ПРЕДЛОЖЕНИЕ

за изпълнение на обществената поръчка

ДО: „ЧЕЗ РАЗПРЕДЕЛЕНИЕ БЪЛГАРИЯ" АД,

ОТ: АББ България ЕООД

адрес: гр. София, 1592 бул. „Христофор Колумб", № 9, ет. 3
тел.: : +359 (0) 2 807 55 00; факс: +359 (0) 2 807 55 99; e-mail: office@bg.abb.com
Единен идентификационен код: 831133152,
Представлявано от Екехарт Нойрайтер и Стефан Минчев – Управители
Лице за контакти: Стефан Минчев, тел +35928075521, факс: +35928075599, e-mail: stefan.minchev@bg.abb.com

УВАЖАЕМИ ГОСПОЖИ И ГОСПОДА,
Предоставяме на Вашето внимание предложението ни за изпълнение на обществена поръчка с предмет **„Доставка на електрически апарати 110кV"**, реф. № PPD 17-064.
Обособена позиция 4 – Доставка на комбинирани измервателни трансформатори 110кV за монтаж на открито – 15бр

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. 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.

7. Предлагам гаранционен срок за предлаганите стоки – 36 (тридесет и шест) месеца, от датата на приемо – предавателен протокол за получаване на стоката от Възложителя.
8. Срок за доставка на предлаганите стоки – 90 (деветдесет) дни от датата на поръчка от Възложителя до Изпълнителя

Приложения:

1. *Приложение 1 - Технически изисквания и спецификации за изпълнение на поръчката – раздел II от документацията за участие – попълнени на съответните места;*
2. *Приложение 2 - Изисквани документи от приложение - Технически изисквания и спецификации;*

Дата: 14.07.2017 г.
София

С уважение:

Екехарт Нойрайтер
Управител
АББ България ЕООД

Стефан Минчев
Управител
АББ България ЕООД

ИЗИСКВАНИЯ КЪМ ДОКУМЕНТАЦИЯТА И ИЗПИТВАНИЯТА ПО ОБОСОБЕНА ПОЗИЦИЯ №4
ДОСТАВКА НА КОМБИНИРАНИ ИЗМЕРВАТЕЛНИ ТРАНСФОРМАТОРИ 110 KV, ЗА МОНТАЖ НА ОТКРИТО
ИЗИСКВАНИЯ КЪМ ДОКУМЕНТАЦИЯТА И ИЗПИТВАНИЯТА ПО ОБОСОБЕНА ПОЗИЦИЯ № 4:

№	Документи за участие	Приложение № (или текст)
1.	Точно обозначение на типа на комбинираните измервателни трансформатори, производителя и страната на произход и последно издание на каталога на производителя	**PVA123a** ABB Sp. zo.o., Полша Приложение 1 - PVA-123a-145a-karta-EN
2.	Удостоверение за одобряване на типа на комбинираните измервателни трансформатори, издадено по реда и при условията на Закона за измерванията	Приложение 2 - Удостоверение за Одобрен тип СИ - PVA123a-PVA145a
3.	Техническо описание на комбинираните измервателни трансформатори, гарантирани параметри и характеристики, тегло и др.	Приложение 3.1 - Технически параметри на комб. ИТ PVA123a Приложение 3.2 - Волтамперна характеристика на ядрата на комб. ИТ PVA123a Приложение 3.3 - Чертеж на комб. ИТ PVA123a porcelain insulator 200-400-800A CEz Bulgaria_KU598_17 Приложение 3.4 - Чертеж на клемната кутия на комб. ИТ PVA123a Приложение 3.5 - Чертеж на табелата на комб. ИТ PVA123a Приложение 3.6 - Ел. схема на комб. ИТ PVA123a Приложение 3.7 - Сертификат за съответствие на комб. ИТ PVA123a Приложение 3.8 - Manual PVA 123a145a EN_31-03 Приложение 3.9 - Nytro_10XN_PO_EN_SDS Приложение 3.10 - Nytro_Libra_PO_EN_SDS
4.	Протоколи от типови изпитвания на комбинираните измервателни трансформатори на английски или български език, проведени от независима изпитателна лаборатория с приложени резултати от изпитванията	Приложение 4 - Протоколи от типови изпитания на комб. ИТ PVA123a
5.	Сертификат/акредитация на независимата изпитателна лаборатория, провела типовите изпитвания	Приложение 5.1 - ISO 17025-_ABB Przasnysz Приложение 5.2 - Сертификат за акредитаци 117 323 324
6.	Информация за провежданите от производителя контролни (рутинни) изпитвания	Приложение 6 - Routine Test Plan for Combined Instrument Transformer

ТАБЛИЦА 1
Стандарт на материала за комбинирани измервателни трансформатори 110 kV, за монтаж на открито

Технически параметри на комбинирани измервателни трансформатори 110 kV, за монтаж на открито, които се попълват от Участника в графа „Гарантирано предложение“:

Наименование на материала		Комбиниран измервателен трансформатор 110:√3 / 0.1:√3 / 0.1:√3 / 0.1:√3 / 0.1:3 kV, 200/400/800/5/5/5/5 за монтиране на открито	
Съкратено наименование на материала		КИТ 110:√3 / 0.1:√3 / 0.1:√3 / 0.1:√3 / 0.1:3 kV, 200/400/800/5/5/5/5, ОМ	
№	Параметър	Изискване	Гарантирано предложение
1.	Тип/референтен номер съгласно каталога на производителя	Да се посочи	**PVA123a**
2.	Производител	Да се посочи	ABB Sp. zo.o., Полша

Характеристика на материала:
Комбинирани (с напреженова и токова част) индуктивни измервателни трансформатори 110 kV, с изолаторно тяло от порцелан/полимер, и вътрешна изолационна среда - масло (без PCB), за монтиране на открито, с обявени коефициенти на трансформация за:
Напреженов измервателен трансформатор (110 000:√3 / 100:√3 / 100:√3 / 100:√3 / 100:3) kV, като вторичните намотки са както следва:

- две намотки за целите на измерването;

- две намотки за целите на защитата;

Токов измервателен трансформатор 200/400/800//5/5/5/5 А като вторичните намотки са както следва:

- две намотки за целите на измерването;
- две намотки за целите на защитата.

Комбинираните измервателни трансформатори са от одобрен тип, преминали са през първоначална метрологична проверка и са маркирани със съответния знак по реда и при условията на „Наредба за средствата за измерване, които подлежат на метрологичен контрол" по чл. 28, от Закона за измерванията.

Използване:

Комбинираните измервателни трансформатори са предназначени за захранване на напреженовите и токовите вериги на електромерите за търговско и контролно измерване на електрическа енергия, на релейните защити и на контролно-измервателните апарати в електрическите разпределителни уредби.

Съответствие на предложеното изпълнение със стандартизационните документи:

Комбинираните измервателни трансформатори трябва да отговарят на:

- БДС EN 61869-2:2012 „Измервателни трансформатори. Част 2: Допълнителни изисквания за токови трансформатори (IEC 61869-2:2012)" или еквивалентно/и;
- БДС EN 61869-3:2011 "Измервателни трансформатори. Част 3: Допълнителни изисквания за индуктивни напреженови трансформатори (IEC 61869-3:2011)" и на неговите валидни изменения и допълнения или еквивалентно/и.

Параметри на електрическата разпределителна мрежа

№	Параметър	Стойност
1.	Обявено напрежение	110 000 V
2.	Максимално работно напрежение	123 000 V
3.	Най-високо напрежение между фаза-земя при нормални условия	71 kV
4.	Обявена честота	50 Hz
5.	Заземяване на звездния център	Директно заземен

Характеристики на работната среда и място на монтиране

№	Характеристика /място на монтиране	Стойност/описание
1.	Максимална околна температура	+ 40°C
2.	Минимална околна температура	Минус 25°C
3.	Относителна влажност	До 95 %
4.	Замърсяване с прах, пушек, агресивни газове и пари	Умерено
5.	Надморска височина	До 1 000 m
6.	Място на монтиране	В открити разпределителни уредби 110 kV

Конструктивни характеристики и др. данни за комбинирани измервателни трансформатори 110 kV за монтаж на открито, за които Участникът декларира в техническото си предложение – Раздел V от настоящата документация, че предложеното от него оборудване отговаря на посочените минимални технически изисквания на Възложителя, посочени в таблицата по-долу:

№	Характеристика	Минимални технически изисквания
1.	Конструкция	а) Комбинираните измервателни трансформатори трябва да бъдат от подпорен тип с изолаторно тяло от порцелан/полимер и вътрешна изолираща среда от масло (без PCB)
		б) Комбинираните измервателни трансформатори трябва да бъдат съоръжени с подходящи клеми с винтови съединения, за свързване на първичните напреженови и токови намотки и клемен блок за свързване на вторичните напреженови и токови вериги.
2.	Вторични намотки - брой и предназначение	а) две напреженови и две токови намотки за целите на измерването; и
		б) две напреженови и две токови намотки за целите на защитата
3.	Монтиране	Комбинираните измервателни трансформатори трябва да позволяват монтиране във вертикално положение.

№	Характеристика	Минимални технически изисквания
4.	Клеми за свързване на първичната намотка	Клемите трябва да бъдат изработени от подходящ метал или метална сплав, недопускащи електрохимична корозия.
5.	Клемни блокове за свързване на вторичните вериги	а) Клемните блокове трябва да бъдат поместени в защитни клемни кутии с IP44, с възможност за пломбиране
		б) Клемите на клемните блокове трябва да бъдат изработени от месинг или друга подходяща некорозираща сплав.
6.	Резбови и скрепителни съединения	Всички резбови и скрепителни съединения трябва да бъдат изработени от подходящи некорозиращи метали или метални сплави.
7.	Маркиране на обявените стойности	Комбинираните измервателни трансформатори трябва да бъдат маркирани с информация за обявените стойности върху табелка съгласно изискванията БДС EN 61869-2 или еквивалентно/и. и БДС EN 61869-3 или еквивалентно/и.
8.	Маркиране на изводите	Изводите на комбинираните измервателни трансформатори трябва да бъдат маркирани трайно и четливо съгласно изискванията БДС EN 61869-2 или еквивалентно/и. и БДС EN 61869-3 или еквивалентно/и.
9.	Първоначална проверка и знаци за удостоверяване (съгласно разпоредбите на Закона за измерванията)	а) При доставка, комбинираните измервателни трансформатори трябва да бъдат с извършена, валидна към момента първоначална метрологична проверка.
		б) Първоначалната метрологична проверка трябва да бъде удостоверена със знак за първоначална проверка и копието на протокола от проведените изпитвания.
10.	Транспортна опаковка	Комбинираните измервателни трансформатори трябва да бъдат защитени посредством подходяща опаковка, предпазваща ги от повреди и въздействия на околната среда, подредени и закрепени на транспортни палети.
11.	Експлоатационна дълготрайност	≥ 25 години

Общи технически параметри, характеристики и др. данни за комбинирани измервателни трансформатори 110 kV за монтаж на открито, за които Участникът декларира в техническото си предложение – Раздел V от настоящата документация, че предложеното от него оборудване отговаря на посочените минимални технически изисквания на Възложителя, посочени в таблицата по-долу:

№	Параметър	Минимални технически изисквания
1.	Изолаторно тяло	Порцелан или полимер
2.	Обявено издържано напрежение с промишлена честота за изолацията на първичната намотка	230 kV (ефективна стойност)
3.	Обявено издържано напрежение с мълниев импулс за изолацията на първичната намотка	550 kV (върхова стойност)
4.	Обявено издържано напрежение с промишлена честота на изолацията за вторичните намотки	3 kV (ефективна стойност)
5.	Най-високо напрежение за съоръженията, U_m	123 kV (ефективна стойност)
6.	Път на пропълзяване по повърхността на изолатора	≥ 31 mm/kV
7.	Сеизмична устойчивост	≥ 0.3 g

Технически параметри, характеристики и др. данни за напреженовата част на комбинирани измервателни трансформатори 110 kV за монтаж на открито, за които Участникът декларира в техническото си предложение – Раздел V от настоящата документация, че предложеното от него оборудване отговаря на посочените минимални технически изисквания на Възложителя, посочени в таблицата по-долу:

№	Параметър	Минимални технически изисквания
1.	Обявено първично напрежение	110 000:√3 V
2.	Обявени вторични напрежения:	

№	Параметър	Минимални технически изисквания
-	за измервателните намотки	100:√3 V ; 100:√3 V
-	за намотките за защитите	100:√3 V ; 100:3 V
3.	Обявена честота	50 Hz
4.	Обявени коефициенти на трансформация:	
-	измервателни намотки	(110:√3 / 0,1:√3 / 0,1:√3) kV
-	защитни намотки	(110:√3 / 0,1:√3 / 0,1:3) kV
5.	Класове на точност:	
-	измервателната намотка - търговско мерене	≤ 0,2
-	измервателна намотка - контролно мерене	≤ 0,2
-	2 бр. намотки за защитите: 1 бр. схема звезда; и 1 бр. схема отворен триъгълник за ЗС	≤ 3 P
6.	Номинална вторична мощност:	
-	измервателни намотки	≥ 15 VA
-	защитни намотки	≥ 30 VA
7.	Обявен коефициент на напрежение и обявено време на прилагане:	
-	измервателни намотки	≥ 1,2 продължително; и ≥ 1,5 за 30 S
-	защитни намотки	≥ 1,2 продължително; и ≥ 1,5 за 30 S

Технически параметри, характеристики и др. данни за токовата част на комбинирани измервателни трансформатори 110 kV за монтаж на открито, за които Участникът декларира в техническото си предложение – Раздел V от настоящата документация, че предложеното от него оборудване отговаря на посочените минимални технически изисквания на Възложителя, посочени в таблицата по-долу:

№	Параметър	Минимални технически изисквания
1.	Обявени коефициенти на трансформация	200/400/800//5/5/5/5 A
2.	Превключване на коефициента на трансформация	Първично
3.	Изолаторно тяло	Порцелан/полимер
4.	Класове на точност:	
-	измервателната намотка - търговско мерене	≤ 0,2 S
-	измервателна намотка - контролно мерене	≤ 0,2 S
-	2 бр. намотки за защитите: 1 бр. за резервна МТЗ; и 1 бр. за НДЗ	≤ x 10 P
5.	Номинална вторична мощност:	
-	измервателни намотки	≥ 15 VA
-	защитни намотки	≥ 30 VA
6.	Обявен първичен ток, I_{pr}	200/400/800 A
7.	Обявени вторични токове	x//5/5/5/5 A
8.	Обявен продължителен термичен ток, I_{cth}	≥ 1,2 x I_{pr}
9.	Обявен първичен ток на термична устойчивост, I_{th}	≥ 31,5 kA/1s
10.	Обявен електродинамичен ток, I_{dyn}	≥ 78.8 kA
11.	Номинален коефициент на безопасност - FS	≥ 5
12.	Допустими нива на частичния разряд при 1,2 $U_m/\sqrt{3}$	≤ 20 pC

Дата: 14.07.2017 г.
София

С уважение:

Екехарт Нойрайтер
Управител
АББ България ЕООД

Стефан Минчев
Управител
АББ България ЕООД

Certificate

Standard **ISO 9001:2015**

Certificate Registr. No. 01 100 1541808

Certificate Holder: **ABB Sp. z o.o.**
ul. Żegańska 1
04-713 Warszawa

including the locations according to annex

Scope: Research and development as well as design, programming, manufacturing, sale, process and final testing, services and turnkey execution:
· distribution and power transformers, insulation kits as well as painting and welding works; dry transformers including also components for dry transformers, components for traction transformers
· low, medium and high voltage electrical apparatus and power systems;
· automation products including control and measurement equipment, motors, interlocks
· and protection, informative as well as automation systems for power facilities and industry;
· gas compressor and metering stations, gas compressor units and equipment, underground gas storages, gas pipelines and similar services for gas industry petroleum rafineries and petrochemical industry;
· robots and industrial robotics stations;
· supercharging of diesel and gas engines;
· main host;
· production of low voltage motors;
· production of power electronics and medium voltage drives.
· Computer software production and implementation.
Technical training in scope of automatics, robotics and electrical power equipment and systems
Programs science and research in the fields of power and automation

Proof has been furnished by means of an audit that the requirements of ISO 9001:2015 are met.

Validity: The certificate is valid from 2016-11-29 until 2019-11-28.
First certification 2013

2016-11-24

Grzegorz Gwabka

TÜV Rheinland Cert GmbH
Am Grauen Stein · 51105 Köln

www.tuv.com

DAkkS Deutsche Akkreditierungsstelle D-ZM-16031-01-00

TÜVRheinland®
Precisely Right.

Annex to certificate

Standard **ISO 9001:2015**

Certificate Registr. No. 01 100 1541808

No.	Location	Scope
0198 113 00113 /01	**ABB Sp. z o.o.** ul. Żegańska 1 04-713 Warszawa	As for certificate
0198 113 00113 /02	**Oddział w Łodzi** ABB Sp. z o.o. ul. Aleksandrowska 67/93 91-205 Łódź	
0198 113 00113 /03	**Oddział w Aleksandrowie Łódzkim** ABB Sp. z o.o. ul. Placydowska 27 95-070 Aleksandrów Łódzki	
0198 113 00113 /04	**Oddział w Krakowie** ABB Sp. z o.o. ul. Wadowicka 12 30-415 Kraków	
0198 113 00113 /05	**Oddział w Krakowie** ABB Sp. z o.o. ul. Starowiślna 13A 31-038 Kraków	
0198 113 00113 /06	**Oddział w Elblągu** ABB Sp. z o.o. ul. Królewiecka 11 82-300 Elbląg	

www.tuv.com

TÜVRheinland®
Precisely Right.

34

Annex to certificate

Standard **ISO 9001:2015**

Certificate Registr. No. 01 100 1541808

0198 113 00113 /07	**Oddział w Przasnyszu** ABB Sp. z o.o. ul. Leszno 59 06-300 Przasnysz
0198 113 00113 /08	**Oddział we Wrocławiu** ABB Sp. z o.o. ul. Graniczna 8B 54-610 Wrocław
0198 113 00113 /09	**Oddział we Wrocławiu** ABB Sp. z o.o. ul. Bacciarellego 54 51-649 Wrocław

2016-11-24

Grzegorz Gwabka

TÜV Rheinland Polska Sp. z o.o.
ul. 17 Stycznia 56 02-146 Warszawa

www.tuv.com

TÜVRheinland®
Precisely Right.

35

СЕРТИФИКАТ

/превод от английски език/

Стандарт **ISO 9001:2015**

Рег. Ном.: 01 100 1541808

Носител на сертификата: АББ Сп. з о.о.
ул. Зеганска 1
04-713 Варшава
включително локациите съгласно приложението

Обхват: Проучване и разработване, както и проектиране, програмиране, производство, продажба, процедиране и финално изпитване, сервизни услуги и цялостно изпълнение „под ключ" на следното:

- Разпределителни и силови трансформатори, изолационни комплекти, както и работи по боядисване и заваряване; сухи трансформатори включително също компоненти за сухи трансформатори, компоненти за тягови трансформатори
- Електрически апарати за ниско, средно и високо напрежение и електрически системи
- Продукти за автоматизация включително апаратура за управление и измерване, двигатели и блокировки
- И защита, информативна както и система за автоматизация за енергийни обекти и индустрията
- Газ-компресорни и измервателни станции, газ-компресорни блокове и оборудване, подземни хранилища за газ, газопроводи и подобни услуги за газовата индустрия петролни рафинерии и нефтената химическа промишленост
- Главно хранилище
- Роботи и индустриални роботизирани станции
- Суперзареждане на дизелови и газ двигатели
- Производство на двигатели ниско напрежение
- Производство на силова електроника и задвижвания за двигатели средно напрежение
- Производство на компютърен програмен софтуер и внедряване.

Техническо обучение в обхват на автоматика, роботика и електрическо силово оборудване и системи.

Доказателства са представени , въз основа на проведения одит, че изискванията съгласно ISO 9001:2015 са изпълнени.

Валидност: Този сертификат е валиден от 29.11.2016г. до 28.11.2019 г.
Първа сертификация 2013 г.

24.11.2016 г.

Подпис /не се чете/
ТЮВ Реиланд Серт
Am Grauen Stein, 51105 Кьолн

Приложение към СЕРТИФИКАТ

Стандарт **ISO 9001:2015**

Рег. Ном.: 01 100 1541808

№	Локация:	Обхват
0198 113 00113/01	АББ Сп. з о.о. ул. Зеганска 1 ПЛ 04-713 Варшава	както е в сертификата
0198 113 00113/02	Клон в Луч, АББ Сп. з о.о. ул. Александровска67/93, ПЛ-91-205 Луч	
0198 113 00113/03	Клон в Александровие Лучким, АББ Сп. з о.о. ул. Плачидовска 27 ПЛ-95-070 Александров Лучким	
0198 113 00113/04	Клон в Краков, АББ Сп. з о.о. ул. Вадовичка 12 ПЛ-30-415 Краков	
0198 113 00113/05	Клон в Краков, АББ Сп. з о.о. ул. Старовислна 13А ПЛ-31-038 Краков	
0198 113 00113/06	Клон в Елблагу, АББ Сп. з о.о. ул. Кролевиецка 11 ПЛ-82-300 Елблаг	

Приложение към СЕРТИФИКАТ

Стандарт **ISO 9001:2015**

Рег. Ном.: 01 100 1541808

0198 113 00113/07	Клон в Пшаснич, АББ Сп. з о.о. ул. Лесно 59 ПЛ-06-300 Пшаснич
0198 113 00113/08	Клон в Вроцлав, АББ Сп. з о.о. ул. Гранична 8В ПЛ-54-610 Вроцлав
0198 113 00113/09	Клон в Вроцлав, АББ Сп. з о.о. ул. Бачиарелего 54 ПЛ-51-649 Вроцлав

24.11.2016 г.

Подпис /не се чете/
ТЮВ Реиланд Полска Сп. з о.о.
ул. 17 Стижна 56 02-146 Варшава

Certificate

Standard **ISO 14001:2015**

Certificate Registr. No. 01 104 1541809

Certificate Holder: **ABB Sp. z o.o.**
ul. Żegańska 1
04-713 Warszawa

including the locations according to annex

Scope: Research and development as well as design, programming, manufacturing, sale, process and final testing, services and turnkey execution:
· distribution and power transformers, insulation kits as well as painting and welding works; dry transformers including also components for dry transformers, components for traction transformers
· low, medium and high voltage electrical apparatus and power systems;
· automation products including control and measurement equipment, motors, interlocks
· and protection, informative as well as automation systems for power facilities and industry;
· gas compressor and metering stations, gas compressor units and equipment, underground gas storages, gas pipelines and similar services for gas industry petroleum rafineries and petrochemical industry;
· robots and industrial robotics stations;
· supercharging of diesel and gas engines;
· main host;
· production of low voltage motors;
· production of power electronics and medium voltage drives.
· Computer software production and implementation.
Technical training in scope of automatics, robotics and electrical power equipment and systems
Programs science and research in the fields of power and automation

Proof has been furnished by means of an audit that the requirements of ISO 14001:2015 are met.

Validity: The certificate is valid from 2016-11-29 until 2019-11-28.
First certification 2013

2016-11-24

Grzegorz Gvabka

TÜV Rheinland Cert GmbH
Am Grauen Stein · 51105 Köln

www.tuv.com

DAkkS Deutsche Akkreditierungsstelle D-ZM-16031-01-00

TÜVRheinland®
Precisely Right.

Annex to certificate

Standard **ISO 14001:2015**

Certificate Registr. No. 01 100 1541809

No.	Location	Scope
0198 113 00113 /01	**ABB Sp. z o.o.** ul. Żegańska 1 04-713 Warszawa	As for certificate
0198 113 00113 /02	**Oddział w Łodzi** ABB Sp. z o.o. ul. Aleksandrowska 67/93 91-205 Łódź	
0198 113 00113 /03	**Oddział w Aleksandrowie Łódzkim** ABB Sp. z o.o. ul. Placydowska 27 95-070 Aleksandrów Łódzki	
0198 113 00113 /04	**Oddział w Krakowie** ABB Sp. z o.o. ul. Wadowicka 12 30-415 Kraków	
0198 113 00113 /05	**Oddział w Krakowie** ABB Sp. z o.o. ul. Starowiślna 13A 31-038 Kraków	
0198 113 00113 /06	**Oddział w Elblągu** ABB Sp. z o.o. ul. Królewiecka 11 82-300 Elbląg	

Annex to certificate

Standard **ISO 14001:2015**

Certificate Registr. No. 01 100 1541809

0198 113 00113 /07	**Oddział w Przasnyszu** ABB Sp. z o.o. ul. Leszno 59 06-300 Przasnysz
0198 113 00113 /08	**Oddział we Wrocławiu** ABB Sp. z o.o. ul. Graniczna 8B 54-610 Wrocław
0198 113 00113 /09	**Oddział we Wrocławiu** ABB Sp. z o.o. ul. Bacciarellego 54 51-649 Wrocław

2016-11-24

Grzegorz Gwabka

TÜV Rheinland Polska Sp. z o.o.
ul. 17 Stycznia 56 02-146 Warszawa

www.tuv.com

TÜVRheinland®
Precisely Right.

43

СЕРТИФИКАТ

/превод от английски език/

Стандарт **ISO 14001:2015**

Рег. Ном.: 01 104 1541809

Носител на сертификата: АББ Сп. з о.о.
ул. Зеганска 1
04-713 Варшава
включително локациите съгласно приложението

Обхват: Проучване и разработване, както и проектиране, програмиране, производство, продажба, процедиране и финално изпитване, сервизни услуги и цялостно изпълнение „под ключ" на следното:

- Разпределителни и силови трансформатори, изолационни комплекти, както и работи по боядисване и заваряване; сухи трансформатори включително също компоненти за сухи трансформатори, компоненти за тягови трансформатори
- Електрически апарати за ниско, средно и високо напрежение и електрически системи
- Продукти за автоматизация включително апаратура за управление и измерване, двигатели и блокировки
- И защита, информативна както и система за автоматизация за енергийни обекти и индустрията
- Газ-компресорни и измервателни станции, газ-компресорни блокове и оборудване, подземни хранилища за газ, газопроводи и подобни услуги за газовата индустрия петролни рафинерии и нефтената химическа промишленост
- Главно хранилище
- Роботи и индустриални роботизирани станции
- Суперзареждане на дизелови и газ двигатели
- Производство на двигатели ниско напрежение
- Производство на силова електроника и задвижвания за двигатели средно напрежение
- Производство на компютърен програмен софтуер и внедряване.

Техническо обучение в обхват на автоматика, роботика и електрическо силово оборудване и системи.

Доказателства са представени , въз основа на проведения одит, че изискванията съгласно ISO14001:2015 са изпълнени.

Валидност: Този сертификат е валиден от 29.11.2016г. до 28.11.2019 г.
Първа сертификация 2013 г.

24.11.2016 г.

Подпис /не се чете/
ТЮВ Реиланд Серт
Am Grauen Stein, 51105 Кьолн

Приложение към СЕРТИФИКАТ

Стандарт	**ISO 14001:2015**	
Рег. Ном.:	01 104 1541809	
№	**Локация:**	**Обхват**
0198 113 00113/01	АББ Сп. з о.о. ул. Зеганска 1 ПЛ 04-713 Варшава	както е в сертификата
0198 113 00113/02	Клон в Луч, АББ Сп. з о.о. ул. Александровска67/93, ПЛ-91-205 Луч	
0198 113 00113/03	Клон в Александровие Лучким, АББ Сп. з о.о. ул. Плачидовска 27 ПЛ-95-070 Александров Лучким	
0198 113 00113/04	Клон в Краков, АББ Сп. з о.о. ул. Вадовичка 12 ПЛ-30-415 Краков	
0198 113 00113/05	Клон в Краков, АББ Сп. з о.о. ул. Старовислна 13А ПЛ-31-038 Краков	
0198 113 00113/06	Клон в Елблагу, АББ Сп. з о.о. ул. Кролевиецка 11 ПЛ-82-300 Елблаг	

Приложение към СЕРТИФИКАТ

Стандарт **ISO 14001:2015**

Рег. Ном.: 01 104 1541809

0198 113 00113/07	Клон в Пшаснич, АББ Сп. з о.о. ул. Лесно 59 ПЛ-06-300 Пшаснич
0198 113 00113/08	Клон в Вроцлав, АББ Сп. з о.о. ул. Гранична 8В ПЛ-54-610 Вроцлав
0198 113 00113/09	Клон в Вроцлав, АББ Сп. з о.о. ул. Бачиарелего 54 ПЛ-51-649 Вроцлав

24.11.2016 г.

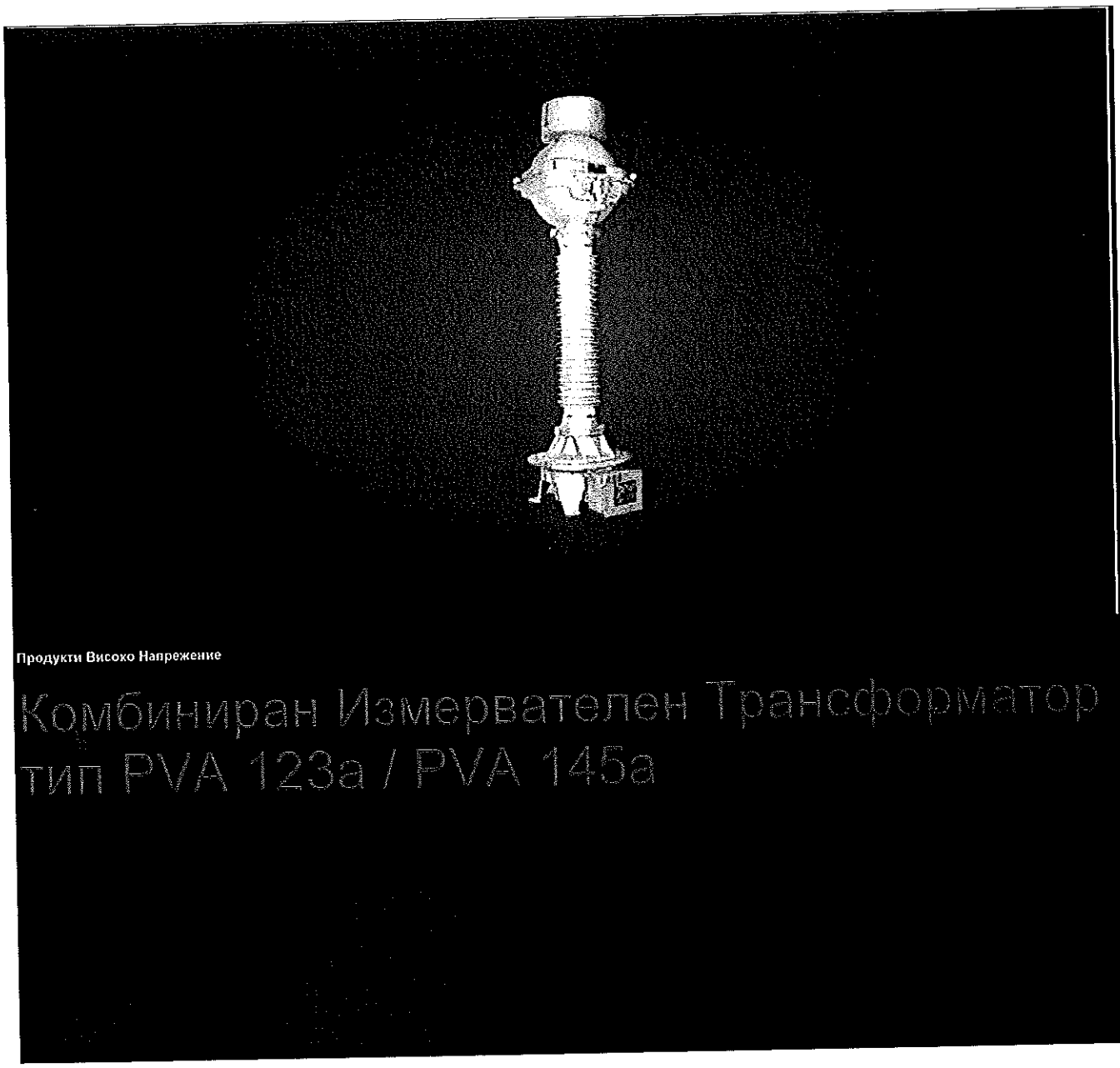
Подпис /не се чете/
ТЮВ Реиланд Полска Сп. з о.о.
ул. 17 Стижна 56 02-146 Варшава

47

„Доставка на електрически апарати 110kV“, реф. № PPD 17-064.

Обособена позиция 4 – Доставка на комбинирани измервателни трансформатори 110kV за монтаж на открито – 15 бр.

ПРИЛОЖЕНИЕ 1



Продукти Високо Напрежение

Комбиниран Измервателен Трансформатор тип PVA 123a / PVA 145a

Power and productivity
for a better world™

ABB

Описание на продукта

Комбинираните измервателни трансформатори тип PVA 123a и PVA 145a се използват за захранване на системи за измерване и защита в електрическите мрежи с най-високо системно напрежение от 123 kV или 145 kV и честота 50 Hz. Те са предназначени за работа в мрежи с ефективно заземени или изолирани неутрали, както и в компенсирани заземителни системи. Комбинираните измерителни трансформатори са подходящи за работа в условия на открито, с температура на околната среда от 233 K (-40°C) до 313 K (+40°C) и при относителна влажност до 100% при 303 K (+30°C) и на височина не повече от 1000 м над морското равнище. Две конструкции са на разположение: с композитен или порцеланов изолатор.

Комбинираните измервателни трансформатори тип PVA 123a и PVA 145a са с конструкции, където намотки се намират вгорната част; състои от токов и напреженов модули, капсуловани в в общ херметически затворен корпус, напълнен трансформаторно масло , без съдържание на полихлорирани бифенили (PCB). Токовият модул се намира в главата на трансформатора, а напреженовия модул е в казана на дъното на трансформатора. Разширителният съд, от неръждаема стомана на трансформатора е фиксиран към главата и тя е направена от неръждаема стомана. Разширителният съд компенсира за температурните промени в обема масло.
Местоположението на токовия и напреженовия модули в един корпус, предлага намаляване на общите разходи за собствениците на подстанции, поради:

- - по-малък брой трансформатори в полето,
- - по-малък брой на носещи конструкции,
- - по-малък брой връзки,
- - по-ниски транспортни разходи,
- - по-ниски разходи и намаляване на времето необходимо за монтаж,
- - намалена площ на подстанцията.

Конструкция с намотки в горната част на трансформатора
Използването на конструкция с намотки в горната част на трансформатора в PVA 123a и PVA 145a, дава възможност за постигане на високи стойности на термичния и динамичния токове на късо съединение, както и широк обхват ат първични токове и изводи на вторични намотки.

Превключване на токовия обхват
Трансформаторът може да се превключва на първичната страна, както и на вторичната страна. Метален джъмпер се използва за превключване на обхвата на тока на първичната страна. Той се поставя на съответното място на клемореда. Това решение не изисква извършване на допълнителни дейности, свързани с промяната на местоположението на връзките към линията.

Първични и вторични намотки и класове на точност
Първичните и вторичните намотки са изработени от най-висококачествени електрическата мед и алуминий.
За клиенти, изискващи висока точност трансформация с ниски стойности на избрания номинален първичен ток, ние сме в състояние да доставим решение, състоящи се в използването на специални класове 0.2S и 0.5S.

Ние гарантираме много висока точност трансформация в специалните класове, от 1% до 120%, 150% и дори до 200% от стойността на избраните номинални първични токове и за двата вторични тока при 1 A и 5 A.
Напреженовият модул на PVA 123a и PVA 145a има точност от 0.1 за намотки за мерене. Висока точност на трансформация за намотките за защита е гарантирана от 2% до 190% от номиналното първично напрежение.
Нашата лаборатория за измерване на класа на точност и измервателни трансформатори, е един от най-модерните и добре оборудвани изследователски съоръжения в страната. Ние сме акредитирани от Полското Централно Управление по Метрология

Основна изолация
Основната изолация е направена от изолационна хартия, импрегнирана с трансформаторно масло. Ние използваме високо качество масло, отговарящо на изискванията на стандарт IEC 60296. Това масло не съдържа полихлорирани бифенили (PCB) или други токсични вещества и е с ниска степен на въздействие върху околната среда.

Изолатор
Стандартният изолатора е направен от кафяв порцелан с път на утечка, изисквана за 3-та зона на замърсяване. Сивият композитен изолатор, с път на утечка, изисквана за 4-та зона на замърсяване, е на разположение при поискване. Всички материали, използвани в производството на нашите изолатори, отговарят на изискванията на съответните IEC стандарти.

Корпус
Всички външни части са здрави и направени от устойчиви на корозия материали. Всички присъединения на корпуса, са устойчиви на течове, поради система уплътнения О-пръстен. Всеки напълно сглобен трансформатор, е обект на строги проверки за течове, по време на рутинни изпитания. Разширителният съд е оборудван с голям индикатор за нивото на маслото, което дава възможност за наблюдение на промените в обема на масло, дори от голямо разстояние.

Първични клеми
Стандартните първични терминалите са плоски, изработени от алуминий, с ширина 100 мм или 200 мм. При поискване можем да предложим първични клеми тип щифт, изработени от алуминий, с диаметър от 30 мм или 40 мм.

Клемна кутия
Клемната кутия е изработена от алуминий и е фиксирана към казана в дъното на трансформатора. Степен на защито – съгласно IP55. Вторичните клеми са налични за свързване на проводници със сечение до 10 mm². Пломбиране на токовите и напреженовите измервателни клеми, също е възможно при поискване. Клемната кутия има два M32 щуцери (за кабели от ϕ 11 мм до ϕ 21 mm) и два M40 щуцера (за кабели от ϕ19 мм до ϕ 28 mm). Ние предлагаме клемни кутии с различен брой щуцери при поискване. Точки на прекъсване, за защита на измервателния трансформатор, от повреди в случай на късо съединение във вторичните клеми, са разположени в клемната кутия. Точките на прекъсване се прилагат на всички вторични намотки на напреженовата част на трансформатора

52

Технически данни

Обща информация

Параметър	Стойност
Тип	PVA 123a / PVA145a
Съответствие със стандарти	IEC 61869-4
Номинално първично напрежение	110: √3 kV / 132: √3 kV
Максимално напрежение на системата	123 kV / 145 kV
Изпитвателно индуцирано напрежение с промишлена честота	50 Hz 230 kV / 275 kV
Изпитвателно напрежение със стандартна импулсна вълна	1,2/50 μs 550 kV / 650 kV
Мин. път на утечка	16; 20; 25; 31 mm/kV
Номинална честота	50 Hz
Общо тегло (макс.)	620; 540* kg

*Композитен изолатор.

Токов модул

Номинален ток [A]	Номинален ток на термична устойчивост 1s [kA]	Номинален ток на динамична устойчивост [kA]
50-3000	до 63	до 157

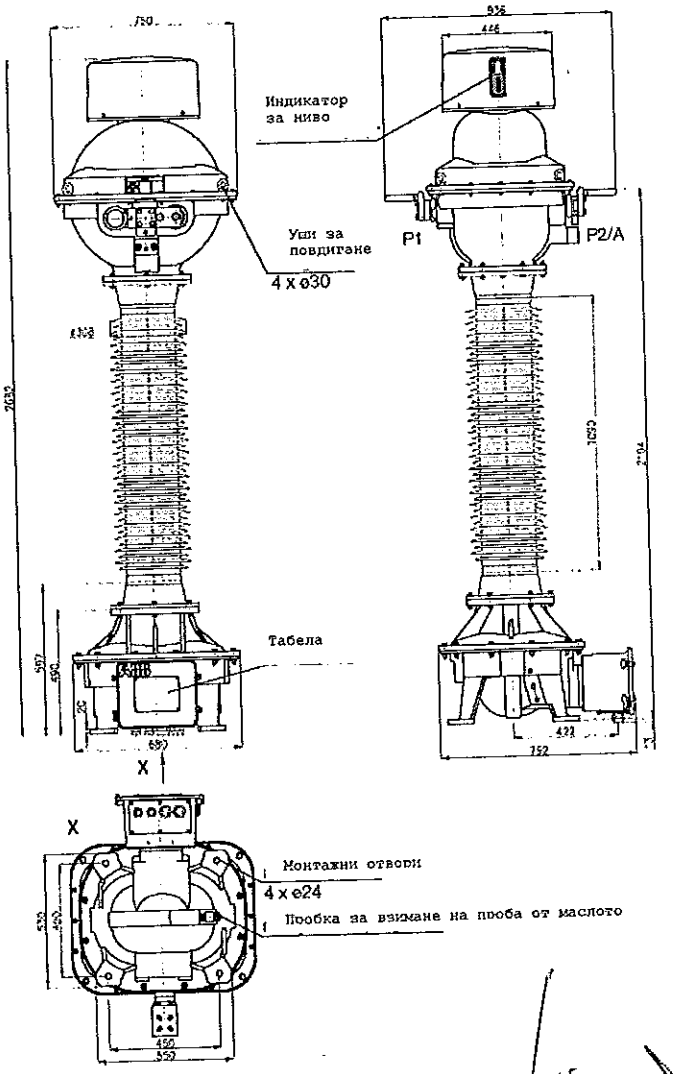
Превключваема конструкция 1:2 или 1:2:4 при поискване

Параметър	Стойност
Номинален вторичен ток	1 A; 5 A
Разширен токов обхват	120%; 150%; 200%
Брой намотки:	1-6
Параметри на намотките за мерене:	
- обща номинална мощност	2.5-90 VA
- клас на точност	0,1; 0,2; 0,2S; 0,5; 0,5S; 1; 3; 5
Параметри на намотките за защита:	
- обща номинална мощност	2.5-90 VA
- клас на точност	5P, 10P, 5PR, 10PR, PX, PXR,TPX, TPY, TPZ

Напреженов модул

Параметър	Стойност		
Напреженов фактор / време на действие	1.2 продължително и 1.5/30 s; 1.9/30 s; 1.9/8 h		
Брой намотки:	1-5		
Намотки за мерене:			
- номинално напрежение	100: √3 V; 110: √3 V		
- обща номинална мощност	до 100 VA	до 200 VA	до 500 VA
- клас на точност	0.1; 0.1/3P	0.2; 0.2/3P	0.5; 0.5/3P
Остатъчни намотки:			
- номинално напрежение	100 V; 110 V; 100:3 V; 110:3 V		
- обща номинална мощност	до 450 VA		
- клас на точност	0.5; 1; 3; 3P; 6P		
- обща номинална мощност	4000 VA		

Оразмерителен чертеж



53

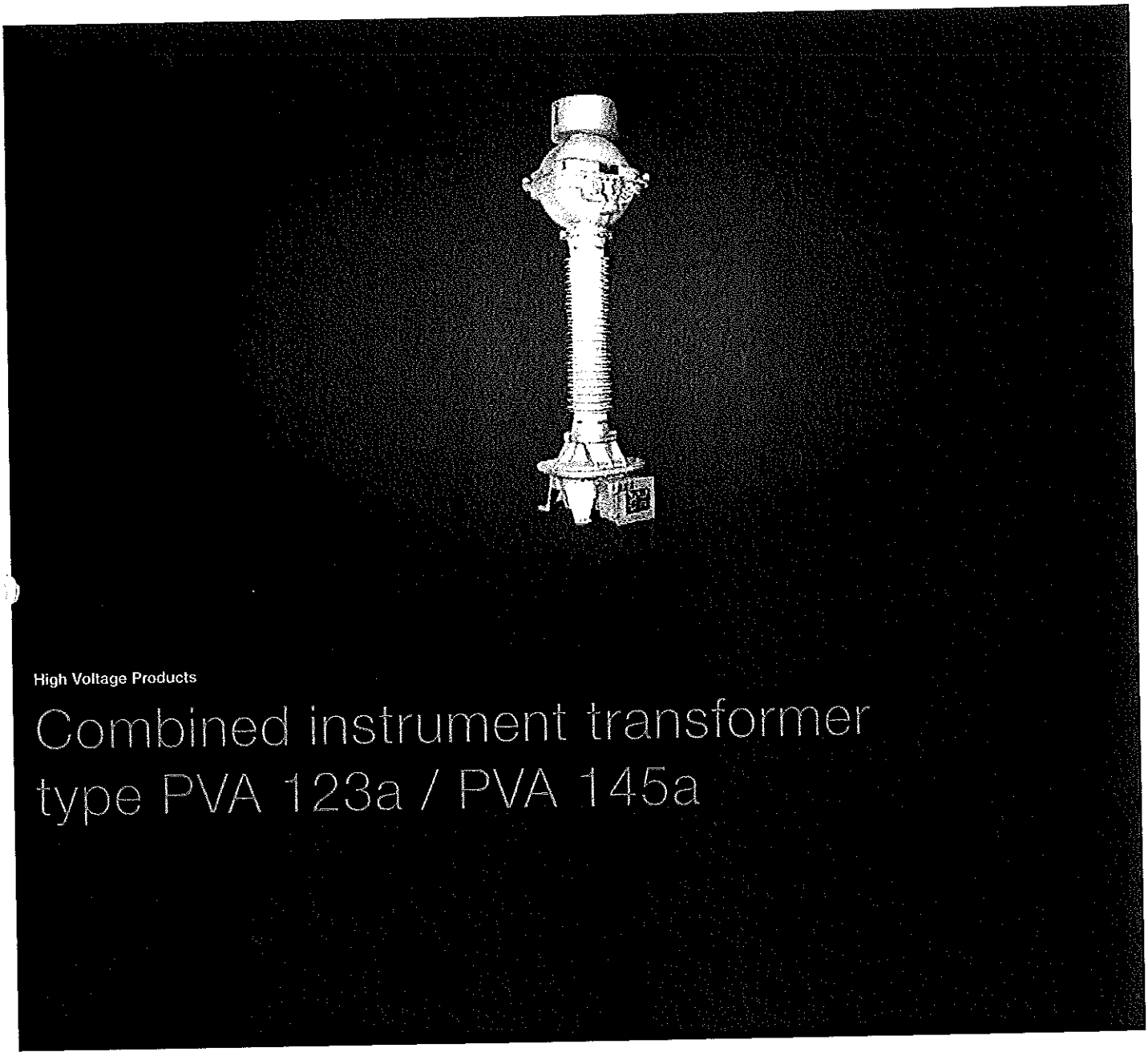
Свържете се с нас

ABB Contact Center
Тел.: +48 22 22 37 777 e-
mail: kontakt@pl.abb.com

ABB Sp. z o.o.
Branch Office in Przasnysz
ul. Leszno 59 06-300
Przasnysz
Phone: +48 22 22 38 931, +48 22 22 39 255
Fax: +48 22 22 38 958

www.abb.pl

Power and productivity
for a better world™



High Voltage Products

Combined instrument transformer type PVA 123a / PVA 145a

Power and productivity
for a better world™

ABB

55

Product description

The PVA 123a and PVA 145a combined instrument transformers are used for feeding measurement and protection systems in electric power grids with highest system voltage of 123 kV or 145 kV and frequency of 50 Hz. They are designed to operate in grids with effectively earthed or insulated neutral points as well as in compensated earthed systems. The combined instrument transformers are suitable to operate in outdoor conditions with ambient temperature from 233 K (-40°C) to 313 K (+40°C) and at relative humidity of up to 100% at 303 K (+30°C) and at the altitude not exceeding 1000 m above sea level. Two designs are available: with composite or porcelain insulator.

The PVA 123a and PVA 145a combined instrument transformer is top core construction; it comprises current and voltage modules encapsulated in common hermetically sealed housing filled with PCB free transformer oil. The current module is located in transformer's head and voltage module is in the bottom tank. The transformer's stainless steel expansion bellows is fixed to the head and it is made of stainless steel. The expansion bellows compensates for thermal changes in oil volume.
The location of both CT and VT modules in one housing offers reductions in the total cost of ownership of a substation due to:
– lower number of transformers in a bay,
– lower number of supporting structures,
– lower number of connections,
– lower transportation costs,
– lower installation costs and reduced time needed for installation,
– reduced station footprint.

Top core construction

Use of top core construction in PVA 123a and PVA 145a instrument transformers makes it possible to achieve high values of thermal and dynamic short-circuit currents as well as a broad range of rated primary currents and outputs of secondary windings.

Current range switching

The transformer can be switched on the primary side as well as on the secondary side. A metal jumper is used for current range switching on the primary side. It shall be placed in appropriate location in accordance with the terminal board. This solution does not require performance of additional operations related to change of location of line connections.

Primary and secondary windings and accuracy classes

The primary and secondary windings are made of highest quality electrical copper and aluminium.
For customers requiring high transformation accuracy with low values of selected rated primary current we are able to deliver solution comprising use of special classes 0.2S and 0.5S.

We guarantee very high transformation accuracy in the special classes, from 1% to 120%, 150% and even to 200% of the valueof selected rated primary currents for both secondary currents of 1 A and 5 A.
The voltage module of PVA 123a and PVA 145a has accuracy from 0.1 for measuring windings. High transformation accuracy for protection windings is guaranteed from 2% to 190% of rated primary voltage.
Our laboratory for measurements of accuracy classes and instrument transformers is one of the most advanced and well-equipped research facilities in the country. We are accredited by the Polish Central Office of Measures.

Main insulation

The main insulation is made of insulation paper impregnated with transformer oil. We utilize a high quality oil conforming to IEC 60296 Standard requirements. This oil does not contain PCBs or any other toxic substances and has low environmental impact.

Hollow insulator

The standard insulator is made of brown porcelain with creepage distance required for the 3rd pollution zone. A grey composite insulator with creepage distance required for the 4th pollution zone is available upon request. All materials used in the production of our insulators conform to relevant IEC Standards.

Housing

All external parts are robust and made from corrosion resistant materials. All housing joints are leak proof due to O-ring sealing system. Each completely assembled unit is subject to stringent leakage checks during routine testing. The expansion bellows is equipped with large oil level indicator that enables observations of changes in oil volume even from a large distance.

Primary terminals

The standard primary terminals are flat, made of aluminium, 100 mm or 200 mm width. Upon request we can offer pin type primary terminals, made of aluminium, with a diameter of 30 mm or 40 mm.

Terminal box

The terminal box is constructed of aluminium and fixed to the transformer's bottom tank. Tightness – according to IP55. Secondary terminals are available for connection of up to 10 mm² conductors. Sealing of current and voltage measurement terminals is also possible upon request. The terminal box has two M32 cable glands (for cables from Ø 11 mm to Ø 21 mm) and two M40 cable glands (for cables from Ø 19 mm to Ø 28 mm). We offer terminal boxes with different number of cable glands upon request. Breaking points to protect the instrument transformer from damage in case of secondary terminal short circuit are located in the terminal box. The breaking points are applied on all secondary windings of voltage part of the transformer

576

Technical data

General information

Parameter	Value
Type	PVA 123a / PVA145a
Compliance with the standards	IEC 61869-4
Rated primary voltage	110: √3 kV / 132: √3 kV
Highest system voltage	123 kV / 145 kV
Power-frequency withstand test voltage	50 Hz 230 kV / 275 kV
Rated lighting-impulse withstand voltage	1,2/50 µs 550 kV / 650 kV
Minimum creepage distance	16; 20; 25; 31 mm/kV
Rated frequency	50 Hz
Total weight (max.)	620; 540* kg

*Composite insulator.

Current module

Rated current [A]	Rated 1s thermal current [kA]	Rated dynamic current [kA]
50–3000	up to 63	up to 157

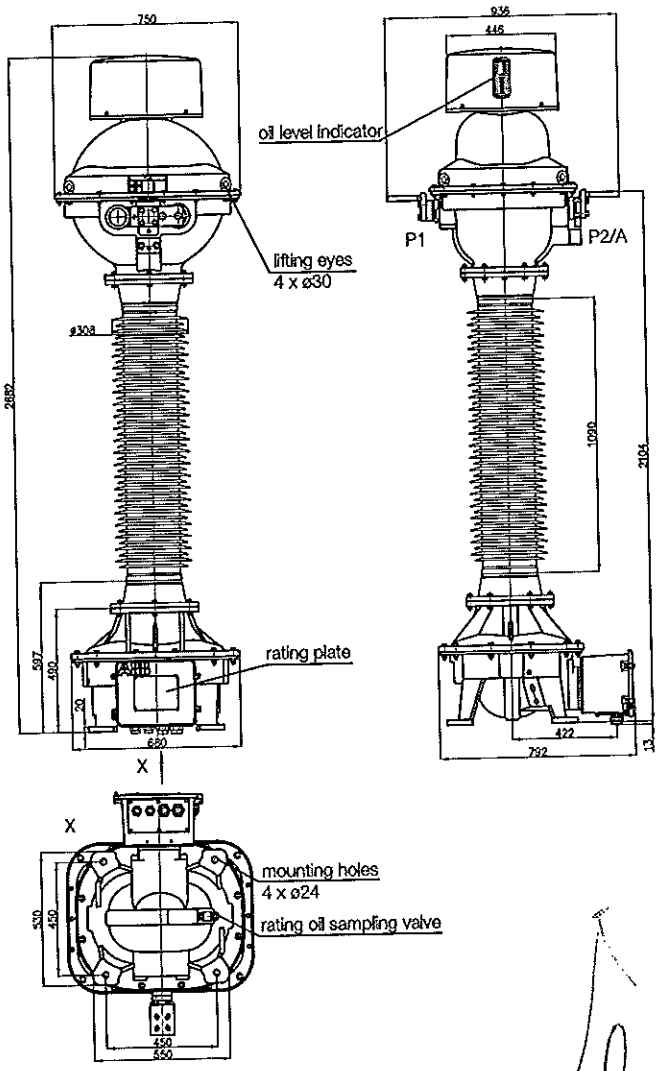
Reconnectable design 1:2 or 1:2:4 on request

Parameter	Value
Rated secondary current	1 A; 5 A
Extended current range	120%; 150%; 200%
Number of cores:	1–6
Measuring cores parameters:	
– total rated output	2,5–90 VA
– accuracy class	0,1; 0,2; 0,2S; 0,5; 0,5S; 1; 3; 5
Protection cores parameters	
– total rated output	2,5–90 VA
– accuracy class	5P, 10P, 5PR, 10PR, PX, PXR,TPX, TPY, TPZ

Voltage module

Parameter			Value
Voltage factor and time	1.2 continuous and 1.5/30 s; 1.9/30 s; 1.9/8 h		
Number of windings:			1–5
Measuring windings:			
– rated voltage			100: √3 V; 110: √3 V
– total rated output	up 100 VA	up to 200 VA	up to 500 VA
– accuracy class	0.1; 0.1/3P	0.2; 0.2/3P	0.5; 0.5/3P
Residual winding:			
– rated voltage			100 V; 110 V; 100:3 V; 110:3 V
– total rated output			up to 450 VA
– accuracy class			0,5; 1; 3; 3P; 6P
– limiting power			4000 VA

Dimensional drawing



Contact us

ABB Contact Center
Phone: +48 22 22 37 777
e-mail: kontakt@pl.abb.com

ABB Sp. z o.o.
Branch Office in Przasnysz
ul. Leszno 59
06-300 Przasnysz
Phone: +48 22 22 38 931, +48 22 22 39 255
Fax: +48 22 22 38 958

www.abb.pl

2129PL1017-W1-en. Edition 02.2014

Power and productivity
for a better world™

ABB

„Доставка на електрически апарати 110kV“, реф. № PPD 17-064.

Обособена позиция 4 – Доставка на комбинирани измервателни трансформатори 110kV за монтаж на открито – 15 бр.

ПРИЛОЖЕНИЕ 2

РЕПУБЛИКА БЪЛГАРИЯ
Български институт по метрология

REPUBLIC OF BULGARIA
Bulgarian Institute of Metrology

УДОСТОВЕРЕНИЕ
ЗА ОДОБРЕН ТИП СРЕДСТВО ЗА ИЗМЕРВАНЕ

Measuring Instrument Type-approval Certificate

№ 17.04.5119

Издадено на производител: ABB Sp. z o.o., ul. Leszno 59 06-300 Przasnysz, Poland
Issued to manufacturer:

На основание на: чл. 32, ал. 1 от Закона за измерванията (ДВ, бр. 46 от 2002 г., изм. бр. 88 от 05 г., изм. и доп. бр. 95 от 2005 г.)
In Accordance with:

Относно: измервателни комбинирани трансформатори тип PVA 123a/PVA 145a
In Respect of:

Знак за одобрен тип:
Type Approval Mark:

BG 17
5119

Технически и метрологични характеристики: приложение, неразделна част от настоящото удостоверение за одобрен тип средство за измерване
Technical and metrological characteristics:

Срок на валидност: 28.04.2027 г.
Valid until:

Вписва се в регистъра на одобрените за използване типове средства за измерване под №: 5119
Reference №:

Дата на издаване на удостоверението за одобрен тип: 28.04.2017 г.
Date:

И. Д. ПРЕДСЕДАТЕЛ:
Паун Илчев

61

Приложение към удостоверение за одобрен тип № 17.04.5119

Издадено на производител: ABB Sp. z o.o., ul. Leszno 59 06-300 Przasnysz, Poland

Относно: измервателни комбинирани трансформатори тип PVA 123a/PVA 145a

1. Описание на типа:

Измервателните комбинирани трансформатори тип PVA 123a/PVA 145a се използват за измерване и защита в електрически мрежи с максимално допустимо работно напрежение до 123 kV или до 145 kV и честота 50 Hz. Те са предназначени за работа в мрежи с ефективно заземени или изолирани неутрали, както и в компенсирани заземителни системи.

Измервателните комбинирани трансформатори тип PVA 123a/PVA 145a са подходящи за работа в условия на открито с температура на околната среда от (-40 °C) до (+40 °C) при относителна влажност до 100% при (+30 °C) и на височина не повече от 1000 метра над морското равнище.

Възможни са две конструкции на измервателните комбинирани трансформатори тип PVA 123a/PVA 145a: с композитен или с порцеланов изолатор.

Токовият и напреженовият модул са капсуловани в общ херметически затворен корпус, напълнен с трансформаторно масло, без съдържание на полихлорирани бифенили (PCB). Токовият модул се намира в главата на трансформатора, а напреженовият модул е в казана, на дъното на трансформатора. Главата на трансформаторите е изработена от неръждаема стомана. Разширителният съд компенсира температурните промени в обема на маслото. Той е от неръждаема стомана и е фиксиран към главата.

Намотките на измервателните комбинирани трансформатори тип PVA 123a/PVA 145a са разположени в горната част на трансформатора. Това дава възможност за постигане на високи стойности на термичния и на динамичния токове на късо съединение, както и широк обхват от първични токове и изводи на вторични намотки.

Първичните и вторичните намотки са изработени от висококачествени електрическа мед и алуминий. При измервателните комбинирани трансформатори тип PVA 123a/PVA 145a има възможност за превключване на първичната намотка.

Основната изолация е направена от изолационна хартия, импрегнирана с трансформаторно масло. Всички външни части на корпуса са изработени от устойчиви на корозия материали. Клемната кутия е изработена от алуминий и е фиксирана към казана, в дъното на трансформатора.

2. Технически и метрологични характеристики:

№	Характеристика	Трансформатори тип PVA 123a/ PVA 145a
1.	Максимално работно напрежение, kV	123; 145
2.	Номинална честота, Hz	50
	Токова част	
3.	Номинален първичен ток, A	от 50 до 3000
4.	Номинален термичен ток 1 s, kA	до 63
5.	Номинален динамичен ток, kA	до 157
6.	Номинален вторичен ток, A	1; 5
7.	Мощност, VA	от 2,5 до 90
8.	Клас на точност:	
	- измервателна намотка	0,1; 0,2; 0,2S; 0,5; 0,5S; 1; 3; 5
	- защитна намотка	5P; 10P; 5PR; 10PR; PX; PXR; TPX; TPY; TPZ
9.	Брой намотки	от 1 до 6

Напрежителна част		
10.	Номинално първично напрежение, kV	110/√3; 132/√3
11.	Коефициент на напрежение и време на прилагане	1,5/30s; 1,9/30s; 1,9/8h; 1,2 продължително
12.	Номинално вторично напрежение, V	100/√3; 110/√3; 100; 110; 100/3; 110/3
13.	Мощност, VA	до 500
14.	Клас на точност:	
	- измервателна намотка	0,1; 0,2; 0,5; 1; 3
	- защитна намотка	3P; 6P
15.	Брой намотки	от 1 до 5

3. Типово означение: PVA 123a/PVA 145a.

4. Описание на местата, предназначени за поставяне на знаци от метрологичен контрол:

- Знакът за одобрен тип (марка за залепване) се поставя на табелката с технически данни в дясно;
- Знакът за първоначална проверка (марка за залепване) се поставя табелката с технически данни под знака за одобрен тип.

63

„Доставка на електрически апарати 110kV“, реф. № PPD 17-064.

Обособена позиция 4 – Доставка на комбинирани измервателни трансформатори 110kV за монтаж на открито – 15 бр.

ПРИЛОЖЕНИЕ 3

ABB

Технически данни : Индуктивен комбиниран трансформатор

Дата :	**2017-06-20**	**Име :**	**bozena.trajer@pl.abb.com**
CCP Number:	-		
Наш реф. :	**KU 598/17**	**Ревизия :**	**A**
Проект :	**CEZ Bułgaria**		

Общи данни

Количество	15
Тип	PVA 123a
Стандарти	IEC 61869-4
Монтаж	Открит
Изолация	Масло / хартия херметичен
Производител, страна	ABB, Полша

Работни условия

Най-високо напрежение на с-мата (фаза-фаза) U_{sys}	kV r.m.s.	123
Номинална честота f_R	Hz	50
Температура на околната среда	°C	-40/ +40
Средна темп. На околната среда (период 24ч)	°C ≤	35
Надморска височина	m	1000
Сеизмична активност съгл. IEC 62271-300		AF5

Номинално изолационно ниво

Най-високо напрежение за оборудването (фаза-фаза) U_m	kV r.m.s.	123
Обявено издържано напрежение с мълниев импулс 1,2/50	kV peak	550
Обявено издържано напрежение с мълниев импулс 1,2/50	kV r.m.s.	230
Обявено издържано напрежение с мълниев импулс 1,2/50	kV r.m.s.	230

Отношения на тока

Номинален първичен ток I_{pr}	A r.m.s.	200 - 400 - 800
Ном. продължителен термичен ток I_{cth}	A r.m.s.	240-480-960
Ном. Краткосрочен термичен ток I_{th} / време	kA r.m.s./s	31,5-31,5-31,5/1
Номинален динамичен ток I_{dyn}	kA peak	80 - 80 - 80
Превключване		Първично 1:2:4

Класове на точност

Ядро №.	Клеми	отношение A / A	Точност	Rct75	Брой клемна кутия	Капак за пламбиране
1, 2	[x]S1-[x]S2	200-400-800/5	1-15VA 0,2S ext.120% FS5	-	1	-
3, 4	[x]S1-[x]S2	200-400-800/5	30VA 10P10	-	1	-

[x] – означава даден номер на ядрото

Оношение на напрежението

Номинална първично напрежение U_{pr}	V	110000 /√3
Ном. Напреженов фактор Fv / ном. време		1.2/ продължително & 1.5/30s

Класове на точност

Намотка №		Ном. вт. напр. U_{sr}	Ном. мощност S_r	клас	Обща едновр.. мощност	Термичнol огр. мощност	№ на кл. Кут.	Капак or g апломб.
I	(1a - 1n)	100 : √3 V	15 VA	0,2	60 VA	1000 VA	1	-
II	(2a - 2n)	100 : √3 V	15 VA	0,2	60 VA	1000 VA	1	-
III	(3a - 3n)	100 : √3 V	30 VA	1/3P	60 VA	1000 VA	1	-
IV	(da - dn)	100 : 3 V	30 VA	3P	90 VA	450 VA	1	-

67

Данни за продукта		
Оразмерителен чертеж		2GKK614717A0598;rev.A
Мин. път на утечка		български
Мин. дъгово разстояния		Порцелан / кафяв
Тип на първичните клеми	mm	4495
Оразмерителен чертеж	mm	1190
Мин. път на утечка		Al плоска шина 100x120 T=20 mm; 4xD=14/50x50mm
Тип на заземителните клеми		2xø14/50-60mm
Тип на вторичните напреженови клеми		Phoenix rail клемни блокове; пружинна връзка, тип ST 10
Тип на вторичните токови клеми		Phoenix rail клемни блокове
Кабелни уплътнения – клемна кутия No. 1		Без кабелни уплътнения;
Изпитано издържано натоварване на първичните клеми FR	(Статично/Дин)N	3600/5000
Боядисване (цвят)		
- Корпус над изолатора		Не е боядисан
- Корпус под изолатора		Не е боядисан
Общо тегло	kg	590
Тегло на маслото	kg	185
Тип на изолационното масло		Nynas Nytro 10XN – инхибирано Минерално изолационно масло съгл. IEC 60296
Опаковане		Хоризонтално- дървена основа
Тегло на пратката	kg/unit	700
Размери на пратката	cm x cm x cm/unit	291x101x101
Обем на пратката	m3/unit	3

ABB

Data Schedule : Inductive Combined Transformer

Date :	**2017-06-20**	**Name :**	**bozena.trajer@pl.abb.com**
CCP Number:	-		
Our ref :	**KU 598/17**	**Revision :**	**A**
Project :	**CEZ Bułgaria**		

General data	
Quantity	15
Type	PVA 123a
Standards	IEC 61869-4
Design	Outdoor
Insulation	Oil / paper hermetic
Manufacturer, country	ABB, Poland

Service conditions		
Highest voltage of a system (phase-to-phase) U_{sys}	kV r.m.s.	123
Rated frequency f_R	Hz	50
Ambient air temperature (Temperature category)	°C	-40/ +40
Average ambient air temp. (period 24h)	°C ≤	35
Altitude	m	1000
Seismic activity acc. to IEC 62271-300		AF5

Rated insulation level		
Highest voltage for equipment (phase-to-phase) U_m	kV r.m.s.	123
Rated lightning impulse withstand voltage 1,2/50 µs	kV peak	550
Rated power-frequency withstand voltage, dry	kV r.m.s.	230
Rated power-frequency withstand voltage, wet	kV r.m.s.	230

Current ratings		
Rated primary current I_{pr}	A r.m.s.	200 - 400 - 800
Rated continuous thermal current I_{cth}	A r.m.s.	240-480-960
Rated short-time thermal current I_{th} / time	kA r.m.s./s	31,5-31,5-31,5/1
Rated dynamic current I_{dyn}	kA peak	80 - 80 - 80
Reconnection		Primary 1:2:4

Accuracy ratings

Core No.	Terminals	Ratio A / A	Accuracy	Rct75	No. of terminal box	Cover for sealing
1, 2	[x]S1-[x]S2	200-400-800/5	1-15VA 0,2S ext.120% FS5	-	1	-
3, 4	[x]S1-[x]S2	200-400-800/5	30VA 10P10	-	1	-

[x] – means given number of the core

Voltage ratings		
Rated primary voltage U_{pr}	V	110000 /√3
Rated voltage factor F_v / Rated time		1.2/continuous & 1.5/30s

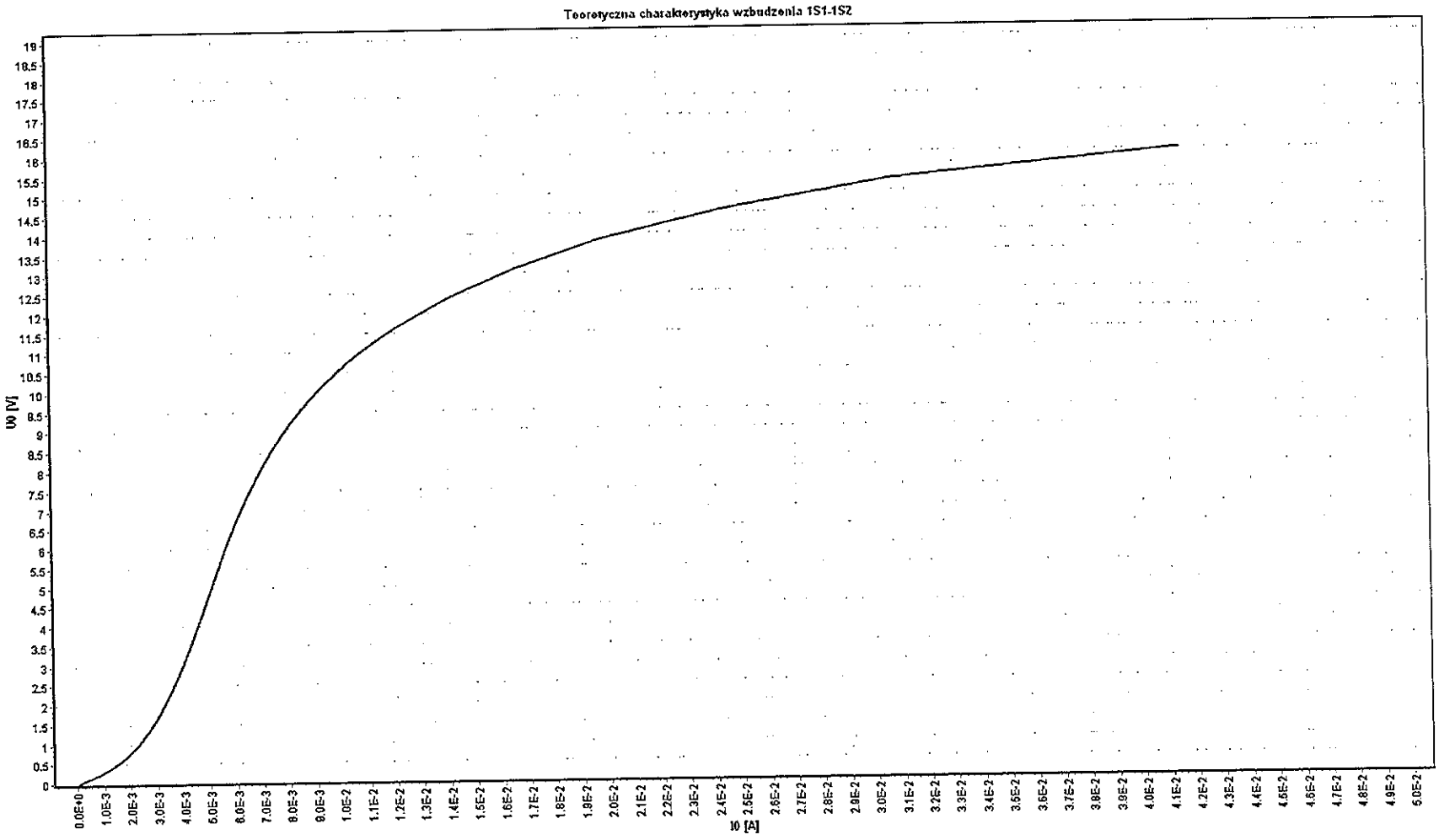
Accuracy ratings

Winding No.		Rated sec. voltage U_{sr}	Rated output S_r	Class	Total simult. output	Thermal limiting output	No. of terminal box	Cover for sealing
I	(1a - 1n)	100 : √3 V	15 VA	0,2	60 VA	1000 VA	1	-
II	(2a - 2n)	100 : √3 V	15 VA	0,2	60 VA	1000 VA	1	-
III	(3a - 3n)	100 : √3 V	30 VA	1/3P	60 VA	1000 VA	1	-
IV	(da - dn)	100 : 3 V	30 VA	3P	90 VA	450 VA	1	-

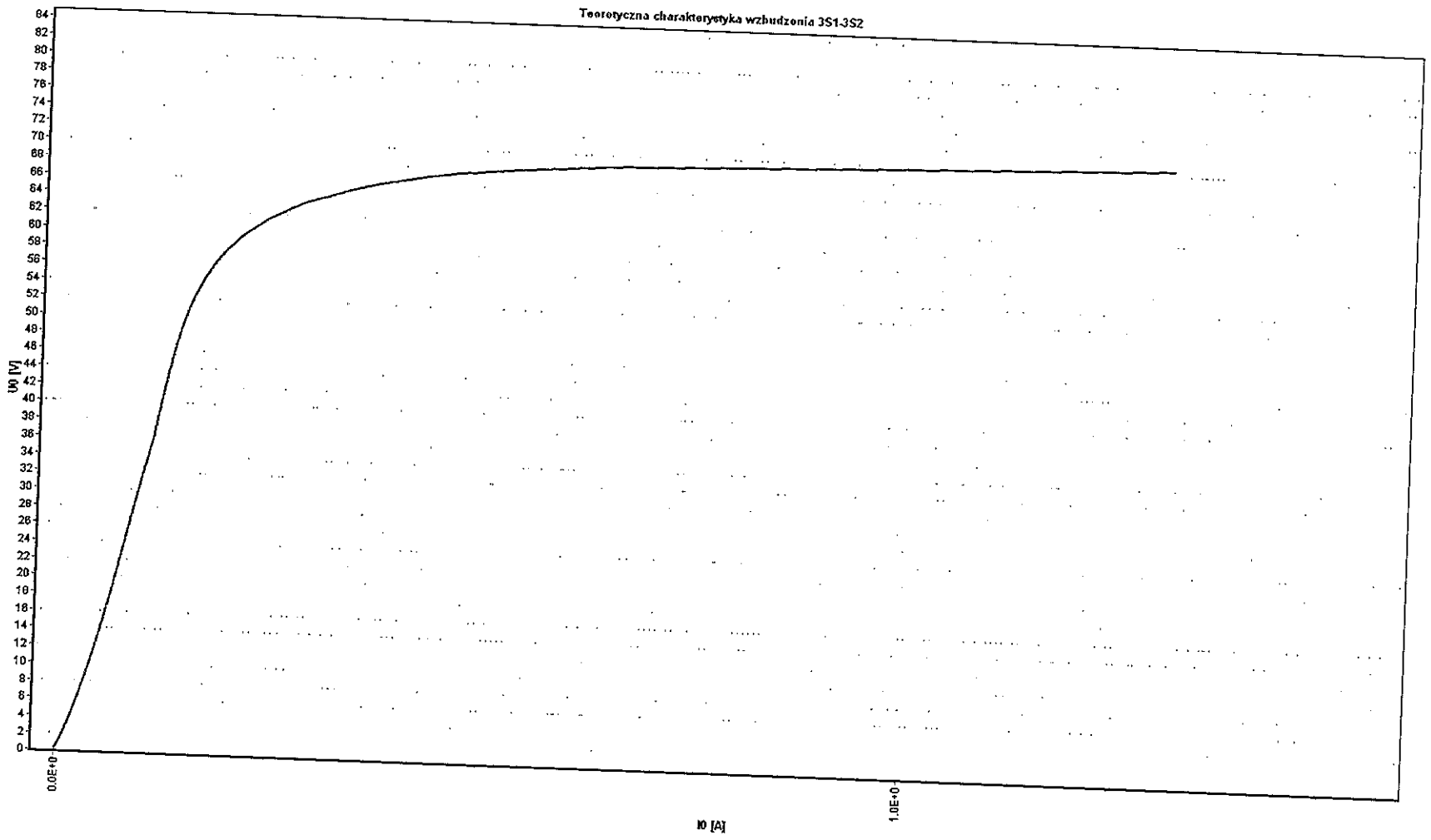
Product data		
Dimension drawing		2GKK614717A0598;rev.A
Rating plate language		Bulgarian
Insulator type / colour		Porcelain / brown
Minimum creepage distance	mm	4495
Minimum arcing distance	mm	1190
Primary terminal type		Al flat pad 100x120 T=20 mm; 4xD=14/50x50mm
Earthing terminals type		2xø14/50-60mm
Voltage secondary terminals type		Phoenix rail terminal blocks; spring connection, type ST 10
Current secondary terminals type		Phoenix rail terminal blocks
Cable glands – terminal box No. 1		without cable glands;
Withstand test load on primary terminal FR	(Static/Dyn)N	3600/5000
Painting (colour)		
- Housing above insulator		Not painted
- Housing below insulator		Not painted
Total weight	kg	590
Weight of oil	kg	185
Insulating oil type		Nynas Nytro 10XN – Inhibited mineral insulating oil acc. to IEC 60296
Packing		Horizontal - wooden base
Shipping weight	kg/unit	700
Shipping dimensions	cm x cm x cm/unit	291x101x101
Shipping volume	m3/unit	3

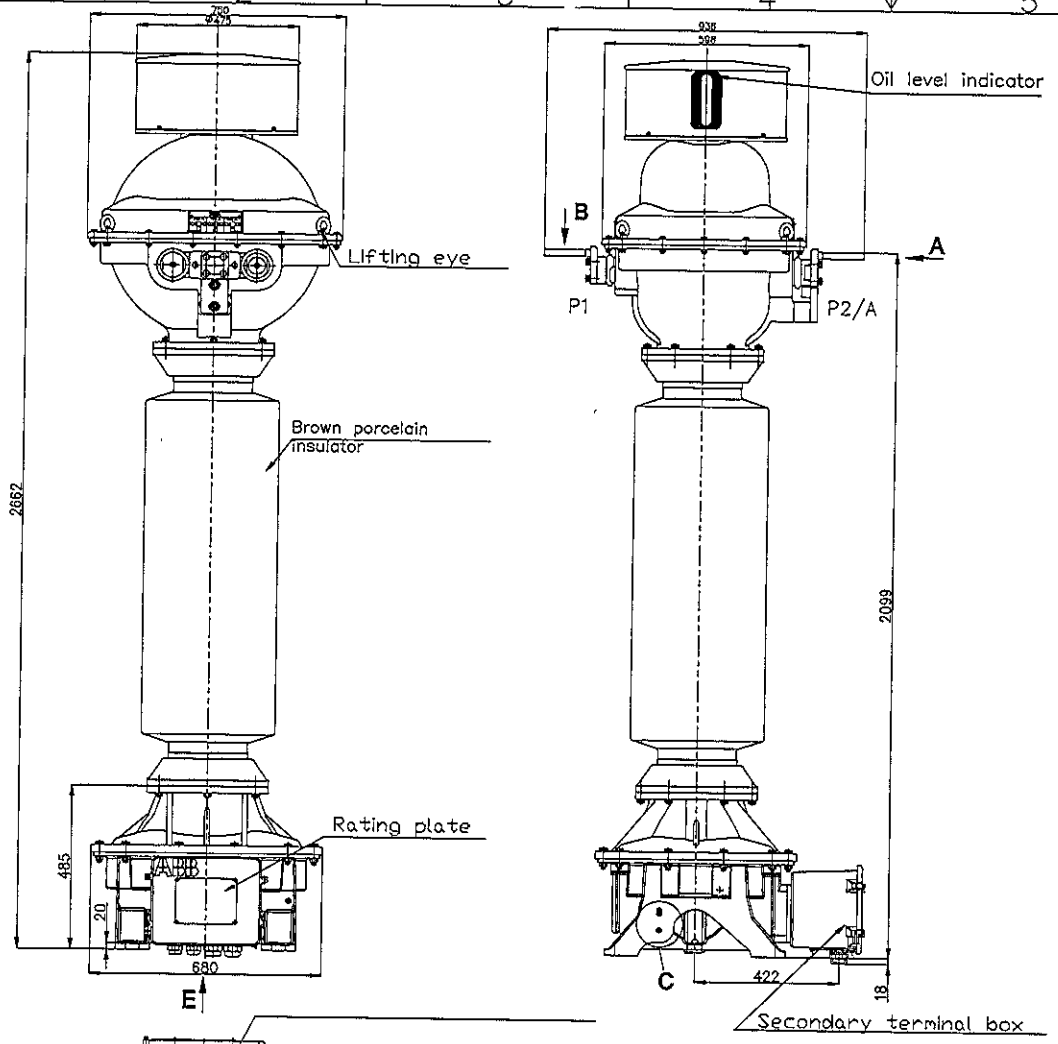
KU598/17

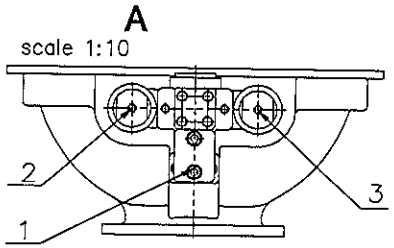
1S1-1S2 = 2S1-2S2

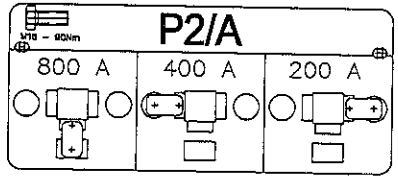


3S1-3S2 = 4S1-4S2



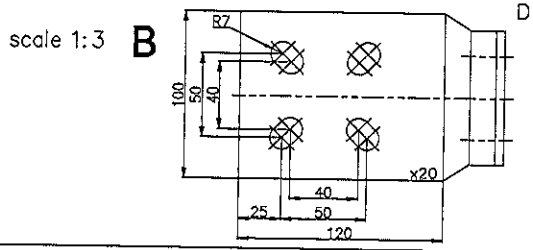




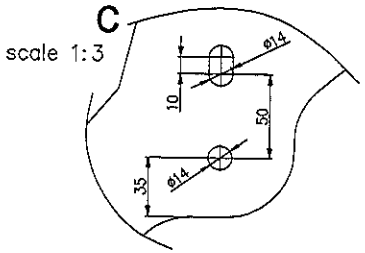


Flat terminals – Aluminium alloy

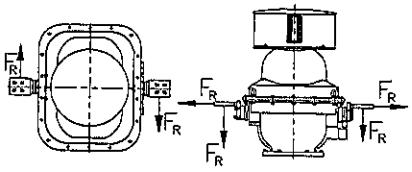
DIN 46206–3 F1



Earthing terminals



Mechanical load



Maximum operating voltage	(kV)	123
Total weight	(kg)	590
Insulating oil amount	(kg)	185
Wind pressure surface	(m^2)	1,03
Minimum creepage distance	(mm)	4495

Mechanical load:

F_R – Static load	(kN)	3,6
F_R – Dynamic load	(kN)	5,0

Standard IEC 61869–4

Comments
–

Order

Scale 1:15 | Units mm | Format A3

Prepared 22.06.2017 P.Mikulski

Based on –

Reviewed

Responsible department PGHV/PLABB/IT/TS

Approved 22.06.2017 J.Duzdowski

Document kind Drawing

Title: Dimensional drawing Combined instrument transformer PVA 123a

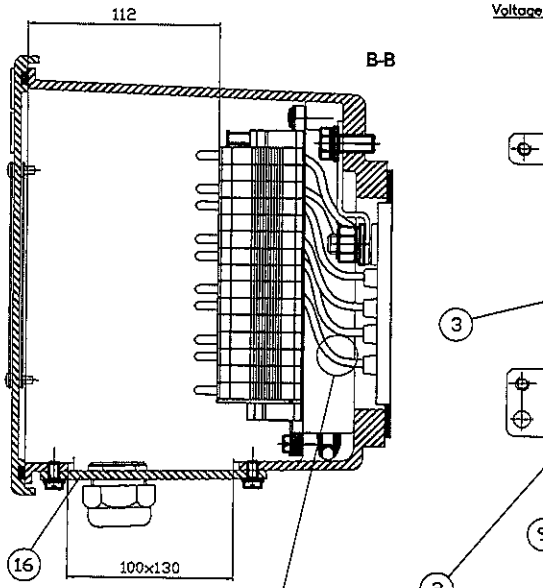
Language EN

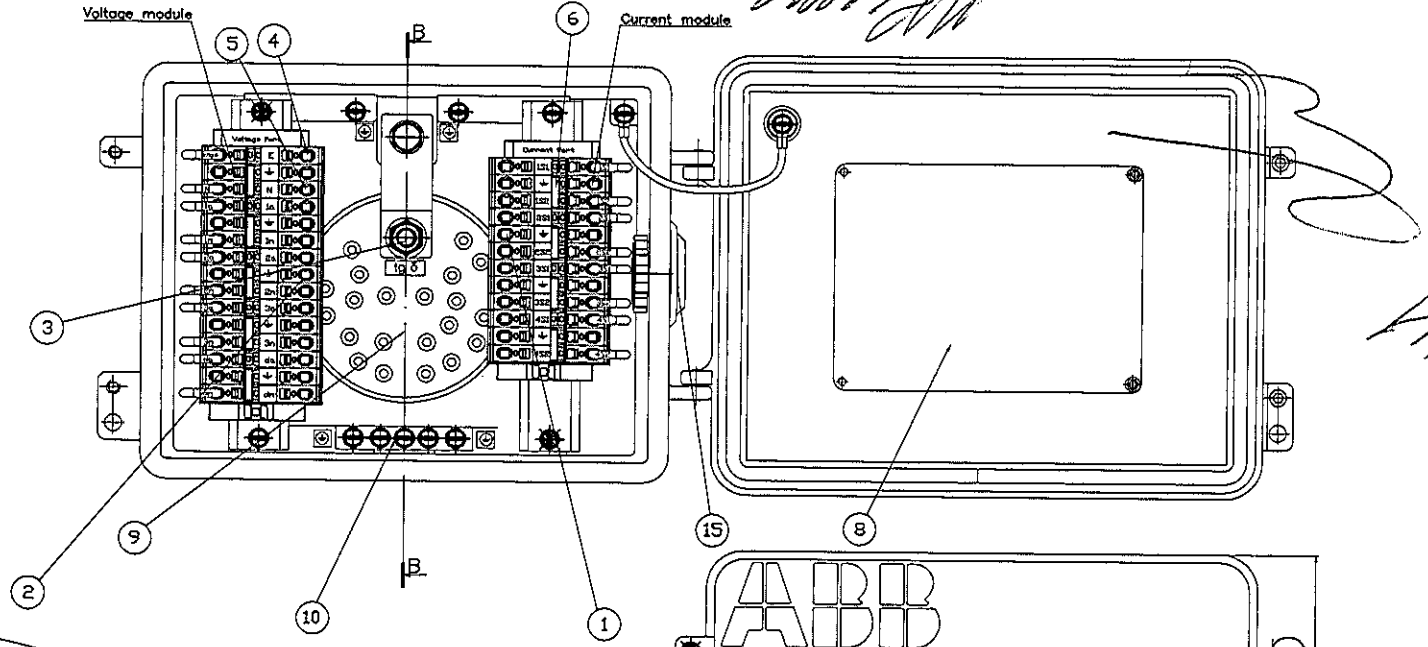
Page 1

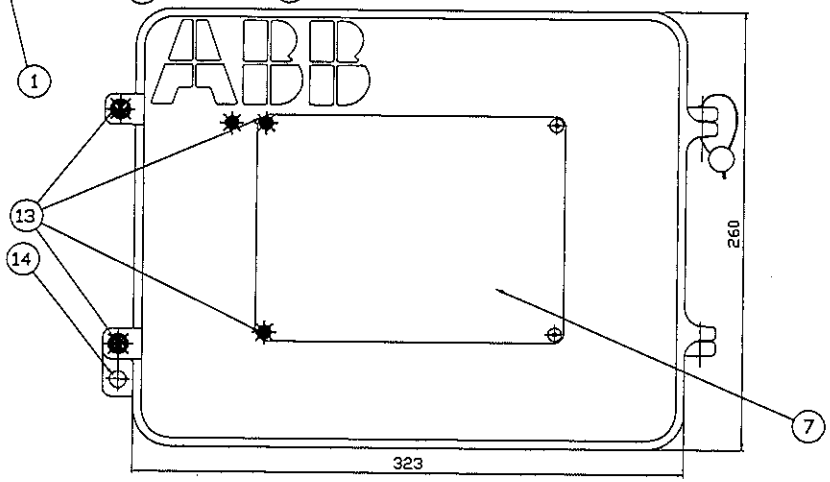
Revision A

ABB Technology Ltd

Document id. 2GKK614717A0598







As protection against short–circuit of voltage module secondary circuits are equipped with cross–section reduced "breaking points" made of copper wire Ø 1.2 mm; These "points" are located at: 1a, 2a, 3a, 4a, da cable outlets.

1. Current secondary terminals Phoenix ST–10
2. Voltage secondary terminals Phoenix ST–10
3. Current coil screen terminal "tg δ" [during normal operation it is earthed with jumper]
4. Voltage coil screen terminal "E/tg δ" [during normal operation it is earthed with plug–in bridge]
5. Voltage coil primary winding terminal "N" [during normal operation it is earthed with plug–in bridge]
6. Earthing jumper [crosswise plug–in bridge]
7. Rating plate
8. Schematic diagram plate
9. Resin bushing
10. Earthing rail
11. ———————————————
12. ———————————————
13. Screws used for sealing of terminal box
14. Locking [for padlock]
15. Ventilation valve
16. Cable panel [detachable]

Dimensions are given in mm.

Prepared V.Kundelski	Date 22.06.2017	Replacement of	Scale 1:3	Size A3
Modified by	Date	Responsible department PGHV	Title: Secondary terminal box of combined instrument transformer	
Approved by P. Mikulski	Date 22.06.2017	Take over department		Language EN
Revision A				Sheet no. 1
ABB	ABB Sp. z o.o. Power Products		Document no. 2GKK714317A0598	No. Shts. 1

Комбиниран измервателен трансформатор

Тип	PVA 123a	Сериен №	2GGKKnnnnnnn	Производство година	уууу
Изолационно ниво	123/230/550 kV	Стандарт	IEC 61869-4	Темп.	-40/40 °C
f_R	50 Hz	F	3,6 kN	F_V	1.5/30s
Клас изолация	A				
Транспортиране	Pionowy/Poziomy			U_e	<0,375 mV/kA

Токова Част

I_{th} 31,5-31,5-31,5 kA/1s I_{dyn} 80-80-80 kA

I_{cth} 240-480-960 A

1S1-1S2	200-400-800/5A 1-15VA cl.0,2S ext.120% FS5
2S1-2S2	200-400-800/5A 1-15VA cl.0,2S ext.120% FS5
3S1-3S2	200-400-800/5A 30VA cl.10P10
4S1-4S2	200-400-800/5A 30VA cl.10P10

Напреженова Част

A-N 110000/√3 V

1a-1n	100/√3V 15VA cl.0,2 1000VA$_{th}$
2a-2n	100/√3V 15VA cl.0,2 1000VA$_{th}$
3a-3n	100/√3V 30VA cl.1/3P 1000VA$_{th}$
da-dn	100/3V 30VA cl.3P 450VA$_{th}$

Тегло 590 kg Тегло на маслото 185 kg

Тип на маслото Nynas Nytro 10XN ISO-L-NTI0-2960130

ВНИМАНИЕ Херметично устройство, не отваряйте. Масло за проба се взема съгласно инструкциите на производителя.

135

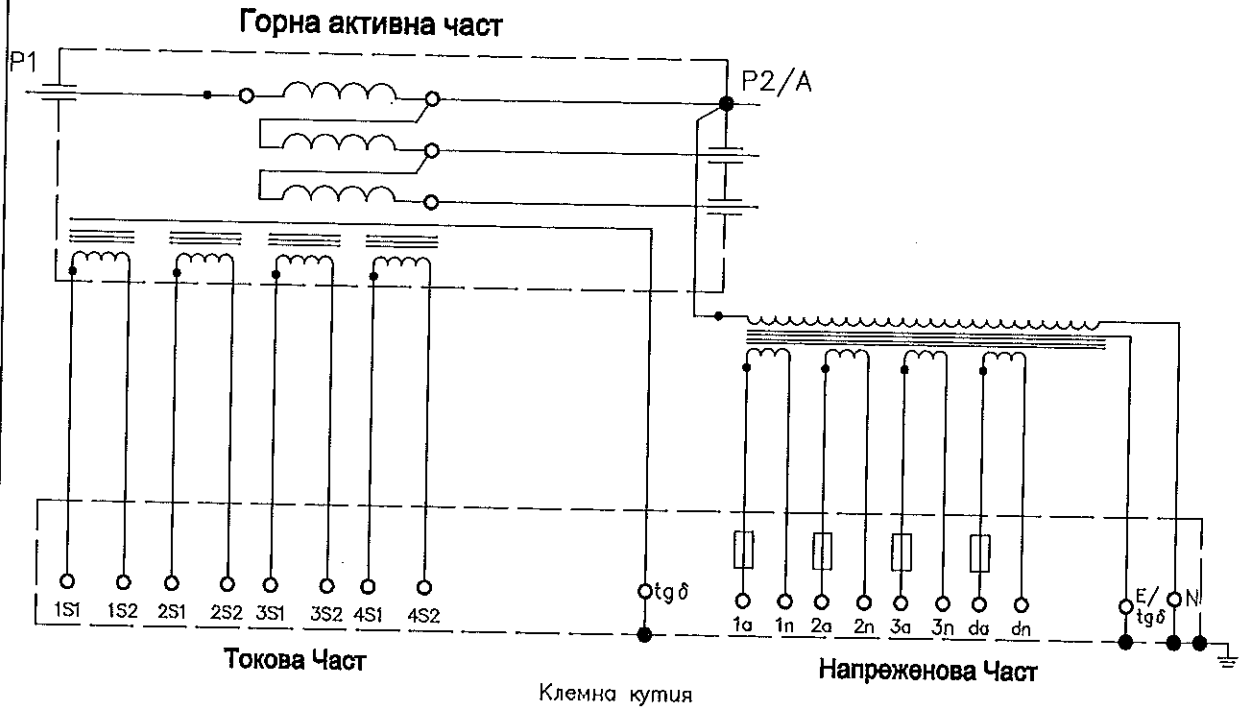
180

Serial number 2GGKKnnnnnnn
Production year yyyy = Actual year of production

Marking of the plate performed by laser engraving method.

Aluminium sheet: EN AW-5754(AlMg3) Material standard: EN 485-1/EN 573-3			Anodizing: ISO 7599 Layer thickness: 20µm		Black
Material:			Coating:		Colour:
Prepared by:	P.Mikulski	Date: 22.06.2017	Replacement of: ------	Application: ------	Page size: A4
Checked by:		Date:	Name of item:	Title: Rating plate	Language EN
Approved by:	J.Duzdowski	Date: 22.06.2017	Mass:		Sheet no. 1
Revision: A	Responsible department: PGHV	Take over department:	Scale: 1:1	Document no.: 2GKK714117P0598	No. Shts. 1

ABB Sp z o.o. Power Grids



Електрическа схема на измервателнит трансформатор

ВНИМАНИЕ!

1. ВИСОКО НАПРЕЖЕНИЕ ПРИ ОТВОРЕНИ ТОКОВИ ВТОРИЧНИ КЛЕМИ XS1 – XS2
2. ПО ВРЕМЕ НА РАБОТА НА ИЗМЕРВАТЕЛНИЯ ТРАНСФОРМАТОР КЛЕМИТЕ :N, E/tgδ, tgδ ТРЯБВА ДА БЪДЕ ЗАЗЕМЕНА
3. **СЛЕД СВЪРЗВАНЕ НА ТРЕТАТА НАМОТКА da - dn В СХЕМА ОТВОРЕН ТРИЪГЪЛНИК, ВЕРИГАТА СЕ ЗАЗЕМЯВА САМО В ЕДНА ТОЧКА**

135

180

Marking of the plate performed by laser engraving method.

Aluminium sheet: EN AW-5754(AlMg3) Material standard: EN 485-1/EN 573-3			Anodizing: ISO 7599 Layer thisckness: 20µm		Black
Material:			Coating: /		Colour:
Prepared by:	P.Mikulski	Date: 22.06.2017	Replacement of: - - - - - -	Application: - - - - - -	Page size: A4
Checked by:		Date:	Name of item:	Title: Diagram plate	
Approved by:	J.Duzdowski	Date: 22.06.2017	Mass:		Language EN
Revision: A	Responsible department: PGHV	Take over department:	Scale: 1:1	Document no.: 2GKK714217P0598	Sheet no. 1
ABB Sp z o.o. Power Grids					No. Shts. 1

79

ИНСТИТУТ ПО ЕНЕРГЕТИКА
ИНСТИТУТ ЗА ИЗСЛЕДВАНИЯ
ул. Мори 8, 01-330 Варшава
тел.: +48 22 34 51299
факс: +48 22 836 63 63
instytut.energetyki@ien.com.pl

AC 117

СЕРТИФИКАТ ЗА СЪОТВЕТСТВИЕ

№ 016/2017
Издание № 01 от 10.02.2017

Име и адрес на притежателя на сертификата:	**ABB Sp. z o.o. ул. Зеганска 1 04-713 Варшава, Полша**
Име на продукта:	**Комбиниран трансформатор**
Тип:	**PVA 123a**
Производител:	**ABB Sp. z o.o. клон в Пшашниш ул. Лешно 59 06-300 Пшашниш, Полша**
Параметри и приложение на продукта:	**Съгласно Приложение Комбиниран трансформатор, предназначен за открит монтаж в електрически мрежи с най-високо напрежение 126 kV**
Продуктът отговаря на изискванията на:	**IEC 61869-1:2007 (изд. 1.0) и IEC 61869-4:2013 (изд. 1.0)**
Според доклада, изработен от:	**Институт по енергетика**
Номер на доклада за оценка:	**DZC/24c/E/2017**
Период на валидност:	**от 10-ти Февруари 2017 г. до10-ти Февруари 2020**

Правото на използване на сертификата за съответствие, в рамките на срока на валидност, важи само за:

- **тези копия, които отговарят на изискванията, посочени по-горе и имат същите характеристики (параметри), като модела/продукта представен за изпитания,**
- **Притежателя на сертификата или негови представители**

Приложението към сертификата за съответствие, включва списъка с доказани параметри.
Брой приложения: 1

Системата на сертификация на продукти 1a (съгл. PN-EN ISO/IEC 17067&2014-01)
(параметри на продукта потвърдени от типови изпитания)

Директор на Института по енергетика
проф. др. инж. Томаш Галка

Варшава, 10.02.2017 г.

AC 117

ПРИЛОЖЕНИ КЪМ СЕРТИФИКАТ ЗА СЪОТВЕТСТВИЕ № 016/2017

Издание № 01 от 10.02.2017

СПИСЪК НА ДОКАЗАНИТЕ ПАРАМЕТРИ

Комбиниран трансформатор тип PVA 123a	
Макс. напрежение на комб. трансформатор [U_m]	≤ 126 kV
Номинална честота [f_R]	50 Hz
Номинално изолационно ниво	AC 230 kV / LI 550 kV
Изпитание на издръжливост на статично натоварване F_R	3600 N
Външна изолация – път на утечка на изолатора: - Порцеланов - Композитен	 3640 mm – 4495 mm 3800 mm – 4495 mm
Степен на защита на вторичната клемна кутия	IP55
Степен на защита срещу механично мъздеиствие на обшивката [1]	IK07
Възможност за извършване на вътрешна дъга 40 kA / 0.1 s	Защитен етап 1, клас на защита 1
Токова част	
Номинален първичен ток [I_{pr}]	50 A ÷ 3000 A
Номинален вторичен ток [I_{sr}]	1 A ; 5 A
Разширен токов обхват	≤ 200%
Номинален продължителен ток на термична устойчивост [I_{cth}]	≤ 3600 A
Номинален ток на термична устойчивост [I_{th}], 1s	≤ 63 kA
Номинален ток на термична устойчивост [I_{th}], 3s	≤ 40 kA
Номинален ток на динамична устойчивост [I_{dyn}]	≤ 158 kA
Номинална мощност на намотките за мерене - Номинална мощност S_r - Клас на точност - FS	 1 VA – 200 VA 0,1; 0,2; 0,2S; 0,5; 0,5S; 1; 3; 5 FS5; FS10
Номинална мощност на намотките за защита - Номинална мощност S_r - Клас на точност - AFL	 1 VA – 200 VA 5P, 10P, 5PR, 10PR, PX, PXR,TPX, TPY, TPZ ≤ 60
Клас на точност на намотките за мерене (кл.)	
Клас на точност на намотките за защита (кл.)	
Напреженова част	
Номинално първично напрежение [U_{pr}]	≤ 110: √3 kV
Номинално вторично напрежение [U_{sr}]	100: √3 V; 110: √3 V
Клас на точност на намотките за мерене и защита	0.1; 0.2; 0.5; 1; 3; 3P; 6P
Номинална мощност на намотките за мерене и за защита (Sr)	≤ 1000 VA
Номинално напрежение на остатъчна намотка [$U_{sr(da-dn)}$]	100 V; 110 V; 100:3 V; 110:3 V
Клас на точност на остатъчна намотка (кл.)	0.5; 1; 3; 3P; 6P
Номинална мощност остатъчна намотка (Sr)	≤ 450 VA
Номинален напреженов фактор Fv / време на действие	1.5/30 s; 1.9/30 s; 1.9/8h
Обща номинална мощност [$S_{\Sigma th}$]	4000 VA

ЗАБЕЛЕЖКА:

[1] Не е приложимо за порцеланови изолатори.

INSTYTUT ENERGETYKI
Research Institute
01-330 Warszawa, ul. Mory 8
tel. +48 22 34 51 299
fax. +48 22 836 63 63
instytut.energetyki@ien.com.pl

AC 117

CERTIFICATE OF CONFORMITY

No. 016/2017

Issue No. 01 of 2017.02.10

Name and address of the Certificate Holder:	**ABB Sp. z o.o. 1 Żegańska Str. 04-713 Warsaw Poland**
Name of the product:	**Combined transformer**
Type:	**PVA123a**
Manufacturer:	**ABB Sp. z o.o. Branch Office in Przasnysz 59 Leszno Str. 06-300 Przasnysz Poland**
Parameters and application of the product:	**According to appendix Outdoor combined transformer assigned for power systems with highest voltage up to 126 kV**
The product meets the requirements of:	**IEC 61869-1:2007 (ed. 1.0) and IEC 61869-4:2013 (ed. 1.0)**
According to the evaluation report made by:	**Instytut Energetyki**
Number of the evaluation report:	**DZC/24c/E/2017**
Period of validity:	**from 10th of February 2017 until 10th of February 2020**

The right to use the certificate of conformity within its validity period applies only to:

- **these copies that meet the requirements specified above and have the same characteristics (parameters) as the model / product samples submitted for testing,**
- **certificate owner or his authorized representative.**

The list of evidenced parameters is included in the appendices to the certificate of conformity.
Number of appendices: 1

THE SYSTEM OF PRODUCT CERTIFICATION 1a (PN-EN ISO/IEC 17067:2014-01)
(product parameters confirmed by type test)

DIRECTOR OF
INSTYTUT ENERGETYKI
dr hab. inż. Tomasz Gałka, prof. IEn

Warsaw, 2017.02.10

#3

AC 117

APPENDIX TO CERTIFICATE OF CONFORMITY
No. 016/2017
Issue No. 01 of 2017.02.10

LIST OF EVIDENCED PARAMETERS

Combined transformer type PVA123a	
Highest voltage for equipment U_m	≤ 126 kV
Rated frequency f_R	50 Hz
Rated insulation level	AC 230 kV / LI 550 kV
Static withstand test load F_R	3600 N
External insulation – creepage distance of insulators: • porcelain • composite	 3640 mm ÷ 4495 mm 3800 mm ÷ 4495 mm
Degree of protection of secondary terminals enclosure	IP55
Degree of protection against mechanical impact of enclosure [1]	IK07
Ability to withstand an internal arc of 40 kA / 0,1 s	Protection stage 1, protection class I
Current part	
Rated primary current I_{pr}	50 A ÷ 3000 A
Rated secondary current I_{sr}	1 A; 5 A
Extended current rating	≤ 200%
Rated continuous thermal current I_{cth}	≤ 3600 A
Rated short-time thermal current I_{th} during 1 s	≤ 63 kA
Rated short-time thermal current I_{th} during 3 s	≤ 40 kA
Rated dynamic current I_{dyn}	≤ 158 kA
Parameters of measurement cores • rated power S_r • accuracy class • FS	 1 ÷ 200 VA 0,1; 0,2S; 0,2; 0,5S; 0,5; 1; 3; 5 FS5; FS10
Parameters of protection cores • rated power S_r • accuracy class • ALF	 1 ÷ 200 VA 5P; 10P; 5PR; 10PR; PX; PXR; TPX; TPY; TPZ ≤ 60
Voltage part	
Rated primary voltage U_{Pr}	≤ 110/√3 kV
Rated secondary voltage U_{sr}	100/√3 V; 110/√3 V;
Accuracy class of measurement and protection windings	0,1; 0,2; 0,5; 1; 3; 3P; 6P
Rated output of measurement and protection windings S_r	≤ 1000 VA
Rated voltage of residual voltage winding $U_{sr(da-dn)}$	100/3 V; 110/3 V; 100 V; 110 V
Accuracy class of residual voltage winding	0,5; 1; 3; 3P; 6P
Rated output of residual voltage winding S_r	≤ 450 VA
Rated voltage factor F_V / time	1,5/30 s; 1,9/30 s; 1,9/8 h
Total thermal limiting output S_{Zth}	4 000 VA

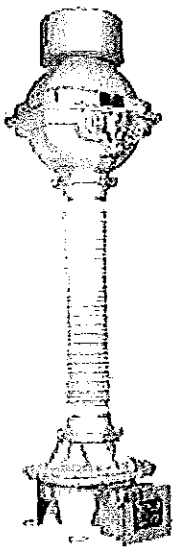
NOTES:

[1] Does not apply to porcelain insulators.

High Voltage Products

Combined instrument transformer PVA 123a/PVA 145a

Installation and operation manual



Your safety first!

This is the reason why our manual begins with the following guidelines:

- Use the transformer for its intended purpose.
- Follow the technical data given on the rating plate and in the specification.
- To facilitate and ensure high quality standards, the installation should be carried out by specially trained personnel or supervised by the ABB service department.
- Operations have to be carried out by specially trained electricians who are familiar with this manual.
- Observing the standards (DIN VDE/IEC), the local H&S regulations and the requirements of the local electric authority is recommended.
- The transformer operation mode should be changed in accordance with the instructions in this manual.
- All documentation should be available to all persons involved in installation, maintenance and operation.
- The involved personnel shall bear all responsibility for all aspects related to the operational safety as stated in EN 50110 (VDE 0105) and national regulations.
- Observe the safety rules, which are compliant with EN 50110 (VDE 0105). This standard regards ensuring a no-voltage status at the site for works to be carried out on the transformer.

If you have any questions regarding the information contained in this manual, our organisation will provide the necessary information.

Power and productivity
for a better world™

ABB

45

Important information

This manual is intended to explain the product operation principle and product installation procedures.

NOTE:
All descriptions contained in this document are for general information only and do not make consideration for specific design requirements. Please refer to the exact design documentation while connecting the device.

Operating the device without first reading the manual may entail property damage, serious injury or death. The person responsible for the installation of the device should read this manual and follow the recommendations contained herein.

For your own safety:
- Make sure that all installation, service and maintenance works are carried by our professionals.
- Make sure that all applicable regulations will be preserved during all the work phases (installation, service, maintenance).
- Make sure that the guidelines contained in this manual are followed.

Basic guidelines for this manual.

Read the relevant chapters of this manual to provide adequate work.

Chapters in this manual are marked according to their meaning.

For the purposes of this manual, failure to follow the instructions concerning the dangers could result in death, serious injury and damage of equipment.

Table of contents

Combined instrument transformer PVA 123a and PVA 145a

1. Introduction

This manual is valid for the combined instrument transformer type PVA 123a / PVA 145a. The instrument transformers are used for feeding the measurement and protection systems in power networks of 123 kV or 145 kV highest system voltage networks (or lower voltage) (regarding the highest phase-to-phase voltage effective value) and 50 Hz frequency. They are designed for operation in power systems with earthed or insulated neutral points as well as in compensated networks.

2. Transformer delivery

As standard method, the transformers are delivered in a unit packaging, in horizontal position on a transport bed.
The delivered transformers are fully assembled, tested and ready for direct use. Product test protocols are delivered together with the transformers.
Immediately after the delivery, check the transformer for any transport damage. Check the transport packaging. A damaged packaging may indicate a careless handling of the transformer. Then, check the transformer. Special attention should be paid to possible damage of sheds and binder at insulator flanges, the transformer tightness and the correct oil level indication in the device.
Make sure that technical parameters given on the rating plate are in compliance with the parameters written in the purchase order. Any damage or other defects should be immediately notified to the manufacturer, and, if appropriate, the carrier. Photos will be helpful for any damage assessment.

3. Transport, unpacking, erection

Transformers may be transported in either vertical or horizontal position.
In the case of horizontal transport, transformers should be laid on a special bed in accordance with transport manual No 2GKK614136. Before laying the transformer, restrain its compensation bellows by inserting a flexible disc made of, for example, polyurethane foam, under the bellows cover. During horizontal transportation, the compensation bellows cannot have any freedom of movement due to its flexibility and possibility of damage. This manual contains all the information regarding the unpacking and erecting the transformer after delivery.

The flexible disc locking the compensation bellows should be removed once the transformer has been erected and stands upright.
In vertical transportation, due to the high centre of gravity position, the transformer should be transported on feet or platforms that enlarge the base size. Those elements shall be removed before locating the transformer on its support structure at the site. Transformers should be lifted with a crane of min. 1,000 kg lifting capacity using four slings of equal length (min. 3 m), min. 200 kg lifting capacity each. Hooks should be inserted in the lifting eyes on the transformer head.

4. Storage

Transformers should be stored on a level and hardened surface, preferably in the original packaging. Before a long-term storage, corrosion protection for the contact surfaces is recommended. Under unfavourable weather, during storage in horizontal position, water can condense inside the terminal box and induce corrosion. In such a case, take appropriate countermeasures.

Transformers can be stored outdoor for up to two years. If this period is exceeded, it is recommended to put transformers in a well-ventilated room or under a roof, and to insert silica gel or another moisture absorbent into the terminal boxes.

5. Installation

The support structure should be flat and horizontal. The level correction can be carried out using shims between the transformer and the support structure. Item 3 should be followed while erecting/lifting the transformer. Use bolts of correct size for fastening the transformer to the support structure. The support structure and fastening elements are not included in the delivery.
The transformer should be placed in the vertical position at least 24 h before energising.

5.1. Earthing terminals

Two earthing terminals are located diagonally in the bottom tank. The contact surface should be thoroughly cleaned from oxides, so it becomes uniform and smooth. Additionally, a thin layer of conducting grease can be applied in order to improve contact. The earthing should be connected using stainless bolts.

5.2. Primary terminals

Primary terminals of the transformer, marked P1 and P2/A, are placed on the opposite sides of the head. The transformer can be switched on the primary side as well as on the secondary side. **A metal jumper is used for current range switching on the primary side.** The P2 terminal of the current module corresponding to the highest current range is connected with the A terminal of the voltage module.

The primary winding should be switched to the required current range by locating a moving jumper in the respective position. Fasten the jumper with two M16 bolts.

Note:
Jumper tightening torque 90 Nm

Current range jumper positions are shown on the rating plate.

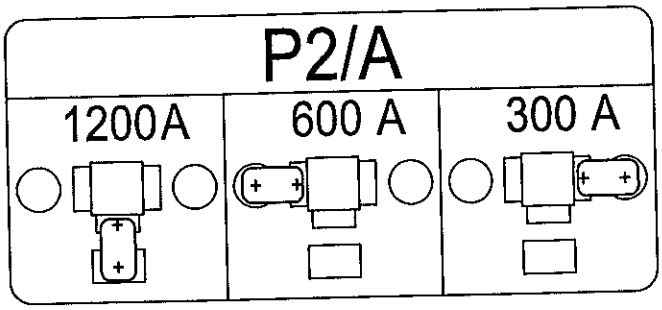


Fig. 1. Example: Rating plate with current range jumper positions shown.

All contact surfaces of the primary terminals should be flat and cleaned from the oxide layer before connecting. In the case of copper terminals, using extraction naphtha is usually sufficient. Conducting grease can be applied in order to improve contact. Use M12 bolts (stainless steel is recommended) to connect wire lugs with the terminals. Incorrect joints in the primary connections could induce the transformer to overheat, which can cause failures. Primary connections should be made in such a way so as to minimise mechanical static loads of the transformer terminals. The maximum short-term (60 seconds) allowable static load for each transformer terminal is 3,600 N in any direction. Only one terminal may be loaded with such force at a time. In the standard operation mode, the sum of all loads on the primary terminals should not exceed 50% of that value.

5.3. Secondary terminals

Secondary windings are connected to terminal blocks in the terminal box on the bottom tank of the transformer. Standard solution: Phoenix Contact ST spring connectors with terminals for up to 10 mm^2 or up to 6 mm^2 wire size. Each terminal is described in compliance with the winding markings given on the rating and schematic diagram plates.

Yellow-green terminals (with the earthing mark) are intended for earthing the secondary windings with the use of push-in crosswise bridges. The crosswise bridge can be removed with a screwdriver, by inserting it in the slit and levering.

Optionally, the connectors to which metering windings are led, may be adapted for sealing with use of a transparent cover.

The current coil screen is led out with a pin through the resin bushing (tg δ terminal).

The terminal box also includes: the voltage coil screen (E) terminal, the voltage coil primary winding (N) terminal.

The rating plate is located on the external side of the door, the schematic diagram plate is located inside. The plate with holes for the secondary circuit wire glands is located on the terminal box bottom wall. Standard solution includes: for current module – two M40 glands for Φ19 mm–Φ 28 mm choking range; for voltage module – two M32 glands for Φ 11 mm–Φ 21 mm choking range. An example of a terminal box for secondary windings is shown in Figure 2.

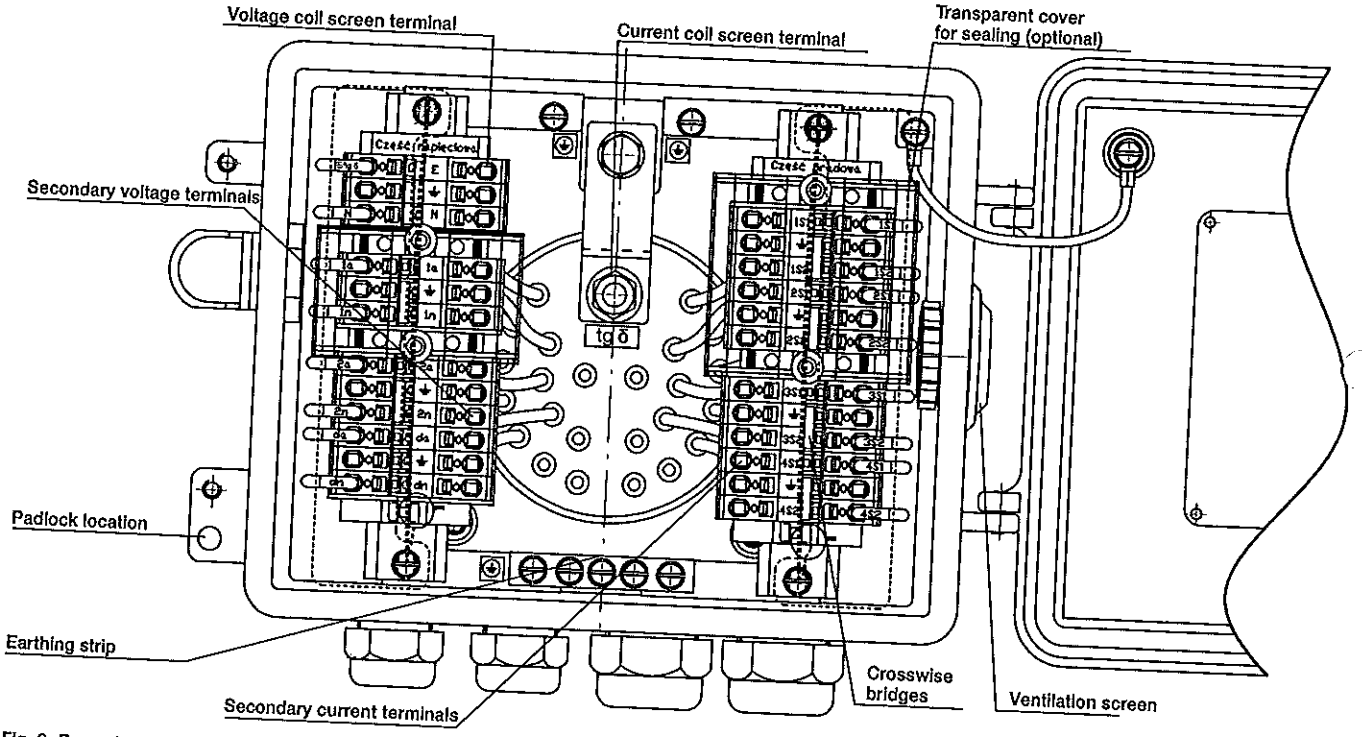


Fig. 2. Example of a terminal box

5.3.1. Current module terminals

Connect the external circuits to the current module secondary terminals as shown on the schematic diagram plate and in the design documentation.

In the standard operation mode, the current coil screen terminal (tg δ) should be earthed with a jumper.

Terminals in the terminal box are arranged so that, when using crosswise bridges, earthing is possible for any secondary terminal of a given winding.

Transformer with taps on the secondary side:

In the case of a transformer with the secondary side switching option, the unused taps must remain unearthed. Only connect the earthing to one of the terminals, which are connected with the external circuit for the selected secondary winding. Unused windings:

The first and the last terminals (for the secondary side switching option: those terminals correspond to the highest transformer ratio) of the unused secondary winding should be connected with each other (minimum wire size: 6 mm2) and earthed with a crosswise bridge. Each unused winding should be earthed in one point only.

Note:

Opening the current module secondary circuit in the standard operation mode causes high voltage on terminals of this circuit. This is hazardous to the staff and may damage the transformer insulation.

5.3.2. Voltage module terminals

Connect the external circuits to the current module secondary terminals as shown on the schematic diagram plate and in the design documentation.

In the standard operation mode, the screen terminal (E) and the primary winding terminal (N) for the voltage coil should be earthed using crosswise bridges to the adjacent earthing terminal. Terminals in the terminal box are arranged so that, when using crosswise bridges, earthing is possible for any secondary terminal of a given winding. The unused winding of the voltage part shall remain open; its end marked "..n" should be earthed using a crosswise bridge.

All the voltage module secondary windings include narrow sections made of copper wire (Cu-ETP), 1.2 mm diameter and 50

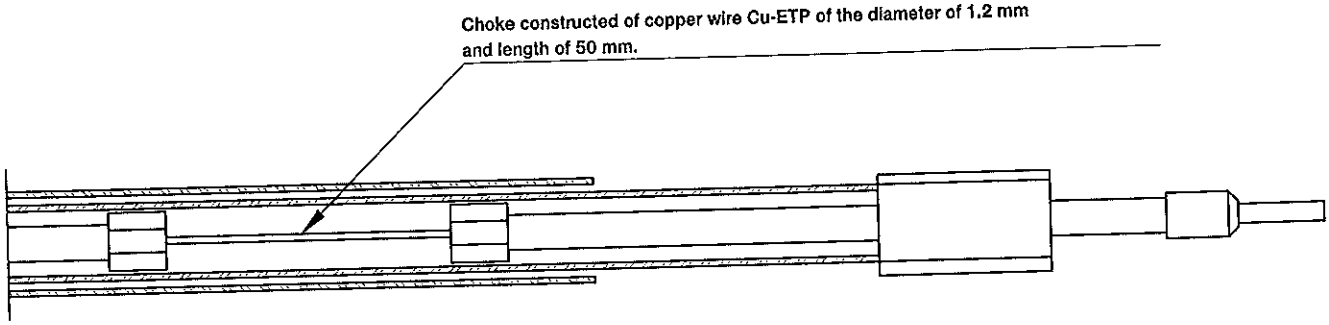


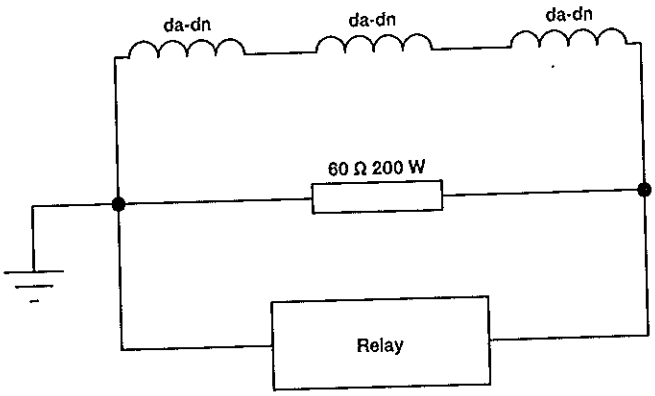
Fig. 3. Narrow section of the voltage module secondary winding

mm length (Fig. 3). Those narrow sections are located outside- of the resin bushing downstream of the terminal block located in the transformer box.
Fig. 3. Narrow section of the voltage module secondary winding
The narrow sections protect the transformer against damage in the case of secondary terminals short-circuit. This solution is sufficient as the transformer protection within the short distance to the nearest protection device. Additional fuses in the transformer terminal box are not necessary.
If a short-circuit occurred and this protection was blown, the copper wire must be replaced.

Note:
Secondary terminals of the voltage module must never be short-circuited.
The 'da-dn' residual voltage windings used to connect three transformers in the open delta configuration should be earthed in one point only (in one of the three transformers). Earthing of those "da-dn" windings connected in more than one point will cause short-circuit and may damage the transformer.

5.4. Ferroresonance

The PVA 123a / PVA 145a combined transformers are ferroresonance-proof in a wide range of earthing and control capacitor capacitances as used in circuit breakers. However, in the case of networks where ferroresonance occurred before, or for particularly sensitive network configurations (e.g. with long cable lines), it is recommended to use an additional damping resistor of 50-60 Ohm/200 W in the open delta circuit of three da-dn transformer windings (the values are valid for the resistor voltage drop not exceeding 100 V during the earthing short-circuit.)



Resistor connection in the open delta circuit

6. Bolt tightening torques

M16 bolts for current jumper	90Nm
M112 bolts for primary terminals	60 Nm
Bolts fastening the transformer to the support structure	280 Nm

7. Operation and maintenance

Note:
Combined transformers are HV devices, hence appropriate safety precautions shall be observed during their operation.
The transformer measurement range is only guaranteed within the operating range determined based on the ratings in compliance with the respective standards. The standard number is shown on the transformer rating plate. The measurement range of the transformer is also shown in the product test protocol as delivered with the transformer. The measurement parameters are not guaranteed off that range.

7.1. Maintenance

The combined transformers do not require any special maintenance procedures. Visual inspection is usually sufficient. The check-list is included at the end of this manual.

Visual inspection

The visual inspection should include the checking of:

- position of the oil level indicator,
- transformer tightness,
- absence of mechanical damage,
- insulator and binder condition at the insulator/flange joints. From time to time, the primary terminals torque should be checked.

The transformer tightness is of a particular importance as moisture could penetrate the device in the case of oil leaks.

Oil level indicator:

Changes of the oil level indicator position depend on oil temperature in the transformer. The indicator should remain within the green field range. Indication of the upper or bottom red field means an incorrect transformer operation. In such a case, the transformer should be put out of service, and the manufacturer should be contacted.

An expansion bellows (1) (stainless steel) is mounted on the head lid. The bellows compensates for the oil thermal expansion inside the transformer. The oil level indicator (2) is placed on the upper surface of the bellows. The bellows is seated in a metal housing (3) equipped with a window (4). The cover removal does not result in unsealing of the transformer. The entire compensation system is shown in Fig. 5.

Note:

Oil level indication for all three transformers installed on adjacent phases should be almost equal.

Measurement of the dielectric loss factor tg δ:

It is recommended to perform such measurement separately for each module: voltage module, and current module. In each of these modules, respective terminals are marked with the symbols: tg δ and E. Those terminals are used for connecting the measuring bridge only. Remember to earth them after the measurement. Typically, the test voltage should be 10 kV RMS and should be applied across the primary terminals and earth.

Oil sampling:

Due to the fact that transformers are tight, they do not require oil level inspection on regular basis. Oil used in the transformer meets PN-EN 60296 requirements (IEC 60296).
Oil check is recommended after 15–20 years of operation or after a fault if any suspicion as to the transformer efficiency exists. Contact the manufacturer in order to obtain necessary instructions for the oil sampling procedure. Oil sampling without the manufacturer's permission during the guarantee period is the reason for guarantee cancellation.

7.2. Corrosion protection

External components of the transformer casing are made of corrosion-proof cast aluminium alloy. Casts can be unpainted or painted. Standard colours for the paint coat: light-grey (RAL 7035), grey-green (RAL 7033). The remaining metal parts, e.g. bolts, are made of stainless steel.

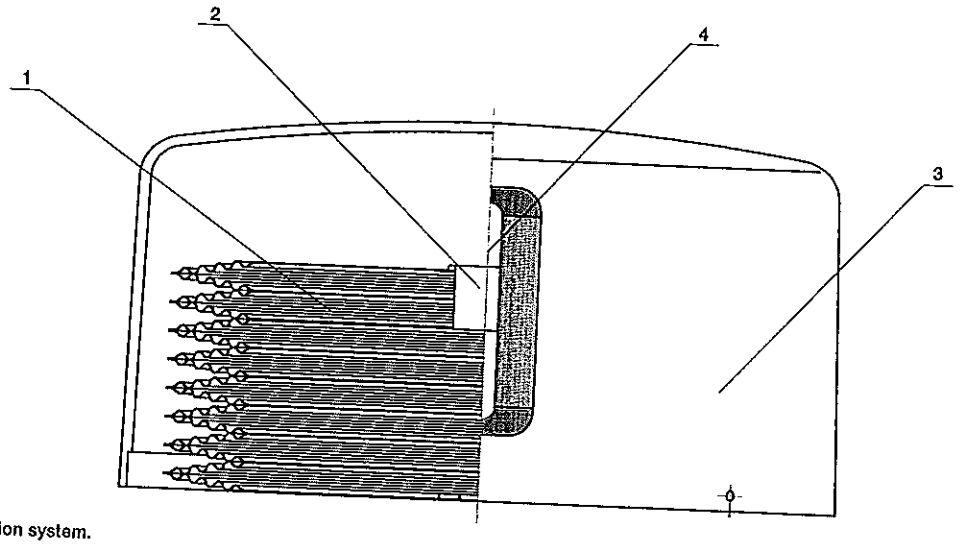
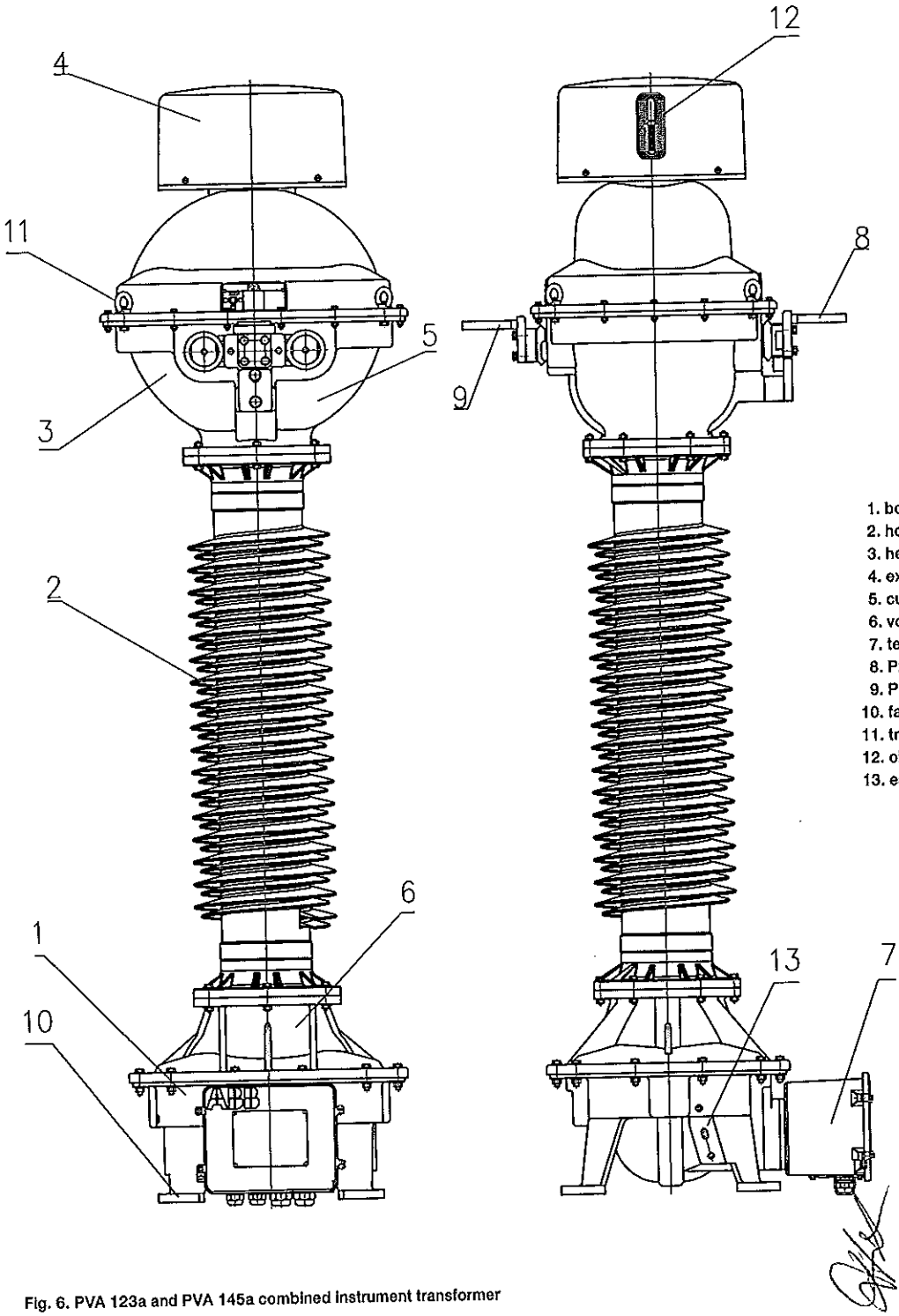


Fig. 5. Compensation system.

8. Transformer design

The PVA 123a / PVA 145a combined instrument transformer consists of: current module, and voltage module located in a common air-tight housing filled with transformer oil.

O-ring seals are made of NBR oil-resistant rubber.
Calibration results and markings (if any) for the measuring windings are shown on the transformer body and on the rating plate (if required).



1. bottom tank
2. hollow insulator
3. head
4. expansion bellows in housing
5. current module
6. voltage module
7. terminal box for secondary circuits
8. P2/A primary terminal
9. P1 primary terminal
10. fastening holes
11. transport and erection eyes
12. oil level indicator
13. earthing terminal

Fig. 6. PVA 123a and PVA 145a combined instrument transformer

93

9. Disposal

In the case of correct operation and no mechanical damage, the transformer should operate for more than 30 years. Once this period has expired or if operation is no longer required, it is recommended to dispose of the transformer.

Basic materials:

Item	Material	Quantity [kg]
1	Copper (Cu – ETP)	30
2	Aluminium alloy AC-Al Si10Mg (Cu)	130
3	Steel	55
4	Transformer sheet steel	50 – 150
5	Permalloy (iron-nickel alloy)	10
6	Mineral transformer oil	150
7	Electrical grade paper	45
8	Solid insulation materials (epoxy resin, bakelite paper)	10
9	Porcelain	110
10	Composite Insulator	40

Item 9 and 10 are alternatives.

Above values are approximate.

9.1. Recycling and disposal proceedings

Recycling and disposal should meet national (or local) regulations. On the territory of the Republic of Poland, the transformer disposal procedure is defined in the 'Ustawa o odpadach' ('The Waste Act') dated the 14th of December 2012 as published in Dziennik Ustaw (official gazette) issue 21/2013, as amended.

94

10. Check list

10.1. Before the first energising

What to check:	When	Check
1. External packing appearance	A	No signs of careless handling
2. Transformer tightness	A, B, C	No visible oil leaks or greasy stains (even if the packaging is intact)
3. Transformer housing	B, C	Insulator, terminals and housing of the transformer show no signs of mechanical damage.
4. Oil level	B, C	Oil level indicator is in the proper position
5. Quality and correctness of connections	C	The connections are reliable and in accordance with the design

10.2. After the first energising

What to check:	When	Check
6. Transformer tightness	D, E	No visible oil leaks or greasy stains
7. Transformer housing	D, E	Insulator, terminals and housing of the transformer show no signs of mechanical damage.
8. Oil level	D, E	Oil level indicator is in the proper position
9. Secondary winding insulation test (measurement method	E	Values dependent on age, voltage level, measurement method and temperature
10. Dielectric loss factor tg δ (measurement method depends on local practices)	E	Values dependent on age, voltage level, measurement method and temperature. It is recommended to measure the current module and voltage module separately. Respective terminals are marked: tgδ' and 'E'
11. Oil sampling: gas analysis (DGA), tg δ, water content	E	Measurements did not indicate exceeding of permissible limits

When	
A	After arrival of the transformer to the site
B	After unpacking
C	Directly before applying voltage
D	During routine inspections in accordance with the schedule determined for the station
E	After 15–20 operation years, or an inspection of efficiency after a fault if any suspicion as to the transformer efficiency

11. End

For additional information concerning the operation and maintenance of PVA 123a / PVA 145a transformers, please contact the transformer manufacturer.

95

For more information, please contact:

ABB Contact Center
tel.: +48 22 22 37 777
e-mail: kontakt@pl.abb.com

ABB Sp. z o.o.
Branch Office in Przasnysz
ul. Leszno 59
06-300 Przasnysz
Tel.: +48 22 22 38 931, +48 22 22 39 255
Fax: +48 22 223 89 58

www.abb.pl

2129PL1023-W1-en. Wydanie 03.2014

Power and productivity
for a better world™

ABB

36

Nytro 10 XN

SAFETY DATA SHEET

Date of printing	2015-09-11
Date of issue/ Date of revision	2015-09-11
Date of previous issue	No previous validation
Version	1

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifier

Product name	Nytro 10 XN
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
National contact	Nynas sp. z o.o. ul. Kolberga 48D PL-44 100 Gliwice POLAND +48 32 232 74 10

1.4 Emergency telephone number

National advisory body/Poison Centre

Telephone number	+44 (0) 1235 239 670
Hours of operation	24 hour service

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	Not applicable.

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 Regulation (EC) No. 1272/2008 [CLP]	Type
Distillate (petroleum), hydrotreated light naphthenic	REACH #: 01-2119480375-34 EC: 265-156-6 CAS: 64742-53-6 Index: 649-466-00-2	>99	Asp. Tox. 1, H304	[1]
2,6-di-tert-butyl-p-cresol	REACH #:	<0.3	Aquatic Acute 1, H400	[1]

SECTION 3: Composition/information on ingredients

	01-2119555270-46 EC: 204-881-4 CAS: 128-37-0		Aquatic Chronic 1, H410 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. 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.

SECTION 4: First aid measures

4.3 Indication of any immediate medical attention and special treatment needed

Notes to physician

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.

Specific treatments

Always assume that aspiration has occurred.

SECTION 5: Firefighting measures

5.1 Extinguishing media

Suitable extinguishing media

Use dry chemical, CO_2, 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, SOx (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.

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.

SECTION 6: Accidental release measures

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. Note: see Section 1 for emergency contact information and Section 13 for waste disposal. See Section 8 for information on appropriate personal protective equipment.

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.

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. Hazard of slipping on spilt product. Keep away from heat/sparks/open flames/hot surfaces. - No smoking. Use and store only outdoors or in a well-ventilated area.

Avoid release to the environment.

7.1 Precautions for safe handling

SECTION 7: Handling and storage

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 European, national or local legislation. 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

Product/ingredient name	Exposure limit values
Oil mist	*[Air contaminant]* **Rozporzadzenie Ministra Pracy I Polityki Spolecznej (Dz.U. 2014 poz. 817) (Poland, 6/2014).** TWA: 5 mg/m³ 8 hours. Form: Inhalable fraction

SECTION 8: Exposure controls/personal protection

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 appropriate monitoring standards. 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/m³	Workers	Local

PNECs

No PNECs available

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.

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 applicable.

pH: Not applicable.

Melting point/freezing point: -60°C

Initial boiling point and boiling range: >250°C

Flash point: Closed cup: >140°C [Pensky-Martens.]

Conforms to Regulation (EC) No. 1907/2006 (REACH), Annex II
Nytro 10 XN

SECTION 9: Physical and chemical properties

Evaporation rate	Not available.
Flammability (solid, gas)	Not available.
Upper/lower flammability or explosive limits	Not available.
Vapour pressure	160 Pa @ 100 °C
Density	0.88 g/cm³ [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): 0.076 cm²/s (7.6 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, H2S, SOx (sulfur oxides) or sulfuric acid and unidentified organic and inorganic compounds.

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)
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

SECTION 11: Toxicological information

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)
2,6-di-tert-butyl-p-cresol	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)

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	-

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)

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

Conclusion/Summary — No known significant effects or critical hazards.

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)

SECTION 11: Toxicological information

Conclusion/Summary — No known significant effects or critical hazards.

Aspiration hazard

Product/ingredient name	Result
Distillate (petroleum), hydrotreated light naphthenic	ASPIRATION HAZARD - Category 1

Information on the 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.

Developmental effects — 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
2,6-Di-tert-butyl-p-cresol	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	Aquatic half-life	Photolysis	Biodegradability
Distillate (petroleum), hydrotreated light naphthenic	-	-	Inherent
2,6-Di-tert-butyl-p-cresol	-	-	Not readily

Conclusion/Summary — Inherently biodegradable.

12.3 Bioaccumulative potential

SECTION 12: Ecological information

Product/ingredient name	$LogP_{ow}$	BCF	Potential
Distillate (petroleum), hydrotreated light naphthenic	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.

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	-	-	-	-

Conforms to Regulation (EC) No. 1907/2006 (REACH), Annex II
Nytro 10 XN

SECTION 14: Transport information

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.

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	All components are listed or exempted.
Malaysia	All components are listed or exempted.
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: Complete.

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
CO_2 = 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	Calculation method
Aquatic Chronic 3, H412	Calculation method

Poland

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: 2015-09-11
Date of issue/ Date of revision: 2015-09-11
Date of previous issue: No previous validation
Version: 1

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.

Identification of the substance or mixture

Product definition: Mixture
Product name: Nytro 10 XN

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 110 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) 0.01 % 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.

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. 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	≤100%
Physical state	solid
Dust	Solid, medium dustiness
Frequency and duration of use	Exposure duration per day: 8 h (full shift). Exposure duration per year: 230 d
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.
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). (04/2010)
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 10 XN
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.

Nytro 10 XN

Annex to the extended Safety Data Sheet (eSDS)

Professional

Identification of the substance or mixture

Product definition	Mixture
Product name	Nytro 10 XN

Section 1 - Title

Short title of the exposure scenario	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.

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

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.

Nytro 10 XN

Annex to the extended Safety Data Sheet (eSDS)

NYNAS

Industrial

Identification of the substance or mixture

Product definition	Mixture
Product name	Nytro 10 XN

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 (days/year) 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 domestic sewage treatment plant, no onsite 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 of64.4 If discharging to domestic sewage treatment plant, provide the required onsite wastewater removal efficiency of 0
Organisational measures to prevent/limit release from site	Do not apply industrial sludge to natural soils. 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 treatment94.7 Total efficiency of removal from wastewater after on-site and off-site (domestic treatment plant) RMMs94.7 Maximum allowable site tonnage (M_{Safe}) based on release following total wastewater treatment removal1.1E+5 Assumed on-site sewage treatment plant flow2000
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	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 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 systems
No other specific measures identified.

Bulk transfers open systems
No other specific measures identified.

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.

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 occuring 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, classifies as H304 (R65), these measures should be

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.

Nytro 10 XN

Annex to the extended Safety Data Sheet (eSDS)

NYNAS

Industrial

Identification of the substance or mixture

Product definition	Mixture
Product name	Nytro 10 XN

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, tabletting, 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 (days/year)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	Risk from environmental exposure is driven by freshwater sediment. Prevent discharge of undissolved substance to or recover from onsite wastewater. If discharging to domestic sewage treatment plant, no onsite wastewater treatment required.

Section 2 - Exposure controls

Risk management measures - Air	Treat air emission to provide a typical removal efficiency of0
Risk management measures - Water	Treat on-site wastewater (prior to receiving water discharge) to provide the required removal efficiency of69.5 If discharging to domestic sewage treatment plant, provide the required onsite wastewater removal efficiency of 0
Organisational measures to prevent/limit release from site	Do not apply industrial sludge to natural soils. 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 (domestic treatment plant) RMMs94.7 Maximum allowable site tonnage (M_{Safe}) based on release following total wastewater treatment removal5.7E+5 Assumed on-site sewage treatment plant flow2000
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 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

Laboratory activities
No other specific measures identified.Bulk transfers Dedicated facility

No other specific measures identified.

Mixing operations (open systems)
No other specific measures identified.

Transfer from/pouring from containers Manual Non-dedicated facility
No other specific measures identified.

Drum/batch transfers Dedicated facility
No other specific measures identified.

Production of preparation or articles by tabletting, compression, extrusion or pelletisation
No other specific measures identified.

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.

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	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.

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 occuring 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, 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.

Nytro 10 XN

Annex to the extended Safety Data Sheet (eSDS)

NYNAS

Industrial

Identification of the substance or mixture

Product definition	Mixture
Product name	Nytro 10 XN

Section 1 - Title

Short title of the exposure scenario	Manufacturer of substance- Industrial (Other Lubricant Base Oils, IP346<3%, H304)
List of use descriptors	**Identified use name:** Manufacture of substance - Industrial **Process Category:** PROC01, PROC02, PROC03, PROC04, PROC08a, PROC08b, PROC15 **Substance supplied to that use in form of:** Substance **Sector of end use:** SU03, SU08, SU09 **Subsequent service life relevant for that use:** No. **Environmental Release Category:** ERC04, ESVOC SpERC 1.1.v1 **Market sector by type of chemical product:** Not applicable. **Article category related to subsequent service life:** Not applicable.
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	Fraction of EU tonnage used in region0.1 Regional use tonnage 8.5E+5 Fraction of Regional tonnage used locally 1 Annual site tonnage 6.0E+5 Maximum daily site tonnage 2.0E+6
Frequency and duration of use	Continuous release Emission Days (days/year)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) 1.0e-4 Release fraction to wastewater from process (initial release prior to RMM) 1.0e-5 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 domestic sewage treatment plant, no onsite wastewater treatment required.

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 of84.8 If discharging to domestic sewage treatment plant, provide the required onsite wastewater removal efficiency of 0
Organisational measures to prevent/limit release from site	Do not apply industrial sludge to natural soils. 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 treatment94.7 Total efficiency of removal from wastewater after on-site and off-site (domestic treatment plant) RMMs94.7 Maximum allowable site tonnage (M_{Site}) based on release following total wastewater treatment removal5.7E+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 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

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 occuring 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, classifies 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.

Nytro 10 XN

Annex to the extended Safety Data Sheet (eSDS)

NYNAS

Industrial

Identification of the substance or mixture

Product definition	Mixture
Product name	Nytro 10 XN

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 region0.1 Regional use tonnage1.2E+3 Fraction of Regional tonnage used locally1 Annual site tonnage1.0E+1 Maximum daily site tonnage5.0E+2
Frequency and duration of use	Continuous release Emission Days (days/year)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 onsite wastewater. If discharging to domestic sewage treatment plant, no onsite wastewater treatment required.
Risk management measures - Air	Treat air emission to provide a typical removal efficiency of0

Section 2 - Exposure controls

Risk management measures - Water	Treat on-site wastewater (prior to receiving water discharge) to provide the required removal efficiency of64.4 If discharging to domestic sewage treatment plant, provide the required onsite wastewater removal efficiency of0
Organisational measures to prevent/limit release from site	Do not apply industrial sludge to natural soils. 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 treatment94.7 Total efficiency of removal from wastewater after on-site and off-site (domestic treatment plant) RMMs94.7 Maximum allowable site tonnage (M_{Site}) based on release following total wastewater treatment removal3.3E+3 Assumed on-site sewage treatment plant flow2000
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 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.

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 occuring 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.

113

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.

Nytro 10 XN

Annex to the extended Safety Data Sheet (eSDS)

NYNAS

Professional

Identification of the substance or mixture

Product definition	Mixture
Product name	Nytro 10 XN

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	Concawe 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 region0.1 Regional use tonnage1.2E+3 Fraction of Regional tonnage used locally1 Annual site tonnage6.0E-1 Maximum daily site tonnage1.6E+0
Frequency and duration of use	Continuous release Emission Days (days/year)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 domestic sewage treatment plant, no onsite wastewater treatment required.
Risk management measures - Air	Treat air emission to provide a typical removal efficiency ofN/A

Section 2 - Exposure controls

Risk management measures - Water	Treat on-site wastewater (prior to receiving water discharge) to provide the required removal efficiency of64.9 If discharging to domestic sewage treatment plant, provide the required onsite wastewater removal efficiency of0
Organisational measures to prevent/limit release from site	Do not apply industrial sludge to natural soils. 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 treatment94.7 Total efficiency of removal from wastewater after on-site and off-site (domestic treatment plant) RMMs94.7 Maximum allowable site tonnage (M_{Safe}) based on release following total wastewater treatment removal1.1E+1 Assumed on-site sewage treatment plant flow2000
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 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.

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 occuring 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, 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.

Nytro Libra

SAFETY DATA SHEET

Date of printing	2015-09-17
Date of issue/ Date of revision	2015-09-17
Date of previous issue	No previous validation
Version	1

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifier

Product name	Nytro Libra
Product description	Insulating oil
Product type	Liquid.
MARPOL Annex 1	Oils

1.2 Identified uses

Identified uses
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
National contact	Nynas sp. z o.o. ul. Kolberga 48D PL-44 100 Gliwice POLAND +48 32 232 74 10

1.4 Emergency telephone number

National advisory body/Poison Centre

Telephone number	+44 (0) 1235 239 670
Hours of operation	24 hour service

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

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.
Precautionary statements	
Prevention	Not applicable.
Response	P301 + P310 + P331 - IF SWALLOWED: Immediately call a POISON CENTER or physician. Do NOT induce vomiting.
Storage	P405 - Store locked up.
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	Not applicable.

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 Regulation (EC) No. 1272/2008 [CLP]	Type
Distillate (petroleum), hydrotreated light naphthenic	REACH #: 01-2119480375-34 EC: 265-156-6 CAS: 64742-53-6 Index: 649-466-00-2	50 - 70	Asp. Tox. 1, H304	[1]
Distillate (petroleum), hydrotreated light paraffinic	REACH #: 01-2119487077-29 EC: 265-158-7	0 - 50	Asp. Tox. 1, H304	[1]

SECTION 3: Composition/information on ingredients

Distillates (petroleum), hydrotreated heavy paraffinic	CAS: 64742-55-8 REACH #: 01-2119484627-25 EC: 265-157-1	0 - 50	Not classified.	-
Lubricating oils (petroleum), C15-30, hydrotreated neutral oil-based	CAS: 64742-54-7 Index: 649-467-00-8 REACH #: 01-2119474878-16 EC: 276-737-9	0 - 50	Asp. Tox. 1, H304	[1]
Distillates (petroleum), solvent-refined heavy naphthenic	CAS: 72623-86-0 Index: 649-482-00-X REACH #: 01-2119483621-38 EC: 265-097-6	0 - 5	Not classified.	-
Distillates (petroleum), solvent-refined light naphthenic	CAS: 64741-96-4 Index: 649-457-00-3 REACH #: 01-2119480374-36 EC: 265-098-1 CAS: 64741-97-5 Index: 649-458-00-9	0 - 5	Asp. Tox. 1, H304	[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.

SECTION 4: First aid measures

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. 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

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.

Specific treatments

Always assume that aspiration has occurred.

SECTION 5: Firefighting measures

5.1 Extinguishing media

Suitable extinguishing media

Use dry chemical, CO_2, 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.

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, SOx (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.

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	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. Note: see Section 1 for emergency contact information and Section 13 for waste disposal. See Section 8 for information on appropriate personal protective equipment.
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.

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. Hazard of slipping on spilt product. Keep away from heat/sparks/open flames/hot surfaces. - No smoking. Use and store only outdoors or in a well-ventilated area. 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. 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 European, national or local legislation. 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

Product/ingredient name	Exposure limit values
Oil mist	*[Air contaminant]* **Rozporzadzenie Ministra Pracy i Polityki Spolecznej (Dz.U. 2014 poz. 817) (Poland, 6/2014).** TWA: 5 mg/m³ 8 hours. Form: Inhalable fraction

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 appropriate monitoring standards. 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/m³	Workers	Local
Distillate (petroleum), hydrotreated light paraffinic	DNEL	Long term Inhalation	5,4	Workers	Local
Distillates (petroleum), solvent-refined light naphthenic	DNEL	Long term Inhalation	5,4 mg/m³	Workers	Local

PNECs

No PNECs available

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.

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	-51°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	0.88 g/cm³ [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): 0.096 cm²/s (9.6 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, H2S, SOx (sulfur oxides) or sulfuric acid and unidentified organic and inorganic compounds.

SECTION 11: Toxicological information

11.1 Information on toxicological effects

Acute toxicity

SECTION 11: Toxicological information

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)
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)
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)
Distillates (petroleum), solvent-refined 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)

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)
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)
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)
Distillates (petroleum), solvent-refined 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)

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

SECTION 11: Toxicological information

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)
Lubricating oils (petroleum), C15-30, hydrotreated neutral oil-based	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)
Distillates (petroleum), solvent-refined light naphthenic	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	-
Lubricating oils (petroleum), C15-30, hydrotreated neutral oil-based	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 paraffinic	OECD 473 473 In vitro Mammalian Chromosomal Aberration Test	Experiment: In vitro Subject: Mammalian-Animal Metabolic activation: with and witout	Negative	-
Distillates (petroleum), solvent-refined light naphthenic	OECD 473 473 In vitro Mammalian Chromosomal Aberration Test	Experiment: In vitro Subject: Mammalian-Animal Metabolic activation: With and without	Negative	Reference report 1987 (similar material)

Conclusion/Summary: No known significant effects or critical hazards.

Carcinogenicity

SECTION 11: Toxicological information

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)
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)
Distillate (petroleum), hydrotreated light paraffinic	Negative - Dermal	Mouse - Female	0.22 to 0.25 ml	78 weeks; Various	Doak, 1983, McKee, 1989 (similar material)
Distillates (petroleum), solvent-refined light naphthenic	Negative - Dermal	Mouse - Female	0.22 to 0.25 ml	78 weeks; Various	Doak 1983, McKee 1989 (similar material)

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

Conclusion/Summary: No known significant effects or critical hazards.

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)
Lubricating oils (petroleum), C15-30, hydrotreated neutral oil-based	Negative - Dermal	Rat	0 to 2000 mg/kg mg/kg/day	-	-
Distillate (petroleum), hydrotreated light paraffinic	Negative - Dermal	Rat	0 to 2000 mg/kg mg/kg/day	-	-
Distillates (petroleum), solvent-refined light naphthenic	Negative - Dermal	Rat	0 to 2000 mg/kg mg/kg/day	-	1987 (similar material)

Conclusion/Summary: No known significant effects or critical hazards.

Aspiration hazard

Product/ingredient name	Result
Distillate (petroleum), hydrotreated light naphthenic	ASPIRATION HAZARD - Category 1
Lubricating oils (petroleum), C15-30, hydrotreated neutral oil-based	ASPIRATION HAZARD - Category 1
Distillate (petroleum), hydrotreated light paraffinic	ASPIRATION HAZARD - Category 1
Distillates (petroleum), solvent-refined light naphthenic	ASPIRATION HAZARD - Category 1

Information on the 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

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.

Conforms to Regulation (EC) No. 1907/2006 (REACH), Annex II
Nytro Libra

SECTION 11: Toxicological information

Mutagenicity: No known significant effects or critical hazards.

Teratogenicity: No known significant effects or critical hazards.

Developmental effects: 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
Lubricating oils (petroleum), C15-30, hydrotreated neutral oil-based	Acute LL50 >100 mg/l Acute NOEL >100 mg/l Chronic NOEL 10 mg/l Acute LL50 >10000 mg/l	Fish Algae Aquatic invertebrates. Aquatic invertebrates.	96 hours 72 hours 21 days 96 hours
Distillates (petroleum), hydrotreated light paraffinic	Acute LL50 >100 mg/l Acute NOEL >100 mg/l Chronic NOEL 10 mg/l Acute IC50 >100 mg/l	Fish Algae Aquatic invertebrates. Algae	96 hours 72 hours 21 days 48 hours
Distillates (petroleum), solvent-refined light naphthenic	Acute LC50 >100 mg/l Acute LL50 >10000 mg/l Acute LL50 >100 mg/l Acute NOEL >100 mg/l Chronic NOEL 10 mg/l Acute LL50 >10000 mg/l	Fish Aquatic invertebrates. Fish Algae Aquatic invertebrates. Aquatic invertebrates.	96 hours 96 hours 96 hours 72 hours 21 days 96 hours
	Acute LL50 >100 mg/l Acute NOEL >100 mg/l Chronic NOEL 10 mg/l	Fish Algae Aquatic invertebrates.	96 hours 72 hours 21 days

Conclusion/Summary: No known significant effects or critical hazards.

12.2 Persistence and degradability

Product/ingredient name	Aquatic half-life	Photolysis	Biodegradability
Distillate (petroleum), hydrotreated light naphthenic	-	-	Inherent
Lubricating oils (petroleum), C15-30, hydrotreated neutral oil-based	-	-	Inherent
Distillates (petroleum), hydrotreated light paraffinic	-	-	Inherent
Distillates (petroleum), solvent-refined light naphthenic	-	-	Inherent

Conclusion/Summary: Inherently biodegradable.

12.3 Bioaccumulative potential

SECTION 12: Ecological information

Product/Ingredient name	$LogP_{ow}$	BCF	Potential
Distillate (petroleum), hydrotreated light naphthenic	2 to 6	<500	low
Lubricating oils (petroleum), C15-30, hydrotreated neutral oil-based	2 to 6	<500	low
Distillates (petroleum), hydrotreated light paraffinic	2 to 6	<500	low
Distillates (petroleum), solvent-refined light naphthenic	2 to 6	<500	low

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.

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

SECTION 14: Transport information

	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.

Other EU regulations

Seveso Directive

This product is not controlled under the Seveso Directive.

National regulations

Product/ingredient name	List name	Name on list	Classification	Notes
Distillates (petroleum), hydrotreated light paraffinic	Poland Carcinogen, Mutagen chemicals	Destylaty lekkie parafinowe, obrabiane wodorem (ropa naftowa); olej bazowy - niespecyfikowany	Carc.. cat.2	-

International lists

SECTION 15: Regulatory information

National inventory

Australia	All components are listed or exempted.
Canada	All components are listed or exempted.
China	All components are listed or exempted.
Japan	All components are listed or exempted.
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: Complete.

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
CO_2 = 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	Calculation method

Poland

Full text of abbreviated H statements	H304	May be fatal if swallowed and enters airways.
Full text of classifications [CLP/GHS]	Asp. Tox. 1, H304	ASPIRATION HAZARD - Category 1

Date of printing: 2015-09-17
Date of issue/ Date of revision: 2015-09-17

SECTION 16: Other information

Date of previous issue: No previous validation
Version: 1

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.

Nytro Libra

Annex to the extended Safety Data Sheet (eSDS)

Industrial

Identification of the substance or mixture

Product definition	Mixture
Product name	Nytro Libra

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 (days/year) 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 domestic sewage treatment plant, no onsite 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 of64.4 If discharging to domestic sewage treatment plant, provide the required onsite wastewater removal efficiency of 0
Organisational measures to prevent/limit release from site	Do not apply industrial sludge to natural soils. 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 treatment94.7 Total efficiency of removal from wastewater after on-site and off-site (domestic treatment plant) RMMs94.7 Maximum allowable site tonnage (M_{Safe}) based on release following total wastewater treatment removal1.1E+5 Assumed on-site sewage treatment plant flow2000
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	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 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 systems No other specific measures identified. Bulk transfers open systems No other specific measures identified.

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.
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 occuring 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, classifies as H304 (R65), these measures should be

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.

Nytro Libra

Annex to the extended Safety Data Sheet (eSDS)

Industrial

Identification of the substance or mixture

Product definition	Mixture
Product name	Nytro Libra

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, tabletting, 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 (days/year)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 domestic sewage treatment plant, no onsite wastewater treatment required.

Section 2 - Exposure controls

Risk management measures - Air	Treat air emission to provide a typical removal efficiency of0
Risk management measures - Water	Treat on-site wastewater (prior to receiving water discharge) to provide the required removal efficiency of69.5 If discharging to domestic sewage treatment plant, provide the required onsite wastewater removal efficiency of 0
Organisational measures to prevent/limit release from site	Do not apply industrial sludge to natural soils. 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 (domestic treatment plant) RMMs94.7 Maximum allowable site tonnage (M_{Safe}) based on release following total wastewater treatment removal5.7E+5 Assumed on-site sewage treatment plant flow2000
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 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

Laboratory activities
No other specific measures identified.Bulk transfers Dedicated facility

No other specific measures identified.

Mixing operations (open systems)
No other specific measures identified.

Transfer from/pouring from containers Manual Non-dedicated facility
No other specific measures identified.

Drum/batch transfers Dedicated facility
No other specific measures identified.

Production of preparation or articles by tabletting, compression, extrusion or pelletisation
No other specific measures identified.

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.

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	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.

Nytro Libra
Formulation & (re)packing of substances and mixtures- Industrial (Other Lubricant Base Oils, IP346<3%)

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 occuring 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, 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.

Nytro Libra

Annex to the extended Safety Data Sheet (eSDS)

Industrial

Identification of the substance or mixture

Product definition	Mixture
Product name	Nytro Libra

Section 1 - Title

Short title of the exposure scenario	Manufacturer of substance- Industrial (Other Lubricant Base Oils, IP346<3%, H304)
List of use descriptors	**Identified use name:** Manufacture of substance - Industrial **Process Category:** PROC01, PROC02, PROC03, PROC04, PROC08a, PROC08b, PROC15 **Substance supplied to that use in form of:** Substance **Sector of end use:** SU03, SU08, SU09 **Subsequent service life relevant for that use:** No. **Environmental Release Category:** ERC04, ESVOC SpERC 1.1.v1 **Market sector by type of chemical product:** Not applicable. **Article category related to subsequent service life:** Not applicable.
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	Fraction of EU tonnage used in region0.1 Regional use tonnage 8.5E+5 Fraction of Regional tonnage used locally 1 Annual site tonnage 6.0E+5 Maximum daily site tonnage 2.0E+6
Frequency and duration of use	Continuous release Emission Days (days/year)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) 1.0e-4 Release fraction to wastewater from process (initial release prior to RMM) 1.0e-5 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 domestic sewage treatment plant, no onsite wastewater treatment required.

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 of84.8 If discharging to domestic sewage treatment plant, provide the required onsite wastewater removal efficiency of 0
Organisational measures to prevent/limit release from site	Do not apply industrial sludge to natural soils. 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 treatment94.7 Total efficiency of removal from wastewater after on-site and off-site (domestic treatment plant) RMMs94.7 Maximum allowable site tonnage (M_{safe}) based on release following total wastewater treatment removal5.7E+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 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

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 occuring 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, classifies 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.

Nytro Libra

Annex to the extended Safety Data Sheet (eSDS)

Industrial

Identification of the substance or mixture

Product definition	Mixture
Product name	Nytro Libra

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 region0.1 Regional use tonnage1.2E+3 Fraction of Regional tonnage used locally1 Annual site tonnage1.0E+1 Maximum daily site tonnage5.0E+2
Frequency and duration of use	Continuous release Emission Days (days/year)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 onsite wastewater. If discharging to domestic sewage treatment plant, no onsite wastewater treatment required.
Risk management measures - Air	Treat air emission to provide a typical removal efficiency of0

Section 2 - Exposure controls

Risk management measures - Water	Treat on-site wastewater (prior to receiving water discharge) to provide the required removal efficiency of64.4 If discharging to domestic sewage treatment plant, provide the required onsite wastewater removal efficiency of0
Organisational measures to prevent/limit release from site	Do not apply industrial sludge to natural soils. 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 treatment94.7 Total efficiency of removal from wastewater after on-site and off-site (domestic treatment plant) RMMs94.7 Maximum allowable site tonnage (M_{Smax}) based on release following total wastewater treatment removal3.3E+3 Assumed on-site sewage treatment plant flow2000
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 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.

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 occuring 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.

Nytro Libra | Uses in Functional fluids - 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

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.

Nytro Libra

Annex to the extended Safety Data Sheet (eSDS)

Professional

Identification of the substance or mixture

Product definition	Mixture
Product name	Nytro Libra

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	Concawe 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 region0.1 Regional use tonnage1.2E+3 Fraction of Regional tonnage used locally1 Annual site tonnage6.0E-1 Maximum daily site tonnage1.6E+0
Frequency and duration of use	Continuous release Emission Days (days/year)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 domestic sewage treatment plant, no onsite wastewater treatment required.
Risk management measures - Air	Treat air emission to provide a typical removal efficiency ofN/A

Section 2 - Exposure controls

Risk management measures - Water	Treat on-site wastewater (prior to receiving water discharge) to provide the required removal efficiency of64.9 If discharging to domestic sewage treatment plant, provide the required onsite wastewater removal efficiency of0
Organisational measures to prevent/limit release from site	Do not apply industrial sludge to natural soils. 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 treatment94.7 Total efficiency of removal from wastewater after on-site and off-site (domestic treatment plant) RMMs94.7 Maximum allowable site tonnage (M_{Safe}) based on release following total wastewater treatment removal1.1E+1 Assumed on-site sewage treatment plant flow2000
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 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.

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 occuring 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, 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.

„Доставка на електрически апарати 110kV“, реф. № PPD 17-064.

Обособена позиция 4 – Доставка на комбинирани измервателни трансформатори 110kV за монтаж на открито – 15 бр.

ПРИЛОЖЕНИЕ 4

Summary of type tests for Voltage Transformer type EMF-E123

Type tests performed	Tested acc. to	Report number	Test performed
Temperature rise test	IEC 61869-1; §.6.4.1; §.7.2.2 IEC 61869-3; §.6.4.1; §.7.2.2	EWP/52/E/2015-3 EWP/52/E/2015-4	2015 year
Short-circuit withstand capability test	IEC 61869-1; §.6.301; §.7.2.301 IEC 61869-3; §.6.301; §.7.2.301	8734/NZL/NBR/15	2015 year
Lightning impulse test	IEC 61869-1; §.7.2.3 IEC 61869-3; §.7.2.3	EWN/109/E/15-1	2015 year
Switching impulse voltage test	IEC 61869-1; §.7.2.3	Not applicable	–
Wet test for outdoor type transformers	IEC 61869-1; IEC 61869-3 IEC 60060-1: 2010 cl.4.4.1 and 4.4.2	RQ 15-78 RQ 15-79	2015 year
Determination of errors	IEC 61869-3; §.5.6	EMF-E123 1HSE8851774	2015 year
Measurement of the radio interference voltage (RIV)	IEC 61869-1; §.7.2.5.1; §.6.11.2 IEC 61869-3; §.7.2.5	EWN/109/E/15-4 EWN/109/E/15-5	2015 year
Chopped lightning impulse test on the primary winding	IEC 61869-1; §.7.2.3; §.7.4.1 IEC 61869-3; §.7.2.3	EWN/109/E/15-1	2015 year
Mechanical tests	IEC 61869-1:2007; §.7.4.5	EUR/44/E/16-4 EUR/44/E/16-5 EUR/44/E/16-6	2016 year
Transmitted overvoltage measurement	IEC 61869-1; §.7.4.4; §.6.11.4 IEC 61869-3; §.7.4.4; §.6.11.4	EWN/109/E/15-1	2015 year
Classification of degree of protection by enclosures – Mechanical impact test IK07 *	IEC 61869-1:2007; § 7.2.7.2	EWP/40/E/2015	2015 year
Seismic test	IEEE Std 693TM-2005; PN-EN 60068-2-6; PN-EN 60068-3-3; PN-IEC 68-2-59	RS-2015/B-128/E	2015 year
Capacitor discharge	Individual customer demands	EWN/109/E/15-1	2015 year
Verification of the degree of protection IP55	IEC 60529: 1989+A1:1999	8604/NZL/NBR/15	2015 year

* Test performed on test object with porcelain insulator.

We hereby certify that the tests listed above verify guaranteed data for EMF-E123

ABB AB

This document is issued by means of a computerized system. A manual signature is not required.

Document No. 2GHV040323; en; rev. A; 2017-01-25

137

INSTYTUT ENERGETYKI
INSTITUTE OF POWER ENGINEERING
LABORATORIUM WIELKOPRĄDOWE
HIGH CURRENT LABORATORY

01-330 Warszawa
ul. Mory 8
tel. 22 34-51-386
tel./fax 22 836-80-16
e-mail: ewp@ien.com.pl
www.ien.com.pl/ewp

TEST REPORT No. EWP/10/E/2014-1e

TEST OBJECT:	Combined instrument transformer type PVA 145a
MANUFACTURER:	ABB Sp. z o.o. Power Products 59 Leszno Str. 06–300 Przasnysz, Poland
TESTS ORDERED BY:	Institute of Power Engineering High Voltage Department Internal order No. EWN/145/E/13/14 dated 15.01.2014
TYPE OF TESTS:	**Temperature-rise test (construction)**
TEST PROCEDURE:	IEC 61869-1:2007, IEC 61869-2:2012, IEC 61869-3:2011, IEC 61869-4:2013, IEC 62271-1:2011, PN-EN 61869-1:2009E, PN-EN 61869-2:2013-06E, PN-EN 61869-3:2011E, PN-EN 62271-1:2009/A1:2011E.
TEST OBJECT DELIVERED:	13.01.2014
DATE OF TESTS:	15.01.2014-16.01.2014
TESTS RESULTS:	**Positive**
THE TESTS WERE WITNESSED BY:	
TEST ENGINEER:	Jacek Tymochowicz M.Sc. Eng.
HEAD OF LABORATORY:	Lidia Gruza M.Sc. Eng.

Warsaw, 21.01.2014r.

Contents

Report contains 17 numbered pages with:	
1	Drawing
2	Photographs
2	Appendixes

1.	Description of the test object
Test object	Combined instrument transformer
Type	PVA 145a
Serial number	2GKP013K1486145
Manufacturer	ABB Sp. z o.o. Power Products 59 Leszno Str. 06–300 Przasnysz, Poland
Year of production	2013
Insulator	Composite Insulator
Number of windings	CT part – 5, CT part –4
Oil type	Nytro Libra
Minimum creepage distance	4495 mm
Insulating oil weight	150 kg
Total weight	540 kg
Dimensions	According to drawing no. 2GKK614123

The laboratory made the identification of test objects on the base of the documentation given in par. 3 – see Appendix.
The test object is shown in the photographs No. 1 and 2. The object was prepared for testing by the Manufacturer.

2.	Technical data declared by the Manufacturer
Maximum operating voltage	145 kV
Rated frequency	50 Hz
Voltage factor and time	$1{,}9U_n/8h$
Rated continuous thermal current, I_{cth}	180-360 A
Rated short-time thermal current, I_{th}/ 1s	20-20 kA
Rated dynamic current, I_{dyn}	50-50 kA

VT part					
Type of secondary winding	1a-1n	2a-2n	3a-3n	4a-4n	da-dn
Rated secondary voltage	110:√3 V	110:√3 V	110:√3 V	110:√3 V	110 V
Rated output	100 VA	100 VA	100 VA	100 VA	200 VA
Accuracy class	1,0	1,0	1/3P	3/3P	3,0
Thermal limiting output	1000 VA	1000 VA	1000 VA	1000 VA	450 VA

CT part				
Type of secondary winding	1S1-1S2	2S1-2S2	3S1-3S2	4S1-4S2
Rated secondary current	5 A	1 A	5 A	1 A
Rated output	30 VA	40 VA	60 VA	60 VA
Accuracy class	0,2	5P	5P	5P
FS/ALF	5	20	20	20
Ext.	120 %	-	-	-

3.	Technical documentation of the test object
1.	Drawing no. 2GKK614123 – Dimensional drawing. Combined instrument transformer PVA 123a – 145a, ABB Sp. z o.o. Power Products, approved 17.12.2013
2.	Routine tests report of combined instrument transformer, typ PVA 145a, serial number: 2GKP013K1486145, ABB Sp. z o.o., Przasnysz, 04.12.2013

4. Scope of the tests

Test programme agreed with Orderer comprised of tests:

No.	Kind of test	Tests according the Standard	Location of the test
1.	Temperature-rise tests	IEC 61869-1:2007 p. 6.4 i p. 7.2.2, IEC 61869-2:2012 p. 6.4.1 i p. 7.2.2.204, IEC 61869-3:2011 p. 6.4.1 i p. 7.2.2, IEC 61869-4:2013 p. 6.4.1 i p. 7.2.2, IEC 62271-1:2011, table 3.	EWP

EWP – The test was performed in Institute of Power Engineering, by High - Current Laboratory.

5. Tests and their results

Combined transformer was installed at the test stand, as it was during normal operation.
Electric diagram of terminal box of tested combined transformer is given in Fig. 1.
The rated voltage with a required value was applied to the primary voltage winding.
The secondary voltage windings and the residual voltage winding were loaded with the suitable power, according to the test programme given below, which was agreed with the Orderer.
Primary current terminals P1 and P2/A was bridged at the range of 300 A.
According to Manufacturer's request current in primary current winding was equal to $\mathbf{I_{cth} = 360\ A}$.
The arrangement of the thermocouples is given in Figure No. 2.
The temperature-rises of windings were measured by the resistance rise method.
During the test, the measurements of loaded windings were made every 1 hour and registered the deflection of oil level indicator.
The resistances of all windings were measured before the tests and after of each stage of tests.
The abstract of the protocol of temperature-rise test is given in Table No. 1.
The summary of test results is given in Table 2.

The temperature-rise of windings were calculated from the formula:

$$\Delta T = \frac{R}{R_0 \alpha} = \frac{R_1 - R_0}{R_0 \cdot 0{,}004}$$

Stage No. 1 Test at the rated load

Test was performed according to the IEC 61869-1 p. 6.4 i p. 7.2.2; IEC 61869-2 p. 6.4.1 i p. 7.2.2.204; IEC 61869-3 p. 6.4.1 i p.7.2.2; IEC 61869-4 p. 6.4.1 i p. 7.2.2.

The voltage value 1,2 U_n = 91,5 kV was applied to the P2/A terminal.
The secondary voltage windings were loaded as follows: 1a-1n ⇒ 100 VA, cos φ = 1, at the voltage 100/√3 V; 2a-2n ⇒ 100 VA, cos φ = 1, at the voltage 100/√3 V; 3a-3n ⇒ 100 VA, cos φ = 1, at the voltage 100/√3 V; 4a-4n ⇒ 100 VA, cos φ = 1, at the voltage 100/√3 V.
The winding of residual voltage remained open.

The secondary current windings of the CT were loaded as follows: 1S1-1S2 ⇒ 30 VA, cos φ = 1; 2S1-2S2 ⇒ 40 VA, cos φ = 1; 4S1-4S2 ⇒ 60 VA, cos φ = 1.
Supply (current control) was applied to the secondary current winding 3S1-3S2.
Terminals P1 and P2/A were short-circuited at the range 300 A.
The test was performed till reached steady state of the measured temperatures.

Stage No. 2 Test of 8 h

Test was done immediately after the Stage No. 1 according to the IEC 61869-1 p. 6.4 i p. 7.2.2; IEC 61869-2 p. 6.4.1 i p. 7.2.2.204; IEC 61869-3 p. 6.4.1 i p.7.2.2; IEC 61869-4 p. 6.4.1 i p. 7.2.2.
The voltage value 1,9 U_n = 144,8 kV was applied to the P2/A terminal.
The secondary voltage windings were loaded as follows: 1a-1n ⇒ 100 VA, cos φ = 1, at the voltage 100/√3 V; 2a-2n ⇒ 100 VA, cos φ = 1, at the voltage 100/√3 V; 3a-3n ⇒ 100 VA at the voltage 100/√3 V; 4a-4n ⇒ 100 VA, cos φ = 1, at the voltage 100/√3 V.
The residual winding da-dn was loaded by ⇒ 450 VA, cos φ = 1, at the voltage 100 V.

The secondary windings of the CT part were loaded by powers: 1S1-1S2 ⇒ 30 VA cos φ = 1; 2S1-2S2 ⇒ 40 VA cos φ = 1; 4S1-4S2 ⇒ 60 VA, cos φ = 1.
Supply (current control) was applied to the secondary current winding 3S1-3S2.
Terminals P1 and P2/A were short-circuited at the range 300 A.
The duration of the test was 8 h.

Stage No. 2 Test with thermal limit power

Test was done immediately after Stage No. 2 according to the IEC 61869-1 p. 6.4 i p. 7.2.2; IEC 61869-2 p. 6.4.1 i p. 7.2.2.204; IEC 61869-3 p. 6.4.1 i p.7.2.2; IEC 61869-4 p. 6.4.1 i p. 7.2.2.
The voltage value U_n = 76,2 kV was applied to the P2/A terminal.
According to Manufacturers request secondary voltage windings (1a-1n, 2a-2n, 3a-3n and 4a-4n) were loaded by limit power 1000 VA at cos φ = 1.
The residual winding remained open.

The secondary current winding of the CT part were loaded as follows: 1S1-1S2 ⇒ 30 VA, cos φ = 1; 2S1-2S2 ⇒ 40 VA; 4S1-4S2 ⇒ 60 VA, cos φ = 1.
Supply (current control) was applied to secondary current winding 3S1-3S2.
Terminals P1 and P2/A were short-circuited at the range 300 A.
The test was performed till reaching the steady state of the measured temperatures.

Measuring instruments

The temperatures were measured by means of type K thermocouples (NiCr – NiAl) with accuracy ± 0,6°C[1].
The ambient temperature was measured using four mercurial thermometers immersed into tank filled with oil. These thermometers were placed in the distance of 1 meter from the tested transformer at the height of 1 meter above floor - the accuracy of measurement ± 0,03°C[2].
The resistance was measured by means of meter type 2291 manufactured by TETTEX Instrument with accuracy 0,01 mΩ[3]

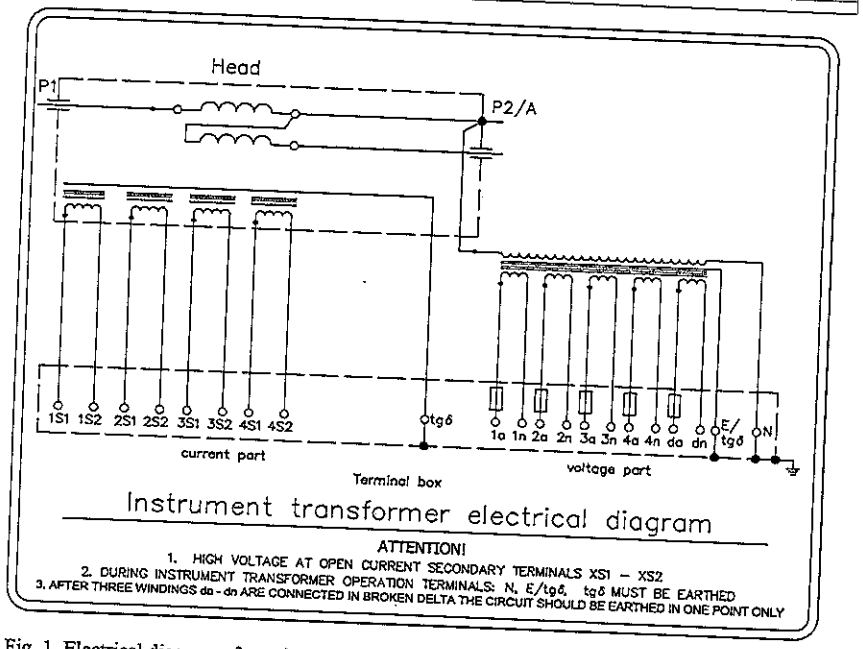


Fig. 1. Electrical diagram of terminal box of tested combined instrument transformer

[1] The expanded uncertainty assigned corresponds to a coverage probability of 95 % and the coverage factor k = 2.
[2] The expanded uncertainty assigned corresponds to a coverage probability of 95 % and the coverage factor k = 2.
[3] The expanded uncertainty assigned corresponds to a coverage probability of 95 % and the coverage factor k = 2.

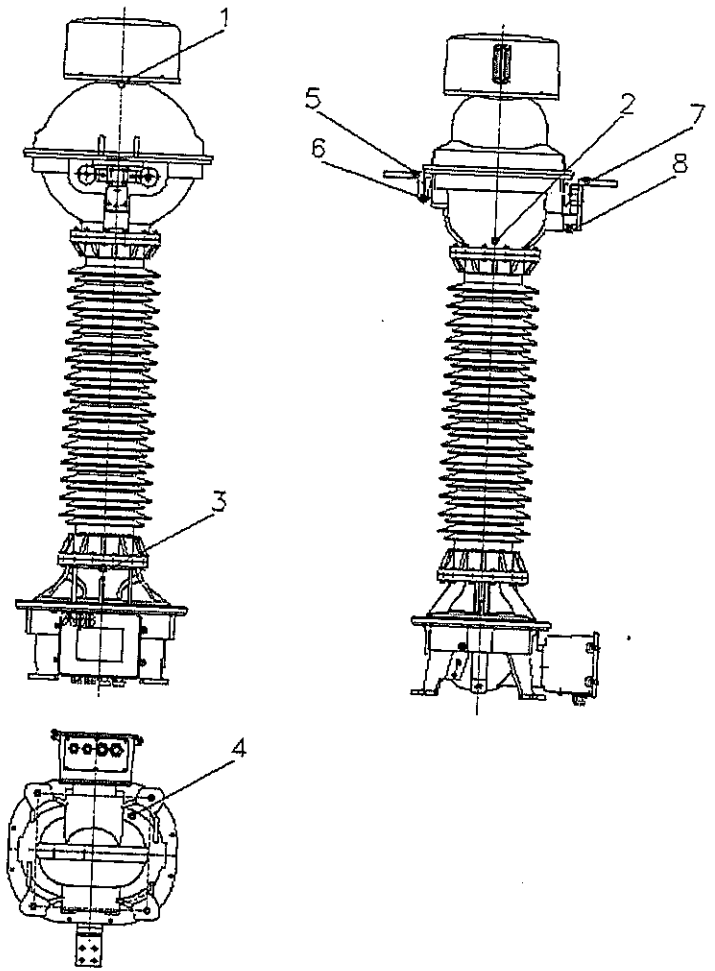


Fig. 2. Arrangement of thermocouples during temperature-rise test:
1 – oil (over current coil), 2 – head (contraction of the flange connecting the head the the insulator), 3 – under the flange of tank lid, 4 — lower tank (placed inside over earthing terminal, 5 – terminal P1, 6 – terminal P1, 7 – terminal P2/A (300A), 8 – terminal P2/A (300A).

Table 1. Temperature-rise test results of combined instrument transformer PVA 145a, nr fabr. 2GKP013K1486145

No. of thermocouple	Heating time [h]																					
	Stage 1																		Etap 2			
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
ΔT 1, K	-	0,00	0,60	2,92	2,82	3,65	5,10	6,33	7,30	7,65	8,48	9,38	10,10	11,03	11,03	11,23	11,30	11,35	11,65	12,08	12,39	13,08
ΔT 2, K	-	0,90	2,00	4,37	4,35	4,92	6,05	6,73	7,25	7,35	7,90	8,50	8,98	9,80	9,83	9,88	9,98	10,30	10,68	10,73	10,89	11,33
ΔT 3, K	-	-0,33	0,62	2,30	1,60	1,75	2,55	2,52	2,95	2,65	2,92	3,27	3,32	3,72	3,72	4,00	4,30	4,50	4,55	4,95	5,21	5,70
ΔT 4, K	-	-0,80	0,10	1,40	0,50	0,82	1,27	1,30	1,57	1,42	1,65	1,23	1,45	1,52	1,52	1,55	1,57	1,57	1,65	1,70	1,49	1,65
ΔT 5, K	-	4,45	5,85	7,80	7,45	8,20	8,95	8,95	9,28	9,55	9,53	10,43	10,48	10,93	10,93	10,93	11,33	11,53	11,40	11,45	11,29	10,68
ΔT 6, K	-	5,25	6,90	8,95	9,03	9,40	10,30	10,83	11,15	11,33	11,83	12,10	12,65	13,25	13,28	13,30	13,43	13,68	13,48	13,38	13,51	13,88
ΔT 7, K	-	2,10	3,30	5,25	5,40	5,85	6,68	7,20	7,55	7,78	8,13	8,48	8,85	9,55	9,55	9,60	9,68	10,08	9,98	9,93	10,11	10,25
ΔT 8, K	-	2,30	3,57	5,60	5,77	6,35	7,23	7,75	8,05	8,30	8,70	9,15	9,53	10,23	10,25	10,33	10,50	11,28	10,75	10,73	10,91	11,30
$T_{ot\,\#}$, °C	16,50	16,58	16,65	16,73	16,68	16,68	16,70	16,73	16,73	16,75	16,80	16,78	16,80	16,80	16,83	16,83	16,85	16,88	17,03	17,10	17,16	17,15
U_{ot}, kV	91,5																		144,8			
$I_{3S1-3S2}$, A	0,0	6,10	6,07	6,07	6,07	6,07	6,08	6,07	6,08	6,09	6,04	6,04	6,05	6,07	6,06	6,06	6,05	6,05	6,01	6,06	6,05	6,07
$I_{1S1-1S1}$, A	0,0	6,080	6,056	6,053	6,072	6,051	6,032	6,042	6,053	6,062	6,024	6,036	6,037	6,090	6,080	6,070	6,050	6,060	6,010	6,060	6,060	6,080
$I_{P1-P2/A}$, A	0,0	364,8	363,4	363,2	364,3	363,1	361,9	362,5	363,2	363,7	361,4	362,2	362,2	365,4	364,8	364,2	363,0	363,6	360,6	363,6	363,6	364,8
$I_{P2/A-N}$, mA	0,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,0	9,00	9,0	15,5	15,5	15,5	15,5
$R_{1S1-1S2}$ mΩ	234,21	238,16	240,46	242,66	244,83	246,84	248,71	250,47	252,04	253,60	255,05	256,38	257,58	258,62	259,65	260,55	261,37	262,18	262,21	263,14	263,91	264,61
$R_{3S1-3S2}$ mΩ	7,7998	7,9040	7,7970	8,0661	8,1445	8,2180	8,2868	8,3517	8,4113	8,4674	8,5205	8,5693	8,6139	8,6536	8,6909	8,7253	8,7563	8,7854	8,7876	8,8184	8,8444	8,8690
$R_{3S1-3S2}$ mΩ	378,94	384,57	389,15	392,89	396,47	400,24	403,03	406,11	409,21	412,89	415,07	416,88	419,12	421,09	423,24	425,43	426,73	426,67	427,18	429,50	430,73	431,79
$R_{4S1-4S2}$ mΩ	9,2106	9,3358	9,4414	9,5302	9,6258	9,7124	9,7953	9,8706	9,9442	10,010	10,080	10,136	10,195	10,239	10,283	10,324	10,366	10,393	10,398	10,433	10,467	10,495
$R_{P1-P2/A}$ mΩ	0,8788	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
$\Delta T_{1S1-1S2}$, K	-	4,22	6,67	9,02	11,34	13,48	15,48	17,36	19,03	20,70	22,24	23,66	24,95	26,06	27,16	28,12	28,99	29,86	29,89	30,88	31,70	32,45
$\Delta T_{3S1-3S2}$, K	-	3,34	-0,09	8,54	11,05	13,40	15,61	17,69	19,60	21,40	23,10	24,66	26,09	27,37	28,56	29,66	30,66	31,59	31,66	32,65	33,48	34,27
$\Delta T_{3S1-3S2}$, K	-	3,71	6,74	9,20	11,57	14,05	15,89	17,93	19,97	22,40	23,84	25,03	26,51	27,81	29,23	30,67	31,53	31,49	31,83	33,36	34,17	34,87
$\Delta T_{4S1-4S2}$, K	-	3,40	6,26	8,67	11,27	13,62	15,87	17,91	19,91	21,70	23,60	25,12	26,72	27,91	29,11	30,22	31,36	32,09	32,23	33,18	34,10	34,86
$\Delta T_{P1-P2/A}$, K	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 1. cont.

	Heating time [h]																					
	Stage 1																		Etap 2			
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
R_{1s-1s_0} mΩ	47,448	47,669	47,986	48,177	49,062	48,464	48,563	48,626	48,700	48,730	48,784	48,828	48,855	48,889	48,904	48,922	48,946	48,952	49,151	49,375	49,548	49,653
R_{2s-2s_0} mΩ	48,790	48,983	49,298	49,500	50,388	49,785	49,887	49,957	50,036	50,067	50,125	50,163	50,190	50,234	50,248	50,267	50,284	50,299	50,488	50,715	50,903	51,016
R_{3s-3s_0} mΩ	50,002	50,298	50,642	50,845	51,574	51,131	51,217	51,325	51,378	51,436	51,496	51,536	51,573	51,596	51,618	51,649	51,657	51,681	51,861	52,087	52,287	52,412
R_{4s-4s_0} mΩ	51,266	51,559	51,900	52,114	52,859	52,419	52,596	52,616	52,672	52,736	52,795	52,832	52,872	52,898	52,916	52,959	52,957	52,987	53,167	53,396	53,697	53,731
R_{d-d_0} mΩ	34,300	34,487	34,683	34,821	35,413	35,011	35,071	35,122	35,168	35,208	35,242	35,278	35,289	35,310	35,334	35,344	35,352	35,360	35,478	35,618	35,745	35,827
$R_{P2/A-N}$, kΩ	20,62	20,76	20,80	20,86	20,88	20,95	21,01	21,08	21,09	21,11	21,14	21,20	21,25	21,28	21,30	21,32	21,34	21,40	21,47	21,49	21,50	21,51
ΔT_{1s-1s_0} K	-	1,16	2,83	3,84	8,50	5,35	5,87	6,21	6,60	6,75	7,04	7,27	7,41	7,59	7,67	7,77	7,89	7,92	8,97	10,15	11,06	11,62
ΔT_{2s-2s_0} K	-	0,99	2,60	3,64	8,19	5,10	5,62	5,98	6,38	6,54	6,84	7,04	7,17	7,40	7,47	7,57	7,66	7,73	8,70	9,86	10,83	11,41
ΔT_{3s-3s_0} K	-	1,48	3,20	4,21	7,86	5,64	6,07	6,61	6,88	7,17	7,47	7,67	7,85	7,97	8,08	8,23	8,27	8,39	9,29	10,42	11,42	12,05
ΔT_{4s-4s_0} K	-	1,43	3,09	4,14	7,77	5,62	6,49	6,58	6,86	7,17	7,46	7,64	7,83	7,96	8,05	8,26	8,25	8,39	9,27	10,39	11,85	12,02
ΔT_{d-d_0} K	-	1,36	2,79	3,80	8,11	5,18	5,62	5,99	6,33	6,62	6,87	7,13	7,21	7,36	7,54	7,61	7,67	7,73	8,59	9,61	10,53	11,13
$\Delta T_{P2/A-N}$, K	-	1,70	2,18	2,91	3,15	4,00	4,73	5,58	5,70	5,94	6,30	7,03	7,64	8,00	8,24	8,49	8,73	9,46	10,31	10,55	10,67	10,79
Deflection of the oil level indicator mm	2	4	6	8	10	13	14	16	18	21	23	24	27	29	30	30	31	32	33	35	35	36

Table 1, cont.

No. of thermocouple	Heating time [h]								
	Stage 2				Stage 3				
	22	23	24	25	26	27	28	29	30
ΔT 1, K	13,10	13,30	14,03	14,05	13,75	13,93	14,80	14,40	15,08
ΔT 2, K	10,50	10,85	11,25	11,38	11,00	11,23	11,93	11,70	12,10
ΔT 3, K	5,80	6,13	6,35	6,65	5,95	6,38	6,83	6,28	7,03
ΔT 4, K	1,92	2,32	2,35	2,37	1,10	1,27	1,97	1,22	2,02
ΔT 5, K	10,88	11,35	11,63	11,75	11,38	11,75	12,58	12,00	12,50
ΔT 6, K	13,08	13,53	13,65	13,75	13,80	14,20	14,73	14,73	14,98
ΔT 7, K	9,85	10,43	10,45	10,60	10,30	10,58	11,13	11,10	11,45
ΔT 8, K	10,73	11,20	11,23	11,30	11,13	11,50	11,93	11,90	12,33
$T_{ot.fr.}$, °C	17,18	17,18	17,18	17,18	17,18	17,23	17,23	16,75	16,75
U_{zas}, kV	144,8				76,2				
$I_{3S1-3S2}$, A	6,05	6,05	6,03	6,06	6,09	6,09	6,08	6,06	6,03
$I_{1S1-1S2}$, A	6,060	6,060	6,040	6,070	6,074	6,061	6,069	6,051	6,020
$I_{P1-P2/A}$, A	363,6	363,6	362,4	364,2	364,4	363,7	364,1	363,1	361,2
$I_{P2/A-N}$, mA	15,5	15,5	15,5	15,5	52,0	52,0	52,0	52,0	52,0
$R_{1S1-1S2}$ mΩ	265,19	265,78	266,27	266,77	267,07	267,35	267,68	267,98	268,22
$R_{2S1-2S2}$ mΩ	8,8894	8,9104	8,9288	8,9459	8,9582	8,9692	8,9804	8,9910	8,9990
$R_{3S1-3S2}$ mΩ	432,20	433,58	434,34	434,45	435,51	436,06	436,34	437,50	438,23
$R_{4S1-4S2}$ mΩ	10,521	10,547	10,570	10,587	10,602	10,618	10,627	10,648	10,655
$R_{P1-P2/A}$ mΩ	-	-	-	-	-	-	-	-	0,9801
$\Delta T_{1S1-1S2}$, K	33,07	33,70	34,22	34,76	35,08	35,37	35,73	36,05	36,30
$\Delta T_{2S1-2S2}$, K	34,92	35,60	36,19	36,73	37,13	37,48	37,84	38,18	38,44
$\Delta T_{3S1-3S2}$, K	35,14	36,05	36,55	36,62	37,32	37,68	37,87	38,63	39,12
$\Delta T_{4S1-4S2}$, K	35,57	36,27	36,90	37,36	37,77	38,20	38,44	39,01	39,20
$\Delta T_{P1-P2/A}$, K	-	-	-	-	-	-	-	-	28,82

Table 1, cont.

Table 1. Temperature-rise test results of combined instrument transformer PVA 145a, nr fabr. 2GKP013K1486145

	Heating time [h]								
	Stage 2				Stage 3				
	22	23	24	25	26	27	28	29	30
R_{1a-1o}, mΩ	49,726	49,809	49,851	49,863	51,118	51,339	51,486	51,623	51,695
R_{2a-2o}, mΩ	51,087	51,170	51,220	51,225	52,713	52,968	53,141	53,286	53,365
R_{3a-3o}, mΩ	52,475	52,556	52,610	52,618	54,183	54,473	54,656	54,818	54,912
R_{4a-4o}, mΩ	53,803	53,890	53,946	53,949	55,615	55,943	56,137	56,308	56,412
R_{da-do}, mΩ	35,871	35,932	35,957	35,983	36,918	37,099	37,229	37,337	37,402
$R_{P2/A-N}$, kΩ	21,54	21,55	21,58	21,61	22,51	23,02	23,37	23,51	23,58
ΔT_{1a-1o}, K	12,00	12,44	12,66	12,72	19,34	20,50	21,28	22,00	22,38
ΔT_{2a-2o}, K	11,77	12,20	12,45	12,48	20,10	21,41	22,29	23,04	23,44
ΔT_{3a-3o}, K	12,36	12,77	13,04	13,08	20,90	22,35	23,27	24,08	24,55
ΔT_{4a-4o}, K	12,37	12,80	13,07	13,08	21,21	22,81	23,75	24,59	25,09
ΔT_{da-do}, K	11,45	11,90	12,08	12,27	19,08	20,40	21,35	22,14	22,61
$\Delta T_{P2/A-N}$, K	11,15	11,28	11,64	12,00	22,91	29,10	33,34	35,04	35,89
Deflection of the oil level indicator mm	38	39	40	40	41	42	43	44	45

Table 2. **Temperature-rises ΔT [K] given during the tests combined instrument transformer** PVA 145a serial number 2GKP013K1486145

Winding	ΔT after Stage 1	ΔT after Stage 2	ΔT after Stage 3	ΔT_{dop}
1S1-1S2	29,86	34,76	36,30	
2S1-2S2	31,59	36,73	38,44	
3S1-3S2	31,49	36,62	39,12	75 [1),3)]
4S1-4S2	32,09	37,36	39,20	
P1-P2/A	*Not measured*	*Not measured*	28,82	
1a-1n	7,92	12,72	22,38	
2a-2n	7,73	12,48	23,44	
3a-3n	8,39	13,08	24,55	75 [2),3)]
4a-4n	8,39	13,08	25,09	
da-dn	7,73	12,27	22,61	
P2/A-N	9,46	12,00	35,89	

No. of thermo-couple	Location	ΔT after Stage 1	ΔT after Stage 2	ΔT after Stage 3	ΔT_{dop}
1	Oil	11,35	14,05	15,08	55 [1),2),3),4)]
2	Head – top part next to terminal	10,30	11,38	12,10	40 [5)]
3	Under the tank lid from side of terminal box	4,50	6,65	7,03	
4	Enclosure of lower tank	1,57	2,37	2,02	
5	Terminal P1	11,53	11,75	12,50	65 [5)]
6	Terminal P1	13,68	13,75	14,98	
7	Terminal P2/A	10,08	10,60	11,45	
8	Terminal P2/A	11,28	11,30	12,33	

[1)] acc. to IEC 61869-1, [2)] acc. to IEC 61869-2, [3)] acc to IEC 61869-3,
[4)] acc to IEC 61869-4, [5)] acc. to IEC 62271-1

$\Delta\vartheta$ - temperature-rise; $\Delta\vartheta_{dop}$ – permitted value in steady state

6. Summary

In tested combined instrument transformer type PVA 145a, with composite insulator, as results of temperature rise test with current I_{cth}= **360 A**:

- in steady state, at the rated load of secondary current and voltage windings (without residual winding), at cos φ = 1 and supply voltage $1{,}2U_n$ (Stage No. 1), permitted temperature-rise limits were not exceeded.
The tested combined transformer met requirements of IEC 61869-1:2007, IEC 61869-2:2012, IEC 61869-3:2011, IEC 61869-4:2013i IEC 62271-1:2011 standards.

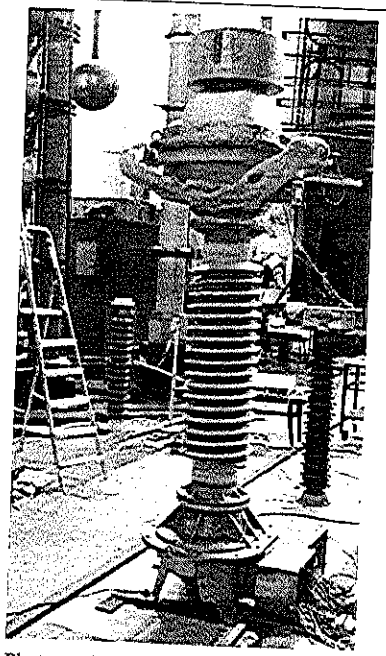
- results of test 8 h at supply voltage $1{,}9U_n$ and rated load of current and voltage windings at cos φ = 1 and load of residual winding with thermal limit power (Stage No. 2), shows that permitted temperature-rise limits were not exceeded.
The tested combined transformer met requirements of IEC 61869-1:2007, IEC 61869-2:2012, IEC 61869-3:2011, IEC 61869-4:2013i IEC 62271-1:2011 standards.

- results of test with thermal limit power (Stage No. 3) at rated load of current windings at cos φ = 1 and supply voltage U_n, and at the same time loading of all voltage windings (without residual windings) with thermal limit power, shows that permitted temperature-rise limits were not exceeded).
The tested combined transformer met requirements of IEC 61869-1:2007, IEC 61869-2:2012, IEC 61869-3:2011, IEC 61869-4:2013i IEC 62271-1:2011 standards.

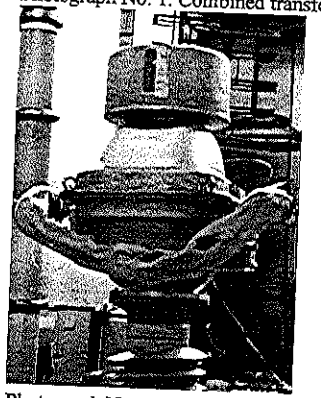
7. Opinions and interpretations

None

8. Photographic documentation



Photograph No. 1. Combined transformer on the test stand during temperature-rise test.

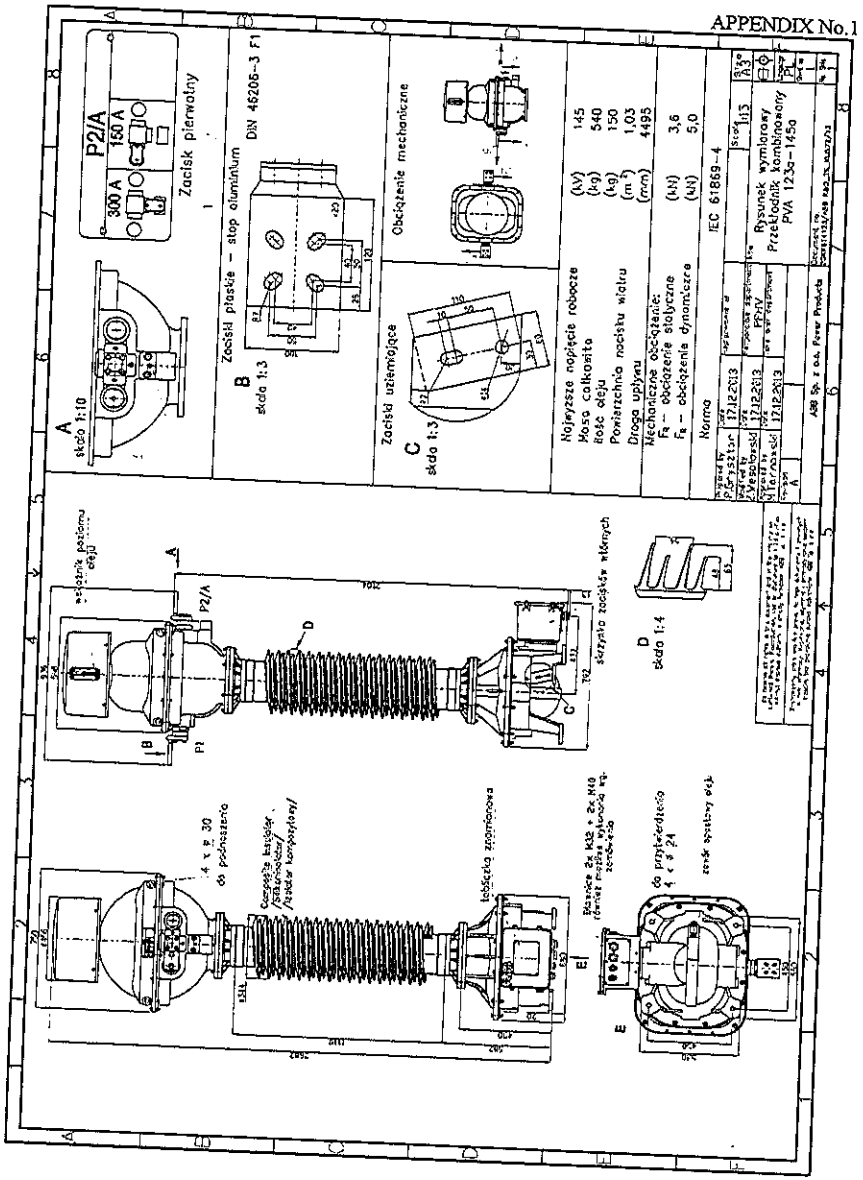


Photograph No. 2. The conductors short-circuiting of P1–P2/A terminals.

INSTITUTE OF POWER ENGINEERING
HIGH CURRENT LABORATORY

Test Report No.
EWP/10/E/2014-1e

APPENDIX No.1



APPENDIX No.2

ABB Sp. z o.o.	Declaration of conformity	ABB Sp. z o.o. Dept. in Przasnysz POLAND

DECLARATION OF CONFORMITY No. 092/2013 (EN)
(acc. to ISO/IEC 17050-1)

Manufacturer: ABB Sp. z o.o. Dept. in Przasnysz

Address: Str. Leszno 59
06-300 Przasnysz / POLAND

Product: Combined Instrument Transformer PVA 145a

Above mentioned product comforms with the following standard :

Standard	Title	Edition/Date
IEC 61869 - 4	Combined Instrument Transformers	2013

Additional information:
Serial numbers: **2GKP013K1486145;**

Place and date of issue of declaration

Przasnysz 13.01.2014

ABB Sp. z o.o.
ul. Żegańska 1, 04-713 Warszawa
NIP: 526-030-44-84; PL 5260304484
Regon 010017165
ODDZIAŁ W PRZASNYSZU
ul. Leszno 59, 06-300 Przasnysz
tel. (22) 223 8821, fax (22) 223 8856
(9)

Kierownik ds. Zapewnienia Jakości
ABB Sp. z o.o.
Oddział w Przasnyszu
Krzysztof Łobocki

(Name) (Signature)

HIGH VOLTAGE LABORATORY

INSTYTUT ENERGETYKI

LABORATORY ACCREDITED
BY THE POLISH CENTRE FOR ACCREDITATION
Accreditation Certificate of Testing Laboratory
No AB 272

TEST REPORT

No. EWN/145/E/13

Type test, special tests and additional tests
of combined transformers type PVA123a and PVA145a
manufactured by ABB sp. z o.o.

Warsaw, January 2014

TESTS REPORTS No EWN/145/E/13

TEST OBJECT:	Combined transformers type PVA123a and PVA145a
TEST ORDERED BY:	ABB Sp. z o.o. 04-713 Warszawa, ul. Żegańska 1
ORDER NO:	4500513518 – 21.10.2013
SCOPE OF TEST:	Type test, special tests and additional tests
PROCEDURA OF TESTS:	in accordance with standards: PN-EN/IEC 61869-1, PN-EN/IEC 61869-2, PN/EN/IEC 61869-3, IEC 61869-4
DATE OF TESTS:	November - December 2013
TESTS RESULTS:	Positive – details are presented in following parts of report Test results refer to tested objects only.

TEST PERFORMERS:	Michał MOLAS, M.Sc.E.E.	SIGNATURE
	Jan SZOKALSKI, M.Sc.E.E.	SIGNATURE
AUTHORIZATION:	Jerzy MIKOŁAJCZYK M.Sc.E.E.	SIGNATURE
HEAD OF HIGH VOLTAGE DEPARTMENT:	January L. MIKULSKI, Prof., Dr. hab. E. E.	SIGNATURE

Warsaw, January 2014

CONTENTS

The Report contain:
29 numbered pages
In Report are presented:
5 drawings
1 photography
7 numbered tables
4 annexes
and non numbered diagrams and tables

1. COMPETENCE OF THE LABORATORY

The High Voltage Laboratory of Institute of Power Engineering (IEn) in Warsaw is in possession of accreditation issued by the Polish Centre for Accreditation (Accreditation Certificate of Testing Laboratory No AB 272) concerning following tests:

Insulators and insulator strings	– lightning and switching impulse tests – power-frequency voltage 50 Hz tests – radio interference measurements
Distribution substations	– lightning and switching impulse tests – power-frequency voltage 50 Hz tests – radio interference measurements
Circuit breakers, disconnectors	– lightning and switching impulse tests – power-frequency voltage 50 Hz tests – radio interference measurements
Insulators	– lightning and switching impulse tests – power-frequency voltage 50 Hz tests – radio interference measurements
Current and voltage transformers	– lightning and switching impulse tests – power-frequency voltage 50 Hz tests
Power transformers	– lightning and switching impulse tests – power-frequency voltage 50 Hz tests
Lightning arresters and limiters	– lightning and switching impulse tests – power-frequency voltage 50 Hz tests
Cables and cable fittings	– lightning and switching impulse tests

Note! Tests described in sub-clauses 4.3, 4.6, 4.7 of this Report don't comply with the scope of Laboratory accreditation.
This Report concerns test results obtained in other competent laboratories -
(see Annex 2) :

- Factory Laboratory of ABB sp. z o.o. in Przasnysz – calibration unit in cooperation with Central and Regional Office of Measures in Warsaw - determination of errors and test in range of type tests at supervision of representative of High Voltage Laboratory of Institute of Power Engineering in Warsaw.

149

2. DESCRIPTION OF TEST OBJECT

The tested objects were two types of combined transformers PVA123a and PVA145a manufactured by ABB sp. z o.o. 04-713 Warszawa, Żegańska 1 St. (Fabryka Aparatury Wysokich i Średnich Napięć, 06-300 Przasnysz, Leszno 59 St.), with the following parameters:

Prototype 1– PVA123a
Serial number 2GKP013K1486138

- Rated primary voltage $110/\sqrt{3}$ kV
- Rated primary current 50 -100- 200 A
- Rated frequency 50 Hz
- Rated insulation level 126/230/550 kV
- Rated short-time thermal current 40-63-63 kA
- Rated dynamic current 100-158-158 kA
- Minimum creepage distance 3800 mm (composite insulator)

Prototype 3
Serial number 86143/13

- Porcelain insulator, creepage distance 4495 mm (annex 1, drawing 2GKK614123/ABB R&D_TS_KU570/13)
- Model of the transformer with disassembled winding

Prototype 4
Serial number 86142/13

- Composite insulator, creepage distance 4495 mm (annex 1, drawing 2GKK614121/ABB R&D_TS_KU570/13)
- Model of the transformer with disassembled winding

Prototype 7– PVA145a
Serial number 2GKP013K1486145

- Rated primary voltage $132/\sqrt{3}$ kV
- Rated primary current 150-300 A
- Rated frequency 50 Hz
- Rated insulation level 145/275/650 kV
- Rated short-time thermal current 20-20 kA
- Rated dynamic current 50-50 kA
- Minimum creepage distance 4495 mm (composite insulator)

Prototype 6– PVA145a
Serial number 2GKP013K1486144

- Rated primary voltage $132/\sqrt{3}$ kV
- Rated primary current 300-600 A
- Rated frequency 50 Hz
- Rated insulation level 145/275/650 kV
- Rated short-time thermal current 40-40 kA
- Rated dynamic current 100-100 kA
- Minimum creepage distance 4495 mm (composite insulator)

The identification of the objects was made on the basis of the following documents attached to this report:

- Manufacturer Conformity Declaration (applies only for objects for electrical tests: prototype 1 - 2GKP013K1486138, prototype 6 - 2GKP013K1486144, prototype 7- 2GKP013K1486145) – annex 1,
- Dimension drawings, rating plates, electrical diagrams – annex 1,
- Routine test reports of combined instrument transformers – annex 2.

3. AGREED SCOPE OF TESTS

According to ordered tests the type test and selected special test were performed according to the following standards:

- IEC 61869-1:2007 „Instrument transformers - Part 1: General requirements" (equiv. with: PN-EN 61869-1:2007 "Przekładniki – Część 1: Wymagania ogólne")
- IEC 61869-2:2012 „Instrument transformers - Part 2: Additional requirements for current transformers" (equiv. with: PN-EN 61869-2:2013 "Przekładniki – Część 2: Wymagania szczegółowe dotyczące przekładników prądowych")
- IEC 61869-3:2011 „Instrument transformers - Part 3: Additional requirements for inductive voltage transformers" (equiv. with: PN-EN 61869-3:2011 "Przekładniki – Część 3: Wymagania szczegółowe dotyczące przekładników napięciowych indukcyjnych")
- IEC 61869-4:2013 „Instrument transformers - Part 4: Additional requirements for combined transformers"

On request of ordering party the additional special test were performed. List of the performed are contained in Table 1.
During the tests mentioned above at Factory Laboratory of ABB sp. z o.o. in Przasnysz Leszno 59 Street, determination of errors of transformer was performed to prove the positive results of consecutive tests. The complete tests were performed according to mentioned above standards. The tests were supervised by representatives of High Voltage Laboratory of Institute of Power Engineering in Warsaw in purpose to prove results of tests (Annex 2).

Table 1: List of performed tests.

Item	Performed tests	Prototype (SN)	Requirement
TYPE TESTS			
1	Lighting impulse test	1(2GKP013K1486138) 6(2GKP013K1486144)	61869-4, p.7.2.3
2	Wet test for outdoor transformers	3(86143/13) 4(86142/13)	61869-1, p.7.2.4
3	Mutual influence test	1(2GKP013K1486138) 7(2GKP013K1486145)	61869-4,p.7.2.6.401 p.7.2.6.402
4	Measurement of the radio interference voltage (RIV)	6(2GKP013K1486144)	61869-1, p.7.2.5.1
SPECIAL TESTS			
5	Chopped impulse test on the primary winding	1(2GKP013K1486138) 6(2GKP013K1486144)	61869-1, p.7.4.1
6	Transmitted overvoltage measurement	1(2GKP013K1486138) 6(2GKP013K1486144)	61869-1, p.7.4.4
ADDITIONAL TESTS			
7	Discharge capacitor test	1(2GKP013K1486138)	C=6μF, U=1,1·$\sqrt{2}$·$110/\sqrt{3}$ kV No breakdown and temperature rise over 65 K.

4. PERFORMED TESTS

4.1 Lightning impulse test

Test was done in test arrangement of surge generator type Haefely 5 MV, 375 kJ. Equivalent circuit diagram is shown in the Figure 1. The test was performed on standardized lightning impulse 1,2/50μs. The purpose of test was checking internal insulation of transformer. The influence of atmospheric condition on test voltage value was not taken into consideration.

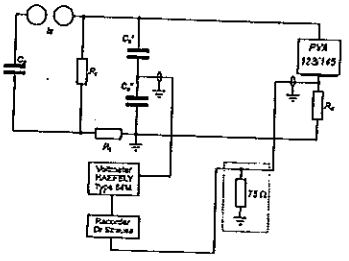


Fig. 1 Equivalent circuit diagram of test arrangement for lightning impulses:
C_2 = 0,125 μF, C_s = 1,2 nF, R_1 = 175 Ω, R_2 = 600 Ω, R_d = 8,95 Ω.
Measurement uncertainty: 1,5 % of the measured value (confidence interval 95%, k=2).

The Lightning impulse test was performed jointly with chopped impulse test on the primary winding (clause 4.5 of this Report). Test conditions are specified in the table 2:

Table 2: Lightning impulse voltage test conditions.

Prototype	1 (2GKP013K1486138)	6 (2GKP013K1486144)
Full impulse test voltage [kV]	550	650
Chopped impulse test voltage [kV]	1,15 · 550 = 632,5	1,15 · 650 = 747,5
Sequence of impulses	Positive polarity – 15 full impulses; Negative polarity – 1 full impulse, 2 chopped impulses, 14 full impulses.	
Registration	Transients of test voltage and current flowing through the whole transformer.	

450

Oscillograms registered during the tests of the prototypes 1(2GKP013K1486138) and 6 (2GKP013K1486144) don't indicate any failures of the transformers' insulation.
Comparison of the accuracy verification before and after the lightning impulse test of the transformers (annex 2) don't indicate significant changes of the transformers' metrological characteristics.
Test result - positive.

Recorded oscillograms of all applied impulses are shown in Annex No. 3 of this Report.

4.2 Wet test for outdoor transformers

The test was performed in arrangement of test transformer type TuR 700kV, 0,5A. Equivalent circuit diagram is presented in the Figure 2.

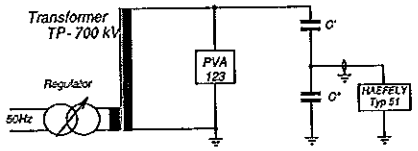
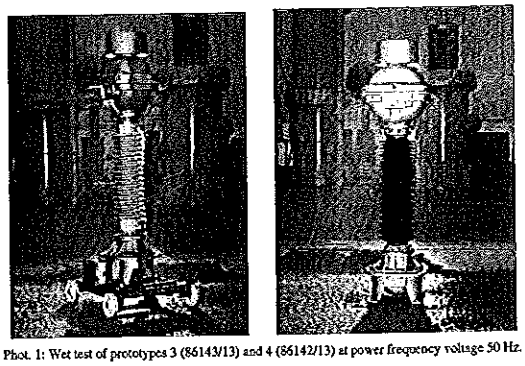


Fig. 2 Equivalent circuit diagram for power frequency voltage 50 Hz: C = 200 pF (C' in series with C*).
Measurement uncertainty: 1,5 % of the measured value (confidence interval 95%, k=2).

The test was performed on transformers prototypes with disassembled winding (prototypes 3-86143/13 and 4 - 86142/12; presented in the photography 1). All external elements of transformers, which could influence test results were identical to the complete transformer. The purpose of the test was to check withstanding of porcelain housing (prototype 3) and composite housing (prototype 4), which are exposed to the artificial rain conditions.



Phot. 1: Wet test of prototypes 3 (86143/13) and 4 (86142/13) at power frequency voltage 50 Hz.

In each case the test voltage U=275 kV (corresponding to the equipment with Um=145 kV) was applied for 1 minute.
During wet test for outdoor transformers the transformer was wetting by artificial rain at parameters:

- vertical component of precipitation H_r = 1,4 mm/min
- horizontal component of precipitation H_h = 1,4 mm/min
- water electrical resistivity ρ= 101÷103 Ωm

The test voltage was corrected according to density of air.

During the tests no flashover or failure of insulation could be observed.

Test result - positive.

Electric strength of the inner insulation does not depend on atmospheric conditions and it was tested during routine test at ABB's Factory Laboratory (Annex 2).

4.3 Mutual influence test

4.3.1 Checking influence of the current transformer on the voltage transformer

Prototype 1- 2GKP013K1486138

The measurements were performed by exciting in primary current winding with range I_n = 200 A of current part of combined transformer 50 Hz current at value:

$$2 \cdot I_n = 400 \text{ A}$$

The supply line to current transformer had the shape of a horizontal rectangular loop with dimensions of approximately 3500 x 1100mm. Secondary windings of current transformer and primary winding of voltage of transformer were short-circuited. On all windings of voltage part of combined transformer which are burdened by 15 VA were measured in turn interference voltage using instrument KEITHLEY type 2001.

Results:

Winding	1a-1n	2a-2n	3a-3n	4a-4n	da-dn
Burden [VA]	15	15	15	15	15
U [mV]	0,150	0,139	0,118	0,111	0,089

The following parameters were calculated:

$\Delta\varepsilon_V = (U_V \cdot 100)/(0{,}8\ U_{SN})$ change of voltage error (at 80% voltage of secondary winding for measurement)

$\Delta\varepsilon_V = (U_V \cdot 100)/(0{,}02\ U_{SN})$ change of voltage error (at 2% voltage of secondary winding for protection)

$\Delta\delta_V = \Delta\varepsilon_V \cdot 34{,}4$ change of phase displacement (in min.)

where:

U_{SN} – secondary rated voltage [V]

Table 3: Calculated voltage errors and phase displacements – prototype 1.

Winding	1a-1n	2a-2n	3a-3n	4a-4n	da-dn
x U_{SN}	80%	80%	2%	2%	2%
$\Delta\varepsilon_V$ [%]	0,00032	0,00030	0,01022	0,00961	0,01335
$\Delta\delta_V$ [min]	0,0112	0,0104	0,3515	0,3307	0,4592

Factor of proportionality between induced voltage (interfere) and current in current transformer (in mV/kA)

$p < U_V/(2 \cdot I_N) = 0{,}150$ mV / 0,400 kA ≅ 0,375 mV/kA

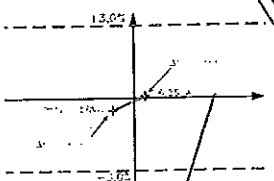
The maximal error of voltage transformer was evaluated by summarize mentioned above errors originated from influence of current path on voltage path together with extreme values of errors measured during routine test at $U = 0{,}8 \cdot U_n \div 1{,}2 \cdot U_n$ (Report No. 2GKP013K1486138 – 12.11.2013, Annex No. 2 of hereby Report)

Below are presented chosen results of calculation in analytic and graphic form (for maximal errors).

Maximal possibly voltage error of measurement winding 1a-1n ($U = 0{,}8 \cdot U_n$)

$\pm\varepsilon_1' = |\varepsilon_1| + |\Delta\varepsilon_1| = 0{,}517\% + 0{,}00032\% = 0{,}517\%$

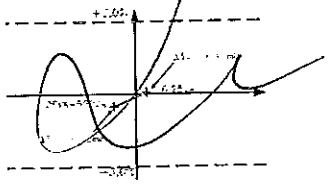
$\pm\varepsilon_1' = |\varepsilon_1| + |\Delta\varepsilon_1| = 0{,}075\% + 0{,}00032\% = 0{,}075\%$



Maximal possibly phase displacement of measurement winding 1a-1n ($U = 0{,}8 \cdot U_n$)

$\pm\delta_1' = |\delta_1| + |\Delta\delta_1| = 7{,}1$ min + 0,0112 min = 7,1 min

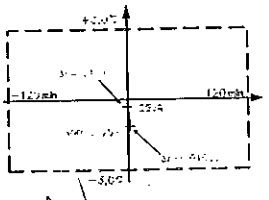
$\pm\delta_1' = |\delta_1| + |\Delta\delta_1| = 3{,}5$ min + 0,0112 min = 3,5 min



Maximal possibly voltage error of winding for protection 3a-3n ($U = 0{,}02 \cdot U_n$)

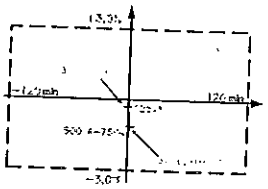
$\pm\varepsilon_1' = |\varepsilon_1| + |\Delta\varepsilon_1| = 1{,}151\% + 0{,}01022\% = 1{,}161\%$

$\pm\varepsilon_1' = |\varepsilon_1| + |\Delta\varepsilon_1| = 0{,}305\% + 0{,}01022\% = 0{,}315\%$



151

Maximal possibly phase displacement of winding for protection 3a-3n (U=0,02·U_n)



$\pm\varepsilon_i' = |\varepsilon_i| + |\Delta\varepsilon_i| = 1,151\% + 0,01022\% = 1,161\%$

$\pm\varepsilon_i' = |\varepsilon_i| + |\Delta\varepsilon_i| = 0,305\% + 0,01022\% = 0,315\%$

It was found that errors derived from influence of current path on voltage path of combined transformer PVA123a (prototype 1- 2GKP013K1486138) don't cause loss of metrological properties (loss of accuracy class) for all secondary voltage windings . Test result - positive.

Prototype 7 - 2GKP013K1486145

The measurements were performed by exciting in primary current winding with range I_n = 300 A of current part of combined transformer 50 Hz current at value:

$$1,5 \cdot I_n = 450 \text{ A}$$

The supply line to current transformer had the shape of a horizontal rectangular loop with dimensions of approximately 3500 x 1100mm. Secondary windings of current transformer and primary winding of voltage of transformer were short-circuited. On all windings of voltage part of combined transformer which are burdened by rated burden (winding da-dn were burdened by 15 VA) were measured in turn interference voltage using instrument KEITHLEY type 2001.

Results:

Winding	1a-1n	2a-2n	3a-3n	4a-4n	da-dn
Burden [VA]	100	100	100	100	15
U [mV]	0,336	0,388	0,405	0,462	0,611

The following parameters were calculated:

$\Delta\varepsilon_V = (U_V \cdot 100)/(0,8\ U_{SN})$ change of voltage error (at 80% voltage of secondary winding for measurement)

$\Delta\varepsilon_V = (U_V \cdot 100)/(0,02\ U_{SN})$ change of voltage error (at 2% voltage of secondary winding for protection)

$\Delta\delta_V = \Delta\varepsilon_V \cdot 34,4$ change of phase displacement (in min.)

where:

U_{SN} – secondary rated voltage [V]

Tabele 4: Calculated voltage errors and phase displacements – prototype 1.

Winding	1a-1n	2a-2n	3a-3n	4a-4n	da-dn
x U_{SN}	80%	80%	2%	2%	2%
$\Delta\varepsilon_V$ [%]	0,00066	0,00076	0,03189	0,03637	0,00208
$\Delta\delta_V$ [min]	0,0227	0,0263	1,0969	1,2512	0,0717

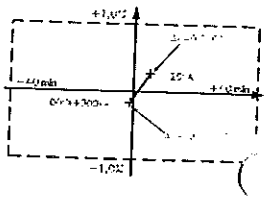
Factor of proportionality between induced voltage (interfere) and current in current transformer (in mV/kA)

$p < U_V/(1,5 \cdot I_N) = 1,2512 \text{ mV} / 0,450 \text{ kA} \equiv 2,78 \text{ mV/kA}$

The maximal error of voltage transformer was evaluated by summarize mentioned above errors originated from influence of current path on voltage path together with extreme values of errors measured during routine test at U = 0,8·U_n ÷1,2·U_n (Report No. 2GKP013K1486145 – 04.12.2013, Annex No. 2 of hereby Report)

Below are presented chosen results of calculation in analytic and graphic form (for maximal errors).

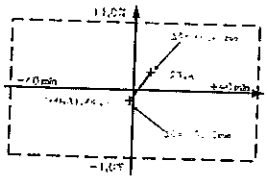
Maximal possibly voltage error of measurement winding
2a-2n (U = 0,8·U_n÷1,2·U_n)



$\pm\varepsilon_i' = |\varepsilon_i| + |\Delta\varepsilon_i| = 0,163\% + 0,00076\% = 0,163\%$

$\pm\varepsilon_i' = |\varepsilon_i| + |\Delta\varepsilon_i| = 0,266\% + 0,00076\% = 0,266\%$

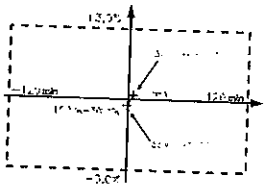
Maximal possibly phase displacement of measurement winding 2a-2n (U = 0,8·U_n)



$\pm\delta_i' = |\delta_i| + |\Delta\delta_i| = 1,1 \text{ min} + 0,0263 \text{ min} = 1,1 \text{ min}$

$\pm\delta_i' = |\delta_i| + |\Delta\delta_i| = 5,2 \text{ min} + 0,0263 \text{ min} = 5,2 \text{ min}$

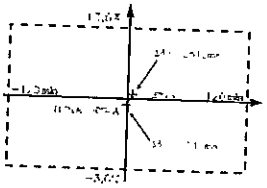
Maximal possibly voltage error of winding for protection 4a-4n (U=0,02·U_n)



$\pm\varepsilon_i' = |\varepsilon_i| + |\Delta\varepsilon_i| = 0,261\% + 0,03637\% = 0,297\%$

$\pm\varepsilon_i' = |\varepsilon_i| + |\Delta\varepsilon_i| = 0,179\% + 0,03637\% = 0,215\%$

Maximal possibly phase displacement of winding for protection 4a-4n (U=0,02·U_n)



$\pm\delta_i' = |\delta_i| + |\Delta\delta_i| = 1,0 \text{ min} + 1,2512 \text{ min} = 2,25 \text{ min}$

$\pm\delta_i' = |\delta_i| + |\Delta\delta_i| = 4,6 \text{ min} + 1,2512 \text{ min} = 5,85 \text{ min}$

It was found that errors derived from influence of current path on voltage path of combined transformers PVA145a (prototype 7- 2GKP013K1486145) don't cause loss of metrological properties (loss of accuracy class) for all secondary voltage windings . Test result - positive.

4.3.2 Checking influence of the voltage transformer on the current transformer

The test was performed by applying two value of voltage of power frequency 50 Hz to the voltage transformer primary winding of combined transformer:

Prototype 1 – PVA123a	Prototype 7 – PVA145a
$U = 1,9 \cdot 110/\sqrt{3}$ kV = 121 kV	$U = 1,9 \cdot 132/\sqrt{3}$ kV = 145 kV
$U = 1,2 \cdot 110/\sqrt{3}$ kV = 76 kV	$U = 1,2 \cdot 132/\sqrt{3}$ kV = 91 kV

On all secondary windings of current transformer were measured interfere voltages U_i. Winding with rated current In = 5 A were burdened by resistor R = 4 Ω and winding with rated

current In = 1 A were burdened by resistor R = 100 Ω.. Measurements were performed using instrument KEITHLEY type 2001 was 1 μV.

For each of windings were done two measurements of interfere voltage U_i, with earthed input terminal or input terminal. The calculation were performed:

- value of interfere current $I=U_i/R$
- change of measured current error (at 5% of rated current) $\Delta\varepsilon_i=(U_i \cdot 100)/(R \cdot 0,05\ I_n)$
- change of measured current error (at 100% of rated current) $\Delta\varepsilon_i=(U_i \cdot 100)/(R \cdot I_n)$
- change of phase displacement (in minutes) $\Delta\delta_i=\Delta\varepsilon_i \cdot 34,4$

Prototype 1 - 2GKP013K1486138

Test results and calculated values are present in tables below.

Tested winding 1s1-1s2 **earthed 1s1**

x U_N	U_i (R=4 Ω)	$I=U_i/R$	$\Delta\varepsilon_i$	$\Delta\delta_i$
[-]	[mV]	[mA]	[%]	[min]
1,9	1,960	0,490	0,196	6,74
1,2	1,030	0,258	0,103	3,54

Tested winding 1s1-1s2 **earthed 1s2**

x U_N	U_i (R=4 Ω)	$I=U_i/R$	$\Delta\varepsilon_i$	$\Delta\delta_i$
[-]	[mV]	[mA]	[%]	[min]
1,9	1,870	0,468	0,187	6,43
1,2	1,070	0,268	0,107	3,68

Tested winding 2s1-2s2 **earthed 2s1**

x U_N	U_i (R=100 Ω)	$I=U_i/R$	$\Delta\varepsilon_i$	$\Delta\delta_i$
[-]	[mV]	[mA]	[%]	[min]
1,9	10,830	0,108	0,217	7,45
1,2	5,440	0,054	0,109	3,74

152

Tested winding 2s1-2s2 earthed 2s2

x U_N	U_i (R=100 Ω)	$I=U_i/R$	$\Delta\varepsilon_i$	$\Delta\delta_i$
[-]	[mV]	[mA]	[%]	[min]
1,9	8,810	0,088	0,176	6,06
1,2	5,580	0,056	0,112	3,84

Tested winding 3s1-3s2 earthed 3s1

x U_N	U_i (R=4 Ω)	$I=U_i/R$	$\Delta\varepsilon_i$	$\Delta\delta_i$
[-]	[mV]	[mA]	[%]	[min]
1,9	0,690	0,173	0,003	0,12
1,2	0,070	0,018	0,000	0,01

Tested winding 3s1-3s2 earthed 3s2

x U_N	U_i (R=4 Ω)	$I=U_i/R$	$\Delta\varepsilon_i$	$\Delta\delta_i$
[-]	[mV]	[mA]	[%]	[min]
1,9	0,480	0,120	0,002	0,08
1,2	0,100	0,025	0,001	0,02

Tested winding 4s1-4s2 earthed 4s1

x U_N	U_i (R=100 Ω)	$I=U_i/R$	$\Delta\varepsilon_i$	$\Delta\delta_i$
[-]	[mV]	[mA]	[%]	[min]
1,9	1,540	0,015	0,002	0,05
1,2	0,890	0,009	0,001	0,03

Tested winding 4s1-4s2 earthed 4s2

x U_N	U_i (R=100 Ω)	$I=U_i/R$	$\Delta\varepsilon_i$	$\Delta\delta_i$
[-]	[mV]	[mA]	[%]	[min]
1,9	1,590	0,016	0,002	0,05
1,2	0,940	0,009	0,001	0,03

Tested winding 5s1-5s2 earthed 5s1

x U_N	U_i (R=100 Ω)	$I=U_i/R$	$\Delta\varepsilon_i$	$\Delta\delta_i$
[-]	[mV]	[mA]	[%]	[min]
1,9	0,710	0,007	0,001	0,02
1,2	0,070	0,001	0,000	0,00

Tested winding 5s1-5s2 earthed 5s2

x U_N	U_i (R=100 Ω)	$I=U_i/R$	$\Delta\varepsilon_i$	$\Delta\delta_i$
[-]	[mV]	[mA]	[%]	[min]
1,9	0,490	0,005	0,000	0,02
1,2	0,120	0,001	0,000	0,00

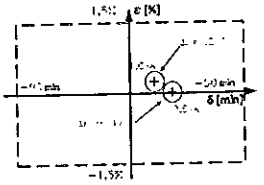
Current transformer maximal error of combined transformer was evaluated by summarize mentioned above errors originated from influence voltage path on current path together with extreme values of errors measured during routine test at $I = 0{,}05 \cdot I_n \div 2 \cdot I_n$
(Report No. 2GKP013K1486138 – 12.11.2013, Annex No. 2 of hereby Report).

Below are presented chosen results of calculation in analytic and graphic form (for maximal errors).

Maximal possibly current error of winding for measurement 2S1-2S2 ($I = 0{,}05 \cdot I_n \div 2 \cdot I_n$)

$\pm\varepsilon_i' = |\varepsilon_i| + |\Delta\varepsilon_i| = 0{,}024\% + 0{,}217\% = 0{,}241\%$

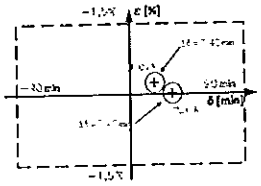
$\pm\varepsilon_i' = |\varepsilon_i| + |\Delta\varepsilon_i| = 0{,}252\% + 0{,}217\% = 0{,}469\%$



Maximal possibly phase displacement of for measurement 2S1-2S2 ($I = 0{,}05 \cdot I_n \div 2 \cdot I_n$)

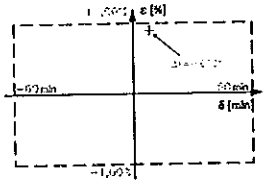
$\pm\delta_i' = |\delta_i| + |\Delta\delta_i| = 33{,}2$ min $+ 7{,}45$ min $= 40{,}65$ min

$\pm\delta_i' = |\delta_i| + |\Delta\delta_i| = 19{,}3$ min $+ 7{,}45$ min $= 26{,}75$ min



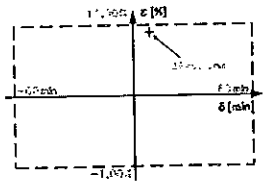
Maximal possibly current error of winding for protection 3S1-3S2 ($I = 0{,}05 \cdot I_n \div 2 \cdot I_n$)

$\pm\varepsilon_i' = |\varepsilon_i| + |\Delta\varepsilon_i| = 0{,}896\% + 0{,}003\% = 0{,}899\%$



Maximal possibly phase displacement of winding for protection 3S1-3S2 ($I = 0{,}05 \cdot I_n \div 2 \cdot I_n$)

$\pm\delta_i' = |\delta_i| + |\Delta\delta_i| = 8{,}3$ min $+ 0{,}12$ min $= 8{,}42$ min



It was found that errors derived from influence of voltage path on current path of combined transformers PVA 123a (prototype 1- 2GKP013K1486138) not cause loss of metrological properties (loss of accuracy class) for all secondary voltage windings .

Test result - positive.

Prototype 7 - 2GKP013K1486145

Test results and calculated values are present in tables below.

Tested winding 1s1-1s2 earthed 1s1

x U_N	U_i (R=4 Ω)	$I=U_i/R$	$\Delta\varepsilon_i$	$\Delta\delta_i$
[-]	[mV]	[mA]	[%]	[min]
1,9	0,540	0,135	0,054	1,86
1,2	0,136	0,034	0,014	0,47

Tested winding 1s1-1s2 earthed 1s2

x U_N	U_i (R=4 Ω)	$I=U_i/R$	$\Delta\varepsilon_i$	$\Delta\delta_i$
[-]	[mV]	[mA]	[%]	[min]
1,9	0,599	0,150	0,060	2,06
1,2	0,346	0,087	0,035	1,19

Tested winding 2s1-2s2 earthed 2s1

x U_N	U_i (R=100 Ω)	$I=U_i/R$	$\Delta\varepsilon_i$	$\Delta\delta_i$
[-]	[mV]	[mA]	[%]	[min]
1,9	0,766	0,008	0,001	0,03
1,2	0,410	0,004	0,000	0,01

Tested winding 2s1-2s2 earthed 2s2

x U_N	U_i (R=100 Ω)	$I=U_i/R$	$\Delta\varepsilon_i$	$\Delta\delta_i$
[-]	[mV]	[mA]	[%]	[min]
1,9	2,990	0,030	0,003	0,10
1,2	1,970	0,020	0,002	0,07

Tested winding 3s1-3s2 earthed 3s1

x U_N	U_i (R=4 Ω)	$I=U_i/R$	$\Delta\varepsilon_i$	$\Delta\delta_i$
[-]	[mV]	[mA]	[%]	[min]
1,9	1,366	0,342	0,007	0,23
1,2	0,173	0,043	0,001	0,03

Tested winding 3s1-3s2 earthed 3s2

x U_N	U_i (R=4 Ω)	$I=U_i/R$	$\Delta\varepsilon_i$	$\Delta\delta_i$
[-]	[mV]	[mA]	[%]	[min]
1,9	0,564	0,141	0,003	0,10
1,2	0,364	0,091	0,002	0,06

Tested winding 4s1-4s2 earthed 4s1

x U_N	U_i (R=100 Ω)	$I=U_i/R$	$\Delta\varepsilon_i$	$\Delta\delta_i$
[-]	[mV]	[mA]	[%]	[min]
1,9	1,930	0,019	0,002	0,07
1,2	1,900	0,019	0,002	0,07

Tested winding 4s1-4s2 earthed 4s2

x U_N	U_i (R=100 Ω)	$I=U_i/R$	$\Delta\varepsilon_i$	$\Delta\delta_i$
[-]	[mV]	[mA]	[%]	[min]
1,9	2,860	0,029	0,003	0,10
1,2	1,880	0,019	0,002	0,06

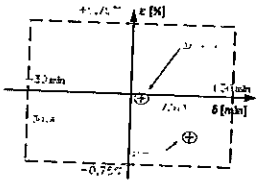
Current transformer maximal error of combined transformer was evaluated by summarize mentioned above errors originated from influence voltage path on current path together with extreme values of errors measured during routine test at $I = 0,05 \cdot I_n \div 2 \cdot I_n$
(Report No. 2GKP013K1486145 – 04.12.2013, Annex No. 2 of hereby Report).

Below are presented chosen results of calculation in analytic and graphic form (for maximal errors).

Maximal possibly current error of winding for measurement 1S1-1S2 ($I = 0,05 \cdot I_n \div 2 \cdot I_n$)

$\pm\varepsilon_i' = |\varepsilon_i| + |\Delta\varepsilon_i| = 0,441\% + 0,060\% = 0,501\%$

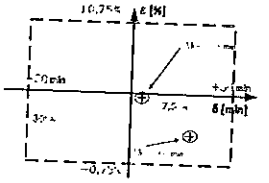
$\pm\varepsilon_i' = |\varepsilon_i| + |\Delta\varepsilon_i| = 0,043\% + 0,060\% = 0,103\%$



Maximal possibly phase displacement of for measurement 1S1-1S2 ($I = 0,05 \cdot I_n \div 2 \cdot I_n$)

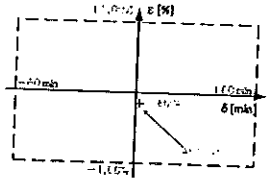
$\pm\delta_i' = |\delta_i| + |\Delta\delta_i| = 17,7 \text{ min} + 2,06 \text{ min} = 19,76 \text{ min}$

$\pm\delta_i' = |\delta_i| + |\Delta\delta_i| = 3,1 \text{ min} + 2,06 \text{ min} = 5,16 \text{ min}$



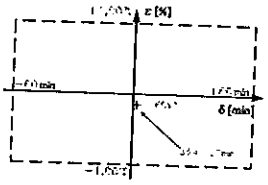
Maximal possibly current error of winding for protection 3S1-3S2 ($I = 0,05 \cdot I_n \div 2 \cdot I_n$)

$\pm\varepsilon_i' = |\varepsilon_i| + |\Delta\varepsilon_i| = 0,148\% + 0,007\% = 0,155\%$



Maximal possibly phase displacement of winding for protection 3S1-3S2 ($I = 0,05 \cdot I_n \div 2 \cdot I_n$)

$\pm\delta_i' = |\delta_i| + |\Delta\delta_i| = 1,7 \text{ min} + 0,23 \text{ min} = 1,93 \text{ min}$



It was found that errors derived from influence of voltage path on current path of combined transformers PVA145a (prototype 7 - 2GKP013K1486145) don't cause loss of metrological properties (loss of accuracy class) for all secondary voltage windings.
Test result - positive.

4.4 Radio interference voltage measurement

According to the IEC 61869-1 RIV measurement was performed in a test circuit shown in the figure 3 (IEC/CISPR 18-2). Voltage value was measured on the resistance 300 Ω for the frequency 0,5 MHz. Before the measurement the test setup was calibrated using a stable signal generator, what resulted in estimation of the RIV correction value +24 dB. Measuring was done with a RIV meter LMZ-5. „Background noise level" was measured within the range of test voltage values 0 - 100 kV. Level of the radio interference voltage caused by the test setup, radio stations, etc. was less than 5μV (14 dB).

According to IEC 61869-1 Maximum level of the radio interference voltage shouldn't exceed $RIV_{dop} = 2500\mu V$ for the test voltage value $Up = 1.1 \cdot U_m/\sqrt{3} = 92$ kV (U_m=145 kV).

The LMZ-5 radio interference voltmeter is a logarithmic scale meter: $RIV_{dop} = 2500\mu V \rightarrow 68$ dB (0 dB = 1 μV).

Before the actual measurement voltage of $1,5 \cdot U_m/\sqrt{3}$ was applied to the transformer for 30 seconds, then in 10 seconds the voltage was decreased to $1,1 \cdot U_m/\sqrt{3}$ and maintained for another 30 seconds. Afterwards the actual RIV level measurement was done.

Additionally the RIV level was measured as a function of rated test voltage value in range of $0,3 \div 1,1 \cdot U_m/\sqrt{3}$. Test voltage was lowered with a step of $0,1 \cdot Up$ from $Up = 1,1 \cdot U_m/\sqrt{3}$ down to $Up = 0,3 \cdot U_m/\sqrt{3}$. Afterwards, with the same step value, the test voltage was raised and lowered again. RIV value was measured for the each of test voltage values, and for the last series of lowering the test voltage, the RIV level graph was drawn.

The RIV measurement was performed on the prototype 6 (2GKP013K1486144).

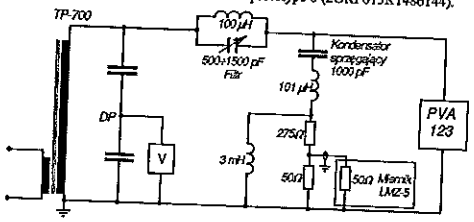


Fig. 3 Test arrangement for RIV measurement.

The results of measurements are presented in the table and diagram below.

Table 5: RIV measurement results.

Up [kV]		92	84	75	67	59	50	42	33	25
x Uf		1,1	1	0,9	0,8	0,7	0,6	0,5	0,4	0,3
[dB]	→	11,5	10	7	1	-5				
	←	10,5	10	7	4	-7				
	→	10,5	9	5,5	1	-8				
Result: [dB]		34,5	33,0	29,5	25,0	16,0				
	[μV]	53,1	44,7	29,9	17,8	6,3				

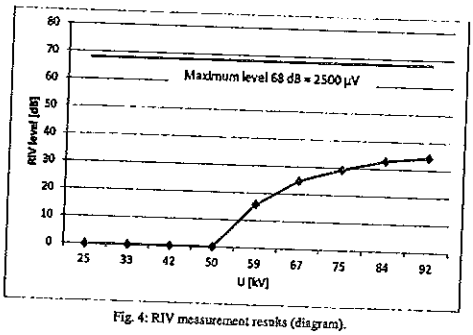


Fig. 4: RIV measurement results (diagram).

Measured Radio Interference Voltage RIV = 53,1 μV (34,5 dB) is much less than permissible level $RIV_{perm} = 2500$ μV (68 dB) for the tested transformer prototype 6 (2GKP013K1486144).
Test result - positive.

4.5 Chopped impulse test on the primary winding

Chopped Impulse Test was supplemented to Lightning Impulse test 1,2/50μs and was described in clause 4.1 of this Report.

Recorded oscillograms don't indicate insulation failure of the tested transformers.
Test result - positive.

Oscillograms of all applied impulses are presented in Annex No. 3 of this Report.

4.6 Transmitted overvoltage measurement

During the test of transformers prototypes 1 (2GKP013K1486138) and 6 (2GKP013K1486144) impulse voltage was applied to the HV terminal. Maximal value of overvoltages was recorded which came in each secondary windings - both current and voltage. According to requirement of Standard for impulse 0,5/50 μs and value U_{test}=1,6 x $\sqrt{2}$ x $U_n/\sqrt{3}$ the values of transmitted overvoltages can not exceed 1,6 kV. During all measurements to the transformer were applied lightning impulses at value ten times less, that is $U_1 = U_p/10$. Concerning linear of phenomenon, registered overvoltages should have values less than 160 V (maximum absolute peak value). Wave shapes of impulses and transmitted overvoltage were recorded with impulse voltage measuring system Dr Strauss TR-AS 200-14.

Results of test are presented in the table below.

Table 6: Transmitted overvoltage measurement results.

Winding	Prototype 1 (2GKP013K1486138) U_p=160 kV ; U_1=16 kV		Prototype 6 (2GKP013K1486144) U_p=190 kV ; U_1=19 kV	
	Overvoltage value $U_{pp}/2$ [V]	Percent of permissible overvoltage [%]	Overvoltage value $U_{pp}/2$ [V]	Percent of permissible overvoltage [%]
1a-1n	33,50	20,9	47,66	29,8
2a-2n	33,01	20,6	44,63	27,9
3a-3n	35,87	22,4	55,98	35,0
4a-4n	42,21	26,4	66,13	41,3
da-dn	57,63	36,0	40,02	25,0
1S1-1S2	82,71	51,7	93,96	58,7
2S1-2S2	35,68	22,3	103,30	64,6
3S1-3S2	95,93	60,0	101,50	63,4
4S1-4S2	58,59	36,6	86,20	53,9
5S1-5S2	43,54	27,2		

It was found that for each of secondary winding of tested transformers (prototype 1 - 2GKP013K1486138 and 6- 2GKP013K1486144) transmitted overvoltages don't exceed value of 1600 V that is maximum permissible value.
Test result - positive.

The oscillograms of all applied and registered impulses are present in Annex No. 4 of hereby Report.

4.7 Discharge capacitor test

Prototype 1 - 2GKP013K1486138

Discharge capacitor test consists of ten time discharged capacitor with capacitance C = 6 μV charged through combined transformer to voltage of value $U = 1{,}1 \cdot \sqrt{2} \cdot 110/\sqrt{3}$ kV ≈ 100 kV. Before tests and before each discharge the resistance of winding was measured and temperature rise were calculated., The discharges was performed after 3 minutes, that is short as possibly time because charging capacitor and performing measurements. Additionally in purpose of checking transformer cooling the measurements of resistance of winding were performed and measurement value were used to calculation decrease of temperature during 15 minutes. Ambient temperature (initial temperature of transformer) was T_0 = 5,8°C.

Rise of temperature was calculated according to formula:

$$\Delta T = \frac{\Delta R}{R_0 \cdot \alpha}$$

where: ΔR – increase of resistance of winding;

R_0 – resistance of winding before test;

α – temperature coefficient of resistance for copper (assumed α = 0,004)

Results of performed test are presented in the table 7 and diagram in the figure 5.

Table 7: Rise of the temperature during discharging test resuks.

t [min]	R [Ω]	ΔR [Ω]	ΔT [K]
0	16310	0	0,0
3	16450	140	2,1
6	16570	260	4,0
9	16700	390	6,0
12	16820	510	7,8
15	16920	610	9,4
18	17040	730	11,2
21	17170	860	13,2
24	17290	980	15,0
27	17410	1100	16,9
30	17540	1230	18,9
33	17400	1090	16,7
36	17270	960	14,7
39	17150	840	12,9

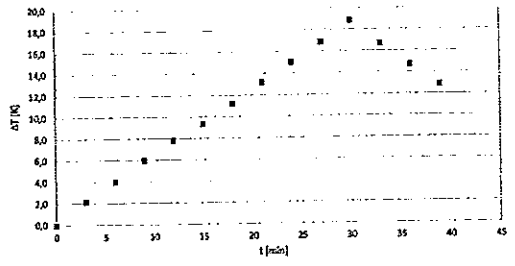


Fig. 5: Rise of the temperature of the transformer during discharging test C=6uF, U=100kV.

The measured rise of temperature ΔT=18,9 K is not dangerous for insulation of combined transformer. Maximal permissible rise of temperature in temperature-rise test is 65 K (according to 61869-1, p. 6.4.1). This criterion can be applied to capacitor discharge test too. The behave of the combined transformer during test was proper. After the test any damages or oil leakage could be observed. It was found that metrological properties of combined transformer are comply assigned accuracy classes for separate windings and measured values after tests are virtually identical to values measured before tests (No. 2GKP013K1486138 – 20.12.2013 – Annex No. 2).
Test result - positive.

5. LIST OF ANNEXES

Annex No. 1
Documents provided by ABB Sp. z o.o. used as base of identification of test object:

- Manufacturer Conformity Declaration No. 001/2014 (13.01.2014),
- Manufacturer Conformity Declaration No. 091/2013 (13.01.2014),
- Manufacturer Conformity Declaration No. 092/2013 (13.01.2014),
- Dimension drawing 2GKK614122/ABB R&D_TS_KU568/13 (17.12.2013),
- Dimension drawing 2GKK614123/ABB R&D_TS_KU570/13 (17.12.2013),
- Dimension drawing 2GKK614121/ABB R&D_TS_KU570/13 (17.12.2013),
- Dimension drawing 2GKK614123/ABB R&D_TS_KU571/13 (17.12.2013),
- Dimension drawing 2GKK614123/ABB R&D_TS_KU572/13 (17.12.2013),
- Rating plate of transformer SN 2GKP013K1486138
- Rating plate of transformer SN 86142/13
- Rating plate of transformer SN 86143/13
- Rating plate of transformer SN 2GKP013K1486144
- Rating plate of transformer SN 2GKP013K1486145
- Electrical diagram of transformer SN 2GKP013K1486138
- Electrical diagram of transformer SN 86142/13
- Electrical diagram of transformer SN 86143/13
- Electrical diagram of transformer SN 2GKP013K1486144
- Electrical diagram of transformer SN 2GKP013K1486145

Annex No. 2
Reports of routine test and determination of errors of combined transformers type PVA123a and PVA145a performed in Factory Laboratory of ABB sp. z o.o.

- Tests before type test and special test (Measurements before type test and special tests) - Report No. 2GKP013K1486138 – 12.11.2013,
- Tests before type test and special test (Measurements before type test and special tests) - Report No. 2GKP013K1486144 – 18.11.2013,
- Tests before type test and special test (Measurements before type test and special tests) - Report No. 2GKP013K1486145 – 04.12.2013,
- Tests after lightning impulse test - Report No. 2GKP013K1486138 – 09.12.2013,
- Tests after lightning impulse test - Report No. 2GKP013K1486144 – 20.12.2013.

Annex No. 3

Lightning impulse test. Impulse 1,2/50 μs, full and chopped:

- Oscillograms of test voltages and detection currents.
- Report No. EWN/145/E/13-1a – 20.11.2013.
- Report No. EWN/145/E/13-1b – 09.11.2013.

Annex No. 4

Transmitted overvoltage measurement:

- Oscillograms of measured overvoltages transmitted to the secondary windings.
- Report No. EWN/145/E/13-2a – 21.11.2013.
- Report No. EWN/145/E/13-2b – 13.11.2013.

ANNEX 1 for test report EWN/145/E/13

Documents provided by ABB Sp. z o.o. used as base of identification of test object:

- Manufacturer Conformity Declaration No. 001/2014 (13.01.2014),
- Manufacturer Conformity Declaration No. 091/2013 (13.01.2014),
- Manufacturer Conformity Declaration No. 092/2013 (13.01.2014),
- Dimension drawing 2GKK614122/ABB R&D_TS_KU568/13 (17.12.2013),
- Dimension drawing 2GKK614123/ABB R&D_TS_KU570/13 (17.12.2013),
- Dimension drawing 2GKK614121/ABB R&D_TS_KU570/13 (17.12.2013),
- Dimension drawing 2GKK614123/ABB R&D_TS_KU571/13 (17.12.2013),
- Dimension drawing 2GKK614123/ABB R&D_TS_KU572/13 (17.12.2013),
- Rating plate of transformer SN 2GKP013K1486138
- Rating plate of transformer SN 86142/13
- Rating plate of transformer SN 86143/13
- Rating plate of transformer SN 2GKP013K1486144
- Rating plate of transformer SN 2GKP013K1486145
- Electrical diagram of transformer SN 2GKP013K1486138
- Electrical diagram of transformer SN 86142/13
- Electrical diagram of transformer SN 86143/13
- Electrical diagram of transformer SN 2GKP013K1486144
- Electrical diagram of transformer SN 2GKP013K1486145

ABB Sp. z o.o. | Declaration of conformity | ABB Sp. z o.o. Dept. in Przasnysz POLAND

DECLARATION OF CONFORMITY No. 001/2014 (EN)
(acc. to ISO/IEC 17050-1)

Manufacturer: ABB Sp. z o.o. Dept. in Przasnysz

Address: Str. Leszno 59
06-300 Przasnysz / POLAND

Product: Combined Instrument Transformer PVA 123a

Above mentioned product comforms with the following standard :

Standard	Title	Edition/Date
IEC 61869 - 4	Combined Instrument Transformers	2013

Additional information:
Serial numbers: **2GKP013K1486138;**

Place and date of issue of declaration

Przasnysz 13.01.2014

ABB Sp. z o.o.
ul. Żegańska 1, 04-713 Warszawa
NIP: 526-030-44-84; PL 526030484
Regon 010017168
ODDZIAŁ W PRZASNYSZU
ul. Leszno 59, 06-300 Przasnysz
tel. (22) 223 8921, fax (22) 223 8958

(Name) (Signature)

ABB Sp. z o.o. | Declaration of conformity | ABB Sp. z o.o. Dept. in Przasnysz POLAND

DECLARATION OF CONFORMITY No. 091/2013 (EN)
(acc. to ISO/IEC 17050-1)

Manufacturer: ABB Sp. z o.o. Dept. in Przasnysz

Address: Str. Leszno 59
06-300 Przasnysz / POLAND

Product: Combined Instrument Transformer PVA 145a

Above mentioned product comforms with the following standard :

Standard	Title	Edition/Date
IEC 61869 - 4	Combined Instrument Transformers	2013

Additional information:
Serial numbers: **2GKP013K1486144;**

Place and date of issue of declaration

Przasnysz 13.01.2014

ABB Sp. z o.o.
ul. Żegańska 1, 04-713 Warszawa
NIP: 526-030-44-84; PL 526030484
Regon 010017168
ODDZIAŁ W PRZASNYSZU
ul. Leszno 59, 06-300 Przasnysz
tel. (22) 223 8921, fax (22) 223 8958

(Name) (Signature)

156

ABB Sp. z o.o.	Declaration of conformity	ABB Sp. z o.o. Dept. in Przasnysz POLAND

DECLARATION OF CONFORMITY No. 092/2013 (EN)
(acc. to ISO/IEC 17050-1)

Manufacturer: ABB Sp. z o.o. Dept. in Przasnysz

Address: Str. Leszno 69
06-300 Przasnysz / POLAND

Product: Combined Instrument Transformer PVA 145a

Above mentioned product comforms with the following standard :

Standard	Title	Edition/Date
IEC 61869 - 4	Combined Instrument Transformers	2013

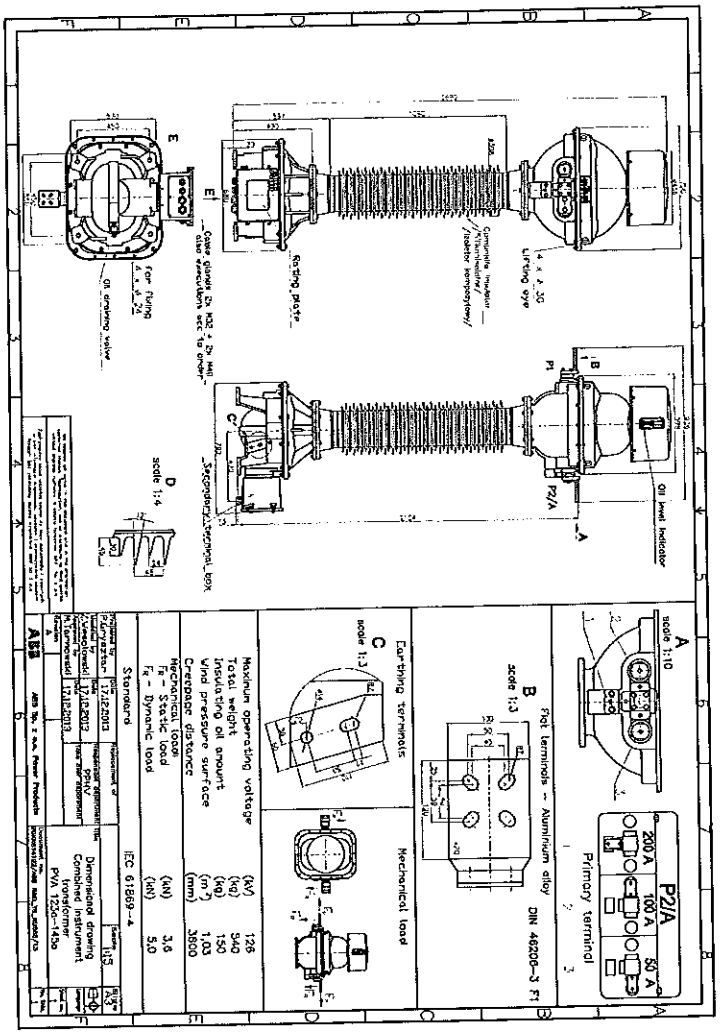
Additional information:
Serial numbers: 2GKP013K1486145;

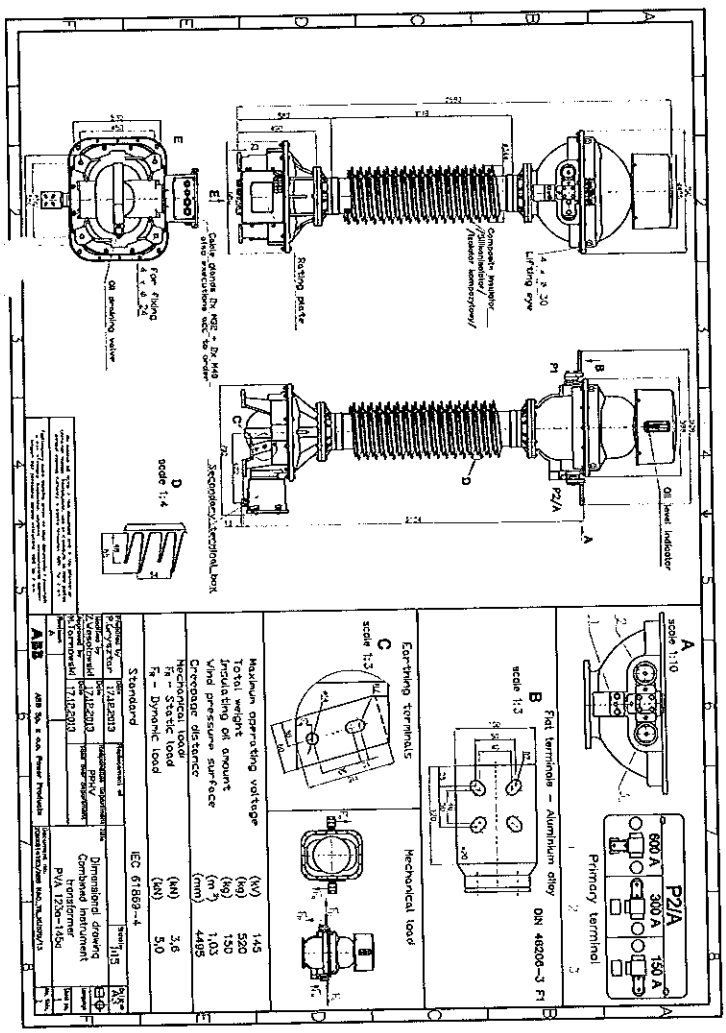
Place and date of issue of declaration

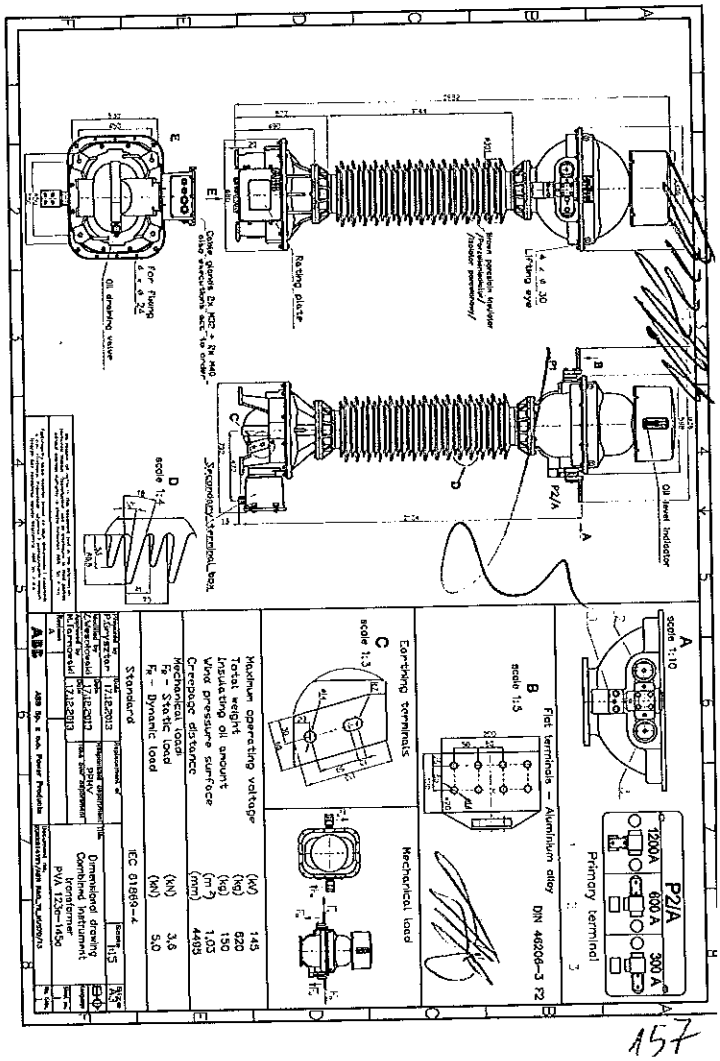
Przasnysz 13.01.2014

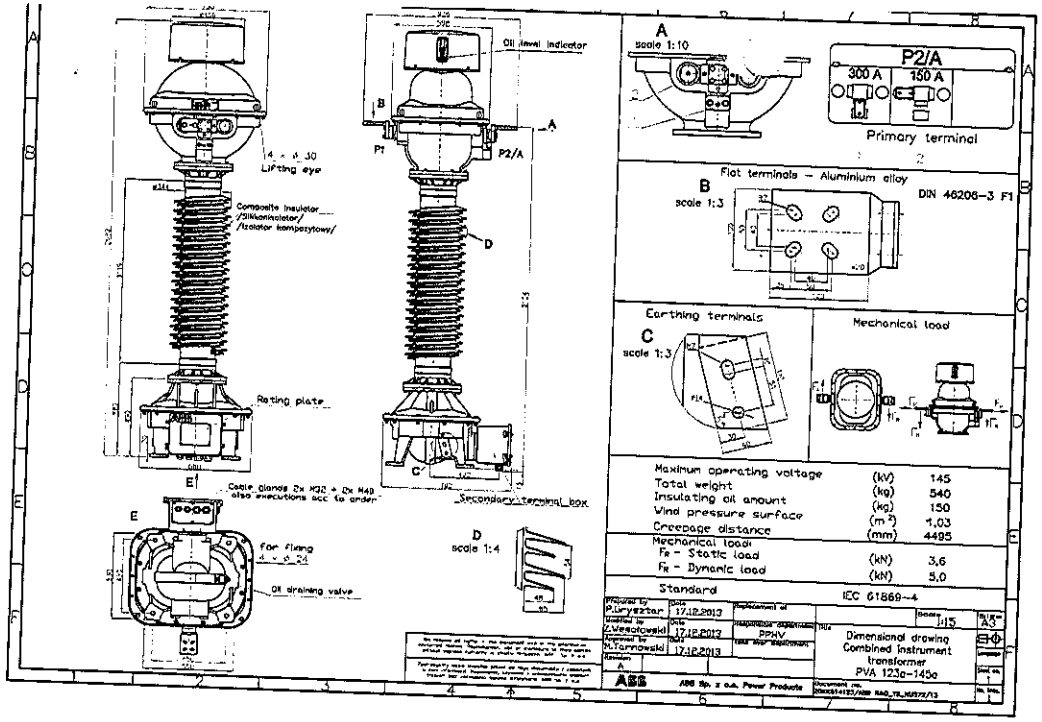
ABB
ABB Sp. z o.o.
ul. Zegrzyńska 1, 04-713 Warszawa
NIP: 525-030-14-34 PL 526030434
Regon 010017165
ODDZIAŁ W PRZASNYSZU
ul. Leszno 69, 06-300 Przasnysz
tel. (22) 223 6921, fax (22) 223 6958

(Name) (Signature)









ABB

Combined Instrument Transformer

Insulation level	145/275/650kV	Standard	IEC 61869-4	Type	PVA 145a
Oil type	Nytro Libra	Weight / Oil weight	520 / 150 kg	fn	50 Hz
S/N	86142 / 13	Voltage factor	1,9Un/8h	Temp. range	-40°C ⇾ +40°C
				Ue	0,2 mV/kA

CURRENT PART

K_n 150-300-600/5-5 A/A

I_{th}/1s 40-40-40 kA I_{dyn} 100-100-100 kA

I_{cth} 180-360-720 A

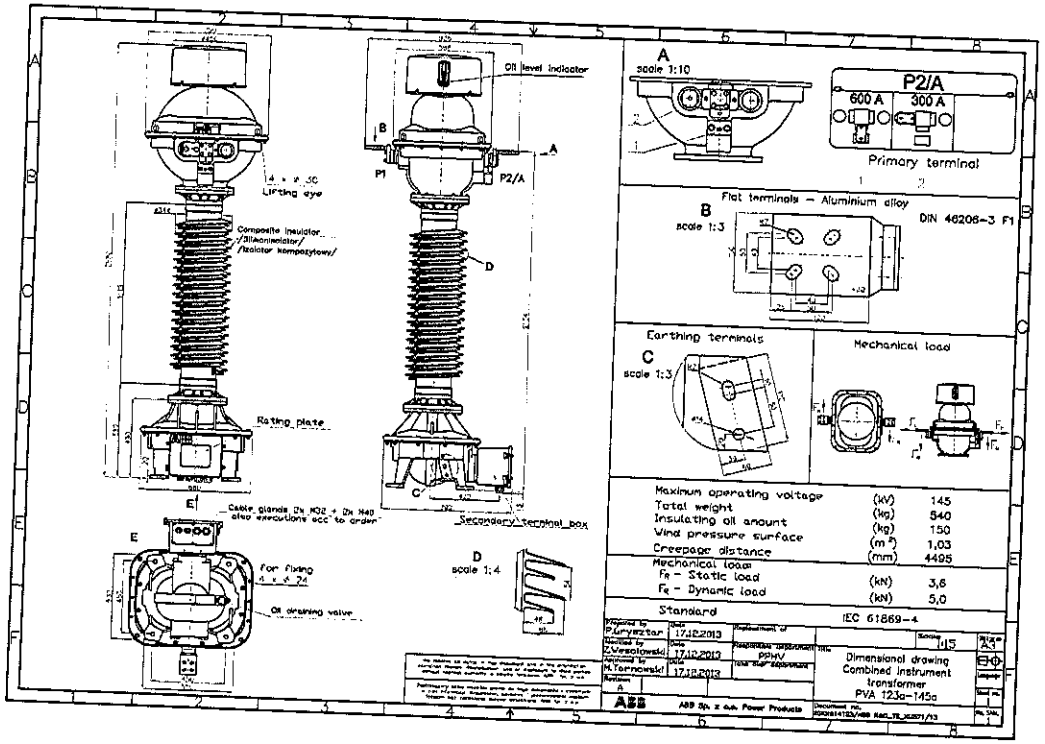
	1S1-1S2	2S1-2S2	3S1-3S2	4S1-4S2	5S1-5S2	6S1-6S2
A	5	5				
VA	30	30				
Class	5P	5P				
FS/ALF	20	20				
Ext.%						

VOLTAGE PART

A-N 132:√3 kV

	1a-1n	2a-2n	3a-3n	4a-4n	da-dn
V	110:√3	110:√3			
VA	25	25			
Class	0,5	0,5/3P			
VA_{sth}	1000	1000			

Transportation Vertical / Horizontal



ABB

Combined Instrument Transformer

Insulation level	126/230/550 kV	Standard	IEC 61869-4	Type	PVA 123a
Oil type	Nytro Libra	Weight / Oil weight	540 / 150 kg	fn	50 Hz
S/N	2GKP013K1486138	Voltage factor	1,9Un/8h	Temp. range	-50°C ⇾ +40°C
				Ue	0,2 mV/kA

CURRENT PART

K_n 50-100-200 / 5-1-5-1-1 A/A

I_{th}/1s 40 - 63 - 63 kA I_{dyn} 100 - 158 - 158 kA

I_{cth} 100 - 200 - 400 A

	A	VA	class	FS/ALF	Ext.%
1S1-1S2	5	1 -> 5	0,5	5	200
2S1-2S2	1	1 -> 2,5	0,5	10	200
3S1-3S2	5	10	5P	10	-
		2,5	5P	80	-
4S1-4S2	1	Rb=3,5Ω,class PX, 4-2-1/200, Ek=190 V, Ie<=0,1 A / 95 V, Rct<=0,3Ω, Kx=50			
		Rb=1Ω, classTPX 13x14,6, Rct <=0,3Ω , cykl 100 ms, Tp=50 ms			
5S1-5S2	1	5	5P	10	-
6S1-6S2					

VOLTAGE PART

A-N 110:√3 kV

	1a-1n	2a-2n	3a-3n	4a-4n	da-dn
V	100:√3	100:√3	100:√3	100:√3	100:3
VA	25	25	25	25	100
Klass	0,1	0,1	0,1/3P	0,1/3P	1,0
VA	(25)	(25)	(500)	(25)	300)
Klass	(3)	(3)	(3/3P)	(3/3P)	(3P)
VA_{sth}	1000	1000	1000	1000	450

Transportation Vertical / Horizontal

ABB

Combined Instrument Transformer

Type: PVA 145a

Insulation level	145/275/650 kV	Standard	IEC 61869-4	fn	50 Hz
Oil type	Nytro Libra	Weight / Oil weight	540 / 150 kg	Temp. range	-50°C → +40°C
S/N	2GKP013K1486144 / 13	Voltage factor	1,9Un/8h	Ue	0,2 mV/kA

CURRENT PART

K_n 300-600 / 5-1-5-1 A/A

$I_{th}/1s$ 40-40 kA I_{dyn} 100-100 kA

I_{cth} 450-900 A

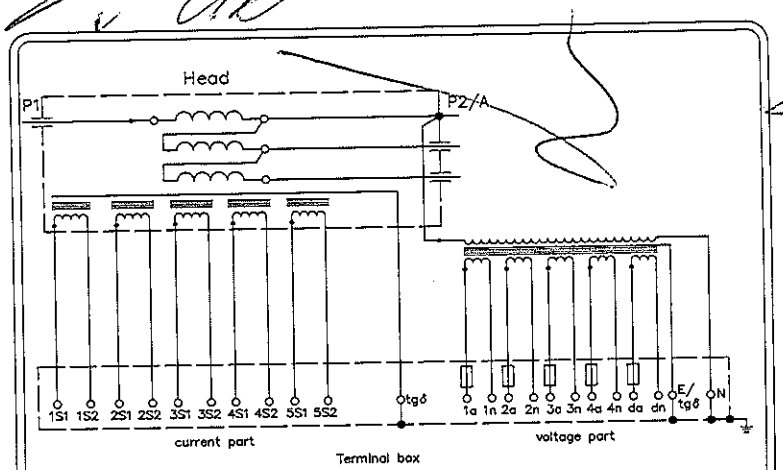
	1S1-1S2	2S1-2S2	3S1-3S2	4S1-4S2	5S1-5S2	6S1-6S2
A	5	1	5	1		
VA	40	30	60	120		
Kl.	0,2	0,5	5P	10P		
FS/ALF	5	10	20	15		
Ext.%	150	150				

VOLTAGE PART

A-N 132:√3 kV

	1a-1n	2a-2n	3a-3n	4a-4n	da-dn
V	110:√3	110:√3	110:√3	110:√3	110
VA	0->10	25	25	40	100
Kl.	0,1	0,1	0,1/3P	1/3P	1,0
VA_{sn}	1000	1000	1000	1000	450

Transportation: Vertical / Horizontal



Instrument transformer electrical diagram

ATTENTION!

1. HIGH VOLTAGE AT OPEN CURRENT SECONDARY TERMINALS XS1 – XS2
2. DURING INSTRUMENT TRANSFORMER OPERATION TERMINALS: N, E/tgδ, tgδ MUST BE EARTHED
3. AFTER THREE WINDINGS da - dn ARE CONNECTED IN BROKEN DELTA THE CIRCUIT SHOULD BE EARTHED IN ONE POINT ONLY

ABB

Combined Instrument Transformer

Type: PVA 145a

Insulation level	145/275/650 kV	Standard	IEC 61869-4	fn	50 Hz
Oil type	Nytro Libra	Weight / Oil weight	600 / 180 kg	Temp. range	-40°C → +40°C
S/N	86143 / 13	Voltage factor	1,9Un/8h	Ue	0,2 mV/kA

CURRENT PART

K_n 150-300-600/5-5 A/A

$I_{th}/1s$ 40-40-40 kA I_{dyn} 100-100-100 kA

I_{cth} 180-360-720 A

	1S1-1S2	2S1-2S2	3S1-3S2	4S1-4S2	5S1-5S2	6S1-6S2
A	5	5				
VA	30	30				
Class	5P	5P				
FS/ALF	20	20				
Ext.%						

VOLTAGE PART

A-N 132:√3 kV

	1a-1n	2a-2n	3a-3n	4a-4n	da-dn
V	110:√3	110:√3			
VA	25	25			
Class	0,5	0,5/3P			
VA_{sn}	1000	1000			

Transportation: Vertical / Horizontal

ABB

Combined Instrument Transformer

Type: PVA 145a

Insulation level	145/275/650 kV	Standard	IEC 61869-4	fn	50 Hz
Oil type	Nytro Libra	Weight / Oil weight	540 / 150 kg	Temp. range	-50°C → +40°C
S/N	2GKP013K1486145 / 13	Voltage factor	1,9Un/8h	Ue	0,2 mV/kA

CURRENT PART

K_n 150-300 / 5-1-5-1 A/A

$I_{th}/1s$ 20-20 kA I_{dyn} 50-50 kA

I_{cth} 225-450 A

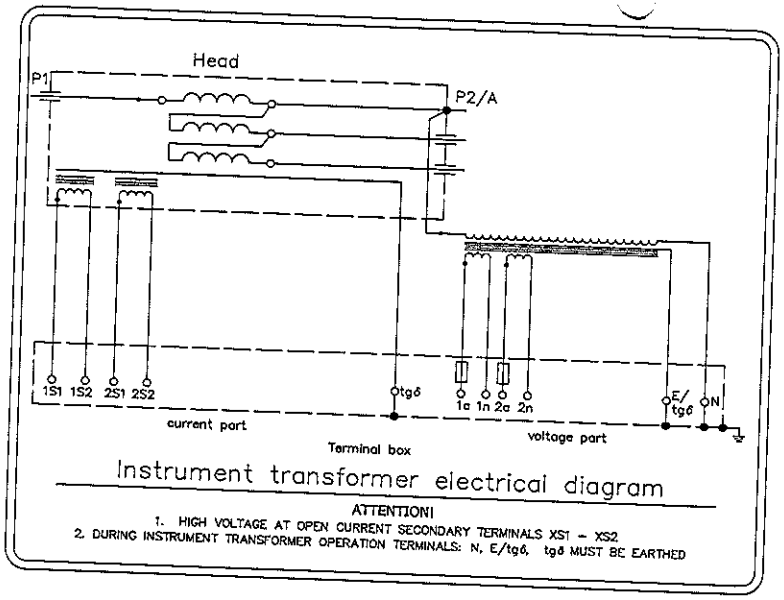
	1S1-1S2	2S1-2S2	3S1-3S2	4S1-4S2	5S1-5S2	6S1-6S2
A	5	1	5	1		
VA	30	40	60	60		
Kl.	0,2	5P	5P	5P		
FS/ALF	5	20	20	20		
Ext.%	150					

VOLTAGE PART

A-N 132:√3 kV

	1a-1n	2a-2n	3a-3n	4a-4n	da-dn
V	110:√3	110:√3	110:√3	110:√3	110:3
VA	100	100	100	100	200
Kl.	1,0	1,0	1/3P	3/3P	3,0
VA_{sn}	1000	1000	1000	1000	450

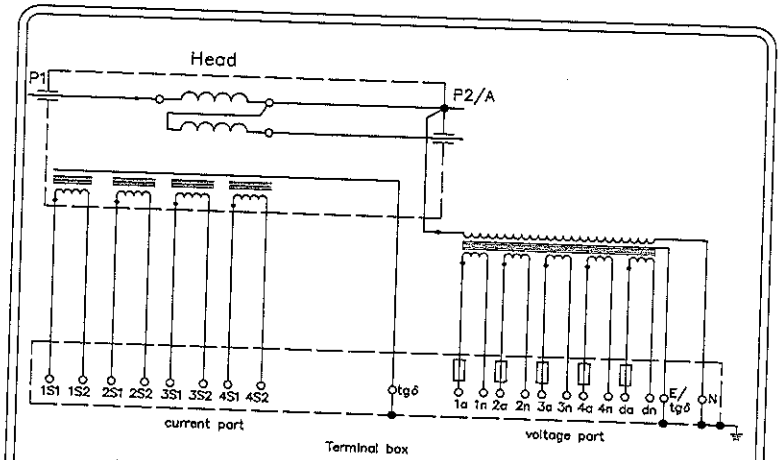
Transportation: Vertical / Horizontal



Instrument transformer electrical diagram

ATTENTION!

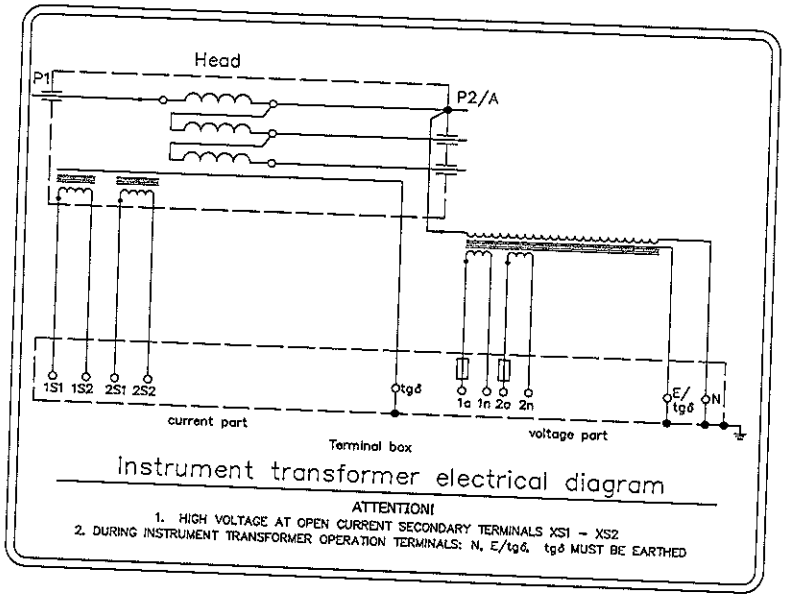
1. HIGH VOLTAGE AT OPEN CURRENT SECONDARY TERMINALS XS1 – XS2
2. DURING INSTRUMENT TRANSFORMER OPERATION TERMINALS: N, E/tgδ, tgδ MUST BE EARTHED



Instrument transformer electrical diagram

ATTENTION!

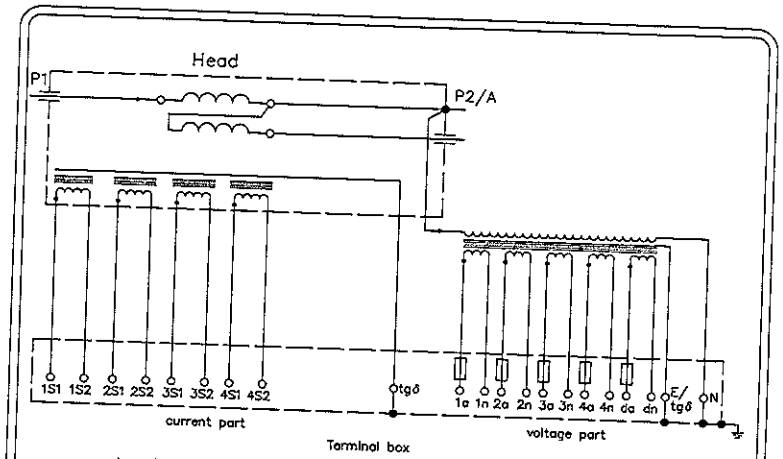
1. HIGH VOLTAGE AT OPEN CURRENT SECONDARY TERMINALS XS1 – XS2
2. DURING INSTRUMENT TRANSFORMER OPERATION TERMINALS: N, E/tgδ, tgδ MUST BE EARTHED
3. AFTER THREE WINDINGS da - dn ARE CONNECTED IN BROKEN DELTA THE CIRCUIT SHOULD BE EARTHED IN ONE POINT ONLY



Instrument transformer electrical diagram

ATTENTION!

1. HIGH VOLTAGE AT OPEN CURRENT SECONDARY TERMINALS XS1 – XS2
2. DURING INSTRUMENT TRANSFORMER OPERATION TERMINALS: N, E/tgδ, tgδ MUST BE EARTHED



Instrument transformer electrical diagram

ATTENTION!

1. HIGH VOLTAGE AT OPEN CURRENT SECONDARY TERMINALS XS1 – XS2
2. DURING INSTRUMENT TRANSFORMER OPERATION TERMINALS: N, E/tgδ, tgδ MUST BE EARTHED
3. AFTER THREE WINDINGS da - dn ARE CONNECTED IN BROKEN DELTA THE CIRCUIT SHOULD BE EARTHED IN ONE POINT ONLY

LABORATORIUM WYSOKICH NAPIĘĆ
INSTYTUTU ENERGETYKI
01-330 WARSZAWA, ul. Mory 8, tel. (+48 22) 3451242
tel. fax. (+48 22) 836-80-48, e-mail: ewn@ien.com.pl

EWN/145/E/13

ANNEX 2

ANNEX 2 for test report EWN/145/E/13

Reports of routine test and determination of errors of combined transformers type PVA123a and PVA145a performed in Factory Laboratory of ABB sp. z o.o.

- Tests before type test and special test (Measurements before type test and special tests)
  - Report No. 2GKP013K1486138 – 12.11.2013,
- Tests before type test and special test (Measurements before type test and special tests)
  - Report No. 2GKP013K1486144 – 18.11.2013,
- Tests before type test and special test (Measurements before type test and special tests)
  - Report No. 2GKP013K1486145 – 04.12.2013,
- Tests after lightning impulse test
  - Report No. 2GKP013K1486138 – 09.12.2013,
- Tests after lightning impulse test
  - Report No. 2GKP013K1486144 – 20.12.2013.

ABB Sp. z o.o. 06 – 300 Przasnysz ul. Leszno 59	Routine tests report of combined instrument transformer			TYP: PVA123a Nr fabr. 2GKP013K1486138	
A – N 110: $\sqrt{3}$ kV	Insulation level: 126/230/550 kV	Voltage factor: 1,9 /8h	Ith 1 s [kA] 40-63-63	Idyn [kA] 100-158-158	Ith [A]: 160-350-720 / IEC 61869-4 50 Hz

VOLTAGE PART	Winding	Usn [kV]	Sn [VA]	class	Sth [VA]
	1a-1n	0,1:√3	25	0,1	1000
		0,1:√3	25	3,0	1000
	2a-2n	0,1:√3	25	0,1	1000
		0,1:√3	25	3,0	1000
	3a-3n	0,1:√3	25	0,1/3P	1000
		0,1:√3	600	3/3P	1000
	4a-4n	0,1:√3	25	0,1/3P	1000
		0,1:√3	25	3/3P	1000
	da-dn	0,1: 3	100	1	450
		0,1: 3	300	3P	450

CURRENT PART	Winding	Isn [A]	Sn [VA]	class	Przekładnia [A/A]
	1S1-1S2	5	1->5	0,5FS5	50-10-200/5
	2S1-2S2	1	1->2,5	0,5FS10	50-10-200/1
	3S1-3S2	5	10	5P 10	50-10-200/5
	4S1-4S2	1	2,5	5P10	50-10-200/1
		1		PX Ek=190V Ie<=0,1A/95 V Rct<=0,3Ω Rb=3,6 Ω Kx=50 4-2-1/200	50-10-200/1
		1		TPX Kssc= 13 Ktd= 14,6 cykl = 0,1s Tp= 0,05 Rct<=0,3Ω Rb=1 Ω Ratio error <=0,5%	50-10-200/1
	5S1-5S2	1	5	5P10	50-10-200/1

List of performer tests

1. Oil dielectric parameters check before filling (oil after tgδ wg IEC 60247, breakdown voltage acc. IEC 60156) ☑
2. Verification of terminal ☑
3. Pressure and tightness test: oil overpressure: 0,6 bar / 24h – no traces of oil ☑
4. Power-frequency withstand on primary windings – P1+P2/A;Up=230 kV / 60 s,f =97 Hz; N; Up = 3 kV/ 60s, f=50 Hz ☑
5. Partial discharge ☑
6. Power-frequency withstand test on secondary – Up = 3 kV/60 s ☑
7. Inter-turn overvoltage test for current transformers– lower value (U szczyt. = 4,5 kV lub U szczyt. Przy Ith) / 60s ☑
8. Determination of errors ☑
9. Determination of the over current factors: FS, ALF ☑
10. Measurement of capacitance and dielectric dissipation factor (tgδ) ☑
11. Determination of core magnetization characteristics ☑
12. Measurement of windings' resistance ☑

Oil dielectric parameters check before filling (oil after treatment)

- Measurement of oil tgδ according to IEC 60247
  Tgδ = 0,06%; electrical stress = 1 kV/mm, f=50 Hz, Oil temp. = 90°C±1°C

- Measurement of breakdown voltage according to IEC 60156
  Mean breakdown voltage =77,42 kV, Relative standard deviation = 5,64%; f=50 Hz,
  oil temp. = 26 °C, measurement with the stirrer, type of electrodes used: partially spherical.

Sample	Breakdown voltage [kV]
1	83.2
2	80.1
3	70.8
4	79.2
5	76.4
6	74.8

Partial discharge measurement

- Measurement according to procedure A (PD test voltages were reached while decreasing the voltage after the power-frequency withstand test on primary winding)
  Stress voltage 230 kV / 60 s
  Frequency 97 Hz

Test voltage	1,2 Um = 151 kV	1,2 Um / √3 = 87,5 kV
Level of partial discharge	2 pC	1,5 pC

Remarks: background noise level: 1 (measured after voltage switch off), measuring circuit was calibrated with 5 pC (calibrating charge).

Inter-turn overvoltage test for current transformers

	Peak voltage on secondary winding [kVpeak]	Current in primary winding [A]
1S1-1S2	0.069	400
2S1-2S2	0.307	400
3S1-3S2	0.205	400
4S1-4S2	1.41	400
5S1-5S2	0.736	400

Determination of voltage part errors (ε U %), (Δφ U min), cosφ = 0,8

Uzwojenie	Usn [kV]	Sn [VA]	klasa	Sth [VA]
1a-1n	0,1:√3	25	0,1	1000
2a-2n	0,1:√3	25	0,1	1000
3a-3n	0,1:√3	25	0,1/3P	1000
4a-4n	0,1:√3	25	3/3P	1000
da-dn	0,1: 3	100	3P	450

1a – 1n 25 VA; cos fi = 0,8 ind.
2a-2n 25 VA; 3a-3n 25 VA; 4a-4n 25 VA cos fi = 0,8 ind

	0,8 U_n	1,0 U_n	1,2 U_n	k_t U_n
ε U	-0,037	-0,035	-0,035	
Δφ U	2,2	2,2	2,3	

1a – 1n 6,25 VA; cos fi = 0,8 ind.
2a-2n 25 VA; 3a-3n 25 VA; 4a-4n 25 VA cos fi = 0,8 ind

	0,8 U_n	1,0 U_n	1,2 U_n	k_t U_n
ε U	0,004	0,005	0,005	
Δφ U	2,1	2,1	2,2	

2a – 2n 25 VA; cos fi = 0,8 ind.
1a-1n 25 VA; 3a-3n 25 VA; 4a-4n 25 VA, cos fi = 0,8 ind

	0,8 U_n	1,0 U_n	1,2 U_n	k_t U_n
ε U	-0,027	-0,025	-0,025	
Δφ U	2,3	2,3	2,4	

2a – 2n 6,25 VA; cos fi = 0,8 ind.
1a-1n 25 VA; 3a-3n 25 VA; 4a-4n 25 VA cos fi = 0,8 ind

	0,8 U_n	1,0 U_n	1,2 U_n	k_t U_n
ε U	0,013	0,014	0,015	
Δφ U	2,1	2,2	2,2	

3a – 3n 25 VA; cos fi = 0,8 ind.
1a-1n 25 VA; 2a-2n 25 VA; 4a-4n 25 VA cos fi = 0,8 ind

	0,02 U_n	0,05 U_n	0,8 U_n	1,0 U_n	1,2 U_n	1,9 U_n*
ε U	-0,171	-0,109	-0,020	-0,016	-0,017	-0,117
Δφ U	-3,0	0,2	2,4	2,6	2,5	1,1

3a – 3n 6,25 VA; cos fi = 0,8 ind.
1a-1n 25 VA; 2a-2n 25 VA; 4a-4n 25 VA cos fi = 0,8 ind

	0,02 U_n	0,05 U_n	0,8 U_n	1,0 U_n	1,2 U_n	1,9 U_n*
ε U	-0,126	-0,056	0,019	0,021	0,021	-0,078
Δφ U	-3,2	-0,0	2,2	2,2	2,3	0,9

4a – 4n 25 VA; cos fi = 0,8 ind.
1a-1n 25 VA; 2a-2n 25 VA; 3a-3n 25 VA cos fi = 0,8 ind

	0,02 U_n	0,05 U_n	0,8 U_n	1,0 U_n	1,2 U_n	k_t U_n
ε U	-0,170	-0,109	-0,024	-0,023	-0,023	-0,122
Δφ U	-2,7	0,5	2,6	2,6	2,9	1,4

4a – 4n 6,25 VA; cos fi = 0,8 ind.
1a-1n 25 VA; 2a-2n 25 VA; 3a-3n 25 VA cos fi = 0,8 ind

	0,02 U_n	0,05 U_n	0,8 U_n	1,0 U_n	1,2 U_n	k_t U_n
ε U	-0,125	-0,065	0,021	0,023	0,023	-0,077
Δφ U	-3,0	0,1	2,4	2,4	2,4	1,0

da – dn 100 VA; cos fi = 0,8 ind.
1a-1n 25VA; 2a-2n 25VA; 3a-3n 500VA; 4a-4n 25VA , cos fi = 0,8 ind

	0,8 U_n	1,0 U_n	1,2 U_n
ε U	-0,741	-0,739	-0,738
Δφ U	8,9	8,9	9,0

1a – 1n 25 VA; cos fi = 0,8 ind.
2a-2n 0 VA; 3a-3n 0 VA; 4a-4n 0 VA

	0,8 U_n	1,0 U_n	1,2 U_n
ε U	0,035	0,037	0,037
Δφ U	3,6	3,6	3,6

1a – 1n 6,25 VA; cos fi = 0,8 ind.
2a-2n 0 VA; 3a-3n 0 VA; 4a-4n 0 VA

	0,8 U_n	1,0 U_n	1,2 U_n
ε U	0,075	0,077	0,077
Δφ U	3,4	3,5	3,5

2a – 2n 25 VA; cos fi = 0,8 ind.
2a-2n 0 VA; 3a-3n 0 VA; 4a-4n 0 VA

	0,8 U_n	1,0 U_n	1,2 U_n
ε U	0,044	0,046	0,047
Δφ U	3,7	3,7	3,8

2a – 2n 6,25 VA; cos fi = 0,8 ind.
1a-1n 0 VA; 3a-3n 0 VA; 4a-4n 0 VA

	0,8 U_n	1,0 U_n	1,2 U_n
ε U	0,084	0,056	0,058
Δφ U	3,5	3,6	3,6

3a – 3n 25 VA; cos fi = 0,8 ind.
1a-1n 0 VA; 2a-2n 0 VA; 4a-4n 0 VA

	0,02 U_n	0,05 U_n	0,8 U_n	1,0 U_n	1,2 U_n	1,9 U_n*
ε U	-0,094	-0,037	0,050	0,052	0,053	-0,048
Δφ U	-1,4	1,7	3,7	3,8	3,8	2,5

3a – 3n 6,25 VA; cos fi = 0,8 ind.
1a-1n 0 VA; 2a-2n 0 VA; 4a-4n 0 VA

	0,02 U_n	0,05 U_n	0,8 U_n	1,0 U_n	1,2 U_n	1,9 U_n*
ε U	-0,054	0,003	0,090	0,092	0,092	-0,007
Δφ U	-1,6	1,4	3,6	3,6	3,6	2,3

4a – 4n 25 VA; cos fi = 0,8 ind.
1a-1n 0 VA; 2a-2n 0 VA; 3a-3n 0 VA

	0,02 U_n	0,05 U_n	0,8 U_n	1,0 U_n	1,2 U_n	1,9 U_n*
ε U	-0,101	-0,041	0,045	0,047	0,047	-0,052
Δφ U	-1,2	1,9	4,0	4,0	4,1	2,7

4a – 4n 6,25 VA; cos fi = 0,8 ind.
1a-1n 0 VA; 2a-2n 0 VA; 3a-3n 0 VA

	0,02 U_n	0,05 U_n	0,8 U_n	1,0 U_n	1,2 U_n	1,9 U_n*
ε U	-0,054	0,002	0,090	0,092	0,092	-0,007
Δφ U	-1,4	1,5	3,6	3,6	3,7	2,4

da – dn 25 VA; cos fi = 0,8 ind.
1a-1n 0VA; 2a-2n 0VA; 3a-3n 0VA; 4a-4n 0VA ,

	0,8 U_n	1,0 U_n	1,2 U_n
ε U	-0,304	-0,302	-0,302
Δφ U	5,2	5,2	5,3

*) at 1,9 Un winding da-dn is loaded with Sn, cos fi = 0,8 ind.

Determination of voltage part errors (ε U %), (Δφ U min), cosφ = 0,8

Uzwojenie	Usn [kV]	Sn [VA]	klasa	Sth [VA]
1a-1n	0,1:√3	25	3,0	1000
2a-2n	0,1:√3	25	3,0	1000
3a-3n	0,1:√3	500	3/3P	1000
4a-4n	0,1:√3	25	3/3P	1000
da-dn	0,1: 3	300	3P	450

1a – 1n 25 VA; cos fi = 0,8 ind.
2a-2n 25 VA; 3a-3n 500 VA; 4a-4n 25 VA cos fi = 0,8 ind

	0,8 U_n	1,0 U_n	1,2 U_n	$k_t U_n$
ε U	-0.517	-0.515	-0.516	
Δφ U	-7.1	-7.1	-7.0	

1a – 1n 6,25 VA; cos fi = 0,8 ind.
2a-2n 25 VA; 3a-3n 500 VA; 4a-4n 25 VA cos fi = 0,8 ind

	0,8 U_n	1,0 U_n	1,2 U_n	$k_t U_n$
ε U	-0.478	-0.476	-0.476	
Δφ U	-7.2	-7.2	-7.1	

2a – 2n 25 VA; cos fi = 0,8 ind.
1a-1n 25 VA; 3a-3n 500 VA; 4a-4n 25 VA cos fi = 0,8 ind

	0,8 U_n	1,0 U_n	1,2 U_n	$k_t U_n$
ε U	-0.511	-0.509	-0.509	
Δφ U	-7.1	-7.1	-7.0	

2a – 2n 6,25 VA; cos fi = 0,8 ind.
1a-1n 25 VA; 3a-3n 500 VA; 4a-4n 25 VA cos fi = 0,8 ind

	0,8 U_n	1,0 U_n	1,2 U_n	$k_t U_n$
ε U	-0.470	-0.470	-0.469	
Δφ U	-7.3	-7.3	-7.2	

3a – 3n 500 VA; cos fi = 0,8 ind.
1a-1n 25 VA; 2a-2n 25 VA; 4a-4n 25 VA cos fi = 0,8 ind

	0,02 U_n	0,05 U_n	0,8 U_n	1,0 U_n	1,2 U_n	1,9 U_n*
ε U	-1.151	-1.089	-0.996	-0.995	-0.993	-1.245
Δφ U	1.9	4.9	7.2	7.3	7.3	2.7

3a – 3n 125 VA; cos fi = 0,8 ind.
1a-1n 25 VA; 2a-2n 25 VA; 4a-4n 25 VA cos fi = 0,8 ind

	0,02 U_n	0,05 U_n	0,8 U_n	1,0 U_n	1,2 U_n	1,9 U_n*
ε U	-0.383	-0.318	-0.230	-0.228	-0.227	-0.478
Δφ U	-1.9	1.2	3.5	3.5	3.6	-1.1

4a – 4n 25 VA; cos fi = 0,8 ind.
1a-1n 25 VA; 2a-2n 25 VA; 3a-3n 500 VA cos fi = 0,8 ind

	0,02 U_n	0,05 U_n	0,8 U_n	1,0 U_n	1,2 U_n	$k_t U_n$
ε U	-0.595	-0.537	-0.449	-0.445	-0.443	-0.699
Δφ U	-10.7	-7.5	-5.1	-5.1	-5.1	-9.7

4a – 4n 6,25 VA; cos fi = 0,8 ind.
1a-1n 25 VA; 2a-2n 25 VA; 3a-3n 500 VA cos fi = 0,8 ind

	0,02 U_n	0,05 U_n	0,8 U_n	1,0 U_n	1,2 U_n	$k_t U_n$
ε U	-0.265	-0.203	-0.113	-0.112	-0.11	-0.367
Δφ U	-4.6	-1.2	1.1	1.1	1.1	-3.6

da – dn 300 VA; cos fi = 0,8 ind.
1a-1n 25VA; 2a-2n 25VA; 3a-3n 500VA; 4a-4n 25VA, cos fi = 0,8 ind

	0,02 U_n	0,05 U_n	1,0 U_n	1,9 U_n
ε U	-1.229	-1.172	-1.072	-1.669
Δφ U	-5.8	-2.4	0.7	0.9

1a – 1n 25 VA; cos fi = 0,8 ind.
2a-2n 0 VA; 3a-3n 0 VA; 4a-4n 0 VA.

	0,8 U_n	1,0 U_n	1,2 U_n
ε U	0.035	0.037	0.037
Δφ U	3.6	3.6	3.6

1a – 1n 6,25 VA; cos fi = 0,8 ind.
2a-2n 0 VA; 3a-3n 0 VA; 4a-4n 0 VA

	0,8 U_n	1,0 U_n	1,2 U_n
ε U	0.075	0.077	0.077
Δφ U	3.5	3.5	3.5

2a – 2n 25 VA; cos fi = 0,8 ind.
2a-2n 0 VA; 3a-3n 0 VA; 4a-4n 0 VA

	0,8 U_n	1,0 U_n	1,2 U_n
ε U	0.045	0.048	0.047
Δφ U	3.7	3.7	3.6

2a – 2n 6,25 VA; cos fi = 0,8 ind.
1a-1n 0 VA; 3a-3n 0 VA; 4a-4n 0 VA

	0,8 U_n	1,0 U_n	1,2 U_n
ε U	0.084	0.086	0.086
Δφ U	3.6	3.5	3.6

3a – 3n 500 VA; cos fi = 0,8 ind.
1a-1n 0 VA; 2a-2n 0 VA; 4a-4n 0 VA

	0,02 U_n	0,05 U_n	0,8 U_n	1,0 U_n	1,2 U_n	1,9 U_n*
ε U	-1.090	-1.019	-0.926	-0.924	-0.924	-1.175
Δφ U	3.3	6.3	8.5	8.5	8.7	4.1

3a – 3n 125 VA; cos fi = 0,8 ind.
1a-1n 0 VA; 2a-2n 0 VA; 4a-4n 0 VA

	0,02 U_n	0,05 U_n	0,8 U_n	1,0 U_n	1,2 U_n	1,9 U_n*
ε U	-0.306	-0.247	-0.156	-0.156	-0.155	-0.407
Δφ U	-0.5	2.7	4.8	4.6	4.9	0.3

4a – 4n 25 VA; cos fi = 0,8 ind.
1a-1n 0 VA; 2a-2n 0 VA; 3a-3n 0 VA

	0,02 U_n	0,05 U_n	0,8 U_n	1,0 U_n	1,2 U_n	1,9 U_n*
ε U	-0.097	-0.040	0.047	0.049	-0.049	-0.205
Δφ U	-1.2	1.9	4.0	4.0	4.1	-0.6

4a – 4n 6,25 VA; cos fi = 0,8 ind.
1a-1n 0 VA; 2a-2n 0 VA; 3a-3n 0 VA

	0,02 U_n	0,05 U_n	0,8 U_n	1,0 U_n	1,2 U_n	1,9 U_n*
ε U	-0.053	0.007	0.091	0.093	0.094	-0.151
Δφ U	-1.5	1.5	3.8	3.7	3.7	-0.9

da – dn 75 VA; cos fi = 0,8 ind.
1a-1n 0VA; 2a-2n 0VA; 3a-3n 0VA; 4a-4n 0VA,

	0,02 U_n	0,05 U_n	1,0 U_n	1,9 U_n
ε U	-0.731	-0.658	-0.672	-0.884
Δφ U	4.5	7.7	9.8	10.2

*) at 1,9 Un winding da-dn is loaded with Sn, cos fi = 0,8 ind.

Determination of current part errors (ε I %), (Δφ I min),

Ipn (A): 50

1S1-1S2 5 VA; cosφ = 0,8

	0,05 I_n	0,2 I_n	1,0 I_n	2,0 I_n
ε I	-0.432	-0.235	-0.018	0.127
Δφ I	19.5	7.5	-1.0	-3.1

1S1-1S2 1 VA; cosφ = 0,8

	0,05 I_n	0,2 I_n	1,0 I_n	2,0 I_n
ε I	0.264	0.299	0.314	0.328
Δφ I	15.8	8.9	4.9	3.4

2S1-2S2 2,5 VA; cosφ = 1

	0,05 I_n	0,2 I_n	1,0 I_n	2,0 I_n
ε I	0.024	-0.011	0.132	0.184
Δφ I	33.2	23.1	7.4	4.3

2S1-2S2 1 VA; cosφ = 1

	0,05 I_n	0,2 I_n	1,0 I_n	2,0 I_n
ε I	0.252	0.251	0.283	0.316
Δφ I	19.3	11.8	5.5	4.6

3S1-3S2

	1,0 In
ε I	0.898
Δφ I	8.3

4S1-4S2

	1,0 In
ε I	-0.394
Δφ I	14.4

6S1-6S2

	1,0 In
ε I	0.709
Δφ I	15.4

Ipn (A): 100

1S1-1S2 5 VA; cosφ = 0,8

	0,05 I_n	0,2 I_n	1,0 I_n	2,0 I_n
ε I	-0.393	-0.277	0.007	0.132
Δφ I	17.7	9.3	-0.4	-3.3

1S1-1S2 1 VA; cosφ = 0,8

	0,05 I_n	0,2 I_n	1,0 I_n	2,0 I_n
ε I	0.284	0.303	0.314	0.329
Δφ I	13.3	8.8	4.9	3.3

2S1-2S2 2,5 VA; cosφ = 1

	0,05 I_n	0,2 I_n	1,0 I_n	2,0 I_n
ε I	0.025	0.013	0.136	0.184
Δφ I	33.1	20.6	6.4	5.2

2S1-2S2 1 VA; cosφ = 1

	0,05 I_n	0,2 I_n	1,0 I_n	2,0 I_n
ε I	0.249	0.244	0.277	0.316
Δφ I	18.0	12.4	5.7	4.1

3S1-3S2

	1,0 In
ε I	0.830
Δφ I	8.4

4S1-4S2

	1,0 In
ε I	-0.402
Δφ I	14.7

6S1-6S2

	1,0 In
ε I	0.711
Δφ I	15.1

Ipn (A): 200

1S1-1S2 5 VA; cosφ = 0,8

	0,05 I_n	0,2 I_n	1,0 I_n	2,0 I_n
ε I	-0.581	-0.280	0.010	0.013
Δφ I	27.7	9.6	-0.7	0.2

1S1-1S2 1 VA; cosφ = 0,8

	0,05 I_n	0,2 I_n	1,0 I_n	2,0 I_n
ε I	0.084	0.262	0.305	0.270
Δφ I	25.8	11.2	5.2	7.5

2S1-2S2 2,5 VA; cosφ = 1

	0,05 I_n	0,2 I_n	1,0 I_n	2,0 I_n
ε I	0.002	-0.002	0.132	0.192
Δφ I	39.4	22.6	6.8	4.8

2S1-2S2 1 VA; cosφ = 1

	0,05 I_n	0,2 I_n	1,0 I_n	2,0 I_n
ε I	0.237	0.257	0.281	0.313
Δφ I	20.7	11.8	6.8	4.6

3S1-3S2

	1,0 In
ε I	0.880
Δφ I	8.9

4S1-4S2

	1,0 In
ε I	-0.389
Δφ I	14.4

6S1-6S2

	1,0 In
ε I	0.765
Δφ I	15.4

Current part: Measurements uncertainty: ε I = ±0,045 %, Δφ I = ±2,3 min
Voltage part: Measurements uncertainty: ε U = ±0,044 %, Δφ U = ±2,2 min

Determination of the over current factors:

- Instrument security factor (FS) of measuring cores

Winding	Ie [A]	U [V]	EFS [V]	Condition	Assessment
1S1-1S2	2,5	4,32	6,22	$U < E_{FS}$	☑
2S1-2S2	1	9,83	31,35	$U < E_{FS}$	☑

- granicznego dokładności (ALF) – próba błędu złożonego ε_c rdzeni zabezpieczeniowych

Winding	E_{ALF} [V]	Ie [A]	ε_c [%]	Condition	Assessment
3S1-3S2	21.18	1.176	2.35	ε_c < 5%	☑
4S1-4S2	220.64	0.124	0.18	ε_c < 5%	☑
6S1-6S2	53.08	0.128	1.29	ε_c < 5%	☑

Determination of parameters of class PX core 4S1-4S2:

Ipn (A)	50	100	200
Factor Kx	53.85	54.87	54.87
Turns ratio error [%]	-0.809	-0.003	0.092

Determination of parameters of class TPX core 4S1-4S2:

Ipn (A)	50	100	200
Factor Kssc	13.41	13.87	13.86
Factor Kid	14.48	14.48	14.48
Current ratio error [%]	-0.232	-0.230	-0.235
Ts [s]	5.319	5.611	5.509
e-peak [%]	2.36	1.57	1.65

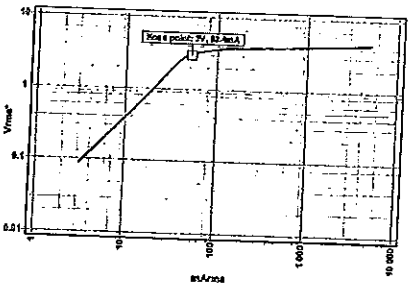
Measurement of capacitance and dielectric dissipation factor (tg δ)
Temperature: 22,3 °C, Frequency: 60 Hz

Primary voltage	Instrument transformer			Current part			Voltage part		
	Capacity	Capacity	Leak current	Tg δ	Capacity	Leak current	Tg δ	Capacity	Leak current
	[%]	[pF]	[mA]	[%]	[pF]	[mA]	[%]	[pF]	[mA]
10 kV	0.24	1383	4.36	0.25	1116	3.532	0.23	268	0.838
63 kV	0.24	1383	27.54	0.24	1116	22.21	0.22	266	5.297
71 kV	0.24	1383	30.9	0.24	1117	24.98	0.22	266	5.953

Core magnetization characteristics:

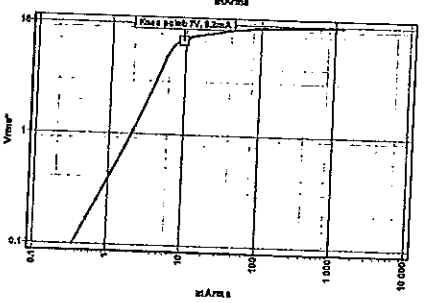
Winding 1S1-1S2

[V]	[mA]
4.5	5292
4.3	2108.3
3.8	135.8
3.2	55.41
2.7	42.37
2.2	35
1.8	28.78
1	20.73
0.5	12.12
0.1	3.25



Winding 2S1-2S2

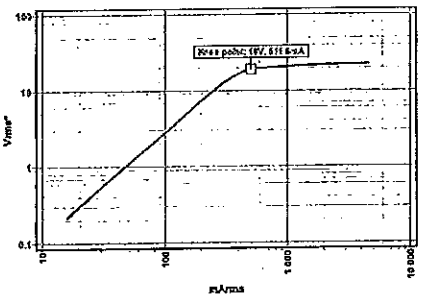
[V]	[mA]
9.7	1224.3
9.5	413.6
8.9	53.1
8.4	26.71
7.8	14.58
7.2	9.49
6.7	7.87
6.1	6.93
5.5	6.18
5	5.68
3.8	4.75
2.9	3.89
1.7	2.65
0.5	1.23
0.1	0.32



162

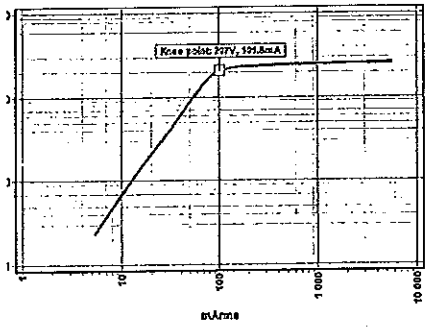
Winding 3S1-3S2

[V]	[mA]
22	2714.7
21.4	1328.1
20.6	814.6
19.2	555.1
17.8	444.8
16.5	395.7
15	358.4
13.8	329.9
12.3	297
10.9	268.9
9.6	243.4
6.7	168.1
4.1	130.9
1.2	51.58
0.2	13.46



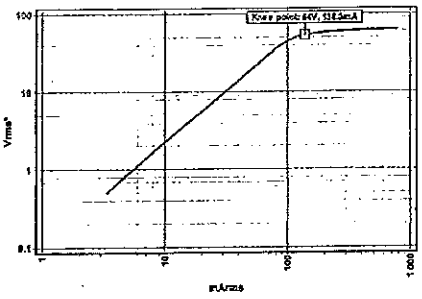
Winding 4S1-4S2

[V]	[mA]
256.5	5777
251.1	1957.8
248.2	1141.9
241.4	449.8
234	217
229.3	168.1
220.8	123.9
207.3	100.74
194.2	90.63
178.1	81.76
152.6	72.53
109.8	58.59
67.7	43.23
25.2	23
1.8	4.79



Winding 6S1-6S2

[V]	[mA]
64.5	1117.4
62.8	569.9
60.2	267.2
58.6	204.4
57.1	169.8
56.1	156
52.9	127.3
50.3	114.1
47.6	105.77
39	87.24
30.5	71.18
22	50.3
13.7	40.21
5.1	19.51
0.6	3.51



Measurement of windings' resistance

Windings' resistance of current part:

	R (23°C)	R ct (75°C)
P1-P2 range 50 A	268.0 µΩ	320.4 µΩ
P1-P2 range 100 A	100.0 µΩ	120.4 µΩ
P1-P2 range 200 A	47.0 µΩ	56.6 µΩ
1S1-1S2	0.048 Ω	0.058 Ω
2S1-2S2	0.527 Ω	0.635 Ω
3S1-3S2	0.024 Ω	0.029 Ω
4S1-4S2	0.214 Ω	0.257 Ω
5S1-5S2	0.315 Ω	0.380 Ω

Windings' resistance of voltage part:

	R (24,9°C)	R ct (75°C)
A-N	17.30 kΩ	20.835 kΩ
1a-1n	44.120 mΩ	53.138 mΩ
2a-2n	45.150 mΩ	54.377 mΩ
3a-3n	46.690 mΩ	56.230 mΩ
4a-4n	48.050 mΩ	57.869 mΩ
da-dn	31.900 mΩ	38.419 mΩ

Checked by: ... OG-4 KJ-06

Przasnysz. 12.11.2013 r.

ABB Sp. z o.o. 06-300 Przasnysz ul. Leszno 59		Routine tests report of combined instrument transformer			TYPE: PVA145a Serial no: 2GKP013K1486144	
A-N 132:√3 kV	Insulation level 145/275/650 kV	Voltage factor: 1.9/8h	Ith 1s [kA]: 40-40	Idyn [kA]: 100-100	Ioth [A]: 450-900	IEC 61869-4 50 Hz

	Winding	Usn [kV]	Sn [VA]	class	Sth [VA]
VOLTAGE PART	1a - 1n	0,11:√3	0->10	0,1	1000
	2a - 2n	0,11:√3	25	0,1	1000
	3a - 3n	0,11:√3	25	0,1/3P	1000
	4a - 4n	0,11:√3	40	1/3P	1000
	da - dn	0,11	100	1,0	450
CURRENT PART	Winding	Isn [A]	Sn [VA]	class	Ratio [A/A]
	1S1-1S2	5	40	0,2FS 5	300-600/5
	2S1-2S2	1	30	0,5FS 10	300-600/1
	3S1-3S2	5	60	5P 20	300-600/5
	4S1-4S2	1	120	10P 15	300-600/1

List of performed tests:

1. Oil dielectric parameters check before filling (oil after treatment): tg δ acc. IEC 60247, breakdown voltage acc. IEC 60156 ☑
2. Verification of terminal ☑
3. Pressure and tightness test: oil overpressure: 0,8 bar / 24h – no traces of oil ☑
4. Power-frequency withstand on primary windings - P1-P2/A: Up = 275kV / 60s, f = 97 Hz; N: Up = 3kV / 60s, f = 50Hz ☑
5. Partial discharge ☑
6. Power-frequency withstand test on secondary - Up = 3 kV/60s ☑
7. Inter-turn overvoltage test for current - lower value (U peak=4,6kV or U peak for Ioth) / ☑
8. Determination of ☑
9. Determination of the over current factors: FS, ☑
10. Measurement of capacitance and dielectric dissipation factor - tg δ ☑
11. Determination of core magnetization characteristics ☑
12. Measurement of windings' resistance ☑

Oil dielectric parameters check before filling (oil after treatment)

- Measurement of oil tg δ according to IEC
  Tg δ = 0.07 %; electrical stress = 1kV/mm, f = 50Hz, oil temp. = 90C

- Measurement of breakdown voltage according to IEC 60156
  Mean breakdown voltage = 75.92 kV, Relative standard deviation = 7.19
  f = 50Hz, oil temp. = 26 °C, measurement with the stirrer, type of electrodes used: partially

Sample	Breakdown voltage [kV]
1	81
2	68.2
3	77.5
4	76.3
5	82.2
6	71.3

Partial discharge measurement

- Measurement according to procedure A (PD test voltages were reached while decreasing the after the power-frequency withstand test on primary
  Stress voltage: 275 kV / 60 s
  Frequency: 97 Hz

Test voltage	1,2 Um = 174 kV	1,2 Um / $\sqrt{3}$ = 100,5 kV
Level of partial discharge	1,5 pC	1,25 pC

Remarks: background noise level: 1 (measured after voltage switch off),
measuring circuit was calibrated with 5 pC (calibrating

Inter-turn overvoltage test for current transformers

Winding	Peak voltage on secondary winding [kVpeak]	Current in primary winding [A]
1S1-1S2	1.31	900
2S1-2S2	4.5	620
3S1-3S2	2.06	900
4S1-4S2	4.6	86

Determination of voltage part errors (ε U%), $\Delta\varphi$ U min)

1a-1s: 10 VA — 2a-2s: 25VA; 3a-3s: 25VA; 4a-4s: 40VA — p.f. = 1 / p.f. = 0,8 lag.

	0,8 Un	1,0 Un	1,2 Un
ε U	-0.025	-0.025	-0.027
Δφ U	0.5	0.5	0.6

1a-1s: 0 VA — 2a-2s: 25VA; 3a-3s: 25VA; 4a-4s: 40VA — p.f. = 0,8 lag.

	0,8 Un	1,0 Un	1,2 Un
ε U	-0.009	-0.009	-0.011
Δφ U	0.9	0.8	0.9

2a-2s: 25 VA — 1a-1s: 10VA; 3a-3s: 25VA; 4a-4s: 40VA — p.f. = 0,8 lag. / p.f. = 0,8 lag.

	0,8 Un	1,0 Un	1,2 Un
ε U	-0.043	-0.042	-0.044
Δφ U	1.3	1.3	1.4

2a-2s: 6.25 VA — 1a-1s: 10VA; 3a-3s: 25VA; 4a-4s: 40VA — p.f. = 0,8 lag. / p.f. = 0,8 lag.

	0,8 Un	1,0 Un	1,2 Un
ε U	-0.008	-0.005	-0.006
Δφ U	1.2	1.3	1.3

3a-3s: 25 VA — 1a-1s: 10VA; 2a-2s: 25VA; 4a-4s: 40VA — p.f. = 0,8 lag. / p.f. = 0,8 lag.

	0,02 Un	0,05 Un	0,8 Un	1,0 Un	1,2 Un	1,9 Un*
ε U	-0.105	-0.117	-0.035	-0.035	-0.038	-0.131
Δφ U	0.1	1.1	1.4	1.4	1.5	0.3

3a-3s: 6.25 VA — 1a-1s: 10VA; 2a-2s: 25VA; 4a-4s: 40VA — p.f. = 0,8 lag. / p.f. = 0,8 lag.

	0,02 Un	0,05 Un	0,8 Un	1,0 Un	1,2 Un	1,9 Un*
ε U	-0.070	-0.079	0.003	0.003	0.001	-0.094
Δφ U	-0.0	1.0	1.3	1.3	1.4	0.3

4a-4s: 40 VA — 1a-1s: 10VA; 2a-2s: 25VA; 3a-3s: 25VA — p.f. = 0,8 lag. / p.f. = 0,8 lag.

	0,02 Un	0,05 Un	0,8 Un	1,0 Un	1,2 Un	1,9 Un*
ε U	-0.120	-0.134	-0.048	-0.047	-0.048	-0.142
Δφ U	0.9	1.9	2.1	2.1	2.2	1.1

1a-1s: 10 VA — 2a-2s: 0 VA; 3a-3s: 0 VA; 4a-4s: 0 VA — p.f. = 1

	0,8 Un	1,0 Un	1,2 Un
ε U	0.061	0.061	0.059
Δφ U	2.4	2.4	2.6

1a-1s: 0 VA — 2a-2s: 0 VA; 3a-3s: 0 VA; 4a-4s: 0 VA

	0,8 Un	1,0 Un	1,2 Un
ε U	0.076	0.077	0.076
Δφ U	2.8	2.9	2.9

2a-2s: 25 VA — 1a-1s: 0 VA; 3a-3s: 0 VA; 4a-4s: 0 VA — p.f. = 0,8 lag.

	0,8 Un	1,0 Un	1,2 Un
ε U	0.030	0.030	0.029
Δφ U	2.9	3.0	3.0

2a-2s: 6.25 VA — 1a-1s: 0 VA; 3a-3s: 0 VA; 4a-4s: 0 VA — p.f. = 0,8 lag.

	0,8 Un	1,0 Un	1,2 Un
ε U	0.067	0.068	0.067
Δφ U	2.9	2.9	3.0

3a-3s: 25 VA — 1a-1s: 0 VA; 2a-2s: 0 VA; 4a-4s: 0 VA — p.f. = 0,8 lag.

	0,02 Un	0,05 Un	0,8 Un	1,0 Un	1,2 Un	1,9 Un*
ε U	-0.043	-0.053	0.039	0.036	0.035	-0.060
Δφ U	1.9	2.8	3.0	3.0	3.1	2.0

3a-3s: 6.25 VA — 1a-1s: 0 VA; 2a-2s: 0 VA; 4a-4s: 0 VA — p.f. = 0,8 lag.

	0,02 Un	0,05 Un	0,8 Un	1,0 Un	1,2 Un	1,9 Un*
ε U	-0.008	-0.015	0.073	0.073	0.072	-0.023
Δφ U	1.8	2.7	2.9	3.0	3.0	2.0

4a-4s: 40 VA — 1a-1s: 0 VA; 2a-2s: 0 VA; 3a-3s: 0 VA — p.f. = 0,8 lag.

	0,02 Un	0,05 Un	0,8 Un	1,0 Un	1,2 Un	1,9 Un*
ε U	-0.057	-0.078	0.005	0.006	0.006	-0.086
Δφ U	2.3	3.2	3.3	3.3	3.4	2.3

4a-4s: 10 VA — 1a-1s: 10VA; 2a-2s: 25VA; 3a-3s: 25VA — p.f. = 0,8 lag. / p.f. = 0,8 lag.

	0,02 Un	0,05 Un	0,8 Un	1,0 Un	1,2 Un	1,9 Un*
ε U	-0.055	-0.069	0.016	0.016	0.015	-0.078
Δφ U	0.8	1.8	1.8	1.8	1.9	0.8

4a-4s: 10 VA — 1a-1s: 0 VA; 2a-2s: 0 VA; 3a-3s: 0 VA — p.f. = 0,8 lag.

	0,02 Un	0,05 Un	0,8 Un	1,0 Un	1,2 Un	1,9 Un*
ε U	-0.004	-0.012	0.071	0.072	0.071	-0.022
Δφ U	2.1	3.0	3.1	3.1	3.1	2.1

4a-4s: 100 VA — 1a-1s: 10VA; 2a-2s: 25VA; 3a-3s: 25VA; 4a-4s: 40VA — p.f. = 0,8 lag. / p.f. = 0,8 lag.

	0,8 Un	1,0 Un	1,2 Un
ε U	-0.751	-0.751	-0.751
Δφ U	1.8	1.8	1.9

4a-4s: 25 VA — 1a-1s: 0 VA; 2a-2s: 0 VA; 3a-3s: 0 VA; 4a-4s: 0 VA — p.f. = 0,8 lag.

	0,8 Un	1,0 Un	1,2 Un
ε U	-0.519	-0.517	-0.518
Δφ U	3.1	3.0	3.2

* at 1,9 Un winding 4a-4s is loaded with 100 VA, p.f. = 0,8

Determination of current part errors (ε i%), $\Delta\varphi$ i min)

Ipn (A): 300

1S1-1S2: 40 VA — p.f. = 0,8 lag.

	0,05 In	0,2 In	1,0 In	1,5 In
ε I	-0.061	-0.047	-0.033	-0.034
Δφ I	0.6	0.1	-0.3	-0.3

2S1-2S2: 30 VA — p.f. = 0,8 lag.

	0,05 In	0,2 In	1,0 In	1,5 In
ε I	-0.060	-0.063	-0.017	-0.029
Δφ I	2.0	1.3	-0.4	0.5

3S1-3S2: 60 VA — p.f. = 0,8 lag.

	1,0 In
ε I	-0.109
Δφ I	0.7

1S1-1S2: 10 VA — p.f. = 0,8 lag.

	0,05 In	0,2 In	1,0 In	1,5 In
ε I	-0.015	-0.014	-0.016	-0.018
Δφ I	0.1	0.1	0.0	0.0

2S1-2S2: 7.50 VA — p.f. = 0,8 lag.

	0,05 In	0,2 In	1,0 In	1,5 In
ε I	0.007	0.010	0.014	0.018
Δφ I	1.3	0.8	0.2	0.2

4S1-4S2: 120 VA — p.f. = 0,8 lag.

	1,0 In
ε I	-0.128
Δφ I	0.9

Ipn (A): 600

1S1-1S2: 40 VA — p.f. = 0,8 lag.

	0,05 In	0,2 In	1,0 In	1,5 In
ε I	-0.053	-0.047	-0.032	-0.032
Δφ I	0.9	0.4	-0.2	-0.2

2S1-2S2: 30 VA — p.f. = 0,8 lag.

	0,05 In	0,2 In	1,0 In	1,5 In
ε I	-0.060	-0.053	-0.019	-0.040
Δφ I	2.8	1.5	-0.2	1.2

3S1-3S2: 60 VA — p.f. = 0,8 lag.

	1,0 In
ε I	-0.108
Δφ I	0.7

1S1-1S2: 10 VA — p.f. = 0,8 lag.

	0,05 In	0,2 In	1,0 In	1,5 In
ε I	-0.008	-0.013	-0.014	-0.014
Δφ I	0.1	0.3	0.1	0.0

2S1-2S2: 7.50 VA — p.f. = 0,8 lag.

	0,05 In	0,2 In	1,0 In	1,5 In
ε I	0.013	0.010	0.017	0.019
Δφ I	1.0	0.7	0.1	0.1

4S1-4S2: 120 VA — p.f. = 0,8 lag.

	1,0 In
ε I	-0.125
Δφ I	0.9

Current part: Measurements $\varepsilon_I = \pm 0{,}045$ %, $\Delta\varphi_I = \pm 2{,}3$ min
Voltage part: Measurements uncertainty: $\varepsilon_U = \pm 0{,}044$ %, $\Delta\varphi_U = \pm 2{,}2$ min

Determination of the over current factors:

- Instrument security factor (FS) of measuring cores

Winding	Is [A]	U [V]	Efs [V]	Condition	Assessment
1S1-1S2	2.5	31.18	50.21	U < Efs	☑
2S1-2S2	1	90.0	360.76	U < Efs	☑

- accuracy limit factor (ALF) – test for composite error ε_c of protective cores

Winding	EALF [V]	Is [A]	ε_c [%]	Condition	Assessment

3S1-3S2	283.75	0.153	0.15	$\varepsilon_c \leq 5\%$	☑
4S1-4S2	1932.84	0.014	0.09	$\varepsilon_c \leq 10\%$	☑

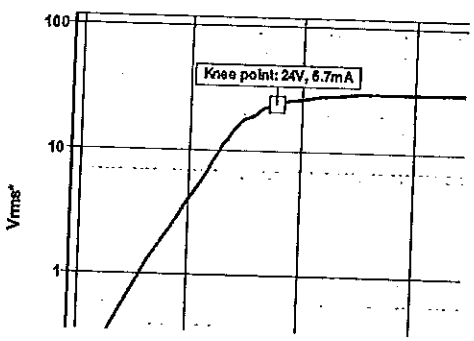
Measurement of capacitance and dielectric dissipation factor - δ
Temperature: 23,3 °C, Frequency: 60

Primary voltage	Instrument transformer			Current part			Voltage part		
	Tg δ [%]	Capacity [pF]	Leak.current [mA]	Tg δ [%]	Capacity [pF]	Leak.current [mA]	Tg δ [%]	Capacity [pF]	Leak.current [mA]
10 kV	0.24	1409	4.44	0.26	1131	3.571	0.22	277	0.873
63 kV	0.25	1409	28.18	0.25	1131	22.5	0.22	277	5.522
71 kV	0.25	1409	31.8	0.25	1132	25.3	0.22	277	6.214

Core magnetization characteristics:

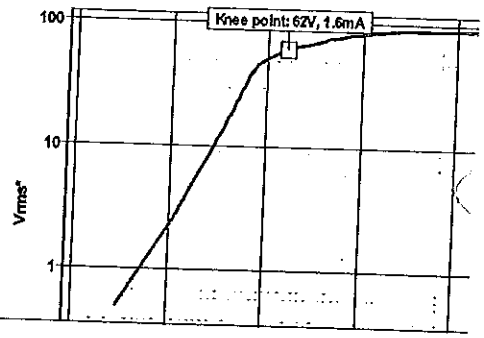
Winding 1S1-1S2

[V]	[mA]
31.5	3069.1
30	46.38
28	15.21
25.8	7.59
25.3	6.76
24.4	5.8
23.7	5.53
22.3	4.6
21	4.17
19.8	3.75
15.4	2.54
11.1	1.95
6.9	1.42
2.6	0.71
0.3	0.16



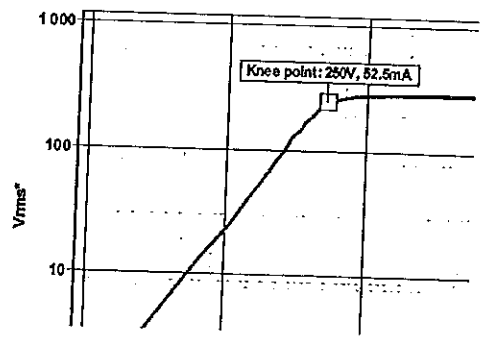
Winding 2S1-2S2

[V]	[mA]
97.9	1134.1
85.6	11.43
79.7	6.8
73.8	3.99
67.9	2.52
65.2	2.08
62.2	1.69
59.3	1.43
56.6	1.24
53.3	1.07
42.1	0.74
30.9	0.58
19.7	0.44
8.3	0.25
0.5	0.03



Winding 3S1-3S2

[V]	[mA]
307.	7274
304.	2660.1
290.	314
267.	62.38
261.	57.88
253.	53.51
240.	49.83
228.	47.34
210	44.59
197.	42.65
154.	35.26
111.	27.48
68.8	20.51
25.6	10.79
2.4	2.14



164