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ПРЕДЛОЖЕНИЕ

за изпълнение на обществената поръчка

ДО: „ЧЕЗ РАЗПРЕДЕЛЕНИЕ БЪЛГАРИЯ“ АД,

ОТ: Обединение „МИГ - ХЮНДАЙ“
(участник)

адрес: гр. София , р-н Красно Село, ул. „Костенец“ № 12

тел: +359 888 525 324; e-mail: bg@mig23-bg.com

Единен идентификационен код: 177153223

Представявано от Антон Иванов Илиев – Управител
(длъжност)

Лице за контакти: Божил Рангелов, тел.: +359 884 274 016; e-mail: mv@mig23-bg.com

УВАЖАЕМИ ГОСПОЖИ И ГОСПОДА,

Предоставяме на Вашето внимание предложението ни за изпълнение на обществена поръчка с предмет „Доставка, демонтаж и монтаж на трифазни маслонапълнени понижаващи силови трансформатори 110kV/Средно напрежение (СрН) и цялото необходимо помощно оборудване“, реф. № PPD 17-001, Обособена позиция № 2 /ОП2/ , подстанция /ПС/ “Бояна” (записва се обособената позиция, за която се участва)

1. В случай, че бъдем избрани за изпълнител, ще изпълним предмета на поръчката в пълно съответствие с изискванията на Възложителя, като се задължаваме да спазваме изискванията на нормативната уредба на Република България.

2. Представям техническите спецификации от раздел II на документацията с попълнени всички изисквани стойности за всички позиции от стоката по предмета на поръчката.

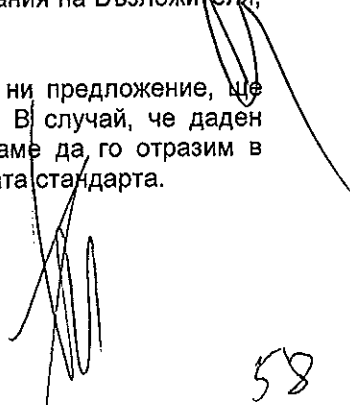
3. Декларирам, че предлаганото от нас оборудване отговаря на минималните технически изисквания на Възложителя, които не съдържат графа „Гарантирано предложение“ в таблиците на техническите спецификации на стоката, приложение към настоящото предложение за изпълнение на поръчката.

4. Представям всички изисквани данни и документи, посочени в Приложение 2 от настоящото техническо предложение. Запознат съм с изискването, че представените документи трябва да бъдат на български език или с превод на български език, придружени с оригиналните документи, с изключение на каталозите и протоколи от изпитания *в случай, че се изискват* за материалите, които могат да се представят и само на английски език.

5. Запознат съм, че представените от нас технически документи са доказателство за декларираните от мен технически данни и параметри в техническите спецификации на стоката.

6. Всички материали, апаратура, оборудване, съоръжения и резервни части, които ще доставим и ще влягаме при изпълнение на обекта на поръчката ще са нови, неупотребявани, придружени от декларации и/или сертификати/декларации за съответствие, съгласно изискванията на българското законодателство и отговарят на минималните технически изисквания на Възложителя, определени в техническите спецификации.

7. Потвърждавам, че представяните от нас стоки, описани в Техническото ни предложение, ще отговарят 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 двата стандарта.



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Първи етап – Доставка на цялостно оборудване по съответна обособена позиция:

Максимален срок за доставка и монтаж върху временен фундамент на нов/и трифазен/и маслонапълнен/и понижаващ/и трансформатор/и 110kV/СрН, ведно със съответните резервни части, както и за доставка на допълнително оборудване за съответната обособена позиция: до 300 (триста) дни от датата на подписване на Договор с Изпълнител.

• 8.Срокове за изпълнение на обществената поръчка:

Предлагам срок за Доставка и монтаж върху временен фундамент на нов трифазен маслонапълнен понижаващ трансформатор 110/Ср.Н., ведно със съответните резервни части, - 149 дни /не повече от 300 дни/ от датата на подписване на Договор. Наясно съм, че този срок ще бъде оценяван, съгласно Методика за оценка, показател – П2. /за обособена позиция 2 предложениия срок е за 2 броя нов трифазен маслонапълнен понижаващ трансформатор 110/Ср.Н./

Предлагам срок за Доставка на допълнително оборудване - 149 дни /не повече от 300 дни/ от датата на подписване на договор. Запознат съм, че мога да доставя допълнителното оборудване преди доставката на нов трифазен маслонапълнен трансформатор.

Ще изпълним монтажните дейности и въвеждане в експлоатация на нов трифазен маслонапълнен понижаващ трансформатор 110/Ср.Н в срок до 30 /тридесет/дни от датата на подписан възлагателен протокол на Възложителя.

В срок от 30 дни след подписване на договор ще представя на Възложителя Програма и Линеен график, съгласно изискванията на договора.

Линейният график ще включва график за доставка на цялостното оборудване и списък с лицата, отговорни за изпълнение на дейностите по заскладяване и изземане на оборудването.

Запознат съм че всички дейности, за които се изисква изключване на напрежение на съоръжения без възможност за възстановяване за определен интервал от време (минимум два календарни дни) в ОРУ/ЗРУ 110 kV трябва да се извършват в периода между месец Април и месец Октомври на 2018 година.

9. Запознат съм, че следва да бъдат определени точни размери на трансформатора, съобразно мястото на неговия монтаж за конкретната обособена позиция тъй като посочените размери в техническите спецификации за трансформатора са индикативни (приблизителни).

10. Декларирам, че представител на участника, когото представлявам е извършил оглед на обекта, в който се доставя и монтира на постоянен фундамент новия трифазен маслонапълнен понижаващ трансформатор 110/Ср.Н., съгласно изискванията на документацията за участие и прилагам декларация за извършен оглед към настоящото предложение.

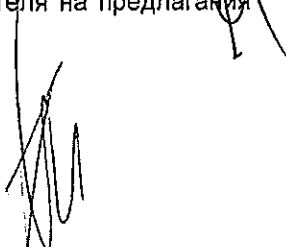
11. Предлагам гаранционен срок:

11.1. за силов трансформатор и резервни части - 24 месеца /не по-малко от 24 месеца/, от датата на приемо – предавателен протокол за извършен монтаж върху временен фундамент.

11.2. за допълнително оборудване - 24 месеца /не по-малко от 24 месеца/, от датата на приемо – предавателен протокол за получаване на стоката от Възложителя.

11.3. на монтажни дейности: 60 месеца от датата на протокол за успешно проведени 72-часови проби.

12. Декларирам, че производителят на предлаганите от мен в настоящата процедура трифазни маслонапълнени понижаващи силови трансформатори 110kV/Средно напрежение (СрН), прилага система за управление на качеството по стандарт БДС EN ISO 9001 или еквивалентен. Прилагам копие на валиден сертификат по стандарт БДС EN ISO 9001 на проидзводителя на предлагания трансформатор.



13. Упълномощено лице за отговорник (координатор) по безопасността, ако бъде избран за изпълнител е: Васил Ангелов Стоянов Тел 02/ 9 526 925 GSM: 0886 150 135

Приложения:

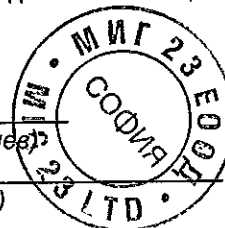
- Технически изисквания и спецификации за изпълнение на поръчката – раздел IV от документацията за участие – попълнени на съответните места;
- Изисквани документи от Технически изисквания и спецификации;
- Декларация за конфиденциалност и извършен оглед на обекта
- Копие на сертификат по стандарт БДС EN ISO 9001 : 2008 на производителя на предлагания трансформатор
- Приложение № 8 Презентация на завода производител
- Приложение №9 Произведени трансформатори
- Приложение №10 Каталогна информация Вентилни отводи
- Приложение №11 Каталогна информация Релейни защиты SPRECHER
- Приложение № 12 Каталогна информация Релейни защиты Woodward
- Приложение №13 Декларация от производителя Woodward, че предлаганите защиты поддържат исканите комуникационни протоколи
- Приложение №14 Декларация от производителя SPRECHER, че предлаганите защиты поддържат исканите комуникационни протоколи

Дата 18.04.2017 г.

ПОДПИС и ПЕЧАТ:

(Антон Илиев)

(Управител)



Обособена позиция 2 /ОП 2/

Доставка, демонтаж и монтаж на трифазни маслонапълни понижаващи силови трансформатори 110kV/СрН за подстанция /ПС/ „Бояна“, , както и доставка на цялото необходимо помощно оборудване

ТАБЛИЦА № 1

Стандарт на материала за трифазен маслонапълнен силов трансформатор за ПС „Бояна“, 20/25 MVA, 110 ± 12x1,25%/21/10.5 kV

Характеристика на материала:

Трифазен маслонапълнен силов тринамотъчен трансформатор 110 ± 15 % / 21 / 10,5 kV, за непрекъснато натоварване с мощност 20/25 MVA, с максимално ниво на звуково налягане 66 dB(A). Неутралите на намотките на страна 110 kV и на страна 21 kV са оразмерени да издържат съответните товарни токове и токове на земни къси съединения.

Магнитопроводът на трансформатора трябва да бъде трибедрен, изработен от трансформаторна ламарина с ниски загуби, покрита с високоустойчива на горещо трансформаторно масло неорганична изолация. Намотките на трансформатора трябва да бъдат изработени от електролитна мед. Казанът на трансформатора трябва да бъде камбанен тип и изработен от въглеродна стомана и трябва да издържа 100% вакуум.

Средното прегряване във всяка точка на намотките, измерено по метода на съпротивлението, не трябва да надвишава 65 K. Средното прегряване в горния слой на маслото не трябва да превишава 60 K.

Охлаждащата система на трансформатора трябва да бъде ONAN/ONAF. Охлаждащата система трябва да се включва автоматично посредством контактен термометър или ръчно от шкафа (таблото) за управление. Да се предвидят допълнителни клеми и вериги за осигуряване възможност за дистанционно управление от командна зала или от SCADA система. Изключването на защитното устройство на охлаждащата система трябва да бъде сигнализирано.

Регулирането на напрежението трябва да се извършва под товар чрез превключване на отклоненията на намотките 110 kV с възможност за дистанционно управление (от командна зала или от SCADA система) или местно управление. Местното управление трябва да се извършва посредством бутони и чрез манивела. Стъпалният регулатор трябва да има най-малко същите стойности на обявените величини, както на силовия трансформатор: обявен ток, обявено напрежение, брой на фазите, изолационно ниво, устойчивост на претоварване и на къси съединения. Стъпалният регулатор трябва да бъде съоръжен с брояч на операциите.

Трябва да бъде осигурена сигнализация в командна зала или в SCADA система: за превключването на отклоненията на намотките; за изключванията от претоварване на защитното устройство на електродвигателя на задвижващия механизъм; и за задействането на защитните изключватели срещу неконтролиран ход на задвижващия механизъм.

Шкафът (таблото) за управление на стъпалния регулатор трябва да осигурява електрическо захранване 230V/16A и 3x400V/32A и трябва да бъде съоръжен със защитни устройства в съответствие с приложимите стандарти на IEC. Шкафът (таблото) за управление трябва да бъде разположен от страна на стъпалния регулатор. Конструкцията на обвивката на шкафа (таблото) за управление трябва да осигурява ефективна вентилация, за да се предпазва вътрешността от кондензация на водни пари. Шкафът (таблото) за управление трябва да бъде съоръжен с нагревател с подходяща мощност, управляван с термостат.

Трансформаторът трябва да бъде съоръжен с носеща рама с четири колела, които могат да се позиционират на 90°, позволяващи надлъжно и напречно придвижване, и четири опори за повдигане на трансформатора с хидравлични крикове. Трансформаторът да е снабден със стационарна стълба за достъп до горната част на казана, с приспособление за хващане в горната част при изкачване на стълбата – при последните горни стъпала. Стълбата да бъде оборудвана с всички изискуеми табели и знаци за безопасност.

Болтовете, гайките и шайбите, монтирани на открито, трябва да бъдат изработени от неръждаема стомана. Всички външни стоманени части (без казана и трансформатора) трябва да бъдат горещо поцинковани в съответствие с изискванията на БДС EN ISO 1461 или еквивалентно/и и с нанесено върху тях лаковобояджийско покритие, гарантиращо адекватна защита срещу корозия.

Съответствие на предложеното изпълнение с нормативно-техническите документи:

Трифазният маслонапълнен силов трансформатор трябва да отговаря на приложимите български и международни стандарти или еквиваленти и нормативно-технически документи, включително на посочените по-долу и на техните валидни изменения и поправки:

БДС EN 60076-1:2011 „Доставка на трифазен маслонапълнен понижаващ трансформатор 110/Ср.Н.. Част 1: Общи положения (IEC 60076-1:2011)” (или еквивалент/и);
БДС EN 60076-2:2011 „Доставка на трифазен маслонапълнен понижаващ трансформатор 110/Ср.Н.. Част 2: Прегряване на трансформатори, потопени в течност” (или еквивалент/и);
БДС EN 60076-3:2013 „Доставка на трифазен маслонапълнен понижаващ трансформатор 110/Ср.Н.. Част 3: Нива на изолацията, изпитвания на електрическата якост на изолацията и външни изолационни разстояния през въздух (IEC 60076-3:2013)” (или еквивалент/и);
БДС EN 60076-4:2003 „Доставка на трифазен маслонапълнен понижаващ трансформатор 110/Ср.Н.. Част 4: Ръководство за изпитване с мълниев импулс и с комутационен импулс. Доставка на трифазен маслонапълнен понижаващ трансформатор 110/Ср.Н. и реактори (IEC 60076-4:2002)” (или еквивалент/и);
БДС EN 60076-5:2006 „Доставка на трифазен маслонапълнен понижаващ трансформатор 110/Ср.Н.. Част 5: Устойчивост на издържани къси съединения (IEC 60076-5:2006)” (или еквивалент/и);
БДС IEC 60076-7:2012 „Доставка на трифазен маслонапълнен понижаващ трансформатор 110/Ср.Н.. Част 7: Ръководство за натоварване на маслонапълнени Доставка на трифазен маслонапълнен понижаващ трансформатор 110/Ср.Н.” (или еквивалент/и);
БДС IEC 60076-8:2007 „Доставка на трифазен маслонапълнен понижаващ трансформатор 110/Ср.Н.. Част 8: Ръководство за приложение” (или еквивалент/и);
БДС EN 60076-10:2003 „Доставка на трифазен маслонапълнен понижаващ трансформатор 110/Ср.Н.. Част 10: Определяне на нивата на шума (IEC 60076-10:2001)” (или еквивалент/и);
БДС EN 60137:2008 „Преходни изолатори за променливи напрежения над 1 000 V (IEC 60137:2008)“;
БДС EN 50180:2010 „Преходни изолатори над 1 kV до 52 kV включително и от 250 A до 3,15 kA за потопени в течност трансформатори” (или еквивалент/и);
БДС EN 60296:2012 „Флуиди за приложение в електротехниката. Неработили минерални изолационни масла за трансформатори и прекъсвачи (IEC 60296:2012)” (или еквивалент/и);
БДС EN 61619:2004 „Изолационни течности. Примеси на полихлорирани бифенили (PCB). Метод за определяне чрез капиллярна газхроматография (IEC 61619:1997)” (или еквивалент/и);
БДС EN ISO 1461:2009 „Горещопоцинковани покрития на готови продукти от чугун и стомана. Технически изисквания и методи за изпитване (ISO 1461:2009)” (или еквивалент/и);
НАРЕДБА № 3 от 9 юни 2004 г. за устройството на електрическите уредби и електропроводните линии, издадена от министъра на енергетиката и енергийните ресурси (Наредба № 3 УЕУЕЛ);
НАРЕДБА № 9 от 9 юни 2004 г. за техническата експлоатация на електрически централи и мрежи, издадена от Министерството на енергетиката и енергийните ресурси (Наредба № 9 ТЕЕЦМ); и
РЕГЛАМЕНТ (ЕС) № 548/2014 НА КОМИСИЯТА от 21 май 2014 година за прилагане на Директива 2009/125/ЕО на Европейския парламент и на Съвета по отношение на малките, средните и големите Доставка на трифазен маслонапълнен понижаващ трансформатор 110/Ср.Н..

Използване:

Трансформаторът е предназначен за монтиране на открито.

Изисквания към документацията и изпитванията:

№	Документ за участие	Приложение № (или текст)
	Техническо описание и каталози за трансформатора и съоръжаването – проходни изводи, стъпален регулатор, температурни индикатори и т.н.	1, 2
	Протоколи от типови изпитвания на подобен трансформатор, доставян от производителя, на английски или български език, с приложени резултати от изпитванията – заверени копия	3
	Сертификат/акредитация на независимата изпитвателна лаборатория, провела типовите изпитвания – заверено копие	4
	Сертификат за контролирана работна среда (чистота, температура и влажност) в производствените халета	5, 6

№	Документ за участие	Приложение № (или текст)
	Декларация за отсъствие на полихлорирани бифинили (PCB) в изолационното масло	7
	Общо тегло на трансформатора, транспортно тегло (без консерватор и радиатори) и тегло на изолационното масло, kg	59000, 45000, 17500
	Експлоатационна дълготрайност, години	25

Технически данни:

Характеристики на работната среда и място на монтиране:

№	Характеристика/място на монтиране	Стойност/описание
	Температура на околния въздух	<ul style="list-style-type: none"> Не по-висока от +40°C Не по-ниска от минус 30°C
	Макс. средна температура за 24ч	+ 35°C
	Замърсяване	Степен на замърсяване 1 (P1)
	Надморска височина	До 1000 m
	Място на монтиране	На открито
	Сеизмична устойчивост	0,3 g

Параметри на мрежата 110 kV:

№	Параметър	Стойност/описание
	Номинално напрежение	3~110 000 V
	Максимално напрежение	123 000 V
	Максимална мощност на късо съединение	5000 MVA
	Номинална честота	50 Hz
	Брой на фазите	3
	Заземяване на мрежата	Директно заземяване

Параметри на електроразпределителна мрежа 20 kV:

№	Параметър	Стойност/описание
	Номинално напрежение	3~20000 V
	Максимално напрежение	24000 V
	Номинална честота	50 Hz
	Брой на фазите	3
	Заземяване на мрежата	През активно съпротивление

Параметри на електроразпределителната мрежа 10 kV:

№	Параметър	Стойност/описание
	Номинално напрежение	3~10000 V
	Максимално напрежение	12000 V
	Номинална честота	50 Hz
	Брой на фазите	3
	Заземяване на мрежата	През активно съпротивление

Технически параметри, които се попълват от Участника в графа „Гарантирано предложение“:

№	Наименование	Изискване	Гарантирано предложение
	Обявено напрежение	110 ± 15 % / 21 / 10,5 kV	110 ± 15 % / 21 / 10,5 kV
	Брой на фазите	3	3
	Обявена мощност 110 kV	20/25 MVA	20/25 MVA
	Обявена мощност 21 kV	12/15 MVA	12/15 MVA
	Обявена мощност 10,5 kV	12/15 MVA	12/15 MVA

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№	Наименование	Изискване	Гарантирано предложение
	Схема на свързване	YN/yn0/d5	YN/yn0/d5
	Обявена честота	50 Hz	50 Hz
	Обхват на изменение на коефициента на трансформация	$\pm 12 \times 1,25 \%$	$\pm 12 \times 1,25 \%$
	Брой на стъпалата	27	27
	Напрежение на късо съединение между намотки:	-	-
-	13+15 стъпало на страна 110 kV – първа страна 21 kV	в диапазона $10,35\% \pm 0.5$	10,35% (15 MVA)
-	13+15 стъпало на страна 110 kV – втора страна 10,5 kV	в диапазона $18,65\% \pm 0.5$	18,65% (15 MVA)
-	първа страна 21 kV – втора страна 10,5 kV	Да се посочи	6,5% (15 MVA)
	Загуби на празен ход, P0	$\leq 8,5 \text{ kW}$	8,5 kW
	Загуби на късо съединение	$\leq 95 \text{ kW}$	90kW (15 MVA)
	Максимални нива на звукова мощност	-	-
-	в режим ONAN, dB(A)	66	66
-	в режим ONAF, dB(A)	73	73
	Издържан ток при външно късо съединение (3 s)	31,5 kA	31,5 kA
	Минимален път на утечка по външната повърхност на проходните изводи	31 mm/kV	31 mm/kV
	Ниво на частичните разряди	$\leq 300 \text{ pC}$	$\leq 300 \text{ pC}$

Допълнителни изисквания и други данни, които се гарантират от Участника, че предложеното оборудване отговаря на посочените по-долу минималните технически изисквания на Възложителя:

№	Наименование	Минималните технически изисквания
	Режим на работа	Продължителен
	Превключване на отклоненията на намотките на страна 110 kV	Под товар
	Стъпален регулатор	Стъпален регулатор с вакуумни камери:
	Постоянна мощност на всички стъпала	Да
	Изолационни нива:	-
-	страна 110 kV	LI/AC 450/185 kV
-	страна 21 kV	LI/AC 125/50 kV
-	страна 10,5 kV	LI/AC 75/28 kV
	Съединителни клеми на проходните изводи 110 kV	Цилиндрична медна клема $\varnothing 30\text{mm}$
	Съединителни клеми на проходните изводи 21 kV и 10,5 kV	Клемни адаптери (флаг клеми) за правоъгълни алуминиеви шини
	Колела	Позициониращи се на ъгъл 90°
	Захранващо напрежение за електродвигателите за охлаждане и управление на стъпален регулатор (APH)	3x230/400 V, 50 Hz AC
	Захранващо напрежение за управлението на температурни датчици и технологични защити	220 V DC
	Табела за обявените данни и свързването на намотките	Табела за стойностите на обявените величини и свързването на намотките и отклонителните секции на български език съгласно БДС EN/IEC 60076 или еквивалентно/и
	Материал на намотките	Cu

№	Наименование	Минималните технически изисквания
	Тип на охлаждане	ONAN/ONAF (60/100%)
	Максимална температура на прегряване на намотките	65 K
	Максимална температура на прегряване на горния слой на маслото	60 K
	Изоляционно масло	Минерално масло в съответствие с БДС EN 60296 или еквивалентно/и. Трансформаторното масло, трябва да позволява експлоатационна дълготрайност на трансформаторите от 35 години, и да е преминало всички тестове съгласно електрохимичните му свойства в съответствие с международните норми и трябва да не съдържа РСВ и хлор. Съдържанието на РСВ се доказва чрез анализ съгласно БДС EN 61619 или еквивалентно/и и не трябва да надвишава 1 ppm.
	Външни размери на асемблирания трансформатор: дължина x ширина x височина	(6000x4000x5000) mm (индикативно)
	Транспортиране и монтаж	Транспортирането и монтажът на трансформатора не трябва да бъде съпроводено с механични повреди, като нарушаването на антикорозионното покритие трябва да бъде минимално (max 1,5% от общата площ). Евентуалните повреди по покритието се възстановяват от изпълнителя след монтажа на трансформатора на обекта.

Съоръжаване, фитинги и аксесоари, които се гарантират от Участника, че предложеното оборудване отговаря на посочените по-долу минималните технически изисквания на Възложителя:

№	Наименование	Минималните технически изисквания
	3 бр. фазови (линейни) полимерни проходни изводи 110 kV от кондензаторен тип	Да
	1 бр. полимерен проходен извод 110 kV от кондензаторен тип за неутралата със същото изоляционно ниво както на фазовите проходни изводи	Да
	Медни рогове за искровата междина на проходните изводи 110 kV	Да
	6 бр. фазови (линейни) порцеланови проходни изводи на намотките 21 kV и 10,5 kV от маслонапълнен тип (DIN)	Да
	1 бр. порцеланов проходен извод от маслонапълнен тип (DIN) за неутралата на намотките 21 kV със същото изоляционно ниво както на фазовите проходни изводи	Да
	Консерватор с отделение (отсек) за стъпалния регулатор	Да
	Двустепенно газово реле, монтирано на тръбата, свързваща консерватора и казана, с два нормално отворени контакта съответно за сигнализация и изключване на трансформатора	Да
	Едностепенно (струйно) газово реле, монтирано на тръбата, свързваща консерватора и стъпалния регулатор, с един или два нормално отворени контакта за изключване на трансформатора	Да

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№	Наименование	Минималните технически изисквания
	Индикатори (маслопоказатели - 2 бр.) за долно ниво на маслото в казана на консерватора (за трансформатора и стъпалния регулатор) с един нормално отворен и един нормално затворен контакт за сигнализация	Да
	Температурни индикатори (термометри – 2 бр.) за намотките и за трансформаторното масло: с минимален диаметър 150 mm; с два нормално отворени и един нормално затворен контакти съответно за сигнализация и изключване на трансформатора	Да
	Джобове за термометрите с винтова месингова капачка, гарантираща водонепроницаемост	Да
	Pt чувствителни датчици за дистанционно измерване на температурата на намотките и на маслото (подробно описание след таблицата)	Да
	Система за мониторинг на горещи точки в трансформатора и разтворени газове в трансформаторното масло (подробно описание след таблицата)	Да
	Устройство за освобождаване на налягането на маслото в казана (Pressure relief device) с един нормално отворен контакт	Да
	Вентили с фланци (2 броя, с по четири отвора за болтово закрепване Ø 18 и диагонално разположение на отворите на разстояние 160 mm от център до център) за свързване на инсталация за филтриране и изсушаване на маслото, разположени диагонално на казана, съоръжени със заключващи устройства	Да
	Вентили за вземане на проби от маслото, разположени в долната част на казана на три нива – долно, средно и горно ниво, и на стъпалния регулатор, с възможност за заключване и пломбиране	Да
	Дихател със силикагел за консерватора с прозорец за наблюдение	Да
	Отвор с капак на консерватора за наливане на масло	Да
	Вентил за източване на маслото със заключващо устройство	Да
	Устройства (пробки) за обезвъздушаване	Да
	Радиатори, разположени по дългата страна, съоръжени със спирателни кранове, приспособления за повдигане, пробки за обезвъздушаване и пробки за източване на маслото	Да
	Всеки вентилатор да е подсигурен с отделна моторна защита	Да
	2 бр. заземителни клеми	Да
	Заземителна връзка между казана и капака на трансформатора	Да
	Колела за придвижване в двете посоки на разстояние 1435 mm на тясната страна и 2050 mm на широката страна (окончателните размери се уточняват от възложителя преди поръчка)	Да
	Уши за изтегляне на трансформатора по дългата и късата ос и товарозахватни приспособления (халки) за повдигане на капака, консерватора, магнитопровода, намотките и т.н.	Да
	Шкаф за управление	-
-	Шкафът за управление и задвижващият механизъм трябва да бъдат монтирани на 30 cm от долната страна на казана.	Да
-	Обвивките на шкафа за управление и задвижващият механизъм трябва да имат степен на защита от проникване на твърди тела и вода във вътрешността най-малко IP 54.	Да
-	Токопроводимите жила на входящите и изходящите кабели трябва да бъдат свързани към клеморед, изграден от клеми от проходен тип, който трябва да има най-малко четири свободни клеми.	Да
-	Всички кабели монтирани на открито трябва да бъдат с външна обвивка, устойчива на UV-лъчи и агресивни среди, и сигурно укрепени по казана на трансформатора със скоби от неръждаема стомана.	Да

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№	Наименование	Минималните технически изисквания
-	Шкафът за управление трябва да бъде осигурен с вътрешно осветление и щепселен контакт с дефектнотокова защита.	Да
	Минимална дебелина от 160 µm на сухия филм на лаковобояджийското покритие със светло зелен цвят RAL 7032	Да
	Резервни части за силов трансформатор	
	1 бр. резервен фазов (линеен) проходен извод за 110 kV	Да
	1 бр. резервен проходен извод за 21 kV	Да
	1 бр. резервен проходен извод за 10,5 kV	Да
	Трансформаторно масло за първото напълване с 10 % екстра от общото тегло на маслото	Да
	Допълнително количество боя за възстановяване при необходимост на горното лаковобояджийско покритие със светло зелен цвят RAL 7032	2 kg
	Резервни части за система за мониторинг на газове в маслото	
	1 бр. фитинги за вентил 2"	Да
	1 бр. монтажен адаптер 2"	Да

Описание на система за мониторинг на горещи точки в трансформатора и на Pt чувствителни датчици за дистанционно измерване на температурата на намотките и на маслото

Брой на сензорите:

Минимално количество: по 1 бр. на всяка фаза и намотка в мястото на най-горещата точка.

Допуска се да се монтират по два сензора на намотка.

Общо: 9 бр.

Вид на сензора: Flouroptic Thermometry Sensors (FOT Technology) with 200µm all silica, double PFA Teflon jacketed, Kevlar cabled fibre или еквивалентно/и

Сензор (вътре):

9бр. Температурни сензори: дължина 10 m (Точната дължина се определя от конкретната конструкция, 10 м. са примерни)

Делител (за монтаж между намотките):

9 бр. 1/16" дебела плоча, 6" x 6", с инструкция

Проходна част:

9 бр. Проходно тяло за стената на казана за температурните сензори. Включва проходно тяло от легирана стомана и осигурителна гайка (1 необходим брой за всяка точка на измерване)

Сензор (отвън):

9 бр. удължител на световода: дължина 5 m

1 бр. Пакет за проходна плоча за 12 прехода. Вкл. кръгла плоча с диаметър 253 mm (9,97") с 12 заварени проходни тела. Плочата съдържа 12 външни капачки за защита на преминаващите съединители по време на монтажа. За предотвратяване на теч на масло неизползваните проходни отвори трябва да се затворят с вътрешния затварящ комплект и външния комплект капачки. Включва също така пръстен с външен диаметър 253 mm (9,97") (нелегирана стомана) за заваряване на стената на казана, кръгъл пръстен и болтове за свързване на SS-плоча към стоманения пръстен.

Описание на система за мониторинг на разтворени газове в трансформаторното масло

Технически изисквания на система за мониторинг на разтворени газове в трансформаторно масло:

Измерване на газ (газ в маслени концентрати):

Предложената система трябва да може да измерва концентрациите на 9 DGA газа в посочения обхват и влажност от 1-99% RS

ГАЗ	Минимум (PPM)	Максимум (PPM)
Водород (H ₂)	5	10,000
Въглероден оксид (CO)	10	10,000

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Ацетилен (C ₂ H ₂)	0.5	10,000
Вода (RS%)	1%	99%
Въглероден диоксид (CO ₂)	20	20,000
Метан (CH ₄)	5	50,000
Етилен (C ₂ H ₄)	5	50,000
Етан (C ₂ H ₆)	5	20,000
Кислород (O ₂)	100	50,000
Азот (N ₂)	10,000	100,000

Точност:

± 5% или ±LDL (ниско ниво на гъстота)

Точност при влажност: ± 3 ppm или ± 2 % RS

Време на вземане на проба

Всеки 6 часа (по подразбиране)

Възможност за диапазон настройка от 30 минути до 12 часа

Начин на монтиране:

Директно инсталиране в маслена фаза.

Изходи и комуникации:

Изходи: Четири видими на слънчева светлина индикатора за кодове за състоянието на трансформатора

Зелен – Нормално

Жълт – Внимание

Син – Предупреждение

Червен – Тревога

Сигнален контакт на аларма

Три (3) програмируеми релейни изхода (тип C, NO/NC) за „внимание“, „предупреждение“ и „тревога“

Един (1) релейен сигнален изход за състояние на системата (тип C, NO/NC)

Номинални стойности на релейни контакти

Еднофазни сигнални релета 5 A, 250 V AC, 30 V DC

Памет

2 години съхраняване на данни/ краткосрочно

40 години съхраняване на данни/ дългосрочно

Налични комуникации

RS485, ASC II Protocol, и влажност

MODBUS RTU и MODBUS TCP/IP

БДС EN 60870-5-103

Софтуер

DGA Viewer за показване на концентрация на газ или еквивалентно/и

Да предлага триъгълник на Дювал (Duvals Δ), Съотношение на Роджър (Roger's Ratios),

Извеждане на тенденции, Съотношение CO/CO₂ и степен на промяна на газовете.

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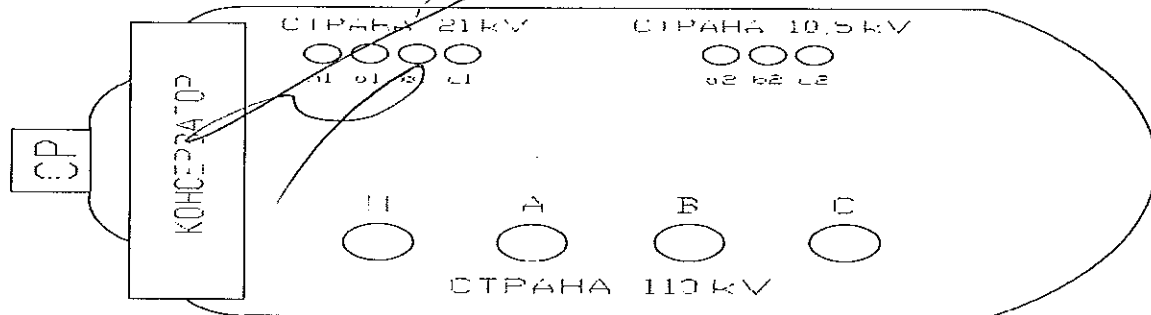
Минимални количества за доставка

1 бр. Контролер с дисплей, десет канален, който да обединява двете функции за мониторинг на горещи точки с технология FOT и функция за мониторинг на разтворени в маслото газове-DGA. Вкл. със сензорен дисплей (touch Screen-Display (5,7")), крепежни елементи за стена, универсален захранващ източник AC/DC, температурен обхват -30 ... 230°C, интерфейси RS232, RS485 и сериен Ethernet (Standard), MODBUS RTU и MODBUS TCP/IP, ASCII, и БДС EN 60870-5-103, аналогов изход 4...20 mA или 0...1mA – 16 програмируеми превключващи релета (НО + НЗ контакт) и един бр. превключващо реле са статус на системата, щекер и инструкция за експлоатация.

2 бр. защитен корпус за прехода през казана:

комплект корпус за компонентите за преминаване на стената на казана „голяма“ (за 9,97" проходни плочи за 12 и повече проходни отвора)

1 бр. Система за мониторинг на разтворени в маслото газове (NDIR Technology) на трансформатори за 9 газа + влага, вкл. EZHub за захранване на прибора, за връзка към компютър и контролера, DGA Viewer софтуер и инструкция, 10 метра свързващ кабел, фитинги за вентил 2 „ монтажен адаптер 2" с възможност за степен на изменение за всичките 9 газа триъгълник на Дювал, of change for all 9 DGA gases Duvals Δ, съотношения на Роджър, Roger's Ratios, анализ на ключови газове, състояние на трансформатора.



Фиг. 1 - Разположение на стъпалния регулатор, изводите и консерватора

069

ТАБЛИЦА № 2

Стандарт на материала за вентилни отводи, метало – оксиден тип без искрови разрядници 20 kV, 10 kA

Характеристика на материала:

Метало-оксиден (ZnO) вентилен отвод без искрови разрядници, за монтиране на закрито и открито, с трайно работно напрежение min 21,6 kV, с номинален разряден ток 10 kA, с разряден клас на линията 2, с полимерна изолационната обвивка, с принадлежности (аксесоари) за свързване между тоководещи части и земя. Конфигурацията на стрехите на полимерната изолационна обвивка съответстват на изискванията на IEC/TS 60815-3 или еквивалент.

Използване:

Вентилният отвод е предназначен за използване в електроразпределителни мрежи с номинално напрежение 20 kV със заземена през активно съпротивление в райони с интензивност на мълниеносната дейност над 100 часа годишно или с преобладаващ брой потребители с повишени изисквания за осигуреност на електрообезопасването.

Съответствие на предлаганото изделие със стандартизационните документи:

Вентилният отвод трябва да отговаря на приложимите български и международни стандарти, включително на посочените по-долу и на техните валидни изменения и поправки или еквиваленти:

БДС EN 60099-4:2014 „Вентилни отводи. Част 4: Металооксидни вентилни отводи без разрядници за електрически системи за променливо напрежение (IEC 60099-4:2014) ” (или еквивалент/и); и IEC/TS 60815-3:2008 „Selection and dimensioning of high-voltage insulators intended for use in polluted conditions – Part 3: Polymer insulators for a.c. systems” (или еквивалент/и).

Технически данни:

Характеристики на работната среда:

№	Характеристика	Стойност
	Място на монтиране	На открито/закрито
	Максимална околна температура	+ 40°C
	Минимална околна температура	Минус 25°C
	Относителна влажност	До 100 %
	Надморска височина	До 1000 m
	Интензивност на мълниеносната дейност	Над 100 часа годишно
	Други работни условия	Съгласно т. 5.4.1 от БДС EN 60099-4 (или еквивалент/и)

Параметри на електроразпределителната мрежа:

№	Параметър	Стойност
	Номинално напрежение	20 000 V
	Най-високо напрежение на съоръженията	24 000 V
	Най-високо напрежение на системата	21 600 V
	Номинална честота	50 Hz
	Брой на фазите	3
	Заземяване на звездния център	През AC
	Максимална стойност на временните пренапрежения (при земно съединение)/максимална продължителност на временните пренапрежения:	
-	заземяване през активно съпротивление	21,6 kV/3 s
	Изолационно ниво:	-
-	Обявено издържано мълниевое импулсно напрежение (върхова стойност)	125 kV
-	Обявено краткотрайно (1 min) издържано напрежение с промишлена честота (50 Hz) (ефективна стойност)	50 kV

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№	Параметър	Стойност
	Ток на късо съединение в мястото на монтиране на вентилния отвод – максимален ток при трифазно късо съединение	25 kA

Свързване в системата и защитавани съоръжения:

№	Наименование	Изискване
	Свързване в системата	Между фаза и земя
	Защитавани съоръжения	кабелни линии 20 kV; входове на разпределителните уредби; КРУ в елегазова изолационна среда (GIS)



Технически данни, които се гарантират от Участника, че предложеното оборудване отговаря на посочените по-долу минималните технически изисквания на Възложителя:

№	Характеристика	Минимални технически изисквания
	Обявено издържано напрежение при атмосферни пренапрежения 1,2/50 μ s	≥ 125 kV
	Обявено издържано 1 min напрежение с промишлена честота 50 Hz при мокра изолация	≥ 50 kV
	Ниво на частичните разряди при 1,05 U _c	≤ 10 pC
	Материал, от който е изработено нелинейното съпротивление (варистор)	ZnO
	Материал, от който е изработена изолационната обвивка	Полимер
	Материал, от който са изработени принадлежностите (аксесоарите)	Неръждаема стомана
	Якост на опън	≥ 1 kN
	Якост на усукване	≥ 50 Nm
	Якост на огъване	≥ 200 Nm

Технически параметри, които се гарантират от Участника, че предложеното оборудване отговаря на посочените по-долу минималните технически изисквания на Възложителя:

№	Параметър	Минимални технически изисквания
	Трайно работно напрежение, U _C	$\geq 21,6$ kV
	Обявено напрежение, U _g	≥ 27 kV
	Номинален разряден ток, I _n (8/20 μ s)	10 kA
	Силнотоков импулс (4/10 μ s)	100 kA
	Разряден клас на линията	2
	Устойчивост на ток на късо съединение	≥ 20 kA/0,2 s
	Остатъчно напрежение при номинален разряден ток I _n , U _{res}	≤ 75 kV
	Устойчивост на продължителен токов импулс	≥ 250 A/2000 μ s
	Стойност на временните пренапрежения съгласно приложение D на БДС EN 60099-4 (или еквивалент/и):	-
-	с продължителност 3 s	≥ 28 kV
-	с продължителност 100 s	≥ 26 kV
-	с продължителност 7200 s	$\geq 23,7$ kV
	Изолационно разстояние по повърхността	≥ 540 mm
	Височина без аксесоарите за присъединяване	≤ 425 mm

ТАБЛИЦА № 3

  071

Стандарт на материала за вентилни отводи, метало – оксиден тип без искрови разрядници 10 kV, 10 kA

Характеристика на материала:

Метало-оксиден (ZnO) вентилен отвод без искрови разрядници, за монтиране на закрито и открито, с трайно работно напрежение min 10,8 kV, с номинален разряден ток 10 kA, с разряден клас на линията 2, с полимерна изолационната обвивка, с принадлежности (аксесоари) за свързване между тоководещи части и земя. Конфигурацията на стрехите на полимерната изолационна обвивка съответстват на изискванията на IEC/TS 60815-3 или еквивалент.

Използване:

Вентилният отвод е предназначен за използване в електроразпределителни мрежи с номинално напрежение 10 kV с изолирана неутрала, със заземена през дългогасителна бобина неутрала, със заземена през активно съпротивление неутрала или с комбинирано заземяване на неутралата през дългогасителна бобина и активно съпротивление.

Съответствие на предлаганото изделие със стандартизационните документи:

Вентилният отвод трябва да отговаря на приложените български и международни стандарти, включително на посочените по-долу и на техните валидни изменения и поправки или еквиваленти:

БДС EN 60099-4:2014 „Вентилни отводи. Част 4: Металооксидни вентилни отводи без разрядници за електрически системи за променливо напрежение (IEC 60099-4:2014)” (или еквивалент/и); и IEC/TS 60815-3:2008 „Selection and dimensioning of high-voltage insulators intended for use in polluted conditions – Part 3: Polymer insulators for a.c. systems” (или еквивалент/и).

Технически данни:

Характеристики на работната среда:

№	Характеристика	Стойност
	Място на монтиране	На открито/закрито
	Максимална околна температура	+ 40°C
	Минимална околна температура	Минус 25°C
	Относителна влажност	До 100 %
	Надморска височина	До 1000 m
	Други работни условия	Съгласно т. 5.4.1 от БДС EN 60099-4 (или еквивалент/и)

Параметри на електроразпределителната мрежа:

№	Параметър	Стойност
	Номинално напрежение	10 000 V
	Най-високо напрежение на съоръженията	12 000 V
	Най-високо напрежение на системата	10 800 V
	Номинална честота	50 Hz
	Брой на фазите	3
	Заземяване на звездния център	през активно съпротивление
	Максимална стойност на временните пренапрежения (при земно съединение)/максимална продължителност на временните пренапрежения:	
-	заземяване през дългогасителна бобина; или изолиран звезден център	11,8 kV/2 часа
-	заземяване през активно съпротивление; или през дългогасителна бобина комбинирана с активно съпротивление	10,8 kV/3 s
	Изоляционно ниво:	-
-	Обявено издържано мълниевое импулсно напрежение (върхова стойност)	75 kV

-	Обявено краткотрайно (1 min) издържано напрежение с промишлена честота (50 Hz) (ефективна стойност)	28 kV
	Ток на късо съединение в мястото на монтиране на вентилния отвод - максимален ток при трифазно късо съединение	18 kA

Свързване в системата и защитавани съоръжения:

№	Наименование	Изискване
	Свързване в системата	Между фаза и земя
	Защитавани съоръжения	кабелни линии 10 kV; входове на разпределителните уредби; КРУ в элегазова изолационна среда (GIS)

Технически данни, които се гарантират от Участника, че предложеното оборудване отговаря на посочените по-долу минималните технически изисквания на Възложителя:

№	Характеристика	Минимални технически изисквания
	Обявено издържано напрежение при атмосферни пренапрежения 1,2/50 μ s	≥ 75 kV
	Обявено издържано 1 min напрежение с промишлена честота 50 Hz при мокра изолация	≥ 28 kV
	Ниво на частичните разряди при 1,05 U _c	≤ 10 pC
	Материал, от който е изработено нелинейното съпротивление (варистора)	ZnO
	Материал, от който е изработена изолационната обвивка	Полимер
	Материал, от който са изработени принадлежностите (аксесоарите)	Неръждаема стомана
	Якост на опън	≥ 1 kN
	Якост на усукване	≥ 50 Nm
	Якост на огъване	≥ 200 Nm

Технически параметри, които се гарантират от Участника, че предложеното оборудване отговаря на посочените по-долу минималните технически изисквания на Възложителя:

№	Параметър	Минимални технически изисквания
	Трайно работно напрежение, U _C	$\geq 10,8$ kV
	Обявено напрежение, U _r	$\geq 13,5$ kV
	Номинален разряден ток, I _n (8/20 μ s)	10 kA
	Силнотокът импулс (4/10 μ s)	100 kA
	Разряден клас на линията	2
	Устойчивост на ток на късо съединение	≥ 20 kA/0,2 s
	Остатъчно напрежение при номинален разряден ток I _n , U _{res}	≤ 42 kV
	Устойчивост на продължителен токов импулс	≥ 250 A/2000 μ s
	Стойност на временните пренапрежения съгласно приложение D на БДС EN 60099-4 (или еквивалент/и):	-
-	с продължителност 3 s	≥ 14 kV
-	с продължителност 100 s	≥ 13 kV
-	с продължителност 7200 s	$\geq 11,8$ kV
	Изолационно разстояние по повърхността	≥ 370 mm
	Височина без аксесоарите за присъединяване	≤ 350 mm

073

ТАБЛИЦА 4

Стандарт на материала за цифрови защиты за силов тринамотъчни трансформатори 110/20/10 (надлъжно – диференциална защита и резервна максимално токова защита)

Характеристика на материала:

Цифровите защиты включват основна надлъжно-диференциална защита (НДЗ) за силови тринамотъчни трансформатори ВН/Ср.Н/Ср.Н с всички възможни групи на свързване и различни коефициенти на трансформация на самия трансформатор и токовите трансформатори, резервна максимално токова защита (МТЗ), реагираща на всички видове къси съединения, както и резервна земна защита (ЗЗ), вградена в релеен комплект на МТЗ и представляваща максималнотокова защита за токове с нулева последователност.

Позволява трифазно измерване в мрежа 110 kV с директно заземен звезден център – с голям ток на еднофазно късо съединение и заземен през активно съпротивление и изкуствен звезден център на страна Ср.Н. НДЗ е свързана към токови измервателни трансформатори, в отделно вторично ядро с номинален вторичен ток 5 А за всяко работно напрежение.

Резервната максималнотокова защита да е предназначена да изпълнява функциите на резервна защита на трансформатора при междуфазни и еднофазни къси съединения в мрежи високо напрежение с директно заземен звезден център.

Защитата е микропроцесорно (цифрово) устройство, което автоматично изключва защитаваните електрически съоръжения, при нарушаване на нормалният режим на работа. Всички функции от регистрирането на измерваните стойности до подаване на команда за изключване на силовия прекъсвач се преработват цифрово. ЦЗ има вградена система за телеизмерване, телесигнализация, телеуправление и местна сигнализация. Притежава вграден регистратор на информация за осцилографен анализ на аварийните събития и процеси, енергонезависима памет и изпълнява функциите: управление, контрол, измерване, мониторинг и защита. ЦЗ да има комуникационен интерфейс за връзка с телемеханичен периферен пост (RTU – Remote Terminal Unit). Комуникационният интерфейс да има възможност за свързване към двупроводна и четирипроводна RS-485 мрежа, със скорост на предаване до 38400 BdD, или към мрежа с оптичен, като връзката се осъществява посредством сериен, RJ-45 или HFBR-4516Z connector. Основната и резервната ЦЗ са поместени в самостоятелни кутии с възможност за монтаж върху панел, със степен на защита min IP 51, с LCD/LED дисплей на лицевата страна за извеждане на информация (визуализиране на моментни стойности на електрически величини) и клавиатура за управление на менюто. ЦЗ да позволяват да се изпълняват управляващи функции, с помощта на които се дава възможност за извършване на комутации на силовите елементи чрез клавиатурата или чрез използване на системен интерфейс посредством дистанционно управление.

По време на късо съединение в защитаваната част на електрическата мрежа, величината на моментната стойност на тока да се записва за период от 5 секунди и да е на разположение за последователен анализ на преходния процес.

Постоянният контрол на апаратната част и програмното осигуряване на ЦЗ да позволява бързо сигнализиране при вътрешни повреди и неизправности.

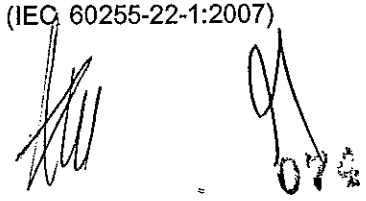
Използване:


Цифровата надлъжна диференциална защита е основна защита на силовите трансформатори и е предназначена да изключва без допълнително времезакъснение късите съединения в зоната, заключена между токовите трансформатори на различните страни на трансформатора (НДЗ не реагира на къси съединения извън посочената зона). Резервната цифрова максималнотокова защита е предназначена да изпълнява функциите на резервна защита на страна 110 kV на трансформатора при междуфазни и еднофазни къси съединения в мрежи високо напрежение с директно заземен звезден център.

Съответствие на предлаганото изделие със стандартизационните документи:

Цифровите защиты трябва да отговарят на посочените по долу стандарти или еквиваленти, включително на техните валидни изменения и допълнения:

БДС EN 60255-22-1:2008 Измервателни релета и защитни съоръжения Част 22-1: Изпитване на смущаващи въздействия. Изпитване на пакети импулси с честота 1 MHz (IEC 60255-22-1:2007) (или еквивалент/и);





БДС EN 60255-22-2:2008 Измервателни релета и защитни съоръжения. Част 22-2: Изпитвания на електрически смущаващи въздействия – Изпитване на устойчивост на електростатични разряди (IEC 60255-22-2:2008) (или еквивалент/и);

БДС EN 60255-22-3:2008 Измервателни релета и защитни съоръжения. Част 22-3: Изпитвания на електрически смущаващи въздействия. Изпитване на устойчивост на излъчено електромагнитно поле (IEC 60255-22-3:2007) (или еквивалент/и);

БДС EN 60255-22-4:2008 Измервателни релета и защитни съоръжения. Част 22-4: Изпитвания на електрически смущаващи въздействия. Изпитване на устойчивост на електрически бърз преходен процес/пакет импулси (IEC 60255-22-4:2008) (или еквивалент/и);

БДС EN 60255-22-5:2011 Измервателни релета и защитни съоръжения. Част 22-5: Изпитвания на електрически смущаващи въздействия. Изпитване на устойчивост на импулс (IEC 60255-22-5:2008) (или еквивалент/и);

БДС EN 60255-22-6:2003 Електрически релета. Част 22-6: Изпитвания за електрически смущаващи въздействия на измервателни релета и защитни съоръжения. Устойчивост на кондуктивни смущаващи въздействия, индуцирани от радиочестотни полета (IEC 60255-22-6:2001) (или еквивалент/и);

БДС EN 60255-27:2014 Измервателни релета и защитни съоръжения. Част 27: Изисквания за безопасност на продукта (IEC 60255-27:2013) (или еквивалент/и);

БДС EN 60255-1:2009 Измервателни релета и защитни съоръжения. Част 1: Общи изисквания (IEC 60255-1:2009) (или еквивалент/и);

БДС EN 60255-5:2002 Електрически релета. Част 5: Координация на изолацията за измервателни релета и защитни съоръжения. Изисквания и изпитвания (IEC 60255-5:2000) (или еквивалент/и);

БДС EN 60255-6:2003 Електрически релета. Част 6: Измервателни релета и защитни съоръжения (IEC 60255-6:1988, с промени) (или еквивалент/и);

БДС EN 60255-11:2010 Измервателни релета и защитни съоръжения. Част 11: Спадания, кратковременни прекъсвания, промени и пулсации на напрежението върху помощни захранващи изводи (IEC 60255-11:2008) (или еквивалент/и);

БДС EN 60255-21-1:2003 Електрически релета. Част 21: Изпитвания на вибрации, удари, тръскане и сеизмични изпитвания на измервателни релета и защитни съоръжения. Раздел 1: Изпитвания на вибрации (синусоидални) (IEC 60255-21-1:1988) (или еквивалент/и);

БДС EN 60255-21-2:2003 Електрически релета. Част 21: Изпитвания на вибрации, удари, тръскане и сеизмични изпитвания на измервателни релета и защитни съоръжения. Раздел 2: Изпитвания на удари и тръскане (IEC 60255-21-2:1988) (или еквивалент/и);

БДС EN 60255-21-3:2003 Електрически релета. Част 21: Изпитвания на вибрации, удари, тръскане и сеизмични изпитвания на измервателни релета и защитни съоръжения. Раздел 3: Сеизмични изпитвания (IEC 60255-21-3:1993) (или еквивалент/и);

БДС EN 60068-2-1:2007 Изпитване на въздействия на околната среда. Част 2-1: Изпитвания. Изпитване А: Студ (IEC 60068-2-1:2007) (или еквивалент/и);

БДС EN 60068-2-2:2008 Изпитване на въздействия на околната среда. Част 2-2: Изпитвания. Изпитване В: Суха топлина (IEC 60068-2-2:2007) (или еквивалент/и);


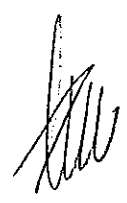
БДС EN 61000-4-3:2006 Електромагнитна съвместимост (ЕМС). Част 4-3: Методи за изпитване и измерване. Изпитване за устойчивост на излъчено радиочестотно електромагнитно поле (IEC 61000-4-3:2006) (или еквивалент/и);

БДС EN 61000-4-4:2006 Електромагнитна съвместимост (ЕМС). Част 4-4: Методи за изпитване и измерване. Изпитване на устойчивост на електрически бърз преходен процес/пакет импулси (IEC 61000-4-4:2004) (или еквивалент/и);

БДС EN 61000-4-5:2014 Електромагнитна съвместимост (ЕМС). Част 4-5: Методи за изпитване и измерване. Изпитване на устойчивост на отскок (IEC 61000-4-5:2014) (или еквивалент/и);

БДС EN 61000-4-6:2014 Електромагнитна съвместимост (ЕМС). Част 4-6: Методи за изпитване и измерване. Устойчивост на кондуктивни смущаващи въздействия, индуцирани от радиочестотни полета (IEC 61000-4-6:2013) (или еквивалент/и);

БДС EN 61000-4-8:2010 Електромагнитна съвместимост (ЕМС). Част 4-8: Методи за изпитване и измерване. Изпитване на устойчивост на магнитно поле, причинено от честоти на захранващите напрежения (IEC 61000-4-8:2009) (или еквивалент/и);



БДС EN 61850-5:2013 Съобщителни мрежи и системи за автоматизация на преноса и разпределението на енергия. Част 5: Изисквания за връзки за функции и модели на устройства (IEC 61850-5:2013) (или еквивалент/и);

БДС EN 60870-5-103:2003 Устройства и системи за дистанционно управление. Част 5-103: Протоколи за предаване. Съответстващ стандарт за информационния интерфейс на защитни устройства (IEC 60870-5-103:1997) (или еквивалент/и).

Характеристики на работната среда:

№	Характеристика	Стойност
	Място на монтиране	На закрито
	Максимална температура на околната среда	До + 55°C
	Минимална температура на околната среда	Минус 20°C
	Надморска височина	До 1000 m
	Относителна влажност	До 90% при 20°C

Параметри на електрическата разпределителна мрежа:

№	Параметър	Стойност
	Номинално напрежение	110 kV
	Максимално работно напрежение	123 kV
	Номинална честота	50 Hz
	Брой на фазите	3
	Заземяване на звездния център	Директно заземен звезден център

№	Параметър	Стойност	
	Номинални напрежения	10 000 V	20 000 V
	Максимални работни напрежения	12 000 V	24 000 V
	Номинална честота	50 Hz	
	Брой на фазите	3	
	Заземяване на звездния център	През активно съпротивление	

Технически данни за основна цифрова надлъжна диференциална защита на силов тринамотъчен трансформатор, които се попълват от Участника в графа „Гарантирано предложение“:

Номер на стандарта		Основна цифрова надлъжна диференциална защита на силов тринамотъчен трансформатор	
20 18 2201			
Название на материала		Основна ЦНДЗ СТТ	
Съкратено название на материала			
№	Технически параметър	Изискване	Гарантирано предложение
	Тип	Да се посочи	Sprecon-E-P-D3Q6
	Производител	Да се посочи	Sprecher Automation GmbH, Австрия

Технически данни за основна цифрова надлъжна диференциална защита на силов тринамотъчен трансформатор, които се гарантират от Участника, че предложеното оборудване отговаря на посочените по-долу минималните технически изисквания на Възложителя:

№	Технически параметър	Минимални технически изисквания
	Оперативно напрежение	220 V DC/AC ±20 %
	Аналогови входове:	-

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-	Брой токови входове	9
-	Номинален ток	5 A
2.1	Претоварване в токовите вериги:	-
-	Трайно	4 In
-	За 1 s	100 In
	Функционални изисквания:	-
-	Наличие на спирачна характеристика с най-малко два настройваеми наклона.	Да
-	Бързодействие (заедно с времето на изходните релета) при съотношение между диференциалния ток и настройката – $I_{diff}/I_{sett} > 3$.	35 ms
-	Точност при измерване на диференциалния и спирачен ток в % от настройката.	5 %
-	Минимален диференциален ток на заработване на диференциалната защита – от 0.1 до 0.5 In.	0.2 I втор.ном.
-	Наличие на алгоритъм „Неизправност в токовите вериги“.	Да
-	Блокировка от намагнитващия ток на трансформатора, при включване на празен ход. Като взаимно допълващи се критерии да се използват съдържание на втори и пети хармоник и формата на синусоидата.	Да
-	Нечувствителност при външни къси съединения, включително и при насищане на токовите трансформатори.	Да
-	Вътрешно изравняване на преводните отношения на токовите трансформатори и на групата на свързване на силовия трансформатор посредством дефиниране на параметри от клавиатурата на устройството.	Да
-	Наличие на диференциална токова отсечка (ДТО) за ускорено изключване при големи токове на к.с.	Да
-	Бързодействие на ДТО (заедно с времето на изходните релета).	20 ms
-	Диапазон за настройка на тока на заработване на ДТО.	(8 + 20) In
-	Възможност за програмно определяне на предназначението на цифровите входове и изходи.	Да
-	Възможност за настройка на продължителността на изходния импулс.	Да
-	Наличие на функция претоварване на страна 110/10 kV.	Да
-	Брой стъпала на претоварване с независимо от тока закъснение.	2
-	Бързодействие на претоварването с включено време на изходното реле.	35 ms

Технически данни за резервна цифрова максималнотокова защита на силов тринамотъчен трансформатор, които се попълват от Участника в графа „Гарантирано предложение“:

Номер на стандарта	Резервна цифрова максималнотокова защита на силов тринамотъчен трансформатор
20 18 2202	
Название на материала	
Съкратено название на материала	Резервна ЦМТ3 СТТ

№	Технически параметър	Изискване	Гарантирано предложение
	Тип	Да се посочи	MCA4-2D0ATA
	Производител	Да се посочи	Woodward Kempen GmbH, Германия

Технически данни за резервна цифрова максималнотокова защита на силов тринамотъчен трансформатор, които се гарантират от Участника, че предложеното оборудване отговаря на посочените по-долу минималните технически изисквания на Възложителя:

№	Технически параметър	Минимални технически изисквания
	Оперативно напрежение	220 V DC/AC $\pm 20\%$
	Аналогови входове:	-
-	Брой токови входове	4
-	Номинален ток	5 A
-	Претоварване в токовите вериги:	-
2.1	Трайно	4 In
-	За 1 s	100 In
-	Диапазон на точна работа	0.1+30 In
-	Измервани (изчислени) величини:	-
-	Токове IA, IB, IC, 3Io	4
-	Функционални изисквания:	-
-	Вградена функция на МТЗ с брой стъпала с независимо от тока закъснение.	Min 3
-	Независима настройка по време за всяко стъпало.	Да
-	Бързодействие на защитата с включено време на изходното реле.	35 ms
-	Диапазон на настройка по време	0+10 s
-	Минимална стъпка на настройката по време	0.1 s
-	Диапазон на настройка по време	0+10 s
-	Допустима грешка на таймерите	1 % от настройката или 10 ms
-	Възможност за ускоряване на изключването от избрано стъпало след получаване на външна команда.	Да
-	Ускорено изключване след включване върху к.с.	Да

Общи технически параметри, характеристики и др. данни за ЦЗ, които се гарантират от Участника, че предложеното оборудване отговаря на посочените по-долу минималните технически изисквания на Възложителя:

№	Параметър/характеристика	Изискване
	Защити и автоматика:	-
-	Основна надлъжно-диференциална защита.	Да
-	Резервна максимално токова защита (МТЗ) и резервна земна защита (ЗЗ) (вградена в релеен комплект на МТЗ). Резервната МТЗ е изпълнена в отделен хардуер, независим от основната НДЗ на трансформатора.	Да
	Обща функционалност:	-

№	Параметър/характеристика	Изискване
-	Командите за изключване на прекъсвачите да се препращат чрез помощни релета, които да комутират и "+" и "-" на изключвателните бобини. Веригите за управление и релейни защиты да имат постоянен контрол на захранващото оперативно напрежение.	Да
-	Независимост от насищането на ТТ и незаработване при външни къси съединения	Да
-	Всяка една от защитните функции, които са интегрирани в една защита да е с възможност за извеждане от действие, независимо от другите.	Да
-	ЦЗ да има възможност за създаване и поддържане на минимум два набора от настройки и конфигурации, които могат да се избират дистанционно или от мястото на експлоатация .	Да
-	Защитите да следят и сигнализируют за възникване на несиметричен режим.	Да
-	Всички защиты трябва да притежават свободно програмируеми цифрови входове, изходи и светодиодна индикация, както и възможност за задаване на продължителността на импулса за изключване за всеки цифров изход по отделно.	Да
-	Да е осигурена аварийна сигнализация при неизпълнена команда, подаване на неразрешени команди и други.	Да
-	При отпадане на захранването да се запазват въведените настройки, конфигурации, аварийната и архивната информации.	Да
-	Контрол на броя и вида на изключванията на прекъсвачите.	Да
-	ЦЗ трябва да имат 2 нива на достъп, реализирани с пароли и да позволяват: - потребителска настройка на комуникацията от място(от лицев панел) или дистанционно(от лицев панел, с преносим компютър и дистанционно). - потребителска настройка на защитните функции, конфигуриране и тестване от място (от лицев панел, с преносим компютър и дистанционно).	Да
-	Всеки запис в регистъра на аварийна информация, да съдържа астрономическо време и пълни данни, характеризиращи събитието. Регистраторът на аварийна информация да осигурява и осцилографна информация с история и предистория за зададен времеви интервал за регистрирано събитие.	Да
-	ЦЗ трябва да включва система за самоконтрол и самодиагностика, включително и на комуникациите с вътрешни и външни потребители.	Да
-	Всички защиты трябва да притежават вграден LCD/LED-дисплей за визуализиране на текущо измерваните ефективни стойности (модул и фаза) на всеки от аналоговите входове на устройството и аварийната информация.	Да

№	Параметър/характеристика	Изискване
-	Всяка защита да притежава стандартен интерфейс за комуникация по Ethernet, RS-485 или оптичен интерфейс, стандартен интерфейс за комуникация с персонален компютър, необходим при осъществяване на функции по настройка, конфигуриране и изчитане на регистрирана от защитата информация и съответно програмно осигуряване.	Да
-	Комуникационния интерфейс за връзка с RTU да се счита като неразделна част от ЦЗ. Комуникационния интерфейс да има светодиодна индикация за режима на работа.	Да
-	Да се осигури възможност за шунтиране на токовите вериги и присъединяване на външна измервателна техника на изградените клемореди.	Да
	Клеми на токови и оперативни вериги	Винтови клеми позволяващи присъединяване на медни проводници, клас 1, със сечение между 1,5 mm ² и 4 mm ² (Степен на защита: min IP20).
	Лицев панел:	-
-	Наличие на LCD/LED дисплей и светодиодна индикация на лицевия панел, зареждане, изключване, неизправност на защитата и др. (Дисплеят трябва да бъде ясно четим при всички възможни условия на осветление в помещението, дори при пълен мрак).	Да
-	Брой на светодиодните индикатори с възможност за мигаща индикация и наличие на два цвята при промяна на състоянието, зелен-червен (програмируеми).	≥ 12
-	Заводски програмирани светодиоди за състоянието на ЦЗ.	2
-	Визуализиране на дисплея на параметрите за настройка и на текущите и архивирани данни от работата на защитата.	Да
-	Наличие на клавиатура за визуализиране на информация от работата на устройството, за настройка и конфигуриране и за управление на прекъсвача.	Да
-	Всяка от защитите, на лицевия си панел, трябва да има като минимум сигнализация за „Неизправност“ и „Задействала РЗ“.	Да
-	Степен на защита на лицева панел	IP 54
	Комуникации:	-
-	Наличие на стандартен интерфейс и протокол съгласно БДС EN 60870-5-103, БДС EN 61850-5, MODBUS RTU и MODBUS TCP/IP за оптична или жична връзка с локална мрежа за предаване на информация от дневника на събития и от аварийния регистратор и за управление на силовото комутиращо устройство.	Да

№	Параметър/характеристика	Изискване
-	Достъп от РС и от собствената клавиатура до промяна на настройките и на вградените защитни и комуникационни функции.	Да
-	Достъп от РС и от собствената клавиатура до промяна на конфигурацията.	Да
-	Наличие на стандартен интерфейс на лицевия панел за връзка с преносим компютър.	Да
-	Наличие на сменяема парола за различните нива на достъп до данните за настройките на: - комуникационни функции на ЦЗ; - защитни функции на ЦЗ.	Да
-	Буфериране на информацията при повреда в комуникациите.	Да
	Управляващи изходи:	-
-	Номинално работно напрежение за изходните контакти	220 V DC \pm 20 %
-	Време на заработване	10 ms
-	Допустим ток при отваряне на контактите при $L/R < 40$ ms (при 220 V DC \pm 20 %)	0.1 A
-	Траен допустим ток през затворен контакт (при 220 V DC \pm 20 %)	5 A
-	Брой на управляващите изходи – команда за изключване към всяка от страните на трансформатора.	≥ 3
	Сигнални изходи:	-
-	Номинално работно напрежение за изходните контакти	220 V DC \pm 20 %
-	Допустим ток при отваряне на контактите при $L/R < 40$ ms (при 220 V DC \pm 20 %)	0.06 A
-	Брой сигнални изходи – за изключване от ДЗТ/ДТО, максималнотокова защита, заработила земна защита, заработила защита от претоварване, готовност на устройството и др.	≥ 6
	Измервани (изчислени) величини на НДЗ:	-
-	Фазови токове за трите страни на трансформатора, диференциални токове и ток I_0 през заземяването на звездния център на страна 110 kV.	Да
-	Ъгли между подадените към защитата токове.	Да
-	Данни от моментното състояние на алгоритъма за защитата от претоварване.	Да
	Цифрови входове на НДЗ	-
-	Номинално захранващо напрежение	220 V DC/AC \pm 20 %
-	Брой на цифровите входове	≥ 10
-	Праг на заработване	≥ 130 V DC
	Цифрови входове на РМТЗ	-
-	Номинално захранващо напрежение	220 V DC/AC \pm 20 %
-	Брой на цифровите входове – ускорение на МТЗ, ръчно включване/изключване и др.	≥ 6
-	Праг на заработване	≥ 130 V DC
	Регистратори:	-

№	Параметър/характеристика	Изискване
-	Наличие на функция „регистратор на събития“ (fault recorder).	Да
-	Точност на записа при регистриране на събития.	1 ms
-	Брой и съдържание на регистрираните събития – вид зароботилата защита, вид на късото съединение, дата/време.	≥ 10
-	Наличие на функция „авариен регистратор“ (disturbance recorder).	Да
-	Скорост на сканиране.	1000 Hz
-	Обем на буфера за регистриране на аварийни събития.	≥ 15 s
	Софтуер	<p>А) Софтуерът за параметризация да е последна версия и с min 5 (пет) безплатни лицензии). В потребителската си част, напълно документиран и така структуриран, че да може да се променят и добавят бързо нови функции.</p> <p>Б) Надграждането (upgrade) и обновяването (update) на софтуерът (firmware) на ЦЗ се предоставя на възложителя безплатно за срока на експлоатация на ЦЗ..</p> <p>В) ЦЗ трябва да позволяват тестване и обслужване на отделни локални устройства без да се повлиява работата на останалите. Изпитването на двоичните входове и изходи не трябва да предизвиква загуба или промяна на данни от входа или към изхода, който се тества. ЦЗ при тези проби не трябва да стартира или рестартира своята вътрешна логика, нито да се отрази на данните, които са архивирани в нея.</p>

№	Параметър/характеристика	Изискване
		<p>Г) Софтуерът на ЦЗ трябва да изпълнява основно следните функции: управление и блокировки на команди към комутационните електрически съоръжения тип на защитата; сигнализиране и архивиране на състоянието на високоволтовото оборудване; измерване на аналогови величини от измервателните трансформатори към съответните присъединения; изчисляване на аналогови величини; архивиране, обработка и визуализиране на данни от аварийните регистратори; настройка и конфигуриране на всяка защитна функция; настройка и конфигуриране на комуникационния интерфейс; съхраняване на събития и измерени аналогови стойности; поддържане на база данни, възможност за конфигуриране и за потребителско дефиниране на различни видове справки; самотестване и самодиагностика на ЦЗ; моделиране и симулация;</p>
	Монтаж	<p>А) ЦЗ трябва да са изградени като система за вграждане в 19" рамка на шкаф и да притежават пълна независимост от външни електромагнитни влияния.</p> <p>Б) монтаж: съгласно проекта</p> <p>В) Всички операции трябва да се извършват от лицевата част, като не трябва да е необходим достъп отстрани.</p>
	Маркировка	<p>Маркировката трябва да бъде надеждно и трайно нанесена. Типът, номиналните данни, сериен номер, хардуерна и софтуерна версия на ЦЗ трябва да бъдат маркирани в буквено-цифров вид. Всички клемореди, клеми, платки, слотове и т.н. трябва да бъдат ясно маркирани. Обикновени самозалепващи стикери не са допустими.</p>

№	Параметър/характеристика	Изискване
	Окомплектовка	- Лицензиран потребителски софтуер, с min 5 (пет) безплатни лицензии) и кабел за връзка на защитата със преносим компютър(или друго техническо решение), както и други аксесоари в зависимост от указанията на производителя.
	Проектна експлоатационна дълготрайност, год.	≥ 20 години

ТАБЛИЦА 5

Стандарт на материала за цифрови защиты за въздушни и кабелни електропроводни линии Ср.Н.

Характеристика на материала:

Цифровата защитата е микропроцесорно (цифрово) устройство, което автоматично изключва защитаваните електрически съоръжения, при нарушаване на нормалният режим на работа. Всички функции от регистрирането на измерваните стойности до подаване на команда за изключване на силовия прекъсвач се преработват цифрово. ЦЗ има вградена система за телеизмерване, телесигнализация, телеуправление и местна сигнализация. Притежава вграден регистратор на информация за осцилографен анализ на аварийните събития и процеси, енергонезависима памет и изпълнява функциите: управление, контрол, измерване, мониторинг и защита.

ЦЗ да има комуникационен интерфейс за връзка с телемеханичен периферен пост (RTU – Remote Terminal Unit). Комуникационния интерфейс да има възможност за свързване към двупроводна и четирипроводна RS-485 мрежа, със скорост на предаване до 38400 BdD, или към мрежа с оптичен кабел. Връзката се осъществява посредством сериен, RJ-45 или HFBR-4516Z connector..

ЦЗ е поместена в самостоятелна кутия с възможност за монтаж върху панел, със степен на защита min IP 51, с LCD/LED дисплей на лицевата страна за извеждане на информация (визуализиране на моментни стойности на електрически величини) и клавиатура за управление на менюто. ЦЗ да позволява да се изпълняват управляващи функции, с помощта на които се дава възможност за извършване на комутации на силовите елементи чрез клавиатурата или чрез използване на системен интерфейс посредством дистанционно управление.

При използването на ЦЗ като защита на електропроводи, вградената функция на автоматично повторно включване (АПВ) да позволява минимум три опита за включване на прекъсвача на изводно поле и възможност за ускорение преди и след АПВ.

По време на късо съединение в защитаваната част на електрическата мрежа, величината на моментната стойност на тока да се записва за период от 5 секунди и да е на разположение за последващ анализ на преходния процес.

Постоянният контрол на апаратната част и програмното осигуряване на ЦЗ да позволява бързо сигнализиране при вътрешни повреди и неизправности. Токовете релета на ЦЗ да имат възможност за конфигурация при работа с фазни или междуфазни токове, което позволява схемата им на свързване да бъде осъществена с два или три токови трансформатори, в зависимост от начина на заземяване на звездния център на защитаваната мрежа.

Използване:

Цифровата защита се използва основно като максималнотокова защита с независими от тока времехарактеристики или като максималнотокова защита със зависими характеристики на забавяне (при налично обосновано решение) и намира приложение за управление и контрол на въздушни и кабелни електропроводни линии и Доставка на трифазен маслонапълнен понижаващ трансформатор 110/Ср.Н. в разпределителните мрежи СрН.

Съответствие на предлаганото изделие със стандартизационните документи:

Цифровите защиты трябва да отговарят на посочените по долу стандарти или еквиваленти, включително на техните валидни изменения и допълнения:

БДС EN 60255-22-1:2008 Измервателни релета и защитни съоръжения Част 22-1: Изпитване на смущаващи въздействия. Изпитване на пакети импулси с честота 1 MHz (IEC 60255-22-1:2007) (или еквивалент/и);

БДС EN 60255-22-2:2008 Измервателни релета и защитни съоръжения. Част 22-2: Изпитвания на електрически смущаващи въздействия – Изпитване на устойчивост на електростатични разряди (IEC 60255-22-2:2008) (или еквивалент/и);

БДС EN 60255-22-3:2008 Измервателни релета и защитни съоръжения. Част 22-3: Изпитвания на електрически смущаващи въздействия. Изпитване на устойчивост на излъчено електромагнитно поле (IEC 60255-22-3:2007) (или еквивалент/и);

БДС EN 60255-22-4:2008 Измервателни релета и защитни съоръжения. Част 22-4: Изпитвания на електрически смущаващи въздействия. Изпитване на устойчивост на електрически бърз преходен процес/пакет импулси (IEC 60255-22-4:2008) (или еквивалент/и);

БДС EN 60255-22-5:2011 Измервателни релета и защитни съоръжения. Част 22-5: Изпитвания на електрически смущаващи въздействия. Изпитване на устойчивост на импулс (IEC 60255-22-5:2008) (или еквивалент/и);

БДС EN 60255-22-6:2003 Електрически релета. Част 22-6: Изпитвания за електрически смущаващи въздействия на измервателни релета и защитни съоръжения. Устойчивост на кондуктивни смущаващи въздействия, индуцирани от радиочестотни полета (IEC 60255-22-6:2001) (или еквивалент/и);

БДС EN 60255-27:2014 Измервателни релета и защитни съоръжения. Част 27: Изисквания за безопасност на продукта (IEC 60255-27:2013) (или еквивалент/и);

БДС EN 60255-1:2010 Измервателни релета и защитни съоръжения. Част 1: Общи изисквания (IEC 60255-1:2009) (или еквивалент/и);

БДС EN 60255-5:2002 Електрически релета. Част 5: Координация на изолацията за измервателни релета и защитни съоръжения. Изисквания и изпитвания (IEC 60255-5:2000) (или еквивалент/и);

БДС EN 60255-6:2003 Електрически релета. Част 6: Измервателни релета и защитни съоръжения (IEC 60255-6:1988, с промени) (или еквивалент/и);

БДС EN 60255-11:2010 Измервателни релета и защитни съоръжения. Част 11: Спадания, кратковременни прекъсвания, промени и пулсации на напрежението върху помощни захранващи изводи (IEC 60255-11:2008) (или еквивалент/и);

БДС EN 60255-21-1:2003 Електрически релета. Част 21: Изпитвания на вибрации, удари, тръскане и сеизмични изпитвания на измервателни релета и защитни съоръжения. Раздел 1: Изпитвания на вибрации (синусоидални) (IEC 60255-21-1:1988) (или еквивалент/и);

БДС EN 60255-21-2:2003 Електрически релета. Част 21: Изпитвания на вибрации, удари, тръскане и сеизмични изпитвания на измервателни релета и защитни съоръжения. Раздел 2: Изпитвания на удари и тръскане (IEC 60255-21-2:1988) (или еквивалент/и);

БДС EN 60255-21-3:2003 Електрически релета. Част 21: Изпитвания на вибрации, удари, тръскане и сеизмични изпитвания на измервателни релета и защитни съоръжения. Раздел 3: Сеизмични изпитвания (IEC 60255-21-3:1993) (или еквивалент/и);

БДС EN 60068-2-1:2007 Изпитване на въздействия на околната среда. Част 2-1: Изпитвания. Изпитване А: Студ (IEC 60068-2-1:2007) (или еквивалент/и);

БДС EN 60068-2-2:2008 Изпитване на въздействия на околната среда. Част 2-2: Изпитвания. Изпитване В: Суха топлина (IEC 60068-2-2:2007) (или еквивалент/и);

БДС EN 61000-4-3:2006 Електромагнитна съвместимост (EMC). Част 4-3: Методи за изпитване и измерване. Изпитване за устойчивост на излъчено радиочестотно електромагнитно поле (IEC 61000-4-3:2006); (или еквивалент/и)

БДС EN 61000-4-4:2006 Електромагнитна съвместимост (EMC). Част 4-4: Методи за изпитване и измерване. Изпитване на устойчивост на електрически бърз преходен процес/пакет импулси (IEC 61000-4-4:2004) (или еквивалент/и);

БДС EN 61000-4-5:2014 Електромагнитна съвместимост (EMC). Част 4-5: Методи за изпитване и измерване. Изпитване на устойчивост на отскок (IEC 61000-4-5:2014); (или еквивалент/и)

БДС EN 61000-4-6:2014 Електромагнитна съвместимост (EMC). Част 4-6: Методи за изпитване и измерване. Устойчивост на кондуктивни смущаващи въздействия, индуцирани от радиочестотни полета (IEC 61000-4-6:2013) (или еквивалент/и);

БДС EN 61000-4-8:2010 Електромагнитна съвместимост (EMC). Част 4-8: Методи за изпитване и измерване. Изпитване на устойчивост на магнитно поле, причинено от честоти на захранващите напрежения (IEC 61000-4-8:2009) (или еквивалент/и);

БДС EN 61850-5:2013 Съобщителни мрежи и системи за автоматизация на преноса и разпределението на енергия. Част 5: Изисквания за връзки за функции и модели на устройства (IEC 61850-5:2013) (или еквивалент/и);

БДС EN 60870-5-103:2003 Устройства и системи за дистанционно управление. Част 5-103: Протоколи за предаване. Съпътстващ стандарт за информационния интерфейс на защитни устройства (IEC 60870-5-103:1997) (или еквивалент/и);

Характеристики на работната среда:

№	Характеристика	Стойност
	Място на монтиране	На закрито
	Максимална температура на околната среда	До + 55°C
	Минимална температура на околната среда	Минус 20°C
	Надморска височина	До 1000 m
	Относителна влажност	До 90% при 20°C

Параметри на електрическата разпределителна мрежа:

№	Параметър	Стойност	
	Номинални напрежения	10 000 V	20 000 V
	Максимални работни напрежения	12 000 V	24 000 V
	Номинална честота	50 Hz	
	Брой на фазите	3	
	Заземяване на звездния център	През активно съпротивление	

Технически данни за непосочна цифрова защита за въздушни и кабелни електропроводни линии Ср.Н., които се попълват от Участника в графа „Гарантирано предложение“:

Номер на стандарта		Непосочна цифрова защита за въздушни и кабелни електропроводни линии СрН	
20 18 2002			
Название на материала			
Съкратено название на материала		Непосочна ЦЗ ВКЕЛ СрН	
№	Технически параметър	Изискване	Гарантирано предложение
	Тип	Да се посочи	MCA4-2A0ATA
	Производител	Да се посочи	Woodward Kempen GmbH, Германия

Технически данни за непосочна цифрова защита за въздушни и кабелни електропроводни линии Ср.Н., които се гарантират от Участника, че предложеното оборудване отговаря на посочените по-долу минималните технически изисквания на Възложителя:

№	Технически параметър	Изискване
	Аналогови входове:	-
1.1	Токови входове	-
-	Брой токови входове – Ia, Ib, Ic, 3Io	4
-	Номинален ток	5 A
1.2	Термично претоварване в токовите вериги:	-
-	Трайно	4 In постоянно
-	За 30 s	30 In
-	За 1 s	100 In
-	Динамично претоварване за ½ T	250 In

	Функционални изисквания:	-
2.1	Настройка на времерелетата за МТЗ:	-
-	Диапазон на настройка по ток към съответните стъпала	0,1+25 In стъпка 0,01 или ∞
-	Диапазон на настройка на времерелетата към съответните стъпала	0,00+60,00 s със стъпка 0,01
2.2	Настройка на времерелетата за ТО:	-
-	Диапазон на настройка по ток към съответните стъпала	0,1+12,5 In стъпка 0,01 или ∞
2.3	Настройка на времерелетата за ТЗЗ:	-
-	Диапазон на настройка по ток към съответните стъпала	0,05+25 In стъпка 0,01 или ∞
-	Диапазон на настройка на времерелетата към съответните стъпала	0,00+60,00 s със стъпка 0,01

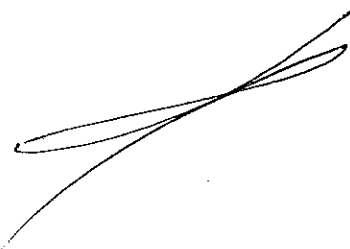
Общи технически параметри, характеристики и др. данни, които се гарантират от Участника, че предложеното оборудване отговаря на посочените по-долу минималните технически изисквания на Възложителя:



№	Параметър/характеристика	Изискване
	Защити и автоматика:	-
-	Трифазна двустъпална максималнотокова защита с независими от тока характеристики	Да
-	Трифазна едностъпална бързодействаща токова отсечка с независими от тока характеристики	Да
-	Трифазна двустъпална токова земна защита с независими от тока характеристики	Да
-	Всяка една от защитните функции, които са интегрирани в една защита да е с възможност за извеждане от действие, независимо от другите.	Да
-	ЦЗ да има възможност за създаване и поддържане на минимум два набора от настройки и конфигурации, които могат да се избират дистанционно или от мястото на експлоатация.	Да
-	Защитите да следят и сигнализират за възникване на несиметричен режим.	Да
-	За земна защита, резултатния земен ток да се изчислява от ЦЗ, като в съответния ѝ токов вход може да бъде присъединен както токов трансформатор тип „ФЕРАНТИ“, така и филтър за токове с нулева последователност, изпълнен чрез три фазни токови трансформатори. Начинът на присъединяването на ЦЗ за отчитане на токовете на земно съединение да се определя индивидуално за всеки конкретен случай.	Да
-	Наличие на вграден часовник (астрономично време) Д/М/Г час:мин:сек:милисекунди и възможност за синхронизация.	Да
-	Всички защиты трябва да притежават свободно програмируеми цифрови входове, изходи и светодиодна индикация, както и възможност за задаване на продължителността на импулса за изключване за всеки цифров изход по отделно.	Да

№	Параметър/характеристика	Изискване
-	Да е осигурена аварийна сигнализация при неизпълнена команда, подаване на неразрешени команди и други.	Да
-	ЦЗ трябва да имат 2 нива на достъп, реализирани с пароли и да позволяват: - потребителска настройка на комуникацията от място(от лицев панел) или дистанционно(от лицев панел, с преносим компютър и дистанционно). - потребителска настройка на защитните функции, конфигуриране и тестване от място (от лицев панел, с преносим компютър и дистанционно).	Да
-	При отпадане на захранването да се запазват въведените настройки, конфигурации, аварийната и архивната информации.	Да
-	Контрол на броя и вида на изключванията на прекъсвачите.	Да
-	Всеки запис в регистъра на аварийна информация, да съдържа астрономическо време и пълни данни, характеризиращи събитието. Регистраторът на аварийна информация да осигурява и осцилографна информация с история и предистория за зададен времеви интервал за регистрирано събитие.	Да
-	Всички защиты трябва да притежават вграден LCD/LED-дисплей за визуализиране на текущо измерваните ефективни стойности (модул и фаза) на всеки от аналоговите входове на устройството и аварийната информация и мнемона схема.	Да
-	Всяка защита да притежава стандартен интерфейс за комуникация по Ethernet, RS-485 или оптичен интерфейс, стандартен интерфейс за комуникация с персонален компютър, необходим при осъществяване на функции по настройка, конфигуриране и изчитане на регистрирана от защитата информация и съответно програмно осигуряване.	Да
-	Комуникационния интерфейс за връзка с RTU да се счита като неразделна част от ЦЗ. Комуникационния интерфейс да има светодиодна индикация за режима на работа.	Да
-	ЦЗ трябва да включва система за самоконтрол и самодиагностика, включително и на комуникациите с вътрешни и външни потребители.	Да
-	Да се осигури възможност за шунтиране на токовете вериги и присъединяване на външна измервателна техника на изградените клемореди.	Да
	Номинално оперативно напрежение	от 24 до 220 V DC \pm 20% и 220 V AC \pm 20%
	Буфер на захранването	\leq 50 ms
	Консумация на защитата при In	\leq 0.3 VA
	Номинален ток, In	5 A

№	Параметър/характеристика	Изискване
	Клеми на токови и оперативни вериги	Винтови клеми позволяващи присъединяване на медни проводници, клас 1, със сечение между 1,5 mm ² и 4 mm ² (Степен на защита: min IP 20).
	Лицев панел:	-
-	Наличие на LCD/LED дисплей и светодиодна индикация на лицева панел за мнемосхема, заработване, изключване, неизправност на защитата и др. (Дисплеят трябва да бъде ясно четим при всички възможни условия на осветление в помещението, дори при пълен мрак).	Да
-	Заводски програмирани светодиоди за състоянието на ЦЗ.	≥ 2
-	Брой на светодиодните индикатори с възможност за мигаща индикация и наличие на два цвята при промяна на състоянието, зелен-червен (програмируеми).	≥ 8
-	Визуализиране на дисплея на параметрите за настройка и на текущите и архивирани данни от работата на защитата.	Да
-	Наличие на клавиатура за визуализиране на информация от работата на устройството, за настройка и конфигуриране и за управление на прекъсвача.	Да
-	Степен на защита на лицев панел	IP 54
	Комуникации:	-
-	Наличие на стандартен интерфейс и протокол съгласно БДС EN 60870-5-103, БДС EN 61850-5, MODBUS RTU и MODBUS TCP/IP за оптична или жична връзка с локална мрежа за предаване на информация от дневника на събития и от аварийния регистратор и за управление на силовото комутиращо устройство.	Да
-	Достъп от РС и от собствената клавиатура до промяна на настройките и на вградените защитни и комуникационни функции.	Да
-	Достъп от РС и от собствената клавиатура до промяна на конфигурацията.	Да
-	Наличие на стандартен интерфейс на лицева панел за връзка с преносим компютър.	Да
-	Наличие на сменяема парола за различните нива на достъп до данните за настройките на: - комуникационни функции на ЦЗ; - защитни функции на ЦЗ.	Да
-	Буферизиране на информацията при повреда в комуникациите.	Да
	Двоични изходи:	-
-	Номинално работно напрежение на изходните контакти	от 24 до 220 V DC±20% и 220 V AC±20%
-	Допустим ток при отваряне на контактите при L/R<40ms (при 220V DC)	0.1 A

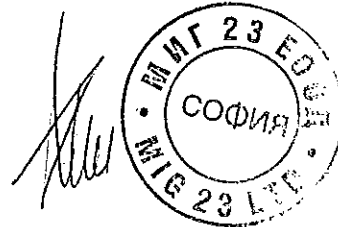
№	Параметър/характеристика	Изискване
-	Траен допустим ток през затворен контакт (при 220V DC)	5 A
-	Краткотраен допустим ток през затворен контакт (при 220V DC)	за 0.5 s
-	Брой програмируеми изходи	≥ 7
-	Измервани и изчислени величини:	-
-	Фазови токове и 3Io	4
-	Грешка при измерване на ефективните стойности на I в диапазона от 0.1-1.2 In в % от измерената стойност	1
-	Двоични входове:	-
-	Номинално захранващо напрежение	от 24 до 220V DC±20% и 220 V AC±20%
-	Брой програмируеми входове	≥ 6
-	Регистратори:	
-	Наличие на функция „регистратор на събития“ (fault recorder).	Да
-	Точност на записа при регистриране на събития.	1 ms
-	Брой и съдържание на регистрираните събития – вид заробителската защита, вид на късото съединение, дата/време.	≥ 10
-	Наличие на функция „авариен регистратор“ (disturbance recorder).	Да
-	Скорост на сканиране.	1000 Hz
-	Обем на буфера за регистриране на аварийни събития.	≥ 15 s
	Софтуер	<p>а) Софтуерът за параметризация да е последна версия и с min 5 (пет) безплатни лицензии). В потребителската си част, да е напълно документиран и така структуриран, че да може да се променят и добавят бързо нови функции.</p> <p>б) Надграждането (upgrade) и обновяването (update) на софтуерът (firmware) на ЦЗ се предоставя на възложителя безплатно за срока на експлоатация на ЦЗ.</p>

№	Параметър/характеристика	Изискване
		<p>В) ЦЗ трябва да позволяват тестване и обслужване на отделни локални устройства без да се повлиява работата на останалите. Изпитването на двоичните входове и изходи не трябва да предизвиква загуба или промяна на данни от входа или към изхода, който се тества. ЦЗ при тези проби не трябва да стартира или рестартира своята вътрешна логика, нито да се отрази на данните, които са архивирани в нея.</p> <p>Г) Софтуерът на ЦЗ трябва да изпълнява основно следните функции: управление и блокировки на команди към високоволтовото оборудване тип на защитата; сигнализиране и архивиране на състоянието на високоволтовото оборудване; измерване на аналогови величини от измервателните трансформатори към съответните присъединения; изчисляване на аналогови величини; архивиране, обработка и визуализиране на данни от аварийните регистратори; настройка и конфигуриране на всяка защитна функция; настройка и конфигуриране на комуникационния интерфейс; съхраняване на събития и измерени аналогови стойности; поддържане на база данни, възможност за конфигуриране и за потребителско дефиниране на различни видове справки; самотестване и самодиагностика на ЦЗ; моделиране и симулация.</p>
Монтаж		<p>а) ЦЗ трябва да са изградени като система за вграждане в 19" рамка на шкаф и да притежават пълна независимост от външни електромагнитни влияния.</p> <p>Б) монтаж съгласно проекта</p>

№	Параметър/характеристика	Изискване
		в) Всички операции трябва да се извършват от лицевата част, като не трябва да е необходим достъп отстрани.
	Маркировка	Маркировката трябва да бъде надеждно и трайно нанесена. Типът, номиналните данни, сериен номер, хардуерна и софтуерна версия на ЦЗ трябва да бъдат маркирани в буквено-цифров вид. Всички клемореди, клеми, платки, слотове и т.н. трябва да бъдат ясно маркирани. Обикновени самозалепващи стикери не са допустими.
	Окомплектовка	- Лицензиран потребителски софтуер, с min 5 (пет) безплатни лицензии) и кабел за връзка на защитата със преносим компютър(или друго техническо решение), както и други аксесоари в зависимост от указанията на производителя.
	Проектна експлоатационна дълготрайност, год.	≥ 20 години

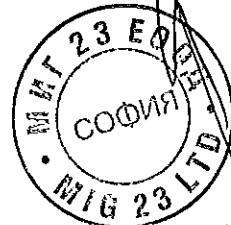
Дата: 20.04.2017



092

Клиент: ЧЕЗ България
Проект: България

ТЕХНИЧЕСКА СПЕЦИФИКАЦИЯ
ЗА
СИЛОВ ТРАНСФОРМАТОР
20/25 MVA, 110/21/10.5 kV



Оферта №:	ОТ 90-17			Изготвил:	
Дата:	04.2017			Проверил:	

093

ОБЩО ОПИСАНИЕ				
1.	Трансформаторът, описан в настоящата спецификация, е трифазен, маслонапълнен, тринамотъчен, предназначен за работа на открито при климатични условия, цитирани по-долу. Група на свързване YNyn0d5.			
СТАНДАРТИ И СПЕЦИФИКАЦИИ				
2.	Трансформаторът ще отговаря на заданието на Клиента, уточнения СВ.ДОС 1475, 1606 и 1862, последните редакции на IEC стандартите (имащи отношение към масло-напълнените трансформатори) и Регламент (ЕС) № 548/2014.			
УСЛОВИЯ НА РАБОТА НА ТРАНСФОРМАТОРА				
3.	3.1	Надморска височина	До 1000 m над морското равнище	
	3.2	Околна температура	Максимална: + 40 °С Минимална: - 30 °С	
ХАРАКТЕРИСТИКИ НА СИСТЕМА ВН				
4.	4.1	Брой фази	3	
	4.2	Номинална честота, Hz	50	
	4.3	Номинално напрежение, kV	110	
	4.4	Максимално напрежение на системата, kV	123	
	4.5	Изпитвателно напрежение мълниев импулс (BIL), 1.2/50 µs, kV peak	450	
ОПИСАНИЕ НА ОСНОВНИТЕ ВЪЗЛИ НА ТРАНСФОРМАТОРА				
5.	5.1	Магнитопровод		
	Магнитопроводът ще бъде изработен от висококачествена студено валцована, зърнесто ориентирана трансформаторна стомана с ниски загуби, изолирана двустранно с неорганично покритие. Типът на магнитопровода ще бъде триядрен с пълна коса снадка под ъгъл 45°. Магнитната верига ще бъде изолирана от металните елементи на конструкцията. Заземяването на магнитопровода ще бъде осъществено само в една точка на достъпно място под капака на трансформатора.			
	5.2	Намотки		
	Намотките на трансформатора ще бъдат навити от правоъгълен проводник от електротехническа мед. Те ще бъдат изолирани така, че да издържат специфичните работни и изпитвателни напрежения за съответните класове на изолация. Взаимното разположение на намотките ще осигурява максимално електромагнитно балансиране и електродинамична устойчивост по отношение на възможните къси съединения, на които може да бъде подложен трансформаторът. Изолационните материали, използвани в конструкцията на трансформатора, ще бъдат пресшпан и трафоборд. Изолационните и притегателните системи ще са оразмерени да издържат електрически и механични натоварвания съгласно по-горе цитираните стандарти по време на изпитване и нормална експлоатация. Главната изолация на трансформатора е от маслено-бариерен тип.			
	5.3	Казан		
	Казанът ще бъде изработен от висококачествена конструктивна (котлостроителна) стомана и укрепен с подходящи профилни греди.			
	Тип на казана		Камбана	
	Вид на основата		Колесници	
	Приспособления за преместване и повдигане		Трансформаторът ще бъде снабден с необходимите пети за крикове, куки, уши и отвори, позволяващи повдигането и изместването, както на целия трансформатор, така и на отделните му части (капак, активна част и пр.).	
	Заземяване		За свързване на казана на трансформатора към заземителния контур на централата ще бъдат предвидени две заземителни клеми, разположени долу ниско, близо до дъното на казана.	
5.4	Система за защита на маслото			
Трансформаторът ще бъде снабден с разширител с гумена торба и изсушител на въздуха, напълнен със силикагел. Размерите на разширителя и изсушителя ще бъдат съобразени с общото количество масло в трансформатора и условията, при които ще работи (надморска височина, околна температура и влажност на въздуха). Предвидено е отделение за маслото на съпалния регулатор. Практиката на производителя е в това отделение маслото да бъде в пряк контакт с въздуха.				
5.5	Тип на охладителната система – ONAN / ONAF			
Охлаждането на трансформатора ще се осъществява посредством пластинчати радиатори, разположени по периферията на казана, (виж чертеж OT 90-17) и подходящо избрани вентилатори, монтирани под тях. Управлението на охлаждането ще бъде осъществено ръчно и автоматично в съответствие с изменението на температурата на намотките.				
5.6	Масло			
Трансформаторното масло ще бъде минерално, инхибирано, отговарящо на изискванията на IEC 60296/2012, тип I.				

ОСНОВНИ ТЕХНИЧЕСКИ ПАРАМЕТРИ НА ТРАНСФОРМАТОРА

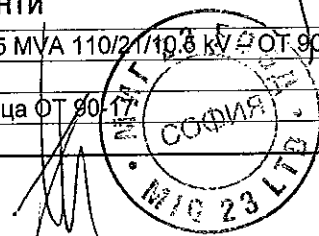
6.	6.1	Производител		Hyundai Heavy Industries Co. България
	6.2	Номинална мощност IEC 60076-1, ВН/НН/ТН ONAN ONAF	MVA MVA	20 / 12 / 12 25 / 15 / 15
	6.3	Номинално напрежение на празен ход	kV	110 / 21 / 10,5
	6.4	Номинална честота / Брой на фазите	Hz	50 / 3
	6.5	Група и схема на свързване на намотките	-	YNyn0d5
	6.6	Тип на регулиране на напрежението на страна ВН	-/kV	под товар/110kV±12 x 1.25%
	6.7	Звуково налягане, Lpa	dB	62
	6.8	Допуск на параметрите	-	Съгласно IEC 60076

Всички други технически параметри са посочени в „Гарантирано предложение“ Таблица OT 90-17

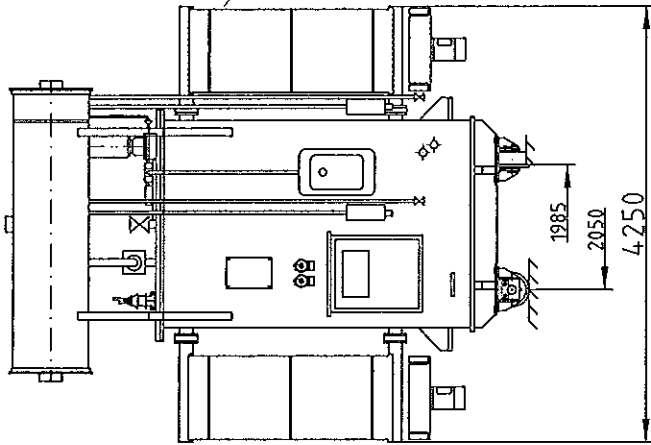
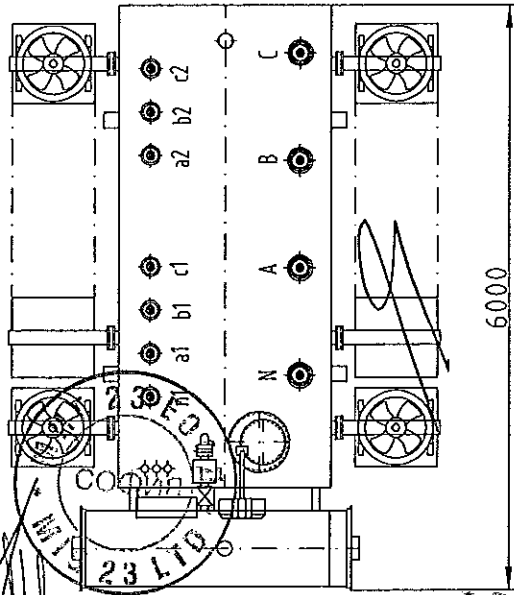
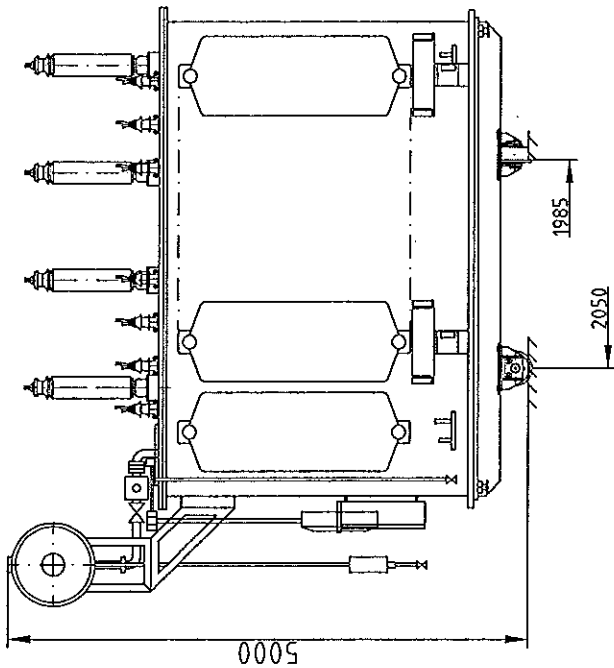
ОСНОВНИ ПРИНАДЛЕЖНОСТИ И ОКОМПЛЕКТОВКИ

7.	7.1	Изводи			
			ВН и ВН-N	НН и НН-N	ТН
	Тип		Кондензаторен тип, силикон	Твърда изолация	Твърда изолация
	Стандарт		IEC	IEC	IEC
	Номинално напрежение, kV		123	24	12
	Номинален ток, A		1.2xIn	1.2xIn	1.2xIn
	Изпитвателни напрежения LI/AC, kV		550 / 230	125 / 50	75 / 28
	Път на пролазване, mm		3813	744	372
	Разположение		На капака	На капака	На капака
	7.2	Регулатор на напрежение			
Тип на регулирането		Под товар			
Производител		Hyundai Heavy Industries Co. – Bulgaria			
Тип на регулатора		RSV 9.3 III 400 123			
Номинално напрежение, kV		123			
Изпитвателни напрежения LI / AC, kV		550 / 230			
Номинален ток, A		400			
Моторно задвижване:		MZ 4.4			
Струйно реле		Да			
Клапан за освобождаване на налягането		Да, диафрагмен тип			
Автоматичен регулатор на напрежение:		Не се изисква			
Дистанционен шкаф		Не се изисква			
Паралелна работа		Не се изисква			
7.3	Защитно реле (тип Бухолц)				
Трансформаторът ще бъде окомплектован със защитно газово реле (тип Бухолц). Релето ще бъде снабдено с един контакт за сигнал и един контакт за изключване.					
7.4	Температурни индикатори (ТИ)				
		ТИ на маслото	ТИ на намотки НН и ТН		
Брой контакти		2	3		
Управление на охлаждането		Не	Да		
Дистанционно отчитане		Не	Да		
Pt 100		Да	Да		
7.5	Клапан за освобождаване на налягането				
Казанът на трансформатора ще бъде защитен от повишено вътрешно налягане чрез предпазен клапан от пружинен тип с електрически контакт.					
7.6	Шкаф за локален контрол				
По стандарт на производителя.					
7.7	Нивопоказател				
Разширителят ще бъде снабден с два броя магнитни нивопоказатели с един нормално отворен и един нормално затворен контакт за сигнализация при достигане на минимално ниво на маслото. Единият нивопоказател ще показва нивото на маслото в казана, а другият ниво на маслото в отделението на съпалния регулатор.					

7.	7.8	Радиатори – горещо поцинковани		
	Охладителната система ще бъде изпълнена с радиатори, пластинчати. Радиаторите ще бъдат монтирани на стените на казана и ще бъдат отделени от него с плоски спирателни клапани, така че при необходимост да могат да се свалят, без да е необходимо да се източва масло от трансформатора. Всеки радиатор ще бъде снабден с устройство за обезвъздушаване, пробка за източване и куки за повдигане.			
	7.9	Токови трансформатори		
	Разположение:		Технически параметри:	Предназначение:
	НН линеен край на фаза „b1”		500/2A 3Fsn5 15VA	Захранване на ТИ на намотките
	ТН линеен край на фаза „b2”		1000/2A 3Fsn5 15VA	Захранване на ТИ на намотките
	7.10	Вентилни отводи		
Не се изискват.				
7.11	Система за мониторинг на горещи точки в трансформатора и разтворени газове в трансформаторното масло			
Примерен тип: LumaSense				
8.	ЗАЩИТНИ ПОКРИТИЯ			
	Покритията на трансформатора ще бъдат изпълнени в съответствие с Клиентската техническа спецификация, процедурата на завода производител и ще бъде съобразена с климатичните условия на експлоатация. Общата дебелина на защитното покритие ще бъде минимум 160 µm. Окончателния цвят на трансформатора ще бъде RAL7032. Защитните покрития на трансформатора ще бъдат съгласувани с Клиента, в случай на поръчка.			
9.	ИЗПИТВАНЕ			
	Трансформаторите ще бъдат изпитани в лабораториите на Производителя, в съответствие с изискванията на Техническото задание и IEC 60076. Изпитванията ще бъдат извършени по предварително изготвена от Hyundai Heavy Industries Co. България програма за изпитване. Устойчивостта на трансформатора на късо съединение се доказва по изчислителен път с помощта на специално създадени за целта компютърни програми.			
10.	ТРАНСПОРТ			
	Трансформаторът ще бъде транспортиран с масло приблизително 200 mm под капака по шосе с авторемарке, собственост на Hyundai Heavy Industries Co. България. За транспортни размери на трансформатора виж чертеж OT 90-17.			
11.	РЕЗЕРВНИ ЧАСТИ			
	11.1	ПРЕПОРЪЧАНИ ОТ ПРОИЗВОДИТЕЛЯ ЗА ДВЕ ГОДИНИ		
		Боя	2 kg	
		Силикагел	1 зарежд.	
		Комплект уплътнители	1	
	11.2	ПОИСКАНИ ОТ КЛИЕНТА		
		Извод ВН 123kV	1 бр.	
		Извод НН 24kV	1 бр.	
		Извод ТН 12kV	1 бр.	
		Трансформаторно масло	10%	
		Последен слой боя, RAL 7032	2 kg	
11.3	ЗА СИСТЕМА ЗА МОНИТОРИНГ НА ГАЗОВЕ В МАСЛОТО			
	фитинги за вентил 2"	1 бр.		
	монтажен адаптер 2"	1 бр.		
12.	КОМЕНТАРИ И ЗАБЕЛЕЖКИ			
	Стъпалният регулатор на напрежение може да превключва стъпалата при температура на маслото от -25 °C до 115 °C. При температура на маслото от -25 °C до -45 °C стъпалният регулатор на напрежение може да функционира, но без да превключва стъпала.			
13.	СПИСЪК С ПРИЛОЖЕНИ ДОКУМЕНТИ			
	13.1	Техническа спецификация за силов трансформатор 20/25 MVA 110/21/110.8 kV OT 90-17.		
	13.2	Чертеж на външен вид на трансформатора - OT 90-17		
	13.3	Попълнена таблица „Гарантирано предложение” – Таблица OT 90-17		
	13.4	Опаковъчен лист – OT 90-17		



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ПРЕДВАРИТЕЛЕН ЧЕРТЕЖ

NO DESCRIPTION

1. В.Н. ИЗВОД
2. В.Н.Н. ИЗВОД
3. Н.Н. ИЗВОД
4. Н.Н.Н. ИЗВОД
5. Т.Н. ИЗВОД
6. РЕГУЛАТОР СЪПЛАМЕН (P.C.)
7. МОТОРНО ЗАДВИЖВАНЕ
8. КОНСЕРВАТОР КАЗАН
9. КОНСЕРВАТОР P.C.
10. НИВОПОКАЗАТЕЛ ЗА МАСЛОТО В КАЗАНА
11. НИВОПОКАЗАТЕЛ ЗА МАСЛОТО В P.C.
12. БУХОЛЦОВО РЕЛЕ
13. СТРУЙНО РЕЛЕ
14. КЛАПАН ЗА СВРЪХНАЛЯГАНЕ
15. ШКАФ ЗА УПРАВЛЕНИЕ НА ОХЛАЖДАНЕТО
16. РАДИАТОР
17. ВЕНТИЛАТОР
18. ТЕМПЕРАТУРЕН ИНДИКАТОР ЗА МАСЛОТО
18. ТЕМПЕРАТУРЕН ИНДИКАТОР ЗА НАМОТКИТЕ
20. ТАБЕЛКА

- x МЕРНИ ЕДИНИЦИ : mm
- x ТОЛЕРАНС : ±10%
- x ОБЩА МАСА : 59000,kg
- x МАСА ЗА ТРАНСПОРТ : 45000,kg
- x ТРАНСПОРТНИ РАЗМЕРИ (LxВxН) : 4900x2100x3300,mm

01 90-17

Л. 1, в.с.л. 1



ОБЩ ВИД
НА ТРАНСФОРМАТОР
20/25 MVA
110±12x1.25%/21/10.5 kV
ONAN/ONAF; YNyn0d5
ЗА БЪЛГАРИЯ

Окомплектовка, каталози

No.	Окомплектовка	Каталози
1	Стъпален регулатор	XXI България
2	проходни изводи 110kV	MSG DTOI 123kV 800-1250A 2015
3	проходен извод 110kV за неутрала	MSG DTOI 123kV 800-1250A 2015
4	проходни изводи 21kV и 10.5kV	Bushings CEDASPE-2004
5	Вградени токови трансформатори	ENPAY BCT
6	Радиатори	BAYSAN Radiators OR EQUIVALENT
7	Устр-во за освобождаване на налягането на маслото в казана	CEDASPE (ITALY)
8	Двустепенно газово реле	CEDASPE (ITALY)
9	Маслопоказатели за казан и стъпален регулатор	Cedaspe OLI 2004 (ITALY)
10	Температурен индикатор масло	Terman (ITALY) or equivalent
11	Температурен индикатор намотка	Terman (ITALY) or equivalent
12	Гумена торба	Musthane MBT RUBBER CELLS-2002
13	Дихател със силикагел за казан и стъп. регулатор	CEDASPE (ITALY)
14	Кранове	Valpres (ITALY)
15	Трансформаторно масло	Nylpas (SWEDEN)
16	С-ма за мониторинг на горещи точки в трансформатора и разтворени газове в трансформаторното масло	

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BUSHINGS: GENERAL INFORMATION

1.0 Electrical characteristics (I_r = rated current; U_r = rated voltage)

1.1 Standard insulation levels

Rated voltage U _r kV(r.m.s.)	One minute power frequency withstand voltage wet and dry kV(r.m.s.)	Dry lightning impulse withstand voltage dry (1,2/50ms)kV
1	10	20
3,6	10	40
12	28	75
24	50	125
36	70	170
52	95	250

1.2 Standard values of rated thermal short time current (I_{th}) 25 times the rated current (I_r) for 2 s ; for I_r equal or greater than 4000A, I_{th} is always 100kA

1.3 Overload conditions (IEC 354): Bushing selected with I_r not less than 120% of the rated current of the transformers are considered to be able to withstand the overload conditions according to IEC 354.

2.0 Mechanical characteristic

2.1 Cantilever operating load (bushing installed less than 30° from vertical)

U _r kV	I _r 800 A	I _r 1600 A	I _r 2500 A	
36	500 N	625 N	1000 N	3150 N
52	500 N	625 N	1000 N	1575 N

2.2 Cantilever operating load (bushing installed more than 30° from vertical)

U _r kV	I _r 800 A	I _r 1600 A	I _r 2500 A	
36	300 N	375 N	600 N	3150 A
52	300 N	375 N	600 N	945 N

2.3 Cantilever test load

U _r kV	I _r 800 A	I _r 1600 A	I _r 2500 A	
36	1000 N	1250 N	2000 N	3150 N
52	1000 N	1250 N	2000 N	3150 N

3.0 Tightening torque (suggested values, +/- 10% depending on the quality of the tank cover surface)

3.1 On the central conductor LV/HV in brass or copper

Size	Torque	Size	Torque
M8	10 Nm	M42x3	110 Nm
M12	13 Nm	M48x3	180 Nm
M20	30 Nm	M55x3	250Nm
M30x2	70 Nm	M75x3	250Nm

3.2 On the steel fixing stud of HV bushings

Size	Torque
M10	15 Nm
M12	25 Nm
M16	40 Nm

3.2 On the locking bolts of the flags

Size	Torque
M10	25 Nm
M12	40 Nm
M16	90 Nm

4.0 Surface treatment of active metallic parts

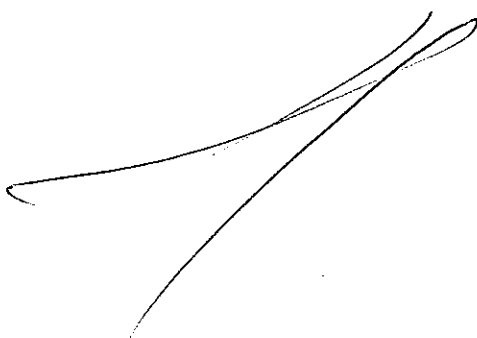
Unless by special request, all active metallic parts in brass and copper have self colour surfaces.

Upon request, particularly for use in highly polluted environment conditions or in tropical climate, above parts can be supplied with electrolytic tinplated surfaces with 6-8 micron average coating thickness.

5.0 N.B.R. gaskets

The material of our gaskets is suitable to be used in mineral oil at the max temperature of 100°C (minimum temperature -20°C) for continuous service; for different limit temperatures, please contact our engineering department. During the impregnation of the transformer it is possible to reach the max temperature of 110°C in oil and 120°C in air for 24 hours, without damaging the gaskets.

Upon request available cork rubber impregnated gaskets, or in Viton, or in silicon rubber.



Sect. 3

BUSHINGS FOR POWER TRANSFORMERS

Page 3.1: Bushings 10-20-30-40/630 according to DIN 42532 or UNEL38159-74

Page 3.2: Arcing horn kit to suit above bushings

Page 3.1-B: Bushings 12-24-36/630 according to the new European standard EN50180 pollution level I-II-III-IV (IEC815)

Page 3.3-4-5 EN: Bushings 10-20-30/1000-2000-3150 according to the new European standard EN50180 pollution level I-II-III-IV (IEC815)

Page 3.3-4-5: Bushings 10-20-30/1000-2000-3150 according to DIN 42533 or UNEL 38174-74

Page 3.6-A: Bushings 52/1000-2000-3150 according to DIN 42534-1983

Page 3.6-B: Bushings 52/250-630 (modification of bushing acc. to DIN 42534)

Page 3.6-A: Bushings 52/1000-2000-3150 with longer creepage 1120mm (modification of bushing acc. to DIN 42534)

Page 3.7: Arcing horn kit to suit above bushings

Page 3.8: Bushings 10-20-30/4500

Page 3.9: Bushings 20/6300

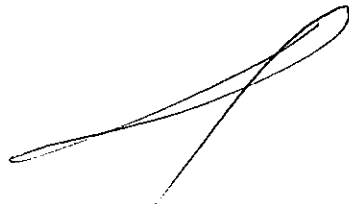
Page 3.10 (Drawing 1040): Bushings 24-36/5000-8000 DIN42541

Page 3.10.B: Bushings 36/5000-8000 with longer creepage 915 & 1100 mm (modif. of DIN42541)

Page 3.11 (Drawing 1164): Bushings 36/12500

DIN 42537

Page 3.12 (Drawing 1030): Bushings 72.5-125/1250-2000 DIN 42535



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INFORMATIONS ON BUSHINGS 10-20-30-40/630 FROM PAGE 3.1 TO 3.2

Normally supplied according fig. A1 pag 3.1, draw lead type, without a/horns, with brass bolt "D" tapped M20x2,5 (Style A1) for the connection to the copper wire.

Upon request, the bushing can be supplied according to fig T1 pag 3.1 with long rigid rod, and/or with arching horns (see page 3.2) with "V" bracket for bottom a/horn (UNEL execution) or without bracket (DIN style).

COMPONENT LIST

FIG. A1

POS. Ref.

DIN Ref. (UNEL Ref)

- Pos 1 (1): Porcelain
- Pos 2 (2): Brass bolt "D" (usually DIN execution, on request execution "EL").
- Pos 3 (4): Cap "E"
- Pos 5 (7): Ring gasket "J"
- Pos 6 (8): Fiber gasket "O"
- Pos 7 (21): Vent screw
- Pos 8 (22): Nylon or fiber gasket
- Pos 9 (10): Flange gasket "N"
- Pos 11 (8): Brass nut M20 DIN 934
- Pos 12 (20): Brass washer dia 21 DIN 125
- Pos 13 (19): Spring washer dia 21 DIN 127
- Pos 14 (17): Mild steel zinkplated nut M10

- Pos 15 (18): Mild steel zinkplated washer dia 10,5 mm

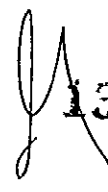
- Pos 17 (14): Fixing ring "B" DIN 42531 (in mild steel zinkplated or, upon request, in aluminium)

- Pos 18 (16): Welding stud M10x55 (not supplied)

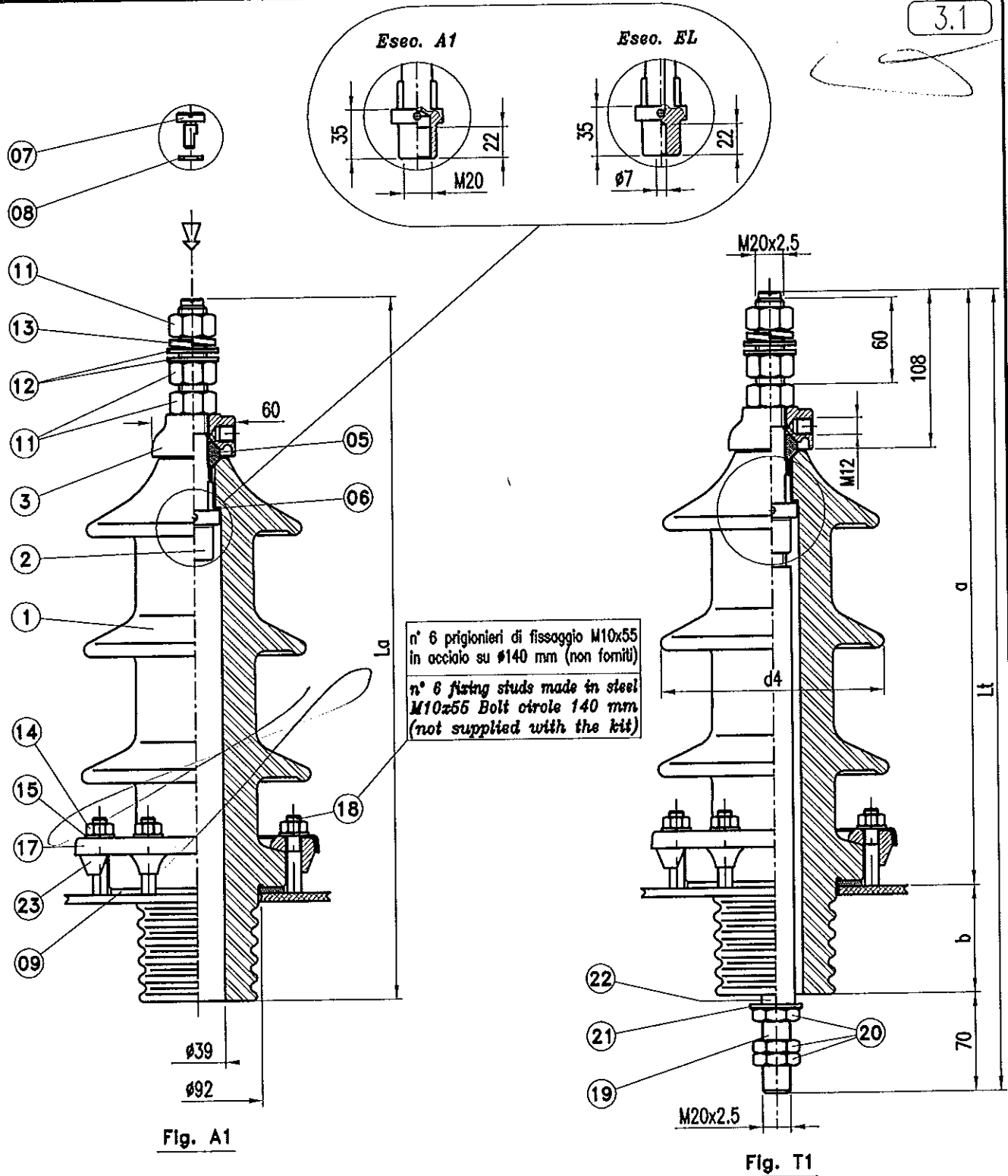
- Pos 23 (15): Aluminium clamping piece "E" DIN 42538

FIG. T1

- Pos 19 (3): Rigid copper rod
- Pos 20 (9): Brass locknut M20 DIN 936
- Pos 21 (12): Brass washer
- Pos 22 (12): Insulating tube C.B.



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LA FIGURA MOSTRA ISOLATORE 20/630 IN SCALA 1:4

THE FIGURE SHOWS THE BUSHING 20/630 (1:4 SCALE)

Isolatore Bushing	Tensione Voltage KV	Corrente Current A	Linea di fuga Creepage distance	a mm	b mm	La mm	Lt mm	d4 mm	N°ALETTE N°of sheds Z	Massa Kg	Volume Volume dm ³
10Nf/630	12	630	290	347	61	408	478	150	2	7.2	17
20Nf/630	24	630	440	422	76	498	568	165	3	9.2	25
30Nf/630	36	630	630	527	96	623	693	180	4	12.2	39
40Nf/630	36	630	830	617	171	788	858	190	5	15.9	50

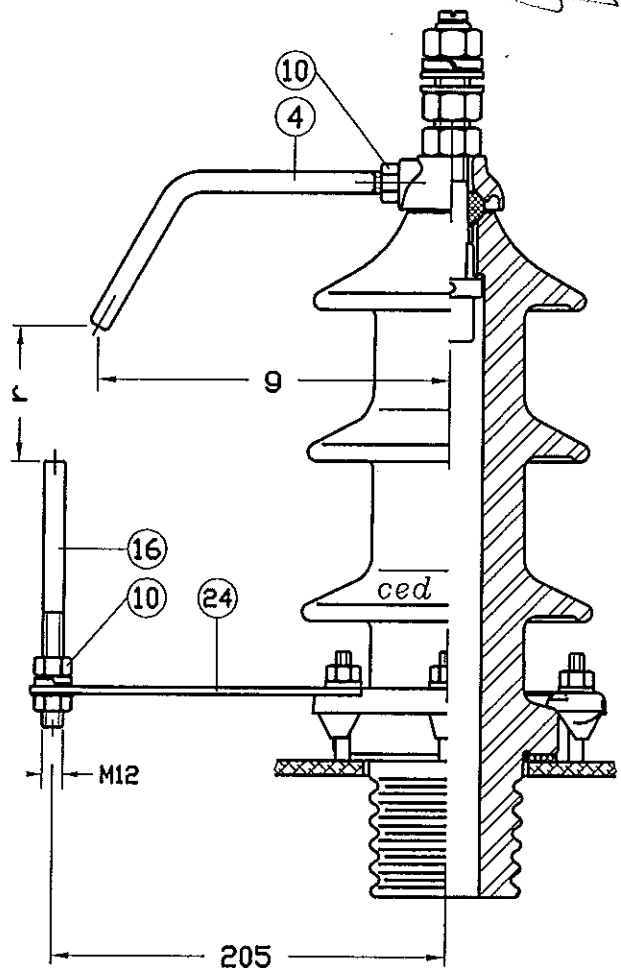
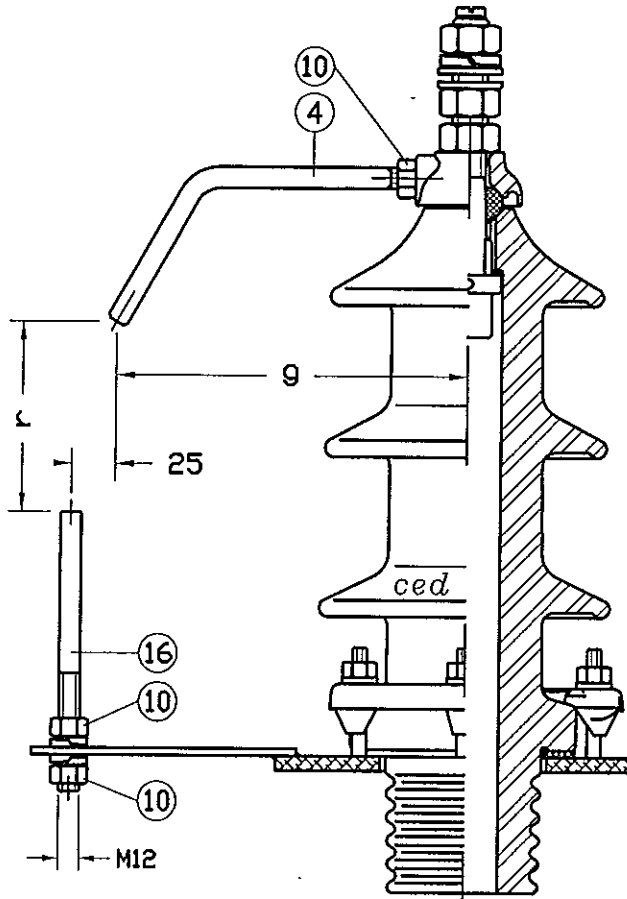
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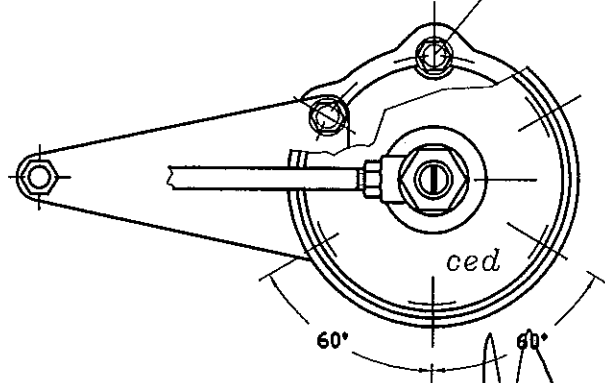
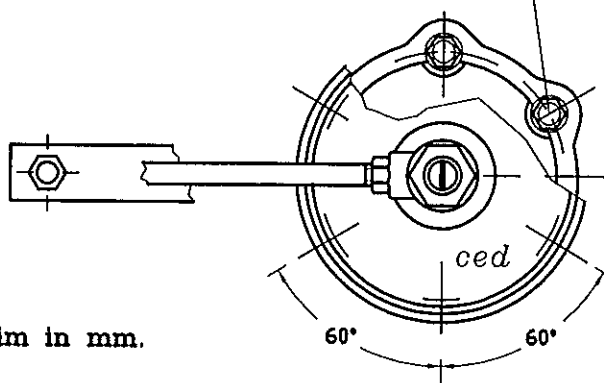
Esec. DIN

Esec. UNEL

3.2



N° 6 STUDS M10x58 on ø140



dim in mm.

Pos.	Qty D/U	Descrizione	Description
4	1	Scaric. sup.	Top a/horn
10	3 2	Dado M12 Fe UNI 5588	Steel nut M12 DIN 934
16	1	Scaric. Inf.	Bottom a/horn
24	- 1	Supporto a 'V'	Steel 'V' bracket

TIPO	Esec. DIN		Esec. UNEL	
	r	g	r	g
10 Nf/630	85	180	70	180
20 Nf/630	155	180	100	180
30 Nf/630	220	200	220	180
40 Nf/630	220	200	220	180

CEDASPE

SCHEMA MONTAGGIO SPINTEROMETRI 10-20-30-40/630

Arcing horns assembly for 10-20-30-40/630 140

INFORMATIONS ON BUSHINGS EN 50180**12-24-36/630-1250-2000-3150**

from page 3.1- EN to 3.5-EN

These are the bushings according to the latest European specifications
They normally supplied without a/horns, complete with fixing kit, which for 1000 and 2000-3150 can be typical DIN 42538 size or new EN size (bolt circle 5 mm bigger); please state on order the fixation required.

COMPONENT LIST page 3.1- EN.

- Pos 1 Porcelain
- Pos 2 Brass bolt "D" (usually DIN execution)
- Pos 3 Cap "E"
- Pos 4 Ring gasket "J"
- Pos 5 Fiber spacer "O" Ring gasket "J"
- Pos 6 Flange gasket "N"
- Pos 7 Brass nut M20 DIN 934
- Pos 8 Brass washer dia 21 DIN 125
- Pos 9 Mild steel zinkplated nut M10
- Pos 10 Mild steel zinkplated washer dia 10,5 mm
- Pos 11 Spring washer dia 21 DIN 127
- Pos 13 Fixing ring "B" DIN 42531 (in mild steel zinkplated or, upon request, in aluminium)
- Pos 14 Aluminium clamping piece "E" DIN 42538
- Pos 15 Welding stud M10x55 (not supplied)
- Pos 16 Rigid copper rod
- Pos 17 Insulating tube C.B.
- Pos 18 Brass locknut M20 DIN 936

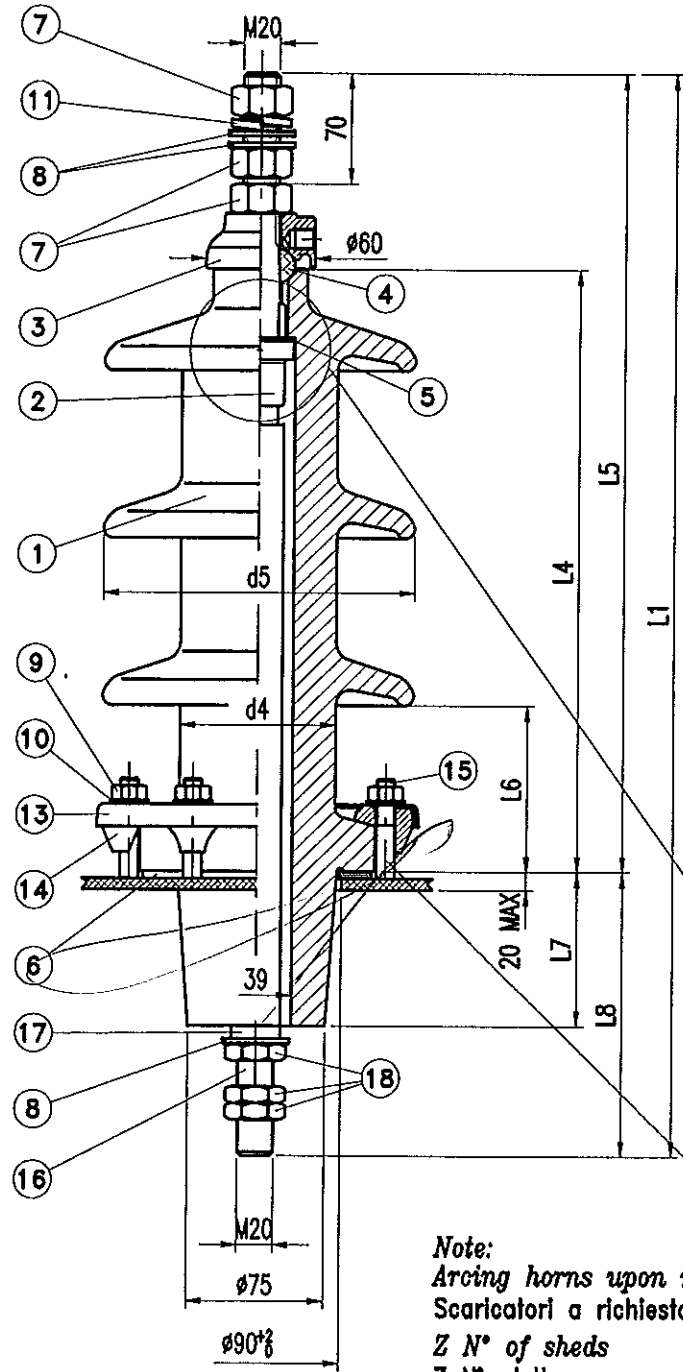
COMPONENT LIST page 3.3/4/5- EN.

- Pos. 1 Porcelain
- Pos. 2 Copper rod
- Pos. 3 Brass nut DIN-934
- Pos. 4 Brass top washer "F"
- Pos. 5 NBR ring gasket "J"
- Pos. 6 Brass cap "E"
- Pos. 7 Fiber gasket
- Pos. 8 Vent/screw "R"
- Pos. 9 NBR gasket "M"
- Pos. 10 Fiber spacer "O"
- Pos. 11 Brass ring "P"
- Pos. 12 Locking screw
- Pos. 13 Copper ring "S"
- Pos. 14 Mild steel zinkplated chromium passivated M12 DIN 934
- Pos. 15 Mild steel washer d. 13
- Pos. 16 Fixing ring "C-D" DIN 42538
Or EN 1000 / EN 3150
- Pos. 17 Aluminium clamping piece "F" DIN 42538
- Pos. 18 NBR flange gasket "N"
- Pos. 19 Centering ring
- Pos. 20 Fixing stud M12x70 (not supplied)
- Pos. 21 Bronze contact ring "U"

- Pos. 51D Flag EP/FP DIN 43675
- Pos. 51U Flag UNEL size
- Pos. 52 Brass nut DIN 934
- Pos. 53 Brass locknut DIN 936
- Pos 54D-U Internal connecting flag

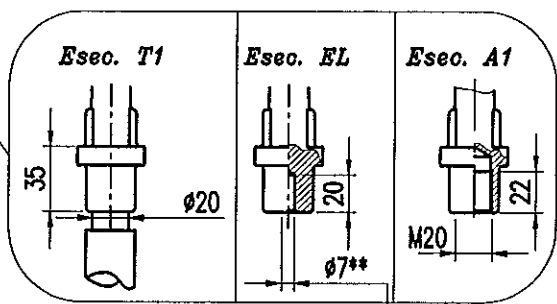
141

FILE = PAC3-1EN.DWG LMT [0.0] (196.286) A4 (210x297)
 REV. 06 DTG 02/05/2002
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Posizione	Descrizione / Description
1	PORCELLANA PORCELAIN
2	PERNO DI CHIUSURA "D" BRASS BOLT "D"
3	CAPPA "E" BRASS CAP "E"
4	GUARNIZIONE TORODALE "J" SEALING RING GASKET "J"
5	GUARNIZIONE SAGONATA INTERNAL GASKET
6	GUARNIZIONE FLANGIA FLANGE GASKET
7	DADO M20 OT. UNI 5588 BRASS NUTS M20 DIN 934
8	RONDELLA OTTONE #21 BRASS WASHER #21
9	DADO M10 Fe UNI 5588 STEEL NUTS M10 DIN 934
10	RONDELLA Fe #10.5 STEEL WASHER #10.5
11	RONDELLA GROWER UNI 1751 SPRING WASHER #21
13	ANELLO DI FISSAGGIO FIXING RING "A"
14	BLOCCHETTO ALLUMINIO ALU-CLAMPING PCE
15	PRIGIONIERO (NON FORNITO) WELDING STUD (NOT SUPPLIED)
* 16	TIRANTE INTERNO IN RAME COPPER INNER ROD
* 17	TUBO ISOLANTE INSULATING TUBE
* 18	DADO M20 OT. UNI 5589 BRASS NUTS M20 DIN 936

* supplied only for Esec. T1 (on request)
* Fornito solo per esec. T1



** Other sizes on demand
** Altre misure a richiesta

n° 6 prigionieri di fissaggio M10x55
in acciaio su Ø140 mm (non forniti)
n° 6 firing studs made in steel
M10x55 Bolt circle 140 mm
(not supplied with the kit)

Note:
Arcing horns upon request
Scaricatori a richiesta
Z N° of sheds
Z N° alette

LA FIGURA MOSTRA ISOLATORE 24/630 P2 IN SCALA 1:4

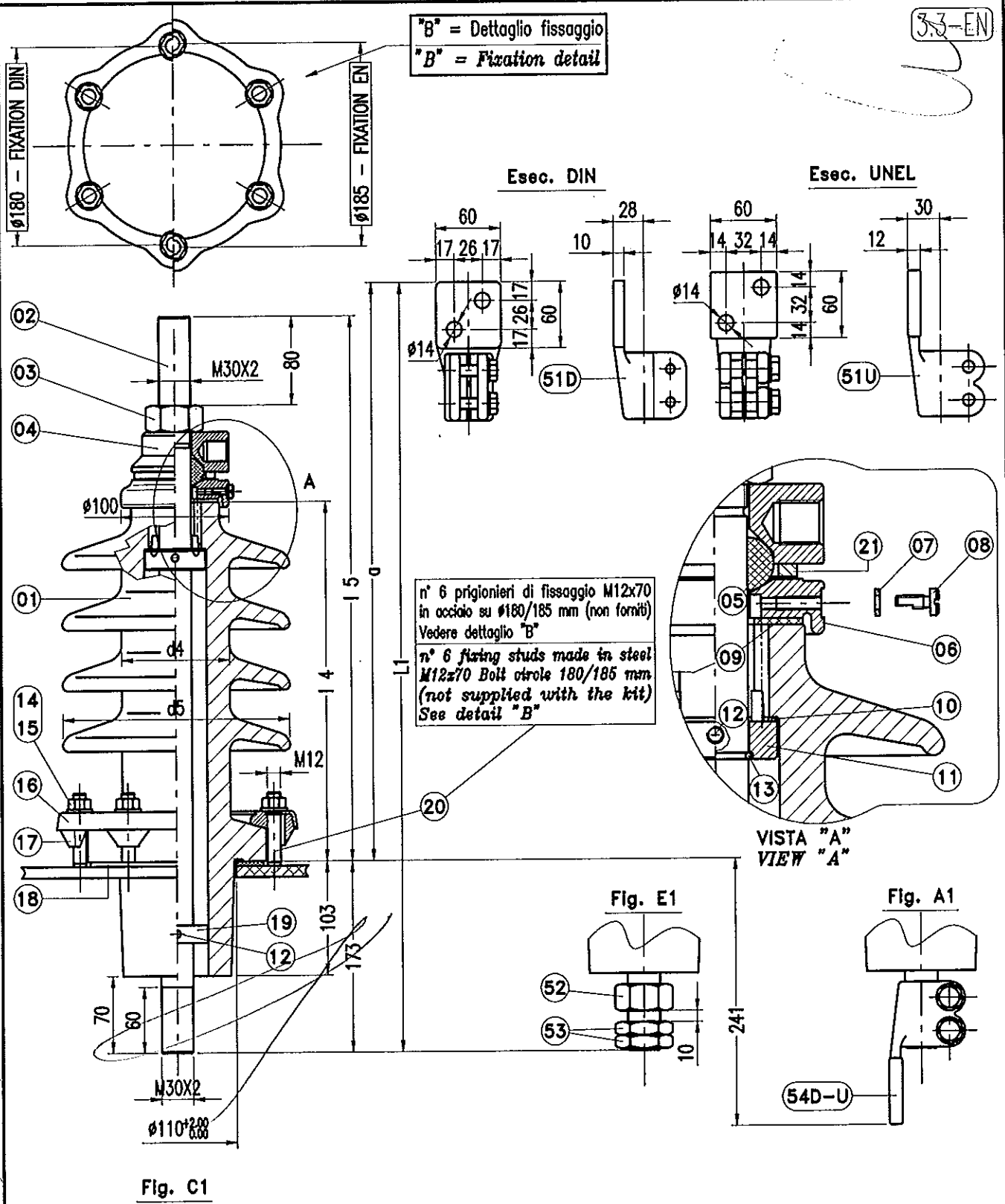
THE FIGURE SHOWS THE BUSHING 24/630 P2 (1:4 SCALE)

Isolatore Bushing	Tensione Voltage KV	Corrente Current A	Livello inquinazione e linea di fuga min. Pollution level and min. creep distance				Porcellana / Porcelain			L4 max mm	L5 max mm	L6 min mm	d4 max mm	d5 max mm	L1 max mm	L7 max mm	L8 max mm	Massa Kg	Z
			I	II	III	IV	Tipo Type	Linea fuga Creepage distance mm	Distanza d'arco Arching distance mm										
12-630/P3	12	630	192	240	300		6	315	190	235	350	90	80	155	503	83	153		2
12-630/P4	12	630				372													
24-630/P2	24	630	384	480			7	490	285	325	440	90	85	170	593	83	153		3
24-630/P4	24	630			600	744													
36-630/P2	36	630	576	720			8	760	375	423	540	100	85	180	693	83	153		5
36-630/P4	36	630			900	1116	9	1155	475	515	630	100	85	210	850	150	220		7

ISOLATORI PASSANTI PER TRASFORMATORI EN 50180
 TENSIONE NOMINALE 12-24-36KV CORRENTE NOMINALE 630A
 Outdoor transformer bushing EN 50180
 rated voltage 12-24-36kV rated current 630A



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LA FIGURA MOSTRA ISOLATORE 24/1250 P3 IN SCALA 1:5

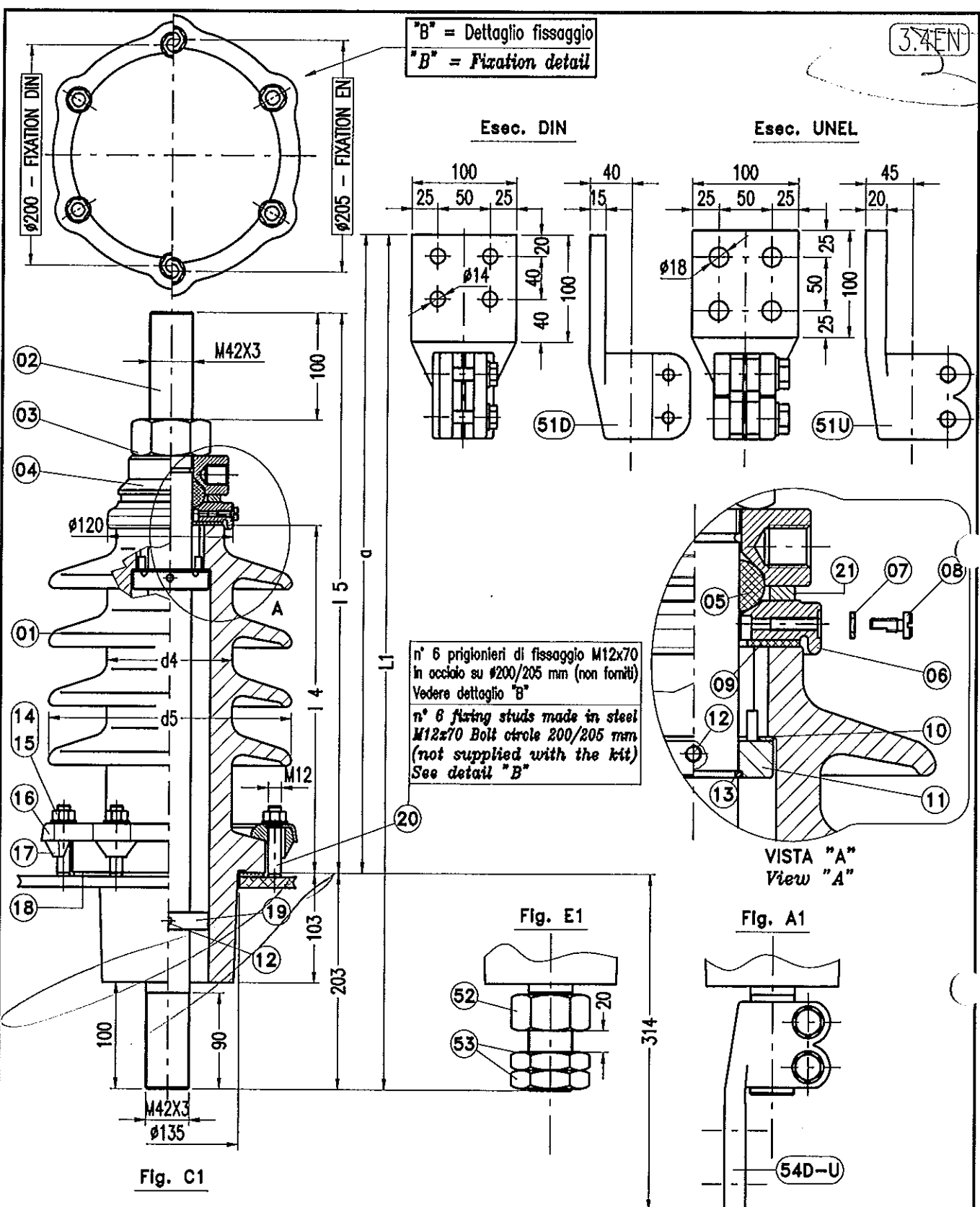
THE FIGURE SHOWS THE BUSHING 24/1250 P3 (1:5 SCALE)

Isolatore Bushing	Tensione Voltage KV	Corrente Current A	Livello inquinazione e linea di fuga min. Pollution level and min. creep. distance				Porcellana / Porcelain (mm)		L4 max	L5 max	d4 max	d5 max	a max	L1 max	N° Alette N° of Sheds	Massa Kg	
			I	II	III	IV	Tipo	Linea di fuga Creepage distance									Distanza d'arco Arcing distance
12-1250/P4	12	1250	192	240	300	372	21	385	215	260	415	100	210	480	655	2	
24-1250/P3	24	1250	384	480	600		22	620	280	325	480	100	210	545	718	4	
24-1250/P4	24	1250				744	23	930	385	420	575	100	240	640	813	5	
36-1250/P3	36	1250	576	720	900		24	1145	500	535	690	100	240	755	928	6	
36-1250/P4	36	1250				1116											

ISOLATORI PASSANTI PER TRASFORMATORI EN 50180
CORRENTE NOMINALE 1250A
OUTDOOR TRANSFORMER BUSHING EN 50180
RATED CURRENT 1250A



FILE = PAG3-4EN.DWG
 REV. 04 DTD 28/03/04
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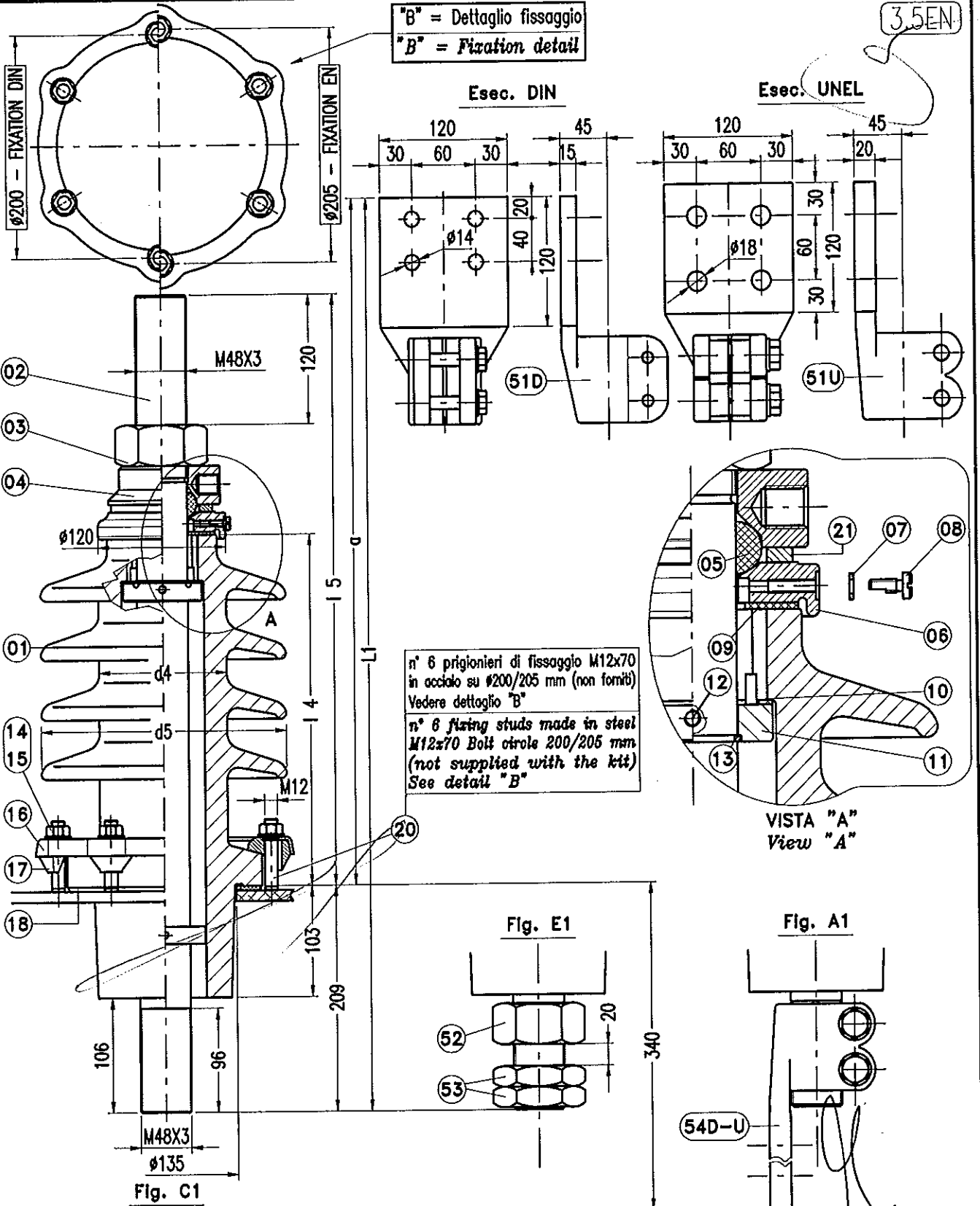
LA FIGURA MOSTRA ISOLATORE 24/2000 P3 IN SCALA 1:5 THE FIGURE SHOWS THE BUSHING 24/2000 P3 (1:5 SCALE)

Isolatore Bushing	Tensione Voltage KV	Corrente Current A	Livello inquinazione e linea di fuga min. Pollution level and min. creep distance				Porcellana / Porcelain (mm)		l4 max	l5 max	d4 max	d5 max	a max	L1 max	N° Alette N° of Sheds	Massa Kg	
			I	II	III	IV	Tipo Type	Linea di fuga Creepage distance									Distanza d'arco Arcing distance
12-2000/P4	12	2000	192	240	300	372	25	385	210	260	450	120	230	563	768	2	
24-2000/P3	24	2000	384	480	600		26	620	275	325	515	120	230	628	831	4	
24-2000/P4	24	2000				744	27	920	385	420	610	125	260	723	928	5	
36-2000/P3	36	2000	576	720	900												
36-2000/P4	36	2000				1116	28	1135	495	535	725	125	260	838	1041	6	

ISOLATORI PASSANTI PER TRASFORMATORI EN 50180
CORRENTE NOMINALE 2000A
OUTDOOR TRANSFORMER BUSHING EN 50180
RATED CURRENT 2000A

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CEDASPE



LA FIGURA MOSTRA ISOLATORE 24/3150 P3 IN SCALA 1:5

THE FIGURE SHOWS THE BUSHING 24/3150 P3 (1:5 SCALE)

Isolatore Bushing	Tensione Voltage KV	Corrente Current A	Livello poluzione e linea di fuga min. Pollution level and min. creep distance				Tipo Type	Porcellana, (mm) / Porcelain		l4 max	l5 max	d4 max	d5 max	a max	L1 max	N° Alette N° of Sheds	Massa Kg
			I	II	III	IV		Linea di fuga Creepage distance	Distanza d'arco Arcing distance								
12-3150/P4	12	3150	192	240	300	372	25	385	210	260	174	120	230	607	816	2	
24-3150/P3	24	3150	384	480	600	744	26	620	275	325	539	120	230	672	881	4	
24-3150/P4	24	3150					27	920	385	420	634	125	260	767	976	5	
36-3150/P3	36	3150	576	720	900	1116	28	1135	495	535	749	125	260	882	1091	6	
36-3150/P4	36	3150															

ISOLATORI PASSANTI PER TRASFORMATORI EN 50180
CORRENTE NOMINALE 3150A
OUTDOOR TRANSFORMER BUSHING EN 50180
RATED CURRENT 3150A

INFORMATION ON BUSHINGS 10-20-30-52/1000-2000-3150 PAGES 3.3 TO 3.7

All this range of bushings is normally supplied in accordance to the customer's own specifications, specially for the oil side connection design; our fig. T1, B1 and A1 show the most common executions; without any contrary specification of the customer, the bushing is supplied as fig C1 (exactly according to DIN standards).

For the air side connection, normally the bushing is fitted with flags EP/FP DIN 43675 (or UNEL 38137-67 for the italian market or UNE 20-176-89 for the spanish market).

A/norms are supplied, only upon request, in two executions shown at page 3.7.

COMPONENTS LIST FOR BUSHINGS

10-20-30-52/1000-2000-3150

10-20-30/4500

- Pos. 1: Porcelain
- Pos. 2: Copper rod
- Pos. 3: Brass cap "E"
- Pos. 4: Brass top washer "F"
- Pos. 7: NBR ring gasket "J"
- Pos. 8: Gasket "O"
- Pos. 9: NBR gasket "M"
- Pos. 10: NBR flange gasket "N"
- Pos. 11D: Flag EP/FP DIN 43675
- Pos. 12: Brass ring "P"
- Pos. 13: Copper ring "S"
- Pos. 14: Brass nut DIN 934
- Pos. 16: Fiber gasket
- Pos. 17: Vent/screw "R"
- Pos. 18: Locking screw
- Pos. 23: Bronze contact ring "U"


- Pos. 24: Aluminium fixing ring "C-D" DIN 42538

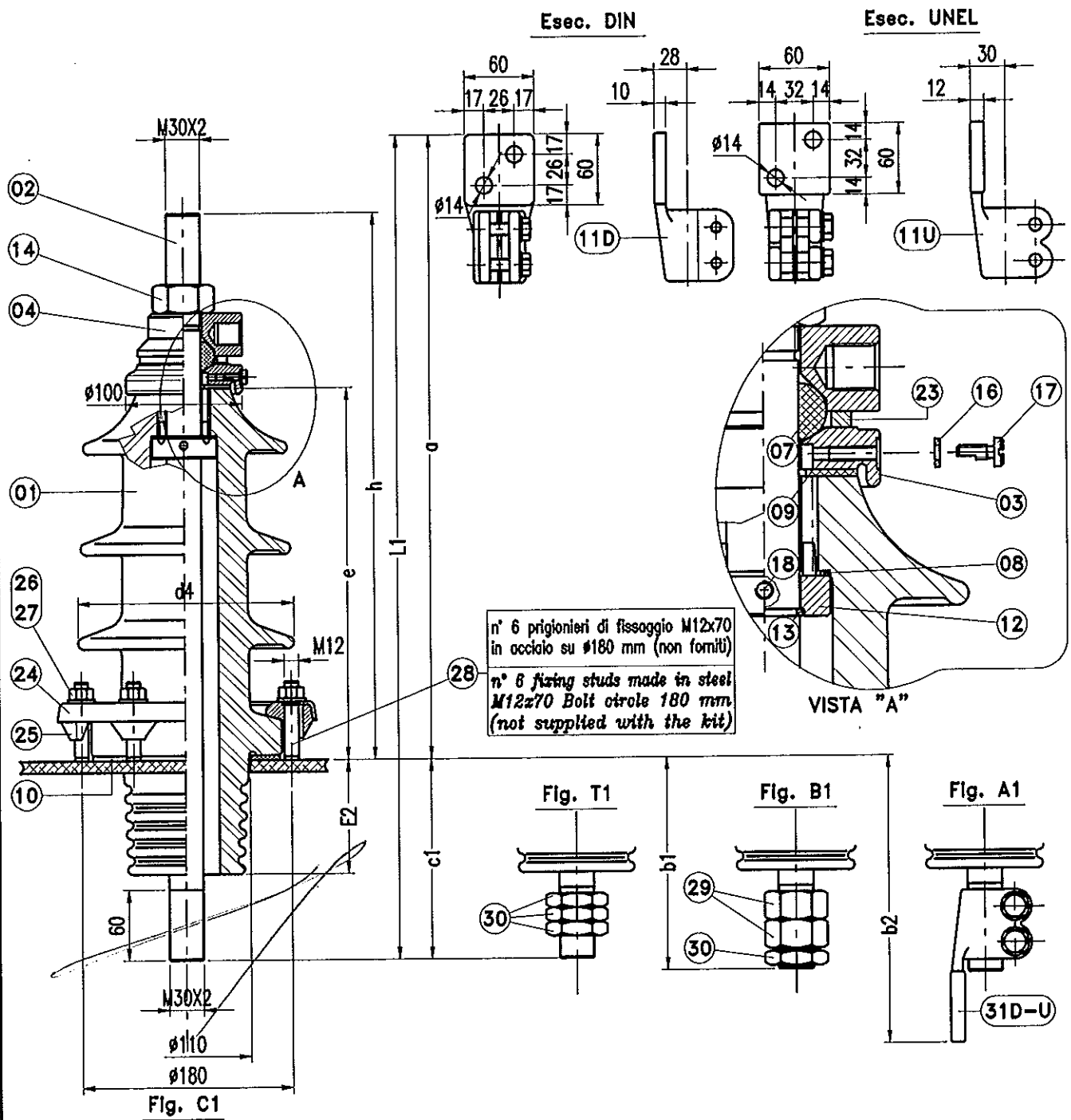
- Pos. 25: Aluminium clamping piece "F" DIN 42538

- Pos. 26: Mild steel zinkplated chromium passivated M12 DIN 934
- Pos. 27: Mild steel washer d. 13

- Pos. 28: Fixing stud M12x70 (not supplied)

- Pos. 29: Brass nut DIN 934
- Pos. 30: Brass locknut DIN 936
- Pos 31D: Flag EP/FP DIN 43675
- Pos 32: Center ring (supplied upon request)

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Isolatore Bushings	Tensione Voltage KV	Corrente Current A	Linea di fuga Creepage distance	a mm	b1 mm	b2 mm	c1 mm	d4 mm	e mm	E2 mm	h mm	L1 mm	N°ALETTE N° of sheds Z	Massa Kg	Volume dm³
10F/1000	12	1000	290	455	181	226	158	170	239	86	387	613	2	15	55
20F/1000	24	1000	440	530	191	236	168	185	314	96	462	698	3	18	60
30F/1000	36	1000	640	635	216	266	198	200	419	121	567	833	4	22	80

LA FIGURA MOSTRA ISOLATORE 20/1000 IN SCALA 1:5

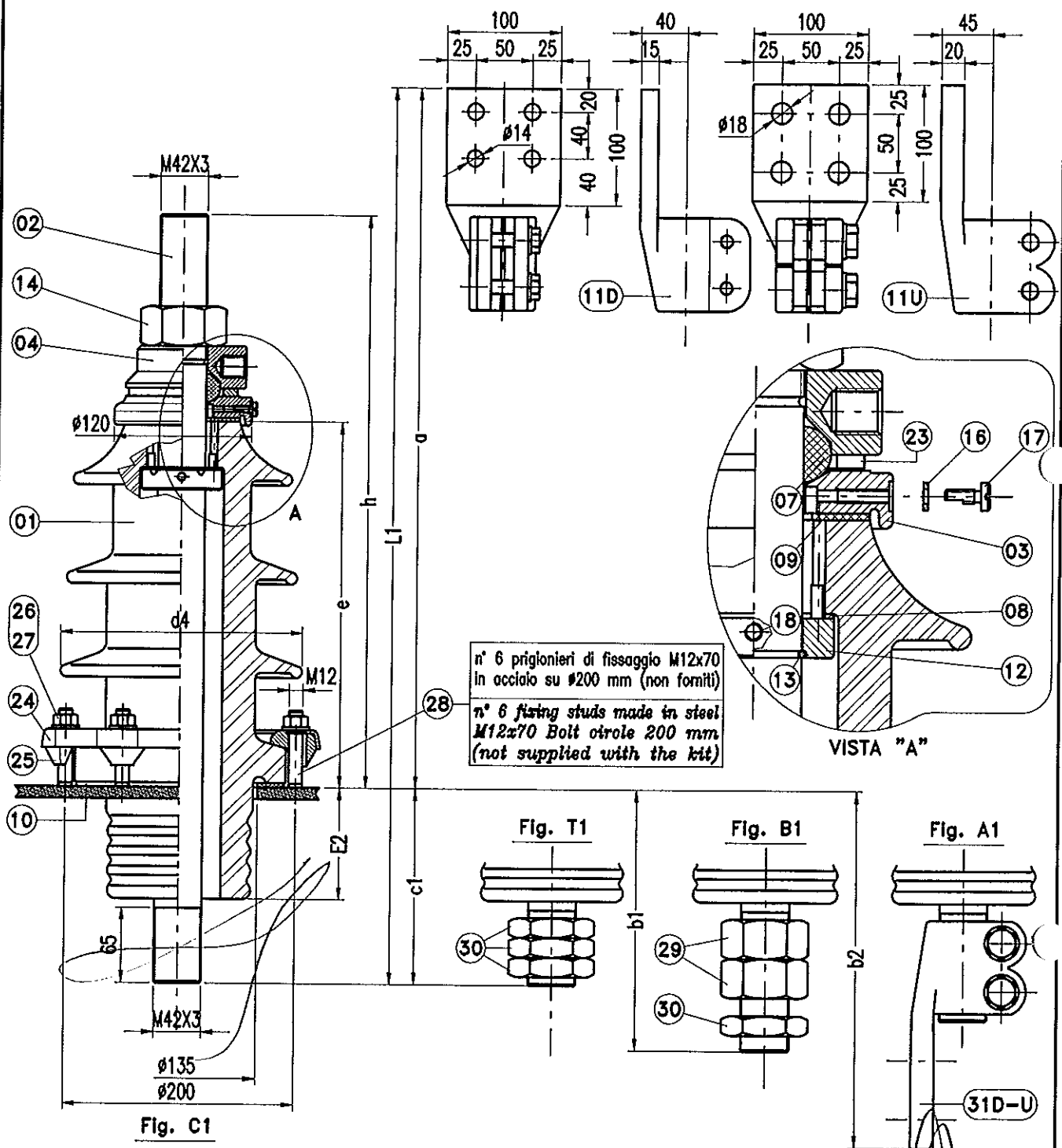
THE FIGURE SHOWS THE BUSHING 20/1000 (1:5 SCALE)



ISOLATORI PASSANTI PER TRASFORMATORI DIN 42533 E UNEL 38174/74
 CORRENTE NOMINALE 1000A
 OUTDOOR TRANSFORMER BUSHING DIN 42533 AND UNEL 38174/74
 RATED CURRENT 1000A

Esec. DIN

Esec. UNEL



Isolatore Bushing	Tensione Voltage KV	Corrente Current A	Linea di fuga Creepage distance	a mm	b1 mm	b2 mm	c1 mm	d4 mm	e mm	E2 mm	h mm	L1 mm	N°ALETTE N° of sheds Z	Massa Kg	Volume Volume dm ³
10F/2000	12	2000	290	530	212	291	158	190	239	86	417	688	2	25	70
20F/2000	24	2000	440	605	222	301	168	210	314	96	492	773	3	29	80
30F/2000	36	2000	680	710	247	331	198	230	419	121	597	908	4	35	90

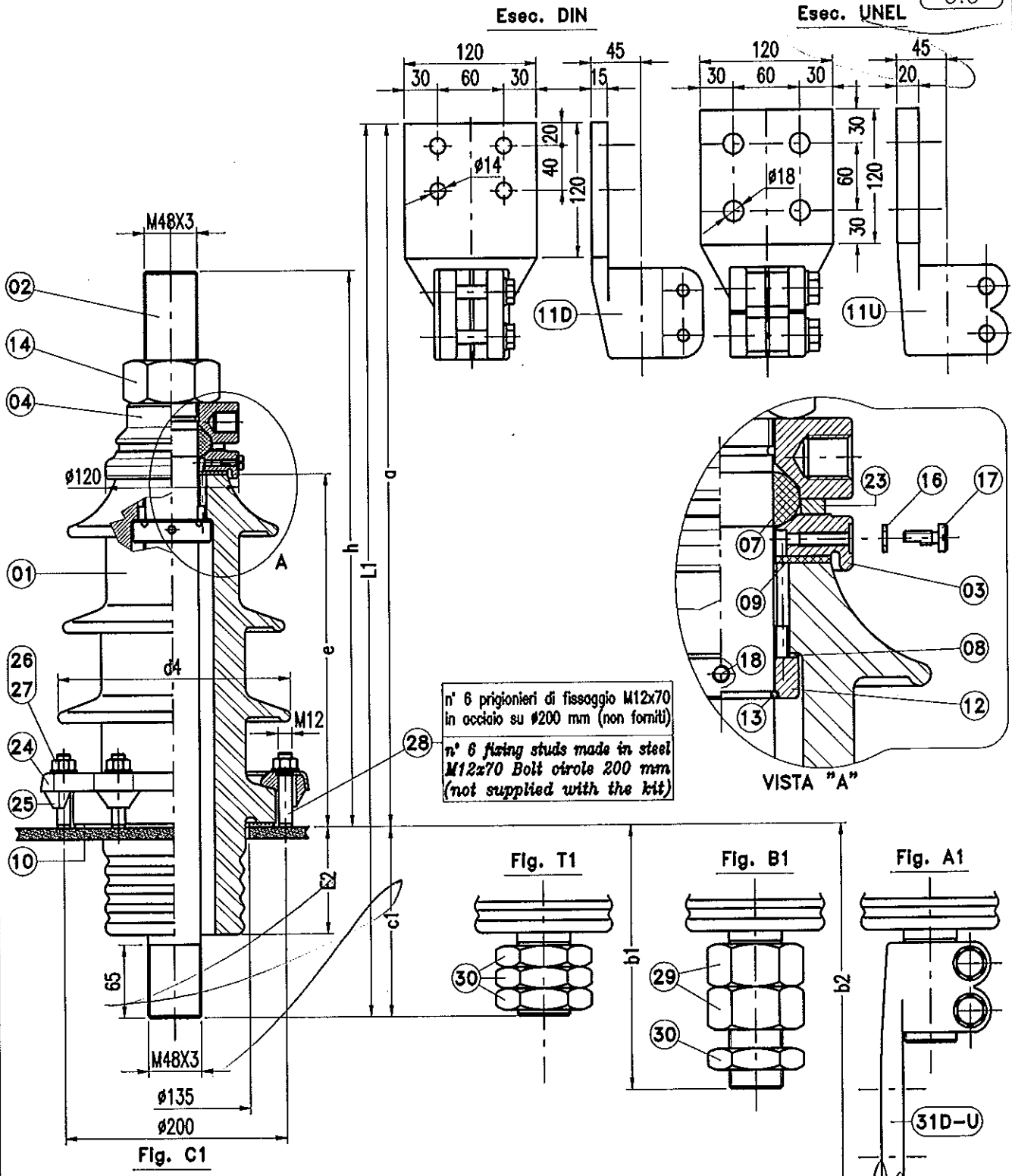
LA FIGURA MOSTRA ISOLATORE 20/2000 IN SCALA 1:5

THE FIGURE SHOWS THE BUSHING 20/2000 (1:5 SCALE)

ISOLATORI PASSANTI PER TRASFORMATORI DIN 42533 E UNEL 38174/74
 CORRENTE NOMINALE 2000A
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 OUTDOOR TRANSFORMER BUSHING DIN 42533 AND UNEL 38174/74
 RATED CURRENT 2000A



FILE = PAG3-5.DWG
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 AA (210x297)
 REV. 02 DTD 03/01/2000
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Isolatore Bushing	Tensione Voltage KV	Corrente Current A	Linea di fuga Creepage distance	a mm	b1 mm	b2 mm	c1 mm	d4 mm	e mm	E2 mm	h mm	L1 mm	N°ALETTE N° of sheds Z	Massa Kg	Volume Volume dm ³
10F/3150	12	3150	290	560	226	316	168	190	239	86	422	728	2	29	75
20F/3150	24	3150	440	635	236	326	178	210	314	96	497	813	3	33	85
30F/3150	36	3150	680	740	261	356	208	230	419	121	602	948	4	39	95

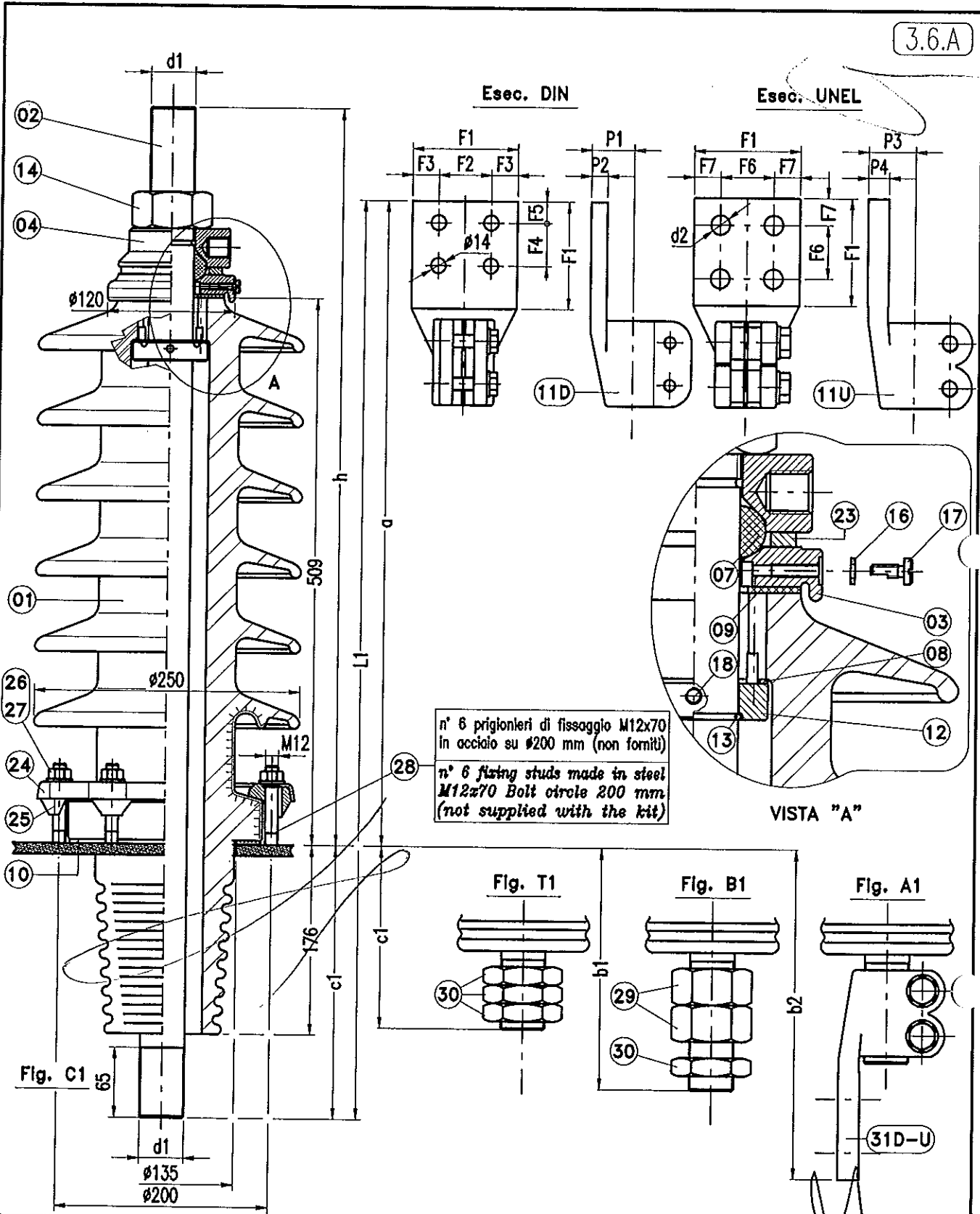
LA FIGURA MOSTRA ISOLATORE 20/3150 IN SCALA 1:5

THE FIGURE SHOWS THE BUSHING 20/3150 (1:5 SCALE)

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ISOLATORI PASSANTI PER TRASFORMATORI DIN 42533 E UNEL 38174/74
CORRENTE NOMINALE 3150A
OUTDOOR TRANSFORMER BUSHING DIN 42533 AND UNEL-38174/74
RATED CURRENT 3150A

FILE = PAG3-6-A.DWG
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 A4 (210x297)
 REV. 02 DTD 03/01/2000
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n° 6 prigionieri di fissaggio M12x70
 in acciaio su Ø200 mm (non forniti)
 n° 6 fixing studs made in steel
 M12x70 Bolt circle 200 mm
 (not supplied with the kit)

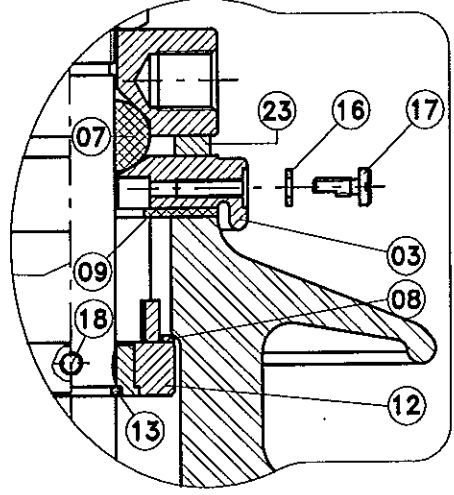
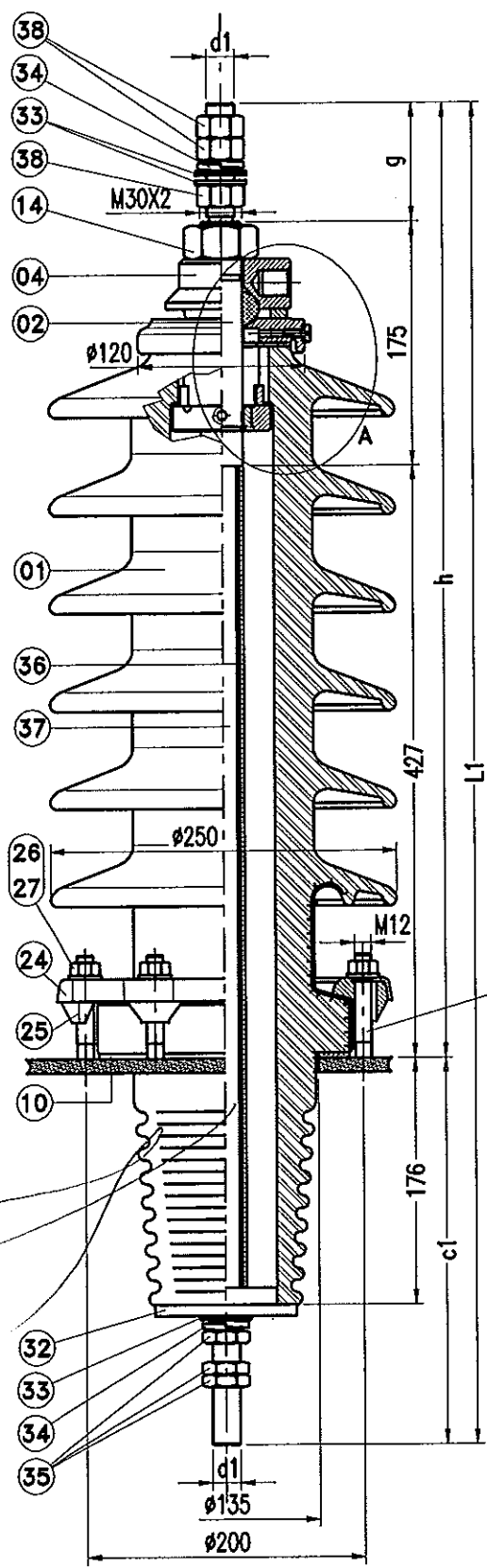
Isolatore Bushing	Corrente Current A	d1	d2	L1	a	c1	b1	b2	h	F1	F2	F3	F4	F5	F6	F7	P1	P2	P3	P4	Linea di fuga Creepage distance	Massa Kg	Volume Volume dm³	N°Fori Band. N°Holes (Flag) Z
52F/1000	1000	M30x2	14	978	725	253	270	316	657	60	26	17	26	17	32	14	28	10	30	12	1080	36	140	2
52F/2000	2000	M42x3	18	1053	800	253	302	381	687	100	50	25	40	20	50	25	40	15	45	20	1080	45	145	4
52F/3150	3150	M48x3	18	1083	830	253	316	406	692	120	60	30	40	20	60	30	45	15	45	20	1080	50	155	4

LA FIGURA MOSTRA ISOLATORE 52/2000 IN SCALA 1:5
 THE FIGURE SHOWS THE BUSHING 62/2000 (1:5 SCALE)



ISOLATORI PASSANTI PER TRASFORMATORI DIN 42534
TENSIONE NOMINALE 52 KV
OUTDOOR TRANSFORMER BUSHING DIN 42534
RATED VOLTAGE 52 KV

3.6.B



PARTICOLARE "A"

n° 6 prigionieri di fissaggio M12x70
in acciaio su Ø200 mm (non forniti)
n° 6 fixing studs made in steel
M12x70 Bolt circle 200 mm
(not supplied with the kit)

Isolatore Bushing	Corrente Current A	d1	L1	c1	h	g	Linea di fuga Creepage distance	Massa Kg	Volume Volume dm ³
52/250	250	M12	910	248	662	60	1080	35	140
52/630	630	M20	960	273	687	85	1080	36	140

LA FIGURA MOSTRA ISOLATORE 52/630 IN SCALA 1:5

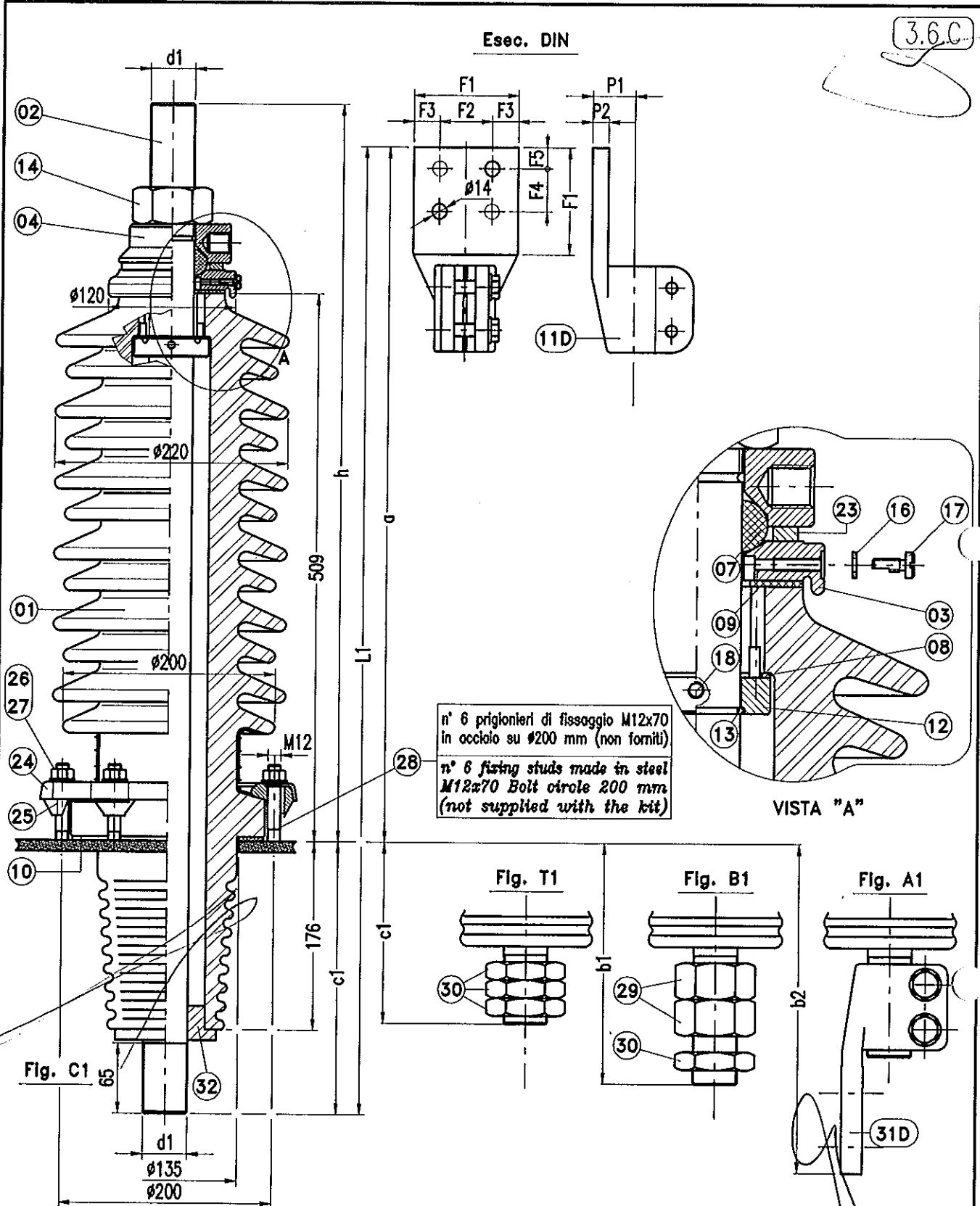
THE FIGURE SHOWS THE BUSHING 62/630 (1:5 SCALE)



Titolo
ISOLATORI PASSANTI PER TRASFORMATORI DIN 42534
TENSIONE NOMINALE 52 KV
OUTDOOR TRANSFORMER BUSHING DIN 42534
RATED VOLTAGE 52 KV

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 FILE = PAG3-6C .DWG
 LMT [(0,0) (196,296)]
 A4 (210x297)



3.6.C

Isolatore Bushing	Corrente Current A	d1	d2	L1	a	c1	b1	b2	h	F1	F2	F3	F4	F5	P1	P2	Linea di fuga Creepage distance	Massa Kg	Volume Volume dm ³	N°Fori Band. N°Holes(Flag) Z
52F/1000/1120	1250	M30x2	14	978	725	253	270	316	657	60	26	17	26	17	28	10	1120	36	140	2
52F/2000/1120	2000	M42x3	18	1053	800	253	302	381	697	100	50	25	40	20	40	15	1120	45	145	4
52F/3150/1120	3150	M48x3	18	1083	830	253	316	406	692	120	60	30	40	20	45	15	1120	50	155	4

LA FIGURA MOSTRA ISOLATORE 52/2000 IN SCALA 1:5

THE FIGURE SHOWS THE BUSHING 52/2000 (1:5 SCALE)

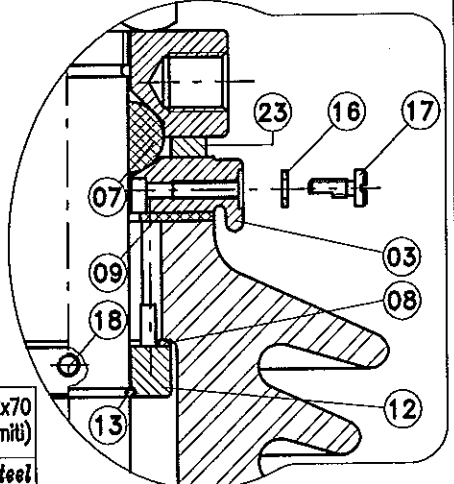
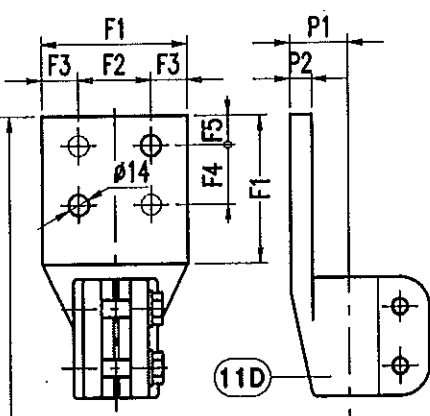
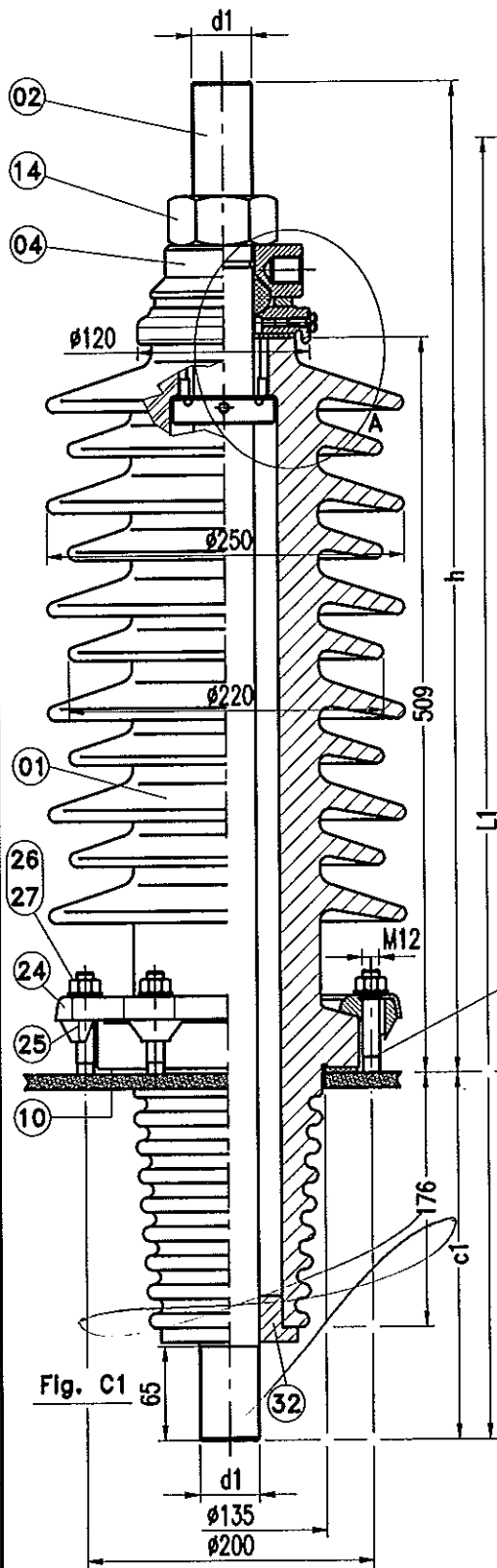


ISOLATORI PASSANTI PER TRASFORMATORI - PROFILO ANTINEBBIA (DIN 42534 MODIFICATA)
TENSIONE NOMINALE 52 KV LINEA DI FUGA 1120mm
OUTDOOR TRANSFORMER BUSHING - ANTIFOG PROFILE (DIN 42534 MODIFIED)
RATED VOLTAGE 52 KV CREEPAGE DISTANCE 1120mm

3.6.D

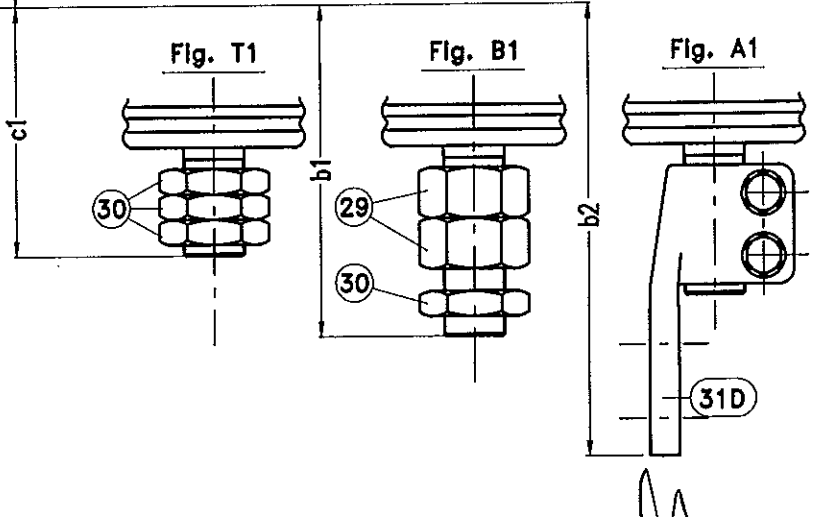
Esec. DIN

FILE = PAC3-6D .DWG
 REV. 00 DTD 05/08/03
 LWT [(0,0) (196,286)] A4 (210x297)
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n° 6 prigionieri di fissaggio M12x70
 in acciaio su 200 mm (non forniti)
 n° 6 firing studs made in steel
 M12x70 Bolt circle 200 mm
 (not supplied with the kit)

VISTA "A"



Isolatore Bushing	Corrente Current A	d1	d2	L1	a	c1	b1	b2	h	F1	F2	F3	F4	F5	F6	F7	P1	P2	P3	P4	Linea di fuga Creepage distance	Massa Kg	Volume Volume dm ³	N°Fori Band. N°Holes(Flag) Z
52F/1000/1435	1250	M30x2	14	978	725	253	270	316	657	60	26	17	26	17	32	14	28	10	30	12	1435	36	140	2
52F/2000/1435	2000	M42x3	18	1053	800	253	302	381	687	100	50	25	40	20	50	25	40	15	45	20	1435	45	145	4
52F/3150/1435	3150	M48x3	18	1083	830	253	316	406	692	120	60	30	40	20	60	30	45	15	45	20	1435	50	155	4

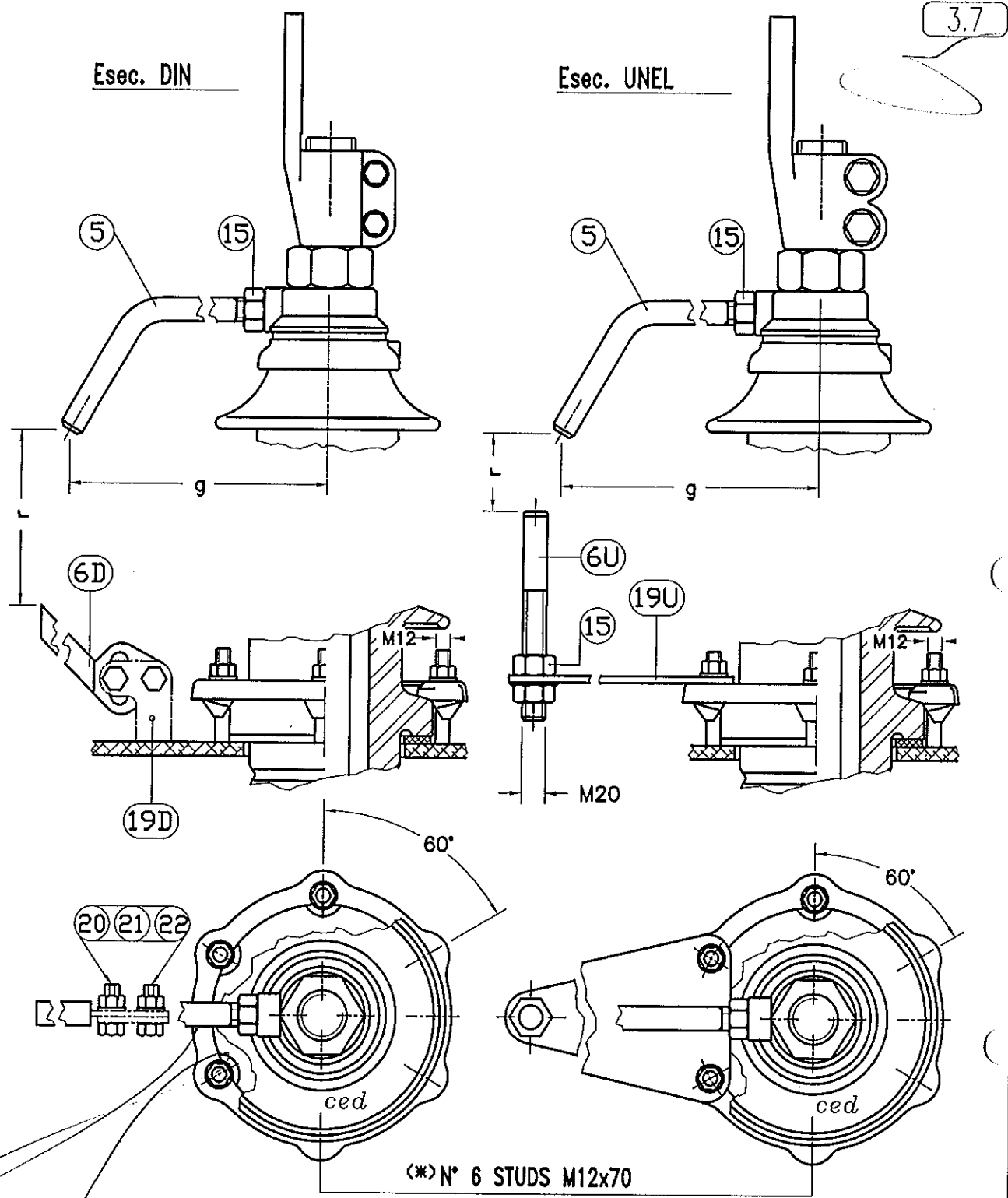
LA FIGURA MOSTRA ISOLATORE 52/2000 IN SCALA 1:5

THE FIGURE SHOWS THE BUSHING 52/2000 (1:5 SCALE)

CEDASPE

ISOLATORI PASSANTI PER TRASFORMATORI - PROFILO ANTINEBBIA (DIN 42534 MODIFICATA)
TENSIONE NOMINALE 52 KV LINEA DI FUGA 1435 mm
OUTDOOR TRANSFORMER BUSHING - ANTIFOG PROFILE (DIN 42534 MODIFIED)
RATED VOLTAGE 52 KV CREPAGE DISTANCE 1435 mm

FILE = PAG3-7.DWG
 LMT [(0,0) (196,286)]
 AA (210x297)
 REV. 01 DTD 22/10/01
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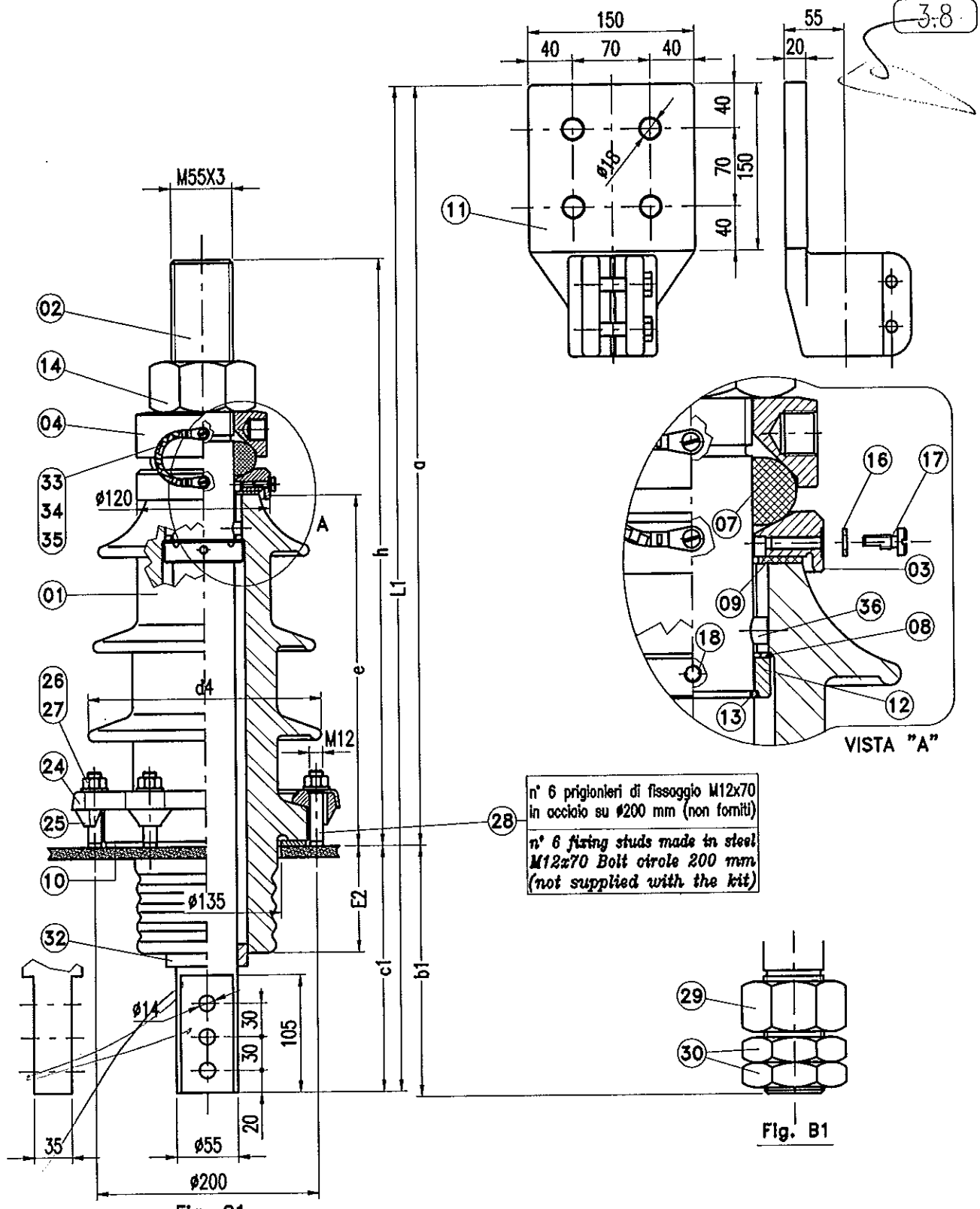
Pos	Qty	Descrizione	Description
5	1	Scaric. sup.	Top a/horn
6D/U	1	Scaric. Inf.	Bottom a/horn
15	1/2	Dado M20 Fe UNI 5588	Steel nut M20 DIN 934
19D/U	1	Supporto	Bracket
20	2	Vite Fe M12	Steel screw M12
21	2	Rondella Fe ø13	Steel washer ø13
22	2	Dado M12 Fe UNI 5588	Steel nut M12 DIN 934

TIPO	Esec. DIN		Esec. UNEL	
	g	r	g	r
10 Ni/1000-3150	225	85	225	70
20 Ni/1000-3150	225	155	225	100
30 Ni/1000-3150	290	220	225	200
52 Ni/1000-3150	350	305	350	300

dim in mm. 154



SCHEMA MONTAGGIO SPINTEROMETRI 10-20-30-52/1000-3150
 ARCING HORNS ASSEMBLY FOR 10-20-30-52/1000-3150



Isolatore Bushing	Tensione Voltage KV	Corrente Current A	Linea di fuga Creepage distance	a mm	b1 mm	c1 mm	d4 mm	e mm	E2 mm	h mm	L1 mm	N°ALETTE N° of sheds Z	Massa Kg	Volume Volume dm³
10F/4500	12	4500	290	600	215	210	190	239	86	449	810	2	39	100
20F/4500	24	4500	440	675	225	220	210	314	96	524	895	3	47	110
30F/4500	36	4500	680	780	250	245	230	419	121	629	1025	4	55	120

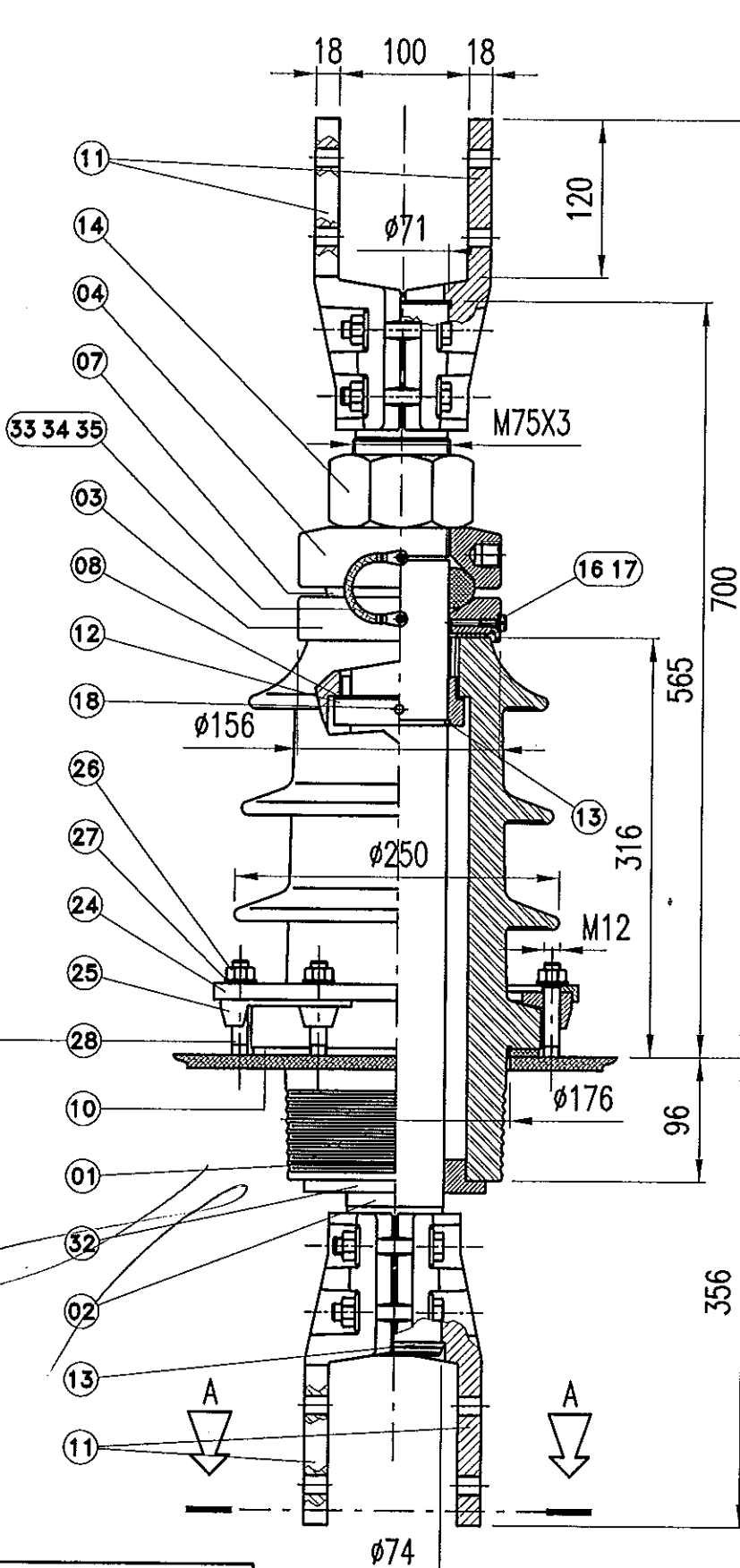
LA FIGURA MOSTRA ISOLATORE 20/4500 IN SCALA 1:5

THE FIGURE SHOWS THE BUSHING 20/4500 (1:5 SCALE)

ISOLATORI PASSANTI PER TRASFORMATORI 12-24-36 kV
CORRENTE NOMINALE 4500A
OUTDOOR TRANSFORMER BUSHING 12-24-36 kV
RATED CURRENT 4500A

155

CEDASPE



Corrente nominale 6300A
<i>Rated current 6300A</i>
Tensione nominale 24KV
<i>Rated voltage 24KV</i>
Peso 80Kg
<i>Weight 80Kg</i>
Volume 160dm
<i>Volume 160dm</i>
Linea di fuga 440mm
<i>Creepage distance 440mm</i>

n°6 prigionieri di fissaggio M12x70
 in acciaio inox su Ø240 mm (non forniti)
 n°6 fixing studs made in stainless steel
 M12x70 Bolt circle 240 mm
 (not supplied with the kit)

**ISOLATORE PASSANTE
 PER TRASFORMATORI TIPO 20/6300
 OUTDOOR TRANSFORMER
 BUSHING TYPE 20/6300**



BANDERUOLA 8000 A
TIPO TP78-180
ARGENTATA 10 µm
(FORNITA A RICHIESTA)

FLAG 8000 A
TIPO TP78-180
SILVER PLATED 10 µm
(SUPPLIED UPON REQUEST)

BANDERUOLA 5000 A
TIPO TP78-120
STAGNATA 10 µm
(FORNITA A RICHIESTA)

FLAG 5000 A
TIPO TP78-120
TIN PLATED 10 µm
(SUPPLIED UPON REQUEST)

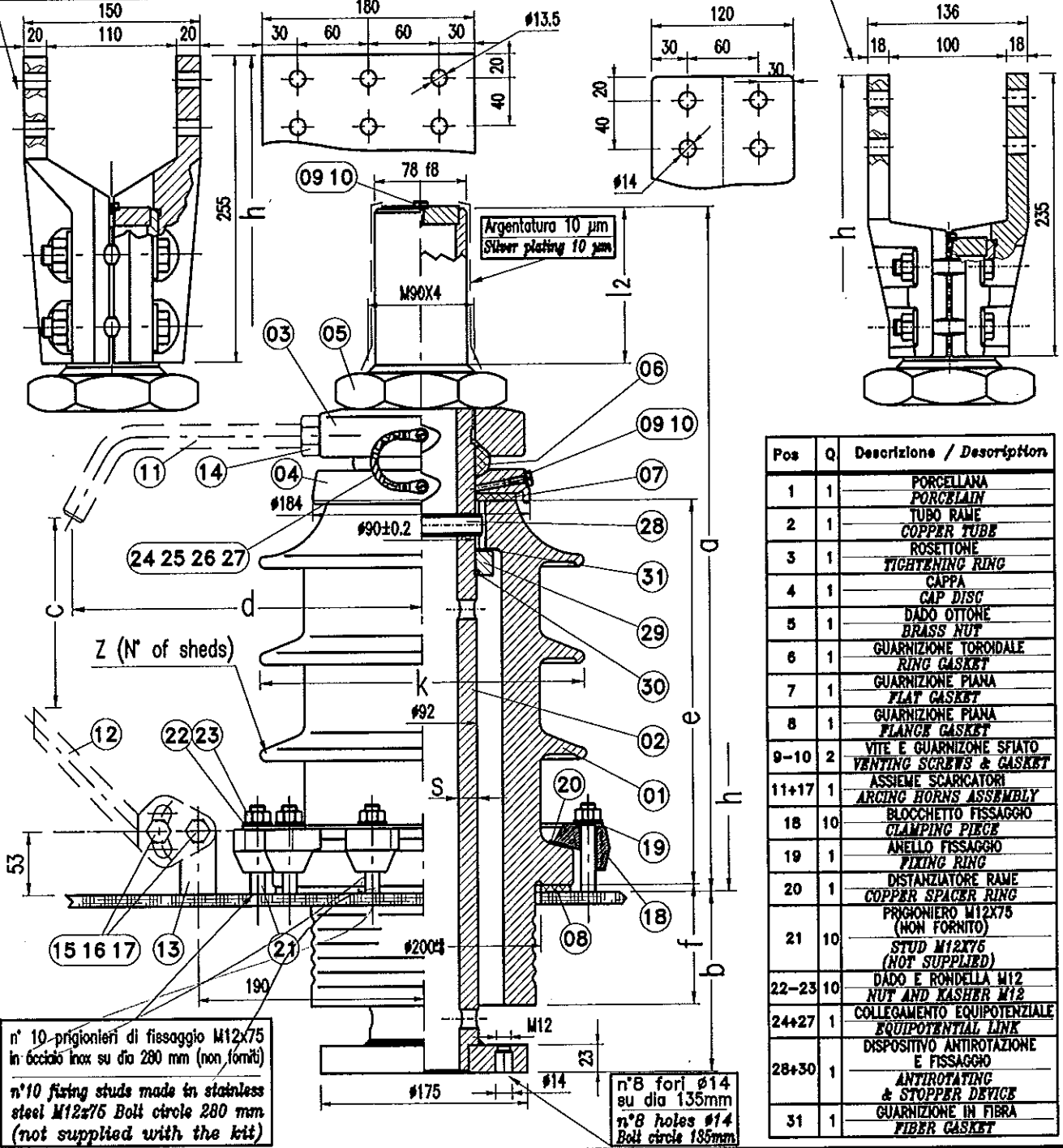
AA (2/10/287)

LMT (0/0) (195/286)

FILE = PAG3.10.DWG

REV. 05 DTD 28/07/03

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n° 10 prigionieri di fissaggio M12x75
in acciaio inox su dia 280 mm (non forniti)

n° 10 firing studs made in stainless
steel M12x75 Bolt circle 280 mm
(not supplied with the kit)

n° 8 fori #14
su dia 135mm
n° 8 holes #14
Bolt circle 135mm

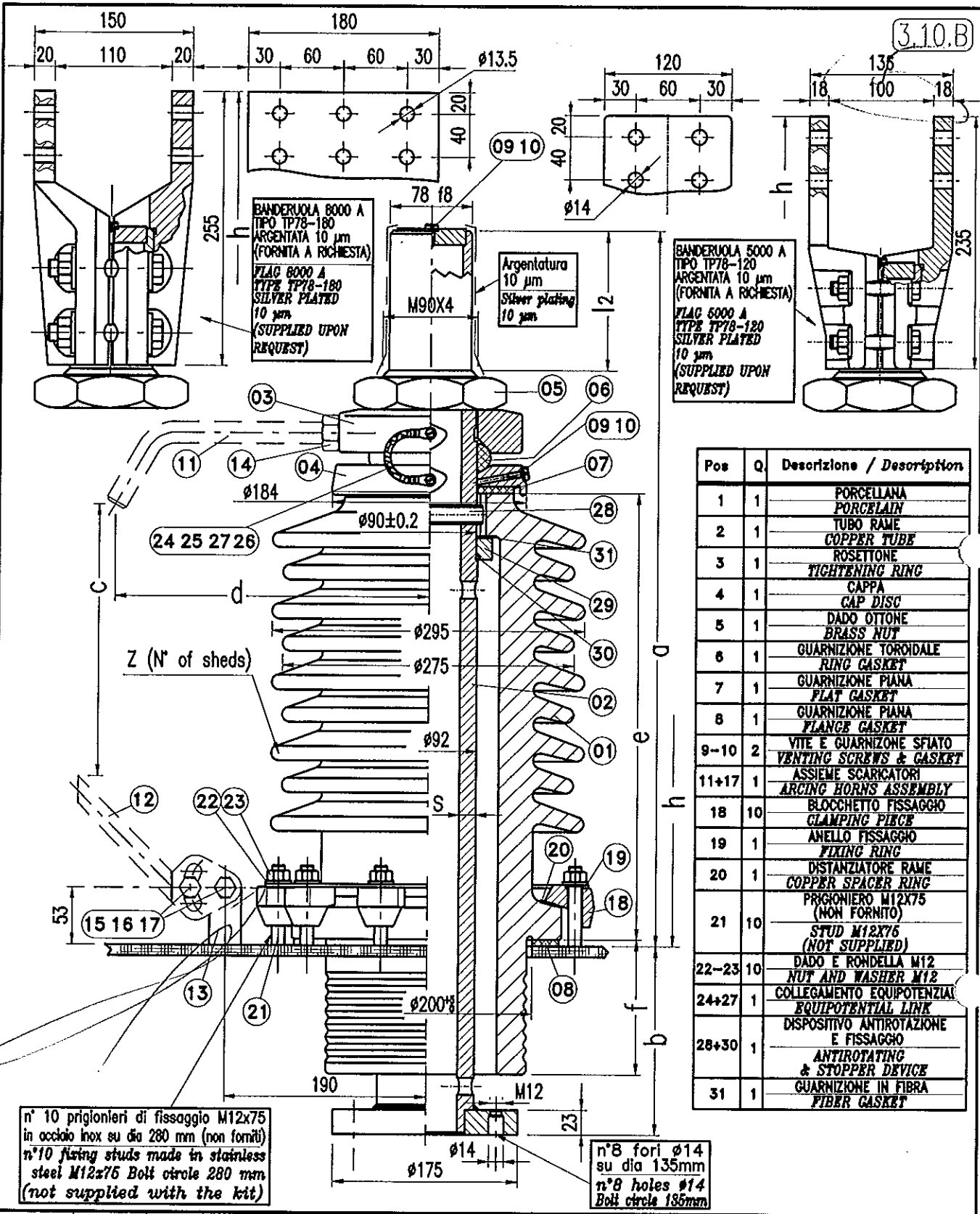
Pos	Q	Descrizione / Description
1	1	PORCELLANA / PORCELAIN
2	1	TUBO RAME / COPPER TUBE
3	1	ROSETTONE / TIGHTENING RING
4	1	CAPPA / CAP DISC
5	1	DADO OTTONE / BRASS NUT
6	1	GUARNIZIONE TOROIDALE / TOROIDAL RING GASKET
7	1	GUARNIZIONE PIANA / FLAT GASKET
8	1	GUARNIZIONE PIANA / FLANGE GASKET
9-10	2	VITE E GUARNIZIONE SFIATO / VENTING SCREWS & GASKET
11-17	1	ASSEMBLEO SCARICATORI / ARCING HORNS ASSEMBLY
18	10	BLOCCHETTO FISSAGGIO / CLAMPING PIECE
19	1	ANELLO FISSAGGIO / FIXING RING
20	1	DISTANZIATORE RAME / COPPER SPACER RING
21	10	PRIGIONIERO M12x75 (NON FORNITO) / STUD M12x75 (NOT SUPPLIED)
22-23	10	DADO E RONDELLA M12 / NUT AND WASHER M12
24+27	1	COLLEGAMENTO EQUIPOTENZIALE / EQUIPOTENTIAL LINK
28+30	1	DISPOSITIVO ANTIROTAZIONE E FISSAGGIO / ANTIROTATING & STOPPER DEVICE
31	1	GUARNIZIONE IN FIBRA / FIBER GASKET

Isolatore Bushing	Tensione Voltage KV	Corrente Current A	Linea di fuga Creepage distance	Distanza d'arco Arcing distance	a mm	b mm	c mm	d mm	e mm	f mm	h mm	l2 mm	s mm	k mm	massa Kg	Z	Note
24-5/P2	24	5000	480 ⁽¹⁾	270	540	150	155	295	320	100	678	100	16	285	60	3	Acc.EN50243:2002-04
24-8/P2		8000			570										698		
24-5/P4	24	5000	744	380	635	175	220	320	415	125	770	100	16	320	70	5	⁽¹⁾ It replaces the old DIN42541 with creepage 470 mm & dia "K" = 275 mm
36-5/P2		8000			665										800		
24-8/P4	24	5000	555	355	635	175	220	320	415	125	773	100	16	280	80	4	DIN 42541-1983
36-8/P2		8000			665										800		
36-5-A	36	5000	555	355	635	175	220	320	415	125	773	100	16	280	80	4	DIN 42541-1983
36-8-A		8000			665										800		

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ISOLATORE COMPLETO 24 - 36 KV
5000 - 8000 A EN 50243:2002-04
COMPLETE BUSHING 24 - 36 KV
5000 - 8000 A EN 50243:2002-04

FILE = PAG3-10B.DWG LWT [(6,0) (196,286)] A4 (210x297)
 REV. 03 DTD 29/07/03
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Pos	Q	Descrizione / Description
1	1	PORCELLANA PORCELAIN
2	1	TUBO RAME COPPER TUBE
3	1	ROSETTONE TIGHTENING RING
4	1	CAPPA CAP DISC
5	1	DADO OTTONE BRASS NUT
6	1	GUARNIZIONE TORCIDALE RING GASKET
7	1	GUARNIZIONE PIANA PLAT GASKET
8	1	GUARNIZIONE PIANA FLANGE GASKET
9-10	2	VITE E GUARNIZIONE SFIATO VENTING SCREWS & GASKET
11+17	1	ASSIEME SCARICATORI ARCING HORNS ASSEMBLY
18	10	BLOCCETTO FISSAGGIO CLAMPING PINCE
19	1	ANELLO FISSAGGIO FIXING RING
20	1	DISTANZIATORE RAME COPPER SPACER RING
21	10	PRIGIONIERO M12X75 (NON FORNITO) STUD M12X75 (NOT SUPPLIED)
22-23	10	DADO E RONDELLA M12 NUT AND WASHER M12
24+27	1	COLLEGAMENTO EQUIPOTENZIALE EQUIPOTENTIAL LINK
28+30	1	DISPOSITIVO ANTIROTAZIONE E FISSAGGIO ANTIROTATING & STOPPER DEVICE
31	1	GUARNIZIONE IN FIBRA FIBER GASKET

n° 10 prigionieri di fissaggio M12x75
 in acciaio inox su dia 280 mm (non forniti)
 n°10 fixing studs made in stainless
 steel M12x75 Bolt circle 280 mm
 (not supplied with the kit)

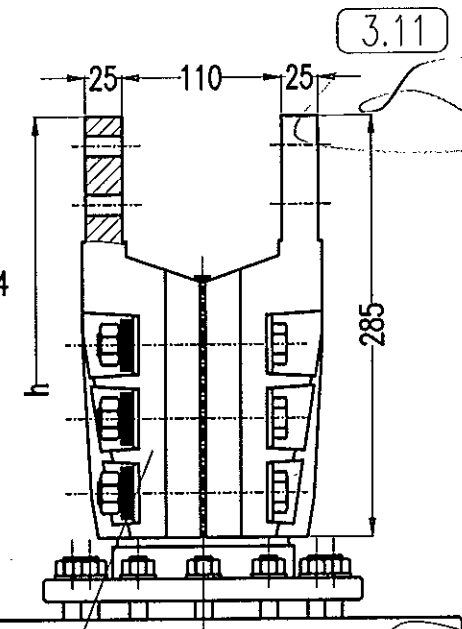
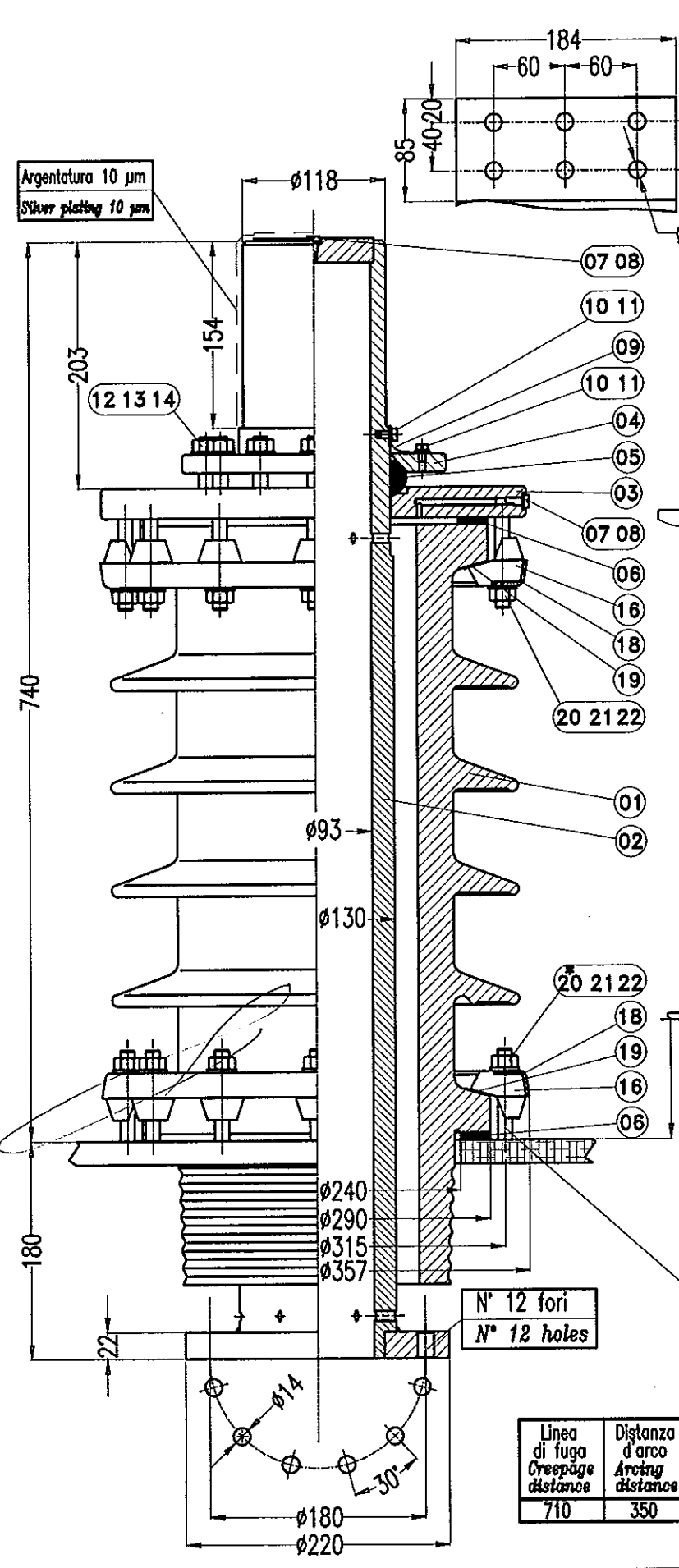
n°8 fori ø14
 su dia 135mm
 n°8 holes ø14
 Bolt circle 135mm

Isolatore Bushing	Tensione Voltage KV	Corrente Current A	Linea di fuga Creepage distance	Distanza d'arco Arcing distance	a	b	c	d	e	f	h	l2	s	Z	massa Kg	Note
36-5/P3	36	5000	900	370	635	175	220	320	415	125	770	100	16	9	80	Acc.EN50243:2002-04
36-8/P3	36	8000	900	370	665	175	220	320	415	125	790	130	21	9	90	Acc.EN50243:2002-04
36-5/P4	36	5000	1100	421	701	199	286	320	481	149	839	100	16	11	85	SPECIAL DESIGN
36-8/P4	36	8000	1100	421	731	199	286	320	481	149	859	130	21	11	95	SPECIAL DESIGN

CEDASPE

ISOLATORE COMPLETO 36 KV - PROFILO ANTINEBBIA
 5000 - 8000 A EN 50243:2002-04
 COMPLETE BUSHING 36 KV - PROFILE ANTIFOG
 5000 - 8000 A EN 50243:2002-04

150



BANDERUOLA 12500 A
 TIPO GPL 118-180
 ARGENTATA 10 µm
 (FORNITA A RICHIESTA)

FLAG 12500 A
 TYPE CPL 118-180
 SILVER PLATED 10 µm
 (SUPPLIED UPON REQUEST)

Pos	Q.ty	Descrizione / Description
1	1	PORCELLANA PORCELAIN
2	1	TUBO RAME COPPER TUBE
3	1	FLANGIA DI CHIUSURA CLOSING FLANGE
4	1	ANELLO PRESSIONE TIGHTENING RING
5	1	GUARNIZIONE TOROIDALE RING GASKET
6	2	GUARNIZIONE PIANA FLANGE GASKET
7-8	2	VITE E GUARNIZIONE SFIATO VENTING SCREWS & GASKET
9+11	1	COLLEGAMENTO EQUIPOTENZIALE EQUIPOTENTIAL LINK
12	12	PRIGIONIERO M12X40 STUD M12X40
13-14	12	DADO E RONDELLA M12 NUT AND WASHER M12
16	24	BLOCCETTO FISSAGGIO CLAMPING PIECE
18	2	ANELLO FISSAGGIO ALU FIXING RING
19	2	DISTANZIATORE RAME COPPER SPACER RING
20	12	PRIGIONIERO M12X75 STUD M12X75
21-22	24	DADO E RONDELLA M12 NUT AND WASHER M12

* n° 12 prigionieri di fissaggio M12x75 in acciaio inox su dia 315 mm (non forniti)
 * n°12 fixing studs made in stainless steel M12x75 Bolt circle 315 mm (not supplied with the kit)

Linea di fuga Creepage distance	Distanza d'arco Arcing distance
710	350

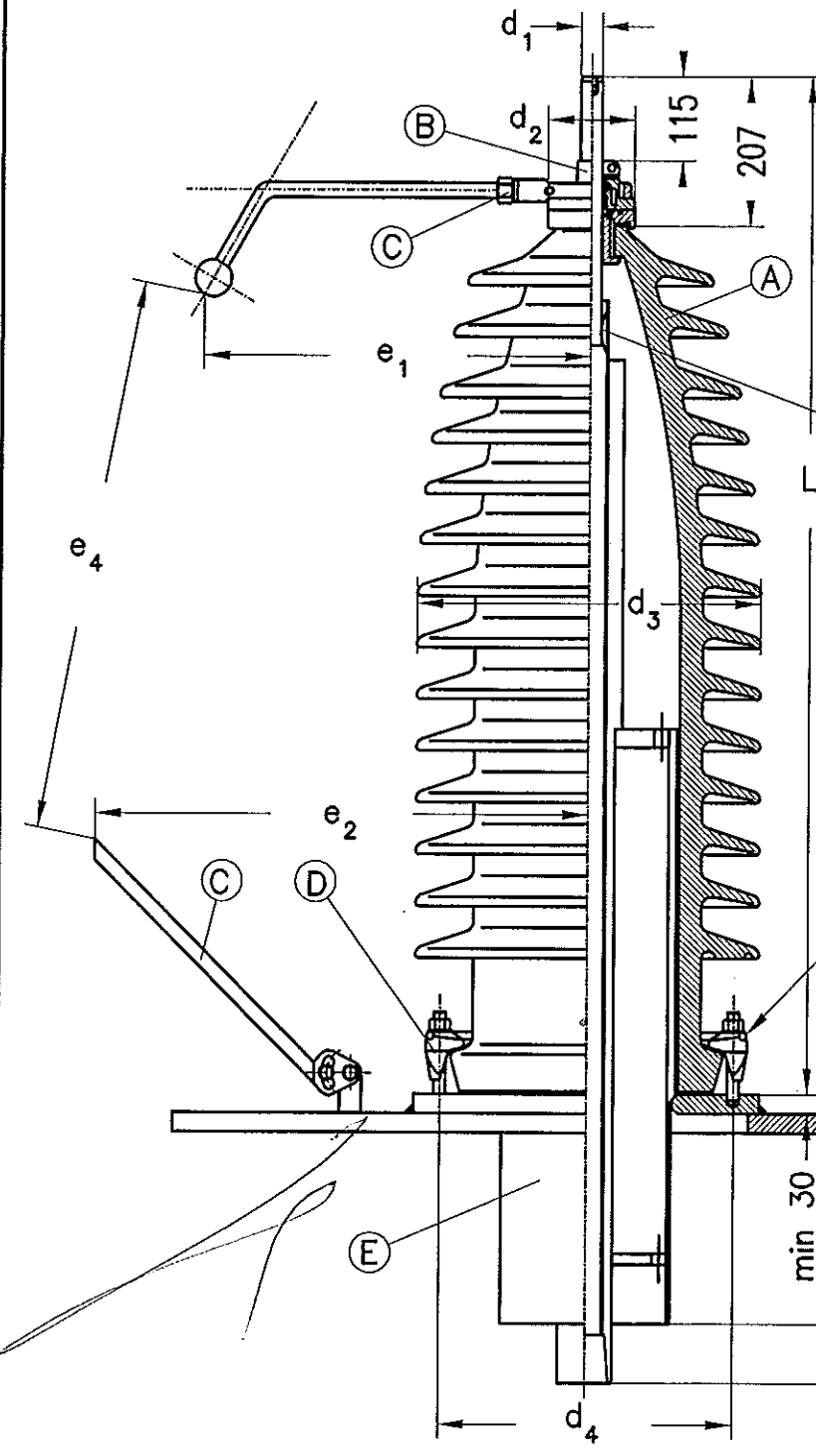
	Senza banderuola Without flag	Banderuola Flag
Peso Kg Weight Kg	140	22



ISOLATORE 36kV 12500A DIN 42537-1983
 BUSHING 36kV 12500A DIN 42537-1983

150

FILE = PAG3.12.DWG
 REV. 04 DTD 28/03/04
 UMT (0.0) (196.286)
 A4 (210x297)
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Pos	Descrizione / Description
A	Porcellana <i>Porcelain</i>
B	Gruppo di testa e conduttore <i>Head assembly and conductor</i>
C	Gruppo spinterometri sup. ed inf. <i>Top & Bottom a/horn kit</i>
D	Kit di fissaggio <i>Fixing & clamping kit</i>
E	Gruppo schermo isolato e supporto <i>Internal insulated shield assembly</i>

Contatto a lamella
Spring contact

Prigionieri di fissaggio M16x100 DIN 939 in acciaio inox (forniti con l'isolatore)
 -72.5kV n° 8 equidistanti su dia 310 mm
 -125kV n° 12 equidistanti su dia 405 mm
Fixing studs made in stainless steel M16x100 DIN 939 (supplied with the kit)
 -72.5 kV n° 8 equally spaced on dia 310 mm
 -125 kV n° 12 equally spaced on dia 405 mm

• Quote indicative e soggette a verifica da parte del cliente e da confermare in sede ordine
 • Indicative sizes to be checked by the customer and to be confirmed when issuing the order

ISOLATORE BUSHING	Tensione Voltage	Corrente Current	Linea di fuga Creepage distance	d ₁	d ₂	d ₃	d ₄	e ₁	e ₂	e ₄		L ₁	h ₁ °	h ₂ °
	kV	A		mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
D72.5-1250	72.5	1250	1250	30	120	345	310	390	530	305	400	951	150	230
D125-1250	125	1250	2800	30	120	475	405	530	675	650	750	1378	305	395
D125-1250N	125	1250N	2800	30	120	475	405	530	765	550	750	1378	305	395
D72.5-2000	72.5	2000	1250	42	135	345	310	390	530	305	400	951	150	230
D125-2000	125	2000	2800	42	135	475	405	530	675	650	750	1378	305	395
D125-2000N	125	2000N	2800	42	135	475	405	530	765	550	750	1378	305	395

CEDASPE

ISOLATORE COMPLETO 72,5/125 kV
 1250/2500 A DIN 42535 - 1978

COMPLETE BUSHING 72,5/125 kV - 180
 1250/2500 A DIN 42535 - 1978



Sect 4-AT **FLAG CONNECTORS**

Page 4.1 : Flags 1000-2000-3150 UNEL 38137-67

Page 4.2: Flags EP - FP DIN 43675 from 1000 to 6300 A

Page 4.3 : Flags ER - FR DIN 43675 from 1000 to 4500 A

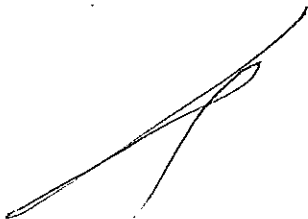
Page 4.4 : Flags 250 & 630 A – different styles

Page 4.7 : Flags TP 6300 - 8000 - 12500 A DIN 43675

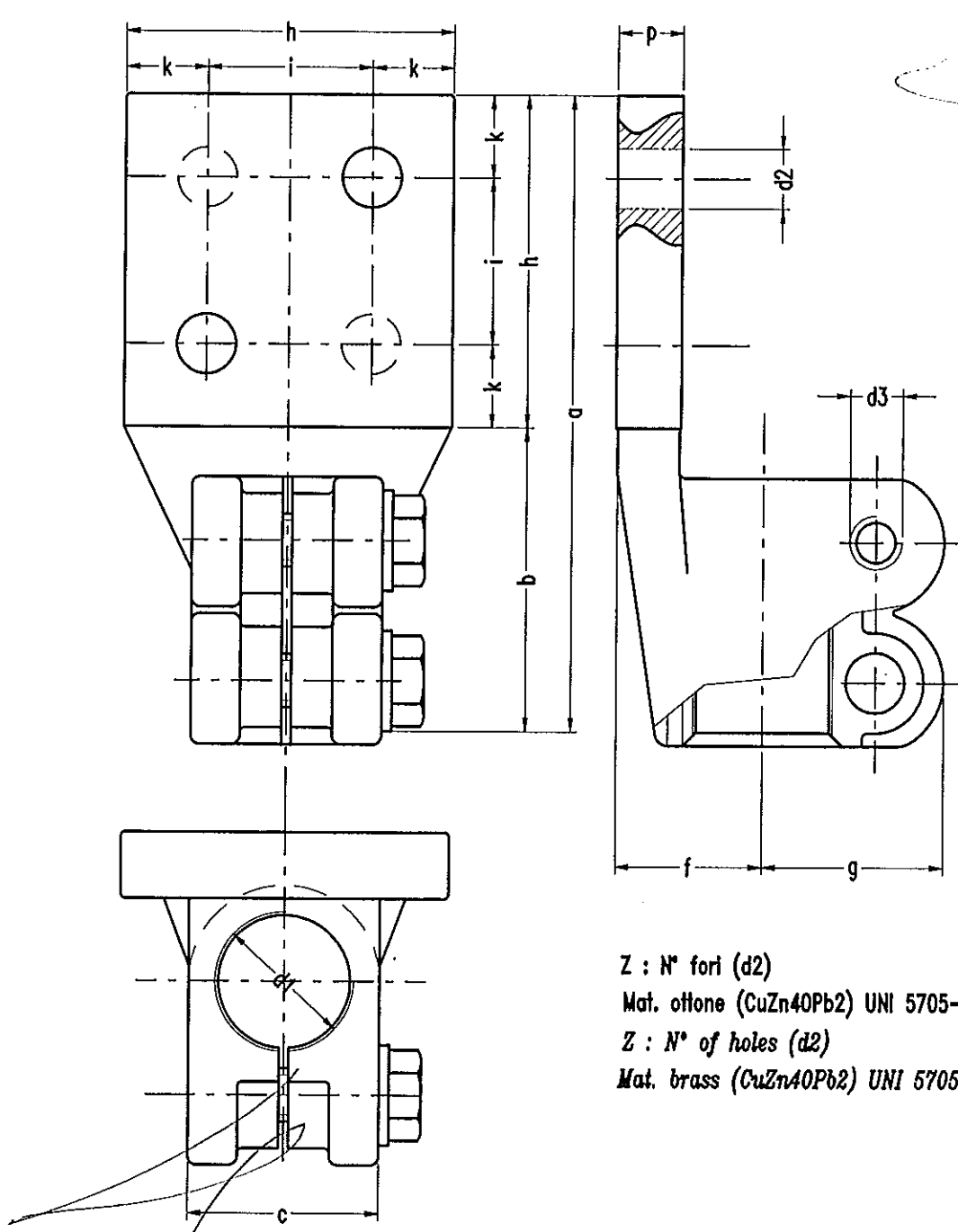
NOTE : All flags are fitted with locking bolts and washers in high tensile steel zincplated chromium passivated; upon request, in stainless steel AISI 304

Tightening torque (suggested values, +/- 10%)
on the locking bolts of the flags

Size	Torque
M10	25 Nm
M12	40 Nm
M16	90 Nm



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Z : N° fori (d2)
 Mat. ottone (CuZn40Pb2) UNI 5705-65
 Z : N° of holes (d2)
 Mat. brass (CuZn40Pb2) UNI 5705-65

Tipo Type	Corrente Current A	a mm	b mm	c mm	d1	d2	d3	f mm	g mm	h mm	i mm	k mm	p mm	Z	Codice Code	
Acc. to Italian standard UNEL 38137-67	UNEL 1000 A	1000	130	60	44	M30X2	14	M12	30	40	60	32	14	12	2	BA1000UVIO
	UNEL 2000 A	2000	195	80	58	M42X3	18	M16	45	55	100	50	25	20	4	BA2000UVIO
	UNEL 3150 A	3150	220	85	68	M48X3	18	M16	45	55	120	60	30	20	4	BA3150UVIO
Acc. to Spanish standard UNE 20 176	UNESA 1000 A	1000	150	60	44	M30X2	14	M12	30	40	80	32	24	12	4	BA1000UNE4
	UNESA 2000 A	2000	195	80	58	M42X3	14	M16	45	55	100	50	25	20	4	BA2000UNE4
	UNESA 3150 A	3150	220	85	68	M48X3	14	M16	45	55	120	60	30	20	4	BA3150UNE4

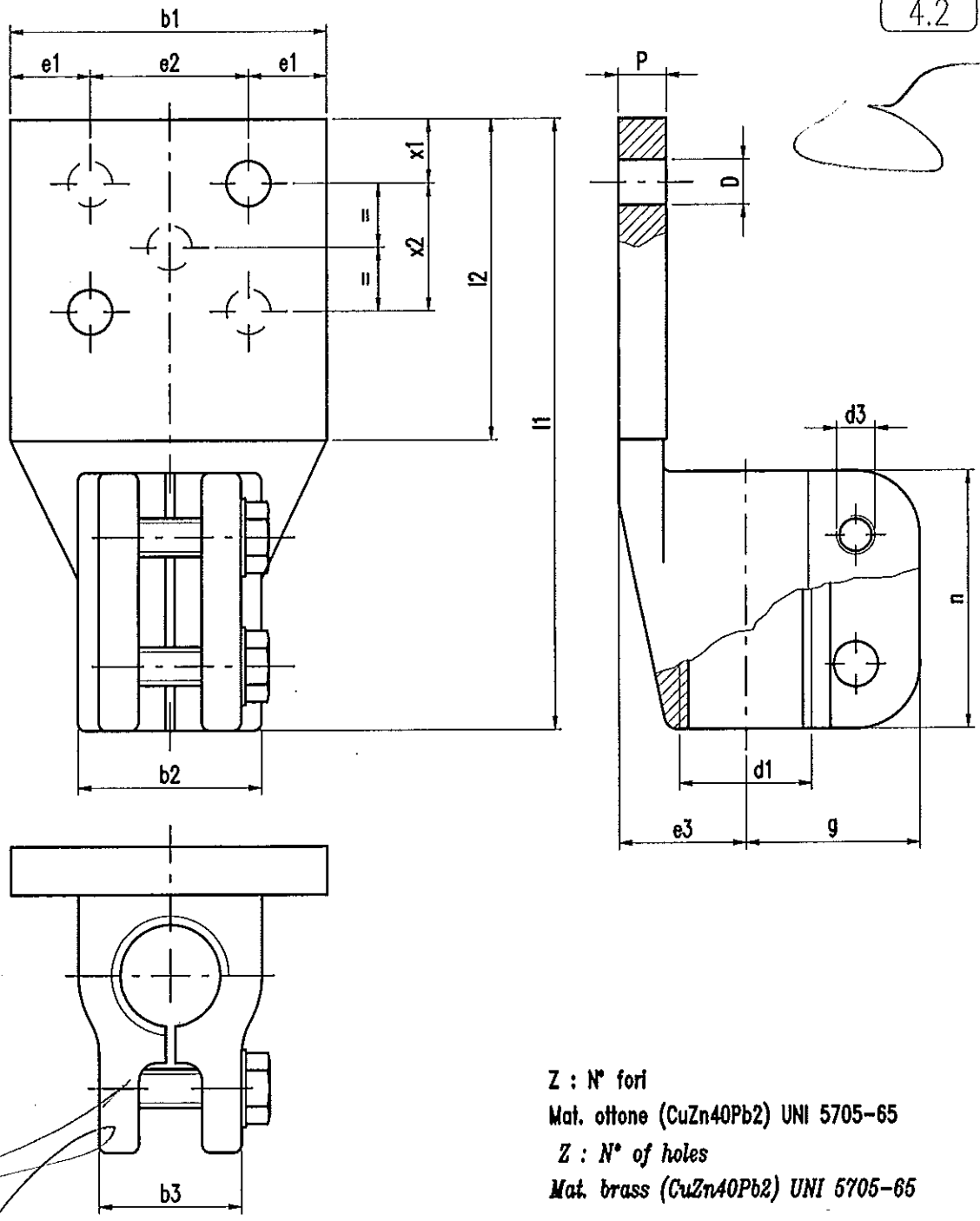
LA FIGURA MOSTRA BANDERUOLA UNEL 2000 IN SCALA 1:2

THE FIGURE SHOWS FLAG UNEL 2000 (1:2 SCALE)

162

BANDERUOLA UNEL 38137-67/UNE 20 176
Flag UNEL 38137-67 / UNE 20 176



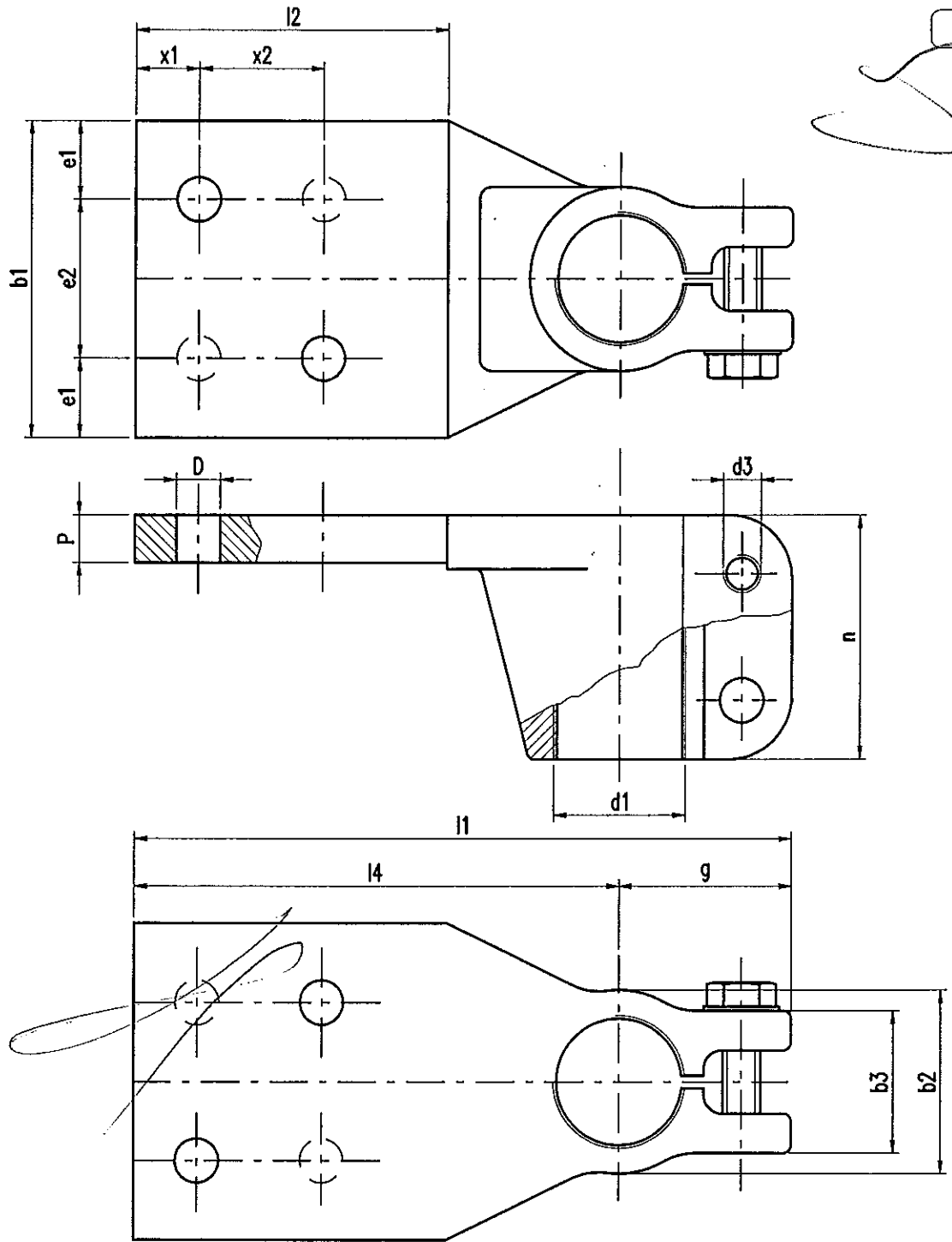


Z : N° fori
 Mat. ottone (CuZn40Pb2) UNI 5705-65
 Z : N° of holes
 Mat. brass (CuZn40Pb2) UNI 5705-65

Tipo Type	Corrente Current A	b1 mm	b2 mm	b3 mm	d1	d3	e1 mm	e2 mm	e3 mm	g mm	l1 mm	l2 mm	n mm	P mm	x1 mm	x2 mm	Z	D ø	NOTA Note	Codice Code
EP 1000	1000	60	45	36	M30X2	M10	17	26	28	40	130	60	60	10	17	26	2	14	Acc. to DIN 43675	BA1000DM0
FP 2000	2000	100	58	45	M42X3	M12	25	50	40	55	190	100	80	15	20	40	4	14	Acc. to DIN 43675	BA2000DM0
FP 3150	3150	120	68	58	M48X3	M12	30	60	45	55	210	120	80	15	20	40	4	14	Acc. to DIN 43675	BA3150DM0
FP 4500	4500	150	80	58	M55X3	M12	40	70	55	42	246	150	90	20	40	70	4	18	Special	BA4500UM0
FP 6300	6300	200	105	62	ø71	M12	40	120	65	70	310	200	100	20	40	120	5	18	Special	BA6300UM0
FP 2000/M30 NEMA	2000	100	58	45	M30X2	M12	27.7	44.5	40	55	190	100	80	15	27.7	44.5	4	14	Special NEMA pads	FA2000DF3
FP 2000/M42 NEMA	2000	100	58	45	M42X3	M12	27.7	44.5	40	55	190	100	80	15	27.7	44.5	4	14	Special NEMA pads	BA2000DM2
FP 2* 1 1/2 UNF NEMA	2000	100	58	45	1 1/2 UNF (12pt)	M12	27.7	44.5	40	55	190	100	80	15	27.7	44.5	4	14	Special NEMA pads	BA2000DM4
FP 3150/M48 NEMA	3150	120	68	58	M48X3	M12	37.7	44.5	45	55	210	120	80	15	37.7	44.5	4	14	Special NEMA pads	FA3150DF2

LA FIGURA MOSTRA BANDERUOLA FP 2000 IN SCALA 1:2

THE FIGURE SHOWS FLAG FP 2000 (1:2 SCALE)



Z : N° fori

Z : N° of holes

Mat. ottone (CuZn40Pb2) UNI 5705-65

Mat. brass (CuZn40Pb2) UNI 5705-65

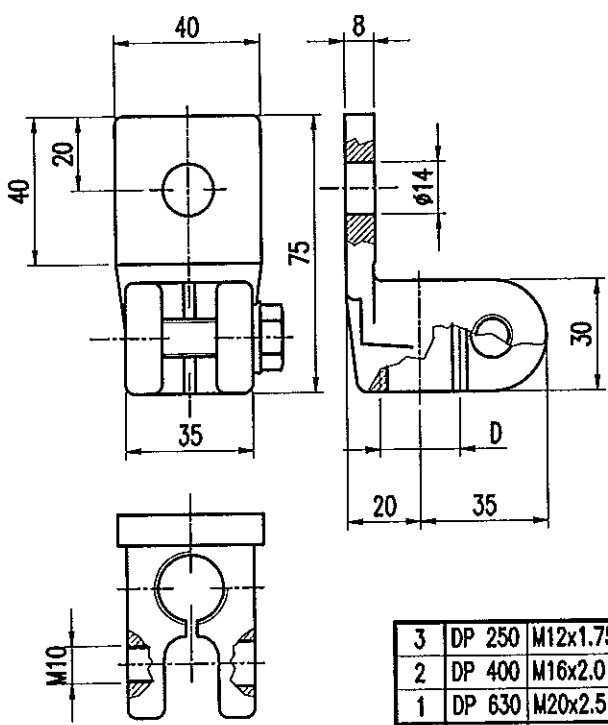
Tipo Type	Corrente Current A	b1 mm	b2 mm	b3 mm	d1	d3	e1 mm	e2 mm	g mm	l1 mm	l2 mm	l4 mm	n mm	P mm	x1 mm	x2 mm	Z	D ø	NOTA Note
ER 1000	1000	60	45	36	M30X2	M10	17	26	40	135	60	95	60	10	17	26	2	14	Acc. to DIN 43675
FR 2000	2000	100	58	45	M42X3	M12	25	50	55	210	100	155	80	15	20	40	4	14	Acc. to DIN 43675
FR 3150	3150	120	68	58	M48X3	M12	30	60	55	230	120	175	80	15	20	40	4	14	Acc. to DIN 43675
FR 4500	4500	150	80	80	M55X3	M12	40	70	60	267	150	205	90	20	40	70	4	18	Special

LA FIGURA MOSTRA BANDERUOLA FR 2000 IN SCALA 1:2

THE FIGURE SHOWS FLAG FR 2000 (1:2 SCALE)

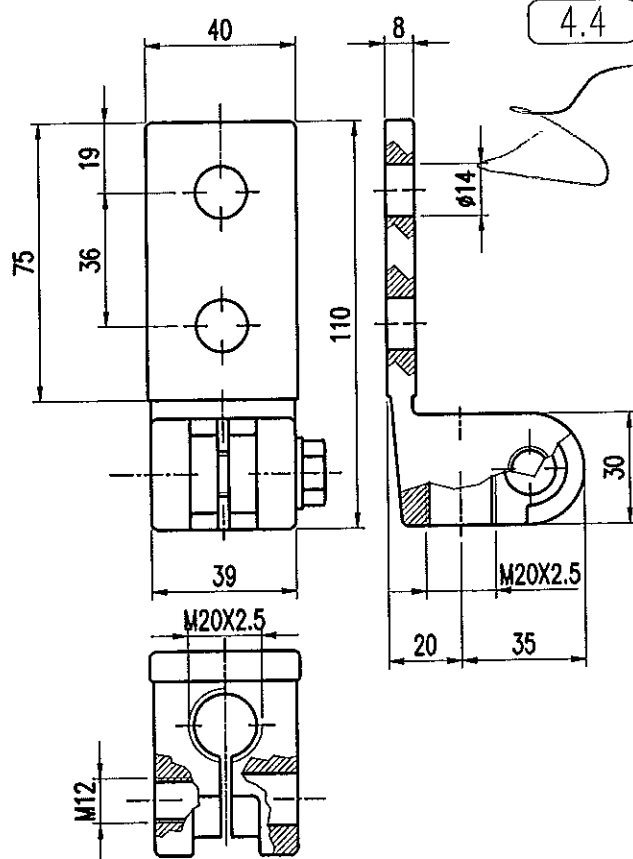
CEDASPE

BANDERUOLE ORIZZONTALI ER-FR
Horizontal Flags ER-FR



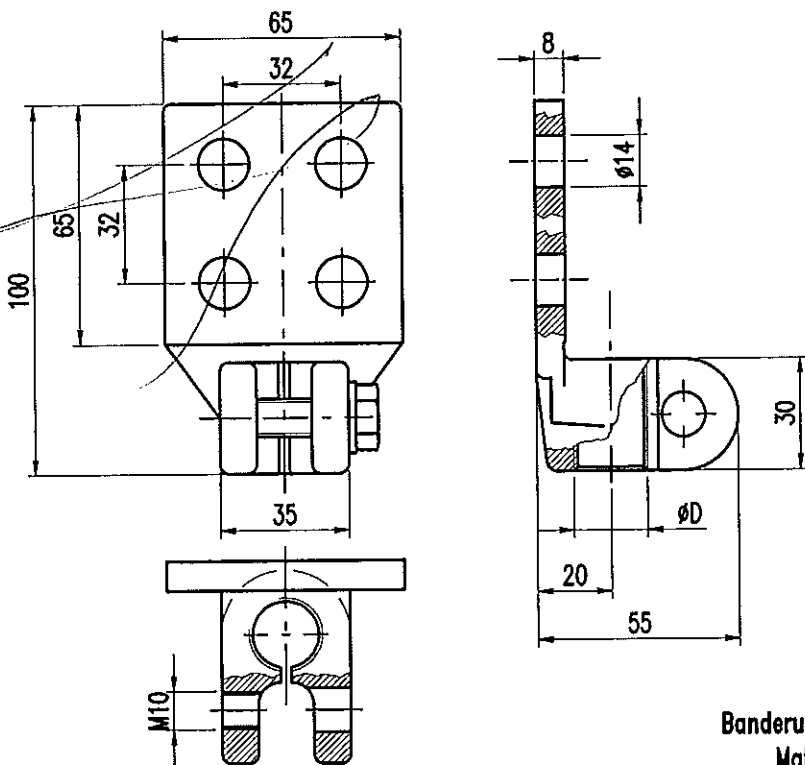
3	DP 250	M12x1.75
2	DP 400	M16x2.0
1	DP 630	M20x2.5
Pos.	TIPO	D

Banderuola/Brass flag DIN 43675 "DP"
 Mat. ottone (CuZn40Pb2) UNI 5705-65
 brass (CuZn40Pb2) UNI 5705-65



4.4

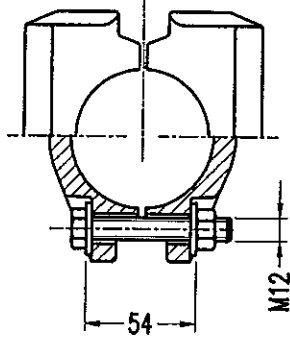
Banderuola/Brass flag DIN 43675 (modified) "AP-EL"
 Mat. ottone (CuZn40Pb2) UNI 5705-65
 brass (CuZn40Pb2) UNI 5705-65



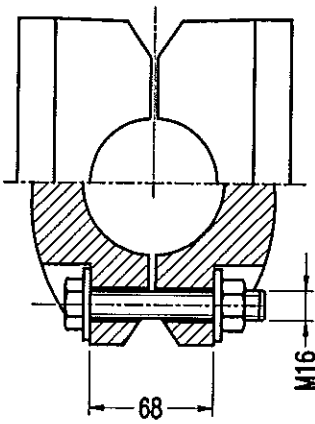
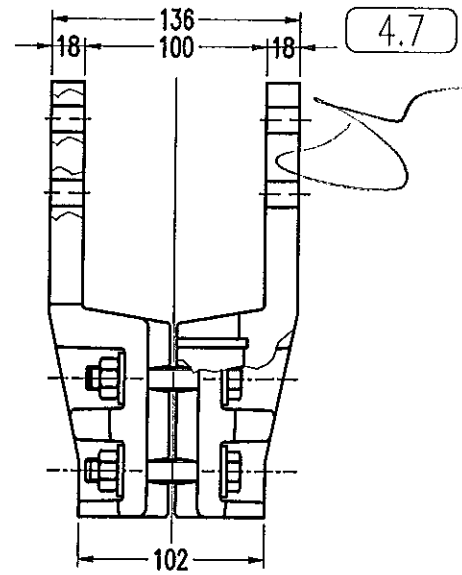
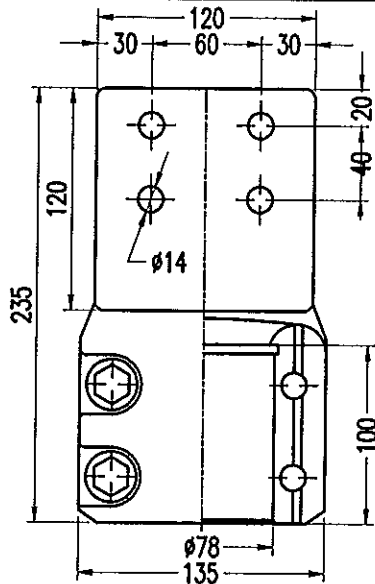
2	DP/LK 250	M12
1	DP/LK 630	M20
Pos.	TIPO	D

Banderuola/Brass flag DIN 43675 (modified) "DP-LK"
 Mat. ottone (CuZn40Pb2) UNI 5705-65
 brass (CuZn40Pb2) UNI 5705-65

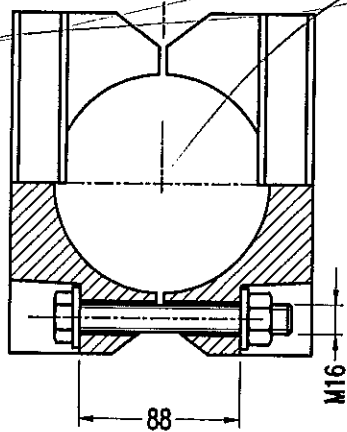
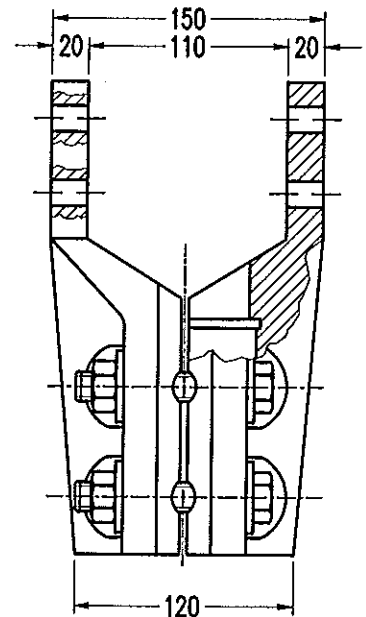
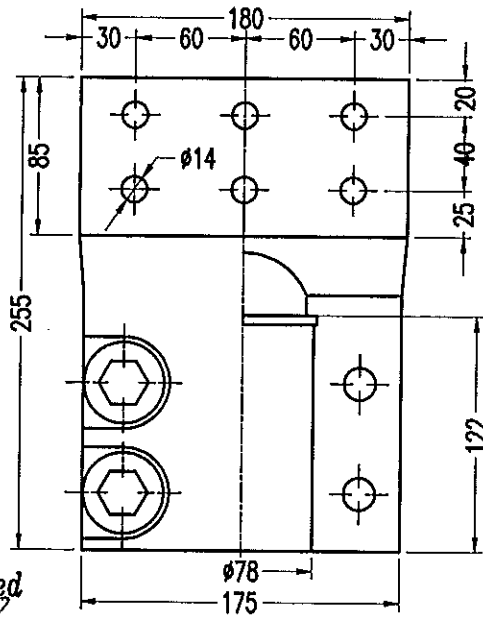
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 REV. 01 DTD 14/11/01
 FILE = PAG4-7.DWG
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 A4 (210x297)



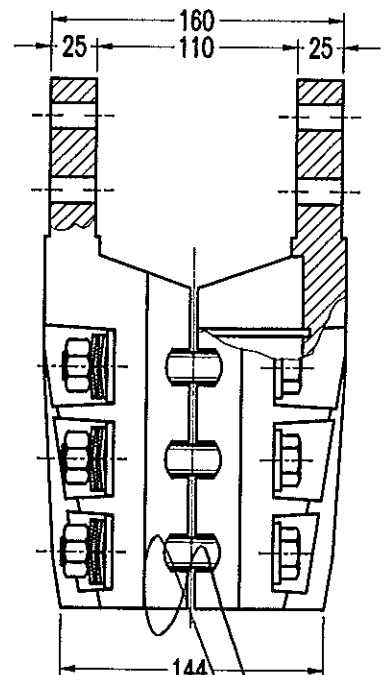
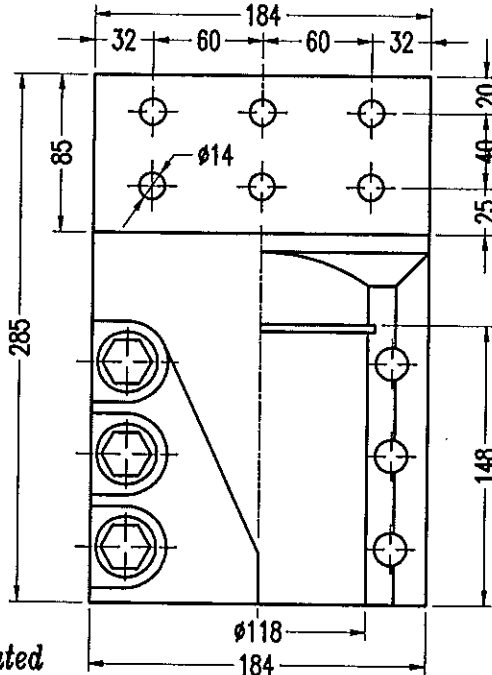
Banderuola/Flag type
TP 78/120 (6300A)
Mat. ottone argentato
brass silver plated



Banderuola/Flag type
TP 78/180 (8000A)
Mat. bronzo alluminio argentato
alu-bronze 88-9-3 silver plated



Banderuola/Flag type
GPL 118-180 (12500A)
Mat. bronzo alluminio argentato
alu-bronze 88-9-3 silver plated



BANDERUOLE A DOPPIO GUSCIO
PER 6300-8000-12500A DIN 43675

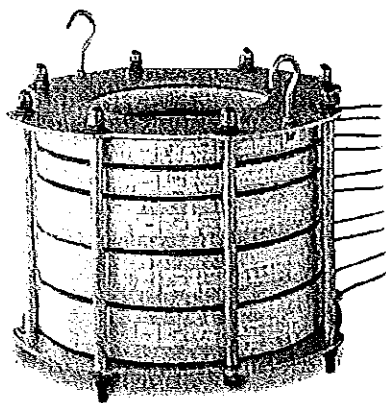
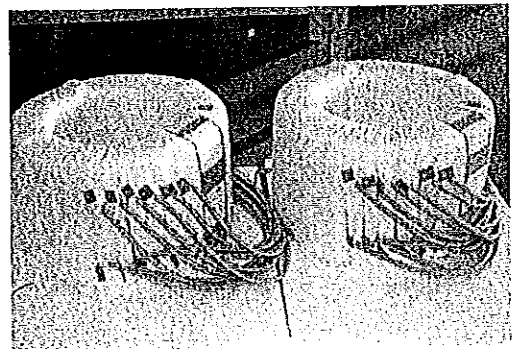
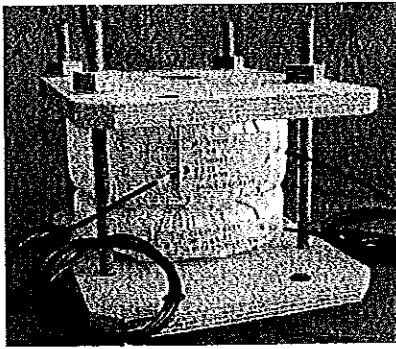
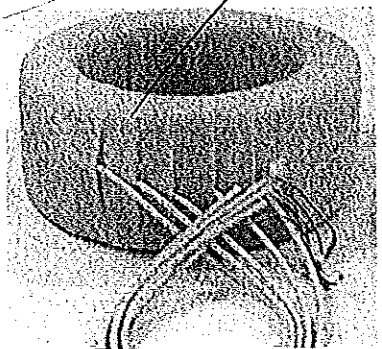
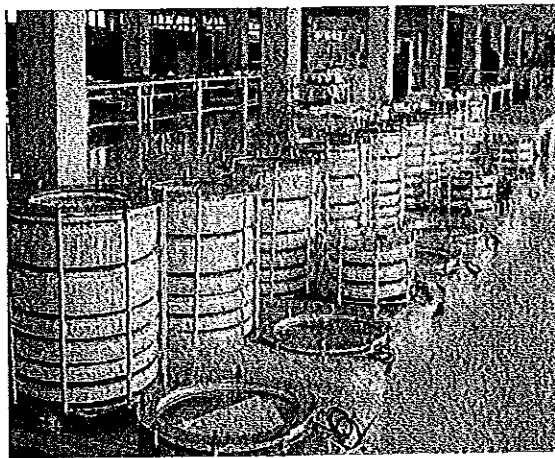
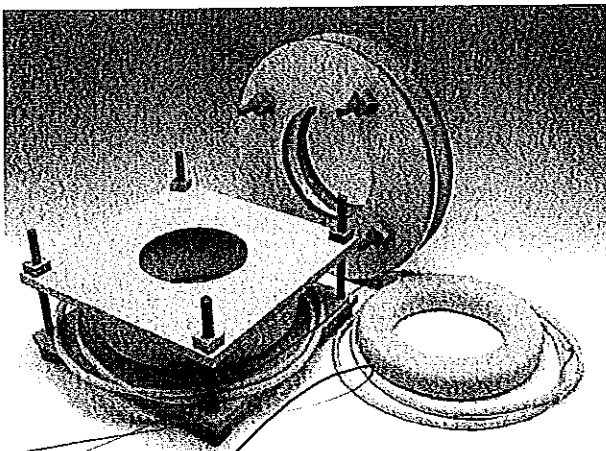
Double flags
For 6300-8000-12500A DIN 43675

BUSHING TYPE CURRENT TRANSFORMERS

5

ENPAY Bushing Type Current Transformers are designed and manufactured according to ENPAY's own design also in compliance with the customer specifications. These transformers are provided with suitable outer insulation of crepe paper or woven polyester tape or NOMEX allowing their usage in High and Medium Voltage Power Transformers. Internal insulation is made conforming their use in liquid such as transformer oil, silicon oil etc.

BT current transformers can easily be designed in different dimensions up to 1000 mm outer diameter, 350 mm height and 500 kg weight connections are made up with the latest technology allowing the lowest possible contact resistance together with the highest mechanical strength.



GENERAL SPECIFICATIONS

STANDARDS: IEC 60044-1, IEC 60044-6, ANSI

C 57.13, BS 3938, CAN3-C, 13-M83

PRIMARY CURRENT: Any requested value

SECONDARY CURRENT: 1A, 5A OR ANY Requested value

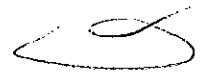
RATED BURDEN: Up to 200 VA

FREQUENCY: 50 Hz or 60 Hz

DESIGN: Assembled pack or individual

9
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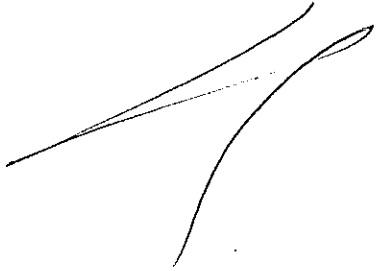
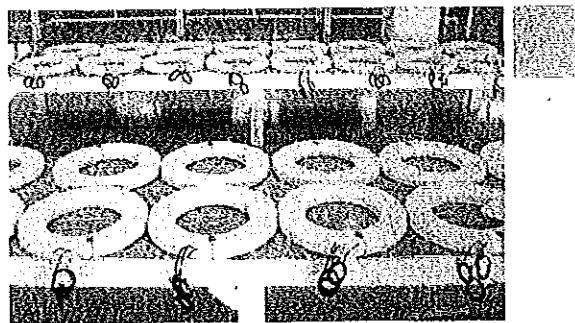
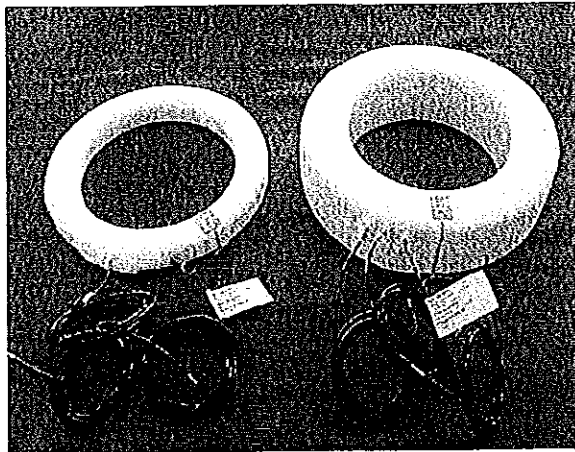
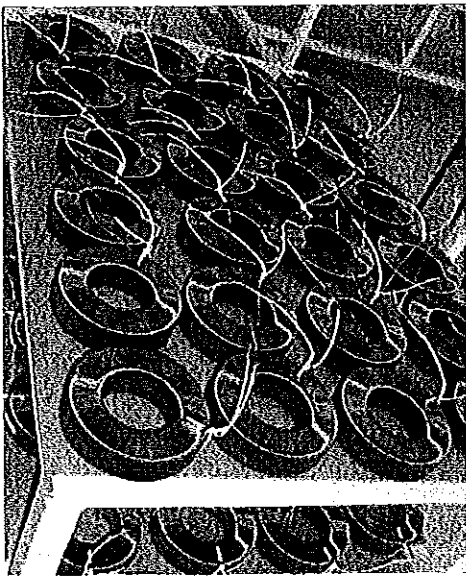
SEMI-FINISHED CURRENT TRANSFORMERS



MV AND HV SEMI-FINISHED CURRENT TRANSFORMERS

ENPAY Medium and High Voltage Semi-Finished Current Transformers are designed and manufactured according to ENPAY's own design or customer drawings. These Transformers are provided with suitable interlayer and outer insulation of polyester film. Internal insulation is made both conforming to their use in liquid or gas such as transformer oil, SF₆, Silicon oil etc. MV and HV current transformers can

easily be designed in different dimensions up to 1000 mm outer diameter, 350 mm height and 500 kg weight of final product. Internal winding connections are made up with the latest technology allowing the lowest possible contact resistance together with the highest mechanical strength.



GENERAL SPECIFICATIONS

STANDARDS: IEC 60044-1, IEC 60044-6, ANSI C 57.13, BS 3938, CAN3-C 13-M83

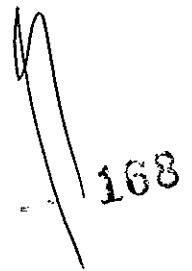
PRIMARY CURRENT: Any requested value

SECONDARY CURRENT: 1A, 5A or any requested value

TESTED BURDEN: Up to 200 VA

FREQUENCY: 50 Hz or 60 Hz

DESIGN: With Compensating Winding of Without Compensation Winding



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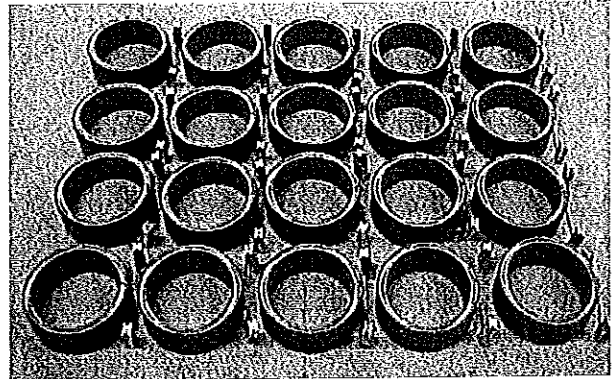
LOW VOLTAGE CURRENT TRANSFORMERS

ENPAY Low Voltage Current Transformers are manufactured according to ENPAY's own design also in compliance with the customer specifications.

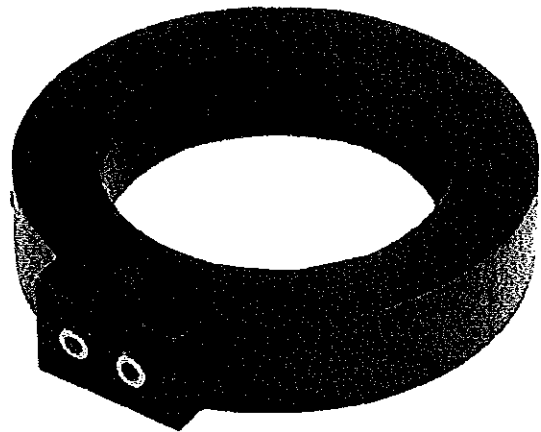
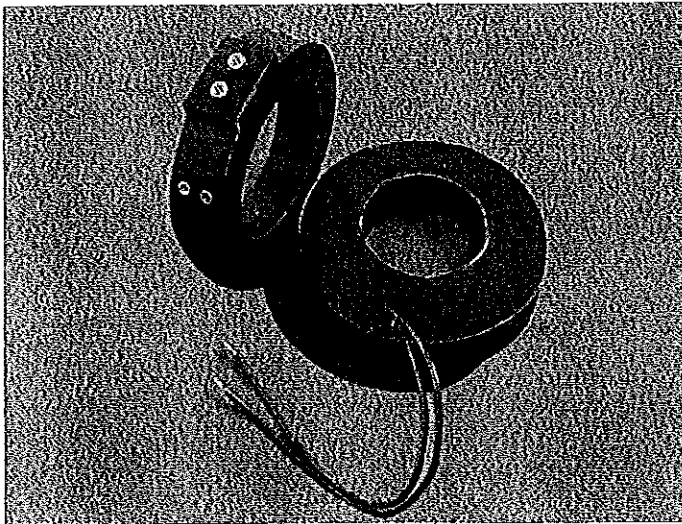
These Transformers are manufactured in two types:

- Wound Primary Types (P.S.): Primary Windings are added by the producer.
- Bar Types (B.T.): Primary Windings are assembled by the user.

ENPAY Low-Voltage Current Transformers are designed to meet world wide safety standards.



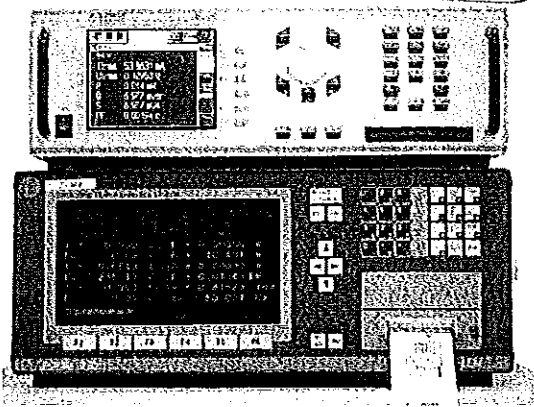
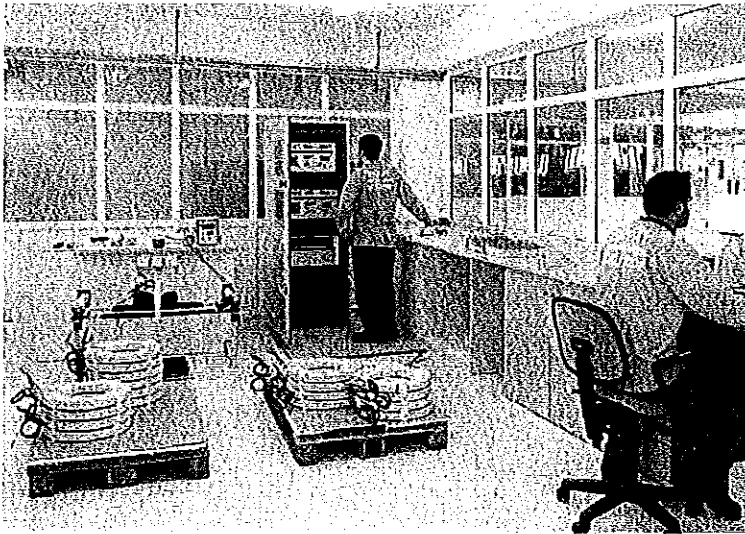
LV CT'S AND BUSHING TYPE CT'S WITH EPOXY RESIN / POLYURETHANE RESIN



ENPAY Low Voltage Current Transformers and Bushing Type Current Transformers are also made from Epoxy Resin and Polyurethane with excellent insulation characteristics. Technical advantages of these Current Transformers are; compact design, easy mounting, high mechanical and dielectric strength. These products are non-hygroscopic and the materials used are non-hazardous.

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WORKING CAPACITY

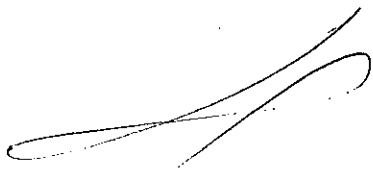


Current for Accuracy Test:

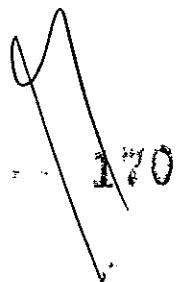
up to 10000A at 50 Hz
up to 7000A at 60 Hz

Voltage for Magnetization Curve Test:

up to 3000V 50 Hz
up to 2500V 60 Hz



Care has been taken to ensure that the contents of this publication are accurate, but ENPAY does not accept responsibility for errors or for information that is found to be misleading. Suggestions for or descriptions of the end use or application of products or methods of working are for information only and ENPAY accepts no liability in respect thereof. Before using products supplied or manufactured by ENPAY, customers should satisfy themselves of their suitability.



RADIATORS FOR TRANSFORMERS

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1- GENERAL INFORMATIONS

1.1- Dimensions :

W = 230 → Radiators for Distribution Transformer, W = 520 → Radiators for Power Transformer,		
Explanation of Dimensions	for W = 230	for W = 520
Width of Radiator Elements	230 mm	520 mm
Distance between the Elements	45 - 50 mm	45 - 50 mm
Thickness of Oil Channel	6 - 7 mm	9 - 10 mm
Thickness of Element Outside	11 mm	13 mm
Centre of Pipes Distance, Spaced Strip	400-1200 mm	800-3500 mm Acc.to DIN 42559

1.2- Material :

- Metal Sheet :
 - for W = 230 Thickness : 1,0 mm , St 12-03 acc. to DIN 1543
 - for W = 520 Thickness : 1,2 mm , St 12-03 acc. to DIN 1543
- Spaced Strip :
 - Diameter : Ø 8,0 - 10,0 ; acc.to DIN 668 ; Quality : St 12-03 ; acc. to DIN 17100.
- Collector Tubes :
 - for W = 230 Tube diameter : Ø 76,1 acc. to DIN 2448
 - for W = 520 Tube diameter : Ø 88,9 acc. to DIN 2448
- Flanges :
 - Size : 150x150x20 mm ; Quality : St 37-2 acc. to DIN 17100
- Lifting Lug :
 - Size : W = 60 mm, h = 10 mm ,Hole = Ø 35 mm ; Quality : St 37-2 acc.to 17100
- Plug :
 - for Air Drainage Plug 6 acc. to DIN 42558
 - for Oil Drainage Plug 12A acc. to DIN 42558
- Bracing Bosses :
 - Size : Ø 25 - M12 ; Quality: St 37-2 acc.to DIN 17100

1.3- Leakage Test :

- BAYSAN's radiators are tight for the transformer oil of 100 °C
- All radiators are checked with pressured air of 2 bar atmospheres overpressured in the water.

1.4- Surface Operations and Protection against corrosion :

- Surface cleaning :
 - Internal = Chemical washing with solution.
 - External = Chemical cleaning or Sand blasting.
 - Base coating = Epoxy based, double component paint, 35 µm.
 - Intermediate coating = Epoxy based, double component paint, 35 µm.
 - Top coating = As Standart, Epoxy based, double component paint, color RAI. 7033 ; 35 µm.
- Shade, Coating thickness and / or Coating type (Epoxy, polyurethane based or etc.) as requested.

2- DEFINITIONS

2.1- Radiator Types :

- B = Radiator with pipes (Without flanges)
F = Radiator with flanges.
A = Radiator with same length elements.
Kd = Radiator with graded elements.
Kb = Radiator with graded one of pipes.

Examples :

- BA = Radiator with pipes and same length element.
FA = Radiator with flanges and same length elements.
BKd = Radiator with pipes and graded elements.
FKd = Radiator with flanges and graded elements.
BKb = Radiator with pipes, but graded one of them.
FKd = Radiator with flanges and graded one of pipes.

2.2- Dimensions :

- L = Centre of pipes distance.
L1 = Centre of graded pipe distance.
G = Width of elements.
Nda = Number of same length elements.
Ndk = Number of graded elements.
Nbk = Number of elements of graded pipe.
a1 = Length of flanged pipe (upper side)
a2 = Length of flanged pipe (under side)

2.3- Protective Against Corrosion,

- Ab = Base coating on epoxy based, double component.
Akb = Intermediate coating on epoxy based, double component.,
Skb = Top coating on epoxy based, double component, Shade as requested.
Vi = Internal coating on resisted to transformer oil.
Br = The color of top coating (Standart : RAT. 7033)
Oi = Special operation (as customer requestes)

2.4- Transportation.

- PN = On the palette.
DN = Acc.to Shipping.
TN = By trailer on the palette.

2.5- Definitions and Examples of Order.

Definition of Order.

Type x G x L x Nda / Ndk / Nbk x a1 / a2 x Surface operations x Transportation

2- DEFINITIONS

Example :1

Designation of Radiator with pipes and same length elements.

L = 1300 mm (Centre of pipes distance)
G = 520 mm (Width of elements)
Nda = 12 elements (Number of same length element)
a1 = 100 mm (Length of pipe - upper side)
a2 = 100 mm (Length of pipe - under side)

Surface operations = Base, intermediate, top coating, RAL 7033, internal coating.
Transport = By trailer on the palette.

BA 520 x 1300 x 12 x 100 / 100 -Ab-Akb-Skb-Br RAL 7033-Vi x TN

Example. 2

Designation of Radiator with flanges and graded elements.

L = 2000 mm (Centre of pipes distance)
G = 520 mm (Width of elements)
Nda = 8 elements (Number of same length elements)
Ndk = 7 elements (Number of graded elements)
a1 = 115 mm (Length of pipe - upper side)
a2 = 115 mm (Length of pipe - under side)

Surface operations = Base, intermediate, top coating, Polyurethane based, RAL 7038, internal coating.
Transport = Acc.to Shipping.

FKd 520 x 2000 x 8 / 7 x 115 / 115 - Ab-Akb-Skb-Br RAL 7038-Vi-OI/Top coating on Polyurethan based x DN

Example. 3

Designation of Radiator with flanges and graded one of pipes.

L = 2300 mm (Centre of pipes distance)
L1 = 1900 mm (Centre of graded pipe distance)
G = 520 mm (Width of elements)
Nda = 14 elements (Number of same length elements)
Nbk = 3 elements (Number of graded elements)
a1 = 130 mm (Length of pipe - upper side)
a2 = 130 mm (Length of pipe - under side)

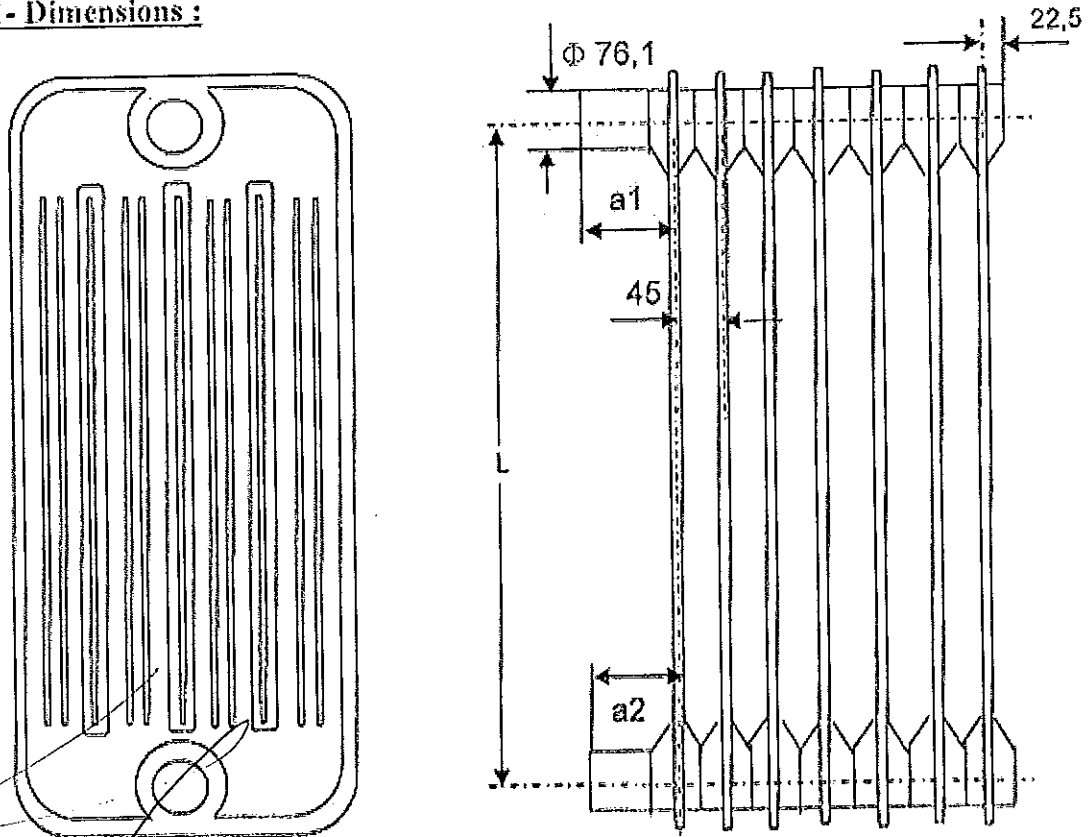
Surface operations = Base, intermediate, top coating, RAL 7033, internal coating.
Transport = By trailer on the palette.

FKb 520 x 2300/1900 x 14 / 3 x 130 / 130 - Ab-Akb-Skb-Br RAL 7033-Vi x TN

3 - CHARACTERISTICS OF RADIATORS

3.1- Radiators for Distribution Transformers (W = 230)

3.1.1- Dimensions :



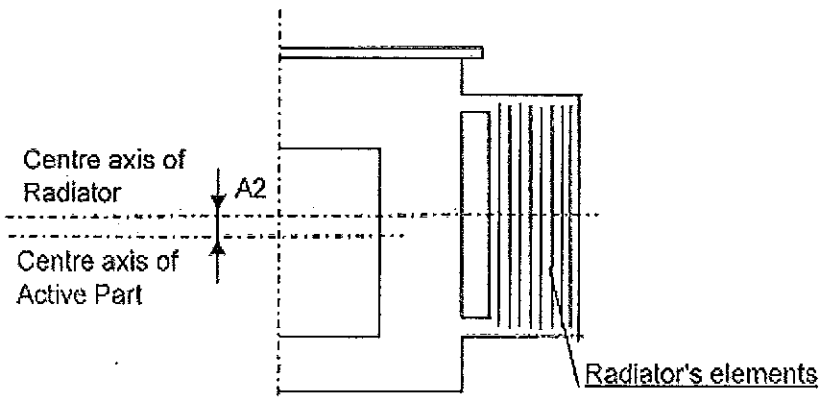
3.1.2- Cooling surface, Dissipation factors, Weight and Volume per Element :

L (mm)	Qe Surface per Elem. (m ²)	W55 / m2 (W)	W55 / ele. (W)	Go Weight per Elem. (kg)	Ve Volume per Elem. (dm ³)
400	0,285	506	134	2,07	0,85
500	0,318	485	154	2,48	0,95
600	0,372	463	172	2,90	1,05
700	0,425	448	190	3,31	1,15
800	0,479	434	208	3,73	1,25
900	0,533	423	226	4,15	1,35
1000	0,586	415	244	4,57	1,45
1100	0,640	406	260	5,00	1,55
1200	0,693	398	276	5,40	1,65

3 - CHARACTERISTICS OF RADIATORS

3.1- Radiators for Distribution Transformers (W = 230)

3.1.3- Correction Factors:



Opening Factor between Groups	
A_1 (mm)	f_1
250	0,740
260	0,756
270	0,772
280	0,788
290	0,804
300	0,820
310	0,836
320	0,852
330	0,868
340	0,884
350	0,897
360	0,910
370	0,921
380	0,931
390	0,941
400	0,950
410	0,959
420	0,966
430	0,973
440	0,979
450	0,985
460	0,990
470	0,994
480	0,997
490	0,999
500	1,000
>500	1,000

Number of Elements Factor	
N_e	f_2
2	1,141
3	1,118
4	1,095
5	1,072
6	1,049
7	1,033
8	1,020
9	1,011
10	1,000
11	0,996
12	0,993
13	0,990
14	0,987
15	0,984
16	0,980
17	0,978
18	0,972

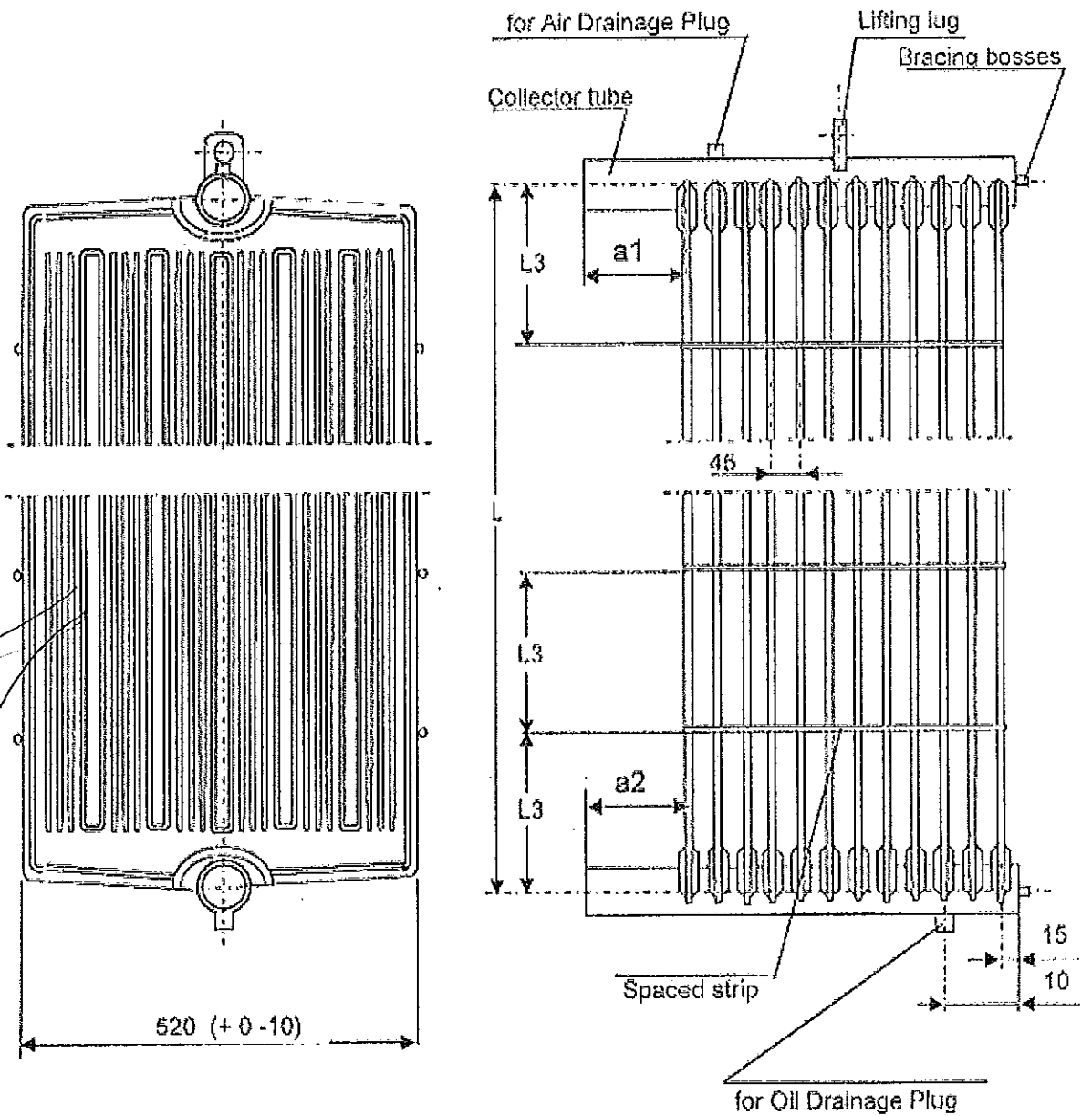
Factor of Height Difference	
A_2 (mm)	f_3
0	0,800
25	0,820
50	0,830
75	0,840
100	0,850
125	0,860
150	0,870
175	0,880
200	0,890
225	0,900
250	0,910
275	0,915
300	0,925
325	0,930
350	0,935
375	0,940
400	0,950
425	0,955
450	0,960
475	0,970
500	0,975

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3 - CHARACTERISTICS OF RADIATORS

3.2- Radiators for Power Transformers ($W = 520$)

3.2.1 Radiator with Pipes and Same Length Elements:



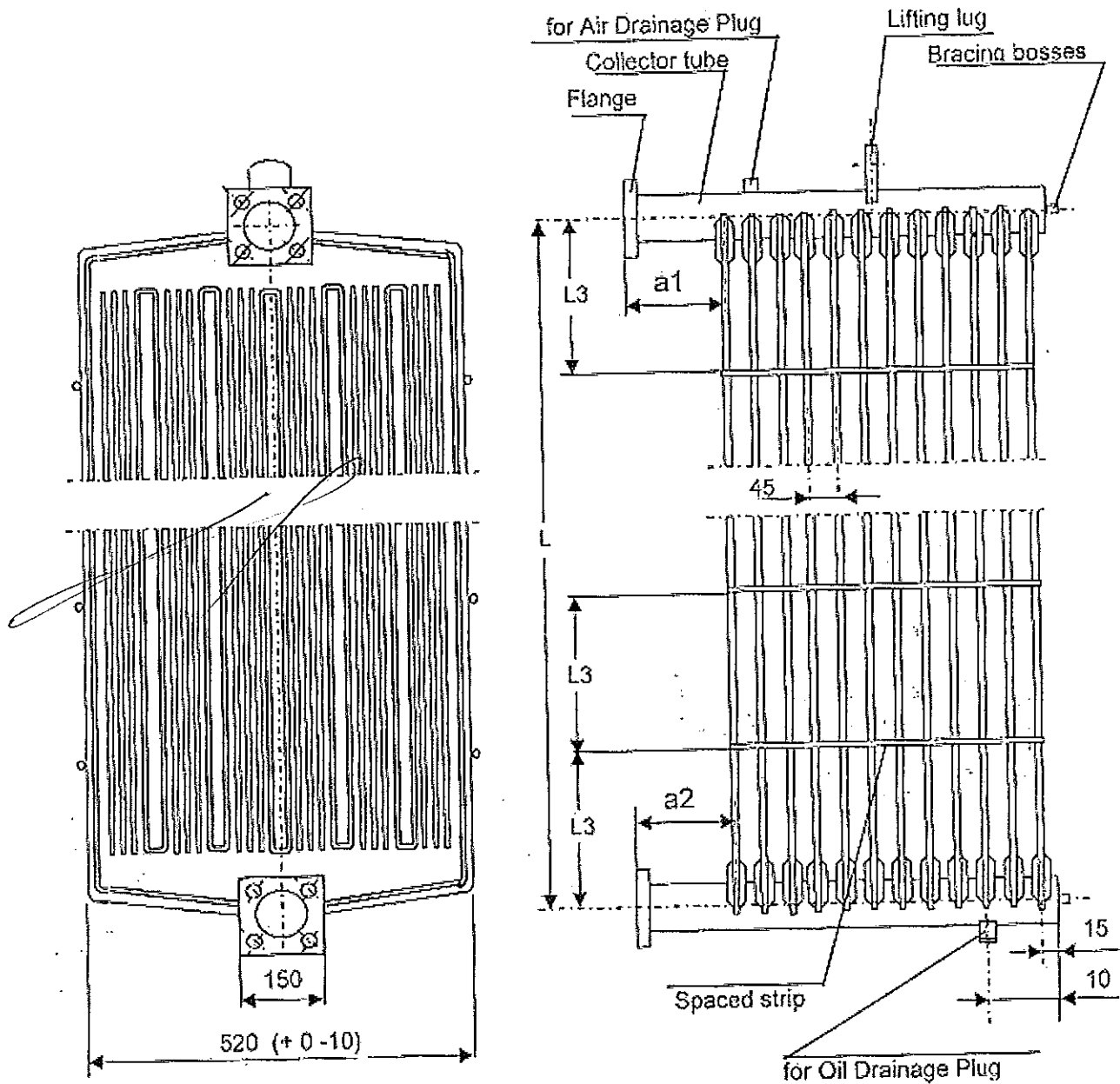
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3 - CHARACTERISTICS OF RADIATORS

3.2- Radiators for Power Transformers ($W = 520$)

3.2.2- Radiator with Flanges and Same Length Elements:

3.2.2.1- Radiator with Flanges and Same Length Elements - Type I:

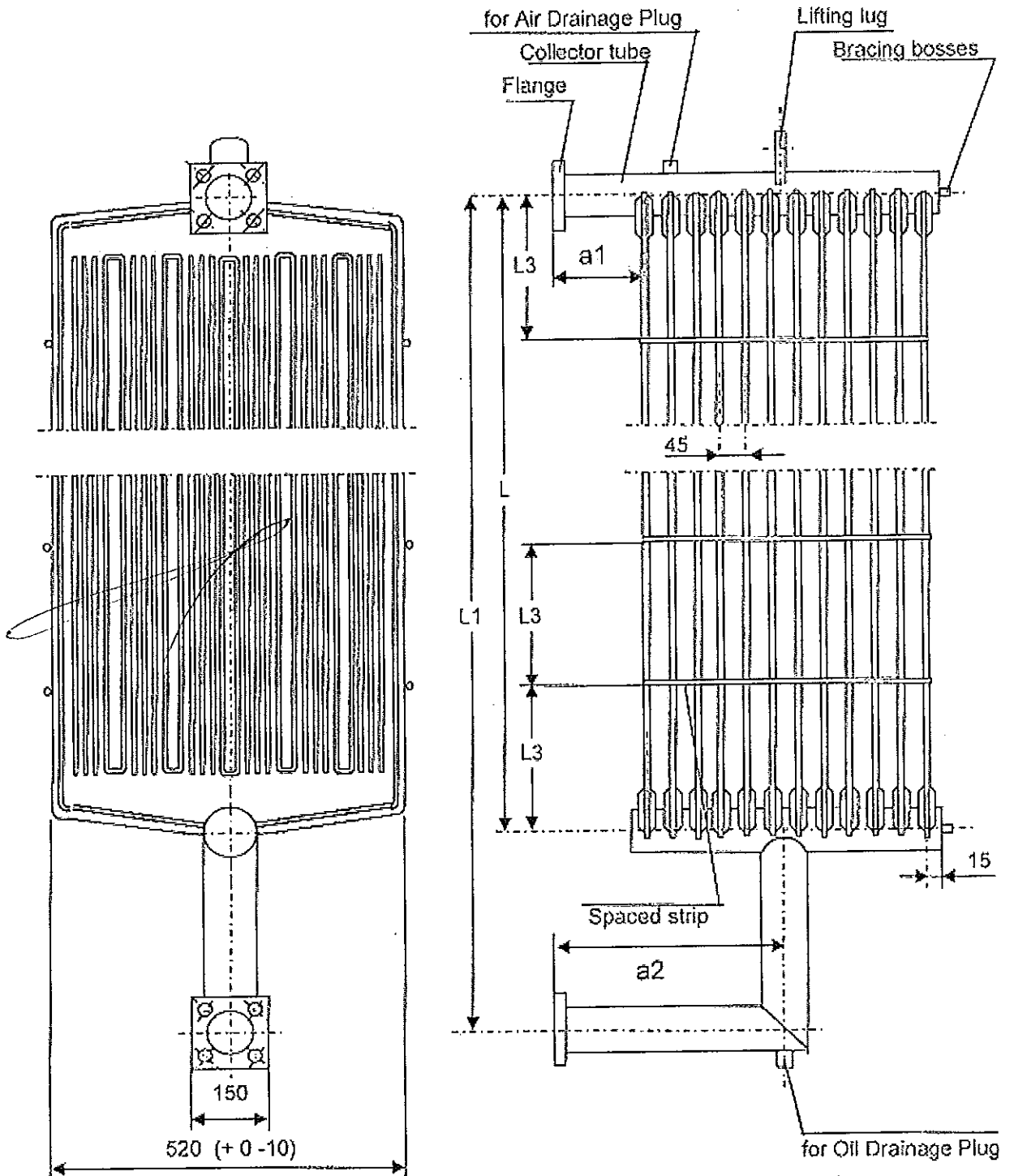


3 - CHARACTERISTICS OF RADIATORS

3.2- Radiators for Power Transformers (W = 520)

3.2.2- Radiator with Flanges and Same Length Elements:

3.2.2.2- Radiator with Flanges and Same Length Elements - Type II:



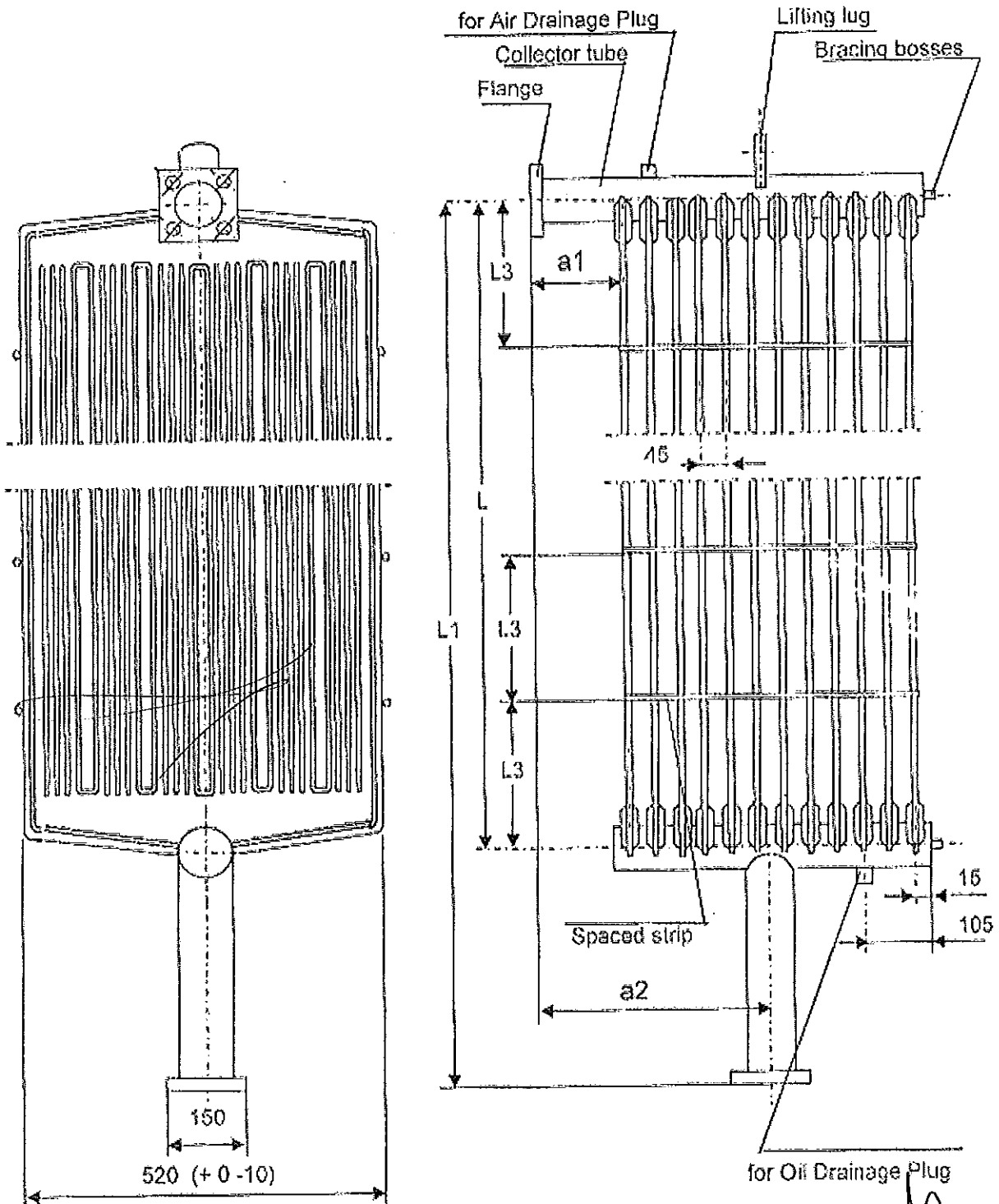
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3 - CHARACTERISTICS OF RADIATORS

3.2- Radiators for Power Transformers (W = 520)

3.2.2- Radiator with Flanges and Same Length Elements:

3.2.2.3- Radiator with Flanges and Same Length Elements - Type III:

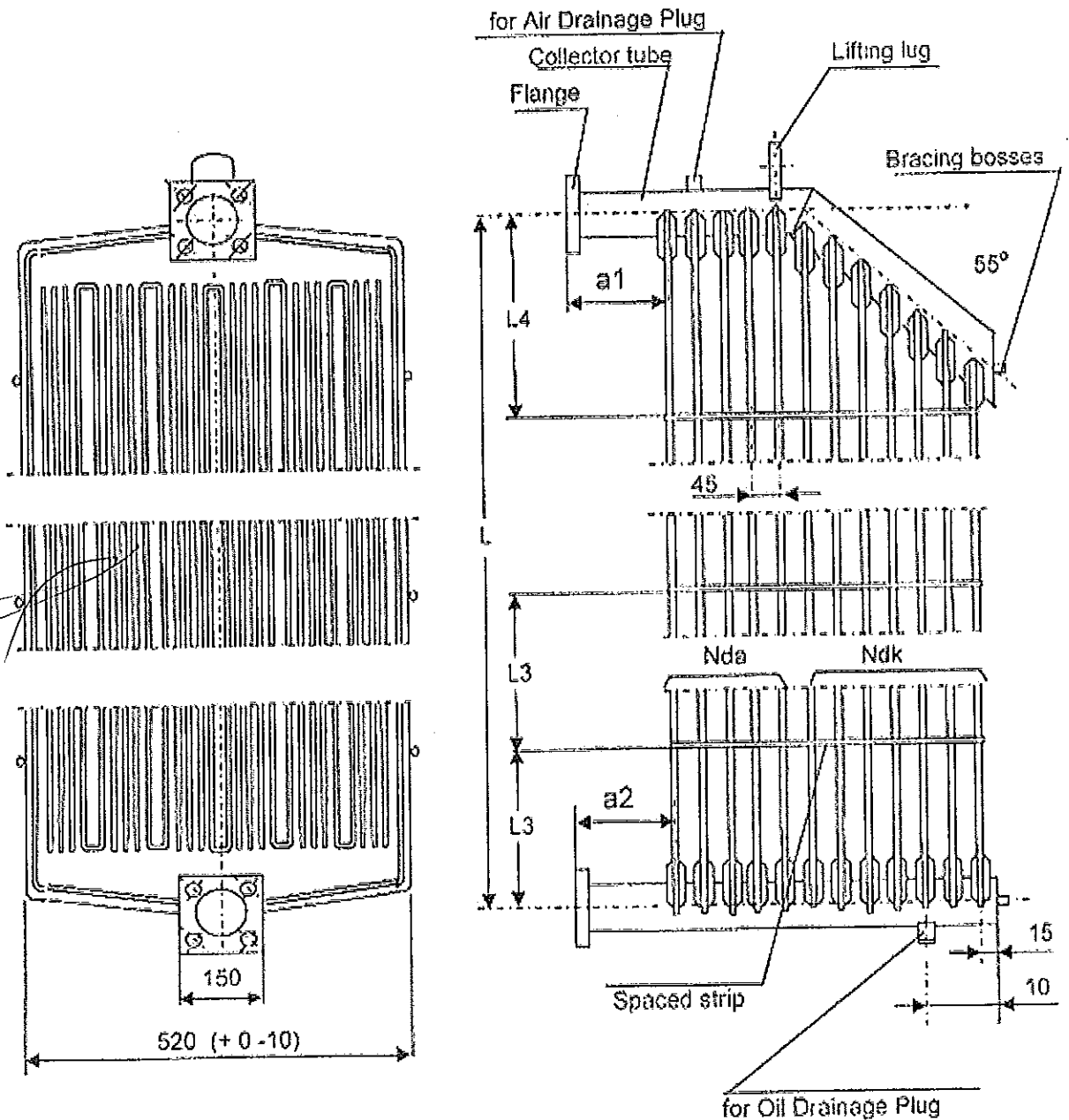


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3 - CHARACTERISTICS OF RADIATORS

3.2- Radiators for Power Transformers ($W = 520$)

3.2.3 Radiator with Flanges and Graded Elements:



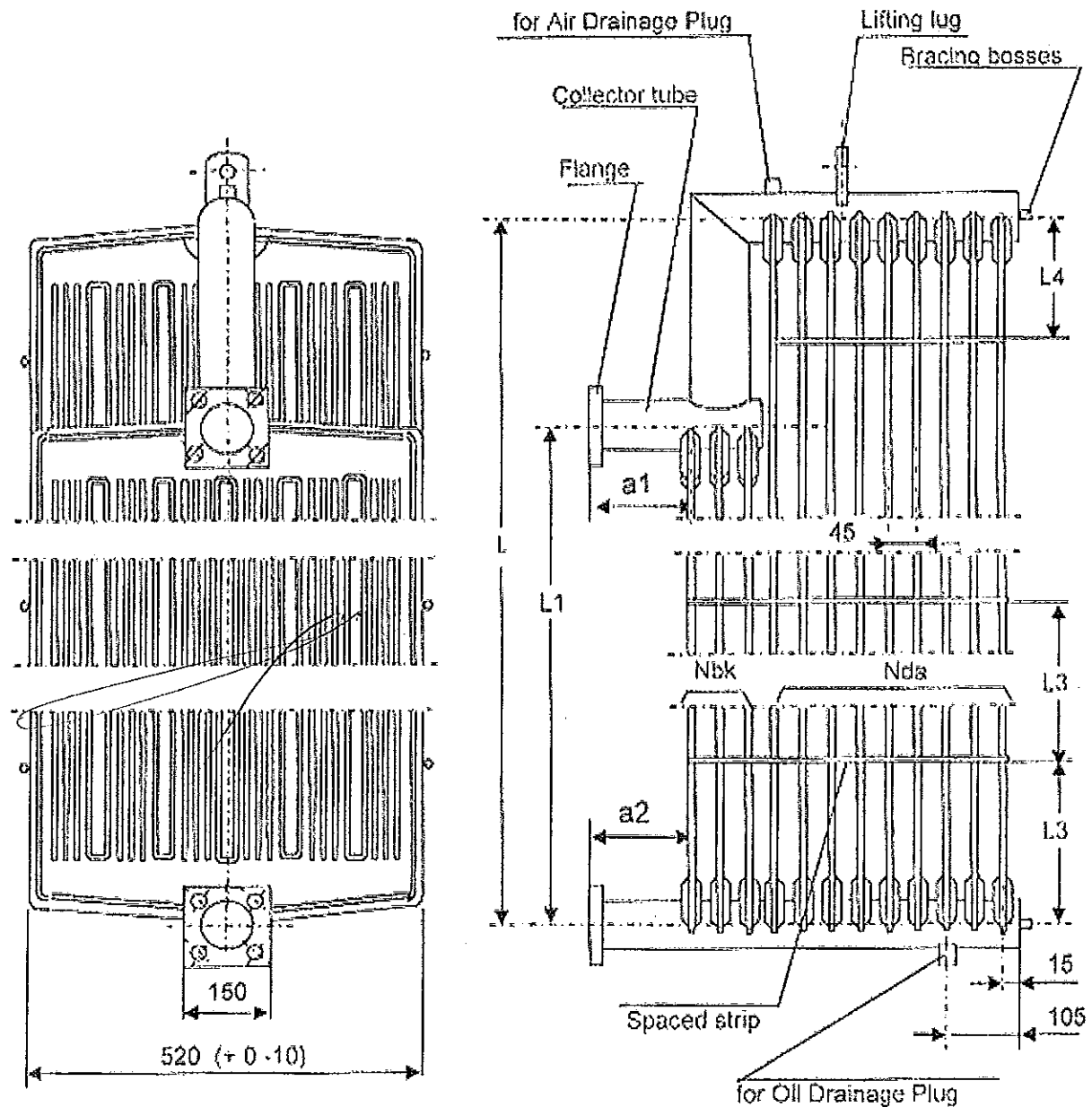
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3 - CHARACTERISTICS OF RADIATORS

3.2- Radiators for Power Transformers (W = 520)

3.2.4- Radiator with Flanges and Graded One of Pipes:

3.2.4.1- Radiator with Flanges and Graded One of Pipes - Type I:



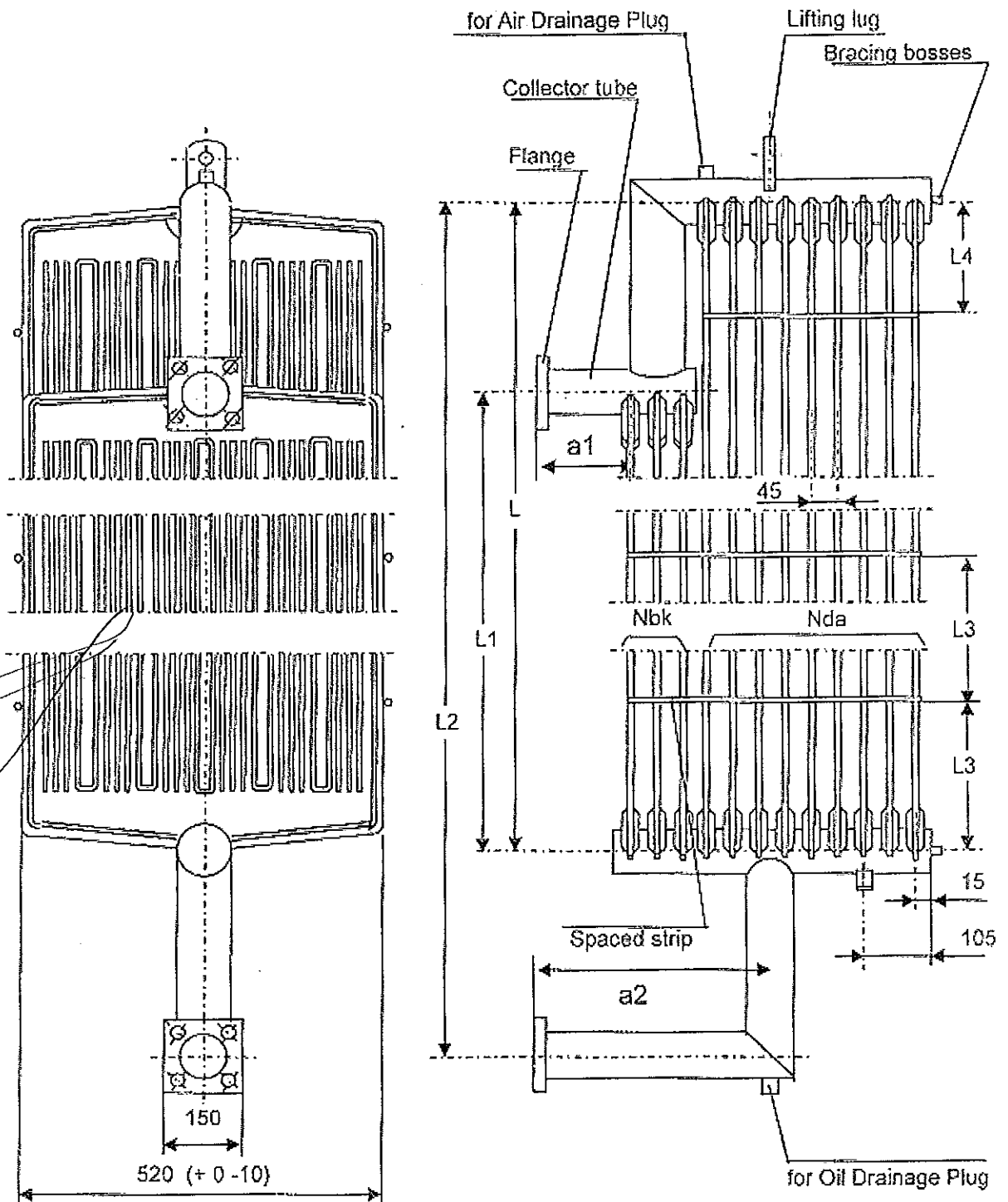
182

3 - CHARACTERISTICS OF RADIATORS

3.2- Radiators for Power Transformers (W = 520)

3.2.4- Radiator with Flanges and Graded One of Pipes:

3.2.4.2- Radiator with Flanges and Graded One of Pipes - Type II:



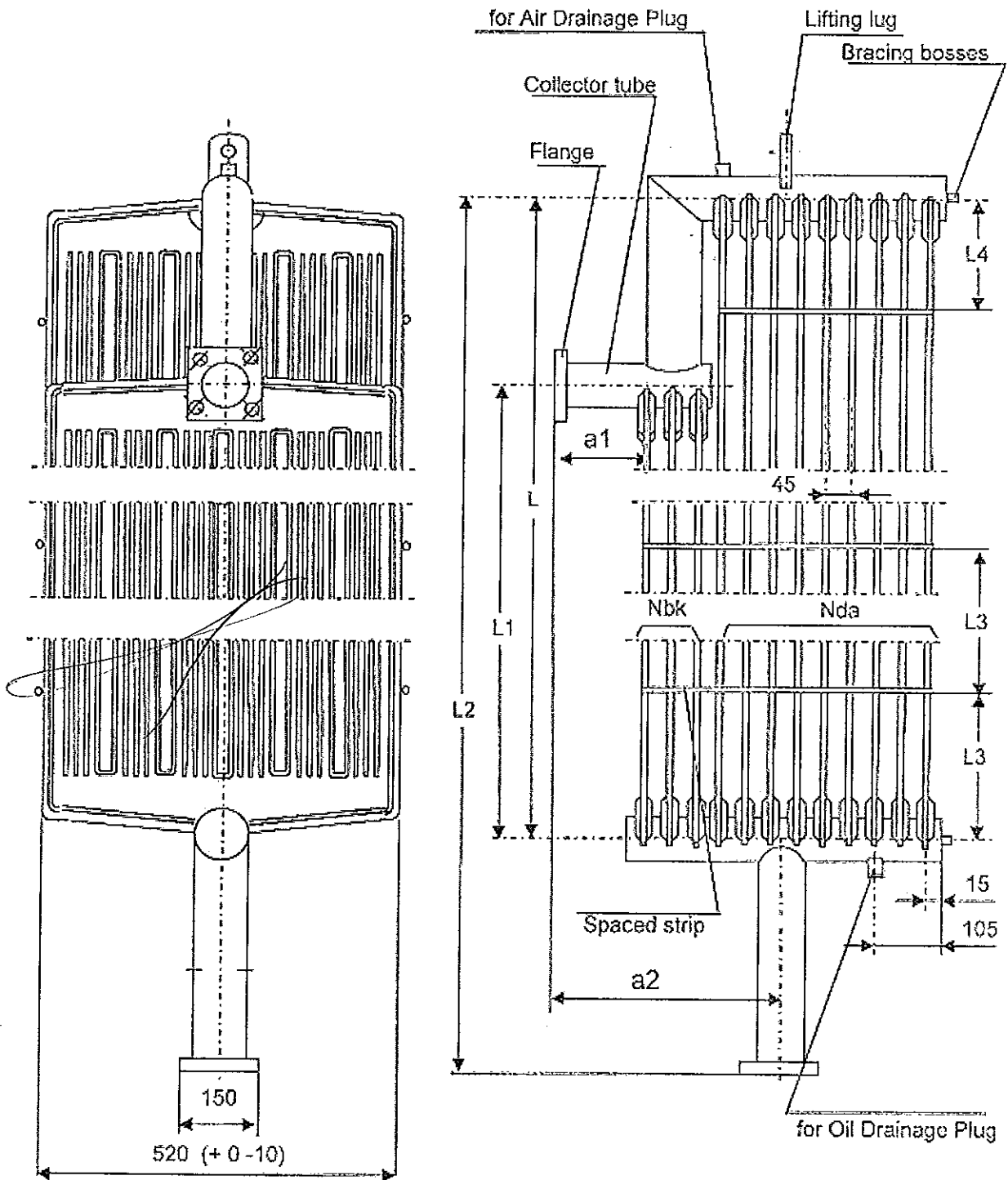
183

3 - CHARACTERISTICS OF RADIATORS

3.2- Radiators for Power Transformers (W = 520)

3.2.4- Radiator with Flanges and Graded One of Pipes:

3.2.4.3- Radiator with Flanges and Graded One of Pipes - Type III:



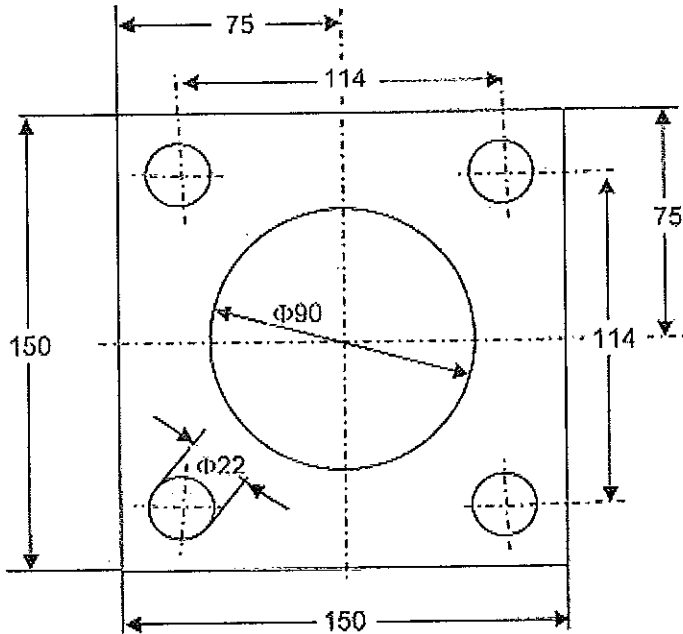
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3 - CHARACTERISTICS OF RADIATORS

3.2- Radiators for Power Transformers (W = 520)

3.2.5- Dimensions of Flange, Lifting lug and Bracing base:

FLANGE

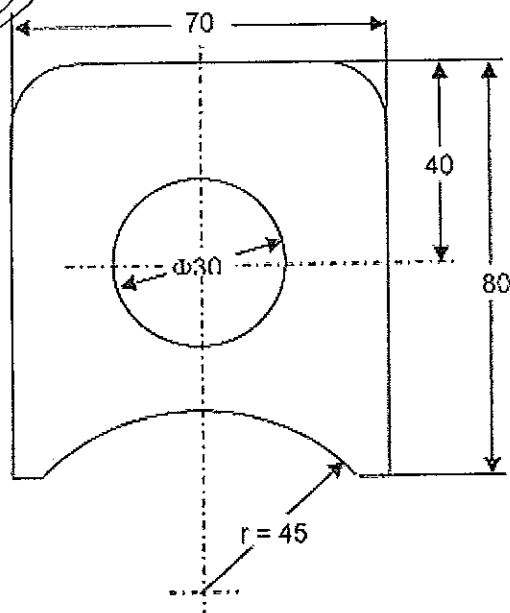


Tolerance:

for Holes : $\pm 0,5$

Other : ± 1

LIFTING LUG

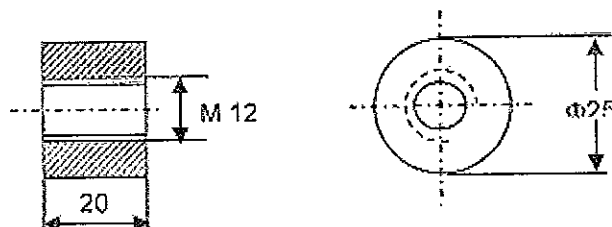


Tolerance:

for Holes : $\pm 0,5$

Other : ± 1

BRACING BASES



Tolerance: $\pm 0,5$

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3 - CHARACTERISTICS OF RADIATORS

3.2- Radiators for Power Transformers (W = 520)

3.2.6- Cooling surface, Dissipation factors, Weigh and Volum per Element :

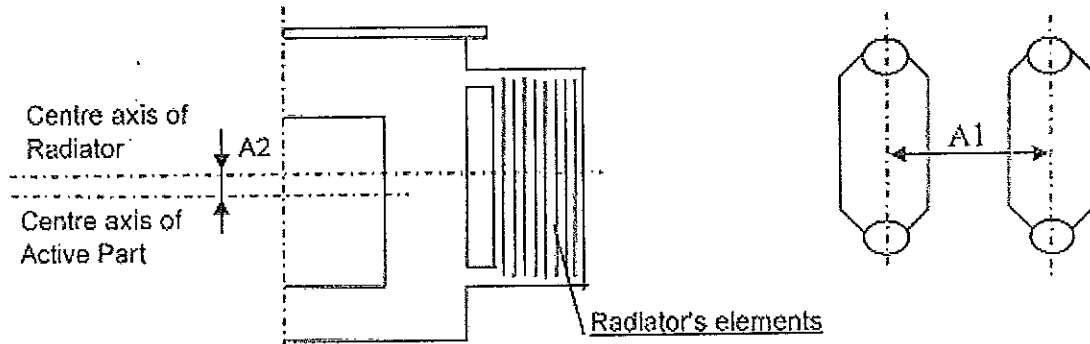
L (mm)	Qe Surface per Elem. (m ²)	W55 / m2 (W)	W55 / ele. (W)	Ge Weight per Elem. (kg)	Ve Volume per Elem. (dm ³)
800	0,953	432	412	9,70	2,80
900	1,073	430	462	10,83	3,08
1000	1,192	428	510	11,94	3,36
1100	1,311	427	560	13,05	3,63
1200	1,430	421	602	14,16	3,92
1300	1,550	418	648	15,28	4,19
1400	1,669	416	694	15,62	4,46
1500	1,778	413	739	17,42	4,73
1600	1,907	408	778	18,62	5,02
1700	2,027	404	819	18,97	5,30
1800	2,146	400	858	20,87	5,57
1900	2,265	398	901	21,98	5,85
2000	2,384	395	942	23,09	6,11
2100	2,503	392	981	24,20	6,31
2200	2,622	389	1020	25,32	6,67
2300	2,742	386	1058	26,44	6,95
2400	2,861	379	1084	26,770	7,23
2500	2,980	375	1116	28,67	7,50
2600	3,099	372	1153	29,78	7,76
2700	3,218	370	1191	30,90	8,04
2800	3,334	369	1230	31,98	8,32
2900	3,457	365	1262	33,13	8,59
3000	3,576	360	1287	33,47	8,87
3100	3,695	358	1323	35,36	9,15
3200	3,814	356	1358	36,47	9,42
3300	3,934	353	1389	36,82	9,68
3400	4,053	349	1415	38,71	9,97
3500	4,172	348	1452	39,82	10,26

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3 - CHARACTERISTICS OF RADIATORS

3.2- Radiators for Power Transformers (W = 520)

3.2.7- Correction Factors:



Opening Factor between Groups	
A1 (mm)	I1
580	0,892
590	0,906
600	0,916
610	0,924
620	0,931
630	0,940
640	0,946
650	0,953
660	0,958
670	0,963
680	0,967
690	0,972
700	0,977
710	0,982
720	0,986
730	0,991
740	0,996
750	1,000
>750	1,000

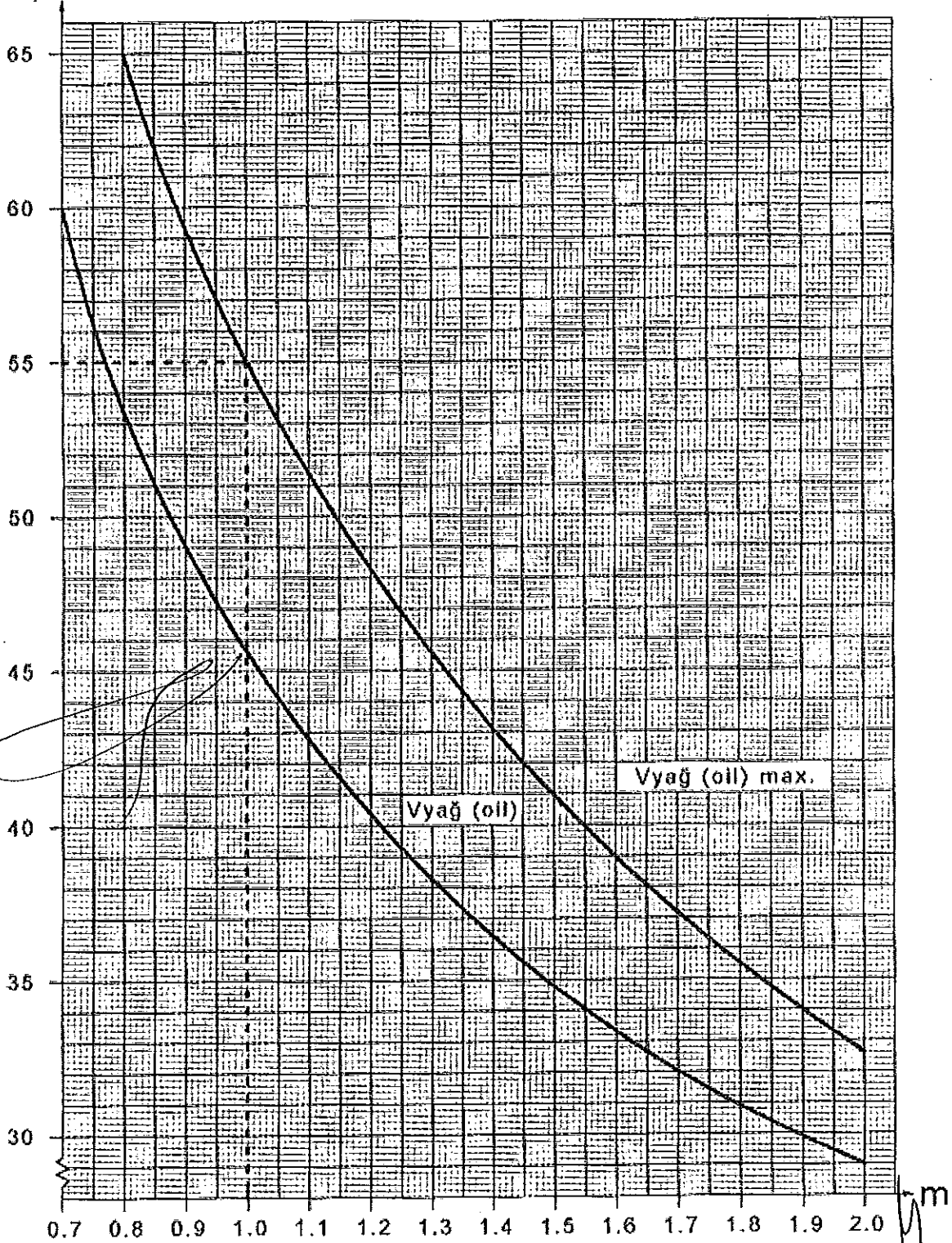
Number of Elements Factor	
Nc	I2
2	1,141
3	1,125
4	1,100
5	1,080
6	1,069
7	1,055
8	1,047
9	1,034
10	1,010
11	1,000
12	0,975
13	0,957
14	0,941
15	0,927
16	0,910
17	0,890
18	0,873
19	0,851
20	0,832
21	0,819
22	0,795
23	0,780
24	0,761

Factor of Height Difference	
A2 (mm)	I3
0	0,800
25	0,820
50	0,830
75	0,840
100	0,850
125	0,855
150	0,870
175	0,880
200	0,880
225	0,900
250	0,910
275	0,915
300	0,925
325	0,930
350	0,935
375	0,940
400	0,950
425	0,955
450	0,960
475	0,970
500	0,975
525	0,980
550	0,985
575	0,990
600	1,000
625	1,005
650	1,010
675	1,020
700	1,025
725	1,030
750	1,035
775	1,040
800	1,050
825	1,055
850	1,060
875	1,070
900	1,075
925	1,080
950	1,085
975	1,090

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ISI DÜZELTME FAKTÖRÜ
HEAT CORRECTION FACTOR

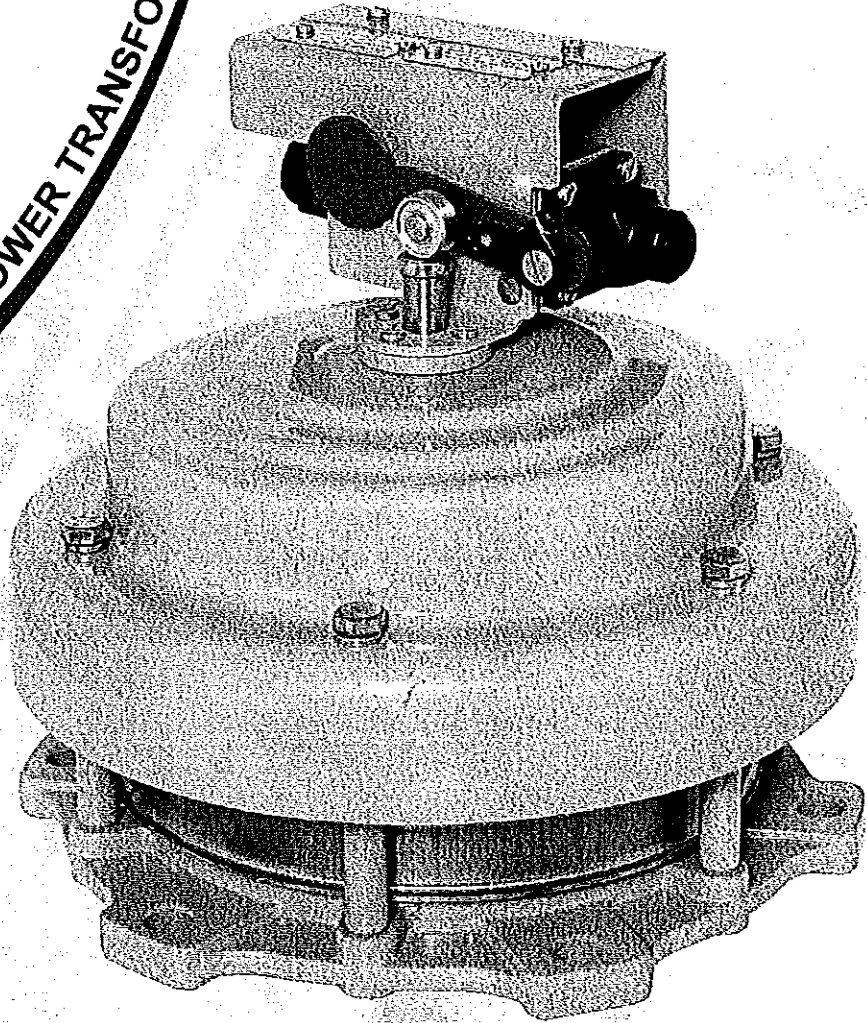
Vyağ (oil) (°C)






CEDASPE

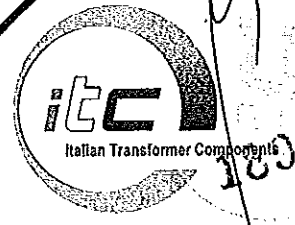
ACCESSORIES FOR POWER TRANSFORMERS



PRESSURE RELIEF VALVE RT6

(Model year 2013)

Made in Italy 



Italian Transformer Components



I. 20099 S. GIULIANO MIL. (ITALY) - VIA COLOMBARA, 1 - FRAZ. PEDRIANO
TELEFONO +39 0298.26.44.11 - TELEFAX +39 02 98.20.44.22
E-Mail: cedaspe@cedaspe.com - InterNet Site: http://www.cedaspe.com
CAP. SOC. € 500.000 I.V. - TVA-P.I. IT 01066780165 - C.F. 01066780165
R.E.A. M 729991 - IMPORT - EXPORT ME 142410 - REG. IMPR. 132146/334446 TRIG. M

1.0 Features

When it is required to limit the pressure rise inside a tank, in order to prevent an excessive mechanical stress of the walls, it is necessary to use a safety valve set at a precise overpressure value.

The tank of oil-immersed transformers is usually fit with this kind of protecting device; as matter of fact, in case of short-circuit due to an insulation failure, the dielectric arc between alive parts vaporises the surrounding insulating fluid which generates a quick rise of the pressure inside the tank, with the risk of permanent deformations, or, even, of the failure of the tank walls with the consequent flow-out of hot oil. Due to the high rapidity of this event, it is necessary to mount on the transformer an adequate protecting device which relieves quite suddenly the excess of pressure generated inside the tank by the above mentioned failure.

Our Pressure Relief device RT6 can assure such kind of protection

2.0 Construction features

Reference drawings

Assembly, overall dimensions, available wiring diagram, and cross section: see drawing 1375

Materials and components

Flange is made in aluminium alloy pressure die casted; shutter in stainless steel; cover in mild steel; springs (compression type) are made of special hardened spring steel; gaskets (in standard execution) in NBR; fittings in stainless steel or brass or mild steel

Surface protection

Flange, cover and contact's casing are painted internally and externally with one primer coat of epoxy paint and externally with a finishing powder coating colour RAL7030. The primer coat on the internal surfaces in contact is compatible with transformer mineral oil up to temperatures of 120°C. Total thickness of the two coats is 120 microns; special painting cycle can be provided for transformer located in very polluted areas; springs and fittings made in mild steel are epoxy coated protected and other parts made in brass are nickel plated

Construction

The pressure relief valve type RT6 is an out of tank spring loaded safety valve, consisting of a 6 holes mounting flange with the central opening closed by a spring loaded shutter; the springs are compressed between shutter and the protective cover (that has also the function of compressive ring), which is assembled to the flange by columns.

No one part of the pressure relief valve protrudes inside the transformer tank.

A specially designed set of gasket assures the oil-tightness between flange and shutter when the valve is in closed position.

Operation indication

A red armed semaphore, horizontally locked in rest position, rotates up, showing approx 50 mm over the top of the valve cover, in case of valve operation due to an overpressure.

The operation of the pressure relief valve is also indicated by one or two electric contacts (see the characteristics at paragraph 5).

Oil-tightness and resistance to pressure

The pressure relief valve RT6 are oil tight with oil at 100°C up to the tightness test pressure P_t (ref table at end of paragraph 6), which depends on the setting pressure

Mechanically, the pressure relief valve are resistant to vacuum (10 torr) and to internal pressure up to 4 bars.

Resistance to dynamical stress

The pressure relief valve RT6 can operate without undue operation in the following conditions:

Sinus vibrations with frequency ≤ 120 Hz and amplitude $\leq 250 \mu$;

Dynamic conditions causing following accelerations:

- Max 3g in all directions, sinus vibration, amplitude ≤ 20 mm;
- Shock condition with max 10 g in all directions.



I - 20098 S. GIULIANO MIL. (ITALY) - VIA COLOMBARA, 1 - FRAZ. PEORIANO
 TELEFONO +39 0298.20.44.11 - TELEFAX +39 02 98.20.44.22
 E-Mail: cedaspe@cedaspe.com - InterNet Site: http://www.cedaspe.com
 CAP. SOC. € 600.000 I.V. - TVA-P.I. IT 01065780166 - C.F. 01065780166
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3.0 Operation and installation

Operation

Should an overpressure inside the transformer tank rise up, higher than the operation pressure set, the shutter of the relief valve lifts slowly from the rest position disjoining the main tightening gasket; the excess of gas can't be released yet from valve due to the second tightening gasket which is still in contact with the shutter; in this position, the gas (or the oil) is operating over a much bigger area than the surface defined by the main gasket; the result is that in few milliseconds there is a very high increase of the load on the shutter which wins the springs counterload and the shutter lifts suddenly; the excess of pressure is released very quickly through the very big section opened by the shutter which, after it, recloses as much suddenly as its opening.

Importance of the electric contact

Real life tests have shown, that failures of the transformer followed by sudden pressure increases, such as for instance short circuits, induce the operation of the pressure relief valve in time spans which are considerably shorter than that of other safety devices, such as the Buchholz Relay.

Installation

There is not any precise formula to be used to determine the nr of valve to be installed on one transformer. The normal practice suggests to use one pressure relief device for each 35.000 litres of transformer oil capacity or fraction.

The pressure relief valve should be installed, either in horizontal or vertical position, on the transformer tank or cover, as near as possible to the failure sources or in a central position to such sources making sure of a good visibility of the red semaphore.

4.0 Setting

The setting of the pressure relief valve RT6 is effected by choosing a proper spring for every operating pressure value; therefore the setting of the pressure relief valve can be changed only at the factory, thus eliminating possible misuses.

The performance of the pressure relief valves depends from the test fluid and the layout of the transformer tank. The pressure values listed below are obtained by operating the valves with compressed air on a test bed having a compressed air volume of 150 dm³.

To avoid oil leakage or undue operation of the valve, the operating pressure must be chosen so that in normal operation the corresponding maximum operating pressure is never reached.

In following table are indicated the tolerance of the standard pressure setting, the service pressure, the closing pressure and the tightness pressure for the different nominal pressure settings.

Pn		Pmin		Pmax		Pc	Pt
[bar]	[kPa]	- %	[bar]	+ %	[bar]		
0,35	35	20	0,28	20	0,42	0,12	0,26
0,42	42	17	0,35	17	0,49	0,14	0,31
0,49	49	14	0,42	14	0,56	0,18	0,36
0,56	56	12	0,49	12	0,63	0,22	0,42
0,7	70	10	0,63	10	0,77	0,28	0,52
0,84	84	8	0,77	8	0,91	0,35	0,63

Pn (nominal pressure) is the setting pressure of the pressure relief valve, on which the tolerance must be applied in order to determinate the minimum and maximum operating pressure.

Pmin, Pmax (minimum and maximum operating pressure) are the limits of the pressure range inside which the pressure relief valve must operate.

Pc (closing pressure) is the minimum pressure at which the valve closes after operation

Pt (tightness test pressure) is the pressure at which the valve is tested during the leakage tests.



I - 28098 S. GIULIANO MIL. (ITALY) - VIA COLOMBARA, 1 - FRAZ. PEDRIANO
TELEFONO +39 0293.28.44.11 - TELEFAX +39 02 98.28.44.22
E-Mail: cedaspe@cedaspe.com - InterNet Site: http://www.cedaspe.com
CAP. SOC. € 600.000 I.V. - TVA-P.I. IT 01065780166 - C.F. 01065780166
R.E.A. MI 729591 - IMPORT - EXPORT IM 142410 - REQ. IMPR. 132146/3344/46 TRIG. ME

5.0 Electric contacts

The contacts used are microswitch type and are mechanically operated by the shutter; after operation the contacts remain in trip position and it is necessary to reset them manually by rotating the red semaphore (located on the cover of the PRD) in the rest position; the contacts are housed inside the terminal box made of aluminium with a cable gland or conduit entry M25

Characteristic of N/O and N/C contacts (used in wiring diagram C1 and C2)

Type	Limit switch
Lever	Stainless steel
Contact material	Silver
Mechanical life of contact	2x10 ⁷ cycles
Temperature range	-40°C - +125°C
Standard interruption power	AC 125/250V-5A - DC 125V-2A
Insulation to earth at 20°C	2.500V
Insulation of open contact at 20°C	1.500V
Protection degree of terminal box	IP 67

Characteristic of changeover contacts (used in wiring CX)

Type	Microswitch
Lever	Stainless steel
Contact material	Nickel coated silver
Mechanical life of contact	1x10 ⁷ cycles
Temperature range	-40°C - +125°C
Standard interruption power	AC 125/250V-15A - DC 125V-1A
Insulation to earth at 20°C	2.500V
Insulation of open contact at 20°C	1.500V
Protection degree of terminal box	IP 65

6.0 Compatibility of installation

The installation compatibility of the pressure relief valve RT6 depends mainly on the material used for the gaskets; our standard material is high quality NBR (which is compatible with the most common ambient conditions) therefore admitted operating conditions are:

Environmental conditions.

Ambient temperature: -20°C to +50°C

Relative humidity: 95% at 20°C - 80% at 40°C - 50% at 50°C

Insulating liquid (transformer mineral or silicon oil).

Temperature: -20°C to +110°C

For other environmental and/or operating conditions to be examined individually.

7.0 Ordering Instructions

When ordering must be defined following data:

- Model of pressure relief device : RT6
- Wiring diagram (ref to drawing 1375) : CX; C1; C2
- Nominal operating pressure in kPa (or bar or psi)
- Special requirements

Example

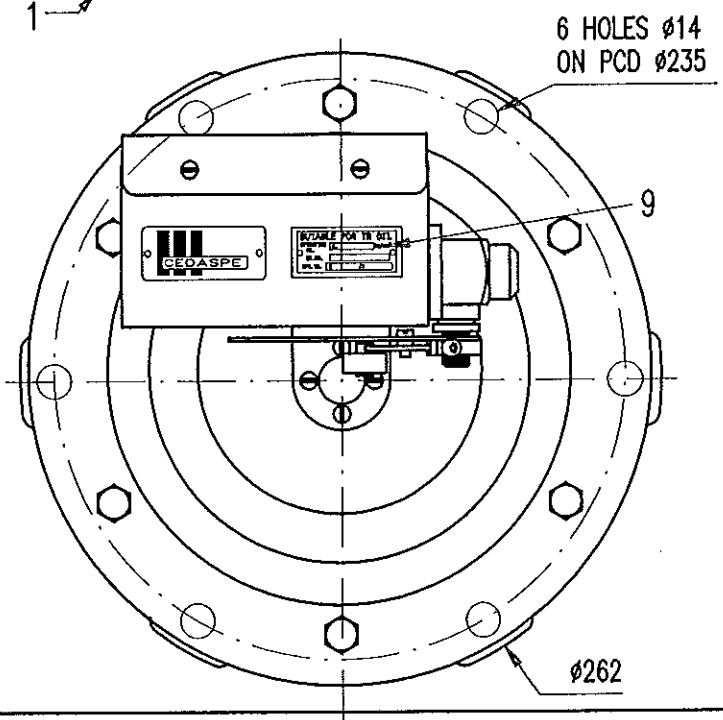
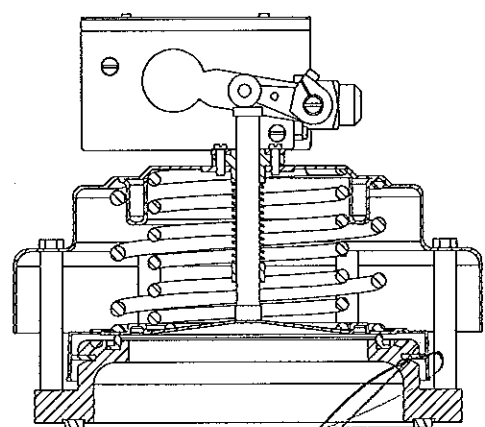
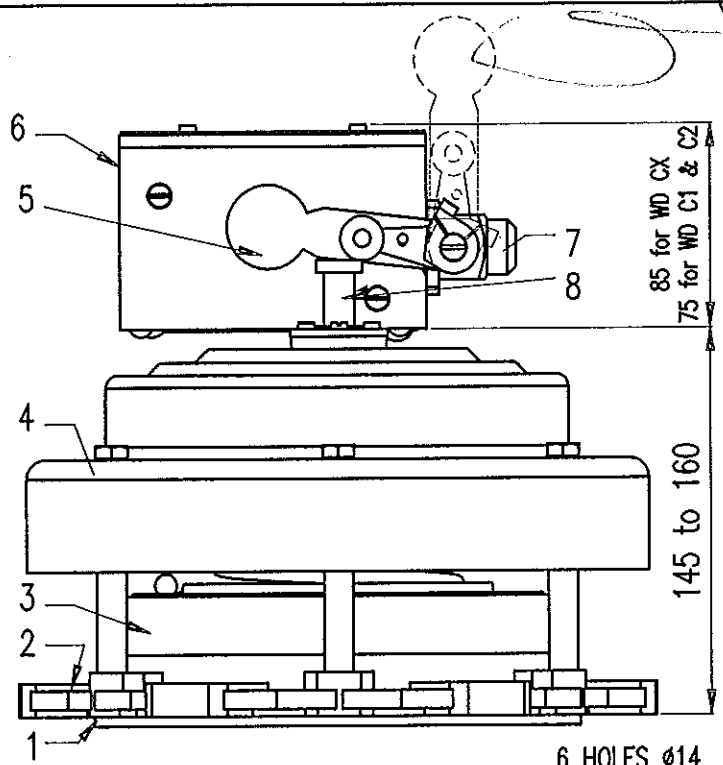
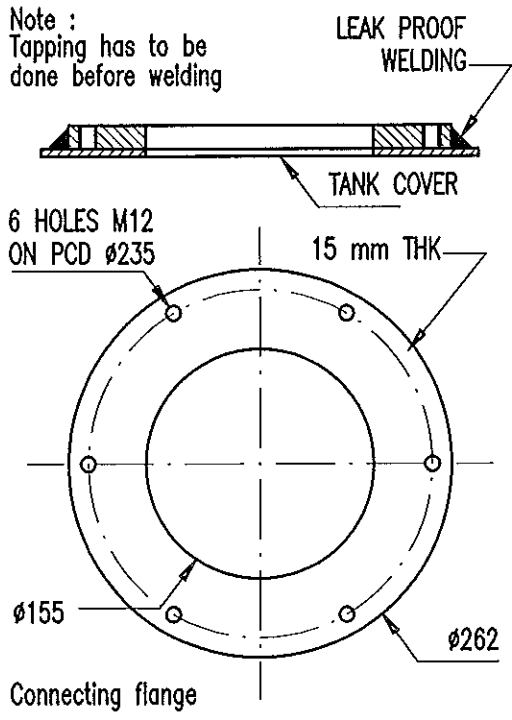
Nr 1 Pressure relief device type RT6 C1 0.5 bar

Means that is required nr 1 PRD type RT6 having 2 contacts 1 N/O and 1 N/C (wiring diagram C1), set at nominal pressure 0.5 bar, standard execution

192

FILE = 1375 .DWG
 REV. 05 DTD 22/11/10
 LM [0.0] (196,288)
 AK (210x237)

Note :
Tapping has to be done before welding



Cross section

	Type CX	Type C1	Type C2
WIRING DIAGRAM	3 1 2 GNT 	15 16 17 18 GNT 	1 2 3 4 5 6 7 8 GNT
CONTACT RATING	AC : 15A 125/250V DC : 1A 125V	AC : 5A 220/240V DC : 2A 220V	

Pos	Description	Material
1	Flange gasket	NBR
2	Body valve	Aluminium
3	Shutter	S/Steel
4	Cover	Steel
5	Red Semaphore	Aluminium
6	Terminal box	Aluminium w/steel cover protection
7	Switch	
8	Actuating rod	S/Steel
9	Data plates	Brass

Titolo

PRESSURE RELIEF VALVE RT6

Data 28/03/08

Scala 1:3

Dis.

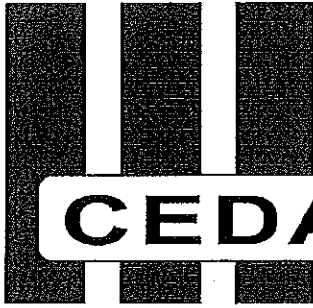
Visto

103 Nr

1375

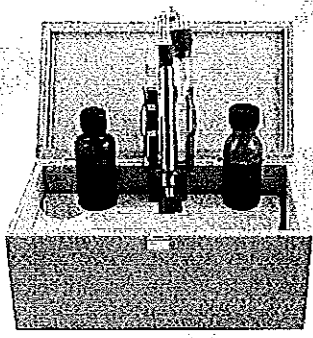
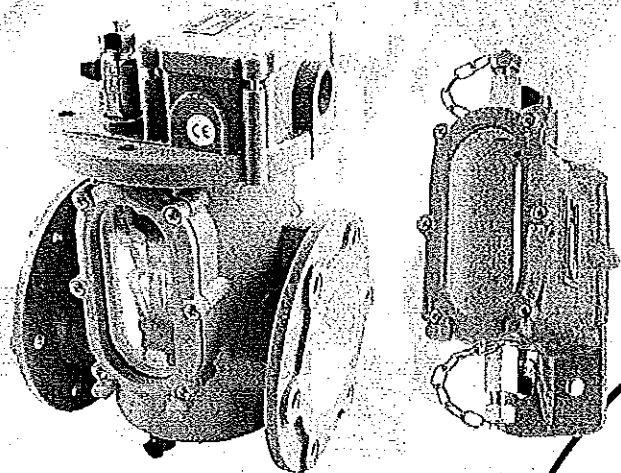
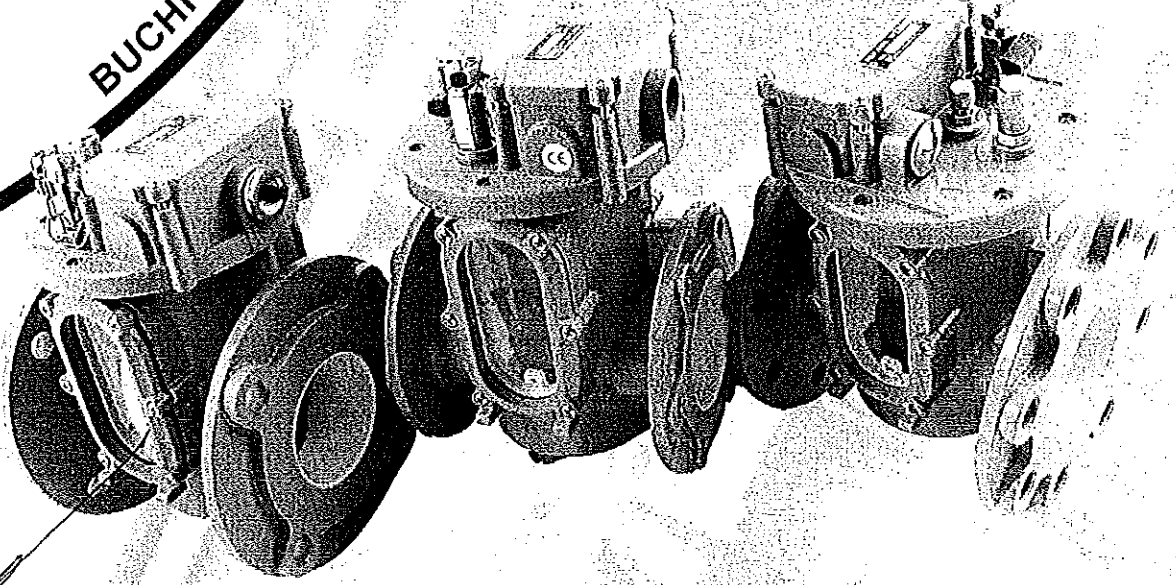
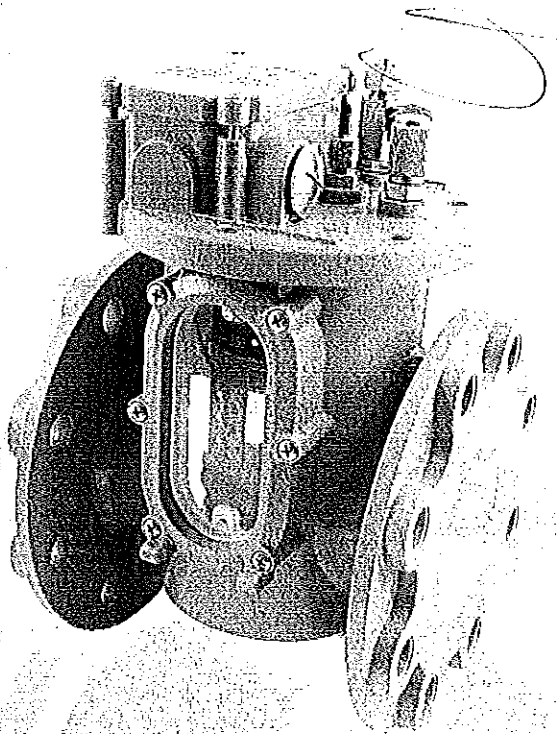
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CEDASPE

BUCHHOLZ RELAYS



Made in Italy

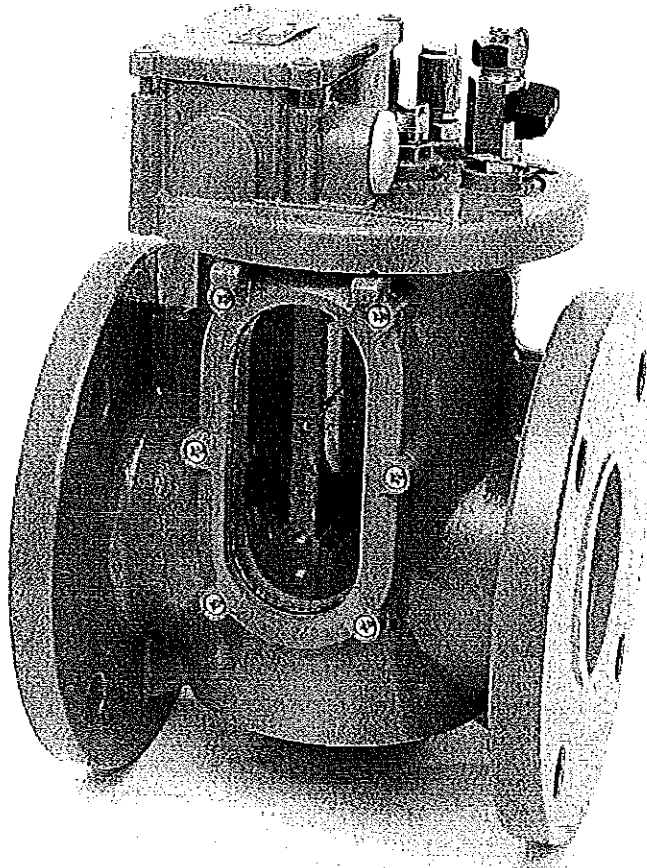


Italian Transformer Components



I - 20098 S. GIULIANO MIL. (ITALY) - VIA COLOMBARA, 1 - FRAZ. PEDRIANO
TELEFONO +39 0298.20.44.11 - TELEFAX +39 02 98.20.44.22
E-Mail: cedaspe@cedaspe.com - InfoNet Site: http://www.cedaspe.com
CAP. SOC. € 500.000 I.V. - TVA-P.I. IT 01065780165 - C.F. 01065780165
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**GAS ACTUATED RELAYS FOR OIL FILLED
TRANSFORMERS
EN 50216-2**



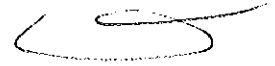
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A handwritten mark or signature in the lower-right quadrant, consisting of a few sharp, intersecting lines.

195



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TELEFONO +39 0299.26.44.11 - TELEFAX +39 02 98.26.44.22
E-Mail: cedaspa@cedaspa.com - Internet Site: http://www.cedaspa.com
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R.E.A. MI 725991 - IMPORT - EXPORT MI 142410 - REG. IMPR. 132146334446 TRIB. MI



1. General Features

1.1 Characteristics

The gas-actuated protective relay is designed to detect faults as well as to minimise the propagation of any damage, which might occur within oil-filled transformers.

The relay is therefore particularly effective in case of:

- short-circuited core laminations
- broken-down core bolt insulation
- overheating of some part of the windings
- bad contacts
- short circuits between phases, turns
- earth faults
- puncture of bushing insulators inside tank

Furthermore the relay can prevent the development of conditions leading to a fault in the transformer, such as the falling of the oil level due to leaks, or the penetration of air as a result of defects in the oil circulating system.

The adoption of other forms of protection does not therefore exclude the use of the gas-actuated Buchholz relay, as this device is the only means of detecting incipient faults, which if unnoticed, can cause heavy failures.

1.2 Operating principle

The operation of the Buchholz relay is based upon the fact that every kind of fault in an oil-filled transformer causes decomposition of the insulating material, be it liquid or solid, due to overheating in the fault zone or to the action of an intense electric field, and generation of bubble of gas.

These reach the relay (normally filled with oil) through the pipe connecting the transformer to the conservator where the buchholz relay is mounted

2. Special features

2.1 Design of active part

The active part of relay is designed in order to permit the free passage of the oil flow through the body, not any obstacle (except the flap that detects the oil flow rate) such as the floats or any other apparatus is present between the entry and the exit of the oil inside the relay.

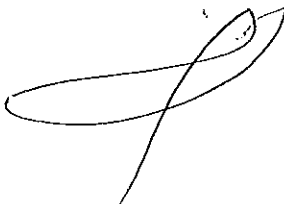
The lower and the upper floats are isolated from flux of oil thus unattended operation due to turbulence of oil are avoided.

On demand, a special device permit, in case of oil surge, to hold the trip contact in his operated position making possible the relay be resettable only manually.

2.2 Design of contacts

The relays are provided with magnetic switches instead of the traditional mercury switches in which the high mobility of the mercury makes it necessary to fit expensive adjustments to avoid unattended closing of the contacts and the consequent mal-functioning of the relay, whenever this is subject to severe vibrations.

Moreover, each contact is operated by 2 magnets displaced in a such way that make a constant magnetic field around the contact itself, in this way contact is not influenced by external magnetic fields that are present on a transformer





1-20098 S. GIULIANO MIL. (ITALY) - VIA COLOMBARA, 1 - FRAZ. PEDRIANO
TELEFONO +39 0298.20.44.11 - TELEFAX +39 02 86.20.44.22
E-Mail: cedaspe@cedaspe.com - InterNet Site: http://www.cedaspe.com
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R.E.A. MI 729931 - IMPORT - EXPORT MI 142410 - REG. IMPR. 1321483344MS TR9. MI

3. Operating features

3.1 Slight faults

When a slight or incipient fault occurs in the transformers, the small bubbles of gas, which pass upwards towards the conservator, are trapped in the relay housing, thus causing a decrease of the oil level inside the relay.

As a result, the upper float closes its magnetic switch, thus completing the alarm circuit and operating an external alarm device.

3.2 Serious faults

3.2.1 Gas generation

When a serious fault occurs in the transformer, the gas generation is violent and causes the oil to rush through the connecting pipe to the conservator.

In the relay, this oil surge impinges on the flap fitted on the lower part (located in front of the hole for the oil passage) and causes the closing of its magnetic switch, completing the tripping circuit to the circuit-breaker and disconnecting the transformer.

The value of the oil speed required to operate the tripping device can be varied by changing a counterweight fitted on the device itself or changing its size.

3.2.2 Oil leak

An oil leak in the transformer causes the fall down of the oil level inside the relay, thus operating first the alarm (upper) float and then the tripping (lower) float, which will close their own circuits

3.2.3 Air inlet

The ingress of air into the transformer, arising from defects in the oil circulating system or from other causes, operates the alarm float first and after the trip contact.

4. Construction feature, Finish and Accessories

4.1 Construction features

The body and the cap of the buchholz relay are made of aluminium alloy casting, oil tight weatherproof; the compact design, that means low weight, small sizes, efficiency, is the result of a very long experience in manufacturing relays. Two flanges on the body permit an easy connection of the relay to the tubes; two large inspection windows made in trogamid (on request made in tempered glass), with graduated scale, are fitted on both sides of the relay housing (on request windows can be provided with sun shield protection).

A flat surface on the cap of the relay make it possible, using a spirit level, to mount the relay with the proper inclination

4.2 Accessories

On the cap of the relay are provided petcock for the release of the gas, a push-button for testing the electrical circuits, a small valve for pneumatic test (standard on Buchholz size 2" & 3" on request on Buchholz size 1") and a cable box (which is cast integrally to the cap) with 2 cable gland entry size M25x1.5.

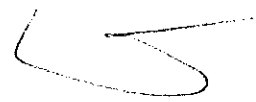
On the bottom of the relay is provided a plug for draining of oil.

4.3 Finish

In standard execution, all cast parts are protected by one coat of epoxy primer and one coat of polyurethane paint (total thickness 80 µm), final colour RAL 7030 and screws and washer are in stainless steel; the protection degree of the device is IP 55. Therefore the device is suitable for outdoor installation in tropical climate and with industrial pollution.



I - 26098 S. GIULIANO MIL. (ITALY) - VIA COLOMBARA, 1 - FRAZ. FEDRIANO
 TELEFONO +39 0296.28.44.11 - TELEFAX +39 02 88.20.44.22
 E-Mail: cedaspe@cedaspe.com - Intranet Site: http://www.cedaspe.com
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 R.E.A. MI 723991 - IMPORT - EXPORT MI 142410 - REG. IMPR. 192146034446 TRIB. MI



5. Contacts

5.1 General

The magnetic switches consist of two thin reed contact blades hermetically sealed inside a glass capsule in an atmosphere of dry inert gas.

The reeds are made of a ferromagnetic material and are cantilevered into the end of the capsule.

The tips of the reeds overlap and are separated by an air gap. The tips, forming the contact surfaces, are coated with a contact material.

The switches are operated by a permanent magnet.

The operating principle of the magnetic switches is very simple: when a magnet approaches the switch, the reeds close the circuit; when the magnets moves away from the switch, the contact gets open.

5.2 Rated current

The rated current for normally open contacts is 2 A r.m.s. and 1 A for changeover contacts;

The short time current is 10A r.m.s. for 30 ms

5.3 Breaking and making capacity

Normally Open Contacts			
Voltage	Max Current	Breaking capacity	
24V d.c. to 240V d.c.	2A	250W	L/R<40ms
230V a.c.	2A	400VA	cosφ>0,5

Change over Contacts			
Voltage	Max Current	Breaking capacity	
24V d.c. to 240V d.c.	1A	130W	L/R<40ms
230V a.c.	1A	250VA	cosφ>0,5

6. Wiring diagrams

6.1 Standard wiring diagrams

Standard wiring diagram available are:

Type "A" - 2 N/O contacts (1 for alarm; 1 for trip signalling)

Type "L" - 2 change-over contacts (1 for alarm; 1 for trip signalling)

Type "G" - 3 N/O contacts (1 for alarm; 2 for trip signalling)

6.2 Special wiring diagrams

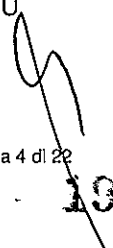
Special wiring diagram are available on demand on relays NB 50 & 80 mm are

Type S2 - 1 changeover contacts for alarm and 1 changeover contact plus 1 N/O contact for trip

Type S3 - 1 changeover contacts plus 1 N/O contact for alarm and 1 changeover contact for trip

Type S4 - 4 contacts N/O; 2 for alarm and 2 for trip

Type R - 2 changeover contacts with a device which hold the trip contact in its position in case of oil surge operation; manual reset of the contact by pushing the test button on top of relay (same as TU system).





I - 20098 S. GIULIANO MIL. (ITALY) - VIA COLOMBARA, 1 - FRAZ. PEDRIANO
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7. Service conditions

7.1 Environmental conditions

Relays comply with following environmental conditions as classified in EN60721-3-4

K	Climatic conditions	4K2
Z	Special climatic conditions	4Z2+4Z4+4Z7
B	Biological conditions	4B1
C	Chemically active substances	4C2
S	Mechanically active substances	4S3

7.2 Special mechanical conditions

Our buchholz relay can withstand to mechanical stresses without unattended operation to the following stresses acc to EN 60721-3-4

- stationary sinusoidal vibration class 4M4
- non stationary vibration : a vertical shock of 100m/s², with type 1 spectrum

7.3 Protection degree

Protection degree of the terminal box is IP65 acc to EN60529

7.4 Corrosion

The relay is designed to withstand to corrosion test acc to ASTM B 117 in salty fog chamber for 200h

7.5 Pressure and vacuum resistance

The relay is designed to work continuously with an internal pressure of 50kPa but is capable to withstand an overpressure of 250 kPa for 2 min and to vacuum pressure of 2.5 kPa for 24h

7.6 Insulating liquid

The relay is designed for operate with transformer oil with viscosity range from 1 mm²/s to 1100 mm²/s

7.7 Working temperature

The relay is suitable for operation in transformer oil over temperature range from minimum minus 25°C to plus 115 °C

The relay is suitable for operation in ambient air temperature range from minimum minus 45°C to plus 70 °C

Special execution are available on demand

7.8 Mounting position

The relay is designed to operate properly on a pipe having an inclination from horizontal between 2 and 5 degrees

8. Operational performance

8.1 Operating characteristics

Typical values of the oil speed required to operate the tripping element under surge conditions and the volume of accumulated gas required to operate the alarm float and trip contact , are:

Oil pipe connection Internal diameter	Alarm for gas accumulation	Trip for steady oil flow	Trip for gas accumulation
25 mm	200±100 cm ³	100±15 cm/s 100±15 cm/s (standard) 150±25 cm/s (upon request) 200±35 cm/s (upon request)	after alarm contact is operated and before the oil reaches lowest point of pipe
50 mm			
80 mm			



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9. Installation

9.1 Mounting

The gas actuated relay is mounted on the connecting pipe between the transformer and the conservator.

The pipe has to allow the easy flow to the relay of the gas arising from faults inside the transformer, starting from the highest point on the transformer cover and must not protrude inside into the transformer.

The pipe should not contain any right-angle elbows. Its diameter should correspond to the diameter of the hole for the passage of oil of the relay.

The pipe must be arranged to slope upwards towards the conservator at an angle of about 2 to 4 degrees to the horizontal (max 5 degrees).

The part of the pipe preceding the relay should be straight for a length equal to at least five pipe diameters; the part of the pipe leading to the conservator immediately adjacent to the relay should be straight for a length equal to at least three pipe diameters.

A flat surface on the cap of the relay make it possible, using a spirit level, to mount the relay with the proper inclination

The petcock at the top of the relay must be at a level below the bottom of the conservator.

When mounting, the arrow engraved on the body of the relay must point in the same direction as the oil flow to the conservator.

If the transformer is provided with an explosion vent or similar attachment, this must be sealed in such a way that any gas liberated by the transformer does not accumulate in the vent, otherwise the operation of the alarm float will be delayed.

9.2 Setting to work

Once the relay has been mounted, unscrew the knurled cap which covers the push-button for checking the circuits and remove from inside it the small spacer which immobilises the alarm and tripping floats in their lower position, thereby preventing their movement during despatch.

Open up the gas release cock, located on the relay cover, to allow the relay to fill up with oil.

The filling up and the position of the floats can be seen through the inspection windows.

When the relay is filled with oil, close the gas release cock.

The electrical circuits must be connected as shown in the diagram accompanying the relay.

9.3 Maintenance

The buchholz relay does not need periodic maintenance; however it is advisable to check regularly the electric contact and the freely movement of float.



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10. Check after actuation of relay

10.1 Alarm signal

When the alarm signal is given, the colour of the gas should be observed through the inspection-windows.

The gas may be released or samples can be taken for analysis. (If the relay is supplied with our "Buchholz gas sampling apparatus RG3, this operation can be carried out at eye-level).

It should be noted that:

- whitish gas : it is caused by electric arcing in contact with paper, cotton and silk
- yellowish gas : it is caused by wood and cardboard
- greyish gas : it is caused by from a breakdown of the magnetic circuit
- black gas : it is caused by from free arcing in the oil

Note that there may be air in the transformer during commissioning or after an operation of oil refilling

In similar cases the alarm is only temporary and should end in a short period of time.

10.2 Trip signal

If the relay disconnects the transformer, similar checks on the gas should be made to determine the colour and the quantity of gas collected.

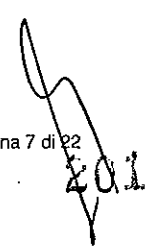
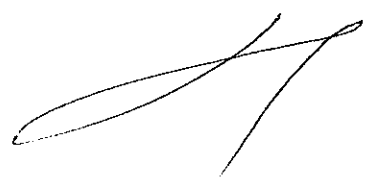
It is always good practice to make a gas analysis.

In any case, the transformer should not be immediately re-energized, as this would increase the seriousness of the fault.

Note that tripping contact can be actuated also by oil leak; in that case refill oil into conservator after discovered the cause of the oil fall before re-energizing the transformer.

11. Test of gas on site

It can be executed only if a gas analyser is available





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12. Order instructions

When ordering a relay it is necessary to indicate (see table)

- Type
- Size
- Wiring diagram
- Oil flow rate
- Operating conditions
- Special requirements

E	B	0	8	0	G	2	7	N
TYPE	SIZE	WIRING DIAGRAM	OIL FLOW RATE	OPERATING CONDITIONS	CTRL CHAR	LEGENDA		
						N	STANDARD	
						X	SPECIAL	
				5	LOW TEMPERATURE			
				7	TROPICAL CONDITIONS			
				6	CORROSIVE AMBIENT			
				0	NORMAL AMBIENT			
			2	100 cm/sec				
			3	150 cm/sec				
			4	200 cm/sec				
		A	2 N/O CONTACTS					
		L	2 SPDT CONTACTS					
		G	3 N/O CONTACTS					
		2	SPECIAL W.D. S2					
		3	SPECIAL W.D. S3					
		4	SPECIAL W.D. S4					
		R	2 SPDT contacts with manual resetting					
	024 025 050 079 080	SEE DRAWINGS						
EB	RELAY DIN STYLE							
EE	RELAY BRITISH STYLE							
ET	RELAY WITH FLANGE PN6							
EU	RELAY ITALIAN STYLE							

Example :

To order nr 3 buchholz relay type EB080 wiring diagram G; standard flow rate (100cm/sec); tropical conditions please indicate the following :

Nr 1 Buchholz relay type EB080G27N

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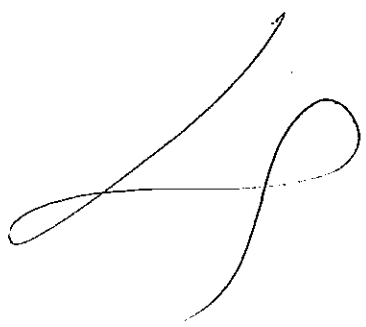


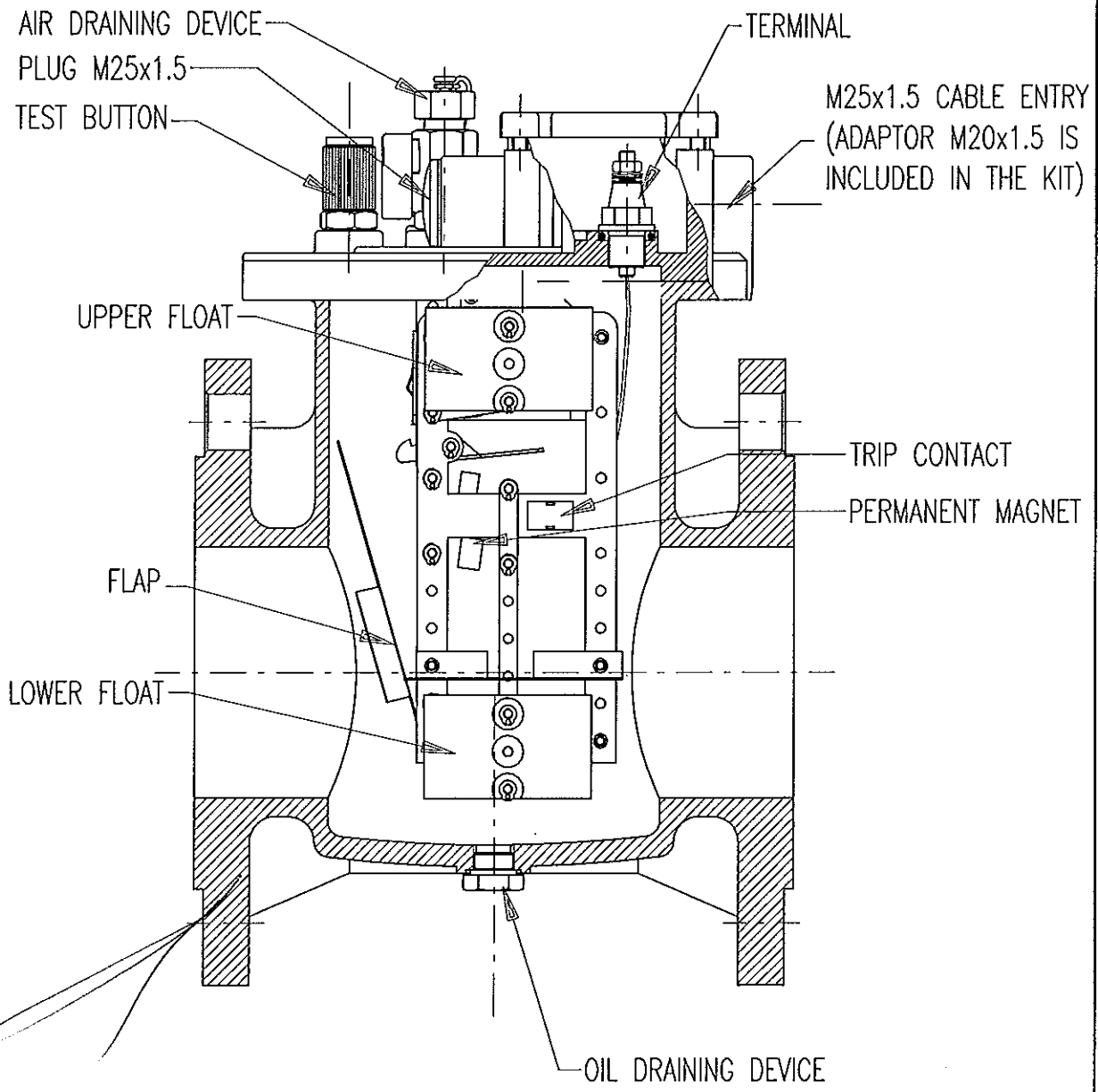
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13. Part denomination of relay

Pos.	Part denomination	Material
1	Inspection window	Trogamid
2	Gas release cock	Brass
3	Push button for checking electric circuits	Brass
4	Terminal box	Aluminium alloy
5	Cable gland entry M25x1.5	
6	Oil flow direction (from tank to conservator)	
7	Oil drain plug	Brass
8	Pneumatic test device	Brass
9	Trip terminals	Brass
10	Alarm terminals	Brass
12	Plug M25x1.5	brass
13	Window sunshield cover	Aluminium
15	Earth screw	Brass
16	Cock for air injection test	Brass



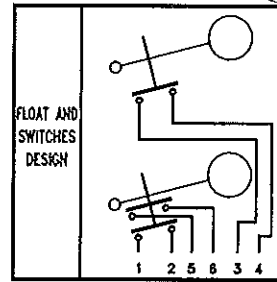
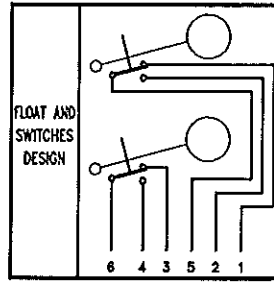
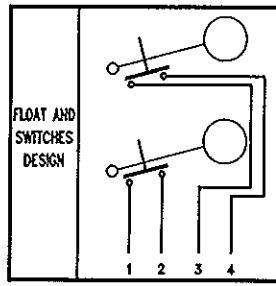


Cross section

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STANDARD WIRING DIAGRAM

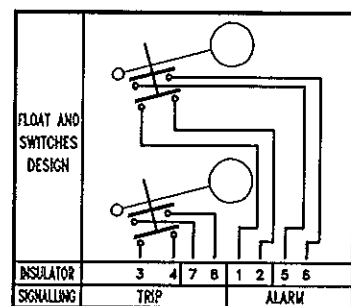
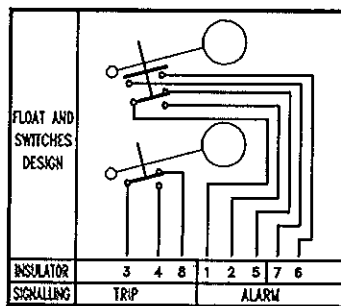
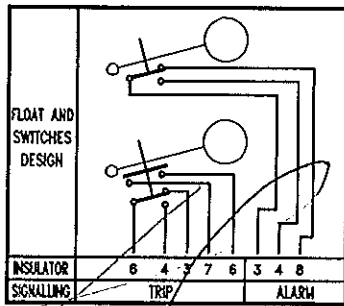


SIGNALLING	ALARM		TRIP	
NUMBER OF INSULATOR	3	4	1	2
WIRING DIAGRAM A	N/O CONTACT		N/O CONTACT	

SIGNALLING	ALARM			TRIP		
NUMBER OF INSULATOR	6	3	4	5	1	2
WIRING DIAGRAM L	CHANGEOVER CONTACT			CHANGEOVER CONTACT		

SIGNALLING	ALARM		TRIP			
NUMBER OF INSULATOR	3	4	1	2	5	6
WIRING DIAGRAM G	N/O CONTACT		N/O CONTACT		N/O CONTACT	

SPECIAL WIRING DIAGRAM



SIGNALLING	TRIP		ALARM				
NUMBER OF INSULATOR	5	2	7	6	8	3	4
WIRING DIAGRAM S2	CHANGEOVER CONTACT		N/O CONTACT		CHANGEOVER CONTACT		

SIGNALLING	TRIP			ALARM				
NUMBER OF INSULATOR	8	3	4	5	1	2	7	6
WIRING DIAGRAM S3	CHANGEOVER CONTACT			CHANGEOVER CONTACT		N/O CONTACT		

SIGNALLING	TRIP				ALARM			
NUMBER OF INSULATOR	3	4	7	8	1	2	5	6
WIRING DIAGRAM S4	N/O CONTACT				N/O CONTACT			

Wiring diagram

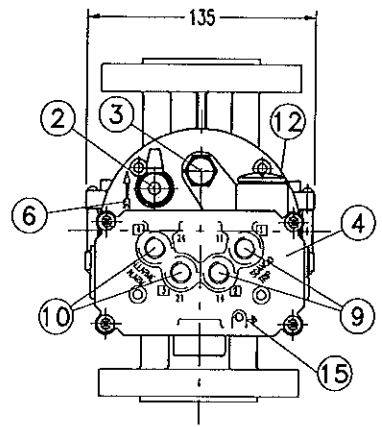
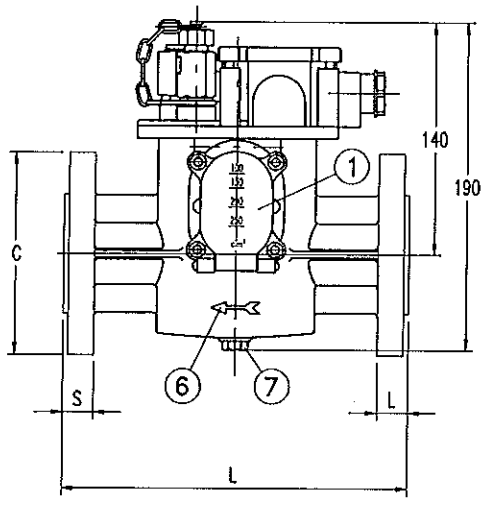
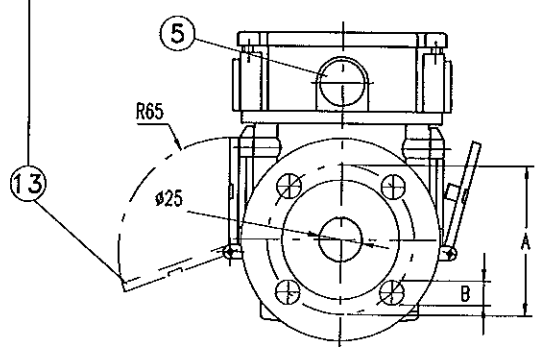
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Float and switch design

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 A4 (210,297)
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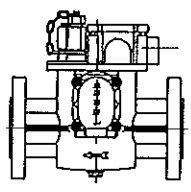
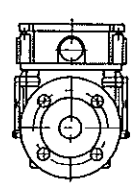
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dim in mm.

The figure shows the relay EB025 Scale 1:4

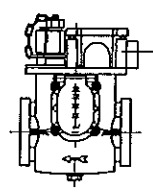
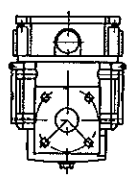
TYPE EB025



A	85
B	14
C	115
L	200
S	18

WEIGHT Kg 1.70

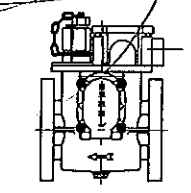
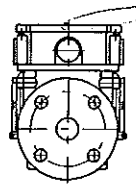
TYPE EE025



A	72
B	M10
C	76
L	127
S	12

WEIGHT Kg 1.40

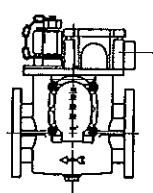
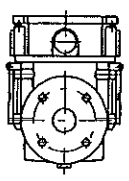
TYPE EU025



A	85
B	14
C	115
L	140
S	15

WEIGHT Kg 1.60

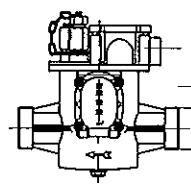
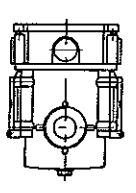
TYPE ET024



A	75
B	11.5
C	100
L	140
S	11

WEIGHT Kg 1.50

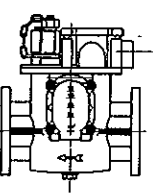
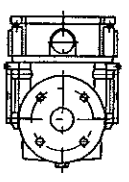
TYPE EB024



A	==
B	==
R	1 1/2" G
L	185
S	16

WEIGHT Kg 1.40

TYPE ET025



A	75
B	11.5
C	100
L	160
S	11

WEIGHT Kg 1.50



Gas actuated relay NB 25 EN50216-2 200

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Sunshield cover upon request

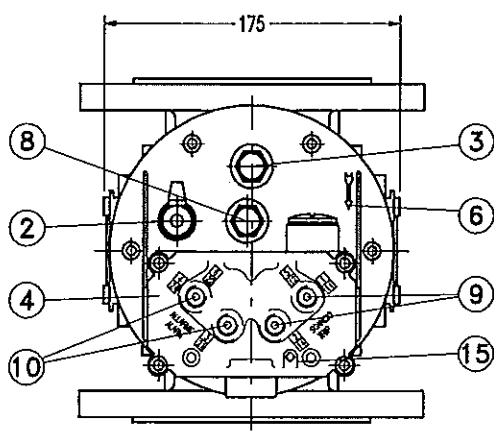
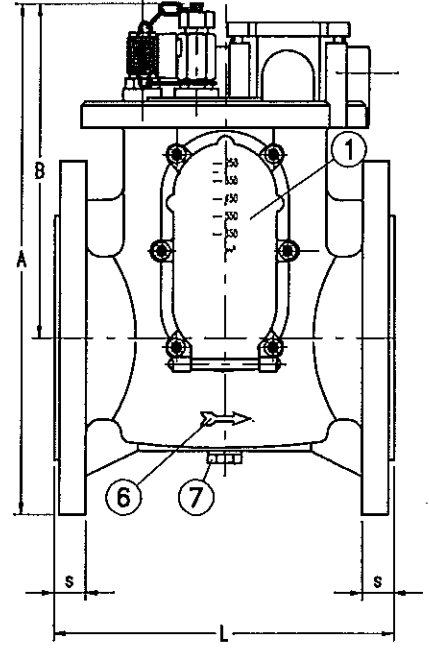
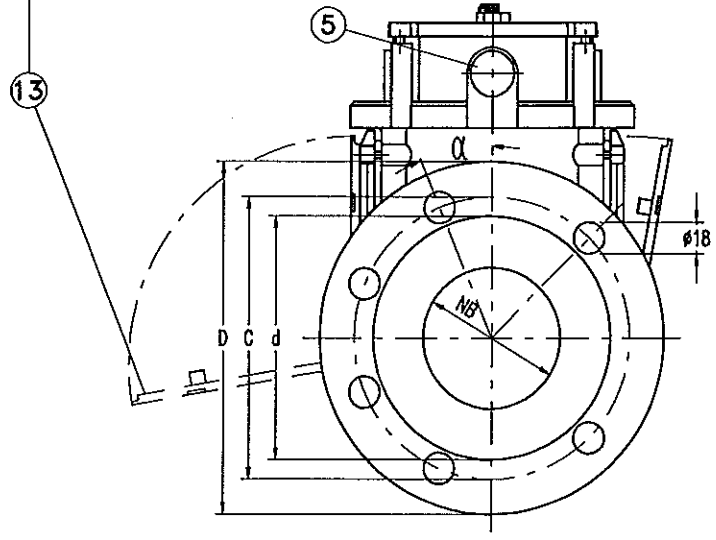
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Z = Nr of holes

Tipo Type	NB	A	D	C	B	s	L	α	d	Z	Peso (kg) Weight (kg)
EB050	50	230	165	125	160	18	195	45°	102	4	≈ 4.60
EB079	80	285	200	160	190	18	195	45°	138	4	≈ 5.50
EB080	80	285	200	160	190	18	195	22,5°	138	8	≈ 5.50
ET050	50	185	140	110	160	13	183	45°	/	4	≈ 4.50

dim in mm.

The figure shows the relay EB080 Scale 1:4

CEDASPE

Gas actuated relay type EB EN50216-2

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Protezione finestra
a richiesta
Sunshield cover
upon request

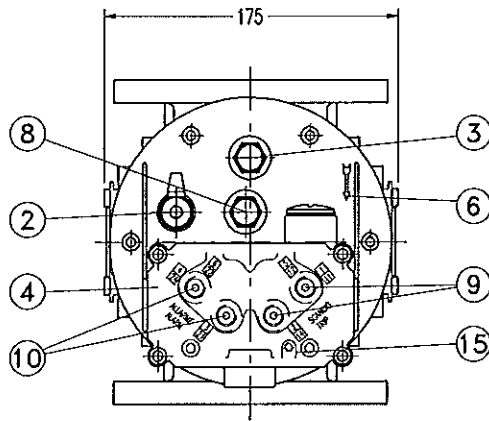
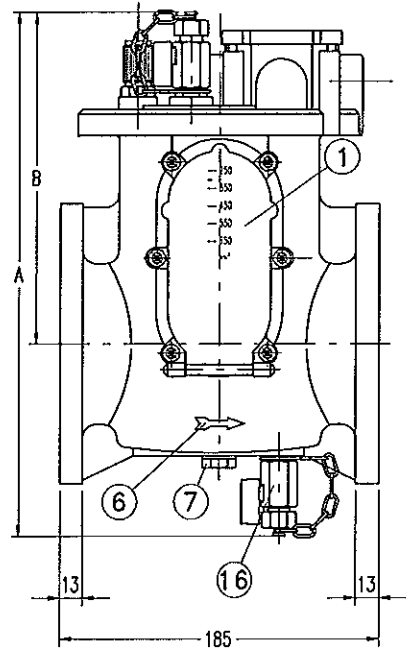
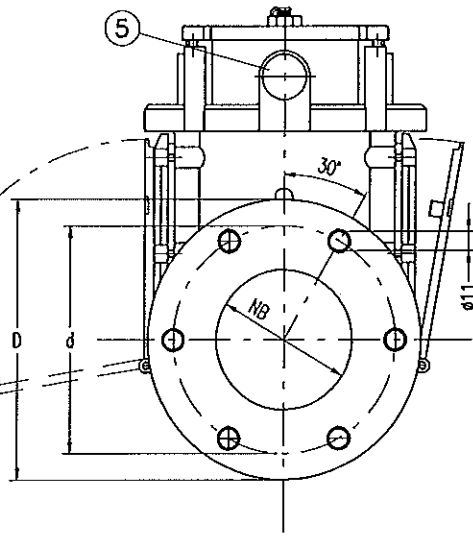
M4 (210x297)

UNT (0,0) (196,288)

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REV. 01 DTD 06/11/06

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Tipo Type	NB	A	B	D	d	Peso (kg) Weight (kg)
EE050	50	270	160	140	110	≈ 4.60
EE080	80	300	190	160	130	≈ 5.50

dim in mm.

The figure shows the relay EE080 Scale 1:4

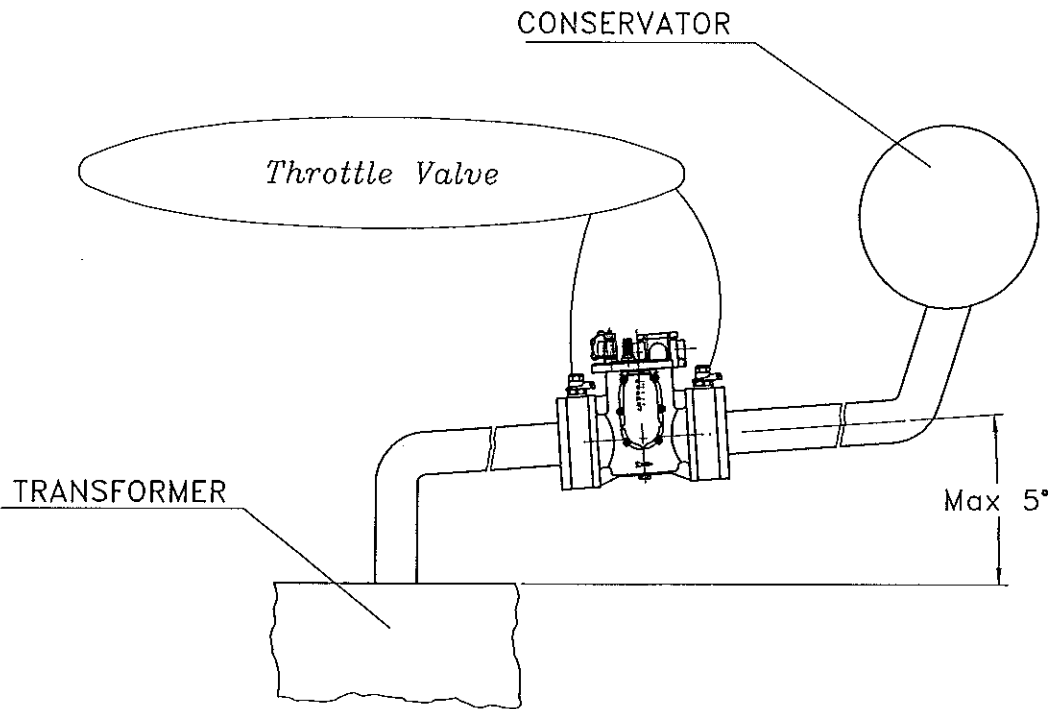


Gas actuated relay type EE

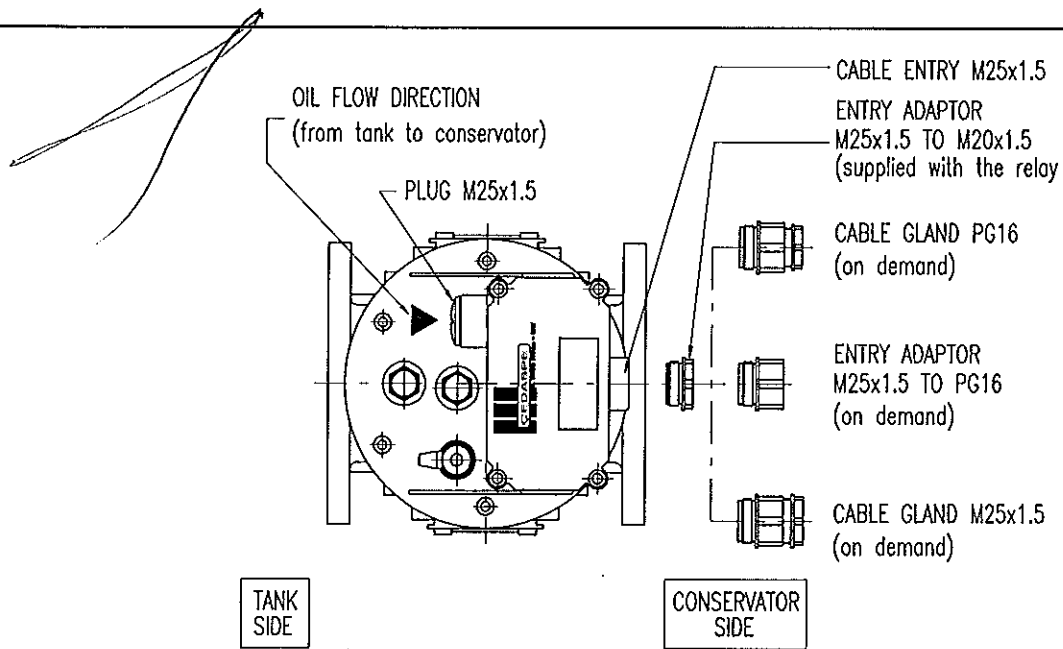
EN50216-2

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Mounting Sketch



Cable entry arrangement



IMPORTANT NOTICE:
 THIS SOLUTION OF CABLE ENTRY IS AVAILBLE ONLY FOR RELAY HAVING SIZE 060; 079; 080.
 RELAY HAVING SIZE 024 & 025 ONLY PG16 CABLE ENTRY IS AVAILBLE

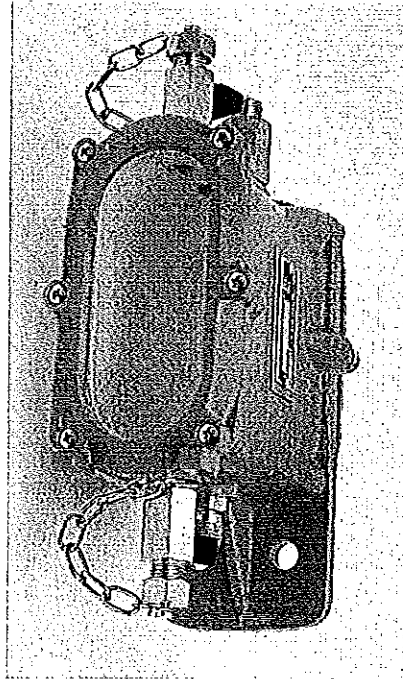
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14. Accessories

14.1 Gas sampling device RG3.2



14.1.1 General features

The body is made of aluminium alloy casting; in order to check gas and oil two large inspection windows made in trogamid (on request made in tempered glass and with sunshield), are fitted on either side of the casting.

Two petcock complete with hermeto joints are present for connection to relay and one pneumatic valve for test and another petcock draining oil complete the apparatus

14.1.2 Installation

The Buchholz gas sampling device "RG3" must be fitted on the transformer tank, from the ground level, within handy height.

A copper tube (size 8 mm OD/ 6 mm ID) must be used to connect the "RG3.2" device, from the cock "12", to the top of the Buchholz relay, cock "R"; for connecting the tube to the cocks, special unions "14" shall be used. If using RG3.3 a second copper tube has to be used for connecting cock "T" to cock "15".

When the RG3 apparatus has been mounted cocks "R" and "T" have to remain open position

For filling the device with oil, open the cocks "R"; "T"; "15" and "12", open the cock "2" and wait until oil has entirely filled the «RG3» device, then close cock "2" and "15"; oil level inside «RG3» may be controlled through the inspection windows located on the two sides.

In the normal operating conditions, the gas sampling device, the Buchholz relay and the connecting tube between them should be oil filled.



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14.1.3 Operating instruction

14.1.3.1 Gas sampling from the Buchholz relay

Open oil drain cock "11" and watch through the «RG3» windows until gas is seen to have flown into the «RG3» device; then close "11".

Now, the gas, formerly accumulated inside the Buchholz relay due to some electrical failure inside the transformer, may be sampled for examination or released, by opening the cock "2".

The gas should be totally released (i.e. until the «RG3» is completely filled again with oil) to reset the Buchholz relay in normal operating conditions; in the case it is necessary to maintain the gas inside the «RG3», the shut-off cock "12" and "2" must be closed; cock "2" may be reopened for sampling the gas for examination, or for gas release.

14.1.3.2 Checking of alarm circuits

Cock "12" in open position.

Inject air inside «RG3.2» through the bottom valve "8" (after removing the knurled protecting cap), using a bottle of compressed air or a normal bicycle tyre pump, until the alarm signal (or signals) have been set in operation.

To reset the Buchholz relay in normal operating conditions, follow above instructions for gas sampling and release.

14.1.3.3 Checking trip circuits

Cock "12" in open position. Inject air inside «RG3.2» through the bottom valve "8" (after removing the knurled protecting cap), using a bottle of compressed air or a normal bicycle tyre pump, until the trip signal (or signals) have been set in operation.

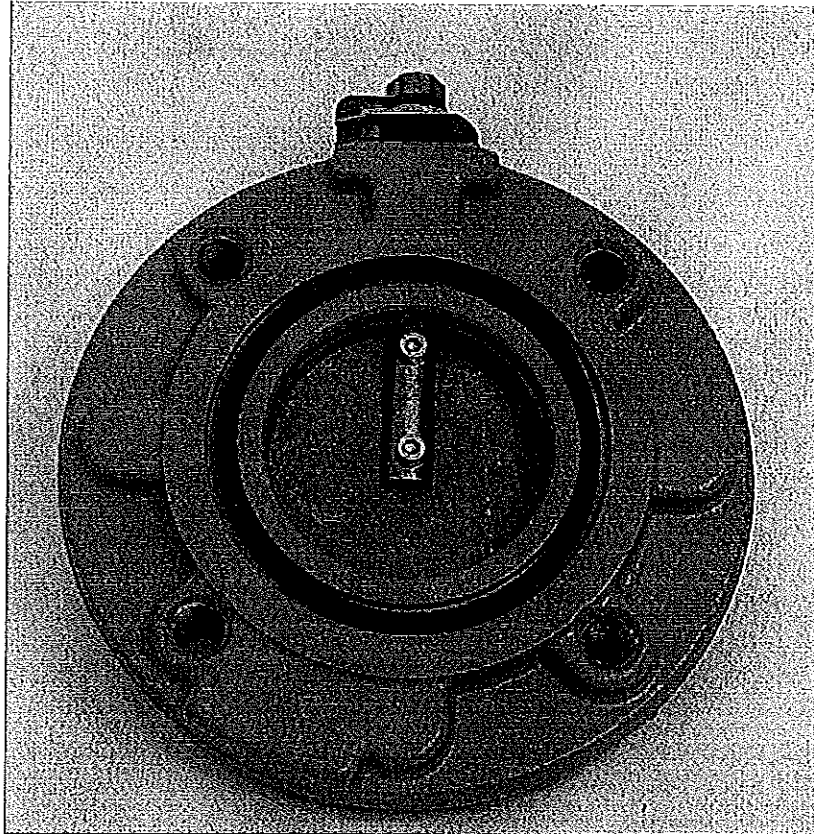
To reset the Buchholz relay in normal operating conditions, follow above instructions for gas sampling and release.

If test is executed on Buchholz relay EE type (NB 50 or 80 mm) an RG3.3 is used and trip contact has to be checked as follows:

Cock "12" in closed position; cock "15" in open position. Inject air inside «RG3.3» through the bottom valve "8" (after removing the knurled protecting cap), using a bottle of compressed air or a normal bicycle tyre pump, until the trip signal (or signals) have been set in operation.

To reset the Buchholz relay in normal operating conditions, follow above instructions for gas sampling and release.

14.2 Throttle valves for buchholz relays



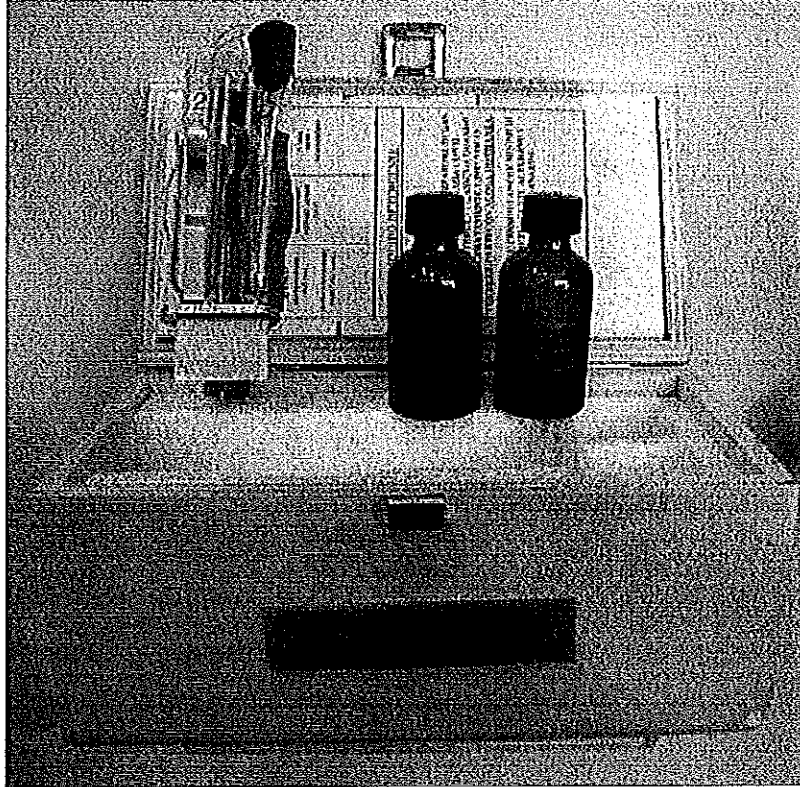
This kind of valves, metal to metal sealing, are used on power transformers with the scope to allow the disconnection of the Buchholz relay from the conservator or from the cover; they are preferred to the conventional gate valves for their compact overall dimensions in the direction of the oil flow.

The throttle design and an accurate machining of all the components minimise the oil leakage from the throttle in close position, during the operations of disconnection of the relay with the transformer oil filled, it is necessary to put small containers on the ground to collect the small quantity of oil which flow out from the throttle; once the disconnection is terminated, blind flanges must be put on the throttle valves.

All these valves have bodies made in steel ASTM A105 zincplated, painted and carefully tooled; the design and the execution of the throttle ensures a good oil proof; once the throttle is closed, the oil losses are very small (< 5 cc/60" every 25mm of the nominal diameter of the throttle); the drive shaft can be locked by means of a small padlock in both the close/open positions, which are also indicated by a label; the sealing gaskets on the drive shaft can be easily changed, if necessary, as shown on the sketch in the drawings.

All those valves are supplied with flange NBR sealing gaskets.

14.3 Gas analyser for buchholz relays



If a gas analyser kit is available it is possible to have an idea of the cause that generated the gas by checking the precipitate inside the test tube of the gas analyser.

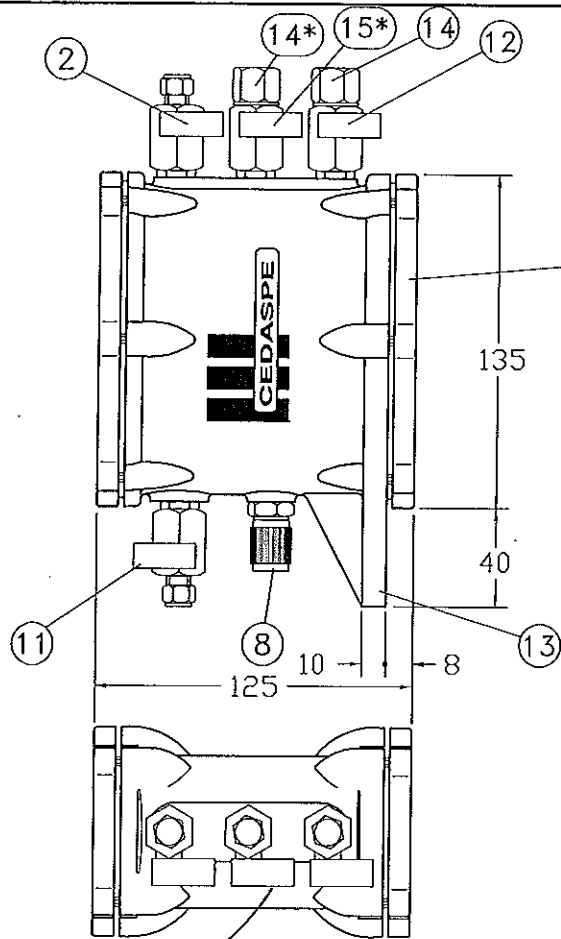
If gas is due only to oil decomposition, in the test tube 1 a white precipitate is formed which, exposed to the light, slowly turns brown.

Should, however, in the test tube "2" a black precipitate be formed, this means that the gases contain decomposition products of solid insulation, such as cotton, paper, wood and the like.

In such a case, a coil deficiency has taken place.

In the case the Buchholz relay operation is caused by air (first installation into work, total oil refilling, defect in the cooling system) there isn't any formation of precipitate inside the tubes.

After the sample of the gases has been drawn, the cock should be closed again, and the analyser housed in its container.

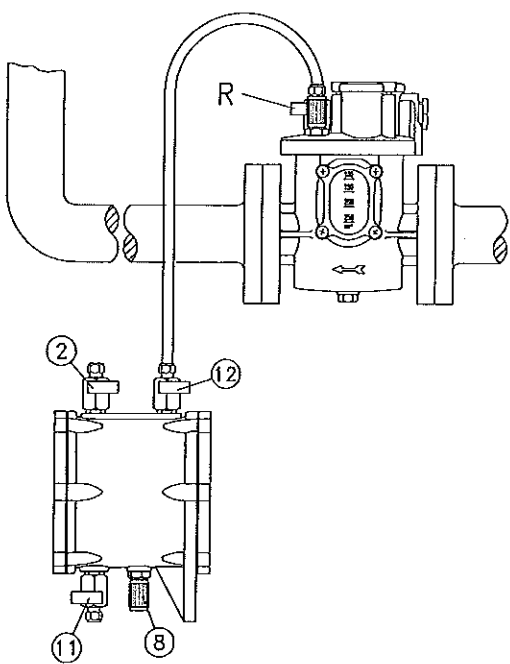


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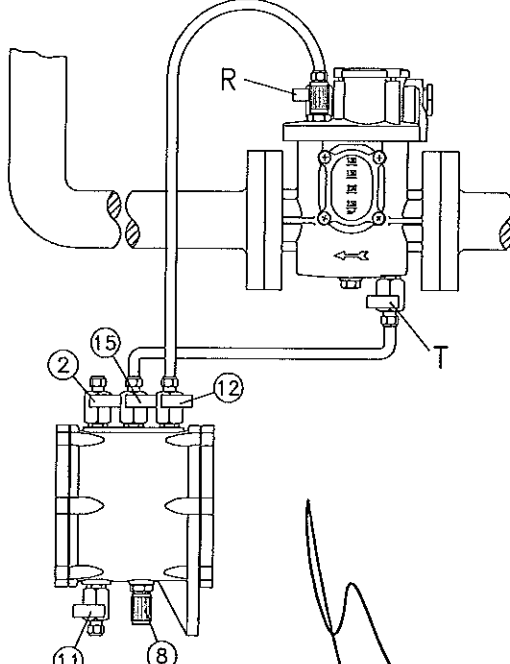
Pos	Description
1	Inspection windows
2	Gas release cock
8	Pneumatic test device
11	Oil drain cock
12	Stop cock
13	Fixing plate
14	Ermeto joint
15*	Stop cock (present only on RG3.3)
14*	Ermeto joint (present only on RG3.3)

dim in mm.

Mounting instructions for RG3.2

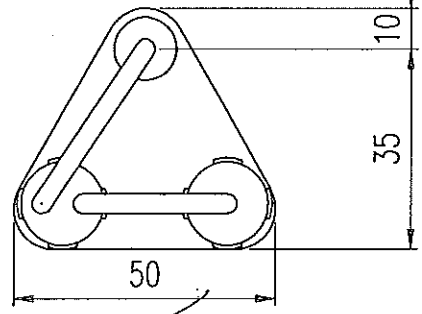
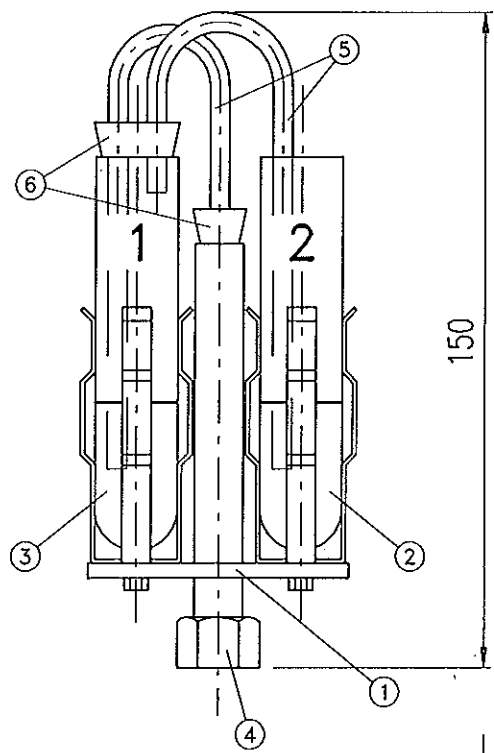


Mounting instructions for RG3.3



Mounting sketch

FILE = PAGE 21.DWG LWT [(0,0) (196,286)] A4 (210x297)
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Pos.	Description
6	Rubber plugs
5	Glass tubes
4	Revolving nut 1/4" BSP
3	Test probe 1
2	Test probe 2
1	Support

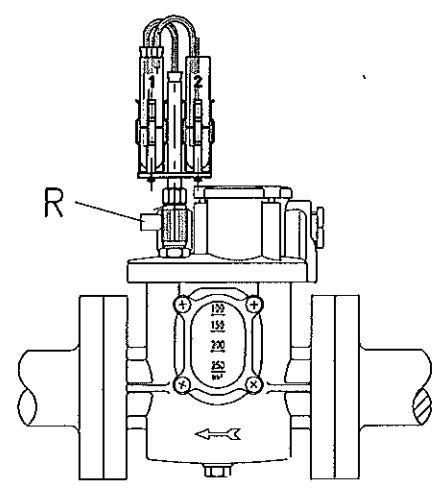


Fig. A: directly on relay

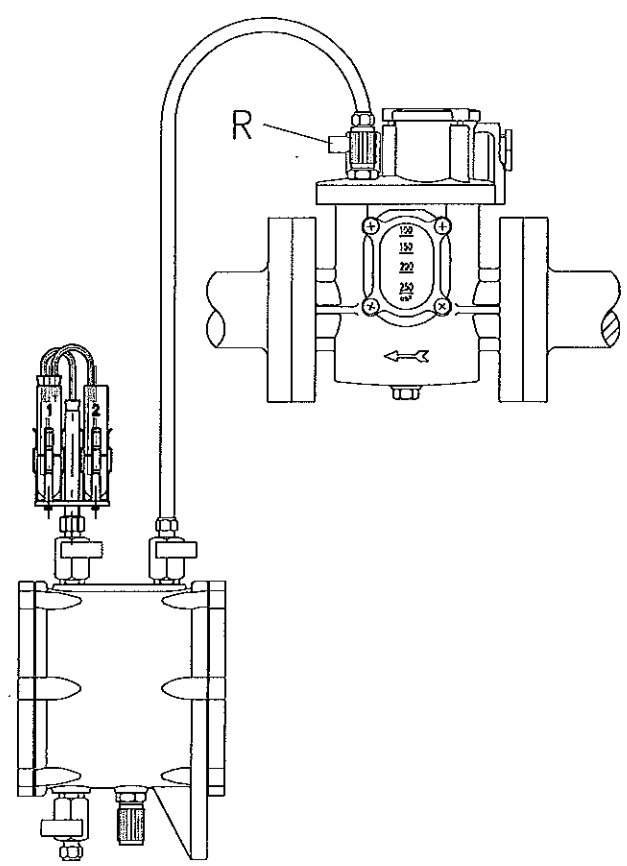
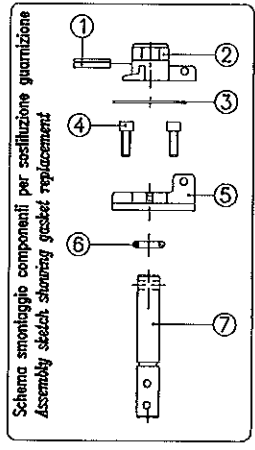
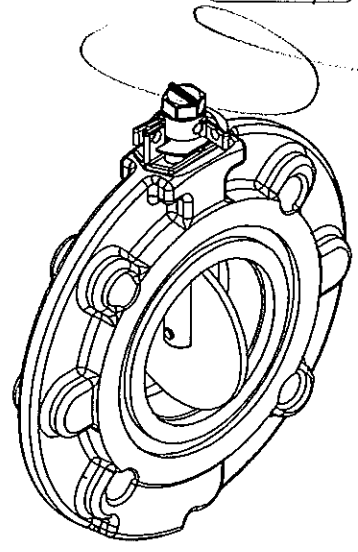
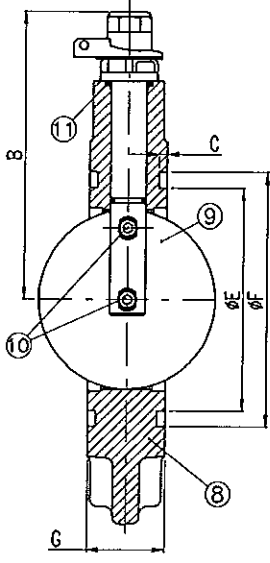
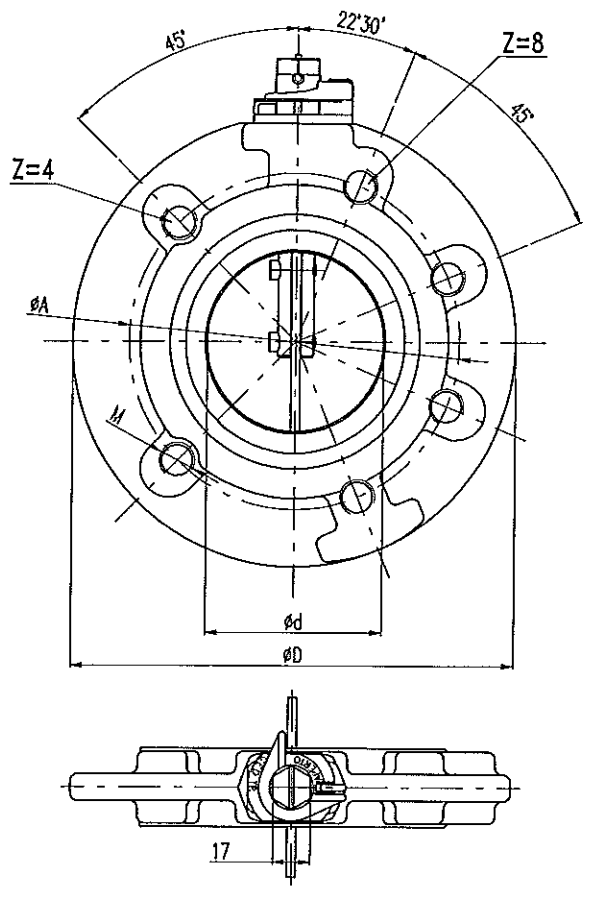


Fig. B: With RC3 apparatus

Gas analyser for Buchholz relays

FILE = PAGE 22 .DWG LWT (195.286) M4 (210x297)
 REV. 01 DTD 06/10/05
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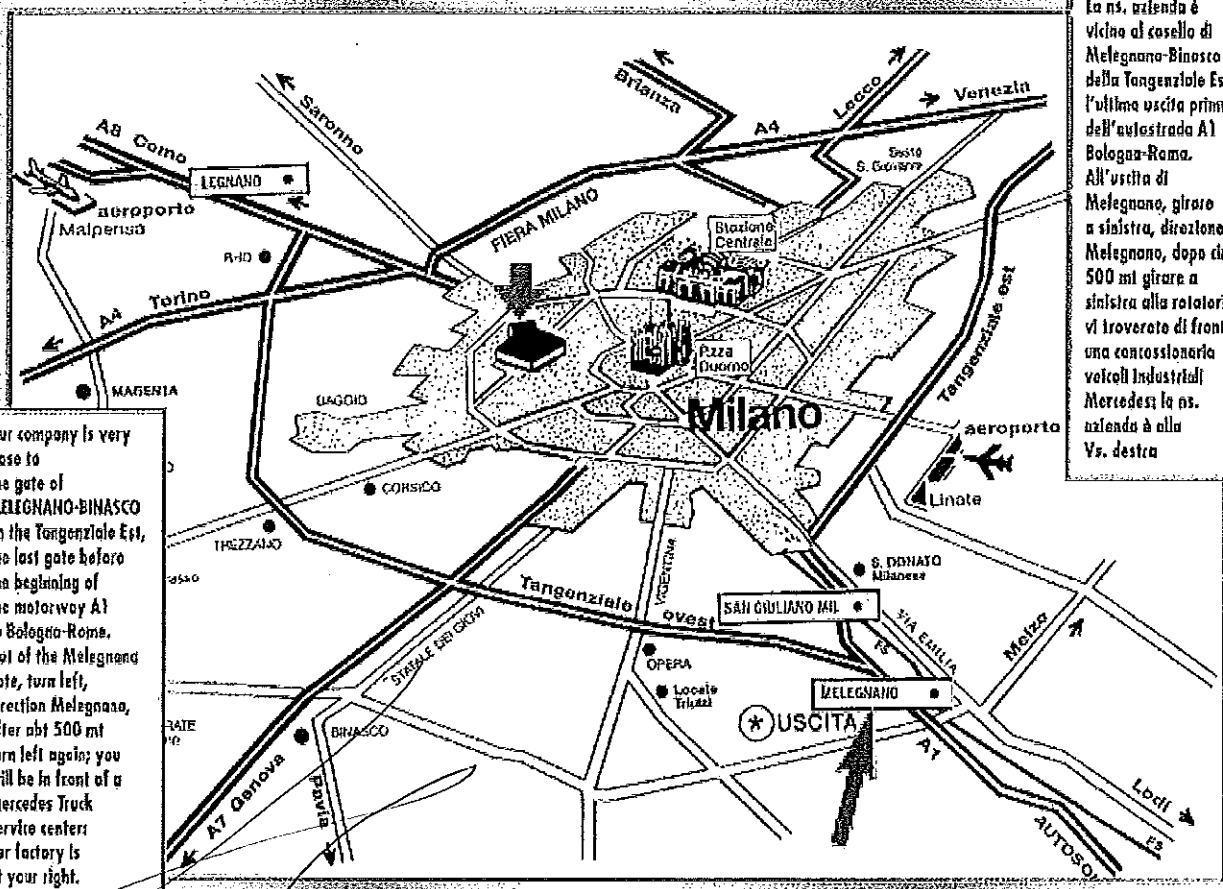
Pos	Description	Material
1	Grooved pin	Stainless Steel
2	Drive	Brass
3	Label open/closed	Aluminium
4	Screw M5	Stainless Steel
5	Gland	Brass
6	O-ring	Viton
7	Spindle	Stainless Steel
8	Body	Fe520 Zinc-Plated
9	Throttle	C40
10	Screw M5	Stainless Steel
11	O-ring	NBR

Z = Nr of holes

Tipo Type	ϕA	B	C	ϕd	ϕD	ϕE	ϕF	G	M	Z	O-Ring	Vite UNI 5739 Screw DIN 933	Tirante Rod
DN25 PN6	75	85	3.6	28	115	37	51	25	M10	4	6150	M10X20	M10x90
DN25 PN10	85	85	3.6	28	115	37	51	25	M12	4	6150	M12X25	M12x90
DN50 PN6	110	110	3.6	52	165	68.5	82.5	35	M12	4	6275	M12X30	M12x100
DN50 PN10	125	110	3.6	52	165	68.5	82.5	35	M16	4	6275	M16X35	M16x110
DN80 PN6	150	130	3.6	80	200	99.5	113.5	35	M16	4	6400	M16X35	M16x110
DN80D PN10	160	130	3.6	80	200	99.5	113.5	35	M16	8	6400	M16X30	M16x120
DN80U PN10	160	130	3.6	80	200	99.5	113.5	35	M16	4	6400	M16X30	M16x120

CEDASPE

THROTTLE VALVE
 TYPE DN25 / DN50 / DN80 210



La ns. azienda è vicino al casello di Melegnano-Binasco della Tangenziale Est, l'ultima uscita prima dell'autostrada A1 Bologna-Roma. All'uscita di Melegnano, girare a sinistra, direzione Melegnano, dopo circa 500 mt girare a sinistra alla rotatoria; vi troverete di fronte una concessionaria veicoli Industriali Mercedes; la ns. azienda è alla Vs. destra

Our company is very close to the gate of MELEGNANO-BINASCO on the Tangenziale Est, the last gate before the beginning of the motorway A1 to Bologna-Roma. Out of the Melegnano gate, turn left, direction Melegnano, after abt 500 mt turn left again; you will be in front of a Mercedes Truck service center; our factory is at your right.

PROGRAMMA DI PRODUZIONE

- Isolatori passanti BT/MT
- Relè ad accumulo di gas
- Indicatori livello olio
- Essiccatori d'aria
- Valvole a farfalla per radiatori e relè.
- Valvole di sovrappressione
- Termometri con e senza contatti elettrici
- Commutatori di presa a vuoto
- Muffole per entrata in cavo (BS2562)

MANUFACTURING PROGRAM

- LV and HV Transformer Bushings
- Gas actuated Relays
- Oil Level Gauges
- Dehydrating Breathers
- Radiator throttle valves
- Pressure Relief Devices
- Thermometers with/without electric contacts
- Off-load Tap Changers
- Cable boxes (BS2562)

PROGRAMA DE PRODUCCION

- Pasatapas BT/AT
- Relés Buchholz
- Indicadores de nivel de aceite
- Deshumectadores de aire
- Valvulas mariposa para radiadores
- Valvulas de subrepression
- Termometros con y sin contactos electricos
- Commutadores
- Cajas de bornas AT (BS2562)

PROGRAMME DE PRODUCTION

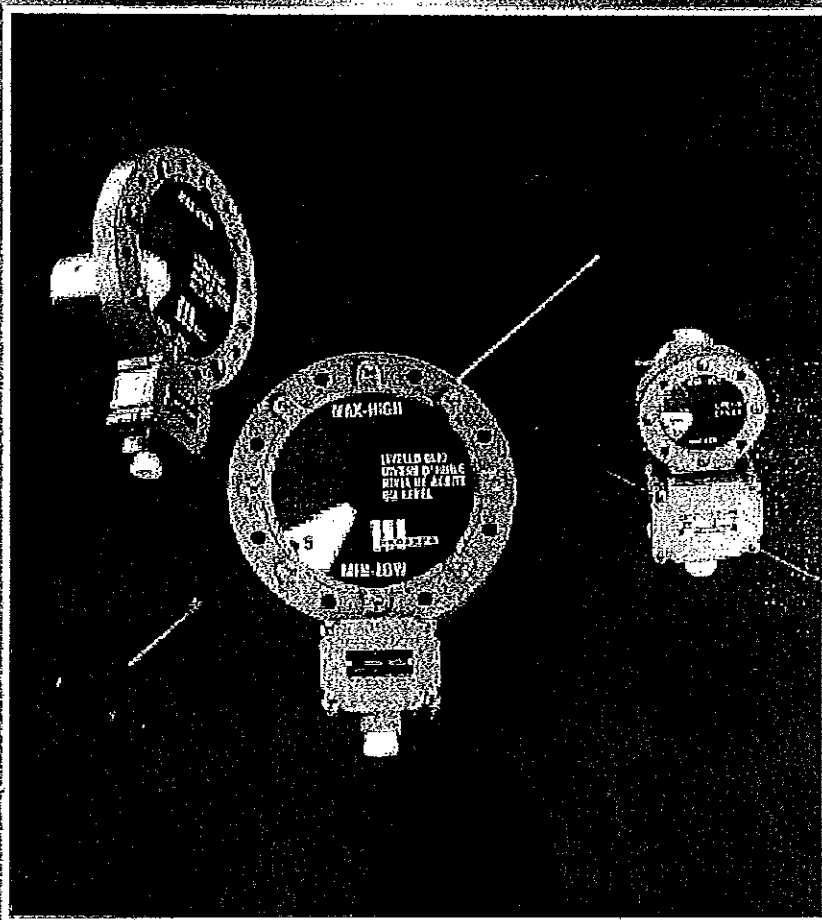
- Traversée isolée BT/HT
- Buchholz Relais
- Indicateur de niveau d'huile
- Assécheur d'air
- Vannes a papillon pour radiateurs
- Soupape de sureté
- Thermomètres avec/sans contacts
- Commutateurs des prises
- Bâite à cable MT (BS2562)

CEDASPE S.p.A.

Via Colombaro, 1 Fraz. Pedrignano - 20098 S. Giuliano Milanese (MI) - Tel. +39/0298204411 - Fax +39/0298204422
 E-MAIL: cedaspe@cedaspe.com - InterNet Site: http://www.cedaspe.com



ACCESSORI PER TRASFORMATORI ELETTRICI ACCESSORIES FOR ELECTRIC TRANSFORMERS



INDICATORI LIVELLO OLIO OIL LEVEL GAUGES

CEDASPE S.p.A.

Via Colombara, 11 - 20098 S. Giuliano Milanese (MI) - Tel. +39/0298204422 - Fax +39/0298204422

E-Mail: cedaspe@cedaspe.com - InterNet Site: <http://www.cedaspe.com>

213

9

C

C

4

219

MAGNETIC OIL LEVEL GAUGES

With electric contacts (serie 2000)

1.0 FEATURES

The gauges type IMLO, for oil immersed power transformers, give an analogic indication of the oil level inside the conservator on which are usually mounted; when required, they give an electric alarm signal if the oil reaches the minimum and/or the maximum admitted level.

The body of the gauge, one piece only, is made of a solid casting of aluminium alloy; inside there is an indicating disc; in the front there is a dial made in transparent plexiglas with the marking of the maximum and minimum level and of the intermediate levels that the oil reaches at the temperature of -20°C, +20°C and +85°C (dial with different marking can be supplied upon request)

The indicating disc is half white and half red coloured: at the minimum level you can see only the red part, at the maximum only the white part; at the intermediate levels, the red part of the disc which is visible is directly proportional to the oil level inside the conservator.

The body has two hollow spaces containing the monitoring and the indication mechanism; a wall between the two hollow spaces guarantees a full separation between the oil inside the conservator and the ambient air.

The magnetic oil level gauges consist of two mechanisms ("Monitoring" the first, "Indication" the second) connected between them by means of a magnetic joint.

1.1 Monitoring system

One float fitted at one end of the arm follows the movement of the surface of the oil; the other end of the arm transmits the movement of the float to a magnet.

The float may move onto a plan parallel to the dial (style R, page 5.27), or orthogonal (style Y, page 5.28): in the first way the float arm is rigidly connected to the magnet; in the second, two bevel gears are in between the float-arm and the magnet.

1.2 Indication system

It consists of one magnet and one indicating disc, one or more cams and as many contacts (depending on the wiring diagram) rigidly connected.

The magnet of the monitoring system leads the magnet of the indication system during its movement, because of the magnetic flux.

The indication system contains inside the min and/or max level switches and wiring.

2.0 MANUFACTURING PROGRAM

2.1 Type IMLO 100-140-220-345 page 5.27-28

It is a complete family of oil level gauges, with four different body sizes, which make them suitable to be used either on small either on large power transformers; the choice of the size is function of the size of the conservator.

They are normally fitted with changeover microswitches for minimum or for minimum and maximum level, so they can be used also on transformers subject to strong vibrations or in case of aseismic requirements.

2.2 Type IMLO-Y-220-ATMOSEAL page 5.29.A-B

This oil level gauge is suitable for use on conservators with hermetically sealed rubber bag and it is normally fitted with one contact to operate at min oil level, but this doesn't exclude the possibility to use any other wiring diagrams.

The page 5.29.A shows the two most common ways of mounting on the conservator end, vertical or with a slight inclination (fig B), or inclined at 45° under the conservator (fig A): a copy of this page filled with all the data can be used as an order form sheet.

The possibility to choose among three executions (see page 5.29.B) that are different owing to the bevel gear ratio (IMLO-Y-222 ratio 1:2; IMLO-Y-223 ratio 1:3; IMLO-Y-224 ratio 1:4) offer a wide flexibility of use; the mounting of the bevel gear inside the body and an adjustable-length strong arm with two big rolling floats offer an high reliability.

The dial of these gauges is customised with special marking for each job.

3.0 ELECTRIC SWITCHES CHARACTERISTICS

3.1 Rated current of the microswitches

a.c.: 3 A (50 Hz) $\cos\phi > 0,4$ at 250 V

d.c.: 1 A at 30V / 0,27 A at 110 V / 0,13 A at 220 V (L/R=5 ms)

Breakdown voltage between contacts: 750 V

Operating life: 30.000.000 cycles at 1 Hz

3.2 Precision of the indication: +1°/-5° disc rotation.

4.0 CONTACT DESIGN & SYMBOLS

4.1 Only changeover contacts are available.

(the switch changes-over the circuit at the set point)

4.2 Symbols of contacts

- F: min changeover contacts
- G: max changeover contact

4.3 Wiring diagrams

-Styles available for all sizes

FM : 1 electric contact at Min level

FGM : 1 electric contact at Min level and 1 electric contact at Max level

-Styles available for the sizes 140,220,345

FFM - S : 2 electric contact at Min level operating simultaneously

FFM - A : 2 electric contacts operating sequentially at Min level (alarm and trip wiring diagram)

-Styles available for the sizes 220 & 345

FFGGM : 2 electric contact at Min level and 2 electric contacts operating at Max level

See page 5.29D for the sketches of the wiring diagram and the identification of the terminals

5.0 CABLE BOX

Our gauges are fitted with a weatherproof cable box, with a PG16 cable gland and a ground screw.

6.0 OPERATING TEMPERATURE

Our oil level gauges are manufactured in order to withstand oil temperature between -25°C and +100°C and ambient temperature between -25°C and +85°C.

7.0 SWITCHES SET-POINT

The set point of the switches is calibrated 2° to 5° in advance to the min or max level.

Overlap at min or max level: 5° (angular)

Switching differential: 5°

8.0 GROUND INSULATION TEST

Each gauge is tested at 2000 V a.c. (50 Hz) for 60", between the gauge housing and the electric circuits, and between the two independent circuits.

9.0 PROTECTION DEGREE: IP 55

10.0 EXTERNAL SURFACES FINISH: epoxy paint RAL 7030, Stainless steel screws.

11.0 SPECIAL REQUIREMENTS

- Special dial marking
- Cable gland adaptor PG16 to 3/4" or M20x1;5 or 1"W
- Special executions for desert or for highly polluted atmosphere

12.0 MOUNTING INSTRUCTIONS

Normally the "Y" execution is suggested when it is necessary to mount an oil level gauge on the cylindrical surface of the conservator; the "R" execution, the most commonly used, is suitable for mounting on the front or back ends of the conservator. Welding studs or blind tapped holes are both acceptable ways to fix the gauge on the wall, using respectively nuts or screws (see page 5.29.D for mounting sketch); a flat cork impregnated gasket, supplied together with the gauge, must be put between gauge and wall before tightening; on demand sizes 140 and 220 may be supplied with an O/ring tightening flange gasket.

At page 5.27 & 5.28 you find the formula for the calculation of the arm float length "R" and of the distance "S" between centre of the dial and of the conservator.

13.0 ORDER INSTRUCTIONS

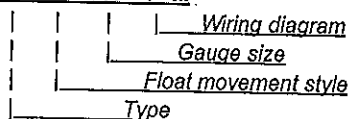
The following details must be given when issuing an order, or asking a quotation:

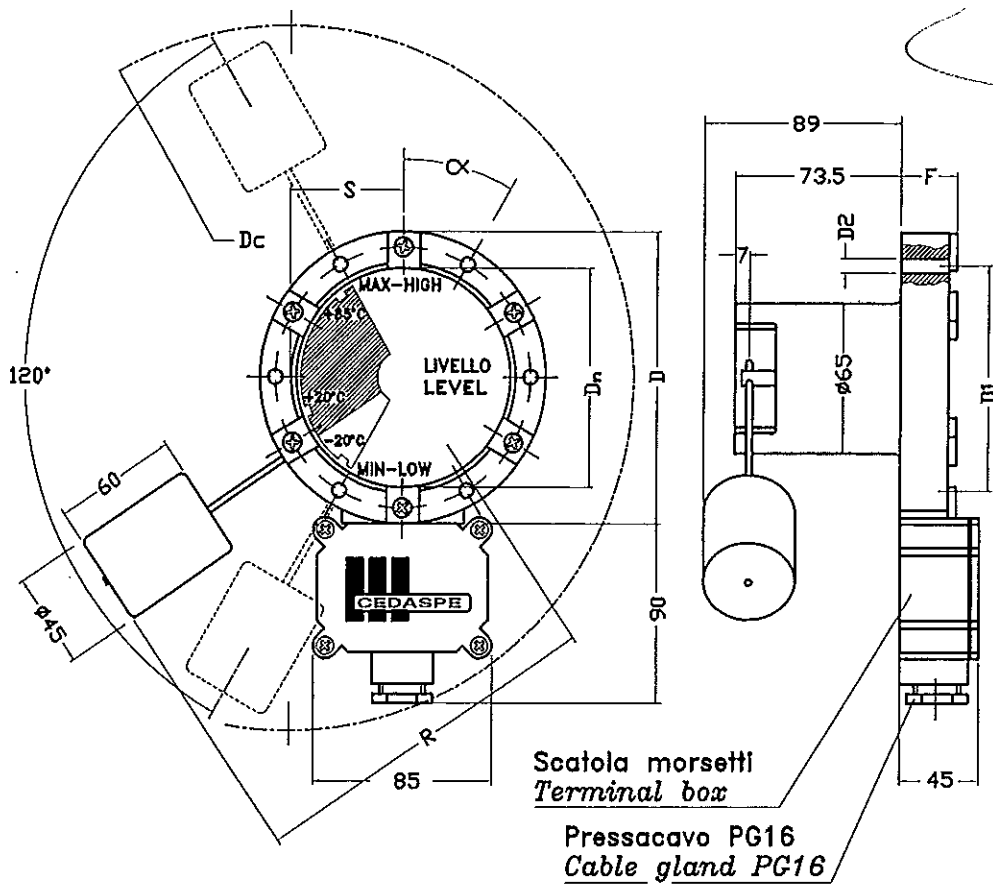
- Type
- Float movement design
- Size
- Wiring diagram

EXAMPLE

IMLO R 220 FGM

IMLO Y 140 FM





- Z: N° Fori D2 su flangia
- Z: N° Holes D2 on flange
- Dc: Diametro conservatore
- Dc: Conservator diameter
- R: Braccio galleggiante = $1,15 \left(\frac{Dc}{2} - 45 \right)$
- R: Arm lenght
- K: Foro per montaggio su conservatore = $70 \pm 1 \text{ mm}$
- K: Mounting hole on the conservator
- S: Scostamento da centro conservatore
- S: Distance between conservator/gauge centers = $0,577 \left(\frac{Dc}{2} - 45 \right)$

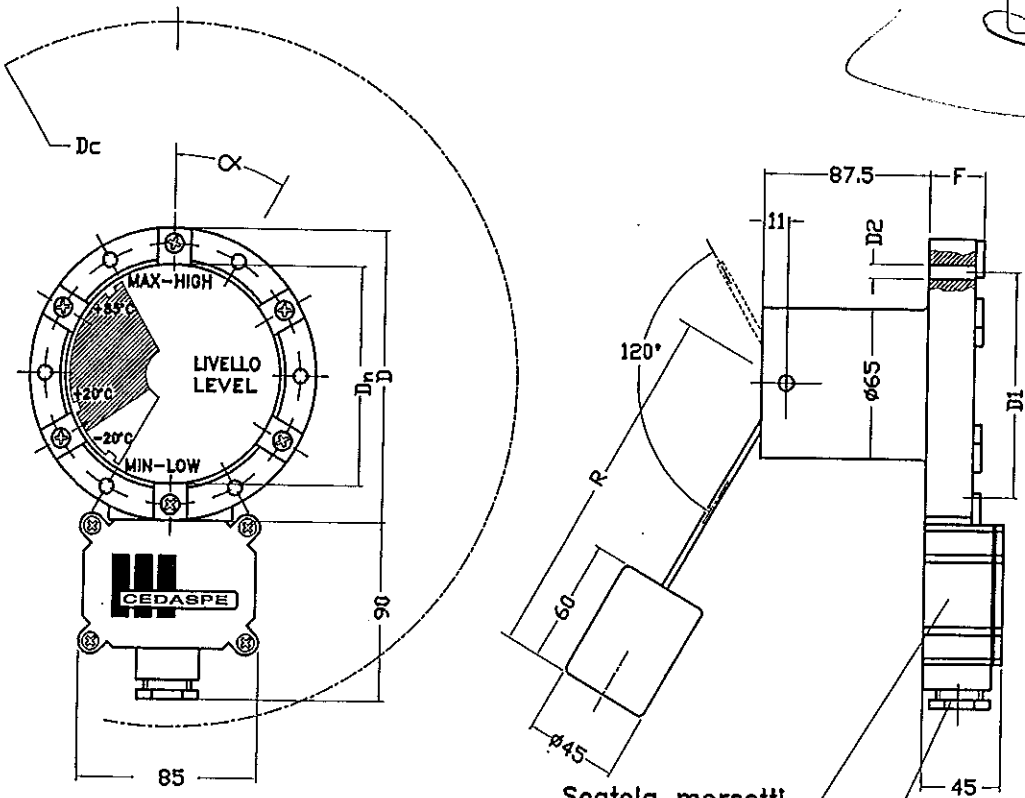
Tipo/Type	D _n	D	D1	D2	α	Z	F	Dc _{MAX}
IMLO R 100	65	100	85	7	45	4	22	400
IMLO R 140	100	140	125	7	30	6	22	400
IMLO R 220	150	220	190	12	22.5	8	26	1000
IMLO R 345	265	345	305	14	22.5	8	26	3000

dim in mm.



Indicatori magnetici di livello olio radiali (forma R)
Radial magnetic oil level gauges (form R)

FILE = PAG5-28.DWG LMT [(0,0) (196,286)] A4 (210x297)
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Scatola morsetti
Terminal box
Pressacavo PG16
Cable gland PG16

- Z: N° Fori D2 su flangia
Z: N° Holes D2 on flange
- Dc: Diametro conservatore
Dc: Conservator diameter
- R: Braccio galleggiante
R: Arm lenght $= 1,15 \left(\frac{Dc}{2} - 45 \right)$
- K: Foro per montaggio su conservatore
K: Mounting hole on the conservator $= 70 \pm 1 \text{ mm}$

Tipo/Type	Dn	D	D1	D2	α	Z	F	DcMAX
IMLO Y 100	65	100	85	7	45	4	22	400
IMLO Y 140	100	140	125	7	30	6	22	400
IMLO Y 220	150	220	190	12	22.5	8	26	1000
IMLO Y 345	265	345	305	14	22.5	8	26	3000

dim in mm.



Indicatori magnetici di livello olio assiali (forma Y)
Axial magnetic oil level gauges (form Y)

Fig. A

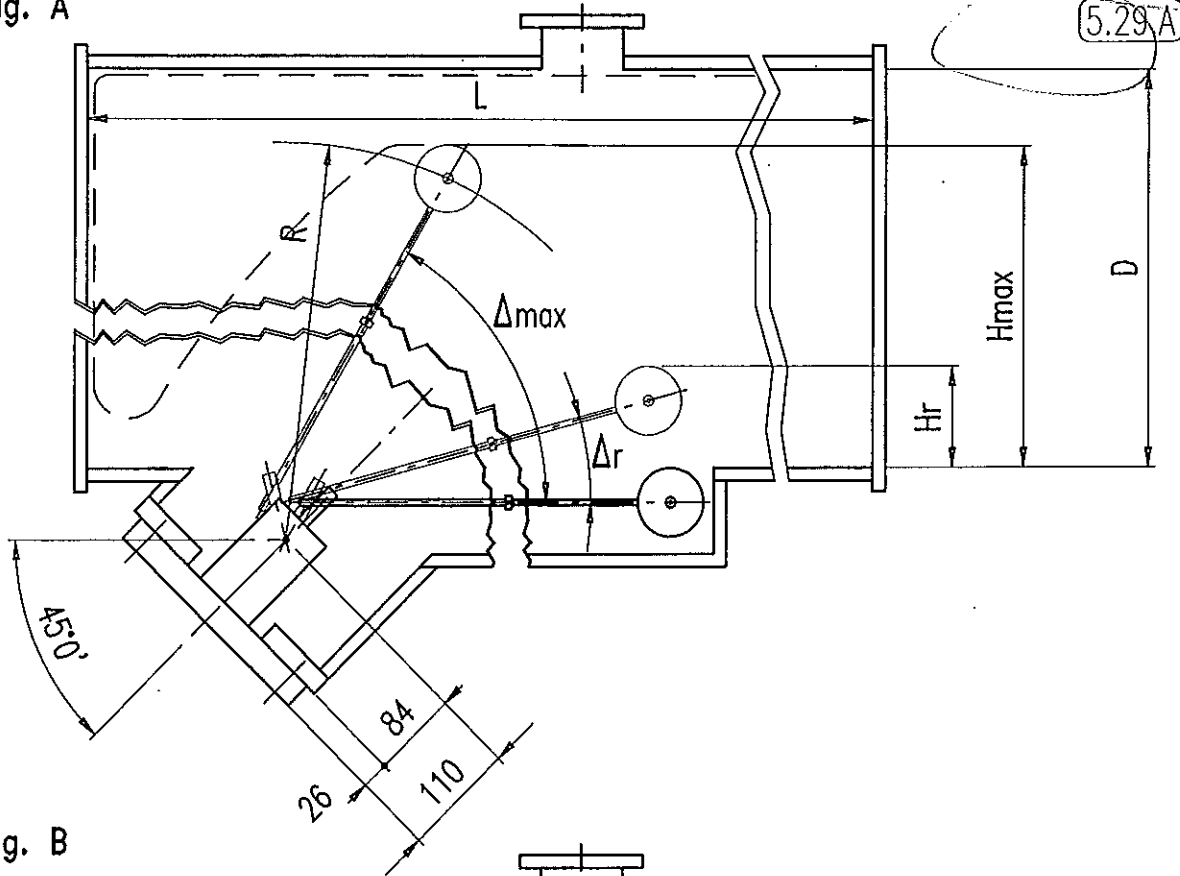
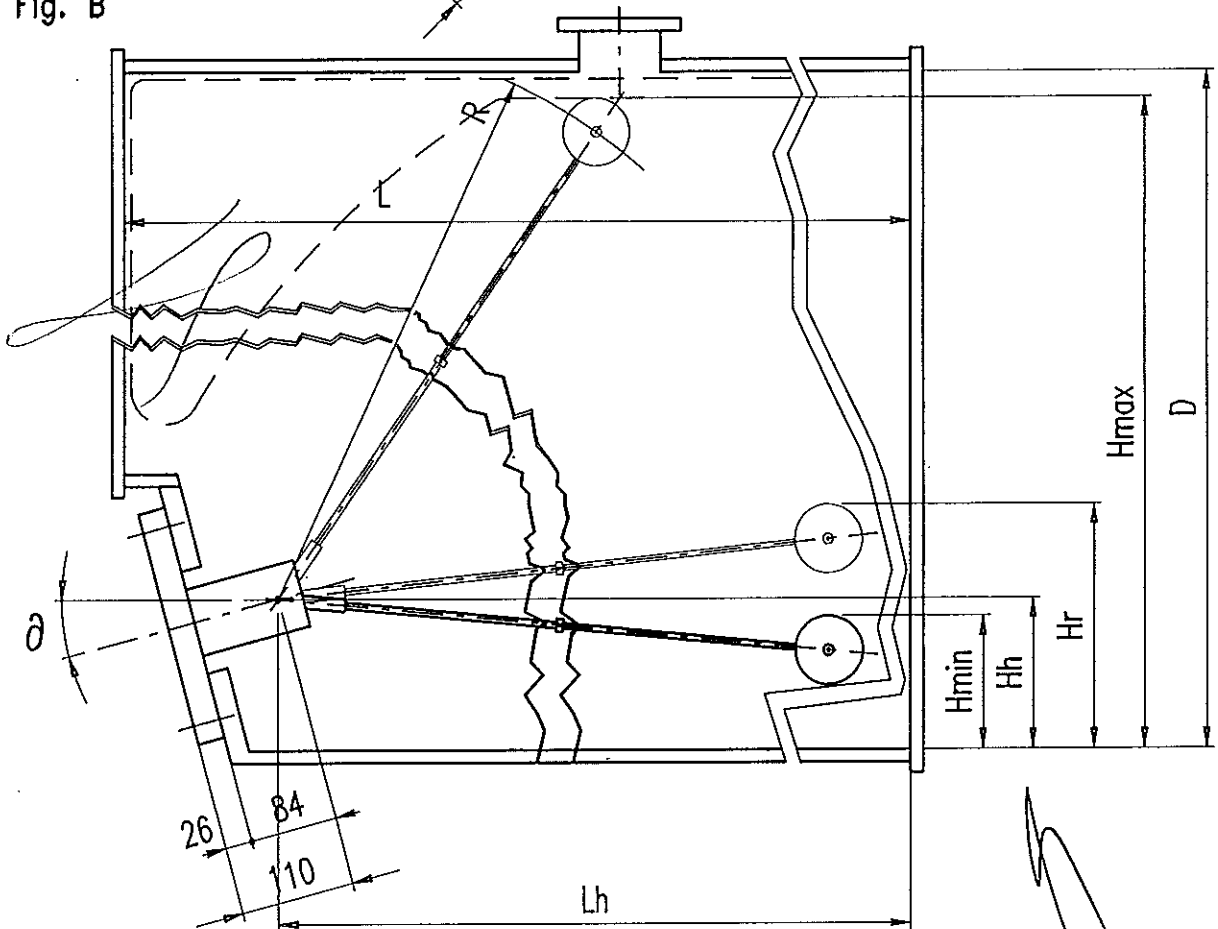
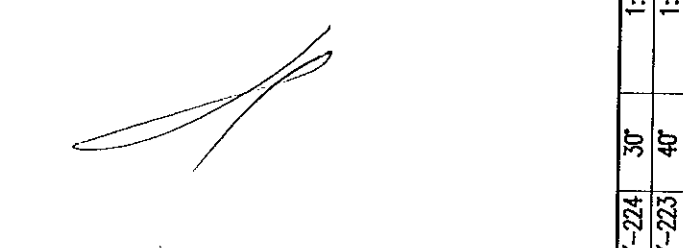
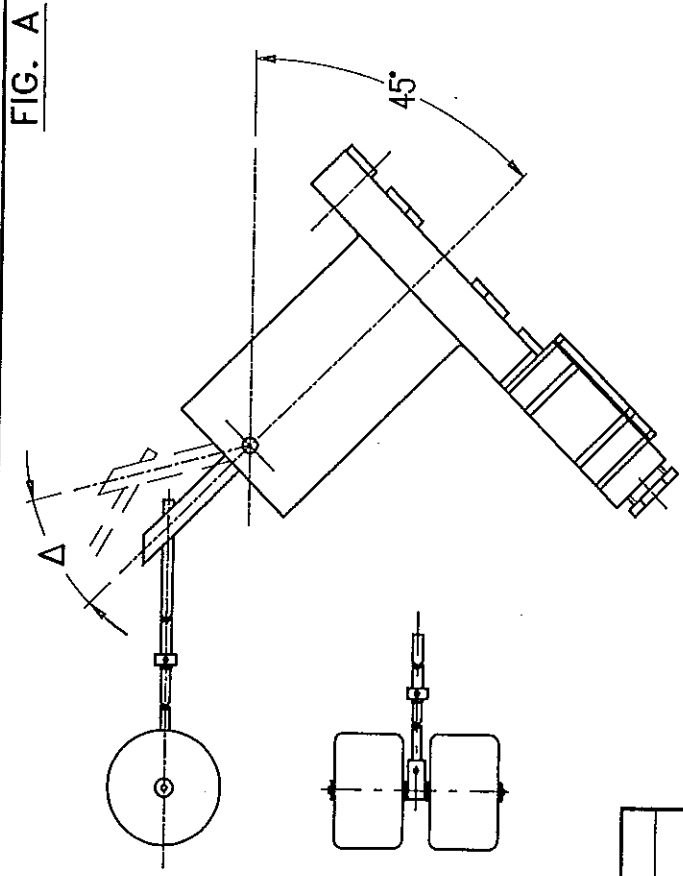


Fig. B

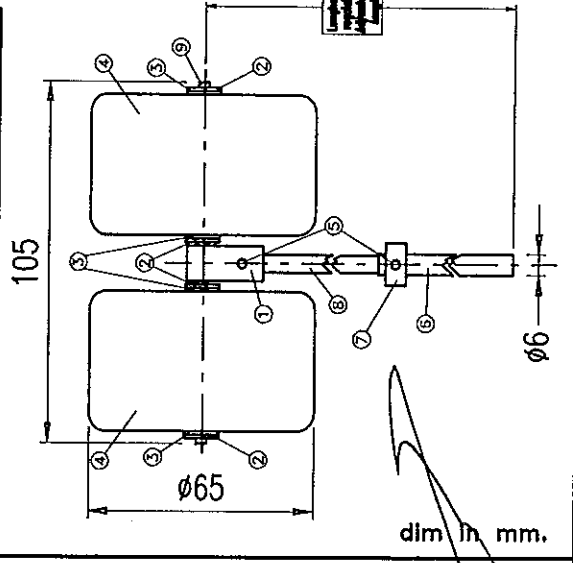
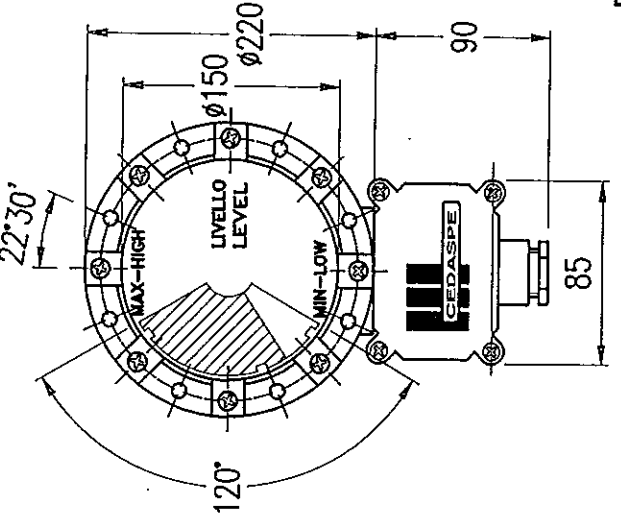


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Indicatori magnetici di livello IMLO Y 220 - ATMOSEAL
 - schema di montaggio -
 Magnetic oil level gauges IMLO Y 220 - ATMOSEAL
 - mounting sketch -



IMLO-Y-224	30°	1:4
IMLO-Y-223	40°	1:3
IMLO-Y-222	60°	1:2
TYPE	Δ max	Bevel gear ratio



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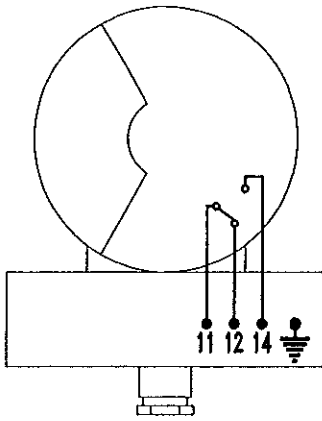
Indicatori magnetici di livello IMLO Y 220 - ATMOSEAL
Magnetic oil level gauges IMLO Y 220 - ATMOSEAL

225

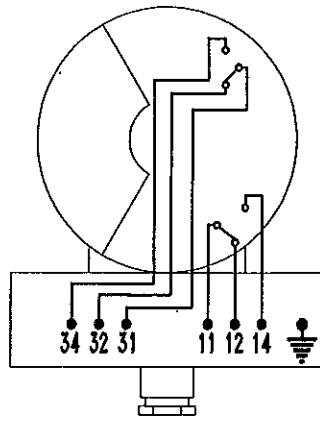
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 REV. 03 OTD 28/03/04
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Wiring diagram & terminal box connection

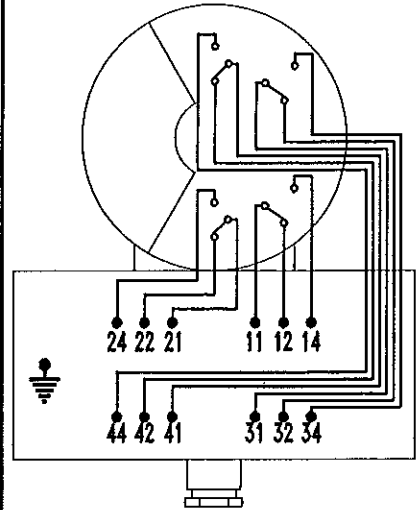
5.29.D



FM (Min cont.)

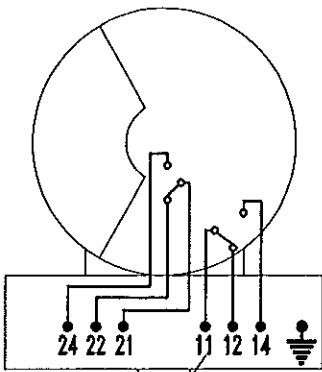


FGM (Min & Max cont.)



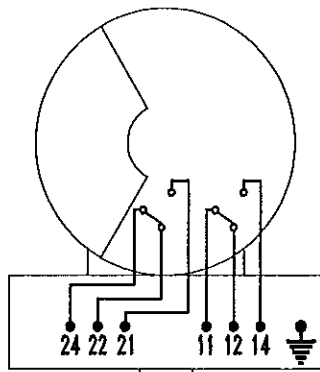
DOPPIO CONT. MIN + DOPPIO CONT. MAX
 Double MIN cont. + Double MAX cont.

FFGG-M



DOPPIO CONT. MIN Double MIN cont.

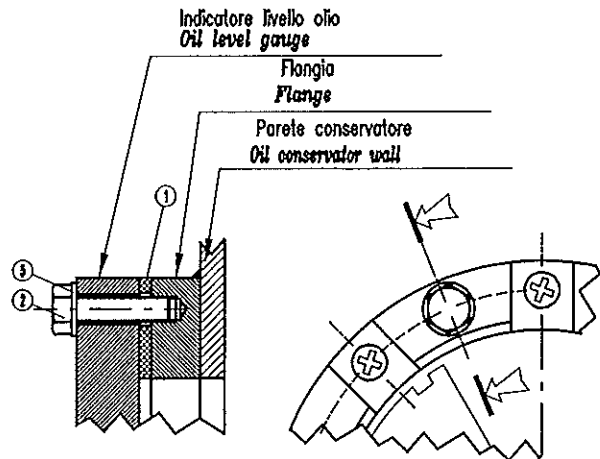
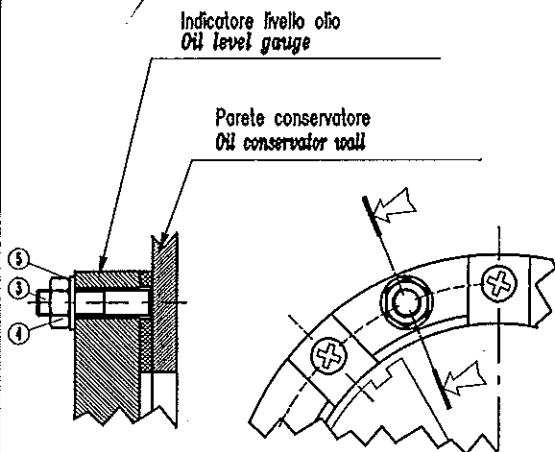
FFM-A (Min. Al + Trip cont.)
 (Cont. Al + Sgancio)



DOPPIO CONT. MIN Double MIN cont.

FFM-S (Simultaneous)

Mounting sketch

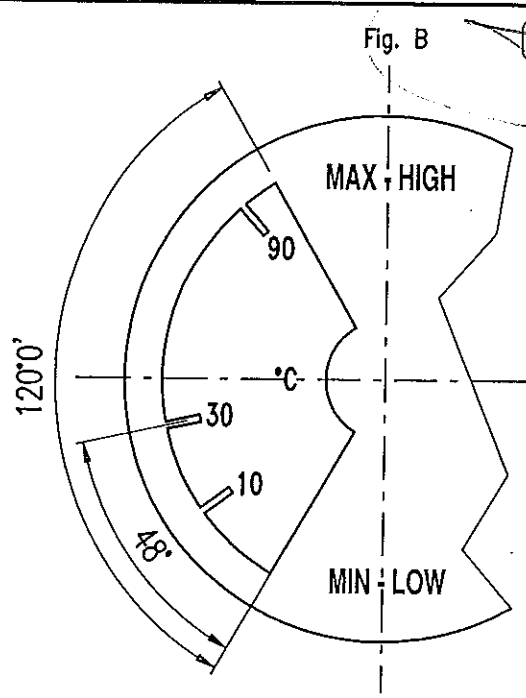
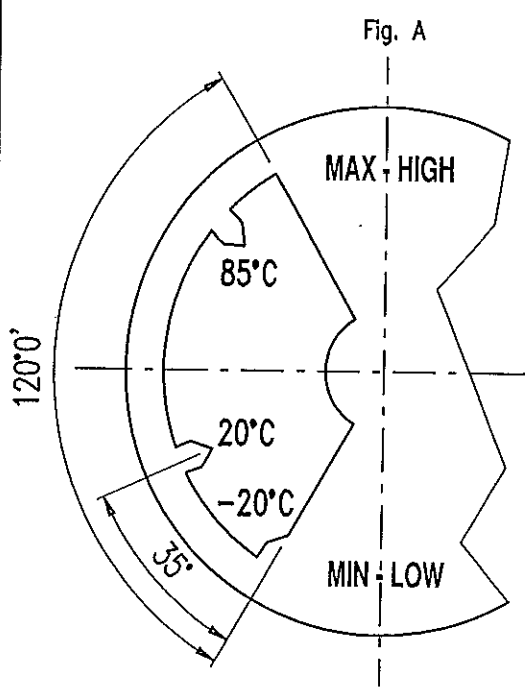


5	ROSETTA PIANA M6	ROSETTA PIANA M10	ROSETTA PIANA M12
4	DADO M6	DADO M10	DADO M12
3	PRIGIONIERO M6X35	PRIGIONIERO M10X40	PRIGIONIERO M12X40
2	VITE T.E. M6X30	VITE T.E. M10X35	VITE T.E. M12X35
1	GUARNIZIONE FLANGIA		
Par.	R/Y100	R/Y140	R/Y220
	INDICATORE DI LIVELLO		

5	WASHER M6	WASHER M10	WASHER M12
4	NUT M6	NUT M10	NUT M12
3	STUD M6X35	STUD M10X40	STUD M12X40
2	SCREW M6X30	SCREW M10X35	SCREW M12X35
1	FLANGE GASKET		
Par.	R/Y100	R/Y140	R/Y220
	MAGNETIC OIL LEVEL INDICATOR		

CEDASPE

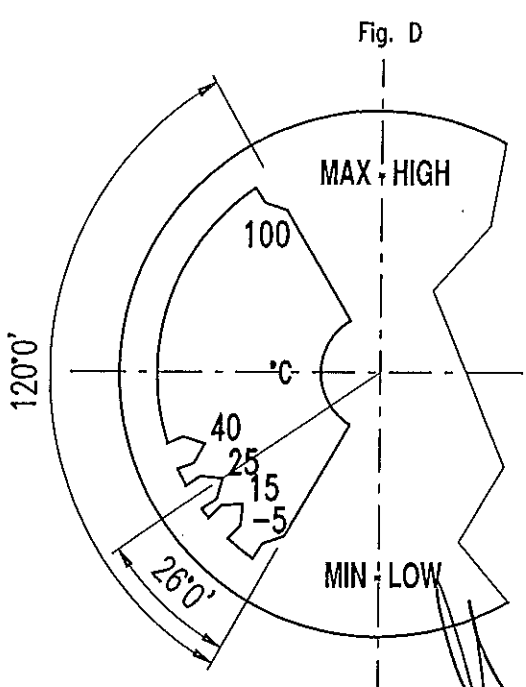
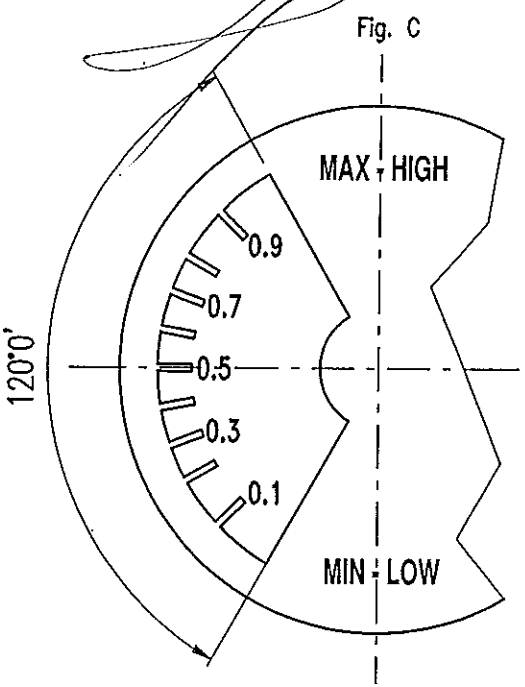
Indicatori magnetici di livello IMLO
 Magnetic oil level gauges IMLO



5.29.E

IMLO R/Y 345	STANDARD	SU RICHIESTA / UPON REQUEST		
IMLO R/Y 220	STANDARD	SU RICHIESTA / UPON REQUEST	SU RICHIESTA / UPON REQUEST	SU RICHIESTA / UPON REQUEST
IMLO R/Y 140	STANDARD	SU RICHIESTA / UPON REQUEST	SU RICHIESTA / UPON REQUEST	
IMLO R/Y 100	STANDARD			
Tipo / Type	Fig. A	Fig. B	Fig. C	Fig. D

Altri quadranti disponibili su richiesta / Other dials available upon request



dim in mm.

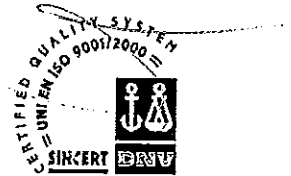
CEDASPE

Indicatori magnetici di livello - Quadranti
Magnetic oil level gauges - Dials

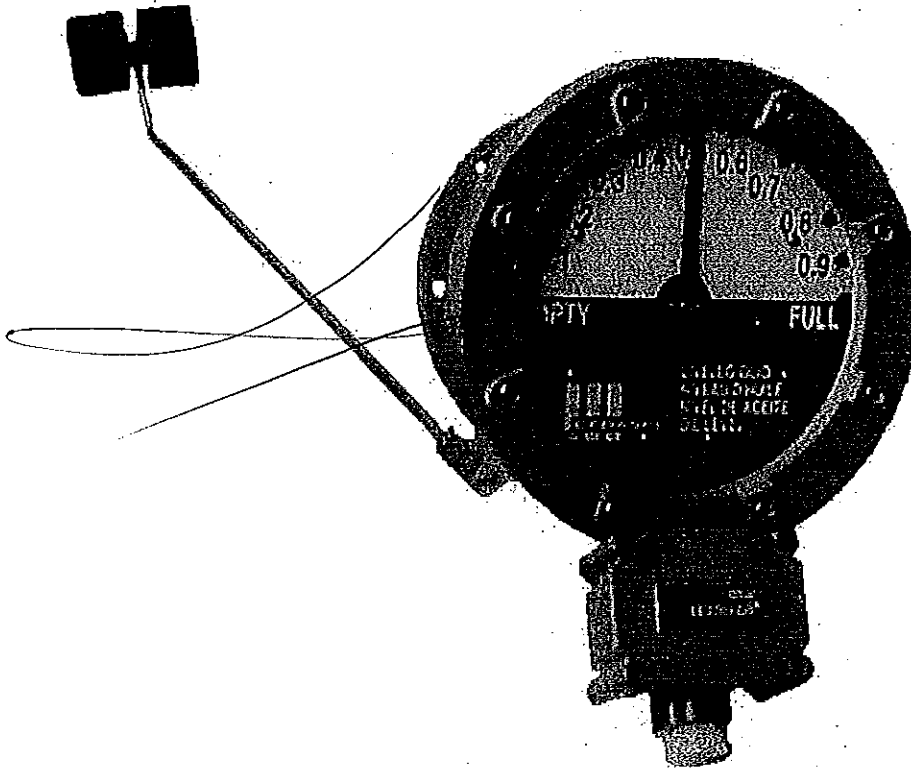


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I - 20098 S. GIULIANO MIL. (ITALY) - VIA COLOMBARA, 1 - FRAZ. PEORIANO
TELEFONO +39 02 98.20.44.11 - TELEFAX +39 02 98.20.44.22
E-Mail: cedaspe@cedaspe.com - InterNet Site: http://www.cedaspe.com
CAP. SOC. € 620.000 I.V. - TVA-PI. IT 01065780165 - C.F. 01065780165
REA MI 729991 - IMPORT - EXPORT MI 142410 - REG. UNIPR. 132146334/46 TRB. MI



MAGNETIC OIL LEVEL INDICATOR FOR POWER TRANSFORMER IFG SERIES (Inclined Flange Gauge)





I - 20098 S. GIULIANO MIL. (ITALY) - VIA COLOMBARA, 1 - FRAZ. PEDRIANO
TELEFONO +39 02 98.20.44.11 - TELEFAX +39 02 98.20.44.22
E-Mail: cedaspe@cedaspe.com - InterNet Site: http://www.cedaspe.com
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1.0 Features

The magnetic oil level indicators type IFG has been specially studied for use on power transformer to give an analogical indication of the oil level inside the conservator by a graduated dial with arrow plus one or more electric signal (max 4 signals) when the oil inside the conservator reaches the max or min level.

2.0 Construction features

o Materials and components

The body of the gauge is made in one piece of solid compact aluminium alloy casting oiltightned proof. The dial face is inclined of 20° from the connecting flange towards the ground, offering a better view at human height of the oil level indication system.

The indicating system is located inside the body and is composed by a yellow arrow, a graduated scale with ten division, one or more contacts activated by cams and a permanent magnet.

The monitoring system is partially located inside the fixing flange and is composed by a permanent magnet, a bevel gear rigidly connected to a float arm which follows the movement of the surface of the oil.

The two systems are connected by a magnetic joint obtained using the magnetic flux of the permanent magnets

The electric signal coming from contacts are carried out through a waterproof terminal box (IP55) fitted with a PG16 cable gland and a ground screw

o Oil-tightness and resistance to pressure

The magnetic oil level indicators IFG are suitable to work with oil up to a max temperature of 115°C; lowest ambient temperature -25°C and are mechanically resistant to vacuum (10 torr)

o Resistance to dynamical stress

The magnetic oil level indicators IFG can operate without undue operation in following conditions:

Sinus vibrations with frequency ≤ 120 Hz and amplitude ≤ 250 μm ;

Dynamical conditions causing following accelerations:

- Max 3g in all directions, sinus vibration, amplitude ≤ 20 mm;
- Shock condition with max 10 g in all directions.

o Surface protection

Body, frame, terminal box and his cover are painted internally and externally with one primer coat of epoxy paint and externally with a finishing coat of polyurethane paint colour RAL 7030. The primer coat on the internal surfaces is compatible with transformer mineral oil up to temperatures of 120°C. Total thickness of two coats is 80 microns; special painting cycle can be provided for transformers located in very polluted areas

3.0 Manufacturing program

Magnetic oil level indicator series IFG is manufactured in 3 different execution

- Type IFG FK2 axial type suitable for use in conservator with rubber bag
- Type IFG AQ2 axial type suitable for use in traditional conservator
- Type IFG BQ2 radial type suitable for use in traditional conservator

All execution are equipped with 1 or more electric contacts, microswitch type that are activated when the oil (and consequently the arrow of the instrument) reaches presettet positions (see available wiring diagram).

Two different connecting flange are available, one (standard type) O.D. 180 mm with 8 holes for connecting to the tank, another (special execution only for types AQ2 and FK2) with O.D. 160 mm and 6 holes.

Indicating arrow moves over a 180° angle, float arm moves over an angle of 60°/90°/140° respectively for type FK2, AQ2, BQ2 (standard execution); for type FK2 is also available a special execution with float arm rotation angle of 45°.

White indicating dial having 10 divisions with black figures and with adjustable red mark indicating filling position.



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TELEFONO +39 02 98.20.44.11 - TELEFAX +39 02 98.20.44.22
E-Mail: cedaspe@cedaspe.com - InterNet Site: http://www.cedaspe.com
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4.0 Operation, installation and maintenance

o Operation

Should an increase of oil inside the conservator (due to heating) or a decrease of oil (due to an oil loss) the float arm detects this variation and gives an optical signal (analogic type) through the arrow and when the oil reaches the presetted value for alarm and/or trip a microswitch is activated and an electric signal is provided inside the terminal box.

o Installation

Use one magnetic oil level indicator for the conservator of the main tank and one for OLTC conservator (if present); the oil level indicator can be fixed to the conservator using 8 (or 6) nuts M10 complete with washer and spring washer that have to be mounted on studs M10x30mm

o Positioning of red arrow of filling position

All our IFG are equipped with an adjustable red mark to show the correct filling level of the oil inside the conservator.

Our IFG is delivered with this red mark positioned at 30% volume of the conservator.

If it is necessary to change the position of the red mark please follow below instruction (refer to sketch at the end of brochure) :

- unloose screws A,B,C
- position the red mark in the desired position
- close screw A,B,C

o Adjusting float arm length

All our IFG are supplied with adjustable float arm length; this in order to have an optimal calibration of the instrument. Adjustment is very easy: you need only to unloose screw A (please refer to drawing at the end of brochure), adjust float arm to desired length and close screw A again.

o Maintenance

Magnetic oil level gauges IFG don't need specific maintenance; we suggest to check regularly contacts during the normal maintenance of the transformer

5.0 Electric contacts

The contacts are microswitches changeover type and are mechanically operated by a cam.

Following main characteristic of microswitches

Lever	Stainless steel
Body and pushbutton	Thermosetting composition
Contact material	Silver
Mechanical endurance of contact	1x10 ⁷ cycles
Temperature range	-40°C - +125°C
Standard interruption power AC	AC 250V-5A
Standard interruption power DC	see diagram at end of brochure
Insulation to earth at 20°C	2.000V
Protection degree of terminal box	IP 55

6.0 Wiring diagrams

Available wiring diagram are:

- wiring diagram type C1 : gives a signal when oil reaches low level inside conservator
- wiring diagram type C2 : gives a signal when oil reaches low and max level inside conservator
- wiring diagram type D1 : gives an alarm signal when oil reaches low level and trip signal for very low level inside conservator
- wiring diagram type D2 : gives a double signal when oil reaches low level inside conservator

All contacts are operated 3/5 degrees before the arrow reach the minimum or the maximum level of oil
See sketch



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7.0 Compatibility of installation

The installation compatibility of the magnetic oil level indicator depend mainly on the material used for the flange gasket; therefore the executions differ because of the material used for this gasket.

o Standard execution N – nitrile rubber gasket

Admitted operating conditions are:

Environmental conditions:

Ambient temperature

-25°C to +50°C

Relative humidity

95% to 20°C - 80% to 40°C - 50% to 50°C

Insulating liquid: transformer mineral or silicon oil

Temperature

- 25°C to + 115°C

o Execution C – cork gasket

Admitted operating conditions are:

Environmental conditions:

Ambient temperature

-20°C to +50°C

Relative humidity

95% to 20°C - 80% to 40°C - 50% to 50°C

Insulating liquid: transformer mineral or silicon oil

Temperature

- 20°C to + 110°C

o Execution V – fluor rubber gasket (Viton V)

Admitted operating conditions are:

Environmental conditions:

Ambient temperature

-15°C to +50°C

Relative humidity

95% to 20°C - 80% to 40°C - 50% to 50°C

Insulating liquid: transformer mineral or silicon oil

Temperature

- 15°C to + 150°C

o Special executions

For other environmental and/or operating conditions to be examined individually.

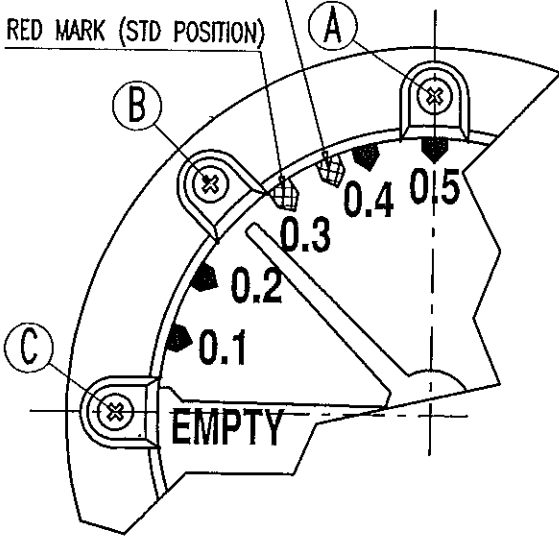
8.0 Ordering Instructions

When ordering must be defined following data:

- Type of magnetic oil level indicator : IFG FK2 or AQ2 or BQ2
- Fixing flange 8H (or 6H)
- Type of gasket required : N; V; C or special
- Wiring diagram: C1; C2; D1; D2
- For type FK2 also float arm rotation or a mounting sketch showing min, max and filling levels of oil, float arm length (see form at the end of brochure)

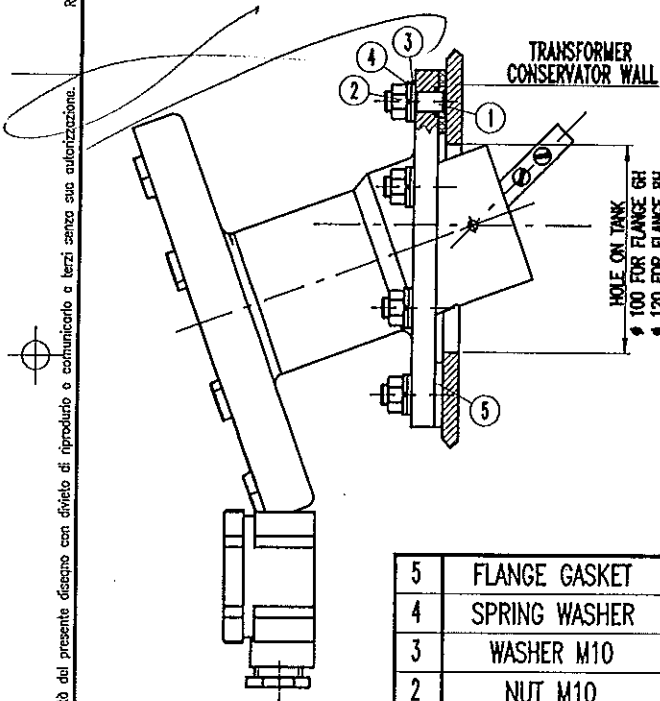
ADJUSTED POSITION OF RED MARK

RED MARK (STD POSITION)



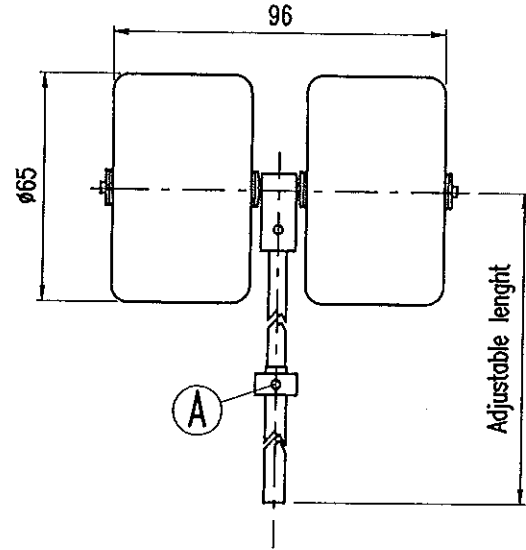
- 1) UNLOOSE SCREWS A, B, C
- 2) MOVE RED ARROW TO REQUIRED POSITION
- 3) CLOSE SCREWS A, B, C

ADJUSTMENT OF RED ARROW

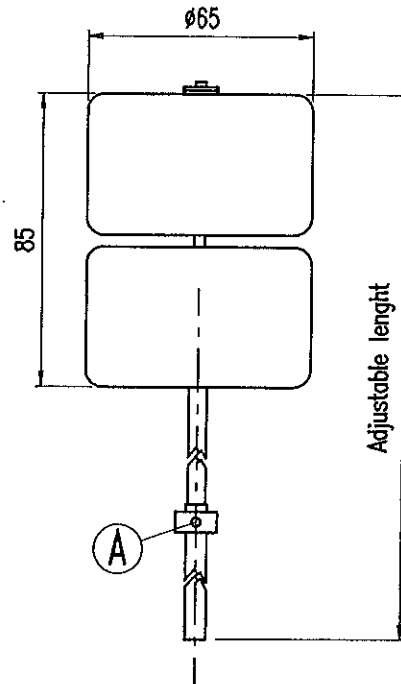


POS.	DESCRIPTION
5	FLANGE GASKET
4	SPRING WASHER
3	WASHER M10
2	NUT M10
1	STUD M10X30

MOUNTING SKETCH



FK2



AQ2 & BQ2

- 1) UNLOOSE SCREW A
- 2) ADJUST ARM TO REQUIRED LENGTH
- 3) CLOSE SCREW A

FLOAT ARM

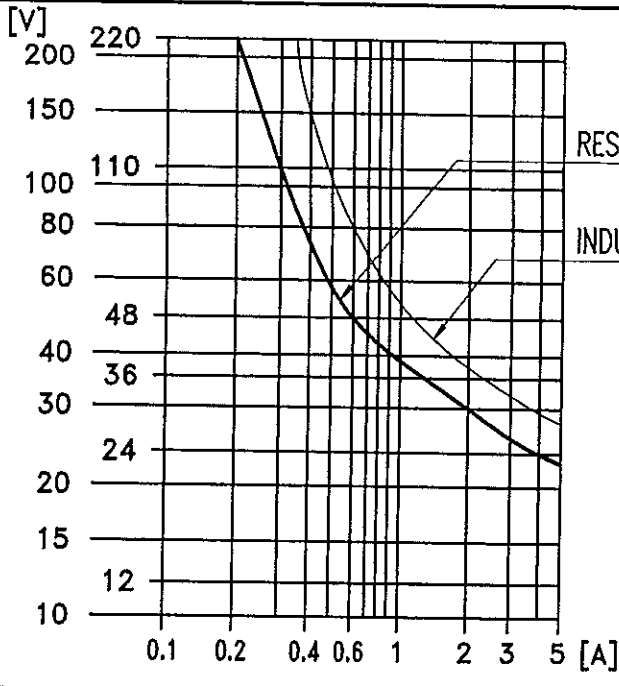
Titolo

MAGNETIC OIL LEVEL INDICATOR IFG

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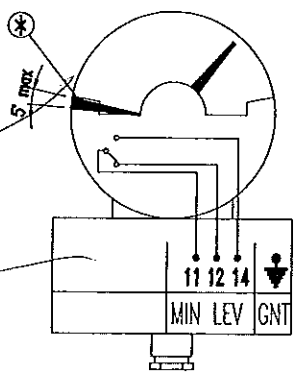
FILE = PAGE6 .DWG LWT [(0,0) (198,286)] M4 (210x287)
 REV. 00 DTD 11/03/04
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CONTACT BREAKING CAPACITY DC

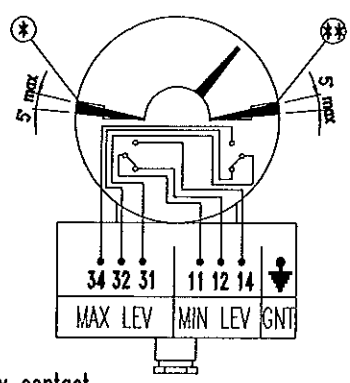
WIRING DIAGRAM

WIRING DIAGRAM C1



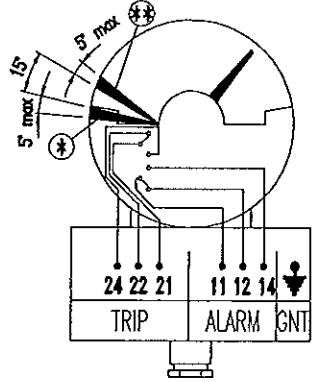
Only min contact
 *) Min contact operates in this area

WIRING DIAGRAM C2



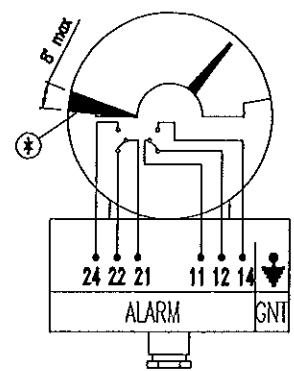
Min & max contact
 *) Min contact operates in this area
 **) Max contact operates in this area

WIRING DIAGRAM D1



Alarm contact low level - Trip contact very low level
 *) Trip contact operates in this area
 **) Alarm contact operates in this area

WIRING DIAGRAM D2



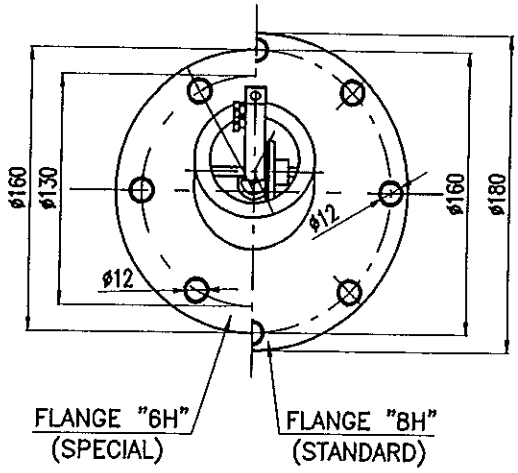
Double contact at min level
 *) Both contacts operate in this area



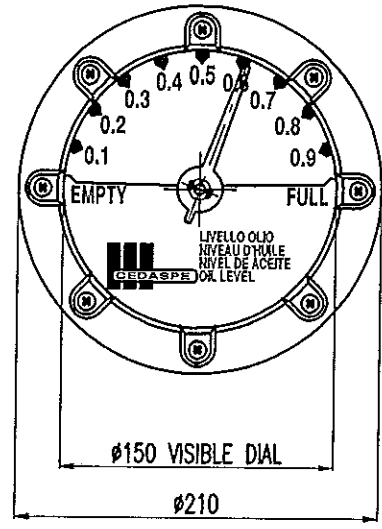
Titolo

MAGNETIC OIL LEVEL INDICATOR "IFG"

VIEW OF CONNECTING FLANGE

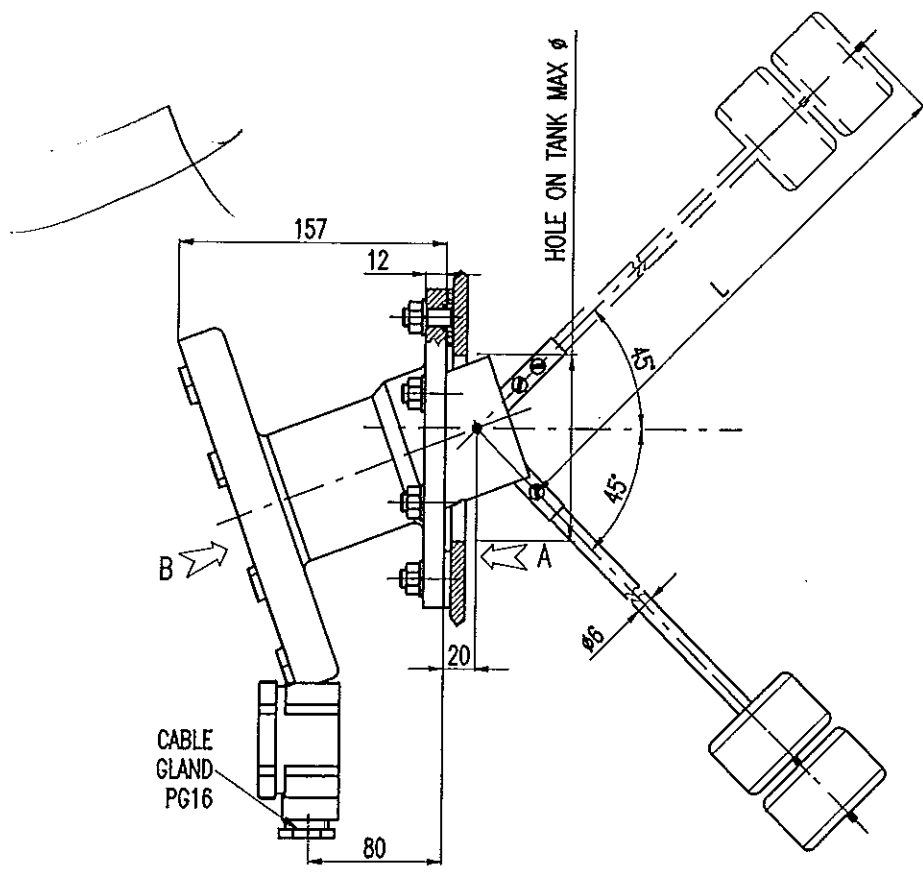


VIEW OF FRONT FACE



FILE = PAGE7.DWG LWT [(0,0) (196,296)] M4 (210x297)

REV. 00 DTG. 11/03/04



2	100	FLANGE "6H" SPECIAL
1	120	FLANGE "8H" STD
POS.	Ø	NOTE

CEDASPE

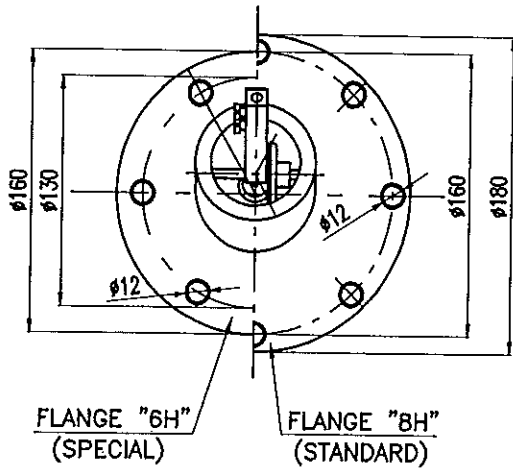
Titolo

MAGNETIC OIL LEVEL INDICATOR IFG
MODEL AQ2 FOR TRADITIONAL CONSERVATORS

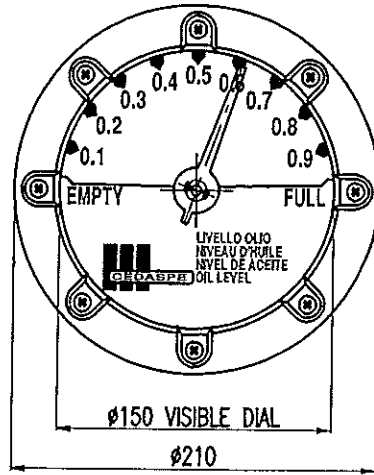
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FILE = PAGE8 .DWG LMT [(0,0) (196,296)] AA (210,297)

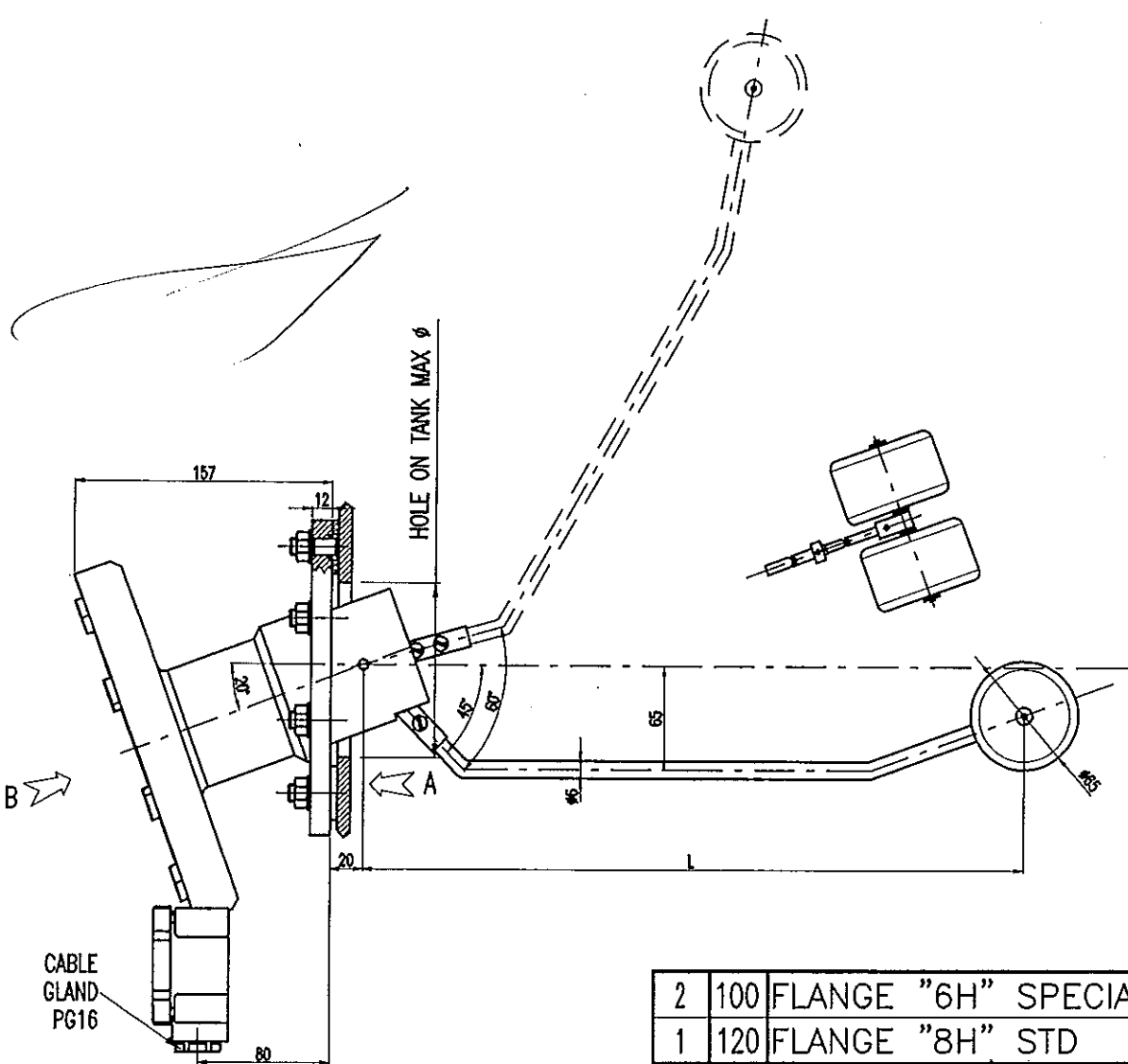
VIEW OF CONNECTING FLANGE



VIEW OF FRONT FACE



REV. 00 DTD 11/03/04



2	100	FLANGE "6H" SPECIAL
1	120	FLANGE "8H" STD
POS.	Ø	NOTE

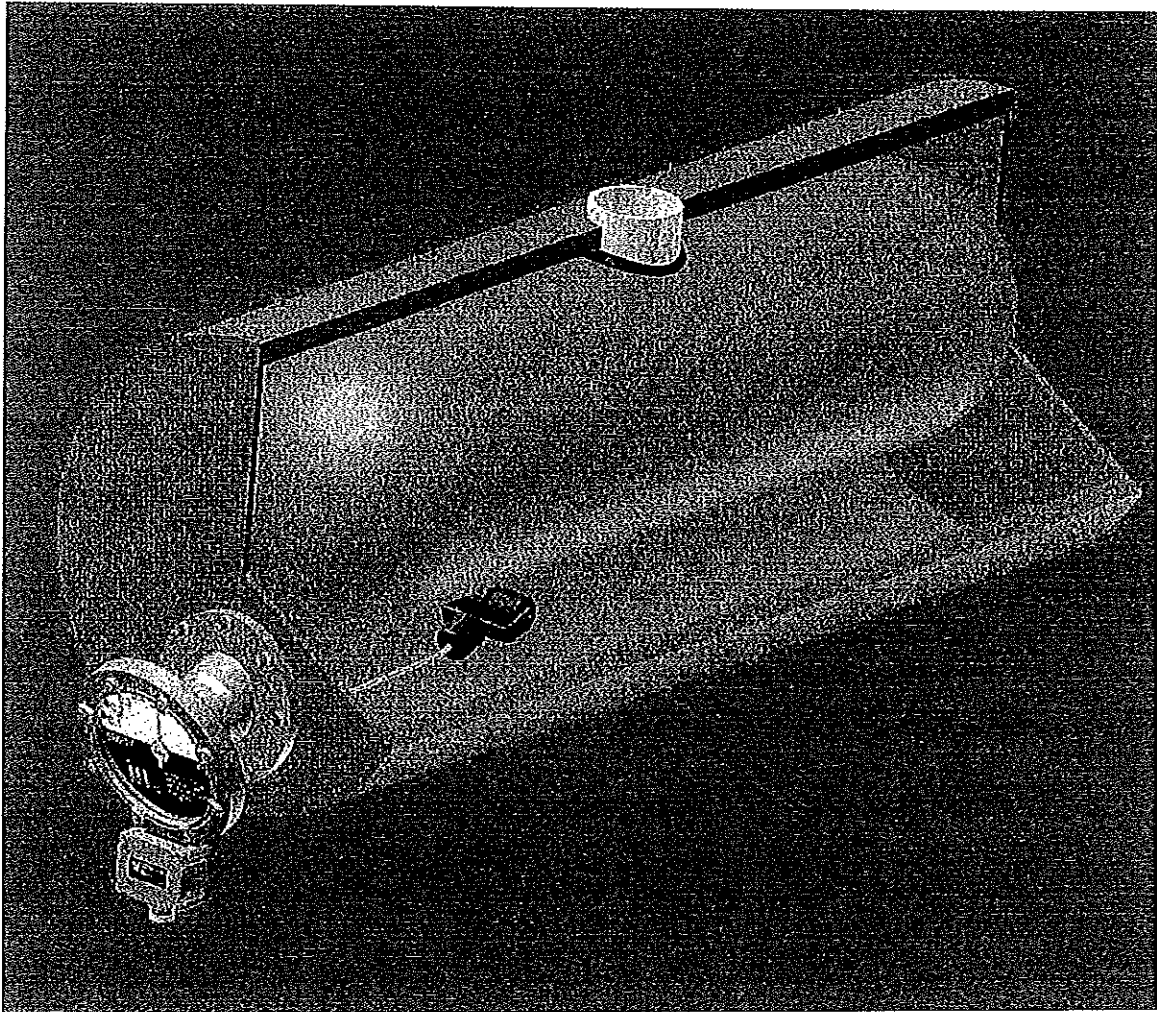


Titolo
**MAGNETIC OIL LEVEL INDICATOR IFG
 MODEL FK2 FOR HERMETIC RUBBER BAG CONSERVATOR**



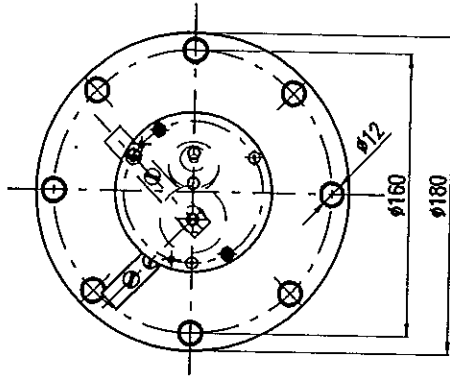
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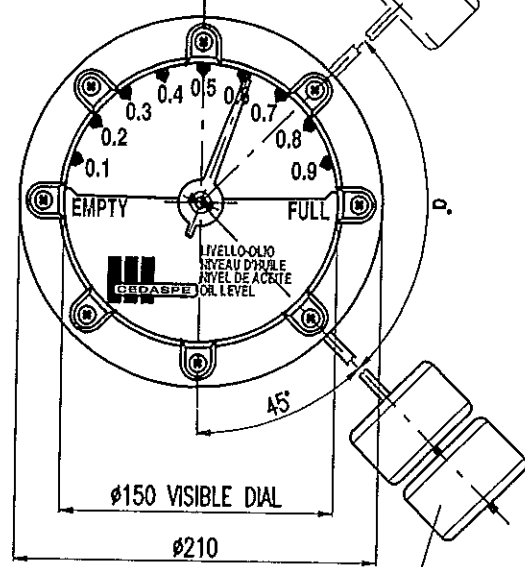


230

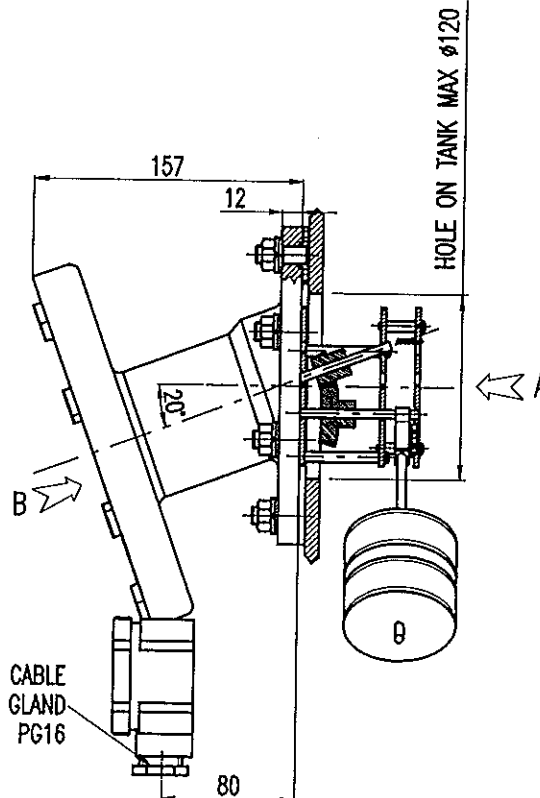
VIEW OF CONNECTING FLANGE



VIEW OF FRONT FACE



ATTENTION:
FLOAT ARM IS ON
RIGHT HAND SIDE



2	90°	SPECIAL
1	140°	STANDARD
POS.	α°	EXECUTION

FILE = PAGE10.DWG
 LWT [(0,0) (196,286)]
 AA (210x287)
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Titolo
**MAGNETIC OIL LEVEL INDICATOR IFG
 MODEL BQ2 RADIAL TYPE**

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ORDER FORM

FILE = PAGE11.DWG DWT [(0,0) (195,286)] AM (210x287)
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TYPE FK2 AQ2 BQ2

GASKET TYPE N C V SPECIAL

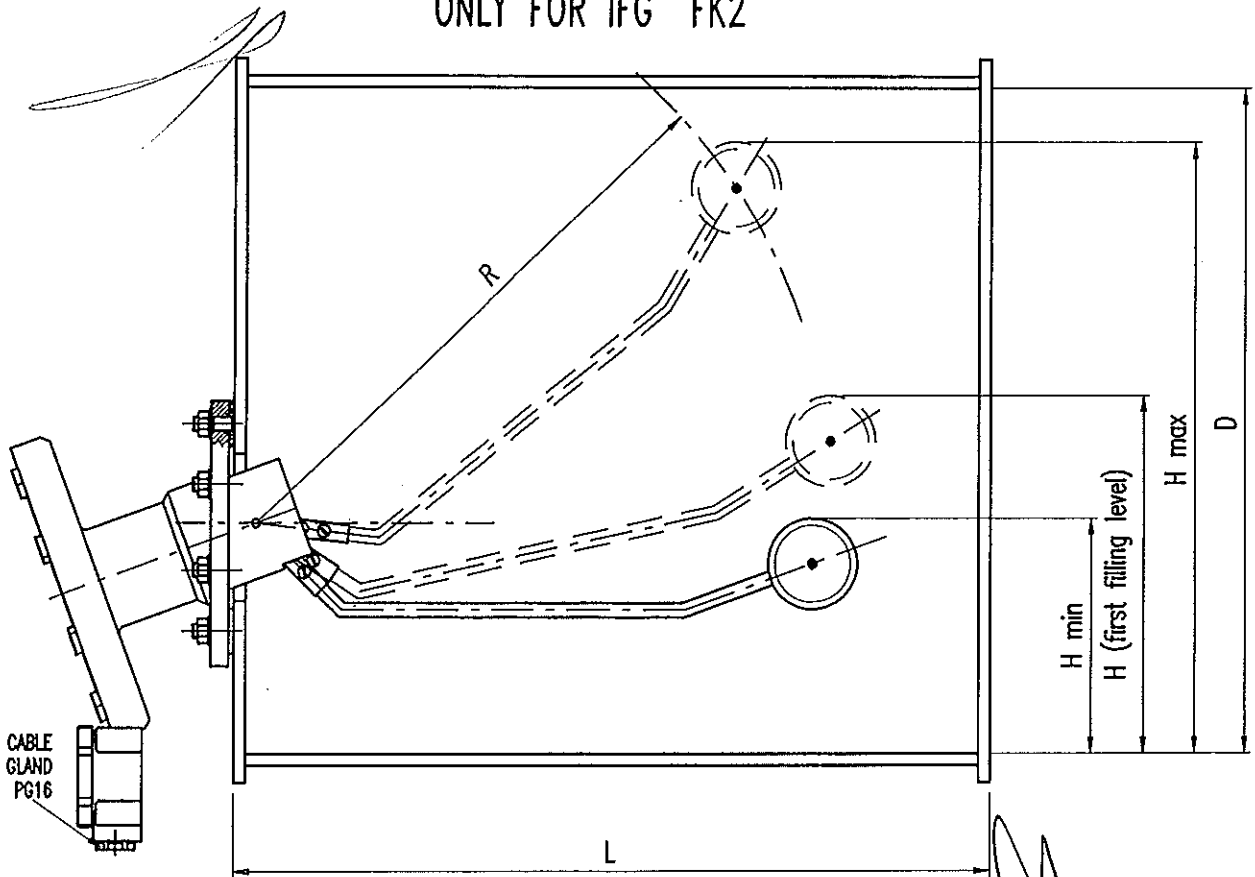
WIRING DIAGRAM C1 C2 D1 D2

FLANGE TYPE 6H 8H

NOTE

SPECIAL REQUIREMENT

ONLY FOR IFG "FK2"



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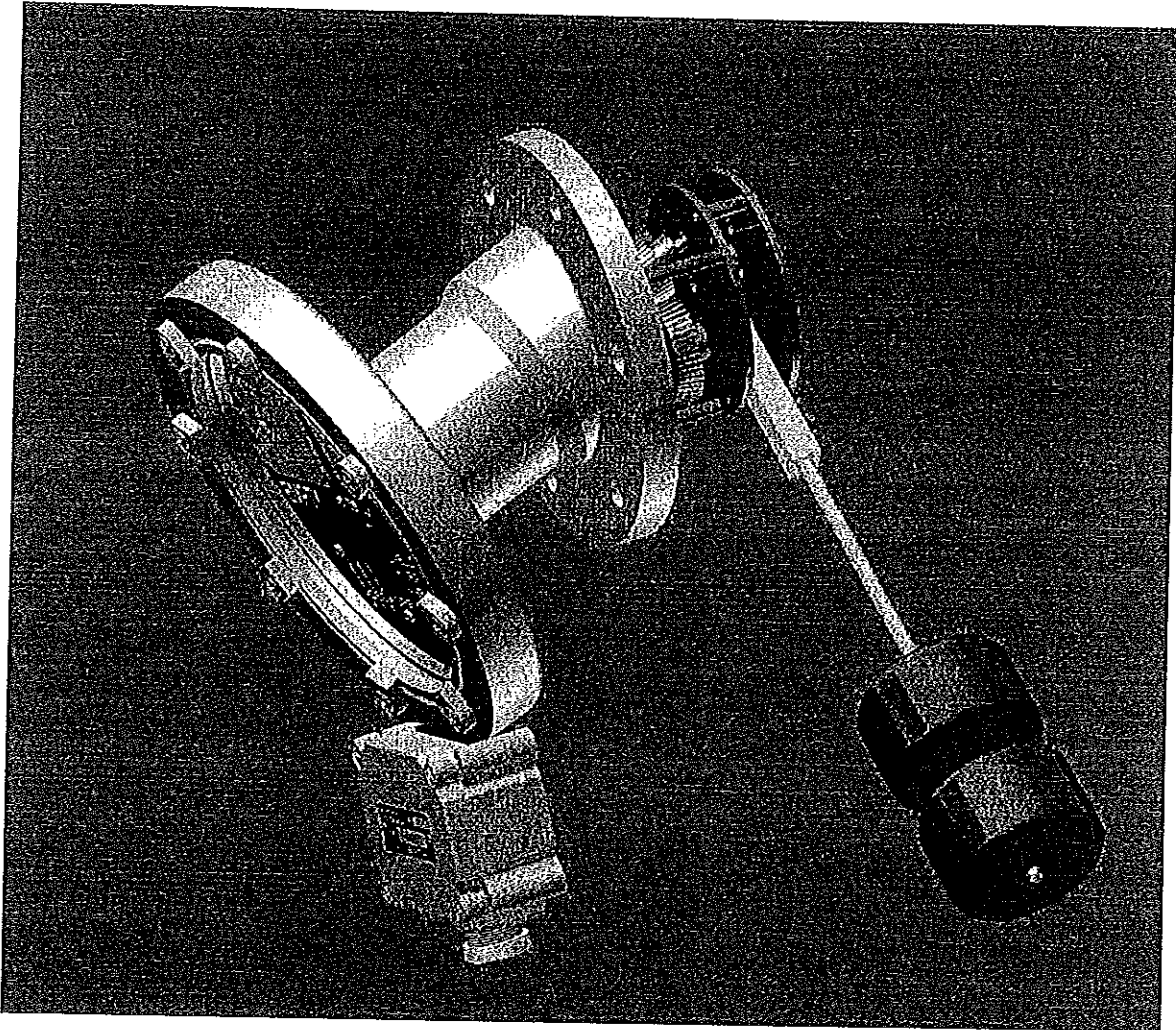
Titolo

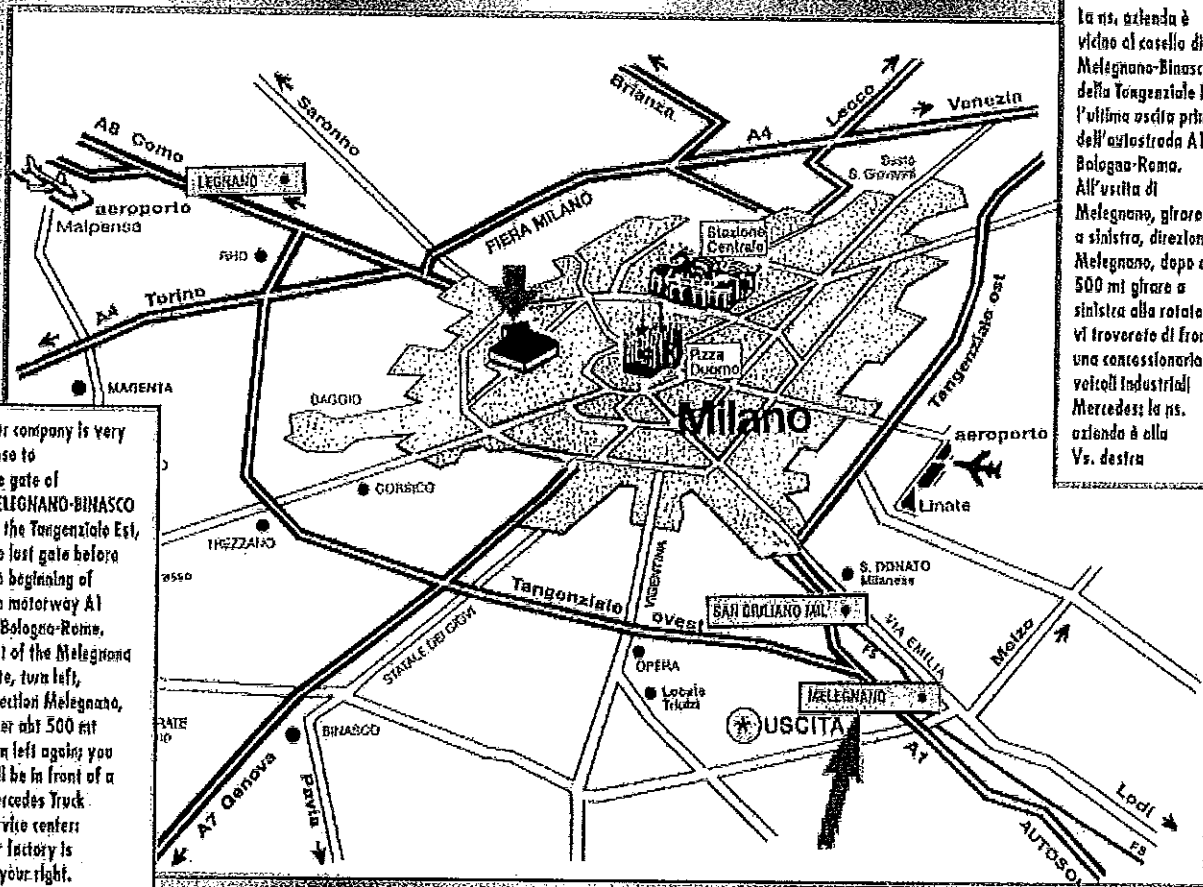
MAGNETIC OIL LEVEL INDICATOR IFG233



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TELEFONO +39 02 98.20.44.11 - TELEFAX +39 02 98.20.44.22
E-Mail: cedaspe@cedaspe.com - InterNet Site: http://www.cedaspe.com
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La ns. azienda è vicino al casello di Melegnano-Binasco della Tangenziale Est, l'ultima uscita prima dell'autostrada A1 Bologna-Roma. All'uscita di Melegnano, girare a sinistra, direzione Melegnano, dopo circa 500 mt girare a sinistra alla rotatoria; vi troverete di fronte una concessionaria veicoli industriali Mercedes; la ns. azienda è alla Vs. destra

PROGRAMMA DI PRODUZIONE

- Isolatori passanti BT/MV
- Relè ad accumulo di energia
- Indicatori livellamento
- Essiccatori d'aria
- Valvole a farfalla, paratermostate e relè
- Valvole di sovrappressione
- Termometri con e senza contatti elettrici
- Commutatori di corrente
- Muffole per antiraffreddamento (BS2562)

PROGRAMA DE PRODUCCION

- Passadores BT/MV
- Relés Buchholz
- Indicadores de nivel de aceite
- Deshumectadores de aire
- Valvulas mariposa, paratermostate e relés
- Valvulas de sobrepresión
- Termómetros con y sin contactos eléctricos
- Commutadores
- Cajas de bornas (BS2562)

MANUFACTURING PROGRAM

- LV and HV Transformer Bushings
- Gas actuated Relay
- Oil Level Gauge
- Dehydrating Breather
- Radiator throttle valve
- Pressure Relief Device
- Thermometers with/without electric contacts
- Offload Tap Changers
- Cable boxes (BS2562)

PROGRAMME DE PRODUCTION

- Traversee isoler BT/MV
- Buchholz Relais
- Indicateur de niveau d'huile
- Assecheur d'air
- Vannes a papillon pour radiateurs
- Soupape de surpression
- Thermometres avec/sans contacts
- Commutateurs de courant
- Boite a cable (BS2562)

GEDASPE S.p.A.

Via Colomba, 1, Fraz. Pedemano, 20098-S. Giuliano Milanese (MI) - Tel. +39/029820441 - Fax +39/0298204422

E-Mail: gedaspe@gedaspe.com - Internet Site: <http://www.gedaspe.com>

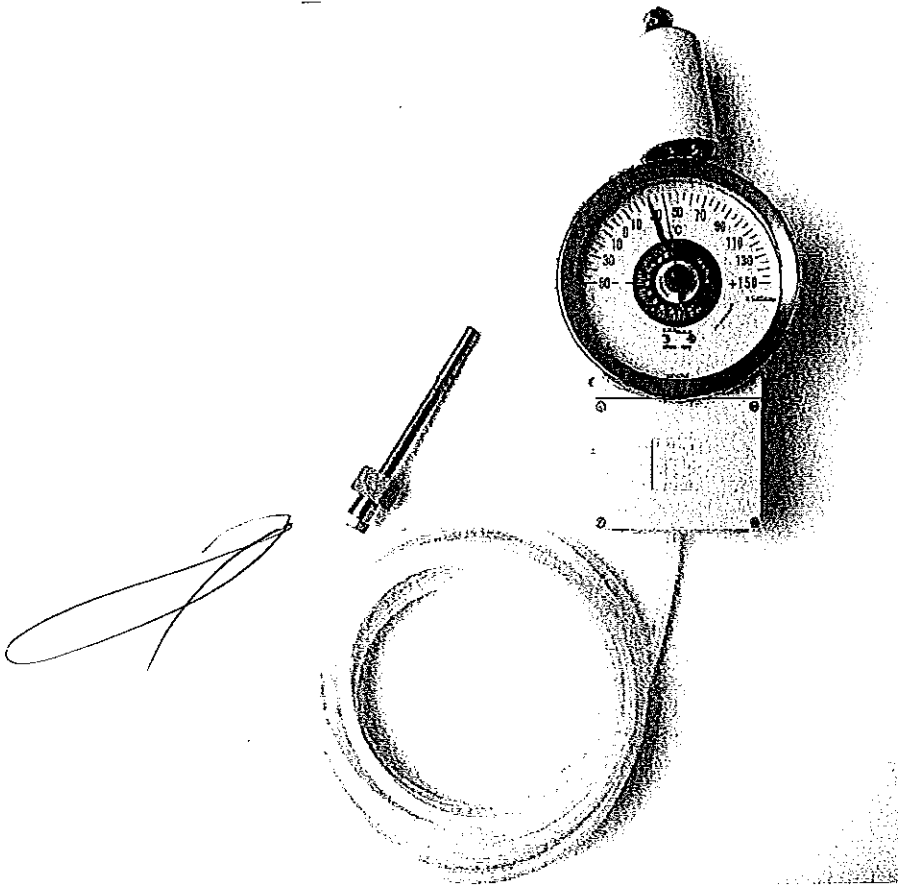
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Quality made to measure

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Oil Temperature Indicator for Power Transformer type :

MSRT 150



Introduction	Pag.	02
Description and general specifications	Pag.	02
Options	Pag.	04
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Finished product quality control tests	Pag.	09
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Introduction.

These instruments are designed to measure the temperature of the insulating oil inside of power transformer tanks and they can fitted with up to five change-over microswitches suitable to control cooling equipments and protection circuits (alarm and trip) of the transformer.

This sector of our production is the result of considerable research and experiment commitment which has led to internationally patented new concept instruments design and construction.

The component designs of our instruments are protected by :

ITALIAN PATENT No. 208603
ITALIAN PATENT No. 89113
E.E.C. PATENT No. 0245212
U.S. PATENT No. 4,727,227

Effectiveness of these instruments must be stressed, both as regards measuring/commutation precision and extreme simplicity of operation.

Special attention has been paid to design of each single part resulting in extreme high reliability of our instruments and ensuring long-lasting accurate operating. We have designed the setting system, the mounting devices and the dimensions of the cable boxes to consent the operator to easily install the indicator and to save time in setting and making cable layout.

Besides the exact constructional and severe quality control we adopt, the high performances of our instruments are further assured by the employ of the best products supplied by European technology's more advanced company names. In particular :

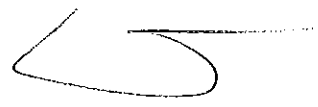
- the **INDICATING SHAFT** is mounted on 2 micro ball bearings to reduce the frictions and to grant right working under vibrations;
- the **AWG 22 CABLES** we adopt are silver plated and protected with Teflon according to MIL - W - 16878-4 Standard;
- the **TERMINAL BLOCKS (WEIDMULLER - Germany)** grant very high performances and are certified in accordance with European standards;
- the **POWDER PAINT** grants protection against corrosion and increases the insulation of the device;
- the **SENSING SPRING TUBE** is manufactured with a special bronze alloy that avoid any plastic deformation and histeresis of the spring.

Description and general specifications.

Temperature sensing system : expansion type compensated for ambient temperature changes by means of a built-in compensating device.

To avoid too many checks after setting into work and periodical re-calibrations we adopt particular cares in testing the components. In particular the sensing system is subject to 3 different tests:

1. vacuum test: the sensing system is connected to a vacuum plant. The plant pressure is decreased to 2×10^{-3} mbar (hpa) to verify the quality of the welding and the porosity of the material;
2. pressure test: the sensing system is put under pressure up to 280 bar to verify the welding and that the spring is not subject to any plastic deformation.
3. overheating test: once the sensing system is completed, its bulb is located in a heating plant controlled by a microprocessor based temperature monitoring system. The temperature is increased up to a value that is 20% higher than the maximum range value of the sensing systems (i.e. for an indicator whose range is 0/150°C the overheating test temperature is 180°C). The temperature remains at that value for 8



hours in this way simulating 1 year life under normal working conditions (i.e. for an indicator whose range is 0/150°C ---> 110°C). In this way we train the spring and verify that the precision remains the same.

Capillary tube protection : rilsan tubing / stainless steel armouring / steel + PVC armouring.

Bulb : bronze.

Casing : aluminium alloy powder painted (RAL 7035) suitable to withstand to any climate and to heavy polluted atmosphere in as well tropical or arctic climates (-40 / +70°C). All components are made of corrosion resistant or surface treated materials. The case is provided with a breather device to avoid dew on the lens. To make cable layout quick and easy, the case is equipped with a large junction box that is completely separate from instrument's sensing system. Cable glands PG 16, 1/2" BSP, 3/4" BSP or M20x1,5.

Mechanical protection degree : IP 65.

Lens : glass or polycarbonate.

Locking ring : Nickel plated brass; transparent coated.

Standard measuring ranges :

-20 / +130°C; 0 / +150°C; -20 / +140°C; 0 / +160°C; 0 / +200°C.

Measuring tolerance : 1,5% of full scale value.

Commutation tolerance : 2% of full scale value.

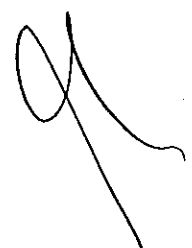
Commutation differential : 4% of full scale value.

On customer's request the differential can be increased.

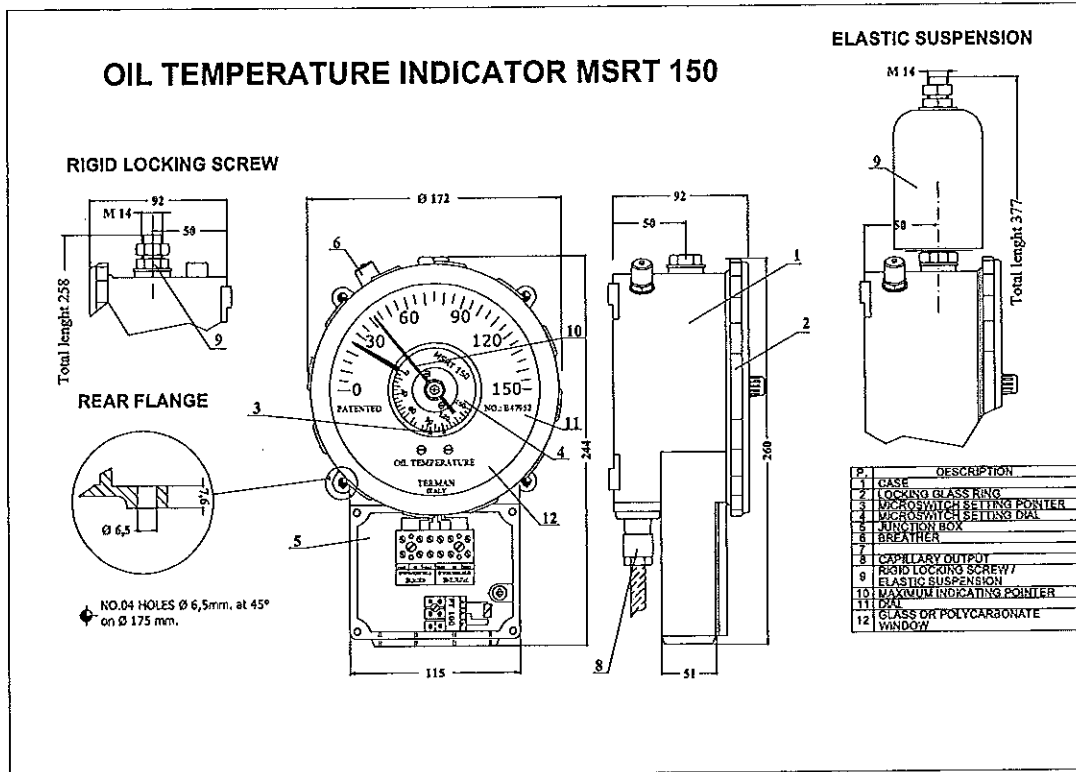
Insulation : 2000V 50Hz between terminals and earth for a 60 seconds time.

MICROSWITCHES MAKING AND BREAKING CAPACITY :

VOLTAGE	STANDARD MICROSWITCHES		HIGH-PERFORMANCE MICROSWITCHES	
	RESISTIVE LOAD	INDUCTIVE LOAD	RESISTIVE LOAD	INDUCTIVE LOAD
125 VAC	5 A	5 A	10 A	10 A
250 VAC	5 A	5 A	10 A	10 A
30 VDC	5 A	3 A	10 A	10 A
50 VDC	1 A	1 A	3 A	2,5 A
75 VDC	0,75 A	0,25 A	1 A	0,5 A
125 VDC	0,5 A	0,1 A	0,5 A	0,1 A
250 VDC	0,25 A	0,1 A	0,25 A	0,1 A



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DRWG. N. 1242

Options.

Elastic suspension (Drwg. No.1231) : it's a vibration damping system able to minimize the effects of a machine vibrations on the instrument.

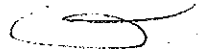
Earthquake proof version : done by equipping the instrument with the elastic suspension and suitable internal components.

PT 100 sensor : the oil temperature indicator can be equipped with one or two a PT 100 sensors that convert the temperature values in resistance values and transmit them to a receiver or to a monitoring system.

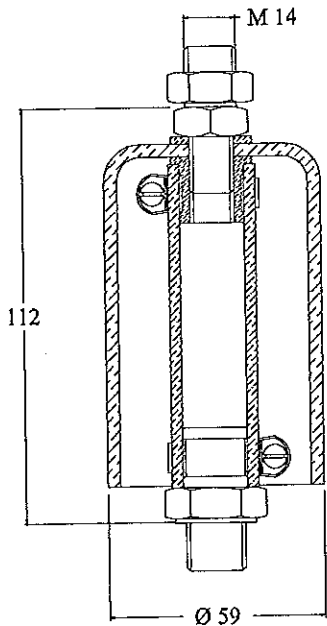
Receiver (Drwg. No.1479) : we can supply a digital receiver (220VAC 50/60Hz) to display the temperature signal received from the sensor.

Transducer 4...20mA (Drwg. No.1707) : we can supply a transducer 4...20mA that converts the resistance values in current values. This device must be mounted on a DIN rail inside of the terminal box.

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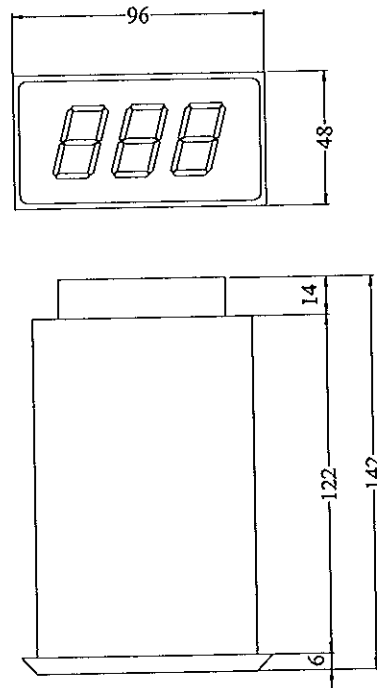


ELASTIC SUSPENSION



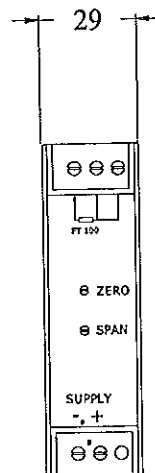
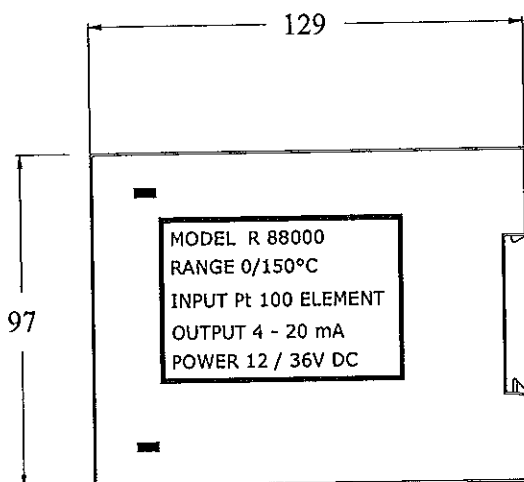
DRWG. N. 1231

PT 100 RECEIVER



DRWG. N. 1479

4...20mA TRANSDUCER for PT 100 PROBE



DRWG. N. 1707



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STANDARD BULBS

O.T.I. BULBS

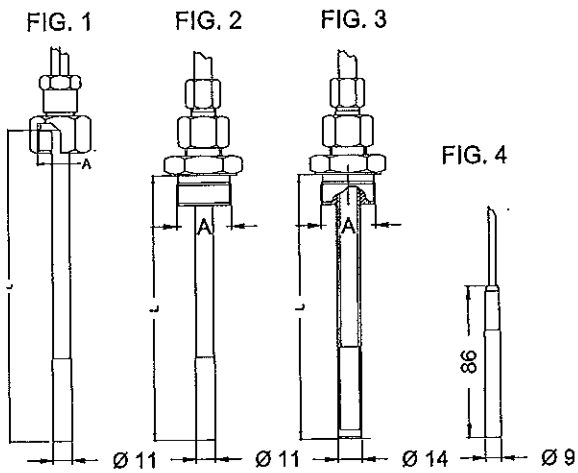


Fig. 1			Fig. 2/3		
A	3/4 BSP	M27x2 other	3/4 BSP	1" BSP	M27x2 M22x1,5 other
L	Min 80 mm.	Std. 150 mm.	Min 80 mm.	Std.	150 mm.

O.T.I. equipped with PT 100 sensor bulbs

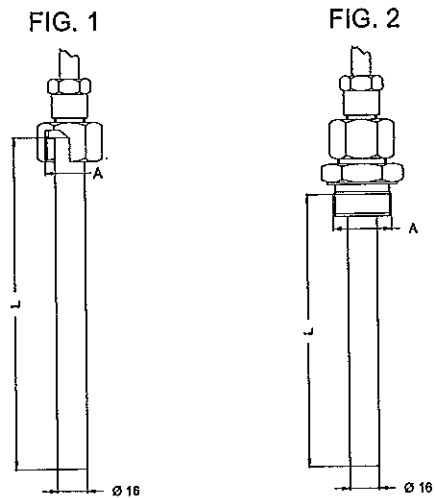


Fig. 1			Fig. 2		
A	3/4 BSP	M27x2 other	3/4 BSP	1" BSP	M27x2 M22x1,5 other
L	Min 150 mm.	Std. 150 mm.	Min 120 mm.	Std.	150 mm.



Quality made to measure

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Mounting : mount the instrument on its machine or plant.

Being the instrument provided with capillary tube it is possible to supply the same with one of the following connections :

- rigid locking screw M14 (Drwg. No.1242) located on the top of the thermometer;
- elastic suspension (Drwg. 1231) that is mounted on the top of the thermometer with a screw M14 that consents to install the instrument to the plant;
- rear flange (Drwg. No.1242/F) for wall mounting on the transformers tank.

Removing of the terminal box cover : by unscrewing the 4 stainless steel screws.

Cable layout : the numerations 1-2-3-4-5 indicate the microswitches progression (red, blue, green, yellow, white pointer). Close to the terminals you can find the following abbreviations :

- C = common
- NO = normally open
- NC = normally closed

that allow the operator to choose the desired cable layout.

Connect the microswitches terminals and the earth terminal.

If the thermometer is equipped with the PT 100 probe you find also the PT 100 terminals with a clear label that indicates how you can connect the probe to the display or to a transducer.

After having done all the connecting operations re-position the terminal box cover taking care to put the flat gasket in the right position and screwing the 4 stainless steel screws.

Setting : to set microswitches pls., follow exactly the instructions :

- remove the locking ring;
- remove the glass or polycarbonate lens (take care of the O-ring);
- stop the microswitches setting dial (small black dial) with two fingers and slide the frictioned microswitches setting pointers until they are located at the desired temperature. Note that to reduce errors you have to slide the pointers towards higher temperature value.
- Replace the glass or polycarbonate lens taking care that the max. temperature indicating pointer is located on the right side of the temperature indicating pointer and that the lens itself correctly positioned over the sealing O-ring;
- Lock the lens screwing the locking ring.

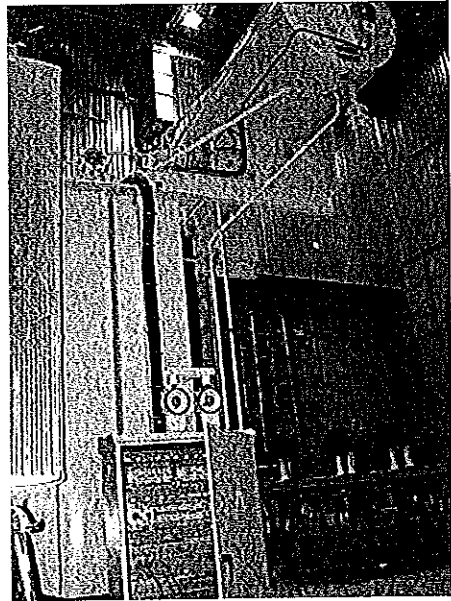
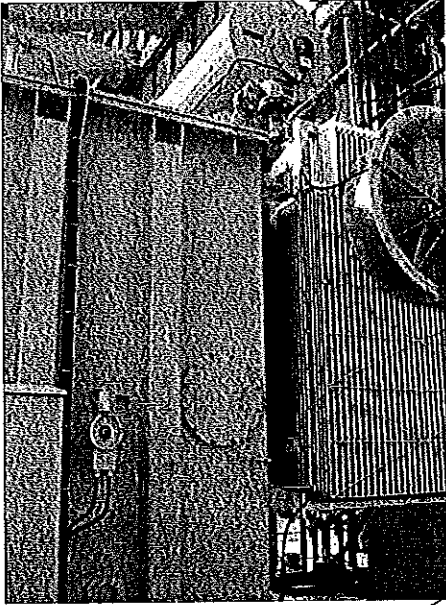
Maintenance

No particular maintenance is required. Only periodical inspections (typical interval 6 months) to verify precision, functions and electrical connections.

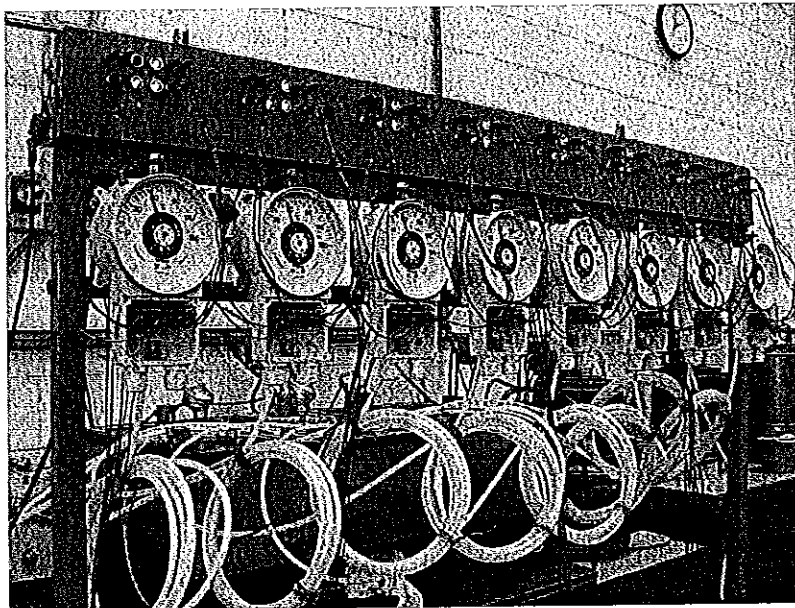
When the instrument is equipped with polycarbonate lens, cleaning must be done with care in order to avoid scraps on the surface. Use water and soap only.


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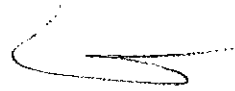
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Quality made to measure



Finished product quality control tests.

Instrument calibration : carried out through thermostatic baths controlled by a computer system. The procedure varies according to instruments scale.

Example of procedure for a thermometer scale -20 / +130°C: the calibration is made using 5 different baths set at the following temperatures :

- bath 1 = -20°C
- bath 2 = 20°C
- bath 3 = 50°C
- bath 4 = 100°C
- bath 5 = 125°C

Calibration procedure :

Step 1: a check is carried out to see whether the temperature taken by the instrument under test differs from that taken through the sample sensor by more than the 70% of the maximum allowed instrument reading tolerance value.

This test is performed by sequentially plunging the Oil Temperature bulb into successive temperature increasing thermostatic baths: -20°C / +20°C / +50°C / +100°C / +125°C.

Step 2: the instrument is heated until the instrument pointer exceeds by 20% the angular full scale value.

Step 3: step 1 is repeated, but inversely.

Microswitches actuation test : performed through a computer controlled testing unit.

The bulb is immersed in a thermostatic bath. The computer changes the temperature inside of the bath and by means of suitable sensors verifies the commutation tolerance, the commutation differential, the electrical circuits of each microswitch.

At the end of the test a report is directly printed by the computer.

Check of instrument mechanical protection degree : IP 65.

This test is carried out by means a lance-sprinkled water jet on all sides of device.

Insulation test : carried out by means of a microprocessor controlled testing unit.

Note : all the collected data are immediately transferred, by means of the computer net, to the quality control and to the design departments to be supervised and evaluated.

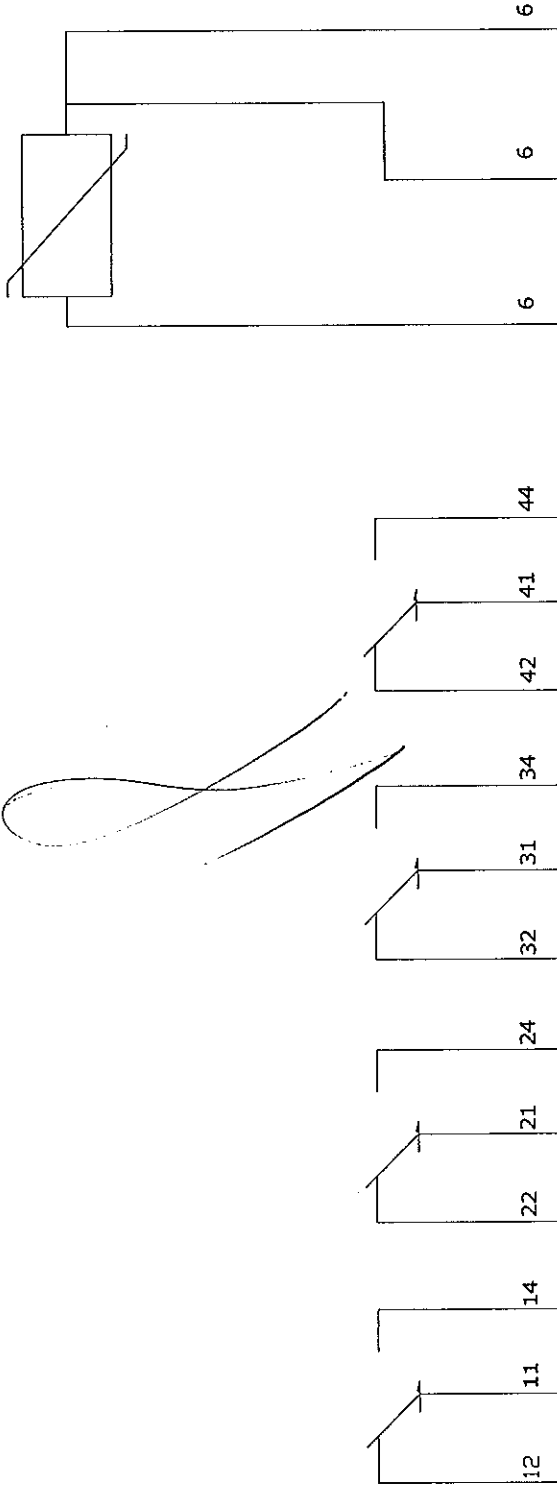
In our files, we keep all the above mentioned informations and we can supply to the customer detailed reports regarding the performances of each instrument delivered.

1 EDITION AUGUST 2006



Terman '90 Strumentazione Industriale S.r.l., Via Ghisalba, 13-20/21, 20021 Bollate (MI) – Italy. Tel: +39 02 38 30 37 12,
Fax: +39 02 38 30 37 19, E-Mail info@terman.com, www.terman.com
C.F./P. IVA IT 09970270154 – C.C.I.A.A. 1332904 – Trib. Milano Reg. Soc. 302729 – Cap. Soc. € 10.400

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nc	c	no	nc	c	no	nc	c	no	A	B	b			
12	11	14	22	21	24	32	31	34	42	41	44	6	6	6
SWITCH N.1			SWITCH N.2			SWITCH N.3			SWITCH N.4			PT 100		
RED			BLUE			GREEN			YELLOW					

O.T.I. wiring diagram

TER.MAN.'90 Srl - Strum. Ind.le.
Bollate - MILAN - ITALY

DRWG. N. 1487
FILE : CAD 1487

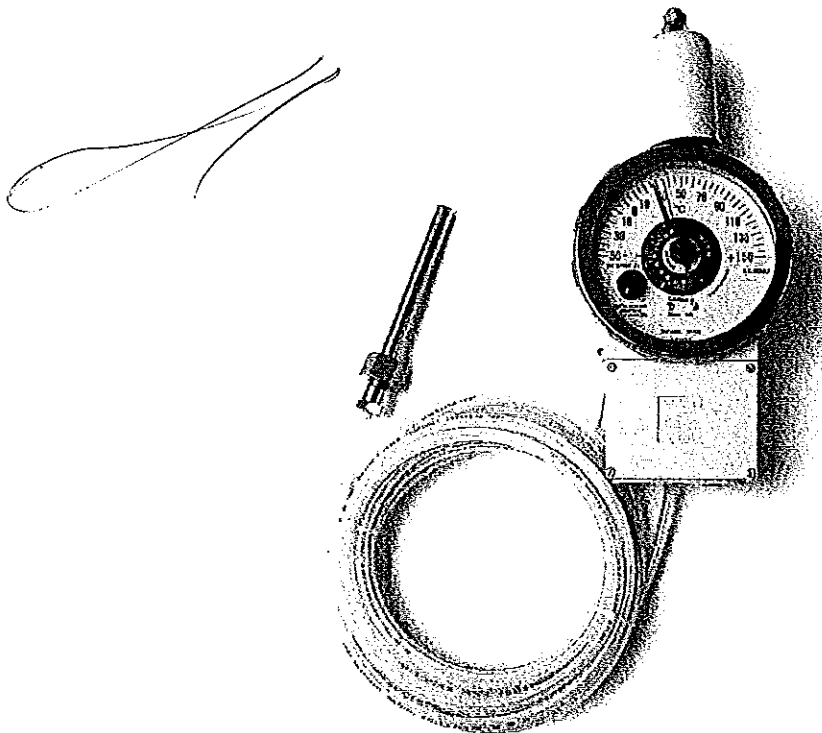
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Quality made to measure

Winding Temperature Indicator for Power Transformers type :

MSRT 150-W



Introduction	page 02
Description and general specifications	page 02
Options	page 04
Operating instructions and maintenance	page 06
Finished product quality control tests	page 08

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Quality made to measure

Introduction.

The winding is the transformer component with the highest temperature and, above all, the one subject to the fastest temperature changes as the load increases. Thus, to have total control of the temperature parameter inside of the transformer, the temperature of the winding must also be measured. An indirect system is used to measure this latter since it is dangerous to place a sensor close to the winding due to the high voltage.

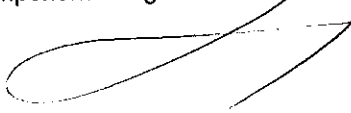
The indirect measuring is done by means of a Thermal Image.

This Winding Temperature Indicator is designed to measure the temperature of the winding by means of a special bulb surrounded by a heating resistance through which passes a current proportional to the current passing through the transformer winding subject to a given load and immersed in insulating oil at temperature T_{oil} . It's possible to adjust the heating system by means of a potentiometer whose knob is located on the winding temperature indicator's dial. In this way the value of the winding temperature indicated by the instrument will be equal to the ones planned by the trafo manufacturer for a given transformer load.

The winding temperature indicators can be fitted with up to five change-over microswitches suitable to control cooling equipments and protection circuits (alarm and trip) of the transformer.

This sector of our production is the result of considerable research and experiment commitment which has led to internationally patented new concept instruments design and construction.

The component designs of our instruments are protected by :



ITALIAN PATENT No. 208603
ITALIAN PATENT No. 89113
E.E.C. PATENT No. 0245212
U.S. PATENT No. 4,727,227

Effectiveness of these instruments must be stressed, both as regards measuring/commutation precision and extreme simplicity of operation. Special attention has been paid to design of each single part resulting in extreme high reliability of our instruments and ensuring long-lasting accurate operating. We have designed the setting system, the mounting devices and the dimensions of the cable boxes to consent the operator to easily install the indicator and to save time in setting and making cable layout.

Besides the exact constructional and severe quality control we adopt, the high performances of our instruments are further assured by the employ of the best products supplied by European technology's more advanced company names. In particular:

- the **INDICATING SHAFT** is mounted on 2 micro ball bearings to reduce the frictions and to grant right working under vibrations;
- the **AWG 22 CABLES** we adopt are silver plated and protected with Teflon according to MIL - W - 16878-4 Standard;
- the **TERMINAL BLOCKS (WEIDMULLER - Germany)** grant very high performances and are certified in accordance with European standards;
- the **POWDER PAINT** grants total protection against corrosion and increases the insulation of the device;
- the **SENSING SPRING TUBE** is manufactured with a special bronze alloy that avoid any plastic deformation and histeresis of the spring.

Description and general specifications.

Temperature sensing system : expansion type compensated for ambient temperature changes by means of a built-in compensating device.

To avoid to many checks after setting into work and periodical re-calibrations we adopt particular cares in testing the components. In particular the sensing system is subject to 3 different tests :

1. vacuum test : the sensing system is connected to a vacuum plant. The plant pressure is decreased to 2×10^{-3} mbar (hpa) to verify the quality of the welding and the porosity of the material;
2. pressure test : the sensing system is put under pressure up to 280 bar to verify the welding and that the spring is not subject to any plastic deformation;

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Quality made to measure



3. overheating test : once the sensing system is completed, its bulb is located in a heating plant controlled by a microprocessor based temperature monitoring system. The temperature is increased up to a value that is 20% higher than the maximum range value of the sensing systems (i.e. for an indicator whose range is 0 / 150°C the overheating test temperature is 180°C). The temperature remains at that value for 8 hours in this way simulating 1 year life under normal working conditions (i.e. for an indicator whose range is 0 / 150°C ----> 110°C). In this way we train the spring and verify that the precision remains the same.

Capillary tube protection : rilsan tubing / stainless steel armouring / steel + PVC armouring.

Bulb : bronze .

Casing : aluminium alloy powder painted (RAL 7035) suitable to withstand to any climate and to heavy polluted atmosphere in as well tropical or arctic climates (-40 / +70°C). All components are made of corrosion resistant or surface treated materials.

The case is provided with a breather device to avoid dew on the lens.

To make cable layout quick and easy, the case is equipped with a large junction box that is completely separate from instrument's sensing system. Cable glands PG 16 - M20 - 3/4"BSP.

Mechanical protection degree : IP 65.

Working temperature : -40 / +70°C.

Lens : glass or polycarbonate.

Locking ring : Nickel plated brass. Transparent coated.

Standard measuring ranges : 0 / +150°C; 0 / +160°C.

Measuring tolerance : 1,5% of full scale value.

Commutation tolerance : 2% of full scale value.

Commutation differential : 4% of full scale value.

On customer's request the differential can be increased.

Insulation : 2000V 50Hz between terminals and earth for a 60 seconds time.

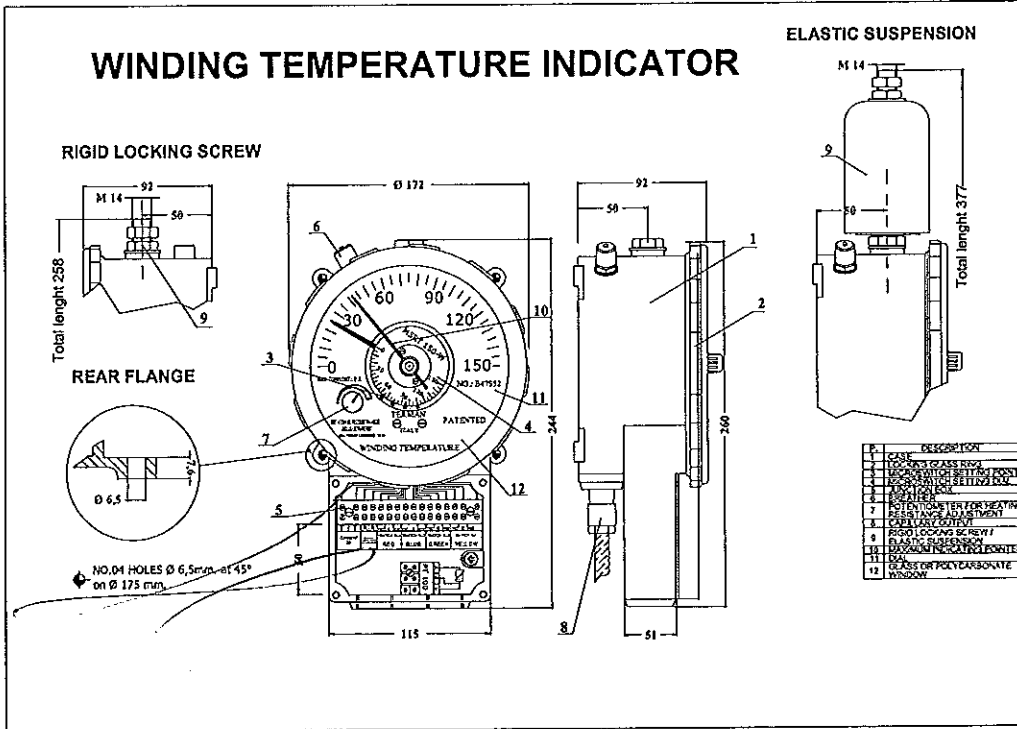
MICROSWITCHES MAKING AND BREAKING CAPACITY :

VOLTAGE	STANDARD MICROSWITCHES		HIGH-PERFORMANCE MICROSWITCHES	
	RESISTIVE LOAD	INDUCTIVE LOAD	RESISTIVE LOAD	INDUCTIVE LOAD
125 VAC	5 A	5 A	10 A	10 A
250 VAC	5 A	5 A	10 A	10 A
30 VDC	5 A	3 A	10 A	10 A
50 VDC	1 A	1 A	3 A	2,5 A
75 VDC	0,75 A	0,25 A	1 A	0,5 A
125 VDC	0,5 A	0,1 A	0,5 A	0,1 A
250 VDC	0,25 A	0,1 A	0,25 A	0,1 A

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Quality made to measure



DRWG. N. 1242/B

Options.

Elastic suspension (Drwg. No.1231) : it's a vibration damping system able to minimize the effects of a machine vibrations on the instrument.

Earthquake proof version : done by equipping the instrument with the elastic suspension and suitable internal components.

PT 100 sensor : the oil temperature indicator can be equipped with one or two PT 100 sensors that convert the temperature values in resistance values and transmit them to a receiver or to a monitoring system. Up to 2 PT 100 sensors can be mounted on the WTI.

Receiver (Drwg. No.1479) : we can supply a digital receiver to display the temperature signal received from the sensor.

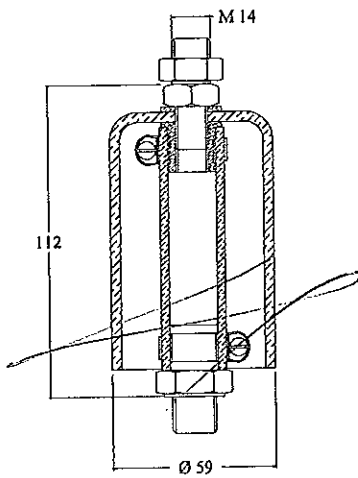
Transducer 4...20mA (Drwg. No.1707) : we can supply a wide range of transducers 4...20mA that convert the resistance values (input Pt100) into current values (output 0..20mA or 4..20mA) or into voltage values (0..5V or 0..10 V). These devices can be mounted on a DIN rail inside of the transformer marshalling box.

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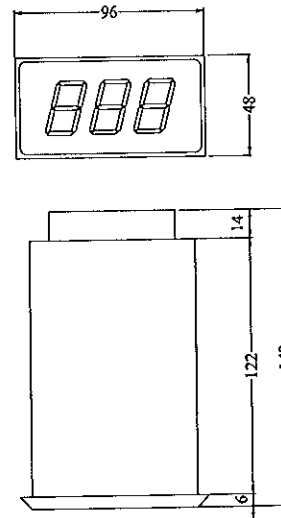
Quality made to measure

ELASTIC SUSPENSION



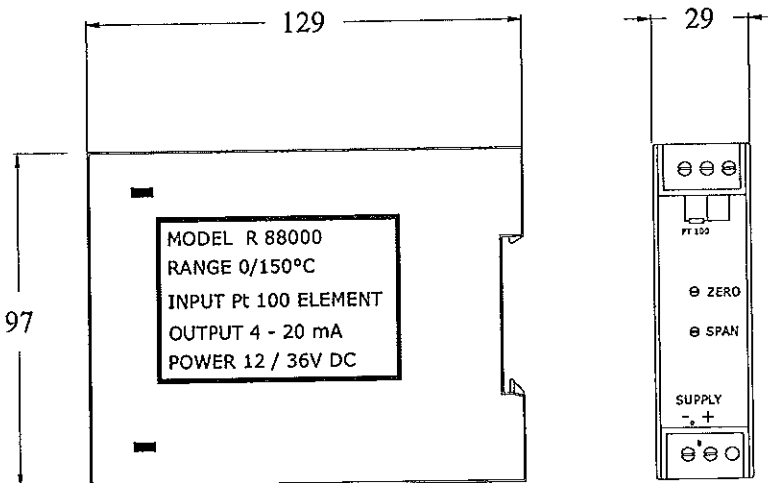
DRWG. N. 1231

PT 100 RECEIVER



DRWG. N. 1479

4...20mA TRANSDUCER PT 100 INPUT

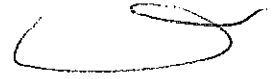


DRWG. N. 1707

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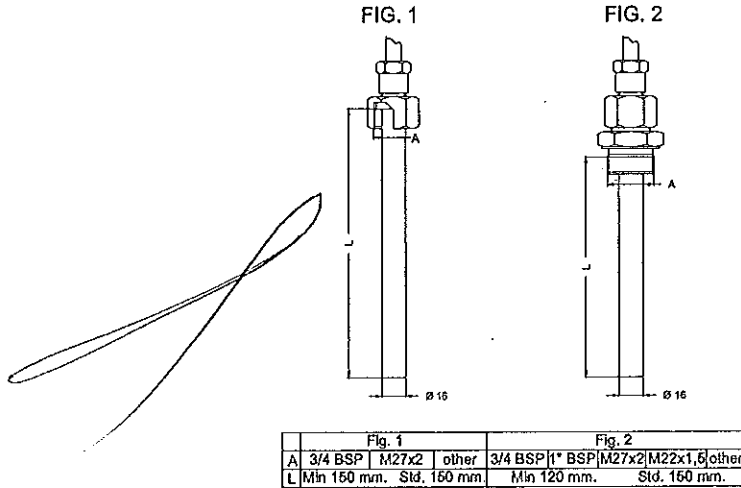


Quality made to measure



STANDARD BULBS

W.T.I. BULBS



Operating instructions and maintenance.

Mounting: mount the instrument on its machine or plant :

- rigid locking screw M14 (Drwg. No.1242/B) located on the top of the thermometer;
- elastic suspension (Drwg. 1231) that is mounted on the top of the thermometer with a screw M14 that consents to install the instrument to the plant,
- rear flange (Drwg. No.1242/B-F) for wall mounting to the oil tank.

Removing of the terminal box cover : by unscrewing the 4 stainless steel screws.

Cable layout : the numerations 1-2-3-4-5 indicate the microswitches progression (red, blue, green, yellow, white pointer). Close to the terminals you will find the following abbreviations :

- C = common
- NO = normally open
- NC = normally closed

that allow the operator to choose the desired cable layout. Connect the microswitches terminals and the earth terminal. If the thermal image is equipped with the PT 100 probe you find also the PT 100 terminals with a clear label that indicates how you can connect the probe to the display or to a transducer. After having done all the connecting operations re-position the terminal box cover taking care to put the flat gasket in the right position and screwing the 4 stainless steel screw.

Regulation of the value of ΔT : within the instrument's terminal board there are, as well as earth and microswitches connection terminals, the terminals T-T and the terminals A-A. Procedure for regulating the instruments :

1. insert the ammeter probes in terminals A-A;
2. remove jumper A-A;
3. connect terminals T-T to the current transformer. **AFTER** having checked that the value of the power supply current printed on the dial (above the knob for regulating overheating) is, in fact, the same as that of CT (current transformer);
4. regulate the current on the basis of curve I - ΔT attached;

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Quality made to measure

5. replace jumper A-A;
6. remove the ammeter probes;

7. wait a few minutes to allow T_w to stabilize;
8. check the exactitude of T_w ;

N.B.: the bulb of the thermometer for the thermal image must be filled with oil to accelerate the heat interchange occurrences. The bulb must be inserted in a well filled with transformer oil : the oil will rise through a suitable hole located in the bottom of the bulb itself until it covers the resistance.

Setting : to set microswitches pls., follow exactly the instructions :

- remove the locking ring;
- remove the glass or polycarbonate lens (take care to the O-ring);
- stop the microswitches setting dial (small black dial) with two fingers and slide the frictioned microswitches setting pointers until they are located at the desired temperature. _____

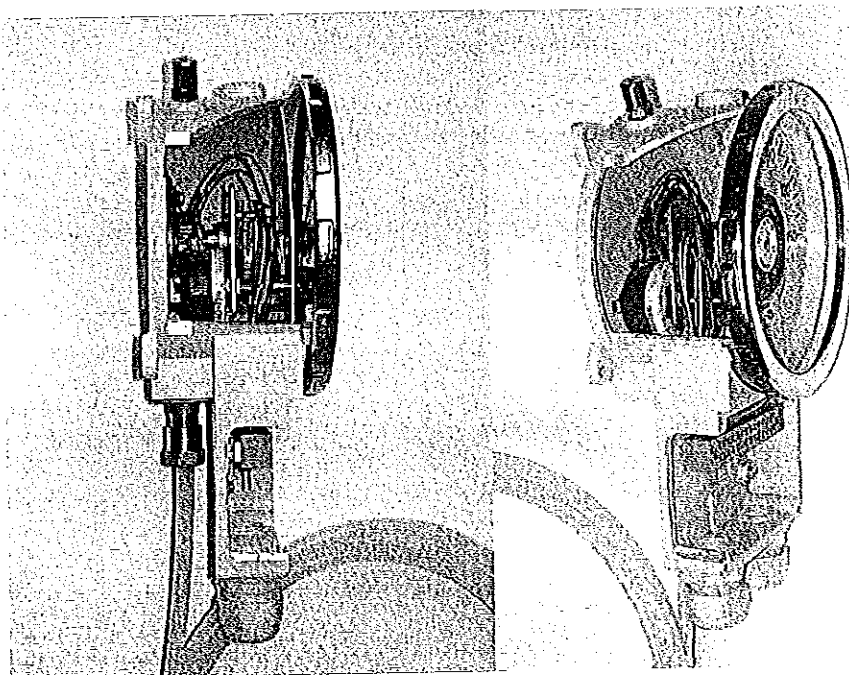
- Replace the lens taking care that the max. temperature indicating pointer is located on the right side of the temperature indicating pointer and that the lens itself is correctly positioned over the sealing O-ring;
- Lock the lens screwing the locking ring.

Maintenance

No particular maintenance is required. Only periodical inspections (typical interval 6 months) to verify precision, functions and electrical connections.

In case of working test effected with thermostatic bath, please note that WTI bulb **MUST NOT** be immersed in water. The WTI bulb is surrounded by the heating resistance and water may cause serious damages to the heating system. The calibration test must be done with oil or hot air only.

When the instrument is equipped with polycarbonate lens, cleaning must be done with care in order to avoid scraps on the surface. Use water and soap only.



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Quality made to measure

Finished product quality control tests.

Instrument calibration : carried out through thermostatic baths controlled by a computer system. The procedure varies according to instruments scale.

Example of procedure for a thermal image scale 0/150°C: the calibration is made using 5 different baths set at the following temperatures :

bath 1 = 0°C
bath 2 = 20°C
bath 3 = 50°C
bath 4 = 100°C
bath 5 = 125°C

Calibration procedure :

Step 1: a check is carried out to see whether the temperature taken by the instrument under test differs from that taken through the sample sensor by more than the 70% of the maximum allowed instrument reading tolerance value.

This test is performed by sequentially plunging the Winding Temperature bulb into successive temperature increasing thermostatic baths: 0°C / +20°C / +50°C / +100°C / +125°C.

Step 2: the instrument is heated until the instrument pointer exceeds by 20% the angular full scale value.

Step 3: step 1 is repeated, but inversely.

Microswitches actuation test : performed through a computer controlled testing unit.

The bulb is immersed in a thermostatic bath. The computer changes the temperature inside the bath and by means of suitable sensors verifies the commutation tolerance, the commutation differential, the electrical circuits of each microswitch.

At the end of the test a test report is directly printed by the computer.

Check of instrument protection degree : IP 65.

This test is carried out by means a lance-sprinkled water jet on all sides of device

Insulation test : carried out by means of a microprocessor controlled testing unit.

Heating system functionality test : to verify trimming functionality of potentiometer and total resistance values of the circuit.

Note : all the collected data are immediately transferred, by means of the computer net, to the quality control and to the design departments to be supervised and evaluated.

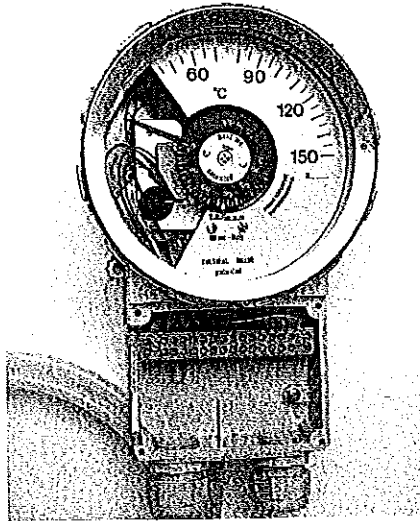
In our files, we keep all the above mentioned informations and we can supply to the customer detailed reports regarding the performances of each instrument delivered.

258

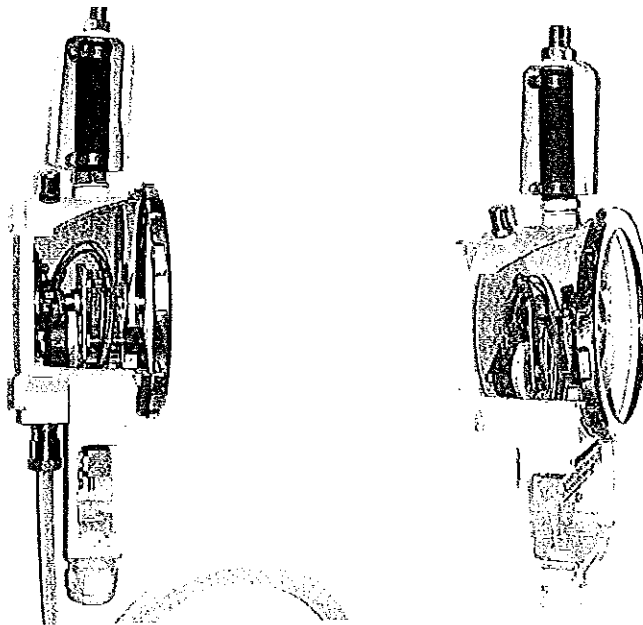
terman

Quality made to measure

5



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1 EDITION AUGUST 2006

terman

Terman '90 Strumentazione Industriale S.r.l., Via Ghisalba, 13-20/21, 20021 Bollate (MI) - Italy. Tel: +39 02 38 30 37 19
Fax: +39 02 38 30 37 19, E-Mail info@terman.com, www.terman.com
C.F./P. IVA IT 09970270154 - C.C.I.A.A. 1332904 - Trib. Milano Reg. Soc. 302729 - Cap. Soc. € 10.400

259

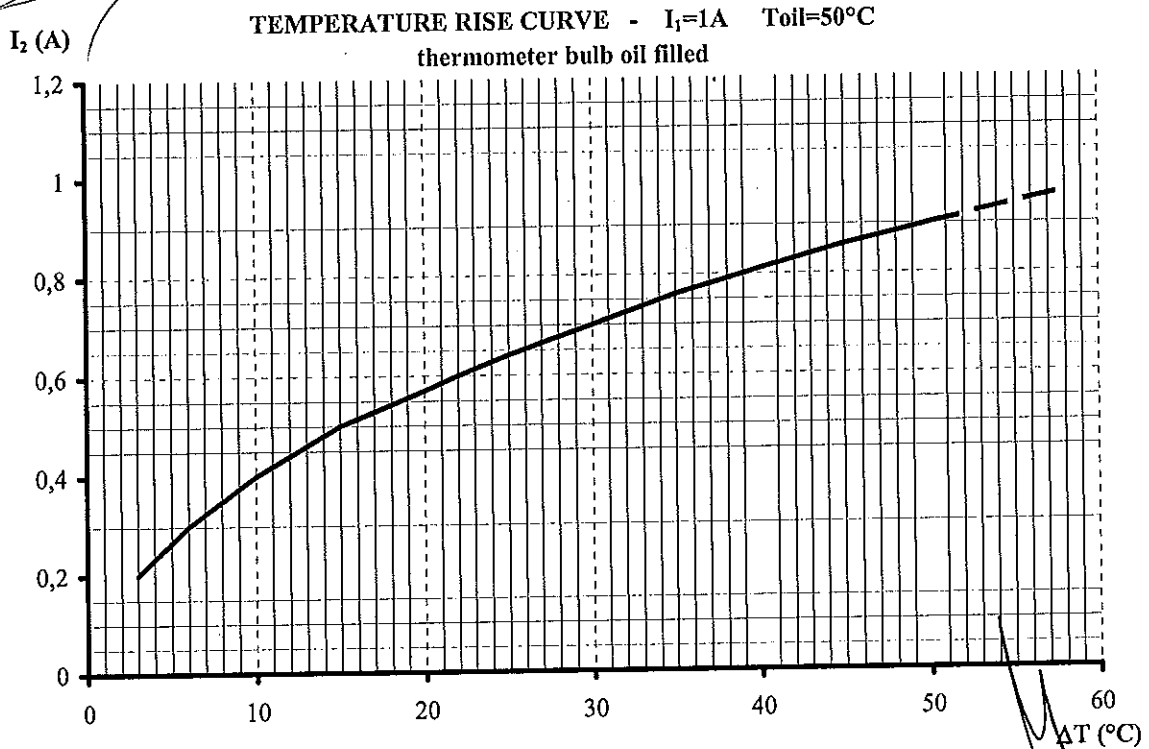
THERMAL IMAGE

MICROSWITCHES-EQUIPPED WINDING TEMPERATURE INDICATOR

"MSRT 150-W"

CURVE I - ΔT FOR TEMPERATURE RISING ADJUSTMENT

CURRENT I_2 (A)	RISE ΔT (°C)	POWER ABSORBED (VA) if $I_1=1A$
0,2	3	2,7
0,3	6	4
0,4	10	5,3
0,5	15	6,6
0,57	20	7,5
0,6	22	7,9
0,64	25	8,5
0,7	30	9,2
0,76	35	10
0,8	39	10,6
0,81	40	10,7
0,86	45	11,4
0,9	50	11,9



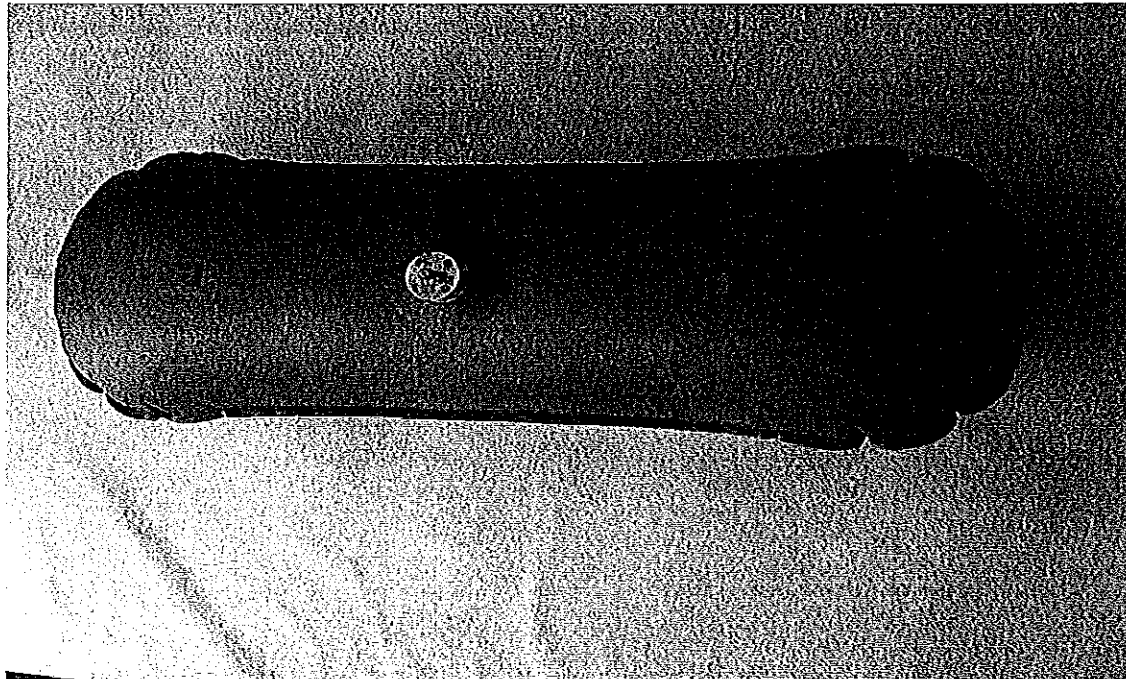
NOTE: I - ΔT CURVE IS VALID ONLY IF THE BULB IS IMMERSSED IN OIL
CURRENT $I_1=1A$ $T_{oil}=50^\circ C$
REINSERT JUMPER AFTER TEMPERATURE RISE ADJUSTMENT

Musthane

Technical intelligence for flexible forces

[Handwritten mark]

**RUBBER AIR CELLS
for oil preservation system of
Power Transformer**



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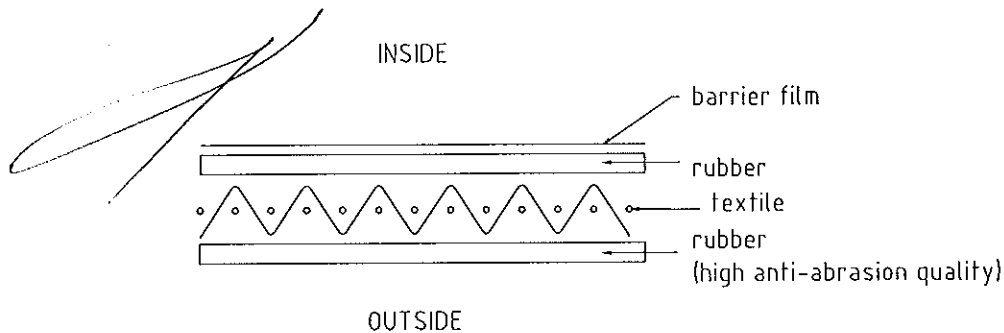
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252

**TECHNICAL INFORMATION
for standard oil conservator
(cylinder shape)**

Material :

Nitrile rubber (NBR) on oil and air side, with textile reinforcement on Polyamid high tenacity (annexe 1 – DOC/COM/010)

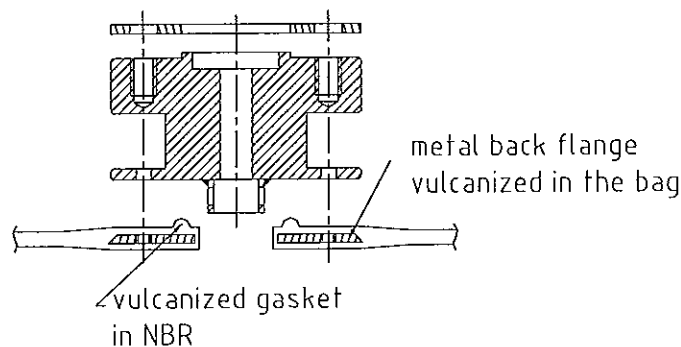
The internal faces of the rubber air cell are coated with a barrier film. This film is vulcanized with the internal rubber in one operation. This barrier improves the life time of the product (Better ozone resistance) *



Flange :

The gasket between the rubber air cell and the flange is directly vulcanized in one operation. This procures a better quality in leakness avoidance. That also means that this gasket is made with the same material than the rubber air cell , can not pollute the oil, can not be forgotten and is garrantied during all the life time of the product.

Example of flange :

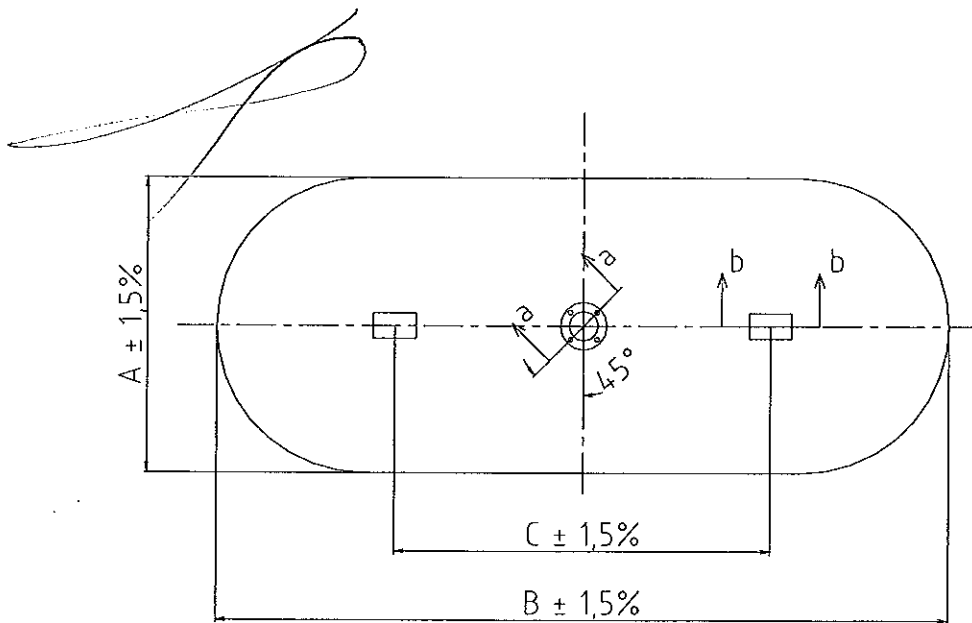
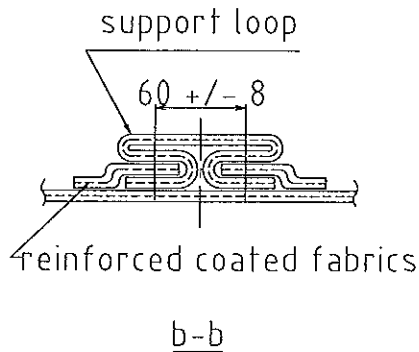


**This barrier film could be optionnal depending on the customer specifications*

203

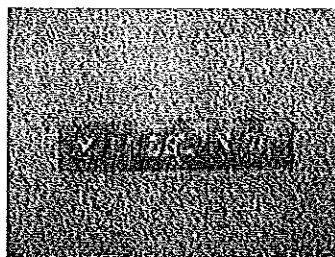
Fixation loops :

The loops are manufactured with a reinforced coated fabric which avoid a possible tear.



Identification :

Each rubber air cell is manufactured with our company name and our serial number, with no additional label. It is printed directly in the rubber in order to avoid all risk of oil pollution. We do not recommended the using of sticker or heat welding label which could not be in accordance with ASTM D974, D877, D924 and D1500.



264

0

Test :

All rubber air cells are tested before shipment :

- a leakage test with a least 0.2 bar during 1 hour
- a visual test with soap of the assembly

(



Test report :

All air cells are delivered with a routing test report that means that 100 % of our air rubber cells are tested before shipment. (annexe 2 – DOC/ATE/029)

Cleaning :

Each rubber air cell is cleaned before shipment in order to be used directly in the oil conservator. After the tests, the rubber air cell is transported in specific wagons.



265

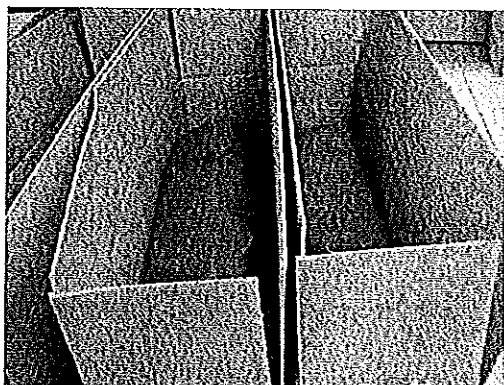
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Packing :

Rubber air cells are delivered in a reinforced cardboard box

Sizes : 1500 X 300 X 400 mm (annexe 3 / drawing MF0522-00)

The instructions for the installation and a test report are sent with the rubber air cell (annexe 4)



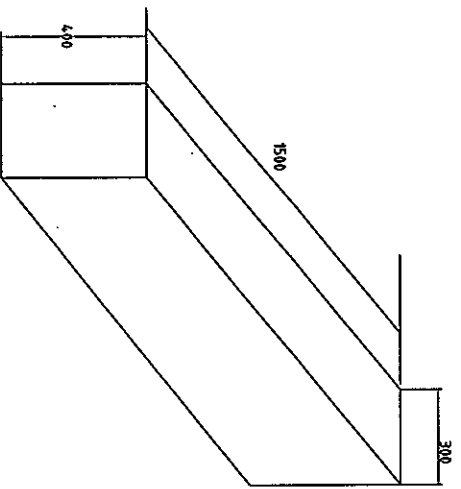
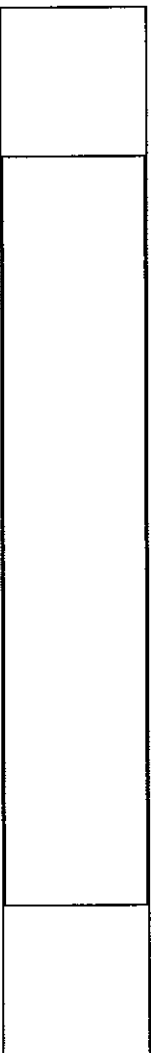
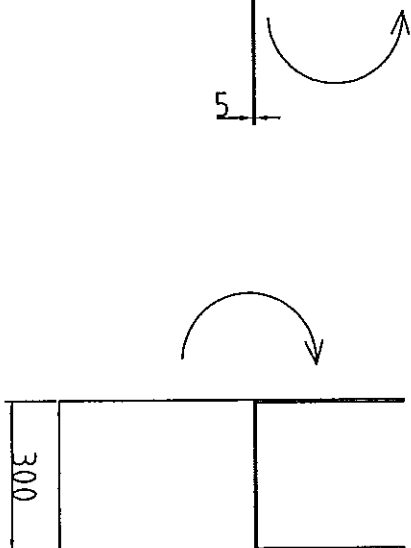
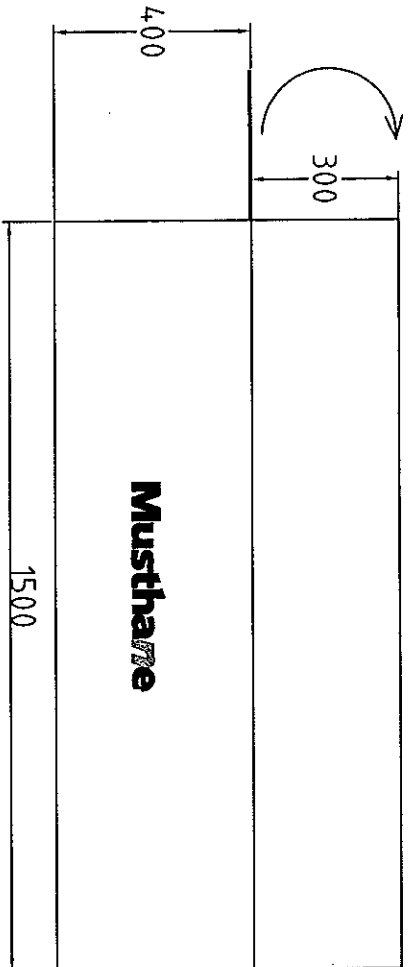
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MUSTHANE		visa		DOC/COM/010	
				Mis à jour le : 22/02/01	
FICHE TECHNIQUE TISSU ENDUIT POUR EQUILIBREURS TECHNICAL DATA SHEET CONCERNING FABRICS COATED FOR BLADDERS					
Support textile : <i>Basic fabric :</i>		Polyamide haute tenacité Polyamid high tenacity			
Gommage extérieur <i>External coating</i>		DP18 (Nitrile rubber)			
Gommage intérieur : <i>Internal coating :</i>		DP18 (Nitrile rubber)			
Epaisseur <i>Thickness</i>		NFG	mm		0,9 +/- 0,1
Masse surfacique <i>Surfacic mass</i>		NFG 37102 FSTM 191/5041	g/m²		950 +/- 130
TESTS TESTS		NORME STANDARD		UNITE UNIT	RESULTAT RESULT
Résistance à la rupture <i>Tensile strength</i>		NFG 37103 ASTM D 751/B FSTM 191/5102	daN/5cm	CH WP TR WF	>=300 >=300
Allongement à la rupture <i>Elongation at break</i>		NFG 37103 ASTM D 751/B FSTM 191/5102	%	CH WP TR WF	>=20 >=20
Résistance à la déchirure <i>Tear resistance</i>					
Pendulaire <i>Pendulum test</i>		NFG 37129/2 ASTM D 751/A	daN	CH WP TR WF	>=12 >=12
Pantalon <i>Tongue test</i>		NFG 37128/A ASTM D 751/B FSTM 191/5134	daN	CH WP TR WF	>=16 >=18
Adhérence par collage/pelage <i>Adhesion (peeling test)</i>		NFT 46008 FSTM 601/8011	daN/cm		>=3,5
Résistance au froid <i>Cold resistance</i>		NFG 37111 MIL, T, 52983/A	°C		<= -20 pass
Température extrême		static			-40, +140
Température Idéale d'utilisation <i>Recommended using temper</i>		dynamic	°C		-20, +120
Résistance à la perforation <i>Perforation resistance</i>			daN		18
Index de neutralisation <i>Neutralization index</i>		laboratoire. SGS ASTMD974 0.03 max	mg KOH/g		0,02
Résistance diélectrique <i>Dielectrical resistance</i>		laboratoire. SGS ASTMD877 28 min	KV		36,3
Tangente delta <i>Power factor at 100°C</i>		laboratoire. SGS ASTMD924 1.1 max	PCT		0,54
Coloration <i>ASTM color</i>		laboratoire. SGS ASTMD1500 < 0,5			< 0,5
Perméabilité à l'oxygène <i>Oxygen permeability</i>		NFT 46-037	m²Pa-1s-1		3,0 10** -18
Perméabilité à la vapeur d'eau <i>Water vapo permeability</i>		NF ISO 2528	g/m².24h		11
Résistance à l'ozone <i>Ozone resistance</i>		ISO 1431	96H 50ppcm		Pas de craquelure no cracks

MUSTHANE FRANCE	Fiche de contrôle équilibrer souple/ Routing test report for bladder Ficha de control deposito de caucho/Controle gegevens	DOC/ATE/029 index: B	
OF/WO N° :	Qté/Qty:	Date de livraison: Delivery time :	
Client: Customer:		N° de série: Serial N° :	
Tissu/Coated fabric Tejido/Material karakteristieken	trile/Nitri	Nitrile /PVC	
Dimensions/Dimensions (mm) Dimensionales/Afmetingen (mm)		N° de commande: Order N° :	
Longueur/Length B	Largeur/Width A	Entraxe/Entraxe C	
Longitud/Lengte B	Anchura/Breedte A	Entraxa/Ophangpunt C	
Accessoire/Fitting Accessorios/Toebehoren	Prévu/Forecasted/Previstos/Vodrzien	Réel/Real/Reales/Werkeluk	
Position patte/Loop position (of plan/drawing) Posicionamento pasadores/Positie ophangpunten	Position	Visa	
Position bride/Flange position Posicionamiento brida/Positie ophangflens	Position	Visa	
Contrôle dimensionnel après vulcanisation/Dimensional control after vulcanization Control dimensional despues de vulcanisation/Afmetines control na vulcanizatie		B A C	
Tolérance : +/- 1,5%			
Etanchéité à l'air/Airproof resistance (0.2 bar=>1H) Impermeabilidat /Dichtheids proef na vulcanizatie	VISA	VISA	
Contrôle à la mousse des assemblages/Visual control with soap Control visual de los conjuntos con espuma/Visuele controle met zeepsop aan de verbindingen	VISA	VISA	
Contrôle d'aspect / Look control			
0 few curlings without any consequence	0 look flaw without any consequence		
0 curlings without any consequence	0 with repairing without any consequence		
Remarque/Notice :			
Observaciones/Opmerkingen :			
Nom/Name RAQ : H BLOND Apellido/Naam RAQ	Contrôleur/Contrôleur Controlador/controlleur	Décision/Opinion RAQ Decision/Beslissing RAQ	Visa/Visa Visa/Goedgekeur
Date/date Fecha/datum	Date/date Fecha/datum		

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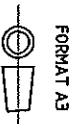


REF	A	DATE	18/06/02	REVISION	ND	EMISSION INITIALE	OBSERVATION	DATE	REVISION	ND	EMISSION INITIALE
TOLERANCES GENERALES SUR PARTIES METALLIQUES: ISO 2768-MK (SAUF INDICATIONS PARTICULIERES)											
ETAT DE SURFACE: Ra 3.2 (SAUF INDICATIONS)											
FINITION: CHANRENS 0.5 A 45° RAYONS DE 0.5 PARTOUT SAUF IND											
DIMENSIONS: H13, H13 FILETAGE: ISO 6H/6g/GAZ A/H											
TYPE: DEFINITION MATIERE: CARTON 5mm											
PROTECTION: XXXX TRAITEMENT: XXXX											
Echelle: 1/10 N° : MF0522-00											

CARBOARD.BOX
1500X300X4,00MM

Musthane

53, rue de la République, 59780 WILLEMS, FRANCE
 TEL: +33.03.28.37.00.50
 FAX: +33.03.28.37.00.49
 www.musthane.com/ Mail: musthane@musthane.com



FORMAT A3

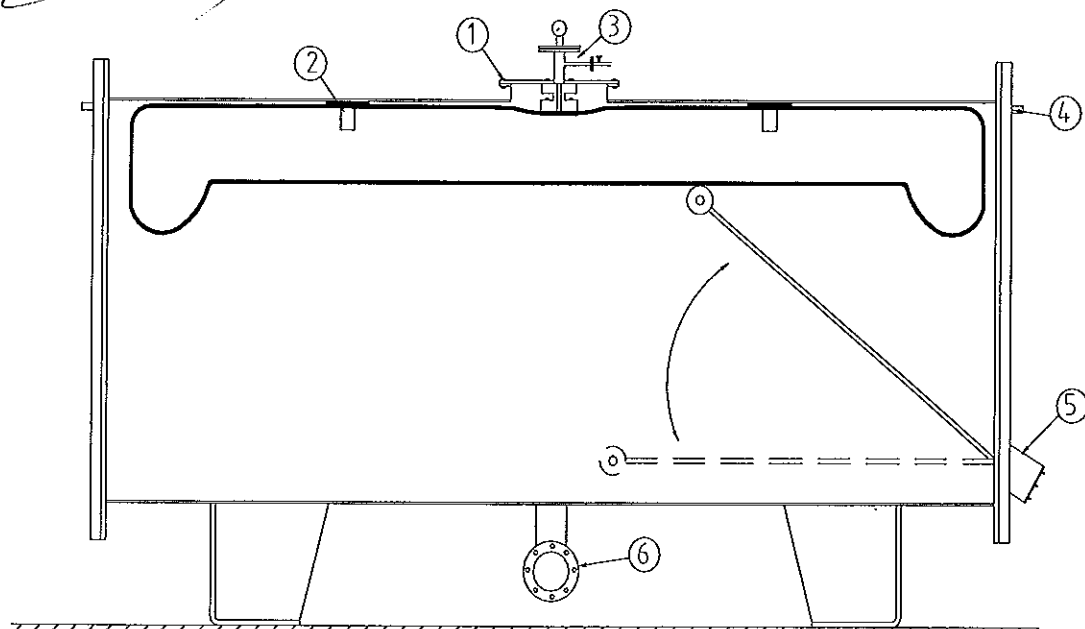
269

Musthane

Technical intelligence for flexible forces

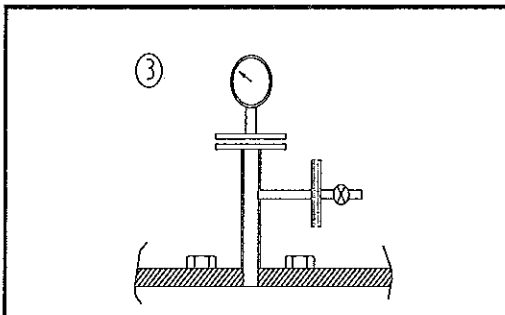
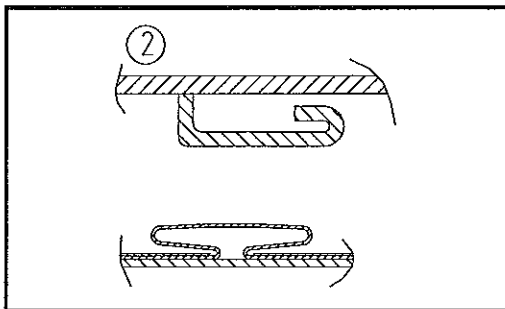
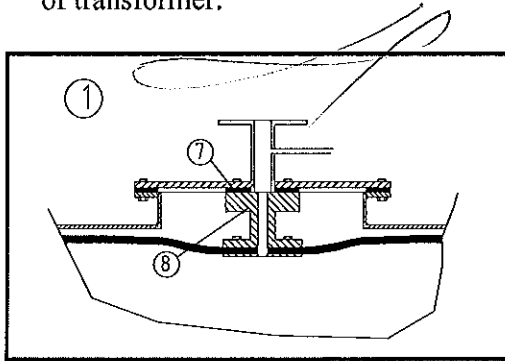
INSTALLATION OF THE MUSTBALANCE MBT

- Push the MBT into the conservator through the open end or inspection hatch in the end of the conservator.
- Suspend the MBT from hooks (2) in the ceiling of the conservator using the loops
- Fit the MBT flange (8) on the conservator flange using a ring* (7) to ensure airtightness of the system
- Close the open end of the conservator
- Fill the MBT to a pressure of 10kPa (0,1 bar). Close the filling valve (3) while leaving the system pressurised. A relief hole (4) must be on the oil filled side of the conservator so that the MBT can freely expand.
- The MBT will gradually stabilise. After 6 hours, adjust the air pressure again to 10kPa (0,1 bar). A 24 hours leak test is then to be made on the MBT. After 24 hours check the pressure reading again. If the pressure has not dropped significantly, the test is correct. The temperature should be as stable as possible during the leakage testing period.

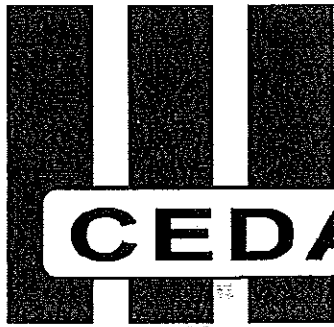


FILLING THE CONSERVATOR

- Check that the air pressure in the MBT is 10kPa (0,1 bar). If not, increase the pressure to the correct level and close the air-filling valve.
- Open the air vent valves (4) in both ends of the conservator.
- Open the valve (6) between the conservator and transformer tank and pump in more oil so that the oil rises to the conservator. The pumping speed should be suitably slow so that the pressure within the MBT does not exceed 13 kPa (0,13 bar). Stop pumping, when oil begins to come out of the vent valves and close the vent screws.
- Adjust the pressure in the MBT to normal by opening the plug in the flange or air filling valve from which the pressure hose is removed.
- Reopen the valve (6) between the conservator and the transformer tank and continue filling with oil until the oil level indicator gives the correct reading according to the temperature of transformer.

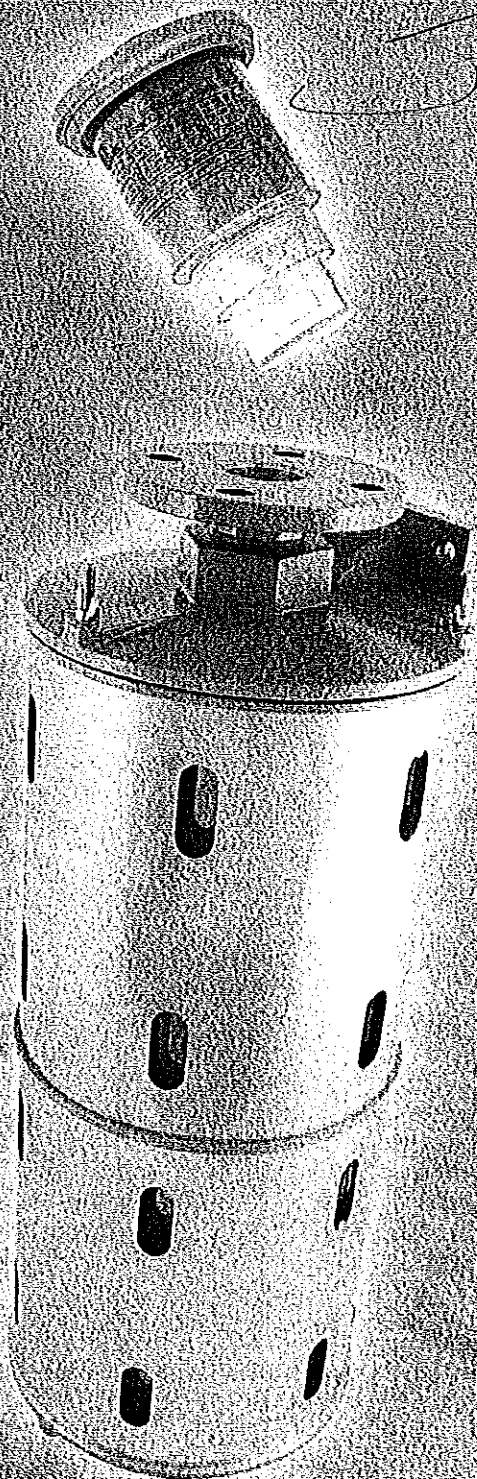
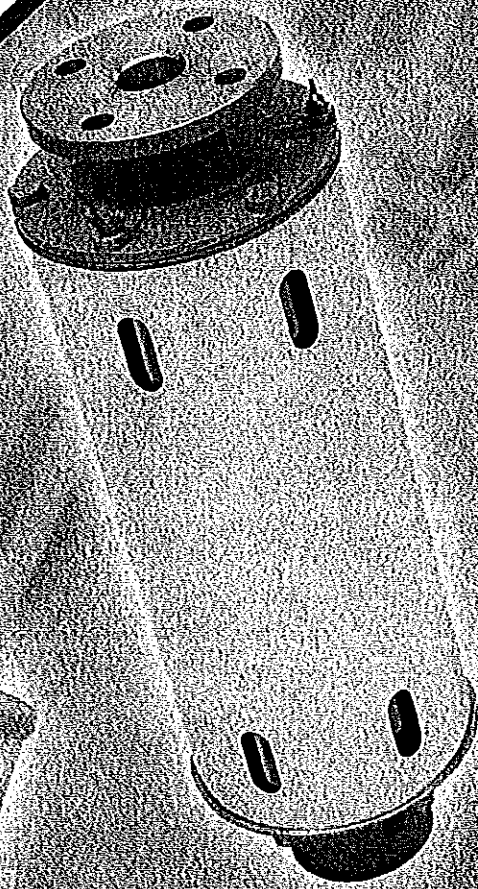


* MUSTHANE can also supply compression rings for contact with transformer oil. Their advantages: excellent mechanical properties, resistance to temperature and aging.

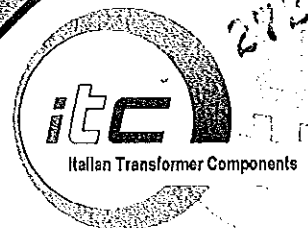


CEDASPE

DEHYDRATING BREATHERS



Made in Italy



Italian Transformer Components



I - 29098 S. GIULIANO MIL. (ITALY) - VIA COLOMBARA, 1 - FRAZ. PEORIANO
TELEFONO +39 0298.20.44.11 - TELEFAX +39 02 98.20.44.22
E-Mail: cedaspe@cedaspe.com - InterNet Site: http://www.cedaspe.com
CAP. SOC. € 600.000 I.V. - TVA-P.I. IT 01066780166 - C.F. 01066780166
R.E.A. MI 729931 - IMPORT-EXPORT MI 142410 - REG. IMPR. 132146534446 TRIB. MI

AIR DEHYDRATING BREATHERS
threaded and/or flanged connection, single unit and modular assy
type VE 05 - 10 - 15 - 30 - 50 - 80 - 100 - 150
for power transformers

1. GENERAL INFORMATION

Air dehydrating breathers are transparent hollow cylinder tubes which contain chemically pure silicium salt (silicagel) with coloured indicator. The air breathed inside the transformer due to the thermal contraction of the oil mass, passes through the silicagel.

The silicagel absorbs the humidity, indicating the saturation degree by changing colour as follows:

YELLOW/ORANGE silicagel completely dry
AMBER silicagel partly humid
CYAN silicagel saturated with humidity

The salt contained in the breather, when saturated, may be easily removed and regenerated by heating it, inside a ventilated oven, at 120° - 150°C, until the colour becomes orange again.

The specific property of the silicagel is its high absorption power of humidity. This is total until the salt has absorbed water for about 15% of its weight, and saturation is reached when the salt has absorbed water for 30 to 40 % of its weight.

2. TECHNICAL FEATURES

The upper and lower parts are made in a non-porous corrosion-proof aluminium alloy casting. The hollow cylinder is made of plexiglas and it is protected by a stainless steel cylinder, with windows which allow the visual control of the silicagel colour.

In the bottom side of the breather, a hydraulic valve prevents continuous air contact with the silicagel and allows the air to pass in both direction (inlet or outlet) only when there is pressure deficiency or excess inside the transformer.

Pressure values for air passage into the dehumidifier are:

0.003 kg/cm² inlet, or 0.005 kg/cm² outlet

The hollow container and the hydraulic valve are separated by a drilled plate with a labyrinth system, which have the double purpose of diffusing inlet air uniformly, and of avoiding that any salt dust may damage the closing system.

3. DRAWINGS AND TECHNICAL DATA

A table on the drawings in the following pages shows, the general overall dimensions, the silicagel contained inside the cylinder, the max oil quantity, contained inside the transformer on which the breather must be installed, calculated for normal conditions, as below indicated, using the formula at paragraph 5:

Average air temperature	20°C
Average air humidity	60%
Average thermal cycle "Δt"	20°C
Average duration of thermal cycle T	8 hours
Maintenance Interval M	90 days

Different environment conditions of the site where the transformer is installed may influence the maintenance interval, when the choice of the size of the breather has been made.

4. PROTECTION OF OUTER SURFACES

Outer surfaces in aluminium alloy are covered with a double coat of high protective paint against all weather/conditions, and temperature between - 40°C and + 100°C. All the screws are made in mild steel zincplated; upon request in stainless steel.

5. CHOICE OF THE BREATHER SIZE (or of the maintenance interval)

The choice of the breather size (or maintenance interval) is directly related to the quantity of the breather silicagel contain. The mass of silicagel necessary for the proper functioning is given approximately by a function of 6 variable quantities, listed here following:

- Mass of oil "V" inside the transformer, denominated in dm³ or in litres.
- Average temperature of the air in the environment where the transformer is installed, denominated in °C
- Average Humidity of the air in the environment where the transformer is installed, denominated in %.
- Average thermal cycle "Δt" of the transformer, denominated in °C, to be calculated as difference between the minimum and the maximum temperatures reached by the oil inside the transformer within a time period.
- Average duration of thermal cycle "T" denominated in hours, to be calculated as the time interval between two thermal cycles.
- Maintenance interval "M" denominated in days.



I - 28038 S. GIULIANO MIL. (ITALY) - VIA COLOMBARA, 1 - FRAZ. PEDRIANO
TELEFONO +39 0298.26.44.11 - TELEFAX +39 02 98.26.44.22
E-Mail: cedaspe@cedaspe.com - InterNet Site: http://www.cedaspe.com
CAP. SOC. € 600.000 I.V. - TVA-P.I. IT 01066780166 - C.F. 01065780166
R.E.A. MI 725991 - IMPORT - EXPORT MI 142410 - REG. IMPR. 19214E/334446 TRB. MI

From the saturated steam table for water (see next pages), depending from the average temperature and humidity of the air, it is possible to calculate the quantity of water "A" (denominated in grams) for each m3 of air which enter inside the transformer.

Now, using the following formula, we are ready to calculate the quantity of silicagel (denominated in Kg) necessary for the proper functioning of the transformer:

$$\text{Mass of silicagel} = (127,056 \times 10^{-9} \times V \times \Delta t \times A \times M) : T \quad [\text{kg}]$$

It is important to note that the result of above formula is only a first approximation value, due to the simplification related to the average values considered as constant values for the duration of the thermal cycles between two following maintenance intervals

It is also evident that shortening the maintenance interval, the average conditions used in the formula simulate more exactly the true conditions of the transformer during its working life (i.e. the average temperature of the air for 30 days in January has a statistic scattering degree lower than the average temperature for 90 days in Dec/Jan/Feb); same comments must be done for humidity, thermal cycle duration and temperature

Only two data may be easily fixed without doubt: mass of oil inside the transformer and maintenance interval.

For a better understanding, we show here following three examples of the choice of quantity of silicagel necessary for the same transformer installed in three different places, but with the same thermal cycle and maintenance interval; the following conditions shall be the same in all the three cases:

- Average thermal cycle " Δt " 20°C
- Average duration of thermal cycle T 8 hours
- Maintenance interval M 90 days
- Mass of oil V 10000 dm³

The mass of silicagel necessary for a good functioning of the transformer will be:

1° CASE: Transformer installed in normal European condition:

- Average air temperature 20°C
- Average humidity 60%
- Silicagel mass 2,95 kg

Suggested size of the breather: size VE30

2° CASE: Transformer installed in tropical climate:

- Average air temperature 30°C
- Average humidity 90%
- Silicagel mass 7,77 kg

Suggested size of the breather: size VE80

3° CASE: Transformer installed in desert condition:

- Average air temperature 35°C
- Average humidity 40%
- Silicagel mass 4,50 kg

Suggested size of the breather: size VE50

7. MANUFACTURING PROGRAM

We propose a full range of dehydrating breathers for power transformers, starting from 1 kg silicagel contain up to 15 kg; additionally, using 4 different sizes of modular unit, it is possible to assembly breathers in racks with high silicagel contain.

All our models are identified with two letters 'VE' followed by two figures which represent the quantity (denominated in hg) of silicagel contain, with this scale in kg 1;1,5;3;5;8;10;15.

All these breathers can be connected to the tube coming from the conservator by means of a threaded connection or by means of a flange.

Starting from size VE50 all the breathers are fitted with a side support which enable to make a bolted connection to a transformer wall or to a rack.

When there is a need of silicagel contain higher than kg 15, we propose a modular assy using multiple units of 5,8,10,15 kg silicagel contain each, as shown at page 5.50; the modular unit follow the same identification littering of the normal breathers adding the letter 'M' at the end

The dehydrating breathers, complete with salts are despatched in sealed packages in order to avoid alteration of the dry state of silicagel. Upon request, we supply also empty breathers with silicagel filling packed separately in ermetic bags, or even without filling, if the customer wants to manage silicagel separately from the breathers.

When they are mounted on the transformer, it is necessary to remove the protective plugs and pour mineral oil up to the mark on the jar.

8. ORDER INSTRUCTIONS

As said, the identification of a model start with two letters VE followed by two figures which represent the weight of silicagel inside the breather and the letter M for the modular unit.

Few example, to make it completely clear:

- VE 50 Breather with 5 kg silicagel contain
 - VE150 Breather with 15 kg silicagel contain
 - VE100M Modular unit with 10 kg silicagel contain
- Special instruction must be indicated separately.

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I - 28098 S. GIULIANO MIL. (ITALY) - VIA COLOMBARA, 1 - FRAZ. PEDRIANO
 TELEFONO +39 0298.26.44.11 - TELEFAX +39 02 98.20.44.22
 E-Mail: cedaspe@cedaspe.com - Internet Site: http://www.cedaspe.com
 CAP. SOC. € 600.000 I.V. - TVA-P.I. IT 01066780166 - C.F. 01066780166
 R.E.A. MI 729991 - IMPORT - EXPORT MI 142410 - REG. IMPR. 152146334446 TRUB. MI

9. SATURATED STEAM TABLE FOR WATER

Showing the mass of water, in gram (10^{-3} kg), contained in one cubic meter of air (related to the air temperature and the air humidity).

°C	AIR TEMPERATURE				AIR HUMIDITY [%]					
	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
0	0.49	0.98	1.47	1.96	2.45	2.94	3.43	3.92	4.40	4.90
5	0.68	1.36	2.04	2.72	3.40	4.08	4.76	5.44	6.10	6.80
10	0.94	1.87	2.82	3.76	4.70	5.64	6.58	7.52	8.50	9.40
15	1.28	2.56	3.84	5.12	6.40	7.68	8.96	10.20	11.50	12.80
20	1.72	3.44	5.16	6.88	8.60	10.30	12.00	13.80	15.50	17.20
25	2.29	4.58	6.87	9.16	11.45	13.70	16.00	18.30	20.60	22.90
30	3.02	6.04	9.05	12.10	15.10	18.10	21.10	24.10	27.20	30.20
35	3.94	7.88	11.80	15.80	19.70	23.60	27.60	31.50	35.40	39.40
40	5.08	10.20	15.30	20.40	25.40	30.50	35.60	40.70	45.80	50.90
50	8.27	16.50	24.80	33.10	41.40	49.60	57.80	66.20	74.40	82.70
60	13.00	26.00	39.00	52.00	65.00	78.00	91.00	104.00	117.00	130.00

10. AIR DEHYDRATING BREATHER TYPE TV75 & VE05 (page 5.40)

They are small sized dehydrating breathers, particularly fit for assembling on small distribution transformers

The type VE05 follows the same manufacturing principles of the bigger sizes like the type VE10.

The type TV75 (or TV74) is the cheapest model of our breathers: its top flange is made in corrosion proof aluminium alloy.

The silicagel housing is made of cellulose triacetate (cellidor by Bayer), suitable for mineral oil; only upon request, this breather can be fitted with a stainless steel cylindrical protection.

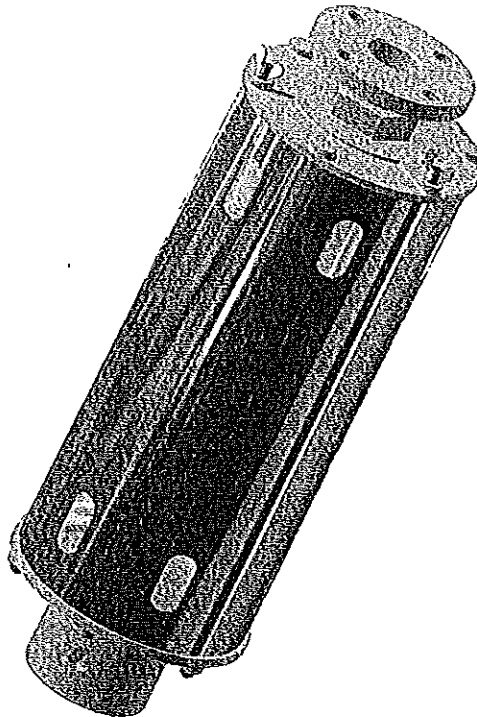
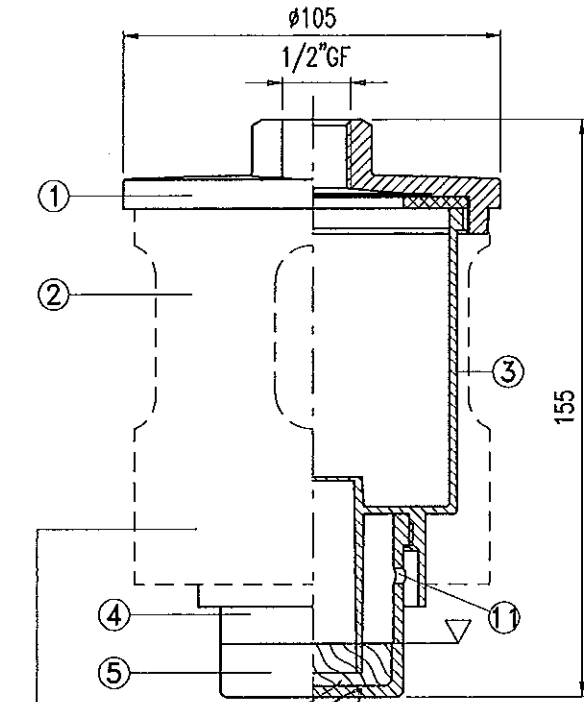


Fig. A1
- Tipo TV
- Type TV

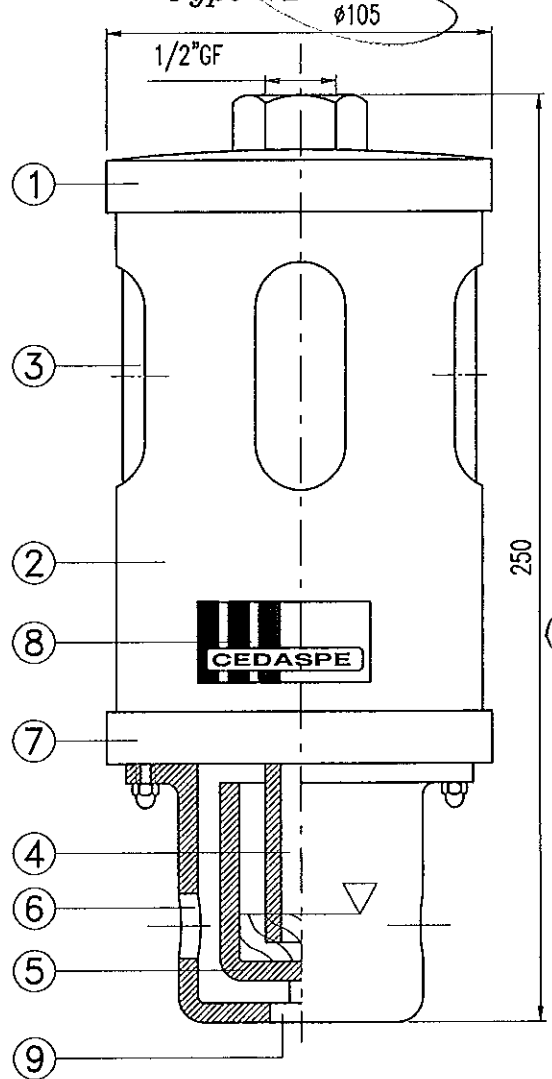


PROTEZIONE SOLO SU TV76NE
S/S HOUSING AVALALBE ONLY ON TV76NE

▽ Livello olio
Oil level

Pos	Descrizione
1	Coperchio
2	Protezione acciaio inox
3	Contenitore trasparente di sali
4	Pescante
5	Coppa olio (trasparente)
6	Spla olio e presa d'aria
7	Coperchio inferiore
8	Targhetta d'identificazione
9	Scarico condensa
11	Presa d'aria

Fig. B1
- Tipo VE
- Type VE



Pos	Description
1	Top cap
2	Stainless steel housing
3	Gel container (transparent)
4	Fishhook out cylinder
5	Oil cup (transparent)
6	Oil window and air intake
7	Bottom cap
8	Data plate
9	Drain hole
11	Air intake

Dim. in mm; Scala 1:2

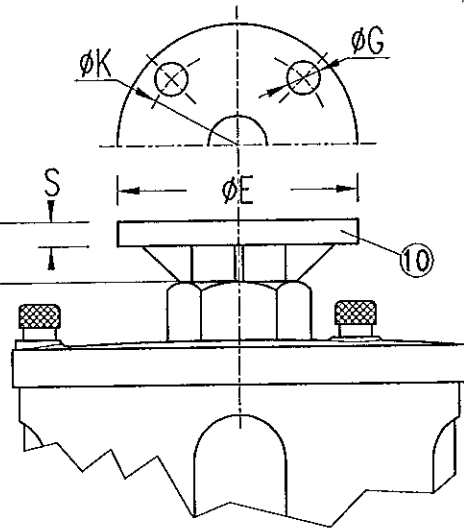
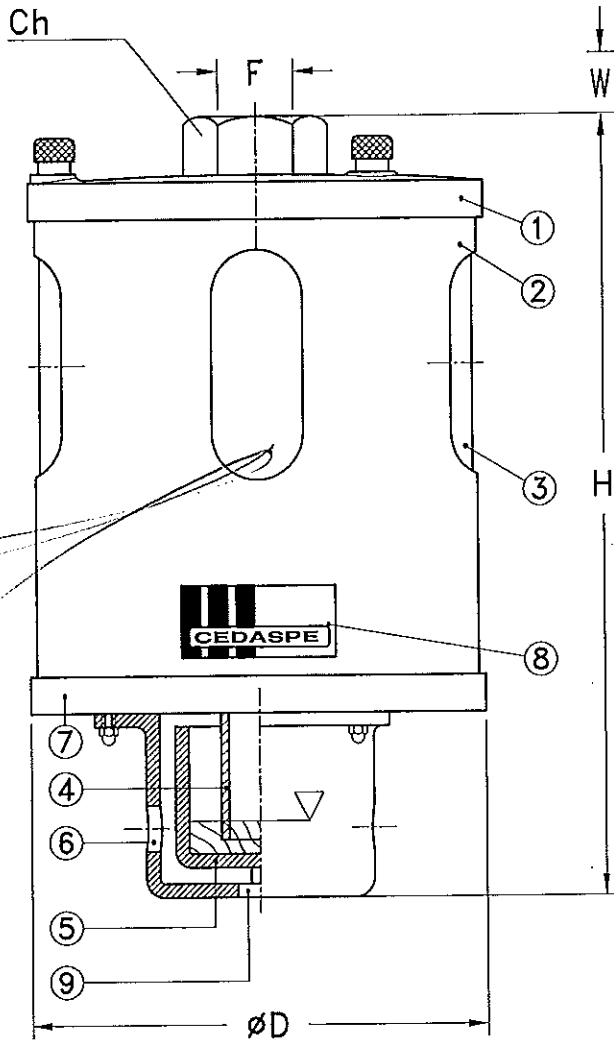
Tipo Type	Olio nel trasf. Transf. oil kg	Silicagel		NOTE:
		Q.ty Kg	Vol. dm ³	
TV75NE	700	0.25	0.35	senza protezione Pos. 2 Fig. A1 - w/out stainless steel housing
TV76NE				con protezione Pos. 2 Fig. A1 - with stainless steel housing
VE05	1500	0.50	0.65	con protezione Pos. 2 Fig. B1 - with stainless steel housing

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Essicatori d'aria per trasformatori di distribuzione
Dehydrating breathers for distribution transformers

Fig. B1
 - Raccordo flangiato
 - Flanged connection

Fig. A1
 - Raccordo filettato
 - Tapped connection



Pos	Descrizione/Description
1	Coperchio Top cap
2	Protezione acciaio inox Stainless steel housing
3	Contenitore trasparente di sabbia Gel container (transparent)
4	Pescante Fishing out cylinder
5	Coppa olio (trasparente) Oil cup (transparent)
6	Spia olio e presa d'aria Oil window and air intake
7	Coperchio inferiore Bottom cap
8	Targhetta d'identificazione Data plate
9	Scarico condensa Drain hole
10	Flangia Flange

▽ Livello olio
Oil level

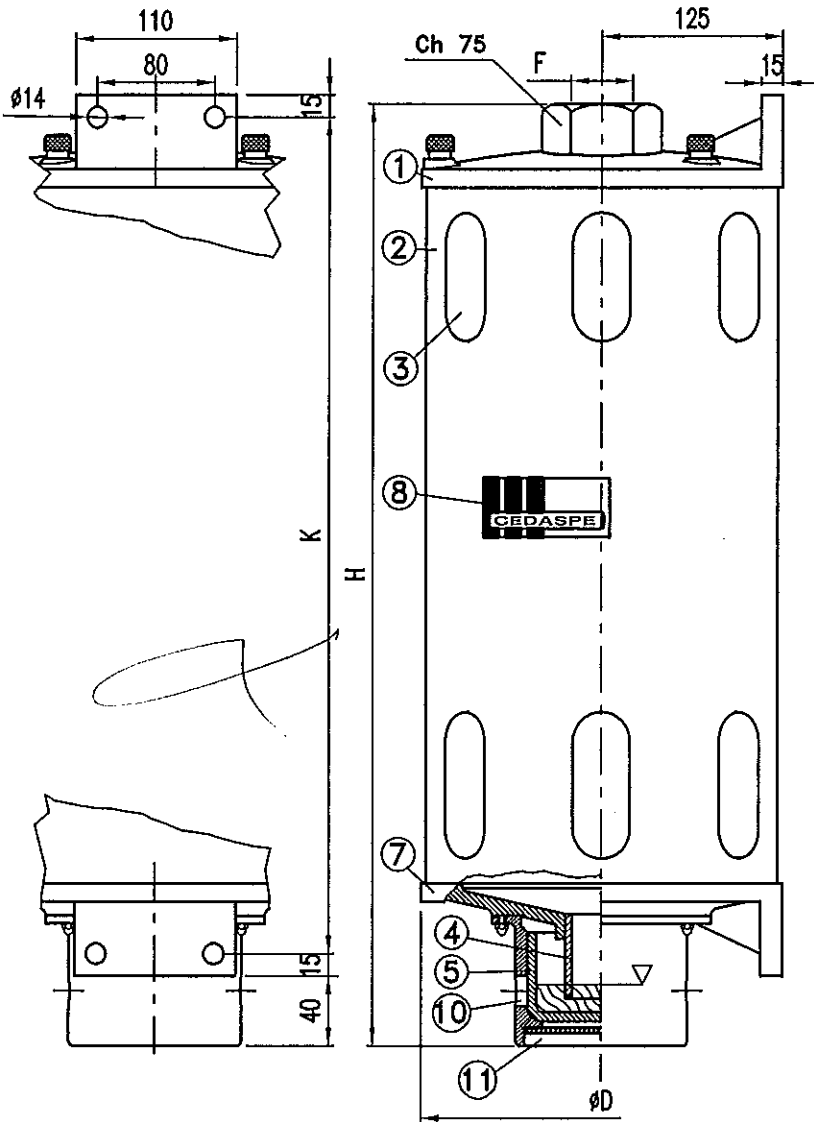
Tipo Type	Olio nel transf. Transf. oil kg	H mm	D mm	F	Silicagel		Ch mm	W mm	S mm	E mm	G mm	K mm
					Q.ty Kg	Vol. dm ³						
VE10	3500	245	140	1" G	1,00	1,35	46	25	10	100	11.5	75
VE15	5000	300			1,50	2,00						
VE30	10000	370	190	1 1/2" G	3,00	4,00	65	30	12	150	18.0	110
VE4-EL	22000	530			5,00	7,00						

Essicatori d'aria per trasformatori di potenza
 Dehydrating breathers for power transformers

5.47

Fig. A1

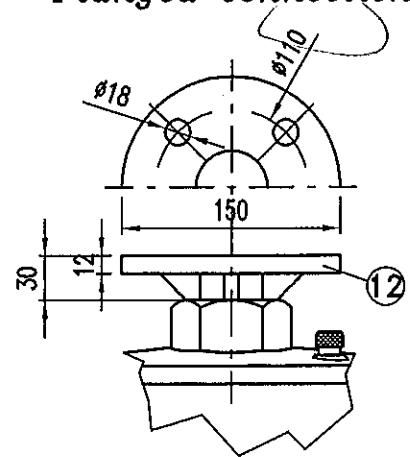
- Raccordo filettato
- Tapped connection



▽ Livello olio
Oil level

Fig. B1

- Raccordo flangiato
- Flanged connection



Pos	Descrizione/Description
1	Coperchio Top cap
2	Protezione acciaio inox Stainless steel housing
3	Contenitore trasparente di sili Gel container (transparent)
4	Pescante Fishing out cylinder
5	Coppa olio (trasparente) Oil cup (transparent)
7	Coperchio inferiore Bottom cap
8	Targhetta d'identificazione Data plate
9	Scarico condensa Drain hole
10	Spia olio Oil window
11	Presca d'aria Air intake
12	Flangia Flange

Tipo Type	Olio nel trasformatore Transformer oil	H	D	K	F	Silicagel	
						Q. ty kg	Vol. dm ³
VE50	17500 Kg	390 mm	245 mm	320 mm	1 1/2" G (*)	5,00	6,70
VE80	28000 Kg	485 mm		410 mm		8,00	10,70

Dim. in mm; Scala 1:5

(*) 2" G Solo su richiesta/Upon request

CEDASPE

Essicatori d'aria per trasformatori di potenza
Dehydrating breathers for power transformers

Fig. A1
 - Raccordo filettato
 - Tapped connection

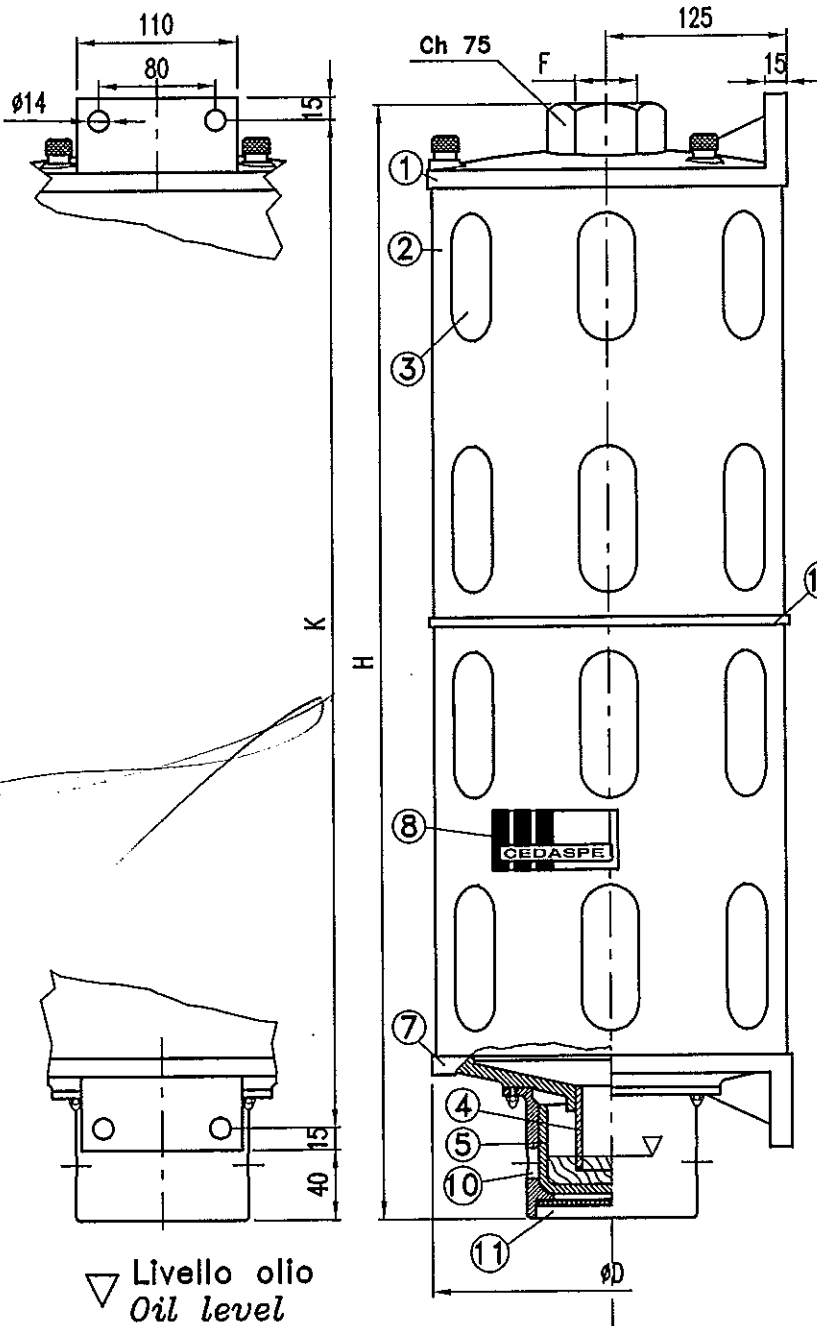
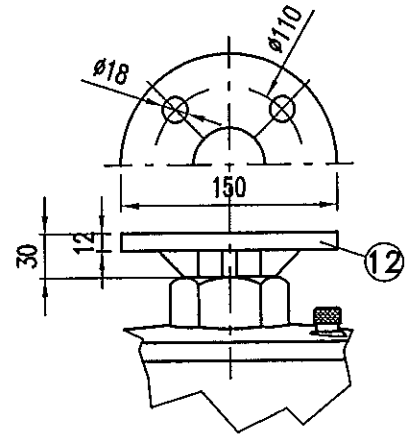


Fig. B1
 - Raccordo flangiato
 - Flanged connection



Pos	Descrizione / Description
1	Coperchio Top cap
2	Protezione acciaio inox Stainless steel housing
3	Contenitore trasparente di sili Gel container (transparent)
4	Pescante Fishing out cylinder
5	Coppa olio (trasparente) Oil cup (transparent)
7	Coperchio inferiore Bottom cap
8	Targhetta d'identificazione Data plate
9	Scarico condensa Drain hole
10	Splia olio Oil window
11	Presca d'aria Air intake
12	Flangia Flange
13	Flangia Intermedia Frame

Tipo Type	Olio nel trasformatore Transformer oil	H	D	K	F	Silicagel	
						Q.ty kg	Vol. dm ³
VE100	35000 Kg	650	245 mm	578 mm	1 1/2"G (*)	10,00	13,50
VE150	56000 Kg	830 mm		758 mm		15,00	21,00

Dim. in mm; Scala 1:5

(*) 2"G Solo su richiesta/Upon request

CEDASPE

Essicatori d'aria per trasformatore di potenza
 Dehydrating breathers for power transformers

Fig. A1

- Raccordo filettato
- Tapped connection

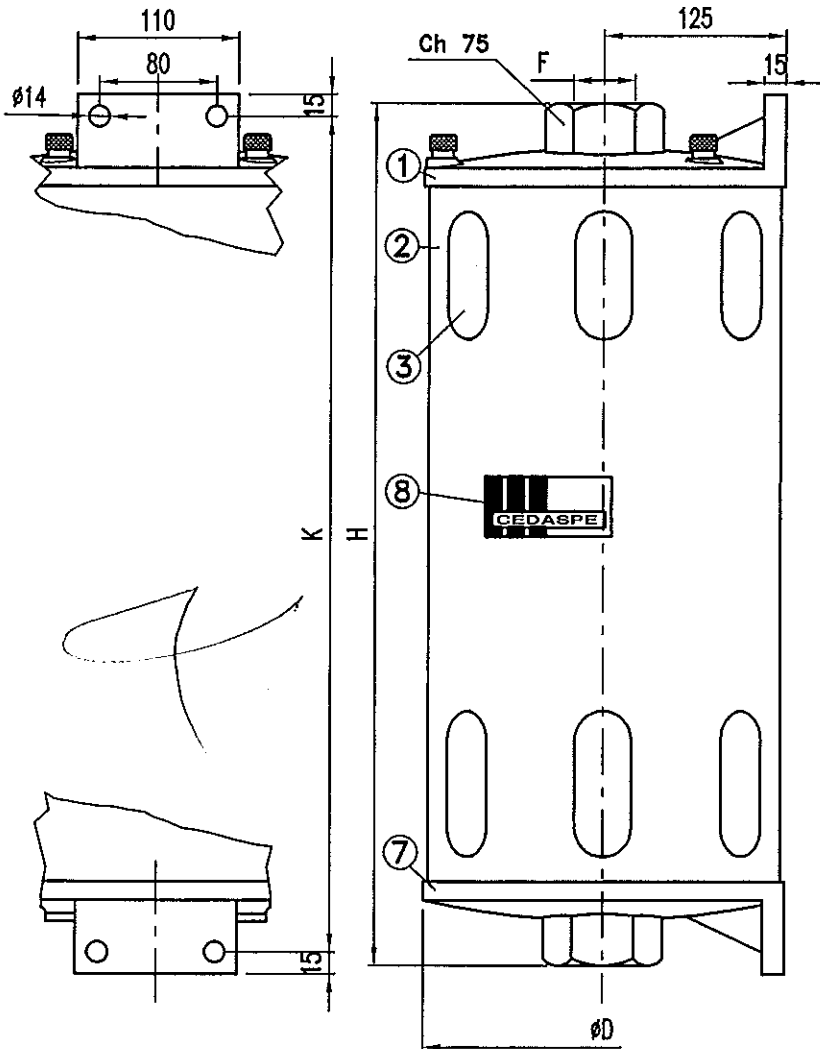
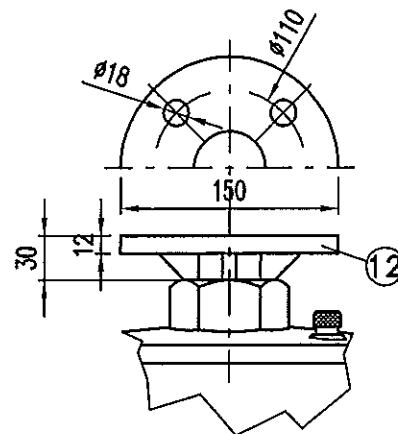


Fig. B1

- Raccordo flangiato
- Flanged connection



Pos	Descrizione / Description
1	Coperchio Top cap
2	Protezione acciaio inox Stainless steel housing
3	Contenitore trasparente di sili Gel container (transparent)
7	Coperchio Inferiore Bottom cap
8	Targhetta d'identificazione Data plate
12	Flangia Flange

Tipo Type	H	D	K	F	Silicagel	
					Q. ty Kg	Vol. dm ³
VE50M	345 mm	245 mm	320 mm	1 1/2" G (*)	5,00	6,70
VE80M	435 mm		410 mm		8,00	10,70
VE100M	605 mm		578 mm		10,00	13,50
VE150M	785 mm		758 mm		15,00	21,00

(*) 2" G Solo su richiesta / Upon request

Dim. in mm; Scala 1:5

CEDASPE

Modulo per montaggio multiplo essiccatori
Module for multiple assembly of dehydrating breathers

Fig. A1
 - Montaggio orizzontale
 - Horizontal assembly

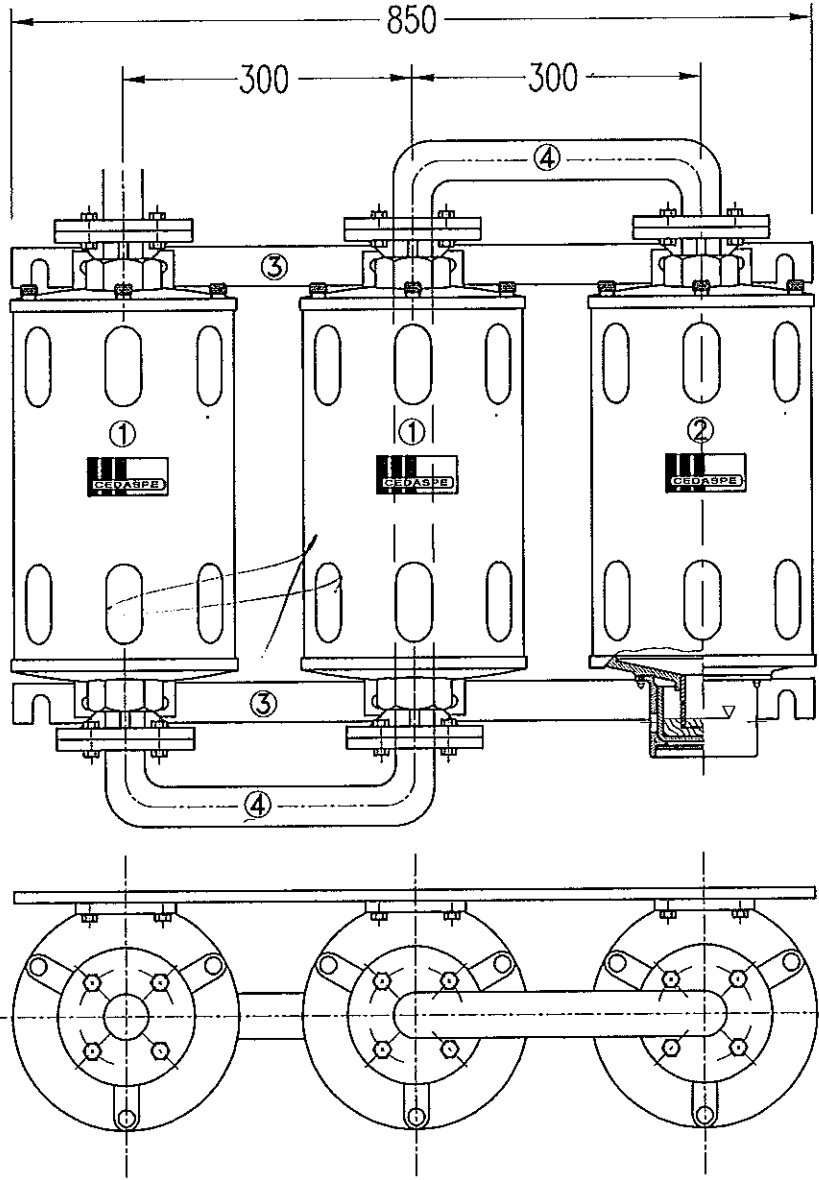
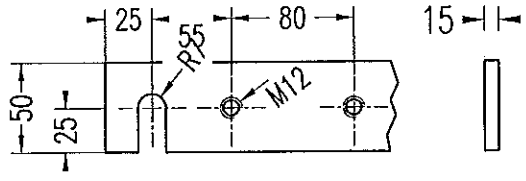
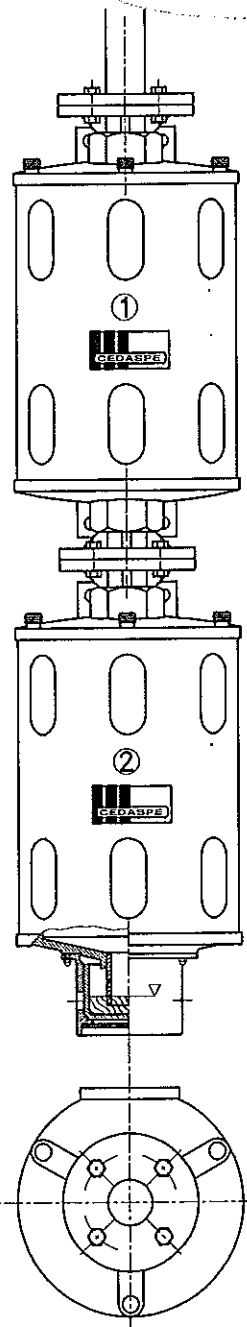


Fig. B1
 - Montaggio verticale
 - Vertical assembly



1	Breather module	VE50M	pag 5.49
		VE80M	pag 5.49
		VE100M	pag 5.49
		VE150M	pag 5.49
2	Breather	VE50	pag 5.47
		VE80	pag 5.47
		VE100	pag 5.48
		VE150	pag 5.48
3	Holder	Not supplied	
4	Connecting pipe	Not supplied	

1	Modulo essiccatore	VE50M	pag 5.49
		VE80M	pag 5.49
		VE100M	pag 5.49
		VE150M	pag 5.49
2	Essiccatore	VE50	pag 5.47
		VE80	pag 5.47
		VE100	pag 5.48
		VE150	pag 5.48
3	Supporto	Non fornito	
4	Tubo collegamento	Non fornito	

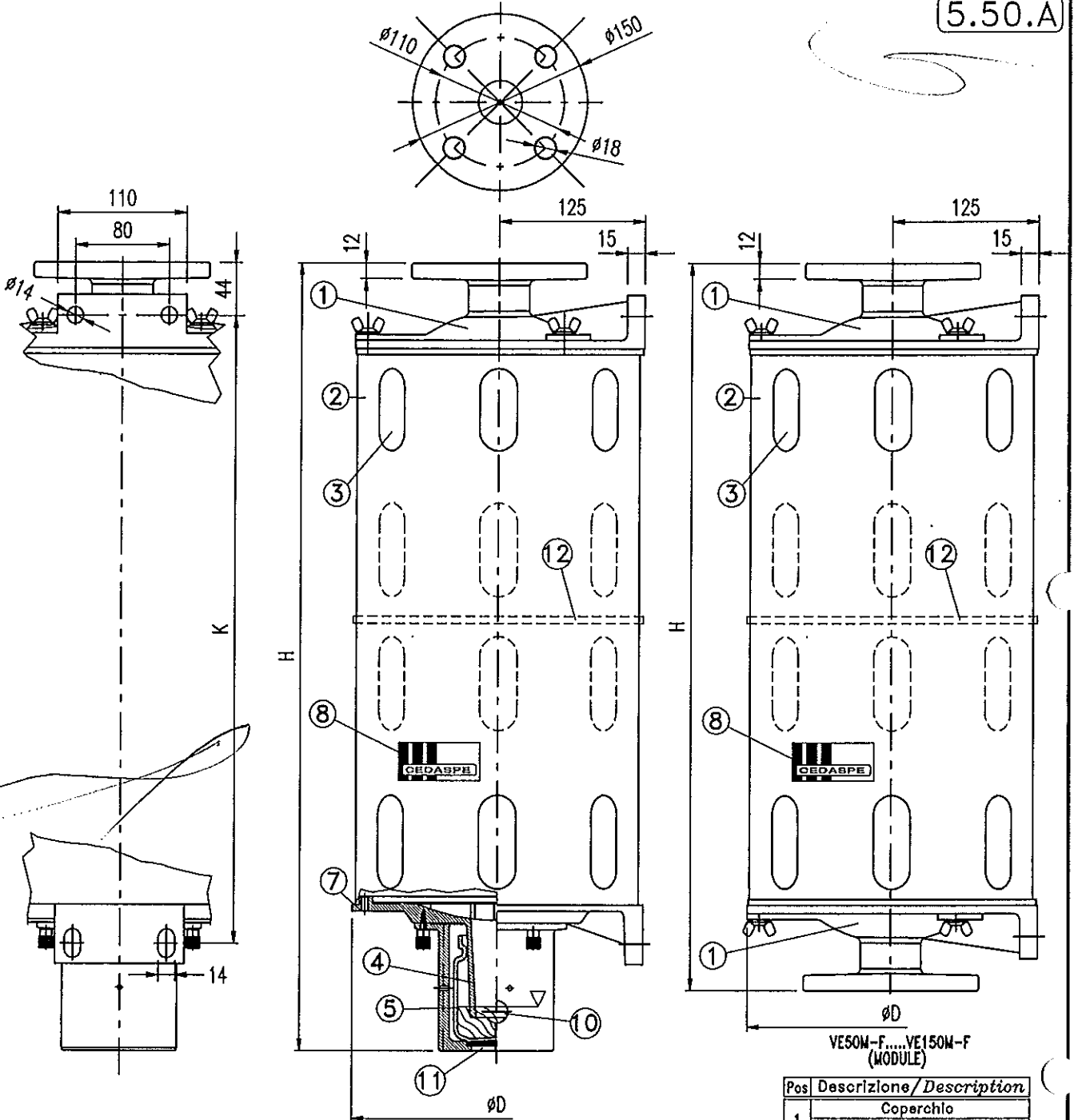
281

Dim. in mm; Scala 1:8



Esempio montaggio multiple essiccatori
 Example of multiple assembly of dehydrating breathers

5.50.A



VE50-F...VE150-F
(BREATHER)

VE50M-F...VE150M-F
(MODULE)

▽ Livello olio
Oil level

Tipo Type	Olio nel trasformatore Transformer oil	H	D	K	Sillcagel	
					Q. ty kg	Vol. dm ³
VE50-F	17500 Kg	453 mm	247 mm	317 mm	5,00	6,70
VE50M-F		410 mm				
VE80-F	28000 Kg	548 mm		427 mm	8,00	10,70
VE80M-F		505 mm				
VE100M-F	35000 Kg	716 mm	567 mm	10,00	13,50	
VE100-F		673 mm				
VE150-F	56000 Kg	896 mm	747 mm	15,00	21,00	
VE150M-F		853 mm				

Pos	Descrizione/Description
1	Coperchio Top cap
2	Protezione acciaio inox Stainless steel housing
3	Contenitore trasparente di sali Gel container (transparent)
4	Pescante Fishing out cyli der
5	Coppa olio (trasparente) Oil cup (transparent)
7	Coperchio inferiore Bottom cap
8	Targhetta d'identificazione Data plate
9	Scarico condensa Drain hole
10	Spia olio Oil window
11	Presa d'aria Air intake
12	Flangia intermedia Frame (VE100/150)

Dim. in mm; Scala 1:5

CEDASPE

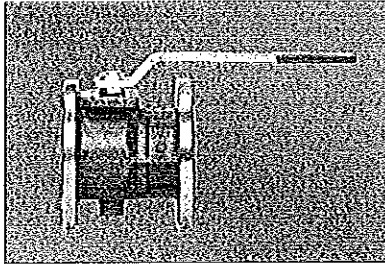
Essiccatori d'aria per trasformatori di potenza
Dehydrating breathers for power transformers
New model VE50....150-F

VALPRES

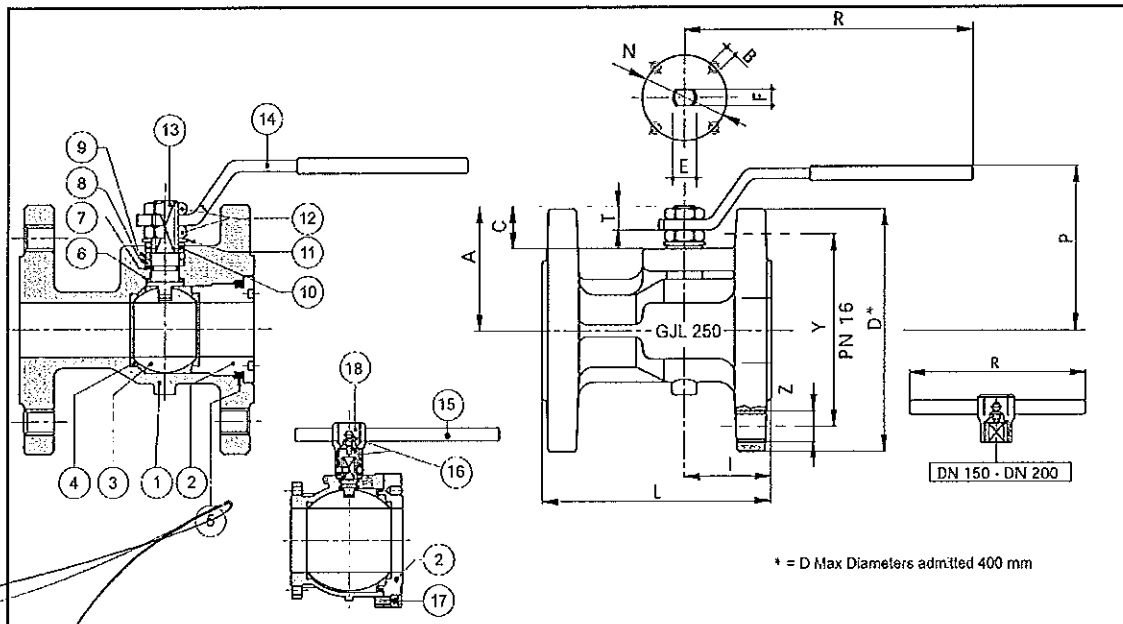
SERIE 730000 Art. 730000

TUV
T.A. LUFT

Valvola Notificata
STES



Full bore flanged ball valve, PN 16 in cast iron, from DN 25 to DN 200. Face to face dimension from DN 25 to DN 150 according to DIN 3202 F4 and DN 200 according to DIN 3202 F5.



* = D Max Diameters admitted 400 mm

POS.	PART NAME	MATERIALS	N°P.
1	BODY	EN-GJL 250	1
2	END CONNECTION	ASTM A105	1
3	BALL	CW617N UNI EN 12165	1
4	BALL SEAT	PTFE	2
5	RING	BUHA	1
6	THRUST WASHER	PTFE	1
7	O-RING	BUHA	1
8	STEM SEAT	PTFE	1
9	PACKING GLAND	CARBON STEEL	1
10	END STOP	1.4308 A5-130 (2025.35) / C45 (201 STEEL DIN 1701 250)	2 - 1
11	SPRING WASHER	CARBON STEEL	2
12	NUT	CARBON STEEL	2
13	STEM	A182-F304	1
14	HANDLE	CARBON STEEL	1
15	HANDLE DN 150-200	CARBON STEEL	1
16	SCREW	CARBON STEEL	1
17	SCREW	CARBON STEEL	8
18	BODY HANDLE DN 150	EN-GJL-250	1

SPECIFICATIONS

SERIE	73
THREAD ENDS	PN 6 - 10 - 16
NOMINAL DIAMETRE	From DN 25 to DN 200
MANEUVER	90° rotation of the lever
PAINTING	Epoxy painting Ral 3002
TESTING	100% tested
OPERATOR	UNI 7070 handle with blue PVC cover

APPLICATION

Assembly in flanged pipe system
 Other specifications in the Technical Specifications catalogue
 Nominal pressure (PN) in bar
 For temperature > 80°C see diagram in the Technical Specifications catalogue
 KV: flow coefficient in m³/h at differential pressure of 100 kPa
 Vacuum: Maximum 10³ torr
 Temperature range: -20°C +120°C OR Buna + 160°C Viton®
 Direction of flow: both directions
 We recommend the valve use in fully open or closed, not in mid position, and to manoeuvre the valve at least twice a year.

DN	D	Y	Z	I	L	R	P	A	C	T	E	F	N	B	KV	PN	Kg	
1"	25	115	85	4xM12	42	125	174,5	79	59	19,5	11,5	12	8	-	43	16	3,1	
1 1/4"	32	140	100	4xM16	47	150	174,5	85,5	64,5	18,5	10,5	12	8	-	69	16	4,8	
1 1/2"	40	150	110	4xM16	49	140	250,5	103	78	24	12,5	15	10	-	230	16	6,1	
2"	50	165	125	4xM16	52	150	250,5	110	85	24	12,5	15	10	-	265	16	7,8	
2 1/2"	65	185	145	4xM16	65	170	321,5	125,5	103	28	18	20	14	-	540	16	11,4	
3"	80	200	160	6xM16	65	180	321,5	137,5	114	28	18	20	14	70	M 8	873	16	14,1
4"	100	220	180	6xM16	69	190	381,5	158	137	32,5	20,5	24	18	102	M10	1390	16	20
5"	125	250	210	8xM16	100	200	381,5	178,5	159,5	32,5	21,5	24	18	102	M10	1707	16	30,4
6"	150	285	240	8xM20	105	210	700	237	201,5	51,5	30	42	30	125	M12	2024	16	44,5
8"	200	340*	295	12xø22	200	400	700	279	244	52	30	42	30	125	M12	2720	16	103

OPTIONS AVAILABLE

730001 PN 10 flange from DN 80 to DN 200

730002 PN 6 flange from DN 40 to DN 80

730003 Ball and stem AISI 304-CF8 from DN 40 to DN 200

730004 PTFE, Viton® stem seal

730005 Without holes

730008 Drilled ISO 5211

730014 Stem extension over A37 blue

730015 For oxygen





Nytro Lyra X

SAFETY DATA SHEET

Date of printing	2016-02-19
Date of issue/ Date of revision	2016-02-19
Date of previous issue	2015-09-17
Version	2

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifier

Product name	Nytro Lyra X
Product description	Insulating oil
Product type	Liquid.
MARPOL Annex 1	Oils

1.2 Identified uses

Identified uses
Use in formulations in lubricants- Industrial
Use as lubricant in open and closed systems - Professional
Distribution of substance - Industrial
Formulation and (re)packing of substances and mixtures - Industrial
Manufacture of substance - Industrial
Functional Fluids - Industrial
Functional Fluids - Professional

Uses advised against	Reason
This product must not be used in applications other than those recommended in Section 1, without first seeking the advice of the supplier.	-

1.3 Details of the supplier of the safety data sheet

Supplier/Manufacturer Head office:
 Nynas AB
 P.O. Box 10700
 SE-121 29 Stockholm
 SWEDEN
 +46 8 602 12 00 (Office hours 8 am - 4.30 pm (CET))
 www.nynas.com

e-mail address of person responsible for this SDS ProductHSE@nynas.com

1.4 Emergency telephone number

Telephone number +44 (0) 1235 239 670
 Hours of operation 24 hour service

National advisory body/Poison Centre

Telephone number 020 - 99 60 00 (Kemiakuten, 24h service)

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Nytro Lyra X

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

Product definition Mixture

Classification according to Regulation (EC) No. 1272/2008 [CLP/GHS]

Asp. Tox. 1, H304
Aquatic Chronic 3, H412

The product is classified as hazardous according to Regulation (EC) 1272/2008 as amended.

See Section 16 for the full text of the H statements declared above.

See Section 11 for more detailed information on health effects and symptoms.

2.2 Label elements

Hazard pictograms



Signal word Danger

Hazard statements
H304 - May be fatal if swallowed and enters airways.
H412 - Harmful to aquatic life with long lasting effects.

Precautionary statements

Prevention P273 - Avoid release to the environment.
Response P301 - IF SWALLOWED:
P310 - Immediately call a POISON CENTER or physician.
P331 - Do NOT induce vomiting.

Storage Not applicable.

Disposal P501 - Dispose of contents and container in accordance with all local, regional, national and international regulations.

Annex XVII - Restrictions on the manufacture, placing on the market and use of certain dangerous substances, mixtures and articles

2.3 Other hazards

Substance meets the criteria for PBT according to Regulation (EC) No. 1907/2006, Annex XIII Not applicable.

Substance meets the criteria for vPvB according to Regulation (EC) No. 1907/2006, Annex XIII Not applicable.

SECTION 3: Composition/information on ingredients

3.2 Mixtures Mixture

Product/ingredient name	Identifiers	%	Classification	Type
			Regulation (EC) No. 1272/2008 [CLP]	
Distillate (petroleum), hydrotreated light naphthenic	REACH #: 01-2119480375-34 EC: 265-156-6 CAS: 64742-53-6 Index: 649-466-00-2	50 - 100	Asp. Tox. 1, H304	[1]
Distillate (petroleum), hydrotreated light	REACH #: 01-2119487077-29	0 - 50	Asp. Tox. 1, H304	[1]

Nytro Lyra X

SECTION 3: Composition/information on ingredients

paraffinic Lubricating oils (petroleum), C20-50, hydrotreated neutral oil-based	EC: 265-158-7 CAS: 64742-55-8 REACH #: 01-2119474889-13 EC: 276-738-4 CAS: 72623-87-1 Index: 649-483-00-5	0 - 50	Asp. Tox. 1, H304	[1]
Distillate (petroleum), hydrotreated heavy paraffinic	REACH #: 01-2119484627-25 EC: 265-157-1 CAS: 64742-54-7 Index: 649-467-00-8	0 - 50	Asp. Tox. 1, H304	[1]
Lubricating oils (petroleum), C15-30, hydrotreated neutral oil-based	REACH #: 01-2119474878-16 EC: 276-737-9 CAS: 72623-86-0 Index: 649-482-00-X	0 - 30	Asp. Tox. 1, H304	[1]
2,6-di-tert-butyl-p-cresol	REACH #: 01-2119555270-46 EC: 204-881-4 CAS: 128-37-0	<0.4	Aquatic Acute 1, H400 (M=1) Aquatic Chronic 1, H410 (M=1)	[1]
			See Section 16 for the full text of the H statements declared above.	

Annex I Nota L applies to the base oil(s) in this product. Nota L - The classification as a carcinogen need not apply if it can be shown that the substance contains less than 3 % DMSO extract as measured by IP 346.

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health or the environment, are PBTs or vPvBs or have been assigned a workplace exposure limit and hence require reporting in this section.

Type

- [1] Substance classified with a health or environmental hazard
- [2] Substance with a workplace exposure limit
- [3] Substance meets the criteria for PBT according to Regulation (EC) No. 1907/2006, Annex XIII
- [4] Substance meets the criteria for vPvB according to Regulation (EC) No. 1907/2006, Annex XIII
- [5] Substance of equivalent concern

SECTION 4: First aid measures

4.1 Description of first aid measures

Eye contact	Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If irritation, blurred vision or swelling occurs and persists, obtain medical advice from a specialist.
Inhalation	If breathing is difficult, remove victim to fresh air and keep at rest in a position comfortable for breathing. If casualty is unconscious and: If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. Get medical attention if adverse health effects persist or are severe. Maintain an open airway.
Skin contact	Wash with soap and water. Remove contaminated clothing and shoes. Handle with care and dispose of in a safe manner. Seek medical attention if skin irritation, swelling or redness develops and persists. Accidental high pressure injection through the skin requires immediate medical attention. Do not wait for symptoms to develop.
Ingestion	Always assume that aspiration has occurred. Do not induce vomiting. Can enter lungs and cause damage. If vomiting occurs, the head should be kept low so that vomit does not enter the lungs. Seek professional medical attention or send the casualty to a hospital. Do not wait for symptoms to develop. Never give anything by mouth to an unconscious person. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway.

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SECTION 4: First aid measures

Loosen tight clothing such as a collar, tie, belt or waistband.

Protection of first-aiders No action shall be taken involving any personal risk or without suitable training. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation.

Before attempting to rescue casualties, isolate area from all potential sources of ignition including disconnecting electrical supply. Ensure adequate ventilation and check that a safe, breathable atmosphere is present before entry into confined spaces.

4.2 Most important symptoms and effects, both acute and delayed

Potential acute health effects

Eye contact Eye contact may cause redness and transient pain.

Inhalation Inhalation of oil mist or vapours at elevated temperatures may cause respiratory irritation.

Skin contact No known significant effects or critical hazards.

Ingestion May be fatal if swallowed and enters airways.

4.3 Indication of any immediate medical attention and special treatment needed

Notes to physician Due to low viscosity there is a risk of aspiration if the product enters the lungs. Treat symptomatically.

Specific treatments Always assume that aspiration has occurred.

SECTION 5: Firefighting measures

5.1 Extinguishing media

Suitable extinguishing media Use dry chemical, CO₂, water spray (fog) or foam.

Unsuitable extinguishing media Do not use direct water jets on the burning product; they could cause splattering and spread the fire. Simultaneous use of foam and water on the same surface is to be avoided as water destroys the foam.

5.2 Special hazards arising from the substance or mixture

Hazards from the substance or mixture In a fire or if heated, a pressure increase will occur and the container may burst. This substance will float and can be reignited on surface water. Fire water contaminated with this material must be contained and prevented from being discharged to any waterway, sewer or drain.

Hazardous thermal decomposition products Incomplete combustion is likely to give rise to a complex mixture of airborne solid and liquid particulates, gases, including carbon monoxide, H₂S, SO_x (sulfur oxides) or sulfuric acid and unidentified organic and inorganic compounds.

5.3 Advice for firefighters

Special precautions for fire-fighters Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training.

Special protective equipment for fire-fighters Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode. Clothing for fire-fighters (including helmets, protective boots and gloves) conforming to European standard EN 469 will provide a basic level of protection for chemical incidents.

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SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

For non-emergency personnel

Avoid breathing vapour or mist. Keep non-involved personnel away from the area of spillage. Alert emergency personnel. Except in case of small spillages, the feasibility of any actions should always be assessed and advised, if possible, by a trained, competent person in charge of managing the emergency. Stop leak if safe to do so. Avoid direct contact with the product. Stay upwind/keep distance from source. In case of large spillages, alert occupants in downwind areas.

Eliminate all ignition sources if safe to do so. Spillages of limited amounts of product, especially in the open air when vapours will be usually quickly dispersed, are dynamic situations, which will presumably limit the exposure to dangerous concentrations.

Note : recommended measures are based on the most likely spillage scenarios for this material; however, local conditions (wind, air temperature, wave/current direction and speed) may significantly influence the choice of appropriate actions. For this reason, local experts should be consulted when necessary. Local regulations may also prescribe or limit actions to be taken.

For emergency responders

Small spillages: normal antistatic working clothes are usually adequate.

Large spillages: full body suit of chemically resistant and thermal resistant material should be used. Work gloves providing adequate chemical resistance, specifically to aromatic hydrocarbons. Note : gloves made of PVA are not water-resistant, and are not suitable for emergency use. Safety helmet, antistatic non-skid safety shoes or boots. Goggles and /or face shield, if splashes or contact with eyes is possible or anticipated.

Respiratory protection : A half or full-face respirator with filter(s) for organic vapours (and when applicable for H2S) a Self Contained Breathing Apparatus (SCBA) can be used according to the extent of spill and predictable amount of exposure. If the situation cannot be completely assessed, or if an oxygen deficiency is possible, only SCBA's should be used.

6.2 Environmental precautions

Water polluting material. May be harmful to the environment if released in large quantities. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air). Prevent product from entering sewers, rivers or other bodies of water. If necessary dike the product with dry earth, sand or similar non-combustible materials. In case of soil contamination, remove contaminated soil and treat in accordance with local regulations.

In case of small spillages in closed waters (i.e. ports), contain product with floating barriers or other equipment. Collect spilled product by absorbing with specific floating absorbents.

If possible, large spillages in open waters should be contained with floating barriers or other mechanical means. If this is not possible, control the spreading of the spillage, and collect the product by skimming or other suitable mechanical means. The use of dispersants should be advised by an expert, and, if required, approved by local authorities.

6.3 Methods and material for containment and cleaning up

Small spill

Stop leak if without risk. Absorb spilled product with suitable non-combustible materials.

Large spill

Large spillages may be cautiously covered with foam, if available, to limit vapour cloud formation. Do not use water jet. When inside buildings or confined spaces, ensure adequate ventilation. Transfer collected product and other contaminated materials to suitable containers for recovery or safe disposal.

6.4 Reference to other sections

See Section 1 for emergency contact information.
See Section 8 for information on appropriate personal protective equipment.
See Section 13 for additional waste treatment information.

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SECTION 7: Handling and storage

The information in this section contains generic advice and guidance. The list of Identified Uses in Section 1 should be consulted for any available use-specific information provided in the Exposure Scenario(s).

General information

Obtain special instructions before use. Keep away from heat/sparks/open flames/hot surfaces. - No smoking. Use and store only outdoors or in a well-ventilated area. Hazard of slipping on spilt product. Avoid release to the environment.

7.1 Precautions for safe handling

Protective measures

Do not ingest. Do not breathe dust/fume/gas/mist/vapours/spray. Avoid contact with eyes, skin and clothing.

Prevent the risk of slipping. Take precautionary measures against static discharge. Avoid splash filling of bulk volumes when handling hot liquid product.

Avoid release to the environment.

Nota : See Section 8 for information on appropriate personal protective equipment. See section 13 for waste disposal information.

Advice on general occupational hygiene

Ensure that proper housekeeping measures are in place. Contaminated materials should not be allowed to accumulate in the workplaces and should never be kept inside the pockets. Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Wash hands thoroughly after handling. Change contaminated clothes at the end of working shift. See also Section 8 for additional information on hygiene measures.

7.2 Conditions for safe storage, including any incompatibilities

Storage area layout, tank design, equipment and operating procedures must comply with the relevant regional, national or local legislation. Storage installations should be designed with adequate bunds in case of leaks or spills. Cleaning, inspection and maintenance of internal structure of storage tanks must be done only by properly equipped and qualified personnel as defined by national, local or company regulations.

Store separately from oxidising agents.

Recommended materials for containers, or container linings use mild steel, stainless steel. Not suitable : Some synthetic materials may be unsuitable for containers or container linings depending on the material specification and intended use. Compatibility should be checked with the manufacturer.

Keep only in the original container or in a suitable container for this kind of product. Keep container tightly closed and sealed until ready for use. Do not store in unlabelled containers. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Empty containers may contain harmful, flammable/combustible or explosive residue or vapours. Do not cut, grind, drill, weld, reuse or dispose of containers unless adequate precautions are taken against these hazards. Store locked up. Protect from sunlight.

7.3 Specific end use(s)

Recommendations

Not available.

Industrial sector specific solutions

Not available.

SECTION 8: Exposure controls/personal protection

The list of Identified Uses in Section 1 should be consulted for any available use-specific information provided in the Exposure Scenario(s).

8.1 Control parameters

Occupational exposure limits

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SECTION 8: Exposure controls/personal protection

Product/ingredient name	Exposure limit values
Oil mist	[Air contaminant] AFS 2011:18 (Sweden, 12/2011). TWA: 1 mg/m ³ 8 hours. Form: mist and fume STEL: 3 mg/m ³ 15 minutes. Form: mist and fume

Recommended monitoring procedures

If this product contains ingredients with exposure limits, personal, workplace atmosphere or biological monitoring may be required to determine the effectiveness of the ventilation or other control measures and/or the necessity to use respiratory protective equipment. Reference should be made to monitoring standards, such as the following: European Standard EN 689 (Workplace atmospheres - Guidance for the assessment of exposure by inhalation to chemical agents for comparison with limit values and measurement strategy) European Standard EN 14042 (Workplace atmospheres - Guide for the application and use of procedures for the assessment of exposure to chemical and biological agents) European Standard EN 482 (Workplace atmospheres - General requirements for the performance of procedures for the measurement of chemical agents) Reference to national guidance documents for methods for the determination of hazardous substances will also be required.

DNELs/DMELs

Product/ingredient name	Type	Exposure	Value	Population	Effects
Distillate (petroleum), hydrotreated light naphthenic	DNEL	Long term Inhalation	5,4 mg/m ³	Workers	Local
Distillate (petroleum), hydrotreated light paraffinic	DNEL	Long term Inhalation	5,4 mg/m ³	Workers	Local
Distillates (petroleum), hydrotreated heavy paraffinic	DNEL	Long term Inhalation	5,4	Workers	Local

PNECs

Product/ingredient name	Compartment Detail	Value	Method Detail
2,6-Di-tert-butyl-p-cresol	Soil	1.04 mg/kg wwt	Equilibrium Partitioning Assessment Factors
	Sewage Treatment Plant	100 mg/l	
	Sediment	1.29 mg/kg wwt	Equilibrium Partitioning Assessment Factors
	Secondary Poisoning	16.7 mg/kg	
	Marine water	0.4 µg/l	Assessment Factors
	Fresh water	4 µg/l	Assessment Factors

PNEC Summary

The Hydrocarbon Block Method has been used to calculate environmental exposure with the Petrorisk model.

8.2 Exposure controls

Appropriate engineering controls

Mechanical ventilation and local exhaust will reduce exposure via the air. Use oil resistant material in construction of handling equipment. Store under recommended conditions and if heated, temperature control equipment should be used to avoid overheating.

Individual protection measures

Hygiene measures

Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Ensure that eyewash stations and safety showers are close to the workstation location. Wash contaminated clothing before reuse.

Eye/face protection

Recommended: safety glasses with side-shields

Skin protection

Hand protection

4 - 8 hours (breakthrough time): nitrile rubber

Body protection

Wear protective clothing if there is a risk of skin contact. Change contaminated clothes at the end of working shift.

Other skin protection

Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

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SECTION 8: Exposure controls/personal protection

Respiratory protection	Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator. Use a properly fitted, particulate filter respirator complying with an approved standard if a risk assessment indicates this is necessary.
Environmental exposure controls	Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

Appearance

Physical state	Liquid.
Colour	Light yellow
Odour	Odourless/Light petroleum.
Odour threshold	Not available.
pH	Not applicable.
Melting point/freezing point	-48°C
Initial boiling point and boiling range	>250°C
Flash point	Closed cup: >140°C [Pensky-Martens.]
Evaporation rate	Not available.
Flammability (solid, gas)	Not available.
Upper/lower flammability or explosive limits	Not available.
Vapour pressure	160 Pa @ 100 °C
Density	0.87 g/cm ³ [15°C]
Solubility(ies)	Insoluble in water.
Partition coefficient: n-octanol/water	Not available.
Auto-ignition temperature	>270°C
Decomposition temperature	>280°C
Viscosity	Kinematic (40°C): 0.093 cm ² /s (9.3 cSt)
Explosive properties	Not available.
Oxidising properties	Not available.
DMSO extractable compounds for base oil substance(s) according to IP346	< 3%

SECTION 10: Stability and reactivity

10.1 Reactivity	No specific test data related to reactivity available for this product or its ingredients.
10.2 Chemical stability	Stable under normal conditions.
10.3 Possibility of hazardous reactions	Under normal conditions of storage and use, hazardous reactions will not occur.
10.4 Conditions to avoid	Oxidising agent.
10.5 Incompatible materials	Keep away from extreme heat and oxidizing agents.
10.6 Hazardous decomposition products	Incomplete combustion is likely to give rise to a complex mixture of airborne solid and liquid particulates, gases, including carbon monoxide, H ₂ S, SO _x (sulfur oxides) or sulfuric acid and unidentified organic and inorganic compounds.

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SECTION 11: Toxicological information

11.1 Information on toxicological effects

Acute toxicity

Product/ingredient name	Result	Species	Dose	Exposure	Remarks
Distillate (petroleum), hydrotreated light naphthenic	LC50 Inhalation Dusts and mists	Rat - Male, Female	>5.53 mg/l	4 hours	EMBSI 1988a (similar material)
	LD50 Dermal	Rabbit	>5000 mg/kg	-	API 1982 (similar material)
	LD50 Oral	Rat	>5000 mg/kg	-	API 1986a (similar material)
Distillate (petroleum), hydrotreated light paraffinic	LC50 Inhalation Dusts and mists	Rat - Male, Female	>5.53 mg/l	4 hours	EMBSI 1988a (similar material)
	LD50 Dermal	Rabbit	>5000 mg/kg	-	API 1982 (similar material)
	LD50 Oral	Rat	>5000 mg/kg	-	API 1986a (similar material)
Lubricating oils (petroleum), C20-50, hydrotreated neutral oil-based	LC50 Inhalation Dusts and mists	Rat - Male, Female	>5.53 mg/l	4 hours	EMBSI 1988a (similar material)
	LD50 Dermal	Rabbit	>5000 mg/kg	-	API 1982 (similar material)
	LD50 Oral	Rat	>5000 mg/kg	-	API 1986a (similar material)
Distillate (petroleum), hydrotreated heavy paraffinic	LC50 Inhalation Dusts and mists	Rat	>5.53 mg/l	4 hours	EMBSI 1988a (similar material)
	LD50 Dermal	Rabbit	>5000 mg/kg	-	API 1982 (similar material)
	LD50 Oral	Rat	>5000 mg/kg	-	API 1986a (similar material)
Lubricating oils (petroleum), C15-30, hydrotreated neutral oil-based	LC50 Inhalation Dusts and mists	Rat - Male, Female	>5.53 mg/l	4 hours	EMBSI 1988a (similar material)
	LD50 Dermal	Rabbit	>5000 mg/kg	-	API 1982 (similar material)
	LD50 Oral	Rat	>5000 mg/kg	-	API 1986a (similar material)
2,6-di-tert-butyl-p-cresol	LD50 Dermal	Rat	>5000 mg/kg	-	Supplier's information
	LD50 Oral	Rat	>5000 mg/kg	-	Supplier's information

Conclusion/Summary

No known significant effects or critical hazards.

Irritation/Corrosion

Product/ingredient name	Result	Species	Score	Observation	Remarks
Distillate (petroleum), hydrotreated light naphthenic	Skin - Non-irritant to skin.	Rabbit	0 to 0.8	24 to 72 hours	UBTL 1984e (similar material)
	Eyes - Non-irritating to the eyes.	Rabbit	0.17 to 0.33	24 to 72 hours	UBTL 1984i (similar material)
Distillate (petroleum), hydrotreated light paraffinic	Skin - Non-irritant to skin.	Rabbit	0 to 0.8	24 to 72 hours	UBTL 1984e (similar material)
	Eyes - Non-irritating to the eyes.	Rabbit	0.17 to 0.33	24 to 72 hours	UBTL 1984i (similar material)
Lubricating oils	Skin - Non-irritant to skin.	Rabbit	0 to 0.8	24 to 72 hours	UBTL 1984e (similar material)

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SECTION 11: Toxicological information

(petroleum), C20-50, hydrotreated neutral oil-based	Eyes - Non-irritating to the eyes. Skin - Non-irritant to skin.	Rabbit	0.17 to 0.33	24 to 72 hours	(similar material) UBTL 1984i (similar material)
Distillate (petroleum), hydrotreated heavy paraffinic		Rabbit	0 to 0.8	24 to 72 hours	UBTL 1984e (similar material)
Lubricating oils (petroleum), C15-30, hydrotreated neutral oil-based	Eyes - Non-irritating to the eyes.	Rabbit	0.17 to 0.33	24 to 72 hours	UBTL 1984i (similar material)
2,6-di-tert-butyl-p-cresol	Eyes - Non-irritating to the eyes.	Rabbit	0.17 to 0.33	24 to 72 hours	UBTL 1984i (similar material)
	Eyes - Redness of the conjunctivae	Rabbit	0.5	-	Supplier's information
	Eyes - Iris lesion	Rabbit	0	-	Supplier's information
	Eyes - Oedema of the conjunctivae	Rabbit	0.1	-	-

Skin No known significant effects or critical hazards.
 Eyes No known significant effects or critical hazards.
 Respiratory No known significant effects or critical hazards.

Sensitisation

Product/ingredient name	Route of exposure	Species	Result	Remarks
Distillate (petroleum), hydrotreated light naphthenic	skin	Guinea pig	Not sensitizing	UBTL 1984j,k,l (similar material)
Distillate (petroleum), hydrotreated light paraffinic	skin	Guinea pig	Not sensitizing	UBTL 1984j,k,l (similar material)
Lubricating oils (petroleum), C20-50, hydrotreated neutral oil-based	skin	Guinea pig	Not sensitizing	UBTL 1984j,k,l (similar material)
Distillate (petroleum), hydrotreated heavy paraffinic	skin	Guinea pig	Not sensitizing	UBTL 1984j,k,l (similar material)
Lubricating oils (petroleum), C15-30, hydrotreated neutral oil-based	skin	Guinea pig	Not sensitizing	UBTL 1984j,k,l (similar material)

Skin No known significant effects or critical hazards.
 Respiratory No known significant effects or critical hazards.

Mutagenicity

Product/ingredient name	Test	Experiment	Result	Remarks
Distillate (petroleum), hydrotreated light naphthenic	OECD 473 473 In vitro Mammalian Chromosomal Aberration Test	Experiment: In vitro Subject: Mammalian-Animal Metabolic activation: with and without	Negative	-
Distillate (petroleum), hydrotreated light	OECD 473 473 In vitro	Experiment: In vitro	Negative	-

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SECTION 11: Toxicological information

paraffinic	Mammalian Chromosomal Aberration Test	Subject: Mammalian-Animal Experiment: In vitro	Negative	-
Lubricating oils (petroleum), C20-50, hydrotreated neutral oil-based	OECD 473 473 In vitro Mammalian Chromosomal Aberration Test	Subject: Mammalian-Animal Metabolic activation: with and without Experiment: In vitro	Negative	-
Distillate (petroleum), hydrotreated heavy paraffinic	OECD 473 473 In vitro Mammalian Chromosomal Aberration Test	Subject: Mammalian-Animal Metabolic activation: With and without Experiment: In vitro	Negative	-
Lubricating oils (petroleum), C15-30, hydrotreated neutral oil-based	OECD 473 473 In vitro Mammalian Chromosomal Aberration Test	Subject: Mammalian-Animal Metabolic activation: with and without Experiment: In vitro	Negative	-
2,6-di-tert-butyl-p-cresol	476 In vitro Mammalian Cell Gene Mutation Test	Subject: Mammalian-Animal Cell: Somatic Experiment: In vitro	Negative	-
	473 In vitro Mammalian Chromosomal Aberration Test	Subject: Mammalian-Animal Cell: Germ	Negative	-

Conclusion/Summary No known significant effects or critical hazards.

Carcinogenicity

Product/ingredient name	Result	Species	Dose	Exposure	Remarks
Distillate (petroleum), hydrotreated light naphthenic	Negative - Dermal	Mouse - Female	0.22 to 0.25 ml	78 weeks; Various	Doak, 1983, McKee, 1989 (similar material)
Distillate (petroleum), hydrotreated light paraffinic	Negative - Dermal	Mouse - Female	0.22 to 0.25 ml	78 weeks; Various	Doak, 1983, McKee, 1989 (similar material)
Lubricating oils (petroleum), C20-50, hydrotreated neutral oil-based	Negative - Dermal	Mouse - Female	0.22 to 0.25 ml	78 weeks; Various	Doak, 1983, McKee, 1989 (similar material)
Distillate (petroleum), hydrotreated heavy	Negative - Dermal	Mouse - Female	0.22 to 0.25 ml	78 weeks; Various	Doak, 1983, McKee, 1989 (similar material)

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paraffinic Lubricating oils (petroleum), C15-30, hydrotreated neutral oil- based	Negative - Dermal	Mouse - Female	0.22 to 0.25 ml	78 weeks; Various	Doak, 1983; McKee, 1989 (similar material)
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Conclusion/Summary The base oil(s) in this product is based on an severely hydrotreated distillate. The product should not be regarded as a carcinogen.

Reproductive toxicity

Teratogenicity

Product/ingredient name	Result	Species	Dose	Exposure	Remarks
Distillate (petroleum), hydrotreated light naphthenic	Negative - Dermal	Rat	0 to 2000 mg/kg mg/ kg/day	-	(similar material)
Distillate (petroleum), hydrotreated light paraffinic	Negative - Dermal	Rat	0 to 2000 mg/kg mg/ kg/day	-	-
Lubricating oils (petroleum), C20-50, hydrotreated neutral oil- based	Negative - Dermal	Rat	0 to 2000 mg/kg mg/ kg/day	-	-
Distillate (petroleum), hydrotreated heavy paraffinic	Negative - Dermal	Rat	0 to 2000 mg/kg mg/ kg bw/day	-	1987 (similar material)
Lubricating oils (petroleum), C15-30, hydrotreated neutral oil- based	Negative - Dermal	Rat	0 to 2000 mg/kg mg/ kg/day	-	-

Conclusion/Summary No known significant effects or critical hazards.

Aspiration hazard

Product/ingredient name	Result
Distillate (petroleum), hydrotreated light naphthenic	ASPIRATION HAZARD - Category 1
Distillate (petroleum), hydrotreated light paraffinic	ASPIRATION HAZARD - Category 1
Lubricating oils (petroleum), C20-50, hydrotreated neutral oil-based	ASPIRATION HAZARD - Category 1
Distillate (petroleum), hydrotreated heavy paraffinic	ASPIRATION HAZARD - Category 1
Lubricating oils (petroleum), C15-30, hydrotreated neutral oil-based	ASPIRATION HAZARD - Category 1

Information on likely routes of exposure Not available.

Potential acute health effects

Eye contact Eye contact may cause redness and transient pain.
 Inhalation Inhalation of oil mist or vapours at elevated temperatures may cause respiratory irritation.
 Skin contact No known significant effects or critical hazards.
 Ingestion May be fatal if swallowed and enters airways.

Potential chronic health effects

Product/ingredient name	Result	Species	Dose	Exposure
2,6-Di-tert-butyl-p-cresol	Chronic NOAEL Oral	Rat	25 mg/kg	28 days; 7 days per week

General No known significant effects or critical hazards.
 Carcinogenicity The base oil(s) in this product is based on an severely hydrotreated distillate. The product should not be regarded as a carcinogen.
 Mutagenicity No known significant effects or critical hazards.
 Teratogenicity No known significant effects or critical hazards.

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SECTION 11: Toxicological information

Product/ingredient name No known significant effects or critical hazards.
 Fertility effects No known significant effects or critical hazards.

Other information Not available.

Specific hazard

SECTION 12: Ecological information

12.1 Toxicity

Product/ingredient name	Result	Species	Exposure
Distillate (petroleum), hydrotreated light naphthenic	Acute LL50 >10000 mg/l	Aquatic invertebrates.	96 hours
	Acute LL50 >100 mg/l	Fish	96 hours
	Acute NOEL >100 mg/l	Algae	72 hours
	Chronic NOEL 10 mg/l	Aquatic invertebrates.	21 days
	Acute IC50 >100 mg/l	Algae	48 hours
Distillate (petroleum), hydrotreated light paraffinic	Acute LC50 >100 mg/l	Fish	96 hours
	Acute LL50 >10000 mg/l	Aquatic invertebrates.	96 hours
	Acute LL50 >100 mg/l	Fish	96 hours
	Acute NOEL >100 mg/l	Algae	72 hours
	Chronic NOEL 10 mg/l	Aquatic invertebrates.	21 days
Lubricating oils (petroleum), C20-50, hydrotreated neutral oil-based	Acute LL50 >10000 mg/l	Aquatic invertebrates.	96 hours
	Acute LL50 >100 mg/l	Fish	96 hours
Distillate (petroleum), hydrotreated heavy paraffinic	Acute NOEL >100 mg/l	Algae	72 hours
	Chronic NOEL 10 mg/l	Aquatic invertebrates.	21 days
	Acute EL50 >10000 mg/l	Aquatic invertebrates.	96 hours
Lubricating oils (petroleum), C15-30, hydrotreated neutral oil-based	Acute LL50 >100 mg/l	Fish	96 hours
	Acute NOEL >100 mg/l	Algae	72 hours
	Chronic NOEL 10 mg/l	Aquatic invertebrates.	21 days
	Acute LL50 >10000 mg/l	Aquatic invertebrates.	96 hours
2,6-di-tert-butyl-p-cresol	Acute LL50 >100 mg/l	Fish	96 hours
	Acute NOEL >100 mg/l	Algae	72 hours
	Chronic NOEL 10 mg/l	Aquatic invertebrates.	21 days
	Acute EC50 0.61 mg/l	Daphnia - Magna	48 hours
	Acute IC50 >0.4 mg/l	Algae - Desmodesmus Subspicatus	72 hours
	Chronic NOEC 0.316 mg/l	Daphnia - Magna	21 days

Conclusion/Summary Harmful to aquatic life with long lasting effects.

12.2 Persistence and degradability

Product/ingredient name	Test	Result	Dose	Inoculum
2,6-di-tert-butyl-p-cresol	OECD 301C 301C Ready Biodegradability - Modified MITI Test (I)	4.5 % - 28 days	-	-

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SECTION 12: Ecological information

Product/ingredient name	Aquatic half-life	Photolysis	Biodegradability
Distillate (petroleum), hydrotreated light naphthenic	-	-	Inherent
Distillate (petroleum), hydrotreated light paraffinic	-	-	Inherent
Lubricating oils (petroleum), C20-50, hydrotreated neutral oil-based	-	-	Inherent
Distillate (petroleum), hydrotreated heavy paraffinic	-	-	Inherent
Lubricating oils (petroleum), C15-30, hydrotreated neutral oil-based	-	-	Inherent
2,6-di-tert-butyl-p-cresol	-	-	Not readily

Conclusion/Summary Inherently biodegradable.

12.3 Bioaccumulative potential

Product/ingredient name	LogP _{ow}	BCF	Potential
Distillate (petroleum), hydrotreated light naphthenic	2 to 6	<500	low
Distillate (petroleum), hydrotreated light paraffinic	2 to 6	<500	low
Lubricating oils (petroleum), C20-50, hydrotreated neutral oil-based	2 to 6	<500	low
Distillate (petroleum), hydrotreated heavy paraffinic	2 to 6	<500	low
Lubricating oils (petroleum), C15-30, hydrotreated neutral oil-based	2 to 6	<500	low
2,6-di-tert-butyl-p-cresol	5,1	>500	high

Conclusion/Summary The product has a potential to bioaccumulate.

12.4 Mobility in soil

Mobility High mobility in soil predicted, based on log Kow > 3.0.

12.5 Results of PBT and vPvB assessment

Not applicable.
Not applicable.

12.6 Other adverse effects

Insoluble in water. Spills may form a film on water surfaces causing physical damage to organisms. Oxygen transfer could also be impaired.

SECTION 13: Disposal considerations

The information in this section contains generic advice and guidance. The list of Identified Uses in Section 1 should be consulted for any available use-specific information provided in the Exposure Scenario(s).

13.1 Waste treatment methods

Product

Methods of disposal Where possible (e.g. in the absence of relevant contamination), recycling of used substance is feasible and recommended. This substance can be burned or incinerated, subject to national/local authorizations, relevant contamination limits, safety regulations and air quality legislation. Contaminated or waste substance (not directly recyclable): Disposal can be carried out directly, or by delivery to qualified waste handlers. National legislation may identify a specific organization, and/or prescribe composition limits and methods for recovery or disposal.

Hazardous waste Yes.

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SECTION 13: Disposal considerations

European waste catalogue (EWC)

Waste code	Waste designation
13 03 07*	mineral-based non-chlorinated insulating and heat transmission oils

Packaging

Methods of disposal

The generation of waste should be avoided or minimised wherever possible. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible.

SECTION 14: Transport information

International transport regulations

	ADR/RID	ADN	IMO/IMDG Classification	ICAO/IATA Classification
14.1 UN number	Not regulated.	Not regulated.	Not regulated.	Not regulated.
14.2 UN proper shipping name	-	-	-	-
14.3 Transport hazard class(es)	-	-	-	-
14.4 Packing group	-	-	-	-
14.5 Environmental hazards	No.	No.	No.	No.
Additional information	-	-	-	-

14.6 Special precautions for user

Transport within user's premises: always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

14.7 Transport in bulk according to Annex I of MARPOL 73/78 and the IBC Code

Oils

SECTION 15: Regulatory information

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture

EU Regulation (EC) No. 1907/2006 (REACH)

Annex XIV - List of substances subject to authorisation

Annex XIV

None of the components are listed.

Substances of very high concern

None of the components are listed.

Annex XVII - Restrictions on the manufacture, placing on the market and use of certain dangerous substances, mixtures and articles

Not applicable.

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SECTION 15: Regulatory information

Other EU regulations

Seveso Directive

This product is not controlled under the Seveso Directive.

International lists

National inventory

Australia	All components are listed or exempted.
Canada	All components are listed or exempted.
China	All components are listed or exempted.
Japan	Japan inventory (ENCS): All components are listed or exempted. Japan inventory (ISHL): Not determined.
Malaysia	Not determined.
New Zealand	All components are listed or exempted.
Philippines	All components are listed or exempted.
Republic of Korea	All components are listed or exempted.
Taiwan	All components are listed or exempted.
United States	All components are listed or exempted.

15.2 Chemical safety assessment Chemical Safety Assessments for all substances in this product are either Complete or Not applicable.

SECTION 16: Other information

Revision comments Not available.

Indicates information that has changed from previously issued version.

- ADN = European Provisions concerning the International Carriage of Dangerous Goods by Inland Waterway
- ADR = The European Agreement concerning the International Carriage of Dangerous Goods by Road
- ATE = Acute Toxicity Estimate
- CLP = Classification, Labelling and Packaging Regulation [Regulation (EC) No. 1272/2008]
- CMR = Carcinogen, Mutagen or Reproductive toxicant
- CSA = Chemical Safety Assessment
- CO₂ = carbon dioxide
- DNEL = Derived No Effect Level
- EC50 = Half maximal effective concentration
- EUH statement = CLP-specific Hazard statement
- IATA = International Air Transport Association
- IC50 = Half maximal inhibitory concentration
- IMDG = International Maritime Dangerous Goods
- LC50 = Median lethal concentration
- LD50 = Median lethal dose
- PNEC = Predicted No Effect Concentration
- PBT = Persistent, Bioaccumulative and Toxic
- RID = The Regulations concerning the International Carriage of Dangerous Goods by Rail
- REACH = Registration, Evaluation, Authorisation and Restriction of Chemicals Regulation [Regulation (EC) No. 1907/2006]
- SCBA = Self-Contained Breathing Apparatus
- SVHC = Substances of Very High Concern

Procedure used to derive the classification according to Regulation (EC) No. 1272/2008 [CLP/GHS]

Classification	Justification
Asp. Tox. 1, H304 Aquatic Chronic 3, H412	Calculation method Calculation method

Sweden

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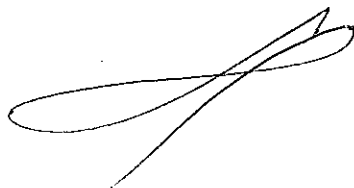
SECTION 16: Other information

Full text of abbreviated H statements	H304	May be fatal if swallowed and enters airways.
	H400	Very toxic to aquatic life.
	H410	Very toxic to aquatic life with long lasting effects.
	H412	Harmful to aquatic life with long lasting effects.
Full text of classifications [CLP/GHS]	Aquatic Acute 1, H400	ACUTE AQUATIC HAZARD - Category 1
	Aquatic Chronic 1, H410	LONG-TERM AQUATIC HAZARD - Category 1
	Aquatic Chronic 3, H412	LONG-TERM AQUATIC HAZARD - Category 3
	Asp. Tox. 1, H304	ASPIRATION HAZARD - Category 1
Date of printing	2016-02-19	
Date of issue/ Date of revision	2016-02-19	
Date of previous issue	2015-09-17	
Version	2	

Notice to reader

To the best of our knowledge, the information contained herein is accurate. However, neither the above-named supplier, nor any of its subsidiaries, assumes any liability whatsoever for the accuracy or completeness of the information contained herein.

Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.




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Nytro Lyra X



Annex to the extended Safety Data Sheet (eSDS)

Industrial

Identification of the substance or mixture

Product definition Mixture
 Product name Nytro Lyra X

Section 1 - Title

Short title of the exposure scenario Use in formulations in lubricants- Industrial (2,6-di-tert-butyl-p-cresol)
 List of use descriptors **Identified use name:** Use in formulations in lubricants- Industrial
Process Category: PROC01, PROC02, PROC03, PROC04, PROC05, PROC08a, PROC08b, PROC09
Substance supplied to that use in form of: As such
Sector of end use: SU03, SU10
Subsequent service life relevant for that use: No.
Environmental Release Category: ERC02
Market sector by type of chemical product: PC17, PC24, PC25

Environmental contributing scenarios
 Health Contributing scenarios

Number of the ES	Not applicable.
Industry/Association	Not applicable.
Generic exposure scenario	Not applicable.
Processes and activities covered by the exposure scenario	Covers the use of formulated lubricants within closed or contained systems including incidental exposures during material transfers, operation of machinery/engines and similar articles, equipment maintenance and disposal of wastes.
Additional information	Industrial

Section 2 - Exposure controls

Product characteristics solid
 Melting/Freezing Point (°C): 69.8

Concentration of substance in mixture or article ≤100%

Amounts used Annual site tonnage
 22 t/a

Frequency and duration of use Continuous release(d/a): 300

Environment factors not influenced by risk management Local freshwater dilution factor 10
 Receiving surface water flow is 18000 m³/d.
 Local marine water dilution factor 100.

Other given operational conditions affecting environmental exposure Not applicable.

Technical conditions and measures at process level (source) to prevent release % Release fraction to wastewater from process (initial release prior to RMM) 0.2
 % Release fraction to air from process (initial release prior to RMM) 0.05
 % Release fraction to soil from process (initial release prior to RMM) 0

Technical on-site conditions and measures to reduce or limit discharges, air emissions and releases to soil On-site wastewater treatment required.
 Ensure all waste water is collected and treated via a waste water treatment plant.
 Floors should be impervious, resistant to liquids and easy to clean.

Organisational measures to prevent/limit release from site Ensure operatives are trained to minimise exposures.

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Section 2 - Exposure controls

Conditions and measures related to municipal sewage treatment plant	Size of industrial sewage treatment plant (m3/d): 2000,
Conditions and measures related to external treatment of waste for disposal	No special measures are required. General information, See section 13 for waste disposal information.
Conditions and measures related to external recovery of waste	See section 13 for waste disposal information.

Contributing scenario controlling worker exposure for 0:

Product characteristics	Melting/Freezing Point (°C): 69.8
Concentration of substance in mixture or article	Covers percentage substance in the product up to 1%.
Physical state	Liquid
Frequency and duration of use	Exposure duration per day: 4 h (half shift). Exposure duration per year: 230 d
Human factors not influenced by risk management	Respiratory (m³/d): 10 Body weight: 70 kg
Other given operational conditions affecting workers exposure	The product should be handled at room temperature. Indoor
Technical conditions and measures at process level (source) to prevent release	No special measures required.
Technical conditions and measures to control dispersion from source towards the worker	Handle only in a place with local exhaust ventilation (or other adequate ventilation). Efficiency of at least 90 %
Organisational measures to prevent/limit releases, dispersion and exposure	Ensure operatives are trained to minimise exposures.
Conditions and measures related to personal protection and hygiene	
Personal protection	Wear protective clothing. See Section 8 of the safety data sheet (personal protective equipment). PROC 05; PROC08a: Wear protective gloves. Efficiency of at least 90 %

Section 3 - Exposure estimation and reference to its source

Website:	Not available.
Exposure estimation and reference to its source - Environment: 2:	
Exposure assessment (environment):	Used EUSES model.(v2.1).
Exposure estimation	Risk characterisation ratio (PEC/PNEC): <1
Exposure estimation and reference to its source - Workers: 1:	
Exposure assessment (human):	Used ECETOC TRA model (May 2010 release).2.0
Exposure estimation	Risk characterisation ratio DNELs <1

Section 4 - Guidance to DU to evaluate whether he works inside the boundaries set by the ES


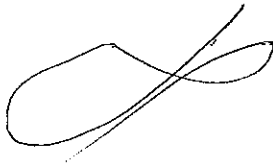
Nytro Lyra X

Use in formulations in lubricants- Industrial (2,6-di-tert-butyl-
p-cresol)

Section 4 - Guidance to DU to evaluate whether he works inside the boundaries set by the ES

Environment	Not available.
Health	Not available.

Environment	Not applicable.
Health	Wear protective gloves/protective clothing/eye protection/face protection. Wear respiratory protection. See Section 8 for information on appropriate personal protective equipment.



Identification of the substance or mixture

Product definition Mixture
 Product name Nytro Lyra X

Section 1 - Title

Short title of the exposure scenario OLD - Use as lubricant in open and closed systems- Professional (2,6-di-tert-butyl-p-cresol)

List of use descriptors
Identified use name: Use as lubricant in open and closed systems - Professional
Process Category: PROC01, PROC02, PROC03, PROC04, PROC05, PROC07, PROC08a, PROC08b, PROC09, PROC10, PROC11, PROC13
Substance supplied to that use in form of: As such
Sector of end use: SU22
Subsequent service life relevant for that use: No.
Environmental Release Category: ERC08a, ERC08d, ERC09a, ERC09b
Market sector by type of chemical product: PC17, PC24

Environmental contributing scenarios
 Health Contributing scenarios

Number of the ES	Not applicable.
Industry Association	Not applicable.
Generic exposure scenario	Not applicable.
Processes and activities covered by the exposure scenario	Covers the use of formulated lubricants in closed and open systems including transfer operations, operation of engines and similar articles, reworking on reject articles, equipment maintenance and disposal of waste oil.
Additional information	Professional

Section 2 - Exposure controls

Product characteristics solid
 Melting/freezing point 69.8

Concentration of substance in mixture or article ≤2%

Amounts used
 Annual site tonnage
 ≤0.16 t/a (Closed system)
 ≤0.03 t/a open systems

Frequency and duration of use Continuous release(d/a): 300

Environment factors not influenced by risk management
 Local freshwater dilution factor 10
 Receiving surface water flow is 18000 m³/d.
 Local marine water dilution factor 100

Other given operational conditions affecting environmental exposure Not applicable.

Technical conditions and measures at process level (source) to prevent release
 % Release fraction to wastewater from process (initial release prior to RMM) 0.2
 % Release fraction to air from process (initial release prior to RMM) 0.01
 % Release fraction to soil from process (initial release prior to RMM) 1

Technical on-site conditions and measures to reduce or limit discharges, air emissions and releases to soil
 On-site wastewater treatment required.
 Ensure all waste water is collected and treated via a waste water treatment plant.
 Floors should be impervious, resistant to liquids and easy to clean.

Organisational measures to prevent/limit release from site
 Ensure operatives are trained to minimise exposures.

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Identification of the substance or mixture

Product definition Mixture
 Product name Nytro Lyra X

Section 1 - Title

Short title of the exposure scenario Distribution of substance- Industrial (Other Lubricant Base Oils, IP346<3%, H304)

List of use descriptors
Identified use name: Distribution of substance - Industrial
Process Category: PROC01, PROC02, PROC03, PROC04, PROC08a, PROC08b, PROC09, PROC15
Substance supplied to that use in form of: Substance
Sector of end use: SU03
Subsequent service life relevant for that use: No.
Environmental Release Category: ERC04, ERC05, ERC06a, ERC06b, ERC06c, ERC06d, ERC07, ESVOC SpERC 1.1b.v1
Market sector by type of chemical product: Not applicable.
Article category related to subsequent service life: Not applicable.

Environmental contributing scenarios Distribution of substance

Health Contributing scenarios Distribution of substance

Number of the ES	9.3.1b
Industry Association	Concawe 2012
Generic exposure scenario	01a
Processes and activities covered by the exposure scenario	Bulk loading (including marine vessel/barge, rail/road car and IBC loading) of substance within closed or contained systems, including incidental exposures during its sampling, storage, unloading, maintenance and associated laboratory activities.
Additional information	Industrial

Section 2 - Exposure controls

Product characteristics Substance is complex UVCB.. Predominantly hydrophobic

Amounts used
 Fraction of EU tonnage used in region 0.1
 Regional use tonnage 8.5E+5
 Fraction of Regional tonnage used locally 1
 Maximum daily site tonnage 1.7E+4

Frequency and duration of use
 Continuous release
 Emission days 100

Environment factors not influenced by risk management
 Local freshwater dilution factor 10
 Local marine water dilution factor 100

Other given operational conditions affecting environmental exposure
 Release fraction to air from process (initial release prior to RMM) 1.0E-4
 Release fraction to wastewater from process (initial release prior to RMM) 1.0E-7
 Release fraction to soil from process (initial release prior to RMM) 0.00001

Technical conditions and measures at process level (source) to prevent release
 Common practices vary across sites thus conservative process release estimates used.

Technical on-site conditions and measures to reduce or limit discharges, air emissions and releases to soil
 Risk from environmental exposure is driven by freshwater sediment. If discharging to municipal sewage treatment plant, no on-site wastewater treatment required.

Risk management measures - Air
 Treat air emission to provide a typical removal efficiency of 90

Section 2 - Exposure controls

Risk management measures - Water	Treat on-site wastewater (prior to receiving water discharge) to provide the required removal efficiency of 64.4 If discharging to municipal sewage treatment plant, provide the required on-site wastewater removal efficiency of 0
Organisational measures to prevent/limit release from site	Do not apply industrial sludge to natural soils. Sewage sludge should be incinerated, contained or reclaimed.
Conditions and measures related to municipal sewage treatment plant	Estimated substance removal from wastewater via on-site sewage treatment 94.7 Total efficiency of removal from wastewater after on-site and off-site (municipal treatment plant) RMMs 94.7 Maximum allowable site tonnage (M _{safe}) based on release following total wastewater treatment removal 1.1E+5 Assumed on-site sewage treatment plant flow 2000
Conditions and measures related to external treatment of waste for disposal	External treatment and disposal of waste should comply with applicable local and/or national regulations.
Conditions and measures related to external recovery of waste	External recovery and recycling of waste should comply with applicable local and/or national regulations.

Contributing scenario controlling worker exposure for 0: Distribution of substance	
Product characteristics	Liquid, vapour pressure < 0.5 kPa at STP
Concentration of substance in mixture or article	Covers percentage substance in the product up to 100% (unless stated differently).
Physical state	Liquid
Frequency and duration of use	Covers daily exposures up to 8 hours (unless stated differently)
Other given operational conditions affecting workers exposure	<p>Operation is carried out at elevated temperature (> 20°C above ambient temperature) Assumes a good basic standard of occupational hygiene is implemented</p> <p>Aspiration hazard if swallowed. Aspiration means the entry of a liquid substance directly into the trachea and lower respiratory tract. Aspiration of hydrocarbon substances can result in severe acute effects such as chemical pneumonitis, varying degree of pulmonary injury or death. This property relates to the potential for low viscosity material to spread quickly into the deep lung and cause severe pulmonary tissue damage. Classification of a hydrocarbon substance for aspiration hazard is made on the basis of reliable human evidence or on the basis of physical properties. Do not induce vomiting as there is high risk of aspiration. IF SWALLOWED: Immediately call a POISON CENTER or physician.</p> <p>Contributing scenarios - Operational conditions and risk management measures</p> <p>General exposures (closed systems) No other specific measures identified.</p> <p>General exposures (open systems) No other specific measures identified.</p> <p>Process sampling No other specific measures identified.</p> <p>Laboratory activities No other specific measures identified.</p> <p>Bulk transfers closed systems No other specific measures identified.</p> <p>Bulk transfers open systems No other specific measures identified.</p>

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Section 2 - Exposure controls

Conditions and measures related to municipal sewage treatment plant	Size of industrial sewage treatment plant (m3/d): 2000 , Removal Efficiency (total) 94%
Conditions and measures related to external treatment of waste for disposal	No special measures are required. See section 13 for waste disposal information.
Conditions and measures related to external recovery of waste	See section 13 for waste disposal information.

Contributing scenario controlling worker exposure for 0:

Product characteristics	Melting/Freezing Point (°C): 69.8
Concentration of substance in mixture or article	≤2%
Physical state	solid
Dust	Solid, medium dustiness
Frequency and duration of use	Exposure duration per year: 230 days Exposure duration per day: 8 h (full shift).
Human factors not influenced by risk management	Respiratory m³/d: 10
Other given operational conditions affecting workers exposure	The product should be handled at room temperature. Lubricants (Closed system)
Technical conditions and measures at process level (source) to prevent release	No special measures required.
Technical conditions and measures to control dispersion from source towards the worker	Handle only in a place with local exhaust ventilation (or other adequate ventilation).
Organisational measures to prevent/limit releases, dispersion and exposure	Ensure operatives are trained to minimise exposures.
Conditions and measures related to personal protection and hygiene	
Personal protection	Wear protective clothing. See Section 8 of the safety data sheet (personal protective equipment).

Section 3 - Exposure estimation and reference to its source

Website:	Not available.
Exposure estimation and reference to its source - Environment: 2:	
Exposure assessment (environment):	Used EUSES model. (v2.1)
Exposure estimation	Risk characterisation ratio (PEC/PNEC): <1
Exposure estimation and reference to its source - Workers: 1:	
Exposure assessment (human):	Used ECETOC TRA model (May 2010 release).
Exposure estimation	Risk characterisation ratio DNELs <1

Section 4 - Guidance to DU to evaluate whether he works inside the boundaries set by the ES

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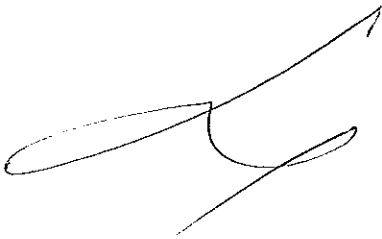
Nytro Lyra X

OLD - Use as lubricant in open and closed systems-
Professional (2,6-di-tert-butyl-p-cresol)

Section 4 - Guidance to DU to evaluate whether he works inside the boundaries set by the ES

Environment	Not available.
Health	Not available.

Environment	Not available.
Health	Wear protective gloves/protective clothing/eye protection/face protection. Wear respiratory protection. See Section 8 for information on appropriate personal protective equipment.



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Section 2 - Exposure controls

	Drum and small package filling No other specific measures identified.
	Equipment cleaning and maintenance Drain down and flush system prior to equipment break-in or maintenance.
	Storage Store substance within a closed system.
Conditions and measures related to personal protection and hygiene	
Personal protection	See Section 8 of the safety data sheet (general health and safety measures). See Section 8 of the safety data sheet (personal protective equipment).

Section 3 - Exposure estimation and reference to its source

Website:	Not applicable.
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Exposure estimation and reference to its source - Environment: 2: Distribution of substance	
Exposure assessment (environment):	Not available.
Exposure estimation	The Hydrocarbon Block Method has been used to calculate environmental exposure with the Petrorisk model.

Exposure estimation and reference to its source - Workers: 1: Distribution of substance	
Exposure assessment (human):	Not available.
Exposure estimation	The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated.

Section 4 - Guidance to DU to evaluate whether he works inside the boundaries set by the ES

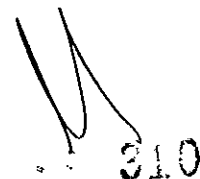
Environment	Guidance is based on assumed operating conditions which may not be applicable to all sites; thus, scaling may be necessary to define appropriate site-specific risk management measures. Required removal efficiency for wastewater can be achieved using onsite/offsite technologies, either alone or in combination. Required removal efficiency for air can be achieved using on-site technologies, either alone or in combination. Further details on scaling and control technologies are provided in SPERC factsheet. Scaled local assessments for EU refineries have been performed using site-specific data and are attached in PETRORISK file - "Site-Specific Production" worksheet.
Health	The CLP hazard statement H304: May be fatal if swallowed and enters airways (the DPD risk phrase R65: Harmful: may cause lung damage if swallowed) relates to potential for aspiration, a non-quantifiable hazard determined by physico-chemical properties (i.e. kinematic viscosity) that can occur during ingestion and also if it is vomited following ingestion. A DNEL (derived no effect levels) cannot be derived. This general qualitative CSA (chemical safety assessment) approach aims to reduce/avoid contact or incidents with the substance. However, implementation of risk management measures (RMMs) and operational conditions (OCs) need to be proportional to the degree of concern for the health hazard presented by the substance. Exposures should be controlled to at least the levels that represent an acceptable level of risk such that the implementation of the chosen RMMs will ensure that the likelihood of an event occurring due to the substance hazard is negligible, and the risk is considered to be controlled to a level of no concern. There are no routine anticipated exposures by ingestion related to any supported uses of the substance. The risk arising from aspiration hazard is solely related to the physico-chemical properties of the substance. The risk can therefore be controlled by implementing risk management measures tailored to this specific risk. For any substance, classified as H304 (R65), these measures should be

Nytro Lyra X

Distribution of substance- Industrial (Other Lubricant Base
Oils, IP346<3%, H304)

Section 4 - Guidance to DU to evaluate whether he works inside the boundaries set
by the ES

communicated via the safety data sheet by use of the following phrase: Do not ingest.
If swallowed then seek immediate medical assistance.



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Identification of the substance or mixture

Product definition Mixture
 Product name Nytro Lyra X

Section 1 - Title

Short title of the exposure scenario Formulation & (re)packing of substances and mixtures- Industrial (Other Lubricant Base Oils, IP346<3%)

List of use descriptors
Identified use name: Formulation and (re)packing of substances and mixtures - Industrial
Process Category: PROC01, PROC02, PROC03, PROC04, PROC05, PROC08a, PROC08b, PROC09, PROC14, PROC15
Substance supplied to that use in form of: Substance
Sector of end use: SU10
Subsequent service life relevant for that use: No.
Environmental Release Category: ERC02, ESVOC SpERC 2.2.v1
Market sector by type of chemical product: Not applicable.
Article category related to subsequent service life: Not applicable.

Environmental contributing scenarios Formulation and (re)packing of substances and mixtures

Health Contributing scenarios Formulation and (re)packing of substances and mixtures

Number of the ES	9.4.1b
Industry Association	Concawe 2012
Generic exposure scenario	02
Processes and activities covered by the exposure scenario	Formulation, packing and re-packing of the substance and its mixtures in batch or continuous operations, including storage, materials transfers, mixing, tableting, compression, pelletisation, extrusion, large and small scale packing, sampling, maintenance and associated laboratory activities.
Additional information	Industrial

Section 2 - Exposure controls

Product characteristics Substance is complex UVCB.. Predominantly hydrophobic

Amounts used
 Fraction of EU tonnage used in region 0.1
 Regional use tonnage 8.5E+5
 Fraction of Regional tonnage used locally 1
 Annual site tonnage 3.0E+4
 Maximum daily site tonnage 1.0E+5

Frequency and duration of use
 Continuous release
 Emission days 300

Environment factors not influenced by risk management
 Local freshwater dilution factor 10
 Local marine water dilution factor 100

Other given operational conditions affecting environmental exposure
 Release fraction to air from process (initial release prior to RMM) 2.5E-3
 Release fraction to wastewater from process (initial release prior to RMM) 5.0E-6
 Release fraction to soil from process (initial release prior to RMM) 0.0001

Technical conditions and measures at process level (source) to prevent release
 Common practices vary across sites thus conservative process release estimates used.

Technical on-site conditions and measures to reduce or limit discharges, air emissions and releases to soil
 Risk from environmental exposure is driven by freshwater sediment.
 Prevent discharge of undissolved substance to or recover from onsite wastewater. If discharging to municipal sewage treatment plant, no on-site wastewater treatment required.

Section 2 - Exposure controls

Risk management measures - Air	Treat air emission to provide a typical removal efficiency of 0
Risk management measures - Water	Treat on-site wastewater (prior to receiving water discharge) to provide the required removal efficiency of 69.5 If discharging to municipal sewage treatment plant, provide the required on-site wastewater removal efficiency of 0
Organisational measures to prevent/limit release from site	Do not apply industrial sludge to natural soils. Sewage sludge should be incinerated, contained or reclaimed.
Conditions and measures related to municipal sewage treatment plant	Not applicable as there is no release to wastewater. Estimated substance removal from wastewater via on-site sewage treatment 94.7 Total efficiency of removal from wastewater after on-site and off-site (municipal treatment plant) RMMs 94.7 Maximum allowable site tonnage (M _{safe}) based on release following total wastewater treatment removal 5.7E+5 Assumed on-site sewage treatment plant flow 2000
Conditions and measures related to external treatment of waste for disposal	External treatment and disposal of waste should comply with applicable local and/or national regulations.
Conditions and measures related to external recovery of waste	External recovery and recycling of waste should comply with applicable local and/or national regulations.

Contributing scenario controlling worker exposure for 0: Formulation and (re)packing of substances and mixtures	
Product characteristics	Liquid, vapour pressure < 0.5 kPa at STP
Concentration of substance in mixture or article	Covers percentage substance in the product up to 100% (unless stated differently).
Physical state	Liquid
Frequency and duration of use	Covers daily exposures up to 8 hours (unless stated differently)
Other given operational conditions affecting workers exposure	Operation is carried out at elevated temperature (> 20°C above ambient temperature) Assumes a good basic standard of occupational hygiene is implemented Aspiration hazard if swallowed. Aspiration means the entry of a liquid substance directly into the trachea and lower respiratory tract. Aspiration of hydrocarbon substances can result in severe acute effects such as chemical pneumonitis, varying degree of pulmonary injury or death. This property relates to the potential for low viscosity material to spread quickly into the deep lung and cause severe pulmonary tissue damage. Classification of a hydrocarbon substance for aspiration hazard is made on the basis of reliable human evidence or on the basis of physical properties. Do not induce vomiting as there is high risk of aspiration. IF SWALLOWED: Immediately call a POISON CENTER or physician.
Contributing scenarios - Operational conditions and risk management measures	
General exposures (closed systems) No other specific measures identified.	
General exposures (open systems) No other specific measures identified.	
Batch processes at elevated temperatures No other specific measures identified.	
Use in contained batch processes No other specific measures identified.	
Process sampling No other specific measures identified.	

Section 2 - Exposure controls

	<p>Laboratory activities No other specific measures identified. Bulk transfers Dedicated facility</p> <p>No other specific measures identified.</p> <p>Mixing operations (open systems) No other specific measures identified.</p> <p>Transfer from/pouring from containers Manual Non-dedicated facility No other specific measures identified.</p> <p>Drum/batch transfers Dedicated facility No other specific measures identified.</p> <p>Production of preparation or articles by tableting, compression, extrusion or pelletisation No other specific measures identified.</p> <p>Drum and small package filling No other specific measures identified.</p> <p>Equipment cleaning and maintenance Drain down and flush system prior to equipment break-in or maintenance.</p> <p>Storage Store substance within a closed system.</p>
Conditions and measures related to personal protection and hygiene	
Personal protection	<p>See Section 8 of the safety data sheet (general health and safety measures). See Section 8 of the safety data sheet (personal protective equipment).</p>

Section 3 - Exposure estimation and reference to its source

Website:	Not applicable.
Exposure estimation and reference to its source - Environment: 2: Formulation and (re)packing of substances and mixtures	
Exposure assessment (environment):	Not available.
Exposure estimation	The Hydrocarbon Block Method has been used to calculate environmental exposure with the Petrorisk model.
Exposure estimation and reference to its source - Workers: 1: Formulation and (re)packing of substances and mixtures	
Exposure assessment (human):	Not available.
Exposure estimation	The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated.

Section 4 - Guidance to DU to evaluate whether he works inside the boundaries set by the ES

Environment	<p>Guidance is based on assumed operating conditions which may not be applicable to all sites; thus, scaling may be necessary to define appropriate site-specific risk management measures. Required removal efficiency for wastewater can be achieved using onsite/offsite technologies, either alone or in combination. Required removal efficiency for air can be achieved using on-site technologies, either alone or in combination. Further details on scaling and control technologies are provided in SPERC factsheet. Scaled local assessments for EU refineries have been performed using site-specific data and are attached in PETRORISK file - "Site-Specific Production" worksheet.</p>
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Section 4 - Guidance to DU to evaluate whether he works inside the boundaries set by the ES**Health**

The CLP hazard statement H304: May be fatal if swallowed and enters airways (the DPD risk phrase R65: Harmful: may cause lung damage if swallowed) relates to potential for aspiration, a non-quantifiable hazard determined by physico-chemical properties (i.e. kinematic viscosity) that can occur during ingestion and also if it is vomited following ingestion.

A DNEL (derived no effect levels) cannot be derived.

This general qualitative CSA (chemical safety assessment) approach aims to reduce/avoid contact or incidents with the substance.

However, implementation of risk management measures (RMMs) and operational conditions (OCs) need to be proportional to the degree of concern for the health hazard presented by the substance.

Exposures should be controlled to at least the levels that represent an acceptable level of risk such that the implementation of the chosen RMMs will ensure that the likelihood of an event occurring due to the substance hazard is negligible, and the risk is considered to be controlled to a level of no concern.

There are no routine anticipated exposures by ingestion related to any supported uses of the substance. The risk arising from aspiration hazard is solely related to the physico-chemical properties of the substance. The risk can therefore be controlled by implementing risk management measures tailored to this specific risk.

For any substance, classified as H304 (R65), these measures should be communicated via the safety data sheet by use of the following phrase: Do not ingest. If swallowed then seek immediate medical assistance.

Identification of the substance or mixture

Product definition	Mixture
Product name	Nytro Lyra X

Section 1 - Title

Short title of the exposure scenario	Manufacturer of substance- Industrial (Other Lubricant Base Oils, IP346<3%, H304)
List of use descriptors	<p>Identified use name: Manufacture of substance - Industrial</p> <p>Process Category: PROC01, PROC02, PROC03, PROC04, PROC08a, PROC08b, PROC15</p> <p>Substance supplied to that use in form of: Substance</p> <p>Sector of end use: SU03, SU08, SU09</p> <p>Subsequent service life relevant for that use: No.</p> <p>Environmental Release Category: ERC04, ESVOC SpERC 1.1.v1</p> <p>Market sector by type of chemical product: Not applicable.</p> <p>Article category related to subsequent service life: Not applicable.</p>
Environmental contributing scenarios	Manufacture of substance
Health Contributing scenarios	Manufacture of substance

Number of the ES	9.1.1b
Industry Association	Concawe 2012
Generic exposure scenario	01
Processes and activities covered by the exposure scenario	Manufacture of the substance or use as a process chemical or extraction agent within closed or contained systems. Includes incidental exposures during recycling/recovery, material transfers, storage, sampling, associated laboratory activities, maintenance and loading (including marine vessel/barge, road/rail car and bulk container).
Additional information	Industrial

Section 2 - Exposure controls

Product characteristics	Substance is complex UVCB.. Predominantly hydrophobic
Amounts used	<p>Fraction of EU tonnage used in region 0.1</p> <p>Regional use tonnage 8.5E+5</p> <p>Fraction of Regional tonnage used locally 1</p> <p>Annual site tonnage 6.0E+5</p> <p>Maximum daily site tonnage 2.0E+6</p>
Frequency and duration of use	<p>Continuous release</p> <p>Emission days 300</p>
Environment factors not influenced by risk management	<p>Local freshwater dilution factor 10</p> <p>Local marine water dilution factor 100</p>
Other given operational conditions affecting environmental exposure	<p>Release fraction to air from process (initial release prior to RMM) 1.0e-4</p> <p>Release fraction to wastewater from process (initial release prior to RMM) 1.0e-5</p> <p>Release fraction to soil from process (initial release prior to RMM) 0.0001</p>
Technical conditions and measures at process level (source) to prevent release	Common practices vary across sites thus conservative process release estimates used.
Technical on-site conditions and measures to reduce or limit discharges, air emissions and releases to soil	<p>Risk from environmental exposure is driven by freshwater sediment.</p> <p>Prevent discharge of undissolved substance to or recover from onsite wastewater.</p> <p>If discharging to municipal sewage treatment plant, no on-site wastewater treatment required.</p>

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Section 2 - Exposure controls

Risk management measures - Air	Treat air emission to provide a typical removal efficiency of 90
Risk management measures - Water	Treat on-site wastewater (prior to receiving water discharge) to provide the required removal efficiency of 84.8 If discharging to municipal sewage treatment plant, provide the required on-site wastewater removal efficiency of 0
Organisational measures to prevent/limit release from site	Do not apply industrial sludge to natural soils. Sewage sludge should be incinerated, contained or reclaimed.
Conditions and measures related to municipal sewage treatment plant	Estimated substance removal from wastewater via on-site sewage treatment 94.7 Total efficiency of removal from wastewater after on-site and off-site (municipal treatment plant) RMMs 94.7 Maximum allowable site tonnage (M _{Safe}) based on release following total wastewater treatment removal 5.7E+6 Assumed on-site sewage treatment plant flow 10000
Conditions and measures related to external treatment of waste for disposal	During manufacturing, no waste of the substance is generated.
Conditions and measures related to external recovery of waste	During manufacturing, no waste of the substance is generated.

Contributing scenario controlling worker exposure for 0: Manufacture of substance	
Product characteristics	Liquid, vapour pressure < 0.5 kPa at STP
Concentration of substance in mixture or article	Covers percentage substance in the product up to 100% (unless stated differently).
Physical state	Liquid With potential for aerosol generation
Frequency and duration of use	Covers daily exposures up to 8 hours (unless stated differently)
Other given operational conditions affecting workers exposure	Operation is carried out at elevated temperature (> 20°C above ambient temperature) Assumes a good basic standard of occupational hygiene is implemented Aspiration hazard if swallowed. Aspiration means the entry of a liquid substance directly into the trachea and lower respiratory tract. Aspiration of hydrocarbon substances can result in severe acute effects such as chemical pneumonitis, varying degree of pulmonary injury or death. This property relates to the potential for low viscosity material to spread quickly into the deep lung and cause severe pulmonary tissue damage. Classification of a hydrocarbon substance for aspiration hazard is made on the basis of reliable human evidence or on the basis of physical properties. Do not induce vomiting as there is high risk of aspiration. IF SWALLOWED: Immediately call a POISON CENTER or physician.
Contributing scenarios - Operational conditions and risk management measures	
General exposures (closed systems) No other specific measures identified.	
General exposures (open systems) No other specific measures identified.	
Process sampling No other specific measures identified.	
Laboratory activities No other specific measures identified.	
Bulk transfers (Closed system) No other specific measures identified.	
Bulk transfers open systems	

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Section 2 - Exposure controls

No other specific measures identified.

Equipment cleaning and maintenance
Drain down and flush system prior to equipment break-in or maintenance.

Bulk product storage
Store substance within a closed system.

Conditions and measures related to personal protection and hygiene

Personal protection See Section 8 of the safety data sheet (general health and safety measures).
See Section 8 of the safety data sheet (personal protective equipment).

Section 3 - Exposure estimation and reference to its source

Website: Not applicable.

Exposure estimation and reference to its source - Environment: 2: Manufacture of substance

Exposure assessment (environment): Not available.

Exposure estimation The Hydrocarbon Block Method has been used to calculate environmental exposure with the Petrorisk model.

Exposure estimation and reference to its source - Workers: 1: Manufacture of substance

Exposure assessment (human): Not available.

Exposure estimation The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated.

Section 4 - Guidance to DU to evaluate whether he works inside the boundaries set by the ES

Environment

Guidance is based on assumed operating conditions which may not be applicable to all sites; thus, scaling may be necessary to define appropriate site-specific risk management measures. Required removal efficiency for wastewater can be achieved using onsite/offsite technologies, either alone or in combination. Required removal efficiency for air can be achieved using on-site technologies, either alone or in combination. Further details on scaling and control technologies are provided in SPERC factsheet. (<http://cefic.org/en/reach-for-industries-libraries.html>) Scaled local assessments for EU refineries have been performed using site-specific data and are attached in PETRORISK file - "Site-Specific Production" worksheet.

Health

The CLP hazard statement H304: May be fatal if swallowed and enters airways (the DPD risk phrase R65: Harmful: may cause lung damage if swallowed) relates to potential for aspiration, a non-quantifiable hazard determined by physico-chemical properties (i.e. kinematic viscosity) that can occur during ingestion and also if it is vomited following ingestion.
A DNEL (derived no effect levels) cannot be derived.
This general qualitative CSA (chemical safety assessment) approach aims to reduce/avoid contact or incidents with the substance.
However, implementation of risk management measures (RMMs) and operational conditions (OCs) need to be proportional to the degree of concern for the health hazard presented by the substance.
Exposures should be controlled to at least the levels that represent an acceptable level of risk such that the implementation of the chosen RMMs will ensure that the likelihood of an event occurring due to the substance hazard is negligible, and the risk is considered to be controlled to a level of no concern.
There are no routine anticipated exposures by ingestion related to any supported uses of the substance. The risk arising from aspiration hazard is solely related to the physico-chemical properties of the substance. The risk can therefore be controlled by implementing risk management measures tailored to this specific risk.
For any substance, classified as H304 (R65), these measures should be communicated via the safety data sheet by use of the following phrase: Do not ingest.

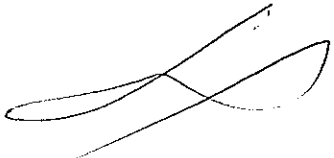
Section 4 - Guidance to DU to evaluate whether he works inside the boundaries set by the ES

If swallowed then seek immediate medical assistance.

Predicted exposures are not expected to exceed the DN(M)EL when the risk management measures/operational conditions outlined in section 2 are implemented.

Where other risk management measures/operational conditions are adopted, then users should ensure that risks are managed to at least equivalent levels.

Available hazard data do not enable the derivation of a DNEL for dermal irritant effects. Available hazard data do not support the need for a DNEL to be established for other health effects. Risk management measures are based on qualitative risk characterisation.



Identification of the substance or mixture

Product definition Mixture
 Product name Nytro Lyra X

Section 1 - Title

Short title of the exposure scenario Uses in Functional fluids - Industrial (Other Lubricant Base Oils, IP346<3%, H304)

List of use descriptors
Identified use name: Functional Fluids - Industrial
Process Category: PROC01, PROC03, PROC08a, PROC08b, PROC02, PROC04, PROC09
Substance supplied to that use in form of: Substance
Sector of end use: SU03
Subsequent service life relevant for that use: No.
Environmental Release Category: ERC07,
Market sector by type of chemical product: Not applicable.
Article category related to subsequent service life: Not applicable.

Environmental contributing scenarios **Functional Fluids**

Health Contributing scenarios **Functional Fluids**

Number of the ES	9.37.1b
Industry Association	Concawe 2012
Generic exposure scenario	13a
Processes and activities covered by the exposure scenario	Use as functional fluids e.g. cable oils, transfer oils, coolants, insulators, refrigerants, hydraulic fluids in industrial equipment including maintenance and related material transfers.
Additional information	Industrial

Section 2 - Exposure controls

Product characteristics Substance is complex UVCB. Predominantly hydrophobic

Amounts used
 Fraction of EU tonnage used in region 0.1
 Regional use tonnage 1.2E+3
 Fraction of Regional tonnage used locally 1
 Annual site tonnage 1.0E+1
 Maximum daily site tonnage 5.0E+2

Frequency and duration of use
 Continuous release
 Emission days 20

Environment factors not influenced by risk management
 Local freshwater dilution factor 10
 Local marine water dilution factor 100

Other given operational conditions affecting environmental exposure
 Release fraction to air from process (initial release prior to RMM) 5.0E-4
 Release fraction to wastewater from process (initial release prior to RMM) 1.0E-6
 Release fraction to soil from process (initial release prior to RMM) 0.001

Technical conditions and measures at process level (source) to prevent release
 Common practices vary across sites thus conservative process release estimates used.

Technical on-site conditions and measures to reduce or limit discharges, air emissions and releases to soil
 Risk from environmental exposure is driven by freshwater sediment.
 Prevent discharge of undissolved substance to or recover from on-site wastewater.
 If discharging to municipal sewage treatment plant, no on-site wastewater treatment required.

Risk management measures - Air
 Treat air emission to provide a typical removal efficiency of 0

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Section 2 - Exposure controls

<p>Risk management measures - Water</p>	<p>Treat on-site wastewater (prior to receiving water discharge) to provide the required removal efficiency of 64.4 If discharging to municipal sewage treatment plant, provide the required on-site wastewater removal efficiency of 0</p>
<p>Organisational measures to prevent/limit release from site</p>	<p>Do not apply industrial sludge to natural soils. Sewage sludge should be incinerated, contained or reclaimed.</p>
<p>Conditions and measures related to municipal sewage treatment plant</p>	<p>Estimated substance removal from wastewater via on-site sewage treatment 94.7 Total efficiency of removal from wastewater after on-site and off-site (municipal treatment plant) RMMs 94.7 Maximum allowable site tonnage (M_{safe}) based on release following total wastewater treatment removal 3.3E+3 Assumed on-site sewage treatment plant flow 2000</p>
<p>Conditions and measures related to external treatment of waste for disposal</p>	<p>External treatment and disposal of waste should comply with applicable local and/or national regulations.</p>
<p>Conditions and measures related to external recovery of waste</p>	<p>External recovery and recycling of waste should comply with applicable local and/or national regulations.</p>

<p>Contributing scenario controlling worker exposure for 0: Functional Fluids</p>	
<p>Product characteristics</p>	<p>Liquid, vapour pressure < 0.5 kPa at STP</p>
<p>Concentration of substance in mixture or article</p>	<p>Covers percentage substance in the product up to 100% (unless stated differently).</p>
<p>Physical state</p>	<p>Liquid With potential for aerosol generation</p>
<p>Frequency and duration of use</p>	<p>Covers daily exposures up to 8 hours (unless stated differently)</p>
<p>Other given operational conditions affecting workers exposure</p>	<p>Operation is carried out at elevated temperature (> 20°C above ambient temperature) Assumes a good basic standard of occupational hygiene is implemented Aspiration hazard if swallowed. Aspiration means the entry of a liquid substance directly into the trachea and lower respiratory tract. Aspiration of hydrocarbon substances can result in severe acute effects such as chemical pneumonitis, varying degree of pulmonary injury or death. This property relates to the potential for low viscosity material to spread quickly into the deep lung and cause severe pulmonary tissue damage. Classification of a hydrocarbon substance for aspiration hazard is made on the basis of reliable human evidence or on the basis of physical properties. Do not induce vomiting as there is high risk of aspiration. IF SWALLOWED: Immediately call a POISON CENTER or physician.</p>
<p>Contributing scenarios - Operational conditions and risk management measures</p>	
<p>Bulk transfers - Closed system No other specific measures identified.</p>	
<p>Drum/batch transfers - Dedicated facility No other specific measures identified.</p>	
<p>Filling of articles/equipment - closed systems No other specific measures identified.</p>	
<p>Filling/preparation of equipment from drums or containers - Non-dedicated facility No other specific measures identified.</p>	
<p>General exposures (closed systems) No other specific measures identified.</p>	
<p>General exposures (open systems) - Elevated temperature Restrict area of openings to equipment. Provide extract ventilation to emission points when contact with warm (>50°C) lubricant is likely.</p>	

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Section 2 - Exposure controls

Remanufacture of reject articles
No other specific measures identified.

Equipment cleaning and maintenance
Drain down system prior to equipment break-in or maintenance.

Storage
Store substance within a closed system.

Conditions and measures related to personal protection and hygiene

Personal protection See Section 8 of the safety data sheet (general health and safety measures).
See Section 8 of the safety data sheet (personal protective equipment).

Section 3 - Exposure estimation and reference to its source

Website: Not applicable.

Exposure estimation and reference to its source - Environment: 2: Functional Fluids

Exposure assessment (environment): Not available.

Exposure estimation The Hydrocarbon Block Method has been used to calculate environmental exposure with the Petrorisk model.

Exposure estimation and reference to its source - Workers: 1: Functional Fluids

Exposure assessment (human): Not available.

Exposure estimation The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated.

Section 4 - Guidance to DU to evaluate whether he works inside the boundaries set by the ES

Environment
Guidance is based on assumed operating conditions which may not be applicable to all sites; thus, scaling may be necessary to define appropriate site-specific risk management measures. Required removal efficiency for wastewater can be achieved using onsite/offsite technologies, either alone or in combination. Required removal efficiency for air can be achieved using on-site technologies, either alone or in combination. Further details on scaling and control technologies are provided in SPERC factsheet. (<http://cefic.org/en/reach-for-industries-libraries.html>) Scaled local assessments for EU refineries have been performed using site-specific data and are attached in PETRORISK file - "Site-Specific Production" worksheet.

Health
The CLP hazard statement H304: May be fatal if swallowed and enters airways (the DPD risk phrase R65: Harmful: may cause lung damage if swallowed) relates to potential for aspiration, a non-quantifiable hazard determined by physico-chemical properties (i.e. kinematic viscosity) that can occur during ingestion and also if it is vomited following ingestion.
A DNEL (derived no effect levels) cannot be derived.
This general qualitative CSA (chemical safety assessment) approach aims to reduce/avoid contact or incidents with the substance.
However, implementation of risk management measures (RMMs) and operational conditions (OCs) need to be proportional to the degree of concern for the health hazard presented by the substance.
Exposures should be controlled to at least the levels that represent an acceptable level of risk such that the implementation of the chosen RMMs will ensure that the likelihood of an event occurring due to the substance hazard is negligible, and the risk is considered to be controlled to a level of no concern.
There are no routine anticipated exposures by ingestion related to any supported uses of the substance. The risk arising from aspiration hazard is solely related to the physico-chemical properties of the substance. The risk can therefore be controlled by implementing risk management measures tailored to this specific risk.

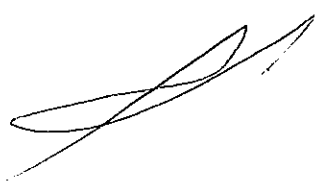
Section 4 - Guidance to DU to evaluate whether he works inside the boundaries set by the ES

For any substance, classified as H304 (R65), these measures should be communicated via the safety data sheet by use of the following phrase: Do not ingest. If swallowed then seek immediate medical assistance.

Predicted exposures are not expected to exceed the DN(M)EL when the risk management measures/operational conditions outlined in section 2 are implemented.

Where other risk management measures/operational conditions are adopted, then users should ensure that risks are managed to at least equivalent levels.

Available hazard data do not enable the derivation of a DNEL for dermal irritant effects. Available hazard data do not support the need for a DNEL to be established for other health effects. Risk management measures are based on qualitative risk characterisation.



Identification of the substance or mixture

Product definition Mixture
 Product name Nytro Lyra X

Section 1 - Title

Short title of the exposure scenario Uses in Functional fluids - Professional (Other Lubricant Base Oils, IP346<3%, H304)
 List of use descriptors **Identified use name:** Functional Fluids - Professional
Process Category: PROC01, PROC02, PROC03, PROC08a, PROC09, PROC20
Substance supplied to that use in form of: Substance
Sector of end use: SU22
Subsequent service life relevant for that use: No.
Environmental Release Category: ERC09a, ERC09b, ESVOC SpERC 9.13b.v1
Market sector by type of chemical product: Not applicable.
Article category related to subsequent service life: Not applicable.
 Environmental contributing scenarios **Functional Fluids**
 Health Contributing scenarios **Functional Fluids**

Number of the ES	9.38.1b
Industry Association	Goncawe 2012
Generic exposure scenario	13b
Processes and activities covered by the exposure scenario	Use as functional fluids e.g. cable oils, transfer oils, coolants, insulators, refrigerants, hydraulic fluids in professional equipment including maintenance and related material transfers.
Additional information	Professional

Section 2 - Exposure controls

Product characteristics Substance is complex UVCB. Predominantly hydrophobic
 Amounts used Fraction of EU tonnage used in region 0.1
 Regional use tonnage 1.2E+3
 Fraction of Regional tonnage used locally 1
 Annual site tonnage 6.0E-1
 Maximum daily site tonnage 1.6E+0
 Frequency and duration of use Continuous release
 Emission days 365
 Environment factors not influenced by risk management Local freshwater dilution factor 10
 Local marine water dilution factor 100
 Other given operational conditions affecting environmental exposure Release fraction to air from process (initial release prior to RMM) 0.05
 Release fraction to wastewater from process (initial release prior to RMM) 0.025
 Release fraction to soil from process (initial release prior to RMM) 0.025
 Technical conditions and measures at process level (source) to prevent release Common practices vary across sites thus conservative process release estimates used.
 Technical on-site conditions and measures to reduce or limit discharges, air emissions and releases to soil Risk from environmental exposure is driven by freshwater sediment.
 If discharging to municipal sewage treatment plant, no on-site wastewater treatment required.
 Risk management measures - Air Treat air emission to provide a typical removal efficiency of N/A

Section 2 - Exposure controls

Risk management measures - Water	Treat on-site wastewater (prior to receiving water discharge) to provide the required removal efficiency of 64.9 If discharging to municipal sewage treatment plant, provide the required on-site wastewater removal efficiency of 0
Organisational measures to prevent/limit release from site	Do not apply industrial sludge to natural soils. Sewage sludge should be incinerated, contained or reclaimed.
Conditions and measures related to municipal sewage treatment plant	Estimated substance removal from wastewater via on-site sewage treatment 94.7 Total efficiency of removal from wastewater after on-site and off-site (municipal treatment plant) RMMs 94.7 Maximum allowable site tonnage (M _{safe}) based on release following total wastewater treatment removal 1.1E+1 Assumed on-site sewage treatment plant flow 2000
Conditions and measures related to external treatment of waste for disposal	External treatment and disposal of waste should comply with applicable local and/or national regulations.
Conditions and measures related to external recovery of waste	External recovery and recycling of waste should comply with applicable local and/or national regulations.

Contributing scenario controlling worker exposure for 0: Functional Fluids	
Product characteristics	Liquid, vapour pressure < 0.5 kPa at STP
Concentration of substance in mixture or article	Covers percentage substance in the product up to 100% (unless stated differently).
Physical state	Liquid With potential for aerosol generation
Frequency and duration of use	Covers daily exposures up to 8 hours (unless stated differently)
Other given operational conditions affecting workers exposure	Operation is carried out at elevated temperature (> 20°C above ambient temperature) Assumes a good basic standard of occupational hygiene is implemented Aspiration hazard if swallowed. Aspiration means the entry of a liquid substance directly into the trachea and lower respiratory tract. Aspiration of hydrocarbon substances can result in severe acute effects such as chemical pneumonitis, varying degree of pulmonary injury or death. This property relates to the potential for low viscosity material to spread quickly into the deep lung and cause severe pulmonary tissue damage. Classification of a hydrocarbon substance for aspiration hazard is made on the basis of reliable human evidence or on the basis of physical properties. Do not induce vomiting as there is high risk of aspiration. IF SWALLOWED: Immediately call a POISON CENTER or physician.
	Contributing scenarios - Operational conditions and risk management measures
	Bulk transfers - Closed system No other specific measures identified.
	Drum/batch transfers - Dedicated facility No other specific measures identified.
	Filling of articles/equipment - closed systems No other specific measures identified.
	Filling/preparation of equipment from drums or containers - Non-dedicated facility No other specific measures identified.
	General exposures (closed systems) No other specific measures identified.
	General exposures (open systems) - Elevated temperature Restrict area of openings to equipment. Provide extract ventilation to emission points when contact with warm (>50°C) lubricant is likely.

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Section 2 - Exposure controls

Remanufacture of reject articles
No other specific measures identified.

Equipment cleaning and maintenance
Drain down system prior to equipment break-in or maintenance.

Storage
Store substance within a closed system.

Conditions and measures related to personal protection and hygiene

Personal protection See Section 8 of the safety data sheet (general health and safety measures).
See Section 8 of the safety data sheet (personal protective equipment).

Section 3 - Exposure estimation and reference to its source

Website: Not applicable.

Exposure estimation and reference to its source - Environment: 2: Functional Fluids

Exposure assessment (environment): Not available.

Exposure estimation The Hydrocarbon Block Method has been used to calculate environmental exposure with the Petrorisk model.

Exposure estimation and reference to its source - Workers: 1: Functional Fluids

Exposure assessment (human): Not available.

Exposure estimation The ECETOC TRA tool has been used to estimate workplace exposures unless otherwise indicated.

Section 4 - Guidance to DU to evaluate whether he works inside the boundaries set by the ES

Environment

Guidance is based on assumed operating conditions which may not be applicable to all sites; thus, scaling may be necessary to define appropriate site-specific risk management measures. Required removal efficiency for wastewater can be achieved using onsite/offsite technologies, either alone or in combination. Required removal efficiency for air can be achieved using on-site technologies, either alone or in combination. Further details on scaling and control technologies are provided in SPERC factsheet. (<http://cefic.org/en/reach-for-industries-libraries.html>) Scaled local assessments for EU refineries have been performed using site-specific data and are attached in PETRORISK file - "Site-Specific Production" worksheet.

Health

The CLP hazard statement H304: May be fatal if swallowed and enters airways (the DPD risk phrase R65: Harmful: may cause lung damage if swallowed) relates to potential for aspiration, a non-quantifiable hazard determined by physico-chemical properties (i.e. kinematic viscosity) that can occur during ingestion and also if it is vomited following ingestion.

A DNEL (derived no effect levels) cannot be derived.

This general qualitative CSA (chemical safety assessment) approach aims to reduce/avoid contact or incidents with the substance.

However, implementation of risk management measures (RMMs) and operational conditions (OCs) need to be proportional to the degree of concern for the health hazard presented by the substance.

Exposures should be controlled to at least the levels that represent an acceptable level of risk such that the implementation of the chosen RMMs will ensure that the likelihood of an event occurring due to the substance hazard is negligible, and the risk is considered to be controlled to a level of no concern.

There are no routine anticipated exposures by ingestion related to any supported uses of the substance. The risk arising from aspiration hazard is solely related to the physico-chemical properties of the substance. The risk can therefore be controlled by implementing risk management measures tailored to this specific risk.

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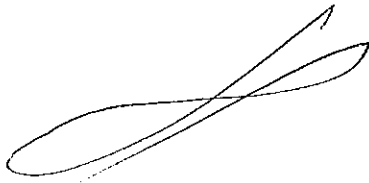
Section 4 - Guidance to DU to evaluate whether he works inside the boundaries set by the ES

For any substance, classifies as H304 (R65), these measures should be communicated via the safety data sheet by use of the following phrase: Do not ingest. If swallowed then seek immediate medical assistance.

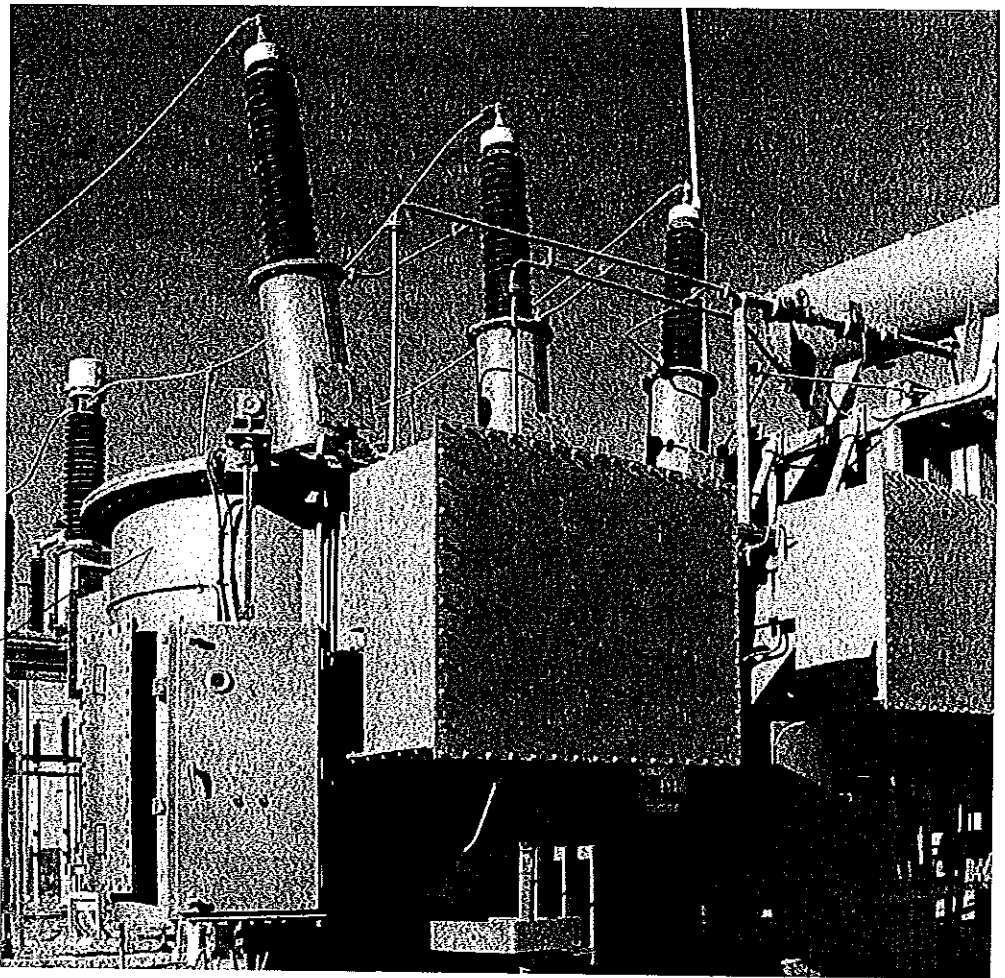
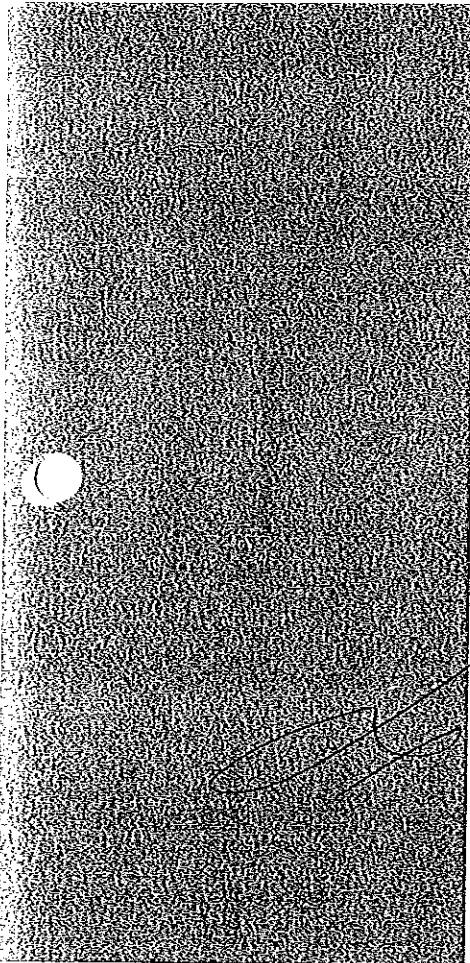
Predicted exposures are not expected to exceed the DN(M)EL when the risk management measures/operational conditions outlined in section 2 are implemented.

Where other risk management measures/operational conditions are adopted, then users should ensure that risks are managed to at least equivalent levels.

Available hazard data do not enable the derivation of a DNEL for dermal irritant effects. Available hazard data do not support the need for a DNEL to be established for other health effects. Risk management measures are based on qualitative risk characterisation.



5



LumaSMART

Fluoroptic-Based Winding Hot Spot Temperature Sensor for Generation, Transmission and Distribution Transformers

LumaSMART is the fifth generation Fluoroptic®-based thermometry system from LumaSense. By providing direct and real-time winding hotspot measurements, utilities can:

- Implement Dynamic Loading
- Extend the Life of Transformers
- Reduce Costly Failures
- Maximize Safe Performance

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Exceptional Reliability and Accuracy in Winding Hot Spots Temperature Monitoring

LumaSense Technologies' LumaSMART winding hot spot temperature system is the most advanced and reliable real-time monitoring solution available today. LumaSense is the leader in Fluoroptic® (FOT) Technology, with decades of proven expertise. The LumaSMART FOT hot spot monitoring systems provide accurate, real-time temperature readings for protection and control of your critical power transformer assets.

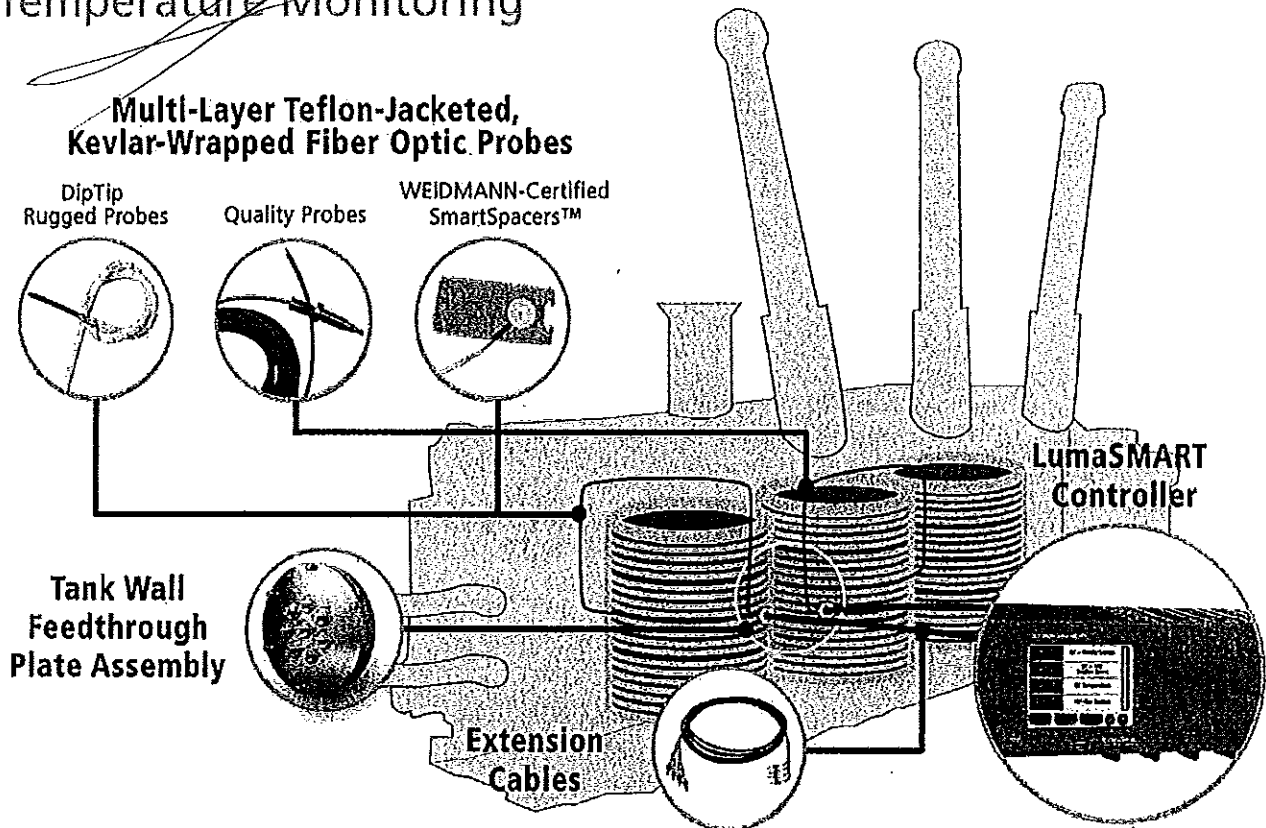
LumaSense's PFA teflon-jacketed Fluoroptic probes are considered the standard in the industry. Featuring five-layer protection in their fiber optic encapsulation for 99% installation success, they are specially designed to withstand harsh environments without deteriorating physically or affecting the accuracy of the temperature measurement.

LumaSense Technologies' LUXTRON brand is the world leader in fiber optic temperature measurement in transformers. With more than 30 years of fiber optic experi-

ence, LumaSense continues to lead the way in innovation of new, robust technology.

Measuring Hot Spot Winding Temperature
Transformers often take the brunt of an overload condition. Monitoring the transformer winding hot spot is critical to safeguard your transformer from damage and extend its usage. Transformer life is directly related to the life of the internal paper insulation. The insulating paper's life is directly affected by its exposure to high temperature. The highest temperature on the windings is the Winding Hot Spot, where the insulating paper will deteriorate first. Conventional methods simulate or calculate this temperature, but do not accurately measure it. The only true way of knowing the actual temperature is through real-time fiber optic measurement. Our reliable, accurate monitors quickly detect and respond to hot spot conditions, triggering alarms and relays to protect your most valuable assets.

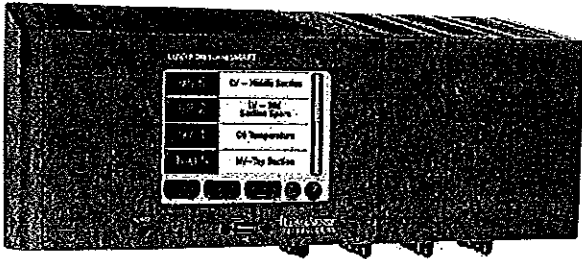
Smart Grid Power Transformer Hot Spots Temperature Monitoring



The Multi-Channel Controller System Should Include:

- LumaSMART Multi-Channel Smart Controller
- Fluoroptic Probes
 - Quality Probes
 - DipTip Rugged Probes
- Extension Cables
 - Single Fiber Extension
 - Four-Fiber Extension
- Tank Wall Feedthrough Plate Assembly
 - Stainless Steel Bolted Plate
 - Individual Tank Wall Feedthroughs
- Optional Accessories
 - NEMA 4 Enclosure
 - WEIDMANN-Certified SmartSpacers™
 - NEMA 12 Tank Wall Cover Box
 - Internal and External Plug Assemblies
 - LUXTRON 812 Handheld Unit

The LumaSMART Controller

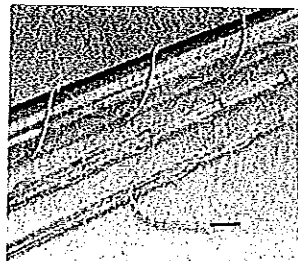


LumaSense Technologies' LumaSMART controller is the newest innovation from the leader in FOT technology. Building on the proven performance of the ThermAsset2, this monitor provides all of the capabilities of its predecessor while adding smart grid capabilities, an innovative touch screen and extended channel and relay capabilities.

- Easily adaptable to user-specific needs with 4 to 16 channels and 0, 8 or 16 Form-C programmable relays
- $\pm 2^{\circ}\text{C}$ accuracy over the entire temperature range for the life of transformer with no calibration
- No drift, no calibration required
- Analog outputs and Modbus, DNP3, ASCII and IEC61850 communication capability standard
- RS-232C and RS-485, Ethernet and USB serial outputs
- Light source lasts the life of the transformer
- Interactive touch screen display for alarms, notifications and set-up
- Equipped with 2GB standard data storage for transformer lifetime memory storage
- On-board diagnostics troubleshooting guidance

Fiber Optic Probes

The measurement performance of LUXTRON probes exceeds common temperature sensors in environments with high voltage, radio frequency interference (RFI), electromagnetic interference (EMI) or corrosive and above boiling point liquids. Our robust probes are designed for ease of installation and have a greater than 99% installation success rate.

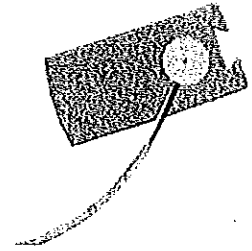


- Industry standard LUXTRON Quality Probes™ and DipTip Rugged Probes™
- Viton O-ring connector for protection against leaks
- PFA Teflon®-jacketed design with Kevlar® construction
- Immune to RF and EMI and Electrically Non-Conductive
- Most robust, well-built fiber optic probes on the market
- Insulated with five layers for superior protection
- DipTip Rugged Probes don't require double installations

- Dielectrically tested to ensure safe, accurate performance
- Chemically inert and compatible with many aggressive chemicals
- Intrinsically safe, stable and drift-free
- Available in various lengths (1m to 16m standard)

WEIDMANN-Certified SmartSpacers™

Our sensor tips can be supplied with WEIDMANN-certified SmartSpacers. All WEIDMANN-certified components including adhesives and assemblies meet strict manufacturing process controls and are shipped with a certificate of compliance outlining that the component has met the five-part WEIDMANN certification process. Available with LumaSense DipTip Rugged Probes™.



Extensions

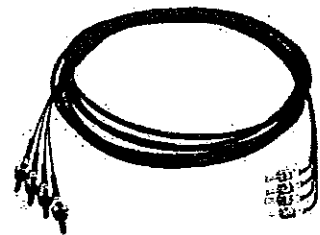
LumaSense offers multiple fiber optic extensions options to connect the probes from the tank wall plate to the instrument.

Single Fiber Extension

- Hard Clad Silica fiber jacketed in PVC and Kevlar®
- Available in lengths of 5, 10, 15 or 20 meters or custom lengths by request up to 50 meters
- SMA connector includes Viton O-ring for protection against leaks

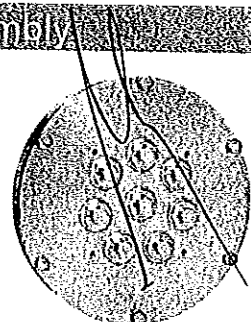
Four-Fiber Extension

- Four fiber cable subunits and a central Kevlar® strength member in one PVC outer jacket
- Each subunit features Hytrel® and Kevlar® over Hard Clad Silica fiber
- Available in lengths of 5, 10, 15 or 20 meters or custom lengths by request up to 50 meters
- Viton O-ring connectors for protection against leaks
- Available in low temperature construction also



Tank Wall Plate Assembly

LumaSense provides welded tank wall feedthrough plate assemblies. Each tank wall plate features our proprietary welded feedthroughs on a stainless steel plate, with a carbon steel backing ring and Viton O-ring for maximum protection against leaks.



Technical Data

Performance	
Number of Channels	4 to 16 (in increments of 2)
Temperature Range	-30 to 230°C
Accuracy	±2°C over entire temperature range for life of transformer without calibration
Display Response Time	1 sec
Measurement Resolution	0.1°C
Precision	±0.5°C
Light Source Life Span	Life of the transformer
EMI/RFI Susceptibility	Complete Immunity

Interface	
Display	5.7-inch interactive touch screen
Probe Signal Strength Readout	Accessible for all channels
Diagnostics	On-board self diagnostics and troubleshooting guide

Environmental Specifications	
Operating Temperature	-30 to 70°C
Storage Temperature	-35 to 75°C

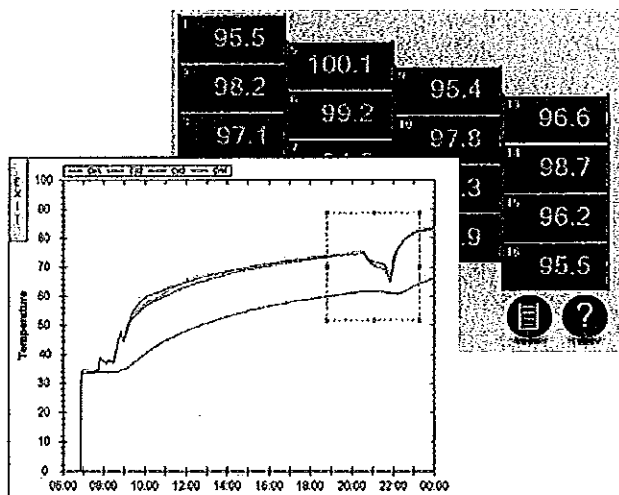
Communication	
Analog Output	Choice of 4-20mA or 0-1mA
Serial Output	RS-232C and RS-485, Ethernet, USB
Relays	0, 8 or 16 Form-C programmable relays
System Status Relay	1 Form-C relay
Communications	Modbus ASCII, Modbus RTU, DNP3.0, ASCII and IEC61850 Standard
Probes	Accepts LUXTRON Rugged and Quality Probes
Data Storage	2 GB of data at 1 minute intervals on all channels, as well as error codes and relay statuses. Retains approximately 40 years of data.

Electrical	
Input Power	90 to 264 VAC or 127 to 370 VDC, 47 to 63 Hz
Surge Protection	4000V (IEEE C37.90.1-2002)
Consumption	108 W (maximum)

Physical	
Mounting	Rack, panel or wall mount available

Innovative On-Board Software

The LumaSMART's innovative on-board software gives a color-coded visual display of all connected probes. Using the touch screen exclusively offered by LumaSense, you can customize channel labels, configure alarms and relays and download data logs. In addition, the diagnostic feature allows you to easily test your configured relay settings by simulating alarm conditions. Our software also allows for trending and data analysis of temperatures measured.



LumaSense Technologies Awaking Your 6th Sense

Americas and Australia
Sales & Service
Santa Clara, CA
Ph: +1 800 631 0176
Fax: +1 408 727 1677

Europe, Middle East, Africa
Sales & Service
Frankfurt, Germany
Ph: +49 69 97373 0
Fax: +49 69 97373 167

India
Sales & Support Center
Mumbai, India
Ph: +91 22 67419203
Fax: +91 22 67419201

China
Sales & Support Center
Shanghai, China
Ph: +86 133 1182 7766
Fax: +86 21 5877 2383

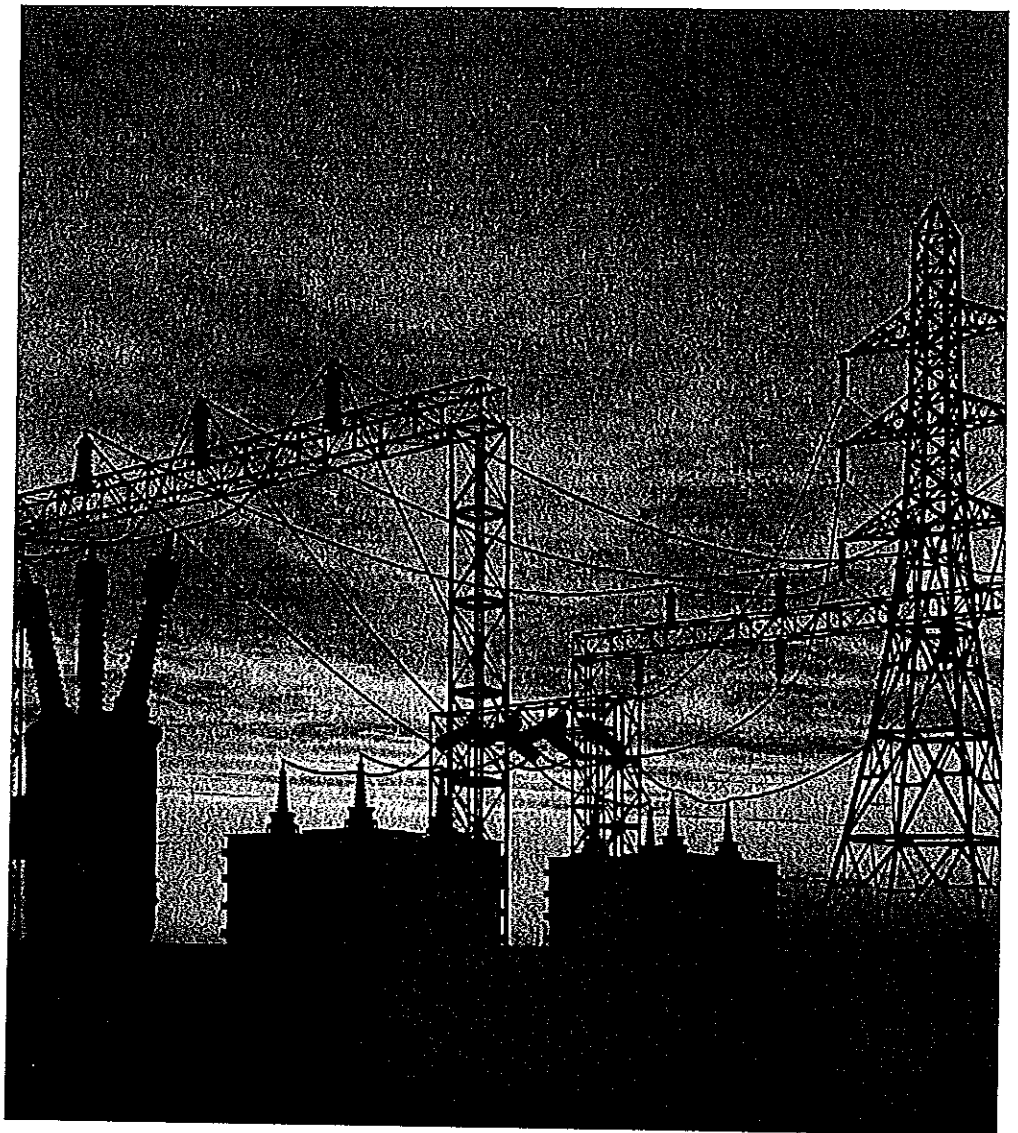
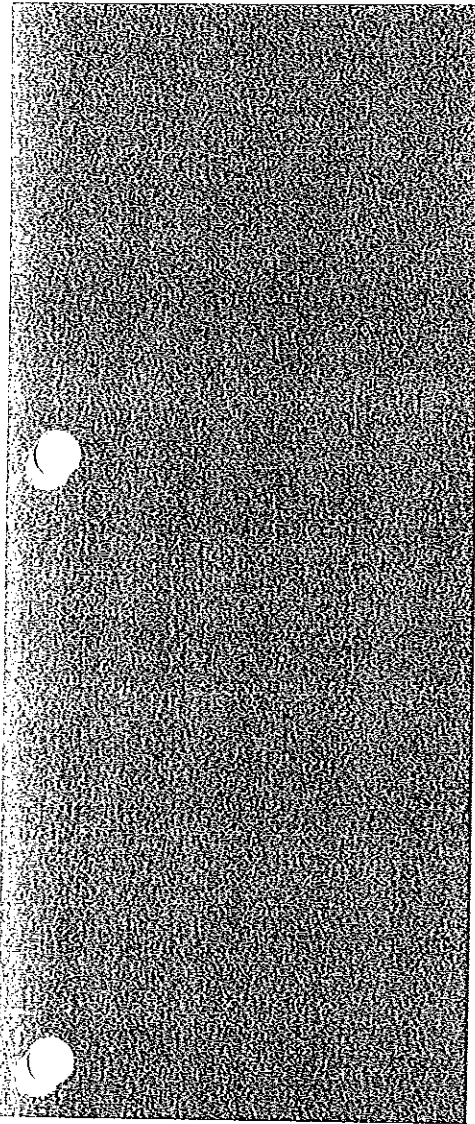
info@lumasenseinc.com

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www.lumasenseinc.com

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LumaSMART Brochure Rev. 09/03/13

5



SmartDGA® Monitoring Solutions

Cost-effective and accurate gas detection solutions based on Non-Dispersive Infrared (NDIR) sensor technology to measure fault gases in transformers or load tap changers (LTCs)

- Identify potential faults prior to failures and reduce unplanned outages and associated cost
- Reduce the number and frequency of LTC maintenance cycles, thereby increasing uptime and maximum efficiency of the LTC
- Proactively investigate premature aging or the cause of faults of a transformer

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Handwritten scribble or signature.

Protect critical assets through comprehensive analysis of transformer fault conditions with online SmartDGA® monitors

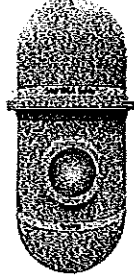
SmartDGA® Instruments

The SmartDGA® family of instruments is the industry's most cost effective Dissolved Gas Analysis (DGA) solution, designed to be the most flexible and to provide the best user experience available.

Each model has been designed using state-of-the-art Non-Dispersive Infrared (NDIR) technology. The continuous online DGA values reported by the SmartDGA® instrument quickly identify potential fault conditions through monitoring of key gas levels, rates, and ratios.

Each SmartDGA® package includes the instrument, mounting hardware, connection cable, the SmartDGA EZHub™ unit, and SmartDGA Viewer Software.

- **SmartDGA Gauge™** is the industry's first dedicated online Load Tap Changer (LTC) condition monitor. The Gauge measures and records Methane, Acetylene, and Ethylene plus moisture to assess LTC health.
- **SmartDGA Guard™** provides a cost effective early warning monitoring system of potential transformer failures. The Guard measures and records Hydrogen, Acetylene, Carbon Dioxide, and Carbon Monoxide plus moisture to provide an early diagnostics tool.
- **SmartDGA Guide™** provides comprehensive online DGA results that enable diagnostic techniques. The Guide measures and reports nine (9) DGA gases plus moisture in an instrument that vastly reduces total cost of ownership of an online monitoring system.

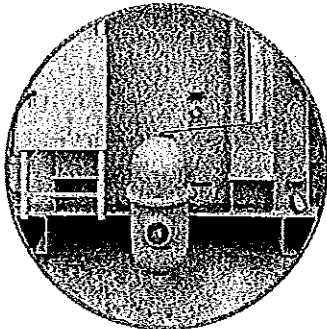


Key Functional Features

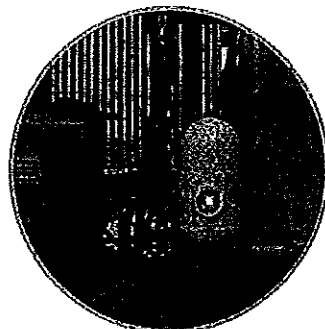
- Versatile mounting configurations – including single and dual valve mount. Inline mounting is available for LTC filter system or non-valve mounting for a transformer.
- Extremely cost effective – total cost of ownership is a fraction of the cost of other instruments and installation can be accomplished in just hours.
- No consumables, carrier gases, or scheduled calibration required.
- Sunlight visible Indicators for Caution, Warning, and Alarm conditions. Status Relay notification and corrective action triggering to ensure optimal system operations.
- Communications supported via all major protocols common in the electric power industry such as Modbus RTU, DNP 3.0, and IEC 61850 with the optional iCore.

40+ Years of Experience with NDIR

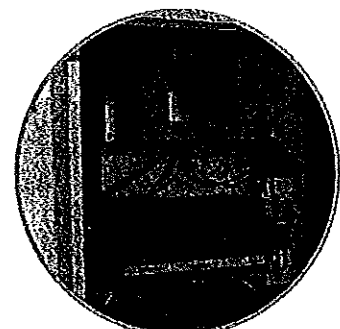
With over 40 years of experience, LumaSense is the industry leader in the use of Non-Dispersive Infrared (NDIR) technologies and has deployed thousands of systems in the field. Our ANDROS® brand pioneered NDIR gas analysis for automotive emissions and patient monitoring. This NDIR technology is the heart of our suite of SmartDGA® products.



Industry leading installation options including on-transformer installation of a full nine gas monitor using a single valve.



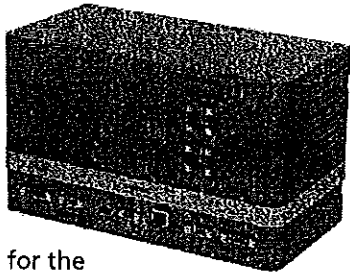
Mount the instrument anywhere using the compact off-transformer mounting kit when space at the transformer is limited or policy prohibits direct mounting to the transformer.



Separate supporting electronics can be mounted up to 30 meters away in a separate enclosure. This allows for a compact sensor that can be conveniently mounted anywhere.

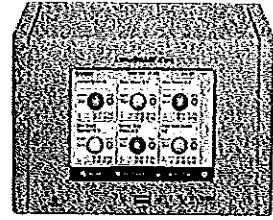
SmartDGA EZHub™

The SmartDGA EZHub™ unit is the central intelligence for the SmartDGA® system. A fully configured unit is capable of handling the power and communication needs for the SmartDGA® system. The EZHub can support a Gauge instrument for the LTC and a Guard or Guide instrument for the transformer. All interface functions and interconnects are provided in the EZHub device as well as internal memory, and four (4) relays with bright LED indicators to indicate Caution, Warning, and Alarm-gas level, rate, and ratio conditions. The fourth relay provides status information on the SmartDGA system itself.



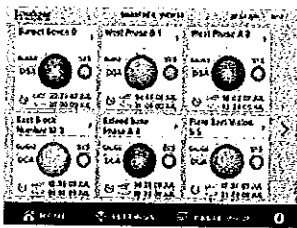
LumaSMART /Core™ (Optional)

The LumaSmart iCore™ controller provides a local interactive touch screen display of DGA data collected from the SmartDGA EZHub™ using the DGA Viewer™ software. The DGA Viewer™ software allows for on-site viewing of DGA data collected from the SmartDGA® instruments. The software provides a local means to set and create operational levels for caution, warning and alarm conditions. Additionally, the LumaSmart iCore™ device provides communications to external systems using RS485 or Ethernet. Each LumaSmart iCore™ device enables connectivity to multiple EZHub™ units (up to a maximum of 4 using either the Ethernet or RS485 connection).

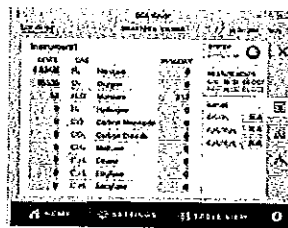


DGA Viewer™ software

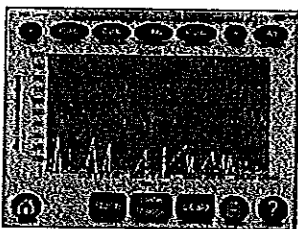
The DGA Viewer™ software allows users to configure systems using various set-up tools and view data being captured by the SmartDGA® instrument.



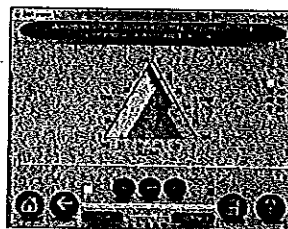
DGA Dashboard
The DGA Viewer™ software displays all connected instruments with status as well as the last and next sampling times.



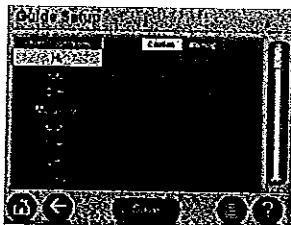
Details Screen
Review Gas levels and PPM/day as well as Ratios in a single screen. The last and next measurement date and times are also visible.



Trends
The Trends screen displays all detected gases via a trend graph over a user-selectable period of time. Each gas can be individually displayed or all 9 gases can be displayed at once.



Duval Triangle
Visual diagnostic tool divided into fault zones based on the types of electrical and thermal faults as defined in Duval triangle type 1 and 2 for transformers and LTCs respectively.



Device Configuration
Customized gas detection levels of Caution, Warning, and Alarm values. Included are user-configurable settings for each gas Rate of Change detection levels. Ratio setpoint activation is also available.

SmartDGA™ System Technical Data

Instrument Specifications

NDIR Gas Phase Sensor Accuracy	± 5% or ± LDL, whichever is greater
Reporting Rate	Every 24 hours - default, user selectable from approximately 3 hours to 7 days.
Measurement Range	Minimum value is the lower detectable limit, maximum value is the upper limit of accurate response
Moisture Accuracy	± 3 ppm or ± 2% R5
Oil Pressure	up to 45 psig (3 bar)
Enclosure Rating	IP 55
Sunlight visible indicators for condition codes	<ul style="list-style-type: none"> • Green - Normal • Yellow - Caution • Blue - Warning • Red - Alarm
Note: Indicators normally flash on for 5 seconds, off for 15 seconds	<ul style="list-style-type: none"> • Red/Blue - System Status Error • Green/Yellow - Loss of Communication

Environmental

	SmartDGA® Instrument	SmartDGA EZHub™	LumaSMART iCore™
Operating Temperature*	-50 to 55 °C	-50 to 55 °C	-40 to 70 °C
Storage Temperature	-50 to 70 °C	-50 to 70 °C	-40 to 75 °C
Storage Humidity (non-condensing)	1-99% RH	1-99% RH	1-99% RH
Dimensions (L x H x D)	20.5" x 8.6" dia.	10.3" x 5.7" x 6"	8.7" x 7.4" x 6.6"
Weight	~18.74 lbs	6.61 lbs	11.02 lbs

Standards Compliance

The SmartDGA system underwent thorough testing and complies with the following standards.

Emissions / Immunity	EN 61000-6-5 (2001) EN 61000-6-4 (2007) +A1 EN 61000-3-2 (2006) +A1 EN 61000-3-3 (2008)
Environmental / Vibration	ETSI EN 300 019-2-4
Surge Protection	4000V (IEEE C37.90.1-2002)

Standard Accessories (included in shipment)

- Mounting Hardware - includes single valve, dual valve or off transformer installation kit
- Connection Cable - 10 m standard (additional lengths and cold weather options available)
- DGA Viewer™ software

SmartDGA® Instrument Gas Measurements (Min-Max)

Gas	Gauge	Guard	Guide
Acetylene (C ₂ H ₂)	0.5-50,000 ppm	0.5-10,000 ppm	0.5-10,000 ppm
Ethylene (C ₂ H ₄)	2-50,000 ppm		2-50,000 ppm
Carbon Monoxide (CO)		10-10,000 ppm	10-10,000 ppm
Moisture (R5)	1-99%	1-99%	1-99%
Hydrogen (H ₂)		5-10,000 ppm	5-10,000 ppm
Carbon Dioxide (CO ₂)		10-20,000 ppm	10-20,000 ppm
Methane (CH ₄)	2-50,000 ppm		2-50,000 ppm
Ethane (C ₂ H ₆)			2-20,000 ppm
Oxygen (O ₂)			500-50,000 ppm
Nitrogen (N ₂)			5,000-100,000 ppm

EZHub™ & LumaSMART iCore™ Specifications

Power Supplied to EZHub & iCore	90 ~ 264 VAC, 127 ~ 370 VDC, 47 ~ 63 Hz, 6.5 A max
Power Supplied to Instrument	48 VDC ~ 4.16 A max
Memory	Up to 40+ years worth of data storage available with optional iCore
Data Export (Available with EZHub and iCore/PC)	Export of results to date in a single file onto a USB memory stick. When using iCore/PC, user can select date range; when using EZHub port, all data is exported
Available Communications (Available with EZHub)	Proprietary communications via RS485 and Ethernet connections to DGA Viewer software
Optional Communications (ModBus available with PC, others available with iCore)	IEC61850 Edition 2, DNP3 IEEE Std 1815-2012, ModBus RTU V1.02, ModBus TCP/IP 1.0b protocols for up to 3 EZHubs
EZHub Alarm Contacts	(3) programmable relay outputs (Type C, NO/NC) for caution, warning, & alarm (1) alarm relay output for system status (Type C, NO/NC)
Relay Contact Ratings	Single phase alarm relays (8 A, 250 VAC; 5 A, 30 VDC)

Optional Accessories

- LumaSMART iCore™ controller
- NEMA4x Enclosure (for SmartDGA EZHub™ and/or iCore)

*For operating temperatures less than -20 °C, the cold weather cable is required. Additional heating of oil transfer lines may be required for operation in cold locations. The unit will generate a system fault if the mineral oil temperature is outside of standard fluid limits of -20 and 120 °C. For operating in environments where the temperature routinely exceeds 40 °C, the high temperature accessory is recommended to prevent premature aging and reduction of component lifetime. Temperatures are based upon air temperatures for unit installation in shaded location.

LumaSense Technologies

Americas and Australia
Sales & Service
Santa Clara, CA
Ph: +1 800 631 0176
Fax: +1 408 727 1677

Europe, Middle East, Africa
Sales & Service
Frankfurt, Germany
Ph: +49 69 97373 0
Fax: +49 69 97373 167

India
Sales & Support Center
Mumbai, India
Ph: +91 22 67419203
Fax: +91 22 67419201

China
Sales & Support Center
Shanghai, China
Ph: +86 133 1182 7766
Fax: +86 21 5877 2383

info@lumasenseinc.com

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Awakening Your 6th Sense

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SmartDGA Brochure-EN - Rev. 03/31/2017

ROUTINE TESTS OF POWER TRANSFORMER

Laboratory Complex "Transformers"
Section "Transformer Test Station"
41, Rojen Blvd.
1271 Sofia, Bulgaria
tel. +359 2 382 989; fax: +359 2 936 07 42

Type <i>ATMPY 160000 / 220</i>	P.O. № 476/CE/STG/DP-I/P243/4740-49/ 31.10.2002
Tr. № <i>112741</i>	Customer: National Transmission & Dispatch Co. Ltd "WAPDA" - PAKISTAN
Project № <i>32809</i>	Standard document: IEC 60076-1/93; IEC 60296

RATINGS

Index	Cooling	HV winding	LV winding	Tertiary winding
Output, kVA	ONAF2	160000	160000	30000
	ONAF1	125000	125000	30000
	ONAN	100000	100000	30000
Current, A	ONAF2	419.89	699.82	1574.59
	ONAF1	328.04	546.73	1574.59
	ONAN	262.43	437.39	1574.59
Voltage, kV		220 ± 13 × 0.769%	132	11
Insulation level: line terminals		SI/LI/AC 850/950/395	LI/AC 650/275	LI/AC 110/38
neutral terminal		LI/AC 325/140		-

	50 Hz	Terminals	Tap	Short-circuit impedance, %
Frequency -	50 Hz	HV - LV	14	12.5 (125 MVA)
Number of phases -	3	HV - Tw	14	45.0 (125 MVA)
Type of mounting -	outdoor	LV - Tw	-	25.0 (125 MVA)
Type of regulation -	on load	Connection - YNa0d1		
Operation duty -	continuous			

Tested by:

- [Signature]*
I. Terziev
- [Signature]*
N. Vladimirov

Chief of Department:

[Signature]
M. Mateev, MSEE /

Inspectors:

- [Signature]*
/ Ir. R.C.A.M. Koevets /

[Signature]
/ Ch. Abdul Hamid /

Sofia, 05.09.2003



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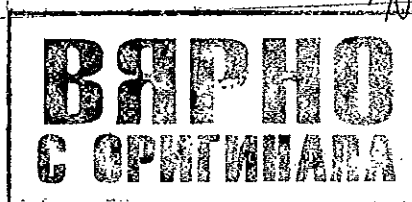
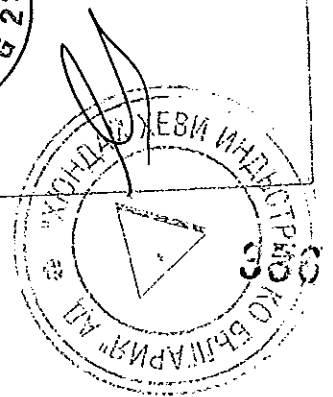
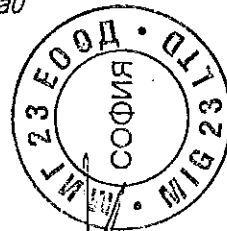
1. Measurement of the voltage ratio and check of the phase displacement

1.1 Measurement of voltage ratio (HV / LV)

Tap	RELATED VALUES		$\frac{U_{HV}}{U_{LV}}$	MEASURED VALUES		
	Voltage, V			Deviation, %		
	U_{HV}	U_{LV}		A _{Na} -A _{mNa}	B _{Na} -B _{mNa}	C _{Na} -C _{mNa}
1	242000	132000	1,833	0,12	0,14	0,13
2	240304		1,820	0,15	0,15	0,15
3	238612		1,808	0,11	0,11	0,12
4	236920		1,795	0,13	0,11	0,10
5	235228		1,782	0,12	0,02	0,13
6	233536		1,769	0,12	0,08	0,12
7	231844		1,756	0,11	0,08	0,09
8	230152		1,744	0,07	0,07	0,10
9	228460		1,731	0,09	0,06	0,09
10	226768		1,718	0,07	0,08	0,05
11	225076		1,705	0,03	0,01	0,05
12	223384		1,692	0,02	0,05	0,04
13	221692		1,679	0,03	0,05	0,02
14	220000		1,667	0,01	0,01	0,02
15	218308		1,654	-0,02	0,02	0,02
16	216616		1,641	0,00	-0,02	0,01
17	214924		1,628	-0,01	-0,03	0,04
18	213232		1,615	-0,04	-0,04	-0,03
19	211540		1,603	-0,03	-0,03	-0,04
20	209848		1,590	-0,04	-0,06	-0,05
21	208156		1,577	-0,08	-0,07	-0,04
22	206464		1,564	-0,07	-0,06	-0,06
23	204772		1,551	-0,11	-0,10	-0,09
24	203080		1,538	-0,10	-0,09	-0,10
25	201388		1,526	-0,12	-0,09	-0,11
26	199696		1,513	-0,12	-0,14	-0,13
27	198000		1,500	-0,12	-0,13	-0,11

Admissible deviation of the voltage ratio - $\leq \pm 0,5\%$

1.2 Check of the phase displacement (HV / LV) -- YNa0



1.3 Measurement of voltage ratio (HV / Tw)

Tap	REATED VALUES			MEASURED VALUES		
	Voltage, V		$\frac{U_{HV}}{U_{TW} \times \sqrt{3}}$	Deviation, %		
	U_{HV}	U_{TW}		ANa-TATb	BNa-TbTc	CNa-TcTA
1	242000	11000	12,702	0,23	0,23	0,25
2	240304		12,613	0,25	0,23	0,25
3	238612		12,524	0,20	0,23	0,22
4	236920		12,435	0,24	0,19	0,23
5	235228		12,346	0,25	0,11	0,26
6	233536		12,257	0,21	0,21	0,23
7	231844		12,169	0,21	0,20	0,19
8	230152		12,080	0,19	0,16	0,18
9	228460		11,991	0,19	0,18	0,20
10	226768		11,902	0,17	0,16	0,15
11	225076		11,813	0,11	0,12	0,15
12	223384		11,725	0,13	0,15	0,14
13	221692		11,636	0,12	0,15	0,14
14	220000		11,547	0,12	0,10	0,12
15	218308		11,458	0,08	0,11	0,15
16	216616		11,369	0,09	0,07	0,12
17	214924		11,281	0,11	0,05	0,13
18	213232		11,192	0,10	0,04	0,07
19	211540		11,103	0,06	0,05	0,07
20	209848		11,014	0,08	0,04	0,08
21	208156		10,925	0,01	0,02	0,07
22	206464		10,837	0,05	0,06	0,02
23	204772		10,748	0,00	0,02	0,03
24	203080		10,659	0,02	0,03	-0,01
25	201388		10,570	0,01	0,01	-0,03
26	199696		10,481	0,01	-0,04	-0,04
27	198000		10,392	-0,03	-0,02	-0,02

Admissible deviation of the voltage ratio - $\leq \pm 0,5\%$

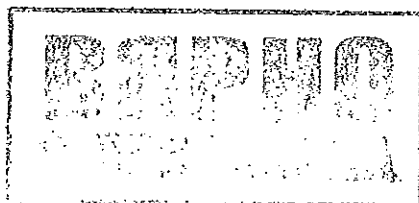
1.4 Check of the phase displacement (HV / Tw) - YNd1

1.5 Measurement of voltage ratio (LV / Tw)

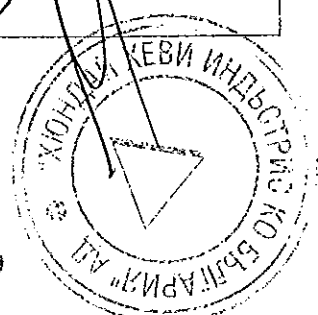
Tap	REATED VALUES			MEASURED VALUES		
	Voltage, V		$\frac{U_{LV}}{U_{TW} \times \sqrt{3}}$	Deviation, %		
	U_{LV}	U_{TW}		AmNa-TATb	BmNa-TbTc	CmNa-TcTA
-	132000	11000	6,928	0,09	0,10	0,09

Admissible deviation of the voltage ratio - $\leq \pm 0,5\%$

1.6 Check of the phase displacement (LV / Tw) - YNd1



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2. Measurement of the winding resistance with D.C.
2.1 HV winding

Tap	Terminals	Voltage, V	Current, A	Resistance, Ω at θ_m	Resistance, Ω at 75 °C
1	ANa	2,860	5	0,5720	0,6820
	BNa	2,866	5	0,5732	0,6834
	CNa	2,874	5	0,5748	0,6853
2	ANa	2,844	5	0,5688	0,6782
	BNa	2,854	5	0,5708	0,6806
	CNa	2,858	5	0,5716	0,6815
3	ANa	2,830	5	0,5660	0,6748
	BNa	2,836	5	0,5672	0,6763
	CNa	2,840	5	0,5680	0,6772
4	ANa	2,816	5	0,5632	0,6715
	BNa	2,820	5	0,5640	0,6725
	CNa	2,822	5	0,5644	0,6729
5	ANa	2,798	5	0,5596	0,6672
	BNa	2,800	5	0,5600	0,6677
	CNa	2,804	5	0,5608	0,6686
6	ANa	2,778	5	0,5556	0,6624
	BNa	2,782	5	0,5564	0,6634
	CNa	2,786	5	0,5572	0,6644
7	ANa	2,760	5	0,5520	0,6582
	BNa	2,764	5	0,5528	0,6591
	CNa	2,770	5	0,5540	0,6605
8	ANa	2,742	5	0,5484	0,6539
	BNa	2,748	5	0,5496	0,6553
	CNa	2,754	5	0,5508	0,6567
9	ANa	2,726	5	0,5452	0,6500
	BNa	2,734	5	0,5468	0,6520
	CNa	2,734	5	0,5468	0,6520
10	ANa	2,714	5	0,5428	0,6472
	BNa	2,718	5	0,5436	0,6481
	CNa	2,722	5	0,5444	0,6491
11	ANa	2,696	5	0,5392	0,6429
	BNa	2,700	5	0,5400	0,6438
	CNa	2,704	5	0,5408	0,6448
12	ANa	2,678	5	0,5356	0,6386
	BNa	2,680	5	0,5360	0,6391
	CNa	2,686	5	0,5372	0,6405
13	ANa	2,660	5	0,5320	0,6343
	BNa	2,664	5	0,5328	0,6353
	CNa	2,670	5	0,5340	0,6367
14	ANa	2,640	5	0,5280	0,6295
	BNa	2,642	5	0,5284	0,6300
	CNa	2,648	5	0,5296	0,6314
27	ANa	2,860	5	0,5720	0,6820
	BNa	2,868	5	0,5736	0,6839
	CNa	2,874	5	0,5748	0,6853

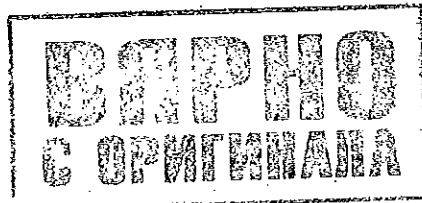
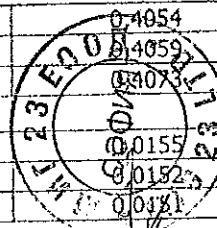
$\theta_m = 25,0 \text{ }^\circ\text{C}$

2.2 LV winding

AmNa	1,7000	5	0,3400
BmNa	1,7020	5	0,3404
CmNa	1,7080	5	0,3416

2.3 Tertiary winding

TaTb	0,0648	5	0,01296
TbTc	0,0640	5	0,01279
TcTz	0,0635	5	0,01269



3. Measurement of the short-circuit impedance and load losses
 3.1 Test HV/LV
 3.1.1 Results of the measurement

Tap	Current - I_m , A	Voltage - U_m , kV	Losses - P_m , kW	Losses - $P_{mcorr.}$, kW	$f = 50 \text{ Hz}$ $\theta_m = 26,0 \text{ }^\circ\text{C}$
1	203,830	19,880	82,000	88,699	
14	217,250	17,330	75,600	81,084	
27	239,070	15,760	89,600	94,367	

3.1.2 Related to the rated values

Tap	Related to I_r		Related to $75 \text{ }^\circ\text{C}$			Us.c, %
	P s.c, kW	Us.c, kV	$I_r^2 R$, kW	P add, kW	P s.c, kW	
Output: 160 MVA						
1	311,080	37,230	244,567	88,547	333,114	15,38
14	302,892	53,495	214,022	103,305	317,327	15,23
27	359,389	30,756	247,519	127,127	374,646	15,53

Guaranteed output 160 MVA : P s.c = 334,00 kW :

Output: 125 MVA

1	189,870	29,086	149,269	54,048	203,317	12,02
14	184,872	26,168	130,626	63,055	193,681	11,89
27	219,351	24,028	151,072	77,591	228,663	12,14

Guaranteed output 125 MVA : P s.c = 226,00 kW : Us.c = 12,5 %

Output: 120 MVA

1	174,983	27,923	137,566	49,810	187,376	11,54
14	170,379	25,121	120,385	58,113	178,498	11,42
27	202,153	23,067	139,227	71,508	210,735	11,65

Guaranteed output 120 MVA : P s.c = 211,00 kW :

Output: 100 MVA

1	121,511	23,268	95,536	34,583	130,119	9,61
14	118,316	20,934	83,604	40,351	123,955	9,52
27	140,383	19,222	96,688	49,656	146,344	9,71

Guaranteed output 100 MVA : P s.c = 151,00 kW :

Output: 93,75 MVA

1	106,797	21,814	83,965	30,397	114,362	9,01
14	103,990	19,626	73,478	35,468	108,946	8,92
27	123,387	18,021	84,979	43,646	128,625	9,10

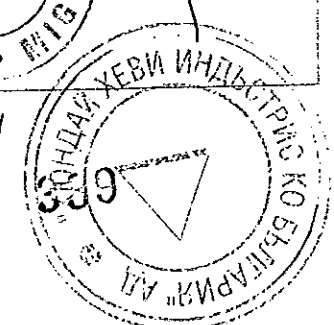
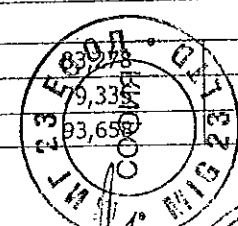
Guaranteed output 93.75 MVA : P s.c = 135,00 kW :

Output: 80 MVA

1	77,770	18,615	61,142	22,136	93,658	7,69
14	75,727	16,748	53,505	25,830	93,658	7,61
27	89,843	15,378	61,879	31,779	93,658	7,77

Guaranteed output 80 MVA : P s.c = 104,00 kW :

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3.1.2 Related to the rated values

Tap	Related to I_r		Related to 75 °C			Us.c. %
	P.s.c. kW	Us.c. kV	$I_r^2 R$, kW	Padd. kW	Ps.c. kW	
Output: 75 MVA						
1	68,352	17,451	53,738	19,456	73,194	7,21
14	66,551	15,700	47,026	22,697	69,723	7,14
27	78,963	14,417	54,386	27,930	82,316	7,28

Guaranteed output 75 MVA : Ps.c = 91,00 kW;

Output: 62,5 MVA

1	47,467	14,543	37,319	13,510	50,829	6,01
14	46,218	13,084	32,658	15,763	48,421	5,95
27	54,835	12,014	37,769	19,395	57,164	6,07

Guaranteed output 62.7 MVA : Ps.c = 65,00 kW;

Output: 50 MVA

1	30,380	11,635	23,882	8,649	32,531	4,81
14	29,581	10,467	20,900	10,090	30,990	4,76
27	35,098	9,611	24,171	12,417	36,588	4,85

Guaranteed output 50 MVA : Ps.c = 48,00 kW;

3.2 Test HV/ Tw

3.2.1 Results of the measurement

Tap	Current - I_m , A	Voltage - U_m , kV	Losses - P_m , kW	Losses - $P_{m_{corr}}$, kW	f = 50 Hz $\theta_m = 26,0$ °C
1	45,970	14,573	25,380	23,763	
14	45,460	11,710	20,770	19,394	
27	50,510	10,433	22,020	20,575	

3.2.2 Related to the rated values

Tap	Related to I_r		Related to 75 °C			Us.c. %
	P.s.c. kW	Us.c. kV	$I_r^2 R$, kW	Padd. kW	Ps.c. kW	
Output 30 MVA						
1	57,598	22,688	48,389	14,193	62,582	9,38
14	58,167	20,280	49,605	13,810	63,415	9,22
27	61,717	18,069	53,581	13,981	67,562	9,13

Guaranteed output 30 MVA : Ps.c = 72,00 kW; 125 MVA: Us.c = 45,0 %

Output 22,5 MVA

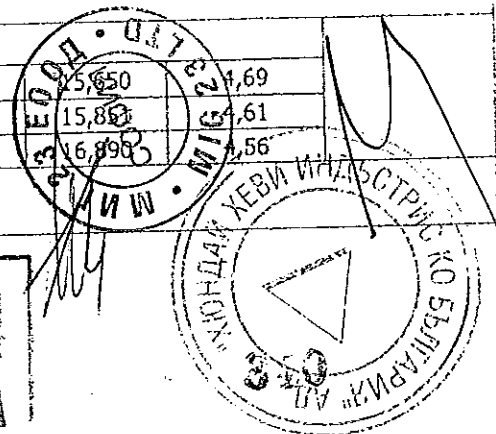
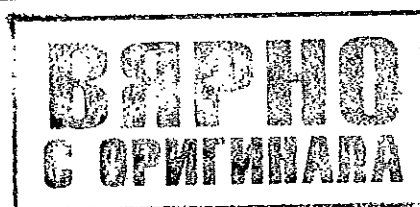
1	32,402	17,017	27,219	7,986	35,205	7,03
14	32,722	15,211	27,903	7,771	35,674	6,91
27	34,716	13,552	30,139	7,864	38,003	6,84

Guaranteed output 22,5 MVA : Ps.c = 43,00 kW;

Output 15 MVA

1	14,404	11,346	12,098	3,552	15,850	7,69
14	14,538	10,139	12,401	3,450	15,863	7,61
27	15,429	9,035	13,395	3,495	16,898	7,56

Guaranteed output 15 MVA : Ps.c = 22,00 kW;



3.3 Test LV/Tw

3.3.1 Results of the measurement

Tap	Current - I_m , A	Voltage - U_m , kV	Losses - P_m , kW	Losses - $P_{m,corr}$, kW*	$f = 50$ Hz $\theta_m = 26,0$ °C
-	104,030	6,104	36,700	36,156	

3.3.2 Related to the rated values

Tap	Related to I_r		Related to 75 °C			Us.c, %	
	P s.c, kW	Us.c, kV	$I_r^2 R$, kW	P add, kW	P s.c, kW	30 MVA	125 MVA
Output 30 MVA							
-	57,658	7,696	58,861	6,820	65,681	5,83	24,29

Guaranteed output 30000 kVA : P s.c = 79.00 kW : 125000 kVA : Us.c = 25.0 %

Output 22.5 MVA

-	32,429	5,772	33,109	3,834	36,943	4,37	
---	--------	-------	--------	-------	--------	------	--

Guaranteed output 22,5 MVA : P s.c = 47.00 kW

Output 15 MVA

-	14,415	3,848	14,715	1,706	16,421	2,92	
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Guaranteed output 15 MVA : P s.c = 24.00 kW

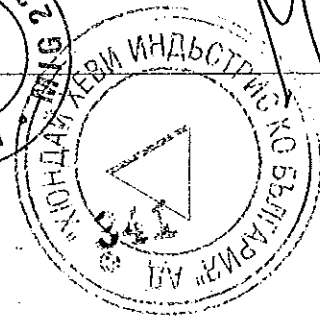
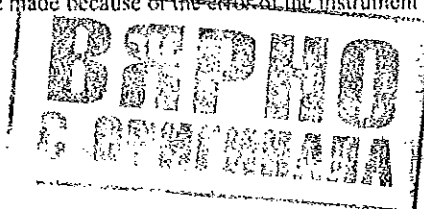
3.4 Short-circuit impedance given in Ohms per phase for different pair of windings

Test	Tap	Us.c., Ohm/ph		Test	Tap	Us.c., Ohm/ph		Test	Tap	Us.c., Ohm/ph	
		Measured	Guaranteed			Measured	Guaranteed			Measured	Guaranteed
HV-LV	1	56,31	59,5	HV-TW	1	183,03	215,0	LV-TW			
	14	46,06	48,4		14	148,72	174,3			33,86	34,8
	27	38,06	40,9		27	119,25	140,5				

3.5 Calculation of the three-winding combined load losses

Output, MVA	Tap	Losses, kW		Output, MVA	Tap	Losses, kW		Output, MVA	Tap	Losses, kW	
		Calculated	Guaranteed			Calculated	Guaranteed			Calculated	Guaranteed
160	1	319,808	382	120	1	179,892	239	80	1	79,952	121
	14	311,424	348		14	175,176	217		14	77,856	109
	27	380,113	403		27	213,813	248		27	95,028	122
125	1	207,289	264	93,75	1	116,600	159	62,5	1	51,822	83
	14	203,437	242		14	114,433	145		14	50,859	75
	27	247,304	278		27	139,109	165		27	61,826	84
100	1	146,437	177	75	1	82,371	118	50	1	36,609	62
	14	144,897	170		14	81,504	108		14	36,224	56
	27	174,393	194		27	98,096	121		27	43,598	62

* Correction is necessary to be made because of the error of the instrument transformer.



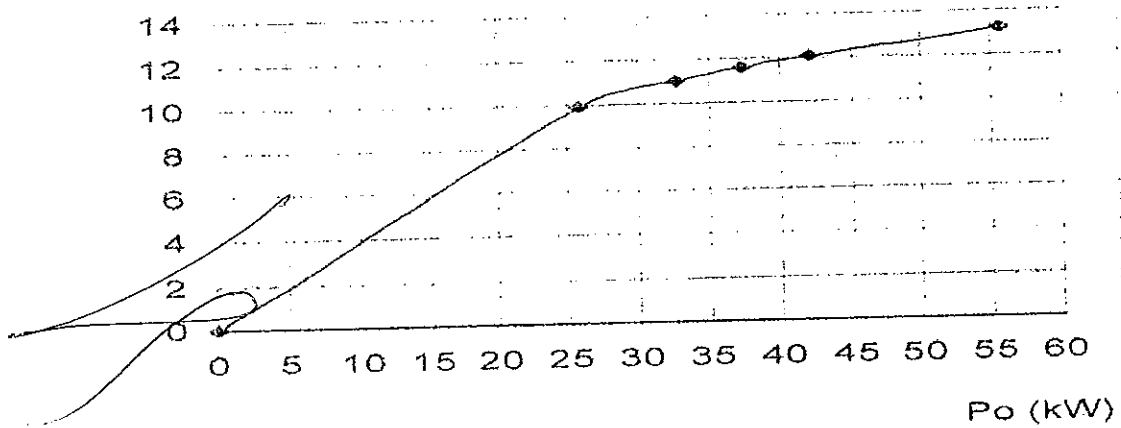
4. Measurement of the no-load losses and current

Tap	U_n/U_r	f, Hz	Voltage	Voltage	Current	Current	Losses	Losses
			U_{av}, kV	U_{eff}, kV	I_0, A	$I_0, \%$	P_{0n}, kW	P_0, kW
14	0,90	50	9,899	9,918	1,686	0,020	25,74	25,70
	1,00	50	10,990	10,990	2,342	0,028	32,74	32,74
	1,05	50	11,552	11,558	3,186	0,038	37,30	37,30
	1,10	50	12,098	12,062	4,365	0,052	42,00	42,15
	1,20	50	13,200	13,090	10,102	0,120	55,06	55,60

Guaranteed for: $U_n/U_r=1,00$; $P_0 = 31,00$ kW; $i_0 = 0,083$ %
 $U_n/U_r=1,05$; $P_0 = 37,40$ kW; $i_0 = 0,109$ %
 $U_n/U_r=1,10$; $P_0 = 45,50$ kW; $i_0 = 0,163$ %

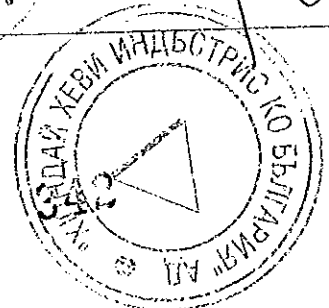
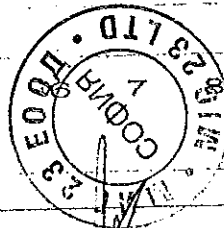
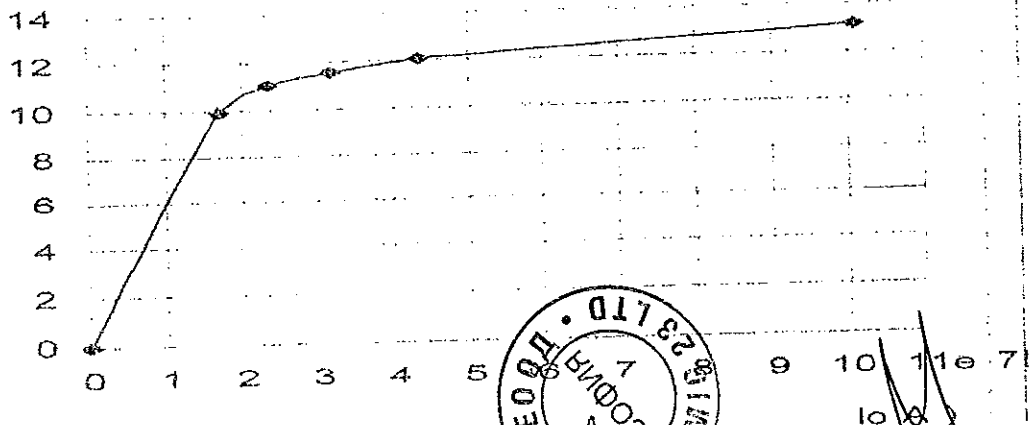
U (kV)

No-load loss



U (kV)

No-load current



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5. Determination of the breakdown voltage of the transformer oil

No of breakdown	1	2	3	4	5	6	Mean value, kV	$\theta_m, ^\circ\text{C}$
Breakdown voltage, kV	75	76	75	75	75	75	75	26,0

6.1 Measurement of the insulation characteristics' - 25.08.2003

Insulation clearance	$R_{1s}, M\Omega$	$R_{60}, M\Omega$	$tg\delta, \%$	Cs.c, pF	$\theta_m, ^\circ\text{C}$
Tertiary / HV+ LV + Tank	1783	3500	0,268	19587	26,0
HV + LV/ Tertiary + Tank	2400	3200	0,205	13091	
HV + LV + Tertiary/ Tank	1564	2611	0,251	21839	
Test Voltage, kV	2,5 kV (D.C.)		10 kV (A.C.; 50 Hz)		

6.2 Measurement of the insulation characteristics - 05.09.2003

Insulation clearance	$R_{1s}, M\Omega$	$R_{60}, M\Omega$	$tg\delta, \%$	Cs.c, pF	$\theta_m, ^\circ\text{C}$
Tertiary / HV+ LV + Tank	1194	2554	0,274	19608	30,0
HV + LV/ Tertiary + Tank	1706	2379	0,208	13088	
HV + LV + Tertiary/ Tank	1092	1758	0,264	21849	
Test Voltage	2,5 kV (D.C.)		10 kV (A.C.; 50 Hz)		

7. Separate-source voltage withstand test

Frequency - 50 Hz Duration - 60 s	HV line terminals withstood	140 kV
	LV line terminals withstood	140 kV
	Neutral terminal withstood	140 kV
	Tw line terminals withstood	38 kV

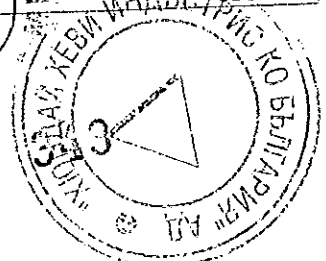
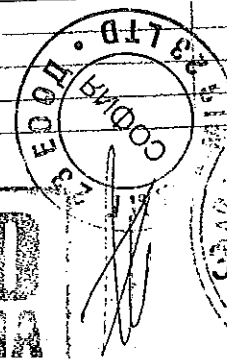
8. Checking the operation of the on-load tap-changing device
inbuilt into the transformer - normal operation

Used measuring devices

No	Device	Type	Serial number
1	Instrument transformer	ТЛ 35 5, 10, 20 / 5	81017
2	Instrument transformer	ТЛ 35 5, 10, 20 / 5	81013
3	Instrument transformer	ТЛ 35 5, 10, 20 / 5	81018
4	Instrument transformer	ТЛ 35 50, 100, 200 / 5	81019
5	Instrument transformer	ТЛ 35 50, 100, 200 / 5	81026
6	Instrument transformer	ТЛ 35 50, 100, 200 / 5	81028
7	Instrument transformer	И 510 3, 6, 10, 15/ 0,1	43
8	Instrument transformer	И 510 3, 6, 10, 15/ 0,1	19
9	Instrument transformer	HK 24 20 / 0,1	00020
10	Instrument transformer	HK 24 20 / 0,1	00017
11	AC-Power Analyzer	Norma D5155	V069812 I
12	Insulation tester	Unilap ISO 5 kV	502490314628
13	C and tgδ Bridge	Tettex 2808	39255
14	Voltage divider	MCF 75/350 P	881913
15	Voltage divider	MCF 135/200 P	873104
16	Amplitude voltmeter	MU7	884484
17	Amplitude voltmeter	MU7	884486
18	Voltmeter	M2018	4722
19	Amperemeter	Д 5014	59227
20	Amplitude voltmeter device	WPOT 0.25/75	858405

The measurement is not actual

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HYUNDAI HEAVY INDUSTRIES Co., Bulgaria
 41, Rojen Blvd. *1271 Sofia, Bulgaria
 tel. (+359 2) 382989*Telefax: (+359 2) 936 07 42*Telex:22923
 LABORATORY COMPLEX "TRANSFORMERS"
 LABORATORY "TRANSFORMER"



Chief of laboratory

complex "Transformers":

[Signature]
 M.Sc.El.Eng.M.Mateev:

total pages: 4

TEST CERTIFICATE
 № T056/29.08.2003

TEMPERATURE RISE TEST

TEST OBJECT: Transformer type ATMPY 160000/220

Doc. № 32809

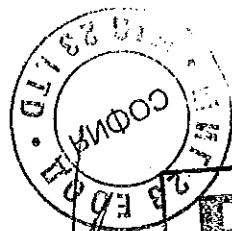
Ser. № 112738 Ser. № 112741

Manufacturer: HYUNDAI HEAVY INDUSTRIES Co., Bulgaria

RATED DATA :

Output, kVA	160000/160000/30000
Voltage, kV	220±13x0.769%/132/11
Current, A	419.9/699.8/1574.6
Frequency, Hz	50
Vector group of connection	YNa0d1
Cooling type	ONAN/ONAF1(12 fans)/ONASF2(24 fans)
Mounting	outdoor
Voltage regulation	on-load tap-changer type MR № 586903

Contractor	HYUNDAI HEAVY INDUSTRIES Co., Bulgaria
Owner	"WAPDA", Islamic republic Pakistan
Contract	476/CE/STG/DP-I/F-243/4740-49/31.10.2002
Standard	IEC 60076



Temperature rise test has been performed according to IEC 60076-2/93 recommendation. Temperature rise test is carried out by the short-circuit method with energised HV winding at tap 27.

The test has been performed on transformer ser.№ 112738 in June 2003 with the next results:

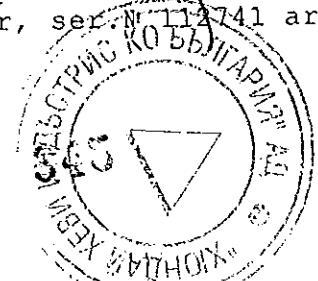
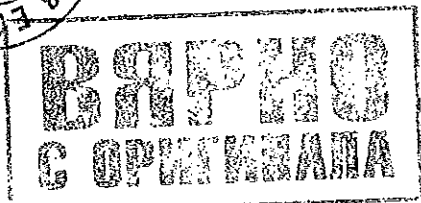
Output Cooling	Losses for oil	Current for winding	Air temperature	Temperature rise, K								
				KVA	W	A	°C	Measured			Guaranteed	
								top oil, av.oil	HV w. av,** h.spot	LV w. av,*** h.spot	top oil,	winding average h.spot
-	-	-	-	-	-	-	-	-	-	-		
179200 *ONAF2	477834	522.53	23.4	53.3 39.2	53.2 71.4	56.8 76.1	60	65 78				
169600 ONAF2	431135	494.54	23.4	48.0 35.3	48.2 64.7	51.5 68.9	55	60 73				
160000 *ONAF2	387007	466.55	23.4	43.2 31.8	43.5 58.4	46.5 62.3	50	55 68				
140000 *ONAF1	303328	408.23	20.0	47.3 34.7	45.8 61.7	49.3 66.3	60	65 78				
132500 ONAF1	274826	386.36	20.0	42.8 31.4	41.6 56.1	44.8 60.7	55	60 73				
125000 *ONAF1	247891	364.49	20.0	38.6 28.3	37.6 50.7	40.6 54.5	50	55 68				
112000 *ONAN	204923	326.58	21.8	40.2 28.6	38.4 52.9	41.8 57.3	60	65 78				
106000 ONAN	186681	309.09	21.8	37.3 26.6	35.4 48.9	38.6 52.9	55	60 73				
100000 *ONAN	169443	291.59	21.8	34.5 24.6	32.7 45.1	35.4 48.7	50	55 68				
30000 ONAF2		87.477	22.1		Wind/oil 16.2	48.0 64.3		55 68				

- * The results are calculated
- ** Serial part of the winding HV
- *** Winding LV (common part of HV)

No load losses, W - 29980
 Copper losses at 75°C for tap 27 and 160 MVA, W - 357027
 Number of the radiators - 18
 Number of the working fans at 85%Un (353V) for ONAF2 - 24
 Number of the working fans at 85%Un (353V) for ONAF1 - 12 inside

Because the transformer do not meet the requirements of all type tests, after 2 months there was another transformer, ser.№ 112741, type test. It was tested in 26 of august 2003 with the heaviest duty (ONAF 2) to confirm the results for the first type tested transformer. The results of this test transformer, ser.№ 112741 are:

(Handwritten signature and date stamp)
 20/03/03



Output Cooling KVA	Losses for oil W	Current for winding A	Air temperature °C	Temperature rise, K				
				Measured			Guaranteed	
				top oil, av.oil	HV w. av,** h.spot	LV w. av,*** h.spot	top oil,	winding average h.spot
179200 *ONAF2	502696	522,53	28,8	52,3 39,6	55,5 72,9	54,5 71,6	60,0 -	65,0 78,0
169600 ONAF2	453692	494,54	28,8	47,2 35,8	50,3 66,1	49,4 64,9	55,0 -	60,0 73,0
160000 *ONAF2	407386	466,55	28,8	42,4 32,1	45,4 59,6	44,5 58,5	50,0 -	55,0 68,0

* The results are calculated

** Serial part of the winding HV

*** Winding LV (common part of HV)

No load losses, W

- 32740

Copper losses at 75°C for tap 27 and 160 MVA, W

- 374646

Number of the radiators

- 18

Number of the working fans at 85%Un (353V) for ONAF2

- 24

Number of the working fans at 85%Un (353V) for ONAF1

- 12 inside

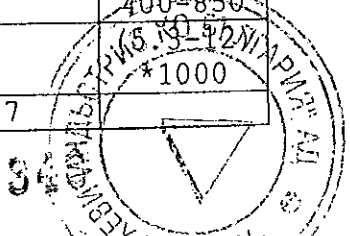
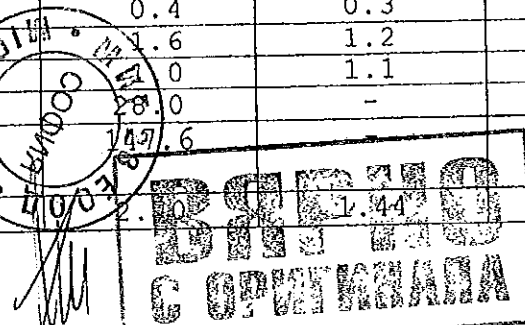
Temperature rise of secondary winding of CT type TMB 70, 800/5 above top oil, during duty ONAF2 (169.6 MVA) - 5.8K.

The densities of the currents of others CT are applied in a table to this protocol.

REMARK: av.oil - oil temperature rise in the middle of the tank
w.av. - average temperature rise of the winding
h.spot - temperature rise of hottest spot of the winding

Gas analysis of the oil before and after temperature rise tests did not show changes of chemical structure of the oil, which means there are not inadmissible local temperatures. The protocols of gas analysis are applied to this protocol and the values have are compare at the next table:

Gas,	Transformer № 112738		Transformer № 112741		Standard IEC60599 1999 y.
	Before test, Report №304 06.06.03	After test, Report №318 09.06.03	Before test, Report №491 27.08.03	After test, Report №492 27.08.03	
H ₂ , ppm	13.4	12.6	7.8	15.8	75-150
CH ₄ , ppm	1.3	1.4	0.9	1.7	35-130
C ₂ H ₆ , ppm	0.4	0.4	0.3	0.6	50-70
C ₂ H ₄ , ppm	1.5	1.6	1.2	2.2	170-250
C ₂ H ₂ , ppm	1.4	0	1.1	2.0	80-270
CO, ppm	16.4	28.0	-	-	400-850
CO ₂ , ppm	86.9	147.6	-	-	*1000
Total, %	1.57	2.0	1.44	4.37	



The power consumption of cooling system:

- one working fan at 353V (85%Un), - , 0.65A, 1471r.p.m.
- one working fan at 415V (100%Un), 226.1W, 0.79A, 1477r.p.m.
- one working fan at 457V (110%Un), - , 1.01A, 1483r.p.m.
- 12 working fans at 415V , 2.72kW, 10.19A
- 24 working fans at 415V , 5.49kW, 20.52A
- 32 working fans at 415V , 7.42kW, 27.26A

MEASUREMENT EQUIPMENT:

Temperature test system: type ES Pt 100
Voltmeters, Ampermeters: type M-1104, ser. № 7520/1971
type M-2018, ser. № 3492/1981
type M-2018, ser. № 1986 (1893)
Power analyzer: type D-5155, ser. № V069812-I

CONCLUSION: The transformer type ATMPY 160000/220, Doc. № 32809, Ser. № 112738 and № 112741 meets the requirements of contract № 476/CE/STG/DP-I/F-243/4740-49/31.10.2002 for temperature-rise test.

Tested by:
/Dipl.Eng. Hr. Hristov/

Chief of laboratory "Transformers":
/M.Sc. Dipl.Eng. Al. Raykov"

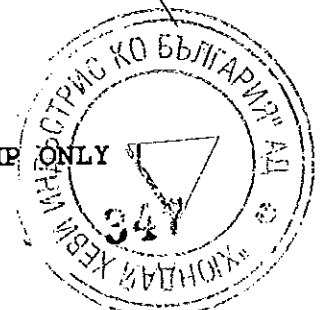
The above tested values were witnessed by :

Mr. Engr. Ch. Abdul Hameed, inspector of "WAPDA", Pakistan:
August 2003

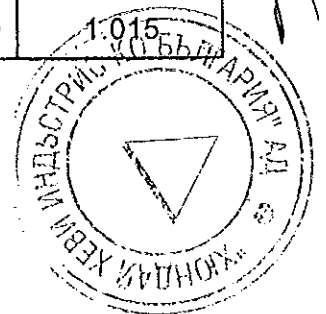
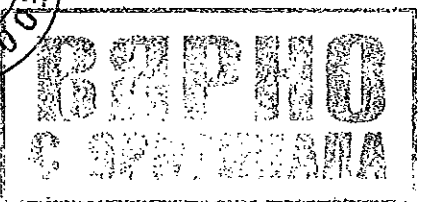
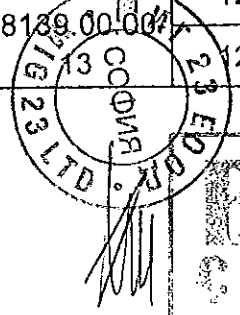
Mr. Ir. R.C.A.M. Koevoets, inspector of "KEMA" laboratory:
June/August 2003

THE TEST REPORT IS VALID WITH ORIGINAL STAMP ONLY

ВЯРНО
С ОПРИГАНА



Bushing current transformers of transformer type ATMPY 160000/220						
Terminals of AMBTPY 160000/220		Current transformers				
Signature	Maximum current, A	Type, doc. №	Rated data	terminals	Winding, mm ²	density of the current, A/mm ²
A	470.3	TMB 69, 38154.00.00	600+1200/1	1S1-1S3-1S2	1.2272	0.815
			600+1200/1	2S1-2S3-2S2	1.2272	0.815
			600/1,5	3S1-3S2	1.3700	1.095
B	470.3	TMB 69, 38154.00.00-01	600+1200/1	1S1-1S3-1S2	1.2272	0.815
			600+1200/1	2S1-2S3-2S2	1.2272	0.815
C	470.3	TMB 69, 38154.00.00-01	600+1200/1	1S1-1S3-1S2	1.2272	0.815
			600+1200/1	2S1-2S3-2S2	1.2272	0.815
Am	783.8	TMB 70, 38155.00.00-02	600+1200/1	1S1-1S3-1S2	1.2272	0.815
			600+1200/1	2S1-2S3-2S2	1.2272	0.815
			800/1,5	3S1-3S2	1.3700	1.095
Bm	783.8	TMB 70, 38155.00.00	600+1200/1	1S1-1S3-1S2	1.2272	0.815
			600+1200/1	2S1-2S3-2S2	1.2272	0.815
			800/5	3S1-3S2	3.5280	1.417
Cm	783.8	TMB 70, 38155.00.00-01	600+1200/1	1S1-1S3-1S2	1.2272	0.815
			600+1200/1	2S1-2S3-2S2	1.2272	0.815
Na	-	TMB 71, 38156.00.00	600+1200/1	1S1-1S3-1S2	1.2272	0.815
			600+1200/1	2S1-2S3-2S2	1.2272	0.815
TA	1574.6	TMB 56, 38139.00.00-13	1200/1	1S1-1S2	0.9850	1.015
			1200/1	2S1-2S2	0.9850	1.015
TB	1574.6	TMB 56, 38139.00.00-13	1200/1	1S1-1S2	0.9850	1.015
			1200/1	2S1-2S2	0.9850	1.015
TC	1574.6	TMB 56, 38139.00.00-13	1200/1	1S1-1S2	0.9850	1.015
			1200/1	2S1-2S2	0.9850	1.015





НАЦИОНАЛНА ЕЛЕКТРИЧЕСКА КОМПАНИЯ ЕАД

ПРЕДПРИЯТИЕ "МРЕЖИ ВИСОКО НАПРЕЖЕНИЕ"
ЦЕНТРАЛНА ЛАБОРАТОРИЯ ЗА ЕНЕРГЕТИЧНИ МАСЛА
Тел. 950 23 05; факс: 950 23 07

ИЗПИТАТЕЛЕН ПРОТОКОЛ
№ 304/06.06.2003

НАИМЕНОВАНИЕ НА ПРОДУКТА – Трансформаторно масло, доставено от Хюндай Хеви Индъстрийз Ко-България

ОТ КЪДЕ Е ВЗЕТА ПРОБАТА – проба от АТМТРУ 220 kV, фабр. № 112738, преди загряване

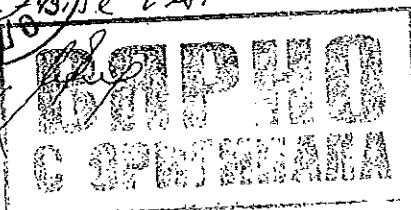
Газ-хроматографски анализ на разтворените газове
в трансформаторното масло

№	ГАЗ	КОНЦЕНТРАЦИЯ
1	H ₂ (водород), ppm	13,4
2	CH ₄ (метан), ppm	1,3
3	C ₂ H ₆ (етан), ppm	0,4
4	C ₂ H ₄ (етилен), ppm	1,5
5	C ₂ H ₂ (ацетилен), ppm	1,4
6	CO (въглероден оксид), ppm	16,4
7	CO ₂ (въглероден диоксид), ppm	86,9
8	Общо газосъдържание, %	1,57

Извършил анализа: *[Signature]*



before temperature rise test



ЕК-ЕАД - ПРЕДПРИЯТИЕ
"МРЕЖИ ВИСОКО НАПРЕЖЕНИЕ"
Р-л-ЦЛЕМ:
ЦЕНТРУМ Катеринов
ЗА ЕНЕРГЕТИЧНИ МАСЛА





НАЦИОНАЛНА ЕЛЕКТРИЧЕСКА КОМПАНИЯ ЕАД

ПРЕДПРИЯТИЕ "МРЕЖИ ВИСОКО НАПРЕЖЕНИЕ"
ЦЕНТРАЛНА ЛАБОРАТОРИЯ ЗА ЕНЕРГЕТИЧНИ МАСЛА
Тел. 950 23 05; факс: 950 23 07

ИЗПИТАТЕЛЕН ПРОТОКОЛ
№ 318/09.06.2003

НАИМЕНОВАНИЕ НА ПРОДУКТА – Трансформаторно масло, доставено от Хюндай Хеви Индъстрийз Ко-България

ОТ КЪДЕ Е ВЗЕТА ПРОБАТА – проба от АТМТРУ 220 kV, фабр. № 112738, след двойно загряване

Газ-хроматографски анализ на разтворените газове в трансформаторното масло

№	ГАЗ	КОНЦЕНТРАЦИЯ
1	H ₂ (водород), ppm	12,6
2	CH ₄ (метан), ppm	1,4
3	C ₂ H ₆ (етан), ppm	0,4
4	C ₂ H ₄ (етилен), ppm	1,6
5	C ₂ H ₂ (ацетилен), ppm	1,0
6	CO (въглероден оксид), ppm	28,0
7	CO ₂ (въглероден диоксид), ppm	147,6
8	Общо газосъдържание, %	2,7

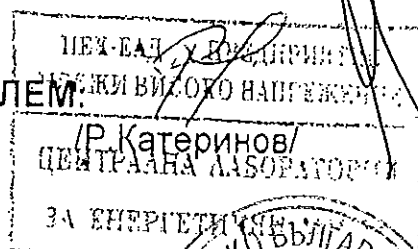
Извършил анализа: *[Signature]*

И.С. Сотирова

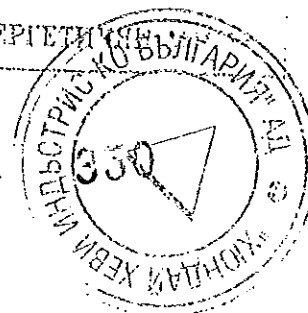
after temperature test



Р-л ЦЕМ



**ВЯРНО
С ОРИГИНАЛА**





НАЦИОНАЛНА ЕЛЕКТРИЧЕСКА КОМПАНИЯ ЕАД

ПРЕДПРИЯТИЕ "МРЕЖИ ВИСОКО НАПРЕЖЕНИЕ"
ЦЕНТРАЛНА ЛАБОРАТОРИЯ ЗА ЕНЕРГЕТИЧНИ МАСЛА
Тел. 950 23 05; факс: 950 23 07

ИЗПИТАТЕЛЕН ПРОТОКОЛ
№ 491/27.08.2003

НАИМЕНОВАНИЕ НА ПРОДУКТА – Трансформаторно масло, доставено от Хюндай Хеви Индъстрийз Ко-България

ОТ КЪДЕ Е ВЗЕТА ПРОБАТА – Пробата е взета от трансформатор тип AMTRY 160/220, № 112741, преди теста.

Газ-хроматографски анализ на разтворените газове в трансформаторното масло

№	ГАЗ	Концентрация
1	H ₂ (водород), ppm	7.8
2	CH ₄ (метан), ppm	0.9
3	C ₂ H ₆ (етан), ppm	0.3
4	C ₂ H ₄ (етилен), ppm	1.2
5	C ₂ H ₂ (ацетилен), ppm	1.1
6.	Общо газосъдържание, %	1,44

Извършил анализа: *С.К.С.*

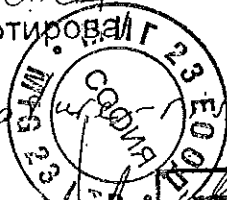
И.С. Сотирова

Р-л

ЦЕМ:

/Р.Катеринов/

before temperature test





НАЦИОНАЛНА ЕЛЕКТРИЧЕСКА КОМПАНИЯ ЕАД

ПРЕДПРИЯТИЕ "МРЕЖИ ВИСОКО НАПРЕЖЕНИЕ"

ЦЕНТРАЛНА ЛАБОРАТОРИЯ ЗА ЕНЕРГЕТИЧНИ МАСЛА

Тел. 950 23 05; факс: 950 23 07

ИЗПИТАТЕЛЕН ПРОТОКОЛ

№ 492/27.08.2003

НАИМЕНОВАНИЕ НА ПРОДУКТА – Трансформаторно масло, доставено от Хюндай Хеви Индъстрийз Ко-България

ОТ КЪДЕ Е ВЗЕТА ПРОБАТА – Пробата е взета от трансформатор тип AMTRY 160/220, № 112741, след теста.

Газ-хроматографски анализ на разтворените газове в трансформаторното масло

№	ГАЗ	Концентрация
1	H ₂ (водород), ppm	15.8
2	CH ₄ (метан), ppm	1.7
3	C ₂ H ₆ (етан), ppm	0.6
4	C ₂ H ₄ (етилен), ppm	2.2
5	C ₂ H ₂ (ацетилен), ppm	2.0
6.	Общо газосъдържание, %	4.37

Извършил анализа: 

I.A. Gateval

after temperature-rise test

РЕК ЕАД ПРЕДПРИЯТИЕ
"МРЕЖИ ВИСОКО НАПРЕЖЕНИЕ"

Р. М. ЦЕМ:
ЦЕНТРАЛНА ЛАБОРАТОРИЯ
ГР. Катеринов/





HYUNDAI HEAVY INDUSTRIES Co., Bulgaria
 41, Rojen Blvd. •1271 Sofia, Bulgaria
 tel. (+359 2) 382989•Telefax: (+359 2) 936 07 42•Telex:22923
LABORATORY COMPLEX "TRANSFORMERS"
LABORATORY "TRANSFORMER"



Chief of laboratory complex "Transformers": *[Signature]*
 M.Sc.El.Eng.M.Mateev

total pages: 3

REPORT OF SOUND LEVEL MEASUREMENT № T058/28.08.2003

Contract number and site: 476/CE/STG/DP-I/F-243/4740-49/31.10.2002, "WAPDA", Islamic republic Pakistan
 Manufacturer HYUNDAI HEAVY INDUSTRIES Co., Bulgaria Place of measurement Sofia Date 28.08.2003
 Place of manufacture Sofia Measurement specification

Details of transformer: ATMTPY 160000/220
 Serial No. 112741 MVA 160 Voltage ratio 220/132/11 kV
 Connections YNa0d1

Tapping range $\pm 13 \times 0.769 \%$

Details of measuring instrument:

Make Br&K Type 2203
 Microphone Type MK 221
 Calibration data of instrument and microphone 25.04.2001

Serial No.672097
 Serial No.6083

Test conditions:

Excitation voltage 11 kV

Frequency 50 Hz Tap position 14

A-weighted sound pressure levels L_{pA}

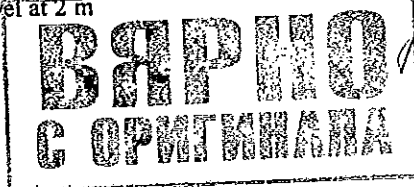
Transformer with 24working fans.

Plan position	1/3 H			Plan position	2/3 H		
	dB(A)				dB(A)		
	1	2	3		1	2	3
1	74.0	50	74.0	1	74.0	50	74.0
2	74.5	50	74.5	2	74.0	50	74.0
3	75.0	50	75.0	3	73.5	50	73.5
4	74.0	50	74.0	4	73.5	50	73.5
5	74.0	50	74.0	5	73.0	50	73.0
6	73.5	50	73.5	6	73.0	50	73.0
7	72.0	50	72.0	7	72.5	50	72.5
8	71.0	50	71.0	8	71.0	50	71.0
9	72.0	50	72.0	9	71.5	50	71.5
10	72.5	50	72.5	10	72.5	50	72.5
11	72.5	50	72.5	11	72.5	50	72.5
12	73.0	50	73.0	12	72.5	50	72.5
13	74.0	50	74.0	13	73.0	50	73.0
14	74.0	50	74.0	14	73.0	50	73.0
15	73.5	50	73.5	15	73.0	50	73.0
16	74.0	50	74.0	16	74.0	50	74.0
17	71.0	50	71.0	17	71.5	50	71.5
18	71.5	50	71.5	18	70.0	50	70.0
19	70.5	50	70.5	19	70.5	50	70.5
20	72.0	50	72.0	20	72.0	50	72.0
							72.8

Energy average

1= noise of the equipment; 2=background noise; 3=corrected noise of the equipment

Guaranteed sound pressure level at 2 m



Contract number and site: 476/CE/STG/DP-I/F-243/4740-49/31.10.2002, "WAPDA", Islamic republic Pakistan
 Manufacturer HYUNDAI HEAVY INDUSTRIES Co., Bulgaria Place of measurement Sofia Date 28.08.2003
 Place of manufacture Sofia Measurement specification
 Details of transformer: ATMPY 160000/220
 Serial No. 112741 MVA 160 Voltage ratio 220/132/11 kV
 Connections YNa0d1
 Tapping range $\pm 13 \times 0.769 \%$
 Details of measuring instrument:
 Make Br&K Type 2203 Serial No.672097
 Microphone Type MK 221 Serial No.6083
 Calibration data of instrument and microphone 25.04.2001

Test conditions:

Excitation voltage 11 kV

Frequency 50 Hz Tap position 14

A-weighted sound pressure levels L_{pA}

Transformer with 12 working fans.

Plan position	1/3 H			Plan position	2/3 H		
	dB(A)				dB(A)		
	1	2	3		1	2	
1	70.0	50	70.0	1	70.0	50	70.0
2	71.0	50	71.0	2	70.0	50	70.0
3	71.0	50	71.0	3	69.0	50	69.0
4	71.0	50	71.0	4	70.0	50	70.0
5	71.0	50	71.0	5	69.0	50	69.0
6	69.5	50	69.5	6	69.5	50	69.5
7	68.5	50	68.5	7	68.0	50	68.0
8	67.5	50	67.5	8	68.0	50	68.0
9	68.5	50	68.5	9	69.0	50	69.0
10	70.0	50	70.0	10	70.0	50	70.0
11	69.0	50	69.0	11	69.0	50	69.0
12	70.0	50	70.0	12	70.0	50	70.0
13	70.5	50	70.5	13	69.5	50	69.5
14	69.5	50	69.5	14	69.5	50	69.5
15	69.5	50	69.5	15	69.0	50	69.0
16	69.5	50	69.5	16	69.5	50	69.5
17	67.5	50	67.5	17	68.0	50	68.0
18	68.0	50	68.0	18	68.0	50	68.0
19	68.0	50	68.0	19	68.0	50	68.0
20	70.0	50	70.0	20	70.0	50	70.0

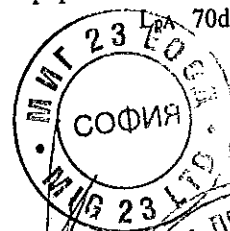
Energy average

69.4

1= noise of the equipment; 2=background noise; 3=corrected noise of the equipment

Guaranteed sound pressure level at 2 m sound

70dB(A)A-weighted



**Test report
T058/2003**

Ser. № 112741

Page: 3
Total pages: 3

Contract number and site: 476/CE/STG/DP-I/F-243/4740-49/31.10.2002, "WAPDA", Islamic republic Pakistan
 Manufacturer HYUNDAI HEAVY INDUSTRIES Co., Bulgaria Place of measurement Sofia Date 28.08.2003
 Place of manufacture Sofia Measurement specification

Details of transformer: ATMPY 160000/220
 Serial No. 112741 MVA 160 Voltage ratio 220/132/11 kV
 Connections YNa0d1
 Tapping range $\pm 13 \times 0.769 \%$
 Details of measuring instrument:
 Make Br&K Type 2203
 Microphone Type MK 221
 Calibration data of instrument and microphone 25.04.2001
 Serial No.672097
 Serial No.6083

Test conditions:
 Excitation voltage 11 kV Frequency 50 Hz Tap position 14

A-weighted sound pressure levels L_{pA}
 pressure levels L_{pA}

Transformer without working fans.

Plan position	1/3 H dB(A)			Plan position	2/3 H dB(A)		
	1	2	3		1	2	3
1	61.0	50	61.0	1	62.0	50	62.0
2	62.5	50	62.5	2	62.5	50	62.5
3	60.0	50	60.0	3	60.5	50	60.5
4	61.5	50	61.5	4	63.0	50	63.0
5	61.5	50	61.5	5	61.0	50	61.0
6	63.0	50	63.0	6	62.5	50	62.5
7	64.0	50	64.0	7	62.5	50	62.5
8	64.0	50	64.0	8	65.0	50	65.0
9	66.0	50	66.0	9	63.0	50	63.0
10	64.5	50	64.5	10	64.5	50	64.5
11	61.0	50	61.0	11	57.0	50	57.0
12	60.0	50	60.0	12	61.0	50	61.0
13	61.0	50	61.0	13	58.0	50	58.0
14	62.0	50	62.0	14	59.0	50	59.0
15	60.0	50	60.0	15	61.0	50	61.0
16	59.0	50	59.0	16	64.0	50	64.0
17	62.0	50	62.0	17	60.0	50	60.0
18	65.0	50	65.0	18	61.0	50	61.0
19	64.0	50	64.0	19	62.0	50	62.0
20	63.0	50	63.0	20	63.0	50	63.0

Energy average 62.4

1= noise of the equipment; 2=background noise; 3=corrected noise of the equipment
 Guaranteed sound pressure level at 0.3 m

L_{pA} 69dB(A)

TESTED BY: Hr Hristov:

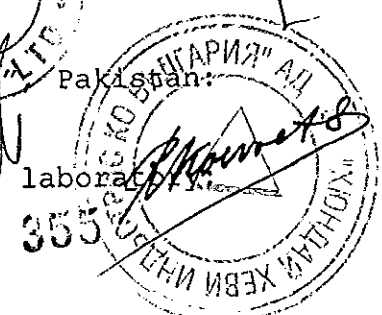
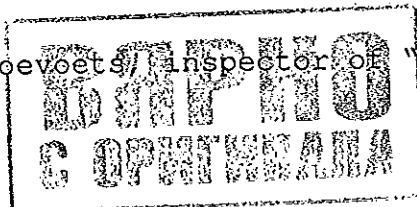
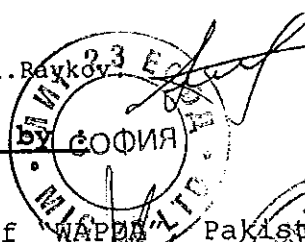
Chief of laboratory:

M.Sc.Dipl.Eng. Al. Raykov

The above tested values were witnessed by

Mr. Engr. Ch. Abdul Hameed, inspector of

Mr. Ir. R.C.A.M. Koevoets, inspector of





HYUNDAI HEAVY INDUSTRIES Co., Bulgaria

41, Rojen Blvd. +1271 Sofia, Bulgaria
tel. (+359 2) 382989+Telefax: (+359 2) 936 07 42+Telex:22923
LABORATORY COMPLEX "TRANSFORMERS"
LABORATORY "TRANSFORMER"



Chief of laboratory

complex "Transformers":

[Signature]
M.Sc.El.Eng.M.Mateev:

total pages: 3

TEST CERTIFICATE
№ T057/29.08.2003

SPECIAL TEST

TEST OBJECT: Transformer type ATMPV 160000/220

Doc. № 32809

Ser. № 112741

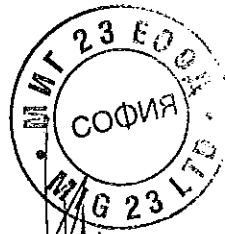
Manufacturer: HYUNDAI HEAVY INDUSTRIES Co., Bulgaria

RATED DATA :

Output, kVA	160000/160000/30000
Voltage, kV	220±13x0.769%/132/11
Current, A	419.9/699.8/1574.6
Frequency, Hz	50
Vector group of connection	YNa0d1
Cooling type	ONAN/ONAF1(12 fans)/ONAF2(24 fans)
Mounting	outdoor
Voltage regulation	on-load tap-changer type MR № 586903

Contractor
Owner
Contract
Standard

HYUNDAI HEAVY INDUSTRIES Co., Bulgaria
"WAPDA", Islamic republic Pakistan
476/CE/STG/DP-I/F-243/4740-49/31.10.2002
IEC 60076



№	TEST		Guaranteed	Measured	y/n
1.	ZERO SEQUENCE IMPEDANCE AT TAP 14 ON 125 MVA BASE (IEC 60076-1/93, point 10.7.):				yes
1.1.	Supplied from HV winding:				
	with short circuit LV w.	%	appr.10 (*21a)	10.34	
	with open LV w.	%	appr.36 (*21c)	32.49	
1.2.	Supplied from LV winding:				
	with open HV w.	%	appr.20 (*21b)	22.77	
	with short circuit HV w.	%	-	7.23	
	* Point of Schedule of technical data				
2.	HARMONICS OF NO-LOAD CURRENT OF TERTIARY WINDING WITH RATED FREQUENCY AND NOMINAL INDUCTION (IEC 60076-1/93, point 10.6.): Harmonic level in % of the fundamental component:				yes
	phase A				
	harmonic 3 (150 Hz)	%	-	4.75	
	harmonic 5 (250 Hz)	%	-	28.0	
	harmonic 7 (350 Hz)	%	-	6.71	
	harmonic 11 (550 Hz)	%	-	3.43	
	harmonic 13 (650 Hz)	%	-	1.44	
	harmonic 15 (850 Hz)	%	-	1.44	
	harmonic 17 (950 Hz)	%	-	3.36	
	phase B				
	harmonic 3 (150 Hz)	%	-	35	
	harmonic 5 (250 Hz)	%	-	28.8	
	harmonic 7 (350 Hz)	%	-	6.57	
	harmonic 11 (550 Hz)	%	-	3.36	
	harmonic 13 (650 Hz)	%	-	1.58	
	harmonic 15 (850 Hz)	%	-	3.08	
	harmonic 17 (950 Hz)	%	-	1.87	
	phase C				
	harmonic 3 (150 Hz)	%	-	61.6	
	harmonic 5 (250 Hz)	%	-	56.4	
	harmonic 7 (350 Hz)	%	-	11.9	
	harmonic 11 (550 Hz)	%	-	7.32	
	harmonic 13 (650 Hz)	%	-	3.58	
	harmonic 15 (850 Hz)	%	-	6.16	
	harmonic 17 (950 Hz)	%	-	9.7	

ВАРНО
С ОПИТНАМА

ММТ 23 EQ
СООДВАЖА
ЛТД

КОНДАН
ХЕВН МАДРОСТНО
КО СЪИМАНЕ

3.	CHECK OF CALIBRATION AND FUNCTIONING OF TEMPERATURE INDICATORS	-	Proper working	Work properly	yes
4.	CHECK OF THE PROPER INSTALATION AND FUNCTION OF THE BUCHHOLZ RELAY	-	Proper working	Work properly	yes

MEASUREMENT EQUIPMENT:

Power analyzer: type D-5155, ser. № V069812-1
Signal Analyzer Br&K type 2033 ser. № ZN0203

CONCLUSION: The transformer type АТМТРУ 160000/220, Doc. № 32809, Ser. № 112741 meets the requirements of contract № 476/CE/STG/DP-I/F-243/4740-49/31.10.2002 for special tests.

Tested by:

Dipl.Eng. Hr. Hristov:

Dipl.Eng. I. Terziev:

Chief of laboratory Transformers:

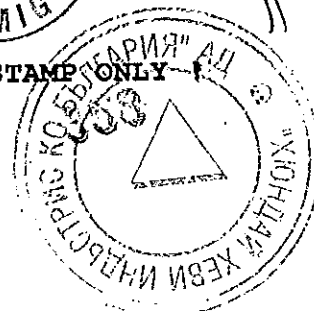
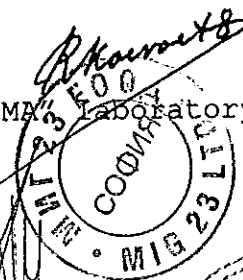
M.Sc.Dipl.Eng.Al.Raykov:

The above tested values were witnessed by :

Mr. Engr. Ch.Abdul Hameed, Inspector of "WAPDA", Pakistan:

Mr. Ir. R.C.A.M. Koevoets, inspector of "KEMA" laboratory:

THE TEST REPORT IS VALID WITH ORIGINAL STAMP ONLY



RAAD VOOR ACCREDITATIE

Dutch Accreditation Council RvA
PO Box 2768 NL-3500 GT Utrecht



The Dutch Accreditation Council RvA, by law appointed as the national accreditation body for The Netherlands, hereby declares that accreditation has been granted to:

KEMA Nederland B.V. High-Voltage Laboratory Arnhem

The organisation has demonstrated to be able to generate technical valid results in a competent way and work according to a management system.

This accreditation is based on an assessment against the requirements as laid down in ISO/IEC 17025:2005.

The accreditation covers the activities as specified in the authorized annex bearing the registration number.

The accreditation is valid provided that the organisation continues to meet the requirements.

The accreditation with registration number:

L 218

is granted on 26 March 2014

This declaration is valid until

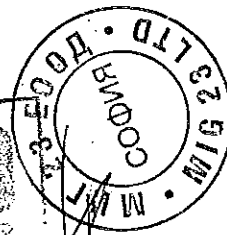
1 April 2018

The accreditation has been granted for the first time on

17 November 1994

The Chief Executive

Ir. J.C. van der Poel



Annex to ISO/IEC 17025:2005 declaration of accreditation for registration number: L 218



of **KEMA Nederland B.V.**
High-Voltage Laboratory
Arnhem

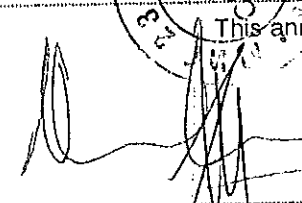
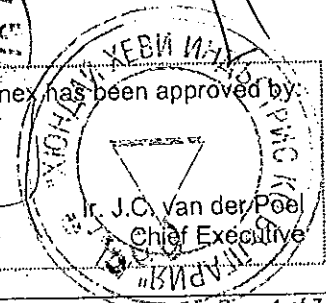
This annex is valid from: **26-03-2014** to **01-04-2018**

Replaces annex dated: **26-10-2011**

No.	Material or product	Type of activity	Internal reference number
1	Coils and/or windings of rotating electrical machines	AC voltage test Lightning impulse voltage test	IEC 60034
2	Power transformers	AC voltage test Lightning impulse voltage test Temperature-rise test Capacitance and tan δ measurement Power measurement DC resistance measurement Temperature measurement Sound level measurement R.I.V. measurement Partial discharge measurement SFRA measurement Verification of voltage ratio and phase displacement Low ambient test on dry-type transformer Thermal shock test on dry type transformer Condensation test on dry-type transformer Humidity penetration test on dry-type transformer Inspection of the active part	IEC 60076-1, -2, -3, -10, -11, -13, -15, -16, -18 CISPR 16 STL Guide to IEC 60076 NEN-EN 50464-1 NEN-EN 50541-1 IEEE Std. C57.12.00 IEEE Std. C57.12.90 IEEE Std. C57.12.91
3	AC Metal-enclosed switchgear and controlgear above 1 kV and \leq 52 kV and prefabricated substations	AC voltage test Lightning impulse voltage test Partial discharge measurement Temperature-rise test Temperature measurement DC resistance measurement Verification of degree of protection R.I.V. measurement	IEC 62271-200 STL Guide to IEC 62271-200 IEC 62271-202 STL Guide to IEC 62271-202 IEEE C37.20.2 IEEE C37.21 ANSI C37.54 ANSI C37.55 IEC 60529



This annex has been approved by:

Ir. J.C. van der Poel
 Chief Executive

Annex to ISO/IEC 17025:2005 declaration of accreditation for registration number: L 218

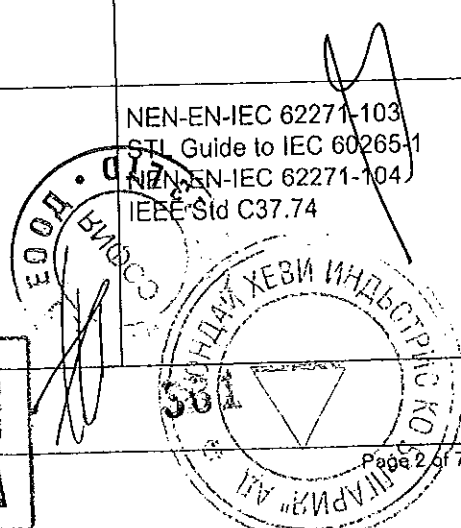


of **KEMA Nederland B.V.**
High-Voltage Laboratory
Arnhem

This annex is valid from: 26-03-2014 to 01-04-2018

Replaces annex dated: 26-10-2011

No.	Material or product	Type of activity	Internal reference number
4	AC Insulation-enclosed switchgear and controlgear above 1 kV and ≤ 52 kV	AC voltage test Lightning impulse voltage test Partial discharge measurement Temperature-rise test Temperature measurement DC resistance measurement Verification of degree of protection R.I.V. measurement	IEC 62271-201 IEC 60529
5	Gas-insulated metal-enclosed switchgear for rated voltages above 52 kV	AC voltage test Lightning impulse voltage test Switching impulse voltage test Partial discharge measurement Temperature-rise test Temperature measurement DC resistance measurement R.I.V. measurement	IEC 62271-203 STL Guide to IEC 60517 IEEE Std C37.122
6	High-voltage AC circuit breakers	AC voltage test Lightning impulse voltage test Switching impulse voltage test Partial discharge measurement Temperature-rise test Temperature measurement DC resistance measurement R.I.V. measurement Test under wet conditions	NEN-EN-IEC 62271-100 STL Guide to IEC 62271-100 IEEE Std C37.09 IEEE Std C37.013 NEN-EN 50152-1
7	High-voltage AC disconnectors and earthing switches	AC voltage test Lightning impulse voltage test Switching impulse voltage test Temperature-rise test Partial discharge measurement DC resistance measurement R.I.V. measurement Test under wet conditions Temperature measurement	IEC 62271-102 STL Guide to IEC 62271-102 IEEE Std C37.34 IEEE Std C37.41
8	High-voltage AC switches	AC voltage test Lightning impulse voltage test Partial discharge measurement Temperature-rise test Temperature measurement DC resistance measurement Verification of degree of protection	NEN-EN-IEC 62271-103 STL Guide to IEC 60265-1 NEN-EN-IEC 62271-104 IEEE Std C37.74



ВАРНО
С ОРГИНАЛА

Annex to ISO/IEC 17025:2005 declaration of accreditation for registration number: L 218

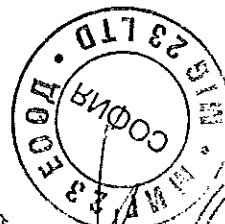


of **KEMA Nederland B.V.**
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Arnhem

This annex is valid from: 26-03-2014 to 01-04-2018

Replaces annex dated: 26-10-2011

No.	Material or product	Type of activity	Internal reference number
9	High-voltage AC contactors	AC voltage test Lightning impulse voltage test Partial discharge measurement Temperature-rise test Temperature measurement DC resistance measurement Verification of degree of protection	NEN-EN-IEC 62271-106
10	Automatic circuit reclosers and fault interrupters	AC voltage test Lightning impulse voltage test Partial discharge measurement Temperature-rise test Temperature measurement DC resistance measurement Verification of degree of protection	IEC 62271-111/ IEEE Std C37.60
11	Busducts	AC voltage test Lightning impulse voltage test Partial discharge measurement Temperature-rise test Temperature measurement DC resistance measurement Verification of degree of protection	IEEE Std C37.23
12	High-voltage AC switch-fuse combinations and high-voltage AC fuses	AC voltage test Lightning impulse voltage test Partial discharge measurement Temperature-rise test Temperature measurement DC resistance measurement Verification of degree of protection	IEC 62271-105 IEEE Std C37.41 IEEE Std C37.74 NEN-EN-IEC 60282-1 IEC 60282-2 STL Guide to IEC 60282-1 STL Guide to IEC 60282-2



Annex to ISO/IEC 17025:2005 declaration of accreditation for registration number: L 218

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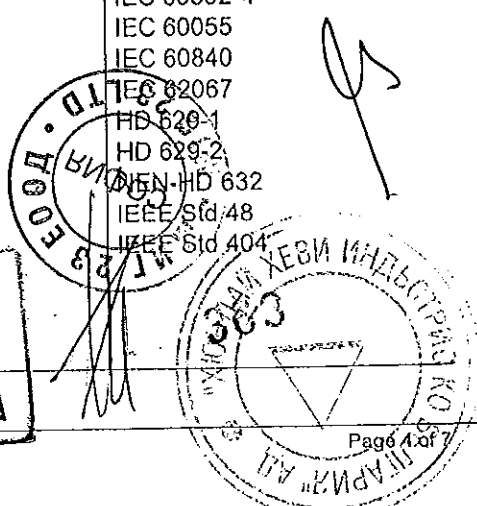
of **KEMA Nederland B.V.**
High-Voltage Laboratory
Arnhem

This annex is valid from: **26-03-2014** to **01-04-2018**

Replaces annex dated: **26-10-2011**

No.	Material or product	Type of activity	Internal reference number
13	Insulators and insulated bushings	AC voltage test Lightning impulse voltage test Partial discharge measurement Test under wet conditions Thermal-mechanical performance test Electro-mechanical failing load test R.I.V. measurement Pollution tests Temperature measurement Visible corona test Steep front wave flashover test Porosity test Visual and dimensional test Galvanizing test Thermal shock test Thermal cycle test Water absorption test Impact test Test of housing: tracking and erosion tests	IEC 60137 IEEE Std C57.19.00 IEEE Std C57.19.01 IEC 60168 IEC 60383 IEC 60507 IEC 60660 IEC 61109 IEC 62217 ANSI C29.1, -2, -6, -7, -12, -13 CAN/CSA C411.1
14	Cables	AC voltage test DC voltage test Lightning impulse test Heat cycle voltage test Capacitance and tan δ measurement Partial discharge measurement Insulation resistance measurement DC resistance measurement Temperature measurement Condition test of XLPE cable Water penetration test Bending test	IEC 60055 IEC 60141 IEC 60502 IEC 60840 IEC 62067 NEN-HD 620 NEN-HD 632 NEN 3619 BS 6622 BS 7835 BS 7870 BS 7912 BS 7970
15	Cable accessories	AC voltage test DC voltage test Lightning impulse voltage test Heat cycle voltage test Temperature measurement Partial discharge measurement Insulation resistance measurement Test under wet conditions Pollution tests R.I.V. measurement Water penetration test Impact test	IEC 60502-4 IEC 60055 IEC 60840 IEC 62067 HD 629-1 HD 629-2 NEN-HD 632 IEEE Std 48 IEEE Std 404

ВАРНО С ОРГИНИАЛА



Annex to ISO/IEC 17025:2005 declaration of accreditation for registration number: L 218

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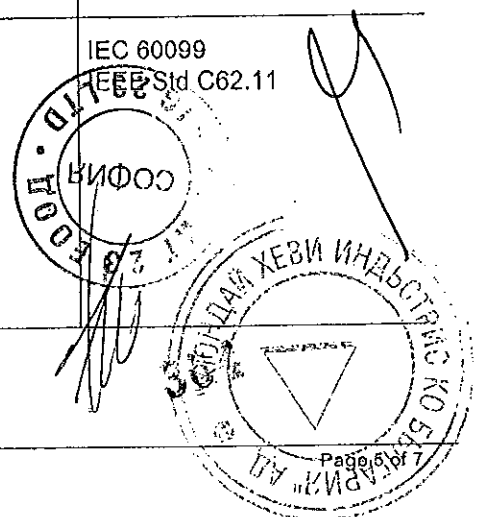
of **KEMA Nederland B.V.**
High-Voltage Laboratory
Arnhem

This annex is valid from: 26-03-2014 to 01-04-2018

Replaces annex dated: 26-10-2011

No.	Material or product	Type of activity	Internal reference number
16	Current transformers	AC voltage test Lightning impulse voltage test Switching impulse voltage test Temperature-rise test Capacitance and tan δ measurement Partial discharge measurement Accuracy test Test under wet conditions Temperature measurement Inspection of active part	NEN-EN-IEC 60044-1 NEN-EN-IEC 60044-6 IEC 60044-8
17	Voltage transformers	AC voltage test Lightning impulse voltage test Switching impulse voltage test Temperature-rise test Capacitance and tan δ measurement Partial discharge measurement Temperature measurement Accuracy test Test under wet conditions Leakage test Inspection of active part	IEC 61869-1 IEC 61869-3 IEC 61869-5 IEC 60044-7
18	Capacitors	AC voltage test Lightning impulse voltage test Capacitance and tan δ measurement Temperature measurement Test under wet conditions Thermal stability test Short-circuit discharge test Endurance test Sealing test Self-healing test Destruction test Ageing test	IEC 60358 IEC 60831 IEC 60871
19	Surge arresters	AC voltage test Lightning impulse voltage test Switching impulse voltage test Current impulse test Pollution tests Partial discharge measurement Temperature measurement Ageing test R.I.V. measurement	IEC 60099 IEC Std C62.11

**ВЯРНО
С ОРИГИНАЛА**



Annex to ISO/IEC 17025:2005 declaration of accreditation for registration number: L 218

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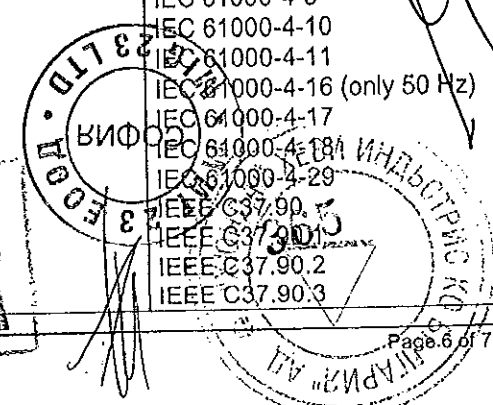
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High-Voltage Laboratory
Arnhem

This annex is valid from: **26-03-2014 to 01-04-2018**

Replaces annex dated: **26-10-2011**

No.	Material or product	Type of activity	Internal reference number
20	Reactors	AC voltage test Lightning impulse voltage test Switching impulse voltage test Temperature-rise test Impedance measurement AC resistance measurement Power measurement DC resistance measurement Temperature measurement Acoustic sound level measurement Verification of voltage ratio and phase displacement check	IEC 60076-6 IEEE Std C57.21
21	Compression and mechanical connectors	Temperature-rise test Temperature measurement DC resistance measurement Mechanical tests	IEC 61238-1
22	Protection relays & substation automation equipment	Functional requirements	IEC 60255-1 IEC 60255-8 IEC 60255-12 IEC 60255-13 IEC 60255-16 IEC 60255-127 IEC 60255-151 IEEE C37.112
		Product safety requirements	IEC 60255-1 IEC 60255-27
		EMC requirements	IEC 60255-1 IEC 60255-26 IEC 60255-22 series IEC 60255-11 IEC 61000-4-2 IEC 61000-4-3 IEC 61000-4-4 IEC 61000-4-5 IEC 61000-4-6 IEC 61000-4-8 IEC 61000-4-9 IEC 61000-4-10 IEC 61000-4-11 IEC 61000-4-16 (only 50 Hz) IEC 61000-4-17 IEC 61000-4-18 IEC 61000-4-29 IEEE C37.90.1 IEEE C37.90.2 IEEE C37.90.3

**ВЯРНО
С ОПРИМНА**



Annex to ISO/IEC 17025:2005 declaration of accreditation for registration number: L 218

RAAD VOOR ACCREDITATIE



of **KEMA Nederland B.V.**
High-Voltage Laboratory
Arnhem

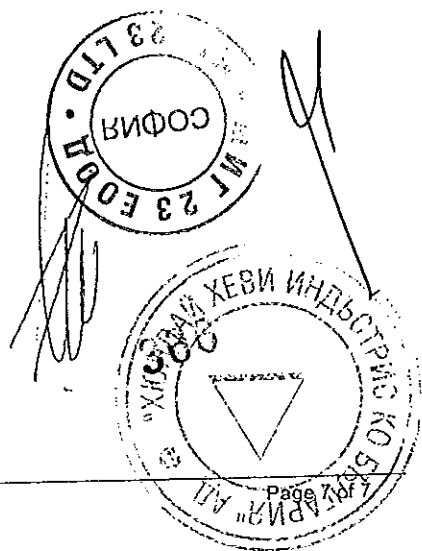
This annex is valid from: 26-03-2014 to 01-04-2018

Replaces annex dated: 26-10-2011

No.	Material or product	Type of activity	Internal reference number
	Protection relays & substation automation equipment	Energizing quantities	IEC 60255-1
		Climatic environmental tests	IEC 60255-1 IEC 60068-2-2 tests Bd, Bb IEC 60068-2-1 tests Ad, Ab IEC 60068-2-14 test Nb IEC 60068-2-78 test Cab IEC 60068-2-30 test Db
		Mechanical environmental tests	IEC 60255-1 IEC 60255-21 series
23	Electrical Energy Meters	Tests of <ul style="list-style-type: none"> - insulation properties, - accuracy requirements, - disturbances of long duration, - electrical requirements, - electromagnetic compatibility, - the effect of climatic environments, - mechanical requirements. 	IEC 62052-11 and IEC 62053-11/21/22/23 EN 50470-1/2/3 - Directive 2004/22/EC, annex I, B, F and MI-003

Remark
 "in accordance with" is applicable for all standards.

**ВЯРНО
 С ОРИГИНАЛА**



СТОЛИЧНА РЕГИОНАЛНА ЗДРАВНА ИНСПЕКЦИЯ

София 1000, ул. "Цар Симеон" № 169 А, п.к 1303
Тел./факс 931 13 39 e-mail aok@srzi.bg

ОРГАН ЗА КОНТРОЛ ОТ ВИДА А

СЕРТИФИКАТ ЗА КОНТРОЛ

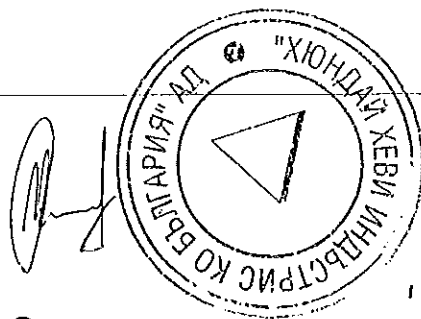
№ 170578 / 13.04.2017 г

- Идентификация на клиента:
"Хюндай Хеви-Индъстрие Ко България" АД / бул. "Рожен" №41, гр. София Ивайло
Паунов Райков - отговорник качество, Заявление №170578 / 21.03.2017 г.
- Идентификация на контролирания обект/продукт:
Завод за производство на трансформатори и стъпални регулатори - обект в експлоатация
бул. "Рожен" №41, гр. София
- Контролирани параметри:
Химични агенти във въздух на работна среда
Химични агенти във въздух на работна среда-прах
Взел пробата/извършил контрола: Камелия Тегаркова - изп. пробовчемач ФХИЖС
- ЗАКЛЮЧЕНИЕ:**
КОНТРОЛИРАНИЯТ ПАРАМЕТЪР НА ПРАХА ИНХАЛАБИЛНА ФРАКЦИЯ СЪОТВЕТСТВА НА
ИЗИСКВАНИЯТА НА НАРЕДБА №13, ОБН., ДВ, БР. 8/2004 г.
КОНТРОЛИРАНИТЕ ХИМИЧНИ АГЕНТИ ВЪГЛЕРОДЕН ОКСИД, АЗОТЕН ДИОКСИД И МАСЛЕНИ
АЕРОЗОЛИ СЪОТВЕТСТВАТ НА ИЗИСКВАНИЯТА НА НАРЕДБА №13, ОБН., ДВ, БР. 8/2004 г.

Приложение: Неразделна част от настоящия "Сертификат за контрол", съдържащ
общо 7 страници, са Протокол /и No No:

170578-3-10201 /- 11.04.2017 г. / 2 стр.

170578-3-10501 / 11.04.2017 г. / 4 стр.



Зам. ръководител на Орган за
контрол от вида А:

д-р В. Люцканова

Извършил оценка на съответствието:

(подпис)

Не се допуска използването на копия от настоящия сертификат или на части от него освен с писмено разрешение на органа за контрол, издал сертификата. Сертификатът може да бъде отнет при неправомерно позоваване или неправилна употреба.

МИНИСТЕРСТВО НА ЗДРАВЕОПАЗВАНЕТО
СТОЛИЧНА РЕГИОНАЛНА ЗДРАВНА ИНСПЕКЦИЯ
УЛ. "ВРАНЯ" № 20
ДИРЕКЦИЯ "ЛАБОРАТОРНИ ИЗСЛЕДВАНИЯ"
ОРГАН ЗА КОНТРОЛ ОТ ВИД А
УЛ. "ЦАР СИМЕОН" № 169 А

**ПРОТОКОЛ
ОТ КОНТРОЛ НА ПРАХ В
РАБОТНА СРЕДА**

№ 170578-3-10201 11.04.2017 г.
ден месец година

1. ОБЕКТ: Завод за производство на трансформатори и стъпални регулатори / обект в експлоатация
2. АДРЕС: бул. "Рожен" №41, гр. София
3. ЗАЯВИТЕЛ: Ивайло Паунов Райков - отговорник качество, Заявление №170578 / 21.03.2017 г. / "Хюндай ХевИ Индъстрис Ко България" АД / бул. "Рожен" №41, гр. София

4. КОНТРОЛИРАНИ ПАРАМЕТРИ: Инхалабилна фракция

5. РАБОТНО МЯСТО № 1 : Цех Трансформатори - заварки, Участък "Монтаж"

заети лица /бр./	24	наблюдава- ни лица /бр./	10	професия	монтьори	експозиция /ч./	4	работно време /ч./	8
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ДАТА НА ПРОБОВЗЕМАНЕ: 05.04.2017 г.

7. ВЗЕЛ ПРОБАТА: Камелия Тегаркова - изпълнител пробовземач

8. ТЕХНОЛОГИЧЕН ПРОЦЕС: заваряване на намотки - прекъснат

/непрекъснат, прекъснат/

9. ВИД НА СЪОРЪЖЕНИЕТО: /машина, инсталация/ ОКСИЖЕН

10. ИЗПОЛЗВАНИ СУРОВИНИ И МАТЕРИАЛИ: медни намотки, метали

11. ВЕНТИЛАЦИЯ: естествена аерация

/вид, състояние /

12. НОРМАТИВНИ ИЗИСКВАНИЯ: НАРЕДБА №13, обн., ДВ, бр. 8/2004 г.

13. МЕТОД ЗА КОНТРОЛ: БДС 2200:1985; БДС EN 689:2001; БДС EN 482:2012+A1:2015

14. СРЕДСТВА ЗА ИЗМЕРВАНЕ:

ПРОБОВЗЕМНА АПАРАТУРА 2Ах20Б

идент. № 1

АНАЛИТИЧНА АПАРАТУРА МПФД-8

идент. № 11473, СК №832/10.09.2016 г.

Везна електронна АССУЛАВ АТІLON АТL 224-1 ED2245

идент. № 22309926, СК №41/19.05.2015 г.

Термометър живачен

идент. № усл. №4А, СК №82J/16.10.2015 г.

Барометър anerоиден

идент. № 3272, СК №33-ИИ/04.08.2016 г.

Сепаратор (микроциклон) за 20 l/min

идент. № №SG-9, СИ №124/11.11.2016 г.

Електронен секундомер

идент. № усл. №1, СК №0783/06.06.2016 г.

ТИП ПРОБОВЗЕМЕН ФИЛТЪР ФШ-15

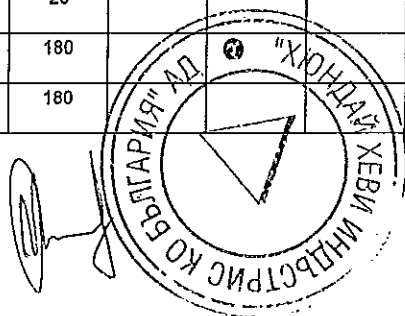
15. НАЧИН НА ПРОБОВЗЕМАНЕ: стационарно

/стационарно, персонално/

16. ВИД ПРАХ: прах железен (оксиди, агломерати, шлака, стомана, чутун); съдържащ под 2% св. кр. силициев диоксид в респирабилната фракция

17. РЕЗУЛТАТИ ОТ КОНТРОЛА:

КАСЕТА №	Инхалабилна фракция	14											
	Респирабилна фракция	15											
ДЕБИТ АСПИРИРАН ВЪЗДУХ dm ³ / min	Инхалабилна фракция	20											
	Респирабилна фракция	20											
ПРОДЪЛЖИТЕЛНОСТ НА ПРОБОВЗЕМАНЕ /min/	Инхалабилна фракция	180											
	Респирабилна фракция	180											



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ПОКАЗАТЕЛИ				Средно-прегледна концентрация mg/m ³	ГРАНИЧНИ СТОЙНОСТИ		КРАТНОСТ	ХИГИЕННА ОЦЕНКА	
					[mg/m ³]	[бр.вл./cm ³]		ВОДЕЦ ПАРАМЕТЪР	НИВО
ПРИВЕС, mg	Инхалабилна фракция	1,1							
	Респирабилна фракция	0,6							
Vo, dm ³	Инхалабилна фракция	3129,8							
	Респирабилна фракция	3129,8							
МАСОВА КОНЦЕНТРАЦИЯ, mg / m ³	Инхалабилна фракция	0,35		0,18±0,002	6,0		0,03	инх. фр.	
	Респирабилна фракция	0,19		0,09±0,004				респ. фр.	
	% респирабилна фракция	50,0							
СВОБОДЕН КРИСТАЛЕН СИЛИЦЕВ ДИОКСИД, mg/m ³	Инхалабилна фракция								
	Респирабилна фракция								
СВОБОДЕН КРИСТАЛЕН СИЛИЦЕВ ДИОКСИД, %	Инхалабилна фракция								
	Респирабилна фракция								
АЗБЕСТОВ ПРАХ	% на азбеста								
	бр. влакна/cm ³								

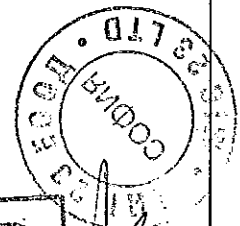
Забележка: Резултатите от изследванията се отнасят само за контролираната проба.
Извлечения от протокола не могат да се размножават без писменото съгласие на ОКА.

Настоящият протокол е неразделна част от "СЕРТИФИКАТ ЗА КОНТРОЛ". № 170578 / 2017 г.
Информацията, получена в процес на контролната дейност е конфиденциална.

ПРОВЕЛ КОНТРОЛА И ИЗВЪРШИЛ ОЦЕНКА НА СЪОТВЕТСТВИЕТО:
ЕМ. ПОПОВА
(фамилия, подпис)

от

НАЧАЛНИК ОТДЕЛ ФХИЖС: В. ЙОРДАНОВА
(фамилия, подпис)



МИНИСТЕРСТВО НА ЗДРАВЕОПАЗВАНЕТО
СТОЛИЧНА РЕГИОНАЛНА ЗДРАВНА ИНСПЕКЦИЯ
УЛ. "ВРАНЯ" № 20
ДИРЕКЦИЯ "ЛАБОРАТОРНИ ИЗСЛЕДВАНИЯ"
ОРГАН ЗА КОНТРОЛ ОТ ВИД А
УЛ. "ЦАР СИМЕОН" № 169 А

Страница 1
Всичко страници 2

ПРОТОКОЛ
ОТ ХИМИЧЕН КОНТРОЛ НА
ХИМИЧНИ АГЕНТИ ВЪВ ВЪЗДУХА
НА РАБОТНАТА СРЕДА

№ 170578-3-10501 11.04.2017 г.
ден месец година

1. ОБЕКТ: Завод за производство на трансформатори и стъпални регулатори / обект в експлоатация
2. АДРЕС: бул. "Рожен" №41, гр. София
3. ЗАЯВИТЕЛ: Ивайло Паунов Райков - отговорник качество, Заявление №170578 / 21.03.2017 г. / "Хюндай Хеви Индъстрис Ко България" АД / бул. "Рожен" №41, гр. София
4. КОНТРОЛИРАНИ ПАРАМЕТРИ: Въглероден оксид
Азотен диоксид
5. ДАТА НА ПРОБОНАБИРАНЕ: 05.04.2017 г.

№	Работно място	Брой работници	Експозиция в часове	Вентилация
1.	Цех трансформаторен - заварки	24	4	естествена аерация

6. ВЗЕЛ ПРОБИТЕ: Камелия Тегаркова - изпълнител пробовземач

7. ПРИСЪСТВАЛ ПРЕДСТАВИТЕЛ НА ОБЕКТА: Евдокия Филипова - охрана на труда
/име, фамилия/

8. НОРМАТИВНИ ИЗИСКВАНИЯ: НАРЕДБА-№13, обн., ДВ, бр. 8/2004 г.

9. МЕТОДИ ЗА КОНТРОЛ: БДС EN 689:2001; БДС EN 482:2012+A1:2015; Методически указания за определяне на токсични газове и пари във въздуха на работната среда по линейно-колориметрични методи, книга 2, изд. МА, НИХПЗ, Сдружение "Хигитест", 1987 г.; ОКА7.1ПК3-1

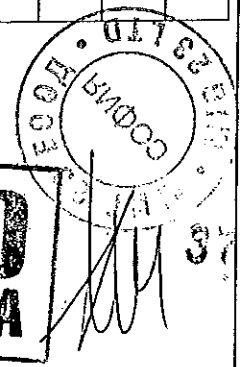
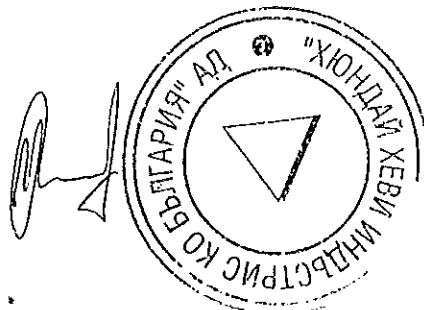
10. СРЕДСТВА ЗА ИЗМЕРВАНЕ:

Дрегеров мех
инд. тръбички

идент № 12923 СИ №95/02.09.2016 г.
идент № 3711-2/2017; 2211-2/2015

11. УСЛОВИЯ ПРИ ПРОБОНАБИРАНЕ:

Химичен агент	Азотен диоксид			Въглероден оксид								
	1'	1'	1'	2'	2'	2'						
Показател												
Брой проби по интервали	1'	1'	1'	2'	2'	2'						
Час на интервала	II		IV	VI								
Дебит на аспириране – dm ³ /min	1/10			1/10								
Vt - dm ³	1			1								
Vo - dm ³	0,9			0,9								
Атмосферно налягане – Нgmm	714											
Температура - С°	22											
Експозиция в часове	1	2	1	1	2	1						



12. РЕЗУЛТАТИ ОТ КОНТРОЛА:

№	Химичен агент	Метод за контрол	Концентрация на химичния агент в mg/m^3 на интервали			Средно-прегледена концентрация mg/m^3	Гранична стойност mg/m^3
			I инт.	II инт.	III инт.		
1	Въглероден оксид	Методично указание "Хигитест" 87 г.	8,5	7,7	7,7	3,95±0,42	40,0
2	Азотен диоксид	Методично указание "Хигитест" 87 г.	1,03	0,7	0,9	0,42±0,25	4,0

Забележка: Резултатите от изследванията се отнасят само за контролираната проба. Извлечения от протокола не могат да се размножават без писменото съгласие на ОК. Настоящият протокол е неразделна част от "СЕРТИФИКАТ ЗА КОНТРОЛ" № 170578 / 2017 г. Информацията, получена в процеса на контролната дейност е конфиденциална.

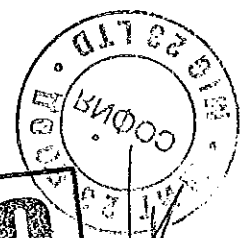
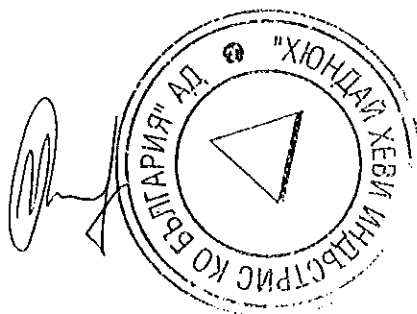
ПРОВЕЛ КОНТРОЛА ЕМ. ПОПОВА
 ИЗВЪРШИЛ
 ОЦЕНКА НА
 СЪОТВЕТСТВИЕТО:

(фамилия, подпис)

да

НАЧАЛНИК ОТДЕЛ ФХИЖС: В. ЙОРДАНОВА

(фамилия, подпис)



МИНИСТЕРСТВО НА ЗДРАВЕОПАЗВАНЕТО
СТОЛИЧНА РЕГИОНАЛНА ЗДРАВНА ИНСПЕКЦИЯ
УЛ. "ВРАНЯ" № 20
ДИРЕКЦИЯ "ЛАБОРАТОРНИ ИЗСЛЕДВАНИЯ"
ОРГАН ЗА КОНТРОЛ ОТ ВИД А
УЛ. "ЦАР СИМЕОН" № 169 А

ПРОТОКОЛ
ОТ ХИМИЧЕН КОНТРОЛ НА
ХИМИЧНИ АГЕНТИ ВЪВ ВЪЗДУХА
НА РАБОТНАТА СРЕДА

№ 170578-3-10501 11.04.2017 г.
ден месец година

1. ОБЕКТ: Завод за производство на трансформатори и стъпални регулатори / обект в експлоатация
2. АДРЕС: бул. "Рожен" №41, гр. София
3. ЗАЯВИТЕЛ: Ивайло Паунов Райков - отговорник качество, Заявление №170578 / 21.03.2017 г. / "Хюндай Хеви Индъстрис Ко България" АД / бул. "Рожен" №41, гр. София
4. КОНТРОЛИРАНИ ПАРАМЕТРИ: Маслени аерозоли
5. ДАТА НА ПРОБОНАБИРАНЕ: 05.04.2017 г.

№	Работно място	Брой работници	Експозиция в часове	Вентилация
2.	Цех трансформатори - при вакуум филтър преса - хале "Монтаж"	10	4	естествена аерация

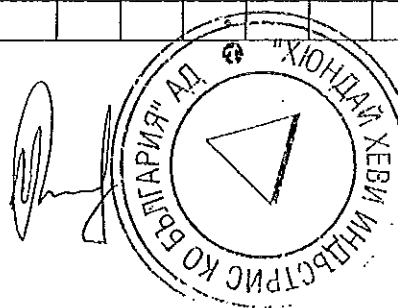
6. ВЗЕЛ ПРОБИТЕ: Камелия Тегаркова - изпълнител пробовземач
7. ПРИСЪСТВАЛ ПРЕДСТАВИТЕЛ НА ОБЕКТА: Евдокия Филипова - охрана на труда
/име, фамилия/
8. НОРМАТИВНИ ИЗИСКВАНИЯ: НАРЕДБА №13, обн., ДВ, бр. 8/2004 г.
9. МЕТОДИ ЗА КОНТРОЛ: БДС EN 689:2001; БДС EN 482:2012+A1:2015; БДС 16406:1986; ОКА7.1ПЗ3-2

10. СРЕДСТВА ЗА ИЗМЕРВАНЕ:

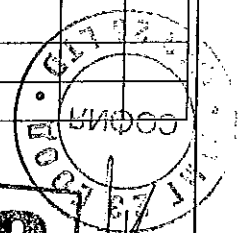
Аспиратор идент. № 96/98022
Везна електронна ACCULAB ATILON ATL 224-1 ED2245 идент. № 22309926, СК №41/19.05.2015 г.
UV-VIS "Lambda 25" идент. № 101N6012605, СК №2/23.10.2015 г.
МПФД-8 идент. № 16954, СК №830/10.09.2016 г.
Термометър живачен идент. № 4А, СК №82/16.10.2015 г.
Барометър анероиден идент. № 3272, СК №33-ИН/04.08.2016 г.

1. УСЛОВИЯ ПРИ ПРОБОНАБИРАНЕ:

Химичен агент	Маслени аерозоли			Показател	1 ²	2 ²	3 ²	4 ²	5 ²	6 ²	7 ²	8 ²	9 ²	10 ²
	1 ²	2 ²	3 ²											
Брой проби по интервали	1 ²	1 ²	1 ²											
Час на интервала	II	IV	VI											
Дебит на аспириране - dm ³ /min	10/10													
Vt - dm ³	10													
Vo - dm ³	9													
Атмосферно налягане - Hgmm	714													
Температура - С°	20°													
Експозиция в часове	1	2	1											



ВЯРНО
С ОРИГИНАЛА



12. РЕЗУЛТАТИ ОТ КОНТРОЛА:

Страница 2
Всичко страници 2

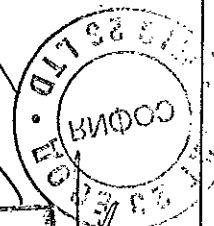
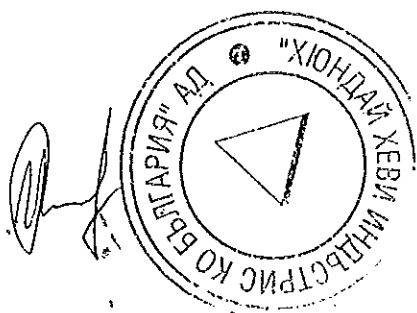
№	Химичен агент	Метод за контрол	Концентрация на химичния агент в mg/m^3 на интервали			Средно-претеглена концентрация mg/m^3	Гранична стойност mg/m^3
			I инт.	II инт.	III инт.		
1	Маслени аерозоли	БДС 16406	под ГКО	под ГКО	под ГКО	под ГКО	5,0

Забележка: Резултатите от изследванията се отнасят само за контролираната проба.
Извлечения от протокола не могат да се размножават без писменото съгласие на ОК.
Настоящият протокол е неразделна част от "СЕРТИФИКАТ ЗА КОНТРОЛ" № 170578 / 2017 г.
Информацията, получена в процеса на контролната дейност е конфиденциална.

ПРОВЕЛ КОНТРОЛА ЕМ. ПОПОВА
И ИЗВЪРШИЛ (фамилия, подпис)
ОЦЕНКА НА
СЪОТВЕТСТВИЕТО:

да

НАЧАЛНИК ОТДЕЛ ФХИЖС: В. ЙОРДАНОВА
(фамилия, подпис)



373

(

(

ОРГАН ЗА КОНТРОЛ от вида С при НАЯ КОНСУЛТ ООД

гр. София, ж.к. „Овча купел 1”, бл. 430, тел: 02 423 80 87,

GSM: 0896 300 159, факс: 02 956 12 35, e-mail: naja2007@abv.bg

Сертификат за акредитация рег. № 86 ОКС/ 02.02.2016 г., валиден до 30.04.2017 г., издаден от ИА БСА, съгласно изискванията на стандарт БДС EN ISO/IEC 17020:2012

**СЕРТИФИКАТ ЗА КОНТРОЛ
№ 2917/ 22.03.2017 г.**

1. Идентификация на клиента:

„Хюндай Хеви Индъстрис Ко. България” АД –
гр. София, бул. „Рожен” № 41

2. Идентификация на контролирания обект:

Завод за производство на трансформатори и стъпални регулатори –
гр. София, бул. „Рожен” № 41

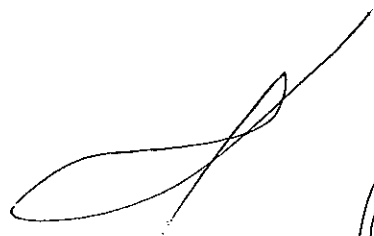
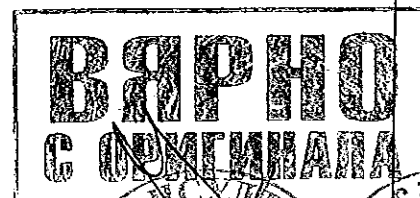
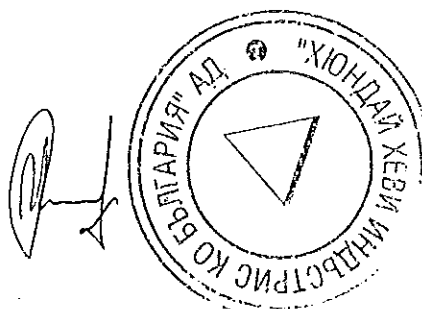
3. Контролирани параметри:

3.1. Температура на въздуха, относителна влажност на въздуха и
скорост на движение на въздуха

4. Заключение (оценка на съответствието) от извършения контрол:

4.1. Контролираните параметри на микроклимата - температура на въздуха, относителна влажност на въздуха и скорост на движение на въздуха в обект – завод за производство на трансформатори и стъпални регулатори – гр. София, бул. „Рожен” № 41 съответстват на допустимите гранични стойности съгласно изискванията на Наредба № РД-07-3/ 18.07.2014 г. (ДВ, бр. 63/2014 г.).

Приложение: Протокол № 2917-1 от 22.03.2017 г. е неразделна част от сертификата за контрол, общо 4 стр.

Дата: 22.03.2017 г.

Ръководител на
органа за контрол:
(инж. Огнян Георгиев)

ОРГАН ЗА КОНТРОЛ от вида С при НАЯ КОНСУЛТ ООД

гр. София, ж.к. „Овча купел 1”, бл. 430, тел. 02 423 80 87,
GSM: 0896 300 159, факс: 02 956 12 35, e-mail: naia2007@abv.bg

Сертификат за акредитация рег. № 86 ОКС/ 02.02.2016 г., валиден до 30.04.2017 г.,
издаден от ИА БСА, съгласно изискванията на стандарт БДС EN/ISO/IEC 17020:2012

ПРОТОКОЛ № 2917-1/ 22.03.2017 година ОТ КОНТРОЛ НА ПАРАМЕТРИТЕ НА МИКРОКЛИМАТ

1. Клиент: „Хюндай Хеви Индъстрис Ко. България” АД –
гр. София, бул. „Рожен” № 41
(идентификация на клиента)

2. Обект: Завод за производство на трансформатори и стъпални регулатори –
гр. София, бул. „Рожен” № 41
(наименование, вид на обекта, подобект, адрес)

3. Вид на обекта: на обект в експлоатация
(на нов или в употреба/експлоатация обект/съоръжение)

4. Основание за контрола: Заявка № 1629 от 20.03.2017 г.
(заявка/възлагателно писмо №.../дата..., договор №.../дата...)

5. Контролиран параметър:

5.1. Температура на въздуха, °C

5.2. Относителна влажност на въздуха, φ%

5.3. Скорост на движение на въздуха, m/s

6. Нормативни актове:

6.1. Метод за контрол: БДС 16686

6.2. Нормативни изисквания: Наредба № РД-07-3/ 18.07.2014г. (ДВ, бр. 63/2014г.)

7. Условия при контрола:

7.1. Период на годината: студен
(студен/топъл)

7.2. Източници на абнормен микроклимат: няма

7.3. Вид на използваното отопление: Централно парно за позиции № 1, 2, 3, 4, 5, 6, 7, 8, 9, 10,
11, 12 и 13; кондиционери за позиции № 14, 15, 16, 17, 19, 20, 21, 22, 23, 24, 25 и 26; калорифер
за позиция № 18

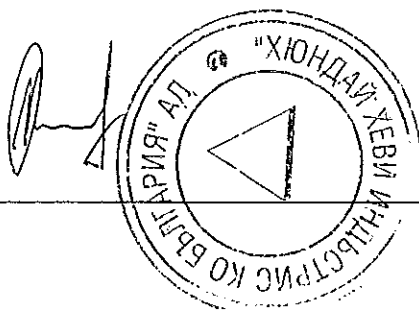
7.4. Наличие на вентилация: Да

7.5. Наличие на климатична инсталация: Не

8. Резултати от контрола:

№ по ред	Място на контрол (цех, участък, помещение) и наименование на работното място	Категория работа	Температура на въздуха, Т°С		Относителна влажност на въздуха, φ%		Скорост на движение на въздуха, m/s	
			Изчислени стойности	Норма	Изчислени стойности	Норма	Изчислени стойности	Норма
1	2	3	4	5	6	7	8	9
Цех „МЗЦ” – участък „Греди”								
1.	Контролна точка - начало	СТФР	20,5 -21,2	15-23	35,8-38,8	30-75	0,08-0,10	До 0,4
2.	Контролна точка - край	СТФР	20,4 -21,0	15-23	35,7-37,4	30-75	0,07-0,09	До 0,4

1	2	3	4	5	6	7	8	9
Цех „МЗЦ“ – малко хале								
3.	Контролна точка - начало	СТФР	21,0 -21,8	15-23	35,4-38,7	30-75	0,06-0,08	До 0,4
4.	Контролна точка - край	СТФР	21,0 -21,9	15-23	35,9-38,6	30-75	0,07-0,10	До 0,4
Цех „МЗЦ“ – голямо хале								
5.	Контролна точка - начало	СТФР	18,4 -19,2	15-23	36,6-40,0	30-75	0,12-0,15	До 0,4
6.	Контролна точка - среда	СТФР	18,6 -19,2	15-23	37,9-40,7	30-75	0,12-0,14	До 0,4
7.	Контролна точка - край	СТФР	18,3 -19,0	15-23	36,9-39,8	30-75	0,13-0,16	До 0,4
ЕМА – ЛАБОРАТОРИЯ „СТЪПАЛЕН РЕГУЛАТОР“								
8.	Зала „Типови изпитвания“	СТФР	20,3 -20,8	15-23	35,4-38,6	30-75	0,07-0,10	До 0,4
9.	Зала „Високоволтови изпитвания“	СТФР	17,8 -18,5	15-23	38,2-41,6	30-75	0,07-0,09	До 0,4
Цех „Трансформатори“ - Участък „Монтаж“								
10.	Контролна точка - начало	СТФР	19,9 -20,7	15-23	33,2-37,0	30-75	0,15-0,19	До 0,4
11.	Контролна точка - край	СТФР	20,2 -20,9	15-23	34,3-37,6	30-75	0,09-0,11	До 0,4
Цех „Трансформатори“ - Участък „Вакуумисти“								
12.	Вакуум филтър преса	СТФР	20,6 -21,4	15-23	31,7-34,6	30-75	0,08-0,10	До 0,4
13.	Парокотелна централа	ЛФР	24,0 -24,5	18-25	33,5-35,5	30-75	0,03-0,06	До 0,2
Цех „СТЪПАЛЕН РЕГУЛАТОР“ – Офис Отдел „Технологичен“								
14.	Контролна точка - ляво	ЛФР	22,3 -23,1	18-25	35,2-38,6	30-75	0,03-0,05	До 0,2
15.	Контролна точка - дясно	ЛФР	22,5 -23,2	18-25	34,4-37,5	30-75	0,04-0,06	До 0,2
ОТДЕЛ „ЕСР“								
16.	Механична Работилница	СТФР	21,1 -22,1	15-23	32,6-35,0	30-75	0,04-0,07	До 0,4
17.	Електро Работилница	СТФР	20,4 -21,3	15-23	32,0-35,6	30-75	0,03-0,05	До 0,4
18.	Компресорно помещение	СТФР	19,6 -20,6	15-23	34,9-37,6	30-75	0,16-0,20	До 0,4
Административна сграда - етаж 3								
19.	Офис отдел „ЕСР“	ЛФР	21,9 -22,9	18-25	35,4-38,6	30-75	0,03-0,05	До 0,2
Административна сграда - етаж 4								
20.	Офис ЕМА – контролна точка ляво	ЛФР	23,0 -24,1	18-25	34,6-37,8	30-75	0,02-0,05	До 0,2
21.	Офис ЕМА – контролна точка дясно	ЛФР	23,0 -24,0	18-25	34,6-38,4	30-75	0,03-0,07	До 0,2
22.	Офис Отдел „Продажби трансформатори“ – контролна точка ляво	ЛФР	22,9 -23,9	18-25	36,0-38,6	30-75	0,02-0,04	До 0,2
23.	Офис Отдел „Продажби трансформатори“ – контролна точка дясно	ЛФР	22,7 -23,9	18-25	34,1-37,9	30-75	0,03-0,05	До 0,2
24.	Офис „Бизнес развитие“	ЛФР	23,4 -24,2	18-25	35,0-37,9	30-75	0,02-0,04	До 0,2
25.	Офис „Продажби стъпални регулатори“	ЛФР	23,0 -23,9	18-25	35,7-38,9	30-75	0,03-0,06	До 0,2
26.	Офис „Главен Юрисконсулт“	ЛФР	21,4 -22,4	18-25	31,8-34,7	30-75	0,03-0,04	До 0,2



9.Забележка:

9.1. Резултатите от контрола се отнасят само за контролирания обект и към датите на контрола.

9.2. Протокол № 2917-1 от 22.03.2017 г. е неразделна част от сертификат за контрол № 2917 от 22.03.2017 г.

9.3. Използвани съкращения в колона 3 „Категория работа“: ЛФР – лека физическа работа; СТФР – средно тежка физическа работа.

10. Технически средства за контрол:

10.1.Термоанемометър, тип: Testo 405-V1, идентификационен №41500220/109, СК №09998 от 09.04.2015 г. за измерване на температура и скорост на движение на въздуха;

10.2. Комбиниран уред тип: Testo 410-2, идентификационен №38524398/107, СК №09997 от 09.04.2015 г. за измерване на относителна влажност на въздуха.

(наименование, тип, производител, идентификационен №....., Свидетелство за калибриране СК №.....)

Дати на извършване на контрола: 21.03.2017 г. и 22.03.2017 г.

Извършил контрола:

1. Контролен специалист:

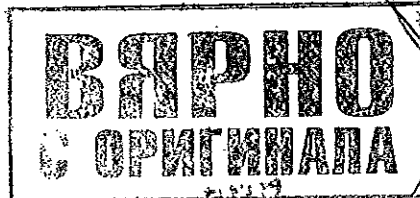
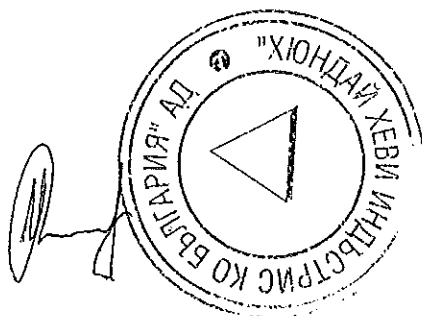
/И. Райков

Ръководител на орган за контрол:

/инж. О. Георгиев



[Handwritten signature]



ДЕКЛАРАЦИЯ

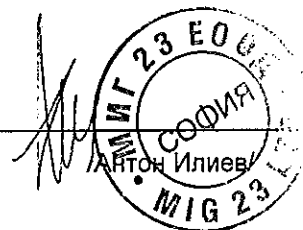
Долуподписаният Антон Иванов Илиев в качеството ми на представляващ Обединение „МИГ - Хюндай“, участник в обществена поръчка с предмет: „Доставка, демонтаж и монтаж на трифазни маслонапълнени понижавачи силови трансформатори 110kV/ Средно напрежение (СрН) и цялото необходимо помощно оборудване“, реф.№ PPD 17-001.

ДЕКЛАРИРАМ, ЧЕ:

Маслото, използвано при доставка на трифазни маслонапълнени понижавачи силови трансформатори 110kV, предмет на горе указаната обществена поръчка, ще бъде без наличието на полихлорирани бифенили (РСВ).

Дата 18.04.2017 г.

Декларатор: _____



ДЕКЛАРАЦИЯ
за конфиденциалност и извършен оглед на обект по предмета на поръчката

Долуподписаният/-ната/ Антон Иванов Илиев, в качеството ми на представляващ Обединение „МИГ - Хюндай“, участник в процедура за възлагане на обществена поръчка с реф. № PPD 17-001 и предмет:

Доставка, демонтаж и монтаж на трифазни маслонапълнени понижавачи силови трансформатори 110kV/Средно напрежение (СрН) и цялото необходимо помощно оборудване,

ДЕКЛАРИРАМ, ЧЕ:

1/ Представител на участника, когото представлявам е извършил оглед на обект: п/ст „Бояна“ и съм запознат със съществуващото положение.

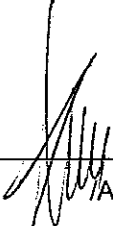

2/ Няма да разпространявам поверителна информация, във връзка с извършения оглед на обекта на Възложителя, като ми е известно, че за поверителна се счита всяка информация, относно пропускателния режим в обекта, организацията на работната сила и работния процес, наличното оборудване и техническите схеми на функционирането му, системите за защита и сигурност в обекта и всичко, което е свързано с наличното оборудване, съоръжения и тяхното функциониране в съответния обект.

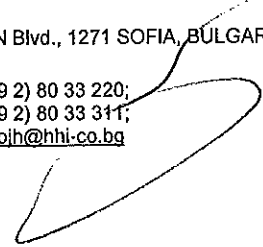
3/ Прилагам документ за извършен оглед, съставен на място в подстанцията.

Приложение: съгласно текста

Дата 18.04.2017г.

Декларатор: _____



Антон Илиев



ДЕКЛАРАЦИЯ
за конфиденциалност и извършен оглед на обект по предмета на поръчката

Долуподписаният/-ната/ Дже Хи У, в качеството ми на представляващ фирма „Хюндай Хеви Индъстрис КО.България“ АД, участник в процедура за възлагане на обществена поръчка с реф. № PPD 17-001 и предмет:

Доставка, демонтаж и монтаж на трифазни маслонапълнени понижаващи силови трансформатори 110kV/Средно напрежение (СрН) и цялото необходимо помощно оборудване,

ДЕКЛАРИРАМ, ЧЕ:

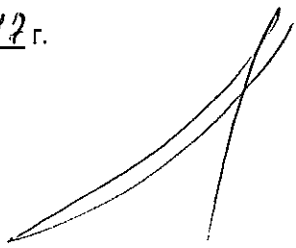
1/ Представител на участника, когото представлявам е извършил оглед на обект: п/ст „Бояна“ и съм запознат със съществуващото положение.

2/ Няма да разпространявам поверителна информация, във връзка с извършения оглед на обекта на Възложителя, като ми е известно, че за поверителна се счита всяка информация, относно пропускателния режим в обекта, организацията на работната сила и работния процес, наличното оборудване и техническите схеми на функционирането му, системите за защита и сигурност в обекта и всичко, което е свързано с наличното оборудване, съоръжения и тяхното функциониране в съответния обект.

3/ Прилагам документ за извършен оглед, съставен на място в подстанцията.

Приложение: съгласно текста

Дата 18.04.2012 г.



Декларатор: J. H. Woo
/име, подпис и печат/





ДЕКЛАРАЦИЯ

за извършен оглед на ПС „Бояна.....“ 110/Ср.Н

Долуподписаният/-ната Антон Иванов Илиев
.....
в качеството ми на представляващ „МИГ 23“ ЕООД
.....
кандидат за участие в процедура за възлагане на обществена поръчка с предмет: „Доставка, демонтаж и монтаж на трифазни маслонапълнени понижавачи силови трансформатори 110kV/Средно напрежение (СрН) и цялото необходимо помощно оборудване“ и реф. № PPD 17-001

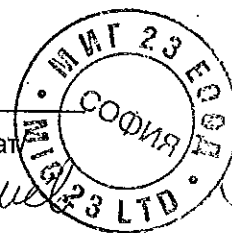
ДЕКЛАРИРАМ:

Извърших оглед на обекта, предмет на обществената поръчка и се запознах със съществуващото положение, включително с действащите електрически съоръжения и спецификата на ПС „Бояна.....“ 110/Ср.Н.

Дата 28.03.2017 г.

Декларатор: ИИИ
Име, подпис и печат

Антон Илиев



Служител на Възложителя допуснал до оглед кандидата:

Иван Янев - ра.ЕО - ИИИ
име и фамилия длъжност подпис



СЕРТИФИКАТ № OHS-677
CERTIFICATE No.

Удостоверява, че системата за управление на здравето и безопасността при работа на
It is hereby certified that the Occupational Health and Safety Management System of

ХЮНДАЙ ХЕВИ ИНДЪСТРИС КО. БЪЛГАРИЯ АД
HYUNDAI HEAVY INDUSTRIES CO. BULGARIA

БУЛ. РОЖЕН 41, СОФИЯ 1271, БЪЛГАРИЯ
 41, ROZHEN BLVD., 1271 SOFIA, BULGARIA

ЗА СЛЕДНИТЕ ОПЕРАТИВНИ СТРУКТУРИ / IN THE FOLLOWING OPERATIONAL UNITS

БУЛ. РОЖЕН 41, СОФИЯ 1271, БЪЛГАРИЯ
 41, ROZHEN BLVD., 1271 SOFIA, BULGARIA

СЪОТВЕТСТВА НА СТАНДАРТ
 IS IN COMPLIANCE WITH THE STANDARD

BS OHSAS 18001:2007

С ОБЛАСТ НА ПРИЛОЖЕНИЕ / FOR THE FOLLOWING FIELD(S) OF ACTIVITIES

КОНСТРУИРАНЕ, ПРОИЗВОДСТВО, ТЪРГОВИЯ И СЕРВИЗ НА ТРАНСФОРМАТОРИ, СЪПЛАЛНИ РЕГУЛАТОРИ,
 АПАРАТИ ВИСОКО НАПРЕЖЕНИЕ И РЕЗЕРВНИ ЧАСТИ.

DESIGN, PRODUCTION, SALE AND SERVICING OF TRANSFORMERS, TAP CHANGERS, HIGH VOLTAGE
 APPARATUSES AND SPARE PARTS.

Използването и валидността на сертификата зависят от спазването на правилата на RINA за сертификация на системи за управление на здравето и безопасността при работа
The use and validity of this certificate are subject to compliance with the RINA document: Rules for the Certification of Occupational Health and Safety Management Systems

Първо издание First Issue	11.08.2011
Настоящо издание Current Issue	30.07.2014
Валидност до Expiry Date	27.07.2017

Ing. Michele Francioni
 (Chief Executive Officer)

(Signature)

RINA Services S.p.A.
 Via Corsica 12 - 16128 Genova Italy

Организацията е сертифицирана по гореуказаните стандарти от 3/9/2008
 This Organisation is certified for the above standard since 3/9/2008.



SGQ N° 002 A SSI N° 001 G
 SCA N° 002 D DAP N° 001 H
 PRD N° 002 B PRS N° 006 C
 SCR N° 003 F LAB N° 0032
 Signatory of EA, IAF and ILAC
 Mutual Recognition Agreements

**ВЯРНО
 С ОРИГИНАЛА**

CISQ is a member of

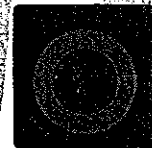
www.lqnet-certification.com

IQNet, the association of the world's first class certification bodies, is the largest provider of management System Certification in the world. IQNet is composed of more than 30 bodies and counts over 150 subsidiaries all over the globe.

За информация относно валидността на сертификата може да посетите www.rina.org

For information concerning validity of the certificate, you can visit the site www.rina.org

EA:19



Валидността на този сертификат зависи от годишните / шестмесечните одити и от цялостния преглед на системата за управление на всеки три години.

The validity of this certificate is dependent on an annual / six monthly audit and on a complete review, every three years, of the management system



Form CERTSICE-08/2013



СЕРТИФИКАТ № EMS-3487/S
CERTIFICATE No.

Удостоверява, че системата за управление по отношение на околната среда на
It is hereby certified that the Environmental Management System of

ХЮНДАЙ ХЕВИ ИНДЪСТРИС КО. БЪЛГАРИЯ АД
HYUNDAI HEAVY INDUSTRIES CO. BULGARIA

БУЛ. РОЖЕН 41, СОФИЯ 1271, БЪЛГАРИЯ
 41, ROZHEN BLVD., 1271 SOFIA, BULGARIA

ЗА СЛЕДНИТЕ ОПЕРАТИВНИ СТРУКТУРИ / IN THE FOLLOWING OPERATIONAL UNITS

БУЛ. РОЖЕН 41, СОФИЯ 1271, БЪЛГАРИЯ
 41, ROZHEN BLVD., 1271 SOFIA, BULGARIA

СЪОТВЕТСТВА НА СТАНДАРТ
 IS IN COMPLIANCE WITH THE STANDARD
ISO 14001:2004

С ОБЛАСТ НА ПРИЛОЖЕНИЕ / FOR THE FOLLOWING FIELD(S) OF ACTIVITIES

КОНСТРУИРАНЕ, ПРОИЗВОДСТВО, ТЪРГОВИЯ И СЕРВИЗ НА ТРАНСФОРМАТОРИ, СЪПЪЛНИ РЕГУЛАТОРИ,
 АПАРАТИ ВИСОКО НАПРЕЖЕНИЕ И РЕЗЕРВНИ ЧАСТИ.

DESIGN, PRODUCTION, SALE AND SERVICING OF TRANSFORMERS, TAP CHANGERS, HIGH VOLTAGE
 APPARATUSES AND SPARE PARTS.

Използването и валидността на сертификата зависят от спазването на правилата на RINA за сертификация на системи за управление по отношение на околната среда.
The use and the validity of this certificate are subject to compliance with the RINA document: Rules for the Certification of Environmental Management Systems.
 Валидността на този сертификат зависи от годишните / шестмесечните одити и от цялостния преглед на системата за управление на всеки три години.
The validity of this certificate is dependent on an annual / six monthly audit and on a complete review, every three years, of the management system

Първо издание First Issue	10.08.2011
Настоящо издание Current Issue	30.07.2014
Валидност до Expiry Date	27.07.2017

Ing. Michele Francioni
 (Chief Executive Officer)

RINA Services S.p.A.
 Via Corsica 12 - 16128 Genova Italy

CISQ is a member of

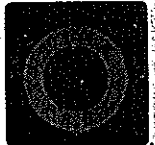
www.ignet-certification.com

IGNet, the association of the world's first class certification bodies, is the largest provider of management System Certification in the world. IGNet is composed of more than 30 bodies and counts over 150 subsidiaries all over the globe.

EA:19

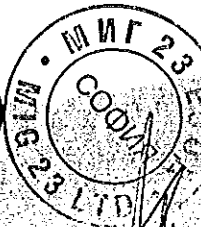
За информация относно валидността на сертификата може да посетите www.rina.org

For information concerning validity of the certificate, you can visit the www.rina.org



SGQ N° 002 A SSI N° 001 G
 SGA N° 002 D OAP N° 001 H
 PRD N° 002 B PRS N° 006 C
 SCR N° 003 F LAB N° 0832

Signatory of EA, IAF and ILAC Mutual Recognition Agreements



Организацията е сертифицирана по горепознатите стандарти от 03/09/2008.

This Organisation is certified for the above standard since 03/09/2008

ВЯРНО С ОРИГИНАЛА



www.cisq.com

Form CERSIGE-08/2013



СЕРТИФИКАТ № 23637/11/S
CERTIFICATE No.

Удостоверява, че системата за управление на качеството на
 IT IS HEREBY CERTIFIED THAT THE QUALITY MANAGEMENT SYSTEM OF

ХЮНДАЙ ХЕВИ ИНДЪСТРИС КО. БЪЛГАРИЯ АД
HYUNDAI HEAVY INDUSTRIES CO. BULGARIA

БУЛ. РОЖЕН 41, СОФИЯ 1271, БЪЛГАРИЯ
 41, ROZHEN BLVD., 1271 SOFIA, BULGARIA

ЗА СЛЕДНИТЕ ОПЕРАТИВНИ СТРУКТУРИ / IN THE FOLLOWING OPERATIONAL UNITS

БУЛ. РОЖЕН 41, СОФИЯ 1271, БЪЛГАРИЯ
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Съответства на стандарт
 IS IN COMPLIANCE WITH THE STANDARD

ISO 9001:2008

С област на приложение / FOR THE FOLLOWING FIELD(S) OF ACTIVITIES

КОНСТРУИРАНЕ, ПРОИЗВОДСТВО, ТЪРГОВИЯ И СЕРВИЗ НА ТРАНСФОРМАТОРИ, СЪПАЛНИ РЕГУЛАТОРИ,
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Използването и валидността на сертификата зависят от спазването на правилата на РИНА за сертификация на системи за управление на качеството.
 The use and validity of this certificate are subject to compliance with the RINA document : Rules for the certification of Quality Management Systems

Първо издание First Issue	10.08.2011
Настоящо издание Current Issue	30.07.2014
Валидност до Expiry Date	27.07.2017

Ing. Michele Francioni
 (Chief Executive Officer)

(Signature)

RINA Services S.p.A.
 Via Corsica 12 - 16128 Genova Italy

Организацията е сертифицирана по гореуказаните
 стандарти от 4/9/2009.

This Organisation is certified for the above standard since 4/9/2009



SGQN° 002 A SSIN° 001 G
 SGA N° 002 D DAP N° 001 H
 PRD N° 002 B PRS N° 066 C
 SCR N° 003 F LAB N° 0632

Signatory of EA, IAF and ILAC Mutual
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For information concerning validity of the certificate, you can visit the site www.rina.org

EA:19



Информация за изключенията от изискванията на стандарта може да бъде намерена в ръчничка по качество

Reference is to be made to the Quality Manual for details regarding the exemptions from the requirements of the standard

CISQ е Италианската Федерация на Органите по Сертификация на Системи за управление

CISQ is the Italian Federation of management system Certification Bodies



www.cisq.com

Form CISQ/ICE-08/2009

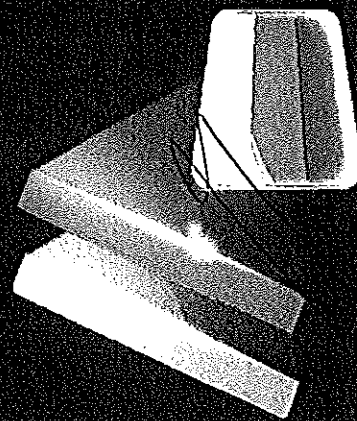
CORPORATE PRESENTATION

Contents

I Bulgaria Overview

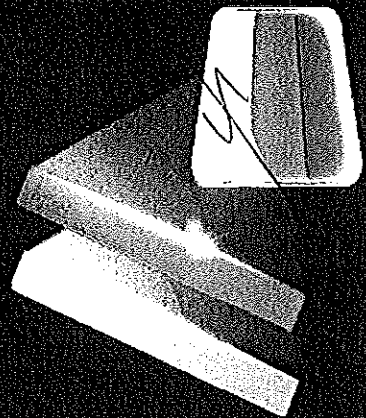
II Company Overview

III Company Products



Chapter I

I Bulgaria Overview



Bulgaria Overview

 Global Leader

1 Area

◀ Land - 111,000 km²

2 Capital

◀ Sofia

3 Population

◀ People - 7,400,000

◀ Density - 66,2 per km²

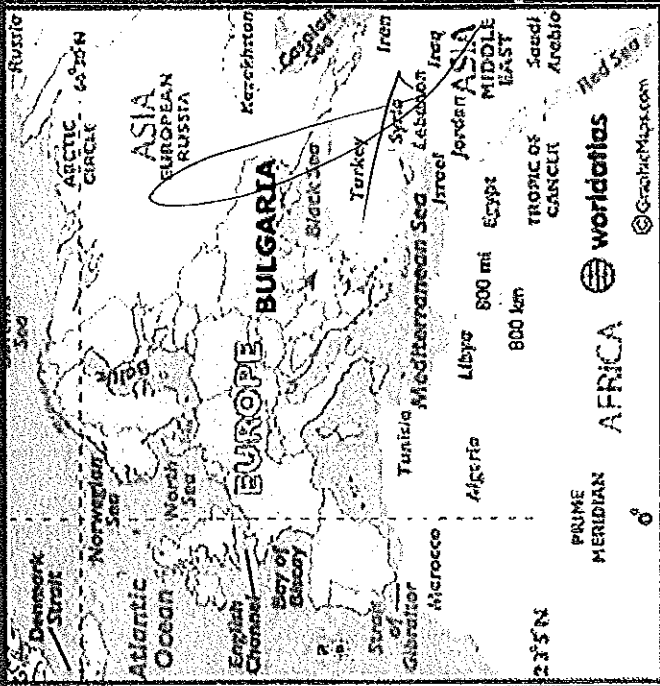
4 Economy

- ◀ Export driven economy
- ◀ Fixed Exchange Rate between BGN and EURO
- ◀ Double Taxation Relief Agreements between BG, EU and USA



323

Location & Advantages

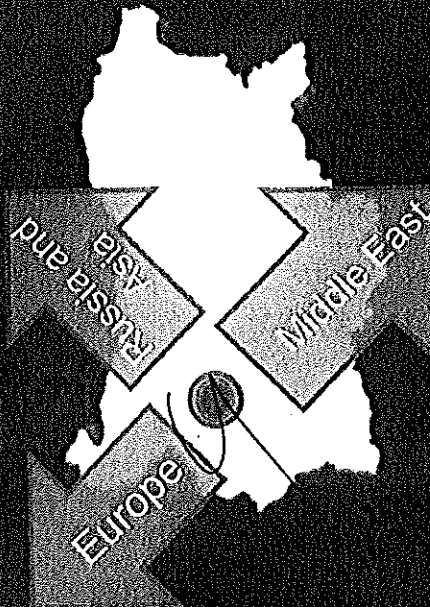


1 Strategic Location

- ◀ Located in Eastern Europe (Central Balkans)
- ◀ 5 Trans-European Corridors pass through the country.
- ◀ Vital connections to Western Europe, Russia, Asia and Middle East

2 Advantages

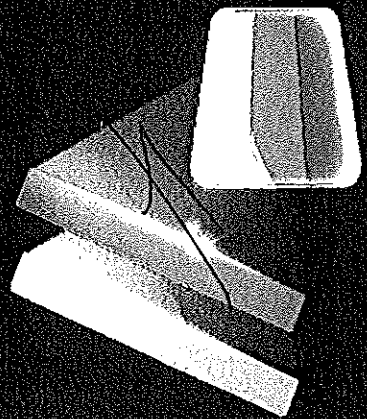
- ◀ Flexibility in production
- ◀ Reliability and quick deliveries
- ◀ Competitive labor cost
- ◀ High Quality



Chapter II

Company Overview

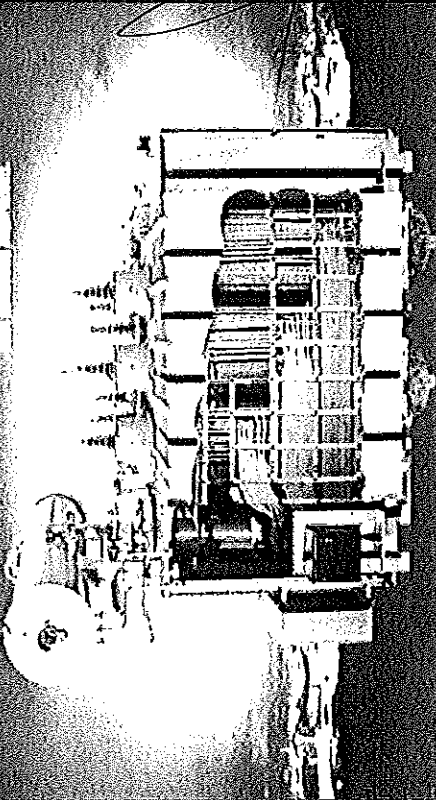
II Company Overview



Company Introduction

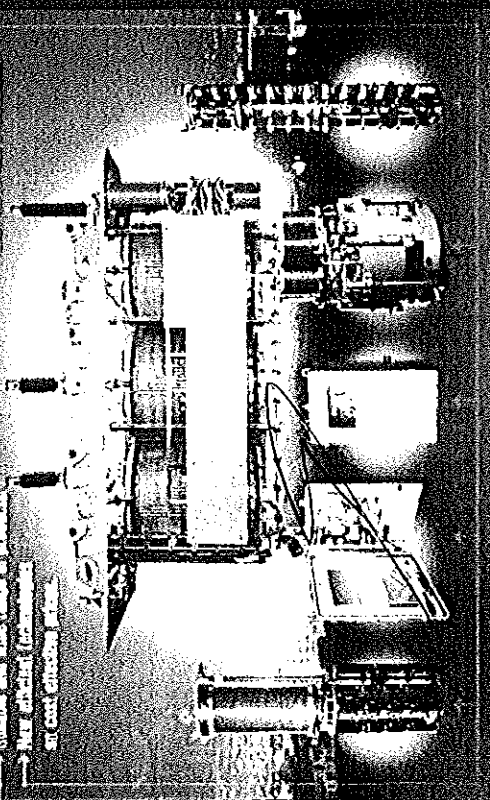
HYUNDAI

Includes 10 operating units within the construction group. 40 countries are the presence to meet the



- Long functional life and easy maintenance.
- Meet the latest technology requirements.
- Robust and wide range of products.
- High efficient (transmission cost effective) items.

HYUNDAI
HEAVY INDUSTRIES CO., LTD. (KOREA)



Building a Better Future
Global Leader

1 LOCATION

← 41, ROJEN BLVD. SOFIA, BULGARIA

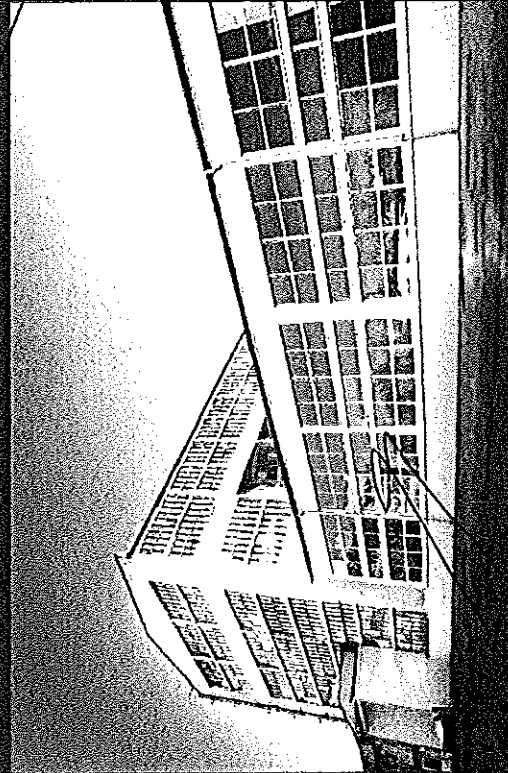
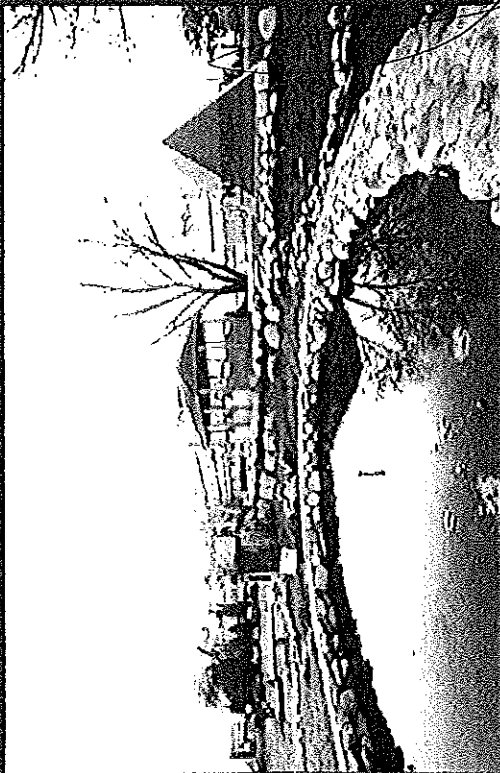
2 FACTORY AREA

← FACTORY (SOFIA) - 237,208 m²

Buildings	Size (m ²)
Administrative	1,657
Metal Welding Workshop	3,981
Transformer Workshop	20,491
Warehouse	4,169
Test laboratories	6,185
Production Facilities	5,096
Tap Changer Workshop	9,075
Others	15,217

HYUNDAI
HEAVY INDUSTRIES CO., BULGARIA

Company Introduction



1 First Steps

- ◀ In 1997 Hyundai Heavy Industries Ltd., Electro Electric Systems took over the Bulgarian state owned Elprom-Trafo Company

2 Company Mission

- ◀ HHIB is focused on sales, new markets, development, new business partners and clients
- ◀ To be a reliable, highly efficient and competitive partner

3 Future Goals

- ◀ HHIB has an ambitious development program to increase the capacity, efficiency and quality of the company

Company History



1949

The organization was established by merging several small factories producing Electrical apparatuses, Transformers and Electrical motors into a State Power Engineering Plant "Vasil Kolarov".



1958

The three main workshops were reorganized into three separate manufacturing plants: Electrical Apparatuses, Transformers and Electrical motors.



1991

The production of ELPROM-ENERGO was divided to five newly established independent companies. The Institute was closed and the production of transformers and Electrical Apparatuses was transferred to ELPROM-TRAFQ.

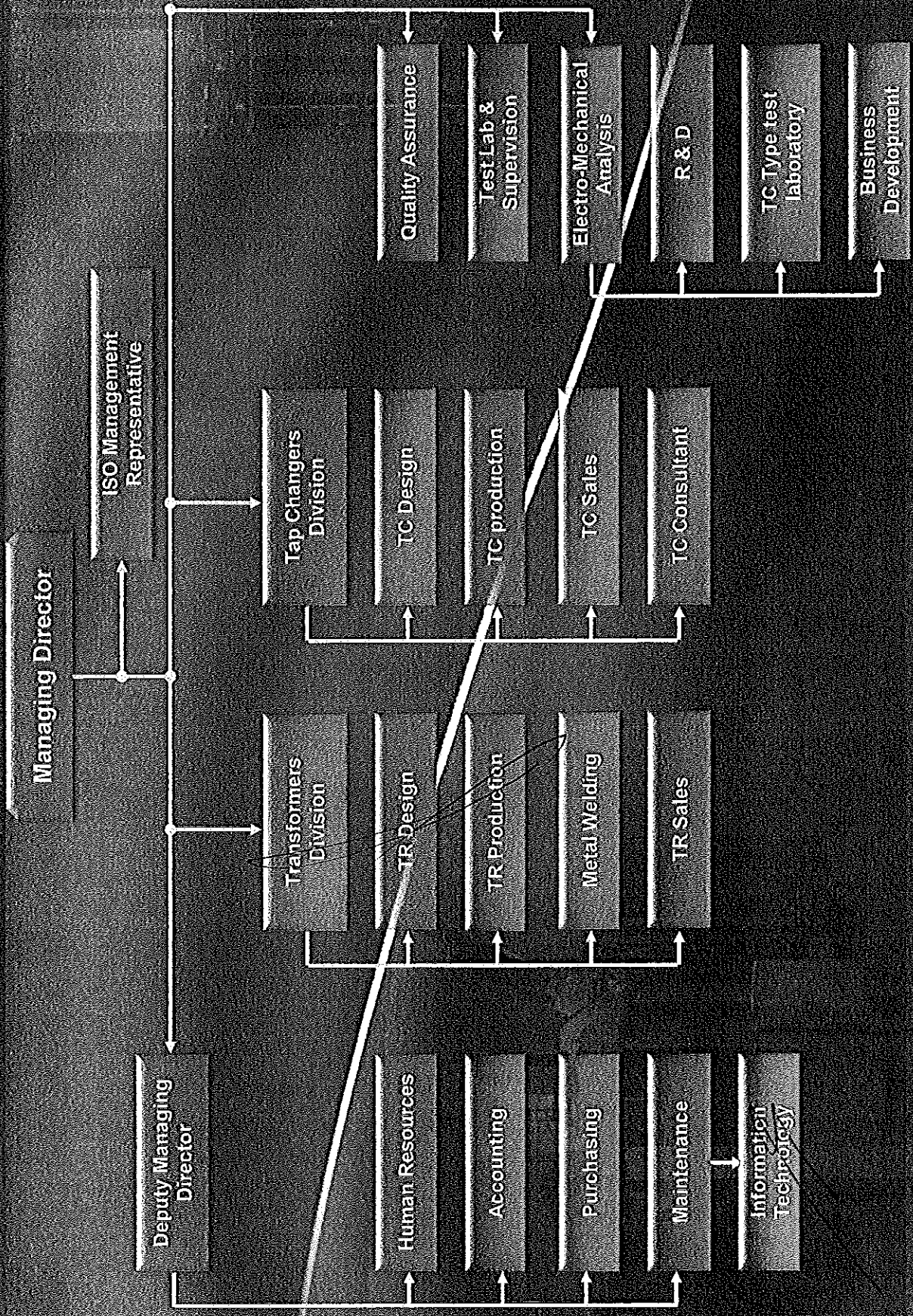


1997

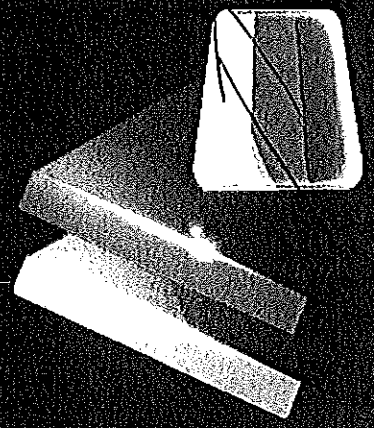
The company was privatized by Hyundai Heavy Industries Co. Korea became the main holder of the organization shares. The company name was changed to HYUNDAI ELPROM TRAFQ JSC.



Company Organization Chart



Chapter III

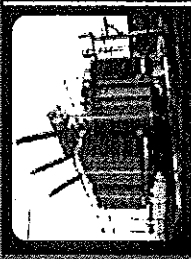


III Company Products

3

Company Markets and Experience - Transformers

Building a Better Future
Global Leader



TRANSFORMERS

MANUFACTURED

Power Transformers - 2 250 UNITS
Power Transformers - 75 000 MVA



- ◀ Annual production capacity 5 000 MVA
- ◀ Transformer rated capacity up to 250 MVA
- ◀ Transformer rated voltage up to 400 kV

HHIB Transformers have successfully passed type tests

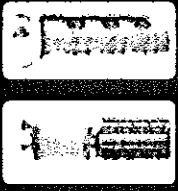
- ◀ KEMA - Netherlands
- ◀ ICMET Craiova - Romania

America	Europe	Africa	Asia
<ul style="list-style-type: none"> Brazil Cuba Dominican Republic Panama Jamaica Venezuela 	<ul style="list-style-type: none"> Albania Bosnia & Herzegovina Cyprus Denmark Estonia, Finland France, Greece Iceland, Ireland Kosovo Lithuania Netherlands Norway, Moldova Romania Russia Spain, UK Ukraine 	<ul style="list-style-type: none"> Algeria Cape Verde Egypt Equatorial Ghana Guinea Kenya Mali Morocco Mozambique Nigeria Sudan Tanzania Tunisia 	<ul style="list-style-type: none"> Bahrain Bangladesh India Iraq Jordan Kuwait Kazakhstan Lebanon Malaysia Oman Pakistan Saudi Arabia Syria Turkey Turkmenistan UAE

Company Markets and Experience – Tap-Changers



Global Leader



TAP-CHANGERS

MANUFACTURED

Tap Changers - More than 65 000 units

◀ Annual production capacity 2 000 units

The OLTCS have successfully passed type tests

- ◀ KEMA - Netherlands
- ◀ CEST - Italy
- ◀ ZKU - Czech Republic

The OLTCS have been awarded with Golden medals from International Fairs

- ◀ Leipzig - Germany
- ◀ Zagreb - Croatia

America

- Cuba
- Dominican Republic
- Jamaica
- Mexico
- Brazil
- USA

Europe

- Albania, Austria
- Belarus, Cyprus
- Bosnia & Herzegovina,
- Czech Republic
- Estonia, Finland,
- France, Greece,
- Hungary, Italy
- Kosovo, Poland
- Lithuania, Spain
- Macedonia, UK
- Moldova, Norway
- Netherlands,
- Ukraine, Portugal
- Romania, Russia
- Turkey, Slovakia
- Switzerland

Africa

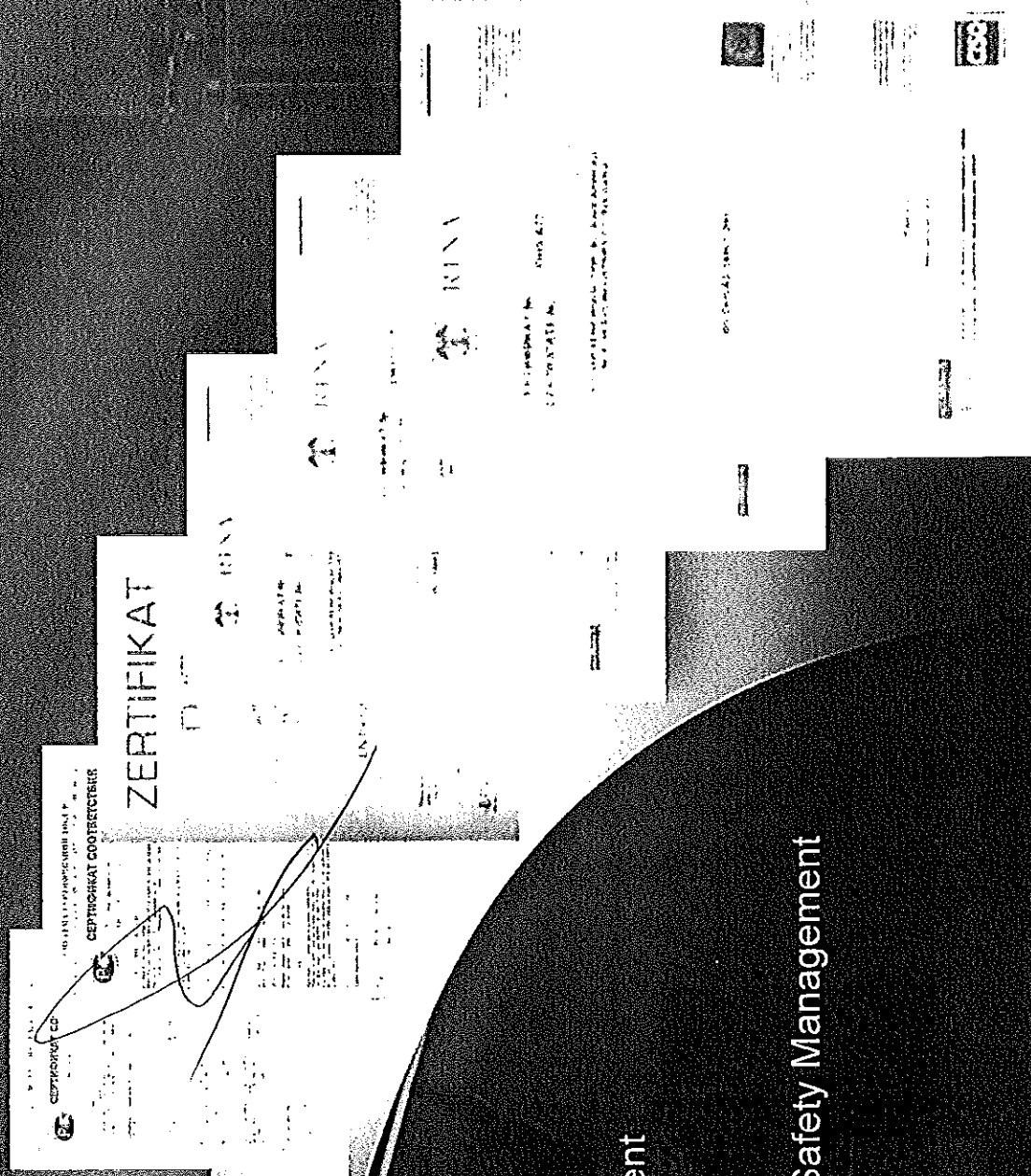
- Egypt
- Equatorial Guinea
- Ghana
- Mali
- Morocco
- Tanzania
- Tunisia

Asia

- Bahrain
- China
- Dubai
- India
- Iran, Iraq
- Jordan
- Korea
- Lebanon
- Pakistan
- Saudi Arabia
- Syria
- Thailand
- UAE
- Uzbekistan
- Vietnam
- Mongolia

Certificates & Standards

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ISO 9001

• Quality Assurance

ISO 14001

• Environment Management

OHSAS 18001

• Occupational Health & Safety Management

EN ISO 3834-2

• Welding Quality

Certificates & Standards

Certificate	Authority	Scope
CE Marking	EU Membership	All Products*
EN	EU	All Products*
BDS	BDS (Bulgaria)	All Products*
DIN	DIN (Germany)	All Products*
ANSI C 57.12.00	ANSI (USA)	All Products*
ISO 9001	RINA	All Products*
ISO 14001	RINA	All Products*
OHSAS 18001	RINA	All Products*
ISO 3834-2	DVS Zert	All Products*
KEMA	KEMA (Netherlands)	OLTC & Transformers
IEC 60076	IEC	Power Transformers
GOST P 52719-2007	GOST (Russia)	Power Transformers
GOST 12.2.007.2-75		
GOST 12.2.024-87		
GOST 1516.3-96		
IEC 60214	IEC	OLTC
KERI	KERI (Korea)	OLTC
ZKU	ZKU HV Laboratory	OLTC
CESI	CESI (Italy)	OLTC
GOST 12.2.007.0-75	GOST (Russia)	OLTC
GOST 12.2.007.2-75		
GOST 1516.3-96		
MIP	Minproekt (Bulgaria)	MDU
SAMEL90	SAMEL90 (Bulgaria)	MDU
CTEC	CTEC (Bulgaria)	MDU



*All Products – OLTC, OCTC, MDU, HDU, Transformers

THANK YOU



www.hhi-co.bg



HHIB performance records for power transformers for years 2000 - 2017

No	Location	Project	Rated power, MVA	Rated Voltages, kV	Units	Year of delivery
1	Bulgaria	AD Tranz	6,67	110/27,5	4	2000
2	Bulgaria	HPP Batak	15	121/10,5	1	2000
3	Bulgaria	HPP Batak	40,5	110/21/10,5	1	2000
4	Bulgaria	HPP Pestera	35	220/105	1	2000
5	Albania	Jacobsen Elektro AS - Norway	100	410/220/30	3	2001
6	Jordan	NEPCO	10	33/11	2	2001
7	Nigeria	NEPA	7,5	33/11	4	2001
8	Nigeria	NEPA	15	33/11	15	2001
9	Oman	AIC - Egypt	120	132/11,5	3	2001
10	Egypt	EETC, S/S El-Eslah	125	220/66/22	2	2002
11	Egypt	REA	25	66/22	3	2002
12	Syria	PEEGT, S/S Swedieh	45,5	230/11,5/6,6	1	2002
13	Bulgaria	HPP St. Kladenetz	45	121/10,5	1	2002
14	Egypt	EETC	125	220/66/11	4	2003
15	Egypt	EETC	125	220/66/11	3	2003
16	Egypt	EETC	125	220/66/22	2	2003
17	Egypt	EETC	125	220/66/22	1	2003
18	Egypt	EETC	75	220/66/22	1	2003
19	Egypt	Trust Chemical Co.	125	220/20/20	2	2003
20	Egypt	EETC	125	220/66/11	1	2003
21	Nigeria	NEPA	7,5	33/11	1	2003
22	Pakistan	WAPDA	160	220/132/11	5	2003
23	Egypt	EETC	125	220/66/11	2	2004
24	Egypt	EETC	125	220/66/11	2	2004
25	Estonia	Gaur	40	347/6,3-6,3 kV	1	2004
26	Jordan	EDCO	10	33/11	2	2004
27	Jordan	EDCO	4	33/3,3	1	2004
28	Albania	KESH, Vlorë	25	110/20 kV	2	2004
29	Egypt	EETC	125	220/66/11	1	2004
30	Egypt	EETC	150	220/132/11	1	2004
31	Eq. Guinea	Jacobsen Elektro AS - Norway	25	20(15)/11	1	2004
32	France	Solvey - Dombasle	25	10,75(21,5)/11/4,5	2	2004
33	France	Solvey - Dombasle	19	11/(22)/10,5	2	2004
34	Bulgaria	HPP Bell Iskar	10	121/6,3	1	2004
35	Bulgaria	HPP Kardzhali	72	121/10,5	1	2004
36	Bulgaria	HPP Ivailovgrad	70	121/10,5	1	2004

No	Location	Project	Rated power, MVA	Rated Voltages, kV	Units	Year of delivery
37	Bulgaria	DSD/RWE	40	32/6,3	3	2004
38	Bulgaria	DSD/RWE	40	220/32	1	2004
39	Albania	KESH - HPP Vau i Dejes	60	242/10,5	1	2005
40	Albania	KESH - HPP Koman	170	242/13,8	1	2005
41	Albania	KESH	120	220/115/37,6	2	2005
42	Egypt	EETC	50	132/36/12	1	2005
43	Jordan	CEGCO	80	132/13,8	1	2005
44	Iraq	Wärtsilä Finland Oy	45	35/11	2	2005
45	Jamaica	Wärtsilä Finland Oy	65	150/11	1	2005
46	Nigeria	NEPA	7,5	33/11	1	2005
47	Nigeria	NEPA	15	33/11	1	2005
48	Bulgaria	EDC Sofia	40	110/21/10,5	2	2005
49	Bulgaria	NEK	40	110/21/16,3	2	2005
50	Bulgaria	HPP Tarmasch	6	115/3,6	1	2005
51	Bulgaria	HPP Pastra	6	115/6,3	1	2005
52	Bulgaria	NEK	40	110/21/16,3	1	2005
53	Ghana	Jacobsen Elektro AS - Norway	26	33/11	15	2005
54	Lithuania	ELGA UAB	10	110/10	2	2005
55	Albania	KESH - HPP Vau i Dejes	60	242/10,5	1	2005
56	Bulgaria	HPP Beli Iskar	11	121/6,3	1	2005
57	Bulgaria	Asarel Meded	8	110/6,3	1	2005
58	Bulgaria	Solvey - Deven	12,5	20/6,3	3	2005
59	Bulgaria	Solvey - Deven	20/16	22/6,3	2	2005
60	Bulgaria	Siemens	10	110/27,5	2	2005
61	Bulgaria	Va-Tech Hydro	50	121/10,5	2	2005
62	Norway	MiniHydro AS	5,5	66/6,6	2	2006
63	India	Hyundai Motors	40	210/11	2	2006
64	Cuba	HHIK	8,5	34,5/4,16	18	2006
65	Cuba	HHIK	8,5	13,8/4,16	19	2006
66	Dominica	HHIK	8,5	12,47/4,16	1	2006
67	Malaysia	Wilson Transformer	50	138/11	2	2006
68	Malaysia	Wilson Transformer	6,3	11/6,93	2	2006
69	Saudi Arabia	Mitsubishi Heavy Industries, Japan	19	13,8/4,16	2	2006
70	Finland	Vaasa Engineering Oy	20	110/6,3	1	2006
71	Bahrain	SIDEM, France	42	21/11/11	1	2006
72	Bahrain	SIDEM, France	42	15,75/11/11	1	2006
73	Bahrain	SIDEM, France	6,9	11/2,1/0,42	1	2006
74	Cuba	HHIK	25	115/6,6	11	2006

No	Location	Project	Rated power, MVA	Rated Voltages, kV	Units	Year of delivery
75	Cuba	HNIK	12,5	34,5/6,6	6	2006
76	Bulgaria	ENEL Maritza East 3	40	15,75/6,3-6,3	3	2006
77	Bulgaria	NEC - Slanchev Bryag	40	110/21	2	2006
78	Greece	Athena SA	64	150/11	2	2007
79	Greece	Athena SA	12,5	11/6,3	2	2007
80	Iceland	RST Net, Iceland	45	132/34,5	1	2007
81	Bulgaria	NEK	70	121/10,5	1	2007
82	Finland	Vaasa Engineering Oy	10	115/21	1	2007
83	Bulgaria	Solvey - Deven	20	21/6,3	2	2007
84	Bulgaria	Solvey - Deven	12,5	21/6,3	2	2007
85	Bulgaria	Lindegaz	12	110/6	1	2007
86	Bulgaria	ABB	25	110/21/6,3	1	2007
87	Tanzania	Wärtsilä Finland Oy	55	140/11	1	2007
88	Bulgaria	Chelopech	30	110/10,5/6,3	1	2007
89	Bulgaria	TPP Pleven	45	110/11,5/6,3	1	2007
90	Bulgaria	CEZ Bulgaria	40	110/21/21	1	2007
91	The Netherlands	Siemens AG Power Generation	37	31,5/10,5	1	2007
92	Ghana	Volta River Authority	66	161/34,5	2	2007
93	Ghana	Volta River Authority	33	161/34,5	1	2007
94	Ghana	Volta River Authority	25	161/36/11,5	1	2007
95	Ghana	Volta River Authority	33	161/34,5/6,63	1	2007
96	Bulgaria	NEK	40	110/21(6,3)	1	2007
97	Bulgaria	NEK	31,5	110/35/10,5	1	2007
98	Bulgaria	NEK	50	110/21(6,3)	3	2007
99	Bulgaria	Alstom Power Turbo - Systems	60	20/10,5	2	2007
100	Bulgaria	Alstom Power Turbo - Systems	100	20/10,5-10,5	2	2007
101	Spain	Alstom Power Turbo - Systems	35	21/6,75/4,7	1	2007
102	Spain	Alstom Power Turbo - Systems	30	21/6,75/5,6	1	2007
103	Bulgaria	NEK	40	110/21(6,3)	1	2007
104	Venezuela	CADAFE	36	115/13,8	6	2007
105	Pakistan	Wärtsilä Finland Oy - Attok Refinery	85	132/15	3	2008
106	Ghana	Volta River Authority	33	161/34,5/11,5	1	2008
107	Ghana	Volta River Authority	20	69/34,5/11,5	1	2008
108	Ghana	Volta River Authority	33	161/74,5/11,7	1	2008
109	Morocco	Siemens AG Power Generation	22,4	15/6,8/6,8	2	2008
110	Bulgaria	NEK	50	110/21/10,5	2	2008
111	Bulgaria	NEK	50	110/21(6,3)	1	2008
112	Saudi Arabia	SIDEM, France	16	13,8/4,16-4,16	6	2008

No	Location	Project	Rated power, MVA	Rated Voltages, kV	Units	Year of delivery
113	Saudi Arabia	FLUOR / Hyundai Corporation	31,5	34,5/14,5	2	2008
114	Greece	Aluminium S.A. Greece / PPC	170	150/15,75	2	2008
115	UK	Alstom Power Turbo - Systems	40	21/6,75/5,6	4	2008
116	Bulgaria	NEK	23	121/10,5	1	2008
117	UK	Alstom Power Turbo - Systems	35	21/11,5/5,6	3	2008
118	India	Alstom Power Turbo - Systems	35	19/6,75/5,6	1	2008
119	Ireland	Alstom Power Turbo - Systems	32	21/11,5/5,9	1	2008
120	Bulgaria	Neohim	25	110/6,3	1	2008
121	Bulgaria	NEK	50	110/35/10,5	1	2008
122	Ghana	Gold Fields Ghana Ltd. - Tarkwa S/S	33	161/34,5	2	2008
123	Bulgaria	NEK	50	110/21/(6,3)	2	2008
124	Greece	Transport Alstom, France	15	150/27,5	4	2008
125	Egypt	EPPC	75	220/11-11	2	2008
126	Egypt	EETC - Zafarana SS	125	220/22/22	2	2009
127	UAE	Alstom Power Turbo - Systems	100	21/11,5/11,5	3	2009
128	UAE	Alstom Power Turbo - Systems	45	21/11,5/3,6	5	2009
129	Bulgaria	NEK	70	121/10,5	1	2009
130	Bulgaria	NEK	50	110/21/(6,3)	6	2009
131	Bulgaria	AES Maritza East I	40	110/21	1	2009
132	Bulgaria	Devnja Cement	40	110/6,3/6,3	1	2009
133	Bulgaria	Siemens Bulgaria	10,5	110/27,5	2	2009
134	Egypt	EETC - Bahteem S/S	125	220/72,5/12	3	2009
135	Cuba	HNIK	12,5	115/6,6	3	2009
136	Egypt	EETC - Bahteem S/S	40	66/11	3	2009
137	France	Alstom Power Turbo - Systems	30	21/6,9/5,6	1	2009
138	Egypt	EETC - Sharm El-Sheikh (3) S/S	40	66/22	4	2009
139	Egypt	EETC	125	220/66/11	6	2009
140	Egypt	EETC - Kafr El Zayad S/S	125	220/66/11	2	2009
141	Egypt	EETC - Kafr El Zayad S/S	40	66/11	3	2009
142	Bulgaria	AES GEO Energy - Kavama	100	110/33	2	2009
143	Bulgaria	Terna	10,5	110/27,5	4	2009
144	Bulgaria	CEZ Bulgaria	63	110/10,5/10,5	1	2009
145	Tunisia	Alstom Power Turbo - Systems	35	21/6,75/5,6	1	2009
146	Bulgaria	Maritza East 2	210	242/18	1	2009
147	Bulgaria	S/S Suvorovo	70	110/20/(6,3)	1	2010
148	The Netherlands	Alstom Power Turbo - Systems	45	20/10,5/5,6	3	2010
149	Egypt	EETC - El Zafarana	125	220/22/22	2	2010
150	Egypt	EETC - Abu Kabeer	125	220/66/11	3	2010

No	Location	Project	Rated power, MVA	Rated Voltages, kV	Units	Year of delivery
151	Mali	Wärtsilä Finland Oy	60	150/30	1	2010
152	Kosovo	KEK / TPP "Kosovo B"	48	24/6,6/6,6	1	2010
153	UK	Alstom Power Turbo - Systems	34	21/6,75/3,5	5	2010
154	Romania	Rodax A.T.E.E. - Greece	40	17/6,9	2	2010
155	Bulgaria	ENEL Maritza East 3	40	15,75/6,3-6,3	1	2010
156	Bulgaria	NEK	50	110/21/6,3	5	2010
157	Bulgaria	NEK	50	110/21/10,5	1	2010
158	Egypt	EETC - Baghdad S/S	125	220/66/22	2	2010
159	Egypt	EETC - Bahtem S/S	125	220/66/11	1	2010
160	Egypt	EETC - Damhhor Power Station	125	220/66/11	1	2010
161	Albania	Fushë Kruja Cement Factory Sh.P.K	35	220/6,3	1	2010
162	Finland	E.ON - Vaasa Engineering Oy	25	115/21	1	2010
163	Bulgaria	Granatoid	20	115/6,3	1	2010
164	Bulgaria	Granatoid	20	110/21/5	1	2010
165	Bulgaria	Granatoid	2	64/5,25	3	2010
166	Egypt	Global Energy	40	66/22	3	2010
167	Bulgaria	Seul Marine - Korea	15	110/20	4	2010
168	Turkey	Rodax A.T.E.E. - Greece	32	19/6,3	2	2010
169	Jamaica	Wärtsilä Finland Oy	55	72,5/11	2	2010
170	Venezuela	Wärtsilä Finland Oy	36	34,5/13,8	2	2010
171	Cape Verde	Wärtsilä Finland Oy	15	20/11	2	2010
172	Egypt	EETC - Obour S/S	125	220/66/22	3	2011
173	Bulgaria	Maritza East 2	210	242/18	2	2011
174	Egypt	EETC - Naga Hammadi S/S	125	220/66/11	1	2011
175	Egypt	EETC - Al Bostan S/S	125	220/66/11	1	2011
176	Egypt	EETC - Suez 2 S/S	125	220/66/11	2	2011
177	Bulgaria	Ideco - Insignia	20	15,75/6,3 kV	2	2011
178	Egypt	Kharafi National - EDEPC, Al Shabab PP	8	15/6,6 kV	8	2011
179	Egypt	Kharafi National - EDEPC, Damietta PP	8	15/6,6 kV	4	2011
180	Egypt	Kharafi National - EDEPC, Al Shabab PP	165	220/15 kV	8	2011
181	Tanzania	SEMCO Maritime, Denmark	40	220/11 kV	2	2011
182	Egypt	EETC - El Mattar S/S	125	220/66/11	3	2011
183	Egypt	EETC - Quesna S/S	125	220/66/11	1	2011
184	Egypt	EETC - El Zakazeek S/S	125	220/66/11	1	2011
185	Egypt	EETC - El Mahalla S/S	125	220/66/11	1	2011
186	Egypt	EETC - El Kalubia S/S	125	220/66/11	1	2011
187	Turkey	Rodax A.T.E.E. - Greece	21	20/10,5	2	2011
188	Denmark	Nordvestjysk Elforsyning	20	60/10	1	2011



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No	Location	Project	Rated power, MVA	Rated Voltages, kV	Units	Year of delivery
189	Finland	Vaasa Engineering Oy	16	117/21	1	2011
190	Morocco	Siemes AG Power Generation	22,4	15/6,8/6,8	1	2011
191	Kosovo	KEK	40	110/21(10,5)/10,5	2	2011
192	Bulgaria	CEZ Bulgaria	63	110/21/10,5	1	2011
193	Egypt	Kharafi National - EDEPC, West Damietta PP	165	220/15 kV	4	2011
194	Egypt	Kharafi National - EDEPC, West Damietta PP	8	15/6,6 kV	4	2011
195	Bulgaria	Electric city OOD - Bulgaria	22	121/6,3 kV	1	2011
196	Bulgaria	E.ON Bulgaria	50	115/21(10,5)	1	2011
197	Russia	Eurocontact - Russia	7,5	15,75/11	2	2011
198	Egypt	Degla CFM - El Gammal S/S	75	220/22	2	2011
199	Greece	Terna S.A. / PPC	24	150/11	7	2012
200	Finland	Herrfors Nät - Verkko Oy Ab	25	117/21	1	2012
201	Finland	VEO - Westenergy Vaasa	16	117/10,5	1	2012
202	Bulgaria	TPP Maritza East 2	32	110/6,3-6,3	1	2012
203	Kuwait	Alstom Power - Switzerland	40	19/6,8	2	2012
204	Turkmenistan	Energostroyontazh Ltd. - Russia	25	115/38,5/11	2	2012
205	Bangladesh	Wärtsilä Finland Oy	24	33/11	1	2012
206	Bulgaria	Toshel - 92 Ltd.	15	120/20(12)	2	2012
207	Bulgaria	Plama - Pleven	25	110/21(6,3)	1	2012
208	Kosovo	KEK / TPP "Kosovo A"	240	230/15,75	1	2012
209	Greece	EFACEC / PPC	50	150/21	6	2012
210	Estonia	Wärtsilä Finland Oy / Elering	73	115/15	2	2012
211	Kosovo	KEK / ABB Germany - "Pristina" 7 S/S	40	110/10,5(21)/10,5	2	2012
212	Kazakhstan	HHIK / KEGOC	200	220/110/10	1	2012
213	Kazakhstan	HHIK / KEGOC	125	220/110/10	1	2012
214	Kazakhstan	HHIK / KEGOC	125	220/110/6	1	2012
215	Kazakhstan	HHIK / KEGOC	25	220/35/10	3	2012
216	Kuwait	OTV France / SIDEM, France	60	132/11,5	2	2012
217	UK	Wärtsilä Finland Oy - Island of Guernsey	22	34,5/11	1	2012
218	Egypt	EETC - Abu Ghaleb S/S	125	220/66/11	2	2012
219	Egypt	EETC - Ashmoon S/S	125	220/66/11	3	2012
220	Egypt	EETC - Abu Ghaleb S/S	40	66/11	4	2012
221	Egypt	EETC - Ashmoon S/S	40	66/11	4	2012
222	Denmark	Nordvestjysk Elforsyning	20	60/10	1	2012
223	Albania	ABB Austria - HPP Temoves	11	110/6,3	1	2012
224	Bulgaria	Technip, Italy	63	110/15,75	2	2012
225	Bulgaria	E.ON Bulgaria	12,5	21/10,5	1	2012
226	Macedonia	EVN Macedonia - Kumanovo	50	110/21/10,5	1	2012

No	Location	Project	Rated power, MVA	Rated Voltages, kV	Units	Year of delivery
227	Estonia	Alstom Power System S.A. - France	60	35/11-11	1	2013
228	Iraq	ALSTOM Projects India Ltd.	8	15/6,75	4	2013
229	Iraq	ALSTOM Projects India Ltd.	6,8	6,6/0,42	2	2013
230	Algeria	Metka, Greece - Sonelgaz	46	220/11,5-11,5	12	2013
231	Estonia	Alstom Power System S.A. - France	60	18/11-11	1	2013
232	Bulgaria	TPP Sofia	50	115/10,5	1	2013
233	Bulgaria	TPP Sofia	15	10,5/5,3	1	2013
234	Bulgaria	TPP Sofia	6,3	10,5/6,3	1	2013
235	Estonia	Wärtsilä Finland Oy / Elering	73	347/15	3	2013
236	Bulgaria	Siemens - Bulgaria	12,5	110/27,5	4	2013
237	Ghana	Enclave Power Company	33	161/34,5	1	2013
238	Ghana	Enclave Power Company	33	161/11,5	1	2013
239	Macedonia	EVN Macedonia - Kumanovo	50	110/21/10,5	1	2013
240	Jordan	Metka - Greece, Samra project	175	132/15	1	2013
241	Kosovo	KOSTT	40	110/21(10,5)/10,5	1	2013
242	Jordan	Metka - Greece, Samra project	185	135/15	1	2013
243	Mozambique	Wärtsilä Finland Oy / NMGEP	73	275/15	4	2013
244	Armenia	EFACEC / Matur S/S	40	110/35/10	2	2013
245	Egypt	ABB Egypt / BMIC S/S	40	66/11	2	2013
246	Egypt	EETC	125	220/66/11	3	2013
247	Brazil	EFACEC/Eletronorte-Santa Maria S/S	100	230/138-13,8	1	2013
248	Switzerland	Alstom Switzerland	30	21/11,3/5,9	2	2013
249	Switzerland	Alstom Switzerland	15	11/5,9	2	2013
250	Switzerland	Alstom Switzerland	20	22/11,3	1	2013
251	Ukraine	Penstock UK - TPP Harkov	63	115/6,3-6,3	1	2013
252	Kosovo	KEK / TPP "Kosovo A"	20	15,75/6,3	1	2013
253	Brazil	EFACEC / Rondonopolis S/S	100	230/138/13,8	1	2013
254	Brazil	EFACEC / Caupe S/S	100	230/69	1	2013
255	Brazil	Wärtsilä Finland Oy / Nova Venecia	13	13,8/4,16	1	2013
256	Iraq	SEMCO Maritime, Denmark	10	11/6,6	1	2013
257	Ghana	Zakhem Construction Ghana Ltd.	17	11,5/2,1/6,9	2	2013
258	Bulgaria	Toshel EOOD	10	110/20(6,3)	1	2013
259	Bulgaria	Toshel EOOD	10	110/6,3(6,3)	1	2013
260	Kenya	Wärtsilä Finland Oy	55	66/11	2	2014
261	Jordan	Metka - Greece, Samra project	185	135/15	1	2014
262	Ghana	GRIDCo / Jacobsen Elektro, Norway	33	161/34,5	3	2014
263	Brazil	EFACEC / Itabaiana S/S	100	230/69	1	2014
264	Brazil	EFACEC / Natal III S/S	150	230/69	1	2014

No	Location	Project	Rated power, MVA	Rated Voltages, KV	Units	Year of delivery
265	Ghana	Enclave Power Company	66	161/34,5	1	2014
266	Ghana	Enclave Power Company	33	161/11,5	1	2014
267	Bulgaria	Energoremont Holding - TPP Sofia	15	115/6,3	1	2014
268	Switzerland	Alstom Switzerland - Birr project	20	19-22/3,6	1	2014
269	Venezuela	Wärtsilä Finland Oy - Pequiven III	20	24/13,8	1	2014
270	Greece	Aluminium S.A. Greece	36,6	15/17,354	1	2014
271	Greece	Aluminium S.A. Greece	31,5	18/2 x 0,895	1	2014
272	Egypt	Inter Machinex Ltd. / KIMA	12,5	30/0,15	1	2014
273	Albania	Fushë Kruja Cement Factory Sh.P.K	35	220/6,3	1	2014
274	Georgia	Çalik Enerji - Gardabani CCPP	110	220/11	1	2014
275	Georgia	Çalik Enerji - Gardabani CCPP	100	220/11	2	2014
276	Georgia	Çalik Enerji - Gardabani CCPP	15	11/6,3	2	2014
277	Germany	Alstom Switzerland - GuD Niehl 3	30	21/6,45/5,9	1	2014
278	Cape Verde	Wärtsilä Finland Oy	15	20/11	2	2014
279	Cape Verde	Wärtsilä Finland Oy	7	20/11	2	2014
280	Kosovo	KOSTT - SS Streda	40	110/21(10,5)/10,5	1	2014
281	Moldova	GNF Spain	40	15,75/6,3-6,3	1	2014
282	Bulgaria	Maritza East 2	40	15,75/6,3-6,3	2	2014
283	Panama	Constructora Urbana, S.A.	6	13,2/0,48	1	2014
284	Armenia	EFACEC Austria - S/S Kashen	16	110/35/6	1	2014
285	Kosovo	KOSTT - SS Prishtina 2	40	110/21(10,5)/10,5	1	2014
286	Iraq	ALSTOM Middle East FZE	20	15/6,3	2	2015
287	Iraq	ALSTOM Middle East FZE	6,8	6/1,8/0,42	2	2015
288	Bulgaria	Aktor S.A. - Helector S.A. MBT plant	10	110/20(6,3)	1	2015
289	Turkey	Gama, Turkey - Kirikkale	34	17/6,9	2	2015
290	Egypt	ABB Egypt - El-Markby steel	15	66/22	1	2015
291	Egypt	ABB Egypt - El-Markby steel	65	66/33	1	2015
292	Mexico	ALSTOM Power Inc.	15	20/2,8	1	2015
293	Ghana	Jacobsen Elektro AS, Norway/GRIDCo	33	161/11,5	1	2015
294	Bulgaria	TPP Gorna Orjahovitza	6,3	21/6,3	1	2015
295	Egypt	Oraskom - EDEPC, Assuit SCPP	165	220/15	8	2015
296	Egypt	Oraskom - EDEPC, Assuit SCPP	16	15/6,9	8	2015
297	Egypt	Oraskom - EDEPC, West Damietta SCPP	165	220/15	4	2015
298	Egypt	Oraskom - EDEPC, West Damietta SCPP	10	15/6,9	4	2015
299	Egypt	Arcosteel - Egypt	80	220/22,5	1	2015
300	Indonesia	Wartsila Finland Oy - Arun project	60	157/11	4	2015
301	Dominican Republic	Technimont, Italy - Power Plant CDEEE	47,5	22/6,9	4	2015
302	Bulgaria	Energopro - HPP Spanchevo	34	121/10,5	1	2015

No	Location	Project	Rated power, MVA	Rated Voltages, kV	Units	Year of delivery
303	Greece	TERNA - Tithorea	15	150/27,5	1	2015
304	Greece	TERNA - Agios Giorgios project	75	150/21	2	2015
305	Dominican Republic	Technimont, Italy - Power Plant CDEEE	47,5 MVA	138/6,9	1	2015
306	Ukraine	Kvant Servis - TPP Harkov	63	115/6,3-6,3	1	2015
307	Panama	SEMCO Maritime, Denmark - Patacon PP	10,5	13,8/13,8	1	2015
308	Bulgaria	PSS Bulgaria - HPP Pasarel	25	118/10,5	1	2015
309	France	Alstom Power System S.A. - France	12	15/6,9	1	2016
310	Ghana	Enclave Power Company - DAWA project	66	330/34,5	2	2016
311	Bulgaria	TPP Maritza East 2	32/16-16	16/6,3-6,3	2	2016
312	UK	Air Products Plc. - UK	20	22/7	2	2016
313	The Netherlands	Siemens AG - Attero Moerdijk	150	150/15,75	1	2016
314	The Netherlands	Siemens AG - Attero Moerdijk	30	15,75/10,5	1	2016
315	British Virgin Islands	Wärtsilä Finland Oy - BVIEC Phase V	35	34,5/13,2	2	2016
316	British Virgin Islands	Wärtsilä Finland Oy - BVIEC Phase V	15	34,5/13,2	1	2016
317	Egypt	EL-Sewedy PSP/EDEPC - Al Shabab CCPP	125	220/66	2	2016
318	Kosovo	KEK / TPP "Kosovë A"	240	230/15,75	1	2016
319	Zambia	Wärtsilä Finland Oy - Ndola Energy Phase II	75	66/15	2	2016
320	Bulgaria	AMYLUM Bulgaria	25	110/6,3	1	2016
321	Bulgaria	PSS Bulgaria - HPP Pasarel	20	118/10,5	1	2016
322	Latvia	JSC „Augstsprieguma tikls” - SS "Jecabpils"	10	115/21/6,3	1	2016
323	Bulgaria	Energoremont Holding - TPP Sofia	15	110/6,3	1	2016
324	Ukraine	Kvant Plus	25	115/38,5/11	1	2016
325	Albania	MIG 23 - Bistrica	80	160/115/(6,6)	1	2016
326	Bosnia & Herzegovina	Bicakcic d.o.o., BiH - Ilijas foundry	25	110/20	1	2016
327	UK	Wärtsilä Finland Oy - Island of Guernsey	22	34,5/11	1	2016
328	Ukraine	Kvant Plus - SS "Ilti"	40	115/38,5/11	1	2016
329	Indonesia	Wärtsilä Finland Oy - Jiipe 23 MW PP	30	20/11	1	2016
330	Saudi Arabia	Wärtsilä Finland Oy - Yamama Cement Plant	35	33/13,8	6	2016
331	Finland	Technicas Reunidas, Spain - Kilpilahti	50,5	117/10,5	2	2016
332	Ukraine	Kvant Plus - TPP Zmieiv	32	15,75/6,3-6,3	1	2016
333	Armenia	EFACEC Austria - S/S Kashen	20	110/35/6	1	2016
334	Egypt	Borg al Arab Plant	25	22/11	2	2017
335	Saudi Arabia	Wärtsilä Finland Oy - Yamama Cement Plant	35	33/13,8	4	2017
336	Saudi Arabia	Wärtsilä Finland Oy - Yamama Cement Plant	15	33/13,8	1	2017
337	Greece	CNI - S/S Agiorgitika	50	150/21	1	2017
338	Argentina	Wärtsilä Finland Oy - Central Termica Pilar	63	138/13,2	2	2017
339	UK	Vaasa Engineering Oy - Nordbord Inverness	15	33/11	2	2017
340	Latvia	JSC „Augstsprieguma tikls” - SS "Koknese"	10	115/21	1	Under manufacturing

No	Location	Project	Rated power, MVA	Rated Voltages, kV	Units	Year of delivery
341	Kazakhstan	HHIK - Karabatan C CPP	63	115/11	6	Under manufacturing
342	Kazakhstan	HHIK - Karabatan C CPP	45	110/10,5	2	Under manufacturing
343	Latvia	AS "Augstsprieguma tīkls" - SS „Daugavpils”	125	330/115/10,5	1	Under manufacturing
344	Spain	SerIDOM Servicios Integrados Idom SAU	135	161/11,5/11,5	1	Under manufacturing
345	Spain	SerIDOM Servicios Integrados Idom SAU	72	161/11,5	1	Under manufacturing
346	Spain	SerIDOM Servicios Integrados Idom SAU	66	22/6,6/11,5	2	Under manufacturing
347	Bulgaria	EVN Bulgaria - S/S Tzaratsovo	50	110/20	1	Under manufacturing
348	Turkey	Exergy, Italy-Kuyucak Jeofermal Elektrik Uretim	26	154/11	1	Under manufacturing
349	Albania	DOKO sh.p.k - Elbasan	42	110/10,5	2	Under manufacturing
350	Venezuela	Wärtsilä Finland Oy - Petro Miranda	22	34,5/13,8	2	Under manufacturing
351	Argentina	GE Switzerland - Tucuman PP	12	15,75/6,75	1	Under manufacturing
352	Philippines	Wärtsilä Finland Oy - Masbate Gold Extension	7	13,8/4,16	1	Under manufacturing
353	Armenia	EFACEC Austria - S/S HVEN 4	25	110/10	2	Under manufacturing
354	Argentina	Wärtsilä Projects Oy - Central Loma La Lata	63	138/13,2	2	Under manufacturing
355	Ghana	Elecnet, Spain - Kumasi S/S (GRIDCo)	200	330/161/34,5	2	Under manufacturing
356	Ghana	Eiffage Energie - Kintampo S/S (GRIDCo)	200	330/161/34,5	2	Under manufacturing
357	Kosovo	KOSTT - S/S Ristina 6	40	110/10(20)	2	Under manufacturing
358	Kosovo	KOSTT - S/S Mitrovica	40	110/10(20)	2	Under manufacturing
359	Kosovo	KOSTT - S/S Drehasi	40	220/35/10(20)	2	Under manufacturing
360	Bosnia & Herzegovina	Bicakcic d.o.o., BiH - S/S Hak	40	110/36,75/10,5(21)	1	Under manufacturing
361	Ukraine	Kvant Plus - S/S Central Kievenergo	63	115/11-11	2	Under manufacturing
362	Greece	TERNA - Vermio project	50	150/21	1	Under manufacturing
363	Greece	TERNA - Aliveri project	50	150/21	1	Under manufacturing
364	Greece	TERNA - Ptolemais Unit V	125	16,25/15,75/10,5	2	Under manufacturing
365	Greece	TERNA - Ptolemais Unit V	125	21/15,75/10,5	1	Under manufacturing
366	UK	Wärtsilä Finland Oy - Centrica, Brigg	62	132/11/11	1	Under manufacturing
367	UK	Wärtsilä Finland Oy - Centrica, Peterborough	62	132/11/11	1	Under manufacturing
368	Armenia	Cobra, Spain - Yerevan	200	220/110	1	Under manufacturing
369	Armenia	Cobra, Spain - Yerevan	27,5	110/35/6	2	Under manufacturing
TOTAL					763	

9/10

3

Siemens H-Pos: 100; 3EK7 150-5CD4

Cage design 

System Information		
Nominal System Voltage (Un)	10,5	kV
Highest Voltage of Equipment (Um)	12,0	kV
Basic Insulation Level (BIL)	145	kV
Maximum altitude of installation (a.s.l.)	1000	m
Neutral system earthing	isolated	
Power Frequency	48 ... 62	Hz
Electrical data		
Applied Standard	IEC 60099-4	
Arrester classification		
Designation	DH	
Nominal discharge current (In, 8/20 μs)	10	kA
Wth	4,5	kJ/kV
Rated voltage (Ur)	15,0	kV
Maximum continuous operating voltage (Uc / MCOV)	12,0	kV
Line discharge class	2	
Long duration impulse current withstand (2 ms)	550	A
High current impulse withstand (4/10 μs)	100	kA
Rated short circuit current (0,2 s)	20,0	kA
Maximum residual voltage at :		
10 kA 1/2 μs	46,4	kV
5 kA 8/20 μs	39,0	kV
10 kA 8/20 μs	41,9	kV
20 kA 8/20 μs	48,2	kV
40 kA 8/20 μs	55,7	kV
500 A 30/60 μs	32,3	kV
1 kA 30/60 μs	33,5	kV
2 kA 30/60 μs	35,2	kV
Temporary overvoltage for 1 s	16,1	kV
Temporary overvoltage for 10 s	15,0	kV
Energy discharge capability - thermal	4,40	kJ/kV _r
Energy discharge capability - impulse	2,70	kJ/kV _r
Power Frequency withstand voltage (1min, wet)	67,0	kV
Lightning Impulse withstand voltage (1,2/50 μs)	144	kV
Mechanical data		
Height (H)	240	mm
Minimum creepage distance	605	mm
Weight (G)	2,4	kg
Color of housing	grey	
Specified long-term load SLL (F _{stat}) ³	1450	N
Specified short-term load SSL (F _{dyn}) ³	2080	N
Accessories		
Line terminal	Clamp, washer, nut M12	
Ground terminal	Washer, nut M12	

³ Values without accessories

AL: N
ECCN: N



411

Technical Datasheet

Siemens H-Pos: 200; 3EK7 270-5CH4

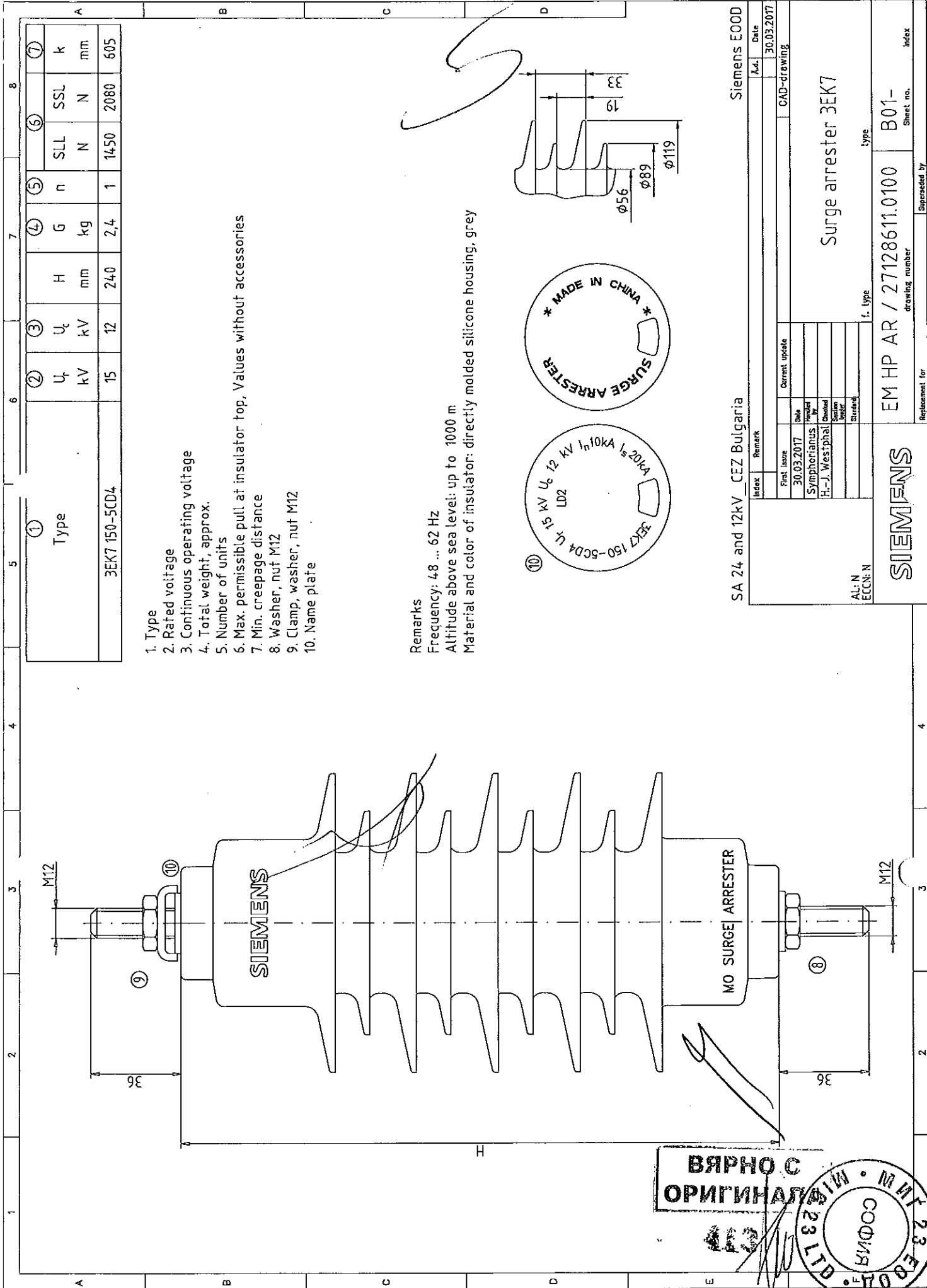
Cage design

System Information	
Nominal System Voltage (Un)	20,0 kV
Highest Voltage of Equipment (Um)	21,0 kV
Basic Insulation Level (BIL)	145 kV
Maximum altitude of installation (a.s.l.)	1000 m
Neutral system earthing	isolated
Power Frequency	48 ... 62 Hz
Electrical data	
Applied Standard	IEC 60099-4
Arrester classification	
Designation	DH
Nominal discharge current (In, 8/20 µs)	10 kA
Rated voltage (Ur)	27,0 kV
Maximum continuous operating voltage (Uc / MCOV)	21,6 kV
Line discharge class	2
Long duration impulse current withstand (2 ms)	~550 A
High current impulse withstand (4/10 µs)	100 kA
Rated short circuit current (0,2 s)	20,0 kA
Maximum residual voltage at :	
10 kA 1/2 µs	71,8 kV
5 kA 8/20 µs	62,4 kV
10 kA 8/20 µs	75,0 kV
20 kA 8/20 µs	77,2 kV
40 kA 8/20 µs	89,3 kV
500 A 30/60 µs	51,0 kV
1 kA 30/60 µs	53,7 kV
2 kA 30/60 µs	56,4 kV
Temporary overvoltage for 1 s	31,0 kV
Temporary overvoltage for 10 s	29,0 kV
Energy discharge capability - thermal	4,40 kJ/kV _r
Energy discharge capability - impulse	2,70 kJ/kV _r
Power Frequency withstand voltage (1min, wet)	113 kV
Lightning Impulse withstand voltage (1,2/50 µs)	242 kV
Mechanical data	
Height (H)	400 mm
Minimum creepage distance	1 230 mm
Weight (G)	3,9 kg
Color of housing	grey
Specified long-term load SLL (F _{stat}) ³	870 N
Specified short-term load SSL (F _{dyn}) ³	1250 N
Accessories	
Line terminal	Clamp, washer, nut M12
Ground terminal	Washer, nut M12

³ Values without accessories

AL: N
ECCN: N

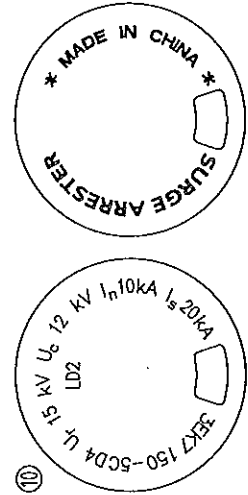




①	Type	②	U _c kV	③	U _c kV	④	G kg	⑤	n	⑥	SLL N	⑦	k mm
	3EK7 150-5CD4		15		12		2,4		1		14-50		2080
													605

1. Type
2. Rated voltage
3. Continuous operating voltage
4. Total weight, approx.
5. Number of units
6. Max. permissible pull at insulator top, Values without accessories
7. Min. creepage distance
8. Washer, nut M12
9. Clamp, washer, nut M12
10. Name plate

Remarks
 Frequency: 48 ... 62 Hz
 Altitude above sea level: up to 1000 m
 Material and color of insulator: directly molded silicone housing, grey



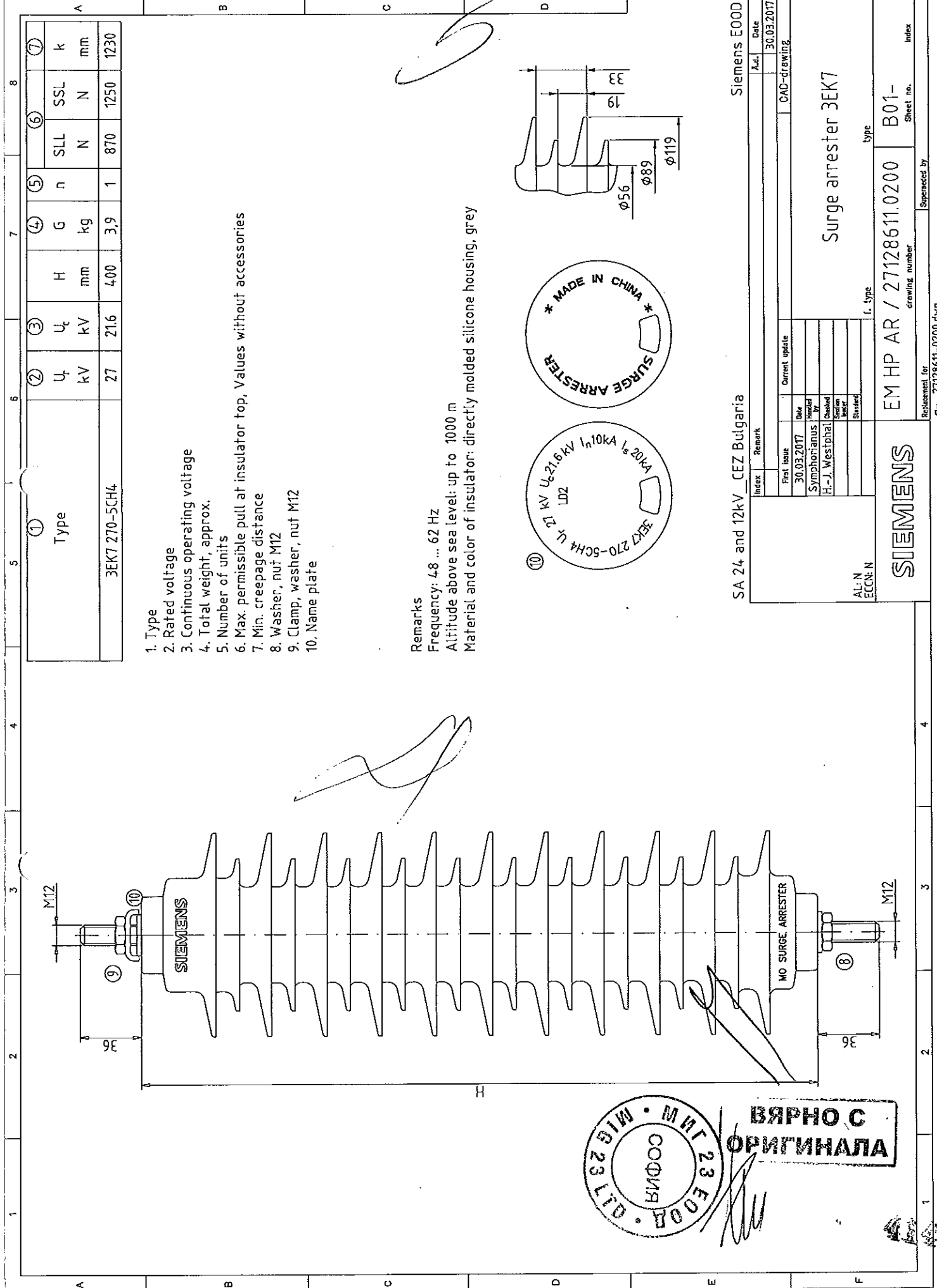
SA 24 and 12kV CEZ Bulgaria		Siemens EOOD	
Index	Remark	Ad.	Date
			30.03.2017
First issue	Current update	CAD-drawing	
Date			
30.03.2017			
Drawn by			
Symphonianus			
Checked			
Hi-J. Westphal			
Accepted			
Standard			
AL: N			
ECC: N			
SIEMENS		Surge arrester 3EK7	
EM HP AR / 27128611.0100		B01-	
Replacement for		Sheet no.	
file: 27128611-0100.dwg		index	
Superseded by			



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①	Type	②	U _c kV	③	U _c kV	④	H mm	⑤	G kg	⑥	SLL N	⑦	k mm
	3EK7 270-5CH4	27	216	400	3,9	1	870	1250	1230				

1. Type
2. Rated voltage
3. Continuous operating voltage
4. Total weight, approx.
5. Number of units
6. Max. permissible pull at insulator top, Values without accessories
7. Min. creepage distance
8. Washer, nut M12
9. Clamp, washer, nut M12
10. Name plate

Remarks
 Frequency: 48 ... 62 Hz
 Altitude above sea level: up to 1000 m
 Material and color of insulator: directly molded silicone housing, grey

SA 24 and 12kV_CEZ Bulgaria

Siemens E00D

Index	Remark	First issue	30.03.2017	Drawn by	Symphonianus	Checked by	H.-J. Westphal	Revision		Current update		A.d.	30.03.2017	Date
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AL: N
 ECCN: N

EM HP AR / 27128611.0200

Surge arrester 3EK7

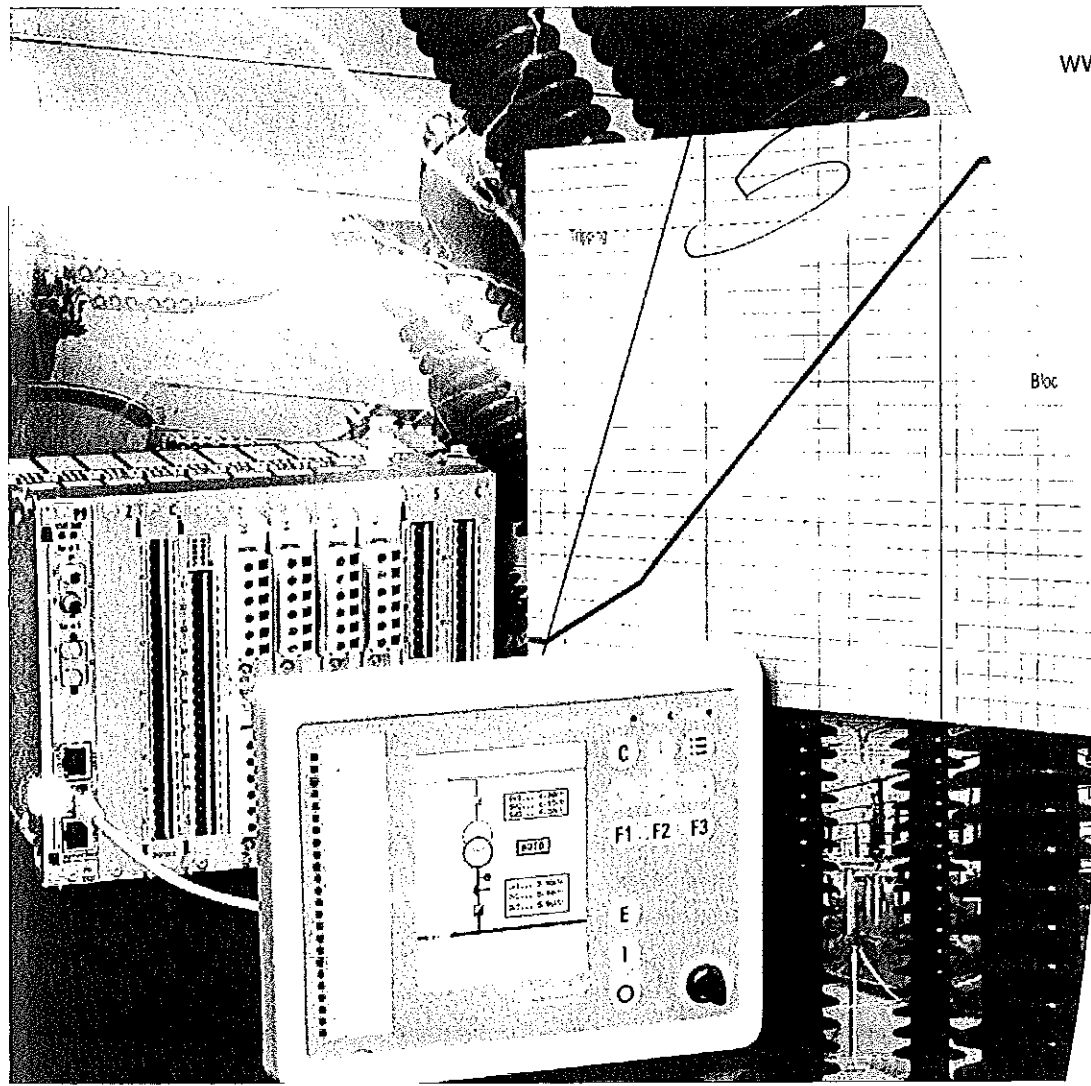
B01-

Replacement for drawing number

Sheet no.

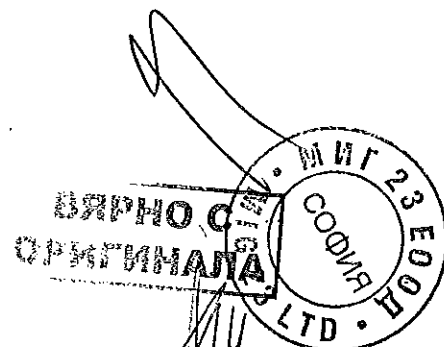
Prepared by

File: 27128611-0200.dwg

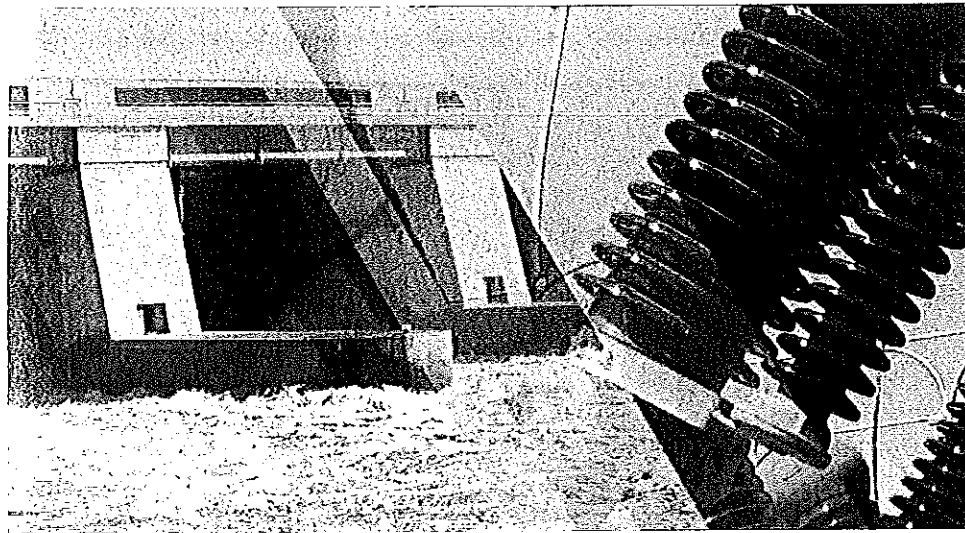


SPRECON®-E-P DQ..6-SERIES

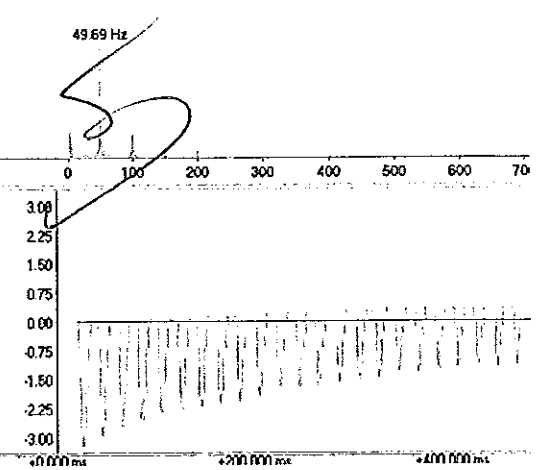
PROTECTION DEVICES AND COMBINED PROTECTION AND CONTROL DEVICES
WITH TRANSFORMER DIFFERENTIAL PROTECTION



sprecher
automation



Auswahl:	644.000 ms	644	1.000 ms
Interpolation:	644.000 ms	1024	0.629 ms
Spektrum:	795.031 Hz	512	1.553 Hz
			Gleichanteil



SPRECON-E-P DQ..6-SERIES

INTRODUCTION

SPRECON-E-P DQ..6 devices provide differential protection for transformers. The devices include standardised hardware modules and firmware. They all provide protection functions of the same range. The series consists of:

- SPRECON-E-P DQ..6-1 (Protection device)
- SPRECON-E-P DQ..6-2 (One-box solutions with combined protection and control)

One-box solutions are distinguished from protection devices by additional control functions. Beside typical protection functions and measured-value collection, protection devices also feature control of circuit-breakers. The one-box solutions allow protection and measurement as well as control and monitoring of secondary systems.

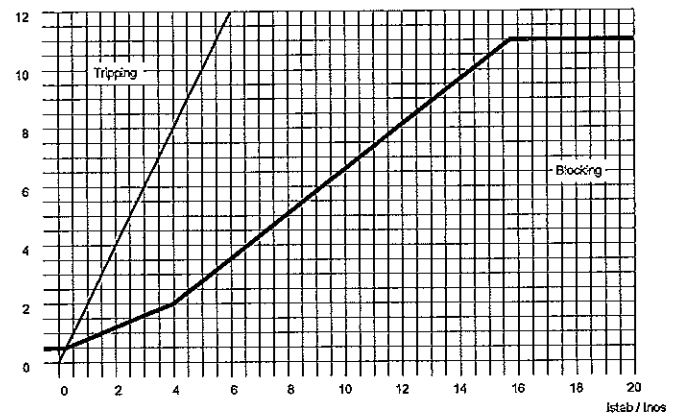
The multifunctional SPRECON-E-P devices feature a clear separation of control and protection functions which allows either combined or separated operations of control and protection functions:

- Separated data models
- Separated control and protection firmware
- Separated control and protection configuration
- Separated passwords
- No testing of protection function at feeder nor primary circuit disconnection required on updating control parameters or firmware

RANGE OF FUNCTIONS

The devices are accentuated by a technologically fully developed and commercially optimised design. They allow realisations of sophisticated and compact solutions with clear economical benefits through highest possible flexibility and scalability.

Idiff / Inos



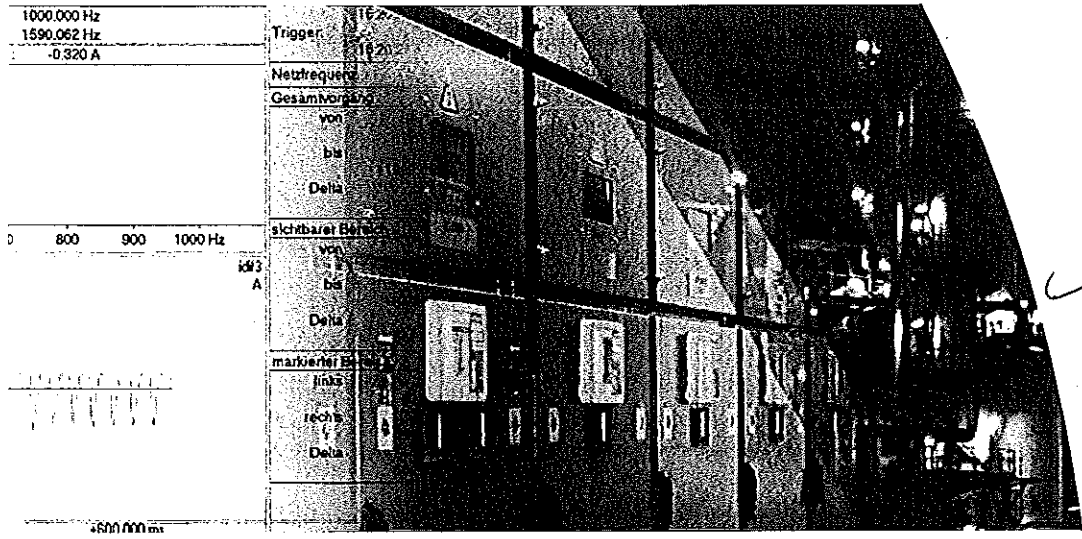
Current stabilised differential protection

AREAS OF APPLICATION

The SPRECON-E-P DQ..6 devices are multifunctional devices for protection, control and automation of energy stations. They can be applied as main protection units of transformers in different neutral-point connections at medium or high voltage levels.

In addition to the characteristic-stabilised differential protection for phase currents, SPRECON-E-P DQ..6 also comes with characteristic-stabilised ground differential protection, zero-sequence filtering, inrush and overexcitation stabilisation as well as overcurrent protection per winding. Furthermore, motor protection, a thermal image as well as overvoltage and undervoltage protection secure the use within medium voltage motor applications.





The implementation of standard and proprietary protocols allows close collaboration with controlling systems of various manufacturers. All necessary protection and control functions are integrated in the devices.

CONFIGURATION

All functions can be configured separately. By separating protection configuration from control configuration, all different kinds of requirements of different applications can be met.

The protection-specific functions are separately configured or deactivated depending on the respective application. Irrelevant functions are hidden and inactive which allows simple and structured configuration of the devices.

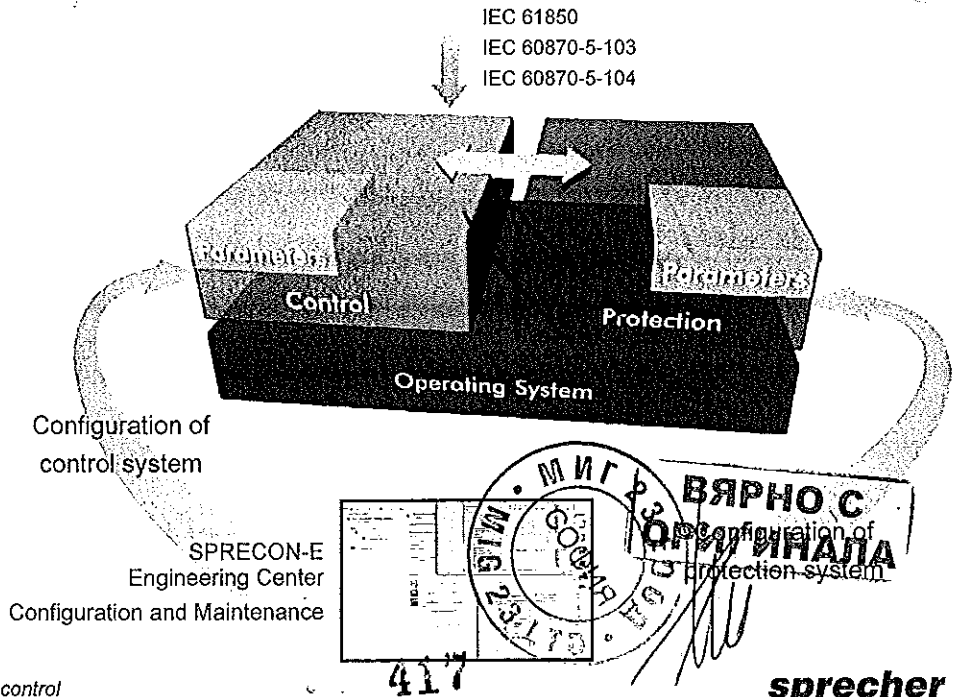
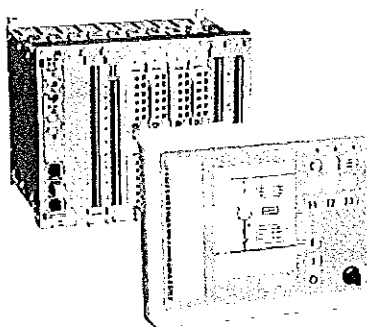
All configured bays are type-oriented stored in a database. They can be therefore copied and re-used as well as easily re-adapted, which facilitates configuration of large-scale systems.

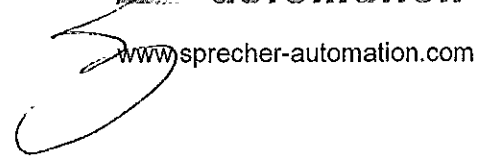
OPERATING

In order to meet the requirements of efficient system management, all operations can be accomplished with the detachable HMI control panel. Hence, protection configurations can be locally carried out beside usage of the operating program "COMM-3".

All relevant information about processes and devices is shown on the full-graphical display of the control panel. Additionally, configurable LEDs are available for signalling.

Separated navigation keys allow clear user guidance through the various pages and submenus. Furthermore, they facilitate simple configuration of extensive protection and control functions.





DIMENSIONS & WEIGHT

- Dimensions: 212x176x257mm (WxD) incl. connections
- Weight: < 7kg

GENERAL FUNCTIONS

- Remote maintenance and configuration
- Time synchronisation (DCF77, GPS, station & remote control)

COMMUNICATION

- IEC 60870-5-103/104, IEC 61850
- RS232, RS422/485, fibre-optic, 10/100 Mbit Ethernet
- 2 additional optical Ethernet interfaces for redundant ring
- Connection via leased or dialup line
- Wireless communication (external GSM or wireless modem)
- Integration of stand-alone devices via station bus (counter, metering devices, protection relays, AVR, Petersen coil controller, etc.)

IMPLEMENTED PROTECTION FUNCTIONS	Reference		Type						
	IEEE C37.2	IEC 61850-7-4	D2Q6		D2QU6	D3Q6		D3QU6	
Number of current and voltage inputs			7I	8I	7I+1U	11I	12I	10I+1U	11I+1U
Neutral-Point current sensitivity			1x	1x/1x or 1x/20x	1x	1x/1x or 1x/20x	1x/1x/20x	1x	1x/1x or 1x/20x
Differential protection, number of ends	87T	PDIF	2	2	2	3	3	3	3
Ground differential protection, number of ends	87N	PDIF	1	2	1	2	2	1	2
Switch on protection (SOTF, SOP)	50, 50N	PIOC	x	x	x	x	x	x	x
Amplitude and vector group matching			x	x	x	x	x	x	x
Zero-sequence filtering			x	x	x	x	x	x	x
Phase-rotation adaption			x	x	x	x	x	x	x
$I_{L>}$ -DT/DMT, three stages per end, number of ends	50, 51	PTOC	2	2	2	3	3	3	3
$I_{L>}$ -DT/DMT, three stages per end, per of ends	50N, 51N, 51Ns	PTOC	2	2	2	3	3	3	3
Inrush restraint		PHAR	x	x	x	x	x	x	x
Overvoltage protection (U>), two stages*	59	PTOV			x			x	x
Undervoltage protection (U<), two stages*	27	PTUV			x			x	x
Frequency protection (f< four stages, f> two stages)*	81	PTUF, PTOF			x			x	x
Negative sequence protection $I_{n2>}$, three stages, assignable to end	46	PTOC	x	x	x	x	x	x	x
Overload protection (2 images, assignable to end)	49, 49N	PTTR	x	x	x	x	x	x	x
Starting protection, locked rotor protection (motor protection), assignable to end*	49R, 66, 48, 51LR	PMRI/PMSS	x	x	x	x	x	x	x
Underload protection (motor protection)*	37	PTUC	x	x	x	x	x	x	x
Lockout*, number of ends	86	PMRI	2	2	2	3	3	3	3
Circuit breaker failure prot. (CBF), two stages per end, number of ends	50BF	RBRF	2	2	2	3	3	3	3
Current annunciation stages (3x $I_{L>}$, 3x $I_{L<}$), assignable to end			x	x	x	x	x	x	x
Circuit breaker tripping by up to 6 external signals		(PTRC)	x	x	x	x	x	x	x
Trip circuit supervision, number of ends	74TC		2	2	2	3	3	3	3
Parameter sets			4	4	4	4	4	4	4
Logic + time stages for optocoupler inputs			x	x	x	x	x	x	x
Virtual binary inputs/control input			15/15	15/15	15/15	15/15	15/15	15/15	15/15
Logic + hold time for output relays			x	x	x	x	x	x	x
Measurands, short report			x	x	x	x	x	x	x
Event logging, non-volatile		RDRE	x	x	x	x	x	x	x
Disturbance data recording, non-volatile		RADR, RBDR	x	x	x	x	x	x	x
Statistics			x	x	x	x	x	x	x
Measurand checks, self supervision			x	x	x	x	x	x	x
Assistance for test and putting into operation			x	x	x	x	x	x	x

* implemented in structure 4602 and higher

ADDITIONAL PROTECTION FUNCTIONS

- Pulse shaper stage (programmable logic)
- Separation of protection data from control data
- Nominal current selection (1/5 A) via terminal connection
- Settings via control panel and PC through menu-assisted plain-text messaging

CONTROL FUNCTIONS

- Control and monitoring of switching devices and process elements
- Power output with high making/breaking capacity (option)

- Command output either directly or by SBO (select before operate)
- Control of transformer tap changers or Petersen coils
- Configurable automatic functions
- Switching device interlocking
- Group-assigned indication and measured-value blocking
- Threshold value monitoring
- Maximum demand value calculation
- Maximum value calculation (non-return pointer)
- Configurable transmission modes for measured values
- Metered value capturing
- Operating hours counter, switching operations counter
- Event recording

HEADQUARTERS

Sprecher Automation GmbH
 Franckstrasse 51
 4018 Linz
 Austria
 T: +43 732 6908-0
 F: +43 732 6908-278
 info@sprecher-automation.com

LOCATIONS

AUSTRIA
Sprecher Automation GmbH
 (Linz, Wien)

GERMANY
Sprecher Automation Deutschland GmbH
 (Berlin, Erfurt, Dortmund, München)

NETHERLANDS
Sprecher Automation Nederland B.V.
 (Breda)

POLAND
Sprecher Automation Polska Sp z o.o.
 (Łódź, Świdnica)

SLOVAKIA
Sprecher Automation spol. s r.o.
 (Bratislava)



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HighPROTEC-2

ТЕХНОЛОГИЯ ЗА ЗАЩИТА
НАПРАВЕНА ПРОСТО

MCA4-2

РЕЛЕЙНА ЗАЩИТА И УПРАВЛЕНИЕ ЗА ИЗВОД,
МРЕЖА И ГЕНЕРАТОР

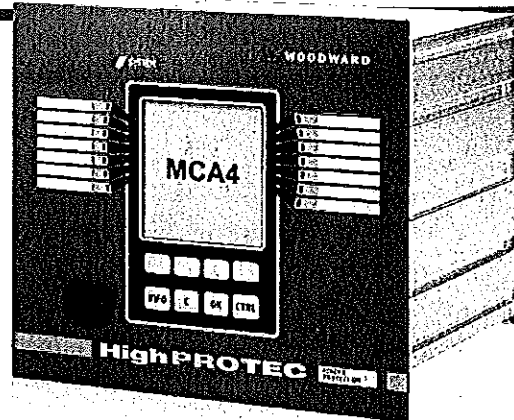
WOODWARD

NEW
FEATURES

- DNP 3.0
- Multiple Communication with one device
- ANSI Menu structure
- Page Editor
- New front plate with USB
- IEC61850 with LC interface

Приложение

MCA4 е прецизно и надеждно реле за защита, управление и мониторинг на извод, мрежа и генератор. Като последно поколение серия от SEG/Woodward, MCA4 включва всички ANSI и IEC стандарти за постигане на съвместимост с постоянно променящите се изисквания при взаимосвързаност на мрежите. Гъвкавостта по отношение на хардуер, софтуер, приложение, потребителски интерфейс и комуникации, прави MCA4 подходяща при днешните изисквания, а също така и в бъдеще. Хардуерът е проектиран да работи при всички номинални стойности, в комбинация с функции по защита и управление. Софтуерът за параметризиране и анализ Smart view е подходящ за всички HighPROTEC устройства.



Подробен

пакет защита ⁽¹⁾

- Шест елемента фазна MT3 посочна или непосочна (ANSI/IEC/51C/51V).
- Четири елемента земна защита ⁽²⁾ непосочна или посочна. Два елемента защита от небалансиран товар. Напреженова защита ⁽²⁾
- шест елемента, по избор: V<, V>, V<(t).
- Шест елементна супервизия по небаланс на напрежение.
- Гъвкав четвърти напреженов вход. ⁽²⁾ Избор от VE> или VX (за синхро-чек).
- Проверка по синхронизъм (синхро-чек)
- Генератор-Система или Система-Система. Всеки от шестте елемента на честотната защита може да се използва като: f<, f>, ROCOF, vector surge...
- Шест елемента мощностна защита, всеки може да се използва като: P>, P<, Pr, Q>, Q<, Qr, S>, S<
- Два елемента защита по cos phi (PF)

Качество на енергията

- THD защита (общо хармонично изкривяване)

Управление на потребление/ Върхови стойности

Върхови ст-ти на ток и мощност. Средно потребление на ток и енергия

Пакет при взаимосвързване на мрежи

Този пакет е обобщен под отделно меню

- Разпределение на товара в зависимост от посоката.
- FRT (LVRT): Настройваеми FRT-профили, координирани с АПВ.
- QV-Защита: Защита по Мин. напреж.-Реактивна мощност
- Автоматична защита по честота:
- Шест елемента конфигурируеми като: f<, f>, df/dt (ROCOF), Vector Surge CB-Intertripping
- Проверка по синхронизъм
- (Генератор-мрежа, мрежа-мрежа), опции на пр. при захранена линия-незахранена шина

Супервизия по средноквадратични стойности
→ Настройваеми (VDE-AR 4105)

Регистратори

- Аварии: 120 с енергонезависими
- Повреди: 20 повреди
- Събития: 300 събития
- Аналогови ст-ти: 4000 енергонезависими въвеждания

Помощни инструменти

- Софтуер за параметризиране и анализ Smart view
- Включен редактор на еднолинейна мнемо схема

Поддръжка

- USB връзка
- Програмируем дисплей (Single-Line, ...)
- Програмируеми входове
- Копиране и сравняване на параметри
- Конвертируеми конфиг. файлове
- Сработване и деактивир. на изходи
- Симулатор на повреди: ток и напреж.
- Графики на изключвателни х-ки
- 7 езика избираеми в релето

Опции за комуникация

- IEC61850
- Profibus DP
- Modbus RTU или Modbus TCP
- IEC60870-5-103
- DNP 3.0 (RTU, TCP, UDP)

Управление

- на до шест съоръжения (прекъсвачи, разединители или земни ножове)
- Износване на прекъсвача

Логика

- до 80 логически уравнения за защита, управление и мониторинг

Синхронизация по време

- SNTR, IRIG-B00X, Modbus, IEC60870-5-103

**ВЪРНО С
ОРИГИНАЛА**

Въз основа на моменти или средни или 12 стойности
Въз основа на моменти или средни стойности



Преглед на функциите

Супервизия	ЗУСТ
------------	------

Защитни функции

I, МТО, МТЗ, всички елементи могат да бъдат конфигурирани като посочни или непосочни. Множество опции за ресет (мигновени, време независими, ресет характеристики съгл. IEC и ANSI). Контролирана по напрежение максималнотокова защита посредством адаптивни параметри Зависима от напрежението максималнотокова защита Максималнотокова защита при обратен фазов ред	6	50P, 51P, 67P 51C 51V 51Q
I2>, защита от небалансиран товар с оценка на токовете на обратна последователност	2	46
IB, защита от претоварване с термична реплика и отделни стойности за аларма и изключване	1	49
IH2/In, регистриране на намагнитващ товар и оценка по 2ри хармоник	1	Inrush
IG, земна отсечка, земна защита, всички елементи могат да бъдат конфигурирани като посочни или непосочни. Множество опции за ресет (мигновени, време независими, ресет характеристики съгл. IEC и ANSI)..	4	50N, 51N, 67N
V<, V>, V(l)<, мин. - и макс. напрежена защита, време зависима мин.напрежена защита	6	27, 59
Супервизия по асиметрия на напрежението (V012) V1, мин. и макс. напрежение на права последователност V2, макс. напрежение на обратна последователност	6	47
Всеки от шестте елемента честотна защита се използва като: f< fs, df, dt, ROCOF, DF/DT, vector surge, ...	6	81U/O, 81R, 78
VX, защита остатъчно напрежение или напрежение на шини за Synch Check	2	25 or 59N
AR, Автоматично повторно включване (АПВ)	1	79
Exp, Функции външна аларма и изключване	4	
PQS, Мощностна защита	6	32, 37
PF, Фактор на мощност	2	55
FRT, блокировка по минимално напрежение (опция координиране с АПВ)	27 (t)	27 (t, AR)
Q(V), Защита (зависима по мин.напрежение посочна реактивна мощност с деактивиране на АПВ)		
UFSL (разпределение на товара в зависимост от посоката на активна мощност)		
10-минутна супервизия на средно-квадратични ст-ти: настройваема съгл. VDE-AR 4105		
Synch Check		25

Управление и логики

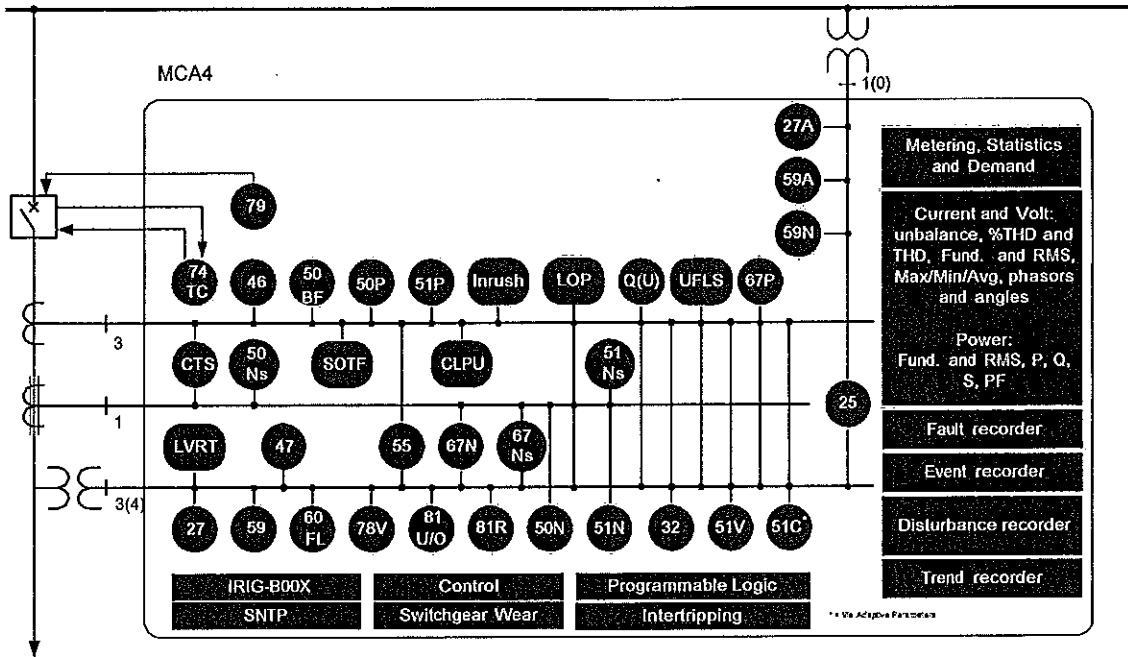
Управление: Индикация на позицията, супервизия на времето и взаимни блокировки за до б съоръжения
 Логика: до 80 броя, всяка с по 4 входа, избираеми логически уравнения и таймери

Функции по супервизия

CBF, Защита от повреда на прекъсвача	1	50BF
TCS, следене на изключвателната верига	1	74TC
LOP, загуба на потенциал	1	60FL
FF, повреда на предпазител чрез цифров вход	1	60FL
CTS, следене състоянието на токов трансформатор	1	60L
CLPU, студен старт	1	
SOTF, превкл. върху к.с.	1	
Супервизия на потребление и върхови ст-ти (ток и мощност)		
THD супервизия		
Износване на прекъсвач		
Регистратори: Аварии, Повреди, Събития, Аналогови ст-ти		









Преглед на функциите по Ansi

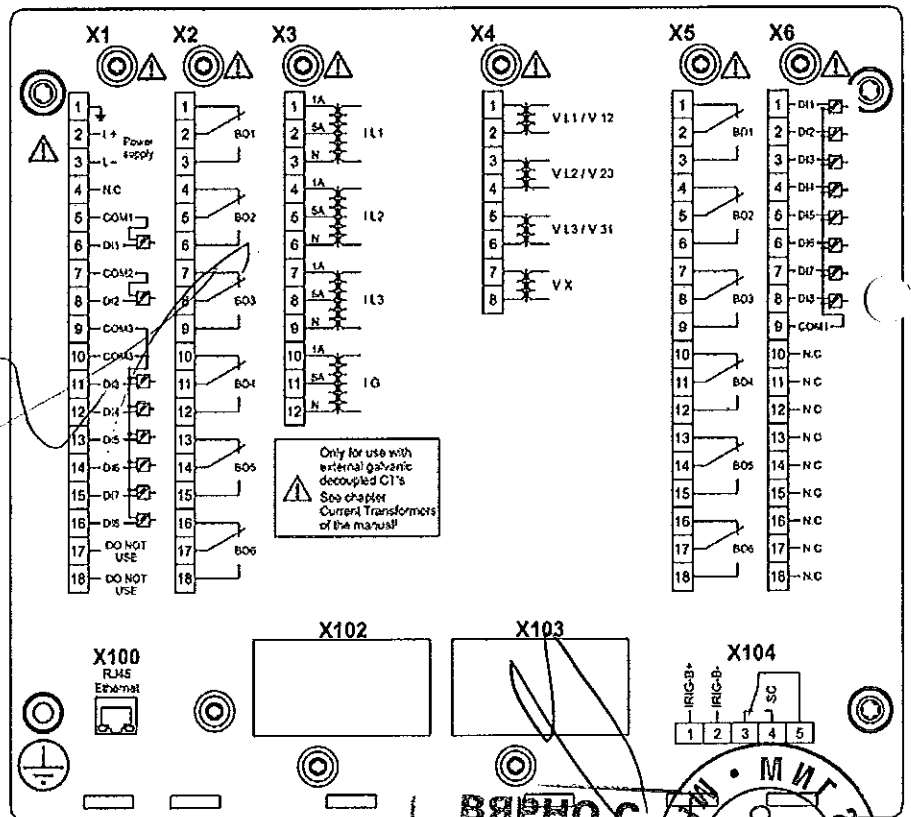


● — Опция ● — Стандартна

Одобрения

Схема на свързване (примерна)

-  CE
-  UL) сертификат съгл. UL508 (Индустиален)
-  SA) сертификат съгл. CSA-C22.2 No. 14 (Индустиален)
-  EAC) сертификат съгл. EAC (Eurasian Conformity)
-  KEMA) Типово одобрени (и сертифицирани) съгл. IEC60255-1 и IEC61850
-  TUV NORD) сертификат съгл. "BDew-Richtlinie für Erzeugungsanlagen am Mittelspannungsnetz, Ausgabe Juni 2008" (Германски стандарт)
- съответства на IEEE 1547-2003 подобрена по IEEE 1547a-2014
- съответства на ANSI C37.90-2005



ВЯРНО С
ОРИГИНАЛА

М И Г
С О О Д
2 3 2 3

Форма за поръчка MCA4-2

Посочна защита на извод				MCA4 -2
Версия 2 с USB връзка, разширена комуникация и потребителски опции				
Цифрови входа	Цифрови изхода	корпус	широк диспл.	
8	7	B2	X	A
16	13	B2	X	D
Хардуерен вариант 2				
Фазов ток 5 A/1 A, Земен ток 5 A/1 A				0
Фазов ток 5 A/1 A, Чувств. земен ток 5 A/1 A				1
Корпус и монтаж				
Вграден				A
Вграден 19" (релеен шкаф)				B
Комуникационен протокол				
Без протокол				A
Modbus RTU, IEC60870-5-103, DNP3.0 RTU RS485/клеморед				B*
Modbus TCP, DNP3.0 TCP/UDP Ethernet 100 MB/RJ45				C*
Profibus-DP оптика/ST-конектор				D*
Profibus-DP RS485/D-SUB				E*
Modbus RTU, IEC60870-5-103, DNP3.0 RTU оптика/ST-конектор				F*
Modbus RTU, IEC60870-5-103, DNP3.0 RTU RS485/D-SUB				G*
IEC61850, Modbus TCP, DNP3.0 TCP/UDP Ethernet 100MB/RJ45				H*
IEC60870-5-103, Modbus RTU, DNP3.0 RTU RS485/клеморед				I*
Modbus TCP, DNP3.0 TCP/UDP Ethernet 100 MB/RJ45				K*
IEC61850, Modbus TCP, DNP3.0 TCP/UDP Optical Ethernet 100MB/LC duplex connector				L*
Modbus TCP, DNP3.0 TCP/UDP Optical Ethernet 100MB/LC duplex connector				
Опция за замърсена среда				
Без				A
Защитно покритие				B
Език на менюто (във всяко устройство)				
English/German/Spanish/Russian/Polish/Portuguese/French				

* За всяка опция на комуникацията се използва само един протокол.
Smart view може да се използва паралелно през Ethernet интерфейс (RJ45).

Софтуерът за параметризиране и анализ Smart view е включен в доставката на HighPROTEC устройствата.

Токови входове	4 (1 A и 5 A) с автоматично закъсяване
Напрежени входове	4 (0-800 V)
Цифрови входове	Праговете на заработване се настр. чрез софтуера
Захранване	Широкообхватно захранване 24 V _{DC} - 270 V _{DC} / 48 V _{AC} - 230 V _{AC} (-20/+10%)
Клеми	Всички клеми са изваждаеми
Тип на покритието	IP54
Размери на корпуса (Ш x В x Д)	19" монтаж: 212.7 mm x 173 mm x 208 mm 8.374 in. x 6.811 in. x 8.189 in. Вграден монтаж: 212.7 mm x 183 mm x 208 mm 8.374 in. x 7.205 in. x 8.189 in.
Тегло (максимално)	прибл. 4.2 kg / 9.259 lb

Контакти:

Северна и Централна Америка

Phone: +1 970 962 7331
E-mail: SalesPGD_NAandCA@woodward.com

Южна Америка

Phone: +55 19 3708 4800
E-mail: SalesPGD_SA@woodward.com

Европа

Phone: +49 2152 145 331
E-mail: SalesPGD_EUROPE@woodward.com

Близък Изток и Африка

Phone: +971 2 6275185
E-mail: SalesPGD_MEA@woodward.com

Русия

Phone: +7 812 319 3007
E-mail: SalesPGD_RUSSIA@woodward.com

Китай

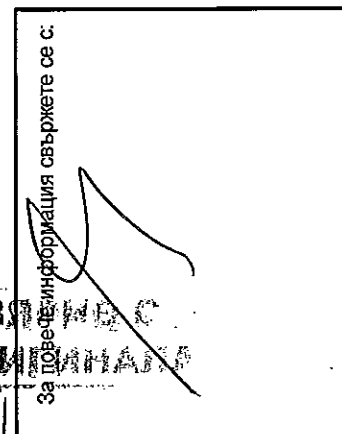
Phone: +86 512 8818 5515
E-mail: SalesPGD_CHINA@woodward.com

Индия

Phone: +91 124 4399 500
E-mail: SalesPGD_INDIA@woodward.com

Азия и Океания

Phone: +49 711 78954 510
E-mail: SalesPGD_ASEAN@woodward.com



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Your reference:
Our reference: BC/Mn
Extension: 610
Date: 02.03.2017

DECLARATION OF MANUFACTURER

We, Sprecher Automation GmbH, a reputable manufacturer of digital protection relays, established under laws of Austria, having our head office at Franckstrasse 51, 4018-Linz/Austria, herewith declares that the offered protection relays and bay controllers type SPRECON-E-C/P support the following communication protocols:

- IEC 60870-5-103
- IEC 61850
- MODBUS RTU
- MODBUS TCP/IP

for optical or electrical connection.

Kind regards

SPRECHER AUTOMATION GMBH

Christian Brauner
Department Manager
Sales Vienna



Sprecher Automation GmbH
Franckstrasse 51
A-4018 Linz/Austria
Phone: +43/(0)732/6908-0
Fax: +43/(0)732/6908-278
www.sprecher-automation.com

Location Vienna:
Ignaz-Köck-Strasse 10
A-1210 Wien / Austria
Phone: +43/(0)732/6908-621
Fax: +43/(0)732/6908-650
www.sprecher-automation.com

FN 216578 y, Handelsgericht
IdNr.: ATU53171108
Bank: Allgemeine Sparkasse OÖ.
Account Nr.: 32100-085088, Bankcode 20320
IBAN: AT092032032100085088
Swift: ASPKAT2L

Превод от английски език



Декларация от производителя

Ние, Шпрехер Аутомейшън ГмбХ, реномиран производител на цифрови релейни защиты, основани под законите на Австрия и имащи главен офис на Франкштрасе 51, 4018-Линц/Австрия, с настоящото декларираме, че оферираните релейни защиты и полеви контролери тип SPRECON-E-C/P поддържат следните комуникационни протоколи:

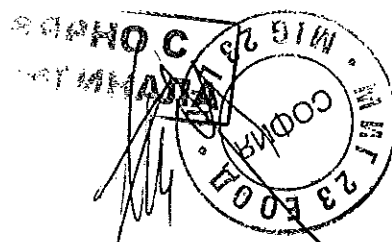
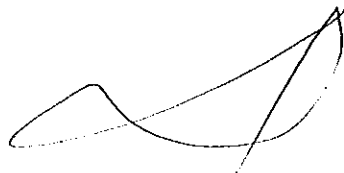
IEC 60870-5-103
IEC 61850-5
MODBUS RTU
MODBUS TCP/IP

за оптична или електрическа връзка.

Сърдечни поздрави,

Шпрехер Аутомейшън ГмбХ

/подпис и печат/



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Declaration of conformity

We, Woodward Kempen GmbH, a reputable manufacturer of digital relay protections, established under laws of Germany, and having a head office at Krefelder Weg 47, 47906 Kempen, Germany, herewith

Certify

That

The offered protection relays type MCA4-2, MRDT4-2 support the following communication protocols:

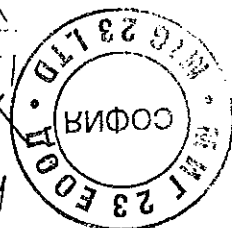
IEC 60870-5-103, IEC 61850-5, MODBUS RTU, MODBUS TCP/IP
for optical or electrical connection.

Signed for and on behalf of Woodward Kempen GmbH

Maciej Madej

Sales Support Engineer

ВЯРНО С
ОРИГИНАЛА





Декларация за съответствие

Ние, Уудуорд Кемпен ГмбХ, реномиран производител на цифрови релейни защити, основани според законите на Германия и имащи главен офис на Крефелдер Вег 47, 47906 Кемпен, Германия, с настоящото

Декларираме

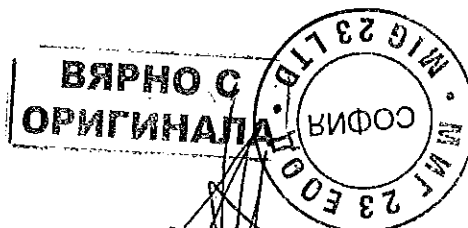

че

Оферираните от нас релейни защити, тип MCA4-2, MRDT4-2 поддържат следните комуникационни протоколи:

IEC 60870-5-103, IEC 61850-5, MODBUS RTU, MODBUS TCP/IP
за оптична или електрическа връзка.

Подписано за и от името на Уудуорд Кемпен ГмбХ,

/подпис и печат/



ДЕКЛАРАЦИЯ

за приемане на условията в проекта на договор

Долуподписаният/-ната/ Антон Иванов Илиев в качеството ми на представляващ Обединение „МИГ - Хюндай“ (името на участника) участник в обществена поръчка с предмет: „Доставка, демонтаж и монтаж на трифазни маслонапълнени понижавачи силови трансформатори 110kV/ Средно напрежение (СрН) и цялото необходимо помощно оборудване“, реф.№ PPD 17-001, обособена позиция № 2 /ОП2/ , подстанция /ПС/ “Бояна”.


(посочва се № и наименование на обособената позиция)

ДЕКЛАРИРАМ, ЧЕ:

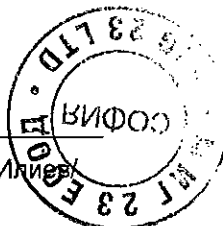
Приемам условията в проекта на договор, приложен в документацията за участие.

Дата 18.04.2017 г.

Декларатор: _____



Антон Илиев



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ДЕКЛАРАЦИЯ
за срока на валидност на офертата

Долуподписаният/ -ата Антон Иванов Илиев,

(собствено, бащино, фамилно име)

притежаващ/а лична карта №641903354, издадена на 01.02.2011г. от МВР – гр. София,

адрес: гр. София, ж.к. Света Троица, бл. 339Б, ет.4, ап.14 ,

(постоянен адрес)

в качеството ми на Управител

(посочва се длъжността)

на Обединение „МИГ – Хюндай”,

(посочете наименованието на участника)

участник в процедура за възлагане на обществена поръчка с предмет: „Доставка, демонтаж и монтаж на трифазни маслонапълнени понижавачи силови трансформатори 110kV/ Средно напрежение (СрН) и цялото необходимо помощно оборудване”,

(наименование на поръчката)

Обособена позиция №2 /ОП2/, подстанция /ПС/ „Бояна”

(посочва се № и наименование на обособената позиция)

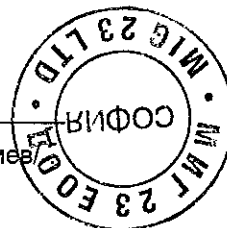
ДЕКЛАРИРАМ, ЧЕ:

С подаване на настоящата оферта, направените от нас предложения и поети ангажименти са валидни за срока, посочен в обявлението, считано от крайния срок за подаване на офертите.

Дата 18.04.2017г.

Декларатор: _____

/Антон Илиев/



C.

C.