicle)*	■ Vérifier que le sectionneur de ligne soit en position ouvert / *Check that the disconnector is in open position*
■ Passage du sectionneur de ligne en position fermé impossible (uniquement pour cellule CVM) / *Line disconnector cannot be set to closed position (only for CVM cubicle)*	■ Vérifier que le sectionneur de ligne soit en position ouvert / *Check that the disconnector is in open position*
■ Le contacteur ne fonctionne pas (uniquement pour cellule CVM) / *Contactor cannot be operated (only for CVM cubicle)*	■ Vérifier que le fusible d'alimentation soit en bon état (ce dernier se trouve sur le bornier installé dans le caisson basse tension) / *Check that the fuse on the power supply is OK (this fuse is located on the terminal block installed in the low voltage enclosure)* **Remarque / Note: un bouchon fusible de rechange est livré sur le bornier / *a spare fuse is supplied on the terminal block.***
■ Manœuvre du sectionneur impossible / Disconnector cannot be operated	■ Vérifier que le sectionneur de terre est ouvert / *Check that the earthing switch is open*

ВЯРНО С ОРИГИНАЛА!

"ТЕХНИЧЕСКИ ПРЕГЛЕД" ЕООД

435

Tableau des anomalies / remèdes - éléments de rechange - options

Anomalies / solutions table - spare parts - options

Anomalies (suite) / *Disfonctions (next)*	Remèdes (suite) / *Solutions (next)*
■ Manœuvre de l'interrupteur impossible / *Switch cannot be operated*	■ Vérifier que le sectionneur de terre est ouvert / *Check that the earthing switch is open*
Motorisation (option) / *Motor mechanism (option)*	
■ Non fonctionnement électrique ; S13 = entrée levier interrupteur ; S14 = entrée levier sectionneur de terre / *Electrical operation impossible ; S13 = switch lever input ; S14 = earth switch lever input.*	■ Vérifier les fusibles BT de type HA21 (sur la platine CIP2) / *Check the LV fuses HA21 (CIP2)* ■ Vérifier les verrouillages électriques S13 -14 (introduction du levier) / *Check electrical interlocks S13 – 14 (lever insertion)* ■ Vérifier que l'arbre de manœuvre du sectionneur de terre se trouve bien en butée d'ouverture / *Check that the earthing switch operating shaft has reached its end position* ■ Vérifier que le contact S14 n'interdit pas l'alimentation. Revoir éventuellement son réglage / *Check that contact S14 has not disabled the power supply and re-adjust if necessary* ■ Vérifier la configuration de la platine CIP1 (voir schéma) / *Check the configuration of the CIP1 subassembly (see diagram)*
■ (*)Impossibilité de manœuvre manuelle après un cycle de fermeture électrique pour un niveau de tension inférieur à -15% / *Manual operation impossible following an electrical closing cycle for a voltage level less than - 15% rated value*	■ Avec le levier de manœuvre, transmettre un couple dans le sens de la fermeture jusqu'en butée, la manœuvre d'ouverture manuelle devient alors réalisable / *Use the operating lever to apply a torque in the closing direction until the end position is reached; manuel operation should now be possible*
■ (*)Impossibilité de mise en place du levier après un cycle de fermeture électrique pour un niveau de tension supérieur à +15% / *Insertion of lever impossible following an electrical closing cycle for a voltage level greater than +15% rated value*	■ Si possible, fonctionner électriquement avec au besoin une source de secours / *If possible, carry out an electrical operation, using a backup power source if necessary* ■ Pour permettre l'introduction du levier de manœuvre, agir sur le fond de l'arbre de l'interrupteur à l'aide d'un gros tournevis dans le sens de la fermeture (prendre la précaution de mettre la commande électrique hors service. Au besoin, maintenir en haut la palette de verrouillage qui agit sur le contact S13) / *To allow insertion of the operating lever, push the back of the switch shaft in the closing direction using a large screwdriver; (for safety reasons, remember to first lock out the electrical operating mechanism; if necessary, push up and hold the locking blade that actuates contact S13)*
(*)Le fonctionnement est garanti à ±15% de la tension nominale / *Operation is guaranteed for rated voltage ± 15%*	

Eléments de rechange / *Spare Parts*

■ Indicateur de présence de tension / *Presence voltage indicator.*

■ Fusibles suivant liste des références fusibles UTE ou DIN. (pour autre type, nous consulter) / *Fuses UTE or DIN (Consult us for other types of fuse)*

■ Fusibles UTE-6,3 A type soléfuse pour CM. / *6,3 A UTE fuses (Soléfuse type) for CM.*

■ Fusibles DIN ou UTE 6,3 A pour CM2 et TM. / *6,3 A DIN or UTE fuses for CM2 ant TM.*

■ Fusibles HTA de type DIN pour CVM. / *DIN type MV fuses for CVM.*

■ Fusibles BT 5 x 20 temporisés pour CVM / *5 x 20 low voltage fuses (time delay type) for CVM*

Un (V)	48	60-72	100-127	220-250
Is (A)	10	3,15	2,5	1,25

Pour d'autres interventions, nous consulter : voir les centres de services de Schneider Electric. / *For other parts, please consult us: see Schneider Electric service centers.*

ВЯРНО С ОРИГИНАЛА!

Tableau des anomalies / remèdes - éléments de rechange - options
Anomalies / solutions table - spare parts - options

Options (Nous consulter) / *Options (Contact us)*

■ Motorisation / *Motor mechanism*
■ Contacts auxiliaires / *Auxiliary contacts*
■ Caisson de raccordement pour arrivée câbles par le haut. / *Incoming cables cabinet from top*
■ Verrouillages par serrures. / *Keyed interlocks*
■ Elément chauffant 50 W / *50 W heating element*
■ Comparateur de phases / *Phase concordance tester*
■ Caisson basse tension / *Low voltage cabinet*
■ Relais défaut terre / *Earth fault relay*
■ Contact de signalisation fusion fusibles (PM, QM, QMC) / *Contact for "fuse blown" indication (PM, QM, QMC)*
■ Déclencheurs d'ouverture Mitop à mise de tension / *Shunt type opening release*
■ Caisson contrôle BT agrandi ou caisson contrôle BT/ *Enlarged LV cabinet or additional LV enclosure*

Pour cellules NSM *For NSM cubicles*

Tableau des anomalies et remèdes / *Anomalies and solutions Table*

Anomalies / *Disfonctions*	**Remèdes / *Solutions***
■ L'indicateur de présence de tension ne s'éclaire pas / *The voltage presence indicator does not come on*	■ Vérifier que les câbles ou barres d'arrivée sont sous tension / *Check that the incoming cables or bars are energised* ■ Vérifier le boîtier de lampes / *Check the lamp boxes*
■ Le panneau avant ne s'ouvre pas ou ne peut être mis en place / *Front panel cannot be opened or closed*	■ Vérifier que le sectionneur de terre est fermé / *Check that the earthing switch is closed*
■ Manœuvre du sectionneur de terre impossible / *Earthing switch cannot be operated*	■ Vérifier que l'interrupteur est ouvert / *Check that the switch is open*
■ Manœuvre de l'interrupteur impossible / *Switch cannot be operated*	■ Vérifier que le sectionneur de terre est ouvert / *Check that the earthing switch is open*
■ Non fonctionnement électrique ; Motorisation, enclenchement et déclenchement (Si après toutes ces vérifications, le défaut persiste, se référer à la notice T200S, voir le manuel de l'utilisateur du T200S n° NT00044 et N° T00045 en Anglais) S13 = entrée levier interrupteur ; S14 = entrée levier sectionneur de terre. / Failure of electrical operation ; Motorisation, enclenchement et declenchement If the fault is still present after all these checks have been carried out, refer to the T200S technical documentation, see the T200S user manuals nos. NT00044 and T00045 in English. S13 = switch lever inlet ; S14 = earthing switch lever inlet.	■ Vérifier les fusibles BT (sur la platine CIP2) / *Check LV fuses (on CIP2)* ■ Vérifier que l'automatisme est en service (voir ch. mise en service de l'automatisme) / *Check that the automation is in operation (see chapter on starting up the automation)* ■ Vérifier les verrouillages électriques S13-14 (introduction du levier) / *Check the electrical lockings S13-14 (inserting the lever)* ■ Vérifier que l'arbre de manœuvre du sectionneur de terre se trouve bien en butée d'ouverture / *Check that the earthing switch operating shaft is at opening* ■ Vérifier que le contact S14 n'interdit pas l'alimentation. Revoir éventuellement son réglage / *Check that the S14 contact does not prevent power supply. Readjust if required.* ■ Vérifier la configuration de la platine CIP1 (voir schéma) / *Check configuration of the CIP1*
■ Impossibilité de manœuvre manuelle après un cycle de fermeture électrique pour un niveau de tension inférieur à -15% / *Manual operation not possible after an electrical with the operating lever, transmit actuating cycle for a voltage level less than -15%*	■ Avec le levier de manœuvre, transmettre un couple dans le sens de la fermeture jusqu'en butée. La manœuvre d'ouverture manuelle devient alors réalisable / *Torque in closing direction (to stop). The manuel opening operation can then be performed*

Tableau des anomalies / remèdes - éléments de rechange - options

Anomalies / solutions table - spare parts - options

Anomalies (suite) / *Disfonctions (next)*	Remèdes (suite) / *Solutions (next)*
■ Impossibilité de mise en place du levier après un cycle de fermeture électrique pour un niveau de tension supérieur à +15% (Si après toutes ces vérifications, le défaut persiste, se référer à la notice T200S, voir le manuel de l'utilisateur du T200S n° NT00044 et N° T00045 en Anglais) / *The lever cannot be placed after an electrical if possible operate electrically withclosing cycle for a voltage level greater than +15% if the fault is still present after all these checks have been carried out, refer to the T200S technical documentation, see the T200S user manuals nos. NT00044 and T00045 in English.*	■ Si possible, fonctionner électriquement avec au besoin une source de secours. / *Use an emergency source if required.* ■ Pour permettre l'introduction du levier de manœuvre, agir sur le fond de l'arbre de l'interrupteur à l'aide d'un gros tournevis dans le sens de la fermeture (prendre la précaution de mettre la commande électrique hors service. Au besoin, maintenir en haut la palette de verrouillage qui agit sur le contact S13.) / *To insert the operating lever, adjust the bottom of the switch shaft using a large screwdriver in the closing direction. (ensure you switch off the electrical operating mechanism. If necessary keep in the upperposition the locking pallet acting on the S13 contact).*
■ Lumière orange éclairée / *Orange light on*	■ Cas défaut sur NORMAL / *Case of fault NORMAL:* ■ Appeler le centre de service Schneider Electric le plus proche. / *Call the nearest Schneider Electric center* ■ Mettre hors service le permutateur (TALUS 200S) pour fonctionnement en manuel (ne pas manœuvrer la cellule normale). / *Switch off the transfer switch (TALUS 200) for operation in manuel mode (do not operate the main cubicle).* ■ Relancer le groupe ou se mettre sur le reseau de secours et fermer le secours (→ fonctionnement sur le secours). / *Restart the set and close the standby device (→ operation on standby).* ■ Intervention pour changer la commande, la bobine et la motorisation de la cellule normale. / *Intervention to change the operating mechanism, coil and drive unit of the main cubicle.* ■ Cas de defaut sur le SECOURS / *Case of fault STANDBY:* ■ Appeler le centre de service Schneider Electric le plus proche (ne pas manoeuvrer manuellement cette cellule). / *Call the nearest Schneider Electric center (do not manually operate this cubicle).* ■ Intervention pour changer la commande, la bobine et la motorisation du secours. / *Intervention to change the operating mechanism, coil and motorisation of the standby device.*

Eléments de rechange / *Spare Parts*

■ Indicateur de présence de tension. / Presence *voltage indicator*
Pour d'autres interventions, nous consulter : voir les centres de services de Schneider Electric. / *For other parts, please consult us: see Schneider Electric service centers.*

Options (Nous consulter) / *Options (Contact us)*

■ Contacts auxiliaires / *Auxiliary contacts*
■ Serrures de verrouillages / *Keyed interlocks*
■ Elément chauffant 50 W / *50 W heating element*

ВЯРНО С ОРИГИНАЛА!

Tableau des anomalies / remèdes - éléments de rechange - options

Anomalies / solutions table - spare parts - options

Pour cellules DM1-A, DM1-S, DM1-D, DM1-W, DM1-Z, DM2, DMVL-A, DMVL-D, DMV-A, DMV-S, DMV-D

For DM1-A, DM1-S, DM1-D, DM1-W, DM1-Z, DM2, DMVL-A, DMVL-D, DMV-A, DMV-S, DMV-D cubicles

Tableau des anomalies et remèdes / *Anomalies and solutions Table*

Anomalies / *Disfonctions*	Remèdes / *Solutions*
■ L'indicateur de présence de tension ne s'éclaire pas / *Voltage indicator does not light up*	■ Vérifier l'indicateur présence de tension / *Check the voltage indicator block* ■ Vérifier que le sectionneur de ligne et le disjoncteur sont fermés (pour une cellule départ) / *Check that the line disconnector and the circuit-breaker are closed (for an outgoing cubicle)* ■ Vérifier que les câbles d'arrivée sont sous tension / *Check that the incoming cables are energised*
■ Le panneau avant ne s'ouvre pas ou ne peut être mis en place / *Front panel cannot be opened or closed*	■ Vérifier que le(s) sectionneur(s) de ligne soi(en)t en position terre / *Check that the line disconnector(s) is(are) in the earth position*
■ Passage du(des) sectionneur(s) de ligne en position terre impossible / *Impossible to move the line disconnector(s) to the earth position*	■ Vérifier que le(s) sectionneur(s) de ligne soit en position ouvert / *Check that the line disconnector(s) switch is(are) in the open position*
■ Passage du(des) sectionneur(s) de ligne en position fermé impossible / *It is impossible to move the line disconnector(s) to the closed position*	■ Vérifier que le(s) sectionneur(s) de ligne soit en position ouvert / *Check that the line disconnector(s) is(are) in the open position*
■ Manœuvre du disjoncteur impossible / *Impossible to operate the circuit-breaker*	■ Vérifier que le sectionneur de ligne soit en position ouvert / *Check that the disconnector is in open position* ■ Voir notice disjoncteur / *See circuit-breaker manual*
■ Fermeture manuelle accidentelle du bras du sectionneur de terre aval / *Accidental manual closure of the downstream earthing disconnector arm*	■ Réouvrir le sectionneur de terre aval en manœuvrant le bras porte contacts puis, réinitialiser le système à l'aide d'un tournevis pour permettre l'introduction du levier de manœuvre / *Re-open the downstream earthing disconnector by operating the contact-holder arm, then re-initialise the system using a screwdriver to insert the operating lever.* ■ ■ ■ ■ ■

Eléments de rechange / *Spare Parts*

■ Indicateur de présence de tension / Presence voltage indicator
Pour d'autres interventions, nous consulter : voir le centre de service du groupe Schneider Electric le plus proche. / *For other operations, consult us: see your nearest Groupe Schneider Electric service center.*

Options (Nous consulter) / *Options (Contact us)*

■ Contacts auxiliaires sur sectionneur / *Auxiliary contacts on disconnector*
■ Serrures de verrouillages / *Keyed interlocks*
■ Caisson contrôle / *Monitoring cabinet*
■ Transformateur de tension / *VT transformer*
■ Elément chauffant 50 W / *50 W heating element*
■ Caisson raccordement câble par le haut / *Incoming cable cabinet from top*
■ Protection par unité électronique programmable SEPAM. / *Protection by a SEPAM programmable electronic protection unit.*

Tableau des anomalies / remèdes - éléments de rechange - options
Anomalies / solutions table - spare parts - options

Pour cellules GBC-A, GBC

For GBC-A, GBC-B cubicles

Eléments de rechange / *Spare Parts*

■ Fusibles pour VRM3 / *Fuses for VRM3*
Pour d'autres interventions, nous consulter : voir le centre de service du groupe Schneider Electric le plus proche. / *For other operations, consult us: see your nearest Groupe Schneider Electric service center.*

Options (Nous consulter) / *Options (Contact us)*

■ Transformateur de potentiel / *VT transformer*
■ Caisson contrôle / *Monitoring cabinet.*

ВЯРНО С ОРИГИНАЛА!

Fin de vie et préservation environnementale

End of life and environmental conservation

Préservation environnementale

Environmental conservation

Présentation du produit

La gamme **SM6-24** a pour principale fonction la commutation et la coupure des réseaux de 1 kV à 24 kV.
Détail de la gamme : jusqu'à 24 kV (Ur), 630/1250 A (Ir) 25 kA/1 s (Ik/tk), et tenue à l'arc interne à 50/60 Hz de 12,5 kA/1 s, 16 kA/1 s et 20 kA/1 s.
Les produits représentatifs utilisés pour l'analyse sont : IM & QM (sans fusibles), DM1-A et DMV-A.
Les impacts environnementaux des produits référencés sont représentatifs des impacts des autres produits de la gamme qui sont développés avec la même technologie.
L'analyse environnementale a été effectuée en conformité avec la norme ISO 14040 «Management environnemental : Analyse du cycle de vie - Principes et cadre".
Cette analyse prend en compte les étapes du cycle de vie du produit.

Product overview

*The main function of the **SM6-24** range is to switching and breaking from 1kV to 24kV.*

This range consists of: up to 24kV (Ur), 630/1250A (Ir) 25kA/1s (Ik/tk), and 12,5 kA/1s, 16 kA/1s and 20 kA/1 s Internal Arc Withstand at 50/60 Hz
The representative product used for the analysis are: IM & QM (without fuses), DM1-A, and DMV-A.
The environmental impacts of this referenced product are representative of the impacts of the other products of the range which are developed with the same technology.
The environmental analysis was performed in conformity with ISO 14040 "Environmental management: Life cycle assessment – Principle and framework".
This analysis takes the stages in the life cycle of the product into account.

Fabrication

La gamme **SM6-24** est fabriquée sur un site de production Schneider Electric bénéficiant d'un système de management environnemental certifié ISO 14001.

Manufacturing

*The **SM6-24** range is manufactured at a Schneider Electric production site on which an ISO 14001 certified environmental management system has been established.*

Distribution

Le poids et le volume des emballages ont été réduits, conformément à la directive de l'Union Européenne sur les emballages.
L'emballage IM & QM pèse 7 kg. Il est constitué d'une palette en bois (4,8 kg), de carton (1,5 kg), de clous (0,4 kg), de polystyrène (0,1 kg), d'un cerclage (0,1 kg).
L'emballage DMV-A pèse 12 kg. Il est constitué d'une palette en bois (8,6 kg), de carton (2 kg), de clous (0,8 kg), de polystyrène (0,2 kg), d'un cerclage (0,4 kg).
L'emballage DM1-A pèse 12,5 kg. Il est constitué d'une palette en bois (8,7 kg), de carton (2,2 kg), de clous (0,8 kg), de polystyrène (0,4 kg), d'un cerclage (0,4 kg).
Les flux de distribution du produit ont été optimisés par l'implantation de centres de distributions locaux proches des zones de marché.

Distribution

The weight and volume of the packaging have been reduced, in compliance with the European Union's packaging directive.
The IM & QM packaging weight is 7-kg. It consists of wooden pallet (4,8kg), carton (1,5kg), nails (0,4kg), polystyrene (0,1kg), band strapping (0,1kg).
The DMV-A packaging weight is 12-kg. It consists of wooden pallet (8,6kg), carton (2kg), nails (0,8kg), polystyrene (0,2kg), band strapping (0,4kg).
The DM1-A packaging weight is 12,5-kg. It consists of wooden pallet (8,7kg), carton (2,2kg), nails (0,8kg), polystyrene (0,4kg), band strapping (0,4kg).
The product distribution flows have been optimised by setting up local distribution centres close to the market areas.

ВЯРНО С ОРИГИНАЛА!

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Utilisation

Les produits de la gamme SM6-24 ne génèrent pas de pollution environnementale réclamant des mesures de protection spéciales (bruit, émissions, etc.).
Pour les produits consommant de l'énergie, indiquer la mention suivante : la puissance dissipée dépend des conditions de mise en œuvre et d'utilisation du produit.
La puissance électrique consommée par la gamme SM6-24 va de 8,6 W à 78,2 W :
- Elle est de 8,6 W en mode actif et de 0 % en mode veille pour IM & QM référencé.
- Elle est de 38,6 W en mode actif et de 0 % en mode veille pour DMV-A référencé.
- Elle est de 78,2 W en mode actif et de 0 % en mode veille pour DM1-A référencé.

Cette puissance consommée représente moins de 30% de la puissance totale qui circule à travers le produit.

Pour les produits dissipant de l'énergie, indiquer la mention suivante : la puissance dissipée dépend des conditions de mise en œuvre et d'utilisation du produit.
La puissance dissipée va de 100 W à 850 W, pour la gamme de produits SM6-24.
Pour un taux d'utilisation de 100 % :
- Elle est de 100 W pour IM & QM référencé.
- Elle est de 440 W pour DMV-A référencé.
- Elle est de 850 W pour DM1-A référencé.

Cette dissipation thermique représente moins de $0,2.10^{-3}$ % pour IM & QM, $1,6.10^{-3}$ % pour DMV-A et $3,3.10^{-3}$ % pour DM1-A, de la puissance qui circule à travers le produit.

Utilisation

The products of the SM6-24 range do not generate environmental pollution requiring special precautionary measures (noise, emissions, and so on).
For consuming products, indicate following mention: the dissipated power depends on the conditions under which the product is implemented and used.
The electrical power consumed by the SM6-24 range spreads out between 8,6 W and 78,2 W:
- *It is 8,6 W in active mode and 0 % in standby mode for the referenced IM & QM.*
- *It is 38,6 W in active mode and 0 % in standby mode for the referenced DMV-A.*
- *It is 78,2 W in active mode and 0% in standby mode for the referenced DM1-A.*

This consumed power represents less than 30 % of the total power which passes through this product.

For dissipating products, indicate following mention The dissipated power depends on the conditions under which the product is implemented and used. This dissipated power spreads out between 100 W and 850 W, for the SM6-24 product range.
For a utilisation rate of 100 %:
- *It is 100 W for the referenced IM & QM.*
- *It is 440 W for the referenced DMV-A.*
- *It is 850 W for the referenced DM1-A.*

This thermal dissipation represents less than $0,2.10^{-3}$ % for IM&QM; $1,6.10^{-3}$ % for DMV-A, $3,3.10^{-3}$ % for DM1-A of the power which passes through the product.

Impacts environnementaux

L'Analyse du Cycle de Vie (ACV) a été réalisée à l'aide du logiciel EIME (Environmental Impact and Management Explorer) version V3 et de sa base de données version 5.4.
La durée de vie estimée du produit est de 30 ans avec un taux d'utilisation de l'installation de 100 %, le modèle de puissance électrique utilisée est européen.
L'étendue de l'analyse a été limitée à IM & QM, DMV-A et DM1-A.
Les impacts environnementaux ont été analysés pour les phases de fabrication (F), y compris le traitement des matières premières, et pour les phases de distribution (D) et d'utilisation (U).
Présentation des impacts environnementaux du produit

Environmental impacts

The EIME (Environmental Impact and Management Explorer) software, version V3, and its database, version 5.4 were used for the life cycle assessment (LCA).
The assumed service life of the product is 30 years with an utilisation rate of the installation of 100 % and the electrical power model used is European.
The scope of the analysis was limited to a IM & QM, DMV-A, and DM1-A.
The environmental impacts were analysed for the Manufacturing (M) phases, including the processing of raw materials, and for the Distribution (D) and Utilisation (U) phases.
Presentation of the product environmental impacts

Approche système

La gamme est conforme à ROHS : les produits de la gamme étant conçus conformément à la directive ROHS (directive européenne 2002/95/EC du 27 janvier 2003), ils peuvent être incorporés sans restrictions dans un assemblage ou une installation soumis à cette directive.

Product Overview

The range is RoHS compliant: as the product of the range are designed in accordance with the RoHS Directive (European Directive 2002/95/EC of 27 January 2003), they can be incorporated without any restriction within an assembly or an installation submitted to this Directive.

ВЯРНО С ОРИГИНАЛА!

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Fin de vie et préservation environnementale

End of life and environmental conservation

Fin de vie et recyclage
End of life and recycling

Fin de vie

En fin de vie, les produits de la gamme SM6-24 doivent être démontéspour faciliter la récupération des différents matériaux constitutifs.
Si le poids du matériau (individuellement) représente plus de 15 % du poids total en fonctionnement, il est considéré comme un matériau recyclable.
La proportion de matière recyclable est supérieure à 85 %.
Ce pourcentage comprend les matériaux suivants : acier et cuivre.

Recyclage

Schneider Electric est engagé dans une démarche environnementale inscrite dans le long terme.
Dans ce cadre, SM6 a été conçu dans le souci du respect de l'environnement et notamment en prenant en compte les aptitudes au recyclage du produit.
Les matériaux utilisés, isolants et conducteurs, sont identifiés, facilement séparables, dans l'analyse profil environnement produit qui a été élaboré en conformité avec l'ISO 14040.
En fin de vie, SM6 pourra être traité, recyclé et valorisé conformément au projet de réglementation européenne sur la fin de vie des produits électriques et électroniques,et en particulier sans émission de gaz dans l'atmosphèreni rejet de fluides polluants.
SM6 est conforme à la directive RoHS qui restreint l'utilisation de six substances dangereuses pour la fabrication de divers types d'équipements électroniques et électriques.

End of life

At end of life, the products of the SM6-24 must be dismantled to facilitate the recovery of the various constituent materials.
If weight of the material (individually) is more than 15 % of total function's weight that is considered as recyclable material.
The proportion of recyclable material is higher than 85 %.
This percentage includes the following materials: steel, and copper.

Recycling

Schneider Electric is committed to a long term environmental approach.
As part of this, the SM6 has been designed to be environmentally friendly, notably in terms of the product's recyclability.
The materials used, both conductors and insulators, are identified in product environmental profile analysis and easily separable. It was performed in conformity with ISO 14040 "Environmental management: life cycle assessment - principle and framework".
At the end of its life, SM6 can be processed, recycled and its materials recovered in conformity with the draft European regulations on the end-of-life of electronic and electrical products, and in particular without any gas being released to the atmosphere nor any polluting fluids being discharged.
SM6 is compliant with the RoHS directive. RoHS restricts the use of six hazardous materials in the manufacture of various types of electronic and electrical equipment.

[redacted]		
Métaux ferreux / *Ferrous metal*	84 %	85 %
Métaux non ferreux / *Non-ferrous metal*	4 %	10,6 %
Thermodurcissables / *Thermosetting*	9,5 %	22%
Thermoplastiques / *Thermoplastics*	2,35 %	2,3 %
Fluides / *Fluid*	0.15%	0,1 %

ВЯРНО С ОРИГИНАЛА!

Fin de vie et préservation environnementale

End of life and environmental conservation

Récupération du gaz SF6 en fin de vie

Recovery of SF6 gas at end of life

Le SF6 doit être retiré avant toute opération de démantèlement selon les procédures décrites dans le document **CEI–61634**.

Le gaz doit être traité conformément au document **CEI–60480**.

- volume de gaz à récupérer : 35litres par interrupteur,
- pression interne relative : 40kPa.

*The SF6 must be removed before any dismantling operation can be carried out in compliance with the procedures describedin **IEC–61634**.*

The gas must be treated in compliance with IEC–60480.

- *volume of gas to be recovered: 35litres per switch,*
- *internal gauge pressure: 40kPa.*

ВЯРНО С ОРИГИНАЛА!

ВЯРНО С ОРИГИНАЛА!

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02-2012

ЕООД „ТЕХНИЧЕСКИ ЕНЕРГИИ"

LILIX

Distribution Moyenne Tension
Medium Voltage Distribution

SM6-24

Cellules modulaires
Modular cubicles

Conditions d'installation
Installation requirements

[redacted]

Schneider Electric

ВЯРНО С ОРИГИНАЛА!

ТЕХНИК ЕНЕРДЖИ ЕООД
TECHNIC ENERGY LTD
ФИРМА

Released for Manufacturing
Printed on 2012/10/29

ВЯРНО
С ОРИГИНАЛА!

"ТЕХНИН ЕКСПЕРТ" ООД

Released for Manufacturing
Issued on 2012/10/29

Conditions d'installation
Installation requirements

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Performance arc interne
Internal arc performance

Introduction

Un arc interne est une forme de court-circuit très sévère qui peut survenir dans une installation électrique.
Contrairement à un court-circuit dit « boulonné » où le courant de défaut circule dans des conducteurs solides, un arc interne fait circuler le courant dans l'air (ionisant plasma) entre deux conducteurs.
En plus des effets classiques d'un court-circuit (échauffement des conducteurs, efforts électromagnétiques), l'arc interne se caractérise donc par une quantité d'énergie énorme transmise au défaut.
L'énergie disipée, allant jusqu'à plusieurs dizaines de mégajoules en une seconde, provoque des effets de pression et thermiques.
Le défaut d'arc interne est rare, mais se criticité impose d'en maîtriser les effets.

Introduction

The internal arc fault is a very severe short-circuit that can occur in electrical equipment.
Whereas a conventional bolted short circuit fault makes the current flow in solid conductors, the internal arc fault makes the current flow in the air (which becomes also plasma) between two conductors.
In addition to the usual consequences of a short-circuit fault (conductors overheating, electromagnetic efforts), the internal arc transmits a huge energy amount to the fault. The dissipated energy, which reaches more than 10 megajoules over one second, provokes hazardous pressure effects and thermal effects.
The internal arc fault is rare, but it is so critical that we must manage its effects.

Causes

L'arc interne est causé par la rupture de rigidité diélectrique entre deux parties au potentiel différent.
Un arc survient entre deux phases ou entre une phase et la masse. Il dégénère alors souvent en défaut triphasé.
L'amorçage initial peut être créé par :
- Le vieillissement des isolants solides que constituent les gaines de câbles, les résines Epoxy (fissures).
- L'intrusion d'un animal entre les parties symétriques, soit créant directement un pont conducteur entre 2 phases, soit dégradant l'isolation des câbles (perçages).
- L'introduction d'un objet entre les phases lors d'une opération de maintenance, ouvrant une clé mettant en court-circuit le jeu de barre.
- Une fuite de gaz isolant (pour les appareils fonctionnant dans le SF6) ou une perte de vide (pour les appareils fonctionnant dans le vide).

Causes

The internal arc fault starts when the dielectric strength is lost between two parts at a different voltage. An arc appears between two phases or between one phase and earth. It often degenerates into a three-phases fault.
The original arc can be the result of:
- *Insulating parts ageing (damaged cables sheath, cracked Epoxy resin).*
- *The intrusion of an animal, thus directly creating a short-circuit between conductors, or damaging the insulation (boring).*
- *The introduction of an object between the phases during a maintenance work, (typically a wrench in the busbar).*
- *A insulating fluid leakage (for the SF6 insulated devices) or a vacuum loss (for the vacuum devices).*

Conséquences

L'arc interne se matérialise par des effets de pression, sollicitation mécanique importante de l'appareil puis par des effets thermiques, expulsion abondante de gaz chauds à évacuer.
L'arc interne se découpe en 3 phases génériques :
- La phase onde de choc : 0-5ms
- La phase naissance de pression : 5-30ms.
- La phase expulsion et thermique : 30ms- ...

Les gaz chauds créés sont évacués en continu, ils doivent être correctement canalisés, non seulement pour que la pression tende vers zéro, mais aussi pour maîtriser leur direction de sortie.

Consequences

The consequences of internal arc are pressure effects, severe mechanical stress of the device and thermal effects (heavy expulsion of hot gases that is to be managed).

The internal arc fault divides into 3 phases:
- *The shock wave phase: 0-5ms*
- *The pressure rise phase: 5-30ms*
- *The expulsion and thermal phase: 30ms*

The generated hot gases are expulsed in a continuous way. They must be correctly canalized in order that the pressure falls to zero, but also to manage their exhaust direction.

Performance arc interne
Internal arc performance

Conséquences (suite)

A ces phases génériques peut s'ajouter une phase d'éclatement de membrane, lorsque la surpression dans un compartiment hermétique est libérée vers les autres compartiments par l'ouverture d'une membrane calibrée.
Elle est caractérisée par une deuxième onde de choc et un transfert de la surpression aux autres compartiments.
Outre les effets mécaniques et thermiques, l'arc interne est dangereux pour :
- sa toxicité : l'air expulsé est chargé de vapeurs plastiques et métalliques irrespirables,
- son bruit : l'onde de choc initiale est une onde acoustique dangereuse (160dB),
- son rayonnement transmis : sans obstacle intermédiaire, le rayonnement émis est capable de brûler la peau au second degré en 100 ms.

Consequences (continued)

In addition to these three generic phases, a valve opening phase can take place, when the overpressure in a hermetic compartment is released to the other compartments by the way of a calibrated valve opening.
This phase is characterized by a second pressure wave and a pressure transfer to the other compartments.
As well as its mechanical and thermal effects, the internal arc fault is hazardous because of:
- *its toxicity: the released gases are loaded with toxic plastic and metal vapors.*
- *its noise: the original pressure wave is a hazardous acoustic wave (160 dB).*
- *its transmitted radiation: without any obstacle, the emitted radiation can burn the skin (second degree level) in 100 ms.*

⚠ DANGER

RISQUES D'ÉLECTROCUTION, D'ARC ÉLECTRIQUE OU DE BRÛLURES
- L'installation de cet équipement doit être confiée exclusivement à des personnes qualifiées, qui ont pris connaissance de toutes les notices d'installation et contrôlé les caractéristiques techniques de l'équipement.
- Ne travaillez JAMAIS seul.
- Coupez toute alimentation avant de travailler sur cet équipement. Tenez compte de toutes les sources d'alimentation et en particulier des possibilités d'alimentation inverse à la cellule où est installé l'équipement.
- Portez des gants isolants pour éviter tout contact avec un conducteur accidentellement mis sous tension.

Le non-respect de ces instructions provoquera la mort ou des blessures graves.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, ELECTRIC ARC OR BURNS
- *Only qualified personnel should install this equipment. Such work should be performed only after reading this entire set of instructions and checking the technical characteristics of the device.*
- *NEVER work alone.*
- *Turn off all power supplying this equipment before working on or inside it. Consider all sources of power, including the possibility of backfeeding.*
- *Wear insulating gloves to avoid any contact with a conductor that has accidentally been energized.*

Failure to follow these instructions will result in death or serious injury.

Les différentes performances arc interne

The different internal arc performances

12,5 kA 1s	X		X	
16 kA 1s	X		X	
		X	X	X
20 kA 1s	X	X		X

Installation sans la performance arc interne

Installation without internal arc performance

⚠ ATTENTION

Dans certaines conditions d'installation, la performance arc interne n'est pas garantie dans le cadre d'un raccordement des câbles par le haut.

⚠ *CAUTION*

In certain installation conditions, internal arc performance is not guaranteed when cables are connected by the top.

Installation

Installation

Conditions pour obtenir la performance arc interne

Conditions to obtain the internal arc performance

La norme CEI 62271-200 utilise A Japonais un niveau de protection testé pour les personnes se trouvant au voisinage de l'appareillage sous enveloppe métallique dans des conditions d'arc interne.

IEC 62271-200 standard applies A Japanese a tested level of protection to persons in the vicinity the switchgear in metal enclosures under internal arc conditions.

Classes accessibilité

2 versions de classes d'accessibilité sont disponibles :
- IAC : A-FL,
- IAC : A-FLR.

IAC : A-FL

A : Type A, limité au personnel autorisé seulement
F : accès par la Face avant
L : accès par les faces Latérales

Lorsque un tableau classifié IAC : A-FL est scellé à un mur, ce mur ne participe pas à la performance arc interne.

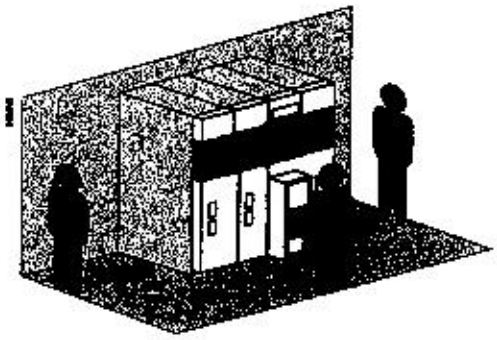
Accessibility classes

2 versions of accessibility classes are available:
- *IAC: A-FL,*
- *IAC: A-FLR.*

IAC: A-FL

A: Type A, restricted to authorized personnel only
F: access by Front side
L: access by Lateral sides

When a switchboard is classified IAC: A-FL wall-mounted, the wall does not contribute to the internal arc performance.

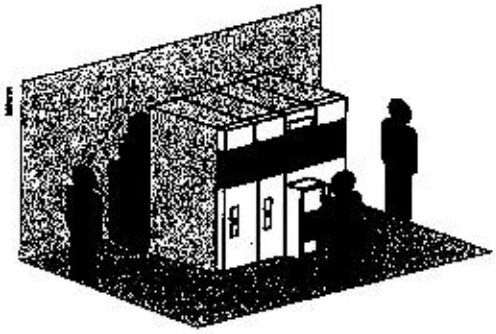


IAC : A-FLR

A : Type A, limité au personnel autorisé seulement
F : accès par la Face avant
L : accès par les faces Latérales
R : accès par la face Arrière

IAC: A-FLR

A: Type A, restricted to authorized personnel only
F: access by Front side
L: access by Lateral side
R: access by Rear side



Installation
Installation

Conditions pour obtenir la performance arc interne
Conditions to obtain the internal arc performance

Evacuation basse

Downward exhaust

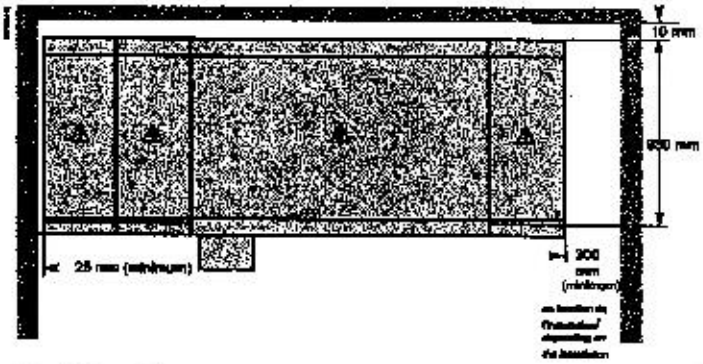
Position des cellules dans le poste

Installation du tableau classifié IAC A-FL par rapport au bâtiment

Position of cubicles in the substation

Installation of the switchboard IAC: A-FL classified relative to building

Le hauteur sous plafond doit être de 2100 mm minimum.
The ceiling height must be 2100 mm minimum.



Implantation (vue de dessus).

Implantation (top view).

L'implantation du tableau est aussi possible tassé au mur de droite avec les mêmes conditions.
The implantation of the switchboard is also possible for a wall to the left.

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Installation

Installation

Conditions pour obtenir la performance arc interne

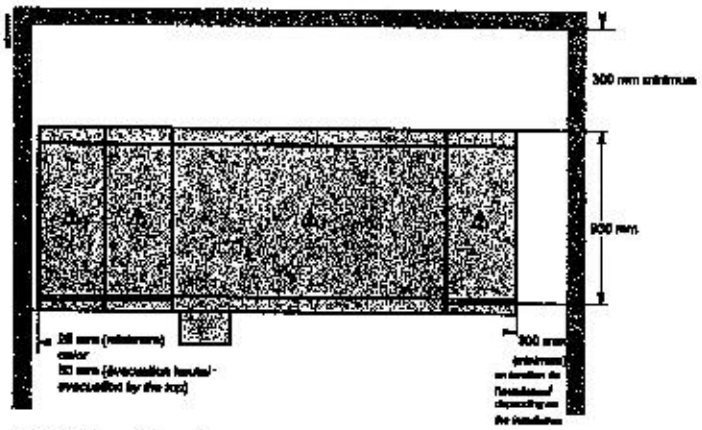
Conditions to obtain the internal arc performance

Installation du tableau classifié IAC A-FLR par rapport au bâtiment

Installation of the switchboard IAC: A-FLR classified relative to building

La hauteur sous plafond doit être de 2100 mm minimum.

The ceiling height must be 2100 mm minimum.



Implantation (vue de dessus).

Implantation (top view).

L'implantation du tableau est aussi possible accolé au mur de droite avec les mêmes conditions.

The implantation of the switchboard is also possible for a wall to the left.

Conditions pour obtenir la performance arc interne
Conditions to obtain the internal arc performance

Mode d'évacuation

2 modes d'évacuation sont disponibles :
- l'évacuation basse par cantonnau,
- l'évacuation haute par conduit.

Evacuation basse

Ce mode permet l'évacuation des gaz dans le cantonnau par l'intermédiaire d'un «flaps» intégré dans le fond de la cellule. La surface sous les «flaps» doit être libre de tout obstacle (voir plan ci-dessous). Afin d'évacuer les gaz, une des extrémités du cantonnau doit déboucher librement dans un espace aéré et ventilé.

Evacuation types

2 evacuation modes are available:
- *evacuation by the bottom via a trench,*
- *evacuation by the top via a duct.*

Evacuation by the bottom

This mode enables gases to be evacuated in a duct via a flap situated underneath the cubicle. The area under the «flaps» must be free of obstacle (see layout below). To enable the evacuation of gases, one of the ends of the duct must open into a well-ventilated area.

⚠ AVERTISSEMENT

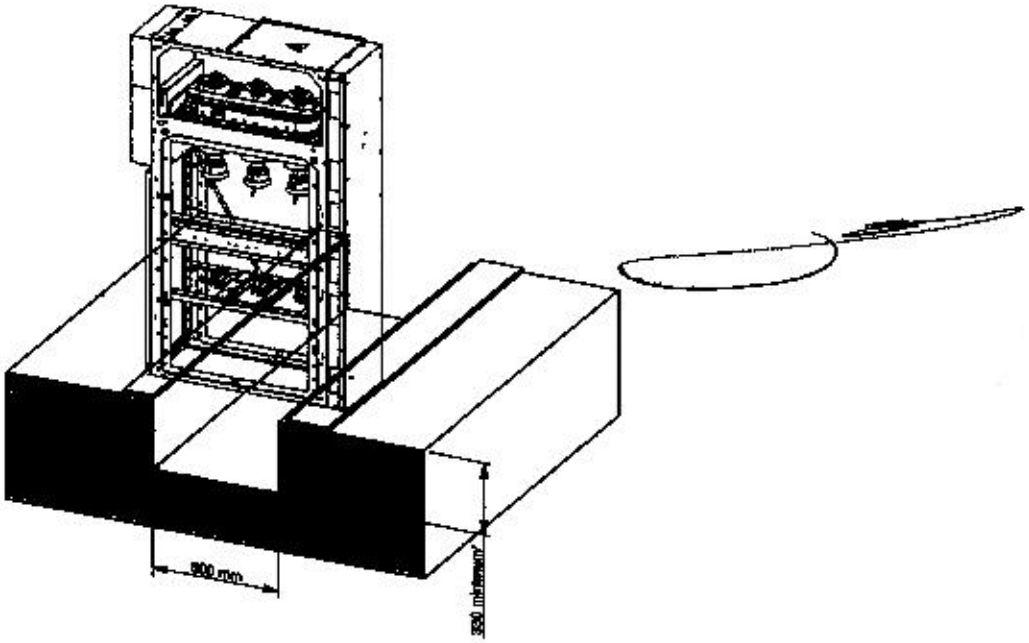
Le non-respect de ces instructions provoquera la mort ou des blessures graves.

⚠ *WARNING*

Failure to follow these instructions will result in death or serious injury.

Dimensions des cantonnaux pour performance 12,5 kA/1 s (en mm)

Dimensions of ducts for 12.5 kA/1 s performance (in mm)



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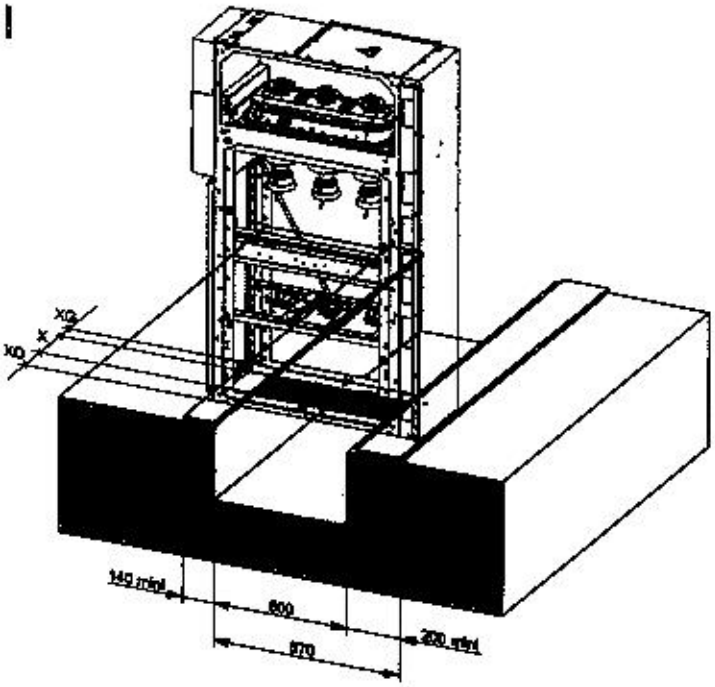
Installation
Installation

Conditions pour obtenir la performance arc interne
Conditions to obtain the internal arc performance

Plan de la zone libre de tout obstacle (en mm) ***Area map free of obstructions (in mm)***



375	Toutes / All	67,5	280	67,5
500	GAM Autres / Other	67,5 182,5	280 280	182,5 67,5
625	GMC Autres / Other	307,5 67,5	280 510	67,5 67,5
750	Toutes / All	432,5	280	67,5

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Conditions pour obtenir la performance arc interne

Conditions to obtain the internal arc performance

Préparation du sol pour la performance arc interne 12,5 kA/ 1 s

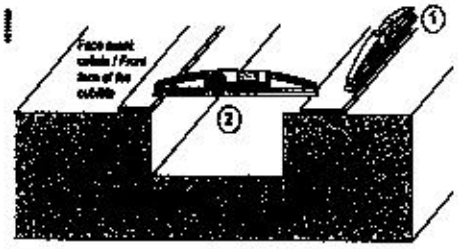
Afin d'obtenir la performance arc interne, la réalisation des sols doit être conforme aux exigences de rectitude et de planéité imposées.
L'utilisation de profilés métalliques est conseillée:
- rectitude : 2 mm/ 3 m (Rep.1),
- planéité : 3 mm maximum (Rep.2).

Tous les éléments permettant l'évacuation des gaz (caniveau, cuvelage, etc ...) doivent supporter une pression de 250 Kg/m².

Preparing the floor for the internal arc performance12,5 kA/ 1 s

To obtain the performance arc, implementation of grounds must comply with the requirements of straightness and flatness imposed.
The use of metal angles brackets is recommended:
- *straightness: 2 mm/ 3 m (Rep. 1),*
- *flatness: 3 mm maximum (Rep.2).*

All the elements allowing the evacuation of the gas (duct, casing, etc ...) must be able to bear a load of 250 Kg/m².



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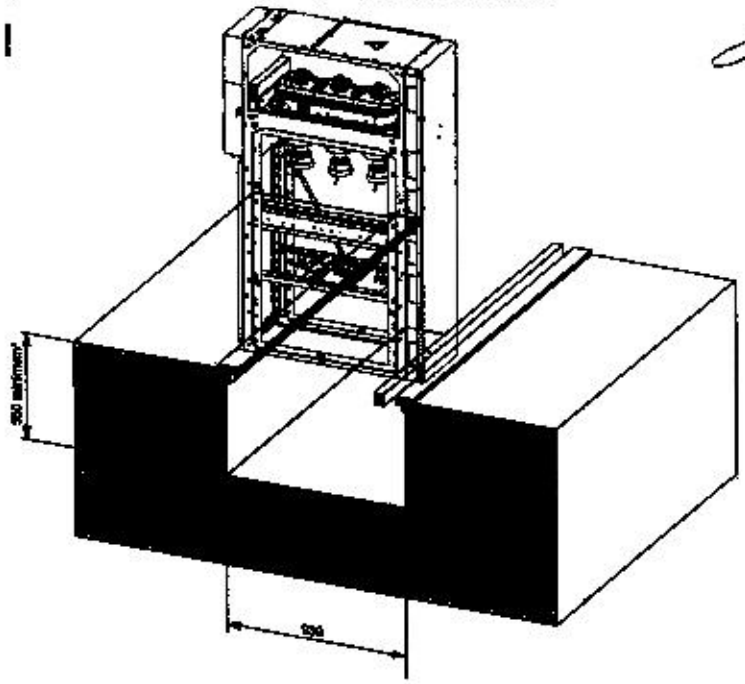
Conditions pour obtenir la performance arc interne

Conditions to obtain the internal arc performance

Dimensions des cadenas pour la performance arc interne 16 kA/1 s (en mm)

Dimensions of doors for 16 kA/1 s internal arc performance (in mm)



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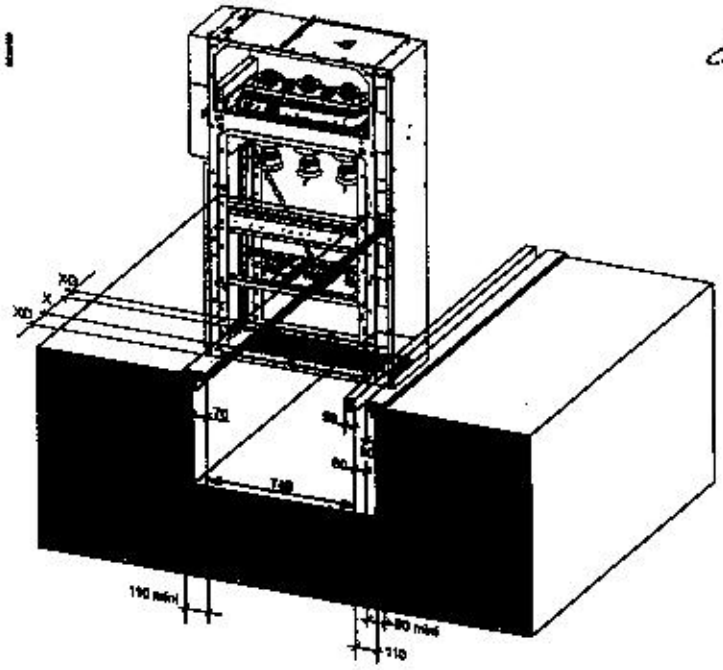
Conditions pour obtenir la performance arc interne
Conditions to obtain the internal arc performance

Plan de la zone libre de tout obstacle (en mm) ***Area map free of obstructions (in mm)***



375	Toutes / All	57,5	260	57,5
500	GAM Autres / Other	57,5 182,5	260 260	182,5 57,5
625	OMC Autres / Other	307,5 57,5	260 610	57,5 57,5
750	Toutes / All	432,5	260	57,5

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Conditions pour obtenir la performance arc interne

Conditions to obtain the internal arc performance

Préparation du sol en 16 kA/1 s

Afin d'obtenir la performance arc interne, la réalisation des sols doit être conforme aux exigences de rectitude et de planéité imposées.

L'utilisation de profils métalliques est conseillée:

- rectitude : 2 mm/ 3 m (Rep.1),
- planéité : 3 mm maximum (Rep.2).

Tous les éléments permettant l'évacuation des gaz (cartelets, cuvelage, etc ...) doivent supporter une pression de 250 Kg/m².

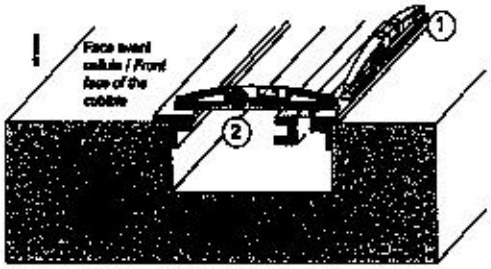
Preparing the floor for 16 kA/1 s

To obtain the performance arc, implementation of grounds must comply with the requirements of straightness and flatness imposed.

The use of metal angles brackets is recommended:

- *straightness: 2 mm/ 3 m (Rep. 1),*
- *flatness: 3 mm maximum (Rep.2).*

All the elements allowing the evacuation of the gas (duct, casing, etc ...) must be able to bear a load of 250 Kg/m².



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Conditions pour obtenir la performance arc interne

Conditions to obtain the internal arc performance

Dimensionnement de la profondeur des cantiveaux en fonction de la section des câbles et de la performance 12 kA/1s ou 16 kA/1s en évacuation basse (cf illustrations p9,11,14) (en mm)

Sizing the depth of duct according to the cable section 12 kA/1s or 16 kA/1s performance in evacuation by the bottom (cf drawings p9,11,14) (in mm)

[redacted]

S<120	330	500	500	900	900	330		500	–	–
120<S<240	330	500	900	–	–	Opposé au disjoncteur / opposite to circuit breaker: 330	Sous le disjoncteur / under the circuit breaker: 460	500	–	–
S>400	–	–	–	–	–	–		–	1000	1400

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Conditions pour obtenir la performance arc interne

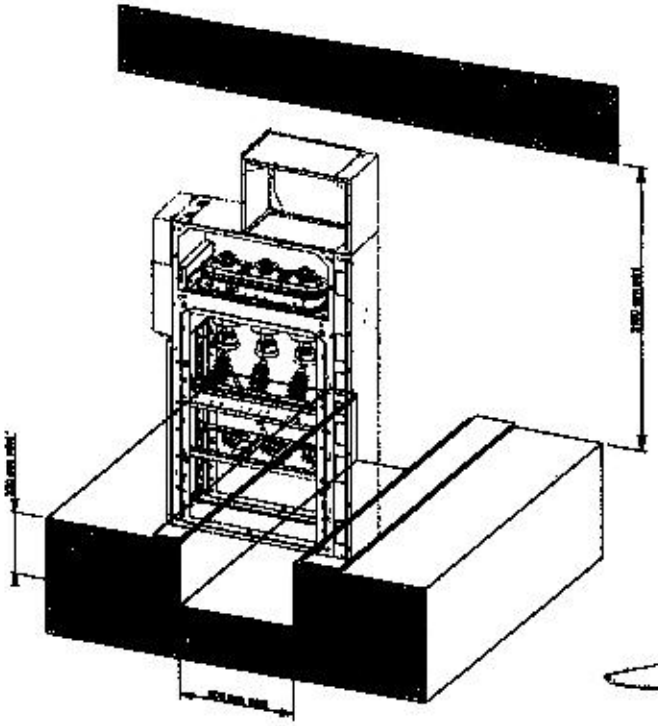
Conditions to obtain the internal arc performance

Evacuation haute

Upward exhaust

Dimension des cantiveaux pour performance 16 kA/1s et 20 kA/1 s (en mm)

Dimension of duct for 16 kA/1 s and 20 kA/1 s performance (in mm)



Ce mode permet l'évacuation des gaz et nécessite l'utilisation d'un conduit placé sur le dessus de la cellule. Pour permettre l'évacuation des gaz, l'extrémité du tableau doit être équipé d'une bride d'accouplement (fournit avec l'équipement), sur laquelle est fixée le conduit d'évacuation (voir le plan de la bride en annexe 1).

This mode enables gases to be ejected and requires the use of a duct situated above the cubicle. To enable the evacuation of gases, the end of the switchboard must be equipped with a coupling flange (supplied by schneider Electric), on which is fixed on the evacuation duct (see the coupling flange layout in Appendix 1).

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Conditions pour obtenir la performance arc interne

Conditions to obtain the internal arc performance

Conduit d'évacuation

Pour permettre l'évacuation des gaz en évacuation haute, les utilisateurs devront installer un conduit à fixer à la bride d'interface.

L'intérêt de ce conduit doit interdire les entrées d'eau, de poussières, d'humidité, d'animaux, etc, tout en permettant l'évacuation des gaz dans une zone dédiée par l'intermédiaire d'un dispositif placé à l'extrémité extérieure du conduit (non fourni).

Suggestion de conduit d'évacuation

Le conduit d'évacuation doit être en tôle d'épaisseur suffisante pour résister aux pressions et gaz chauds.

Evacuation duct

To enable the evacuation of gases by the top, users must install a conduit fixed to the coupling flange.

The end of the duct must block water, dust, moisture, animals, etc. from entering and at the same time enable the evacuation of gases into a dedicated area through a device situated at the outer end of the duct (not supplied).

Evacuation duct example

The evacuation duct must be made of metal sheet of sufficient thickness to withstand pressure and hot gases.

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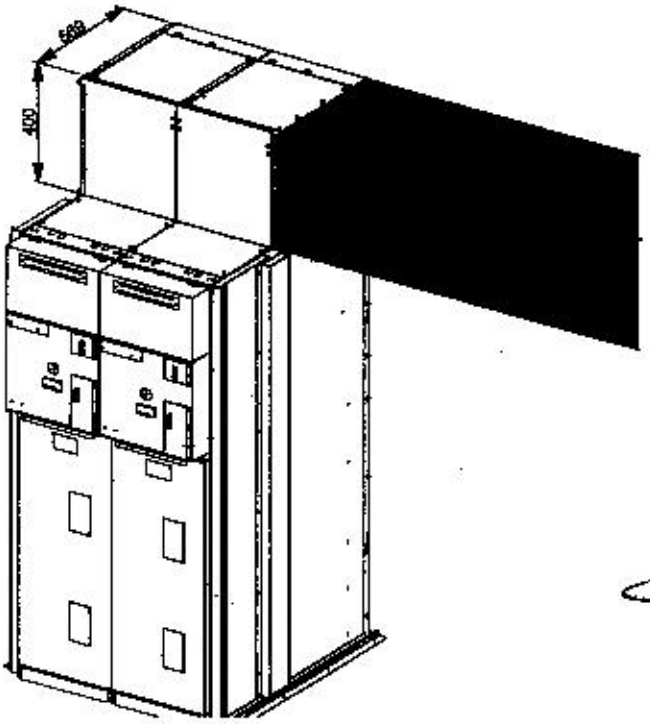
Conditions pour obtenir la performance arc interne
Conditions to obtain the internal arc performance

Exemple en évacuation haute sortie latérale droite

Top evacuation with right side exit example



Installation
Installation

Conditions pour obtenir la performance arc interne
Conditions to obtain the internal arc performance

Fixation des cellules

Fixing of cubicles

Fixation des cellules entre elles

Les cellules qui composent le poste sont maintenues entre elles par simple boulonnage (visserie livrée avec les cellules). Les vis du jeux de barre doivent être serrées au couple à l'aide d'une clé dynamométrique

Fixing of cubicles to each other

The units are simply bolted together to build the MV switchboard (bolts supplied). Screws of busbars must be tightened with a torque wrench.

Fixation des cellules au sol

Toutes les cellules doivent être fixées avec 4 vis M8, ou des tiges filetées fixées au sol.

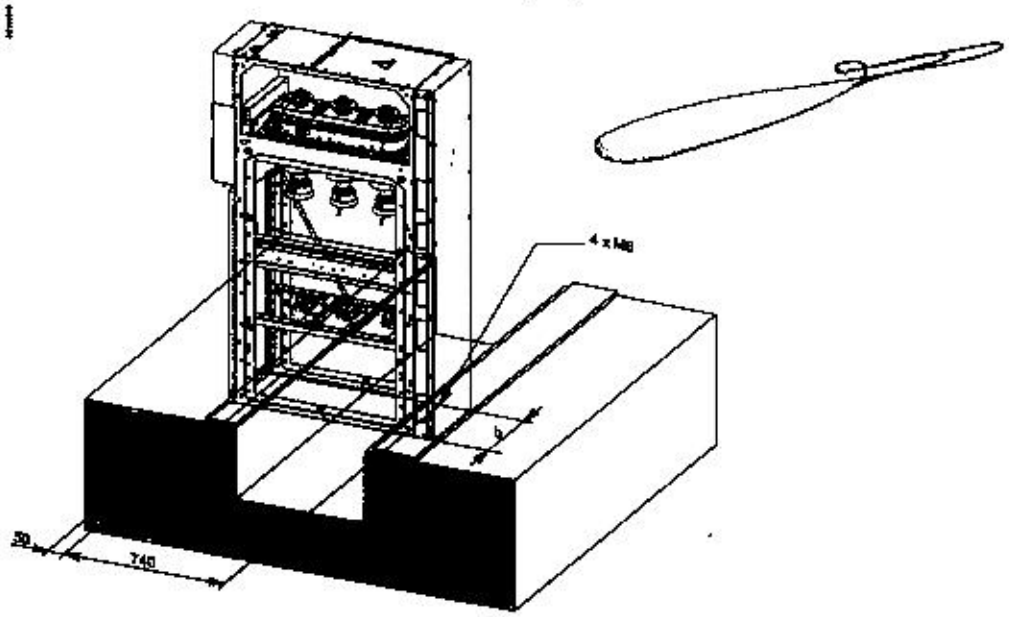
Fixation des cellules *on the ground*

All cubicles must be secured to the ground with using M8 bolts or screw rods grouted into the ground.

largeur de cellule (mm)	125	375	500	625	750
b (mm)	95	345	470	595	720

Fixation des cellules pour performance 12,5 kA/1 s évacuation basse,16 kA/1 s et 20 kA/1 s évacuation haute (in mm)

Fixing of cubicles for 12,5 kA/1 s downward exhaust ,16 kA/1 s and 20 kA/1 s upward exhaust performance (in mm)



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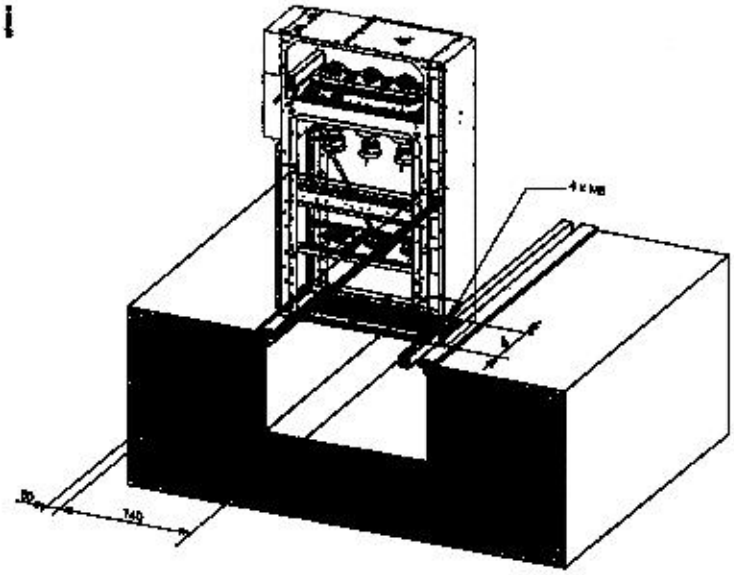
Conditions pour obtenir la performance arc interne

Conditions to obtain the Internal arc performance

Fixation des cellules pour performance 16 kA/1 s évacuation basse (en mm)

Fixing of cubicles for 16 kA/1 s downward exhaust performance (in mm)



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Conditions sévères d'humidité et/ou pollution du matériel MT

Harsh conditions of moisture and / or pollution of the MV equipment

Les tableaux MT remplissent des fonctions de sécurité et doivent donc être installés conformément à certaines pratiques professionnelles.

Ce document a pour objectif de fournir des stratégies d'ordre général afin d'éviter ou de réduire considérablement la dégradation du matériel sur les sites soumis à une forte humidité ou à une pollution importante.

MV switchboards fulfil safety functions and must therefore be installed in line with certain profession practices.

The purpose of this document is to provided general guidelines on how to avoid or greatly reduce MV equipment degradation on sites exposed to high humidity and heavy pollution.

Conditions de service normales pour le matériel MT intérieur

Le matériel MT intérieur comprend des cellules MT modulaires ou des Ring Main Units compactes généralement installées dans des postes préfabriqués avec les transformateurs et l'appareillage BT.

Tous les matériels MT sont conformes aux normes spécifiques et à la norme internationale CEI 62271-1 Appareillage à haute tension - Partie 1 (norme commune). Cette dernière définit les conditions normales d'installation et d'utilisation d'un tel matériel.

Par exemple, concernant l'humidité, la norme mentionne :

Les conditions d'humidité sont les suivantes :
- la valeur moyenne d'humidité relative mesurée sur une période de 24 h n'excède pas 90 %,
- la valeur moyenne de la pression de la vapeur d'eau mesurée sur une période de 24 h n'excède pas 2,2 kPa,
- la valeur moyenne d'humidité relative mesurée sur une période d'un mois n'excède pas 90 %,
- la valeur moyenne de la pression de la vapeur d'eau mesurée sur une période d'un mois n'excède pas 1,8 kPa.

Occasionnellement, ces conditions peuvent provoquer de la condensation.

Note 1 : La condensation peut survenir dans le cas de variations soudaines de température en période de forte humidité.
Note 2 : Pour supporter les effets d'une forte humidité et de la condensation, tels qu'une interruption de l'isolation ou la corrosion des parties métalliques, il convient d'utiliser l'appareillage spécialement conçu pour de telles conditions et testé en conséquence.
Note 3 : Il est possible de prévenir la condensation en concevant un bâtiment ou une enveloppe spéciale, une ventilation et un chauffage adaptés au poste, ou en utilisant un dispositif de déshumidification.

Comme l'indique la norme, la condensation peut rarement survenir occasionnellement dans des conditions normales. La norme poursuit en mentionnant les mesures spéciales susceptibles d'être appliquées sur lieux pour prévenir la condensation (Note 3).

Utilisation dans des conditions critiques

Dans des conditions critiques d'humidité et de pollution, qui dépassent largement les conditions d'utilisation normales mentionnées ci-dessus, le matériel électrique normalement conçu peut subir des dommages à cause de la corrosion rapide des parties métalliques et de la dégradation superficielle des parties isolantes.

Normal service conditions for indoor MV equipment

MV equipment consists of modular MV cubicles or compact Ring Main units generally installed in prefabricated substations along with transformers and LV switchgear.

All MV equipment comply with specific standards and with the IEC 62271 «Common specifications for high-voltage switchgear and controlgear». The latter defines the normal conditions for the installation and use of such equipment.

For instance, regarding humidity, the standard mentions:

The conditions of humidity are as follows:
- *the average value of the relative humidity, measured over a period of 24 h does not exceed 90 %,*
- *the average value of the water vapour pressure, over a period of 24 h does not exceed 2, kPa*
- *the average value of the relative humidity, over a period one month does not exceed 90 %*
- *the average value of water vapour pressure, over a period one month does not exceed 1,8 kPa*

For these conditions, condensation may occasionally occur.

Note 1: condensation can be expected where sudden temperature changes occur in period of high humidity.
Note 2: to withstand the effects of high humidity and condensation, such as a breakdown of insulation or corrosion of metallic parts, switchgear designed for such conditions and tested accordingly should be used.
Note 3: Condensation may be prevented by special design of the building or housing, by suitable ventilation and heating of the station or by use of dehumidifying equipment.

As indicated in the standard, condensation may occasionally occur even under normal conditions. The standard goes on to indicate special measures concerning the substation premises that can be implemented to prevent condensation (Note 3).

Use under severe conditions

Under certain severe conditions concerning humidity and pollution, largely beyond the normal conditions of use mentioned above, correctly designed electrical equipment can be subject to damage by rapid corrosion of metal parts and surface degradation of insulating parts.

Consignes en conditions sévères d'humidité et/ou pollution
Guidelines in harsh conditions of moisture and / or pollution

Mesures préventives pour limiter les effets de la condensation

Concevez et adaptez les ventilations du poste avec précaution

- Pour réduire les variations de température, maintenez la ventilation du poste au niveau minimum requis afin d'évacuer la chaleur générée par le transformateur.
- Quand cela est possible, utilisez de la ventilation naturelle plutôt que de la ventilation forcée.
- Si la ventilation forcée est nécessaire, faites fonctionner les ventilateurs en continu.
- Si dans le poste, seule la ventilation forcée est possible, alors faites la fonctionner en continu.
- Placez les ouvertures de ventilation du poste le plus loin possible de la cellule MT.
- N'ajoutez jamais d'ouvertures de ventilation aux cellules MT.

Évitez les variations de température

- Installez des résistances anti-condensation à l'intérieur des cellules MT et faites-les fonctionner en continu, i.e. sans commande manuelle ou automatique.
- Améliorez l'isolation thermique du poste.
- Évitez que le transformateur soit dans le même local que l'appareillage MT.
- S'il est nécessaire de chauffer le poste, veuillez vérifier que le système de régulation de la température empêche les variations brusques de température ou bien faites fonctionner le chauffage en continu.
- Éliminez les courants d'air froids provenant des conduites pour câbles, des dessous de portes, etc..

Éliminez les sources d'humidité dans le voisinage du poste

- Empêchez la prolifération des plantes autour du poste.
- Réparez les fuites dans le toit du poste.
- Empêchez l'humidité provenant des conduites pour câbles de pénétrer dans les cellules MT.

Installez un système de climatisation

- La climatisation est le moyen le plus sûr pour maîtriser l'humidité et la température.

Assurez-vous que le câblage est conforme aux règles applicables

- Prêtez une attention particulière au positionnement des blindages, des écrans de répartition de champs et des écrans semi-conducteurs.
- Dans la mesure du possible, utilisez des extrémités de câbles de technologie à froid, mais il faut s'assurer qu'elles soit correctement installées.

Mesures préventives pour limiter les effets de pollution

- Équipez les ouvertures de ventilation du poste de grilles de type chevron pour limiter la pénétration de la poussière et de la pollution.
- Maintenez la ventilation du poste au niveau minimum requis pour que l'évacuation de la chaleur générée par le transformateur limite la pénétration de poussière et de pollution.
- Utilisez des cellules MT avec un degré de protection (IP) suffisamment élevé.
- Utilisez des systèmes de climatisation avec filtres pour limiter la pénétration de la poussière et de la pollution.
- Nettoyez régulièrement toutes les traces de pollution des parties métalliques et des parties isolantes.

Preventive measures to limit the effects of condensation

Carefully design or adapt substation ventilation:

- *Keep substation ventilation to the minimum required for evacuation of transformer heat to reduce temperature variations.*
- *Use natural ventilation rather than forced ventilation whenever possible.*
- *If forced ventilation is required, run fans continuously.*
- *If there is only and forced ventilation mode switch in on continuously.*
- *Locate the substation ventilation openings as far as possible from the MV cubicle.*
- *Never add ventilation openings to MV cubicles.*

Avoid temperature variations

- *Install anti-condensation heaters inside MV cubicles and let them run continuously, i.e. without automatic or manual control.*
- *Improve the thermal insulation of the substation.*
- *Avoid the transformer is in the same location as the MV switchgear.*
- *If heating is required, make sure the temperature regulation system avoids large temperature swings or leave heating on continuously.*
- *Eliminate cold air drafts cable trenches, under doors, etc..*

Eliminate sources of humidity in the substation environment

- *Avoid excessive plant growth around the substation.*
- *Repair any leaks in the substation roof.*
- *Prevent humidity from cable trenches from entering MV cubicles.*

Install an air conditioning system

- *Air conditioning is the surest way of controlling humidity and temperature.*

Make sure cabling is in accordance with applicable rules

- *Pay special attention to the positioning of earthing screens, shield control screens and semiconductor screens.*
- *Use cold-shrink cable terminations is possible, but make sure they are properly installed.*

Preventive measures to limit the effects of pollution

- *Equip substation ventilation openings with chevron-type baffles to reduce entry of dust and pollution.*
- *Keep substation ventilation to the minimum required for evacuation of transformer heat to reduce entry of pollution and dust.*
- *Use MV cubicles with a sufficiently high degree of protection (IP).*
- *Use air conditioning systems with filters to restrict entry of pollution and dust.*
- *Regularly clean all traces of pollution from metal and insulating parts.*

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Dimensionner les ouvertures de ventilation

Méthode de calcul

Il existe un certain nombre de méthodes pour estimer la taille requise des ouvertures de ventilation des postes, soit pour la conception de nouveaux postes, soit pour l'adaptation de postes existants qui ont causé des problèmes de condensation.

Méthode de base

Cette méthode est fondée sur la dissipation de puissance du transformateur (effet de Joule).
Les surfaces requises pour les ouvertures de ventilations S et S' peuvent être estimées en utilisant les formules suivantes :

$$S = \frac{1,8 \times 10^{-3} P}{\sqrt{H}} \quad \text{et} \quad S' = 1,1 \times S$$

Où :
S = surface de l'ouverture de ventilation inférieure (entrée d'air) [m²] (surface de la grille déduite).
S' = surface de l'ouverture de ventilation supérieure (sortie d'air) [m²] (surface de la grille déduite).
P = puissance dissipée totale [W], P est la somme de la puissance dissipée par :
- le transformateur (à vide et à cause de la charge),
- l'appareillage BT,
- l'appareillage MT.

H = hauteur entre les points du milieu des ouvertures de ventilation [m].

Sizing the ventilation openings

Calculation methods

A number of calculation methods are available to estimate the required size of substation ventilation openings, either for the design of new substations or the adaptation of existing substations for which condensation problems have occured.

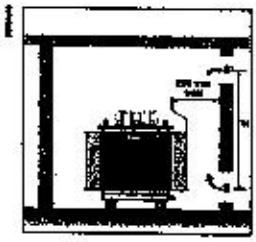
Basic method

This method is based on transformer dissipation.
The required ventilation opening surface areas S and S' can be estimated using the following formulas.

$$S = \frac{1,8 \times 10^{-3} P}{\sqrt{H}} \quad \text{and} \quad S' = 1,1 \times S$$

Where :
S= lower (air entry) ventilation opening area [m²] (grid surface deducted).
S'= upper (air exit) ventilation opening area [m²] (grid surface deducted).
P= total dissipated power [W], P is the sum of the power dissipated by:
- *the transformer (dissipation at no load and due to load)*
- *the LV switchgear*
- *the MV switchgear.*

H= height between ventilation opening mid-points [m].



Note : Cette formule est valable pour une température moyenne annuelle de 20 °C et une altitude maximale de 1000 m.

Exemple :
Dissipation de puissance du transformateur = 7970 W
Dissipation de puissance de l'appareillage BT = 780 W
Dissipation de puissance de l'appareillage MT = 300 W
La hauteur entre les points du milieu des ouvertures de ventilation est égale à 1,5 m.

Calcul :
Puissance dissipée
P = 7970 + 780 + 300 = 9020 W

$$S = \frac{1,8 \times 10^{-3} P}{\sqrt{1,5}} = 1,32 \text{ m}^2$$

et
S' = 1,1 x 1,32 = 1,46 m²

Note: This formula is valid for a yearly average temperature of 20 °C and a maximum altitude of 1000 m.

Example:
Transformer dissipation= 7970 W
Lv switchgear dissipation= 780 W
MV switchgear dissipation= 300 W
The height between ventilation opening mid- points is 1,5 m.

Calculation:
Dissipated Power
P = 7970 + 780 + 300 = 9020 W

$$S = \frac{1,8 \times 10^{-3} P}{\sqrt{1,5}} = 1,32 \text{ m}^2$$

and
S' = 1,1 x 1,32 = 1,46 m²

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Méthode plus complète

Une autre possibilité est la formule suivante basée sur divers aspects de la conception du poste.

$$S = \frac{(P - \Sigma k^*\Sigma K(^\circ S)^*T}{417^*G\sqrt{H}T^{1,4}} \quad \text{et} \quad S' = 1,1 \times S$$

Où :
S = surface de l'ouverture de ventilation inférieure (entrée d'air) [m²].
S' = surface de l'ouverture de ventilation supérieure (sortie d'air) [m²] (surface de la grille déduite).
P = puissance dissipée totale [W]. P est la somme de la puissance dissipée par :
- le transformateur (à vide et à cause de la charge),
- l'appareillage BT,
- l'appareillage MT.

Σi = surface de l'enveloppe i [m²].
Ki = coefficient de transmission de la surface i [W/m2K].
- k = 7 pour la tôle acier,
- k = 3 pour 10 cm de béton et 2,8 pour 20 cm,
- k = 0 pour le sol (pas de transmission de chaleur par le sol).

T = type d'enveloppe (hausse de la température du transformateur) [K].
G = coefficient de la grille
- G = 0,28 à 0,77 pour les grilles de type chevron (0,38 pour des chevrons simples à 90 °C)
- G < 0,2 pour les types les plus compliqués comme les grilles à chicanes protégées.
- G autour de 0,6 pour la tôle perforée de trous rectangulaires

H = hauteur entre les points de milieu des ouvertures de ventilation [m].

More complete method

Another possibility is the following formula based on various aspects of substation design.

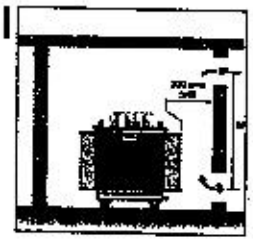
$$S = \frac{(P - \Sigma k^*\Sigma K(^\circ S)^*T}{417^*G\sqrt{H}T^{1,4}} \quad \text{and } S' = 1,10^*S$$

Where:
S=lower (air entry) ventilation opening area [m²].
S'= upper (air exit) ventilation opening area [m²].
P= total dissipated power [W]. P is the sum of the power dissipated by:
- *the transformer (dissipation at no load and due to load)*
- *the LV switchgear*
- *the MV switchgear.*

Σi= area of enclosure surface i [m²].
Ki= transmission coefficient of surface [W/m2K].
- *k= 7 for steel sheets*
- *k= 3 for 10 cm and 2,8for 20 cm of concrete,*
- *k= 0 for the ground (no heat transmission through the ground)*

T= rises of enclosure (transformer temperature rise) [K].
G= grid coefficient
- *G= 0,28 to 0.77 for chevron blade louvers (0.38 for 90 °simple chevrons)*
- *G < 0.2 for more complex types such as overlapped C baffles.*
- *G around 0.6 for punched steel with rectangular holes*

H= height between ventilation opening mid-points [m].



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Méthode plus complète (suite)

Note : Cette méthode donne des surfaces des ouvertures de ventilation plus petites que celles obtenues avec la méthode de base car elle prend en compte la dissipation qui passe par les murs, le toit et les portes.

Exemple :
Dissipation de puissance du transformateur = 7970 W
Dissipation de puissance de l'appareillage BT = 750 W
Dissipation de puissance de l'appareillage MT = 300 W
La surface du poste se décompose comme suit :
- 14,6 m² de murs en béton (10 cm d'épaisseur),
- 7 m² de toit en béton (10 cm d'épaisseur),
- 6 m² de portes métalliques.

L'enveloppe est de catégorie 10 K.
La grille de ventilation est de type grille en chevron (Q = 0,4).
La hauteur entre les points du milieu des ouvertures de ventilation est égale à 1,5 m.

Calcul :
Puissance dissipée
P = 7970 + 750 + 300 = 9020 W

$\sum_i (K_i^*S_i) = 14,6^*3+7,0^*3+6,2^*7 = 108,2$ W/K

$$S = \frac{(9020-2,4^*108,2^*10)}{417^*0,4^*\sqrt{1,5^*10^{-4}}} = 0,99 \text{ m}^2$$

et S' = 1,1 x 0,99 = 1,09 m²

Essai

Les méthodes décrites ci-dessus peuvent être utilisées pour estimer la taille requise des ouvertures de ventilation du poste, toutefois les meilleurs résultats sont obtenus en procédant à des essais.

Pour les nouveaux postes, les essais doivent être effectués par le fabricant du poste afin de s'assurer que le système de ventilation fourni n'est pas surdimensionné.

Pour les nouveaux postes soumis sujets à des problèmes de condensation, les essais servent à déterminer s'il est possible de réduire les surfaces des ouvertures de ventilation sans excéder les limites relatives de hausse de température du transformateur dans les pires conditions possibles.

More complete method (continued)

Note: This gives smaller ventilation opening areas than the previous method because it takes dissipation through the walls, roof and doors into account.

Example:
Transformer dissipation= 7970 W
LV switchgear dissipation= 750 W
MV switchgear dissipation= 300 W
The substation area is made up of:
- *14.6 m² of concrete walls (10 cm thick)*
- *7.0 m² of concrete roof (10 cm thick)*
- *6.2 m² of metallic doors*

The enclosure class is 10 K.
The ventilation grid is of the chevron louver type (Q= 0.4).
The height between ventilation opening mid-points is 1,5 m.

Calculation:
Dissipated Power
P = 7970 + 750 + 300 = 9020 W

$\sum_i (K_i^*S_i) = 14,6^*3+7,0^*3+6,2^*7 = 108,2$ W/K

$$S = \frac{(9020-2,4^*108,2^*10)}{417^*0,4^*\sqrt{1,5^*10^{-4}}} = 0,99 \text{ m}^2$$

and S' = 1,1 x 0,99 = 1,09 m²

Testing

The above methods can be used to estimate the required size of substation ventilation openings, however the best results are obtained by testing.

For new substation, tests should be carried out by the substation supplier to ensure that the provided ventilation system is not oversized.

For existing substations presenting condensation, tests can be carried out to determine whether ventilation opening areas can be reduced without exceeding the maximum temperature rise limits of the transformer under the worst possible conditions.

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Ventilation
Ventilation

Emplacement des ouvertures de ventilation

Ventilation opening locations

Pour favoriser l'évacuation de la chaleur générée par le transformateur via la convection naturelle, les ouvertures doivent être placées en haut et en bas du mur près du transformateur.
La chaleur dissipée par le tableau MT est négligeable.
Pour éviter les problèmes de condensation, les ouvertures de ventilation du poste doivent être situées le plus loin possible du tableau.

To facilitate evacuation of the heat produced by the transformer via natural convection, ventilation openings should be located at the top and bottom of the wall near the transformer.
The heat dissipated by the MV switchboard is negligible.
To avoid condensation problems, the substation ventilation openings should be located as far as possible from the switchboard.

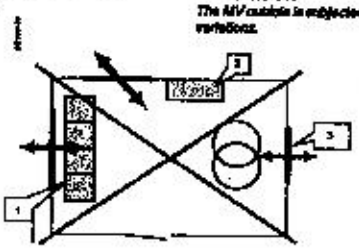
Poste MT/BT «sur-ventilé»

La cellule MT est soumise à des variations de températures soudaines.

«Over» ventilated MV/LV substation

The MV cubicle is subjected to sudden temperature variations.

1 : tableau MT
2 : tableau BT
3 : ventilation Haute et Basse



1: MV switchboard
2: LV switchboard
3: Upper and Lower ventilations

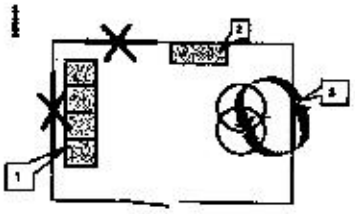
Poste avec ventilation adaptée

La cellule MT n'est plus soumise à des variations de températures soudaines.

Substation with adapted ventilation

The MV cubicle is no longer subjected to sudden temperature variations.

1 : tableau MT
2 : coffret BT
3 : ventilation Haute et Basse



1: MV switchboard
2: LV enclosure
3: High and Low ventilations

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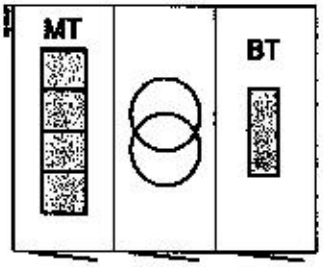
Ventilation
Ventilation

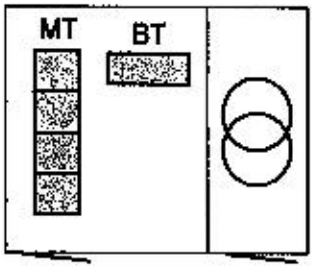
Poste avec ventilation adaptée (suite)

Si le tableau MT est séparé du transformateur, la pièce où se trouve le tableau requiert une ventilation minimale pour assécher l'humidité susceptible de pénétrer.

Substation with adapted ventilation (continued)

If the MV switchboard is separated from the transformer, the room containing the switchboard requires only minimal ventilation to allow drying of any humidity that may enter the room.





Type d'ouvertures de ventilation

Pour limiter l'entrée de poussières, de pollution, d'embruns, etc.... les ouvertures de ventilation du poste doivent être équipées de grilles de type chevron.
Vérifier toujours que les grilles sont orientées dans le bonne direction.

Type of ventilation openings

To reduce the entry of dust, pollution, mist, etc..., the substation ventilation openings should be equipped with chevron-blade baffles.
Always make sure the baffles are oriented in the right direction.

Ventilation de la cellule MT

Tout besoin de ventilation naturelle est pris en compte par le fabricant au moment de la conception des cellules MT. Il ne faut jamais ajouter les ouvertures de ventilation au modèle d'origine.

MV cubicles ventilation

Any need for natural ventilation is taken into account by the manufacturer in the design of MV cubicles.
Ventilation openings should never be added to the original design.

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Température
Temperature

Généralités

General

Les variations de températures dans des conditions de fortes humidités sont sources de condensation.

The temperature variations lead to condensation under high humidity conditions.

Variations de température à l'intérieur des cellules

Pour limiter les variations de températures, installer toujours des résistances anti-condensations à l'intérieur des cellules MT si l'humidité relative moyenne reste élevée pendant un laps de temps important.
Les résistances doivent fonctionner sans interruption, 24 heures sur 24 pendant toute l'année.

Temperature variations inside cubicles

To reduce temperature variations, always install anti-condensation heaters inside MV cubicles if the average relative humidity can remain high over a long period of time.
The heaters must operate continuously, 24 hours a day all year long.

ATTENTION

RISQUE DE DETERIORATION DES CELLULES
- Ne raccordez JAMAIS les résistances à un système de régulation de température.
- Assurez-vous que les résistances offrent une durée de service adéquate (en général les versions standard suffisent).

Le non-respect de ces instructions peut entraîner des blessures ou des dommages matériels.

CAUTION

HAZARD OF DAMAGE TO CUBICLES
- *NEVER connect the resistance to a temperature control or regulation system.*
- *Make sure the heaters offer an adequate service life (standard version are generally sufficient).*

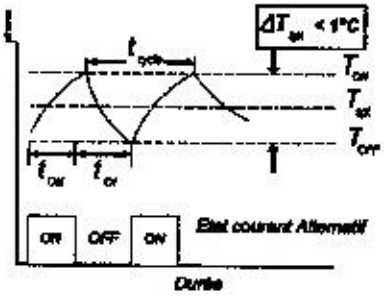
Failure to follow these instructions can result in injury or equipment damage.

Variations de température à l'intérieur du poste

Pour limiter les variations de température à l'intérieur du poste, il est possible de prendre les mesures suivantes :
- Appliquer les mesures décrites dans le chapitre Ventilation.
- Améliorer l'isolation thermique du poste pour réduire les effets des variations de la température extérieure sur la température à l'intérieur du poste.
- Si possible, éviter de chauffer le poste. Toutefois, s'il est nécessaire de le chauffer, assurez-vous que le système de régulation et/ou le thermostat sont suffisamment précis, et conçus pour éviter les variations brutales de températures (i.e pas supérieures à 1 °C).

Temperature variations inside the substation

The following measures can be taken to reduce temperature variations inside the substation:
- *Implement the measures described in the previous section concerning ventilation.*
- *Improve the thermal insulation of the substation to reduce the effects of outdoors temperature variations on the temperature inside the substation.*
- *Avoid substation heating if possible. If heating is required make sure the regulation system and/or thermostat are sufficiently accurate and designed to avoid excessive temperature swings (e.g no greater than 1 °C).*



Si un système de régulation de température précis n'est pas disponible, laissez fonctionner le chauffage en permanence, 24 heures sur 24 pendant toute l'année.

If a sufficiently accurate temperature regulation system is not available, leave the heating on continuously, 24 hours a day all year long.

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Installation
Installation

Température
Temperature

Rappel

Recommandation liées à l'environnement.
Sous certaines conditions climatiques, le phénomène de condensation peut se produire.
Il est possible par des moyens simples d'améliorer le comportement des postes MT et de minimiser le risque d'apparition de condensation et par conséquent de phénomènes d'effluves.
Trois facteurs principaux peuvent être à l'origine du phénomène :
- l'architecture du poste (dimension et remplacement des ventilations, le nature des matériaux utilisés),
- l'environnement climatique du MT/BT (zone très humide, brouillard, précipitation, orientation et pollution),
- la technologie utilisée mise en œuvre des extrémités des câbles.

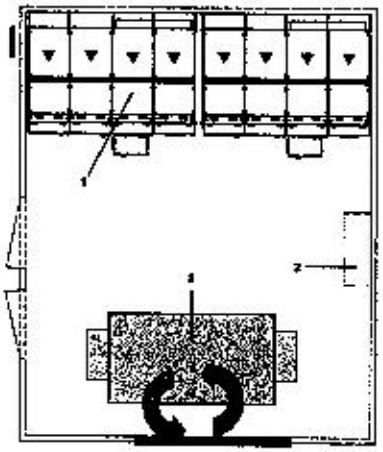
Reminder

Recommendation linked to environmental withstand.
Under certain climatic conditions, the condensation phenomenon may occur.
By simple means it is possible to enhance the behavior of MV substations and to minimise the risk of appearance of condensation and thus of corona discharge phenomena.
Three main factors may be responsible for this phenomenon:
- *substation architecture (dimension and replacement of ventilation systems, type of materials used)*
- *climatic environment of MV/LV (very damp area, fog, precipitation, orientation and pollution)*
- *technology and/or implementation of cable ends.*

Détail de l'environnement

Environnemental details

1 : tableau MT
2 : coffret BT
3 : transformateur
4 : zone de ventilation haute et basse



1: MV switchboard
2: LV enclosure
3: transformer
4: ventilation area top and bottom

Remèdes

Architecture du poste

Adapter la section des ventilations à la puissance dissipée dans le poste pour minimiser les écarts de température.
Supprimer les ventilations dans l'environnement proche du tableau modulaire MT.
Favoriser une ventilation adaptée (haute et basse) par convection autour du transformateur.

Environnement du poste HT/BT

Procéder à l'étanchéité du poste et des fosses à câbles.
Prévoir des ventilations de type chicane pour limiter les pénétrations directes.
Installer des résistances anti-condensation dans les cellules.

Extrémités des câbles

La mauvaise mise en œuvre d'une extrémité des câbles de technologie à froid entraînera des contraintes diélectriques qui généreront aussi le phénomène d'effluves dans des conditions sévères.

Solutions

Substation architecture

Adapt ventilation cross-section to power loss in the substation to minimise temperature differences.
Eliminate ventilation in the environment in the immediate vicinity of the MV modular switchboard.
Provide suitable ventilation (top and bottom) by convection around the transformer.

The HV/LV substation environment

Guarantee tightness of the substation and of the cable pits.
Provide baffle type ventilation systems to limit direct penetration.
Install anti-condensation resistances in the cubicles.

Cables ends

Incorrect implementation of cold technology cables ends will result in dielectric stresses that will also generate the corona discharge phenomenon in harsh conditions.

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Génie civil
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Encombrements et masses
Overall dimensions and weights

M,MB	1600 [1]	375/600	1030	130/140
MC	1600 [1]	800	1030	210
PM, GM, GMB	1600 [1]	375/600	1030	140/180
GMC	1600 [1]	625	1030	190
CVM	2050	750	1030	400
DM1-A, DM1-D, DM1-W, DM2, DMVL-A, DMVL-D	1600 [1]	750	1115	410
DM1-S	1600 [1]	750	1250	360
DMV-A, DMV-D	1600 [1]	625	1030	350
DMV-S	1600 [1]	625	1030	270
GM	1600 [1]	375	1030	200
GMC	1600 [1]	625	1030	220
GBC-A, GBC-B	1600	750	1030	300
NRM-cables, NRM-busbars	2050	750	1030	270
GIM	1600	125	930	40
GBM (2)	1600	125	930/1080 [2]	40/45
SRM	1600	375	1030	130
GAM2	1600	375	1030	150
GAM	1600	500	1030	170
IM	1600 [1]	375/500 [3]	1030	130/160
TM	1600	375	1030	210
DM1-A, DM1-D, DM1-W, DM1-Z (1250 A)	1600	750	1115	430

Ajouter à la hauteur :

(1) 450 mm, si caisson contrôle pour protection et contrôle-commande. Pour avoir un tableau homogène, toutes les cellules (excepté GIM et GBM) peuvent recevoir un caisson contrôle.
(2) suivant la configuration des jeux de barres de la cellule VM6, deux types de gaines d'extension sont possibles :
- si extension d'une cellule VM6 DM1Z ou DM2Z, prendre la gaine de profondeur 1080 mm
- pour toutes les autres cellules VM6, prendre la profondeur de 930 mm.

(3) pour la cellule 1250 A.

Add to height:

(1) 450 mm for low-voltage enclosure for control/monitoring and protection functions. To ensure uniform presentation, all units (except GIM and GBM) may be equipped with low-voltage enclosures.
(2) depending on the busbar configuration in the VM6 unit, two types of extension units may be used:
- *to extend a VM6 DM1Z or DM2Z unit, use an extension unit with a depth of 1080 mm*
- *for all other VM6 units, a depth of 930 mm is required.*

(3) for the 1250 A unit.

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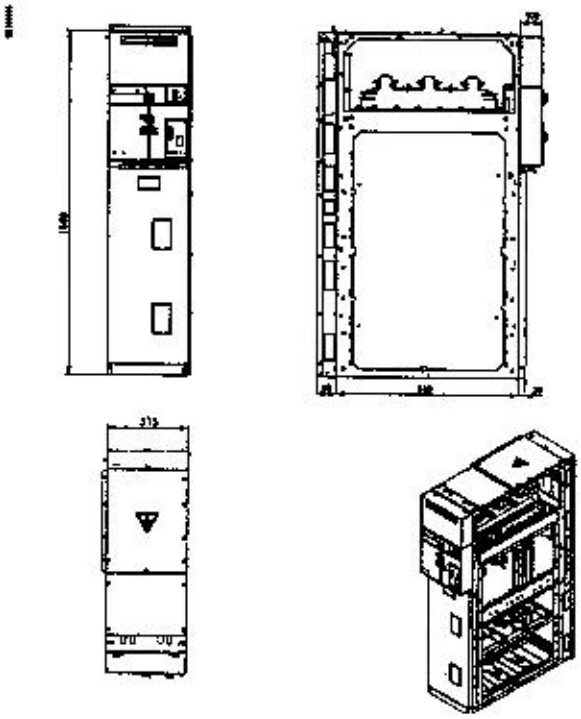
Civil engineering

Dimensions des cellules
Cubicles dimensions

Cellule de largeur 375 *Cubicle width 375*



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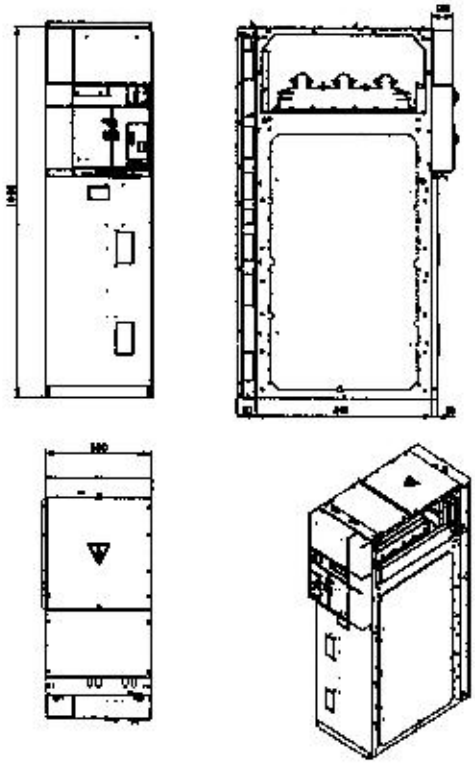
Civil engineering

Dimensions des cellules
Cubicles dimensions

Cellule de largeur 500 *Cubicle width 500*



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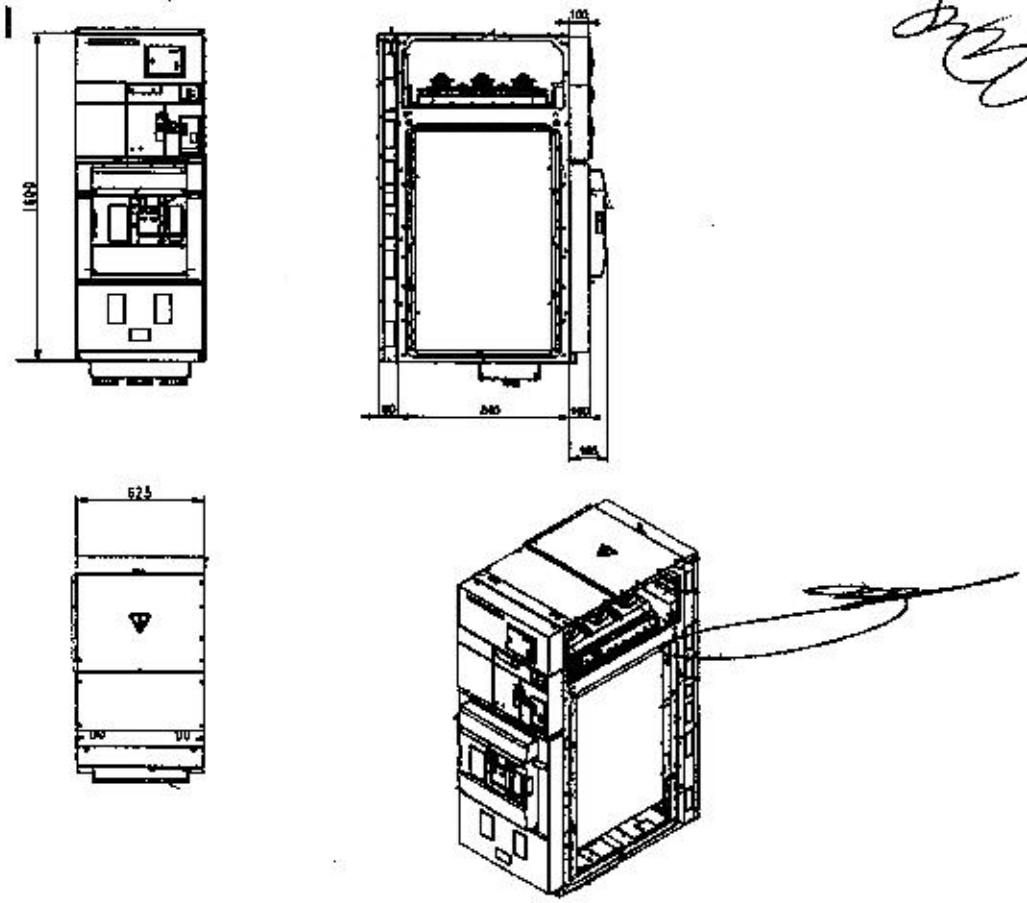
Dimensions des cellules
Cubicles dimensions

Cellule de largeur 625 | *Cubicle width 625*



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Génie civil
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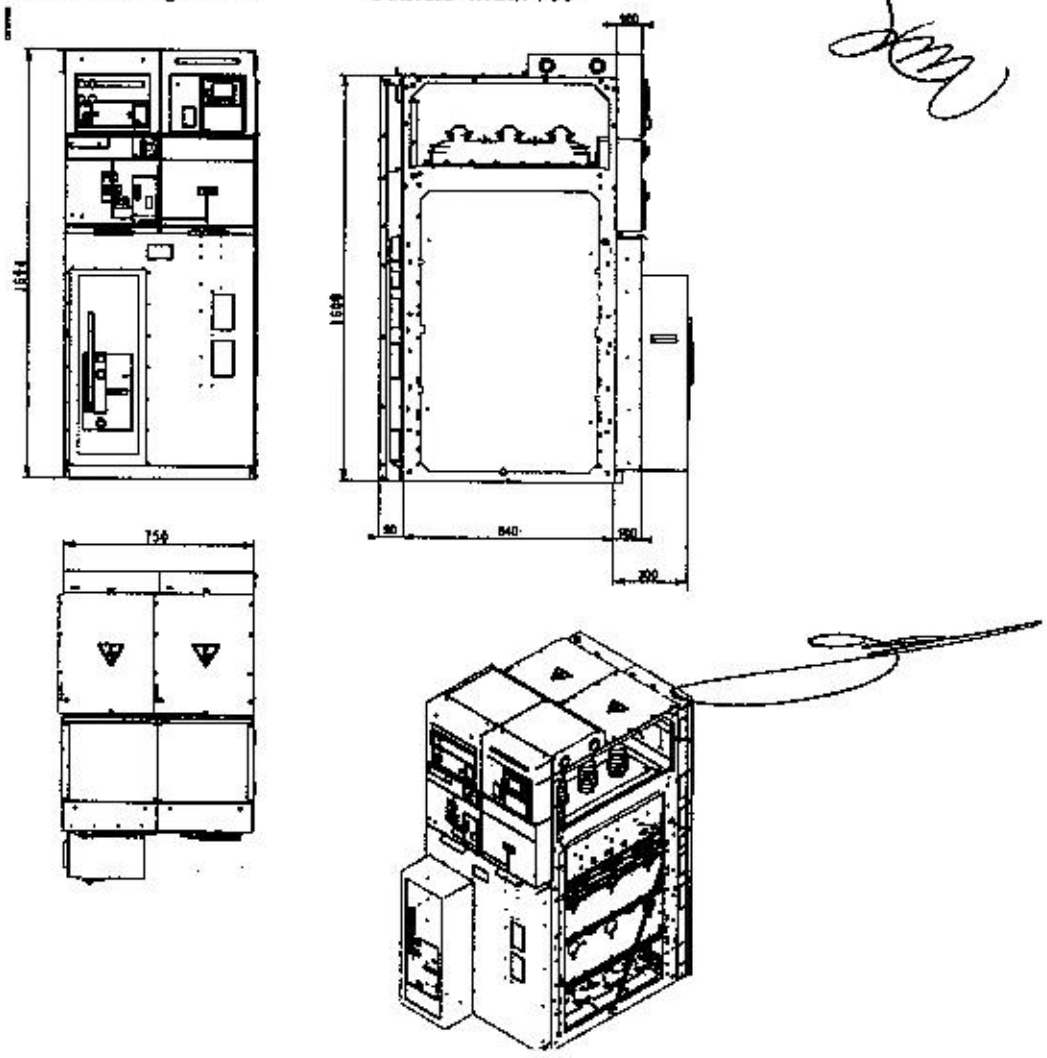
Dimensions des cellules
Cubicles dimensions

Cellule de largeur 750 | ***Cubicle width 750***



Fin de vie et préservation environnementale

End of life and environmental conservation

Préservation environnementale
Environmental conservation

Présentation du produit

La gamme SM6-24 a pour principale fonction la commutation et la coupure des réseaux de 1 kV à 24 kV.
Détail de la gamme : jusqu'à 24 kV (Ur), 630/1250 A (Ir) 25 kA/1 s (prfc), et tenue à l'arc interne à 50/60 Hz de 12,5 kA/1 s, 16 kA/1 s et 20 kA/1 s.
Les produits représentatifs utilisés pour l'analyse sont : IM & QM (sans fusibles), DM1-A et DMV-A.
Les impacts environnementaux des produits référencés sont représentatifs des impacts des autres produits de la gamme qui sont développés avec la même technologie.
L'analyse environnementale a été effectuée en conformité avec la norme ISO 14040 «Management environnemental : Analyse du cycle de vie - Principes et cadre».
Cette analyse prend en compte les étapes du cycle de vie du produit.

Product overview

The main function of the SM6-24 range is to switching and breaking from 1kV to 24kV.

This range consists of up to 24kV (Ur), 630/1250A (Ir) 25kA/1s (prfc), and 12,5 kA/1s, 16 kA/1s and 20 kA/1 s Internal Arc Withstand at 50/60 Hz.
The representative product used for the analysis are: IM & QM (without fuses), DM1-A, and DMV-A.
The environmental impacts of the referenced product are representative of the impacts of the other products of the range which are developed with the same technology.
The environmental analysis was performed in conformity with ISO 14040 "Environmental management: Life cycle assessment – Principle and framework".
This analysis takes the stages in the life cycle of the product into account.

Fabrication

La gamme SM6-24 est fabriquée sur un site de production Schneider Electric bénéficiant d'un système de management environnemental certifié ISO 14001.

Manufacturing

The SM6-24 range is manufactured at a Schneider Electric production site on which an ISO 14001 certified environmental management system has been established.

Distribution

Le poids et le volume des emballages ont été réduits, conformément à la directive de l'Union Européenne sur les emballages.
L'emballage IM & QM pèse 7 kg. Il est constitué d'une palette en bois (4,6 kg), de carton (1,5 kg), de clous (0,4 kg), de polystyrène (0,1 kg), d'un cerclage (0,1 kg).
L'emballage DMV-A pèse 12 kg. Il est constitué d'une palette en bois (8,5 kg), de carton (2 kg), de clous (0,5 kg), de polystyrène (0,2 kg), d'un cerclage (0,4 kg).
L'emballage DM1-A pèse 12,5 kg. Il est constitué d'une palette en bois (5,7 kg), de carton (2,2 kg), de clous (0,8 kg), de polystyrène (0,4 kg), d'un cerclage (0,4 kg).
Les flux de distribution du produit ont été optimisés par l'implantation décentrée de distributions locaux proches des zones de marché.

Distribution

The weight and volume of the packaging have been reduced, in compliance with the European Union's packaging directive.
The IM & QM packaging weight is 7-kg. It consists of wooden pallet (4,6kg), carton (1,5kg), nails (0,4kg), polystyrene (0,1kg), band strapping (0,1kg).
The DMV-A packaging weight is 12-kg. It consists of wooden pallet (8,5kg), carton (2kg), nails (0,5kg), polystyrene (0,2kg), band strapping (0,4kg).
The DM1-A packaging weight is 12,5-kg. It consists of wooden pallet (5,7kg), carton (2,2kg), nails (0,8kg), polystyrene (0,4kg), band strapping (0,4kg).
The product distribution flows have been optimized by setting up local distribution centres close to the market areas.

Fin de vie et préservation environementale

End of life and environmental conservation

Préservation environementale
Environmental conservation

Utilisation

Les produits de la gamme SMB-24 ne génèrent pas de pollution environnementale nécessitant des mesures de protection spéciales (bruit, émissions, etc.).
Pour les produits consommant de l'énergie, indiquer la mention suivante : la puissance dissipée dépend des conditions de mise en œuvre et d'utilisation du produit.
La puissance électrique consommée par la gamme SMB-24 va de 8,8 W à 78,2 W :
- Elle est de 8,8 W en mode actif et de 0 % en mode veille pour IM & OM référencé.
- Elle est de 38,6 W en mode actif et de 0 % en mode veille pour DMV-A référencé.
- Elle est de 78,2 W en mode actif et de 0 % en mode veille pour DM1-A référencé.

Cette puissance consommée représente moins de 30% de la puissance totale qui circule à travers le produit.

Pour les produits dissipant de l'énergie, indiquer la mention suivante : la puissance dissipée dépend des conditions de mise en œuvre et d'utilisation du produit.
La puissance dissipée va de 100 W à 880 W, pour la gamme de produits SMB-24.
Pour un taux d'utilisation de 100 % :
- Elle est de 100 W pour IM & OM référencé.
- Elle est de 440 W pour DMV-A référencé.
- Elle est de 880 W pour DM1-A référencé.

Cette dissipation thermique représente moins de $0,2.10^{-4}$ % pour IM & OM, $1,8.10^{-4}$ % pour DMV-A et $3,3.10^{-4}$ % pour DM1-A, de la puissance qui circule à travers le produit.

Utilisation

The products of the SMB-24 range do not generate environmental pollution requiring special precautionary measures (noise, emissions, and so on).
For consuming products, indicate following mention: the dissipated power depends on the conditions under which the product is implemented and used.
The electrical power consumed by the SMB-24 range spreads out between 8,8 W and 78,2 W:
- *It is 8,8 W in active mode and 0 % in standby mode for the referenced IM & OM.*
- *It is 38,6 W in active mode and 0 % in standby mode for the referenced DMV-A.*
- *It is 78,2 W in active mode and 0% in standby mode for the referenced DM1-A.*

This consumed power represents less than 30 % of the total power which passes through this product.

For dissipating products, indicate following mention The dissipated power depends on the conditions under which the product is implemented and used. This dissipated power spreads out between 100 W and 880 W, for the SMB-24 product range.
For a utilisation rate of 100 %:
- *It is 100 W for the referenced IM & OM.*
- *It is 440 W for the referenced DMV-A.*
- *It is 880 W for the referenced DM1-A.*

This thermal dissipation represents less than $0,2.10^{-4}$ % for IM&OM, $1,8.10^{-4}$ % for DMV-A, $3,3.10^{-4}$ % for DM1-A of the power which passes through the product.

Impacts environnementaux

L'Analyse du Cycle de Vie (ACV) a été réalisée à l'aide du logiciel EIME (Environmental Impact and Management Explorer) version V3 et de sa base de données version 6.4.
La durée de vie estimée du produit est de 30 ans avec un taux d'utilisation de l'installation de 100 %, le modèle de puissance électrique utilisée est européen.
L'études de l'analyse a été limitée à IM & OM, DMV-A et DM1-A.
Les impacts environnementaux ont été analysés pour les phases de fabrication (F), y compris le traitement des matières premières, et pour les phases de distribution (D) et d'utilisation (U).
Présentation des impacts environnementaux du produit

Environmental Impacts

The EIME (Environmental Impact and Management Explorer) software, version V3, and its database, version 6.4 were used for the life cycle assessment (LCA).
The assumed service life of the product is 30 years with an utilisation rate of the installation of 100 % and the electrical power model used is European.
The scope of the analysis was limited to a IM & OM, DMV-A, and DM1-A.
The environmental impacts were analysed for the Manufacturing (M) phases, including the processing of raw materials, and for the Distribution (D) and Utilisation (U) phases.
Presentation of the product environmental impacts

Approche système

La gamme est conforme à ROHS : les produits de la gamme étant conçus conformément à la directive ROHS (directive européenne 2002/95/EC de 27 janvier 2003), ils peuvent être incorporés sans restrictions dans un assemblage ou une installation soumis à cette directive.

Product Overview

The range is RoHS compliant: as the product of the range are designed in accordance with the RoHS Directive (European Directive 2002/95/EC of 27 January 2003), they can be incorporated without any restriction within an assembly or an installation submitted to this Directive.

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Fin de vie et préservation environnementale

End of life and environmental conservation

Fin de vie et recyclage
End of life and recycling

Fin de vie

En fin de vie, les produits de la gamme SM6-24 doivent être démontés pour faciliter la récupération des différents matériaux constitutifs.
Si le poids du matériau (individuellement) représente plus de 15 % du poids total en fonctionnement, il est considéré comme un matériau recyclable.
La proportion de matière recyclable est supérieure à 85 %.
Ce pourcentage comprend les matériaux suivants : acier et cuivre.

End of life

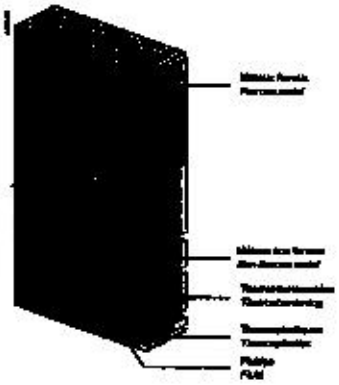
At end of life, the products of the SM6-24 must be dismantled to facilitate the recovery of the various constituent materials.
If weight of the material (individually) is more than 15 % of total function's weight that is considered as recyclable material.
The proportion of recyclable material is higher than 85 %.
This percentage includes the following materials: steel, and copper.

Recyclage

Schneider Electric est engagé dans une démarche environnementale interne dans le long terme.
Dans ce cadre, SM6 a été conçu dans le pour du respect de l'environnement et notamment en prenant en compte les aptitudes au recyclage du produit.
Les matériaux utilisés, isolants et conducteurs, sont identifiés, facilement séparables, dans l'analyse profil environnement produit qui a été élaboré en conformité avec l'ISO 14040.
En fin de vie, SM6 pourra être traité, recyclé et valorisé conformément au projet de réglementation européenne sur la fin de vie des produits électriques et électroniques,et en particulier sans émission de gaz dans l'atmosphère rejet de fluides polluants.
SM6 est conforme à la directive RoHS qui restreint l'utilisation de six substances dangereuses pour la fabrication de divers types d'équipements électroniques et électriques.

Recycling

Schneider Electric is committed to a long term environmental approach.
As part of this, the SM6 has been designed to be environmentally friendly, notably in terms of the product's recyclability.
The materials used, both conductors and insulators, are identified in product environmental profile analysis and easily separable. It was performed in conformity with ISO 14040 "Environmental management: life cycle assessment - principle and framework".
At the end of its life, SM6 can be processed, recycled and its materials recovered in conformity with the draft European regulations on the end-of-life of electronic and electrical products, and in particular without any gas being released to the atmosphere or any polluting fluids being discharged.
SM6 is compliant with the RoHS directive. RoHS restricts the use of six hazardous materials in the manufacture of various types of electronic and electrical equipment.



[redacted]	84 %	88 %
[redacted]	4 %	10,8 %
[redacted]	9,5 %	22%
[redacted]	2,38 %	2,3 %
Fluide Fluid	0.15%	0,1 %

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Fin de vie et préservation environnementale

End of life and environmental conservation

Récupération du gaz SF6 en fin de vie

Recovery of SF6 gas at end of life

Le SF6 doit être retiré avant toute opération de démantèlement selon les procédures décrites dans le document CEI–61634.

Le gaz doit être traité conformément au document CEI–60480.
■ volume de gaz à récupérer : 35litres par interrupteur,
■ pression interne relative : 40kPa.

The SF6 must be removed before any dismantling operation can be carried out in compliance with the procedures describedin IEC–61634.
The gas must be treated in compliance with IEC–60480.
■ *volume of gas to be recovered: 35litres per switch,*
■ *internal gauge pressure: 40kPa.*

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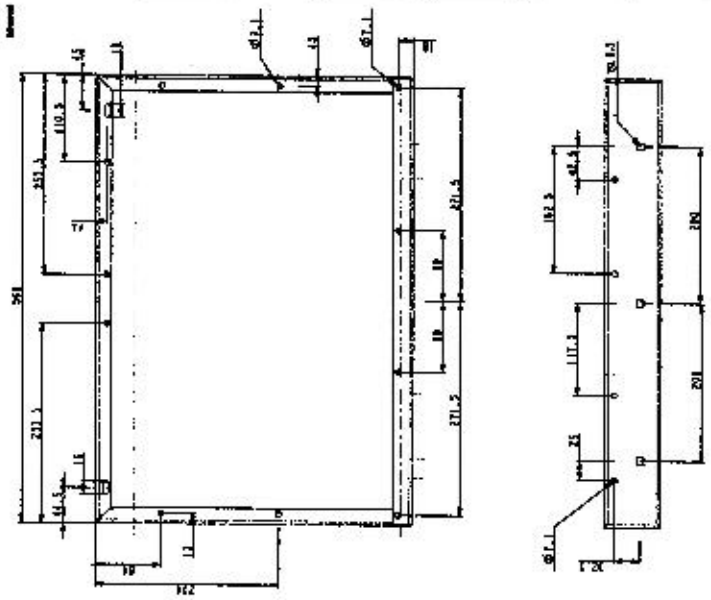
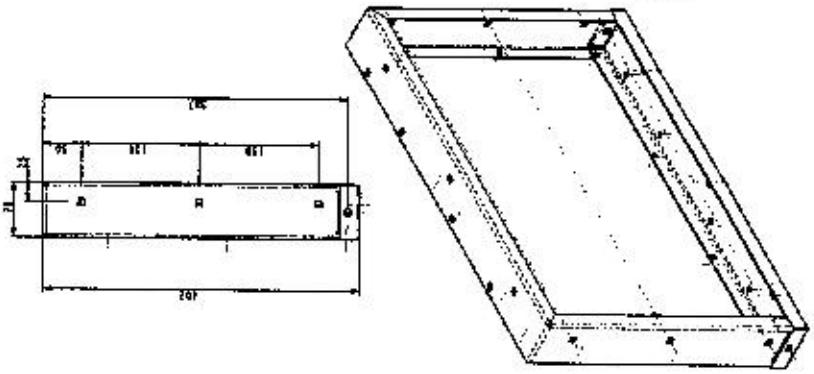
Annexes
Appendix

Plan de la bride d'interface
Coupling flange layout





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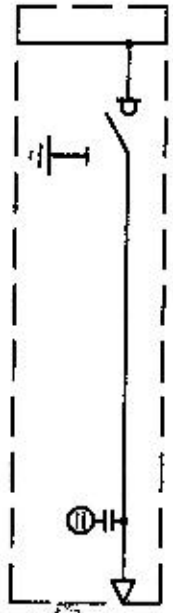

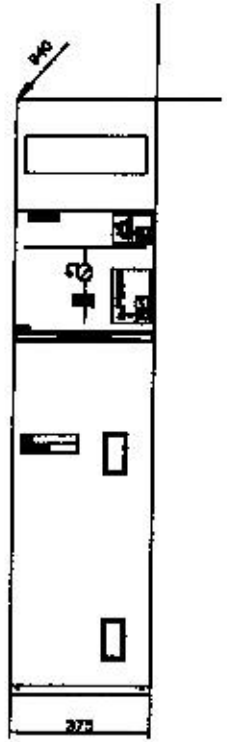

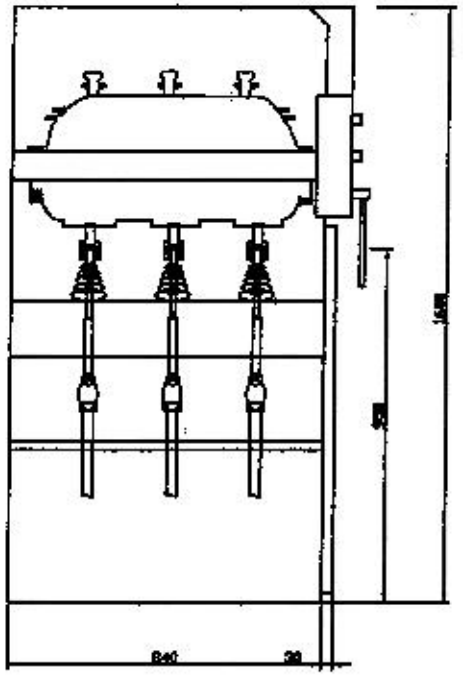

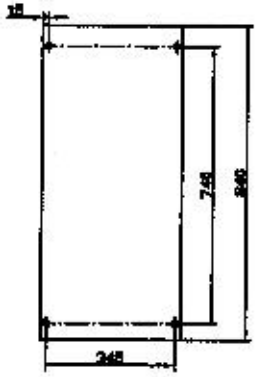

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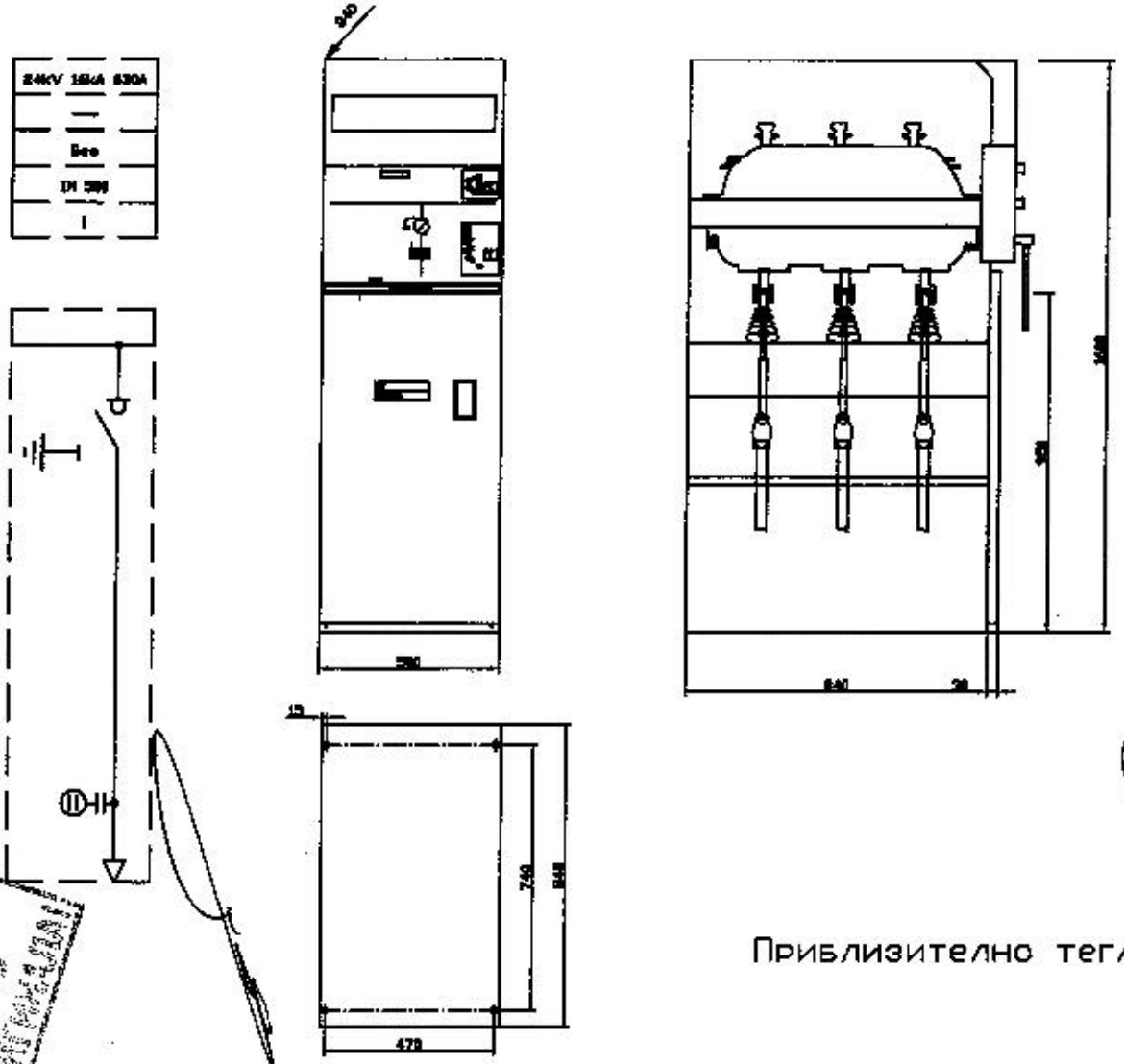

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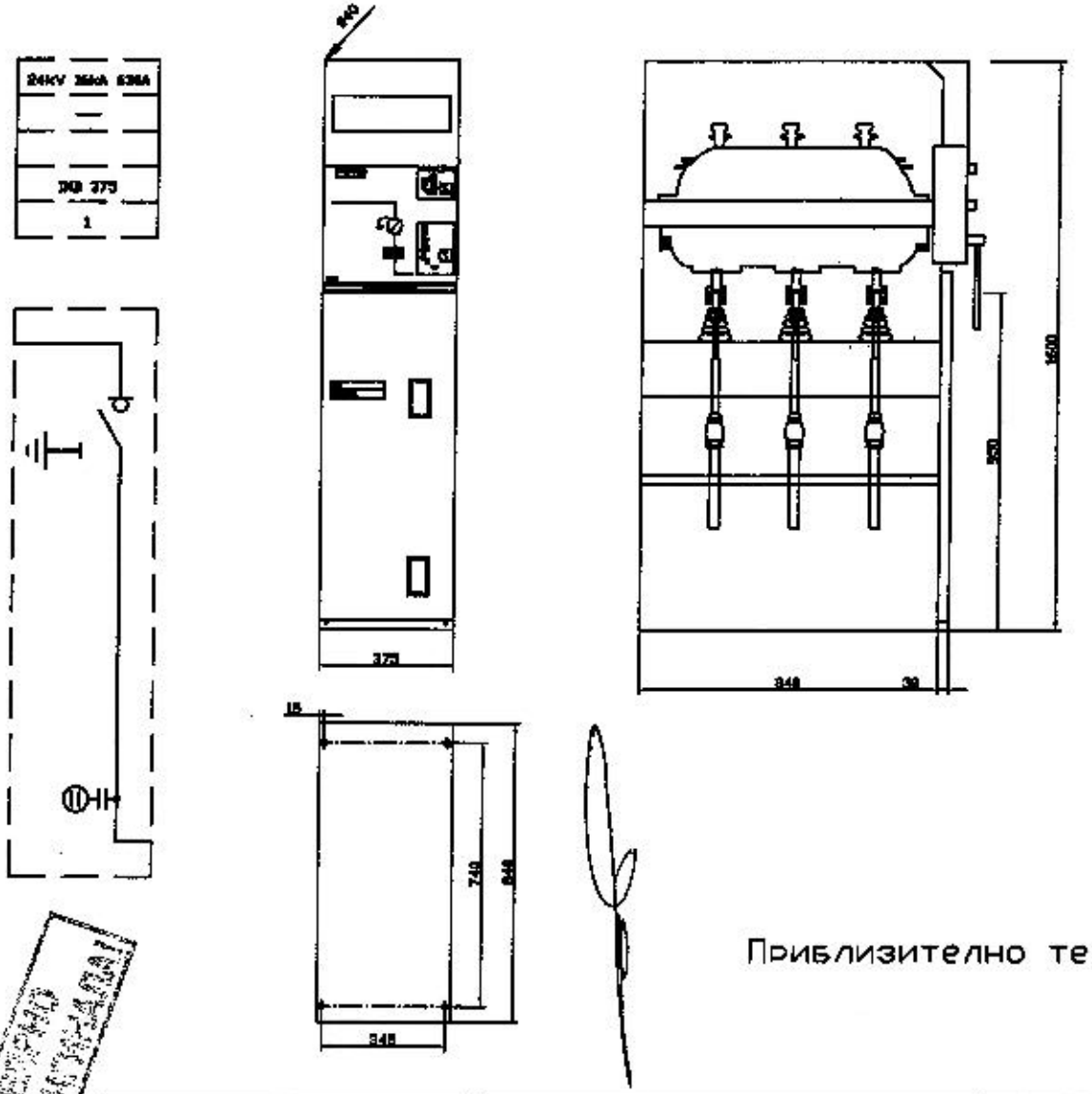

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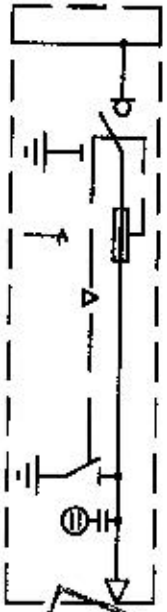

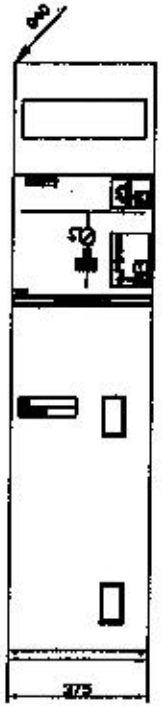

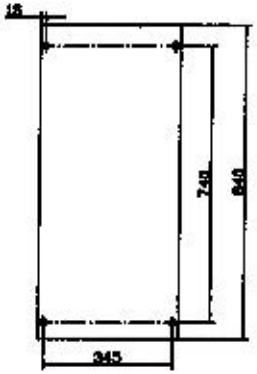

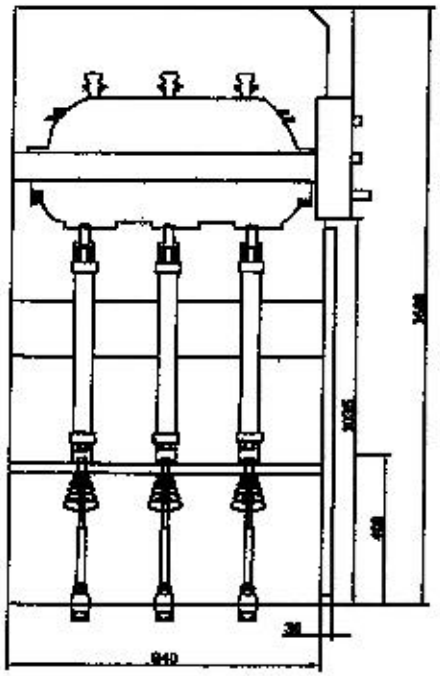

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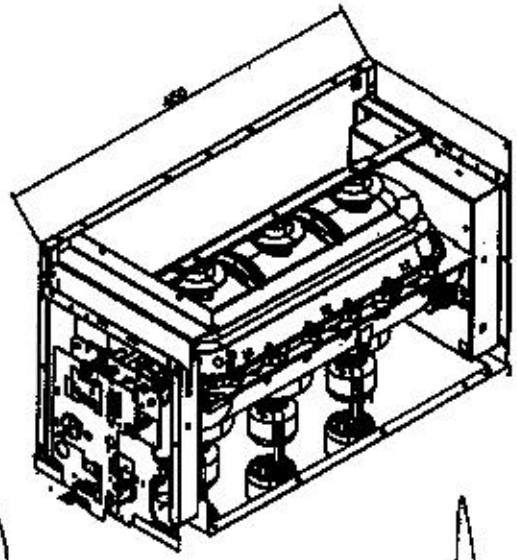

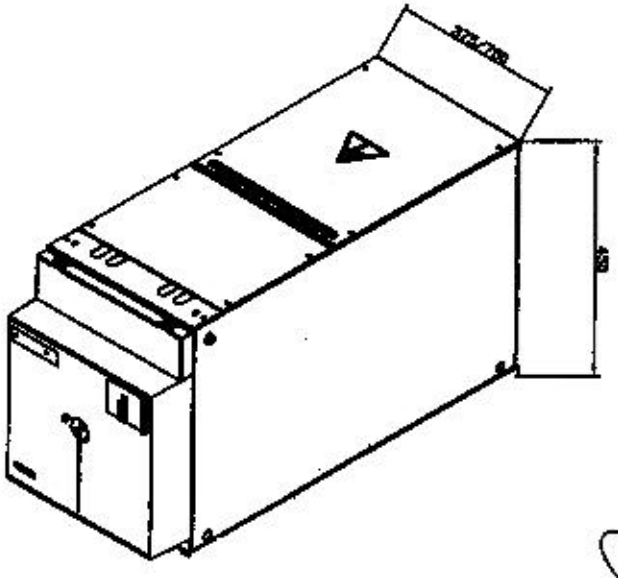

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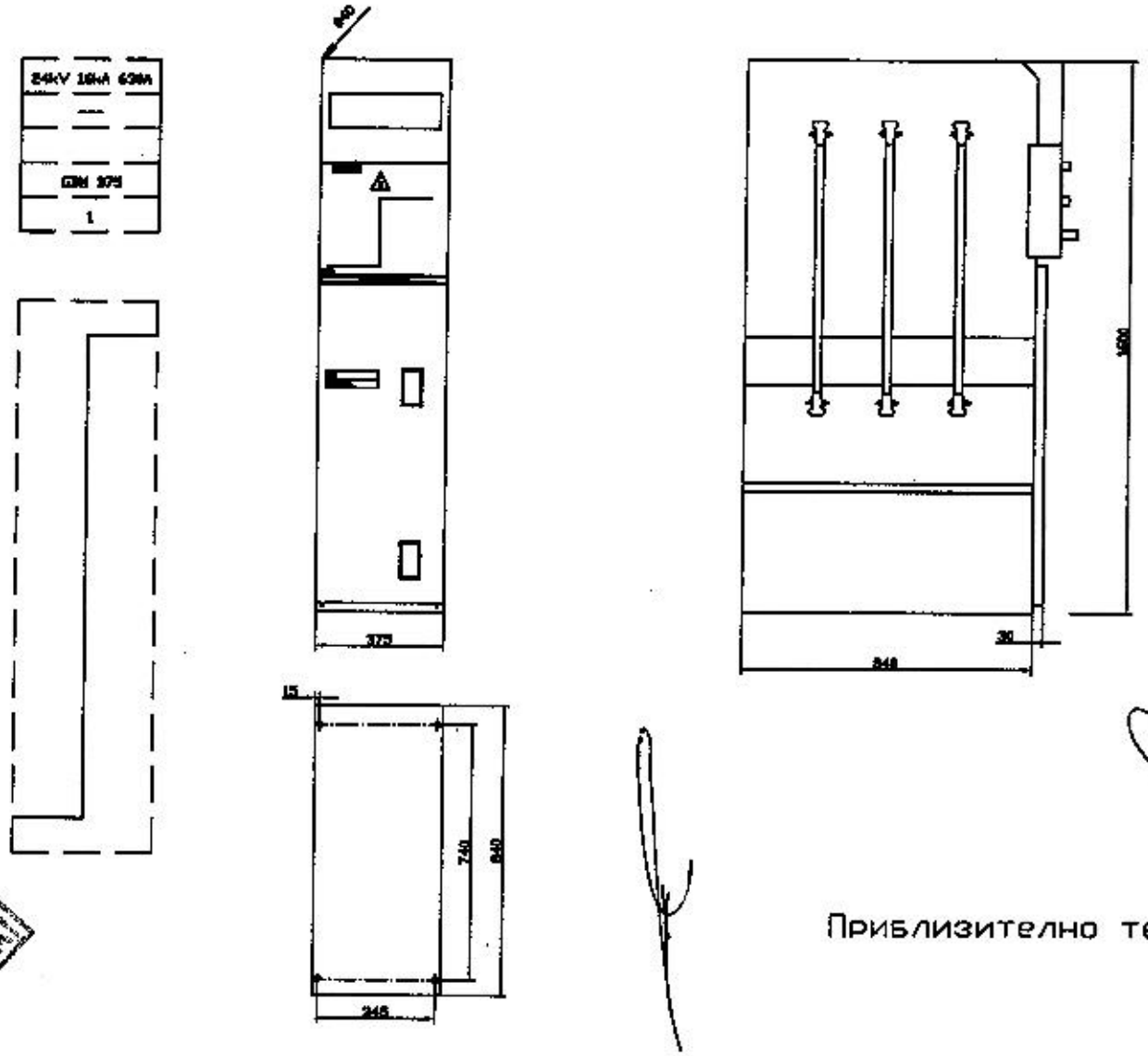

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Дизайн на табелката за обявените данни / Example of engraving on the various plates

SM6- IM			Съдържа флуорирани парникови газове, обхванати от Протокола от Киото затворена система под налягане								
Ur		17,5	kV	Ud	38	kV	Up 95 Kv		IAC	12,5	kA/1s
Ik		12,5	kV	tk	1 s		Ip 31,5/32,5	kA	A-FL R		
Ir	O	630	A	Un	15	kV	fr 50/60Hz	↗	O	7896682EN	
SF6		0,210	kg	Pae	14	kPa	година 2013	S/N		0826327L	
Pre		40	kPa	Pme	9	kPa		HN64S41-IEC 62271-200			

Лого Schneider

Notice / Leaflet

SM6- QM			Съдържа флуорирани парникови газове, обхванати от Протокола от Киото затворена система под налягане								
Ur		17,5	kV	Ud	38	kV	Up 95 Kv		IAC	12,5	kA/1s
Ik		12,5	kV	tk	1 s		Ip 31,5/32,5	kA	A-FL R		
Ir	O	630	A	Un	15	kV	fr 50/60Hz	↗	O	7896682EN	
SF6		0,210	kg	Pae	14	kPa	година 2013	S/N		0826327L	
Pre		40	kPa	Pme	9	kPa		HN64S41-IEC 62271-200			

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ПРИЛОЖЕНИЕ 5

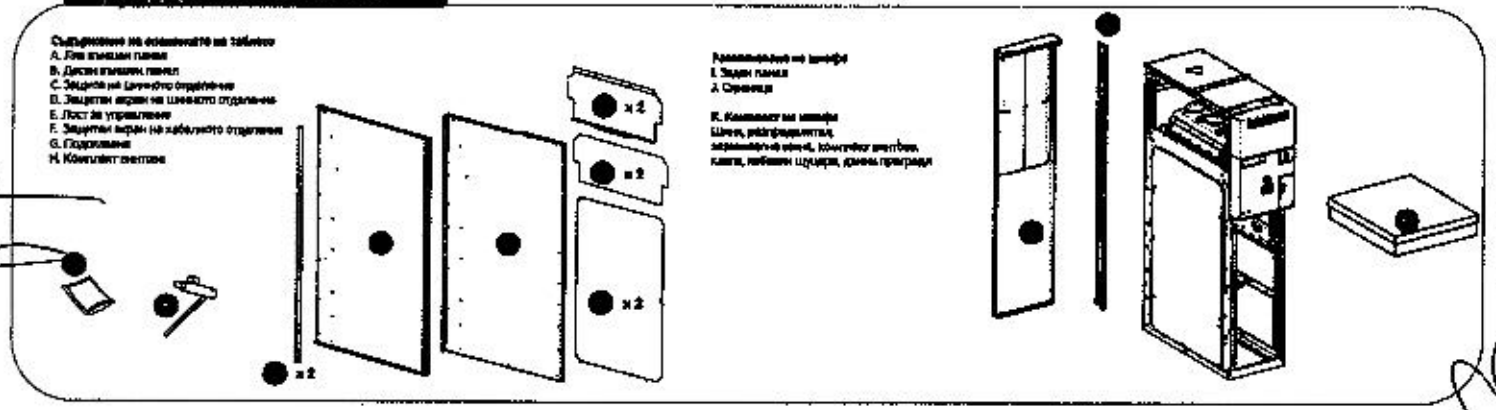
Упътване за сглобяване на уредба SM6

Schneider Electric

SM6-24 12,5 & 16 kA/1s
IAC : AFL & AFL-R

[redacted]

Съдържание на пакета



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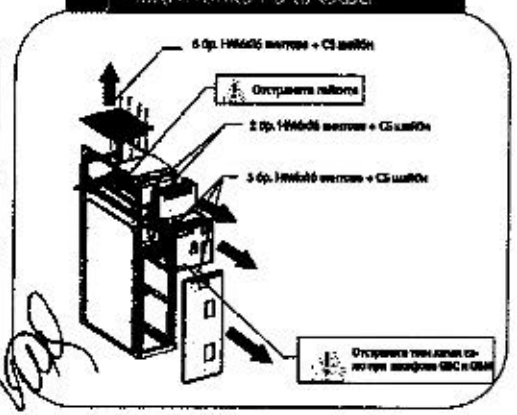
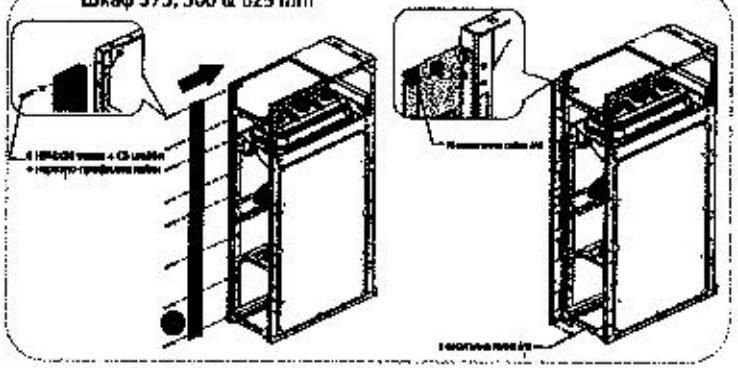


Сглобяване на уредба отляво надясно

Сглобяване на уредба отдясно надясно

стр. 4

Шкаф 375, 500 & 625 mm



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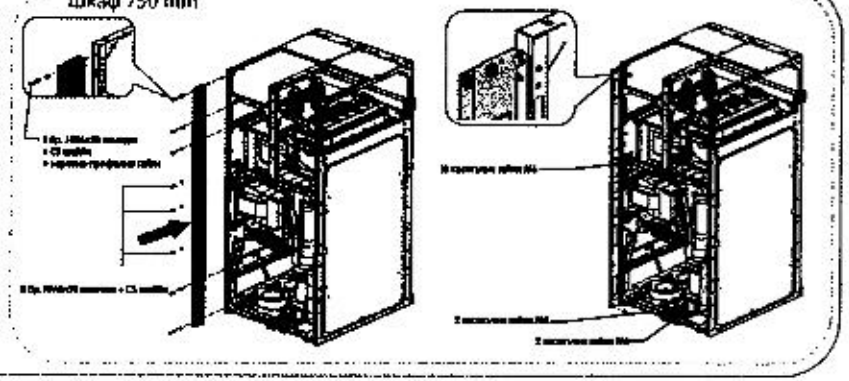

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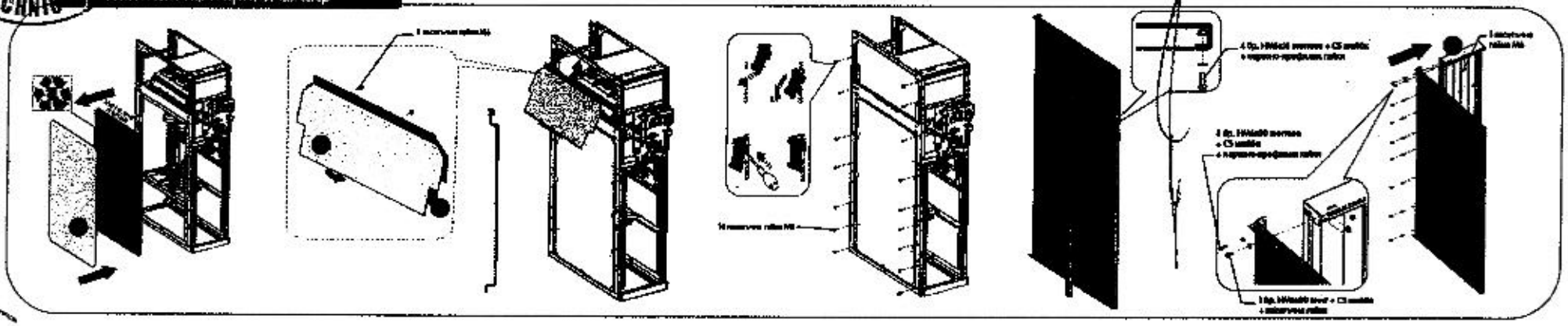

Упътване за сглобяване на уредба SM6

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SM6-24 12,5 & 16 kA/1s
IAC : AFL & AFL-R

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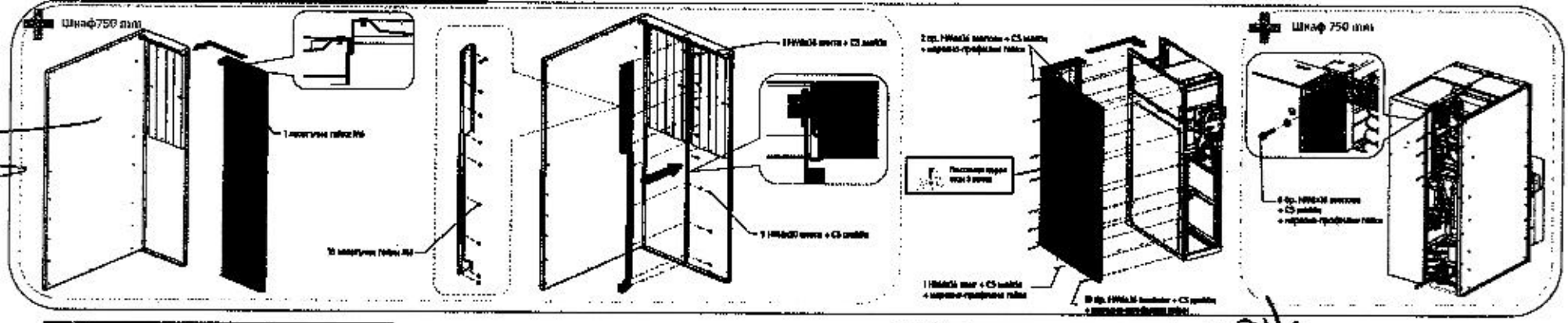
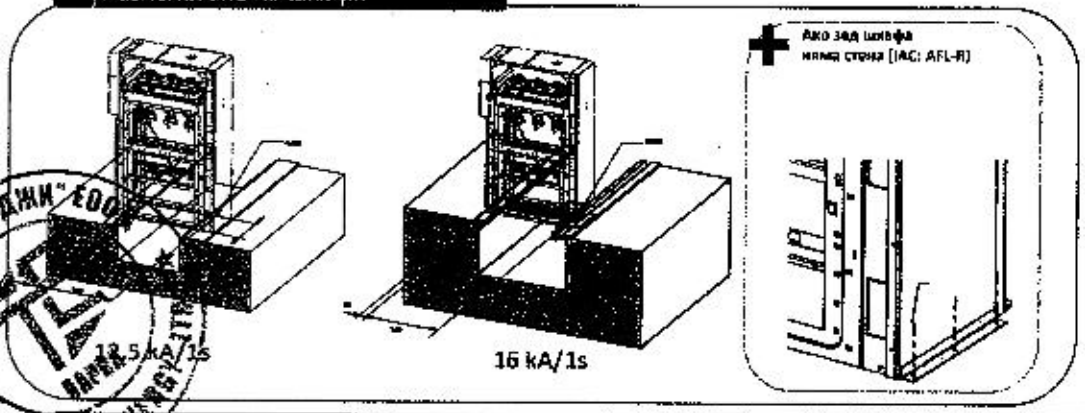
Монтаж на първия шкаф (продължение)



Разполагане на шкафа



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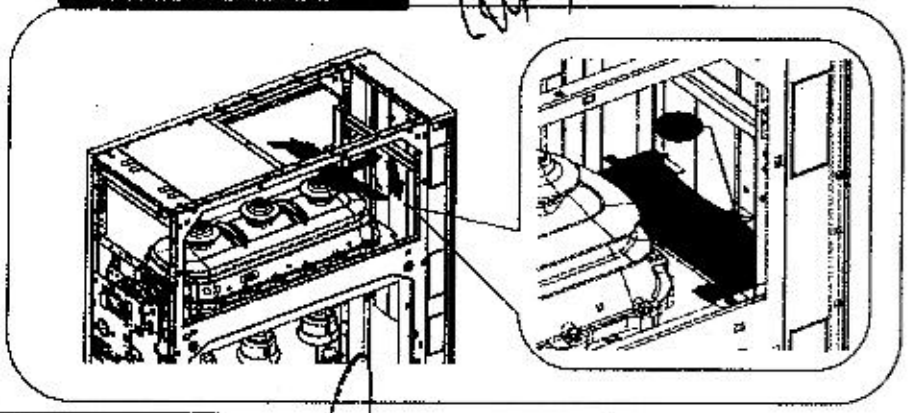

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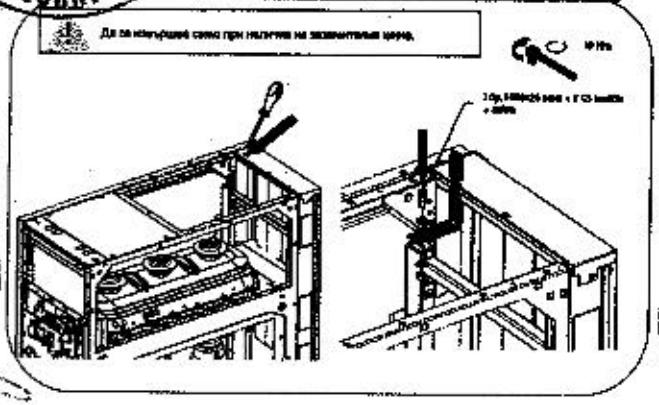

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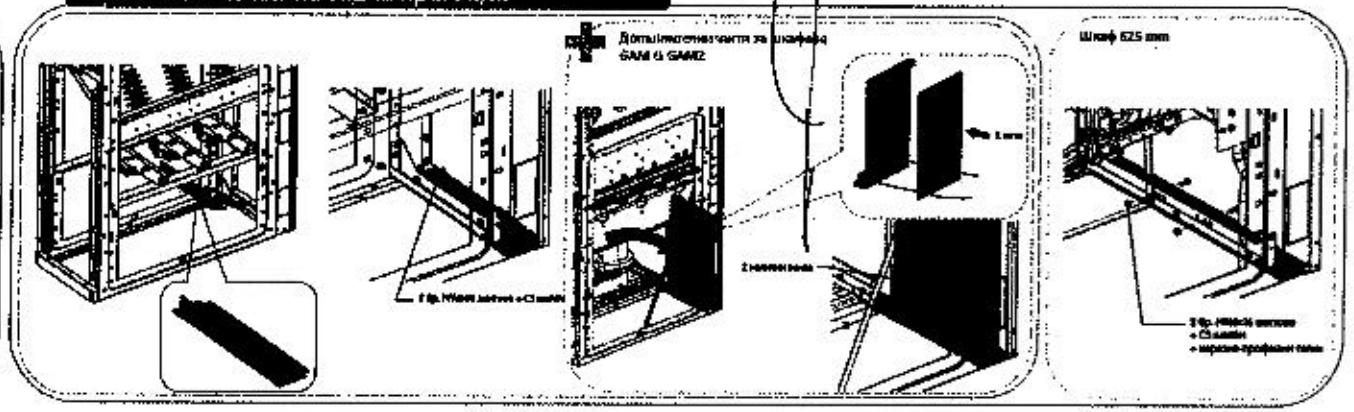


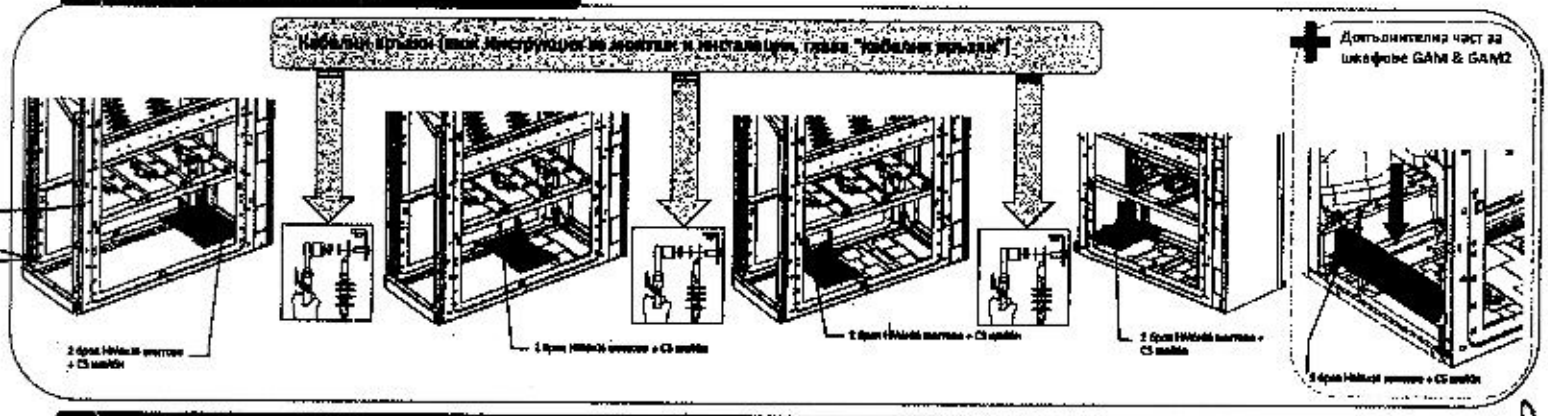
Упътване за сглобяване на уредба SM6

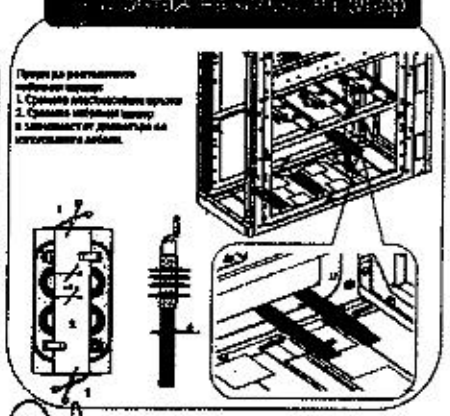
Schneider Electric

SM6-24 12,5 & 16 kA/1s
IAC : AFL & AFL-R

[redacted]

7 Разполагане на шкафа





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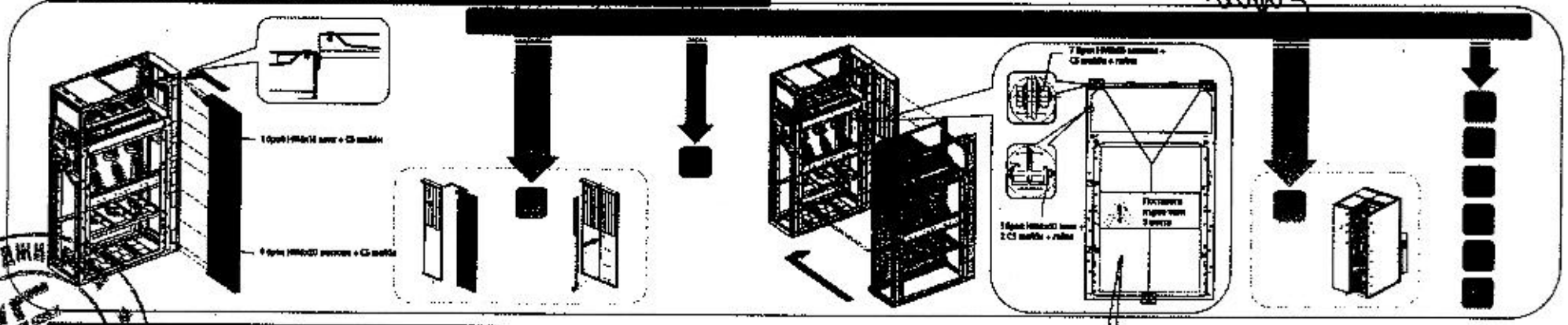
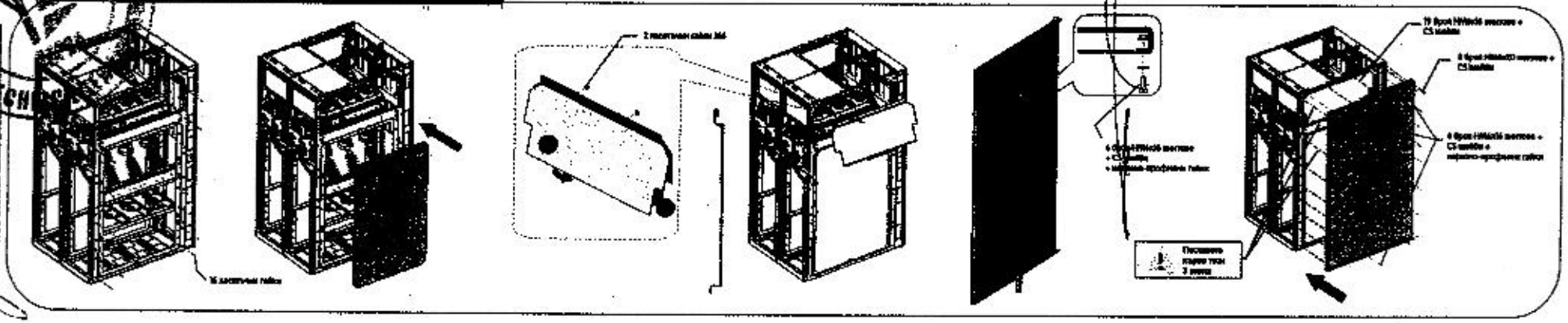


Затваряне на уредбата



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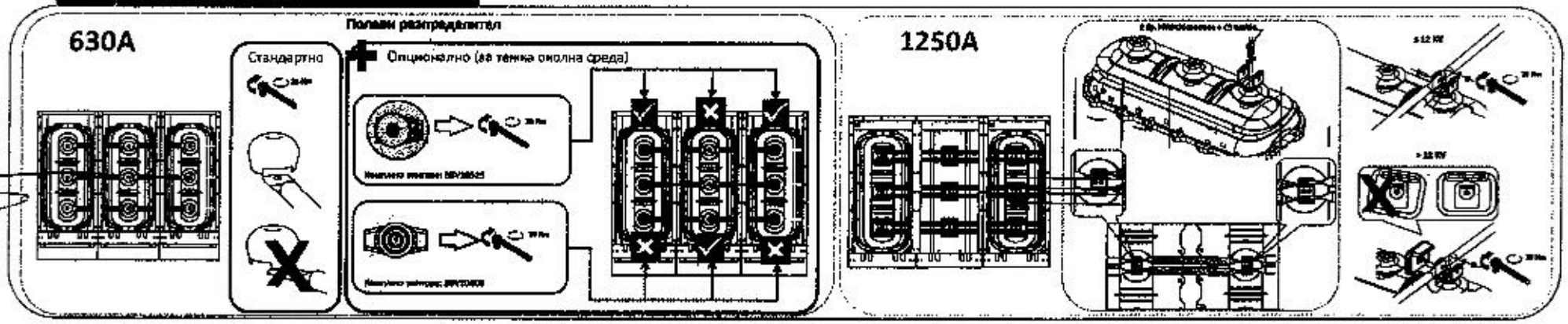
Упътване за сглобяване на уредба SM6

Schneider Electric

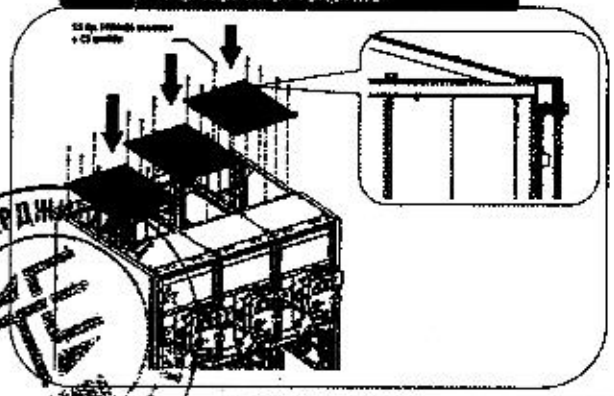
SM6-24 12,5 & 16 kA/1s
IAC : AFL & AFL-R

[redacted]

Монтаж на шините



Монтаж на покривите



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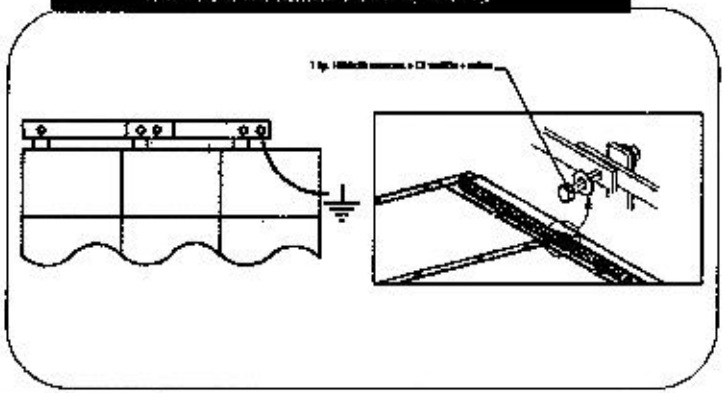
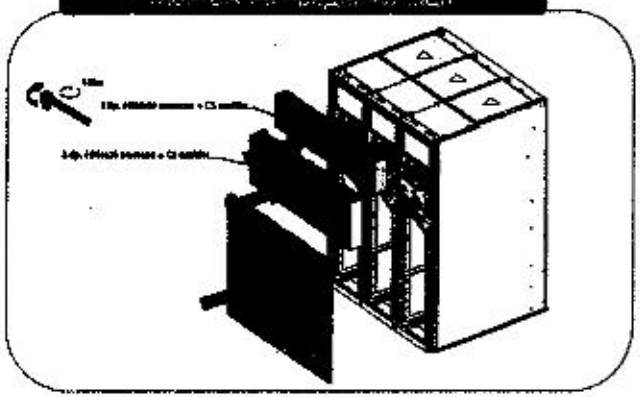
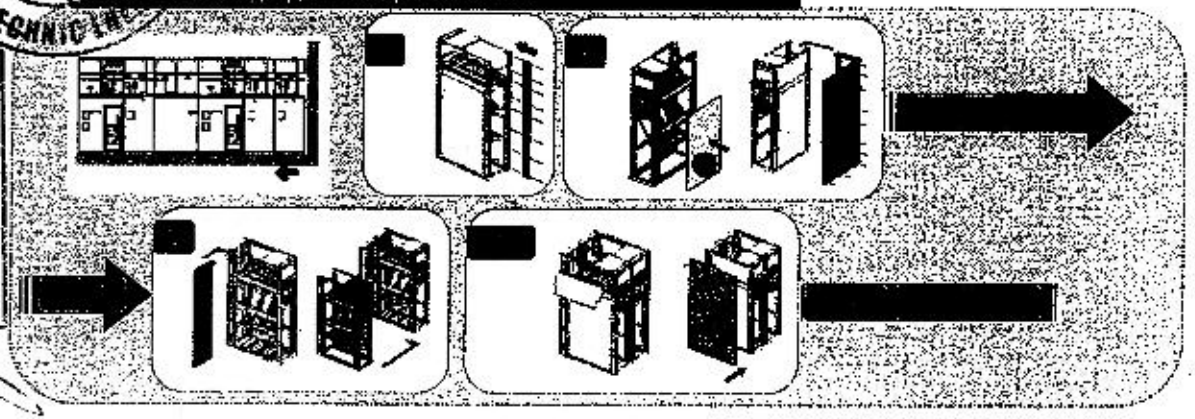


Монтаж на предни капаци



Монтаж на уредбата отдясно наляво



SM6

distribution MT
ensembles préfabriqués
à votre service

notice d'installation *installation instructions*

Installation de capteur de courant TLP130 et des tôles de fond

installation of current transformer TLP130 and back plates

NOTICE A USAGE DES INSTALLATEURS
THIS MANUAL IS INTENDED FOR INSTALLERS

Schneider Electric

symboles et conventions

symbols and conventions

Attention :
vous trouvez l'ensemble de ces symboles ci-dessous durant l'intégralité du document, vous indiquant les degrés des dangerosités selon les différentes mises en situation.

Caution:
you will find all the symbols below throughout the document, indicating the hazard levels depending on the different types of situation.

DANGER — **suivant iso 3864-2** / ***as per iso 3864-2***

DANGER : si cette directive n'est pas respectée, cela entraînera la mort ou blessures graves.

DANGER: *failure to follow this instruction will result in death or serious injury.*

AVERTISSEMENT / ***WARNING*** — **suivant iso 3864-2** / ***as per iso 3864-2***

AVERTISSEMENT : si cette directive n'est pas respectée, cela peut entraîner la mort ou blessures graves.

WARNING: *failure to follow this instruction may result in death or serious injury.*

ATTENTION / ***CAUTION*** — **suivant iso 3864-2** / ***as per iso 3864-2***

ATTENTION : si cette directive n'est pas respectée, cela peut entraîner des blessures.
Ce signal d'alerte peut également être utilisé pour signaler des pratiques pouvant entraîner des dommages pour le matériel SM6.

CAUTION: *failure to follow this instruction may result in injuries.*
This alert signal can also be used to indicate practices that could damage the SM6 unit.

INFORMATION-CONSEIL
Nous attirons votre attention sur ce point particulier

INFORMATION-ADVICE
We draw your attention to this specific point.

Released for Manufacturing
Printed on 20/03/2009

contacter l'unité service de Schneider Electric pour diagnostics et conseils

contact the Schneider Electric service unit for diagnosis and advice

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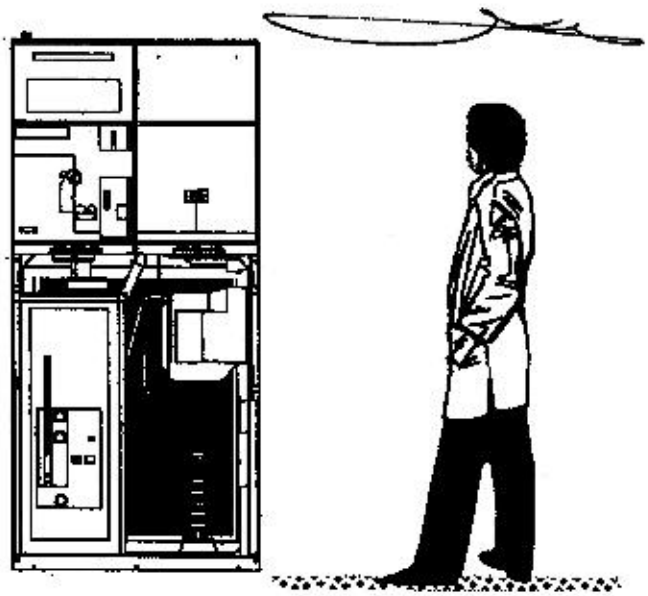
vous pouvez vous connecter sur : www.schneider-electric.com

Call your sales representative who will put you in contact with the closest SCHNEIDER ELECTRIC group service centre.
You can log on to:
www.schneider-electric.com



règles de diffusion

distribution rules

ATTENTION
CAUTION

Le but de cette publication est de permettre l'installation correcte du matériel SM6.

The aim of this publication is to enable the SM6 unit to be installed correctly.

ATTENTION
CAUTION

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Released for Manufacturing
Printed in 2000/08/W
BEV[illegible]4501 revision : 01

règles de sécurité
safety rules

ATTENTION
CAUTION

Toutes les opérations décrites ci–après doivent être effectuées en respectant les normes de sécurité en vigueur, **sous la responsabilité d'une autorité compétente.**

*All the operations described below must be performed in compliance with applicable safety standards, **under the responsibility of a competent authority.***

ATTENTION
CAUTION

N'entreprenez le travail qu'après avoir lu et compris toutes les explications contenues dans ce document.

Si la moindre difficulté à respecter ces règles se présentait, veuillez vous adresser **à Schneider Electric.**

*Only undertake the work after having read and understood all the explanations given in this document. If you have any difficulty complying with these rules, please contact **Schneider Electric.***

AVERTISSEMENT
WARNING

L'installateur doit être habilité et autorisé pour intervenir et manipuler le matériel SM6.

The contractor must be certified and authorised to manipulate and perform work on the SM6 unit.

accessoire pour montage tore

toroid installation accessory

3 TLP :

A : tore TLP130

3TLP:

***A:** toroid TLP130*

constitution du kit :

B : support TLP130

C : appui TLP130

D : sachet visserie
Réf. : BBV19795

E : cache–câbles

Remarque : le câblage, depuis le compartiment câble jusqu'au SEPAM20/40 est déjà réalisé par Schneider.

kit contents:

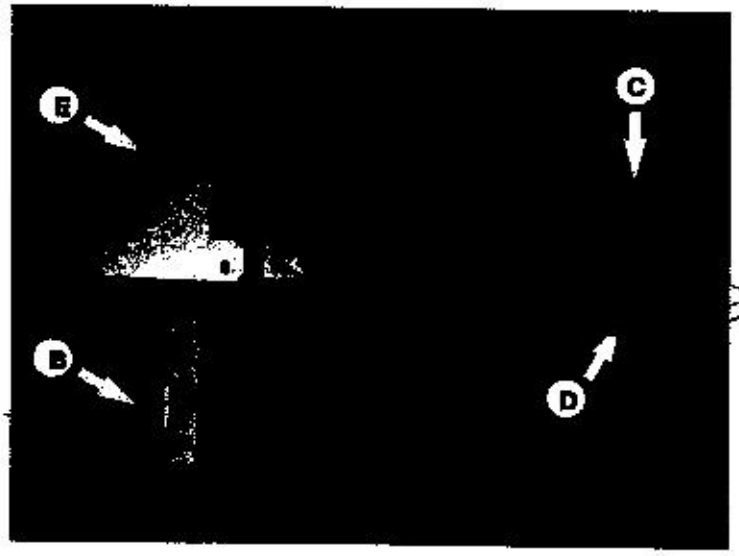
***B** : support TLP130*

***C** : base TLP130*

***D** : screw bag,*
Ref. : BBV19795

E : cable shield

***Comment:** the wiring from the cable compartment to the SEPAM20/40 is already installed by Schneider.*

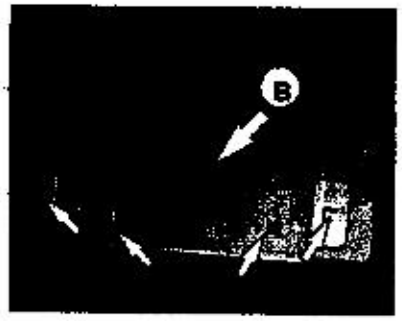


préparation des tores avant montage sur cellules

preparation of toroids prior to installation in the cubicles

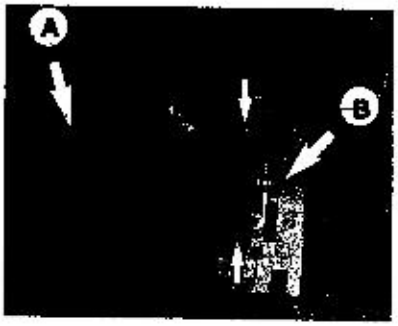
Rappel: visserie livrée dans le kit

Reminder: threaded fasteners provided in the kit



Monter les 4 écrous cages sur le support (B) de TLP130.

Fit the 4 captive nuts on the TLP130 support (B).



Fixer le tore TLP130 (A) sur le support (B) (2 vis HM6 x 16 + 2 rondelles plates Ø 6 mm).

Couple de serrage : 6 N.m

Secure the TLP130 toroid (A) to the support (B) (2 HM6 x 16 hex screws + 2 Ø 6 mm flat washers).

Tightening torque: 6 N.m

ATTENTION
CAUTION

Respecter le sens de montage des pièces.

Respect the order of mounting the parts.

Monter ensuite l'appui (C) avec 1 vis HM6 x 16 + 1 rondelle plate Ø 6 mm + 1 écrou M6.

Couple de serrage : 6 N.m

Fit the base (C) with 1 HM6 x 16 hex screw + 1 Ø 6 mm flat washer + 1 M6 nut.

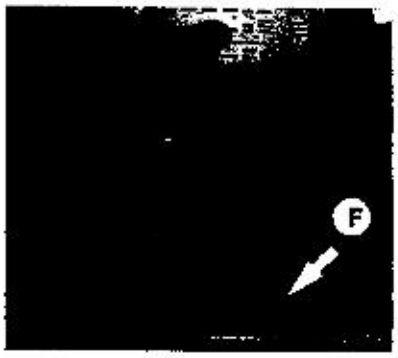
Tightening torque: 6 N.m

tôles de fond

back plates

Démonter la plinthe en face avant (F).

Remove the front skirting (F).



Afin de faire passer les câbles, retirer les tôles de fond (x3), laisser la dernière tôle en place.

In order to route the cables, remove the back plates (x3), leaving the last plate in place.

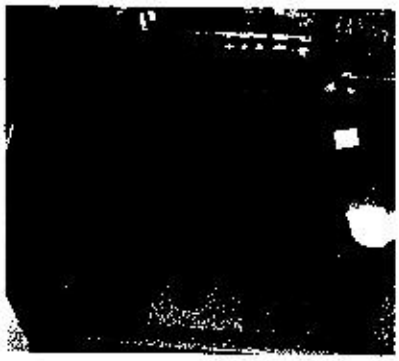
ATTENTION
CAUTION

Vérifier que les brides câbles soient bien montées en dessous des tôles de fond.

Check that the cable clamps are correctly in place below the back plates.

Vue d'ensemble

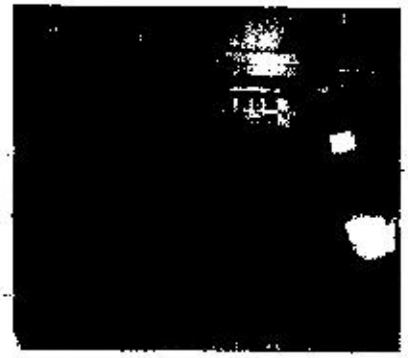
General view

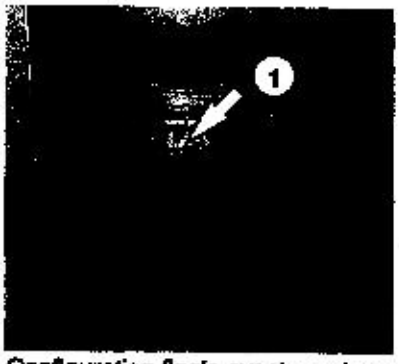


ATTENTION
CAUTION

Le support bride doit être positionné sur la tôle de fond pour des facilités d'accessibilité.

The support flange must be positioned on the back plate for accessibility reasons.





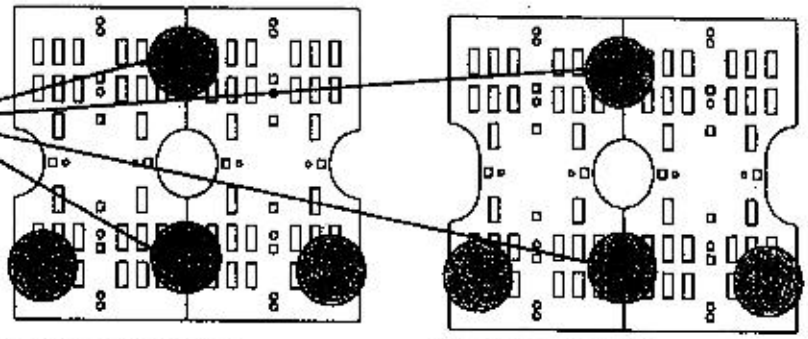
Configuration finale avant montage des tores. La tôle (1) reste en place.

Final configuration prior to mounting the toroids. The plate (1) remains in place.

ATTENTION
CAUTION

Les 2 tôles centrales ont une encoche; les tôles des extrémités n'en ont pas. Les tôles (2) et (3) sont à fixer comme indiqué.

The 2 centre plates have a notch, while the end plates do not. Plates (2) and (3) are to be mounted as shown.



Tôles de fond 1 câble
1 – cable back plates

Tôles de fond 2 câbles
2 – cable back plates

positionnement des câbles

positioning of cables

ATTENTION
CAUTION

Retirer la vis de la tôle de fond pour pouvoir fixer le tore.

Remove the screw from the back plate to secure the toroid.

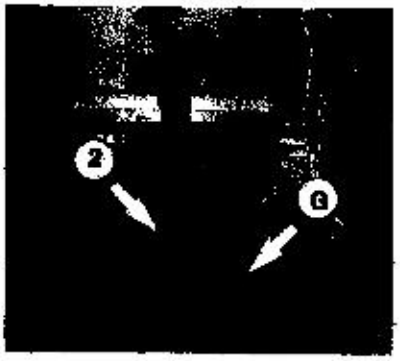
Prédécouper le passe–fil (X) puis le glisser sur le câble.

Pre–cut the bushing (X) then slide it onto the cable.

ATTENTION
CAUTION

La tresse de masse (G) passe entre la tôle et le tore pour pouvoir être raccordé par la suite.

The grounding braid (G) passes between the plate and the toroid for subsequent connection.



Positionner le tore autour du câble.
Raccorder le câble.
Positionner le bride câble, puis le serrer.
Positionner ensuite la tôle (2).
Put the toroid around the cable.
Connect the cable.
Position the clamp, then tighten it.
Position then the plate (2).

Une fois, le 1er tore en place, procéder à l'identique pour l'installation des tores (2) et (3).

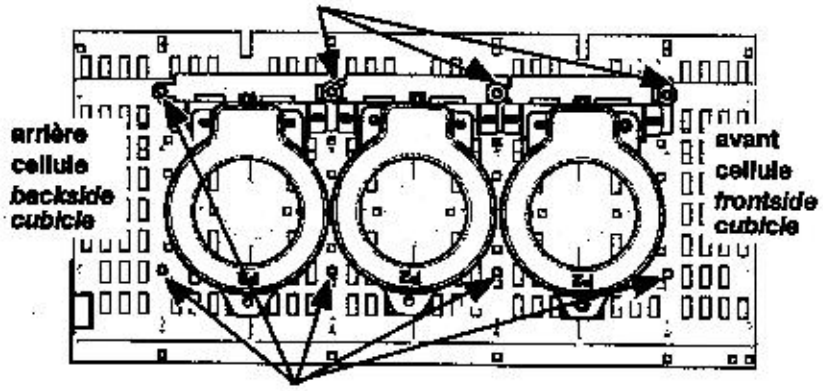
Once the 1st toroid is in place, perform the same procedure to install toroids (2) and (3).

vue générale des vis de fixations pour les tores TLP130

overview of fixation screw for TLP130

3 vis HM6 x 16 + rondelles CS6 à réutiliser + rondelles (larges) LL6 incluses dans le kit

3 HM6 x 16 screws + CS6 washers to re-use + LL6 washers (big), supplied in the kit



5 vis HM6 x 16 + rondelles CS6 à réutiliser

5 HM6 x 16 screws + CS6 washers to re-use

Visser les tôles (1) et (2) avec 3 vis HM6 x 16 + 3 rondelles spécifiques (larges), livrées dans le kit.

Secure plates (1) and (2) with 3 HM6 x 16 hex screw + specific washer (big), supplied in the kit.

connection des tores

connecting the toroids

ATTENTION
CAUTION

Les repères (H) sur les fils des cellules indiquent les numéros de phase. Le tore connecté doit se trouver sur le câble de phase correspondant.

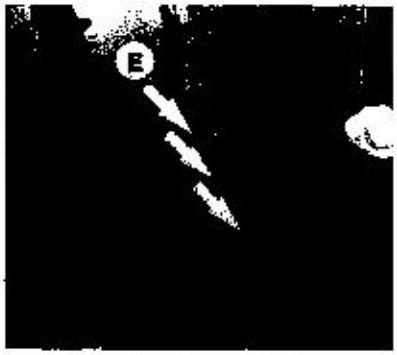
The identification marks (H) on the cubicle wires indicate the phase numbers. The toroid connected must be located on the corresponding phase cable.

Connecter les tores en fonction de leur repérage.

Connect the toroids based on their position and the length of the cables.

Connecter les tresses de masse (G) à la terre.

Connect the ground braids (G) to the ground.



Mettre les tôles de protection câbles (x3) (E) et les visser HM6 x 16 + rondelles plates.

Fit the cable protection panels (x3) (E) and screw it HM6 x 16 + flat washers.

Remettre la plinthe en face avant.

Replace the front skirting.

contrôle final avant mise en exploitation

final control prior to energising

raccordement

connection

1 – **Capteur LPCT,** équipé d'un câble blindé terminé par connecteur RJ45 pour raccordement direct sur le connecteur CCA670.

2 – **Unité de protection Sepam série 20, série 40.**

3 – **Connecteur CCA670,** interface d'adaption de la tension délivrée par les capteurs LPCT, avec paramétrage du courant nominal par micro–interrupteurs.

*1 – **LPCT sensor,** equipped with a shielded cable fitted with an RJ45 connector to be connected directly to the CCA670 connector.*

*2 – **Sepam series 20, series 40 protection unit.***

*3 – **CCA670 connector,** interface that adapts the voltage delivered by the LPCT sensors, with microswitch setting of rated current.*

test et injection

testing and injection

4 – **Prise de test déportée CCA613,** encastrée en face avant de la cellule équipée d'un câble de 3 m à raccorder sur la prise de test du connecteur CCA670 (sub–D9 broches).

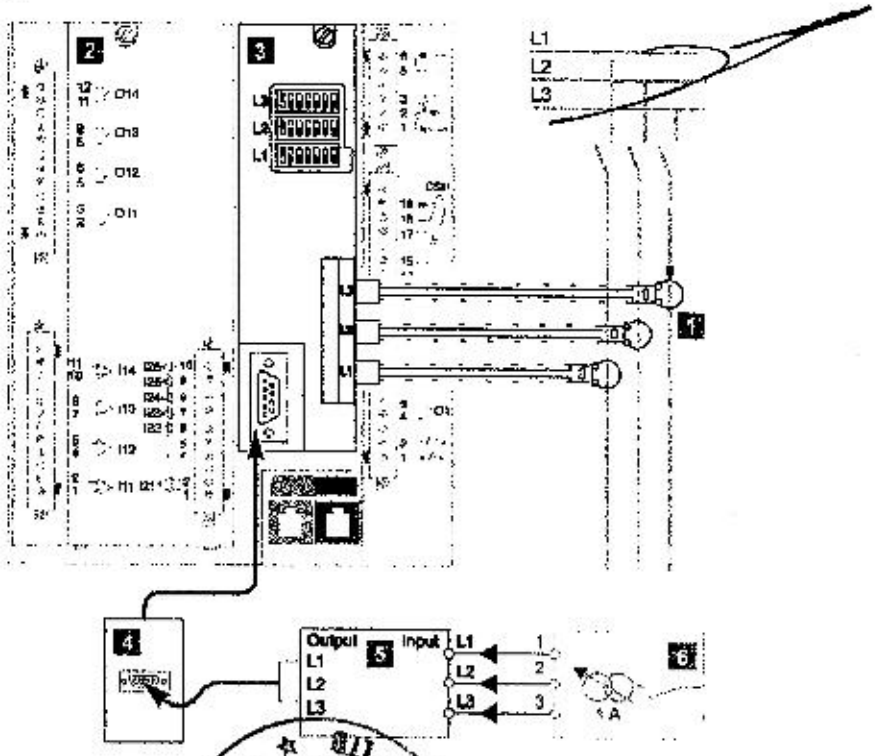
5 – **Adaptateur d'injection ACE917,** interface permettant le teste de la chaîne de protection LPCT avec une boîte d'injection standard.

6 – **Boîte d'injection standard 1 A.**

*4 – **CCA613 remote test plug,** flush–mounted in front panel of cubicle, equipped with a 3–m cord to be connected to the CCA670 connector test socket (9–pin Sub D).*

*5 – **ACE917 injection interface,** used, to test the LPCT protection chain with a standard injection box.*

*6 – **Standard 1A injection box.***



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mise en service
formation
maintenance préventive et corrective
adaptations
pièces de rechange

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BBV1984501 revision : 01

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Edition du : 15/12/2006

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SM6

MV distribution
factory built assemblies
at your service

Anglais

instructions for use

IM 500mm cubicle

MERLIN GERIN
mastering electrical power
GROUPE SCHNEIDER

ВЯРНО
С ОРИГИНАЛА!

516

Pour :pdm
Imprimé :mer, 15 déc, 2004, 18:16:27
Du livre :7896923en
Document :TdM
Dernier enregistrement :mer, 15 déc, 2004, 09:10:10

ВЯРНО С ОРИГИНАЛА!

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contents

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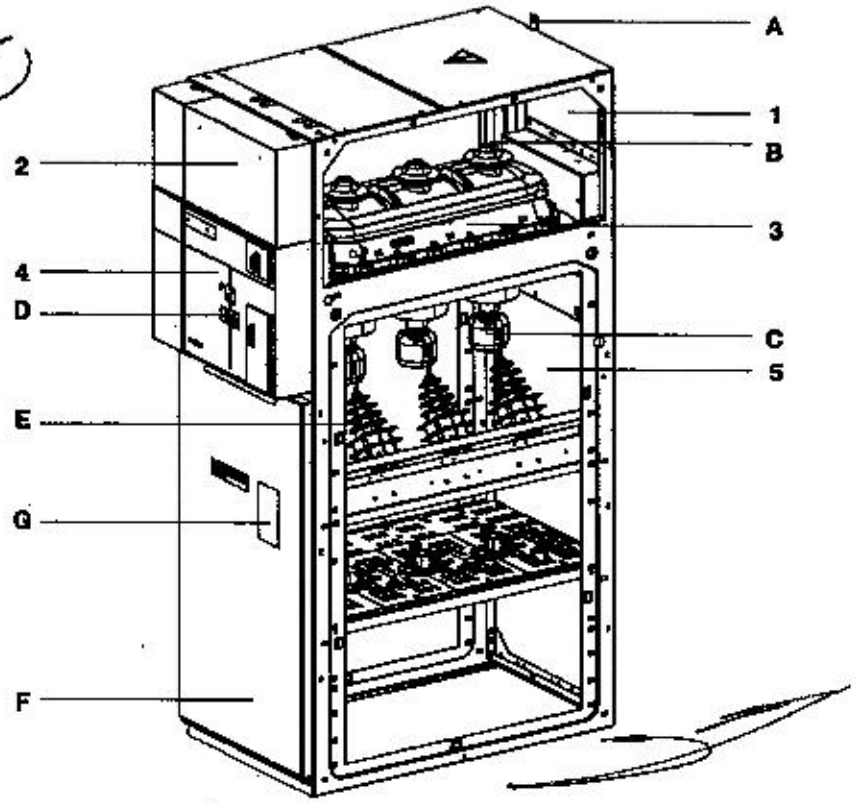
IM : switch cubicle

cabling for single core cables

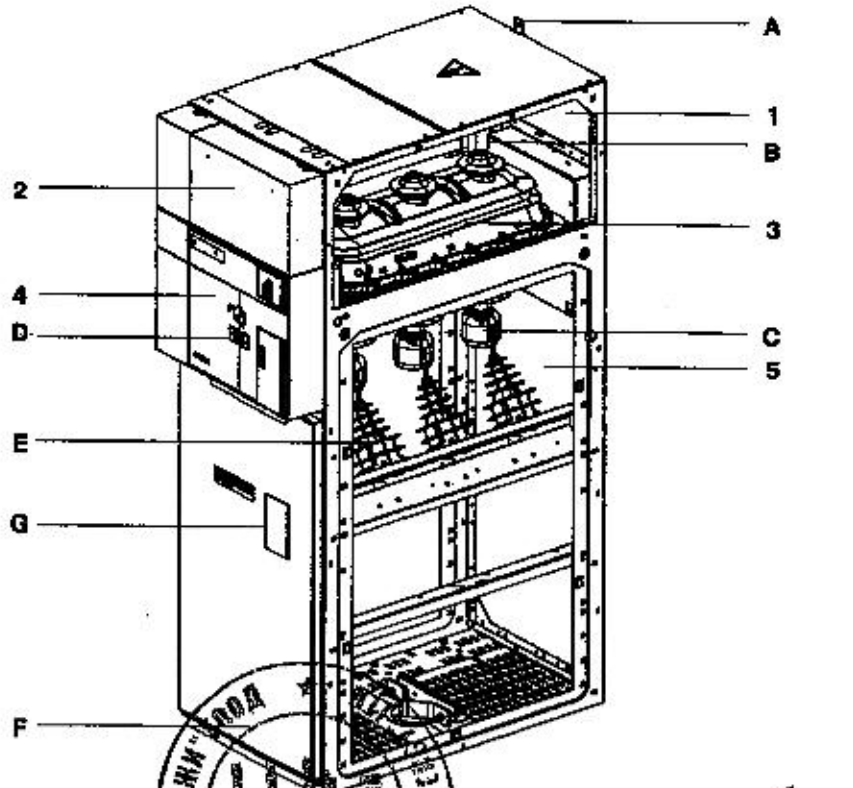
1 : busbar compartment
2 : low voltage compartment
3 : switchgear compartment switch and earthing switch
4 : operating mechanism compartment
5 : cable connection compartment
A : earth bar connection pad
B : busbar connection pads
C : lower field distributor and cable connection
D : voltage indicator
E : capacitive divider
F : front panel
G : cable connection inspection window



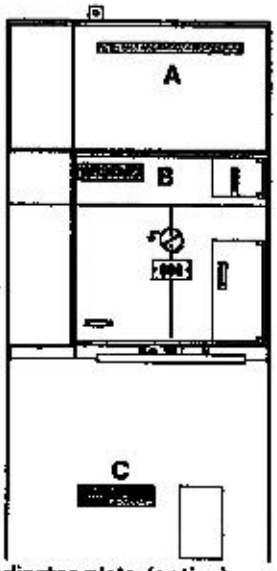
IM : switch cubicle

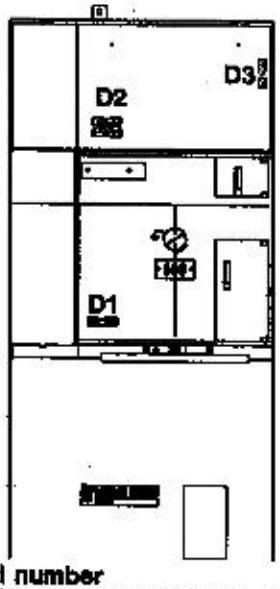
cabling for three core cables

1 : busbar compartment
2 : low voltage compartment
3 : switchgear compartment switch and earthing switch
4 : operating mechanism compartment
5 : cable connection compartment
A : earth bar connection pad
B : busbar connection pads
C : lower field distributor and cable connection
D : voltage indicator
E : capacitive divider
F : front panel
G : cable connection inspection window



cubicle identification





A : indicator plate (option) (for customer use)
B : characteristics and designation
C : manufacturer's name plate

aerial number
D1 : riveted to the front plate of the operating mechanism compartment
D2 : glued to the back of the front plate of the low voltage compartment
D3 : glued to the upright of the frame

accessories list switchboard accessories:

(may vary depending on the cubicles making up the switchboard)

1 wall clearance angle-iron
2 end panels
1 operating lever
1 bag of nuts and bolts for the end panels **S4 : 3730427**

IM accessories:

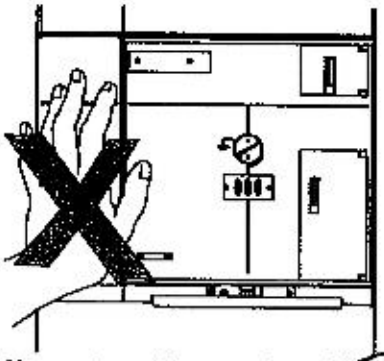
1 bag of intercubicle connection accessories bag **S1: 3729745**
1 bag of field distributors for busbars > 12 kV bag **S2: 3729742**
1 bag of field distributors for busbars ≤ 12 kV **S6 : 3729746**
2 bottom plates
1 set of busbars
1 earth bar

single core bottom
1 bag **3729741**
4 bottom plates
3 cable bushings
3 clamps
3 clamp supports

three core bottom
1 cable bushing
1 bag **3731747**
2 bottom plates
1 clamps
1 clamp supports

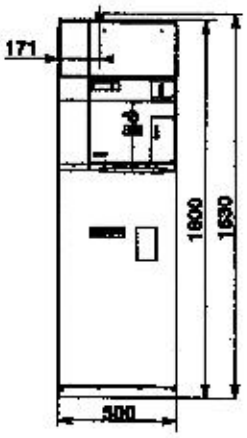
weight

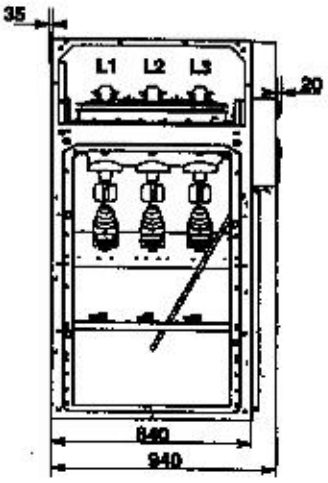
IM : 150 Kg



Never attempt to move the cubicle by exerting force on the control panel.

dimensions





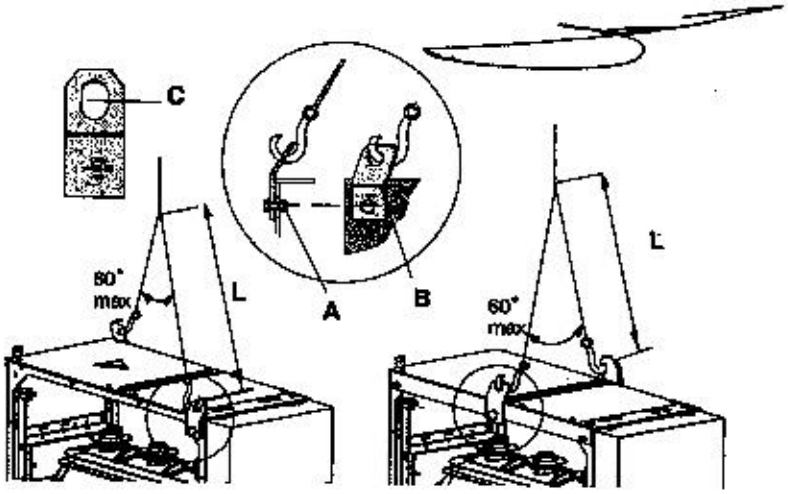
handling by sling

he handling lugs are reserved solely for handling SM6 cubicles.

A : HM12 nuts and screws

B : Schneider Electric CMU =400 KG CE

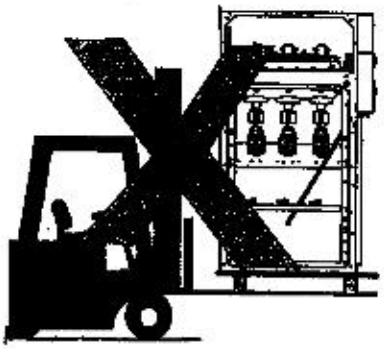
C : should the holes be deformed (ovalisation), replace the lugs, to propose you if required.



L = 977 mm mini.
Without low voltage case or wiring duct.

L = 500 mm mini.
With low voltage case or wiring duct.

handling using a forklift



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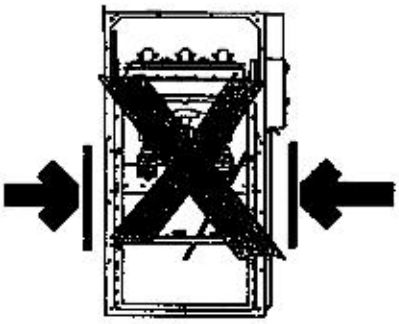
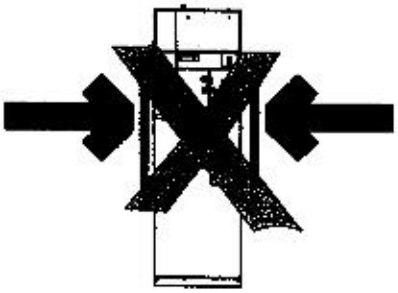
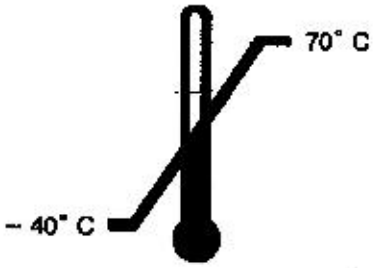
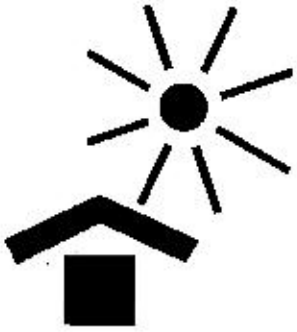




storage





524

525

switchgear ageing withstand in an MV substation depends on 3 main factors

- **The need for proper implementation of connections:**
  the new cold slip–on and retractable technologies offer ease of installation, thereby promoting withstand over time.
  Their design enables operation in polluted environments with harsh atmospheres.

- **The influence of the relative humidity factor:**
  installation of heating resistors is essential in climates with high relative humidity and large temperature differences.

- **Ventilation control:**
  the grids must be sized according to power loss in the substation.
  These grids must only be placed near the transformer, so as to prevent air circulating on the MV switchboard.

operation

We strongly recommend that you carry out at regular intervals (at least roughly every 2 years) **a few operating cycles on the switching devices.**

Outside normal operating conditions (between –5°C and 40°C, absence of dust, corrosive gas, etc.), we recommend that you contact our Groupe Schneider service centre in order to examine the measures to be taken to ensure proper installation operation.

Our service centre is at your disposal at all times:

- To conduct an installation diagnosis.
- To suggest the appropriate maintenance operations.
- To offer you maintenance contracts.
- To suggest adaptations.

"ТЕХНИК ЕНЕРДЖИ" ЕООД
"TECHNIC ENERGY" LTD

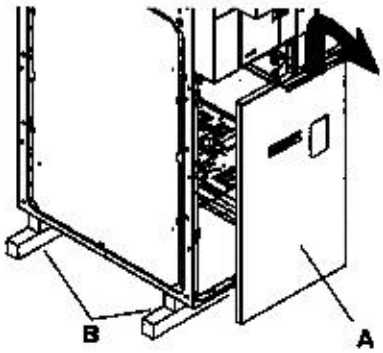
ВЯРНО
С ОРИГИНАЛА!

preparing the cubicles for switchboard assembly

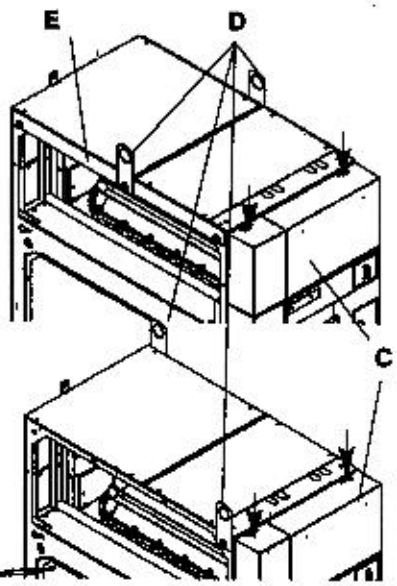
Delivery state:
earthing switch in the **closed** position.

→ : bolt + washer

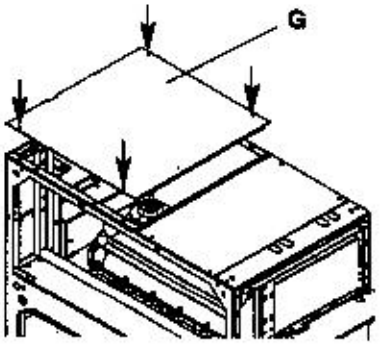
→ : bolt + washer + nylstop nut



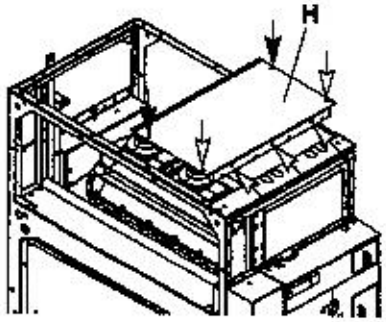
Remove the front panel **A** and then the skids **B**.



Remove the low voltage compartment front plate **C** and the lifting rings **D** and **E**.



Remove top plate **G.** (4 bolts)



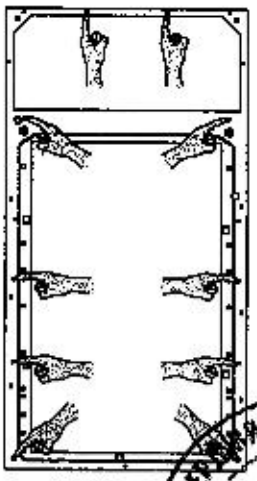
Remove top plate **H.** (7 bolts)

fitting the end panels

preparations

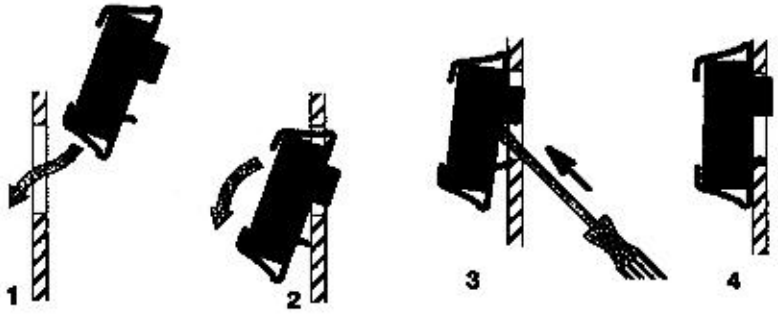
(only if the cubicle is on the end of the switchboard)

Nuts and bolts in bag
S4: 3729744
(HM6 x 12 bolts only)



Fit 10 cage nuts on the wall side of the cubicle.

In the case of extension with equipment manufactured before the 02/02/95, you must replace the end plate of the existing substation.



1 from the outside of the cubicle, insert the cage nut in the square hole.

2 rotate the cage nut so that it sits nearly vertically within the cubicle.

3 push the cage nut in the direction of the arrow so that the top of the cage clips behind the panel.

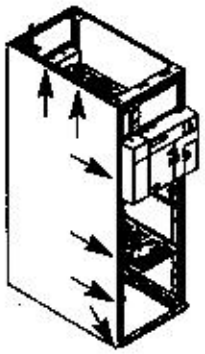
4 the nut is correctly positioned.

securing the end panel

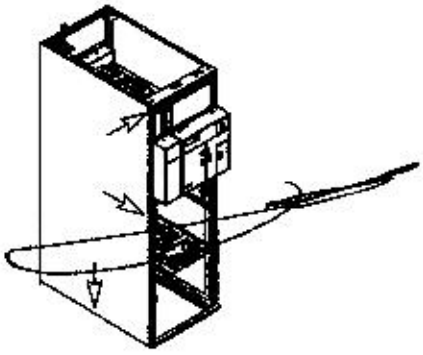
Explication gave for left switchboard extremity, do the same for opposite side.

→ : bolt + washer

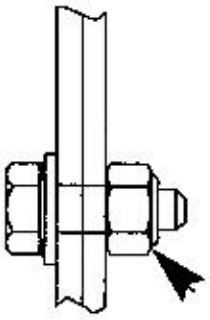
→ : bolt + washers + nylstop nut



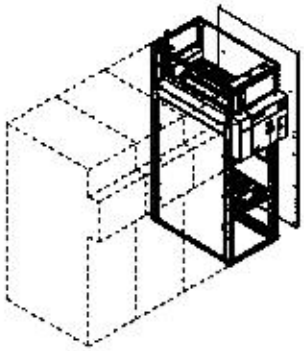
Position the end panel.
Fit the bolts in the nylstop nuts.



Fit the bolts with the nylstop nuts.



Scew and nylstop nut mounting direction. (nut into the cubicle)

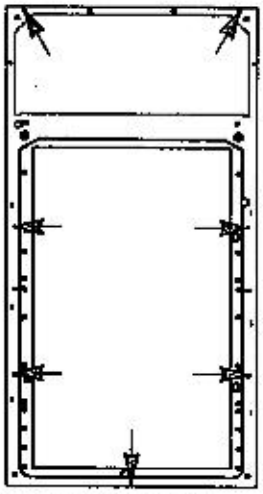


Mount the other end panel in the same manner.
(but without a wall clearance angle iron)

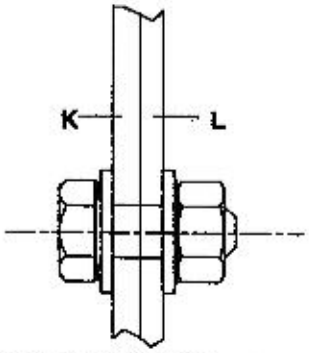
assembling the switchboard

nuts and bolts in bag
S1: 3729745
(HM6 x 16 bolts only)

—▶ : bolt + washers + nut



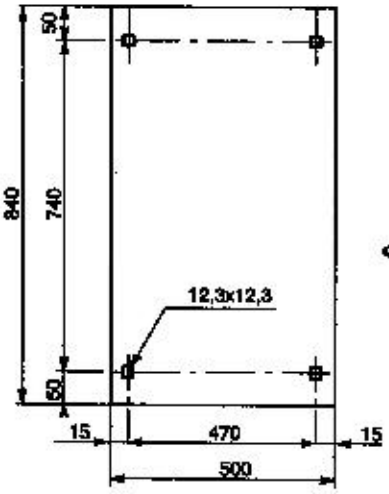
Join the various cubicles.
(the remaining nuts and bolts are for the earth bars)



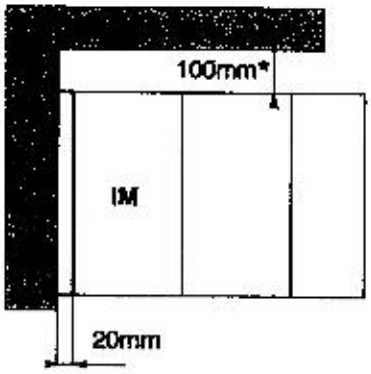
Bolt mounting direction.
K : left cubicle
L : right cubicle

securing to the floor

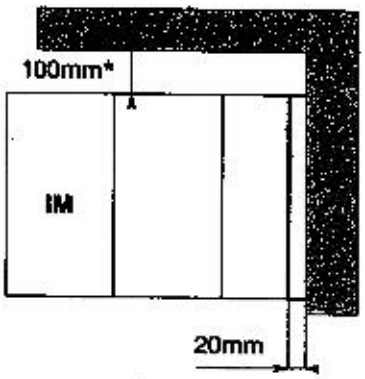
(nuts and bolts not included)



layout in the substation



Switchboard installed to the right of a wall.
*(minimum clearance for trouble-free operation)



Switchboard installed to the left of a wall.

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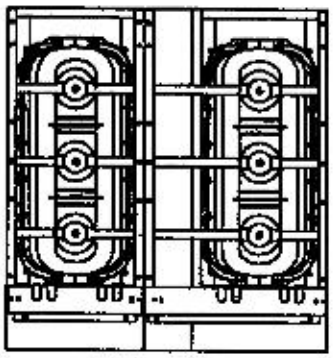
fitting the busbars after installing the cubicles

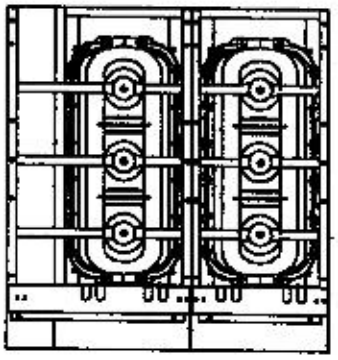
in their operating location

accessories bag
S2 : 3729742 or S6 : 3729746.

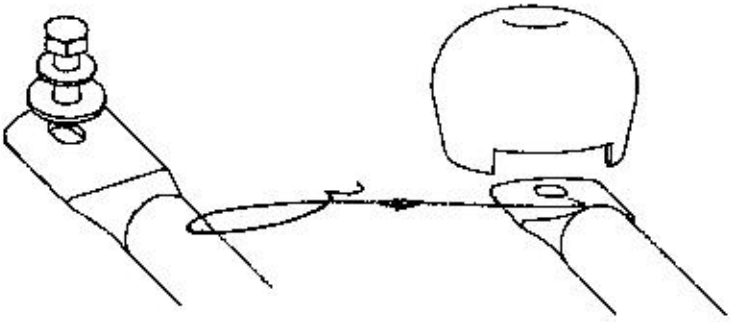
tools :
1 : torque wrench (1 to 50 Nm.)
1 : 1/4–3/8 adapter
1 : 6 mm extension fitting
1 : 6 mm male-hexagonal (Allan)



Busbar connection with cubicle on the left.
Tightening torque: 28 Nm.

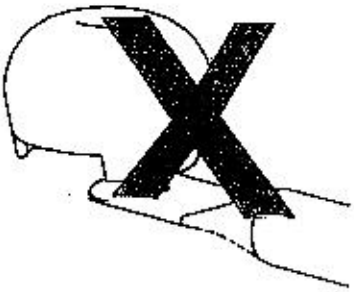


Busbar connection with cubicle on the right.
Tightening torque: 28 Nm.

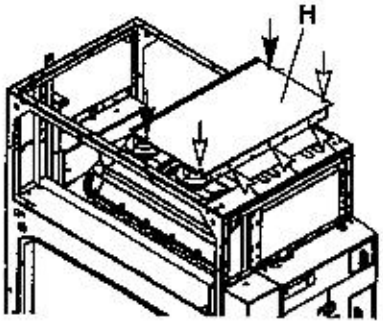


Version ≤ 12 kV
(bag **S6 : 3729746**)
mounted without field distributors.

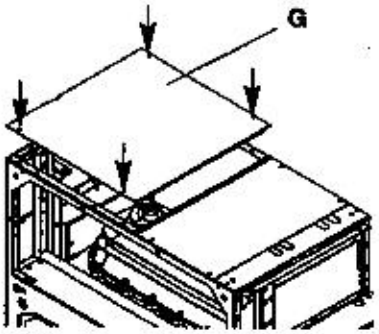
Version > 12 kV
(bag **S2 : 3729742**)
Field distributor positioned correctly.



Field distributor positioned incorrectly.
(risk of damage)

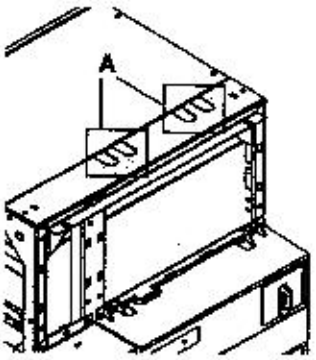


Refit top plate H.
(nuts inside the cubicle)

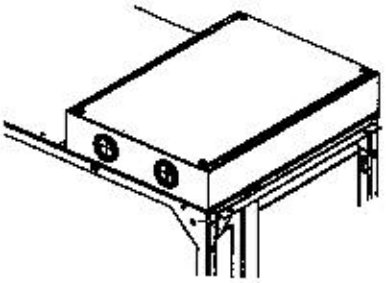


Refit top plate G.

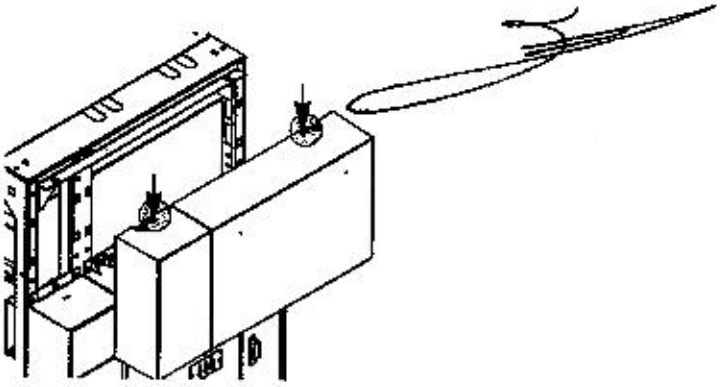
cable entry for connection of low voltage auxiliaries



Cable entry to the auxiliary terminal block is via holes A on top.



Cubicle equipped with a wiring duct. (option)
Proceed in the same manner after removing the trough top plate.

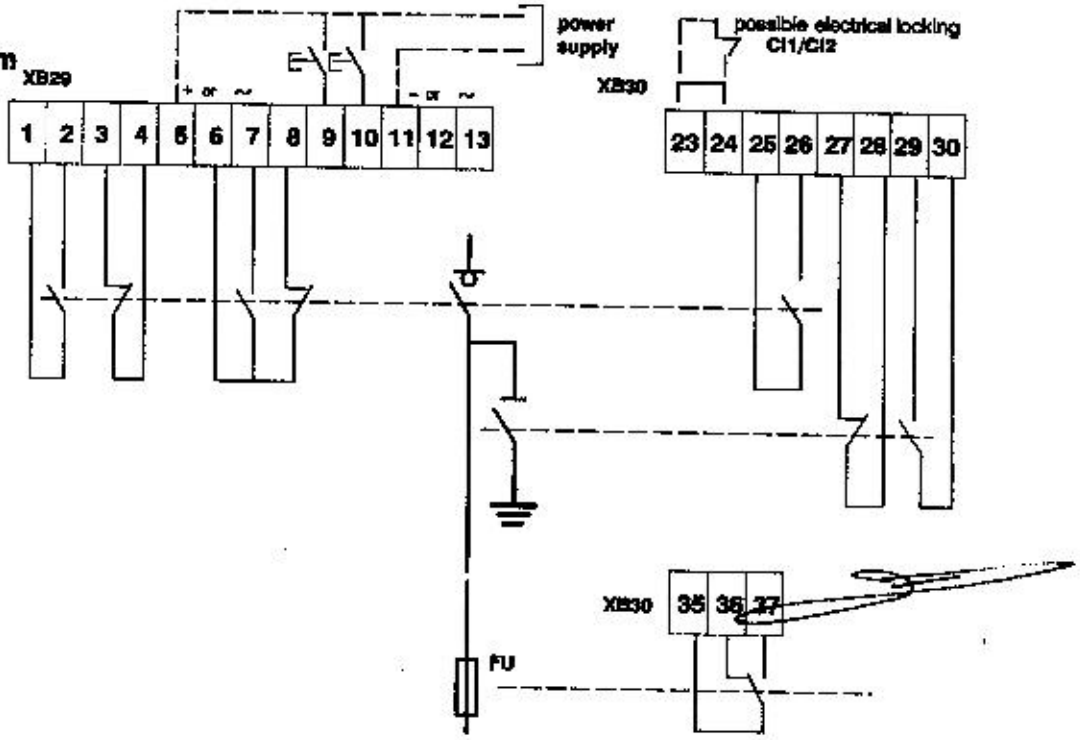


Refit the LV compartment front plate, respecting the indications.

cable entry for connection of low voltage standard auxiliaries in optional supply

Nota : for connection of LV auxiliaries, refer to the wiring diagrams of the cubicle with need other than standard.

terminal block of LV auxiliaries with motorized mechanism



marking of terminal block

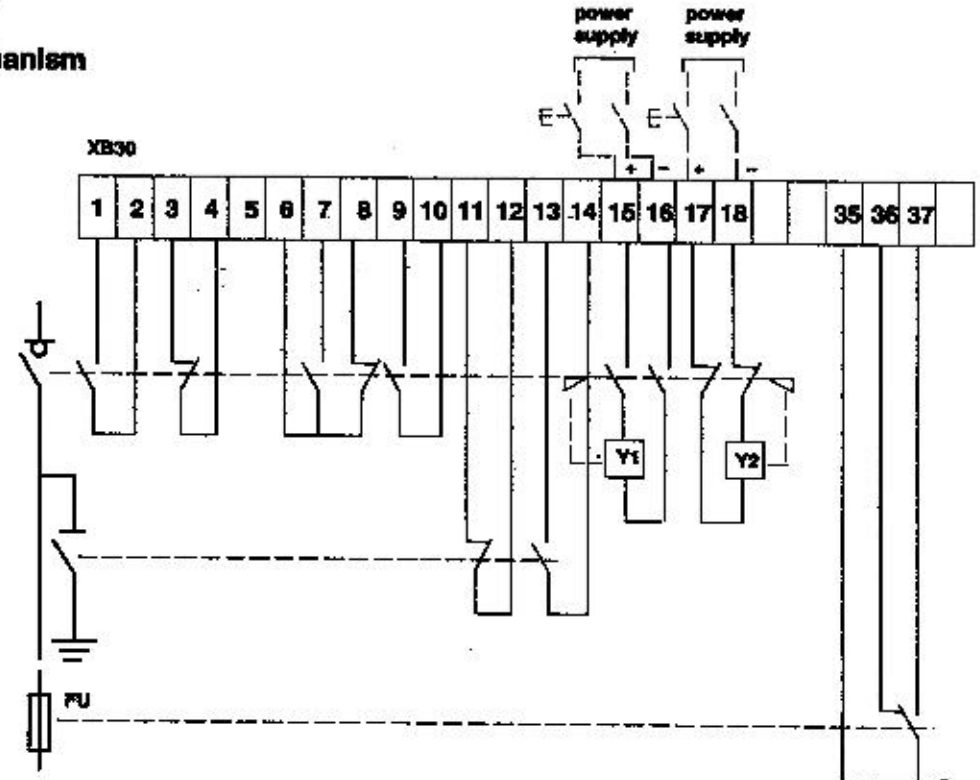
4 auxiliary contacts :
position of the closed MV switch : terminals 1–2 and 6–7.
Position of the open MV switch terminals 3–4 and 6–8.

3 additional auxiliary contacts (optional supply)
Position of the closed MV switch : terminals 25–26.
Position of the open MV earthing switch : terminals 27–28.
Position of the closed MV earthing switch : terminals 29–30.

Motorization :
Power supply : terminals 5–11.
Opening order : terminal 9.
Closing order : terminal 10.
Possible electrical locking for motorization : terminals 23–24.

Fuse blowing indication.
only for **QM cubicle** : terminals 35–36–37.

terminal block of LV auxiliaries with no–motorized mechanism



marking of terminal block

4 auxiliary contacts :
position of the closed MV switch : terminals **1–2** and **6–7**.
Position of the open MV switch : terminals **3–4** and **6–8**.

3 additional auxiliary contacts :
(optional supply)
position of the closed MV switch : terminals **9–10**.
Position of the open MV earthing switch : terminals **11–12**.
Position of the closed MV earthing switch : terminals **13–14**.

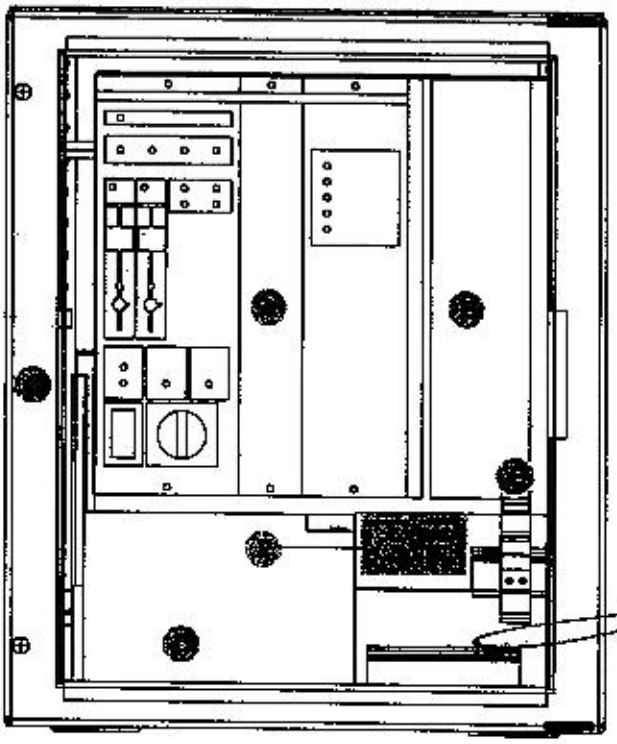
Opening release :
opening order : terminals **15–16**.

Closing release
closing order : terminals **17–18**.

Fuse blowing indication
only for **QM cubicle** : terminals **35–36–37**.

raccordement BT pour Talus 200

A : T200S "relais"
B : emplacement radio "si téléconduite"
C : caisson BT (L : 375 mm)
D : batterie pour alimentation autonome
E : coupe-circuit à fusible pour branchement de l'alimentation du chargeur batterie 230VCA
F : connecteur male/femelle, info SW1, SW2



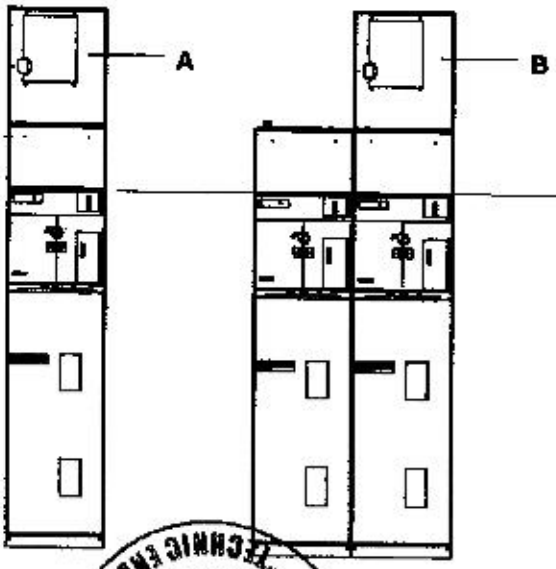
1 : brancher l'alimentation 230 VCA sur le coupe-circuit en (E), et fermé le CC
2 : brancher la batterie
3 : l'automatisme sera pleinement opérationnel au bout d'une heure.

mise en service de l'automatisme

- Vérifier la position des boutons sur la commande. bouton K en position **exploitation normale** bouton D en position ON.
- pour configurer l'automatisme, se reporter au manuel de l'utilisateur du T200S n° NT00044 et N° T00045 en Anglais.

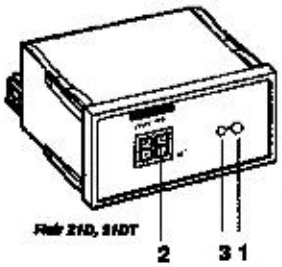
téléconduite pour cellule 1 interrupteur (A)

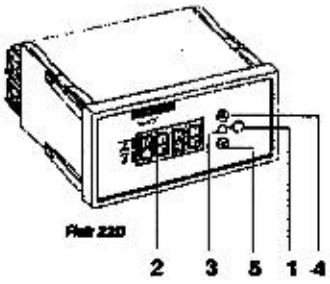
téléconduite pour cellule 2 interrupteur (B)

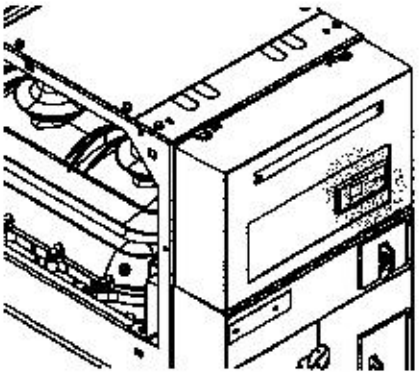


LV connection indicator Flair DIn SORHODEL

operating







Indicators **Flair 21D,21DT, 22D** and **23D** are self-powered from the measurement.

A minimum 3A current is required in the MV cable to start up the **Flair 21D** and **21DT** LCD display, an energy storage guarantees a 4 hours minimum autonomy.

The indicators provide an output SCADA contact (except **Flair 21D** : transistor output).

Flair 22D included a lithium battery for a permament display operating (in case of a load current less than 3A during 4 hours) and for the outdeor lamp supply.

Flair 23D has to be supplied from 12 Vdc to 48Vdc (whith a single zero sequence CT self powering is not possibe.

detector waiting for fault

ammeter function :

In idle mode (no fault detected), a rough load current value is displayed (2).

Each phase load current is successively displayed after its reference : L1–L2–L3.

Displayed values must be multiplied by 10 for **Flair 21D** and **21DT**.

Example for a 80A load current :

 then  (Flair 21D/21DT)  (Flair 22D/23D), then L2 and L3)

should **Flair 22D** and **Flair 23D** being fitting with zero sequence CT, L1 currents is replaced by the unbalanced, tagged with : 

If I >720A  (Flair 21D/21DT),  (Flair 22D/23D)

If I <3A  (Flair 21D/21DT),  (Flair 22D/23D)

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maxmeter function

(**Flair 22D** et **23D** only :)

Press once the **(1)** buttom to get access to the maxmeter function.

For each phase, the maximum load current since the last reset is displayed.

Example for a 500A maximum in phase 1:

[redacted] then [redacted] than M2 and M3

The maximeter values are scrolled only once.

The 3 maximeters are reset all together by pushing the **(4)** and **(5)** buttoms during the scrolling.

Should **Flair 22D** and **Flair 23D** fitted with zéro sequence CT, M2 and M3 only are displayed.

detector in fault indication mode

when the current exceeds one the configured thresholds and becomes lower than 3A within 70s the led **(3)** blinks, the output contact is closed and the faulty phase is shown on the LCD display **(2)** :

[redacted], [redacted], [redacted] or [redacted]

- **I0> threshold exceed on phase 2 :**

[redacted] (or I0 with a zero sequence CT).

LED **(3)** blinks (1 flash every 3s).

The display remains until an automatic reset (>70s) (if configured), or a time out (4 hours for **Flair 21D/21DT**, configurable for **Flair 22D/23D**, or a pulse on external reset input, a manual action on **(1)** buttom.

- **I>treshold exceed** [redacted]

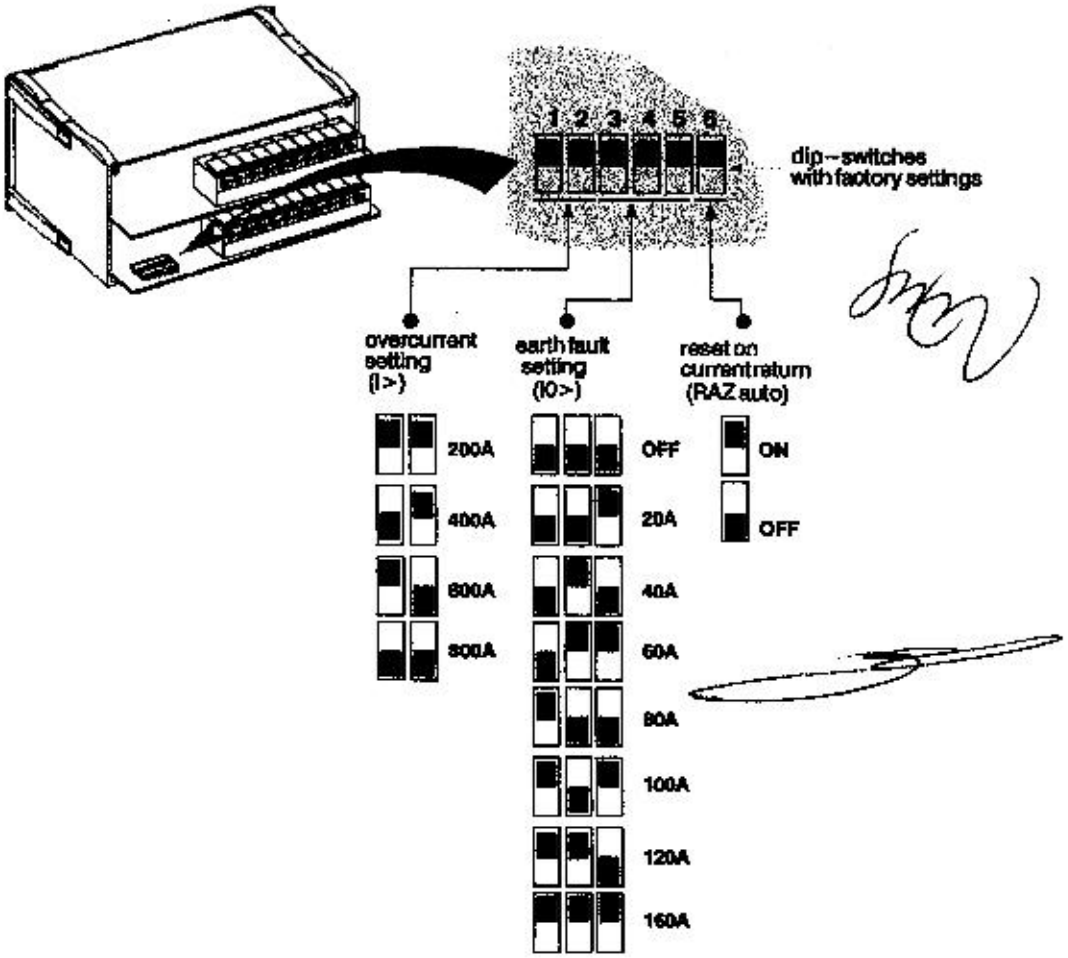
steady with blinking LED **(3)** (2 flashed every 6s).

The display remains until an automatic reset (if configured), or a time out (4 hours for **Flair 21D/21DT**, configurable for **Flair 22D/23D** or pulse on external reset input, a manual action on **(1)** button.

maintenance

- detectors **Flair 21D,21DT** and **23D** require no maintenance (no periodic battery replacement)
- **Flair 22D** lithium battery has be changed once every 15 years approximatively.
- option **SVP** (external light indicator with battery) : battery life time 15 yeards approximatively.

settings



Settings are performed using dip–switches (all version) : press the (1) buttom to validate and front panel push buttons (**Flair 22D** and **Flair 23D** only), these settings replacing those of the dip–switches.

test/setting mode activation

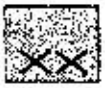
In order to display the settings (all version) or to modify the settings (Flair 22D and Flair 23D), enter the test/settings mode.

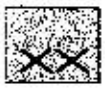
The test mode is activated followed by the setting display mode, act as follow :

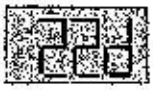
- **Flair 21D and Flair 21DT :** press the (1) button
- **Flair 22D and Flair 23D :** press twice (1) button

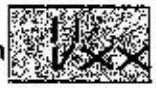
(the first impulse activates the maximeter display mode)

- the led (3) blinks, up to the test completion.
- the display shows successively

Flair 21D :  then  then  (version)

Flair 21DT :  then  then  (version)

Flair 22D :  then  then  (version)

Flair 23D :  then  then  (version)

- the whole settings are scrolled and 10 s after the last one, is displayed, the indicators returns to ammeter display mode.

With a single press on the (1) button during the scrolling returns to the ammeter display mode.

settings mode (Flair 22D and Flair 23D)

Note : the impulses on the buttons are only valided if they last between 1 and 3 seconds.

By pressing simultaneously the (4) or (5) buttons during the setting scrolling, the scrolling becomes manual.

It becomes possible then, using these buttons, to switch the settings and to define new more accurate settings values which replace those defined with the dip–switches :

- when the setting to be modified is selected, push simultaneously (4) and (5) buttons
- displayed value blinks (5s max)
- select a new value using buttons + (4) or – (5)
- confirm by pushing simultaneously on (4) and (5) buttons.

If the new value not is validated within 5s, the old value is displayed again.

After 10s without action on the (4) or (5) buttons, the indicator return to ammeter display mode.

setting scrolling

- CTs mouting (**Flair 22D** and **Flair 23D** only)

 or  or (23D only)  (□ =phase CT and ▯ =zero sequence CT)

■ **network frequency** (example 50 HZ)

Flair 21D/21DT :  then  Flair 22D/23D 

■ **I> threshold** (example 600A)

Flair 21D/21DT :  then  Flair 22D/23D 

■ **I0> threshold** (example 80A)

Flair 21D/21DT :  then  Flair 22D/23D 

If the dip−switches 3,4 and 5 are on OFF position, no earth fault detection, display :

Flair 21D/21DT :  then  Flair 22D/23D 

■ **reset timer** (example 2 hours)

Flair 22D and Flair 23D only 

■ **automatic reset**

Flair 21D/21DT :  then  or  Flair 22D/23D :  or 

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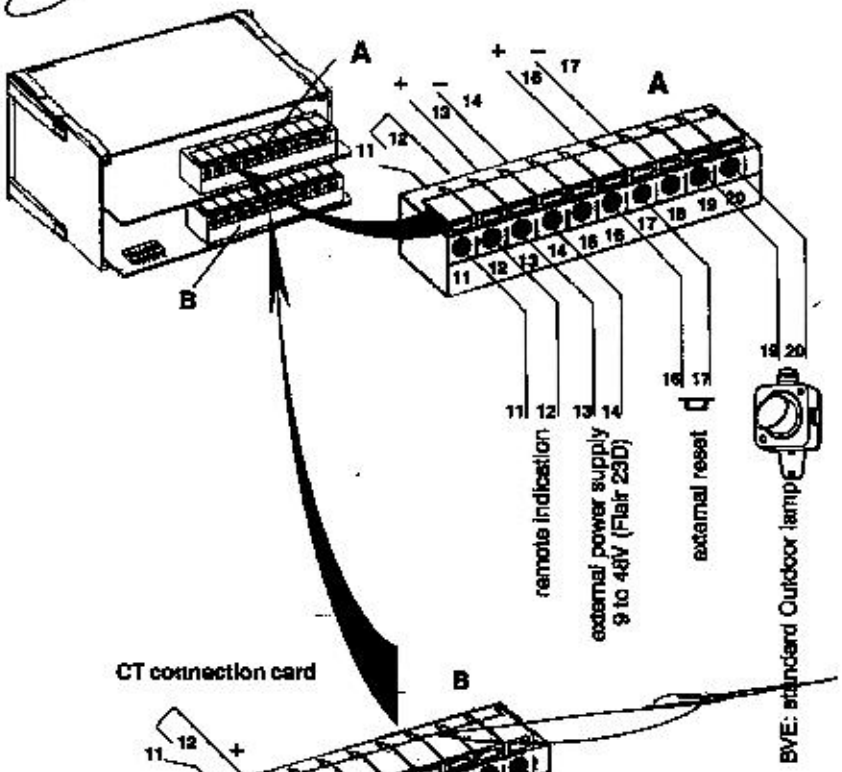
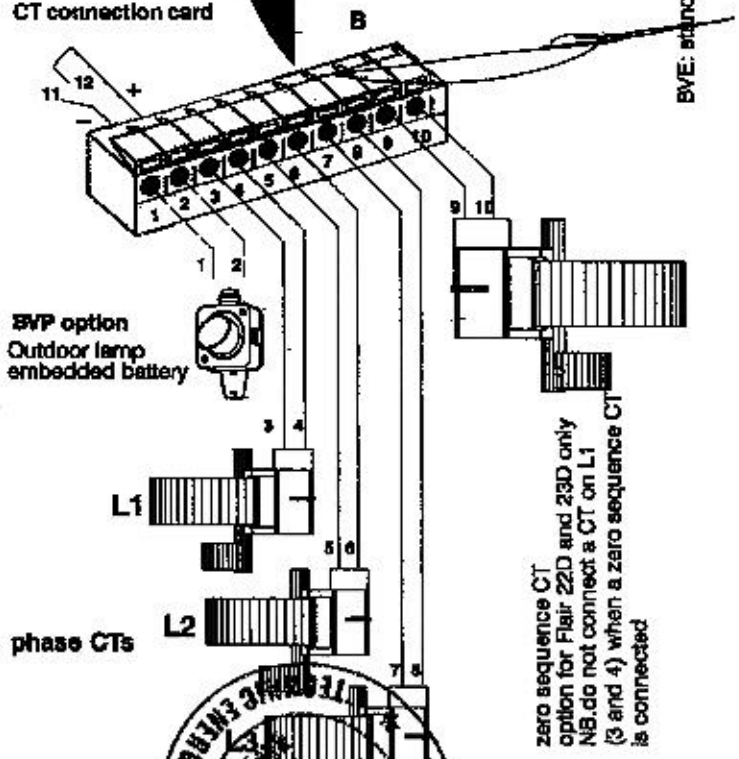
connection

Should the Medium Voltage switchgear being supplied without the CTs installed, the 3 Cts must be mounted the same side up to the busbar.

Important :the MV cable earthing braid must be fitted back trough the CT.

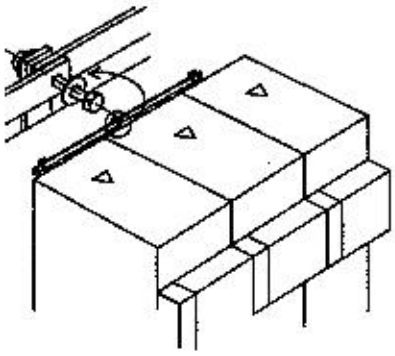
remote control interface



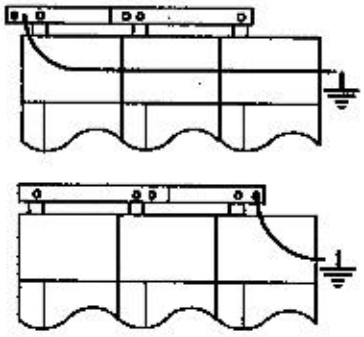


fitting the earth bars

nuts and bolts in bag S1 : 3729745

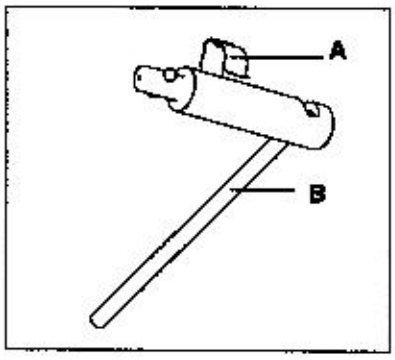


Connect the earth bars together. **(HM8 x 30 bolts)**



Earth the substation frames in either of these two ways.

storing the operating lever



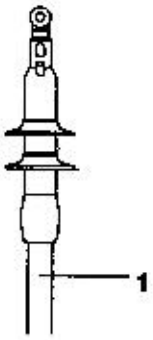
Fix the hook **(A)** and the wall.(screws not supplied)

The operating lever has to be hooked **(B)**.

MV cable connection for an IM cubicle

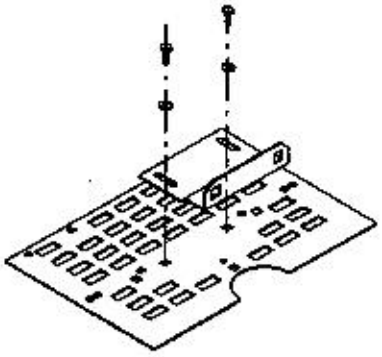
To limit the effort on the cable connection you have to ajust the lenght at the bending radius of the cable.

1 :copper cable or aluminium cable



EUIC (short inner end, cold fitted).

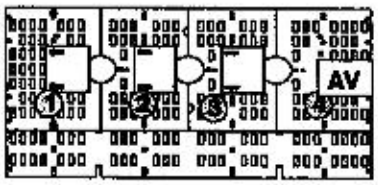
They must be manufactured according to the standard : **IEC.60.502**



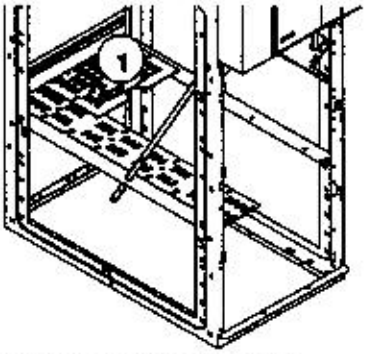
Mount the cable clamp supports.

Nuts and bolts in bag S3 : 3729741 (HM6 x 16 bolts)

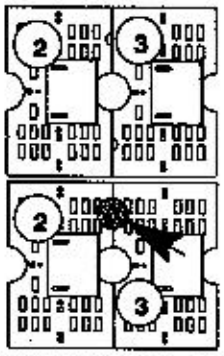
The remaining nuts and bolts are for cable clamping.



Mount the bottom plates using 1 to 4 chronologie.



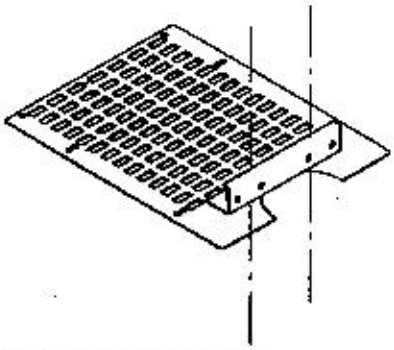
Mount the first bottom plate.



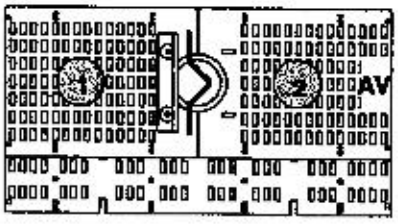
Reverse the bottom plate no 3 to create a way for wiring.
(**mounting 2**)

Fit the cable bushing.

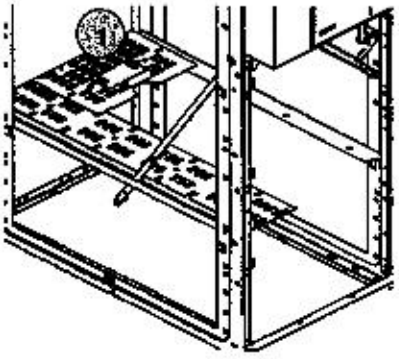
mounting of three core cables



Mount the cable clamp.
Supports.nuts and bolts in bag S3 : 3729747 (HM6 x 16 bolts)
The remaining nuts and bolts are for cable clamping.



Mount the bottom plates using 1 to 2 chronology.

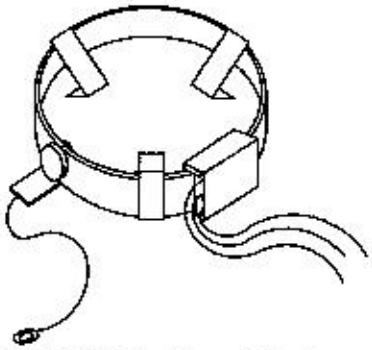


Mount the first bottom plate.

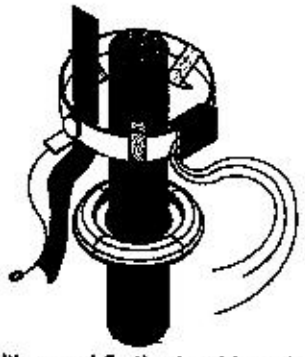
Install the cable bushing.

Installing the fault detection toroids

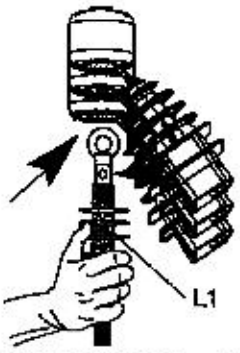
(instructions suggested by **Schneider Electric**)



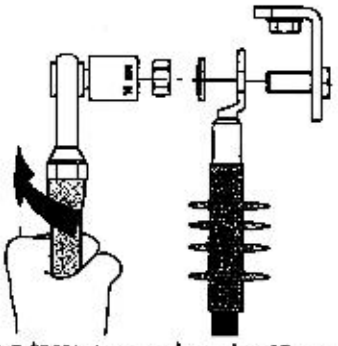
Prepare the toroids outside the cubicle.



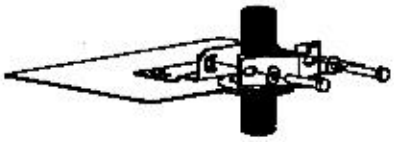
Position and fix the toroid on the cable.
Make the LV connection.



Connect the cable and toroid together to the bolt provided on the phase **L1** connector.

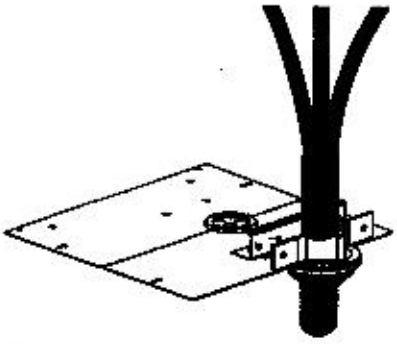


Use a torque wrench and a 19 mm socket to tighten the cable to this bolt.
Tightening torque: 50 Nm.

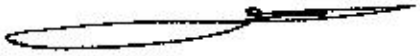


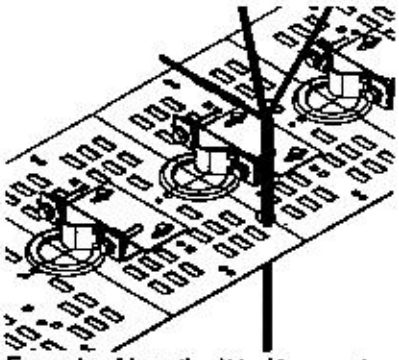
Clamp the cable to the clamp support on the second bottom plate.

Mount phases **L2** and **L3** using the same procedure as for phase **L1**.

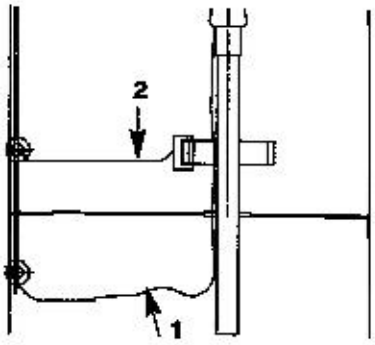


For three core cables **clamp** and mount the following bottom plates

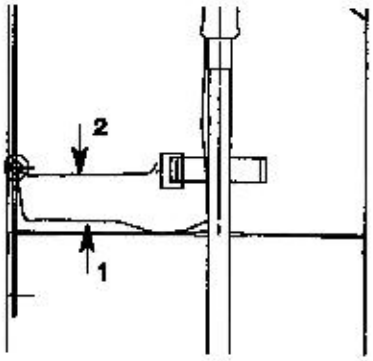


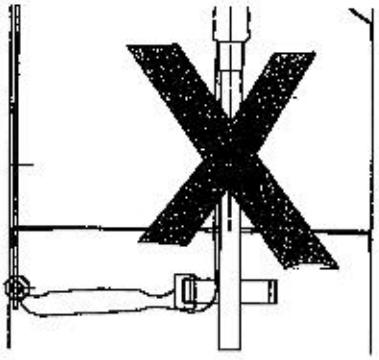


Example of how the LV wiring can be routed.
LV wiring routed throught the hole.



Connect the cable 1 and toroid earthing braids 2 in either of these 2 ways. (the bolts are already installed)



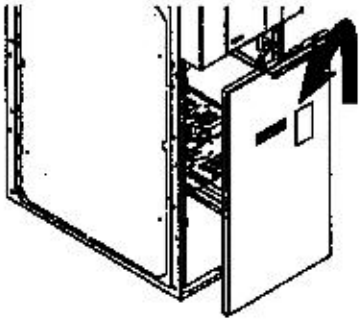


checks before energizing

Check that nothing has been left in the connection compartment.

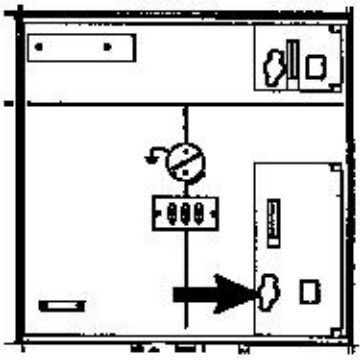
For all phases:

- check that the field distributor covers have been properly closed on all phases.
- check that the fault detector has been properly connected.

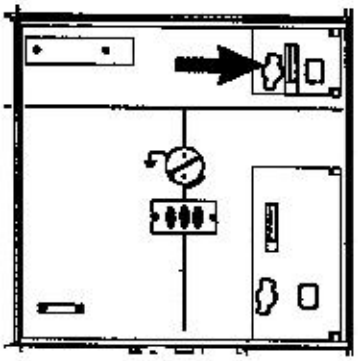


Refit the front panel.

operating test before energizing

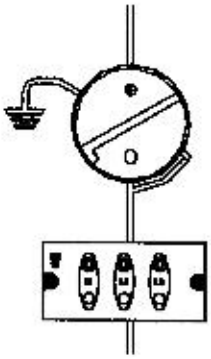


Operate the switch several times.



Operate the earthing switch several times.

energizing the incoming MV cables



The switchgear must be in open position.
(see: operating instructions)

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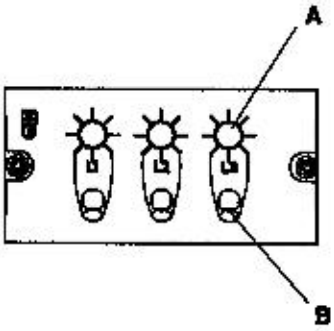
voltage indicators



As soon as the cables have been energized, the voltage indicator lamps should go on.

A : voltage presence indicator lamp (1 for each phase).

B : connection point used to connect a phase concordance unit.

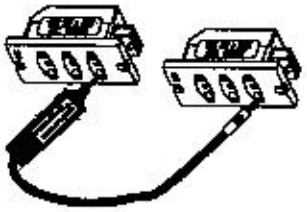
characteristics

The voltage presence indication is ensured in the voltage range defined by **IEC 61958**

phase concordance test

Remark:
the control unit is similar to the concordance unit used for RM6.

Phase concordance unit of the simplified **Merlin Gerin** type.



If the **phases concord,** the concordance unit lamp remains off.
If **the phases do no concord,** the concordance unit lamp goes on.

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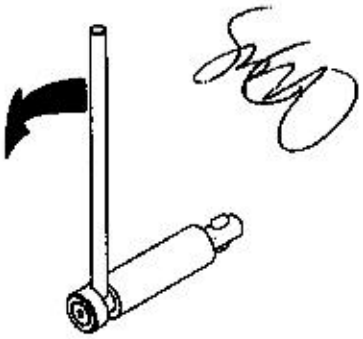
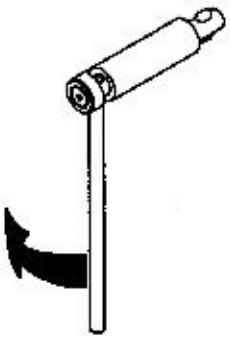
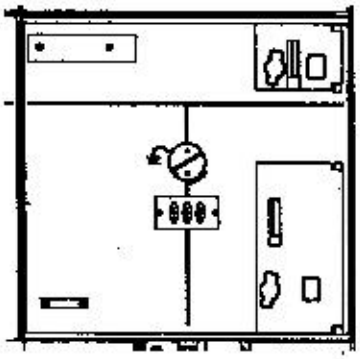
cubicle operation and position indication



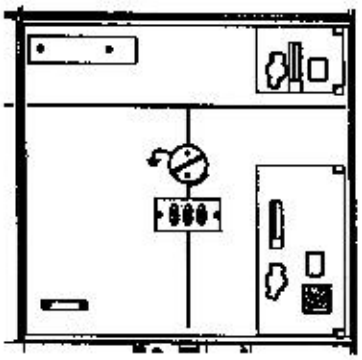
Position the lever as indicated for downward **opening** operations.



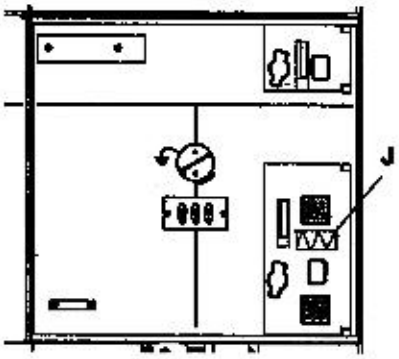
Position the lever as indicated for upward **closing** operations.



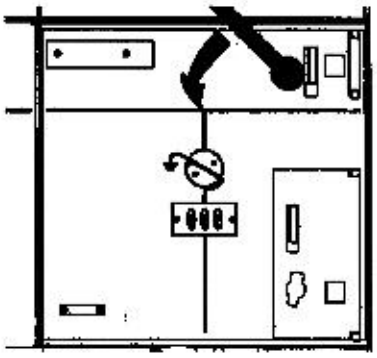
CIT operating mechanism front plate.



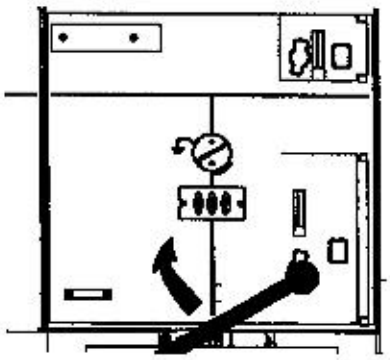
CI1 operating mechanism front plate.



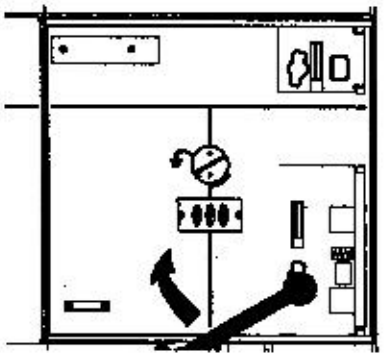
CI2 operating mechanism front plate.
J : charged/uncharged indication.



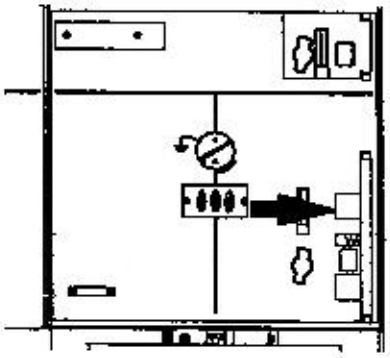
Opening the earthing switch.
(CIT, CI1 and CI2 operating mechanisms)



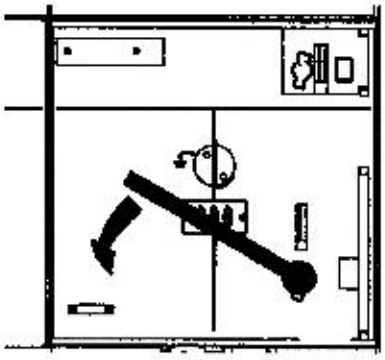
Closing the switch.
(CIT and CI1 operating mechanisms)



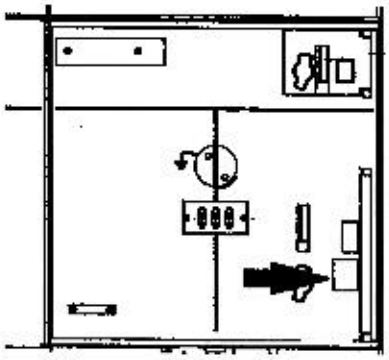
Charging the spring.
(CI2 operating mechanism)



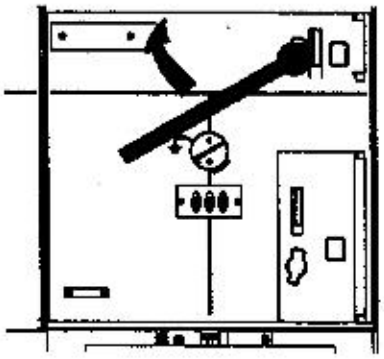
Closing the switch.
(CI2 operating mechanism)



Opening the switch.
(CIT operating mechanism)

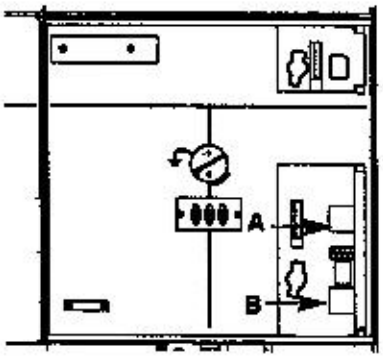


Opening the switch.
(CI1 and CI2 operating mechanisms)

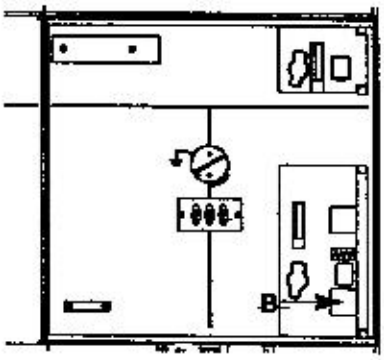


Closing the earthing switch (for **CIT, CI1** or **CI2** operating mechanisms) after checking the voltage status.
(see **voltage indicators**)

discharging a CI2 operating mechanism

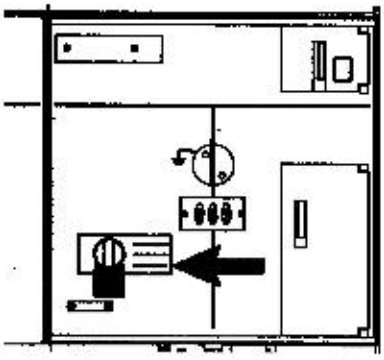


Cubicle **de-energised** :
Close the switch: button **A**
then **open**: button **B**.

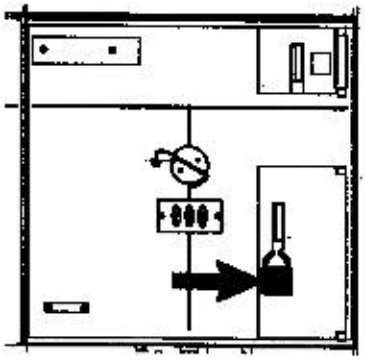


Cubicle **energised** :
Press the open button **B**.
Attention : this operation can damage the operating mechanism.
Perform only when strictly necessary.

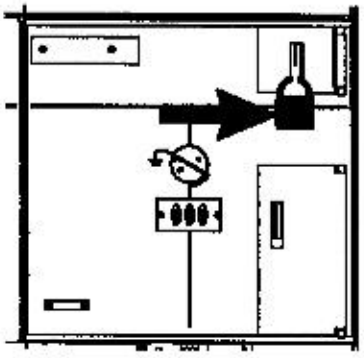
padlocking



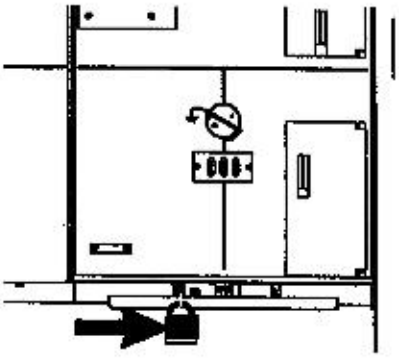
Padlocking of motor mechanism. (option)
Lock out the motor mechanism using a padlock before opening the switch.
The motor mechanism can be **locked** in or out using the padlocks.



Padlock the switch in **open** or **closed** position using 1, 2 or 3 padlocks. (dia. 8 mm)



Padlock the earthing switch in **open** or **closed** position using 1, 2 or 3 padlocks. (dia. 8 mm)

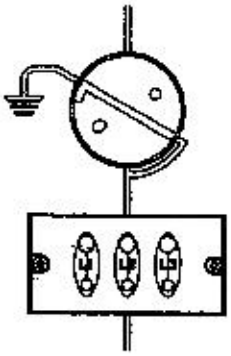


Padlocking the front panel.

keyed interlocks

See the keyed interlock installation and operating instructions 7896785.

operating safety



The front panel can only be removed or fitted if the earthing switch is closed.

preventive maintenance

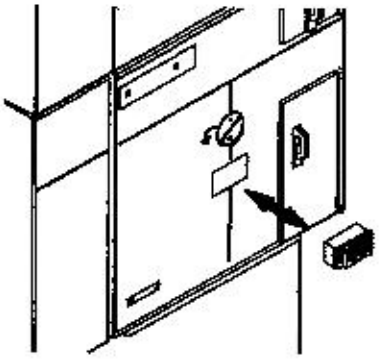
for problems:
see Schneider service centers.

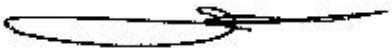
Never lubricate the operating mechanism.

No particular maintenance is required under normal operating conditions.
(temperature between −5°C and 40°C)

For severe operating conditions (aggressive environments, dust, temperatures below −5°C or above 40°C, etc.) consult your nearest **Schneider service centers.**

replacing a voltage indicator block on a cubicle prior to 0040001U





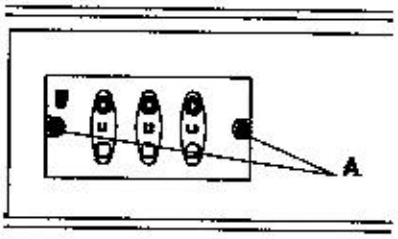
Pull out the voltage indicator block. (the switchboard can remain energized)

replacing a voltage indicator block

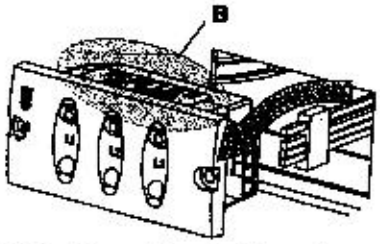
VIPS type on a cubicle after 0040001U

removal

This operation can be conducted with an energised switch.



remove the 2 fixing screws from the voltage indicator block (A).



Remove the voltage indicator block and unplug the incoming connector from it.

install

On the electrical data label (B), make sure that the new block correctly corresponds to the rated network voltage

- 1,7 kV à 3 kV
- 3 kV à 7,2 kV
- 10 kV à 24 kV

Install the new voltage indicator bock in the reverse order for removal.

Tightening torque 0,1 mdaN.

trouble-shooting chart

▪ voltage indicator not illuminated	▪ check that the incoming cables are live ▪ check the voltage indicator block
▪ front panel cannot be opened or closed	▪ check that the earthing switch is closed
▪ earthing switch cannot be operated	▪ check that the switch is open
▪ switch cannot be operated	▪ check that the earthing switch is open

motor mechanism (option)

▪ electrical operation impossible S13 = switch lever input S14 = earth switch lever input	▪ check the LV fuses HA21 (CIP2) ▪ check electrical interlocks S13–14 (lever insertion) ▪ check that the earthing switch operating shaft has reached its end position ▪ check that contact S14 has not disabled the power supply and re-adjust if necessary ▪ check the configuration of the CIP1 subassembly (see diagram)
▪ (*) manual operation impossible following an electrical closing cycle for a voltage level less than −15% rated value	▪ use the operating lever to apply a torque in the closing direction until the end position is reached; manual operation should now be possible
▪ (*) insertion of lever impossible following an electrical closing cycle for a voltage level greater than +15% rated value	▪ if possible, carry out an electrical operation, using a backup power source if necessary ▪ to allow insertion of the operating lever, push the back of the switch shaft in the closing direction using a large screwdriver; (for safety reasons, remember to first lock out the electrical operating mechanism; if necessary, push up and hold the locking blade that actuates contact S13)

(*) Operation is guaranteed for rated voltage ±15%

options

(please consult us)

- motor mechanism
- auxiliary contacts
- phase concordance tester
- keyed interlocks
- enlarged LV compartment
- 50 W heating element
- LV compartment or incoming cables compartment from top
- extra height plinth

spare parts

- voltage indicator

(for other parts, please consult us : see Schneider services centers)

ВЯРНО
С ОРИГИНАЛА!

554

ВЯРНО С ОРИГИНАЛА

С ОРИГИНАЛА!

55

groupe Schneider service centers are there for:

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start-up
training
preventive and corrective maintenance
adaptation work
spare parts

Call your sales representative who will put you in touch with your nearest groupe Schneider service centers, or call directly in Grenoble, France (33) 04 76 57 60 60

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Conception, rédaction: Service Documentation Technique T&D

Edition du : 15 [illegible]

SM6

MV distribution
factory built assemblies
at your service

Anglais

instructions for use

IM–PM–QM cubicles

Released for Manufacturing
Printed on 2010/07/21

Schneider Electric

"ТЕХНИК ЕНЕРДЖИ" ЕООД
"TECHNIC ENERGY" LTD
ВАРНА

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Edition du : 11/07/2001

symbols and conventions

Caution:
you will find all the symbols below throughout the document, indicating the hazard levels depending on the different types of situation.

DANGER — as per iso 3864-2

DANGER: failure to follow this instruction will result in death or serious injury.

WARNING — as per iso 3864-2

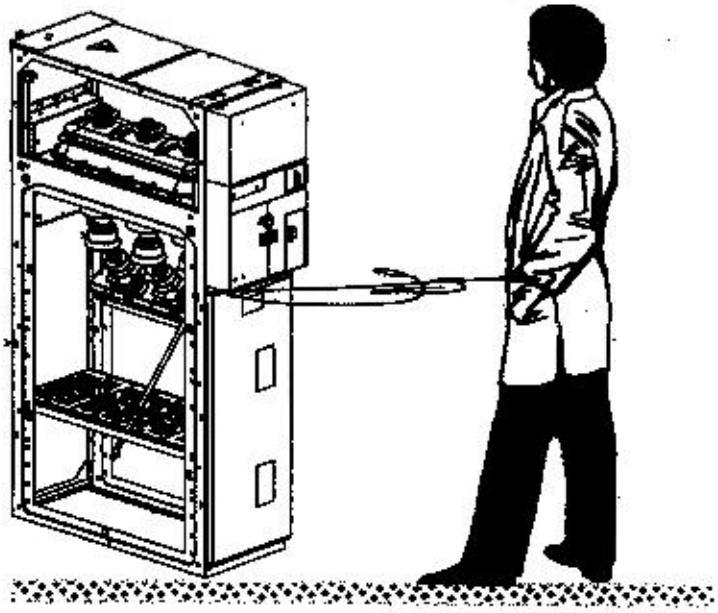
WARNING: failure to follow this instruction may result in death or serious injury.

CAUTION — as per iso 3864-2

CAUTION: failure to follow this instruction may result in injuries.
This alert signal can also be used to indicate practices that could damage the SM6 unit.

INFORMATION-ADVICE
We draw your attention to this specific point.

contact the Schneider Electric service unit for diagnosis and advice



Call your sales representative who will put you in contact with the closest SCHNEIDER ELECTRIC service centre.
You can log on to:
www.schneider-electric.com

distribution rules

CAUTION

The aim of this publication is to enable the SM6 unit to be installed correctly.

CAUTION

This document is not a commercial document.
It is a strictly technical document drawn up by **Schneider Electric.**

safety rules

CAUTION

All the operations described below must be performed in compliance with applicable safety standards, **under the responsibility of a competent authority.**

WARNING

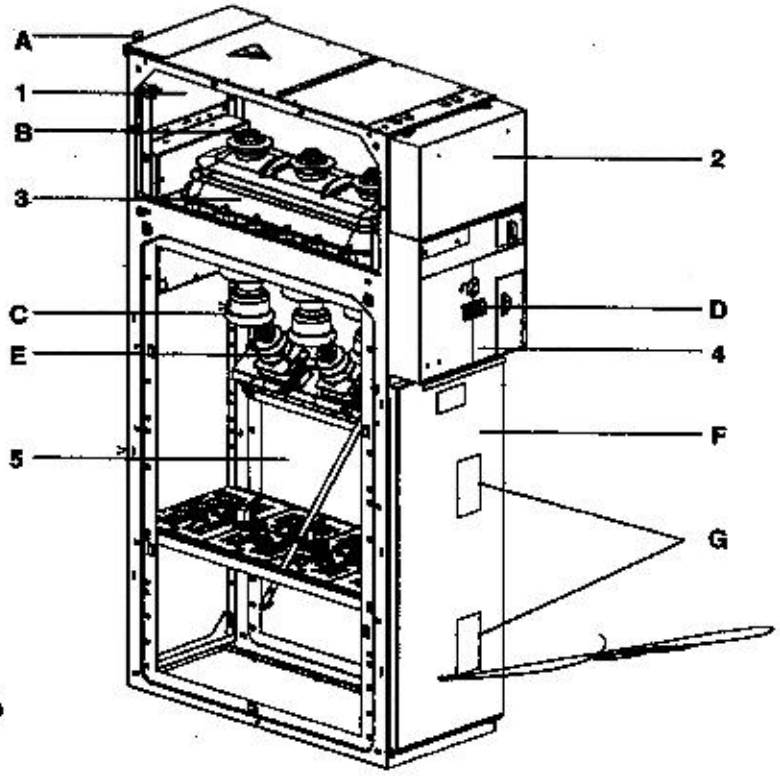
The contractor must be certified and authorised to manipulate and perform work on the SM6 unit.

CAUTION

Only undertake the work after having read and understood all the explanations given in this document.
If you have any difficulty complying with these rules, please contact **Schneider Electric.**

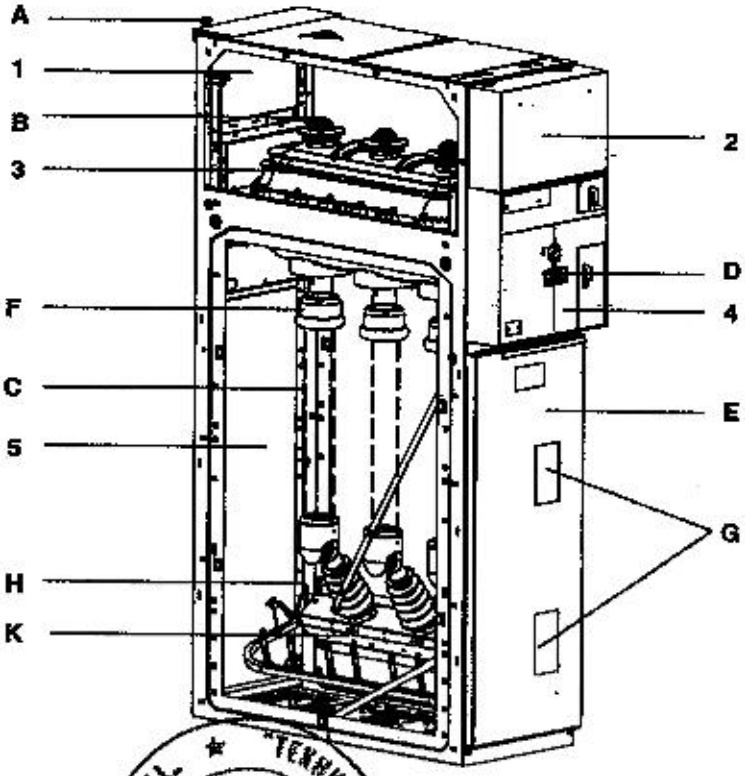
IM : switch cubicle

1 : busbar cabinet
2 : control cabinet
3 : switchgear cabinet : switch and earthing switch
4 : operating mechanism cabinet
5 : cable connection cabinet
A : earth bar connection pad
B : busbar connection pads
C : lower field distributor and cable connection
D : voltage indicator
E : capacitive divider
F : front panel
G : cable connection inspection windows



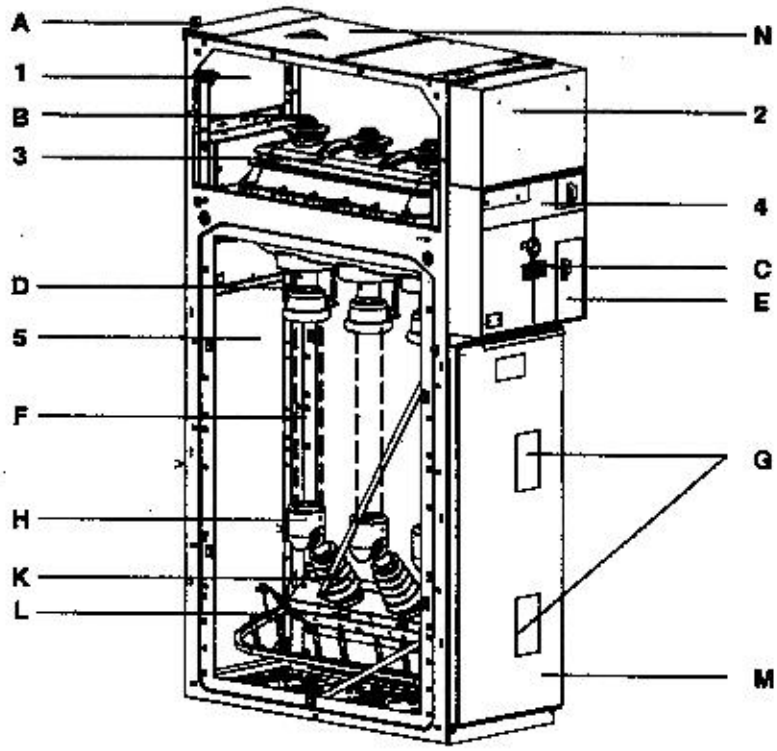
PM : fused switch cubicle

1 : busbar cabinet
2 : control cabinet
3 : switchgear cabinet : switch and earthing switch
4 : operating mechanism cabinet
5 : cable connection and fuse cabinet
A : earth bar connection pad
B : busbar connection pads
C : fuses
D : voltage indicator
E : front panel
F : lower field distributor and cable connection
G : inspection windows for fuses and downstream earthing switch position indicator
H : capacitive divider
K : downstream earthing switch



1°QM : fuse switch combination cubicle

1 : busbar cabinet
2 : control cabinet
3 : switchgear cabinet : switch and earthing switch
4 : operating mechanism cabinet
5 : cable connection and fuse cabinet
A : earth bar connection pad
B : busbar connection pads
C : voltage indicator
D : mechanism used to open switch when fuse blows (QM)
E : indication of switch opening by blown fuse (QM)
F : fuses
G : inspection windows for fuses and downstream earthing switch
H : lower field distributor and cable connection
K : capacitive divider
L : downstream earthing switch
M : front panel
N : rear extension sheet metal

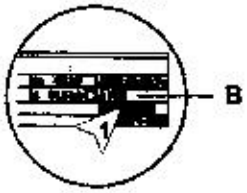


cubicle identification

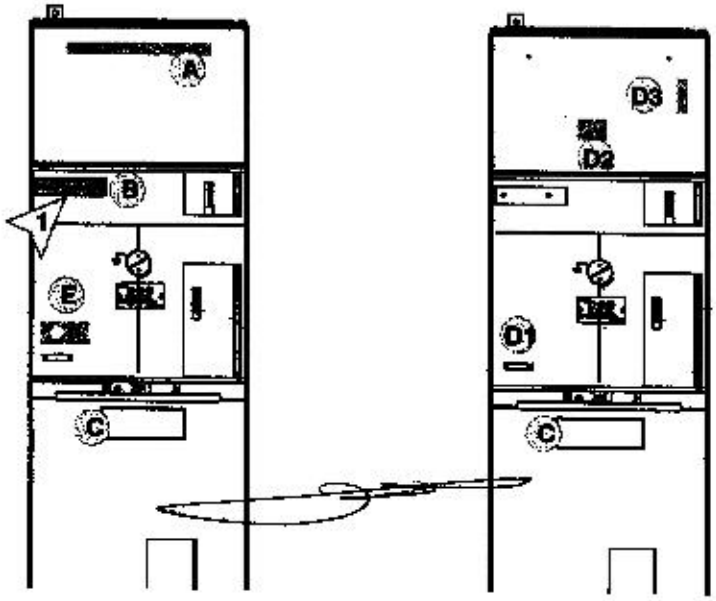
A : indicator plate
(for customer use)
B : characteristics and designation
C : manufacturer's name plate
E : motorization plate (option)

serial number

D1 : riveted to the front plate of the operating mechanism cover
D2 : glued to the back of the front plate of the low voltage cover
D3 : glued to the upright of the frame



1 :instruction for use number



accessories list

Busbar 400–630A version and one phase dry cables connection. For others versions, see specific instructions.

supplied with the cubicle

switchboard accessories:
(may vary depending on the cubicles making up the switchboard)

1 operating lever
2 end panels
1 bag of nuts and bolts for the end panels

IM accessories:

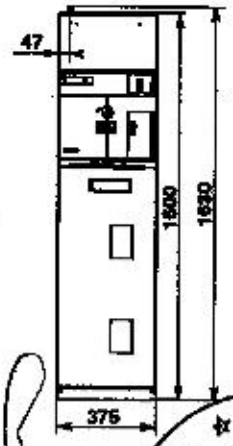
1 bag of intercubicle connection accessories (bag **S1 : 3729745**)
1 bag of field distributors for busbars > 12 kV (bag **S2 : 3729742**)
or 1 bag of fastening accessories for busbars ≤ 12 kV (bag **S6 : 3729746**)
1 bag of bottom plate fastening accessories (bag **S3 : 3729741**)
4 bottom plates
3 cable bushings
3 clamp supports + clamps
1 set of busbars
1 earth bar

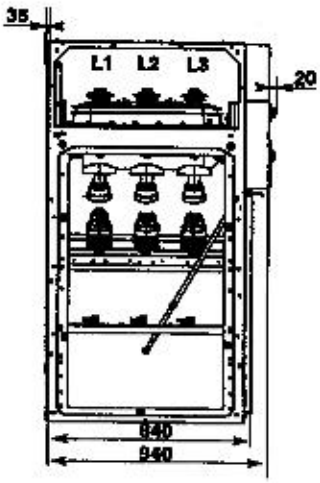
PM and QM accessories:

1 bag of field distributors for busbars > 12 kV (bag **S2 : 3729742**)
or 1 bag of fastening accessories for busbars ≤ 12 kV (bag **S6 : 3729746**)
1 bag of bottom plate fastening accessories (bag **S5 : 3729743**)
4 bottom plates
3 cable bushings

dimensions and mass

IM :120 kg
PM :130 kg
QM :130 kg





handling by sling

he handling lugs are reserved solely for handling SM6 cubicles.

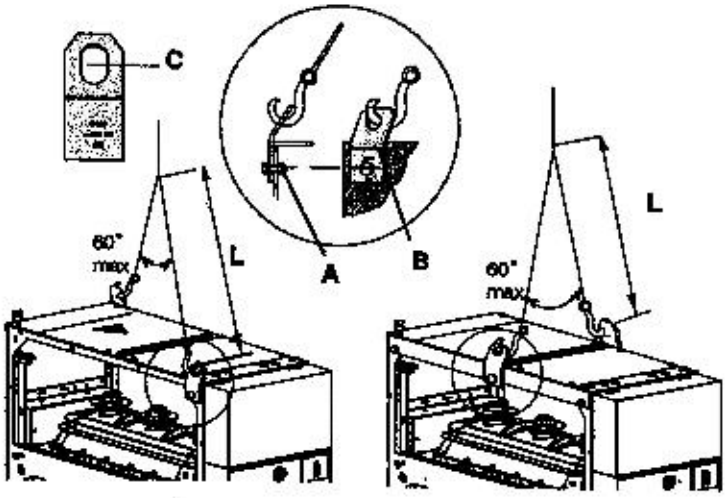
A : HM12 nuts and screws

B : Schneider Electric
CMU =400 KG CE

CMU : Maximal Using Load

CAUTION

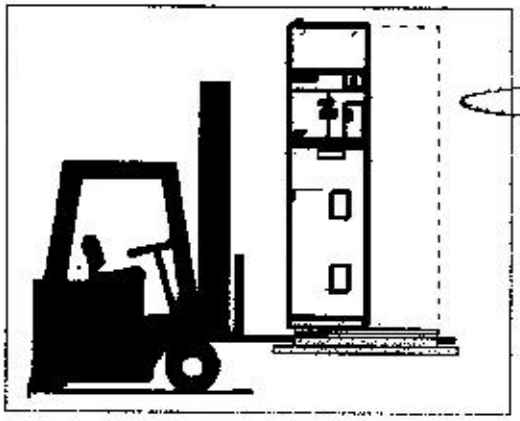
C : should the holes be deformed (ovalisation), replace the lugs, to propose you if required.

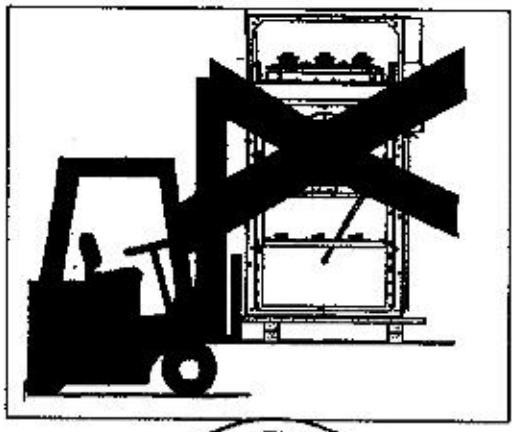


L = 920 mm minL
Without low voltage case or wiring duct.

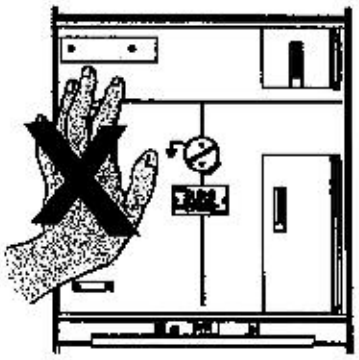
L = 375 mm mini.
With low voltage case or wiring duct.

handling using a forklift

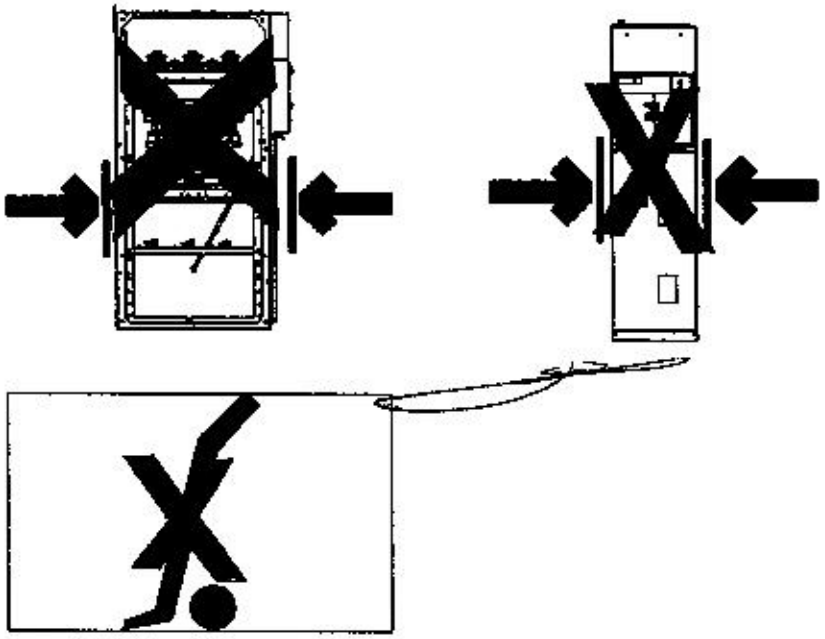




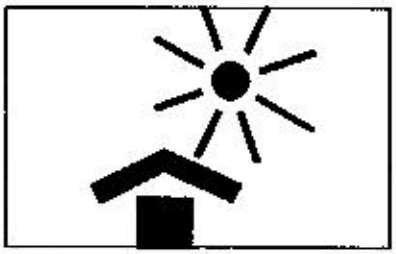
handling

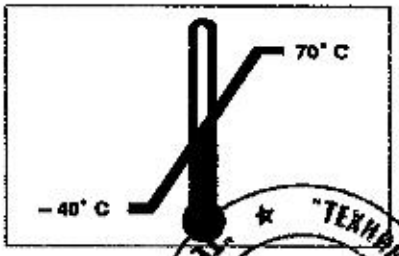


Never attempt to move the cubicle by exerting force on the control panel.



storage





57

switchgear ageing withstand in an MV substation depends on 3 main factors

- **The need for proper implementation of connections:**
  the new cold slip–on and retractable technologies offer ease of installation, thereby promoting withstand over time.
  Their design enables operation in polluted environments with harsh atmospheres.

- **The influence of the relative humidity factor:**
  installation of heating resistors is essential in climates with high relative humidity and large temperature differences.

- **Ventilation control:**
  the grids must be sized according to power loss in the substation.
  These grids must only be placed near the transformer, so as to prevent air circulating on the MV switchboard.

operation

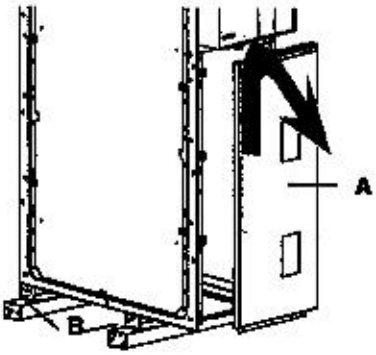
Our service centre is at your disposal at all times:

- To conduct an installation diagnosis.
- To suggest the appropriate maintenance operations.
- To offer you maintenance contracts.
- To suggest adaptations.

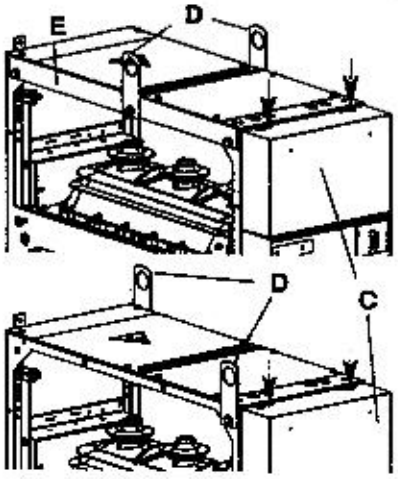
preparing the cubicles for switchboard assembly

Delivery state :
Earthing switch position upon delivery: **closed.**

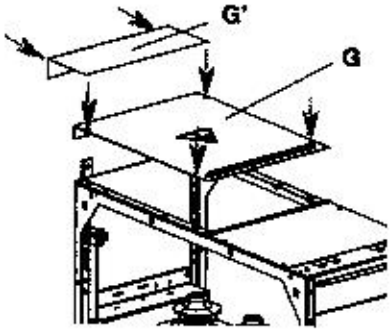
→ bolt + washer
→ bolt + washer + nylstop nut



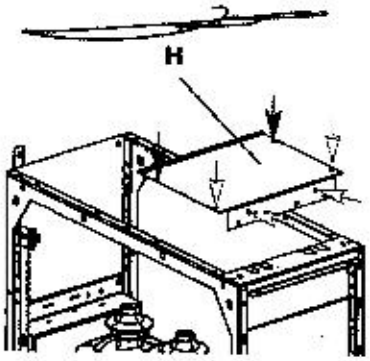
Remove the front panel **A** and then the skids **B**.



Remove the control cabinet cover **C** and the lifting rings **D** and **E**.



Remove top plate **G and G'**. (6 bolts)



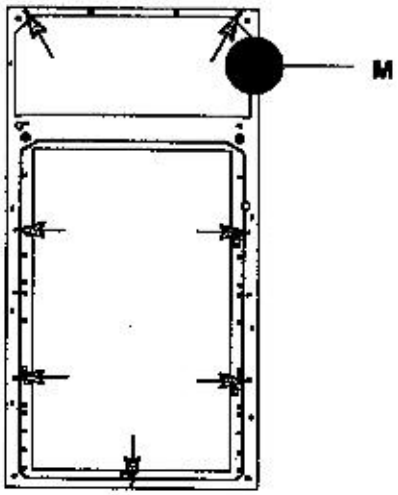
Remove top plate **H**. (6 bolts)

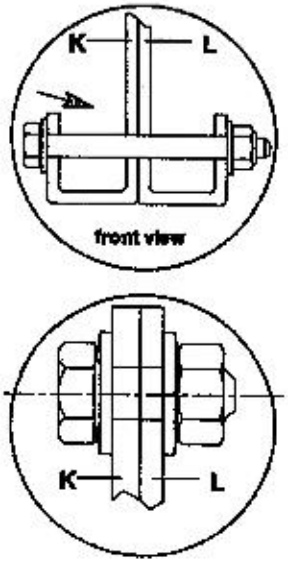
assembly the end panels

Refer to the switchboard parcel manual, as per the upgrade of the new standard **IEC 62271-200.**

assembling the switchboard

nuts and bolts in bag
S1: 3729745
(HM6 x 16 bolts only)
→ : screw+washer+ nut



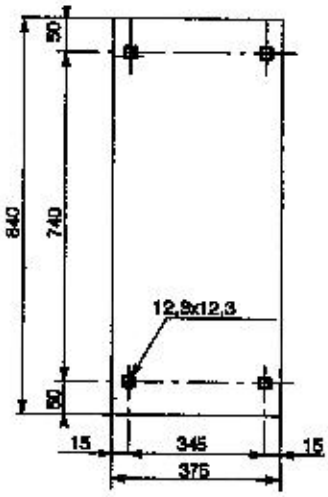


Fix the cubicles together.
(the additional screws are for mounting the earth collector)

Bolt mounting direction.
K : left–hand cubicle
L : right–hand cubicle
M : to join the 2 cubicles.
Screw HM6x60 to tighten moderately.
Tightening torque : 6 Nm.

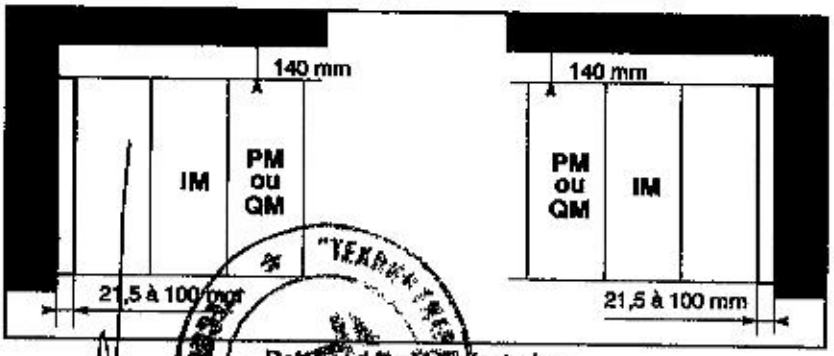
securing to the floor

(screws to be provided by the contractor according to civil engineering)



layout in the substation

(minimum clearance for trouble-free operation)
Switchboard installed to the right of a wall.
Switchboard installed to the left of a wall.



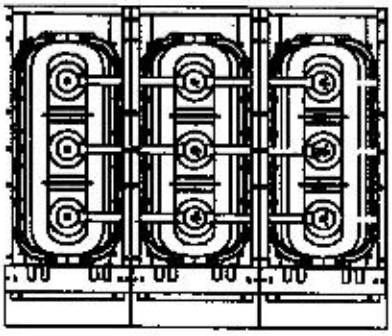
assembly the busbars

Installing the cubicles in their operating location

accessories bag
S2 : 3729742

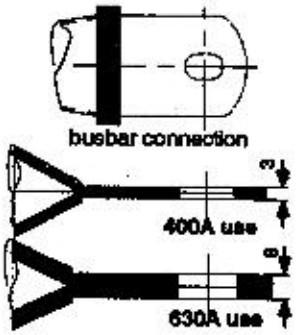
- **Outillage :**

1 torque wrench (1 to 50 Nm.)
1 reduction gear (1/4 – 3/8)
1 socket connector (6 mm)
1 hexagon male socket (6mm)

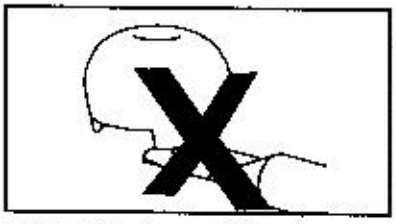


Busbar connection.
Tightening torque : 28 Nm.

Before assembling the busbar, ensure that it complies with use of the switchboard for a rated current of 400A or 630A.



Field distributor **positioned correctly**



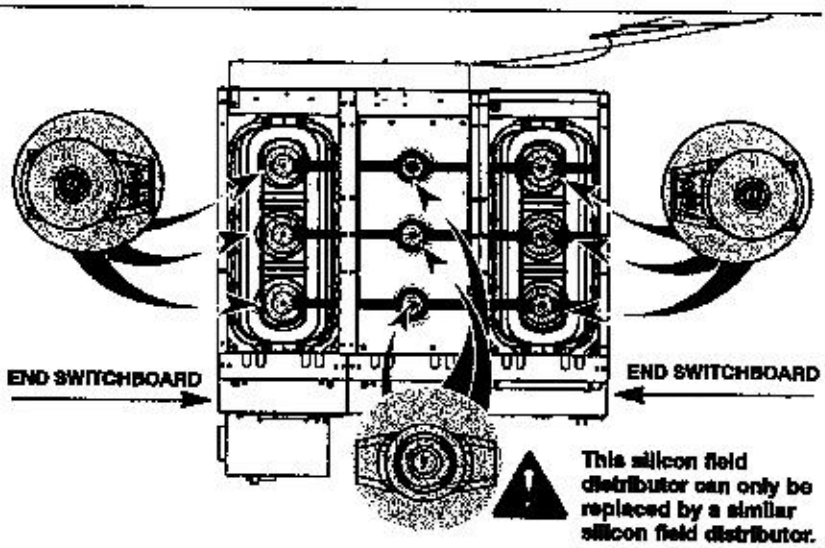
Field distributor **positioned incorrectly.**

assembly the busbars <u>with lower field distributor silicon optional</u> (Optional only 630A)

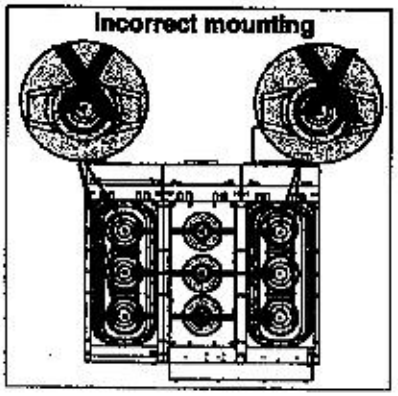
Installing the cubicles in their operating location

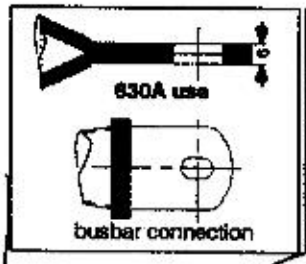
Refer to the above tools

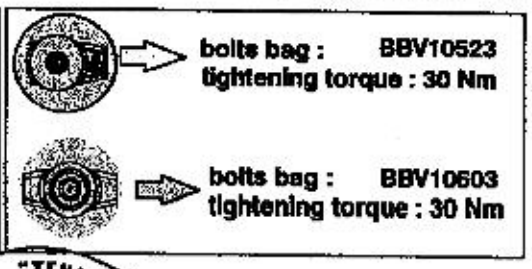
Before assembling the busbar, ensure that it complies with use of the switchboard <u>for a rated current of 630A (only).</u>



This silicon field distributor can only be replaced by a similar silicon field distributor.

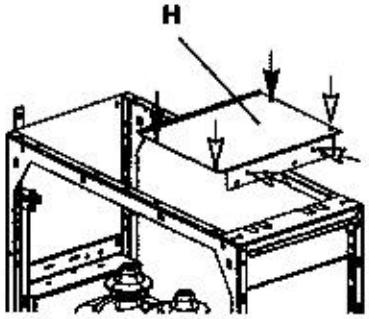




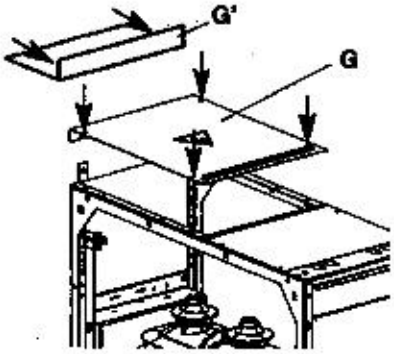


575

bolt + washer + nylstop nut
bolt + washer



Refit top plate H.
(nuts inside the cubicle)

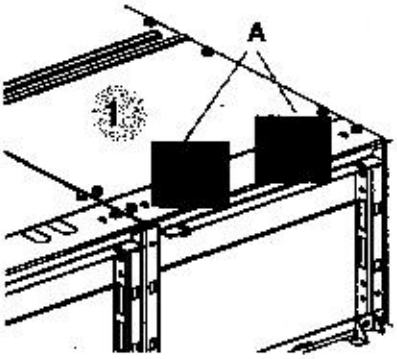


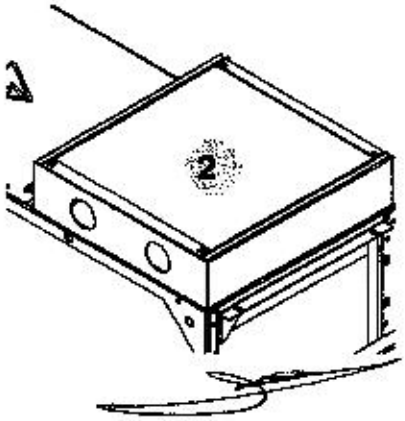
Refit top plate G and G'.

cable entry for connection of low voltage auxiliaries

1 : Cable entry to the auxiliary terminal block is via holes A on top.

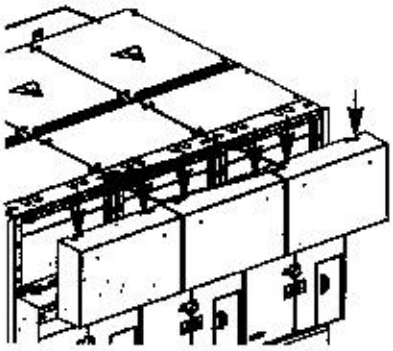
2 :Cubicle equipped with a wiring duct. (option)
Proceed in the same manner after removing the trough top plate.





bolt + washer

Refit the control cabinet cover, respecting the indications.



cable entry for connection of low voltage standard auxiliaries in optional supply

Note : for connection of LV auxiliaries, refer to the wiring diagrams of the cubicle with need other than standard.

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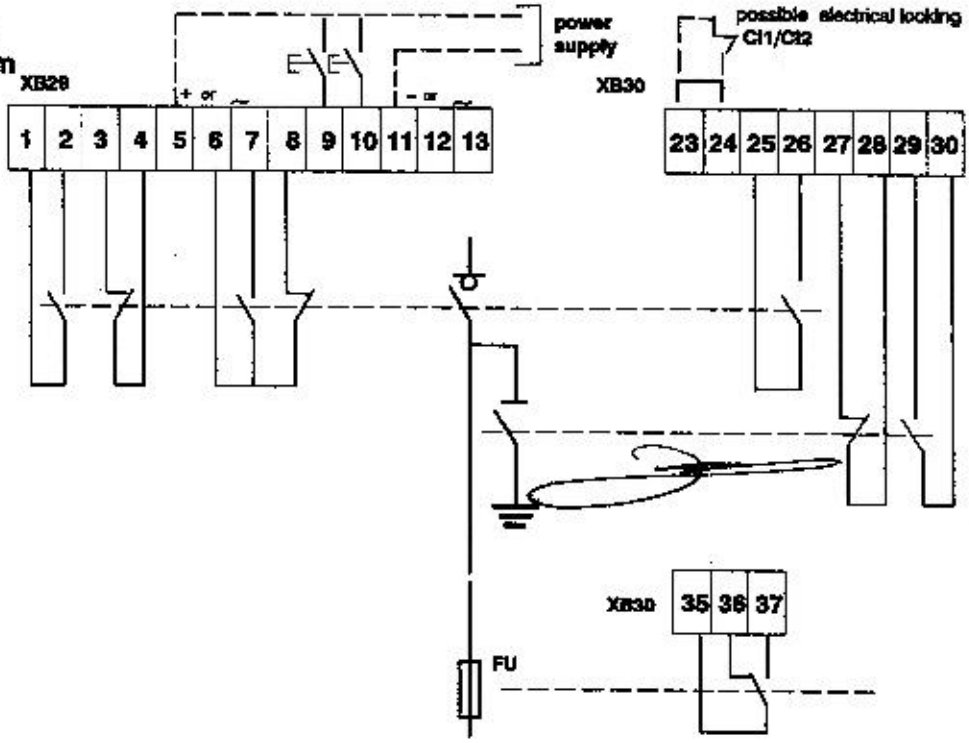
cable entry for connection of low voltage standard auxiliaries in optional supply

terminal block of LV auxiliaries with motorized mechanism



marking of terminal block

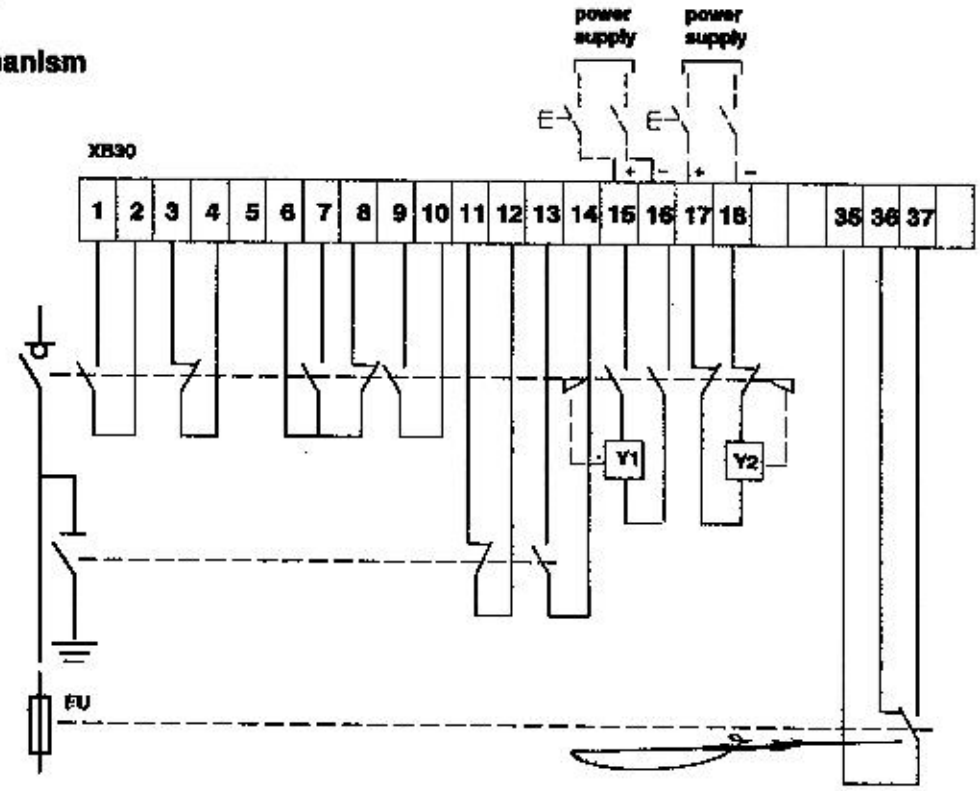
4 auxiliary contacts :
position of the closed MV switch : terminals **1–2** and **6–7**.
Position of the open MV switch terminals **3–4** and **6–8**.

3 additional auxiliary contacts (optional supply)
Position of the closed MV switch : terminals **25–26**.
Position of the open MV earthing switch : terminals **27–28**.
Position of the closed MV earthing switch : terminals **29–30**.

Motorization :
Power supply : terminals **5–11**.
Opening order : terminal **9**.
Closing order : terminal **10**.
Possible electrical locking for motorization : terminals **23–24**.

Fuse blowing indication.
only for **QM cubicle** : terminals **35–36–37**.

terminal block of LV auxiliaries with no-motorized mechanism



marking of terminal block

4 auxiliary contacts :
position of the closed MV switch : terminals **1–2** and **6–7**.
Position of the open MV switch : terminals **3–4** and **6–8**.

3 additional auxiliary contacts :
(optional supply)
position of the closed MV switch : terminals **9–10**.
Position of the open MV earthing switch : terminals **11–12**.
Position of the closed MV earthing switch : terminals **13–14**.

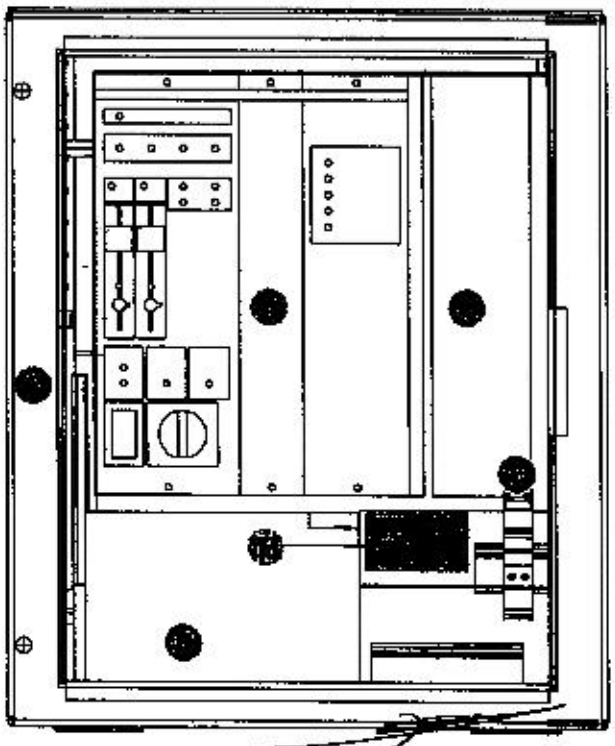
Opening release :
opening order : terminals **15–16**.

Closing release
closing order : terminals **17–18**.

Fuse blowing indication
only for **GM cubicle** : terminals **35–36–37**.

T200S for LV connection

A : T200S "relay"
B : radio location"in the case of remote control"
C : LV cabinet (W : 375mm)
D : battery for independent supply
E : fuse switch for connecting the 230 V AC battery charger supply
F : malle/femalle connector info SW1, SW2, I.SW1 and i.SW2



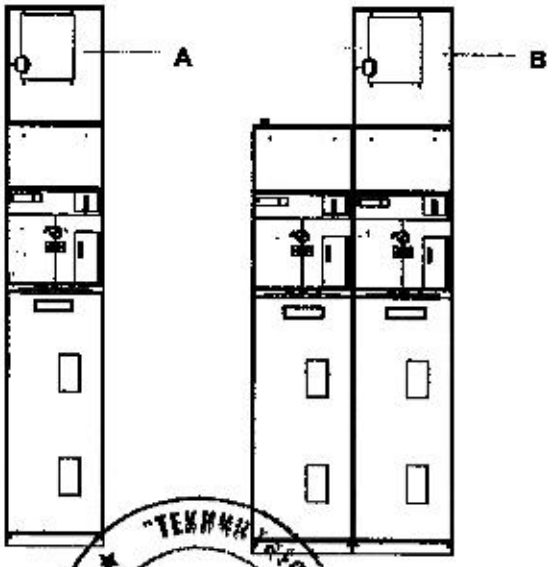
1 : connect the 230 V AC supply to the fuse switch (E) and shut off the switch
2 : connect the battery
3 : the automated controller will be fully operationnal after one hour.

commissioning the automated controller

- check the position of the buttons on the operating mechanism : buttom K in operation position button D set to ON.
- to configure the automated controller, refer to the T200S user manuals nos. NT00044 and N° T00046 in English.

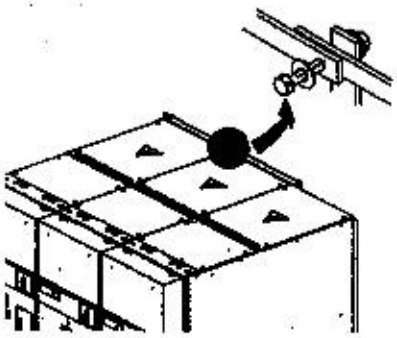
remote control for 1 cubicle switch (A)

remote control for 2 cubicle switch (B)

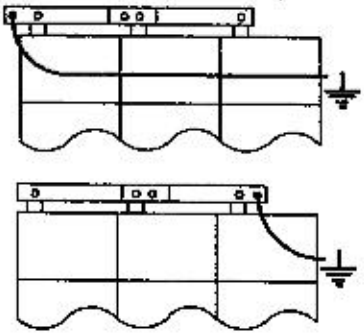


assembly the earthing bars

nuts and bolts in bag S1 : 3729745

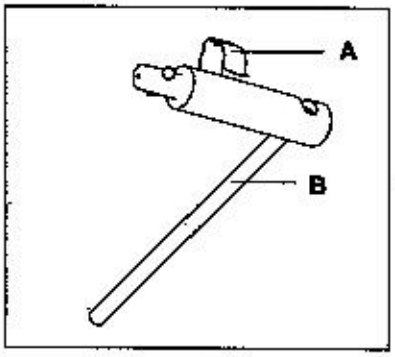


Connect the earthing bars together. (HM8 x 30 bolts)



Earth the substation frames in either of these two ways.

storing the operating lever

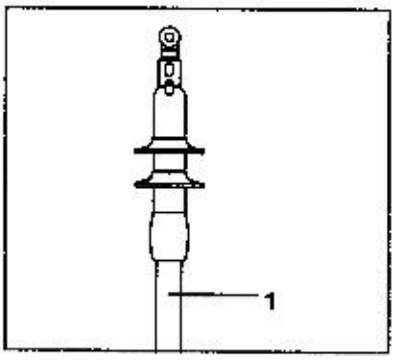


Fix the hook **(A)** and the wall. (screws not supplied)
The operating lever has to be hooked **(B)**.

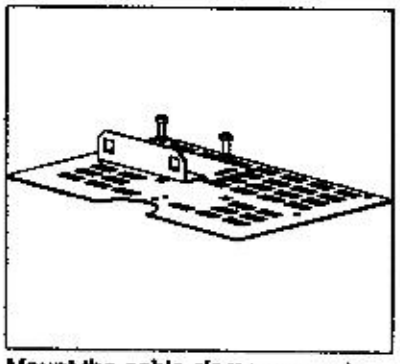
HV cable connection for an IM cubicle

To limit the effort on the cable connection you have to ajust the lenght at the bending radius of the cable.

1 : copper cable or aluminium cable

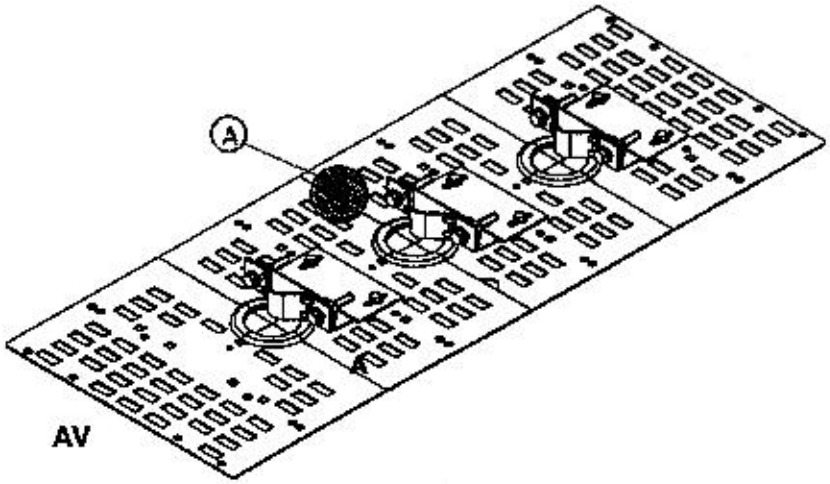


EUIC (short inner end, cold fitted).
They must be manufactured according to the standard : IEC.60.502



Mount the cable clamp supports.
Nuts and bolts in bag **S3 : 3729741** (HM6 x 16 bolts).
The remaining nuts and bolts are for cable clamping.

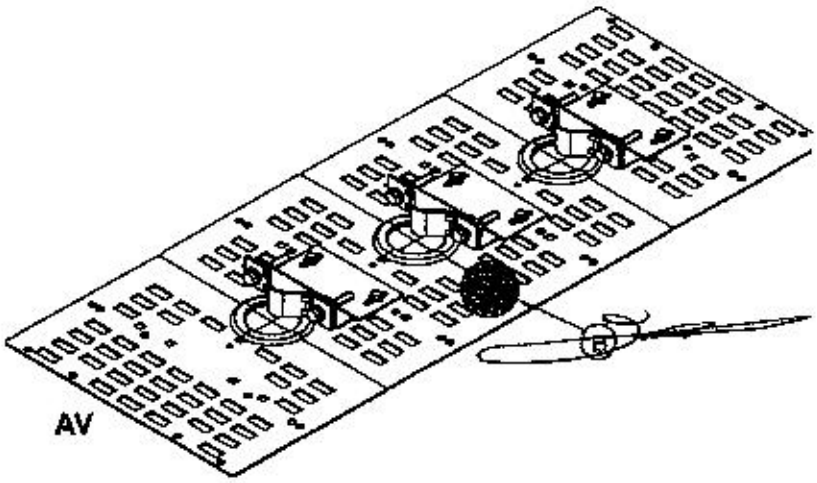
2 mounting possibilities :
A without toroids

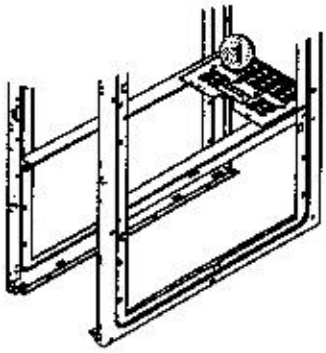


B with toroids

Note : if the assembly B isn't equiped with toroids, the degree of protection **IP2X isn't observed.**

Remind : IP2X : degree of protection following protection suivant **IEC60529.**



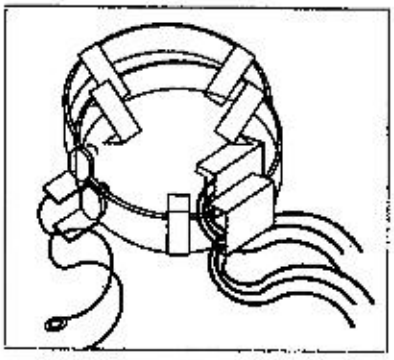


Mount the first bottom plate.

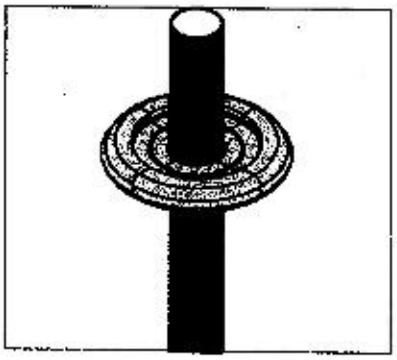
Installing the fault detection toroids

(instructions suggested by Schneider Electric)

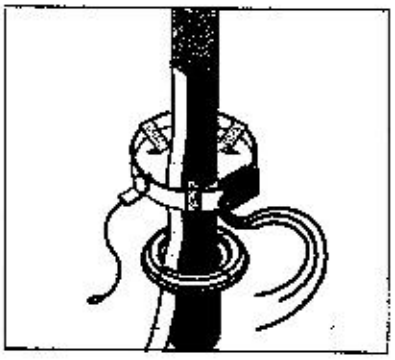
For IM cubicles only.
Follow the instructions of the toroid manufacturer.



Prepare the toroids outside the cubicle.



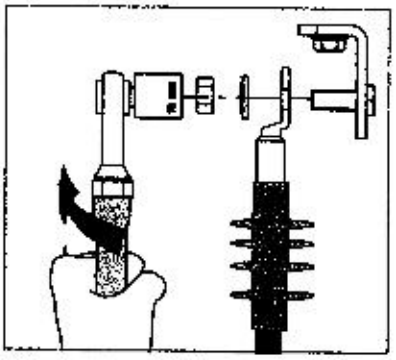
Fit the cable bushing.



Position and fix the toroid on the cable.

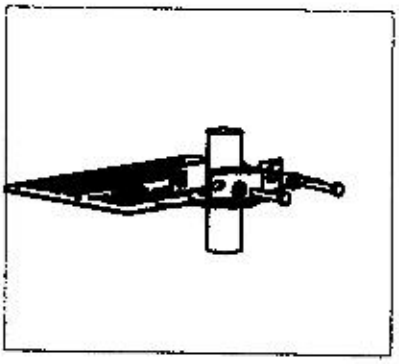
The earthing bread of the cables has (isolated) must go trough the toroids.

Connect the cable to the bolt provided on the phase L1 connector.

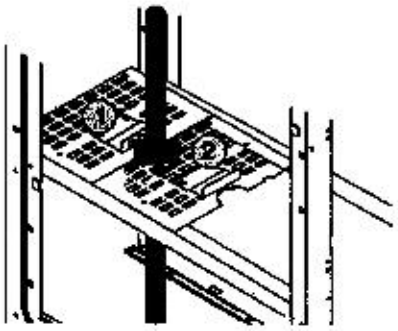


Use a torque wrench and a 19 mm socket to tighten the cable to this bolt.

Tightening torque : 50 Nm.

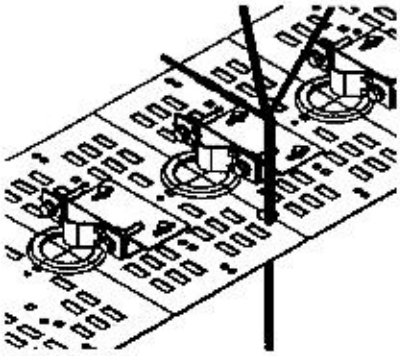


Clamp the cable to the clamp support on the bottom plate. (HM8 x 50 bolts)

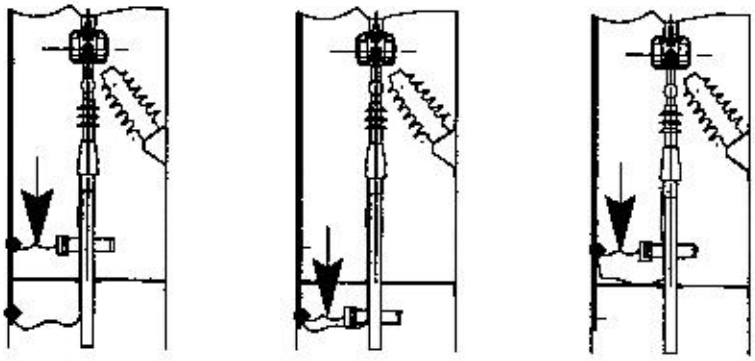


Mount the **second** bottom plate.

- mount phases **L2** and **L3** using the same procedure as for phase **L1**.



Example of low voltage routing : cables pass through the opening.



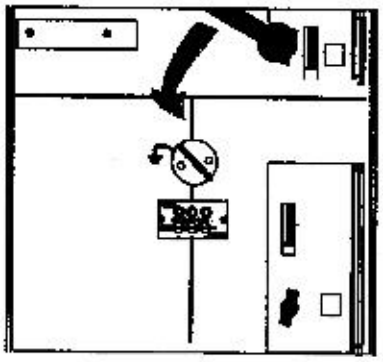
Connect the cable and toroid earthing braids in either of these 3 ways.
(the bolts are already installed)

MV cable connection for PM and QM cubicles

Do not use the cable clamp supports.

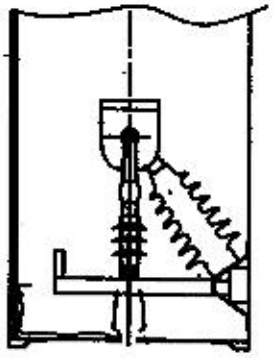
Nuts and bolts in bag S5 : 3729743.

Make sure to fully complete the operating cycle you before removing the lever.



Open the earthing switch using the operating lever.

To see manual operations section.

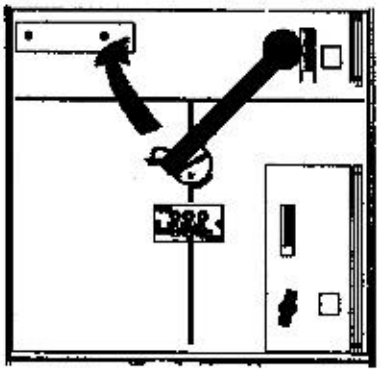


Fit the cables in the same order as for the **IM cubicle.**
Use a torque wrench and a 16 mm socket to tighten the bolts.
Tightening torque : 50 Nm.

ATTENTION

Make sure to fully complete the operating cycle you before removing the lever.

Close the earthing switch

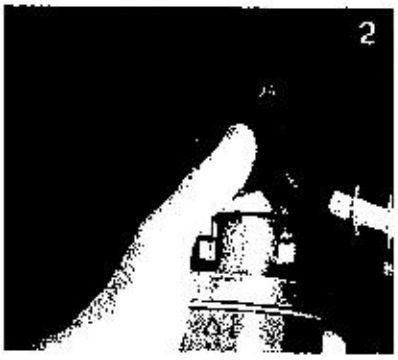


assembly fuses in PM and QM cubicles

Reminder :
Check the condition of the fuses before assembling them .

1 : Insert the bottom of the fuse all the way into the lower annular contact.

2 : Fit the upper part of the fuse, do not forget to draw by hand the upper field repartitor (A).

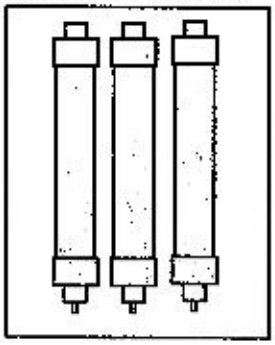


3 : correct mounting

Reminder:
check the correct position of the upper field repartitor (A)

Nota :
- **when changing a fuse, change all 3 fuses .**

■ **B** :Turn the fuse so that the label appears in front.

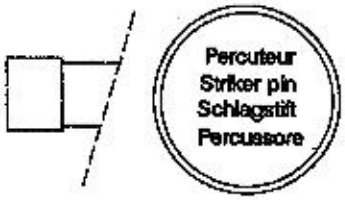


CAUTION

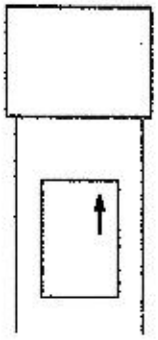
- Do not re-used fuses that have already been used.

In a QM cubicle

Fit striker type fuses that actuate the opening of the switch when they blow.



The striker end of the fuse is marked.



The fuse characteristics and direction of mounting are printed on the fuse.
Turn the fuse so that the label is in front.
(striker at the top)

transformer protection

Fuse ratings for **SM6** protection units such as the **PM** and **QM** depend, among other things, on the following criteria :

- Service voltage
- Transformer rating.
- Fuse technology (manufacturer).

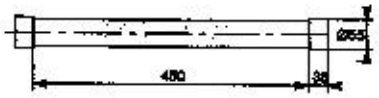
- Different types of fuses with medium loaded striker may be installed:
  —Solefuse fuses as per standard **UTE NFC 64.210.**
  —CF Fusarc fuses as per IEC recommendation **282.1** and DIN dimensions **43.625.**

dimensions of fuses

Example: for the protection of a 400 kVA transformer at 10 kV, select either Solefuse fuses rated 43A or CF Fusarc fuses rated 50A.

Please consult us on installation

solèfuse (UTE standard)



rated voltage (kV)	rating (A)	weight (Kg)
7,2	6,3 à 125	2
12	100	2
17,5	80	2
24	6,3 à 63	2

CF Fusarc (DIN standard)

rated voltage (kV)	rating (A)	L mm	Ø mm	weight (Kg)
7,2	125	292	88	3,3
12	6,3 à 63	292	55	1,4
	80 à 100	292	88	3,3
24	6,3 à 40	442	55	1,4
	50 à 80	442	88	5

selection table

(rating in (A), no overload, −5°C < θ < 40°C)

Please consult us for overloads and operation over 40°C.

type of fuse	service voltage (kV)	transformer rating (KVA) 25	50	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	rated voltage (kV)
UTE NFC standards: 13.100, 64.210																			
Solefuse																			
	5.5																		
	10	6.3	6.3	16	16	31.5	31.5	31.5	63	63	63	63							24
	15	6.3	6.3	16	16	16	16	16	43	43	43	43	43	63					
	20	6.3	6.3	6.3	6.3	16	16	16	16	43	43	43	43	43	63				
General case, UTE NFC standard 13.200																			
Solefuse																			
	3.3								100	100									
	5.5									80	80	100							
	6.6										80	100							
	10	6.3	6.3	16	16	16	31.5	31.5	31.5	43	43	63	80	80	100				12
	13.8	6.3	6.3	6.3	16	16	16	16	31.5	31.5	31.5	43	63	63	80				17.5
	15	6.3	6.3	6.3	16	16	16	16	31.5	31.5	31.5	43	43	63	80				
	20	6.3	6.3	6.3	6.3	16	16	16	16	31.5	31.5	31.5	43	43	63				24
	22	6.3	6.3	6.3	6.3	16	16	16	16	16	31.5	31.5	31.5	43	63	63			
General case, IEC 62271-105 standard																			
CF Fusarc and SIBA*																			
	3,3	16	25	40	63	80	80	80	100										
	5	10	16	31,5	40	40	50	63	80	80									
	5,5	10	16	31,5	31,5	40	50	63	80	80	100			100*					
	6	10	16	25	31,5	40	50	63	63	80	80			100*					
	6,6	10	16	25	31,5	40	50	50	63	80	80	100							
	10	6,3	10	16	20	25	31,5	40	50	50	63	80	80	100	100	125*	100*		12
	11	6,3	10	16	20	25	25	31,5	40	50	50	63	80	100	100	125*	100*		
	13,8	6,3	10	16	16	20	25	31,5	31,5	40	50	50	63	80	80	100*			
	15	6,3	10	10	16	16	20	25	31,5	40	50	50	63	80	80	100	125*		
	20	6,3	6,3	10	10	16	16	25	25	31,5	40	40	50	50	63	80	100*	125*	24
	22	6,3	6,3	10	10	10	16	20	25	25	31,5	40	40	50	50	80	80	100*	

reference list

Reference list of fuse inside QM cubicle according to IEC 62271-105 standard.

Please consult us for all other type of fuses.

FUSARC CF															
Un=7,2 kV		Un=12 kV		Un=17,5 kV		Un=24 kV		SIBA							
								Un=12 kV		Un=17,5 kV		Un=24 kV			
Ir(A)	ref	Ir(A)	ref	Ir(A)	ref	Ir(A)	ref	Ir(A)	ref	Ir(A)	ref	Ir(A)	ref	Ir(A)	ref
125	757352BM	6,3	51006511M0	6,3	51006538M0	160	3736720	125	3736722	125	3736725	100	3736726		
		10	51006512M0	10	51006539M0	200	3736721	160	3736723			125	3736727		
		16	51006513M0	16	51006540M0			200	3737724						
		20	51006514M0	20	51006541M0										
		25	51006515M0	25	51006542M0										
		31,5	51006516M0	31,5	51006543M0										
		40	51006517M0	40	51006544M0										
		50	51006518M0	50	51006545M0										
		63	51006519M0	63	51006546M0										
		80	51006520M0	80	51006547M0										
		100	51006521M0												

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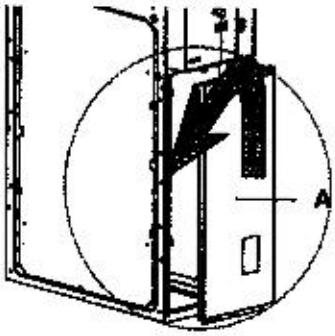
checks before energizing

Check that nothing has been left in the connection cabinet.

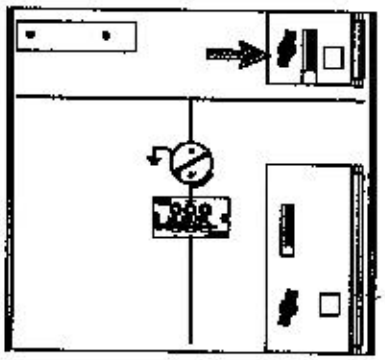
For all phases:

- check that the fuse has been properly fitted.
- check that the field distributor covers have been properly closed on all phases.
- check that the fault detector has been properly connected.

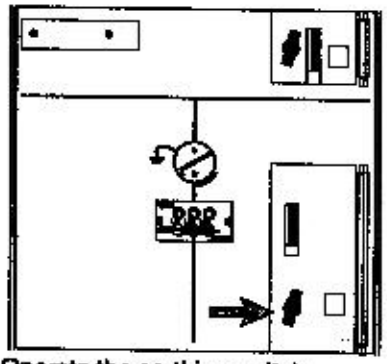


Refit the front panel A.

operating test before energizing

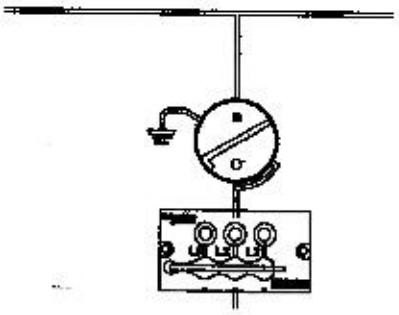


Operate the switch several times.



Operate the earthing switch several times.

energizing the incoming MV cables



The switchgear must be in open position.
(see : **operating instructions**)

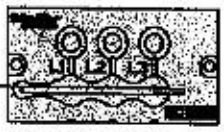
VPIS

presentation of VPIS–V1 and VPIS–V2

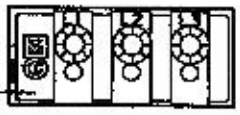
VPIS : Voltage Presence Indicating System, a case with 3 built–in lights.

A 

A : VPIS–V1 : production until september 2009

B 

A : VPIS–V2 : production à partir de september 2009

C 

C : PdU: Old version of the voltage indicator instaled on cubicle before january 2000.

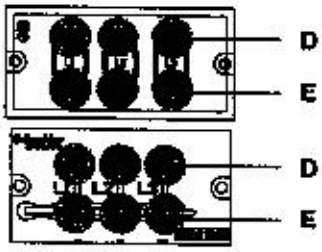
characteristics

Conforming to IEC 61958, relative to voltage presence

operating instructions

The indication provided by a VPIS–V1 or V2 alone is not sufficient to ensure that the system is de–energised.

When the ambient lighting is particularly bright, it may be necessary to improve visibility by protecting the indication.



D : voltage presence indicator light (one for each phase)

E : connection point designed for the connection of a phase concordance unit (one for each phase)

phase concordance unit

Phase concordance testing for VPIS–V1 and VPIS–V2 must be carried out each time a cable is connected to a functional unit.

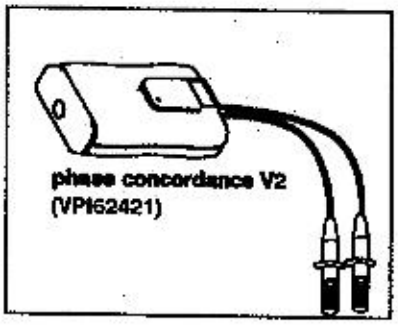
It is a way of making sure that all three cables are each connected to the corresponding phase of the panel.

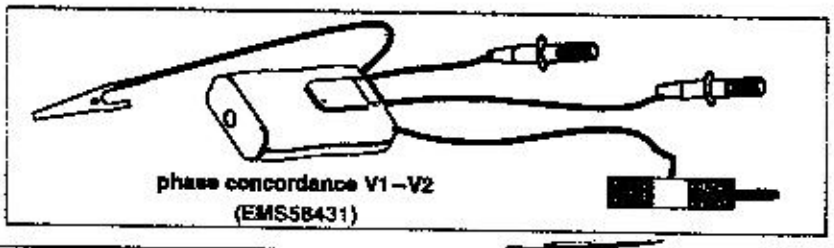
principle

The principle of the phase concordance unit is that it allows a check of the phase...

....concordance between 2 energised functional input units on the same panel.

reminder of accessories that can be used for phase concordance testing

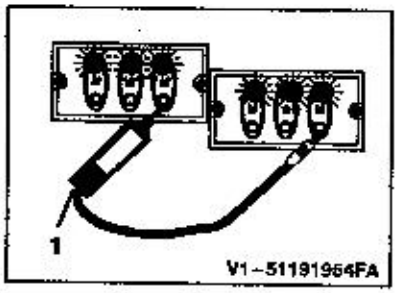


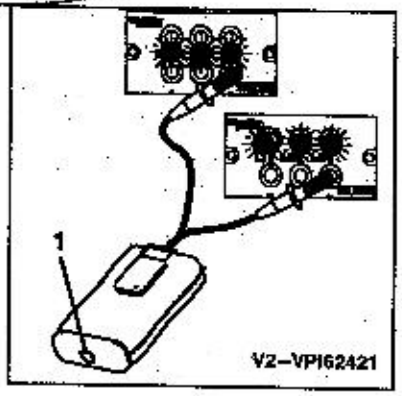


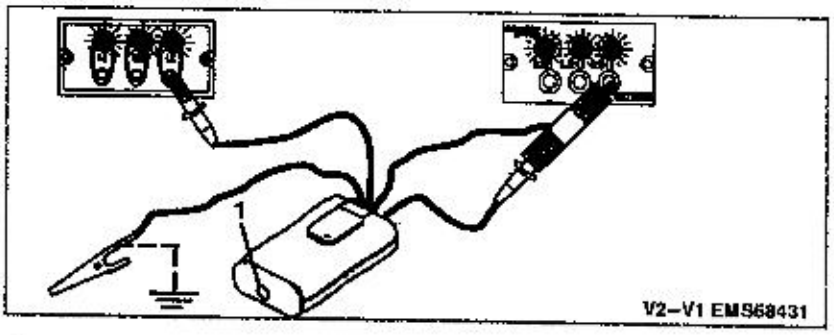
rules for the use of phase concordance unit

Balanced phase: –the phase concordance unit light (1) is unlit

Unbalanced phase :–the phase concordance unit light (1) is lit.





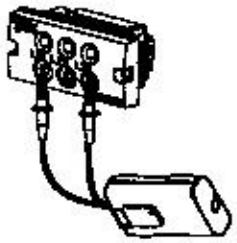
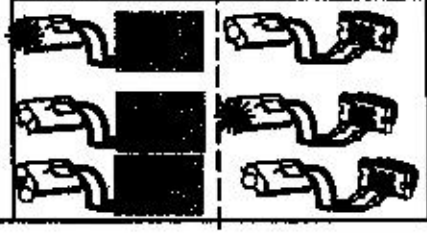


rules for choosing phase concordance unit

phase concordance unit	functional unit 1	functional unit 2	compatibility result	corrective actions
	V1	V1	OK	
	V1	V2	X	1) Replace VPIS–V1 by VPIS–V2. Use a phase concordance unit V2. 2) Use a phase concordance unit V2_V1
	V2	V2	X	Use a phase concordance unit V2 or V2–V1
	V1	V1	X	Replace VPIS–V1 units by VPIS–V2 units OR test with 1 phase concordance unit V1.
	V1	V2	X	Remplacer le VPIS–V1 par le VPIS–V2 ou utiliser le comparateur V2–V1
	V2	V2	OK	
	V2	V2	OK	
	V2	V1	OK	
	V1	V2	OK	
	V1	V1	X	Replace VPIS–V1 units by VPIS–V2 units OR test with 1 phase concordance unit V1.

check before phase concordance test

Please refer to the previous chapters in the event of test malfunctioning.

TEST	RESULT	ACTION
[redacted] 1 2 Visual checking of the indicator lights on the VPIS units of [redacted] and of functional unit 2	The 3 indicator lights of each VPIS are on.	The 2 functional units are energised, the VPIS units are operating and the check can continue.
	The 3 indicator lights of the VPIS are off. The functional unit is not energised or the VPIS is defective.	Apply power to the functional unit. If VPIS–V1 remains unlit, replaced it by a VPIS–V2.
	One or 2 indicator lights unlit.	The VPIS is probably defective. Replace by a VPIS–V2.
Phase concordance unit check choice  On each functional unit test phases 1 and 3.	[redacted] functional unit 2 	You can test.
		You cannot test them.

conditions storage of the phase concordance unit

temperature

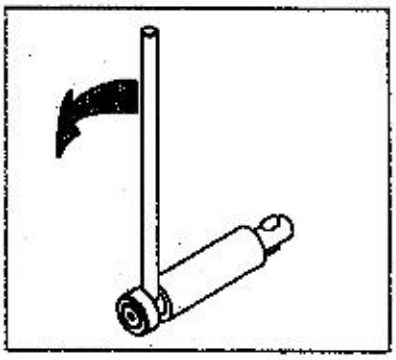
phase concordance test

The 3 indicator lights of the 2 VPIS are lit and the phase concordance unit is correct, meaning that the phase concordance test can be performed.

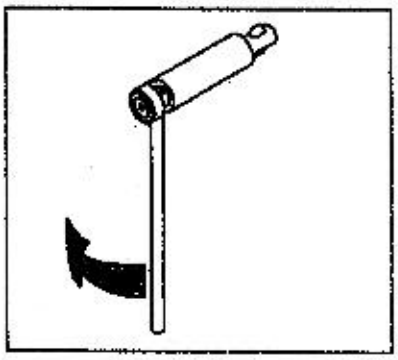
lexique or *phase concordance unit LED lit* ○ *LED unlit*

Functional unit n°2		L1	L2	L3	Conclusion regarding phase concordance
Functional unit n°1	L1	○	✹	✹	Connection is satisfactory
	L2	✹	○	✹	
	L3	✹	✹	○	
	L1	✹	○	✹	Reverse the MV cables connected to L1 and L2 on one of the 2 functional units.
	L2	○	✹	✹	
	L3	✹	✹	○	
	L1	○	✹	✹	Reverse the MV cables connected to L2 and L3 on one of the 2 functional units
	L2	✹	✹	○	
	L3	✹	○	✹	
	L1	✹	✹	○	Reverse the MV cables connected to L1 and L3 on one of the 2 functional units
	L2	✹	○	✹	
	L3	○	✹	✹	
	L1	✹	○	✹	Change the position of each MV cable on one of the 2 functional units
	L2	✹	✹	○	
	L3	○	✹	✹	
	L1	✹	✹	○	Change the position of each MV cable on one of the 2 functional units
	L2	○	✹	✹	
	L3	✹	○	✹	

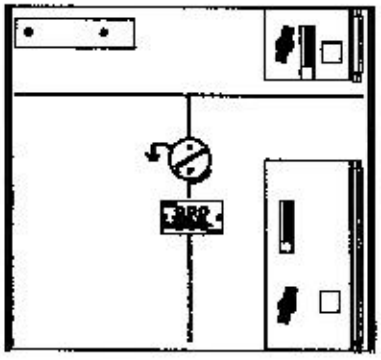
IM, PM and QM cubicle operation and position indication



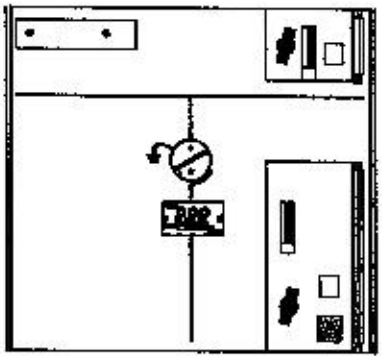
Position the lever as indicated for downward **(opening)** operations.



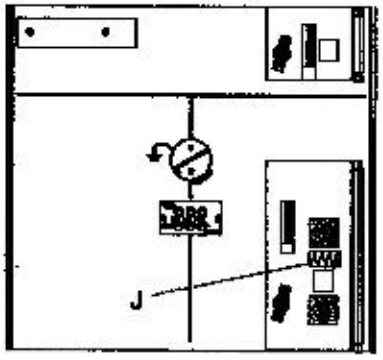
Position the lever as indicated for upward **(closing)** operations.



CIT **operating** mechanism front plate.

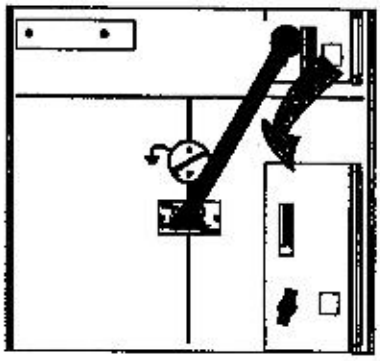


CI1 **operating** mechanism front plate.

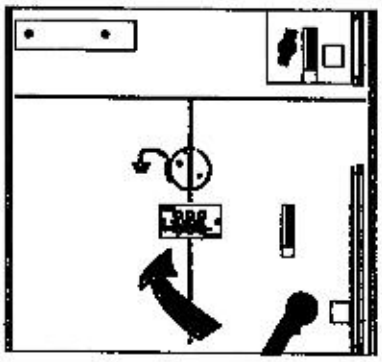


CI2 **operating** mechanism front plate.
J : charged/uncharged indication.

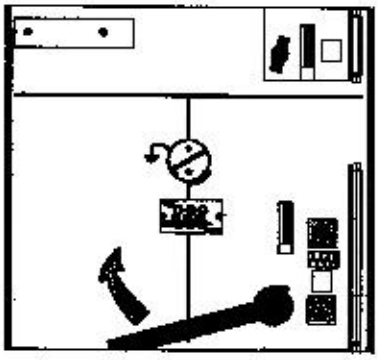
59



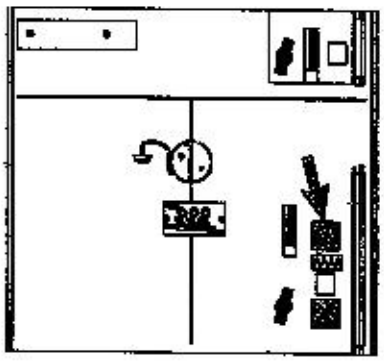
Opening the earthing switch.
(CIT, CI1 and CI2 operating mechanisms)



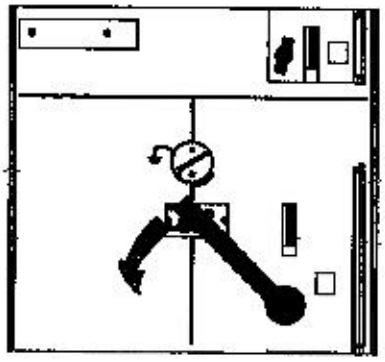
Closing the switch.
(CIT and CI1 operating mechanisms)



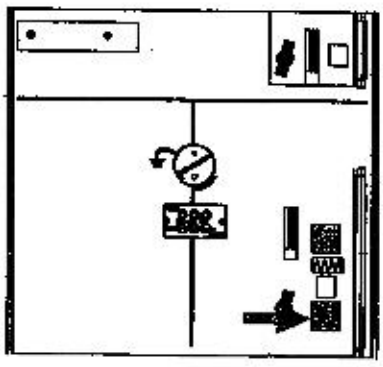
Charging the spring.
(CI2 operating mechanism)



Closing the switch.
(CI2 operating mechanism)



Opening the switch.
(CIT operating mechanism)



Opening the switch.
(CI1 and CI2 operating mechanisms)

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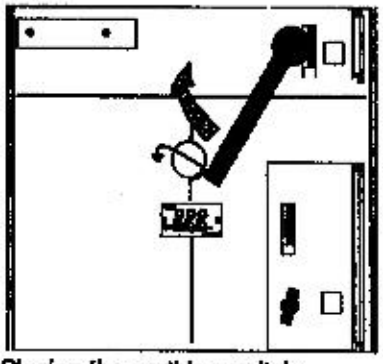
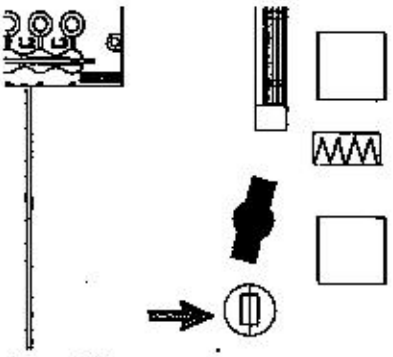
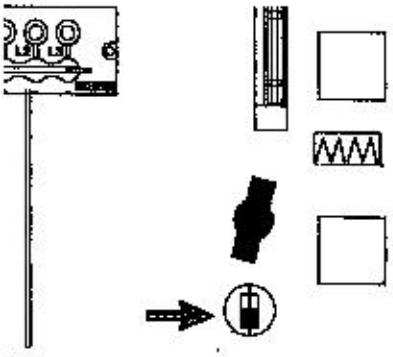


Closing the earthing switch
(for CIT, CI1 or CI2 operating mechanisms) after checking the voltage status.
(see **voltage indicators**)

fuse indications on QM cubicles

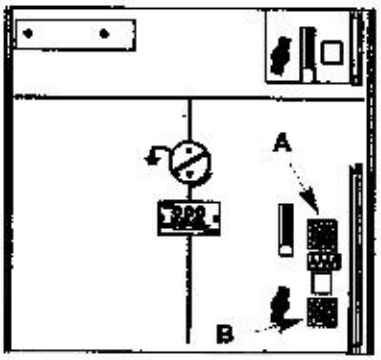


Fuses OK.
(white indicator)

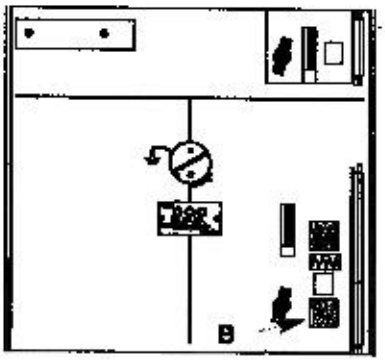


One or more fuses not OK.
(red indicator)

discharging a CI2 operating mechanism



Cubicle **de–energised** :
Close the switch: button A
then open: button B.

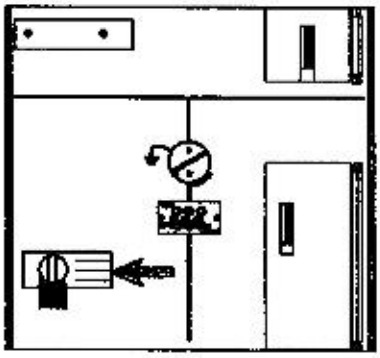


Cubicle **energised** :
Press the open button **B.**

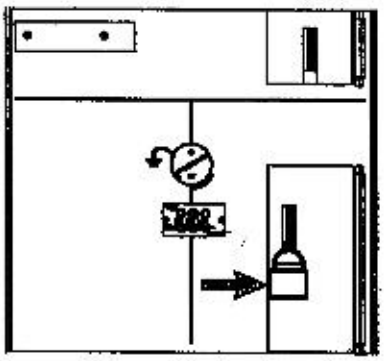
CAUTION

This operation can damage the operating mechanism. **Perform only when strictly necessary.**

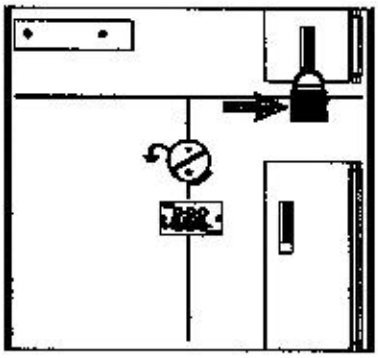
padlocking



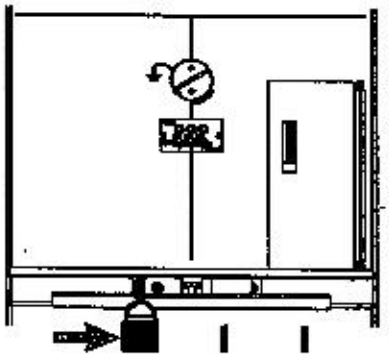
Padlocking of motor mechanism. (option)
Lock out the motor mechanism using a padlock before opening the switch.
The motor mechanism can be locked in or out using the padlocks.



Padlock the switch in open or closed position using 1, 2 or 3 padlocks. (dia. 8 mm)



Padlock the earthing switch in open or closed position using 1, 2 or 3 padlocks. (dia. 8 mm)

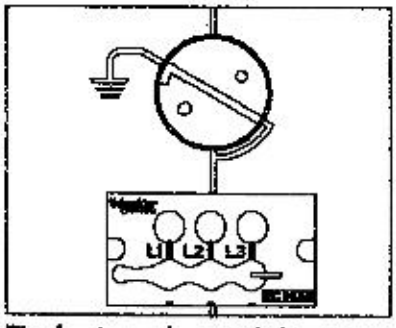


Padlocking the front panel.

keyed interlocks

See the keyed interlock installation and operating instructions **7896785**.

operating safety



The front panel can only be removed or fitted if the earthing switch is closed.

preventive maintenance, cleaning instructions and power–up

If necessary: **contact the Schneider Electric service centre.**

We strongly recommend that you carry out at regular intervals (at least roughly every 2 years) **a few operating cycles on the switching devices.**

CAUTION

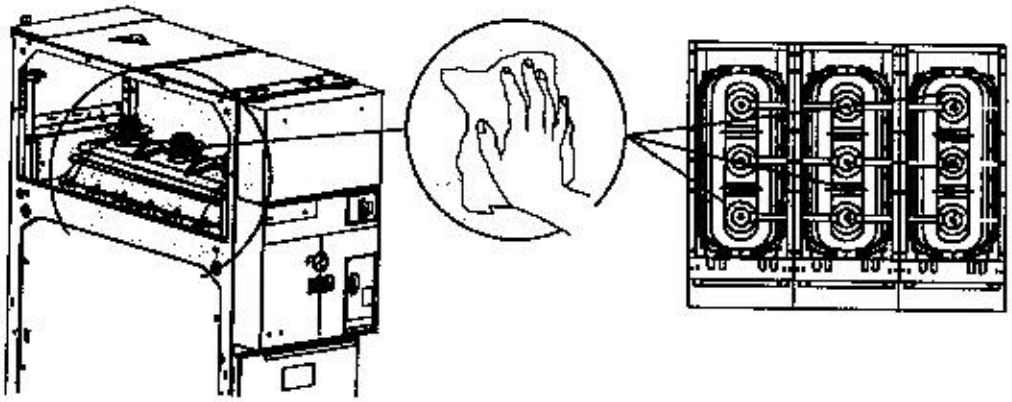
Never lubricate the disconnector operating mechanism.
If necessary: **contact the Schneider Electric service centre.** In normal operating conditions (temperature between – 5°C and 40° C) no special maintenance is required.

CAUTION

Never use solvents and alcohol.
We recommend that you inspect each compartment (cable, fuse, busbar)* at regular intervals according to environmental conditions.

If the insulating parts are dusty, **that yo u remove the dust using a dry cloth.**

example :



In harsher conditions (aggressive atmosphere, dust, temperature less than – 5° C or greater than 40° C) consult **the nearest Schneider Electric service centre.**

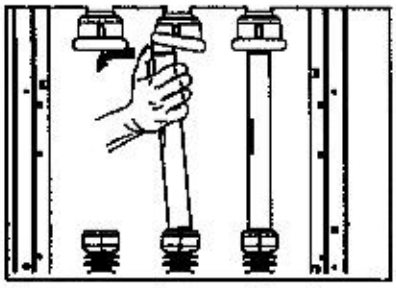
corrective maintenance

Replacing the fuses:

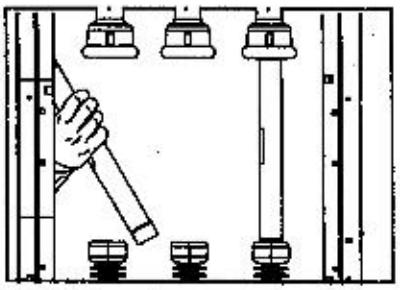
- the cubicle must be de-energized.
- the switch must be open.
- the earthing switch must be closed.

Open the front panel for access to the fuses.

Important:
standard IEC 282.1 § 23.2 states that all three of the MV fuses should be changed whenever one of them blows.

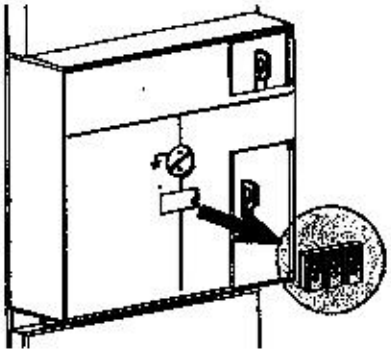


First remove the top of the fuse.



Then lift the fuse out of its bottom support and remove it completely. To fit the new fuses, refer to the section on fitting fuses in **PM** and **QM** cubicles.

replacing a voltage indicator block on a cubicle prior to 0040001U



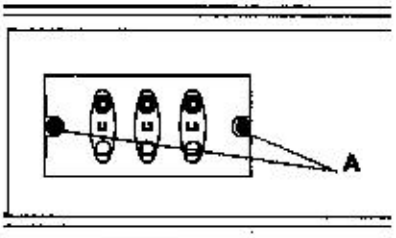
Pull out the voltage indicator block. (the switchboard can remain energized)

replacing a voltage indicator block

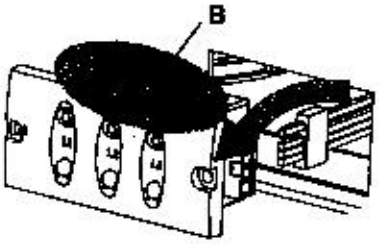
VIPS type on a cubicle after 0040001U

removal

This operation can be conducted with an energised switch.



remove the 2 fixing screws from the voltage indicator block (A).



Remove the voltage indicator block and unplug the incoming connector from it.

install

On the electrical data label (B), make sure that the new block correctly corresponds to the rated network voltage

- 1,7 kV à 3 kV
- 3 kV à 7,2 kV
- 10 kV à 24 kV

Install the new voltage indicator bock in the reverse order for removal.

Tightening torque 0,1 mdaN.

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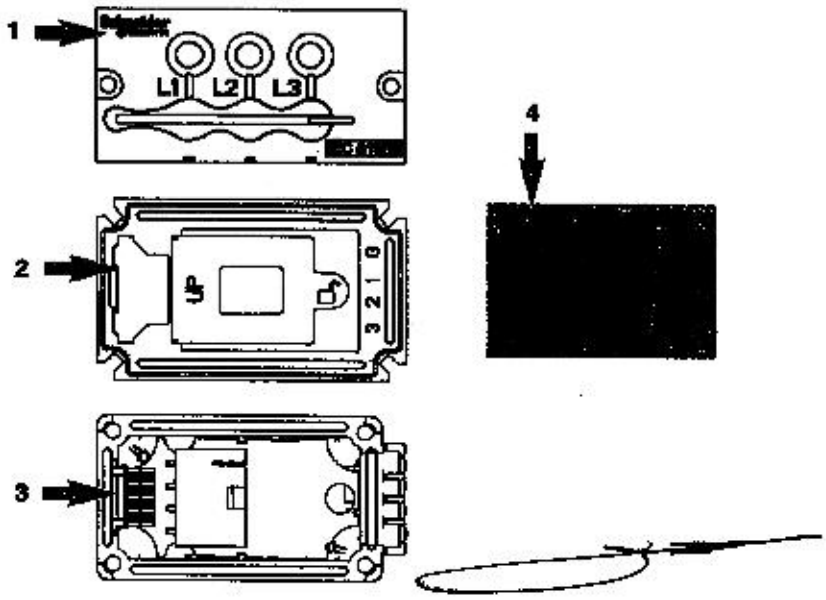
contents of the kit VPIS–V2

1 : indicator unit
2 : cable gland seals
3 : VPIS–V2 safety
4 : screws (x4)

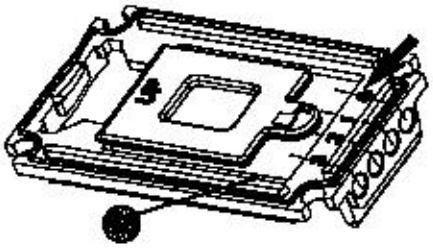
CAUTION

The screws removed earlier are reused. (2 self–tapping screws)



preparation of the cable gland seal before mounting the voltage presence unit VPIS–V2

Follow the dotted line to cut the cable gland

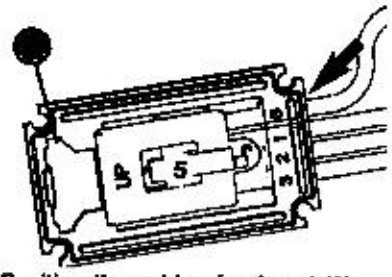


To integrate the cable gland seal (2) onto the wiring harness, the 4 holes must be cut open using a Stanley knife.

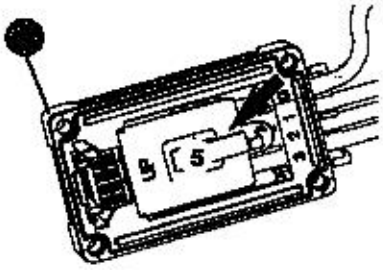
CAUTION

Cut the cable glands in one place ONLY per hole to slide the wires inside.

mounting the voltage presence unit VPIS–V2



Position the cable gland seal (2) on the voltage presence connection (5).



Clip the cable harness connector (5) onto the VPIS–V2 safety (3) and fit the seal.

VPIS–V2 EDF (HN) specific

	VPI62407	
	32.5 µA	
	Min	Max
	8,8 kV	23,3 kV

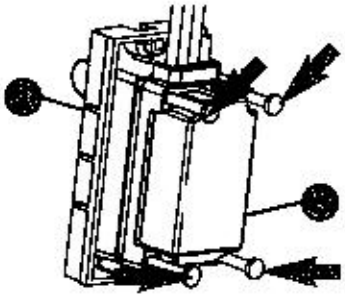
VPIS–V2 EXPORT

	VPI62401 / VPI62411		VPI62403 / VPI62413		VPI62404 / VPI62414		VPI62405 / VPI62415		VPI62407 / VPI62417		VPI62408 / VPI62418	
	3.5 µA		7.4 µA		10.7 µA		15.5 µA		32.5 µA		47.2 µA	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
	1 kV	1,9 kV	2 kV	3 kV	3,1 kV	5,9 kV	6 kV	8,9 kV	8,8 kV	23,3 kV	18 kV	25 kV

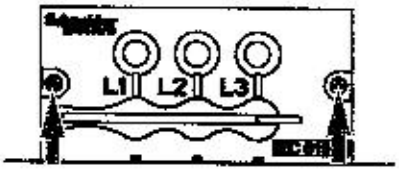
Key

Minimum and maximum operating voltage for usage in **50Hz** and **60Hz.**

Please refer to the chapter entitled "contents of the kit"



Screw the indicator unit (1) onto the **VPIS–V2** safety (3) using the 4 screws.

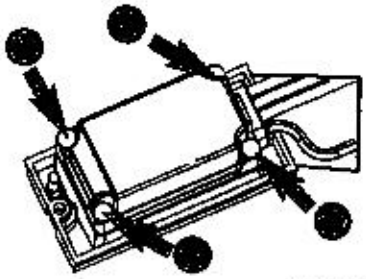


Tighten the screws to exert slight pressure on the cable gland seal without distorting it.

CAUTION

The screws removed earlier are reused.

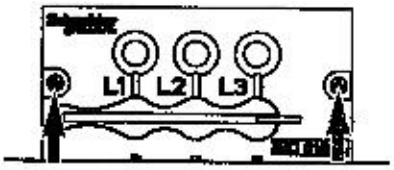
Tighten the 4 screws (A) to exert slight pressure on the cable gland seal without distorting it.
Tightening torque : 0,6 mN



replacement of the voltage presence unit VPIS type VPIS–V2

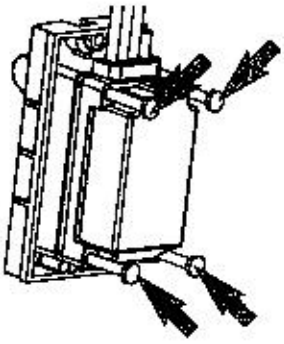
removing the VPIS–V2 voltage presence unit

The screws must be retained



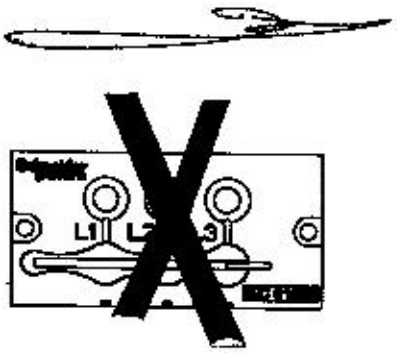
Remove the 2 screws from the front panel.

mounting the new VPIS–V2 voltage presence unit

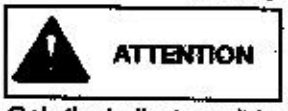


Remove the unit.

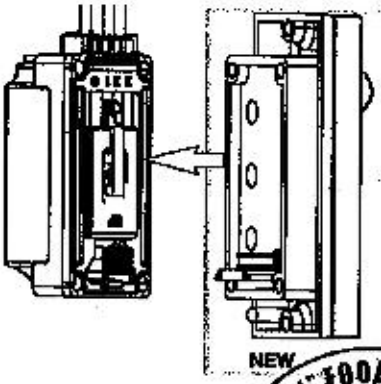
Remove the 4 screws from the indicator unit.



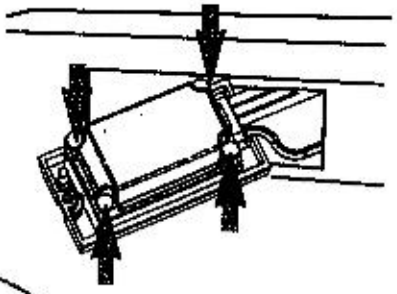
Discard the faulty indicator unit. Leave the existing safety and sea



Only the indicator unit is to be changed.
Contact the **Schneider Electric** administration for recycling products at the end of their service life.



Install the new voltage presence indicator unit.



Screw up the 4 screws.
Tighten the screws to exert slight pressure on the cable gland seal without distorting it.
Tightening torque : 0,6 mN

spare parts

- fuses (UTE or DIN)
- voltage indicator

For other parts, please consult us: see **Schneider Electric service centers**

options

(please consult us)

For IM cubicles

- motor mechanism
- auxiliary contacts
- LV compartment or incoming cables compartment from top
- keyed interlocks
- 50 W heating element
- extra height plinth
- relay Flair Din
- low voltage cabinet
- enlarged LV compartment
- phase concordance tester
- kit two dry single cables a phase
- T200S for remote control

For QM cubicles

- motor mechanism with shunt trip release
- auxiliary contacts
- LV compartment or incoming cables compartment from top
- keyed interlocks
- 50 W heating element
- extra height plinth
- relay Flair Din
- contact for "fuse blown" indication
- enlarged LV compartment
- undervoltage or shunt type opening release

For PM cubicles

- motor mechanism
- auxiliary contacts
- LV compartment or incoming cables compartment from top
- keyed interlocks
- 50 W heating element
- extra height plinth
- relay Flair Din
- low voltage cabinet
- "fuse blown" mechanical signalling

trouble-shooting chart

IM, PM and QM cubicles

▪ voltage indicator not illuminated	▪ check that the incoming cables are live ▪ check the voltage indicator block ▪ check that the switch (PM cubicle) is **closed** ▪ check that the fuses have been fitted ▪ check that the fuses are in working order
▪ front panel cannot be opened or closed	▪ check that the earthing switch is **closed**
▪ earthing switch cannot be operated	▪ check that the switch is **open**
▪ switch cannot be operated	▪ check that the earthing switch is **open**

motor mechanism (option)

▪ electrical operation impossible	▪ check the LV fuses (CIP2) ▪ check electrical interlocks S13–14 (lever insertion) ▪ check that the earthing switch operating shaft has reached its end position ▪ check that contact S14 has not disabled the power supply and re-adjust if necessary
S13 = switch lever input S14 = earth switch lever input	▪ check the configuration of the CIP1 subassembly (see diagram)
▪ (*) manual operation impossible following an electrical closing cycle for a voltage level less than −15% rated value	▪ use the operating lever to apply a torque in the closing direction until the end position is reached; manual operation should now be possible
▪ (*) Insertion of lever impossible following an electrical closing cycle for a voltage level greater than +15% rated value	▪ if possible, carry out an electrical operation, using a backup power source if necessary ▪ to allow insertion of the operating lever, push the back of the switch shaft in the closing direction using a large screwdriver; (for safety reasons, remember to first lock out the electrical operating mechanism; if necessary, push up and hold the locking blade that actuates contact S13)

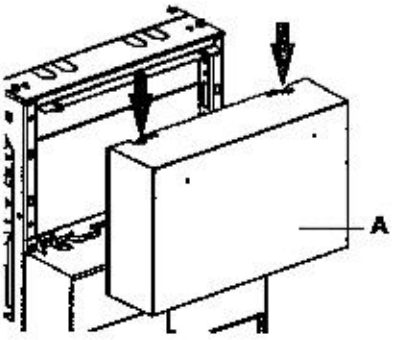
(*) Operation is guaranteed for rated voltage ± 15%.

recovery of SF6 gas at end of life

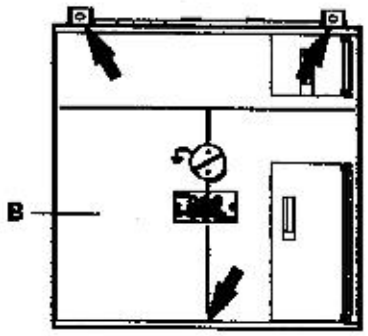
The SF6 must be removed before any dismantling operation can be carried out in compliance with the procedures described in IEC–61634 and according to the following instructions.

The gas must be treated in compliance with IEC–60480.

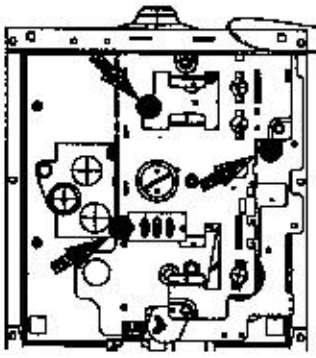
- **volume of gas to be recovered: 35 litres**
- **internal gauge pressure: 40 kPa**



Remove the cover (A) from the control cabinet.

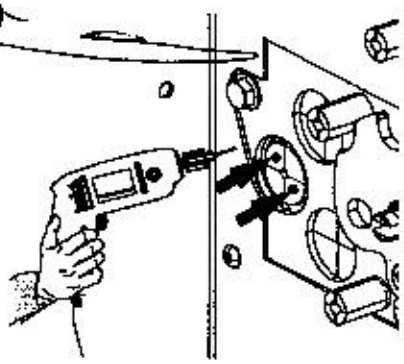


Remove the control cover (B).



Remove the 3 screws retaining the operating mechanism.

Cut the wiring to remove the operating mechanism.

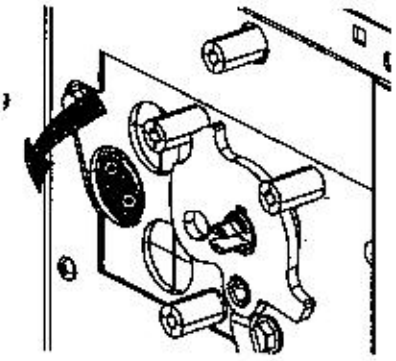


Drill 2 holes in the filler valve safety cap

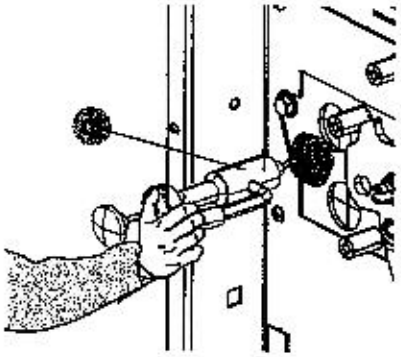
∅ 4 mm, centreline 20 mm, max. depth 4 mm

CAUTION

pump the gas for at least 15 minutes.



Using a spanner wrench, remove the safety cap from the valve.



Connect the special pumping equipment (C).

options and spare parts

- voltage indicator
- CIT operating mechanism
- Kit machansim 48Vcc
- Fuses

(For other parts, please consult us: see **Schneider Electric service centers.**)

Anglais

SM6

MV distribution
factory built assemblies
at your service

instructions for use

SM6. Germany

cubicles
(IM, IMB, QM, QMB, GBM, GAM, DM1–C, DM1–D, DM1–CW, DM1–CS)

"ТЕХНИН ЕНЕРДЖИ" ЕООД
"TECHNIQ ENERGY"
ВАРНА

MERLIN GERIN
mastering electrical power
GROUPE SCHNEIDER

ВЯРНО С ОРИГИНАЛА

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"ТЕХНИК ЕНЕРДЖИ" ЕООД
"TECHNIC ENERGY" LTD
ВАРНА

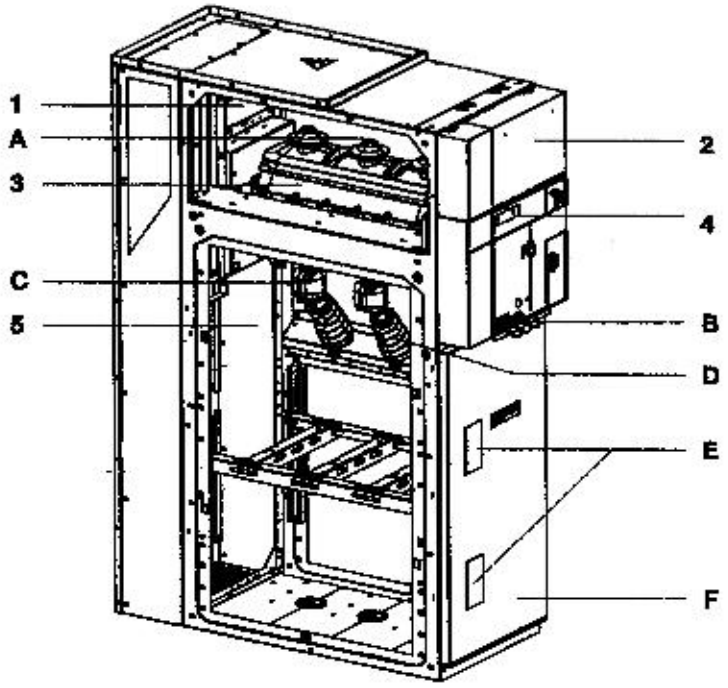
ВЯРНО
С ОРИГИНАЛА!

contents

ТЕХНИК ЕНЕРДЖИ - ЕООД
TECHNIC ENERGY LTD
ВЯРНО С ОРИГИНАЛА

IM: switch cubicle

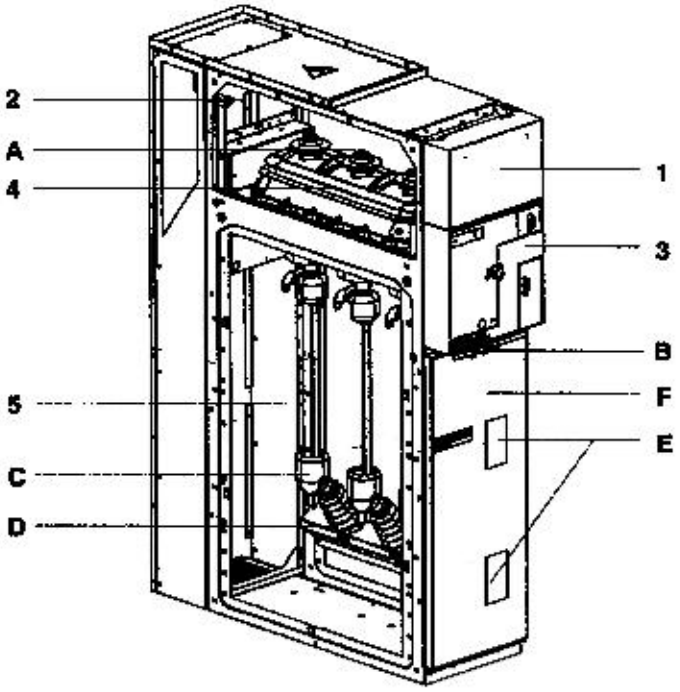
1 : busbar compartment
2 : low voltage compartment
3 : switchgear compartment: switch and earthing switch
4 : operating mechanism compartment
5 : cable connection compartment
A : busbar connection pads
B : voltage presence detector
C : lower field distributor and cable connection
D : capacitive divider
E : cable connection inspection windows
F : front panel



24 kV 630 A
dimension 500 mm

IMB: switch cubicle for bottom left connection

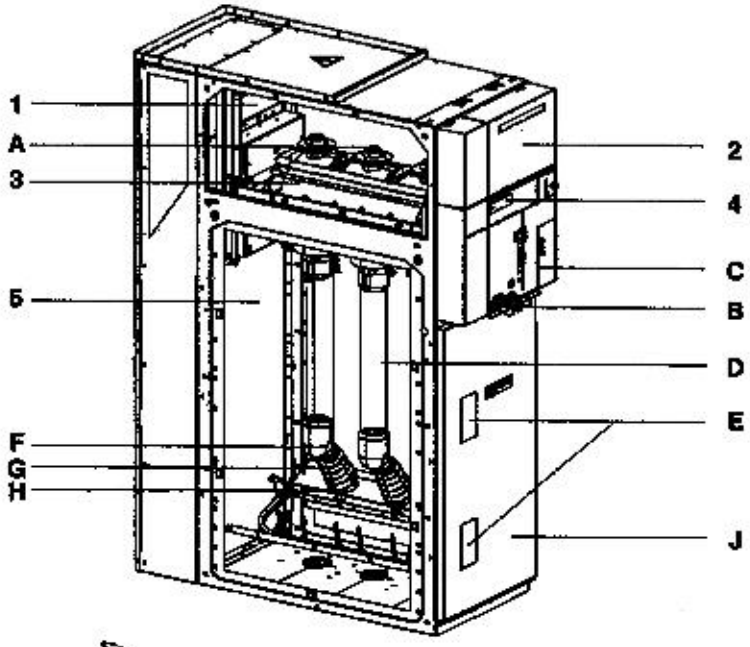
1 : low voltage compartment
2 : top busbar compartment
3 : operating mechanism compartment
4 : switchgear compartment: switch and earthing switch
5 : bottom busbar connection compartment
A : top busbar connection pads
B : voltage presence detector
C : bottom field distributor and busbar connection
D : capacitive divider
E : inspection windows
F : front panel



24 kV 630 A
dimension 875 mm

QM: fuse–switch combination cubicle

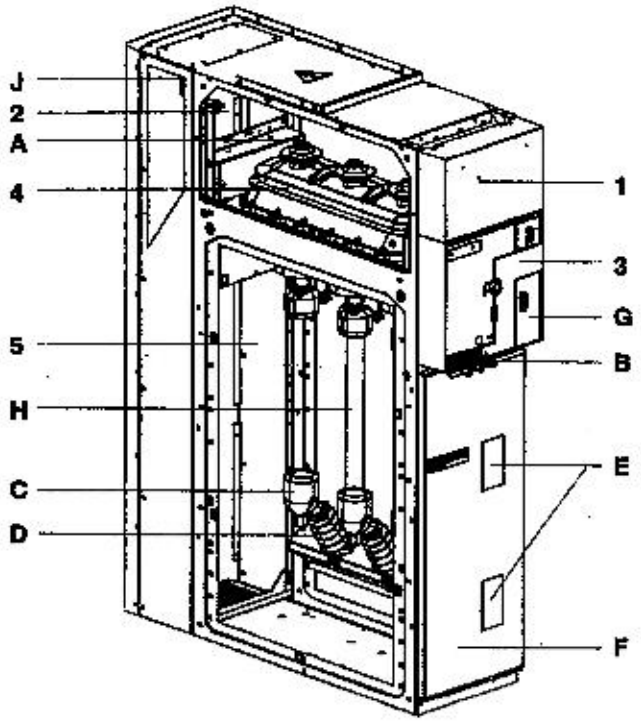
1 : busbar compartment
2 : low voltage compartment
3 : switchgear compartment: switch and earthing switch
4 : operating mechanism compartment
5 : cable connection compartment and fuse installation
A : busbar connection pads
B : voltage presence detector
C : fuse blowing tripping indication
D : fuses
E : inspection windows for fuses and dowstream earthing switch
F : lower field distributors
G : capacitive divider
H : downstream earthing switch
J : front panel



24 kV 200 A
dimension 500 mm

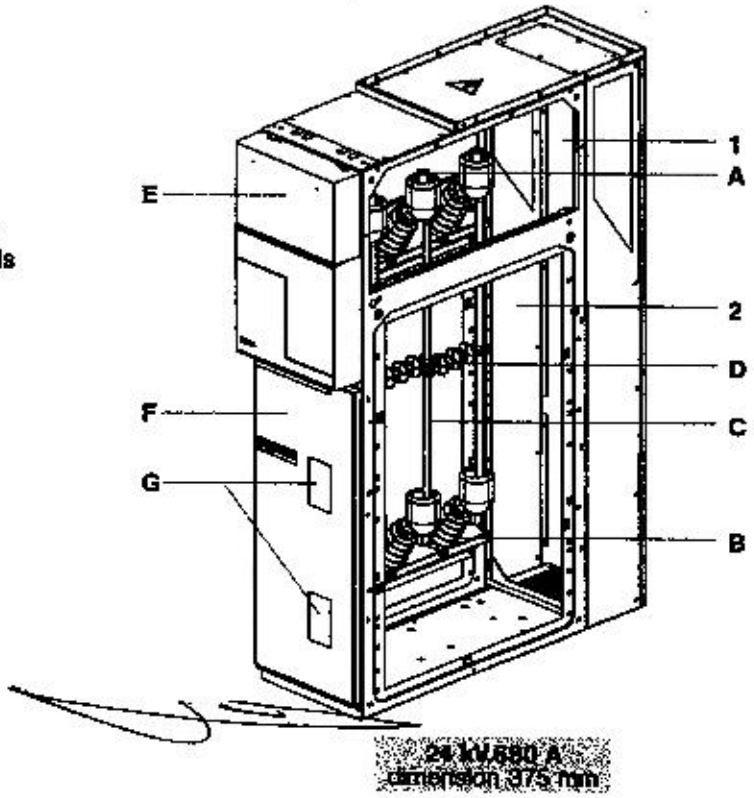
QMB: fuse–switch combination cubicle for bottom left connection

1 : low voltage compartment
2 : upper busbar compartment
3 : operating mechanism compartment
4 : switchgear compartment: switch and earthing switch
5 : lower busbar connection and fuse compartment
A : upper busbar connection pads
B : voltage presence detector
C : lower busbar connection and lower field distributors
D : capacitive divider
E : inspection windows
F : front panel
G: indication of switch opening by blown fuse
H : fuses
J : earth bar connection pad



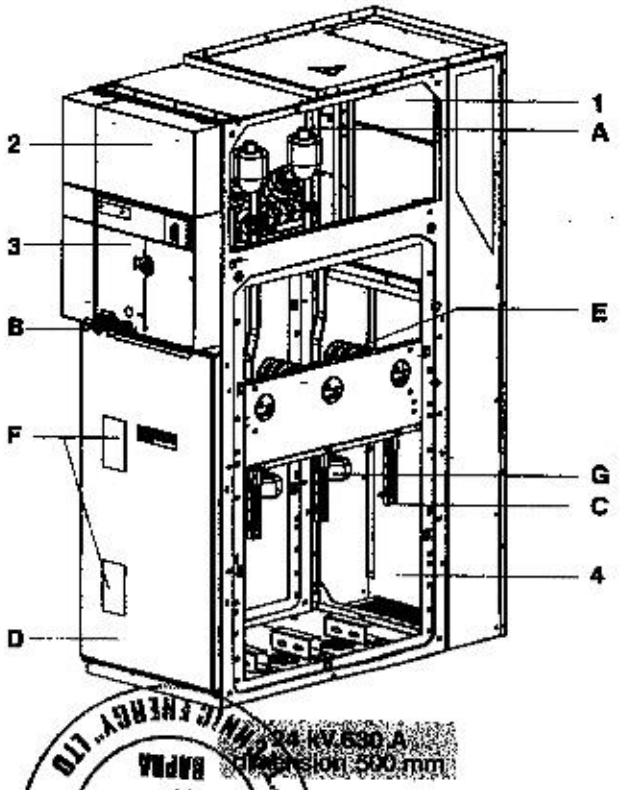
GBM: delivery duct cubicle

1 : upper busbar compartment
2 : lower busbar connection compartment
A : upper busbar connection pads
B : lower busbar connection pads
C : connection busbar
D : spacers
E Low voltage compartment
F : front panel
G : inspection windows



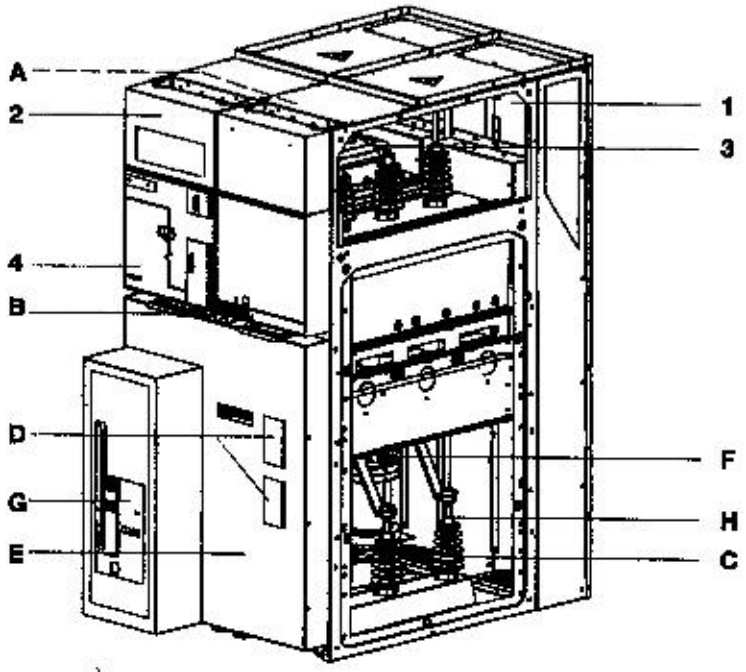
GAM: Incoming cable connection cubicle

1 : busbar compartment
2 : low voltage compartment
3 : operating mechanism compartment
4 : cable connection compartment
A : busbar connection pads
B : voltage presence detector
C : earthing switch
D : front panel
E : capacitive divider
F : inspection windows for cable connection and earthing switch
G : cable connection pads



DM1 D: coupling circuit–breaker cubicle

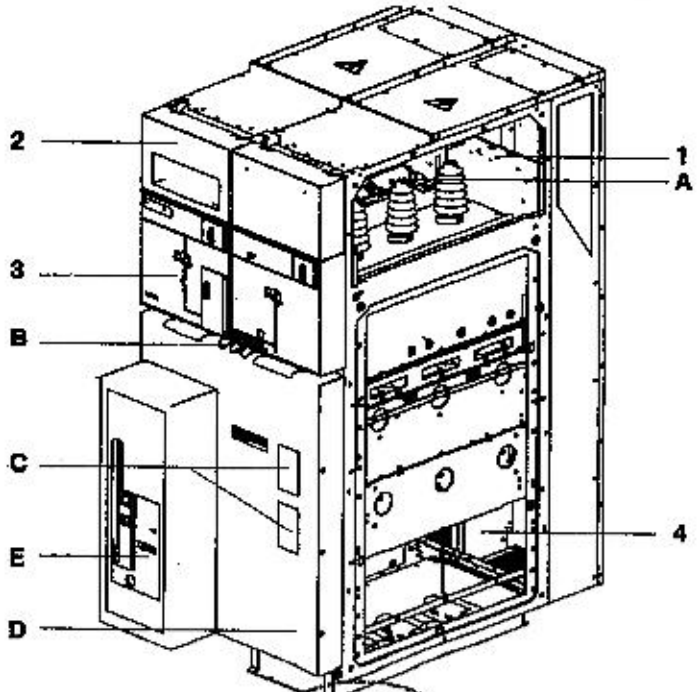
1 : busbar compartment
2 : low voltage compartment
3 : switchgear compartment : switch and earthing switch
4 : operating mechanism compartment
A : upper busbar connection pads
B : voltage presence detector
C : capacitive divider
D : inspection windows
E : front panel
F : circuit–breaker
G : circuit–breaker operating mechanism front plate
F : circuit–breaker
H : lower busbar connection pads



24 kV.630 A
dimension 750 mm

DM1 C: incoming/outgoing circuit–breaker cubicle

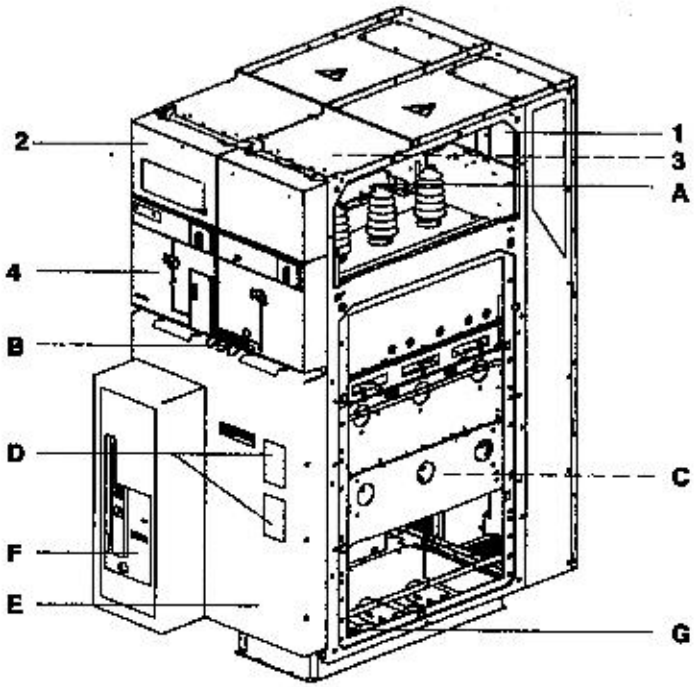
1 : busbar compartment
2 : low voltage compartment
3 : operating mechanism compartment
4 : cable connection compartment
A : busbar connection pads
B : voltage presence detector
C : inspection windows
D : front panel
E : circuit–breaker



24 kV.630 A
dimension 750 mm

DM1–C W: withdrawable circuit–breaker cubicle

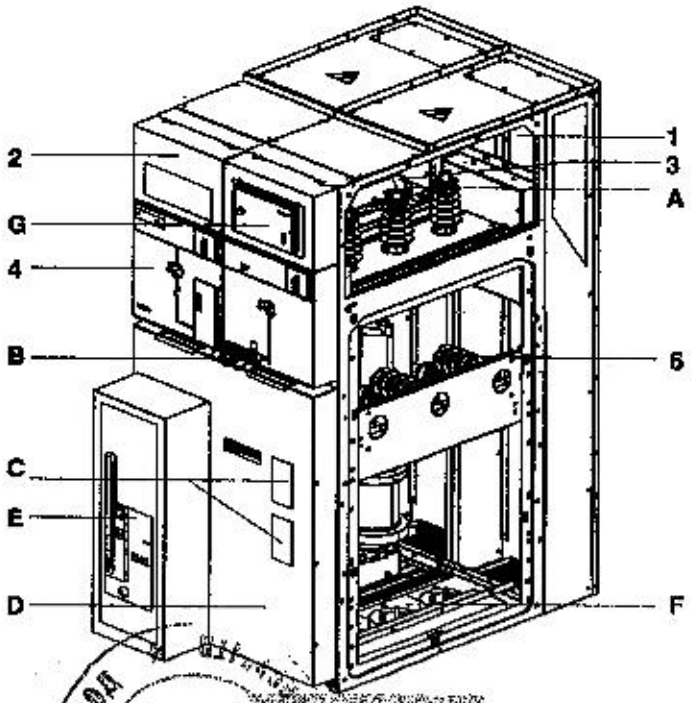
1 : busbar compartment
2 : low voltage compartment
3 : switchgear compartment: switch and earthing switch
4 : operating mechanaim compartment
5 : cable connection compartment
A : busbar connection pads
B : voltage presence detector
C : capacitive divider
D : inspection windows
E : front panel
F : circuit–breaker



24 kV 630 A
dimension 750 mm

DM1–CS: circuit–breaker cubicle

1 : busbar compartment
2 : low voltage compartment
3 : switchgear compartment: switch and earthing switch
4 : operating mechanism compartment
5 : capacitice divider
A : busbar connection pads
B : voltage presence detector
C : inspection windows
D : front panel
E : circuit–breaker
F : toroids
G : protection relay



dimension 750 mm

single–line diagrams

connection to the networks

IM 500 mm:
switch cubicle

IMB (375 mm):
right or left feeder switch cubicle

protection by fuse–switch

QM (500 mm):
fuse–switch combination unit cubicle

QMB (375 mm):
right or left feeder fuse–switch combination unit cubicle

duct

GBM (375 mm):
right or left feeder delivery duct

GAM (500 mm):
Incoming duct


IM


IMB


QM


QMB


GBM


GAM

protection by circuit–breaker

DM1–D (750 mm):
right or left feeder disconnection circuit–breaker


DM1–D

protection by circuit–breaker

DM1–C (750 mm):
circuit–breaker

DM1–CW (750 mm):
draw–out circuit–breaker

DM1–CS (750mm):
circuit–breaker with independent protection

DM1–C

DM1–CW

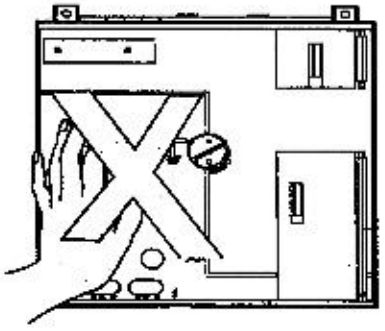
DM1–CS

ВЯРНО С ОРИГИНАЛА

616

weights

Do not handle the cubicle using the operating mechanism front plate.



list and number of additional bags and accessories

discharge from the top :

- **Cubicle package**

–1 inter–cubicle bag:
S1: 51238084FA

- **switchboard packing list : (51238490FA)**

–1 operating lever
–2 Internal Arc end plates
–1 cubicle separation plate
–2 Internal Arc stress–relief compartment top plates
–1 bag of end plate screws
S4: 51238077FA
–2 earth bars
–1 manual **7897365**

- **Internal arc compartment kit**

width: 375 = **51238476FA**
width: 500 = **51238477FA**
width: 750 = (2X) **51238476FA**

discharge from the bottom:

- **Cubicle package**

– 1 inter–cubicle bag:
S1: 51238084FA

- **switchboard packing list (51238039FA)**

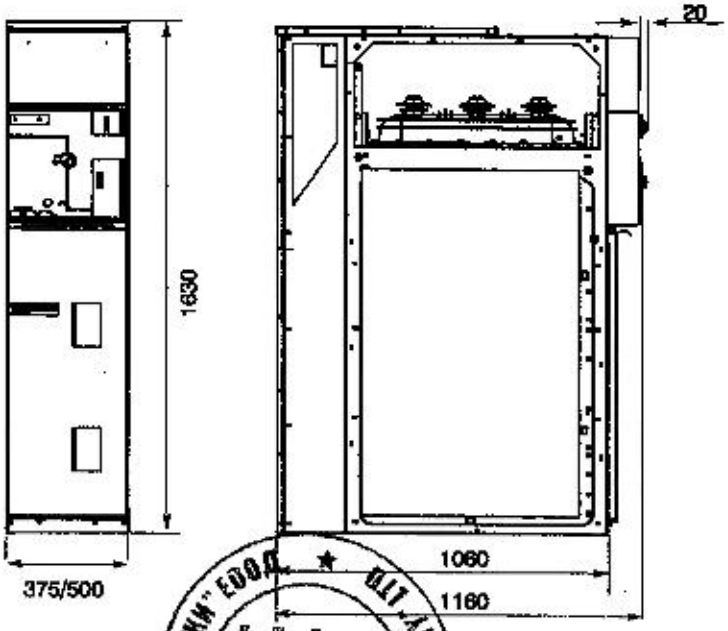
–operating lever
–2 Internal Arc end plates
–1 cubicle separation plate
–1 bag of end plate screws
S4: 51238077FA
–reinforcement angle brackets
–earth bars
–1 manual **7897365**

overall dimensions

Width = 375 mm
weight: 150 to 210 kg *(maxi)

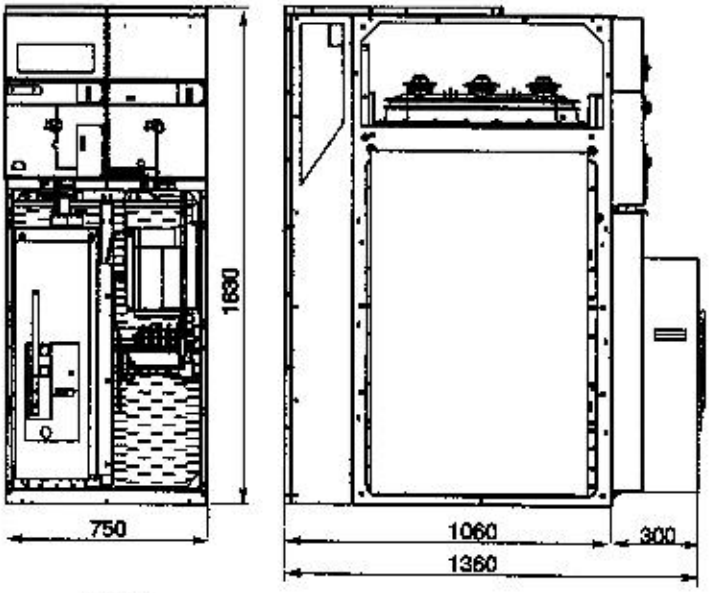
Width = 500 mm
weight: 230 kg * (maxi)

***according to the cubicle type**



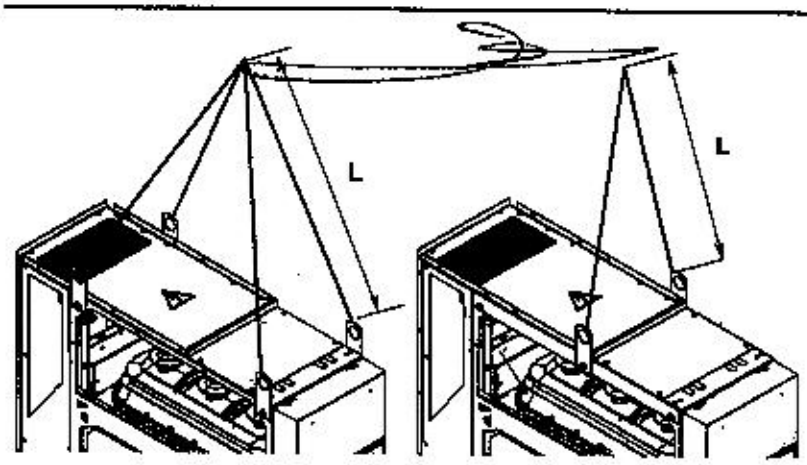
Width = 750 mm
weight: 300 to 440 kg * (maxi)

*** according to the cubicle type**

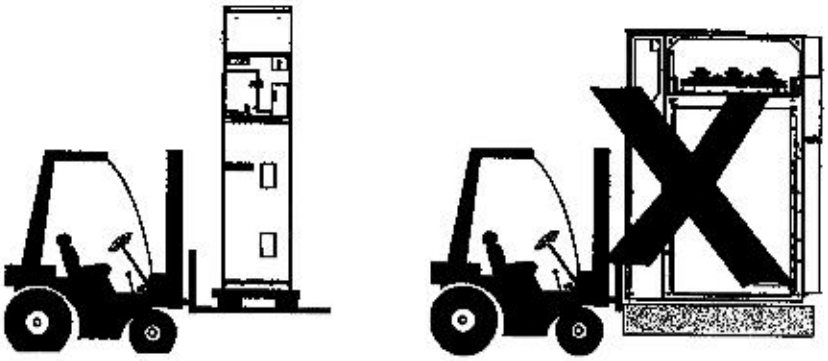


handling by slings

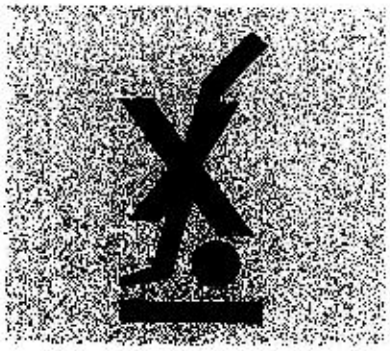
W : 750 mm



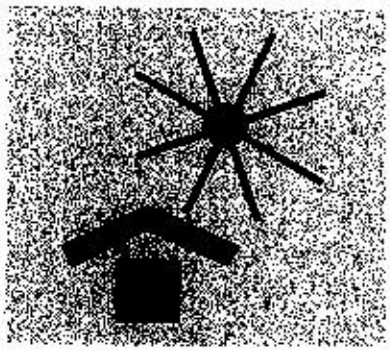
handling by forks

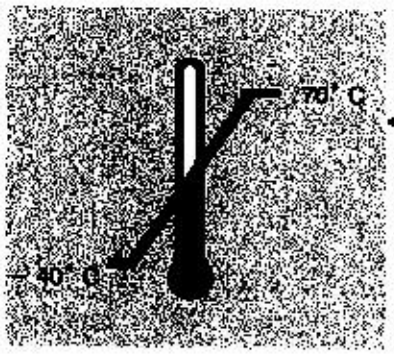


handling



storage





ТЕХНИЧЕСКИ ПРЕГЛЕДИ "БООД" ★ ЕООД

ВЯРНО С ОРИГИНАЛА

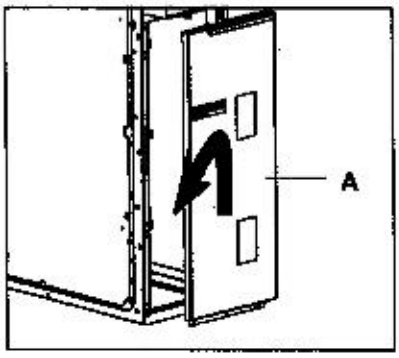
619

checks prior to energisation

Do not leave anything in the connection compartment.

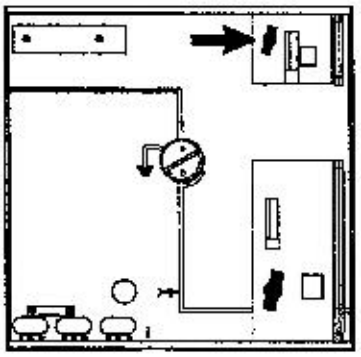
Check on all phases that:

- the fuse is poeitioned correctly
- the field splitter block cover is properly closed
- the fault detector is properly connected

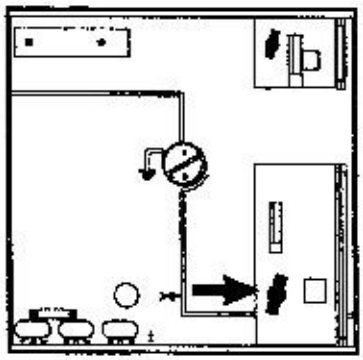


Put back panel A.

operating the device with power off



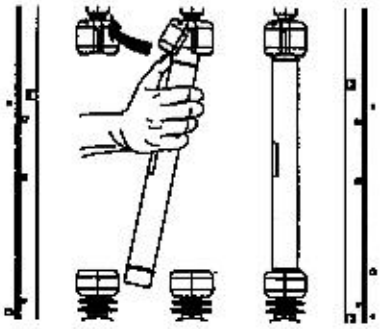
Complete a few operations of the earthing switch.



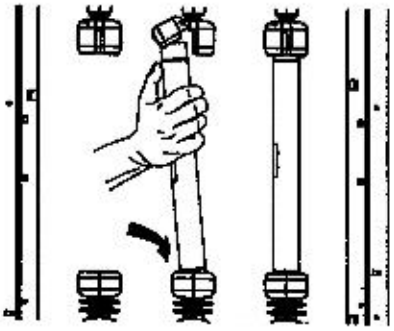
Complete a few operations of the switch.

fitting the fuses in a QM cubicle

Reminder: Check fuse condition before installing the fuses.

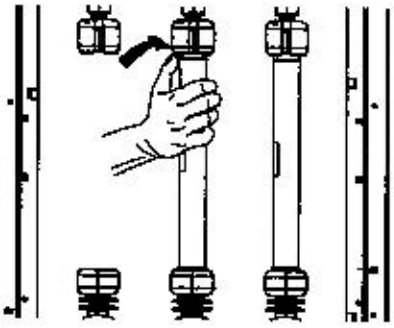


Lift the cover of the top field splitter block using the fuse.



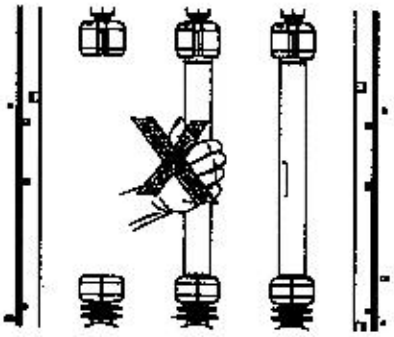
Fit the bottom part of the fuse into the bottom tulip contact.

Note:
– If you need to replace a fuse, replace all 3 fuses.
– Do not re–use fuses that are already worn.



Then fit the top part of the fuse into the top contact and check that the field splitter block covers properly closed.

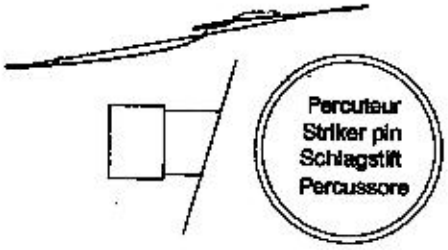
Direct the label towards the front face.



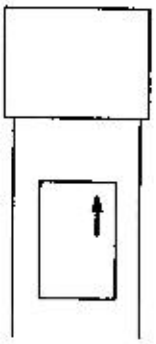
Placing your hand in the middle of the fuse is inadvisable.

in a QM cubicle

Install the fuses with striker pin, blowing of which causes the switch to trip.



The end of the fuse equipped with the striker pin is marked



The characteristics and the mounting direction of the fuse are printed on the body.

Direct the label on the front face.

(striker pin at the top)

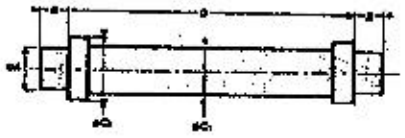
protection of the transformers

The rating of the fuses to be installed in the **SM6** protection cubicles of the **QM** type depends, among other factors, on the following :

- operating voltage
- transformer power
- fuse technology (manufacturer)

dimensions

(dimensions in mm)
as per DIN VDE 0670 Teil 4



Ø A	B	Ø C₀	B C₁ und C₂	C'₁
45 ± 1	33*1	50	68	292
				442

If the transformer is protected by a system combining a disconnector and fuses, the disconnection mode corresponds to **Standard IEC 420.**

The following selection table gives the correspondence between fuse nominal current and the current nominal powers of the transformer as well as the high voltages.

fuse table as per VDE 0670 T402

Nennspannungsbereich der Sicherung des Transformators (kV)	Abschaltenstrom I_1 Sicherung in A	Trafo-Nennleistung in kVA											
		uK = 4%										uK = 6%	
		50	100	125	160	200	250	315	400	500	630	800	1000
3,6/7,2 / 6	Trafonennstrom	4,8	9,6	12	15,4	19,2	24,1	30,3	38,5	48,1	60,6	77,1	96,3
	ohne / mit / mit: NH-Sich. / NH-gL / NH-gTr	10 16 / 16 / 20	16 20 25 / 20 25 / 25	20 31,5 / 25 31,5 / 31,5	25 31,5 40 / 31,5 40 / 40	31,5 40 50 / 40 50 / 50	40 50 63 / 50 63 / 63	50 63 80 / 63 80 / 80	63 80 100 / 80 100 / 100	80 100 125 / 125 / 125	100 125 160 / 125 160 / 160	125 160 / 125 160 / 160	160 / - / 160
7,2/12 / 10	Trafonennstrom	2,8	5,8	7,2	9,2	11,5	14,4	18,2	23,1	28,9	36,4	46,3	57,7
	ohne / mit / mit: NH-Sich. / NH-gL / NH-gTr	10 / 10	16 / 16 / 16	16 20 / 16 / 16	20 25 / 20 / 20	25 31,5 / 25 / 25	35 31,5 40 / 31,5 / 35 31,5	31,5 40 50 / 40 / 40	50 63 / 50 / 50	63 80 / 63 / 63	80 100 / 80 100 / 80 100	80 100 / (100) / 100	100 125 / (125) / 160
12/17,5 / 15	Trafonennstrom	1,9	3,5	4,8	6,1	7,7	9,6	12,1	15,4	19,2	24,2	30,8	38,5
	ohne / mit / mit: NH-Sich. / NH-gL / NH-gTr	6,3 / 6,3	10 / 10 / 10	16 / 16 / 16	16 20 / 16 20 / 16 20	16 20 / 20 / 16 20	20 25 / 25 / 20 25	25 31,5 / 25 31,5 / 25 31,5	31,5 40 / 40 / 31,5 40	31,5 40 50 / 50 / 40 50	40 50 63 / 63 / 50 63	63 80 100 / 80 100 / 80 100	63 80 100 / - / 80 100
17,5/24 / 20	Trafonennstrom	1,5	2,9	3,6	4,6	5,8	7,2	9,1	11,6	14,4	18,2	23,1	28,9
	ohne / mit / mit: NH-Sich. / NH-gL / NH-gTr	6,3 / 6,3	10 / 10 / 10	10 / 10 / 10	10 16 / 16 / 16	16 / 16 / 16	16 25 / 25 / 16 20 25	20 25 / 25 / 25	25 31,5 / 25 31,5 / 25 31,5	25 31,5 40 / 40 / 31,5	31,5 40 50 / 50 / 40 50	40 50 63 / 63 / 40 63	50 63 80 / 80 / 63 80
24/36 / 0,4	Trafonennstrom	72	144	180	231	289	361	455	577	722	909	1155	1443
	NH-gL / NH-gTr	80 / 72	125 / 144	160 / 180	200 / 231	250 / 289	315 / 361	400 / 455	500 / 577	630 / 722	800 / 909	1000 / 1155	1250 / 1443

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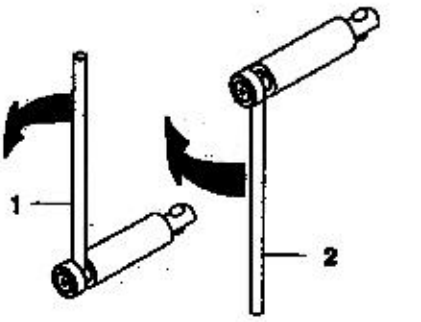
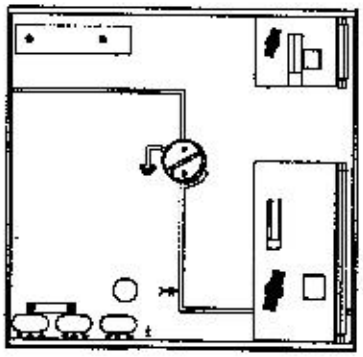
manual operations and visualisation of cubicle status

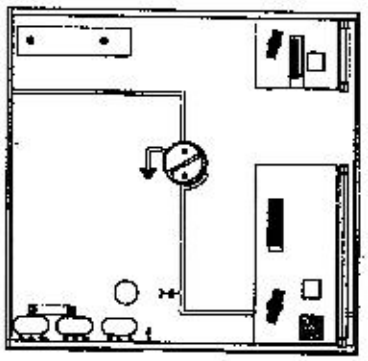


1 : position the lever as shown for the **downward opening operations.**

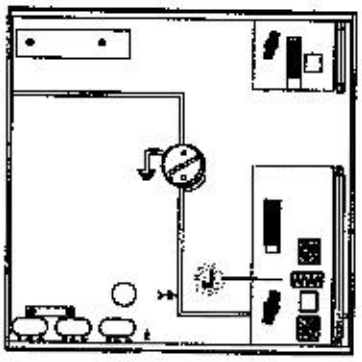
2 : osition the lever as shown for the upward closing operations.



CIT operating mechanism front face.

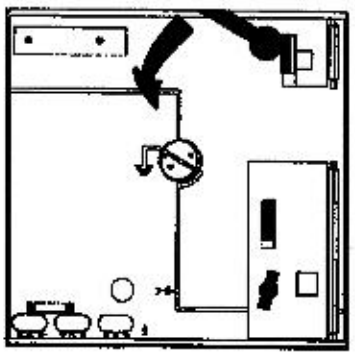


CI1 operating mechanism front face.

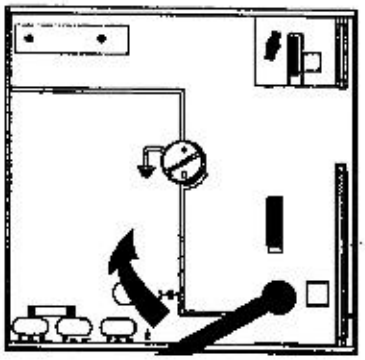


CI2 operating mechanism front face.

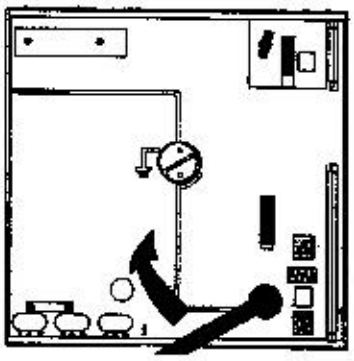
J : identification of charging status.



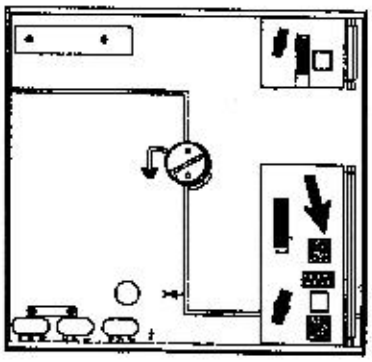
Opening the earthing switch.
(operating mechanisms
CIT / CI1 / CI2)



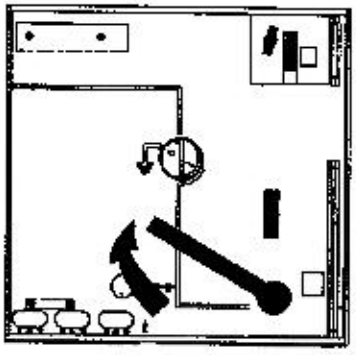
Closing the switch.
(operating mechanisms CIT / CI1)



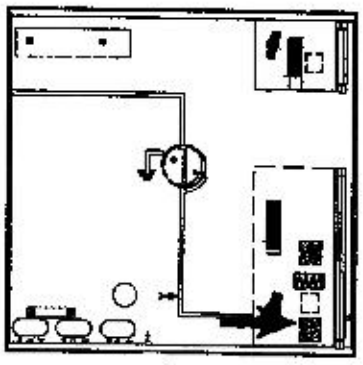
Charging the spring.
(operating mechanism CI2)



Closing the switch.(operating
mechanism CI2)



Opening the switch.
(operating mechanism CIT)



Opening the switch.
(operating mechanisms CI1 / CI2)

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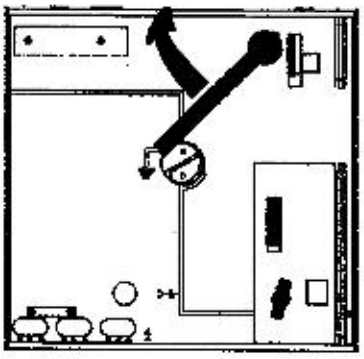
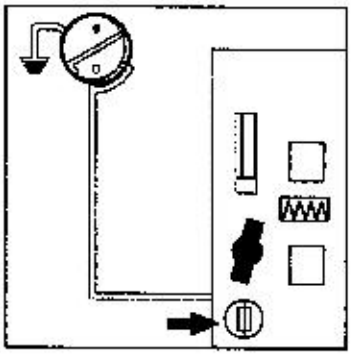
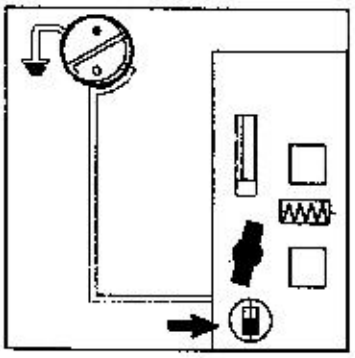


Closing the earthing switch (for operating mechanisms CIT / CI1 / CI2) after verification of voltage status.

visualisation of fuse status in a QM cubicle

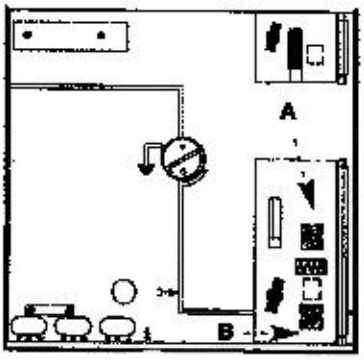


Fuses in operating order.
(white indicator light)

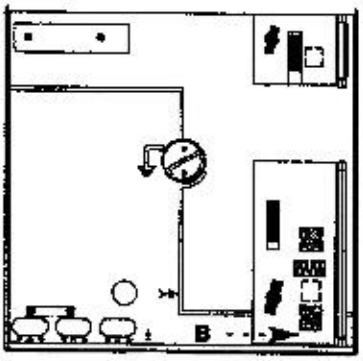


One or more fuses not in operation. **(red indicator light)**

uncharging a CI2 operating mechanism



Cubicle **de-energised:**
Close the switch: button **A** then open: button **B**

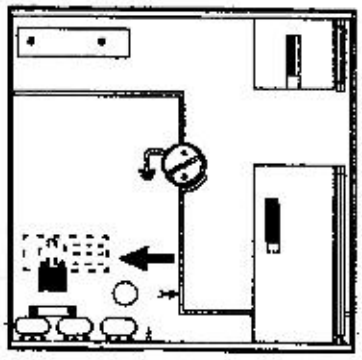


Cubicle **energised:**
Press opening button **B.**

CAUTION: this operation is detrimental to the operating mechanism.

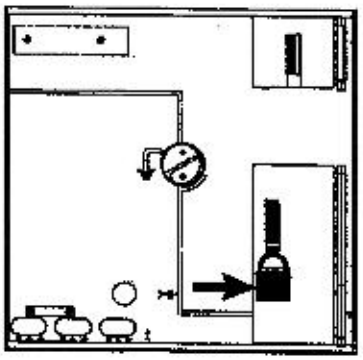
Only use when strictly necessary.

padlocking

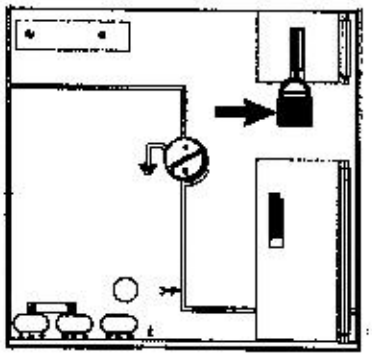


Padlocking the motorisation. (option).

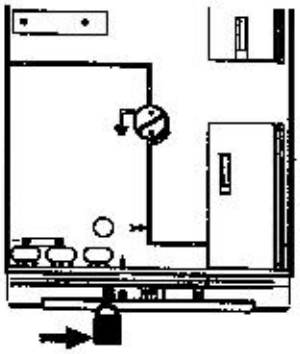
Padlocking the motorisation in the out of operation status before opening the switch. Padlocking possible in the in or out of operation status.



Padlock the switch in the open or closed position by 1, 2 or 3 padlocks ∅ 8 mm.

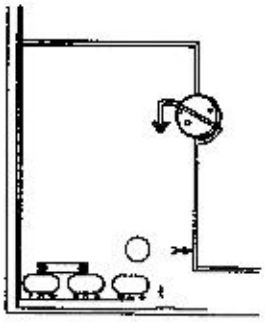


Padlock the earthing switch in the open or closed position by 1, 2 or 3 padlocks ∅ 8 mm.



Padlocking the front panel.

operating safety



The front panel cannot be removed or installed unless the earthing switch is closed.

preventive maintenance

If necessary: contact **the Schneider group services centres.**

Never lubricate the operating mechanism.

In normal operating conditions (temperature between –5°C and 40°C) **no special maintenance.**

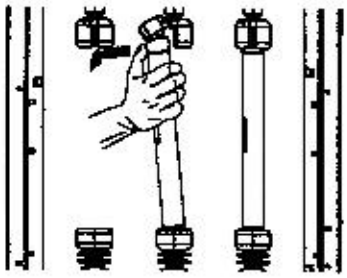
In harsher conditions (aggressive atmosphere, dust, temperature **less than –5°C or greater than 40°C** ,etc) consult **the nearest Schneider group services centre.**

corrective maintenance

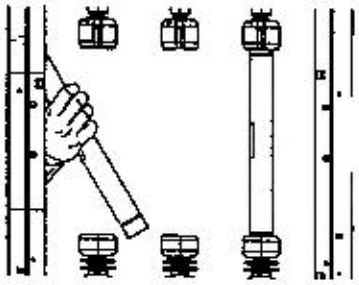
Fuse replacement:

- **cubicle de–energised**
- open the switch
- earthing switch in the closed position

Open the front panel to access the fuses.



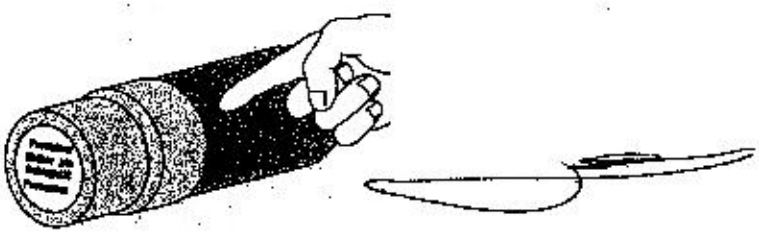
Pull out the fuse from the top.



Then completely remove the fuse from the top.

To install the new fuses, refer to the fuse installation section for a **QM** cubicle.

Important remark: standard IEC 282.1 § 23.2 recommends replacing all 3 fuses should one of them blow.



62.9

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