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ДО
ЕСО ЕАД
гр. София 1404
бул. „Гоце Делчев", №105

ТЕХНИЧЕСКО ПРЕДЛОЖЕНИЕ

за участие в процедура за възлагане на обществена поръчка с предмет:

„Доставка на измервателни трансформатори за напрежение 110 kV",
Обособена позиция № 2 „Напреженови измервателни трансформатори 110 kV"

От АББ България ЕООД

(наименование на участника)

УВАЖАЕМИ ДАМИ И ГОСПОДА,

1. Предлаганият от нас срок за доставка е 150 (Сто и петдесет) календарни дни, считано от датата на влизане на договора в сила.

2. Предлаганият от нас гаранционен срок е 24 (Двадесет и четири) месеца от датата на доставка.
3. Предлаганият от нас срок за отстраняване възникнали повреди на доставените трансформатори или за замяната им с нови по време на гаранционния срок е 30 (Тридесет) календарни дни след получаване на писмено уведомление от страна на възложителя.

Техническите характеристики на предлаганите от нас за доставка напреженови измервателни трансформатори 110 kV са посочени в таблиците по-долу:

Пакет 1 – Таблица № 2.1. Техническа спецификация за 9 (девет) напреженови трансформатора.

№	Технически характеристики	Мярка	Минимални Технически изисквания	Предложение на участника
1	*2*	*2*	*4*	*5*
	Общи данни			
1	Фирма-производител		да се посочи	АББ
2	Стандарт		IEC 61869-1, IEC 61869-3 или еквивалент	IEC 61869-1, IEC 61869-3
3	Тип конструктивно изпълнение		индуктивен	индуктивен
	Електрически параметри			
1	Максимално работно напрежение	kV	123	123
2	Номинално първично напрежение	kV	110/√3	110/√3
3	Номинална честота	Hz	50	50
4	Изпитвателни напрежения на първичната намотка:			
4.1	Със стандартна импулсна вълна 1,2/50 μs	kV	550	550
4.2	С промишлена честота, 1 min	kV	230	230
5	Минимален път на тока на утечка	mm	3813.k_D	4250 (>3813.k_D)
6	Частични разряди при изпитвателно напрежение	pC	10	≤10

АББ България ЕООД
Адрес на управление (ЦУ):
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уеб страница: www.abb.bg
ел. поща: office@bg.abb.com

ЕИК: 831133152
Ид. номер по ЗДДС: BG 831133152
Банкови данни:
ИНГ Банк, клон София
IBAN: BG13INGB91451000027317 (BGN)
IBAN: BG60INGB91451400027311 (EUR)
BIC: INGBBGSF

SGS SGS SGS

№	Технически характеристики	Мярка	Минимални Технически изисквания	Предложение на участника
1	*2*	*2*	*4*	*5*
	Um			
7	Частични разряди при изпитвателно напрежение 1,2Um/ √3	pC	5	≤5
8	Напреженов фактор на системата:			
8.1	Напреженов фактор / продължително време	p.u	1,2	1,2
8.2	Напреженов фактор / време на действие 30 s	p.u.	1,5	1,5
9	Количество вторични намотки	бр.	3	3
10	Първа намотка:			
10.1	Номинално вторично напрежение	V	100/√3	100/√3
10.2	Клас на точност (при товар на останалите намотки от 0 до 100% от номиналния им товар)		0,2	0,2
10.3	Номинална мощност	VA	15	15
11	Втора намотка:			
11.1	Номинално вторично напрежение	V	100/√3	100/√3
11.2	Клас на точност (при товар на останалите намотки от 0 до 100% от номиналния им товар)		1	1
11.3	Номинална мощност	VA	100	100
12	Трета намотка (намотка за защита):			
12.1	Номинално вторично напрежение	V	100	100
12.2	Клас на точност		3 P	3 P
12.3	Номинална мощност	VA	100	100
13	Обща номинална мощност	VA		215
14	Устойчивост на къси съединения	s	1	1
15	Ниво на радио смущения при 1,1Um/3	μV	≤ 2500	≤ 2500
16	Изпитвателно напрежение на вторичните намотки	kV	3	3
	Механични параметри			
1	Допустимо статично натоварване на първичните клеми			
1.1	Хоризонтално натоварване	N	2000	2000
1.2	Вертикално натоварване	N	2000	2000
2	Допустимо динамично натоварване на първичните клеми	N	≥ 3000	3000
3	Сеизмична устойчивост на нивото на монтажа		0,3 g	0,3 g
	Конструктивни параметри			
1	Технология на външната изолация		Порцелан	Порцелан
2	Първична клемна връзка			
2.1	Материал		Al	Al
2.2	Вид		планка отгоре	планка отгоре
2.3	Осево разстояние между отворите	mm	да се посочи	50
3	Клемна кутия – защита		IP55	IP55

Пакет 2 –Таблица № 2.2. Техническа спецификация за 84 (осемдесет и четири) напреженови трансформатора

№	Технически характеристики	Мярка	Минимални Технически изисквания	Предложение на участника
1	*2*	*3*	*4*	*5*
	Общи данни			
1	Фирма-производител		да се посочи	АББ
2	Стандарт		IEC 61869-1, IEC 61869-3 или еквивалент	IEC 61869-1, IEC 61869-3
3	Тип конструктивно изпълнение		индуктивен	индуктивен
	Електрически параметри			
1	Максимално работно напрежение	kV	123	123
2	Номинално първично напрежение	kV	110/√3	110/√3
3	Номинална честота	Hz	50	50
4	Изпитвателни напрежения на първичната намотка:			
4.1	Със стандартна импулсна вълна 1,2/50 μs	kV	550	550
4.2	С промишлена честота, 1 min	kV	230	230
5	Минимален път на тока на утечка	mm		3075 (3075.kp)
6	Частични разряди при изпитвателно напрежение Um	pC	≤ 10	≤ 10
7	Частични разряди при изпитвателно напрежение 1,2Um/ √3	pC	≤ 5	≤ 5
8	Напреженов фактор на системата:			
8.1	Напреженов фактор / продължително време	p.u	1,2	1,2
8.2	Напреженов фактор / време на действие 30 s	p.u.	1,5	1,5
9	Количество вторични намотки	бр.	3	3
10	Първа намотка:			
10.1	Номинално вторично напрежение	V	100/√3	100/√3
10.2	Клас на точност (при товар на останалите намотки от 0 до 100% от номиналния им товар)		0,2	0,2
10.3	Номинална мощност	VA	15	15
11	Втора намотка:			
11.1	Номинално вторично напрежение	V	100/√3	100/√3
11.2	Клас на точност (при товар на останалите намотки от 0 до 100% от номиналния им товар)		1	1
11.3	Номинална мощност	VA	100	100
12	Трета намотка (намотка за защита):			
12.1	Номинално вторично напрежение	V	100	100
12.2	Клас на точност		3 P	3 P
12.3	Номинална мощност	VA	100	100
13	Обща номинална мощност	VA		215
14	Устойчивост на къси съединения	s	1	1
15	Ниво на радио смущения при $1,1U_r/3$	μV	≤ 2500	≤ 2500
16	Изпитвателно напрежение на вторичните намотки	kV	3	3
	Механични параметри			
1	Допустимо статично натоварване на първичните клеми			
1.1	Хоризонтално натоварване	N	2000	3600
1.2	Вертикално натоварване	N	2000	3600
2	Допустимо динамично натоварване на първичните клеми	N	≥ 3000	5000

№	Технически характеристики	Мярка	Минимални Технически изисквания	Предложение на участника
1	*2*	*3*	*4*	*5*
3	Сеизмична устойчивост на нивото на монтажа		0,3 g	0,3 g
	Конструктивни параметри			
1	Технология на външната изолация		порцелан	порцелан
2	Първична клемна връзка			
2.1	Материал		Al	Al
2.2	Вид		планка отгоре	планка отгоре
2.3	Осево разстояние между отворите	mm	да се посочи	50
3	Клемна кутия – защита		IP55	IP55

Като неразделна част от настоящото техническо предложение прилагаме следните документи:

1. Технически данни съгласно приложените таблици, с попълнени всички изисквания в колона № 5;
2. Документи, доказващи параметрите на декларираните (посочените) технически данни, като каталози, проспекти, технически характеристики заверени от фирмата производител и др.
3. Протоколи от всички типови изпитания, проведени в специализирана и акредитирана лаборатория, отговаряща на изискванията на IEC на английски или български език;
4. Сертификат/акредитация на независимата изпитвателна лаборатория, провела типовите изпитвания. (заверено копие и превод на български език, в случай че документът е издаден на чужд език)
5. Протокол от сеизмични изпитания или изчисления на английски или български език;
6. Сертификат за типа и характеристиките на маслото на маслонапълнените трансформатори на английски или български език;
7. Изискванията към конструкцията върху която оборудването ще бъде монтирано или проект на конструкцията, осигуряваща сеизмична устойчивост на оборудването.
8. Монтажни чертежи с габаритни размери и тегла;
9. Детайлен чертеж на клемната връзка;
10. Детайлен чертеж за начина на закрепване на съоръжението към носеща стоманена конструкция;
11. Списък на всички стандарти използвани при разработването и тестването, изготвен от участника.

Гарантираме, че сме в състояние да изпълним качествено поръчката в пълно съответствие с изискванията на възложителя.

Заличено по чл.2 от ЗЗЛД

Заличено по чл.2 от ЗЗЛД

Дата: 18.02.2016
София

Екехарт Нойрайтер
Управител
АББ България ЕООД

Стефан Минчев
Управител
АББ България ЕООД

ABB

Data Schedule : Inductive Voltage Transformer

Date :	**2015-12-15**	**Name :**	**bozena.trajer@pl.abb.com**
Our ref :	**KU 1319/15**	**Revision :**	**A**
Project :	**15Q2843089 - ESO**		

General data		
Quantity		9
Type		PV 123
Standards		IEC 61869-3
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		0,3g
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
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*	115 VA	1000 VA	1	-
II (2a - 2n)	100 : √3 V	100 VA	1,0*	115 VA	1000 VA	1	-
III (da - dn)	100 V	100 VA	3P	215 VA	450 VA	1	-

Product data		
Dimension drawing		2GKV614615A1319;rev.A
Rating plate language		Bulgarian
Insulator type / colour		Porcelain/ brown
Minimum creepage distance	mm	4250
Minimum arcing distance	mm	1425
Primary terminal type		Al flat pad 100x120 T=20 mm; 4xD=14/50x50mm
Earthing terminals type		4xø14/50x50mm
Secondary terminal type		Phoenix rail terminal blocks; spring, type ST 10
Cable glands – terminal box No. 1		Polyamide; 2xM32
		M32 (cable diam. 11-21 mm), with strain relief;
Withstand test load on primary terminal FR	(Static/Dyn)N	2000/3000
Painting (colour)		
- Housing above insulator		RAL 7035 Light grey
- Housing below insulator		RAL 7035 Light grey

Total weight	kg	310
Weight of oil	kg	60
Insulating oil type		Nynas Nytro 10XN – Inhibited mineral insulating oil acc. to IEC 60296
Packing		Vertical -3-pack wooden base
Shipping weight	kg/3units	1030
Shipping volume	m3/3units	5,6

ABB

Data Schedule : Inductive Voltage Transformer

Date :	**2015-12-15**	**Name :**	**bozena.trajer@pl.abb.com**
Our ref :	**KU 1320/15**	**Revision :**	**A**
Project :	**15Q2843089 - ESO**		

General data

Quantity	84
Type	PV 123
Standards	IEC 61869-3
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		0,3g

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

Voltage ratings

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

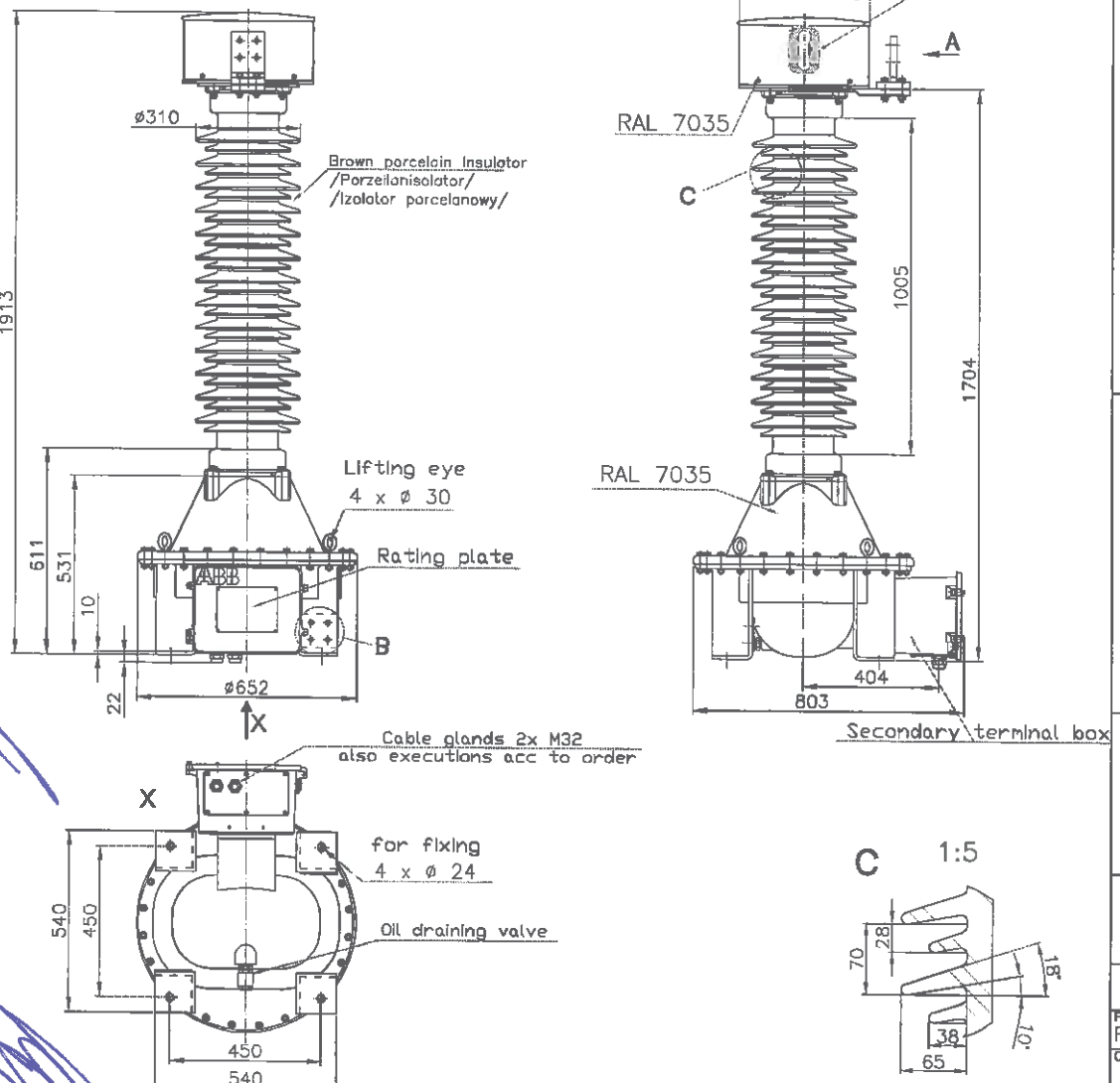
Accuracy ratings

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	115 VA	1000 VA	1	-
II (2a - 2n)	100 : √3 V	100 VA	1,0	115 VA	1000 VA	1	-
III (da - dn)	100 V	100 VA	3P	215 VA	450 VA	1	-

Product data

Dimension drawing		2GKV614615A1320;rev.A
Rating plate language		Bulgarian
Insulator type / colour		Porcelain / brown
Minimum creepage distance	mm	3075
Minimum arcing distance	mm	1005
Primary terminal type		Al flat pad 100x120 T=20 mm; 4xD=14/50x50mm
Earthing terminals type		4xø14/50x50mm
Secondary terminal type		Phoenix rail terminal blocks; spring, type ST 10
Cable glands – terminal box No. 1		Polyamide; 2xM32
		M32 (cable diam. 11-21 mm), with strain relief;
Withstand test load on primary terminal FR	(Static/Dyn)N	3600/5000
Painting (colour)		
- Housing above insulator		RAL 7035 Light grey
- Housing below insulator		RAL 7035 Light grey

Total weight	kg	280
Weight of oil	kg	60
Insulating oil type		Nynas Nytro 10XN – Inhibited mineral insulating oil acc. to IEC 60296
Packing		Vertical -3-pack wooden crate
Shipping weight	kg/3units	1010
Shipping volume	m3/3units	5,6

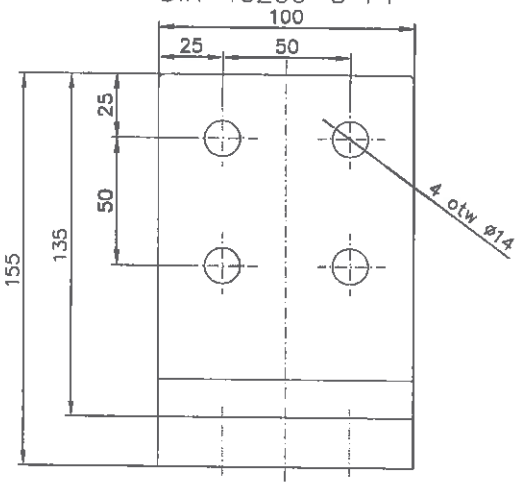


All dimensions in mm

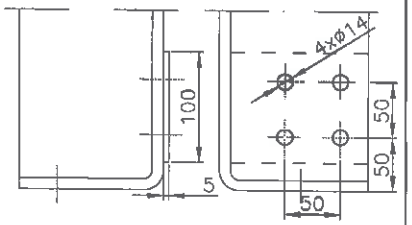
Primary terminal Al

DIN 46206-3 F1

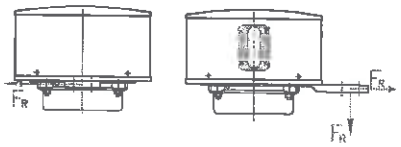
A



B Earthing terminals



Mechanical load

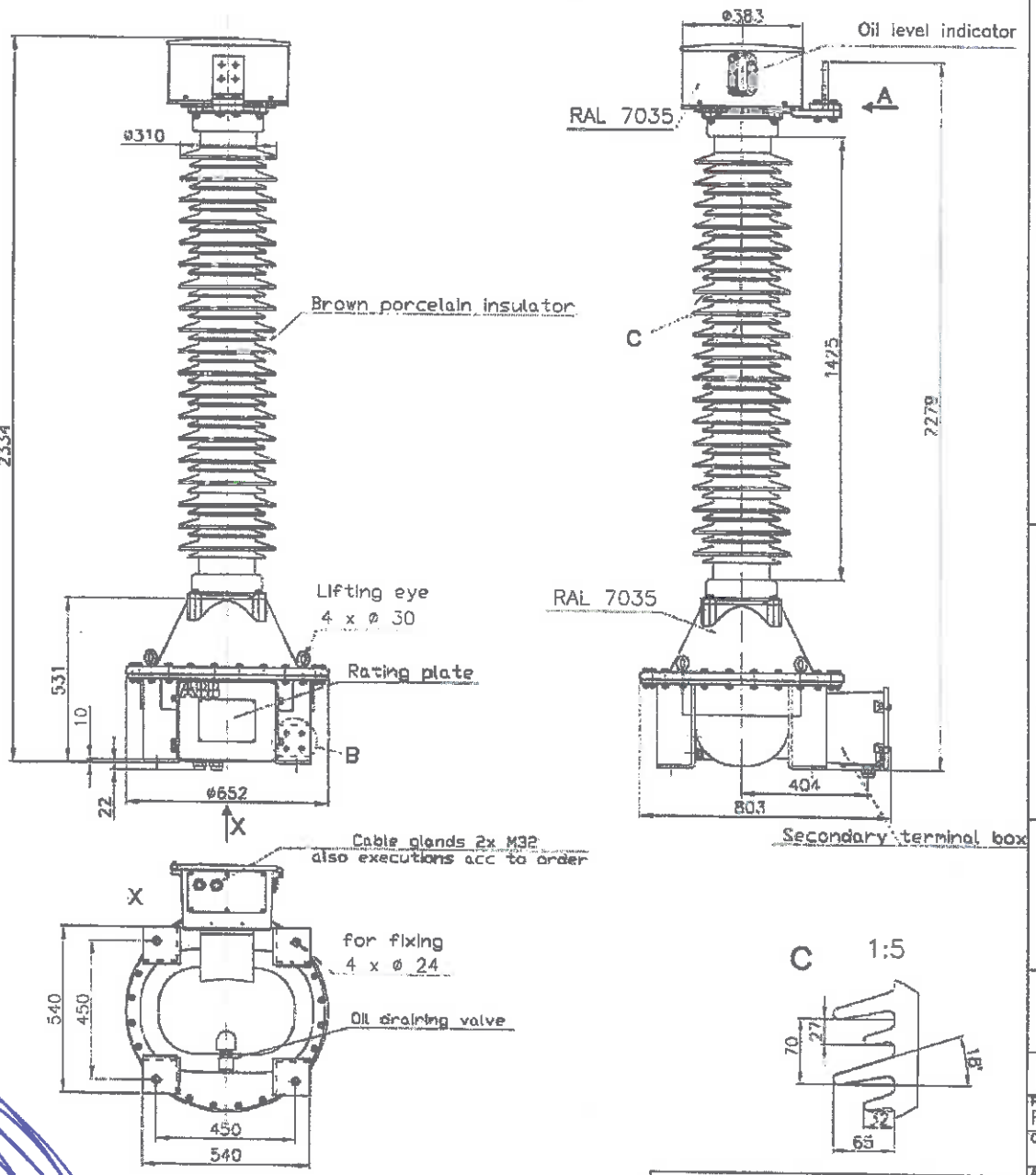


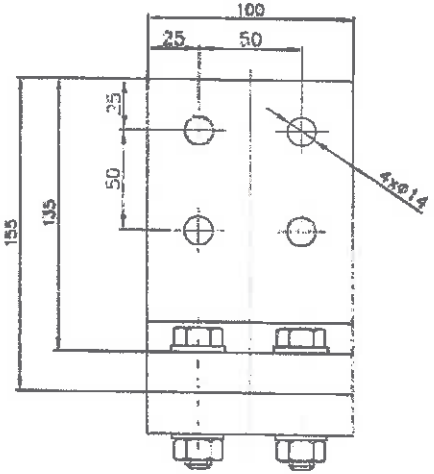
Maximum operating voltage	(kV)	123
Total weight	(kg)	285
Insulating oil amount	(kg)	60
Wind pressure surface	(m^2)	0,5
Creepage distance	(mm)	3075
Mechanical load:		
F_R - Static load	(kN)	3,6
F_R - Dynamic load	(kN)	5,0
Standard		IEC 61869-3

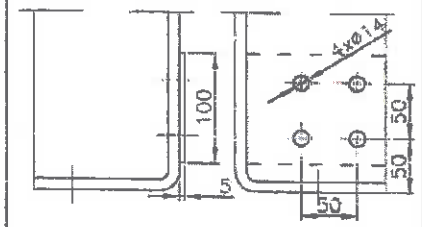
Prepared P.Mikulski	Date 11.02.16	Replacement of		Scale 1:15	Size A3
Checked by	Date	Responsible department PPHV	Title Dimensional drawing Voltage transformer PV 123		Language EN
Approved by J.Duzdowski	Date 11.02.16	Take over department			Sheet no. 1
Revision A					No. Shts. 1
ABB	ABB Sp. z o.o. Power Products		Document no. 2GKV614615A1320		

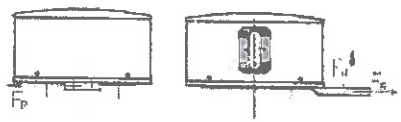
Заличено по чл.2 от ЗЗЛД

ODDZIAŁ W PRZASNYSZU
ul. Leszno 59, 06-300 Przasnysz
tel. (22) 223 8849, fax (22) 223 8958
(16)





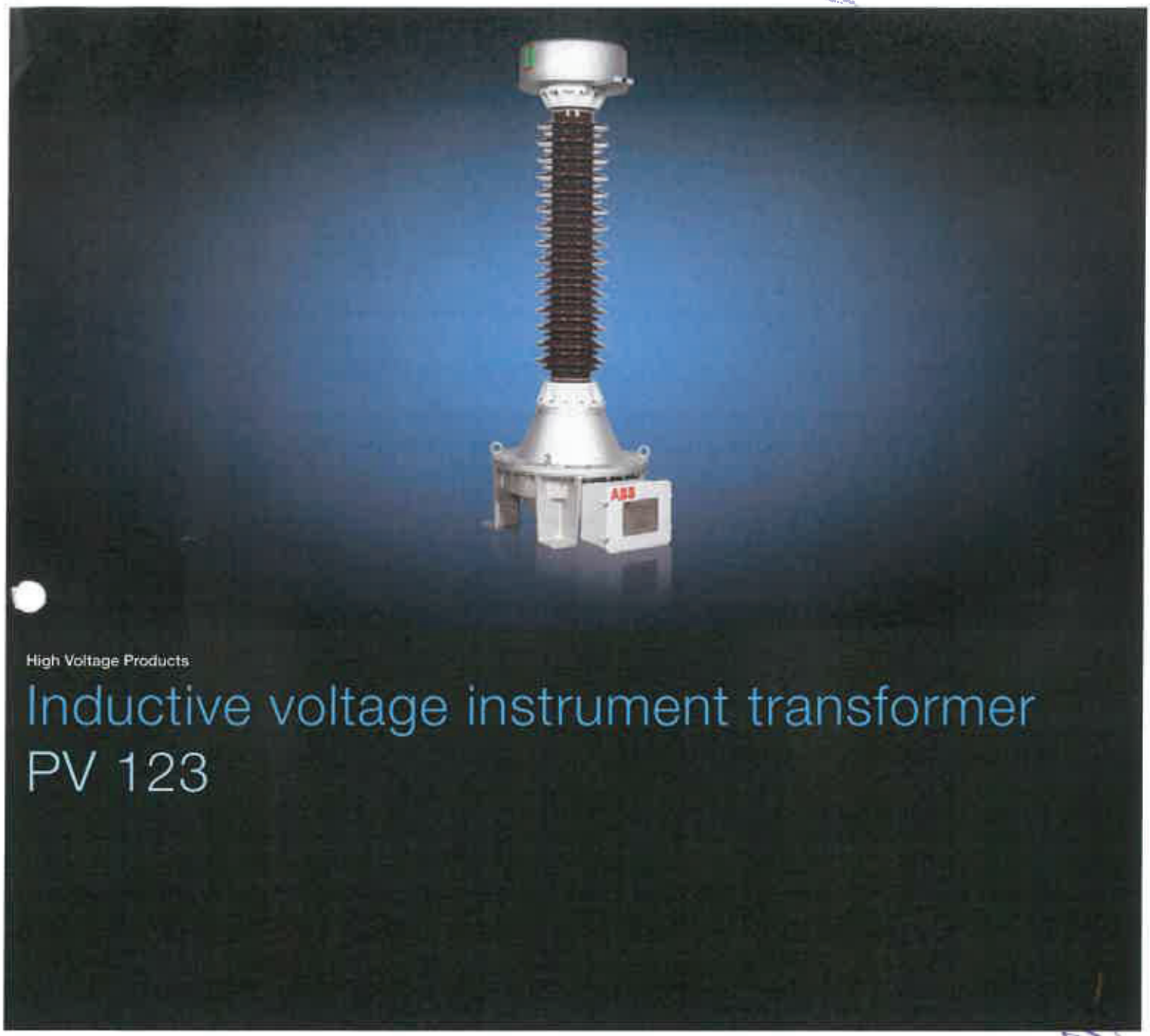




Maximum operating voltage	(kV)	123
Total weight	(kg)	310
Insulating oil amount	(kg)	60
Wind pressure surface	(m^2)	0,5
Creepage distance	(mm)	4250
Mechanical load:		
F_R - Static load	(kN)	2
F_R - Dynamic load	(kN)	3
Standard		IEC 61869-3

Prepared P.Mikulski	Date 17.02.2016	Replacement of	Scale 1:15	Size A3
Checked by	Date	Responsible department PPHV	Title: Dimensional drawing Voltage transformer PV 123	
Approved by J.Duzdowski	Date 17.02.2016	Take over department		Language EN
Revision C				Sheet no. 1
ABB	ABB Sp. z o.o. Power Products		Document no. 2GKV614615A1319	No. Shts. 1

Заличено по чл.2 от ЗЗЛД



High Voltage Products

Inductive voltage instrument transformer PV 123

Power and productivity
for a better world™

General information

The PV 123 voltage instrument transformers are used for feeding measurement and protection systems in electric power grids with highest system voltage up to 123 kV and frequency of 50 Hz.
They are designed to operate in grids with effectively earthed or insulated neutral points as well as in resonant (compensated) earthed systems. The PV 123 voltage 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 the sea level.

General information

The PV 123 voltage instrument transformer contains high voltage coil, secondary windings and a core encapsulated in hermetic housing filled with PCB free transformer oil.
The transformer's stainless steel expansion bellows is fixed to the head and shielded with aluminium cover. The expansion bellows compensates for thermal changes in oil volume.

Primary and secondary windings and accuracy classes

The secondary windings are made of highest quality electrical copper, enabling us to deliver to customers high accuracy classes starting from 0.1.
Our in factory test laboratory is one of the most modern units of this type in the world.

Main insulation

The main insulation is made of insulation paper impregnated with transformer oil. We use high quality oil conforming to IEC 60296 Standard requirements. This oil does not contain PCB's nor any other toxic substances and has low environmental impact.

Hollow insulator

The standard insulator is made of brown porcelain with creepage distance of 25 mm/kV. A grey composite insulator with creepage distance of 31 mm/kV is available upon request.
All materials used in production of our insulators conform to relevant IEC Standards.

Housing

All external parts are robust and made of corrosion resistant materials.
The PV 123 voltage instrument transformers are leak proof due to o-ring sealing system in the housing that is made of high quality aluminium alloy. The expansion bellows is equipped with large oil level indicator that enables observations of thermal changes in oil volume even from a distance. Each completely assembled unit is subject to stringent leakage checks during routine testing.

Primary terminals

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

Secondary terminal box

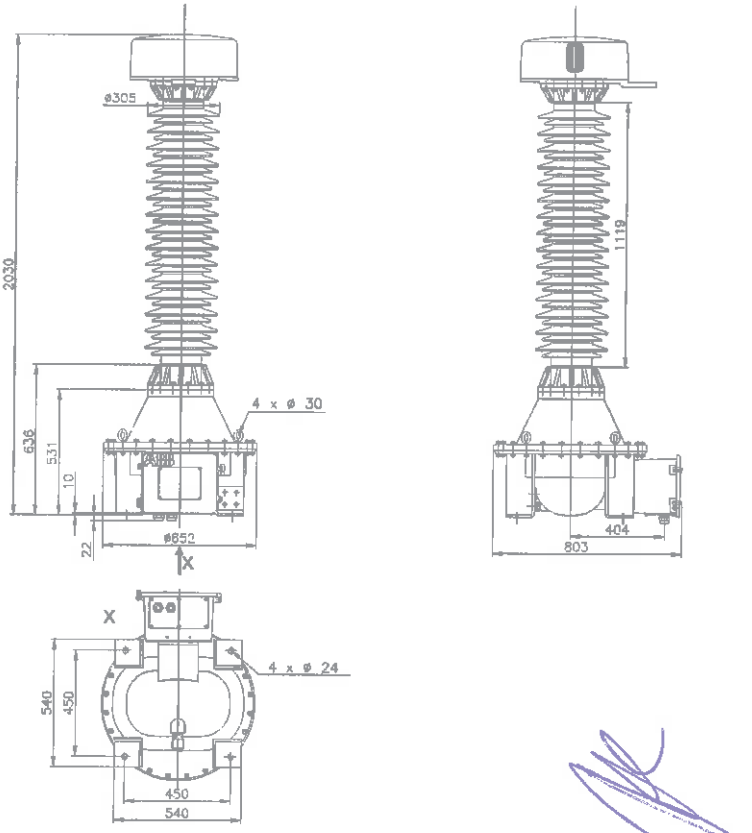
The secondary terminal box is IP55, constructed of aluminium. The terminal box is fixed to the transformer's bottom base. Secondary terminals are available for connection of up to 10 mm^2 conductors. Sealing of voltage measurement secondary terminals is also possible upon request. The secondary terminal box has two M32 cable glands (for cables from Ø 11 mm to Ø 21 mm). We offer secondary terminal boxes with higher number of cable glands upon request.
On all secondary windings of the transformer the breaking points made of copper Cu-ETP 1.2 mm dia 50mm were applied. Breaking points protect the transformer from damage in case of secondary terminal short circuit. This protection is sufficient to protect the transformer for a short distance to the nearest point where adequate protections are installed. Additional fuses in terminal box of the transformer are not needed.

Technical data

Parameter	
Type	PV 123
Compliance with the standards	IEC 61869-3; IEC 61869-1
Rated primary voltage	110: √3 kV
Highest system voltage	123 kV
Rated power – frequency withstand voltage at 50 Hz	230 kV
Rated lighting – impulse withstand voltage 1.2/50 µs	550 kV
Minimum creepage distence	16; 20; 25; 31 mm/kV
Rated frequency	50 Hz
Total weight	280, 220* kg

*composite insulator

Voltage module			
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/protection windings:			
– rated secondary voltage	100: √3 V; 110: √3 V		
– total rated output	up to 75 VA	up to 150 VA	up to 400 VA
– accuracy clases	0.1; 0.1/3P	0.2; 0.2/3P	0.5; 0.5/3P
Residual winding:			
– rated secondary voltage	100 V; 110 V; 100:3 V; 110:3 V		
– rated output	up to 400 VA		
– accuracy classes	1; 3; 3P; 6P		



Contact us

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www.abb.pl

2127/PL618-W3-en, Edition 1.2014

Power and productivity
for a better world™

Power and productivity for a better world™

To: Whom it may concern

Przasnysz,Poland; 15.01.2016

Declaration of Patent Clearance

Tender: Tender 15Q2843089 – ESO- tender HV IT's (110 kV)

Equipment: High voltage instrument transformers type PVA123a, PA123 and PV123

We, ABB Sp. z .o.o., Poland, declare herewith, that our product quoted under the above mentioned tender are protected by below listed patents:

Combined IT type PVA123a- patent no.EP2602802B1

Current IT type PA123- patent no. EP2573781B1

Voltage IT type PV123- patent no. EP2565884B1

Kierownik Sekcji Eksportu PPHV
ABB Sp. z o.o.

ABB
ODDZIAŁ W PRZASNYSZU
ul. Leszno 59, 06-300 Przasnysz
tel. (22) 223 8849, fax (22) 223 8958
(16)

Заличено по чл.2 от ЗЗЛД

ABB Sp. z o.o.
Headquarter:
1, Żeganska St.
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Branch Office in Przasnysz
59, Leszno St.
06-300 Przasnysz, Poland
Phone: +48 29 75 33 200
Fax: +48 29 75 33 321

District Court for the capital city of Warsaw, XIII Economic Department, Polish Court Register No:
KRS 0000004745

Tax identification:
526-030-44-84,
PL 5260304484
Environmental Protection No
GIOŚ E0008536WBW
Share capital:
PLN 260 643 548.88

www.abb.pl

До: Всички заинтересовани

Пшашниш, Полша; 15/01/2016

Декларация за Патентна Чистота

Търг: ECO – търг за доставка на измерителни трансформатори ВН (110 kV)

Оборудване: **Измервателни трансформатори високо напрежение тип PVA123a, PA123 и PV123**

Ние, ABB Sp. z .o.o., Полша, с настоящото декларираме, че нашите продукти, предложени във връзка с по-горе споменатия търг, са защитени от по-долу изброените патенти:

Комбиниран измерителен трансформатор тип PVA123a - патент №EP2602802B1
Токов измерителен трансформатор тип PA123 - патент № EP2573781B1
Напреженов измерителен трансформатор тип PV - патент № EP2565884B1

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CERTIFICATE OF CONFORMITY

No. 013/2016

Issue No. 01 of 2016.02.12

Name and address of the Certificate Holder:	**ABB Sp. z o.o.** **1 Żegańska Str.** **04-713 Warsaw** **Poland**
Name of the product:	**Inductive voltage transformer**
Type:	**PV 123**
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 inductive voltage transformer designed for installing in electrical grid with highest voltage up to 123 kV**
The product meets requirements of:	**IEC 61869-1 ed. 1.0 (2007) and IEC 61869-3 ed. 1.0 (2011)**
According to the evaluation report made by:	**Instytut Energetyki**
Number of the evaluation report:	**DZC/16c/E/2016**
Period of validity:	**from 12th of February 2016 until 12th of February 2019**

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)

pp of the DIRECTOR-OF

Warsaw, 2016.02.12

dr hab. inż. Tomasz Gałka prof. IEn

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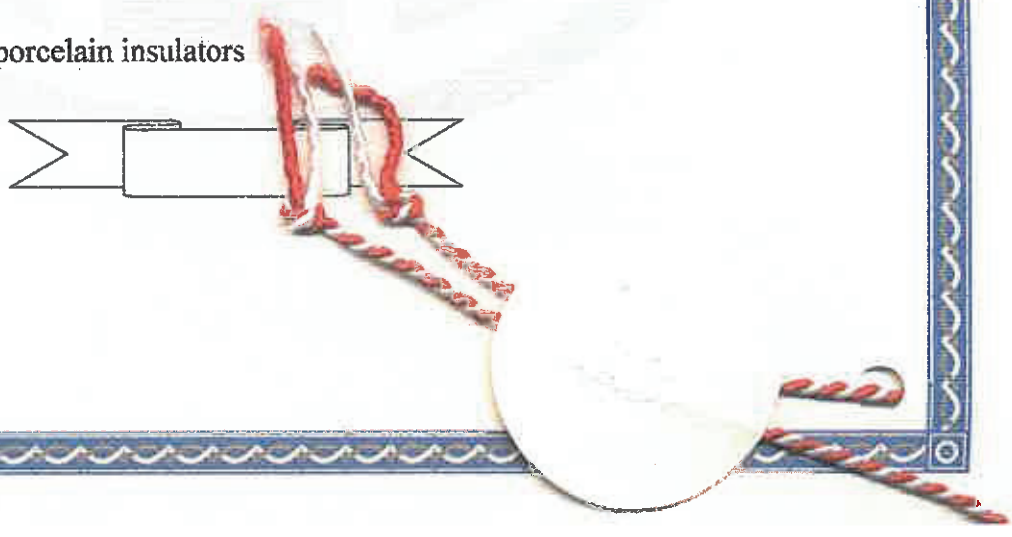
APPENDIX TO THE CERTIFICATE OF CONFORMITY
No. 013/2016
Issue No. 01 of 2016.02.12

LIST OF EVIDENCED PARAMETERS

Inductive voltage transformer type PV 123	
Rated primary voltage U_{Pr}	≤ 110/√3 kV
Highest voltage for equipment U_m	≤ 123 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 insulator • composite insulator	 3075 mm, 3640 mm 3800 mm
Degree of protection against mechanical impact of enclosure [1)]	IK7
Degree of protection of secondary terminals enclosure	IP55
Rated voltage factor F_V	$1{,}5U_r$ / 30 s or $1{,}9U_r$ / 8 h
Rated secondary voltage U_{Sr}	100/√3 V; 110/√3 V
Windings accuracy class to measurements and to protection	0,1; 0,2; 0,5 ; 1; 3 ; 3P ; 6P
Rated output of measurement and to protection windings S_r	≤ 1000 VA
Rated voltage of residual voltage winding $U_{Sr\ (da\text{-}dn)}$	100/3 V; 110/3 V; 100 V; 110 V
Residual voltage winding accuracy class	0,5; 1; 3; 3P; 6P
Residual voltage winding output S_r	≤ 450VA
Total thermal limiting output $S_{\Sigma th}$	4000 VA

REMARKS:

1. [1)] Does not apply do porcelain insulators



ИНСТИТУТ ПО ЕНЕРГЕТИКА
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тел.: +48 22 34 51299
факс: +48 22 836 63 63
instytut.energetyki@ien.com.pl

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СЕРТИФИКАТ ЗА СЪОТВЕТСТВИЕ

№ 013/2016
Издание №01 от 12.02.2016 г.

Име и адрес на притежателя на сертификата:	**ABB Sp. z o.o.** **ул. Зеганска 1** **04-713 Варшава, Полша**
Име на продукта:	**Индуктивен напреженов трансформатор**
Тип:	**PV 123**
Производител:	**ABB Sp. z o.o. клон в Пшашниш** **ул. Лешно 59** **06-300 Пшашниш** **Полша**
Параметри и приложение на продукта:	**Съгласно Приложение** **Индуктивен напреженов трансформатор, за открит монтаж, предназначен за монтаж в електрически мрежи с най-високо напрежение до 123 kV**
Продуктът отговаря на изискванията на:	**IEC 61869-1 изд. 1.0 (07 и IEC61869-3 изд.1.0 (2011)**
Според доклада, изработен от:	**Институт по енергетика**
Номер на доклада за оценка:	**DZC/16c/E/2016**
Период на валидност:	**от 12-ти Февруари 2016 г. до 12-ти Февруари 2019**

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,**
- **собственика на сертификат или негов упълномощен представител.**

Списъците с доказани параметри са включени в приложенията към сертификата за съответствие. Брой приложения:1

СИСТЕМАТА НА СЕРТИФИКАЦИЯ НА ПРОДУКТИ 1a (PN-EN ISO/IEC 17067:2014-01)
(Параметри на продукта потвърдени от типовите изпитания)

Варшава, 12.02.2016 г.

Директор на Института по енергетика
др. инж. Томаш Галка

AC 117

ПРИЛОЖЕНИ КЪМ СЕРТИФИКАТ ЗА СЪОТВЕТСТВИЕ № 007/2013

Издание №01 от 12.02.2016 г.

СПИСЪК НА ДОКАЗАНИТЕ ПАРАМЕТРИ

Индуктивен напреженов трансформатор тип PV 123	
Номинално първично напрежение (U_{Pr})	≤110/√3 kV
Най-висока напрежение на индуктивен трансформатор (U_m)	≤123 kV
Номинална честота (f_R)	50 Hz
Номинално ниво на изолация	AC 230 кV / LI 550 кV
Статичен товар F_R	3600 N
Външна изолация –път на утечка: • порцеланов изолатор • композитен изолатор	 3075 mm, 3640 mm 3800 mm
Клас на защита срещу механично въздействие на външната обвивка [1)]	IK7
Степен на защита на вторичната клемна кутия	IP55
Номинална фактор на напрежение (F_v)	1.5U_N/30s или 1.9U_N/8 часа
Номинално вторично напрежение (U_{sr})	100/√3 V; 110/√3 V
Клас на точност на вторичните намотките за мерене и защита	0.1, 0.2, 0.5, 1, 3, 3P, 6P
Номинална мощност на вторичните намотките за мерене и защита S_r	≤ 1000 VA
Номинално напрежение на остатъчната намотка ($U_{sr(da-dn)}$)	100/3 V, 110/3 V, 100 V, 110 V
Клас на точност на остатъчната намотка	0.5, 1, 3, 3P; 6P
Номинална мощност на остатъчната намотка S_r	≤ 450 VA
Обща топлинно ограничаваща мощност ($S_{\Sigma th}$)	4 000 VA

ЗАБЕЛЕЖКА:

1. [1)] Не е приложимо за порцеланови изолатори.

ABB	**PLAN KONTROLI ORAZ GŁÓWNYCH CZYNNOŚCI TECHNOLOGICZNYCH PRZEKŁADNIKÓW WN** ***Routine test plan and main assembly operations for HV instrument transformers***	Numer / *Number* IT 08-01-007	Strona / *Page* 1 Stron / *Pages* 9
		TYP PRZEKŁADNIKA ***Instrument transformer's type***	

No *Sl.*	**Badanie** ***Test***	**Badanie według:** ***Test according to:***	**Wymaganie według:** ***Requirement according to:***	**Miejsce badania:** ***Place of test:***	**Uwagi** ***Remarks***	**Kombinowany** ***Combined IT***	**Napięciowy** ***Voltage IT***	**Prądowy** ***Current IT***
1	Sprawdzenie wykonania cewki nn: • sprawdzenie poprawności oznaczeń kolejnych uzwojeń • pomiar liczby zwojów • pomiar rezystancji uzwojeń *VT low voltage coil inspection:* • *Verification of terminal markings* • *No. of turns measurement* • *Resistance measurement*	- Dokumentacja techniczna 2GKK314041 2GKK314095 *- Technical documentation 2GKK314041 2GKK314095*	- pkt. 3a, 3b, 3c - pkt. 6a, 6b, 6c *- item* 3a, 3b, 3c *- item* 6a, 6b, 6c	Nawijalnia Nr 2 *Coil winding shop No.2*	--	✓* *część napięciowa *voltage part only*	✓	-
2	Kontrola uzwojonego rdzenia CT: • Sprawdzenie oznaczeń zacisków • Próba izolacji międzyzwojowej (badanie kontrolne na próbce) • Pomiar rezystancji i liczby zwojów • Badania dokładności • Pomiar współczynników: FS/ALF/Kssc*Ktd/K_R/Ts/Ek/Ie • Pomiar wymiarów geometrycznych *CT wound core inspection:* • *Verification of terminal markings* • *Intern-turn overvoltage test (sample test)* • *Resistance and No. of turns measurement* • *Tests for accuracy* • *Measurement of factors:* FS/ALF/Kssc*Ktd/K_R/Ts/Ek/Ie • *Measurement of geometric dimensions*	Dokumentacja techniczna 2GKK314020 IEC 61869-2 *Technical documentation. 2GKK314020* IEC 61869-2	-pkt. I *-pkt. 7.3.6; 7.3.204; 7.3.5; 7.2.6.202; 7.3.201; 7.3.202; 7.3.203; 7.2.6.206* - item I *-cl. 7.3.6; 7.3.204; 7.3.5; 7.2.6.202; 7.3.201; 7.3.202; 7.3.203; 7.2.6.206*	Nawijalnia Nr 2 *Coil winding shop No.2*	--	✓* *część prądowa *current part only*	-	✓

Opracował *Prepared by*	Podpis *Signature*	Data *Date*	Sprawdził *Checked by*	Podpis *Signature*	Data *Date*	Zatwierdził *Approved by*	Podpis *Signature*	Data *Date*
Ł. Lubieniecki		16.03.2015	J. Duzdowski		16.03.2015	P. Dębski		17.03.2015

ABB	PLAN KONTROLI ORAZ GŁÓWNYCH CZYNNOŚCI TECHNOLOGICZNYCH PRZEKŁADNIKÓW WN *Routine test plan and main assembly operations for HV instrument transformers*	Numer / *Number* IT 08-01-007	Strona / *Page* 2 Stron / *Pages* 9
		TYP PRZEKŁADNIKA ***Instrument transformer's type***	

No ***Sl.***	**Badanie** ***Test***	**Badanie według:** ***Test according to:***	**Wymaganie według:** ***Requirement according to:***	**Miejsce badania:** ***Place of test:***	**Uwagi** ***Remarks***	**Kombinowany** ***Combined IT***	**Napięciowy** ***Voltage IT***	**Prądowy** ***Current IT***
3	Kontrola wejściowa materiałów: - sprawdzenie i weryfikacja materiałów wejściowych *Incoming goods control:* - *inspection and verification of incoming goods*	Plan kontroli w SAP QM Inspection plans in SAP QM	Dokumentacja *Documentation*	Kontrola jakości *Quality control*	--	✓	✓	✓
4	Kontrola procesu uzwajania cewki napięciowej: • Pomiar średnicy końcowej cewki • Liczba lutowań *Winding process control of voltage coil:* • *Measurement of the final diameter* • *Number of soldering*	- Dokumentacja techniczna 2GKK338001 2GKK314111 *- Technical documentation* 2GKK338001 2GKK314111	Parametry wg dokumentacji Parameters acc. to documentation	Nawijalnia nr 1 *Coil winding shop No.1*	--	✓	✓	-

Opracował *Prepared by*	Podpis *Signature*	Data *Date*	Sprawdził *Checked by*	Podpis *Signature*	Data *Date*	Zatwierdził *Approved by*	Podpis *Signature*	Data *Date*
Ł. Lubieniecki		16.03.2015	J. Duzdowski		16.03.2015	P. Dębski		17.03.2015

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		TYP PRZEKŁADNIKA ***Instrument transformer's type***	

No ***Sl.***	**Badanie** ***Test***	**Badanie według:** ***Test according to:***	**Wymaganie według:** ***Requirement according to:***	**Miejsce badania:** ***Place of test:***	**Uwagi** ***Remarks***	**Kombinowany** ***Combined IT***	**Napięciowy** ***Voltage IT***	**Prądowy** ***Current IT***
5	Proces izolowania cewki napięciowej - sprawdzenie wymiarów zewnętrznych (średnica, szerokość cewki) - pomiar rezystancji *Insulation process of voltage coil* *- Check of the external dimensions (diameter, width)* *-Resistance measurement*	Instrukcja technolog. - IT 08-01-015; - oraz 2GKK338001 2GKK314111 *Technological instruction.* *- IT 08-01-015* *and* 2GKK338001 2GKK314111	- pkt. 4.3 - cl. 4.3	Nawijalnia nr 1 *Coil winding shop No.1*	--	✓	✓	-
6	Montaż rdzenia i cewki nn w cewce napięciowej pierwotnej - Sprawdzenie poprawności montażu. *Assembly process of LV coil and core in primary voltage coil* *- Assembly correctness inspection*	Instrukcja technolog. IT 08-01-009 *Technological instruction.* *- IT 08-01-009*	pkt. 7 *cl. 7*	Nawijalnia nr 1 *Coil winding shop No.1*	--	✓	✓	-

Opracował *Prepared by*	Podpis *Signature*	Data *Date*	Sprawdził *Checked by*	Podpis *Signature*	Data *Date*	Zatwierdził *Approved by*	Podpis *Signature*	Data *Date*
Ł. Lubieniecki		16.03.2015	J. Duzdowski		16.03.2015	P. Dębski		17.03.2015

ABB	PLAN KONTROLI ORAZ GŁÓWNYCH CZYNNOŚCI TECHNOLOGICZNYCH PRZEKŁADNIKÓW WN *Routine test plan and main assembly operations for HV instrument transformers*	Numer / *Number* IT 08-01-007	Strona / *Page* 4 Stron / *Pages* 9
		TYP PRZEKŁADNIKA ***Instrument transformer's type***	

No ***Sl.***	**Badanie** ***Test***	**Badanie według:** ***Test according to:***	**Wymaganie według:** ***Requirement according to:***	**Miejsce badania:** ***Place of test:***	**Uwagi** ***Remarks***	**Kombinowany** ***Combined IT***	**Napięciowy** ***Voltage IT***	**Prądowy** ***Current IT***
7	Proces wstępnego izolowania cewki prądowej - Pomiar średnicy wewnętrznej *Initial insulation of the current coil* *- Measurement of the internal diameter*	Instrukcja technolog. IT 08-01-001 *Technological instruction.* *- IT 08-01-001*	pkt. 17 *cl. 17*	Nawijalnia nr 1 *Coil winding shop No.1*	--	✓	-	✓
8	Proces izolowania cewki prądowej -Pomiar wymiarów geometrycznych *Insulation of the current coil* *- Dimensions measurement*	Dokumentacja techniczna. 2GKK328018 2GKK314163 *The technical documentation.* 2GKK328018 2GKK314163	pkt. 6 *cl. 6*	Nawijalnia nr 1 *Coil winding shop No.1*	--	✓	-	✓
9	Proces nawijania przepustu prądowego i napięciowego - Sprawdzenie wymiarów *Voltage and current bushing winding process* *- Dimensions check*	Instrukcja technolog. IT 08-01-017; oraz 2GKK310230 2GKK310314 2GKK314121 *Technological instruction IT 08-01-017;and* 2GKK310230 2GKK310314 2GKK314121	pkt. 4 *cl. 4*	Nawijalnia nr 1 *Coil winding shop No.1*	--	✓	✓	✓

Opracował *Prepared by*	Podpis *Signature*	Data *Date*	Sprawdził *Checked by*	Podpis *Signature*	Data *Date*	Zatwierdził *Approved by*	Podpis *Signature*	Data *Date*
Ł. Lubieniecki		16.03.2015	J. Duzdowski		16.03.2015	P. Dębski		17.03.2015

ABB	PLAN KONTROLI ORAZ GŁÓWNYCH CZYNNOŚCI TECHNOLOGICZNYCH PRZEKŁADNIKÓW WN *Routine test plan and main assembly operations for HV instrument transformers*	Numer / *Number* IT 08-01-007	Strona / *Page* 5 Stron / *Pages* 9
		TYP PRZEKŁADNIKA ***Instrument transformer's type***	

No *Sl.*	**Badanie** *Test*	**Badanie według:** *Test according to:*	**Wymaganie według:** *Requirement according to:*	**Miejsce badania:** *Place of test:*	**Uwagi** *Remarks*	**Kombinowany** *Combined IT*	**Napięciowy** *Voltage IT*	**Prądowy** *Current IT*
10	Proces suszenia cewek *Coils' vacuum drying proces*	Instrukcja technolog. IT 08-01-003 *Technological instruction IT 08-01-003*	pkt. V i VI *Cl. V and VI*	Autoklaw *Autoclave*	--	✓	✓	✓
11	Badanie oleju: - przy dostawie - przygotowany do zalania przekładników - po zalaniu przekładników *Oil tests:* *- at the delivery* *- prepared for IT filling* *- after IT filling*	Instrukcja technolog. IT 08-01-035 Technological instruction IT 08-01-035	Pkt.4 Item 4.	Kontrola jakości *Quality control*	--	✓	✓	✓

Opracował *Prepared by*	Podpis *Signature*	Data *Date*	Sprawdził *Checked by*	Podpis *Signature*	Data *Date*	Zatwierdził *Approved by*	Podpis *Signature*	Data *Date*
Ł. Lubieniecki		16.03.2015	J. Duzdowski		16.03.2015	P. Dębski		17.03.2015

ABB	PLAN KONTROLI ORAZ GŁÓWNYCH CZYNNOŚCI TECHNOLOGICZNYCH PRZEKŁADNIKÓW WN *Routine test plan and main assembly operations for HV instrument transformers*	Numer / *Number* IT 08-01-007	Strona / *Page* 6 Stron / *Pages* 9
		TYP PRZEKŁADNIKA ***Instrument transformer's type***	

No ***Sl.***	**Badanie** ***Test***	**Badanie według:** ***Test according to:***	**Wymaganie według:** ***Requirement according to:***	**Miejsce badania:** ***Place of test:***	**Uwagi** ***Remarks***	**Kombinowany** ***Combined IT***	**Napięciowy** ***Voltage IT***	**Prądowy** ***Current IT***
12	Montaż przekładnika: (cewki prądowej, cewki napięciowej) - sprawdzenie rezystancji uzwojenia pierwotnego cewki prądowej *IT assembly:* *(current coil, voltage coil)* *- Primary winding resistance measurement of the current coil*	Instrukcja technolog. IT 08-01-003; oraz 2GKK310202, 2GKK310302, 2GKK2100001 *Technological instruction IT 08-01-003 and: 2GKK310202, 2GKK310302 2GKK2100001*	pkt. VII *Cl. VII*	Stanowisko montażowe przekładników *IT's assembly station*	--	✓	✓	✓
13	Sprawdzenie oznaczeń zacisków *Verification of the terminal markings*	IEC 61869-1 IEC 61869-2 IEC 61869-3	p. 6.13; 7.3.6 p. 6.13 p. 6.13 *Cl. 6.13; 7.3.6* *Cl. 6.13* *Cl. 6.13*	Kontrola jakości *Quality control*	--	✓	✓	✓
14	Napełnianie olejem i proces impregnacji przekładników *Oil filling and impregnation process of the ITs*	Instrukcja technolog. IT 08-01-003 *Technological instruction IT 08-01-003*	pkt. VIII *Cl. VIII*	Stanowisko impregnacji Impregnation station	--	✓	✓	✓

Opracował *Prepared by*	Podpis *Signature*	Data *Date*	Sprawdził *Checked by*	Podpis *Signature*	Data *Date*	Zatwierdził *Approved by*	Podpis *Signature*	Data *Date*
Ł. Lubieniecki		16.03.2015	J. Duzdowski		16.03.2015	P. Dębski		17.03.2015

ABB	PLAN KONTROLI ORAZ GŁÓWNYCH CZYNNOŚCI TECHNOLOGICZNYCH PRZEKŁADNIKÓW WN *Routine test plan and main assembly operations for HV instrument transformers*	Numer / *Number* IT 08-01-007	Strona / *Page* 7 Stron / *Pages* 9
		TYP PRZEKŁADNIKA ***Instrument transformer's type***	

No ***Sl.***	**Badanie** ***Test***	**Badanie według:** ***Test according to:***	**Wymaganie według:** ***Requirement according to:***	**Miejsce badania:** ***Place of test:***	**Uwagi** ***Remarks***	**Kombinowany** ***Combined IT***	**Napięciowy** ***Voltage IT***	**Prądowy** ***Current IT***
15	Sprawdzenie szczelności przekładnika *Oil tightness verification*	Instrukcja technolog. IT 08-01-003 *Technological instruction IT 08-01-003*	pkt. IX *Cl. IX*	Kontrola jakości *Quality control*	--	✓	✓	✓
16	Próba izolacji uzwojeń pierwotnych napięciem o częstotliwości sieciowej oraz pomiar wyładowań niezupełnych *Power-frequency voltage withstand tests on primary windings and partial discharge measurement*	IEC 61869-1 IEC 61869-2 IEC 61869-3 IEC 60270	p. 7.3.1 i 7.3.2 p. 7.3.1 p.7.3.1; 7.3.2 *Cl. 7.3.1 and 7.3.2* *Cl. 7.3.1* *Cl. 7.3.1 and 7.3.2*	Kontrola jakości *Quality control*	--	✓	✓	✓
17	Próba izolacji uzwojeń wtórnych napięciem o częstotliwości sieciowej *Power-frequency voltage withstand test on secondary windings*	IEC 61869-1	p. 7.3.3 p. 7.3.4 *Cl. 7.3.3* *Cl. 7.3.4*	Kontrola jakości *Quality control*	--	✓	✓	✓
18	Próba izolacji międzyzwojowej *Inter-turn overvoltage test*	IEC 61869-2	p. 7.3.204 *Cl. 7.3.204*	Kontrola jakości *Quality control*	--	✓* *część prądowa *current part only*	-	✓
19	Badania dokładności przekładnika prądowego *Tests for accuracy of the current transformer*	IEC 61869-2	*7.3.6; 7.3.204; 7.3.5; 7.2.6.202; 7.3.201; 7.3.202; 7.3.203; 7.2.6.206*	Kontrola jakości *Quality control*	--	✓* *część prądowa *current part only*	-	✓

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Ł. Lubieniecki		16.03.2015	J. Duzdowski		16.03.2015	P. Dębski		17.03.2015

ABB	PLAN KONTROLI ORAZ GŁÓWNYCH CZYNNOŚCI TECHNOLOGICZNYCH PRZEKŁADNIKÓW WN *Routine test plan and main assembly operations for HV instrument transformers*	Numer / *Number* IT 08-01-007	Strona / *Page* 8 Stron / *Pages* 9
		TYP PRZEKŁADNIKA ***Instrument transformer's type***	

No ***Sl.***	**Badanie** ***Test***	**Badanie według:** ***Test according to:***	**Wymaganie według:** ***Requirement according to:***	**Miejsce badania:** ***Place of test:***	**Uwagi** ***Remarks***	**Kombinowany** ***Combined IT***	**Napięciowy** ***Voltage IT***	**Prądowy** ***Current IT***
20	Badania dokładności przekładnika napięciowego *Tests for accuracy of the voltage transformer*	IEC 61869-3	p. 7.3.5 *cl. 7.3.5*	Kontrola jakości *Quality control*	--	✓* *część napięciowa *voltage part only*	✓	-
21	Pomiar rezystancji uzwojeń *Measurement of the windings' internal resistance*	--	Zamówienie (wg wymagania spec.) *Order (on request only)*	Kontrola jakości *Quality control*	--	✓	✓	✓
22	Pomiar pojemności i współczynnika strat dielektrycznych *Capacitance and dielectric dissipation factor measurement*	IEC 61869-1 IEC 61869-2 IEC 61869-3	pkt. 7.4.3 *cl. 7.4.3*	Kontrola jakości *Quality control*	--	✓	✓	✓
23	Sprawdzenie ustawienia wskaźnika poziomu oleju *Oil level indicator inspection*	Instrukcja technolog. IT 08-01-003 *Technological instruction IT 08-01-003*	pkt. X *Item: X*	Kontrola jakości *Quality control*	--	✓	✓	✓
24	Końcowe oględziny *Final visual inspection*	Instrukcja technolog. IT 08-01-003 *Technological instruction IT 08-01-003*	Dokumentacja techniczna, zamówienie *Technical documentation, order*	Kontrola jakości *Quality control*	--	✓	✓	✓

Opracował *Prepared by*	Podpis *Signature*	Data *Date*	Sprawdził *Checked by*	Podpis *Signature*	Data *Date*	Zatwierdził *Approved by*	Podpis *Signature*	Data *Date*
Ł. Lubieniecki		16.03.2015	J. Duzdowski		16.03.2015	P. Dębski		17.03.2015

ABB	PLAN KONTROLI ORAZ GŁÓWNYCH CZYNNOŚCI TECHNOLOGICZNYCH PRZEKŁADNIKÓW WN *Routine test plan and main assembly operations for HV instrument transformers*	Numer / *Number* IT 08-01-007	Strona / *Page* 9 Stron / *Pages* 9
		TYP PRZEKŁADNIKA ***Instrument transformer's type***	

No *Sl.*	Badanie *Test*	Badanie według: *Test according to:*	Wymaganie według: *Requirement according to:*	Miejsce badania: *Place of test:*	Uwagi *Remarks*	Kombinowany *Combined IT*	Napięciowy *Voltage IT*	Prądowy *Current IT*
25	Odbiór klienta *Customer's inspection*	Instrukcja technolog. IT 08-01-003 *Technological instruction IT 08-01-003*	pkt. XIV *Item: XIV*	*Według odrębnych ustaleń* *According to separate agreement*	Pracownicy ABB i przedstawiciele klienta *ABB's staff and customer's representatives*	✓	✓	✓
26	Pakowanie i przekazanie do magazynu *Packing and transfer to warehouse*	Instrukcja technolog. IT 08-01-003 *Technological instruction IT 08-01-003*	pkt. XIV *Item: XIV*	Kontrola jakości *Quality control*	--	✓	✓	✓

Opracował *Prepared by*	Podpis *Signature*	Data *Date*	Sprawdził *Checked by*	Podpis *Signature*	Data *Date*	Zatwierdził *Approved by*	Podpis *Signature*	Data *Date*
Ł. Lubieniecki		16.03.2015	J. Duzdowski		16.03.2015	P. Dębski		17.03.2015

Uwaga / Remark

✓ - ma zastosowanie / applicable

\- - nie ma zastosowanie / not applicable

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

№ 14.06.5042

Издадено на производител: ABB Sp. zo.o., Полша
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: напреженови измервателни трансформатори тип PV 123
In Respect of:

Знак за одобрен тип:
Type Approval Mark:

BG 14
5042

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

Срок на валидност: 13.06.2024 г.
Valid until:

Вписва се в регистъра на одобрените за използване типове средства за измерване под №: 5042
Reference №:

Дата на издаване на удостоверението за одобрен тип: 13.06.2014 г.
Date:

Заличено по чл.2 от ЗЗЛД

доц. д-р Димитър Станков

Приложение към удостоверение за одобрен тип № 14.06.5042

Издадено на производител: ABB Sp. zo.o., Полша

Относно: напреженови измервателни трансформатори тип PV 123

1. Описание на типа:

Напреженовите трансформатори тип PV 123 се използват за измерване и защита на електрически мрежи с максимално работно напрежение 123 kV и честота 50 Hz. Те са проектирани да работят в системи с ефективно заземен или изолиран звезден център, както и в компенсирани системи. Напреженовите трансформатори тип PV 123 са подходящи за работа в условия на открито, с температура на околната среда от –40 °C до +40 °C, при относителна влажност на въздуха до 100% при 30 °C и надморска височина до 1000 м.

Активната част на напреженовия трансформатор тип PV 123 се състои от намотка високо напрежение, вторични намотки и сърцевина, капсулирана в херметичен корпус запълнен с трансформаторно масло. Ядрото с намотките се намира в долната част на резервоара. Вторичните намотки са една или няколко (до 5) на брой. Първичната и вторичните намотки са направени от висококачествен материал, позволяващ висок клас на точност започващ от 0,1. Стандартно изолаторът е направен от кафяв порцелан с път на тока на утечка 25 mm/kV. Възможно е той да бъде изработен и от сив композитен материал с път на тока на утечка 31 mm/kV.

Вторичните клеми са обозначени със стандартни маркировки на изводите.

2. Технически и метрологични характеристики:

Тип на трансформатора	**PV 123**
Ниво на изолация, kV	123/230/550 kV
Номинално вторично напрежение, V	100/√3, 100/3, 110/√3, 100, 110
Номинална честота, Hz	50
Клас на точност	0,1; 0,2; 0,5; 1; 3 3P и 6P
Коефициент на напрежение/време на прилагане	1,2/продължително; 1,9/8 h 1,5/30 s; 1,9/30 s;
Мощност на вторичните намотки, VA	до 400

3. Типово означение: тип PV 123

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

- Знакът за одобрен тип се нанася до табелката с технически данни, над клемите на вторичните верги.
- Знакът за първоначална проверка (марка за залепване) се поставя под знака за одобрен тип.

LABORATORIUM WYSOKICH NAPIĘĆ

INSTYTUTU ENERGETYKI

LABORATORY ACCREDITED
BY THE POLISH CENTRE FOR ACCREDITATION

Accreditation Certificate of Testing Laboratory
No AB 272

AB 272

TEST REPORT

No. EWN/11/E/12-1

Type test and special tests

of voltage instrument transformer type PV 123

manufactured by ABB sp. z o.o.

Warsaw, March 2012

TESTS REPORTS No EWN/11/E/12-1

TEST OBJECT:	**Voltage instrument transformer type PV 123** **Serial No: 2GKP011V1084703 (84703/11)**
TEST ORDERED BY:	**ABB Sp. z o.o.** **04-713 Warszawa, ul. Żegańska 1**
ORDER NO:	**4500380553/1 – 20.01.2012**
SCOPE OF TEST:	**Type test**
PROCEDURA OF TESTS:	**in accordance with standards:** **PN-EN 60044-2:2001 (EN 60044-2:1999)**
RECEIVING OBJECT DATE:	**January 2012**
DATE OF TESTS:	**January 2012 – March 2012**
TESTS RESULTS:	**are presented in following parts of report** **Test results are concern to tested object only.**

Tests was performed in witness of representatives of ABB sp. z o.o. :

Marcin TARNOWSKI M.Sc.E.E.
Paweł DĘBSKI M.Sc.E.E.
Jarosław DUZDOWSKI M.Sc.E.E.
Zbigniew WESOŁOWSKI M.Sc.E.E.

TEST PERFORMER:	**Jan SZOKALSKI** **M.Sc.E.E.**
TEST OVERSEERER:	**Jerzy MIKOŁAJCZYK** **M.Sc.E.E.**
HEAD OF HIGH VOLTAGE DEPARTMENT:	**January L. MIKULSKI,** **Ass. Prof., Dr. hab. E. E.**

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Заличено по чл.2 от ЗЗЛД

Warsaw, March 2012

CONTENTS

The Report contain:
19 numbered pages
In Report are presented:
5 drawing
1 numbered table
6 appendixes
and non numbered diagrams and tables

HIGH VOLTAGE LABORATORY
INSTYTUT ENERGETYKI
POLAND 01-330 WARSZAWA, ul. Mory 8, tel. (+48 22) 836-80-48, fax (+48 22) 836-80-48 e-mail: ewn@ien.com.pl
EWN/11/E/12-1

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 4.10, hereby Report are not comply the scope of Laboratory accreditation.

Hereby Report concerning test results obtained in other competent laboratories - (see Appendixes 2,3,4) :

- Distribution Equipment Laboratory of Institute of Power Engineering in Warsaw having Accreditation Certificate PCA Nr AB 324
- High Current Laboratory of Institute of Power Engineering in Warsaw having Accreditation Certificate PCA Nr AB 323
- Factory Laboratory of ABB sp. z o.o. in Przasnysz - Regional Verification Office 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.

2. DESCRIPTION OF TEST OBJECT

The tested object was voltage instrument transformer type PV 123 manufactured by ABB sp. z o.o. 04-713 Warszawa, ul. Żegańska 1, had following parameters:

Serial number 2GKP011V1084703 (84703/11)

- Rated primary voltage $110/\sqrt{3}$ kV
- Rated frequency 50 Hz
- Rated insulation level LI 550kV/ AC 230kV
- Minimum creepage distance 3640 mm (porceline insolator)

View of rated nameplates of tested transformers show figure 1.

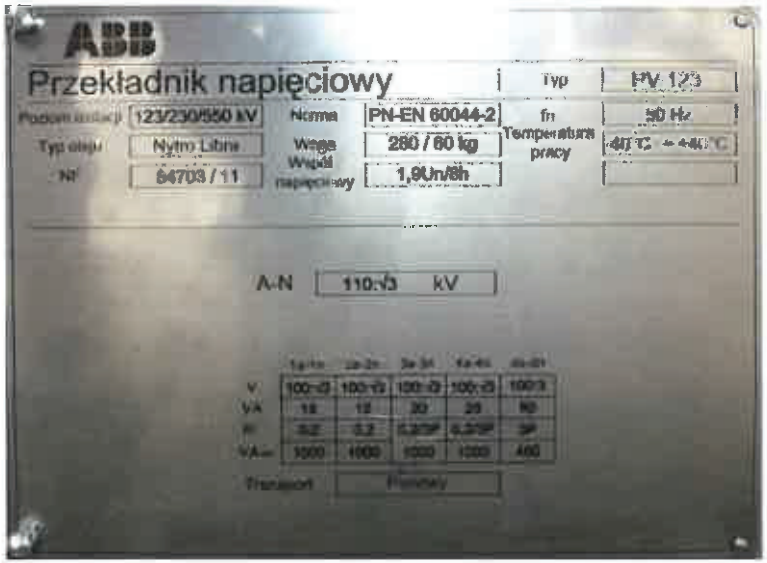


Fig. 1 Rated nameplate of tested transformer

Identification of tested object was done at following documents attached to hereby Report (Appendix 1):

- Manufacturer Conformity Declaration,
- Dimension drawing No. 2GKV614114/ (19.01.2012),
- Electric diagram of Voltage instrument transformer,
- Drawing of rated nameplate.

3. AGREED SCOPE OF TESTS

According to ordered the type test and selected special test were done comply following standard:

- PN-EN 60044-2:2001 + A1:2003 +A2:2004 „Przekładniki. Część 2: Przekładniki napięciowe indukcyjne" (EN-60044-2:1999 + A1:2000 + A2:2003 „Instrument transformers. Part 2: Inductiv voltage transformers").

On request of ordering party the additional special test were performed. The performed test results are contained in Table 1.

Table 1. List of performed tests

Item	Performed tests	Requirement
TYPE TESTS		
1	Temperature-rise test	PN EN 60044-2, p.8.1
2	Short-circuit withstand capability test of secondary windings	PN EN 60044-2, p.8.2,
3	Lighting impulse test	PN EN 60044-2, p.8.3
4	Wet test for outdoor transformers	PN EN 60044-2, p.8.4
5	Determination of errors	PN EN 60044-2, p. 12.3, 13.6.2,
6	Measurement of the radio interference voltage (RIV)	PN EN 60044-2/A1, p. 8.5
SPECIAL TESTS		
7	Chopped impulse test on the primary winding	PN EN 60044-2, p. 10.1
8	Measurement of capacitance and dielectric dissipation factor	PN EN 60044-2, p. 10.2
9	Mechanical test	PN EN 60044-2, p. 10.3
10	Transmitted overvoltage measurement	PN EN 60044-2/A2, p. 10.3

During mentioned above tests at Factory Laboratory of ABB sp. z o.o. in Przasnysz Leszno 59 Street, were performed determination of errors of transformer to prove 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. The tests stands are under authority of Regional Verification Office in Warsaw (No. stand S08/OUM1-5/01 XVI i S08/OUM1-5/01 XVII).

4. PERFORMED TESTS

4.0 Routine test and determination of errors before tests in IEn and after tests finishing.

Before delivery the transformer to IEn Laboratory and after type test and special test completed in ABB Factory Laboratory in Przasnysz were performed determination of errors measurement under supervision of representative of IEn. During test were checked:

- verification of terminals marking,
- power-frequency withstand test on the primary winding 50 Hz, Utest = 230 kV, t = 60 s,
- partial discharge measurement for voltage transformers q<10pC (U_m) q < 5pC (1,2· $U_m / \sqrt{3}$),
- power-frequency withstand test on secondary windings 50 Hz, Utest = 3 kV, t = 60 s,
- power-frequency withstand test between sections 50 Hz, Utest = 4,5 kV, t = 60 s,
- determination of errors.

The test results are presented in reports attached to hereby Report (Appendix 2):

- Tests before type test and special test (Measurements before type test and special tests) - Report No. 2GKP011V1084703 - 19.01.2012,
- Tests after type test and special tests completed (Measurements after type test and special test completed) - 2GKP011V1084703 – 26.03.2012.

It were proved that all tests required in routine test gave positive results. It were proved that all metrological properties of transformer are comply accurate classes for all winding.

These tests results are base for later determination of errors for purpose of verification result of tests described below.

4.1 Temperature-rise test

This test was performed in High Current Laboratory of Institute of Power Engineering in Warsaw.

Stage 1

The voltage value 1,2 Un = 76,2 kV was applied to the A terminal.

The secondary voltage windings were loaded as follows: 1a-1n – 15 VA, cosφ = 1, at the voltage 100/√3 V; 2a-2n – 15 VA, cosφ = 1, at the voltage 100/√3 V; 3a-3n – 20 VA, cosφ = 1, at the voltage 100/√3 V; 4a-4n – 25 VA, cosφ = 1, at the voltage 100/√3 V.

The winding of residual voltage remained open.

The test was performed till reached steady state of the measured temperatures.

Stage 2

The voltage value 1,9 Un = 119,7 kV was applied to the A terminal.

The secondary voltage windings were loaded as follows: 1a-1n – 15 VA, cosφ = 1, at the voltage 100/√3 V; 2a-2n – 15 VA, cosφ = 1, at the voltage 100/√3 V; 3a-3n – 20 VA at the voltage 100/√3 V; 4a-4n – 25 VA, cosφ = 1, at the voltage 100/√3 V.

The residual winding da-dn was loaded by – 450 VA, cosφ = 1, at the voltage 100/3 V.

The duration of the test was 8 h.

Stage 3

The voltage value Un = 63 kV was applied to the A terminal.

According to Manufacturers request secondary voltage windings (i.e. 1a-1n, 2a-2n, 3a-3n and 4a - 4n) were loaded by limit power 1000 VA at cosφ = 1. The residual winding remained open.

The test was performed till reaching the steady state of the measured temperatures.

Rise of temperature in steady state not exceeding permissible value of 65 K + 10 K = 75 K (according to 5.4 of PN-EN 60044-2 and 4.2 of PN-EN 60044-3).

Test result - positive.

Detailed information about test arrangement and performed tests, tests results are present in separate Reports No. EWP/07/E/2012-3e of 27.02.2012. – (Appendix 4)

4.2 Short-circuit withstand capability of secondary circuit

The test of short-circuit withstand capability of secondary circuit of voltage transformer was performed for combined transformers type PVA 123, serial No. 84500, manufactured by ABB. (Test Report EWN/70/E/11-1 – High Voltage Laboratory IEn) Voltage part of this combined transformer PVA 123 was identical construction to the voltage transformer PV 123. The test was performed in Distribution Equipment Laboratory of Institute of Power Engineering in Warsaw.

To the voltage transformer was applied rated voltage $110/\sqrt{3}$ kV during 1 second at short-circuited secondary winding. The test was performed twice – one with short-circuited secondary winding for measurement and second with short-circuited residual voltage winding.

U_{test} = 63,5 kV, t = 1 s

During test transformer behaviour was correct. After test not stated any failures or oil leakage.

Test result - positive.

After the test of short-circuit withstand capability of secondary circuit of transformer in Factory Laboratory of ABB sp. z o.o. in Przasnysz 59 Leszno 59 Street, under supervision of representative of IEn was performed determination of errors.

The test result of these measurement are present in Report No. 2GKP011V1084703 – 26.03.2012 – (Appendix No. 3 of hereby Report).

It was found that metrological properties of transformer are comply to assigned accurate classes of transformer windings and measured values are practically identically to measured values before short-time test. This prove positive result of short-time test.

4.3 Lightning impulse test

Test was done in test arrangement of surge generator type Haefely 5 MV, 375 kJ. Equivalent circuit diagram is shows on Figure 2. 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.

The Lightning impulse test was performed jointly with chopped impulse test on the primary winding (clause 3.8 of hereby Report).

Test condition:

- Full impulse test voltage U = 550 kV,
- Chocked impulse test voltage 1,15 · 550 kV = 632,5 kV,
- Sequence of impulses:
  positive polarity – 15 full impulses.
  negative polarity – 1 full impulse, 2 chocked impulses, 14 full impulses,
- During test was recorded test voltage and current flowed through along of voltage transformer.

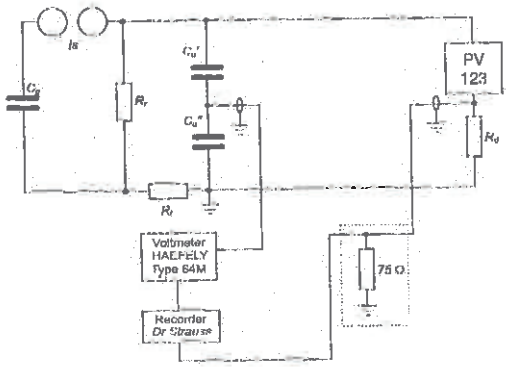


Fig. 2 Equivalent circuit diagram of test arrangement for lightning impulses:
C_g = 0,125 μF, C_u = 1,2 nF, R_1 = 175 Ω, R_2 = 600 Ω, R_d = 8,95 Ω.
Measurement uncertainty - 1,5 %

The oscillograms not shows failures of transformer insulation.

Result of test - positive.

Recorded oscillograms of all applied impulses are shown in Appendix No. 5 of hereby Report.

4.4 Wet test for outdoor transformers

The test was performed in arrangement of test transformer type TuR 700kV, 0,5A. Equivalent circuit diagram is presented on Figure 3.

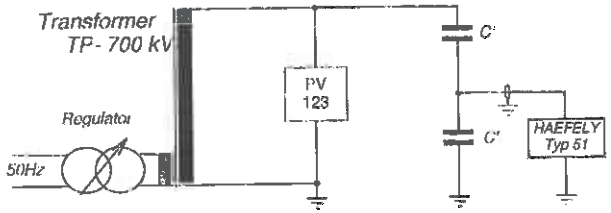


Fig. 3 Equivalent circuit diagram for power frequency voltage 50 Hz:
C = 200 pF (C' in series with C'')
Measurement uncertainty - 1,5 %

The test was performed on transformers model with disassembled winding (Figure 4). All external elements of transformers, which can influenced on test results were identical to the complete transformer.

Fig. 4 Wet test of voltage transformers type PV 123 at power frequency voltage 50 Hz.

Because electric strength of inner insulation is not depend from atmospheric conditions and this property was tested during routine test at ABB's Factory Laboratory (Raports No. 2GKP011V1084703 – 19.01.2012 and No. No. 2GKP011V1084703 – 26.03.2012 of Factory Laboratory ABB sp. z o.o. Przasnysz Division).

In each cases the test voltage was U=230 kV was applied during 1 minute.

During wet test for outdoor transformers the transformer was wetting by artificial rain at parameters:

- vertical component of precipitation H_v = 1,6 mm/min
- horizontal component of precipitation H_h = 1,5 mm/min
- water electrical resistivity ρ= 99 Ωm

The test voltage was corrected according to density of air.

During test were not observed any flashover or failure of insulation.

Test result - positive.

4.5 Determination of errors

Measurements of errors for voltage transformers was performed in Factory Laboratory of ABB sp. z o.o. in Przasnysz 59 Leszno 59 Street, under supervision of representative of IEn.

The measurement was done two times:

- Tests before type test and special test (Measurements before type test and special tests) - Report No. 2GKP011V1084703 – 19.01.2012,
- Tests after type test and special tests completed (Measurements after type test and special test completed) - Report No. 2GKP011V1084703 – 26.03.2012.

Detailed information about tests results consists Appendix No. 2 of hereby Report.

Analyzing test results of measurements of errors for voltage transformer was found that:

- **For measurement windings 1a-1n and 2a-2n class 0,2:**
  - for voltages $0{,}8U_n$, $1U_n$ i $1{,}2U_n$ voltage error $\Delta U(\%) < 0{,}2\%$ and phase displacement $\delta_u(\text{min}) < 10$ min.
- **For winding for protection 3a-3n class 0,2% and 3P:**
  - for voltages $0{,}8U_n$, $1U_n$ i $1{,}2U_n$ voltage error $\Delta U(\%) < 0{,}2\%$ and phase displacement $\delta_u(\text{min}) < 10$ min.

- **for voltages $0{,}02U_n$, $0{,}05U_n$ i $1{,}9U_n$ voltage error $\Delta U(\%) < 3\%$ and phase displacement $\delta_u(\text{min}) < 120$ min.**
- **For winding for protection 4a-4n class 0,2% and 3P:**
  - for voltages $0{,}8U_n$, $1U_n$ i $1{,}2U_n$ voltage error $\Delta U(\%) < 0{,}2\%$ and phase displacement $\delta_u(\text{min}) < 10$ min.
  - for voltages $0{,}02U_n$, $0{,}05U_n$ i $1{,}9U_n$ voltage error $\Delta U(\%) < 3\%$ and phase displacement $\delta_u(\text{min}) < 120$ min.
- **For residual voltage winding da-dn class 3P:**
  - for voltages $0{,}02U_n$, $0{,}05U_n$ $1{,}0U_n$ i $1{,}9U_n$ voltage error $\Delta U(\%) < 3\%$ and phase displacement $\delta_u(\text{min}) < 120$ min.

For each of voltage windings values of error are contain in range compatible to appropriate class of accuracy.

4.6 Radio interference voltage measurement

Following to requirement of IEC/CISPR 18-2 the measurements was performed in testing arrangement as is show on Figure 5. The interference voltage was measured on resistance 300Ω at frequency 0,5 MHz. To determinate coefficient of correction +24 dB before measurement the instrument was calibrated by stabile signal generator . To measurement of interference voltage the instrument LMZ-5 was used. The level of background was checked for range of test voltages 0 - 150 kV. Interference voltages originated form testing arrangement, radio broadcasts etc., were below 5μV (14 dB).

According to PN EN 60044-1/A1 interference voltage at voltage $Up=1.1 \cdot U_m/\sqrt{3}$ =78 kV has not to exceed the value RIV_{dop} = 2500μV.

The instrument had logarithmic scale: RIV_{dop} = 2500μV → 68 dB (0 dB = 1 μV).

Before the test, the instrument transformer was supplied with voltage $1{,}5 \cdot U_m/\sqrt{3}$, held for 30 sec. Next, within about 10 sec the voltage was decreased to value $1{,}1 \cdot U_m/\sqrt{3}$, held for 30 sec.

The measurements were done at test voltages in range $0{,}3 \div 1{,}1 \cdot U_m/\sqrt{3}$ .Test voltage was decreased step by step with value 0,1xUp since $Up=1{,}1 \cdot U_m/\sqrt{3}$ up to value $Up=0{,}3 \cdot U_m/\sqrt{3}$. Next, voltage was increased by this same values and finally deceased again.. For each of test voltage the measurement of radio interference voltage were performed and registered level in last series of decreasing voltage was drawn in function of test voltage Utest.

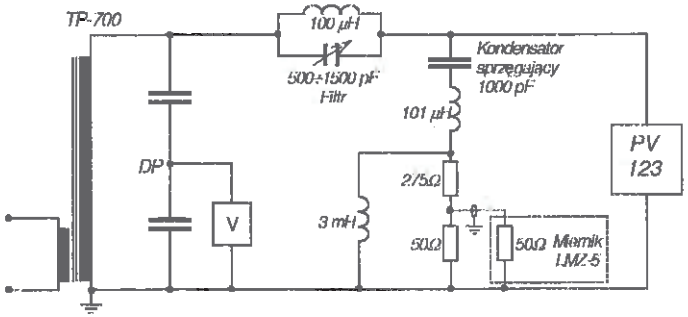
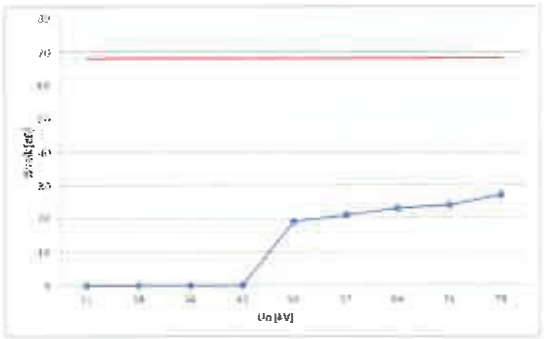


Fig. 5 Test arrangement for Radio interference voltage measurement

The results of measurements are present in Table and diagram below.

Up [kV]		78	71	64	57	50	43	36	28	21
xUn/√3		1,1	1,0	0,9	0,8	0,7	0,6	0,5	0,4	0,3
[dB]	→	3	1	-1	-3	-5	-	-	-	-
	←	3	0	-1	-3	-5	-	-	-	-
	→	3	0	-1	-3	-5	-	-	-	-
Wynik	[dB]	27	24	23	21	19	-	-	-	-
	[µV]	22	16	13	11	9	-	-	-	-



Measured Radio Interference Voltage RIV = 22 µV (27dB) is much less than permissible level RIV_{perm} = 2500 µV (68dB).

Test result - positive.

4.7 Chopped impulse test on the primary winding

Chopped Impulse Test was supplemented to Lightning Impulse test 1,2/50µs and was described in clause 4.3 of hereby Report.

Recorded oscillograms not show of failure of insulation of voltage transformers. Test result - positive.

Oscillograms of all applied impulses are present in Appendix No. 4 of hereby Report.

4.8 Measurement of capacitance and dielectric dissipation factor

The measurement was performed st at ABB's Factory Laboratory (Raports No. 2GKP011V1084703 – 19.01.2012 and No. No. 2GKP011V1084703 – 26.03.2012 of Factory Laboratory ABB sp. z o.o. Przasnysz Division).

Condition of measurements:

Up = 10 kV; $110/\sqrt{3}$ kV = 63,5 kV; $123/\sqrt{3}$ kV = 71 kV

Ambient temperature during measurement was 20,7°C and (22,8°C).

Test results are present in table below:

Up [kV]	C_x [pF]	tgδ [%]
10	264 (265)	0,2 (0,19)
63,5	265 (266)	0,2 (0,2)
71	265 (266)	0,2 (0,21)

The standard specifications for capacitance and dissipation factor for instrument transformers not provide criterion for these parameters. The Standard PN-EN 60044-2:2001 (EN 60044-2:1999) only contain note that value of dissipation factor is usually less than 0,5%.

4.9 Mechanical tests

The mechanical tests were performed in Distribution Equipment Laboratory of Institute of Power Engineering in Warsaw. The test consist in applying to the transformer mechanical load – static and dynamic, in three direction in turn. Static load was 20% higher than standard requirement for II class of load. The test conditions were as follow:

$F_R = 3600$ N, $t = 60$ s

It was assumed that dynamic load is 1,4 times higher than static load.

During the tests behaving of voltage transformer was correct. After test not stated any damages or oil leakage.

Test result - positive.

Detailed information about test arrangement, performed tests and tests results are present in Report No. EUR/12/E/12-3E – 30.03.2012 – (Appendix 3)

4.10 Transmitted overvoltage measurement

During the test to the HV terminal of transformer were applied impulse voltage.

It were recorded maximal value of overvoltages which came in each secondary windings - both current and voltage. According to requirement of Standard for impulse 0,5/50 μs and value $U_{test}=1{,}6 \times \sqrt{2} \times U_m/\sqrt{3} \cong 160$ kV 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 $U_t = 16$ kV. Concerning linear of phenomenon, registered overvoltages should have values less than 160 V (peak-to- peak value).

Registration was don by digital oscilloscope of "Dr Strauss" with input impedance 50 Ω and transmission band 200 MHz.

Results of test are present in table below.

Winding	Overvoltage value $U_{pp}/2 \times 10$ [V]
1a-1n	503
2a-2n	772
3a-3n	910
4a-4n	928
da-dn	732

It was found that for each of secondary winding of transformer transmitted overvoltages not exceed value of 1600 V.

Test result - positive.

The oscillograms of all applied and registered impulses are present in Appendix No. 6 of hereby Report.

5. SUMMARY

- The voltage instruments transformer type PV 123 manufactured by **ABB** sp. z o.o. 04-713 Warszawa, ul. Żegańska 1, with parameters described in clause 2 of hereby Report and identified on base provided documents (as presented in Appendix No. 1) was performed.
- The voltage instruments transformer type PV 123 **passed positively** type test according to requirement of standard:
  - PN-EN 60044-2:2001 + A1:2003 +A2:2004 „Przekładniki. Część 2: Przekładniki napięciowe indukcyjne" (EN-60044-2:1999 + A1:2000 + A2:2003 „Instrument transformers. Part 2: Inductiv voltage transformers"),

  and program described in Table 1, clause 3 of hereby Report.
- The voltage instruments transformer type PV 123 **passed positively** special tests according requirement mentioned above standards and program described in Table 1, clause 3 of hereby Report.

6. LIST OF APPENDIXES

Appendix No. 1

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

- Manufacturer Conformity Declaration
- Dimension drawing No. 2GKV614114/ (19.01.2012)
- Electric diagram of Voltage instrument transformer
- Drawing of rated nameplate

Appendix No. 2

Reports of routine test and determination of errors of voltage transformer type PV 123 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. 2GKP011V1084703 – 19.01.2012,
- Tests after type test and special tests completed (Measurements after type test and special test completed) - 2GKP011V1084703 – 26.03.2012.

Appendix No. 3

Report of performed tests in Distribution Equipment Laboratory of Institute of Power Engineering in Warsaw.

- Test Report No. EUR/12/E/12-3E (Mechanical tests.)

Appendix No. 4

Report of performed tests in High Current Laboratory of Institute of Power Engineering in Warsaw.

- EWP/07/E/2012-3c of 27.02.2012 (Temperature-rise tests)

Appendix No. 5

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

- Oscillograms of test voltages and detection currents.

Appendix No. 6

Transmitted overvoltage measurement:

- Oscillograms of measured transmitted to secondary windings overvoltages.

ABB Sp. z o.o. 06-300 Przasnysz ul. Leszno 59		Routine test report of voltage transformer (before type tests)	TYP: PV 123 Serial no: 2GKP011V1084703	
A-N 110:√3 kV	Insulation level: 123/230/550 kV	Voltage factor: 1.9/8h	IEC 60044-2	50 Hz

Winding	Usn [kV]	Sn [VA]	class	Sth [VA]
1a - 1n	0,1:√3	15	0,2	1000
2a - 2n	0,1:√3	15	0,2	1000
3a - 3n	0,1:√3	20	0,2/3P	1000
4a - 4n	0,1:√3	25	0,2/3P	1000
da - dn	0,1:3	50	3P	450

List of performed tests:

1. Oil dielectric parameters check before transformer filling (oil after treatment): tg δ : IEC 60247, breakdown voltage : IEC 60156 ☑
2. Verification of terminal markings ☑
3. Oil tightness test: oil overpressure: 0,8 bar / 24h – no traces of oil leakage ☑
4. Power-frequency withstand test on primary windings - Up = 275 kV, f = 50Hz ☑
5. Partial discharge measurement ☑
6. Power-frequency withstand test on secondary windings - Up = 3 kV/60s, f = 50Hz ☑
7. Determination of errors ☑
8. Measurement of secondary windings insulation resistance (1kV DC) - R >= 100 MΩ ☑
9. Measurement of primary windings insulation resistance (2,5kV DC) - R >= 200 MΩ ☑
10. Measurement of capacitance and dielectric dissipation factor - tg δ ☑
11. Measurement of windings' resistance ☑

Oil dielectric parameters check before transformer filling (oil after treatment)

- Measurement of oil tg δ according to IEC 60247

tg δ = 0.07 %; electrical stress = 1kV/mm, f = 50Hz, oil temp. = 90°C ±1°C

- Measurement of oil breakdown voltage according to IEC 60156

Mean breakdown voltage = 75.87 kV, Relative standard deviation = 5.17 %;

f = 50Hz, oil temp. = 24 °C, measurement with the stirrer, type of electrodes used: partially spherical.

Sample	Breakdown voltage [kV]
1	70.8
2	78.5
3	79.3
4	71.2
5	76.3
6	79.1

Partial discharge measurement

- Measurement according procedure A

(PD test voltages were reached while decreasing the voltage after the power-frequency withstand test on primary windings)

Stress voltage: 230 kV / 60 s

Frequency: 120 Hz

Test voltage	1,2 Um = 147.8 kV	1,2 Um / √3 = 85.2 kV
Level of partial discharge	0.7 pC	0.7 pC

Remarks: background noise level: 0.6 pC (measured after voltage switch off), measuring circuit was calibrated with 5pC (calibrating charge)

Determination of errors (ΔU%), (δu min), cos φ = 0,8 lagging

Meas. 1a-1n: 15 VA
2a-2n: 15 VA; 3a-3n: 20 VA; 4a-4n: 25 VA

	0,8 Un	1,0 Un	1,2 Un
ΔU	-0.106	-0.100	-0.099
δu	3.9	4.1	4.2

Meas. 1a-1n: 3.75 VA
2a-2n: 15 VA; 3a-3n: 20 VA; 4a-4n: 25 VA

	0,8 Un	1,0 Un	1,2 Un
ΔU	-0.077	-0.072	-0.070
δu	4.0	4.1	4.2

Meas. 2a-2n: 15 VA
1a-1n: 15 VA; 3a-3n: 20 VA; 4a-4n: 25 VA

	0,8 Un	1,0 Un	1,2 Un
ΔU	-0.097	-0.091	-0.090
δu	4.0	4.1	4.3

Meas. 2a-2n: 3.75 VA
1a-1n: 15 VA; 3a-3n: 20 VA; 4a-4n: 25 VA

	0,8 Un	1,0 Un	1,2 Un
ΔU	-0.067	-0.062	-0.061
δu	4.1	4.2	4.3

Meas. 3a-3n: 20 VA
1a-1n: 15 VA; 2a-2n: 15 VA; 4a-4n: 25 VA

	0,02 Un	0,05 Un	0,8 Un	1,0 Un	1,2 Un	1,9 Un*
ΔU	-0.221	-0.175	-0.093	-0.088	-0.087	-0.171
δu	-7.1	-0.7	4.5	4.6	4.7	4.0

Meas. 3a-3n: 5 VA
1a-1n: 15 VA; 2a-2n: 15 VA; 4a-4n: 25 VA

	0,02 Un	0,05 Un	0,8 Un	1,0 Un	1,2 Un	1,9 Un*
ΔU	-0.169	-0.129	-0.049	-0.044	-0.043	-0.123
δu	-7.6	-1.4	4.4	4.4	4.6	3.8

Meas. 4a-4n: 25 VA
1a-1n: 15 VA; 2a-2n: 15 VA; 3a-3n: 20 VA

	0,02 Un	0,05 Un	0,8 Un	1,0 Un	1,2 Un	1,9 Un*
ΔU	-0.213	-0.171	-0.092	-0.088	-0.086	-0.165
δu	-6.7	-0.3	4.8	4.9	5.0	4.2

Meas. 4a-4n: 6.25 VA
1a-1n: 15 VA; 2a-2n: 15 VA; 3a-3n: 20 VA

	0,02 Un	0,05 Un	0,8 Un	1,0 Un	1,2 Un	1,9 Un*
ΔU	-0.157	-0.121	-0.043	-0.038	-0.037	-0.115
δu	-7.3	-0.9	4.7	4.8	4.9	4.1

Meas. da-dn: 50 VA
1a-1n: 15 VA; 2a-2n: 15 VA; 3a-3n: 20 VA; 4a-4n: 25 VA

	0,02 Un	0,05 Un	1,0 Un	1,9 Un
ΔU	0.469	0.416	0.469	0.410
δu	-0.1	7.7	13.3	15.2

Meas. 1a-1n: 15 VA
2a-2n: 0 VA; 3a-3n: 0 VA; 4a-4n: 0 VA

	0,8 Un	1,0 Un	1,2 Un
ΔU	-0.027	-0.022	-0.021
δu	5.7	5.8	6.0

Meas. 1a-1n: 3.75 VA
2a-2n: 0 VA; 3a-3n: 0 VA; 4a-4n: 0 VA

	0,8 Un	1,0 Un	1,2 Un
ΔU	0.002	0.007	0.008
δu	5.8	5.9	6.0

Meas. 2a-2n: 15 VA
1a-1n: 0 VA; 3a-3n: 0 VA; 4a-4n: 0 VA

	0,8 Un	1,0 Un	1,2 Un
ΔU	-0.018	-0.013	-0.011
δu	5.8	6.0	6.1

Meas. 2a-2n: 3.75 VA
1a-1n: 0 VA; 3a-3n: 0 VA; 4a-4n: 0 VA

	0,8 Un	1,0 Un	1,2 Un
ΔU	0.011	0.016	0.018
δu	5.9	6.0	6.1

Meas. 3a-3n: 20 VA
1a-1n: 0 VA; 2a-2n: 0 VA; 4a-4n: 0 VA

	0,02 Un	0,05 Un	0,8 Un	1,0 Un	1,2 Un	1,9 Un*
ΔU	-0.141	-0.129	-0.027	-0.022	-0.021	-0.100
δu	-5.7	1.5	6.2	6.3	6.4	5.7

Meas. 3a-3n: 5 VA
1a-1n: 0 VA; 2a-2n: 0 VA; 4a-4n: 0 VA

	0,02 Un	0,05 Un	0,8 Un	1,0 Un	1,2 Un	1,9 Un*
ΔU	-0.098	-0.085	0.017	0.022	0.024	-0.057
δu	-6.3	1.2	6.0	6.2	6.3	5.6

Meas. 4a-4n: 25 VA
1a-1n: 0 VA; 2a-2n: 0 VA; 3a-3n: 0 VA

	0,02 Un	0,05 Un	0,8 Un	1,0 Un	1,2 Un	1,9 Un*
ΔU	-0.137	-0.128	-0.029	-0.025	-0.023	-0.101
δu	-5.6	1.5	6.2	6.3	6.4	5.7

Meas. 4a-4n: 6.25 VA
1a-1n: 0 VA; 2a-2n: 0 VA; 3a-3n: 0 VA

	0,02 Un	0,05 Un	0,8 Un	1,0 Un	1,2 Un	1,9 Un*
ΔU	-0.078	-0.080	0.020	0.025	0.026	-0.054
δu	-6.4	1.4	6.1	6.2	6.3	5.7

Meas. da-dn: 12.5 VA
1a-1n: 0 VA; 2a-2n: 0 VA; 3a-3n: 0 VA; 4a-4n: 0 VA

	0,02 Un	0,05 Un	1,0 Un	1,9 Un
ΔU	0.933	0.891	0.924	0.913
δu	-5.2	2.3	8.7	9.5

* at 1,9 Un winding da-dn is loaded with 50 VA

Measurements uncertainty: $\Delta_u = \pm 0{,}044\ \%$, $\delta_u = \pm 2{,}2$ min

Measurement of capacitance and dielectric dissipation factor - tg δ

Temperature: 20.7 °C, Frequency: 50 Hz

Primary voltage	tg δ [%]	Capacitance [pF]	Leakage current [mA]
10 kV	0.2	264	0.845
63 kV	0.2	265	5.234
71 kV	0.2	265	5 9

Measurement of windings' resistance:

	R (20.5 °C)	Rct (75 °C)
A-N	20.70 kΩ	25.134 kΩ
1a - 1n	45.140 mΩ	54.808 mΩ
2a - 2n	47.880 mΩ	58.135 mΩ
3a - 3n	49.660 mΩ	60.296 mΩ
4a - 4n	51.500 mΩ	62.531 mΩ
da - dn	33.610 mΩ	40.809 mΩ

Rating plate:

ABB

Voltage Transformer

Type: PV 123

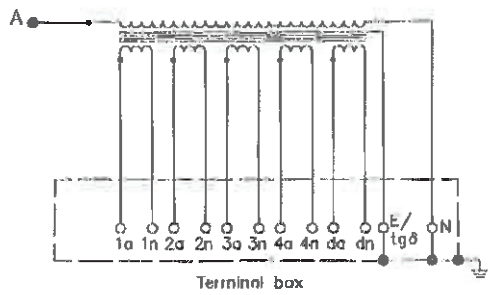
Insulation level	123/230/550 kV	Standard	IEC 60044-2	fn	50 Hz
Oil type	Nytro Libra	Weight / oil	280 / 60 kg	Temp. range	-40°C → +40°C
SN	84703 / 11	Voltage factor	1,9Un/8h		

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	15	15	20	25	50
Cl.	0,2	0,2	0,2/3P	0,2/3P	3P
VAsth	1000	1000	1000	1000	450

Transportation: Vertical

Electrical diagram plate:



Instrument transformer electrical diagram

ATTENTION!

1. TERMINALS MARKED: N, E, tgδ DURING NORMAL OPERATION MUST BE EARTHED
2. AFTER CONNECTION THREE WINDING da-dn IN OPEN DELTA CIRCUIT MUST BE EARTHED IN ONLY ONE POINT

Przasnysz, 2012-01-19

The tests were witnes...

Representative of
HIGH VOLTAGE LABORATORY
INSTYTUT ENERGETYKI
01-330 WARSAW, Mory 8

ABB Sp. z o.o. 06-300 Przasnysz ul. Leszno 59		Routine test report of voltage transformer after dielectric type tests	TYPE: PV 123 Serial no: 2GKP011V1084703	
A-N 110:√3 kV	Insulation level: 123/230/550 kV	Voltage factor: 1.9/8h	IEC 60044-2	50 Hz

Winding	Usn [kV]	Sn [VA]	class	Sth [VA]
1a - 1n	0,1:√3	15	0,2	1000
2a - 2n	0,1:√3	15	0,2	1000
3a - 3n	0,1:√3	20	0,2/3P	1000
4a - 4n	0,1:√3	25	0,2/3P	1000
da - dn	0,1:3	50	3P	450

List of performed tests:

1. Power-frequency withstand test on primary windings - Up = 184 kV/60s, f = 120Hz ☑
2. Partial discharge measurement ☑
3. Power-frequency withstand test on secondary windings - Up = 3 kV/60s, f = 50Hz ☑
4. Determination of errors ☑
5. Measurement of secondary windings insulation resistance (1kV DC) - R >= 100 MΩ ☑
6. Measurement of primary windings insulation resistance (2,5kV DC) - R >= 200 MΩ ☑
7. Measurement of capacitance and dielectric dissipation factor - tg δ ☑
8. Measurement of windings' resistance ☑

Partial discharge measurement

Measurement according to procedure A
(PD test voltages were reached white decreasing the voltage after the power-frequency withstand test on primary windings)
Stress voltage: 184 kV / 60 s
Frequency: 120 Hz

Test voltage	1,2 Um = 147.6 kV	1,2 Um /√3 = 85.2 kV
Level of partial discharge	0.9 pC	0.8 pC

Remarks: background noise level: 0.7 pC (measured after voltage switch off),
measuring circuit was calibrated with 5pC (calibrating charge)

Determination of errors (Δ U%), (δ u min), cos φ = 0,8 lagging

Meas. 1a-1n: 15 VA
2a-2n: 15 VA; 3a-3n: 20 VA; 4a-4n: 25 VA

	0,8 Un	1,0 Un	1,2 Un
Δ U	-0.100	-0.095	-0.094
δ u	3.7	3.7	3.8

Meas. 1a-1n: 3.75 VA
2a-2n: 15 VA; 3a-3n: 20 VA; 4a-4n: 25 VA

	0,8 Un	1,0 Un	1,2 Un
Δ U	-0.070	-0.066	-0.064
δ u	3.8	3.8	3.9

Meas. 2a-2n: 15 VA
1a-1n: 15 VA; 3a-3n: 20 VA; 4a-4n: 25 VA

	0,8 Un	1,0 Un	1,2 Un
Δ U	-0.061	-0.066	-0.064
δ u	3.8	3.8	3.9

Meas. 2a-2n: 3.75 VA
1a-1n: 15 VA; 3a-3n: 20 VA; 4a-4n: 25 VA

	0,8 Un	1,0 Un	1,2 Un
Δ U	-0.061	-0.057	-0.055
δ u	3.8	3.8	4.0

Meas. 1a-1n: 15 VA
2a-2n: 0 VA; 3a-3n: 0 VA; 4a-4n: 0 VA

	0,8 Un	1,0 Un	1,2 Un
Δ U	-0.024	-0.019	-0.018
δ u	5.4	5.5	5.6

Meas. 1a-1n: 3.75 VA
2a-2n: 0 VA; 3a-3n: 0 VA; 4a-4n: 0 VA

	0,8 Un	1,0 Un	1,2 Un
Δ U	0.005	0.010	0.011
δ u	5.5	5.6	5.7

Meas. 2a-2n: 15 VA
1a-1n: 0 VA; 3a-3n: 0 VA; 4a-4n: 0 VA

	0,8 Un	1,0 Un	1,2 Un
Δ U	-0.015	-0.010	-0.008
δ u	5.6	5.6	5.7

Meas. 2a-2n: 3.75 VA
1a-1n: 0 VA; 3a-3n: 0 VA; 4a-4n: 0 VA

	0,8 Un	1,0 Un	1,2 Un
Δ U	0.014	0.019	0.021
δ u	5.6	5.6	5.7

Meas. 3a-3n: 20 VA
1a-1n: 15 VA; 2a-2n: 15 VA; 4a-4n: 25 VA

	0,02 Un	0,05 Un	0,8 Un	1,0 Un	1,2 Un	1,9 Un*
Δ U	-0.324	-0.240	-0.124	-0.120	-0.118	-0.182
δ u	-0.3	2.6	5.2	5.2	5.3	4.1

Meas. 3a-3n: 5 VA
1a-1n: 15 VA; 2a-2n: 15 VA; 4a-4n: 25 VA

	0,02 Un	0,05 Un	0,8 Un	1,0 Un	1,2 Un	1,9 Un*
Δ U	-0.264	-0.179	-0.048	-0.043	-0.042	-0.127
δ u	-0.8	2.0	4.2	4.3	4.4	3.7

Meas. 4a-4n: 25 VA
1a-1n: 15 VA; 2a-2n: 15 VA; 3a-3n: 20 VA

	0,02 Un	0,05 Un	0,8 Un	1,0 Un	1,2 Un	1,9 Un*
Δ U	-0.286	-0.210	-0.083	-0.079	-0.076	-0.160
δ u	-0.4	2.2	4.5	4.5	4.6	3.9

Meas. 4a-4n: 6.25 VA
1a-1n: 15 VA; 2a-2n: 15 VA; 3a-3n: 20 VA

	0,02 Un	0,05 Un	0,8 Un	1,0 Un	1,2 Un	1,9 Un*
Δ U	-0.236	-0.159	-0.032	-0.028	-0.026	-0.109
δ u	-0.5	2.2	4.4	4.4	4.5	3.8

Meas. da-dn: 50 VA
1a-1n: 15 VA; 2a-2n: 15 VA; 3a-3n: 20 VA; 4a-4n: 25 VA

	0,02 Un	0,05 Un	1,0 Un	1,9 Un
Δ U	0.364	0.404	0.485	0.477
δ u	4.2	6.6	7.8	8.4

Meas. 3a-3n: 20 VA
1a-1n: 0 VA; 2a-2n: 0 VA; 4a-4n: 0 VA

	0,02 Un	0,05 Un	0,8 Un	1,0 Un	1,2 Un	1,9 Un*
Δ U	-0.248	-0.165	-0.035	-0.031	-0.029	-0.113
δ u	1.5	4.2	6.3	6.3	6.4	5.8

Meas. 3a-3n: 5 VA
1a-1n: 0 VA; 2a-2n: 0 VA; 4a-4n: 0 VA

	0,02 Un	0,05 Un	0,8 Un	1,0 Un	1,2 Un	1,9 Un*
Δ U	-0.193	-0.110	0.023	0.027	0.028	-0.056
δ u	0.9	3.7	5.8	5.8	5.9	5.3

Meas. 4a-4n: 25 VA
1a-1n: 0 VA; 2a-2n: 0 VA; 3a-3n: 0 VA

	0,02 Un	0,05 Un	0,8 Un	1,0 Un	1,2 Un	1,9 Un*
Δ U	-0.233	-0.150	-0.021	-0.017	-0.015	-0.096
δ u	1.1	3.8	5.9	5.9	6.0	5.3

Meas. 4a-4n: 6.25 VA
1a-1n: 0 VA; 2a-2n: 0 VA; 3a-3n: 0 VA

	0,02 Un	0,05 Un	0,8 Un	1,0 Un	1,2 Un	1,9 Un*
Δ U	-0.180	-0.099	0.029	0.033	0.035	-0.049
δ u	1.0	3.6	5.7	5.8	5.8	5.3

Meas. da-dn: 12.5 VA
1a-1n: 0 VA; 2a-2n: 0 VA; 3a-3n: 0 VA; 4a-4n: 0 VA

	0,02 Un	0,05 Un	1,0 Un	1,9 Un
Δ U	0.683	0.721	0.798	0.791
δ u	3.3	5.8	6.7	7.4

*** at 1,9 Un winding da-dn is loaded with 50 VA**

Measurements uncertainty: $\Delta_u = \pm 0{,}044\ \%$, $\delta_u = \pm 2{,}2$ min

Measurement of capacitance and dielectric dissipation factor - tg δ
Temperature: 22.8 °C, Frequency: 50 Hz

Primary voltage	tg δ [%]	Capacitance [pF]	Leakage current [mA]
10 kV	0.19	265	0.881
63 kV	0.2	266	5.242
71 kV	0.21	268	5.914

Measurement of windings' resistance:

	R (22.7 °C)	Rct (75 °C)
A-N	20.30 kΩ	24.472 kΩ
1a - 1n	46.440 mΩ	55.985 mΩ
2a - 2n	48.250 mΩ	58.167 mΩ
3a - 3n	50.100 mΩ	60.398 mΩ
4a - 4n	52.000 mΩ	62.688 mΩ
da - dn	33.910 mΩ	40.880 mΩ

Rating plate:

ABB

Voltage Transformer

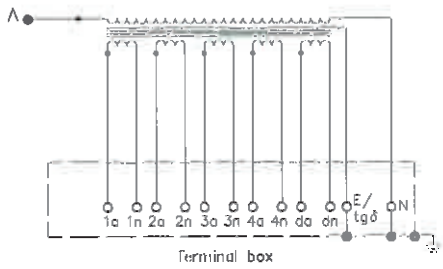
				Type	PV 123
Insulation level	123/230/550 kV	Standard	IEC 60044-2	fn	50 Hz
Oil type	Nytro Libra	Weight / oil	280 / 60 kg	Temp. range	-40°C → +40°C
SN	84703 / 11	Voltage factor	1,9Un/8h		

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	15	15	20	25	50
Cl.	0,2	0,2	0,2/3P	0,2/3P	3P
VA_{rth}	1000	1000	1000	1000	450

Transportation: Vertical

Electrical diagram plate:



Instrument transformer electrical diagram

ATTENTION!

1. TERMINALS MARKED: N, E, tgδ DURING NORMAL OPERATION MUST BE EARTHED
2. AFTER CONNECTION THREE WINDING da-dn IN OPEN DELTA CIRCUIT MUST BE EARTHED IN ONLY ONE POINT

Checked by: .....

Przasnysz, 2012-03-26

The tests were witnesed by:

Representative of
HIGH VOLTAGE LABORATORY
INSTYTUT ENERGETYKI
01-330 WARSAW, Mory 8

INSTITUTE OF POWER ENGINEERING
DISTRIBUTION EQUIPMENT LABORATORY

01-330 Warsaw, ul Mory 8
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tel. +48 22 345-13-86

TEST REPORT No. EUR/12/E/12-3E

TEST OBJECT: Voltage transformer type PV 123 with porcelain insulator

MANUFACTURER: ABB Sp. z o.o. Division in Przasnysz, ul. Leszno 59, 06-300 Przasnysz

TESTS ORDERED BY: Internal order No. EWN/48/E/12 dated 10.05.2012

TYPE OF TESTS: Mechanical tests

TESTS PROCEDURE: According to IEC 60044-2:1997+A1:2000+A2:2002

DATE OF TESTS: 30.03.2012

TESTS RESULT: Positive for
F_R = 3600 N and resulting dynamic load

Tests result refers only to the test object

THE TESTS WERE WITNESSED BY:

Test engineer

HEAD OF LABORATORY

Contents **Page**

Report contents:

numbered pages	7
tables	1
photographs	3

1. TEST OBJECT

1.1 Description

Voltage transformer type PV 123 is used for supplying of measuring and protection circuits in the network of nominal voltage 110 kV and frequency 50 Hz. The transformer consists of voltage transformer mounted in porcelain enclosure immersed with transformer oil.

1.2 Technical data

The Manufacturer attributed the following construction data to the test object.

Rated voltage	$110/\sqrt{3}$ kV
Rated frequency	50 Hz
Rated static load	3600 N

1.3 Technical documentation

For the purpose of tests the orderer delivered the following technical documentation:
- dimensional drawing voltage transformer PV 123, No. 2GKV614114, 19.01.2012, prepared by ABB Sp. z o.o. (Annex 2).

The laboratory proceeded the identification of test object on the base of above documentation and the nameplate.

1.4 Preparation for tests

The test object was prepared for test by factory.

2. SCOPE OF TESTS

Test program, agreed with orderer, comprised the following tests according to requirements of IEC 60044-2:1997+A1:2000+A2:2002:
- mechanical tests acc. to item 9.3 of above standards for F_R = 3600 N and resulting dynamic load of terminal A.

3. TEST AND MEASURING CIRCUITS

For the tests the transformer was fixed to the rigid construction of the test stand.

Mechanical tests were performed applying the load consecutively to the transformer's terminal as shown on photographs 1 to 3 in Annex 2.

4. TESTS AND THEIRS DETAILED RESULTS

Mechanical tests were performed 30.03.2012. Tests results present table 1.

During the tests the photos were made (Annex 1 presents the photographs)
- phot. 1 to 3 - voltage transformer during mechanical tests.

Table 1. Results of static load withstand tests at F = 3620 N and dynamic*)

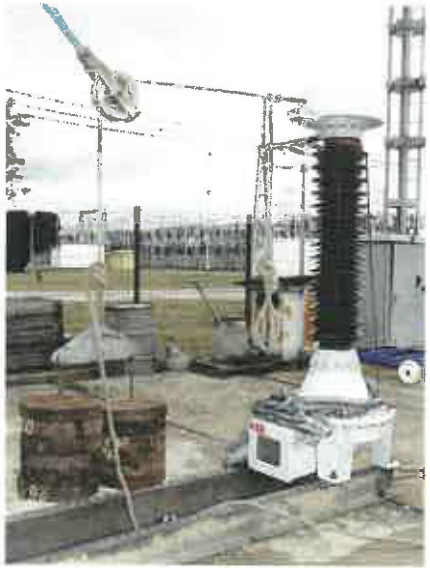
Test No.	Terminal	Load direction	Test time	Observations
-	-	-	s	-
1	A	longitudinal	60	After tests no damage nor oil leak was stated.
2	A	longitudinal	dyn.*)	
3	A	transverse	60	After tests no damage nor oil leak was stated.
4	A	transverse	dyn.*)	
5	A	vertical	60	After tests no damage nor oil leak was stated.
6	A	vertical	dyn.*)	

Remark:
*) Dynamic tests were performed by sudden loading the terminal by the weight 3620 N.

5. TESTS RESULTS EVALUATION

According to criteria given in IEC 60044-2:1997+A1:2000+A2:2002the results of tests of tested combined transformer is positive for:
- F_R = 3600 N and resulting dynamic load.

ANNEX 1 **Photographs taken during the tests**

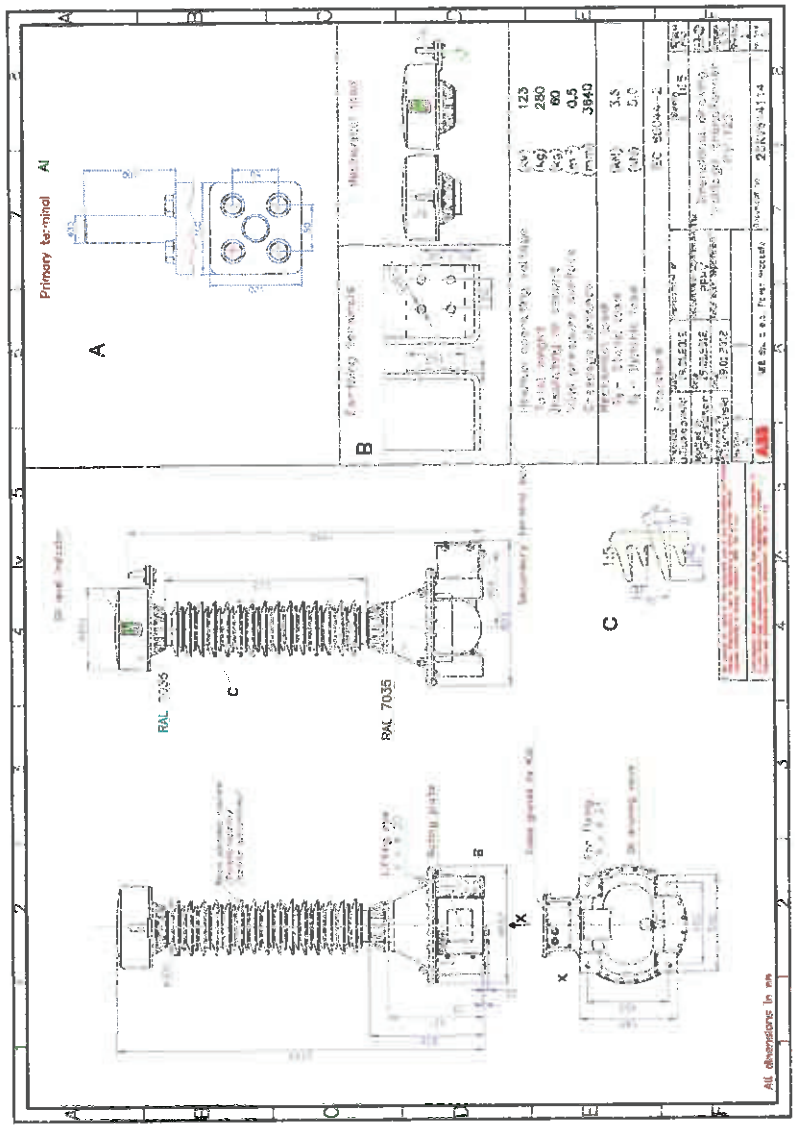


Phot. 1. Longitudinal load of terminal A

Phot. 2. Transverse load of terminal A

Phot. 3. Vertical load of terminal A

ANNEX 2 **Documentations delivered by orderer**



INSTYTUT ENERGETYKI
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http://www.ien.com.pl/pl/ewp

TEST REPORT NO. EWP/07/E/2012-3e

TEST OBJECT:	Voltage instrument transformer type PV 123
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/11/E/12 dated 16.02.2012
TYPE OF TESTS:	Temperature-rise test
TEST PROCEDURE:	IEC 60044-2: 1997, IEC 60044-2 1997 /A2:2002, IEC 62271-1:2007
TEST OBJECT DELIVERED:	10.02.2012
DATE OF TESTS:	22.02.2012 ÷ 23.02.2012
TESTS RESULTS:	Positive

Tests result refers only to the test object.
The Test Report consist tests from and beyond the scope of accreditation (details in sub-cl. 4)
Publishing or reproducing of this report in other version then exact and complete without written permission of laboratory is forbidden

THE TESTS WERE WITNESSED BY :	-
TEST ENGINEER :	Mariusz SUL M.Sc. Eng.
HEAD OF LABORATORY :	Lidia GRUZA M.Sc. Eng.

Warsaw, 27.02.2012

Contents

Report contains 12 numbered pages with:

2	Drawings
2	Photographs
0	Oscillogramms
1	Appendix

1. Description of the test object

Test object	Voltage instrument transformer
Type, Serial number	PV 123, 2GKP011V1084703
Manufacturer	ABB Sp. z o.o. Power Products
Year	2011
Insulator	Porcelain insulator
Oil type	Nytro Libra
Minimum creepage distance	3640 mm
Insulating oil weight	60 kg
Total weight	280 kg
Dimensions	According to drawing no. 2GKV614114

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	123 kV
Rated frequency	50 Hz
Voltage factor and time	1,9Un/8h

Type of secondary winding	1a-1n	2a-2n	3a-3n	4a-4n	da-dn
Rated secondary voltage	100:√3	100:√3	100:√3	100:√3	100:3
Rated output	15 VA	15 VA	20 VA	25 VA	50 VA
Accuracy class	0,2	0,2	0,2/3P	0,2/3P	3P
Thermal limiting output	1000 VA	1000 VA	1000 VA	1000 VA	450 VA

3. Technical documentation of the test object

1.	Drawing no. 2GKV614114/ – Dimensional drawing voltage transformer PV 123, ABB Sp. z o.o. Power Products, approved 19.01.2012
2.	Routine test report of voltage transformer (before type test); type PV 123, Series No. 2GKP011V1084703. ABB Sp. z o.o., Przasnysz, 19.01.2012
3.	Construction of voltage transformer PV 123 – NR 2GKP011V1084703

4. Scope of the tests

Test programme agreed with Orderer comprised of tests:

Kind of test	Tests according the Standard	Location of the test
Temperature-rise tests	IEC 60044-2:1997 sub-cl. 5.4, 8.1, 13.6.1 IEC 62271-1:2007, Table No. 3, sub-cl. 4	EWP

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

5. Tests and their results

Voltage transformer was installed at the test stand, as it was during normal operation. Electric diagram of terminal box of tested voltage 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.

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 60044-2 sub-cl. 8.1, 5.4 a) and 13.6.1). The voltage value 1,2 Un = 76,2 kV was applied to the A terminal.

The secondary voltage windings were loaded as follows: 1a-1n ⇒ 15 VA, cosφ = 1, at the voltage 100/√3 V; 2a-2n ⇒ 15 VA, cosφ = 1, at the voltage 100/√3 V; 3a-3n ⇒ 20 VA, cosφ = 1, at the voltage 100/√3 V; 4a-4n ⇒ 25 VA, cosφ = 1, at the voltage 100/√3 V.
The winding of residual voltage remained open.

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 60044-2 sub-cl. 5.4 c, 8.1, and 13.6.1. The voltage value 1,9 Un = 119,7 kV was applied to the A terminal.

The secondary voltage windings were loaded as follows: 1a-1n ⇒ 15 VA, cosφ = 1, at the voltage 100/√3 V; 2a-2n ⇒ 15 VA, cosφ = 1, at the voltage 100/√3 V; 3a-3n ⇒ 20 VA at the voltage 100/√3 V; 4a-4n ⇒ 25 VA, cosφ = 1, at the voltage 100/√3 V.

The residual winding da-dn was loaded by ⇒ 450 VA, cosφ = 1, at the voltage 100/3 V.

The duration of the test was 8 h.

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HIGH CURRENT LABORATORY
Test Report No.
EWP/07/E/2012-3e

Stage No. 3: Test with thermal limit power

Test was done immediately after Stage No. 2 according to the IEC 60044-2 sub-cl. 5.4 a), 8.1, and 13.6.1. The voltage value Un = 63 kV was applied to the A terminal.

According to Manufacturers request secondary voltage windings (i.e. 1a-1n, 2a-2n, 3a-3n and 4a - 4n) were loaded by limit power 1000 VA at cosφ = 1. The residual winding remained open.

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[1].
The resistance was measured by means of meter type 2291 manufactured by TETTEX Instruments with accuracy ± 0,01 mΩ[1]

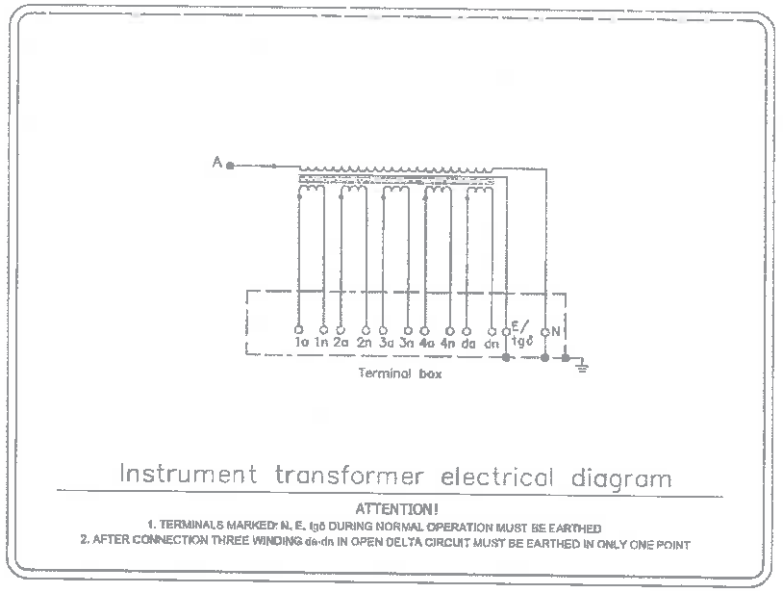


Fig. 1. Electrical diagram of terminal box of tested voltage instrument transformer

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

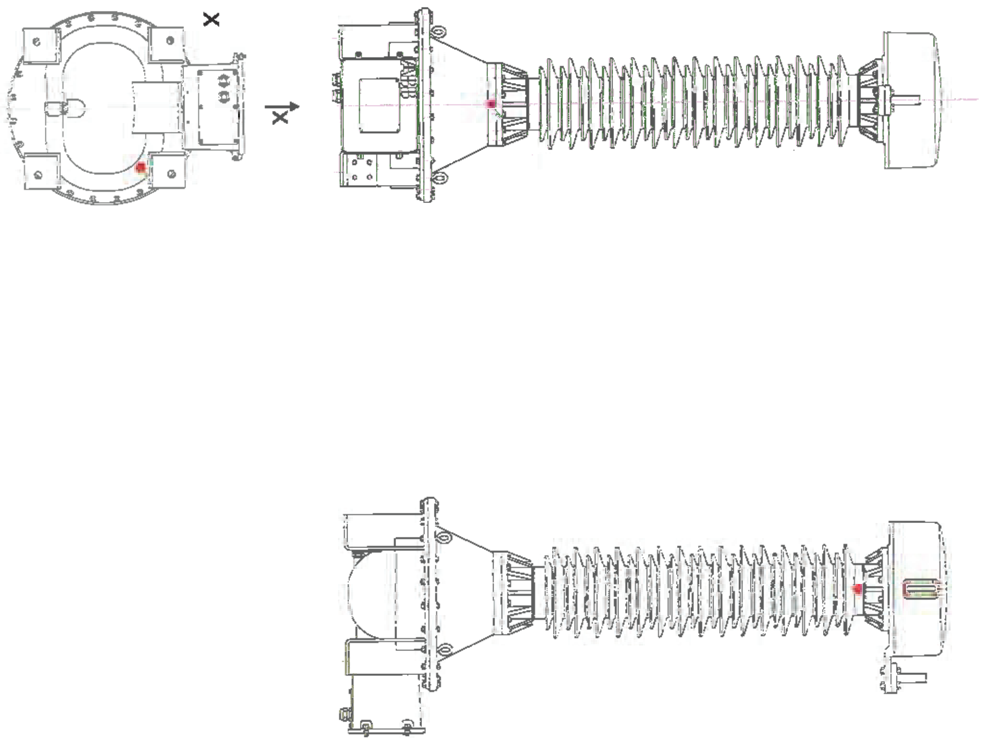


Fig. 2. Arrangement of thermocouples during temperature-rise test:

1- oil; 2- under the flange of tank lid; 3- lower tank (placed inside over earthing terminal).

Table 1. Temperature-rise test results of voltage instrument transformer PV 123, serial no. 2GKP011V1084703 *)

Parameter	Heating time [h]																				
	Stage No. 1					Stage No. 2								Stage No. 3							
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
U_{test}, kV	76,2					119.7								63							
I_{A-N}, mA	2,6	-	-	-	-	16	-	-	-	-	-	-	-	58	-	-	-	-	-	-	-
Thermocouple no. 1, °C	13,95	14,05	14,30	14,61	15,62	17,26	18,02	18,96	19,80	20,62	21,27	21,32	21,52	22,11	22,19	22,27	22,52	23,25	24,00	24,50	24,75
Thermocouple no. 2, °C	12,64	13,49	14,36	14,82	15,75	16,62	17,93	18,81	19,39	19,89	20,30	20,95	21,23	21,95	22,01	22,02	22,02	22,78	23,03	23,50	23,75
Thermocouple no. 3, °C	12,95	13,74	14,83	14,84	15,37	16,59	17,63	18,36	18,87	19,17	19,43	19,84	20,29	20,62	20,85	21,30	21,30	21,52	21,78	22,27	22,52
$T_{ot\ in}$, °C	13,75	14,03	14,28	14,45	14,53	14,60	14,73	14,78	14,90	14,98	15,05	15,10	15,10	15,25	15,27	15,38	15,35	15,33	15,33	15,40	15,43
R_{1a-1n}, mΩ	45,225	45,578	45,829	45,99	46,104	47,277	47,632	47,892	48,105	48,189	48,296	48,408	48,502	50,102	50,335	50,492	50,615	50,729	50,791	50,889	50,952
R_{2a-2n}, mΩ	46,701	47,014	47,272	47,439	47,55	48,842	49,223	49,504	49,703	49,795	49,908	50,028	50,126	51,383	51,641	51,822	51,962	52,092	52,145	52,256	52,32
R_{3a-3n}, mΩ	48,562	48,863	49,122	49,291	49,419	50,829	51,249	51,543	51,771	51,855	51,972	52,106	52,222	53,464	53,779	53,968	54,136	54,282	54,352	54,467	54,526
R_{4a-4n}, mΩ	50,294	50,596	50,854	51,039	51,17	52,665	53,097	53,424	53,676	53,77	53,889	54,03	54,158	55,434	55,788	56,02	56,193	56,346	56,427	56,548	56,61
R_{da-dn}, mΩ	32,828	33,008	33,179	33,295	33,386	34,554	34,86	35,068	35,238	35,313	35,371	35,485	35,558	36,428	36,744	36,958	37,106	37,224	37,293	37,39	37,434
R_{A-N}, kΩ	19,66	19,73	19,78	19,84	19,88	20,15	20,32	20,52	20,62	20,72	20,8	20,9	21,0	22,0	22,7	23,15	23,45	23,71	23,84	23,95	24,02
ΔT_{1a-1n}	0	1,95	3,34	4,23	4,86	11,34	13,31	14,74	15,92	16,38	16,98	17,60	18,11	26,96	28,25	29,12	29,80	30,43	30,77	31,31	31,66
ΔT_{2a-2n}	0	1,68	3,06	3,95	4,54	11,46	13,50	15,01	16,07	16,56	17,17	17,81	18,33	25,06	26,44	27,41	28,16	28,86	29,14	29,74	30,08
ΔT_{3a-3n}	0	1,55	2,88	3,75	4,41	11,67	13,83	15,35	16,52	16,95	17,55	18,24	18,84	25,24	26,86	27,83	28,70	29,45	29,81	30,40	30,70
ΔT_{4a-4n}	0	1,50	2,78	3,70	4,35	11,79	13,93	15,56	16,81	17,28	17,87	18,57	19,21	25,55	27,31	28,46	29,32	30,08	30,49	31,09	31,40
ΔT_{da-dn}	0	1,37	2,67	3,56	4,25	13,14	15,47	17,06	18,35	18,92	19,37	20,23	21,02	27,42	29,82	31,45	32,58	33,48	34,00	34,74	35,08
ΔT_{A-N}	0	0,89	1,53	2,29	2,80	6,23	8,39	10,94	12,21	13,48	14,50	15,77	17,04	29,76	38,66	44,38	48,19	51,50	53,15	54,55	55,44
Deflection of the oil level indicator mm.	0	0	0	0	0	0,1	0,2	0,2	0,3	0,3	0,3	0,3	0,4	0,5	0,5	0,5	0,6	0,6	0,6	0,6	0,6

*) Marked with „-„ are value not measured (agreed with Orderer)

Table No. 2. Temperature-rises [K] given during the tests
Voltage instrument transformer PV 123 serial no. 2GKP011V1084703

Winding	$\Delta\vartheta$ after Stage No. 1	$\Delta\vartheta$ after Stage No. 2	$\Delta\vartheta$ after Stage No. 3	$\Delta\vartheta_{dop}$
1a- 1n	4,86	18,11	31,66	75 [1)]
2a-2n	4,54	18,33	30,08	
3a-3n	4,41	18,84	30,70	
4a-4n	4,35	19,21	31,40	
da-dn	4,25	21,02	35,08	
A-N	2,80	17,04	55,44	

Thermocouple No.	Location	$\Delta\vartheta$ after Stage No. 1	$\Delta\vartheta$ after Stage No. 2	$\Delta\vartheta$ after Stage No. 3	$\Delta\vartheta_{dop}$
1	Oil	1,10	6,42	9,33	55[1)]
2	Under the flange of tank lid	1,23	6,13	8,33	40[2)]
3	Enclosure of lower tank	0,84	5,19	7,10	

[1)] acc. to IEC 60044-2:1997, [2)] acc. to IEC 62271-1:2007,
$\Delta\vartheta$ - temperature-rise; $\Delta\vartheta_{dop}$ – permitted value in steady state

6. Summary

In tested voltage instrument transformer type PV 123 with porcelain insulator, as results of temperature rise test:

- in steady state, at the rated load of secondary voltage windings (without residual winding) , at $\cos\varphi = 1$ and supply voltage $1{,}2U_n$ (Stage No. 1), permitted temperature-rise limits were not exceeded.

The tested voltage transformer met requirements of IEC 60044-2: 1997, IEC 60044-2:1997/A2:2002 and IEC 62271-1: 2007 standards.

- results of test 8 h at supply voltage $1{,}9U_n$ and rated load of voltage windings at $\cos\varphi = 1$ and load of residual winding with thermal limit power (Stage No. 2), shows that permitted temperature-rise limits were not exceeded.

The tested voltage transformer met requirements of IEC 60044-2: 1997, IEC 60044-2:1997/A2:2002 and IEC 62271-1: 2007 standards.

- results of test with thermal limit power (Stage No. 3) at the rated load of voltage windings at $\cos\varphi = 1$ 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 voltage transformer met requirements of IEC IEC 60044-2: 1997, IEC 60044-2:1997/A2:2002 and IEC 62271-1: 2007 standards.

7. Opinions and interpretations

None

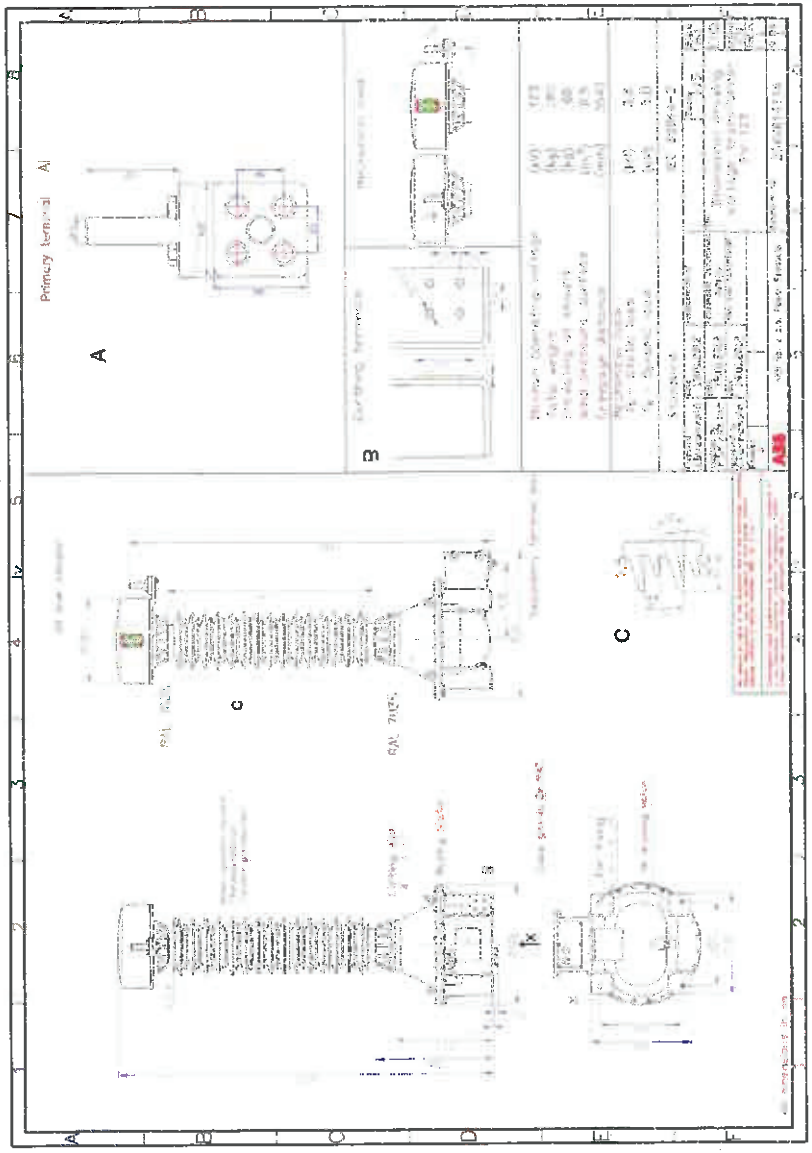
8. Photographic documentation

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

Photograph No. 2. Terminal box of tested voltage transformer during temperature-rise test.

INSTITUTE OF POWER ENGINEERING
HIGH CURRENT LABORATORY
Test Report No.
EWP/07/E/2012-3e

APPENDIX



HIGH VOLTAGE LABORATORY
POLAND 01-330 WARSZAWA, ul. Mory 8
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Lightning impulse test of the voltage transformer

project : ewn11e12-u1 test date 30-03-2012

Test - object - data

WNR	EWN/11/E/12-1	TR-No.	84703/11	O.-No.	
test object	PV123		vector group		
output		kVA	BIL	550	
voltage	123	kV	frequency	50	Hz
customer	ABB Sp. z o. o. ul. Zeganska 1, 04-713 Warszawa				

LI lightning-impulse

no.	Up [kV]	T1[µs]	T2[µs]	Tc[µs]	remark
1	-276.8	1.19	53.2		LI: 1A - RW(50.0%)
2	-554.6	1.19	53.4		LI: 1A - FW(100.0%)
3	-320.5	1.19		3.37	LI: 1A - CRW(57.5%)
4	-634.7	1.21		3.44	LI: 1A - CFW(115.0%)
5	-634.7	1.21		3.46	LI: 1A - CFW(115.0%)
6	-551.5	1.19	53.4		LI: 1A - FW(100.0%)
7	-551.9	1.19	53.4		LI: 1A - FW(100.0%)
8	-552.8	1.19	53.4		LI: 1A - FW(100.0%)
9	-551.2	1.19	53.4		LI: 1A - FW(100.0%)
10	-551.5	1.19	53.4		LI: 1A - FW(100.0%)
11	-551.1	1.2	53.4		LI: 1A - FW(100.0%)
12	-551.3	1.2	53.5		LI: 1A - FW(100.0%)
13	-551.5	1.19	53.5		LI: 1A - FW(100.0%)
14	-551.2	1.19	53.5		LI: 1A - FW(100.0%)
15	-551.4	1.19	53.5		LI: 1A - FW(100.0%)
16	-551.5	1.19	53.5		LI: 1A - FW(100.0%)
17	-551.2	1.2	53.5		LI: 1A - FW(100.0%)
18	-551	1.2	53.5		LI: 1A - FW(100.0%)
19	-550.9	1.19	53.5		LI: 1A - FW(100.0%)
20	277.7	1.19	53.4		LI: 1A - RW(50.0%)
21	552.1	1.19	53.7		LI: 1A - FW(100.0%)
22	552	1.2	53.7		LI: 1A - FW(100.0%)
23	552.2	1.19	53.7		LI: 1A - FW(100.0%)
24	551.9	1.19	53.6		LI: 1A - FW(100.0%)
25	551.9	1.2	53.7		LI: 1A - FW(100.0%)
26	551.6	1.2	53.7		LI: 1A - FW(100.0%)
27	551.5	1.19	53.7		LI: 1A - FW(100.0%)
28	551.8	1.19	53.7		LI: 1A - FW(100.0%)
29	551.7	1.2	53.7		LI: 1A - FW(100.0%)

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project : ewn11e12-u1

30	551.6	1.19	53.7		LI: 1A - FW(100.0%)
31	551.7	1.19	53.7		LI: 1A - FW(100.0%)
32	551.5	1.19	53.7		LI: 1A - FW(100.0%)
33	551.4	1.19	53.7		LI: 1A - FW(100.0%)
34	551.3	1.19	53.7		LI: 1A - FW(100.0%)
35	551.1	1.19	53.7		LI: 1A - FW(100.0%)

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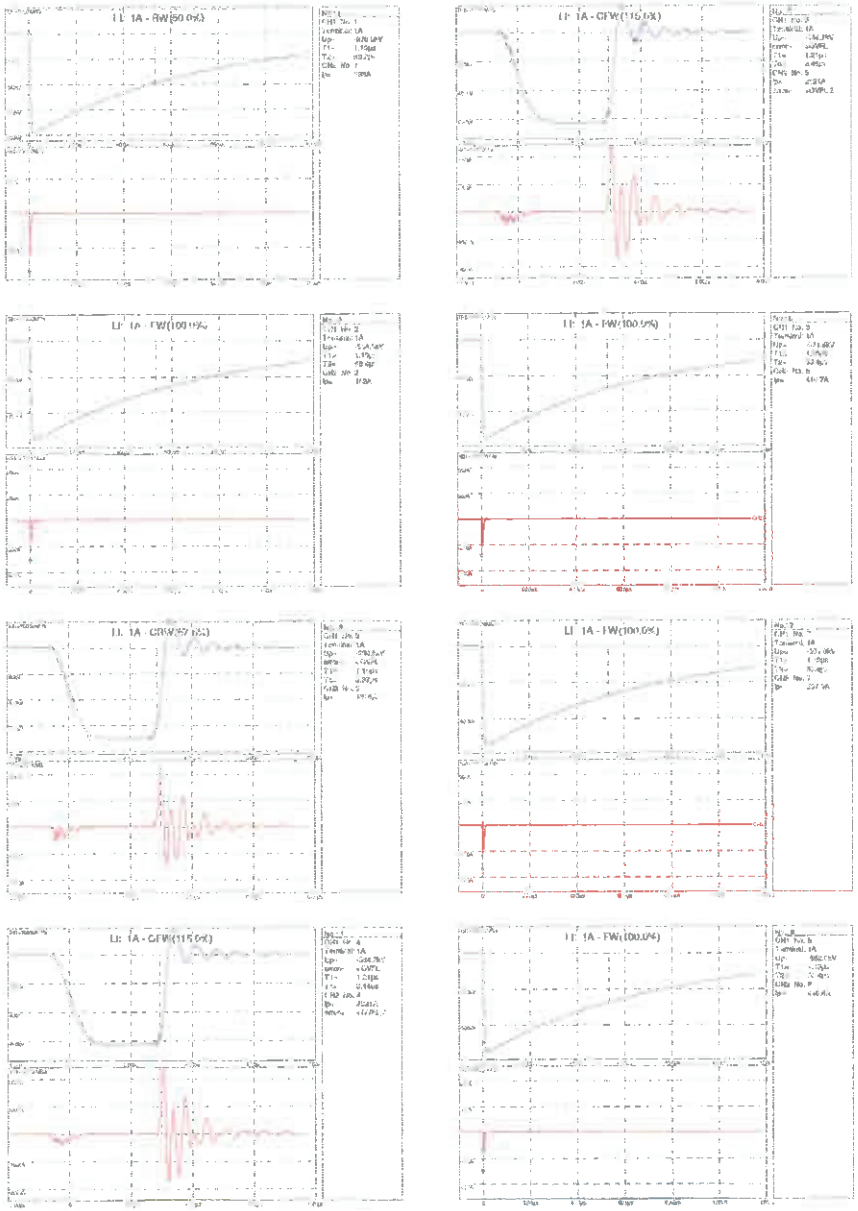
Lightning impulse test of the voltage transformer

project : ewn11o12-u1



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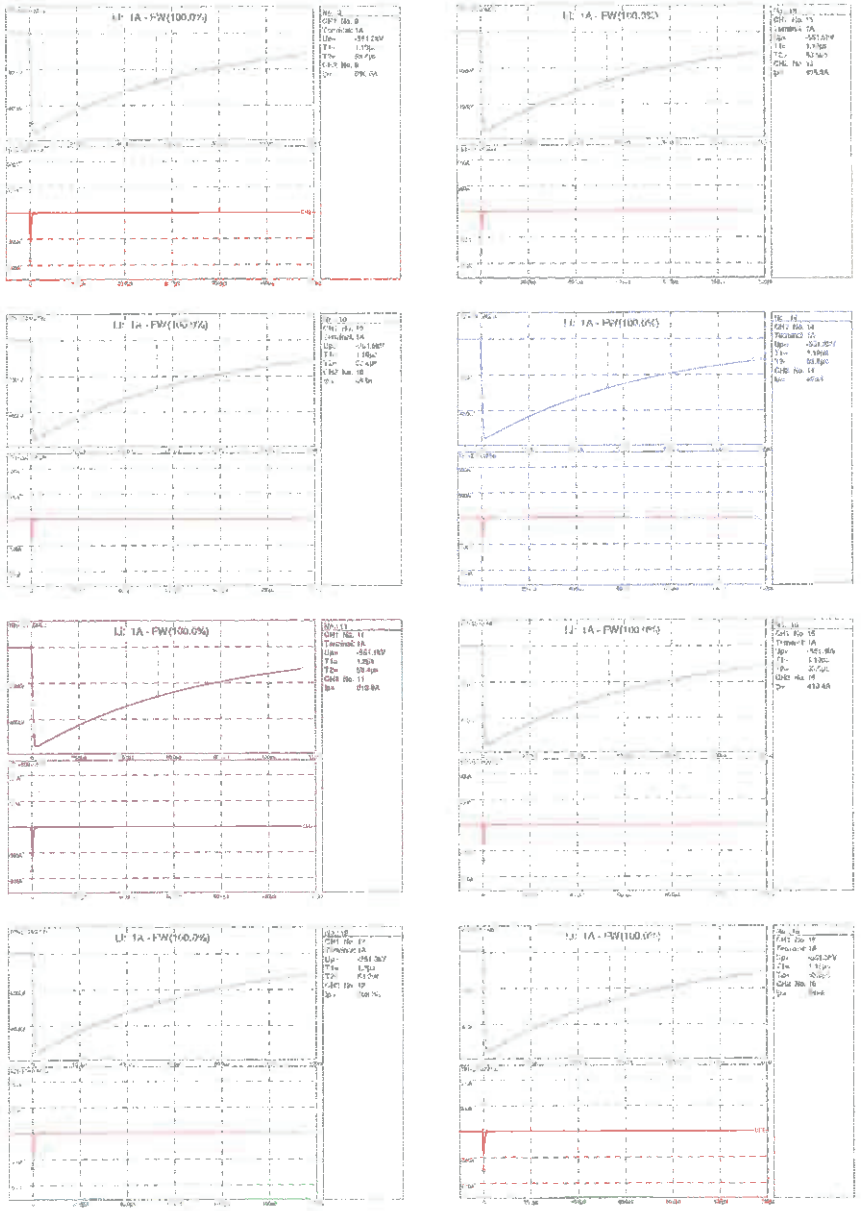
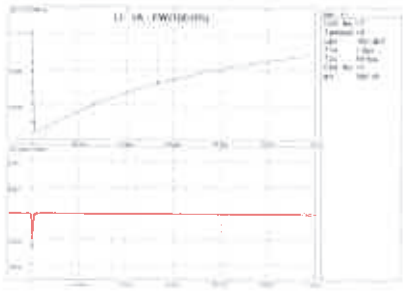
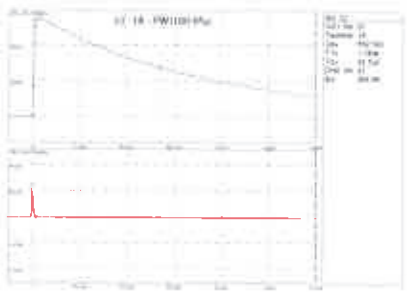
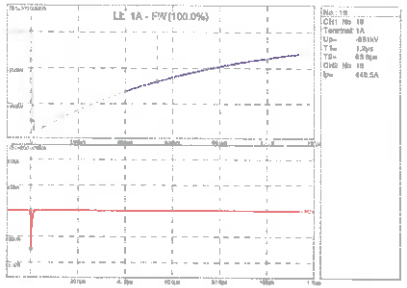
Lightning impulse test of the voltage transformer

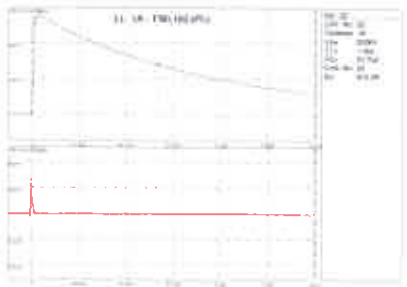
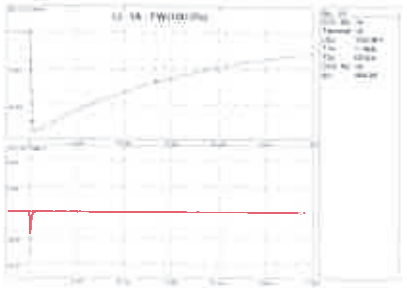
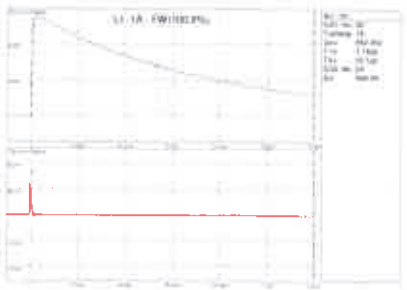
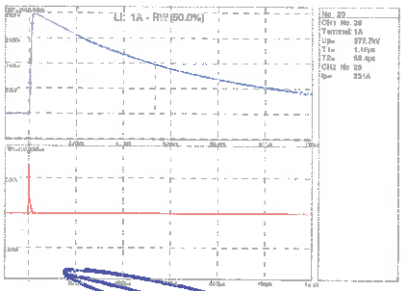
project : ewn11o12-u1

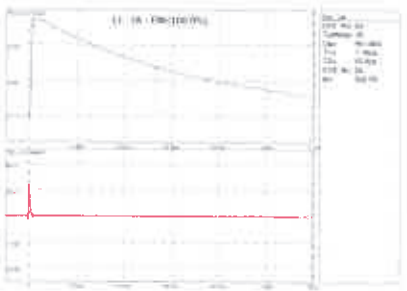


Lightning impulse test of the voltage transformer

project : ewn11e12-u1 page 5

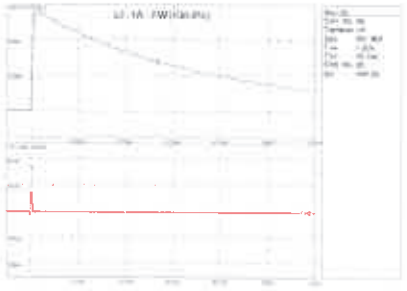
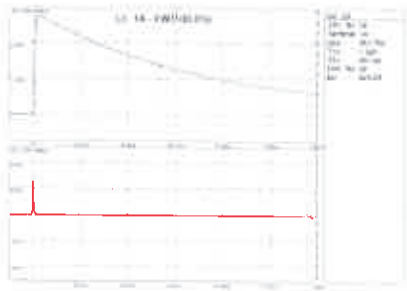
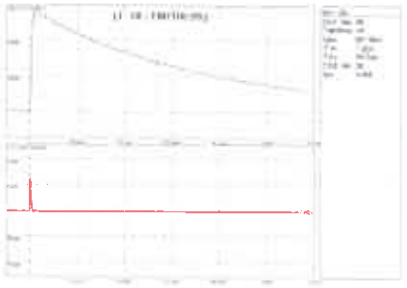
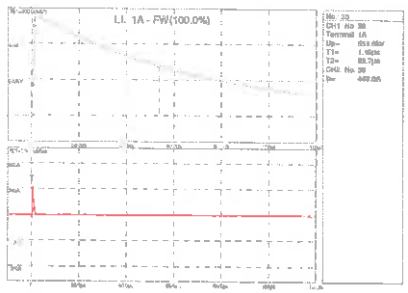




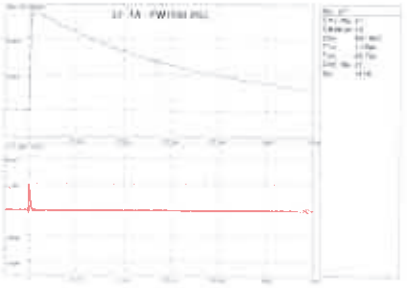
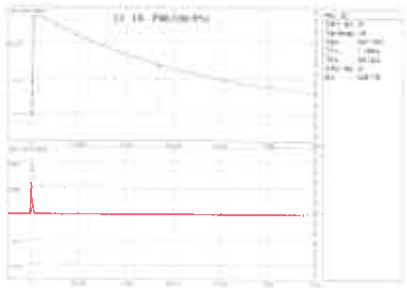
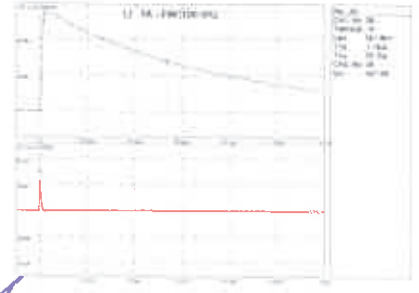
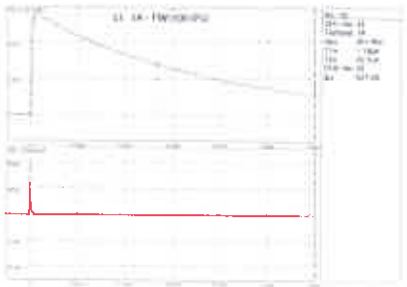







Lightning impulse test of the voltage transformer

project : ewn11e12-u1 page 6

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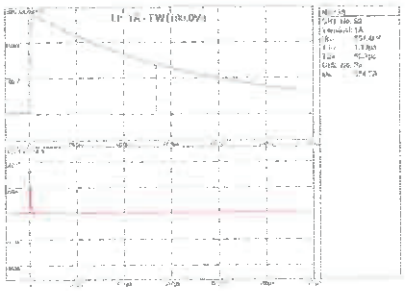
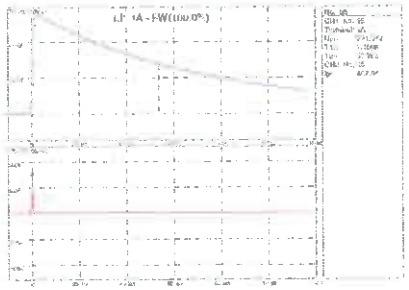
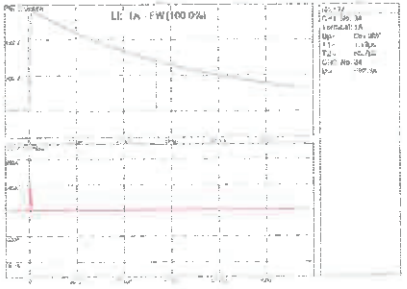
Lightning impulse test of the voltage transformer

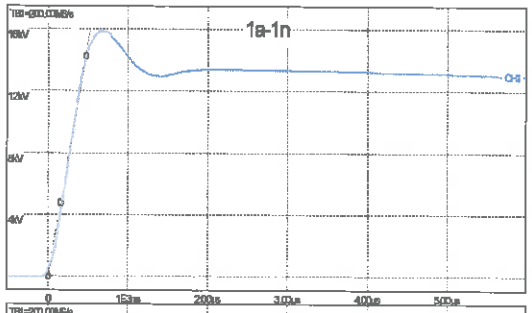
project : ewn11e12-u1



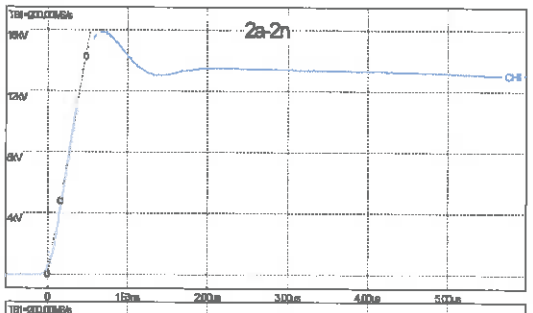




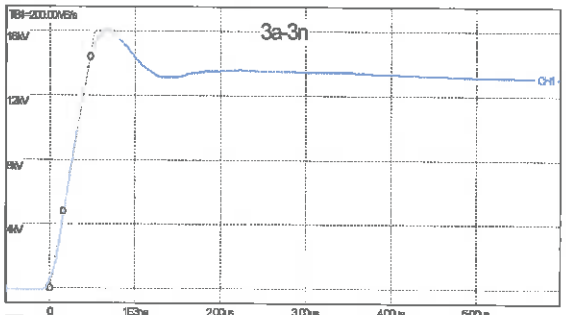
Pomiar przepięć przenoszonych w przekładniku PV 123 o numerze fabrycznym 84703/11



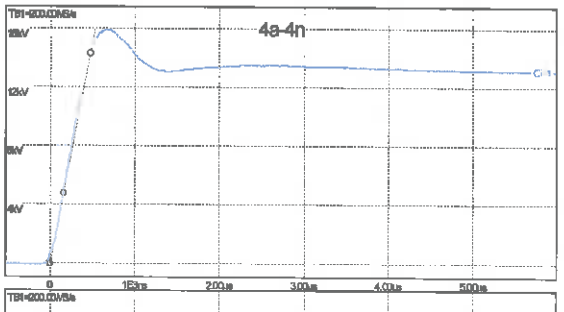
No.: 24989
CH1 No. 24989
Up= 15.88kV
T1= 0.52µs
CH2 No. 24989
Up= 50.27V
Umax1= 40.94V
Umax2= -59.6V
tmin= 0
tmax= 0
RESULTS
Upp= 100.5V



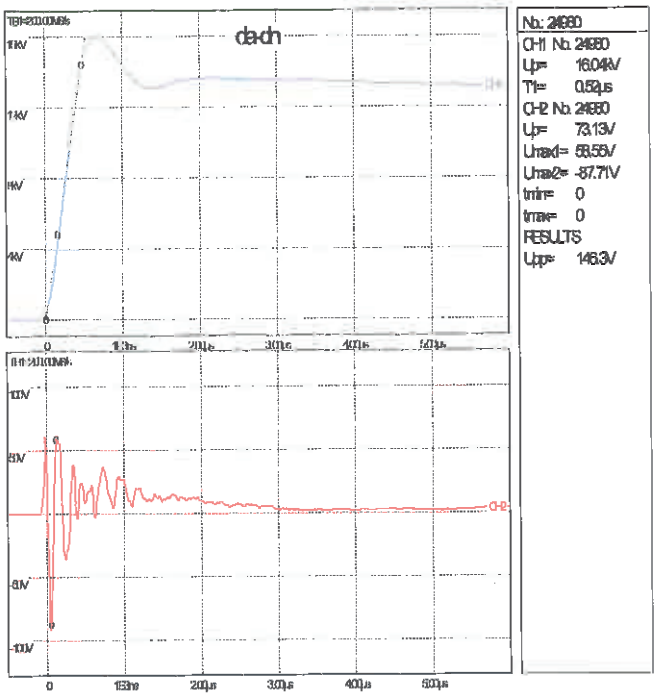
No.: 24987
CH1 No. 24987
Up= 15.89kV
T1= 0.53µs
CH2 No. 24987
Up= 77.16V
Umax1= 53.77V
Umax2= -100.6V
tmin= 0
tmax= 0
RESULTS
Upp= 154.4V



No.: 24985
CH1 No. 24985
Up= 16.07kV
T1= 0.53µs
CH2 No. 24985
Up= 90.99V
Umax1= 72.13V
Umax2= -109.9V
tmin= 0
tmax= 0
RESULTS
Upp= 182.0V



No.: 24983
CH1 No. 24983
Up= 15.93kV
T1= 0.53µs
CH2 No. 24983
Up= 92.79V
Umax1= 81.57V
Umax2= -104V
tmin= 0
tmax= 0
RESULTS
Upp= 185.6V



No.: 24980
CH1 No. 24980
Up= 16.04kV
Tf= 0.52µs
CH2 No. 24980
Up= 73.13V
Umax1= 68.56V
Umax2= -87.71V
tmin= 0
tmax= 0
RESULTS
Upp= 146.3V

POLSKIE CENTRUM AKREDYTACJI
POLISH CENTRE FOR ACCREDITATION

Sygnatariusz EA MLA
EA MLA Signatory

CERTYFIKAT AKREDYTACJI
JEDNOSTKI CERTYFIKUJĄCEJ WYROBY
ACCREDITATION CERTIFICATE FOR PRODUCT CERTIFICATION BODY
Nr AC 117

Potwierdza się, że: / This is to confirm that:

INSTYTUT ENERGETYKI
INSTYTUT BADAWCZY
ZESPÓŁ ds. CERTYFIKACJI
ul. Mory 8, 01-330 Warszawa

spełnia wymagania normy PN-EN ISO/IEC 17065:2013-03
meets requirements of the PN-EN ISO/IEC 17065:2013-03 standard

Akredytowana działalność jest określona w Zakresie Akredytacji Nr AC 117
Accredited activity is defined in the Scope of Accreditation No AC 177

Akredytacja pozostaje w mocy pod warunkiem przestrzegania wymagań jednostki akredytującej określonych w kontrakcie Nr AC 117
This accreditation remains in force provided the Body observes the requirements of Accreditation Body defined in the Contract No AC 117

Certyfikat akredytacji ważny do dnia 03.02.2017 r.
The certificate of accreditation is valid until 03.02.2017

Akredytacji udzielono dnia 04.02.2005 r.
Accreditation was granted on 04.02.2005

p.o. DYREKTORA
POLSKIEGO CENTRUM AKREDYTACJI
LUCYNA OLBORSKA

Warszawa, 24 kwietnia 2015 roku

POLSKIE CENTRUM AKREDYTACJI
POLISH CENTRE FOR ACCREDITATION

Sygnatariusz EA MLA
EA MLA Signatory

CERTYFIKAT AKREDYTACJI
LABORATORIUM BADAWCZEGO
ACCREDITATION CERTIFICATE OF TESTING LABORATORY
Nr AB 323

Potwierdza się, że: / This is to confirm that:

INSTYTUT ENERGETYKI
LABORATORIUM WIELKOPRĄDOWE
ul. Mory 8, 01-330 Warszawa

spełnia wymagania normy PN-EN ISO/IEC 17025:2005
meets requirements of the PN-EN ISO/IEC 17025:2005 standard

Akredytowana działalność jest określona w Zakresie Akredytacji Nr AB 323
Accredited activity is defined in the Scope of Accreditation No AB 323

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The certificate of accreditation is valid until 27.12.2019

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Accreditation was granted on 28.12.2000

DYREKTOR
POLSKIEGO CENTRUM AKREDYTACJI

LUCYNA OLBORSKA

Warszawa, 16 listopada 2015 roku

POLSKIE CENTRUM AKREDYTACJI

POLISH CENTRE FOR ACCREDITATION

Sygnatariusz EA MLA
EA MLA Signatory

CERTYFIKAT AKREDYTACJI

LABORATORIUM BADAWCZEGO

ACCREDITATION CERTIFICATE OF TESTING LABORATORY

Nr AB 324

Potwierdza się, że: / This is to confirm that:

INSTYTUT ENERGETYKI
LABORATORIUM URZĄDZEŃ ROZDZIELCZYCH
ul. Mory 8, 01-330 Warszawa

spełnia wymagania normy PN-EN ISO/IEC 17025:2005
meets requirements of the PN-EN ISO/IEC 17025:2005 standard

Akredytowana działalność jest określona w Zakresie Akredytacji Nr AB 324
Accredited activity is defined in the Scope of Accreditation No AB 324

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Akredytacji udzielono dnia 28.12.2000 r.
Accreditation was granted on 28.12.2000

DYREKTOR
POLSKIEGO CENTRUM AKREDYTACJI
LUCYNA OLBORSKA

Warszawa, 24 listopada 2015 roku

ПОЛСКИ ЦЕНТЪР ЗА АКРЕДИТАЦИЯ

Подписваща страна EA MLA

СЕРТИФИКАТ ЗА АКРЕДИТАЦИЯ НА СЕРТИФИЦИРАЩ ОРГАН ЗА ПРОДУКТИ

№ AC 117

Това е, за да се потвърди, че:

ИНСТИТУТ ПО ЕНЕРГЕТИКА
ИНСТИТУТ ЗА ИЗСЛЕДВАНИЯ
отдел СЕРТИФИЦИРАНЕ
ул. Мори 8, 01-330 Варшава

отговаря на изискванията на стандарт PN-EN ISO/IEC 17065:2013-03

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Тази акредитация остава в сила, при условие че Организацията съблюдава изискванията на органа за акредитация, определени в договор № AC 117

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р.о. Директор
Лучина Олборска

Варшава, 24 Април 2015 г.

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№ AB 323

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ул. Мори 8, 01-330 Варшава

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Акредитацията е предоставена на 28.12.2000 г.

ДИРЕКТОР
ПОЛСКИ ЦЕНТЪР ЗА АКРЕДИТАЦИЯ
Луцина Олборска

Варшава, 16 Ноември 2015 г.

ПОЛСКИ ЦЕНТЪР ЗА АКРЕДИТАЦИЯ

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Това е, за да се потвърди, че:

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Лаборатория Разпределителни Устройства
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Сертификатът за акредитация е валиден до 27.12.2019 г.

Акредитацията е предоставена на 28.12.2000 г.

ДИРЕКТОР
ПОЛСКИ ЦЕНТЪР ЗА АКРЕДИТАЦИЯ
Луцина Олборска

Варшава, 24 Ноември 2015 г.

INSTITUTE OF POWER ENGINEERING
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EVIDENCE OF APPROVAL FOR SUBCONTRACTORS

OF CERTIFICATION DEPARTMENT OF INSTITUTE OF POWER ENGINEERING

IN THE RANGE OF LABORATORY TESTING

No. LBU – 001/2015

(Issue 01)

It is confirmed that

Measuring and testing sites No. 16, 17, 18 and 19
located in the
ABB Sp. z o.o., Branch Office in Przasnysz
Power Products High Voltage
59 Leszno Str., 06-300 Przasnysz, Poland

meets the criteria for the technical requirements specified in point 5 of PN-EN ISO / IEC 17025:2005 (EN ISO/IEC 17025:2005) and obtained recognition of Certification Department of IEn in the scope of performing laboratory tests and measurements for company own use and for Certification Department of IEn.

Certification Department of IEn confirms the validity of test and measurements procedures applied for the measurement and research stations at ABB Sp. z o.o. Branch Office in Przasnysz Power Products High Voltage laboratories for testing according to the following standards:

IEC 61869-1 ed 1.0 (2007); IEC 61869-2 ed 1.0 (2012);
IEC 61869-3 ed 1.0 (2011); IEC 61869-4: ed 1.0 (2013); IEC 60156 ed 2.0 (1995)

Recognized test methods are given in Appendix No. 1

This evidence of approval is valid from **23.02.2015** until **23.02.2016**

Head of Certification
Department of IEn

mgr inż. Glazyna Wieczorek

Warsaw, 23.02.2015

APPENDIX No. 1 TO EVIDENCE OF APPROVAL FOR SUBCONTRACTORS OF CERTIFICATION DEPARTMENT OF INSTITUTE OF POWER ENGINEERING No. LBU – 001/2015

(Issue 01)

Recognized test and mesaurements methods in the range:

1. **Site No. 16. Verification of accuracy of inductive voltage transformers. Measurement of capacitance and dielectric dissipation factor.** [points 7.2.6, 7.3.5, 7.4.3 of standard IEC 61869-3 ed 1.0 (2011)]
2. **Site No. 17. Verification of accuracy of current transformers and tests on inter-turn insulation of current transformers.** [points 7.2.6.201, 7.3.5.201, 7.3.5.202, 7.3.5.204, 7.3.5.206, 7.3.204 of standard IEC 61869-2 ed 1.0 (2012)]
3. **Site No. 18. Breakdown voltage measurement of the insulating oil at power frequency.** [IEC 60156 ed 2.0 (1995)]
4. **Site No. 19. Power-frequency voltage withstand tests on primary terminals and partial discharge measurement in Faraday cage.** [points 7.3.1 i 7.3.2 of standards: IEC 61869-2 ed 1.0 (2012); IEC 61869-3 ed 1.0 (2011)]

ИНСТИТУТ ПО ЕНЕРГЕТИКА
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СВИДЕТЕЛСТВО ЗА ОДОБРЕНИЕ ЗА ПОДИЗПЪЛНИТЕЛИ

НА ОТДЕЛ СЕРТИФИЦИРАНЕ НА ИНСТИТУТ ПО ЕНЕРГЕТИКА

В ДИАПАЗОНА НА ЛАБОРАТОРНИ ИЗПИТАНИЯ

№ LBU-001/2015
(издание 01)

Потвърждаваме, че

Площадки за измерване и изпитания № 16, 17, 18 и 19
намиращи се в ABB Sp. Z o.o., клон в Пшашниш
Продукти Високо Напрежение
ул. Лешно 59, 06-300 Пшашниш, Полша

отговаря на критериите за техническите изисквания, посочени в точка 5 на PN-EN ISO/IEC 17025:2005 (EN ISO/IEC 17025:2005) и получава признаване от Отдел Сертифициране на IEn в обхвата на извършване на лабораторни изпитвания и измервания за собствени нужди на компанията и за Отдел Сертифициране на IEn.

Отдел Сертифициране на IEn потвърждава валидността на процедурите за изпитване и измерване, които се прилагат за измервателните и изследователски станции на ABB Sp. z o.o. клон в Пшашниш, лаборатории за изпитване на Продукти Високо Напрежение, в съответствие със следните стандарти:

IEC 61869-1 изд. 1.0 (2007); IEC 61869-2 изд. 1.0 (2012 г.); IEC 61869-3 изд. 1.0 (2011); IEC 61869-4: изд. 1.0 (2013 г.); IEC 60156 изд. 2.0 (1995)

Признатите методи за изпитване са дадени в Приложение № 1

Това свидетелство за одобрение е валидно от 23.02.2015 до 02.23.2016

Ръководител Отдел Сертифициране на IEn
инж. Гразина Вичорек

Варшава, 23.02.2015 г.

ПРИЛОЖЕНИЕ №1 към СВИДЕТЕЛСТВО ЗА ОДОБРЕНИЕ

ЗА ПОДИЗПЪЛНИТЕЛИ
НА ОТДЕЛ СЕРТИФИЦИРАНЕ
НА ИНСТИТУТ ПО ЕНЕРГЕТИКА
№ LBU-001/2015
(издание 01)

Признатите методи за изпитване и измервания в диапазона:

1. **Площадка №16. Проверка на точността на индуктивни напреженови трансформатори. Измерване на капацитет и фактор на диелектрично разсейване.** (точки 7.2.6, 7.3.5, 7.4.3 на стандарт IEC 61869-3 изд. 1.0 (2011))
2. **Площадка №17. Проверка на точността на токови трансформатори и тестове на вътрешно-намотъчната изолация на токови трансформатори.** (точки 7.2.6.201, 7.3.5.201, 7.3.5.202, 7.3.5.204, 7.3.5.206, 7.3.204 на стандарт IEC 61869-2 изд. 1.0 (2012))
3. **Площадка №18. Измерване на пробивното напрежение на изолационното масло при промишлена честотата.** (IEC 60156 изд. 2.0 (1995))
4. **Площадка №19. Изпитание на издръжливост на напрежение с промишлена честота на първични клеми и измерване на частичните разряди във Фарадеев кафез.** (точки 7.3.1 и 7.3.2 на стандарти: IEC 61869-2 изд. 1.0 (2012); IEC 61869-3 изд. 1.0 (2011))

Customer	ABB PLABB	Classification:	Confidential
Doc. title	**Seismic analyses of HV Instrument Transformers. IEC 62271-300 - AF5 seismic level.**	Status of document	Released
Project name/ID	SST activities - BU9853 - CHTET / 50005877	CR Program:	CHTET
Main Author:	Grzegorz Juszkiewicz/PLCRC/SST	Case ID:	15101
Additional Author(s):			
Distribution	Marcin Tarnowski/PPHV, Pawel Grysztar/PLHV, Jaroslaw Duzdowsk/PPHV, Dariusz Siperek/PPHV, Piotr Mikulski/PPHV, Przemyslaw Nasierowski/PPHV Piotr Saj/PLCRC, Marek Florkowski/PLCRC		
Keywords	simulation, FE method, seismic analysis, frequency modes, response spectrum		
Approved by:	Marek Florkowski/PLCRC	Final Approval Date:	2015-05-21

Technical_Note.dot Rev 1.00

Electronic document

Technical report

Simulation Support Team

Case submitted by	Marcin Tarnowski
Business Unit	PPHV
Type of analysis (used tool)	ABAQUS (seismic analysis)
Description of analysis	Seismic analysis different variants of current, voltage and combined transformers (PA123a / PA145a, PV123, PVA123a / PVA145a) according to guidelines described in IEC standard. Consideration of seismic, wind, and dead loads.

Executive summary

This report covers investigation related to seismic analysis of HV Instrument transformers (PV123, PA123a /PA145a, PVA123a /PVA145a) subjected to various load scenarios. Simulation covered the following load conditions: dead load, wind load, terminal force load, seismic load (AF5 - 0.5 g). Analysis showed that all designs are satisfying required safety criteria.

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ABB | ZCCO Corporate Research | 9ADB008898
Doc. title | Revision | Page

1 INTRODUCTION

The goal of the analysis was to evaluate seismic performance of PA123a /PA145a (see 8.1), PV123 (see 8.2), PVA145a/PVA123a (8.3) type transformers. Simulation was done using guidelines of IEC TR 62271-300 standard. For more information please see [1].

Computations concerned evaluation of stress field distribution and maximum bending moment between flange and insulator. Present report describes used simulation technique, analysis steps, loads and boundary conditions variations and summarizes obtained results.

2 SIMULATION SOFTWARE

All simulations were performed using Abaqus/CAE package. Abaqus includes FEM (finite element method) solver, pre- and post processor and enables performing many types of multiphysics simulations: mechanical, thermal, acoustic, piezoelectric, seismic, and others.

Parts and assemblies can be created in Abaqus, or they can be imported from CAD systems using native file formats. Abaqus functionality enables to define materials, interactions, loads, boundary conditions, mesh. User is also available to set up simulation parameters such as pre-processing memory. It is always possible to change all simulation settings and properties, because they're all parameterized.

Simulation results can be visualized in Abaqus postprocessor or in external software, which is able to import simulation results in Abaqus format. In postprocessor user can view all predefined field outputs, show or hide part instances, create cross-sections, make animations, automatically generate reports, diagnose model (warnings, errors). For more information about ABAQUS please see [2].

3 SIMULATION SETUP

Analysis has been made using Finite Element Method.

3.1 Simulation procedure

According to [1] analysis included three main simulation steps:

- Static load:
  - Wind load.
  - Terminal load.
  - Gravitational load.
- Natural frequency extraction.
- Dynamic analysis.

3.2 Simulation steps

Simulation consisted of three main simulation steps.

3.2.1 Natural frequency extraction

In the first simulation step natural frequency extraction was performed. The frequency extraction procedure performs eigenvalue extraction to calculate the natural frequencies and the corresponding mode shapes of a system.

The eigenvalue problem for the natural frequencies of an undamped finite element model can be described by equation (3-1):

$$(-\omega^2 M^{MN} + K^{MN})\phi^N = 0 \qquad (3\text{-}1)$$

where: M^{MN} – mass matrix (kg); K^{MN} – stiffness matrix (Pa), which includes initial stiffness effects if the base state (gravitational load); ϕ – eigenvector (the mode of vibration); M, N – degrees of freedom (-). Based on specification [1] one can assume that most critical frequency modes are in range of 0-35 Hz.

3.2.2 Response spectrum analysis

The response spectrum method is a convenient way of describing shock motion in terms of the maximum response of a single degree of freedom (1-DOF) oscillator of arbitrary natural period and damping ratio. Each data point of the response spectrum curve represents the peak response from a time history analysis of the earthquake applied to 1-DOF oscillator system. The ordinate defines the natural period at which the oscillator is tuned. Repeating the procedure for a great many frequencies defines a continuous curve for an assumed level of damping.

A spectral response analysis estimates the maximum displacement of the structure during a 'design' shock load without recourse of direct integration. Finite element implementation of the response spectrum calculate the response of each mode independent, and then combine the scaled response one of a number of established combination rules, to give an estimate of peak response. Spectrum plot used in simulation is presented in Figure 1.

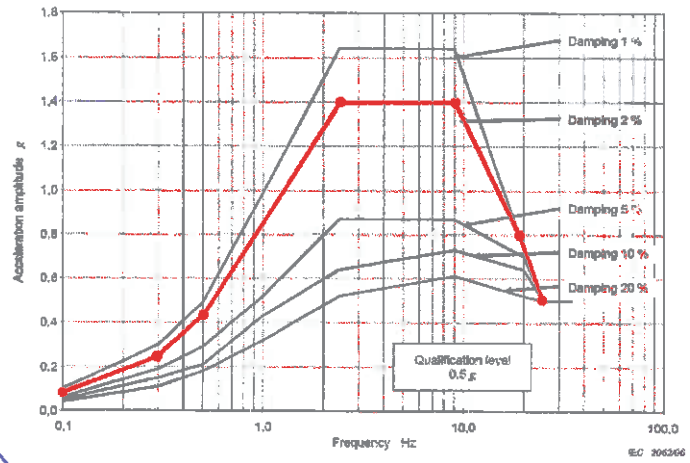

Figure 1. *Design response spectrum – 2% damping (red curve)*

3.3 Loads and boundary conditions

3.3.1 Loads

The following static load scenarios have been considered

1. Gravitational load, g=9.81 m/s².
2. Terminal operating load, acc. to [3]. According to Table 14, page 90 terminal force are adequate to rated voltage and current level. Applied force values were the following:
   a. **PA123a /PA145a:** Longitudinal force-1250 N, Transversal force – 1000 N, Vertical force – 1250 N.
   b. **PV123:** Longitudinal force-1750 N, Transversal force – 1250 N, Vertical force – 1500 N.
   c. **PVA123a/PVA145a:** Longitudinal force-1750 N, Transversal force – 1250 N, Vertical force – 1500 N.
3. Wind load, 10m/s load. Wind load has been represented as directional pressure evaluated according to drag force equation:

$$F_D = \frac{1}{2}\rho u^2 C_D A \qquad (3\text{-}1)$$

where: F_D – drag force [N], ρ – mass density of the fluid [kg/m³], u – flow velocity [m/s], A – reference area [m²], C_D – drag coefficient [-].

Evaluated pressure level for all designs was ca. p=71 Pa.

Seismic load have been predefined according design response spectrum described in the standard [1] – ground acceleration reference AF5. Main input parameters were the following:

- XZ base motion with vertical load equal to 50% of horizontal direction.
- YZ base motion with vertical load equal to 50% of horizontal direction.
- Damping ratio – 2% ([1], page 23, chapter 7.3.2 point b).

As the final outcome from the analysis static loads were combined with the most conservative seismic load.

3.3.2 Boundary conditions

Simulation assumes that the apparatus will be mounted on ground. An example of boundary conditions is presented in

During analysis model has been fixed at the bottom face of used test frame. General view of static loads and boundary conditions is presented in Figure 2. Area highlighted by red has been constrained (Y-rotation released). Base of the bottom tank has been supported in Y direction (as it is placed on the ground). Described boundary conditions have been used for all analyzed models.

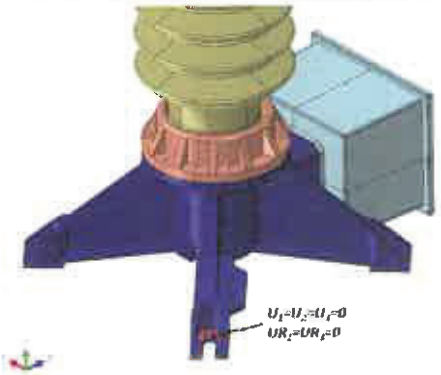

Figure 2. *Boundary conditions – general view*

3.4 Acceptance criteria

According to [1] the following acceptance criteria shall be met:

- Stresses observed at metallic parts should not exceed yield point of material.
- The maximum bending moment of the insulator should not exceed ultimate value. For more information please refer to [4] (Table 1, page 23).

3.5 Current transformer - PA 123a/PA 145a

This chapter gathers details related to FE model of current transformer **PA 123a/PA 145a**.

3.5.1 Model simplifications

For simulation requirements some areas of the model were simplified. Small geometrical features like casting rounding, chamfers were removed in order to improve mesh generation process. Details of the geometry and center of mass can be found in Figure 3. Red point indicates center of mass of the transformer.

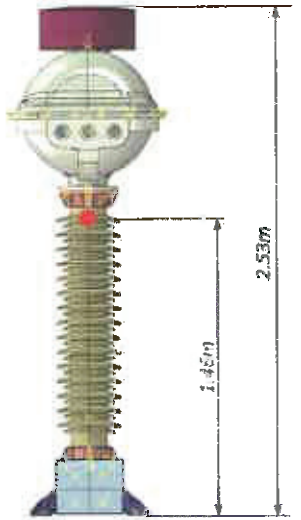

Figure 3. *Simplified representation of the PA 123a/PA 145a transformer*

Concrete between flange and ceramic insulator has been introduced using connector element with predefined rotational stiffness.

Because of the simulation method (dynamics based on modal analysis) components were connected together using bonded connection or conformal mesh.

3.6 Material and mass information

Component naming is presented in Figure 4.

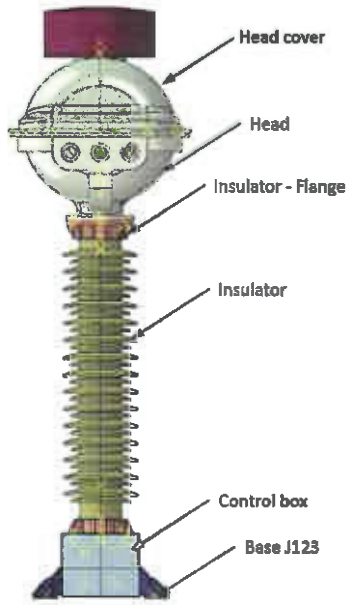

Figure 4. *Assembly – component naming*

Material and mass information is listed in Table 1

Table 1. *Mass and material data*

Drawing number	Component name	Material name	Mass [kg]	Young's modulus [MPa]	Yield strength [MPa]	Ultimate strength [MPa]
2GKA310015	Base J123	EN-AC 43200 (grade F)	18.5	69000	80	160
2GKA310404	Insulator	Porcelain	71	100000	140	
	Insulator - Flange	EN-AC 43200 (grade T6)	3.5	69000	180	220
2GKA414718	Head	EN-AC 43200 (grade F)	22.5	69000	80	160
2GKK314089	Head cover	EN-AC 43200 (grade F)	20	69000	80	160
	Coil	-	150			
2GKK311093R	Control box	EN-AC 43200 (grade F)	5.5	69000	80	160
	Oil		120			

The maximum allowable bending moment for ceramic insulator is equal to M_B=13.3 kNm.

3.7 Finite element (FE) model

General view of FE model is presented in Figure 5.

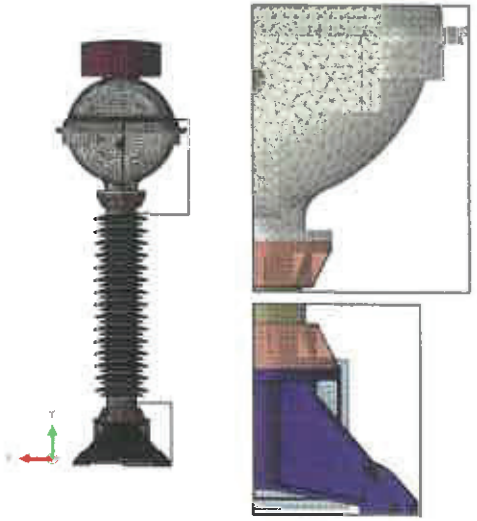

Figure 5. *FE model – general view*

Mesh statistics were the following:

- Total number of nodes: 533430
- Total number of elements: 242866
  - 210555 quadratic tetrahedral elements of type C3D10
  - 31050 quadratic hexahedral elements of type C3D20R
  - 1243 quadratic quadrilateral elements of type S8R
  - 18 quadratic triangular elements of type STRI65

Description of the coordinate system.

- X – 1st horizontal axis.
- Z – 2nd horizontal axis.
- Y – vertical axis.

3.8 Voltage transformer - PV 123

This chapter gathers details related to FE model of voltage transformer **PV 123**.

3.8.1 Model simplifications

For simulation requirements some areas of the model were simplified. Small geometrical features like casting rounding, chamfers were removed in order to improve mesh generation process. Details of the geometry and center of mass can be found in Figure 6. Red point indicates center of mass of the transformer.

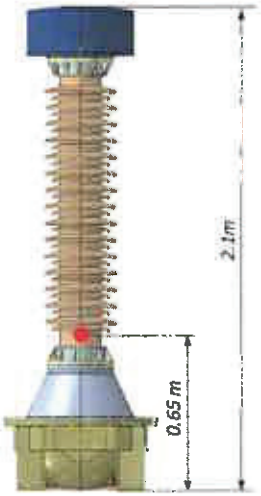

Figure 6. *Simplified representation of the PV 123 transformer*

Concrete between flange and ceramic insulator has been introduced using connector element with predefined rotational stiffness.

Because of the simulation method (dynamics based on modal analysis) components were connected together using bonded connection or conformal mesh.

3.9 Material and mass information

Component naming is presented in Figure 7.

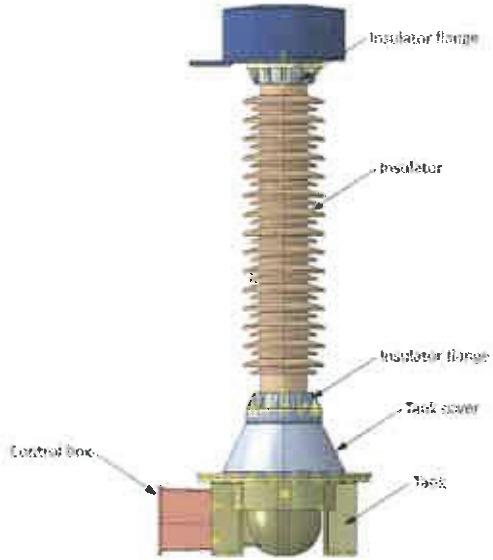

Figure 7. *Assembly – component naming*

Material and mass information is listed in Table 2.

Table 2. *Mass and material data*

Drawing number	Component name	Material name	Mass [kg]	Young's modulus [MPa]	Yield strenght [MPa]	Ultimate strenght [MPa]
2GKK310150P	Bottom tank	EN-AC 43200 (grade F)	25	69000	80	160
2GKK310147P	Core	Steel	22.5	206000	300	370
2GKV314005	Tank cover	EN-AC 43200 (grade F)	15.5	69000	80	160
2GKA310404	Insulator	Porcelain	71	100000	140	
	Insulator flange	EN-AC 43200 (grade T6)	3.5	69000	180	220
	Coil		30			
2GKK311093R	Control box	EN-AC 43200 (grade F)	5.5	69000	80	160
	Oil		60			

The maximum allowable bending moment for ceramic insulator is equal to M_n=**13.3 kNm**.

3.10 Finite element (FE) model

General view of FE model is presented in Figure 8.

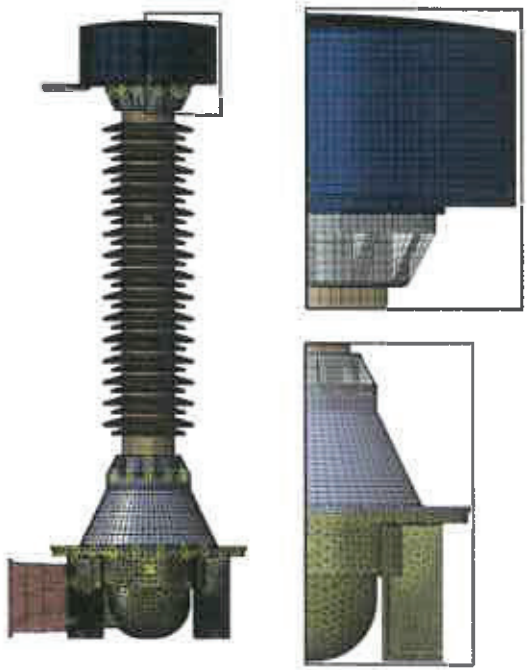

Figure 8. *FE model – general view*

Mesh statistics were the following:

- Total number of nodes: 608507
- Total number of elements: 236033
  - 4606 quadratic quadrilateral elements of type S8R
  - 58 quadratic triangular elements of type STRI65
  - 58965 quadratic hexahedral elements of type C3D20R
  - 8577 linear hexahedral elements of type C3D8R
  - 163827 quadratic tetrahedral elements of type C3D10

Description of the coordinate system.

- X – 1st horizontal axis.
- Z – 2nd horizontal axis.
- Y – vertical axis.

3.11 Combined transformer – PVA123a /PVA145a

This chapter gathers details related to FE model of combined transformer **PVA123a /PVA145a**.

3.11.1 Model simplifications

For simulation requirements some areas of the model were simplified. Small geometrical features like casting rounding, chamfers were removed in order to improve mesh generation process. Details of the geometry and center of mass can be found in Figure 9. Red point indicates center of mass of the transformer.

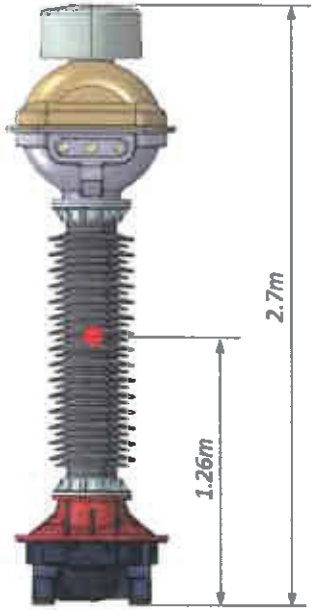

Figure 9. *Simplified representation of the PVA123a /PVA145a transformer*

Concrete between flange and ceramic insulator has been introduced using connector element with predefined rotational stiffness.

Because of the simulation method (dynamics based on modal analysis) components were connected together using bonded connection or conformal mesh.

3.12 Material and mass information

Component naming is presented in Figure 7.

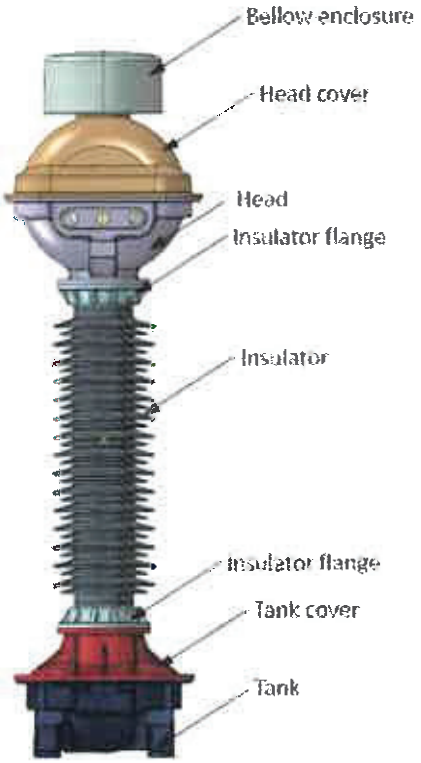

Figure 10. *Assembly – component naming*

Material and mass information is listed in Table 3.

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Seismic analyses of HV Instrument Transformers. IEC 62271-300 - AF5 seismic level | 1.0 | 16/37

Table 3. *Mass and material data*

Drawing number	Component name	Material name	Mass [kg]	Young's modulus [MPa]	Yield strength [MPa]	Ultimate strength [MPa]
2GKK314076	Tank	EN-AC 43200 (grade F)	25	69000	80	160
2GKK314084	Core	Steel	33.8	206000	300	370
2GKK314075	Tank cover	EN-AC 43200 (grade F)	18	69000	80	160
2GKK314070	Insulator	Porcelain	131	100000	140	
	Insulator flange	EN-AC 43200 (grade T6)	5	69000	180	220
2GKK314080	Head	EN-AC 43200 (grade F)	23.5	69000	80	160
2GKK314089	Head cover PVA-PA123a /PA145a-145	EN-AC 43200 (grade F)	23	69000	80	160
2GKK310902	Bellow	Stainless steel	5	190000	200	500
2GKK310014P	Below enclosure	EN-AC 43200 (grade F)	7	69000	80	160
-	Voltage coil	-	30	-	-	-
-	Current coil	-	150	-	-	-
2GKK310802	Epoxy insulator	-	2.5	-	-	-
2GKK311093R	Control box	EN-AC 43200 (grade F)	5.5	69000	80	160
-	Oil		150	-	-	-

The maximum allowable bending moment for ceramic insulator is equal to M_b=13.3 kNm.

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3.13 Finite element (FE) model

General view of FE model is presented in Figure 11.

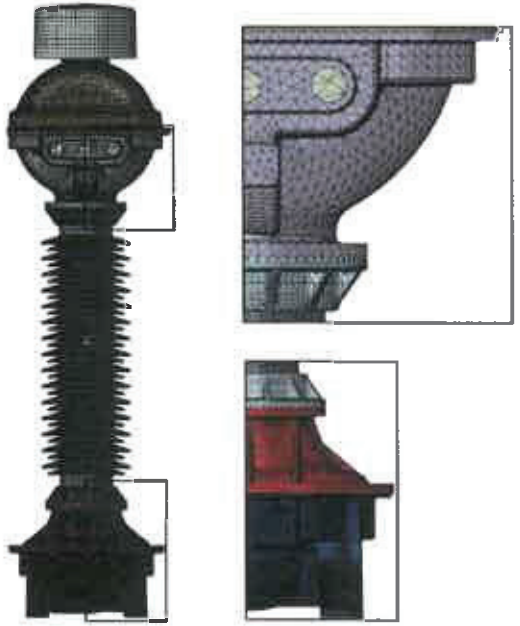


Figure 11. *FE model – general view*

Mesh statistics were the following:

- Total number of nodes: 1009580
- Total number of elements: 463007
  - 58507 quadratic hexahedral elements of type C3D20R
  - 300489 quadratic tetrahedral elements of type C3D10
  - 2519 linear quadrilateral elements of type S4R
  - 97 linear triangular elements of type S3
  - 9900 linear hexahedral elements of type C3D8R
  - 528 quadratic wedge elements of type C3D15
  - 90967 quadratic tetrahedral elements of type C3D10M

Description of the coordinate system.

- X – 1st horizontal axis.
- Z – 2nd horizontal axis.
- Y – vertical axis.

4 SIMULATION RESULTS

This chapter gathers simulation results evaluated in the analysis. Obtained outcome incudes static and the most conservative (design) seismic load.

4.1 PA123a /PA145a

4.1.1 Natural frequency extraction

Effective modal mass plot is presented Figure 12. Bubble size indicated amount of mass which participates in motion at specific frequency range. Based no presented plot one can see that the most critical modes were located between 6.9 – 8.2 Hz.

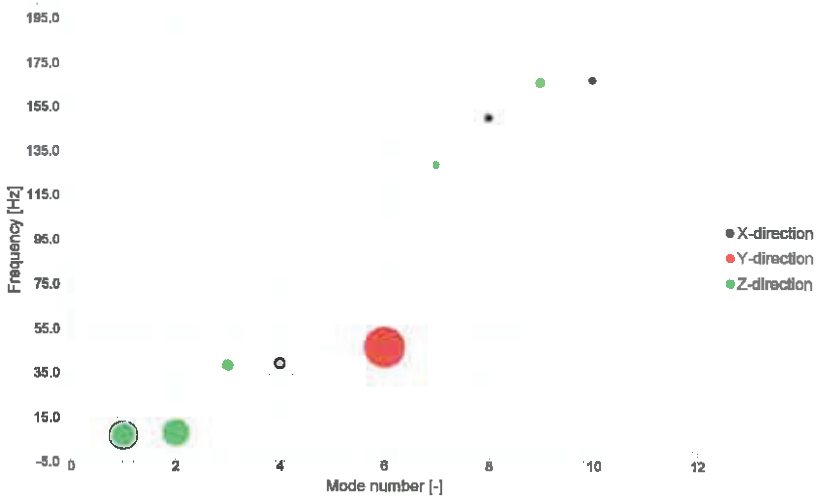


Figure 12. *Natural frequency extraction – effective modal mass*

Effective modes and associated with the shapes are presented in Figure 13.

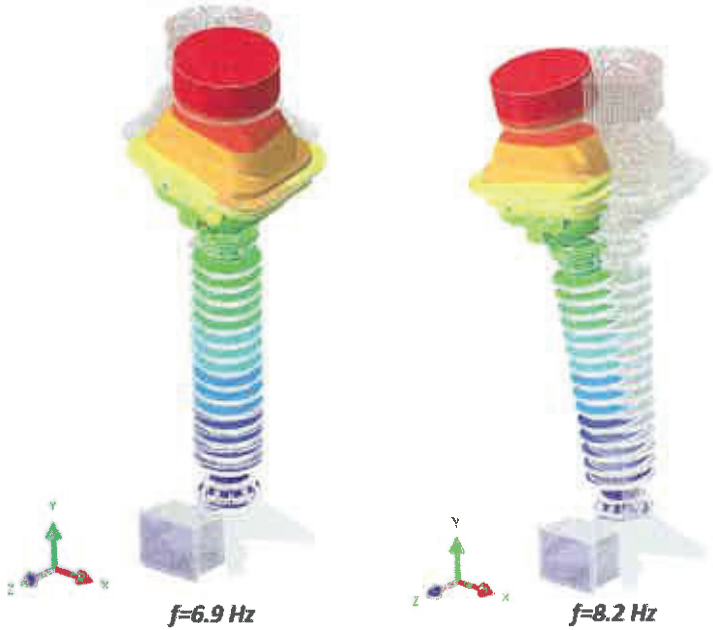


Figure 13. *Natural frequency extraction – mode shapes*

Summary of modal mass participation is listed in Table 4.

Table 4. *Modal mass participation – summary*

Mode no	Frequency [Hz]	X-direction	Y-direction	Z-direction
1	6.9	40%	0%	35%
2	8.2	34%	0%	40%
3	38.9	2%	0%	6%
4	39.7	6%	0%	2%
5	46.9	0%	0%	0%
6	98.7	0%	89%	0%
7	129.2	0%	0%	2%
8	150.3	4%	0%	0%
9	166.6	0%	0%	4%
10	167.4	2%	0%	0%

4.1.2 Dynamic analysis

Stress distribution for tank component is presented in Figure 14 and Figure 15. Stress scale has been limited to 80 MPa as the maximum allowable stress level.

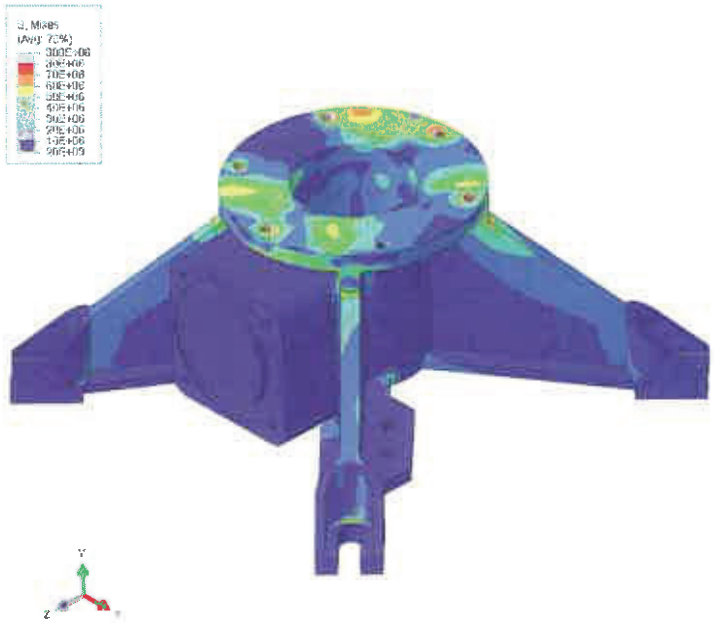


Figure 14. *Von-Mises stress [Pa] distribution – tank (view 01)*

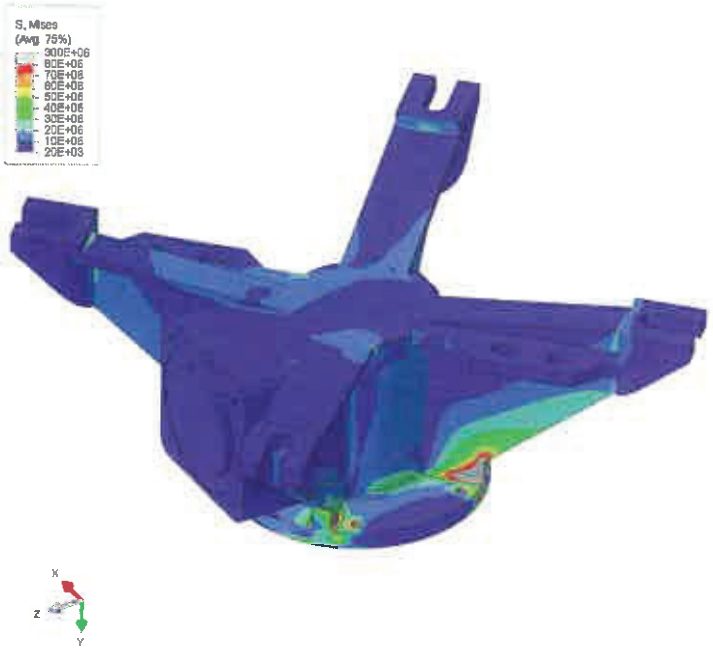


Figure 15. *Von-Mises stress [Pa] distribution – tank (view 02)*

Displacement field is presented in Figure 16.

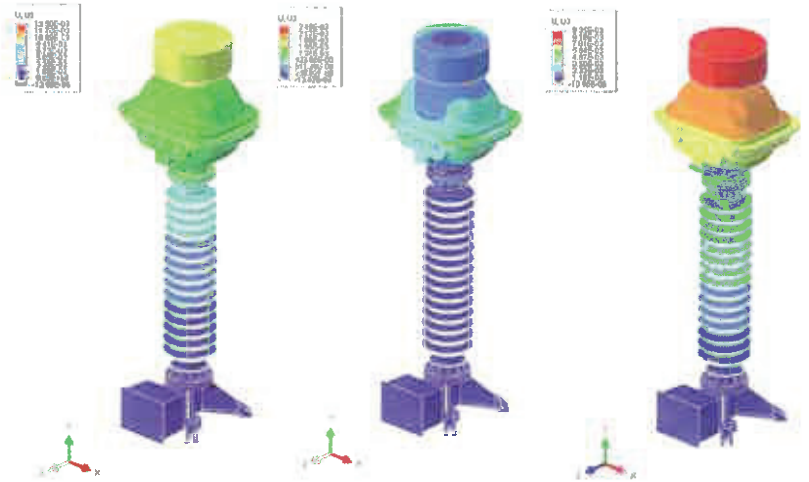


Figure 16.*Displacement [m] field - distribution*

The maximum bending moment evaluated at the interface between flange and insulator was equal to:

- M_x=4848 Nm.
- M_z=7476 Nm.

Insulator has satisfied the maximum bending moment condition. One can observer that stresses evaluated at the base are slightly above yield point of material. Therefore small yielding may occur. One must have in mind that analysis did not cover possible casting imperfections. Design has been also verified according to AF3 seismic level (0.3 g Zero Period Acceleration). Stress distribution for such load scenario is presented from Figure 17 to Figure 18. Obtained stress level was significantly below yield point of material.

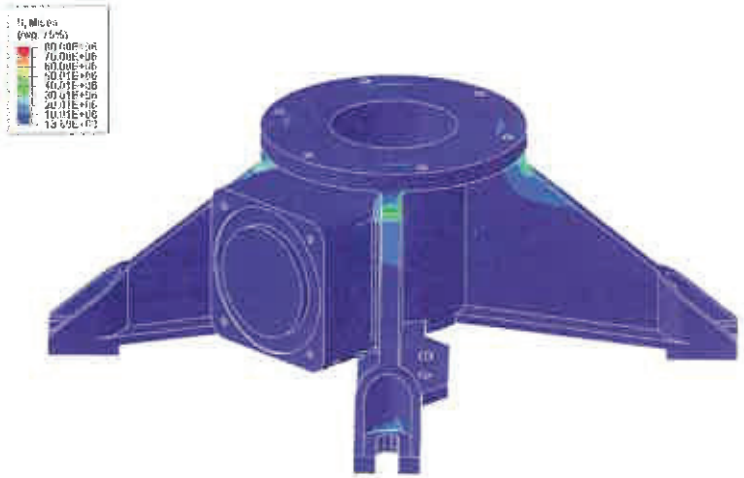


Figure 17. *Von-Mises stress [Pa] distribution (AF3) – tank (view 01)*

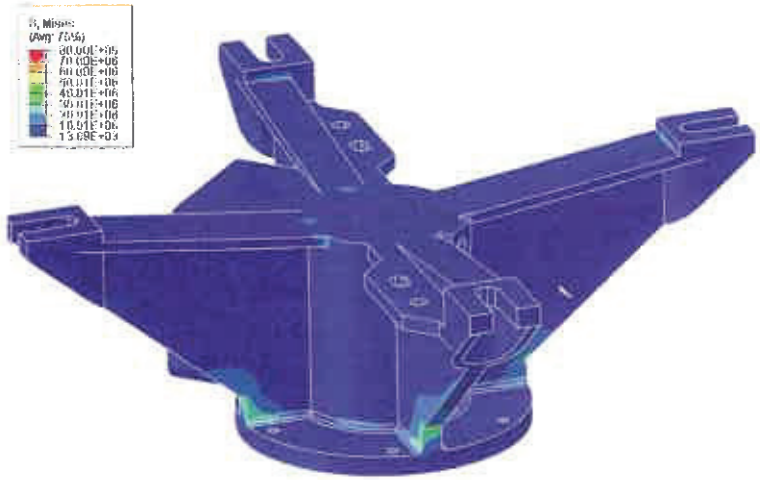


Figure 18. *Von-Mises stress [Pa] distribution (AF3) – tank (view 02)*

4.2 PV 123

4.2.1 Natural frequency extraction

Effective modal mass plot is presented Figure 19. Bubble size indicated amount of mass which participates in motion at specific frequency range. Based no presented plot one can see that the most critical modes were located between 24.7– 25.3 Hz.

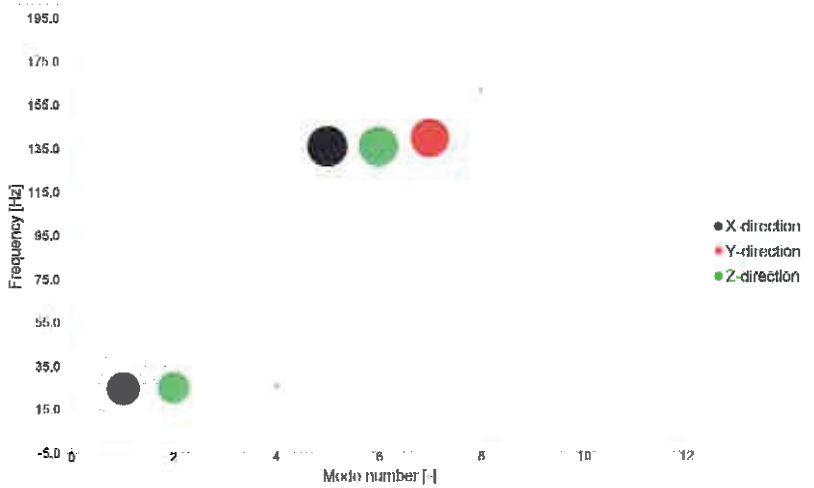


Figure 19. *Natural frequency extraction – effective modal mass*

Effective modes and associated with the shapes are presented in Figure 20.

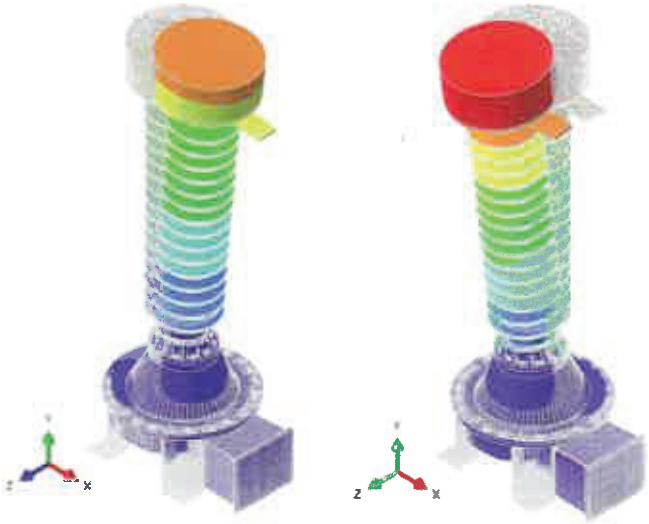


Figure 20. *Natural frequency extraction – mode shapes*

Summary of modal mass participation is listed in Table 5.

Table 5. *Modal mass participation – summary*

Mode no.	Frequency [Hz]	X-direction	Y-direction	Z-direction
1	24.7	24%	0%	0%
2	25.2	0%	0%	24%
3	25.4	0%	0%	0%
4	26.5	0%	0%	0%
5	135.5	37%	0%	0%
6	139.3	0%	0%	36%
7	161.3	0%	34%	0%
8	162.4	0%	0%	0%
9	175.8	0%	0%	0%
10	176.2	0%	0%	0%

4.2.2 Dynamic analysis

Stress distribution for tank component is presented in Figure 21 and Figure 22. As described in chapter 3.8.1 location of center of mass is close to the ground level, therefore expected bending moment and so the stress was low. One can see that the maximum stress level reached ca. 30 MPa and it was located at vicinity of coupling constraint. Stress level satisfies required safety condition.

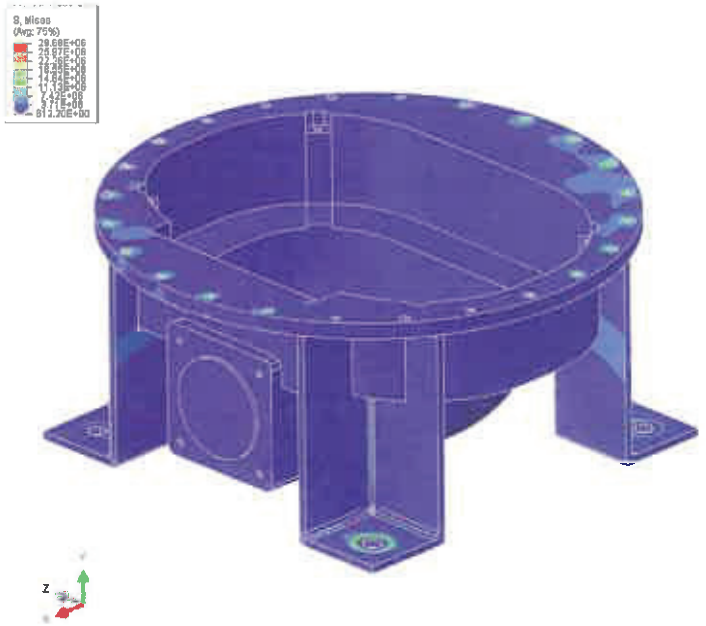


Figure 21. *Von-Mises stress [Pa] distribution – tank (view 01)*

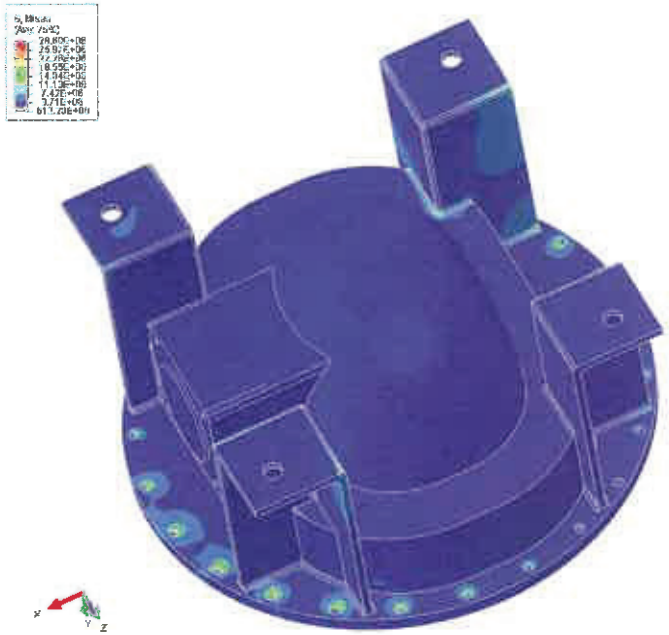


Figure 22. *Von-Mises stress [Pa] distribution – tank (view 02)*

Displacement field is presented in Figure 23.

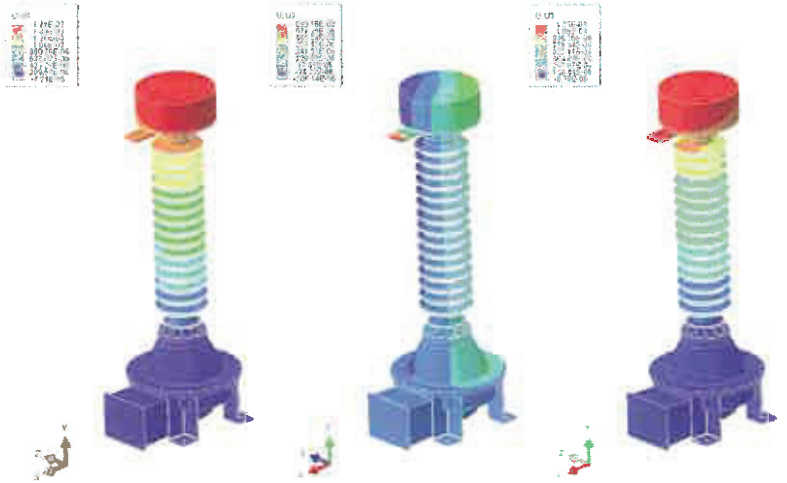


Figure 23.*Displacement [m] field - distribution*

The maximum bending moment evaluated at the interface between flange and insulator was equal to:

- M_x=2079 Nm.
- M_z=2263 Nm.

Insulator has satisfied the maximum bending moment condition.

4.3 PVA123a /PVA145a

4.3.1 Natural frequency extraction

Effective modal mass plot is presented Figure 24. Bubble size indicated amount of mass which participates in motion at specific frequency range. Based no presented plot one can see that the most critical modes were located between 3.8– 4.1 Hz.

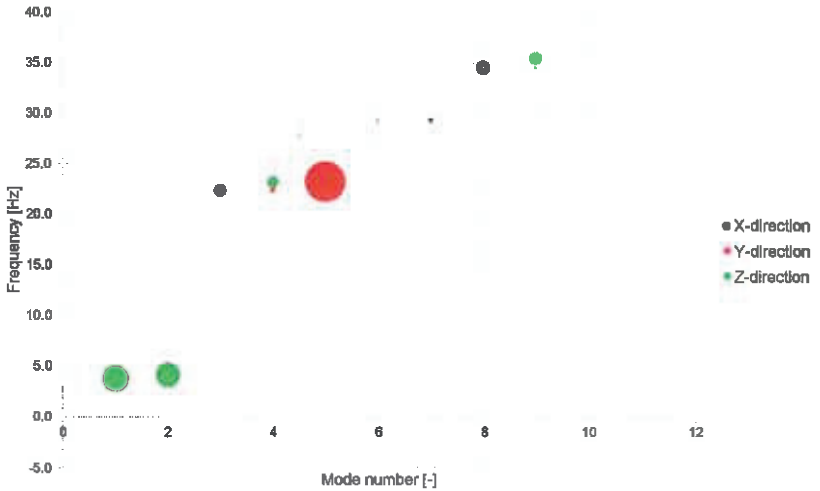
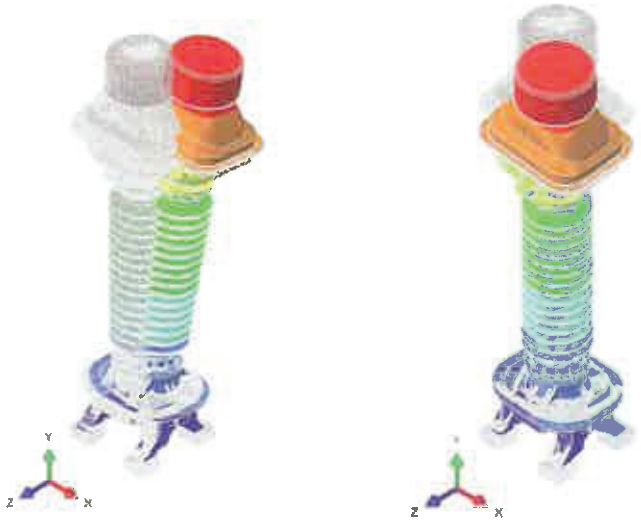


Figure 24. *Natural frequency extraction – effective modal mass*

Effective modes and associated with the shapes are presented in Figure 25.



f=3.8 Hz ***f=4.1 Hz***

Figure 25. *Natural frequency extraction – mode shapes*

Summary of modal mass participation is listed in Table 6.

Table 6. *Modal mass participation – summary*

Mode no.	Frequency [Hz]	X-direction	Y-direction	Z-direction
1	3.8	35%	0%	32%
2	4.1	32%	0%	35%
3	22.4	7%	0%	0%
4	23.2	0%	2%	8%
5	26.5	0%	95%	0%
6	29.2	0%	0%	1%
7	29.3	1%	0%	0%
8	34.6	10%	0%	0%
9	35.5	0%	0%	8%
10	36.2	0%	0%	3%

4.3.2 Dynamic analysis

Stress distribution for tank component is presented in Figure 26 and Figure 27. One can see that the maximum stress level reached ca. 70 MPa. Stress level satisfies required safety condition.

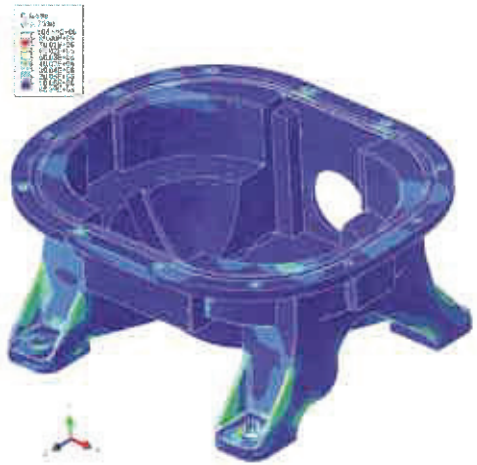


Figure 26. *Von-Mises stress [Pa] distribution – tank (view 01)*

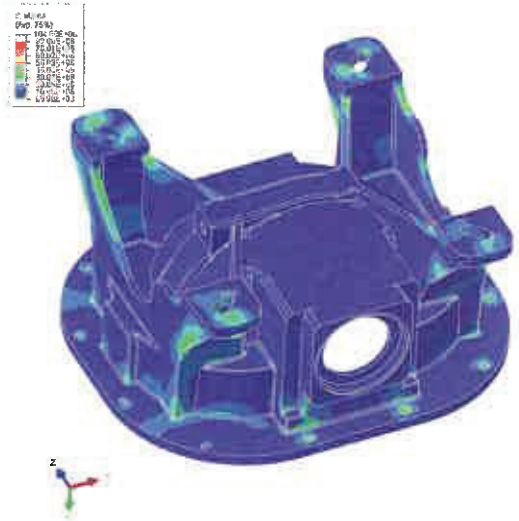


Figure 27. *Von-Mises stress [Pa] distribution – tank (view 02)*

Displacement field is presented in Figure 23.

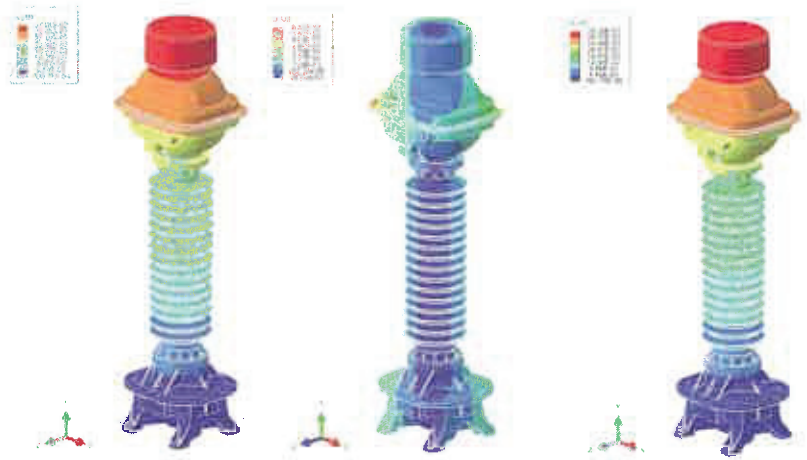


Figure 28.*Displacement [m] field - distribution*

The maximum bending moment evaluated at the interface between flange and insulator was equal to:

- M_x=6864 Nm.
- M_z=7752 Nm.

Insulator has satisfied the maximum bending moment condition.

5 CONCLUSIONS

The goal of the analysis was to investigate family of HV Instrument Transformers using guidelines described in IEC 62271-300. Based on performed analysis main conclusions are the following:

- Current transformer PA 123a/PA 145a. This design has been investigated for two seismic levels: AF5 (0.5 g) and AF3 (0.3 g). For AF5 level stresses were above yield strength of material. These concentrations can be caused by sharp edges which are usually eliminated in real casting process. On the other hand one must have in mind that possible material imperfection were not considered in the simulation. For AF3 load scenario stresses were below yield strength of material. Bushing has satisfied required safety factor for both load scenarios.
- Voltage transformer - PV 123. Seismic level – AF5. Center of mass for this particular design is very close to the ground level. Therefore obtained level of stress and so bending moment was relatively low. Design satisfies required safety factors for AF5 seismic level.
- Combined transformer PVA 123a/PVA 145a. Seismic level – AF5. Obtained stress level was below yield strength of material. Bending moment was also below ultimate value. Whole design should be considered as safe.
- Damping factor used in the analysis was equal to 2%.
- Transformer oil has been modeled as uniformly distributed additional mass.

Disclaimer

The analysis documented herein has been prepared in accordance with reasonable standards of scientific endeavor and the best knowledge of the author(s).

The simulation results may depend on a variety of factors, including quality of input data, applied model simplifications and chosen numerical methods.

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Seismic analyses of HV Instrument Transformers. IEC 62271-300 - AF5 seismic level | 1.0 | 34/37

6 BIBLIOGRAPHY

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[2] ABAQUS, *ABAQUS 6.13 Documentation*, DS Simulia, USA, www.simulia.com

[3] *IEC* **62271-100** – *High voltage switchgear and controlgear – Part 100: Alternating-current circuit-breakers*, Technical report. Edition 2.0: 2008-04

[4] *IEC* **62155-100** – *Hollow pressurized and unpressurized ceramic and glass insulators for use in electrical equipment with rated voltages greater than 1 000 V*, International standard. First edition: 2003-05

7 CHANGE HISTORY

Date	Revision	Author(s)	Change
2015-05-22	Rev. 1	Juszkiewicz Grzegorz	original document

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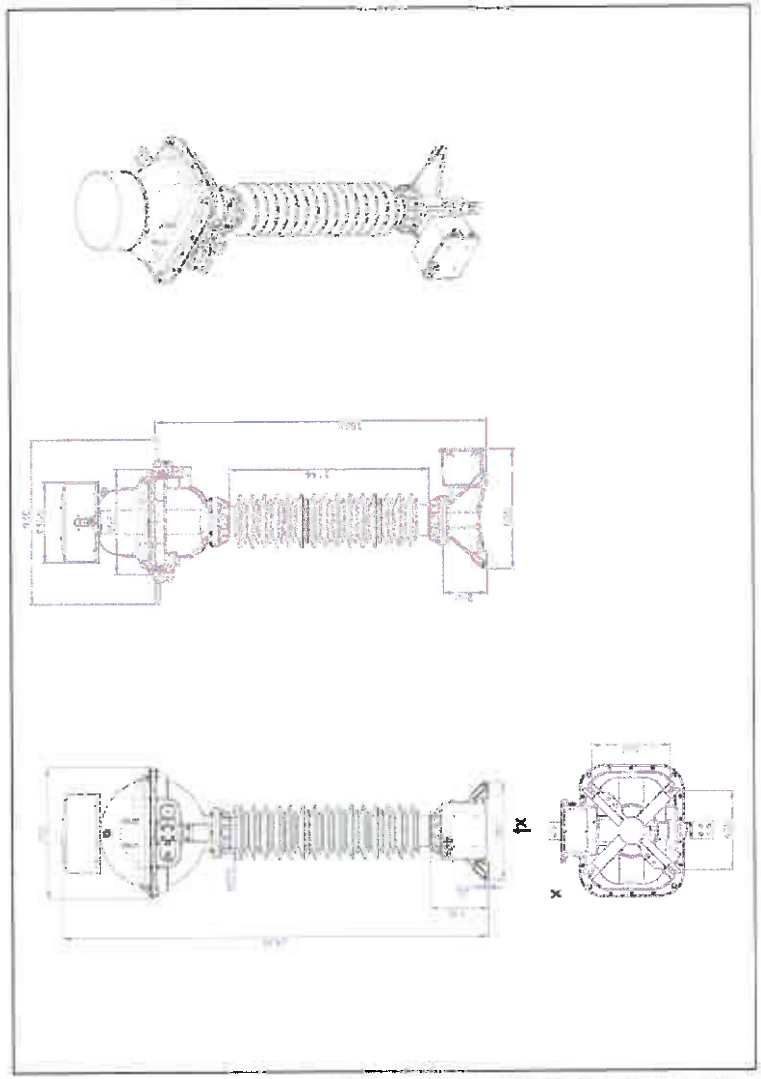
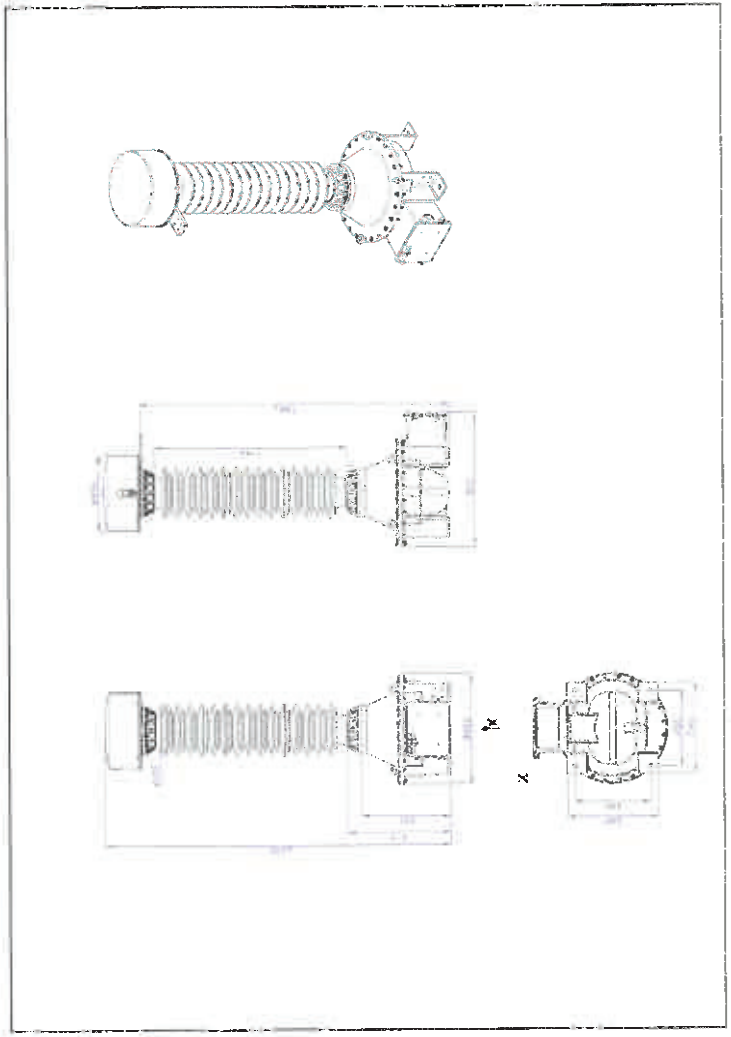
8 APPENDICES

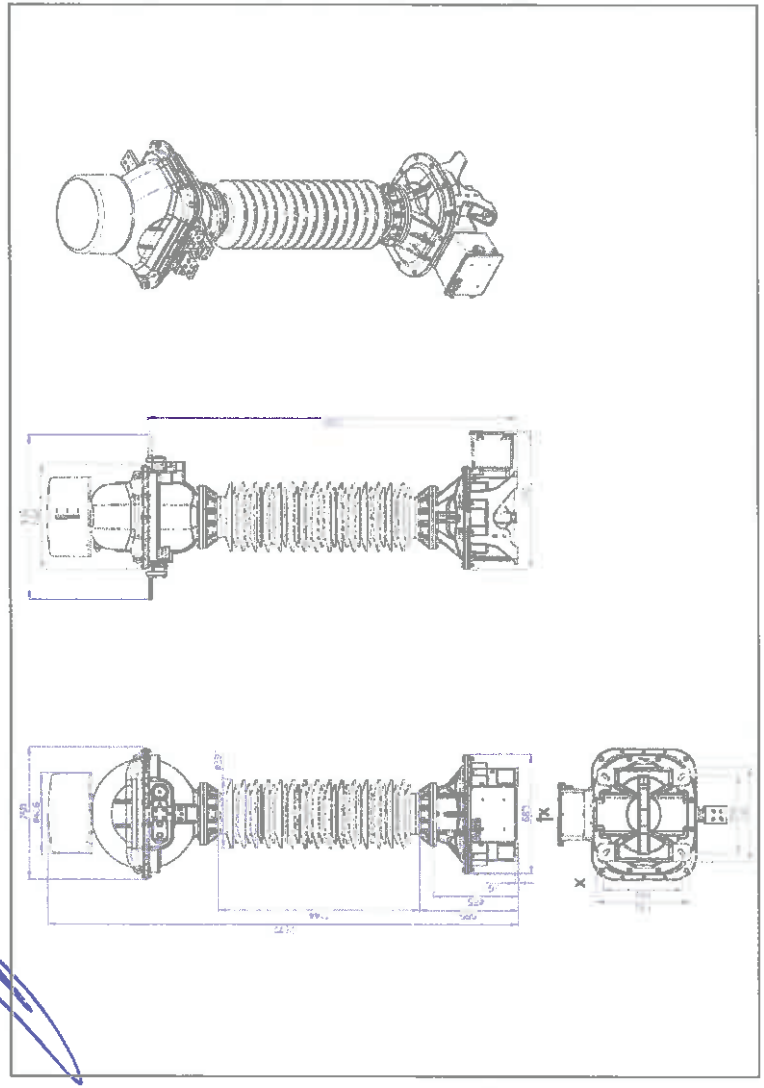
8.1 Current Instrument transformer PA123a/PA145a



8.2 Voltage Instrument transformer PV123



8.3 Combined Instrument transformer PVA123a /PVA145a



Electronic document

Technical report

Simulation Support Team

Case submitted by	Marcin Tarnowski
Business Unit	PPHV
Type of analysis (used tool)	ABAQUS (seismic analysis)
Description of analysis	Seismic analysis different variants of current, voltage and combined transformers (PA123a/PA145a, PV123, PVA123a/PVA 145a) according to guidelines described in IEEE 693 standard. Consideration of seismic and dead loads.

Executive summary

This report covers investigation related to seismic analysis of HV Instrument transformers (PV123, PA123a /PA145a, PVA123a /PVA145a) subjected to various load scenarios. Simulation covered the following load conditions: dead load, terminal force load, seismic load (Moderate - 0.25g; High – 0.5g). Analysis showed that designs: **PA123a/PA145a** and **PVA123a /PVA145a** can withstand moderate seismic level, while **PV123** can withstand high seismic load scenario.

TABLE OF CONTENTS

1 INTRODUCTION

The goal of the analysis was to evaluate seismic performance of PA123a/PA145a (see 8.1), PV123 (see 8.2), PVA145a/PVA123a (see 8.3) type transformers. Simulation was done using guidelines of IEEE 693 standard. For more information please see [1].

Computations concerned evaluation of stress field distribution and maximum bending moment between flange and insulator. Present report describes used simulation technique, analysis steps, loads and boundary conditions variations and summarizes obtained results.

2 SIMULATION SOFTWARE

All simulations were performed using Abaqus/CAE package. Abaqus includes FEM (finite element method) solver, pre- and post processor and enables performing many types of multiphysics simulations: mechanical, thermal, acoustic, piezoelectric, seismic, and others.

Parts and assemblies can be created in Abaqus, or they can be imported from CAD systems using native file formats. Abaqus functionality enables to define materials, interactions, loads, boundary conditions, mesh. User is also available to set up simulation parameters such as pre-processing memory. It is always possible to change all simulation settings and properties, because they're all parameterized.

Simulation results can be visualized in Abaqus postprocessor or in external software, which is able to import simulation results in Abaqus format. In postprocessor user can view all predefined field outputs, show or hide part instances, create cross-sections, make animations, automatically generate reports, diagnose model (warnings, errors). For more information about ABAQUS please see [2].

3 SIMULATION SETUP

Analysis has been made using Finite Element Method.

3.1 Simulation procedure

According to [1] analysis included three main simulation steps:

- Static load:
  - Terminal load.
  - Gravitational load.
- Natural frequency extraction.
- Dynamic analysis.

3.2 Simulation steps

Simulation consisted of three main simulation steps.

3.2.1 Natural frequency extraction

In the first simulation step natural frequency extraction was performed. The frequency extraction procedure performs eigenvalue extraction to calculate the natural frequencies and the corresponding mode shapes of a system.

The eigenvalue problem for the natural frequencies of an undamped finite element model can be described by equation (3-1):

$$(-\omega^2 M^{MN} + K^{MN})\phi^N = 0 \qquad (3\text{-}1)$$

where: M^{MN} – mass matrix (kg); K^{MN} – stiffness matrix (Pa), which includes initial stiffness effects if the base state (gravitational load); ϕ – eigenvector (the mode of vibration); M, N – degrees of freedom (-). Based on specification [1] one can assume that most critical frequency modes are in range of 0-35 Hz.

3.2.2 Response spectrum analysis

The response spectrum method is a convenient way of describing shock motion in terms of the maximum response of a single degree of freedom (1-DOF) oscillator of arbitrary natural period and damping ratio. Each data point of the response spectrum curve represents the peak response from a time history analysis of the earthquake applied to 1-DOF oscillator system. The ordinate defines the natural period at which the oscillator is tuned. Repeating the procedure for a great many frequencies defines a continuous curve for an assumed level of damping.

A spectral response analysis estimates the maximum displacement of the structure during a 'design' shock load without recourse of direct integration. Finite element implementation of the response spectrum calculate the response of each mode independent, and then combine the scaled response one of a number of established combination rules, to give an estimate of peak response. Spectrum plot used in simulation is presented in Figure 1.

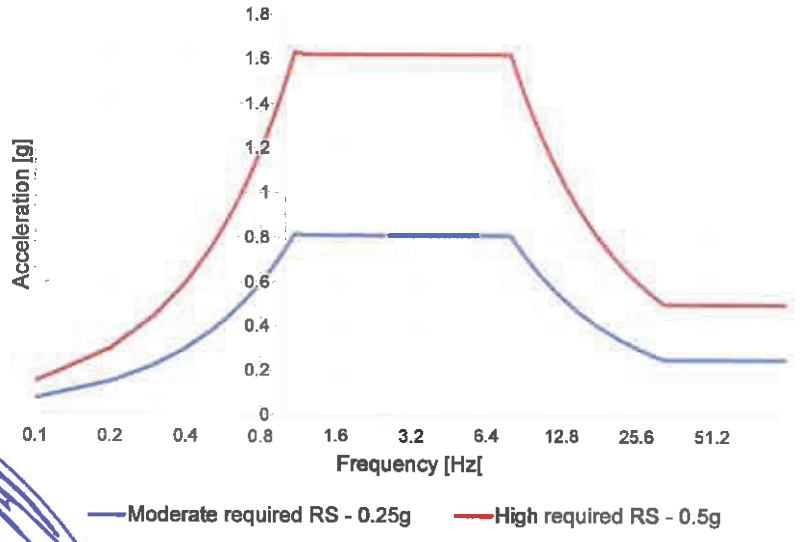


Figure 1. *Design response spectrum (RS) – 2% damping*

3.3 Loads and boundary conditions

3.3.1 Loads

The following static load scenarios have been considered

1. Gravitational load, g=9.81 m/s².
2. Terminal operating load. These load conditions were specified according to [3] (*Table 7 – Static withstand test loads*). For considered voltage-current range static withstand force (Load class II) should be equal to 3000 N. With respect to '*NOTE 1 The sum of the loads acting in routinely operating conditions should not exceed 50% of the specified withstand test load*', maximum operating force is equal to **1500 N**.

Seismic load have been predefined according design response spectrum described in the standard [1] – ground acceleration reference – Moderate/High Required Response Spectrum. Main input parameters were the following:

- XYZ base motion with vertical load (Y) equal to 80% of horizontal direction.
- Damping ratio – 2%.

As the final outcome from the analysis static loads were combined with the seismic load.

3.3.2 Boundary conditions

Simulation assumes that the apparatus will be mounted on ground. During analysis model has been fixed at the bottom face of used test frame. General view of static loads and boundary conditions is presented in Figure 2. Area highlighted by red has been constrained (Y-rotation released). Base of the bottom tank has been supported in Y direction (as it is placed on the ground). Described boundary conditions have been used for all analyzed models.

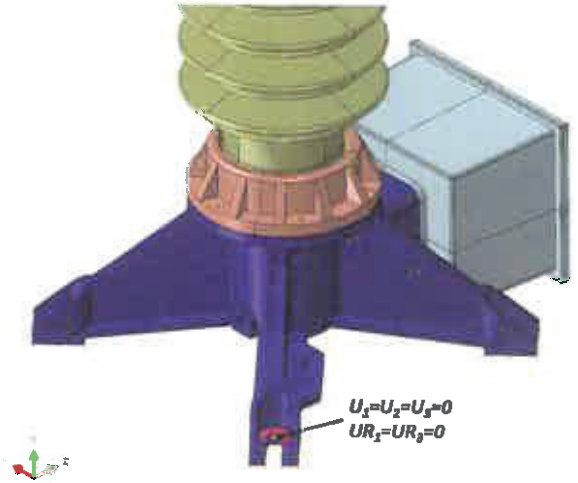


Figure 2. *Boundary conditions – general view*

3.4 Acceptance criteria

With respect to the standard [1] the following acceptance criteria were used

- Seismic load should be combined with dead load and possible normal operating loads.
- The maximum allowable bending moment shall not exceed **6.66 kNm** (50% of ultimate load/stress)
- Aluminum components shall not exceed **73 MPa** (minimum ultimate tensile strength divided by 2.2 safety factor).

3.5 Current transformer - PA 123a/PA 145a

This chapter gathers details related to FE model of current transformer **PA 123a/PA 145a**.

3.5.1 Model simplifications

For simulation requirements some areas of the model were simplified. Small geometrical features like casting rounding, chamfers were removed in order to improve mesh generation process. Details of the geometry and center of mass can be found in Figure 3. Red point indicates center of mass of the transformer.

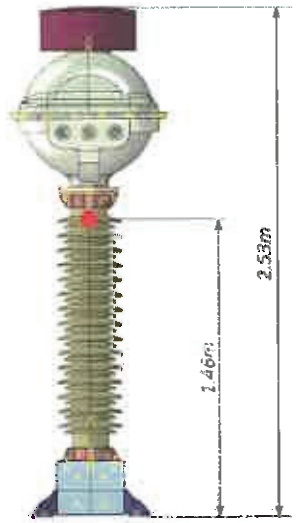


Figure 3. *Simplified representation of the PA 123a/PA 145a transformer*

Concrete between flange and ceramic insulator has been introduced using connector element with predefined rotational stiffness.

Because of the simulation method (dynamics based on modal analysis) components were connected together using bonded connection or conformal mesh.

3.6 Material and mass information

Component naming is presented in Figure 4.

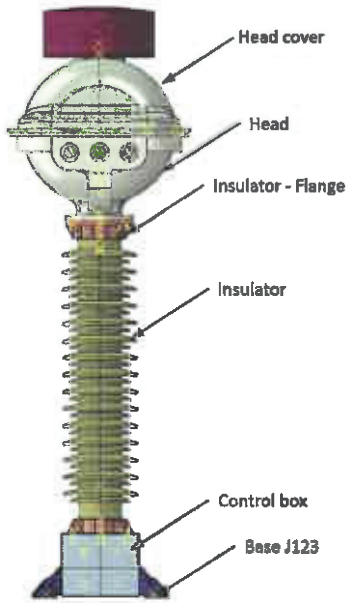


Figure 4. *Assembly – component naming*

Material and mass information is listed in Table 1

Table 1. *Mass and material data*

Drawing number	Component name	Material name	Mass [kg]	Young's modulus [MPa]	Yield strength [MPa]	Ultimate strength [MPa]
2GKA310015	Base J123	EN-AC 43200 (grade F)	16.5	69000	80	160
2GKA310404	Insulator	Porcelain	71	100000	140	
	Insulator - Flange	EN-AC 43200 (grade T6)	3.5	69000	180	220
2GKA414718	Head	EN-AC 43200 (grade F)	22.5	69000	80	160
2GKK314089	Head cover	EN-AC 43200 (grade F)	20	69000	80	160
	Coil	-	150			
2GKK311093R	Control box	EN-AC 43200 (grade F)	5.5	69000	80	160
	Oil		120			

The ultimate bending moment for ceramic insulator is equal to M_B=13.3 kNm.

3.7 Finite element (FE) model

General view of FE model is presented in Figure 5.

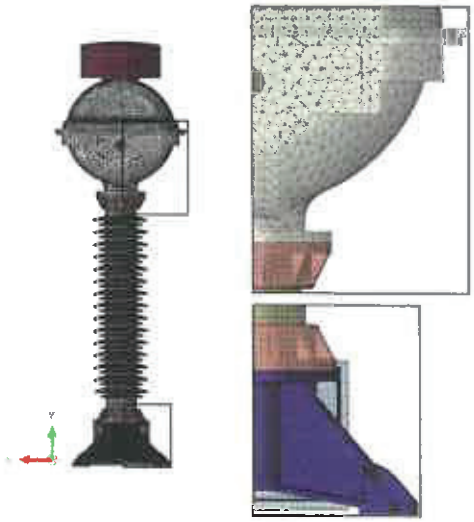


Figure 5. *FE model – general view*

Mesh statistics were the following:

- Total number of nodes: 533430
- Total number of elements: 242866
  - 210555 quadratic tetrahedral elements of type C3D10
  - 31050 quadratic hexahedral elements of type C3D20R
  - 1243 quadratic quadrilateral elements of type S8R
  - 18 quadratic triangular elements of type STRI65

Description of the coordinate system.

- X – 1st horizontal axis.
- Z – 2nd horizontal axis.
- Y – vertical axis.

3.8 Voltage transformer - PV 123

This chapter gathers details related to FE model of voltage transformer **PV 123**.

3.8.1 Model simplifications

For simulation requirements some areas of the model were simplified. Small geometrical features like casting rounding, chamfers were removed in order to improve mesh generation process. Details of the geometry and center of mass can be found in Figure 6. Red point indicates center of mass of the transformer.

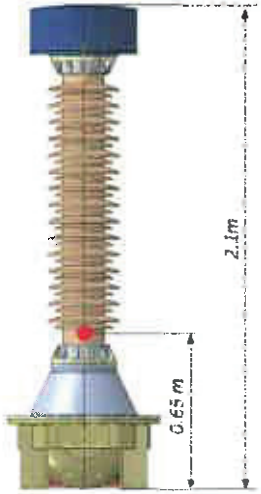


Figure 6. *Simplified representation of the PV 123 transformer*

Concrete between flange and ceramic insulator has been introduced using connector element with predefined rotational stiffness.

Because of the simulation method (dynamics based on modal analysis) components were connected together using bonded connection or conformal mesh.

3.9 Material and mass information

Component naming is presented in Figure 7.

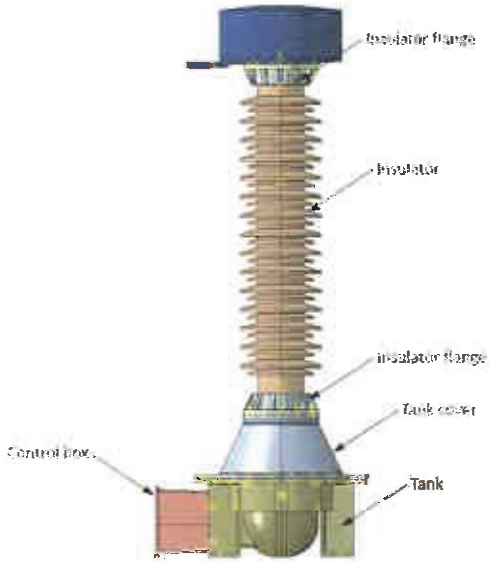


Figure 7. *Assembly – component naming*

Material and mass information is listed in Table 2.

Table 2. *Mass and material data*

Drawing number	Component name	Material name	Mass [kg]	Young's modulus [MPa]	Yield strenght [MPa]	Ultimate strenght [MPa]
2GKK310150P	Bottom tank	EN-AC 43200 (grade F)	25	69000	80	160
2GKK310147P	Core	Steel	22.5	206000	300	370
2GKV314005	Tank cover	EN-AC 43200 (grade F)	15.5	69000	80	160
2GKA310404	Insulator	Porcelain	71	100000	140	
	Insulator flange	EN-AC 43200 (grade T6)	3.5	69000	180	220
	Coil	-	30			
2GKK311093R	Control box	EN-AC 43200 (grade F)	5.5	69000	80	160
	Oil		60			

The ultimate bending moment for ceramic insulator is equal to M_B=13.3 kNm.

3.10 Finite element (FE) model

General view of FE model is presented in Figure 8.

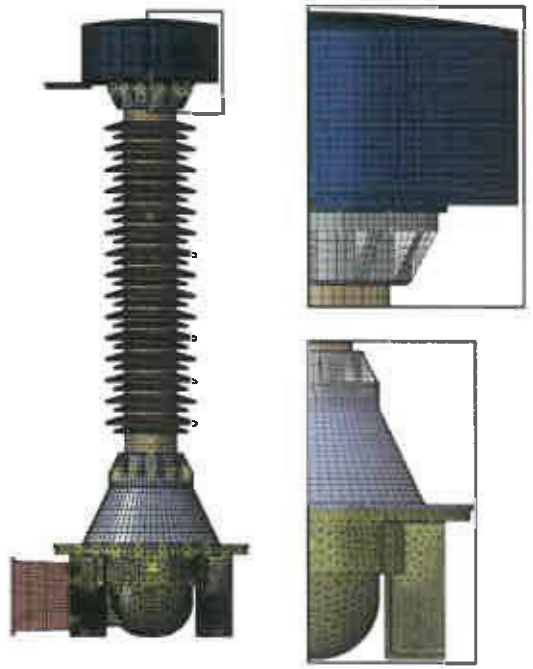


Figure 8. *FE model – general view*

Mesh statistics were the following:

- Total number of nodes: 608507
- Total number of elements: 236033
  - 4606 quadratic quadrilateral elements of type S8R
  - 58 quadratic triangular elements of type STRI65
  - 58965 quadratic hexahedral elements of type C3D20R
  - 8577 linear hexahedral elements of type C3D8R
  - 163827 quadratic tetrahedral elements of type C3D10

Description of the coordinate system.

- X – 1st horizontal axis.
- Z – 2nd horizontal axis.
- Y – vertical axis.

3.11 Combined transformer – PVA123a /PVA145a

This chapter gathers details related to FE model of combined transformer **PVA123a /PVA145a**.

3.11.1 Model simplifications

For simulation requirements some areas of the model were simplified. Small geometrical features like casting rounding, chamfers were removed in order to improve mesh generation process. Details of the geometry and center of mass can be found in Figure 9. Red point indicates center of mass of the transformer.

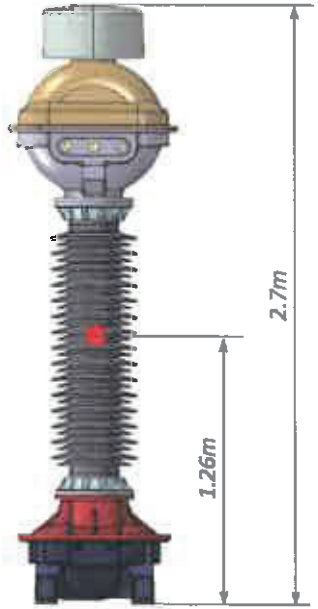


Figure 9. *Simplified representation of the PVA123a /PVA145a transformer*

Concrete between flange and ceramic insulator has been introduced using connector element with predefined rotational stiffness.

Because of the simulation method (dynamics based on modal analysis) components were connected together using bonded connection or conformal mesh.

3.12 Material and mass information

Component naming is presented in Figure 10

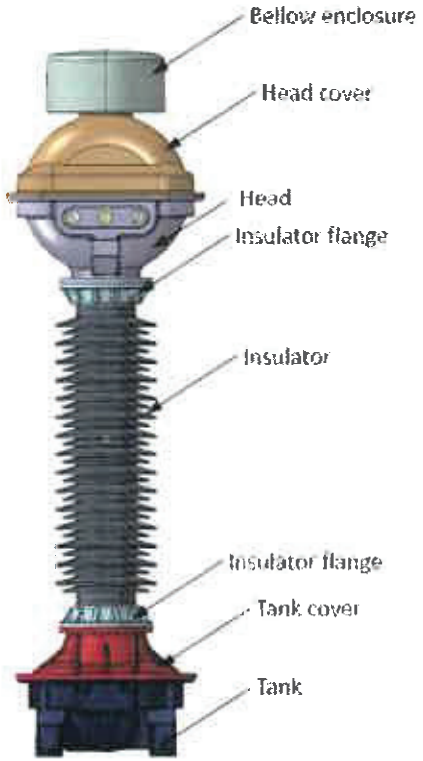


Figure 10. *Assembly – component naming*

Material and mass information is listed in Table 3.

Table 3. *Mass and material data*

Drawing number	Component name	Material name	Mass [kg]	Young's modulus [MPa]	Yield strength [MPa]	Ultimate strength [MPa]
2GKK314076	Tank	EN-AC 43200 (grade F)	25	69000	80	160
2GKK314084	Core	Steel	33.8	206000	300	370
2GKK314075	Tank cover	EN-AC 43200 (grade F)	18	69000	80	160
2GKK314070	Insulator	Porcelain	131	100000	140	
	Insulator flange	EN-AC 43200 (grade T6)	5	69000	180	220
2GKK314080	Head	EN-AC 43200 (grade F)	23.5	69000	80	160
2GKK314089	Head cover PVA-PA123A /PA145A-145	EN-AC 43200 (grade F)	23	69000	80	160
2GKK310902	Bellow	Stainless steel	5	190000	200	500
2GKK310014P	Below enclosure	EN-AC 43200 (grade F)	7	69000	80	160
-	Voltage coil	-	30	-	-	-
-	Current coil	-	150	-	-	-
2GKK310802	Epoxy insulator	-	2.5	-	-	-
2GKK311093R	Control box	EN-AC 43200 (grade F)	5.5	69000	80	160
-	Oil		150	-	-	-

The ultimate bending moment for ceramic insulator is equal to M_B=13.3 kNm.

3.13 Finite element (FE) model

General view of FE model is presented in Figure 11.

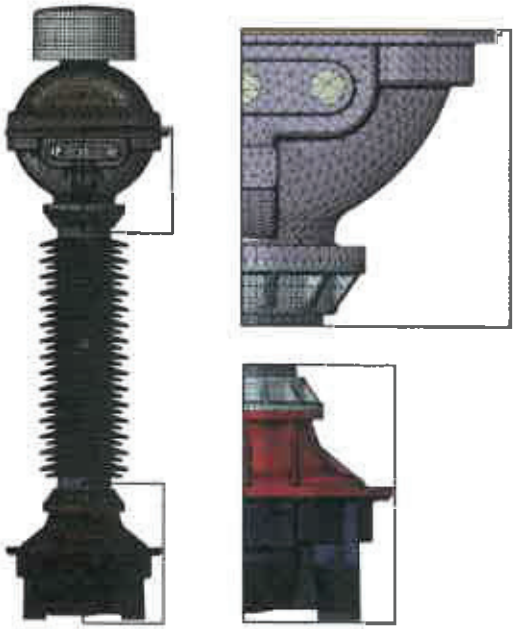


Figure 11. *FE model – general view*

Mesh statistics were the following:

- Total number of nodes: 1009580
- Total number of elements: 463007
  - 58507 quadratic hexahedral elements of type C3D20R
  - 300489 quadratic tetrahedral elements of type C3D10
  - 2519 linear quadrilateral elements of type S4R
  - 97 linear triangular elements of type S3
  - 9900 linear hexahedral elements of type C3D8R
  - 528 quadratic wedge elements of type C3D15
  - 90967 quadratic tetrahedral elements of type C3D10M

Description of the coordinate system.

- X – 1st horizontal axis.
- Z – 2nd horizontal axis.
- Y – vertical axis.

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4 SIMULATION RESULTS

This chapter gathers simulation results evaluated in the analysis. Obtained outcome incudes static and the seismic load.

4.1 PA123a /PA145a

4.1.1 Natural frequency extraction

Effective modal mass plot is presented Figure 12. Bubble size indicated amount of mass which participates in motion at specific frequency range. Based no presented plot one can see that the most critical modes were located between 6.9 – 8.2 Hz.

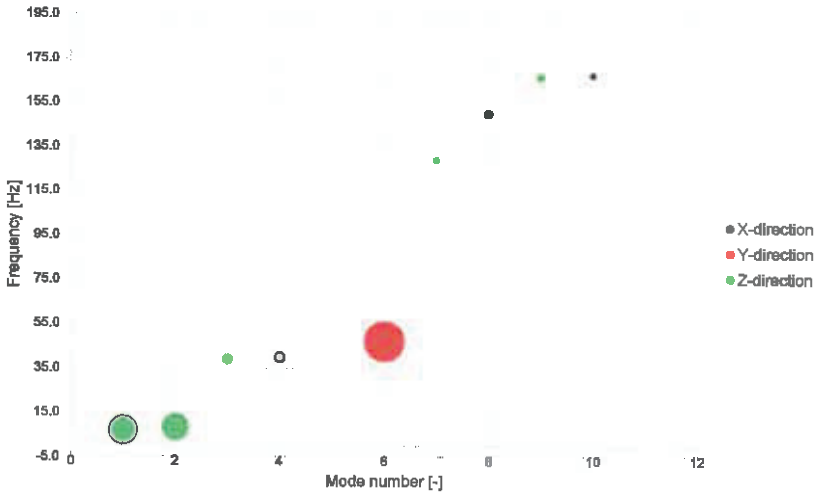

Figure 12. *Natural frequency extraction – effective modal mass*

Effective modes and associated with the shapes are presented in Figure 13.

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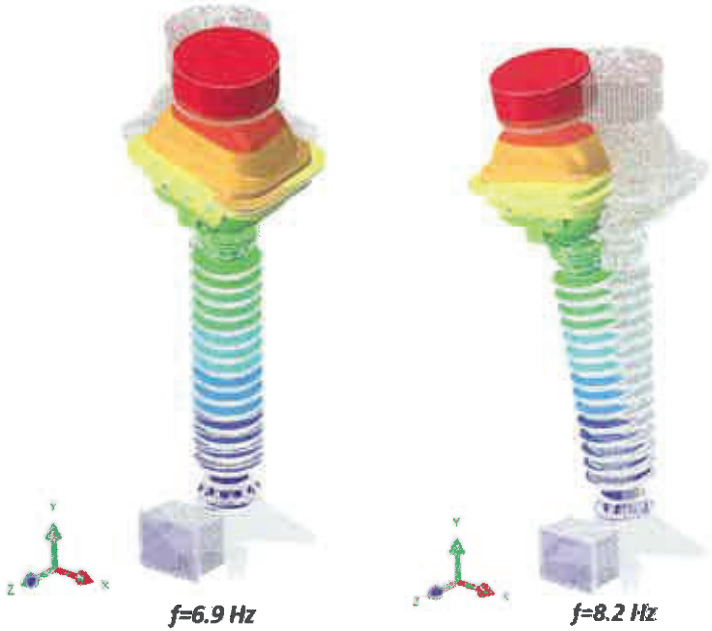

Figure 13. *Natural frequency extraction – mode shapes*

Summary of modal mass participation is listed in Table 4.

Table 4. *Modal mass participation – summary*

Mode no	Frequency [Hz]	X-direction	Y-direction	Z-direction
1	6.9	40%	0%	35%
2	8.2	34%	0%	40%
3	38.9	2%	0%	6%
4	39.7	6%	0%	2%
5	46.9	0%	0%	0%
6	98.7	0%	89%	0%
7	129.2	0%	0%	2%
8	150.3	4%	0%	0%
9	166.6	0%	0%	4%
10	167.4	2%	0%	0%

4.1.2 Dynamic analysis

Stress distribution for tank component is presented in Figure 14 and Figure 15. Stress scale has been limited to 73 MPa as the maximum allowable stress level.

Figure 14. *Von-Mises stress [Pa] distribution – tank (view 01)*

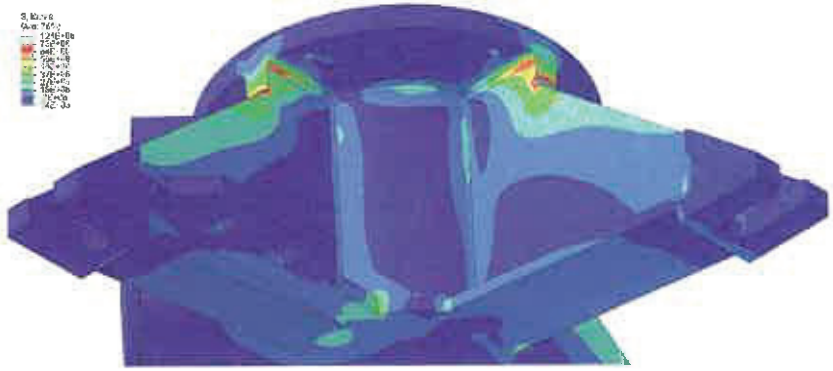

Figure 15. *Von-Mises stress [Pa] distribution – tank (view 02)*

Displacement field is presented in Figure 16.

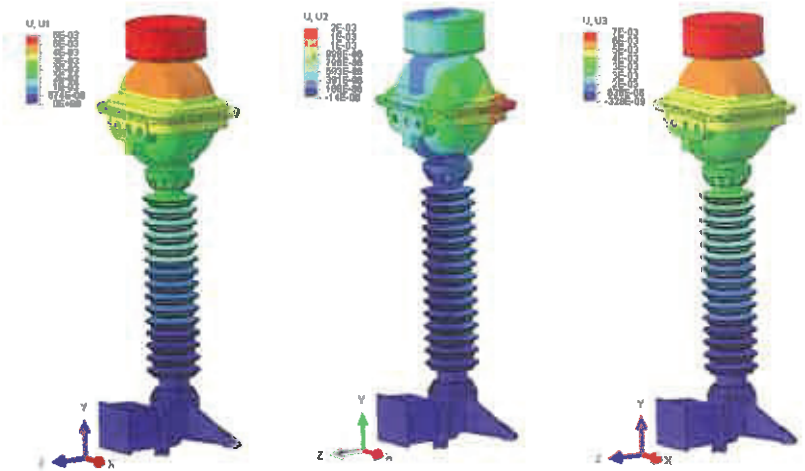

Figure 16. *Displacement [m] field - distribution*

The maximum bending moment evaluated at the interface between flange and insulator was equal to:

- M_x=7961 Nm.
- M_z=7992 Nm.

Insulator **has not satisfied** the maximum bending moment condition. One can observe that stresses evaluated at the base are slightly above allowable value. Therefore small yielding may occur. One must have in mind that analysis did not cover possible casting imperfections.

Design has been verified according to Moderate seismic level (0.25 g Zero Period Acceleration). Stress distribution for such load scenario is presented from Figure 17 to Figure 18. Obtained stress level was below allowable level.

The maximum bending moment evaluated at the interface between flange and insulator was equal to:

- M_x=4816 Nm.
- M_z=4821 Nm.

Insulator **has satisfied** allowable bending moment condition.

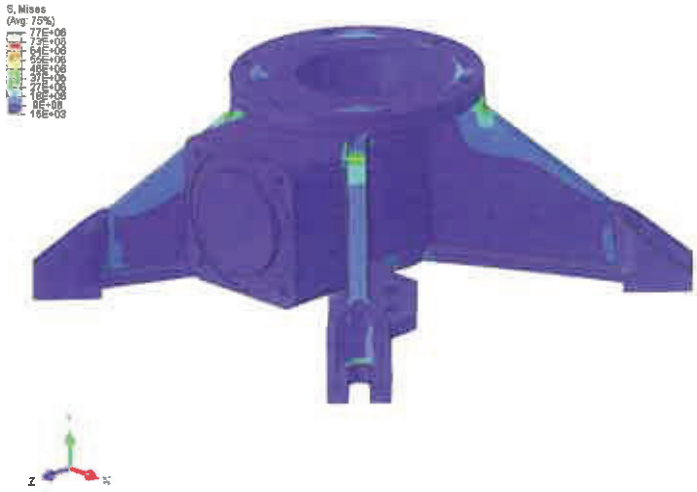

Figure 17. *Von-Mises stress [Pa] distribution (AF3) – tank (view 01)*

Figure 18. *Von-Mises stress [Pa] distribution (AF3) – tank (view 02)*

4.2 PV 123

4.2.1 Natural frequency extraction

Effective modal mass plot is presented Figure 19. Bubble size indicated amount of mass which participates in motion at specific frequency range. Based no presented plot one can see that the most critical modes were located between 24.7-- 25.3 Hz.

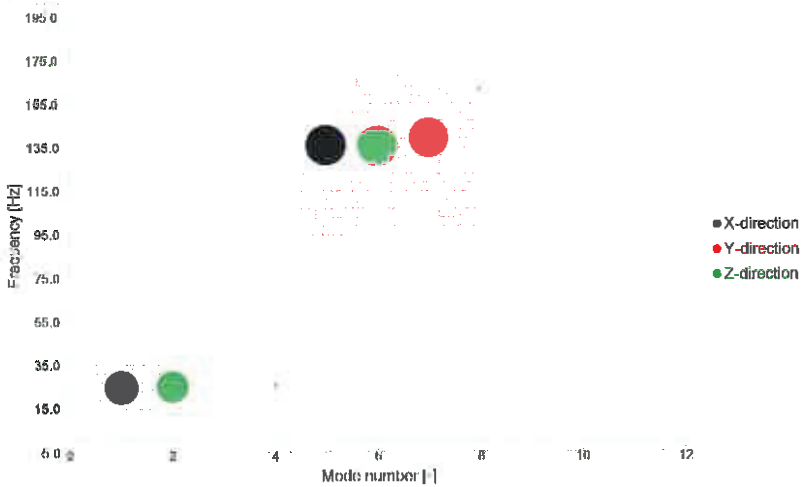

Figure 19. *Natural frequency extraction – effective modal mass*

Effective modes and associated with the shapes are presented in Figure 20.

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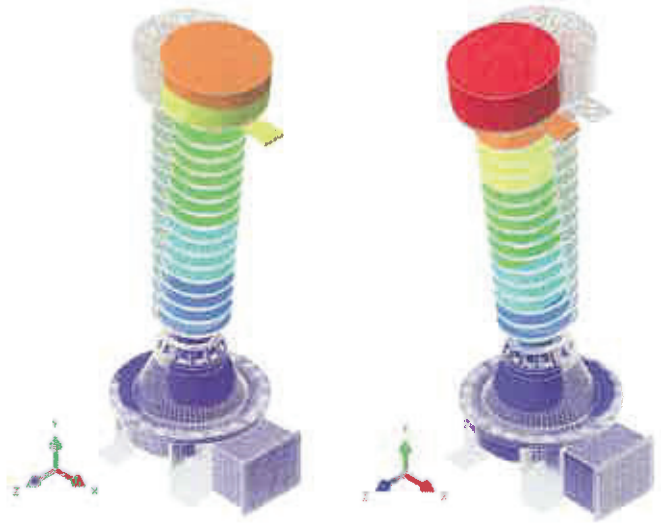

f=24.7 Hz ***f=25.3 Hz***

Figure 20. *Natural frequency extraction – mode shapes*

Summary of modal mass participation is listed in Table 5.

Table 5. *Modal mass participation – summary*

Mode no.	Frequency [Hz]	X-direction	Y-direction	Z-direction
1	24.7	24%	0%	0%
2	25.2	0%	0%	24%
3	25.4	0%	0%	0%
4	26.5	0%	0%	0%
5	135.5	37%	0%	0%
6	139.3	0%	0%	36%
7	161.3	0%	34%	0%
8	162.4	0%	0%	0%
9	175.8	0%	0%	0%
10	176.2	0%	0%	0%

4.2.2 Dynamic analysis

Stress distribution for tank component is presented in Figure 21 and Figure 22. As described in chapter 3.8.1 location of center of mass is close to the ground level, therefore expected bending moment and so the stress was low. One can see that the maximum stress level reached ca. 24 MPa and it was located at vicinity of coupling constraint. Stress level satisfies required safety condition.

Figure 21. *Von-Mises stress [Pa] distribution – tank (view 01)*

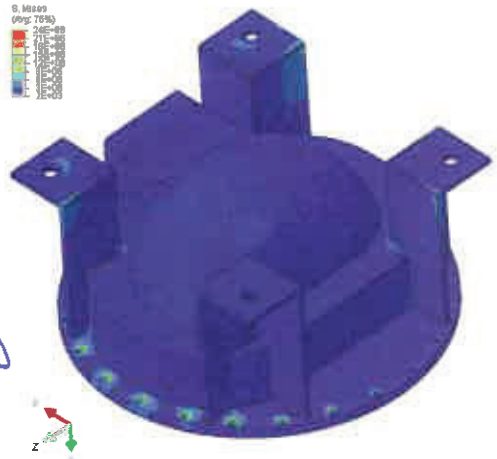

Figure 22. *Von-Mises stress [Pa] distribution – tank (view 02)*

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Displacement field is presented in Figure 23.

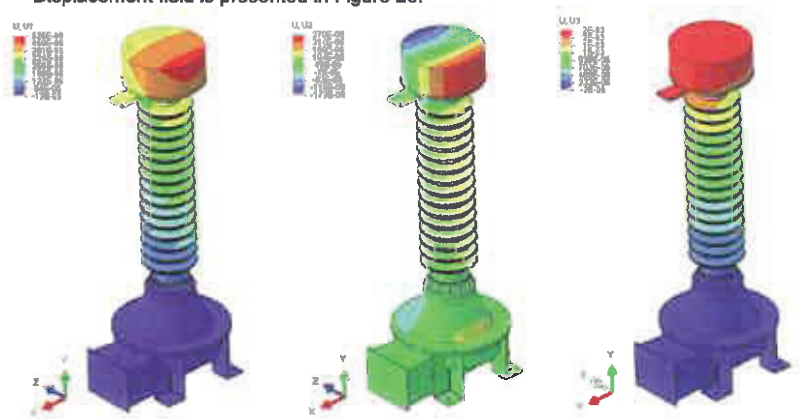

Figure 23.*Displacement [m] field - distribution*

The maximum bending moment evaluated at the interface between flange and insulator was equal to:

- M_X=2224 Nm.
- M_Z=2228 Nm.

Insulator **has satisfied** the maximum bending moment condition.

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4.3 PVA123a /PVA145a

4.3.1 Natural frequency extraction

Effective modal mass plot is presented Figure 24. Bubble size indicated amount of mass which participates in motion at specific frequency range. Based no presented plot one can see that the most critical modes were located between 3.8– 4.1 Hz.

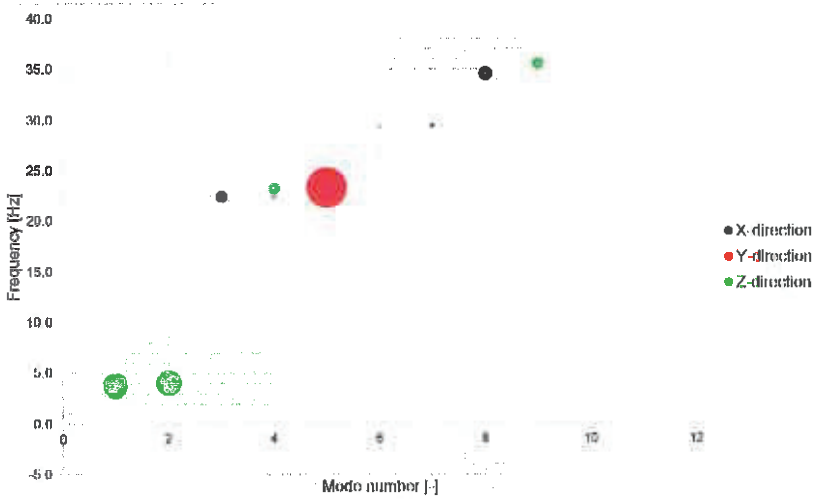
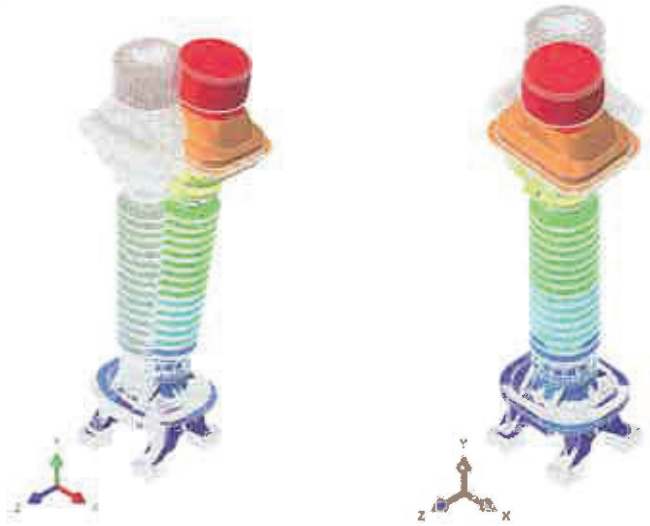


Figure 24. *Natural frequency extraction – effective modal mass*

Effective modes and associated with the shapes are presented in Figure 25.



f=3.8 Hz ***f=4.1 Hz***

Figure 25. *Natural frequency extraction – mode shapes*

Summary of modal mass participation is listed in Table 6.

Table 6. *Modal mass participation – summary*

Mode no.	Frequency [Hz]	X-direction	Y-direction	Z-direction
1	3.8	35%	0%	32%
2	4.1	32%	0%	35%
3	22.4	7%	0%	0%
4	23.2	0%	2%	8%
5	26.5	0%	95%	0%
6	29.2	0%	0%	1%
7	29.3	1%	0%	0%
8	34.6	10%	0%	0%
9	35.5	0%	0%	8%
10	36.2	0%	0%	3%

4.3.2 Dynamic analysis

Stress distribution for tank component is presented in Figure 26 and Figure 27. One can see that the maximum stress was above 73 MPa allowable limit.

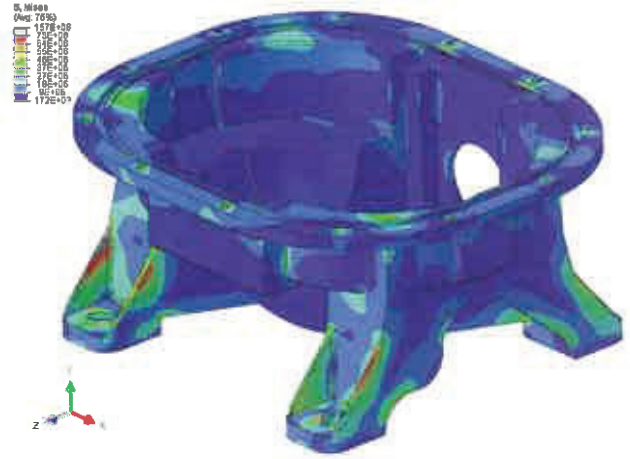


Figure 26. *Von-Mises stress [Pa] distribution – tank (view 01)*

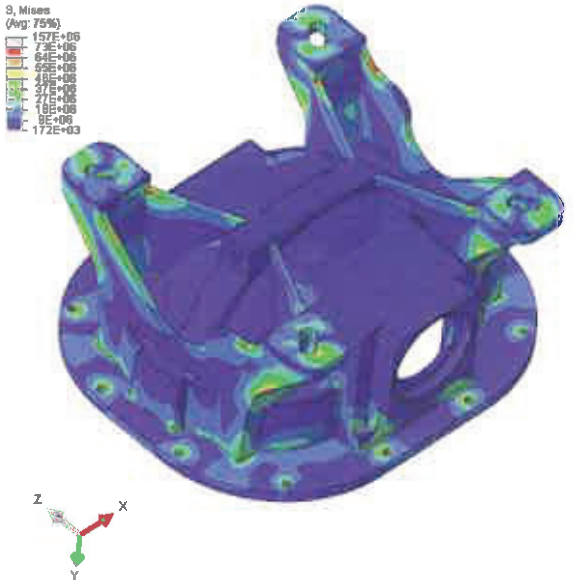


Figure 27. *Von-Mises stress [Pa] distribution – tank (view 02)*

Displacement field is presented in Figure 28.

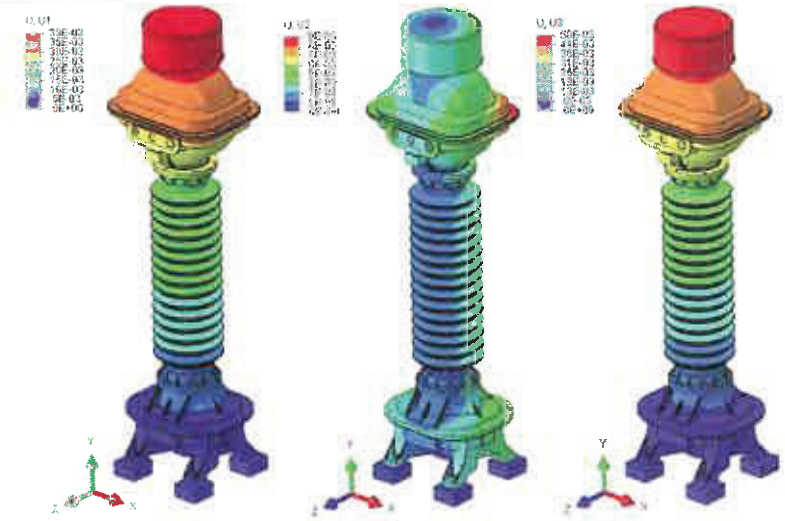


Figure 28. *Displacement [m] field - distribution*

The maximum bending moment evaluated at the interface between flange and insulator was equal to:

- M_x=10451 Nm.
- M_z=8515 Nm.

Insulator **has not** satisfied the maximum bending moment condition. Stress distribution for moderate seismic level is presented in Figure 29 and Figure 30.

Figure 29. *Von-Mises stress [Pa] distribution – tank (view 01)*

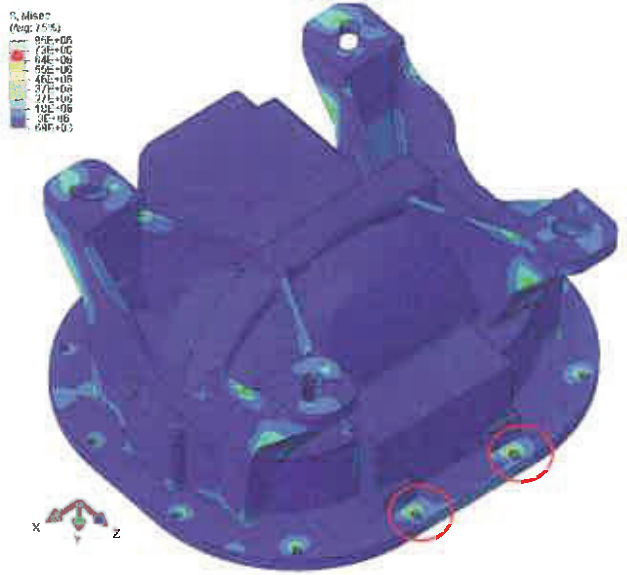


Figure 30. *Von-Mises stress [Pa] distribution – tank (view 02)*

The maximum bending moment evaluated at the interface between flange and insulator was equal to:

- M_x=6335 Nm.
- M_z=4080 Nm.

The maximum bending moment satisfies allowable value.

5 CONCLUSIONS

The goal of the analysis was to investigate family of HV Instrument Transformers using guidelines described in IEEE 693 standard. Summary of satisfied criteria is presented in Table 7. Column 'IEEE 693' lists allowable seismic level for selected design. Columns (2, 3) list seismic level where obtained stresses/bending moment were below yield strength/ultimate bending moment.

Table 7. *Summary of acceptance criteria*

Design name	(1) IEEE 693	(2) Yield strength	(3) Ultimate bending load
PA123a /PA145a	MODERATE	HIGH	HIGH
PV 123	HIGH	HIGH	HIGH
PVA123a /PVA145a	MODERATE	HIGH	HIGH

With respect to **IEEE 693 criteria** main conclusions are the following:

- PA123a/PA145a withstands Moderate seismic qualification level.
- PV 123 withstands High seismic qualification level.
- PVA123a/PVA145a withstand Moderate seismic qualification level.

Disclaimer

The analysis documented herein has been prepared in accordance with reasonable standards of scientific endeavor and the best knowledge of the author(s).

The simulation results may depend on a variety of factors, including quality of input data, applied model simplifications and chosen numerical methods.

6 BIBLIOGRAPHY

[1] **IEEE 693** – *IEEE Recommended Practice for Seismic Design and Substations*, The Institute of Electrical and Electronics Engineers, Inc, NY 10016-5997, USA

[2] ABAQUS, *ABAQUS 6.13 Documentation*, DS Simulia, USA, www.simulia.com

[3] *IEC* **61869-1** – *Instrument transformers – Part 1: General requirements*, International standard, Edition 1.0 2007-10

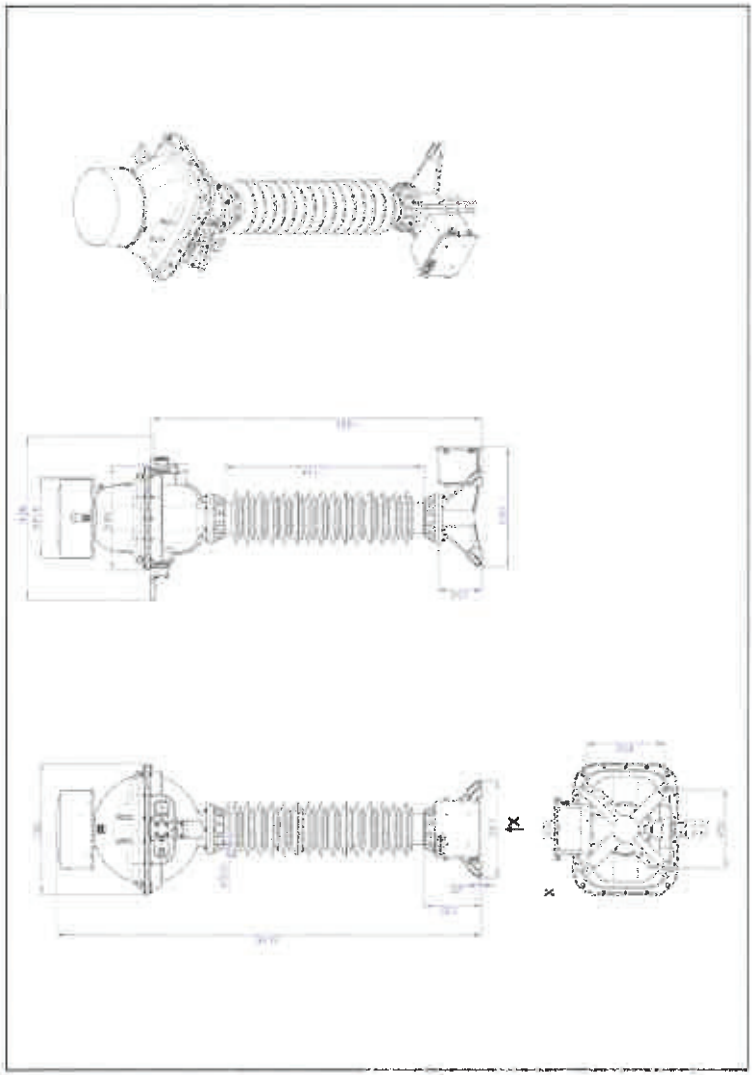
7 CHANGE HISTORY

Date	Revision	Author(s)	Change
2015-08-31	Rev. 1	Juszkiewicz Grzegorz	original document

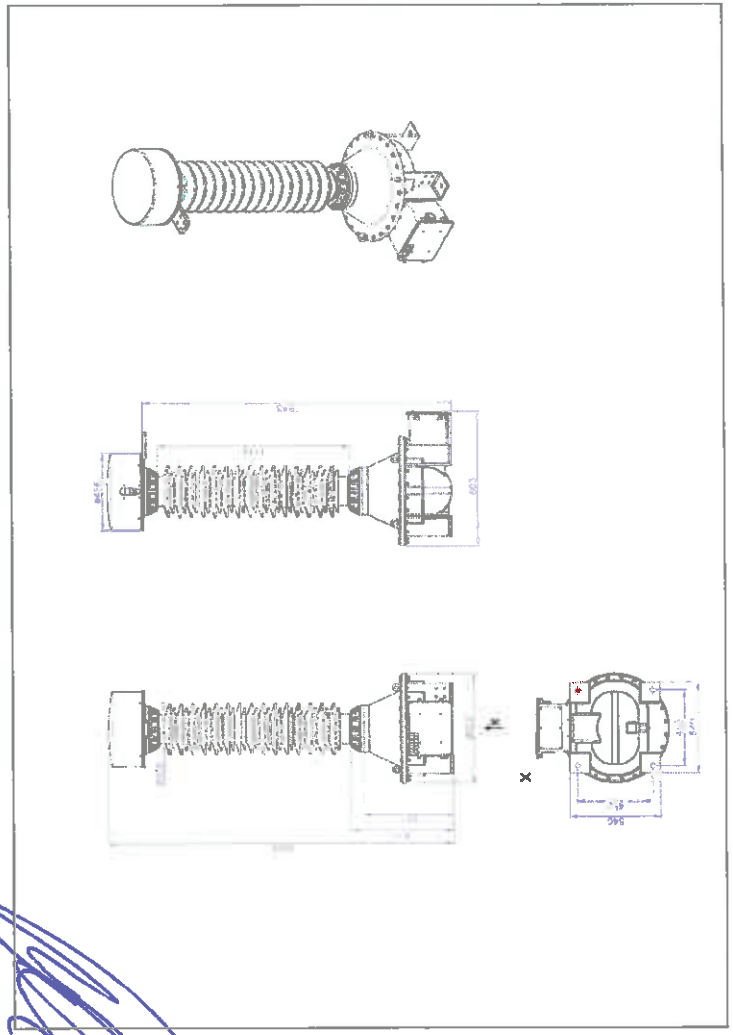
ABB	ZCCO Corporate Research	9ADB009045
Doc. title	Revision	Page
Seismic analyses of HV Instrument Transformers. IEEE 693- high (0.5g)/moderate(0.25g) seismic level	1.0	36/38

8 APPENDICES

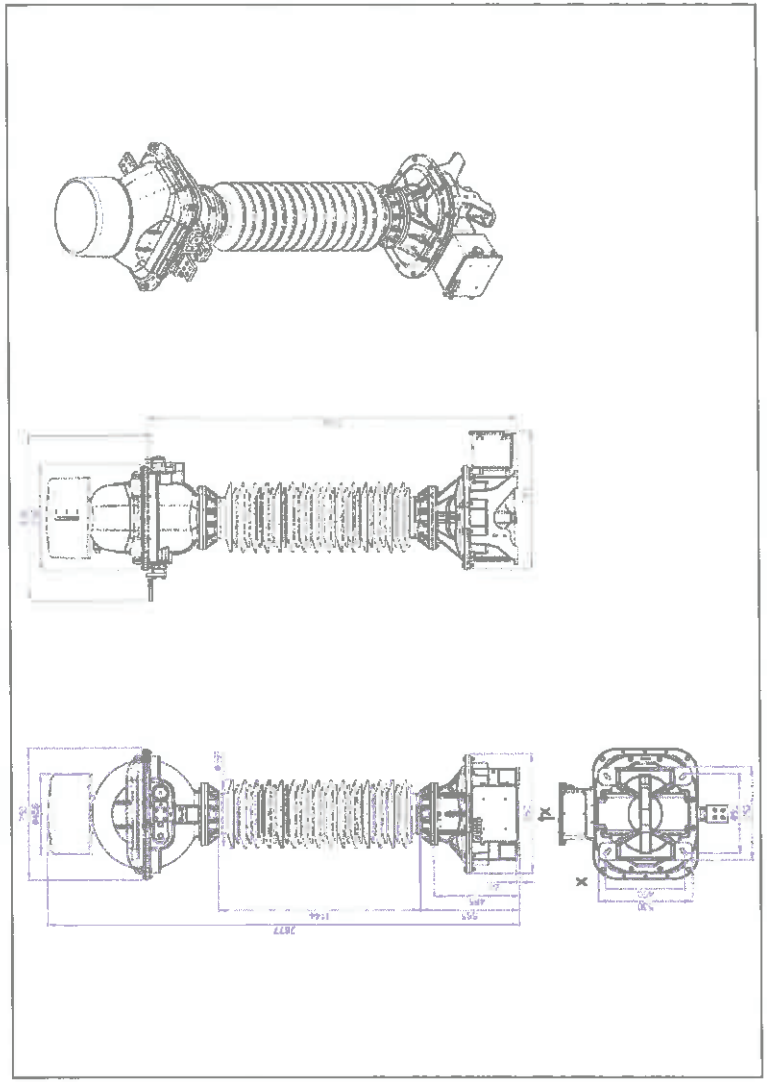
8.1 Current transformer PA123a /PA145a



8.2 Voltage transformer PV123



8.3 Combined transformer PVA123a /PVA145a



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.]

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
2,6-Di-tert-butyl-p-cresol	Acute LL50 >100 mg/l	Fish	96 hours
	Acute NOEL >100 mg/l	Algae	72 hours
	Chronic NOEL 10 mg/l	Aquatic invertebrates.	21 days
	Acute EC50 0.61 mg/l	Daphnia - Magna	48 hours
	Acute IC50 >0.4 mg/l	Algae - Desmodesmus Subspicatus	72 hours
	Chronic NOEC 0.316 mg/l	Daphnia - Magna	21 days

Conclusion/Summary: Harmful to aquatic life with long lasting effects.

12.2 Persistence and degradability

Product/ingredient name	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	-	-	-	-

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

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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.

Industrial

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.

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_{Msafe}) 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.

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 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_{Site}) 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), those 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)

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_{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.

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_{safe}) 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.

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)

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 CAS: 64742-54-7 Index: 649-467-00-8	0 - 50	Not classified.	
Lubricating oils (petroleum), C15-30, hydrotreated neutral oil-based	REACH #: 01-2119474878-16 EC: 276-737-9 CAS: 72623-86-0 Index: 649-482-00-X	0 - 50	Asp. Tox. 1, H304	[1]
Distillates (petroleum), solvent-refined heavy naphthenic	REACH #: 01-2119483621-38 EC: 265-097-6 CAS: 64741-96-4 Index: 649-457-00-3	0 - 5	Not classified.	
Distillates (petroleum), solvent-refined light naphthenic	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 split 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]* **Rozporządzenie Ministra Pracy i Polityki Społecznej (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.

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

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

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

Nytro Libra

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.

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, classifion as H304 (R65), these measures should be communicated via the safety data sheet by use of the following phrase: Do not ingest.

Nytro Libra | Manufacturer of substance- Industrial (Other Lubricant Base Oils, IP346<3%, H304)

Section 4 - Guidance to DU to evaluate whether he works inside the boundaries set by the ES

	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.

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_{Safe}) 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.

Nytro Libra | Uses in Functional fluids - Professional (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.

	Document type	Written by	Date	No of Pages
ABB	Recommendation	Piotr Mikulski	12th February 2016	2
	Address	Title		
	ABB Sp. z o.o. PGHV 59 Leszno St. 06-300 Przasnysz, POLAND	Recommended installation of PVA 123a, PA 123 and PV 123 transformers and requirements for the supporting structure.		

As a manufacturer of transformers, we only specify recommendations for installation and parameters of the supporting structure that can serve as a guide. The installation method and requirements for the supporting structure must take into account guidelines specified by the transmission system operator, where the transformers will operate.

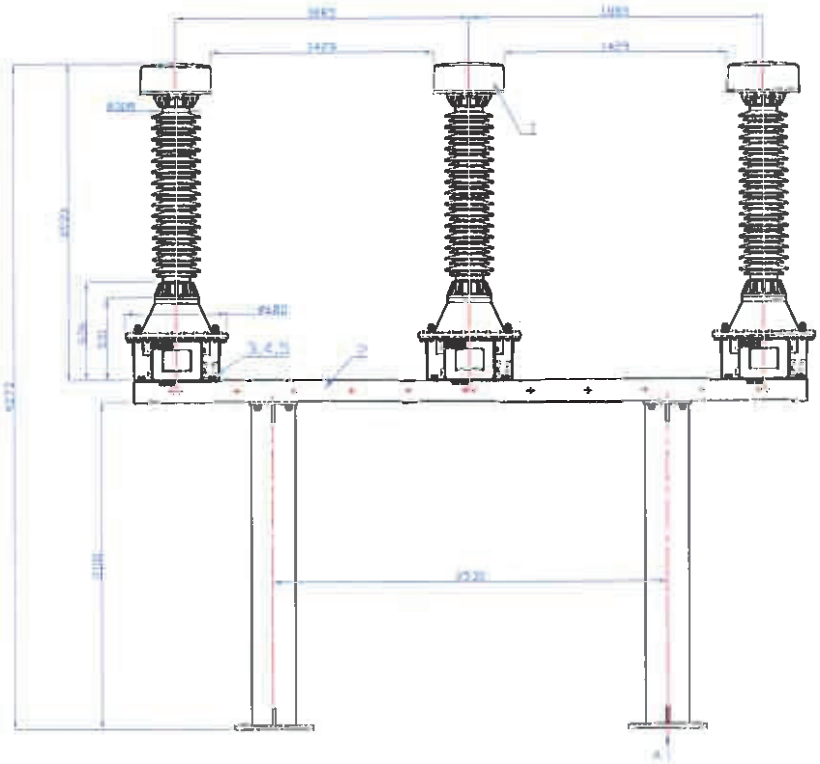
Requirements for the parameters of the supporting structure are presented in IEC 61936-1 "Power installations Exceeding 1 kV a.c. — Part 1: Common rules" and regarding seismic events we recommend you to take into account point 4.4.3.5 "Vibration" of the standard.

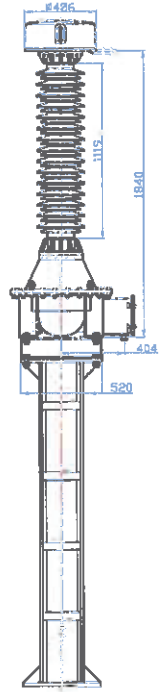
Regarding the installation of transformers on a supporting structure you need to follow the notes included in the operation and maintenance manuals for individual transformers.

Fixing holes distance in the transformers we offer is 450 x 450. The fixing holes are shown in the matrix drawings of transformers.

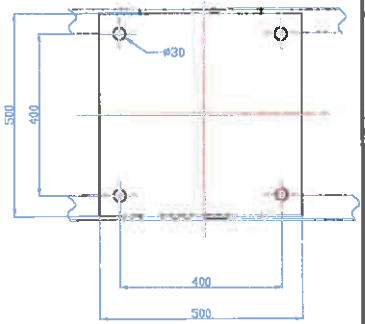
To install PVA 123a transformers we recommend you to use M16 or M18 mounting screws (fixing holes Φ19) and to install PV123 and PA 123 transformers — M20 mounting screws (mounting holes Φ24).

Example of drawing with mounted PV 123 transformers is on the next page.





Widok/ View A
Skala/Scale 1:10



Poz./ Item no.	Nazwa materiału/ Name of the article	Indeks materiału/ No. of the article	J.m./ Unit	Ilość na jeden zespół– Qty. per one assembly
5	M20 pad 200HV steel hot-dip galvanized	DIN 125 A	unit	24
4	M20 nut 8.8 steel hot-dip galvanized	DIN 934	unit	12
3	M20 x 30 screw 8.8 steel hot-dip galvanized	DIN 933	unit	12
2	Supporting structure for transformers	2GKK314330A0001	unit	1
1	PV 123 voltage transformer	----------	unit	3
				A0001 –

								bez malowania/ without painting	–	–	–	–	–	A0001
Materiał: /Material:								Malowanie:/ Painting:	A	B	C	D	E	Wyk.:/Exec.:
c							e							
b	2GKZ920289	02.03.15	P. Mikulski	27.02.15	d									
Zm.:/ Rev.:	Nr zm.:/No.	Ważna od:/ Valid from:	Wprowadził/ Inserted by:	Data:/Date:	Zm.:/ Rev.:	Nr zm.:/No.	Ważna od:/ Valid from:	Wprowadził/ Inserted by:	Data:/Date:					

Konstruował: Prepared by:	G.Baczek	Data: / Date: 22.10.2014	Zastępuje rys. nr:/Replacement of: ----------	Zastosowanie/Application: ----------	Size: A3
Sprawdził: Checked by:	P.Mikulski	Data: / Date: 22.10.2014	Grupa:/Name of firm:	Tytuł:/Title: PV 123 with supporting structure	
Zatwierdził: Approved by:	J.Duzdowski	Data: / Date: 31.10.2014	Masa/Mass:		Language PL/EN
Wersja:/Revision: B	Dział odpowiedzialny/ Responsible department: PPHV	Dział przełożony/ Head of the Department:	Podziałka:/Scale: 1:26	Nr dokumentu/Document no.: 2GKV314016	Sheet nr. 1
ABB	ABB Sp z o.o. Power Products				No. Shts. 1

High Voltage Products

PV 123 voltage transformer
Installation and operation manual

Your safety first!

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

- Use the transformer for its intended purpose.
- Observe the technical data given in the rating plate and in the specification.
- To facilitate and ensure high quality standards, the installation should be carried out by trained personnel or supervised by the service department of ABB.
- Operations have to be carried out by specially trained electricians who are familiar with the following instructions.
- It is recommended to observe the standards (DIN VDE/IEC) and local H&S regulations as well as the requirements of the local electric authority.
- Transformer work should be changed over in accordance with the instructions in the manual.
- All documentation should be available to all persons involved in installation, maintenance and operation.
- Operating 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) standard. It pertains to ensuring a dead state at the site of works carried out on a 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

Important information

This manual is intended to explain the mode of operation and installation of the product.

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

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

For your own safety:

- Make sure that all installation, service and maintenance works are performed by professionals.
- Make sure that during all the phases (installation, service, upkeeping) all applicable regulations will be preserved.
- Ensure that the guidelines contained in this manual are followed.

Basic guidelines for this manual.

Read the relevant chapters of this manual to provide adequate operation. Chapters are marked according to their significance.

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

Table of contents

PV 123 voltage transformer

1. Introduction

The manual covers PV 123 overhead inductive voltage transformers. Those instrument transformers are used for feeding measurement and protection systems in power networks of 123 kV highest system voltage or lower (the greatest effective value of phase-to-phase voltage) and 50 Hz frequency. They are designed either to operate in grids with effectively earthed or insulated neutral points or in compensated networks.

2. Transformer delivery

Typically the transformers are delivered in bulk packaging (3 pcs) where they are stacked vertically. The packaging is in the form of a complete crate or just the base. The delivered transformers are fully assembled, tested and ready for direct use. Product testing protocols are delivered together with the transformers.
Immediately after delivery, check whether the transformer has not been damaged during transportation. Check the transport packaging. Damaged packing may point out to careless handling of the transformer. Next, check the transformer itself. Special attention should be paid to possible damage of sheds and binder at insulator flanges, to the tightness of the transformer and the correct oil level indication in the device.
One should ensure that technical parameters of the transformer given in the rating plate are in accordance with the parameters given when submitting the order and in accordance with the design documentation parameters.
Any damage found or other error should be immediately notified to the manufacturer, and if appropriate, the carrier. Sending photos of damage will be helpful in its assessment.

3. Transportation, unpacking, lifting

Transformers should be transported in a vertical position. Horizontal transport is not possible.
Transformers should be lifted with a crane with appropriate load capacity using four slings of the same length (min. 3 m). Hooks should be placed in designated holders in the bottom tank cover.

4. Storage

Transformers should be stored in the vertical position on a levelled and hardened surface, preferably in the original packaging.
In the case of long-term storage, it is recommended to protect contact surfaces against corrosion.
Transformers can be stored in the open air for up to two years. If this period is exceeded, it is recommended to place transformers in a well-ventilated room or under a roof, and to insert silica gel or another moisture absorbent into terminal boxes.

5. Installation

The support structure should be flat and horizontal. Levelling correction can be performed using distance washers, placing them between the transformer and the structure. Observe the notes given in item 3 while shifting the transformer. It should be fastened to the structure with screw elements of an adequate size. 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 energizing (if it was tilted for any reason).

5.1. Earthing terminals

Two earthing terminals are found on the bottom tank of the transformer across its diagonal. Prior to connection, the contact surface of the terminals should be thoroughly cleaned from oxide layers 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 with stainless bolts.

5.2. Primary terminal (A)

Primary terminal (A) is located on the plate located on the transformer isolator.
The contact surface of the primary terminal should be even and cleaned from the oxide layer before connecting.
To a terminal prepared in such a way the line cable terminals should be tightened with M12 bolts (stainless bolts are recommended).

Primary connections should be made in such a way so as to minimise mechanical static loads of the transformer terminal. It is recommended to use flexible elements as rigid connections may cause damage of the transformer. The maximum allowable static load on a transformer terminal is equal to 3,600 N in any direction. Also, it is recommended to maintain the sum of the loads acting on the primary terminal during normal operation of the transformer below 50% of such a value.

5.3. Secondary terminals

Secondary windings are connected to terminal blocks placed in the terminal box on the bottom tank of the transformer. These are typically Phoenix ST spring connectors with terminals adapted to connection of cables of cross-section up to 10 mm^2 or up to 6 mm^2. Each terminal is described in accordance with winding markings given on the rating and schematic diagram plates. Yellow-green terminals (with the earthing mark) are intended for earthing secondary windings with the use of pushed crosswise bridges. The crosswise bridge can be removed with a screwdriver, by inserting it in the slit and levering. Apart from secondary terminals, there are two additional terminals in the terminal box.

voltage coil screen terminal (E)

primary winding terminal (N)

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

A rating plate is placed on the external side of the door, while the schematic diagram plate is placed inside.

In the bottom wall of the terminal box, there is a plate with openings for glands for secondary circuits' connection cables. In the typical execution, they are two M32 glands with the choking range of ⌀11 mm – ⌀21 mm.

An example of a terminal box for secondary windings of the transformer is shown in Figure 1.

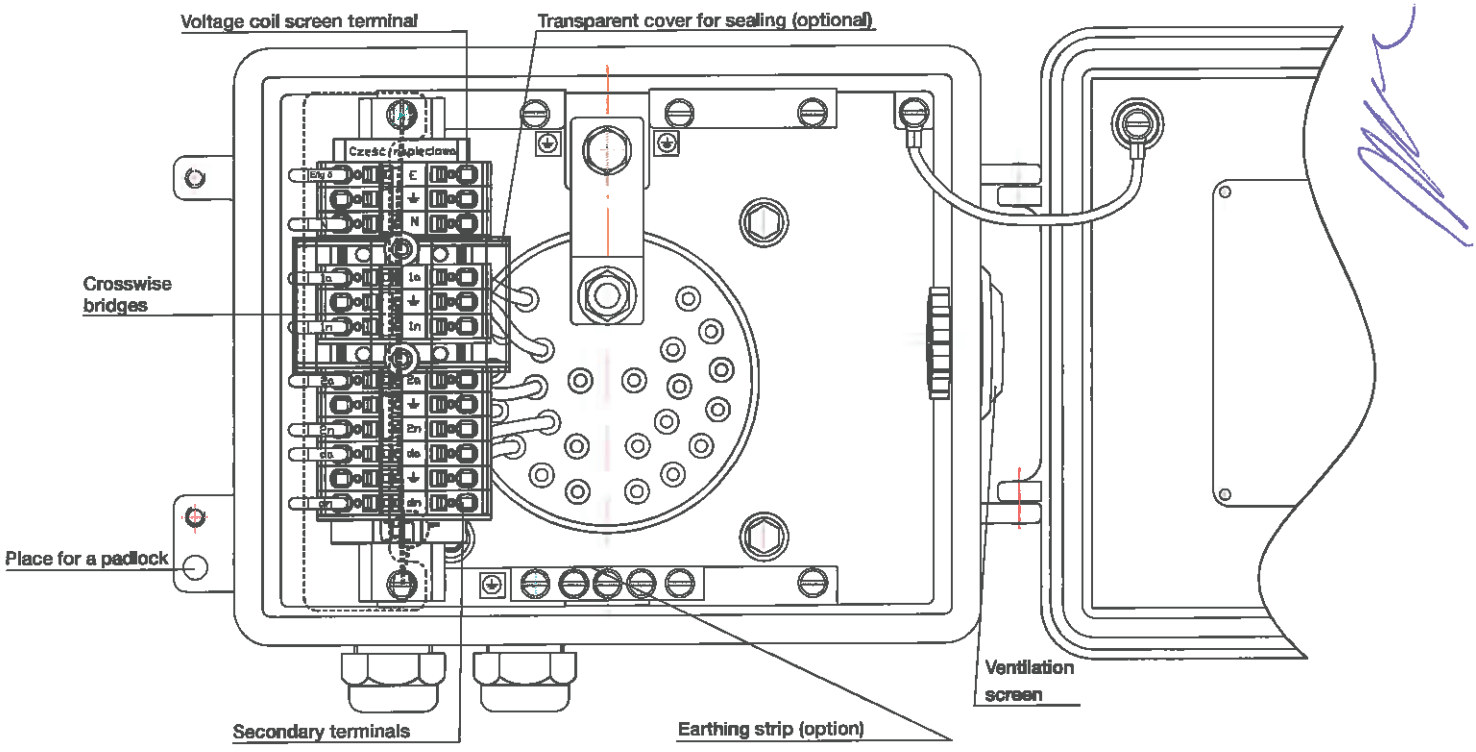


Fig. 1. Example of a terminal box

Connect external circuits to secondary terminals of the voltage module of the transformer pursuant to the design documents and wiring shown on the schematic diagram plate.
The screen terminal (E) and the primary winding (N) terminal of the voltage coil shall be earthed with crosswise bridges with the neighbouring earthing connector during normal transformer operation.
Connectors inside the terminal box are arranged so that, when using crosswise bridges, earthing is possible for any secondary terminal of a given winding. The unused secondary windings shall remain open and its "end" marked as "..n" should be earthed with a crosswise bridge.
In PV 123 type transformers, the chokes on all secondary windings are constructed of copper wire Cu-ETP of the diameter of 1.2 mm and length of 50 mm. The chokes are installed in the conductors running out of the resin bushing downstream the terminal block located in the transformer box.
The chokes protect the transformer against damage in the case of shorting of the transformer secondary terminals. This type of protection is sufficient to protect the transformer at a short section to the nearest point in which proper protections are installed. Additional fuses in the transformer terminal box are not necessary.
If a short circuit has occurred and this type of protection has been activated, the choke must be replaced.

NOTE:
Secondary terminals of the transformer shall never be shorted.
Residual voltage windings marked as "da-dn", used to connect three transformers in an open delta to adjacent phases, should be grounded in one point only (in one of three transformers). Earthing of "da-dn" windings connected in such a way in more than one point will cause shorting and may lead to damage of the transformer.

5.4. Ferroresonance phenomenon

The PV 123 transformers are resistant to ferroresonance in a wide range of capacitance to earth and of control capacitors used in circuit breakers. However, in the case of networks for which these phenomena occurred before or network configurations being particularly sensitive to such phenomena (e.g. with long cable lines), it is recommended to use an additional damping resistor with a value of 50–60 ohms and power of 200 W, connected in the open delta circuit of three da-dn transformer windings.

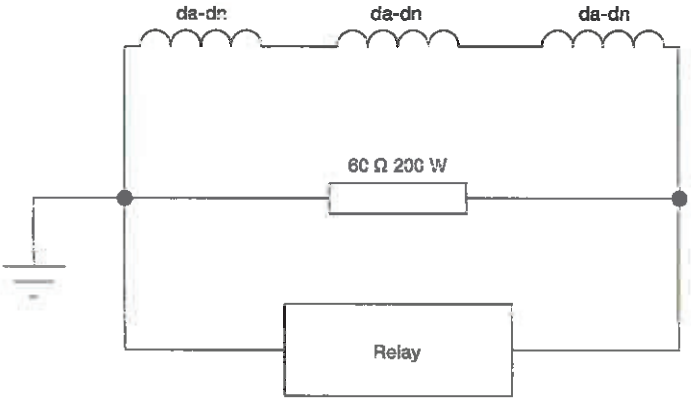


Fig. 3. Schematic diagram of a resistor in the open delta circuit

6. Bolt tightening torques

Primary terminal bolts M12	80 Nm
Bolts fastening the transformer to the support structure	280 Nm

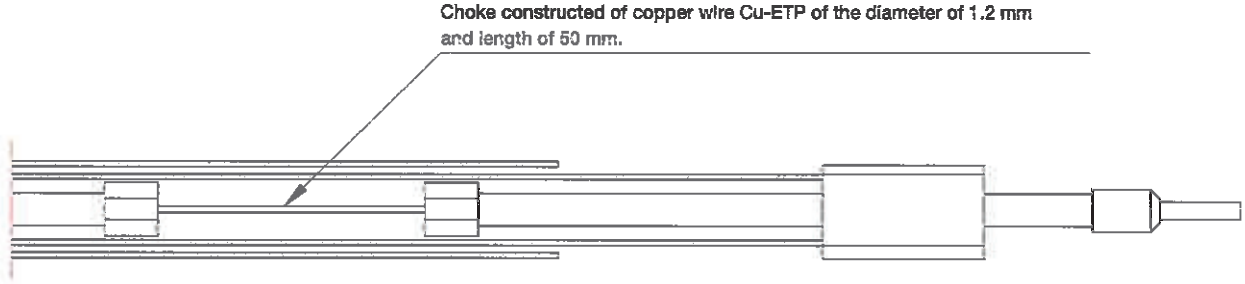


Fig. 2. Secondary winding

7. Operation and maintenance

NOTE:
Voltage transformers are HV equipment, hence appropriate safety precautions shall be observed during their operation.
The metrological range of the transformer is guaranteed exclusively in the field determined by the applicable standard on the basis of rated data. The standard is given on the rating plate of the transformer. The metrological range of the transformer is also shown in the record of the test of product, which is supplied with the transformer. Metrological values of the transformer are not guaranteed in any way beyond this field.

7.1. Operation

Transformers do not require special servicing. Visual inspection is usually sufficient. The check-list is placed at the end of this manual.

Visual inspection:
Visual inspection should be based on:
- position of the oil level indicator,
- tightness of the transformer,
- lack of mechanical damage,
- condition of the insulator and binder connecting the insulator with flanges.

Occasionally, check the tightening degree of the primary terminal.

The transformer tightness is a particularly important criterion as in the case of oil leaks moisture can penetrate the device. Small insulator damage may be repaired on site.

Oil level indicator:
Changes of the position of the oil level indicator depend on oil temperature in the transformer. The position of the indicator should be in the green field range. Shifting of the indicator to the upper or bottom red field points out to incorrect transformer operation. In such a case, the transformer should be put out of service, and the manufacturer should be contacted.

On the top of the transformer a stainless steel expansion bellow (1) is placed, used for compensation of oil volume thermal changes in the transformer. The oil level indicator (2) is placed on the upper surface of the bellows. The bellows are placed in a metal cover (3) equipped with a view-finder (4). Cover removal does not result is unsealing of the transformer. The whole compensation system is shown in Figure 4.

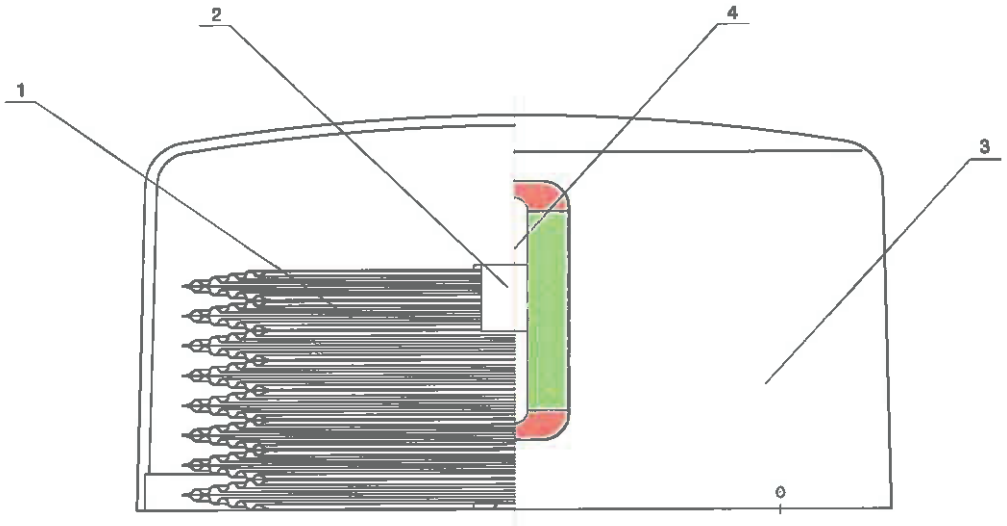


Fig. 4. Construction of the compensation system

Position of the oil level indicator	Interpretation
Indicator in the green area	Correct transformer operation
Indicator on the upper red field	Oil pressure too high Transformer over heating Oil gasification (insulation failure) Further inspection necessary
Indicator on the lower red field	Oil level too low Suspicion of oil leakage (moisture may penetrate inside) Further inspection necessary

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

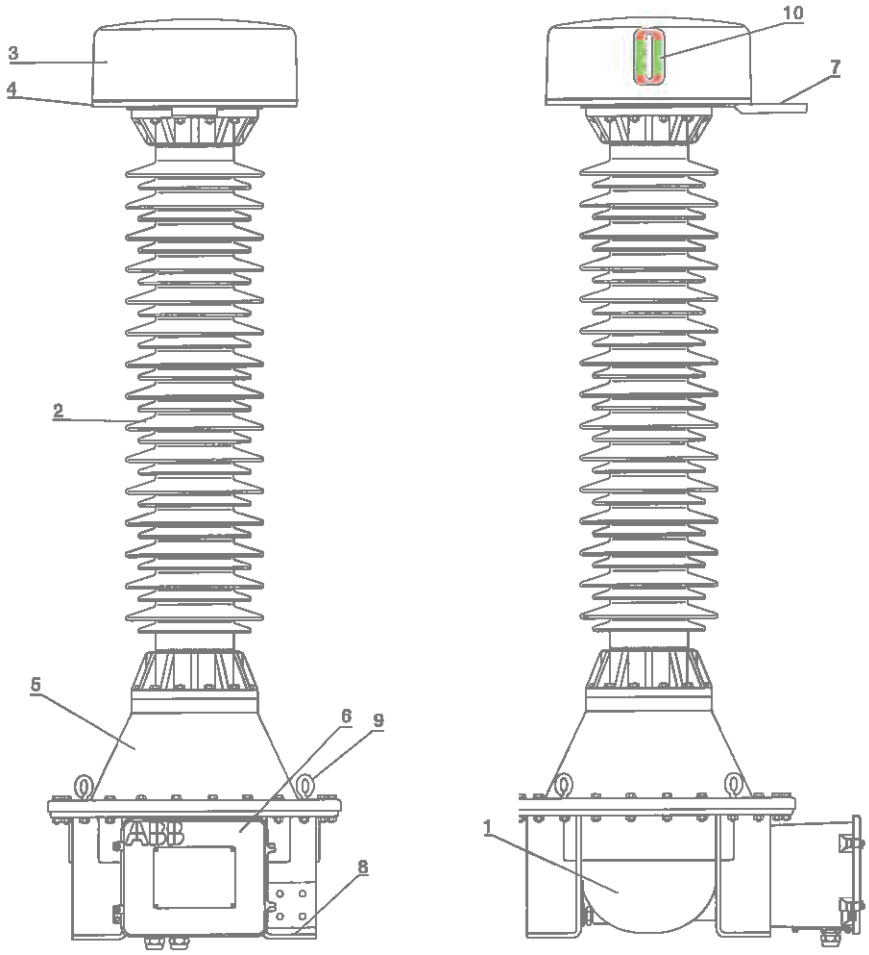
Measurement of the dielectric loss factor tg δ:
During measurement of the dielectric loss factor tg δ, the measuring bridge should be connected to the correct terminal marked with an E.
One should remember to earth it after performing the measurement. Usually, the test voltage should equal 10 kV RMS, and it should be applied across transformer primary terminal A and earth.

Oil sampling:
Due to the fact that transformers are air-tight, they do not require periodical oil checking. Oil used in the transformer meets the requirements of the PN-EN 60296 (IEC 60296) standard.
It is recommended to check the oil after 15–20 years of operation or after a non-conformity state if there are suspicions as to transformer efficiency.
Contact the manufacturer in order to obtain necessary instructions concerning oil sampling. If oil samples are taken during the guarantee period without the manufacturer's permission, the device loses its guarantee.

7.2. Corrosion protection
External elements of the transformer casing are made in the form of aluminium alloy casts, resistant to corrosion. Casts can be unpainted or painted. Typical colours in the case of painted casts include light-grey (RAL 7035) or grey-green (RAL 7033). While remaining metal elements, such as bolts, are made of stainless steel.

8. Transformer construction
PV 123 type voltage transformer comprises a voltage coil in a tight enclosure filled with transformer oil.
On the coiled, cut apron magnetic core, concentric secondary windings and the primary winding are located. Multilayered primary winding is insulated using transformer oil impregnated electrical grade paper. The distribution of stresses in the paper insulation is capacitor controlled. The core with windings is located in the lower tank.

The transformer primary insulation constitutes electric grade paper dried at a high temperature and high vacuum impregnated with transformer oil. The free spaces inside the transformer are filled with transformer oil.
External insulation comprises a hollow insulator made out of electrical porcelain with brown enamel or a glass reinforced plastic (FRP) tube coated with grey silicon rubber.
The seals in the transformer are of the o-ring type, and they are made of NBR oil-resistant rubber.
If calibration of measuring windings has been performed, additional respective markings (designations) have been placed on the transformer and the rating plate (where required).



1. bottom tank
2. hollow insulator
3. compensation bellows
4. bellow plate
5. voltage coil
6. secondary coils terminal box
7. primary terminal (A)
8. openings for fastening the transformer
9. holders for lifting the transformer
10. oil level indicator

Fig. 5. PV 123 voltage transformer

9. Disposal

During correct operation and when no mechanical damage occurs, the transformer should operate over 30 years. Once this period of time has expired or if operation is no longer required, it is recommended to dispose of the transformer.

Primary materials used in the transformer:

Item	Material	Quantity [kg]
1	Copper (Cu – ETP)	10
2	Aluminium alloy AC-Al Si10Mg (Cu)	40
3	Steel	20
4	Transformer plate	50
6	Mineral transformer oil	50
7	Electrical grade paper	25
8	Solid insulation materials (epoxy resin, bakelite paper)	5
9	Porcelain	80
10	Composite insulator	20

Item 9 and 10 alternatively.

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 manner by which the transformer should be recycled and disposed is defined in the Waste Act of 14 December 2012, published in Journal of Laws, 2013, item 21, as amended.

10. Check list

10.1. Before 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 packing 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 performed connections	C	Performed connections are reliable and in accordance with the design

10.2. After 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 depends on local practices)	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 Respective terminals are marked as: E/tg δ
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 final location
B	After unpacking
C	Directly before applying voltage
D	During routine inspection in accordance with the schedule determined for the station
E	After 15–20 years or inspection of efficiency after the non-conformity state if there are suspicions as to transformer efficiency

11. End

For additional information concerning the operation and maintenance of PV 123 transformers, please contact the transformer manufacturer.

Notes

For more information, please contact:

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

ABB Sp. z o.o.
Branch Office in Przasnysz
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06-300 Przasnysz
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Fax.: +48 22 22 38 958

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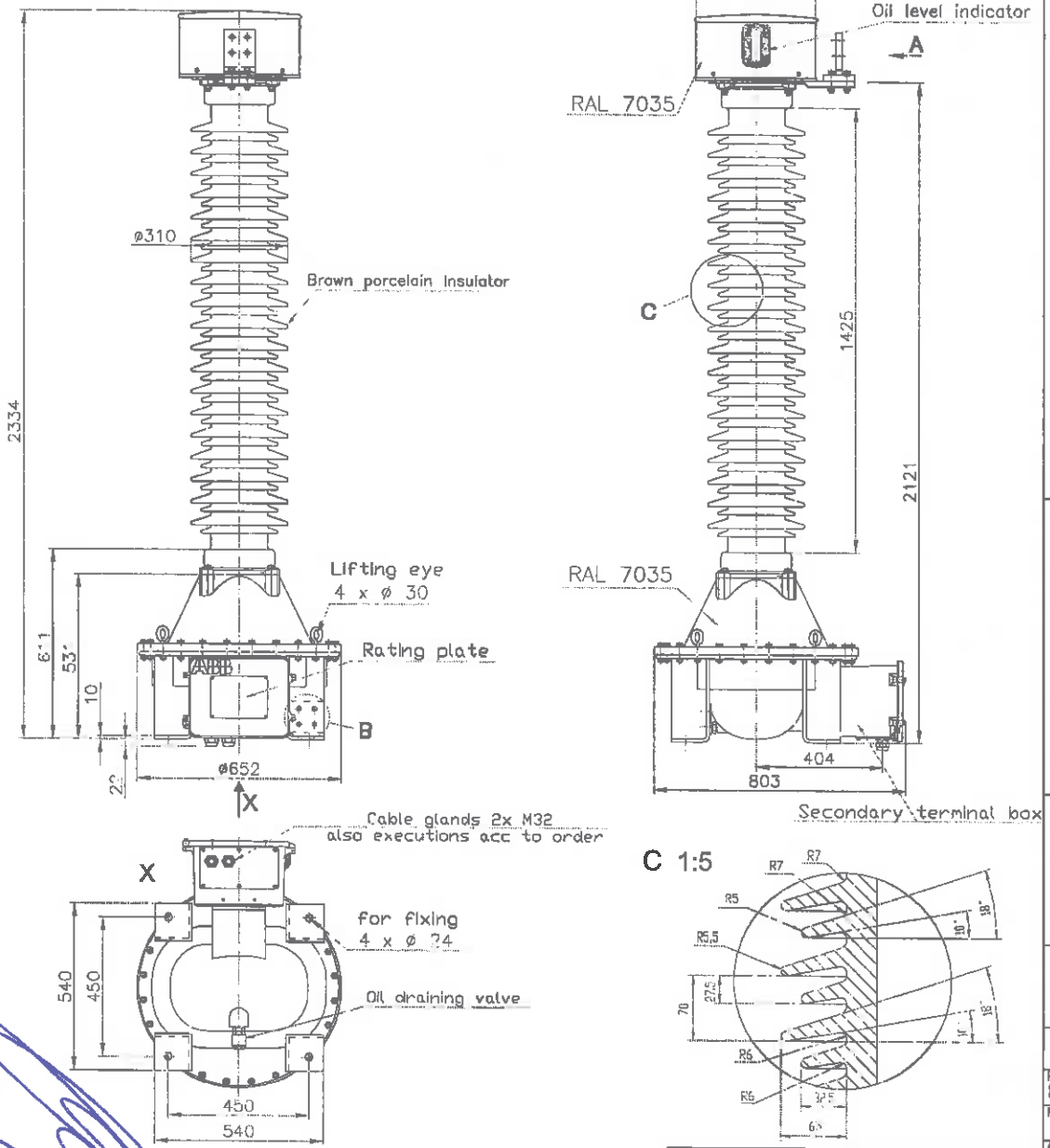
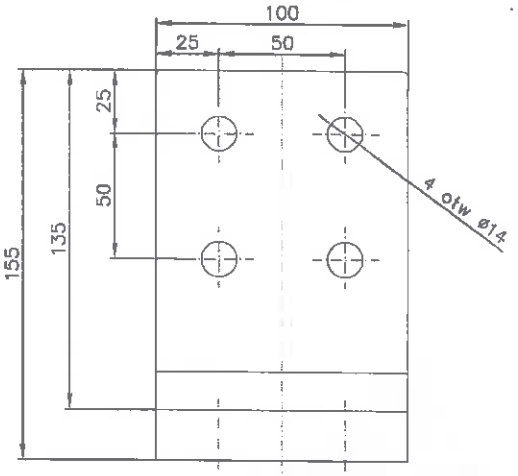


All dimensions in mm

Primary terminal Al

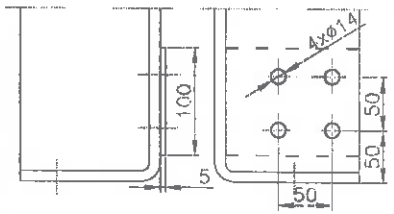
DIN 46206-3 F1

A

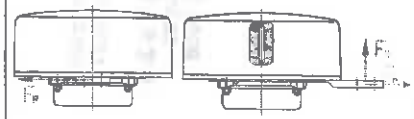


Earthing terminals

B



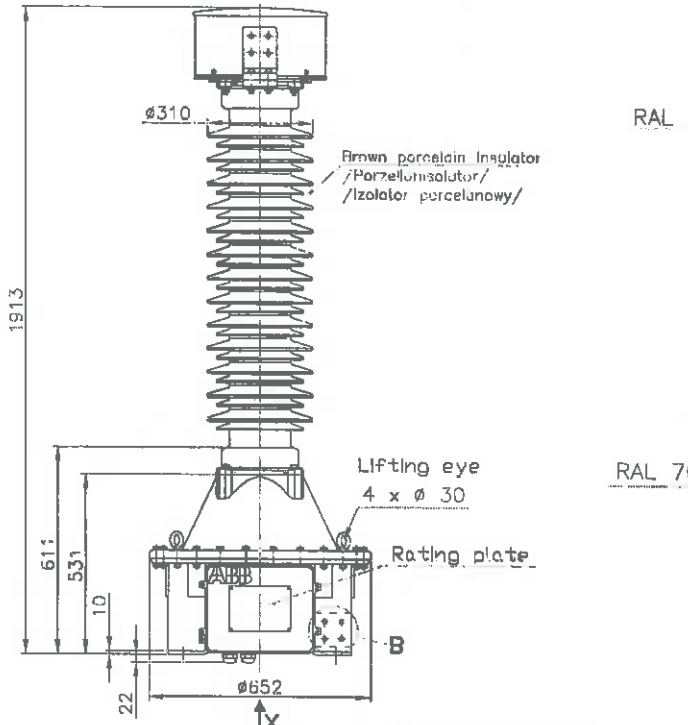
Mechanical load

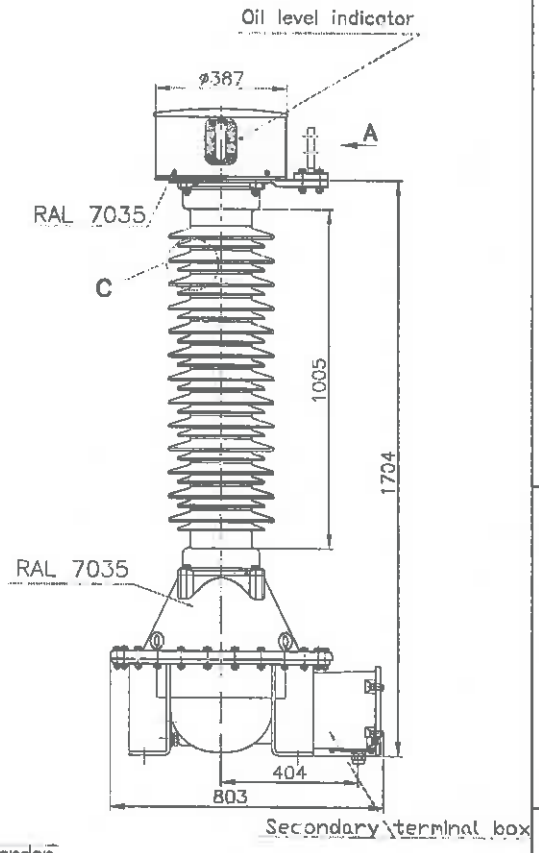


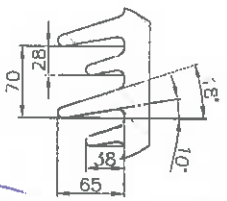
Maximum operating voltage	(kV)	123
Total weight	(kg)	310
Insulating oil amount	(kg)	60
Wind pressure surface	(m²)	0,5
Creepage distance	(mm)	4250
Mechanical load:		
F_R - Static load	(kN)	2
F_R - Dynamic load	(kN)	2,8
Standard		IEC 61869-3

Prepared P.Mikulski	Date 11.02.2016	Replacement of	Scale 1:15	Size A3
Modified by	Date	Responsible department PPHV	Title Dimensional drawing Voltage transformer PV 123	Language EN
Approved by J.Duzdowski	Date 11.02.2016	Take over department		Sheet no 1
Revision B				No. Shts 1
ABB	ABB Technology Ltd		Document no. 2GKV614615A1319	

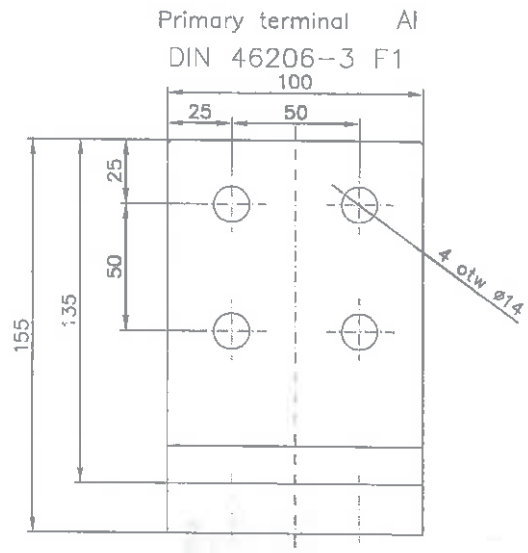
Заличено по чл.2 от ЗЗЛД

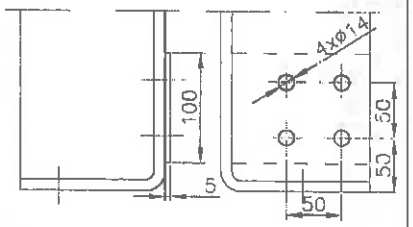


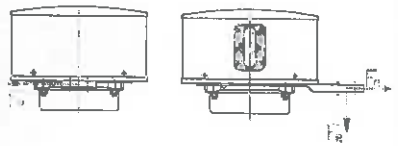




All dimensions in mm







Maximum operating voltage	(kV)	123
Total weight	(kg)	285
Insulating oil amount	(kg)	60
Wind pressure surface	(m^2)	0,5
Creepage distance	(mm)	3075
Mechanical load:		
F_R – Static load	(kN)	3,6
F_R – Dynamic load	(kN)	5,0
Standard		IEC 61869-3

Prepared P.Mikulski	Date 11.02.16	Replacement of	Scale 1:5	Size A3
Checked by	Date	Responsible department PPHV	Title Dimensional drawing Voltage transformer PV 123	Language EN
Approved by J.Duzdowski	Date 11.02.16	Take over department		Sheet no 1
Revision A				No. Shts 1
ABB	ABB Sp. z o.o. Power Products		Document no 2GKV614615A1320	

Заличено по чл.2 от ЗЗЛД

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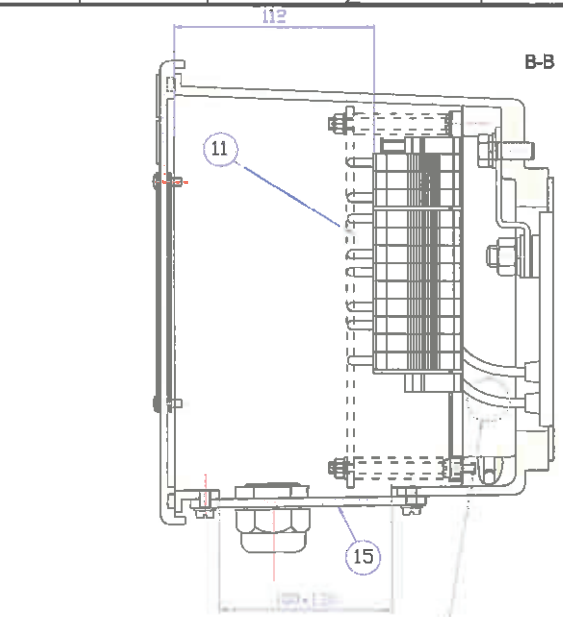
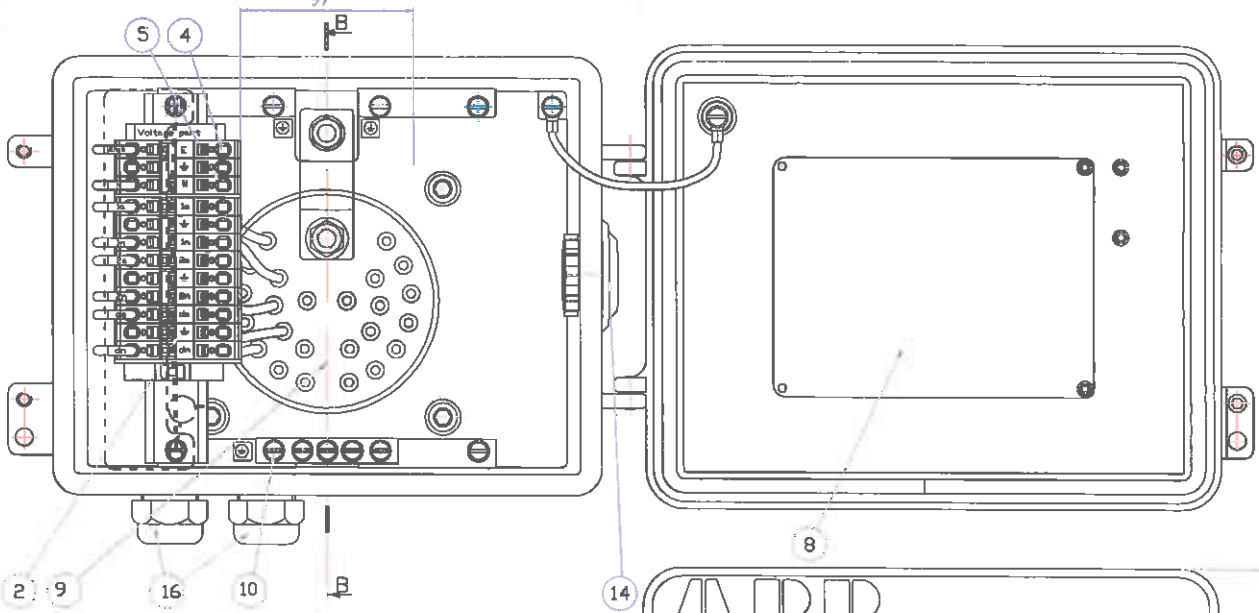
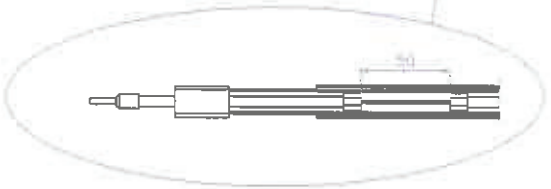
(16)







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, da cable outlets.

Other types / executions of secondary terminals – on request.

1. ----------
2. Voltage secondary terminals [Phoenix terminals ST-10 type]
3. ----------
4. Voltage coil screen terminal "E/tg δ" [grounded during normal operation]
5. Voltage coil primary winding terminal "N" [grounded during normal operation]
6. ----------
7. Rating plate
8. Schematic diagram plate
9. Resin bushing
10. Grounding terminal
11. One-sided cover for feed-through terminals with ability to seal – all secondary terminals are accessible to the user
12. Screws used for sealing of terminal box
13. Locking [for padlock]
14. Ventilation valve
15. Cable panel [detachable]
16. Cable gland M32 [cable diameter from 11 to 21 mm] – 2 cable glands

Dimensions are given in mm.

Prepared P.Mikulski	Date 17.08.2015	Replacement of	Scale 1:3	Size A3
Modified by	Date 17.08.2015	Responsible department PPHV		
Approved by J.Duzdowski	Date 17.08.2015	Take over department		Language EN
Revision A				Sheet no. 1

Secondary terminal box of voltage instrument transformer

ABB Sp. z o.o. Power Products

Document no. 2GKV614012/KU 1319_15

No. Shts. 1

Power and productivity
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Списък на всички използвани стандарти при конструирането и изпитванията

ЕСО ЕАД, гр. София 1404, бул. „Гоце Делчев", №105
Процедура за възлагане на обществена поръчка с предмет:
„Доставка на измервателни трансформатори за напрежение 110 kV",

Обособена позиция № 2 „Напреженови измервателни трансформатори 110 kV"

Предложените напреженови измервателни трансформатори 110 kV тип PV, отговарят на следните стандарти:
- IEC 61869-1
- IEC 61869-3

Заличено по чл.2 от ЗЗЛД

Заличено по чл.2 от ЗЗЛД

Дата: 18.02.2016 г.
София

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IBAN: BG13INGB91451000027317 (BGN)
IBAN: BG60INGB91451400027311 (EUR)
BIC: INGBBGSF