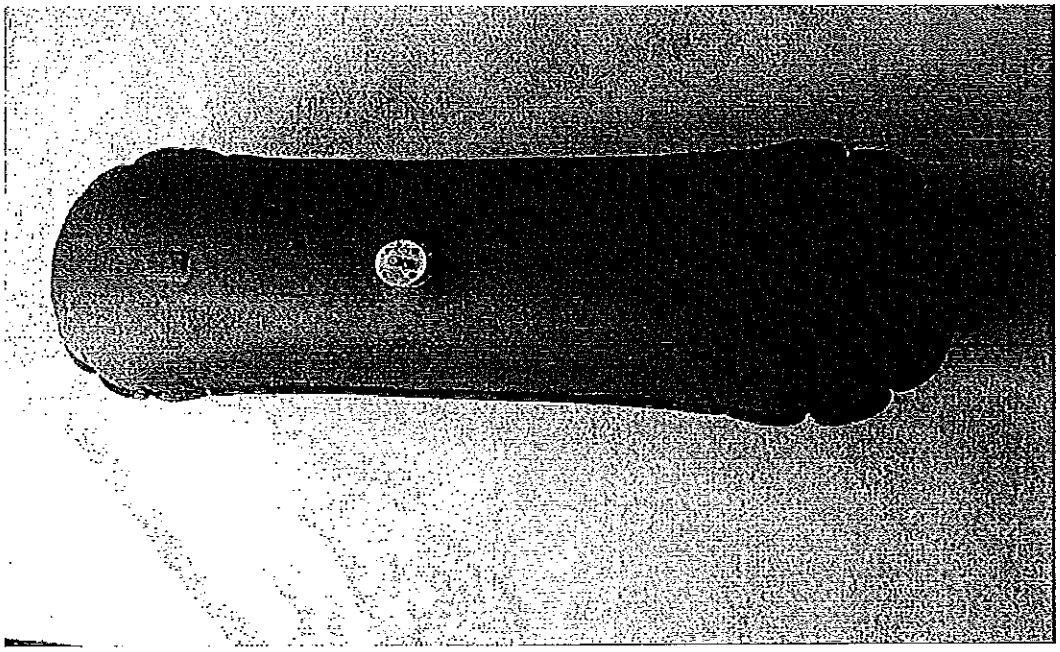
Musthane

Technical intelligence for flexible forces

RUBBER AIR CELLS
for oil preservation system of
Power Transformer



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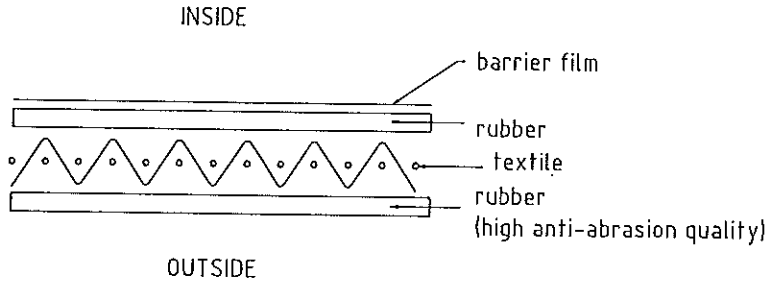
TECHNICAL INFORMATION
for standard oil conservator
(cylinder shape)

Material :

Nitrile rubber (NBR) on oil and air side, with textile reinforcement on Polyamid high tenacity (annexe 1 – DOC/COM/010)

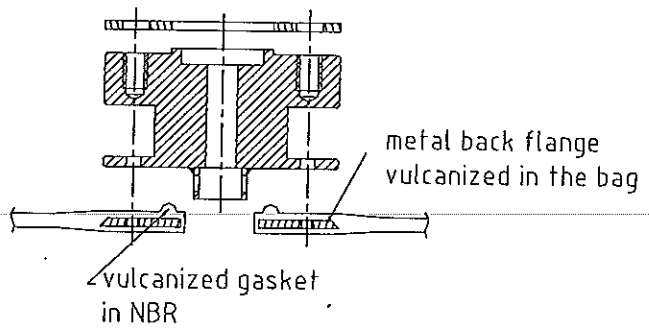
The internal faces of the rubber air cell are coated with a barrier film. This film is vulcanized with the internal rubber in one operation. This barrier improves the life time of the product (Better ozone resistance) *



Flange :

The gasket between the rubber air cell and the flange is directly vulcanized in one operation. This procures a better quality in leakness avoidance. That also means that this gasket is made with the same material than the rubber air cell , can not pollute the oil, can not be forgotten and is guarrantied during all the life time of the product.

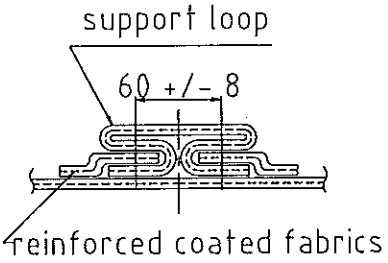
Example of flange :



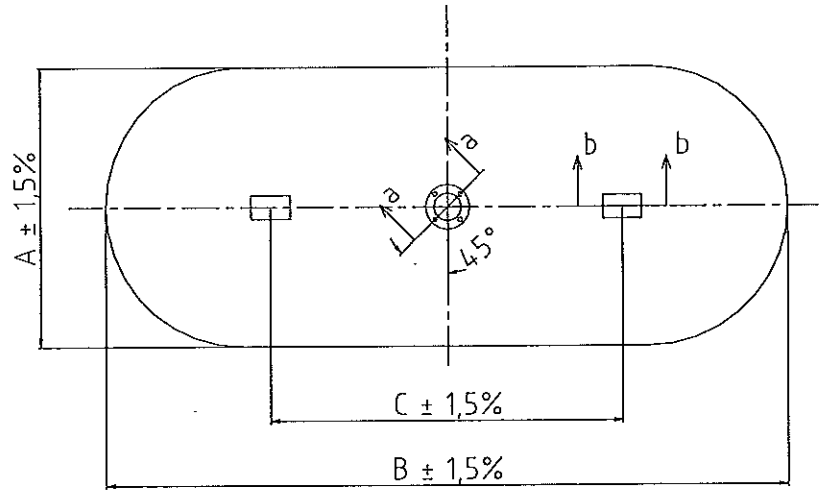
This barrier film could be optionnal depending on the customer specifications

Fixation loops :

The loops are manufactured with a reinforced coated fabric which avoid a possible tear.

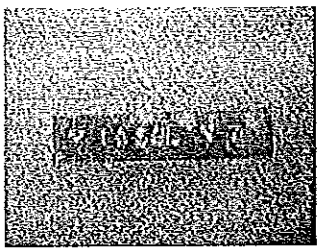


b-b



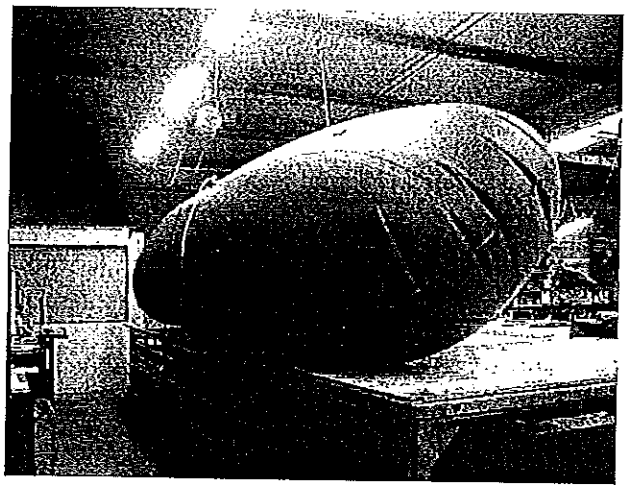
Identification :

Each rubber air cell is manufactured with our company name and our serial number, with no additional label. It is printed directly in the rubber in order to avoid all risk of oil pollution. We do not recommended the using of sticker or heat welding label which could not be in accordance with ASTM D974, D877, D924 and D1500.



Test :

All rubber air cells are tested before shipment :
- a leakage test with a least 0.2 bar during 1 hour
- a visual test with soap of the assembly

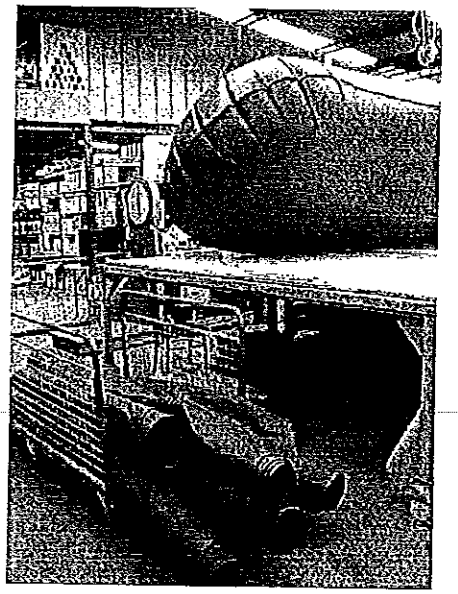


Test report :

All air cells are delivered with a routing test report that means that 100 % of our air rubber cells are tested before shipment. (annexe 2 – DOC/ATE/029)

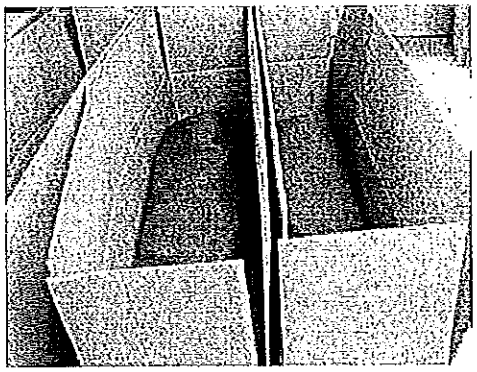
Cleaning :

Each rubber air cell is cleaned before shipment in order to be used directly in the oil conservator. After the tests, the rubber air cell is transported in specific wagons.



Packing :

Rubber air cells are delivered in a reinforced carboard box
Sizes : 1500 X 300 X 400 mm (annexe 3 / drawing MF0522-00)
The instructions for the installation and a test report are sent with the rubber air cell
(annexe 4)



MUSTHANE	Visa	DOC/COM/010
	Mis à jour le :	22/02/01

FICHE TECHNIQUE TISSU ENDUIT POUR EQUILIBREURS
TECHNICAL DATA SHEET CONCERNING FABRICS COATED FOR BLADDERS

Support textile : *Basic fabric :*	Polyamide haute tenacité Polyamid high tenacity			
Gommage extérieur *External coating*	DP18 (Nitrile rubber)			
Gommage intérieur : *Internal coating :*	DP18 (Nitrile rubber)			
Epaisseur *Thickness*	NFG	mm		0,9 +/- 0,1
Masse surfacique *Surfacic mass*	NFG 37102 FSTM 191/5041	g/m²		950 +/- 130
TESTS ***TESTS***	**NORME** **STANDARD**	**UNITE** **UNIT**		**RESULTAT** **RESULT**
Résistance à la rupture *Tensile strength*	NFG 37103 ASTM D 751/B FSTM 191/5102	daN/5cm	CH WP TR WF	>=300 >=300
Allongement à la rupture *Elongation at break*	NFG 37103 ASTM D 751/B FSTM 191/5102	%	CH WP TR WF	>=20 >=20
Résistance à la déchirure *Tear resistance* Pendulaire *Pendulum test*	NFG 37129/2 ASTM D 751/A	daN	CH WP TR WF	>=12 >=12
Pantalon *Tongue test*	NFG 37128/A ASTM D 751/B FSTM 191/5134	daN	CH WP TR WF	>=16 >=18
Adhérence par collage/pelage *Adhesion (peeling test)*	NFT 46008 FSTM 601/8011	daN/cm		>=3,5
Résistance au froid *Cold resistance*	NFG 37111 MIL, T, 52983/A	°C		<= -20 pass
Température extrême Température idéale d'utilisation *Recommanded using temper*	static dynamic	°C		-40, +140 -20, +120
Résistance à la perforation *Perforation resistance*		daN		18
Index de neutralisation *Neutralization index*	laboratoire. SGS ASTMD974 0.03 max	mg KOH/g		0,02
Résistance diélectrique *Dielectrical resistance*	laboratoire. SGS ASTMD877 28 min	KV		36,3
Tangente delta Power factor at 100°C	laboratoire. SGS ASTMD924 1.1 max	PCT		0,54
Coloration *ASTM color*	laboratoire. SGS ASTMD1500 < 0,5			< 0,5
Perméabilité à l'oxygène *Oxygen permeability*	NFT 46-037	m²Pa-1s-1		3,0 10**-18
Perméabilité à la vapeur d'eau *Water vapo permeability*	NF ISO 2528	g/m².24h		11
Résistance à l'ozone *Ozone resistance*	ISO 1431	96H 50ppcm		Pas de craquelure no cracks

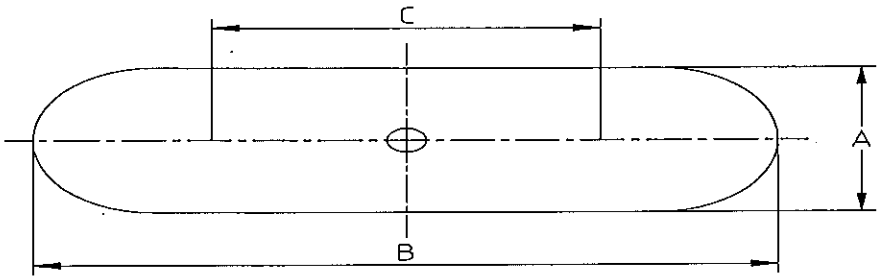
MUSTHANE FRANCE	Fiche de contrôle équilibreur souple/Routing test report for bladder Ficha de control deposito de caucho/Controle gegevens	DOC/ATE/029 index: B

OF/WO N° :	Qté/Qty:	Date de livraison: Delivery time :
		N° de série: Serial N° :
Client: Customer:		N° de commande: Order N° :

Tissu/Coated fabric Tejido/Material karakteristieken	trile/Nitri	Nitrile /PVC	Plan N° Drawing N°

Dimensions/Dimensions (mm)
Dimensionales/Afmetingen (mm)

Longueur/Length B Longitud/Lengte B		Largeur/Width A Anchura/Breedte A		Entraxe/Entraxe C Entraxa/Ophangpunt C	



	Prévu/Forecasted/Previstos/Vodrzien	Réel/Real/Reales/Werkeluk
Accessoire/Fitting Accessorios/Toebehoren		

	Position	Visa
Position patte/Loop position(cf plan/drawing) Posicionamento pasadores/Positie ophangpunten		
Position bride/Flange position Posicionamiento brida/Positie ophangflens		

Contrôle dimensionnel après vulcanisation/Dimensional control after vulcanizatior B
Control dimensional despues de vulcanisation/Afmetines control na vulcanizatie A
Tolérance : +/- 1,5% C

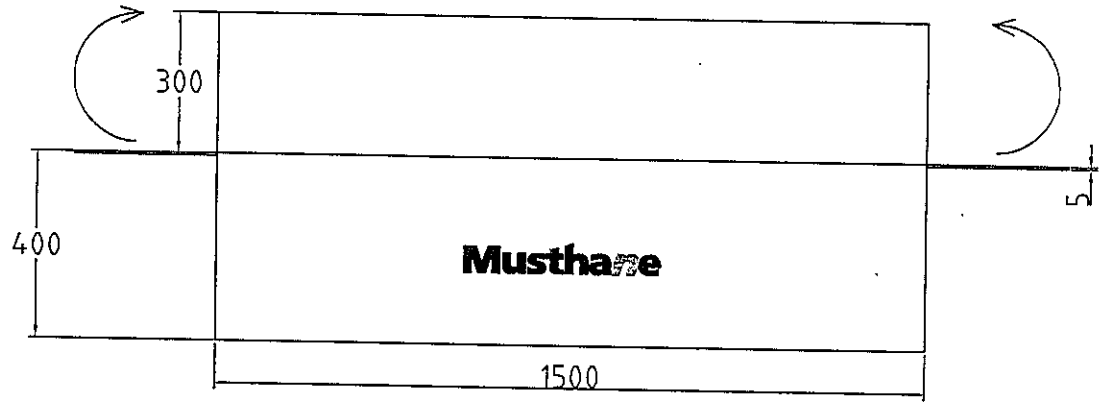
Etanchéité à l'air/Airproof resistance(0.2 bar=>1H) VISA
Impermeabilidad /Dichtheids proef na vulcanizatie

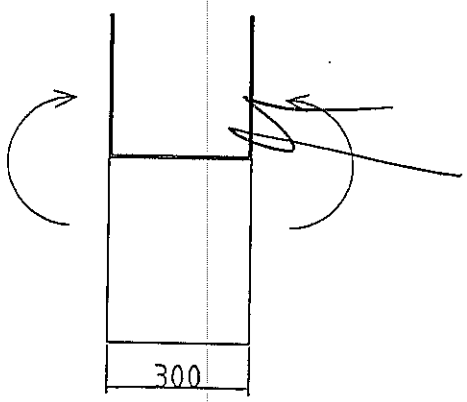
Contrôle à la mousse des assemblages/Visual control with soap VISA
Control visual de los conjuntos con espuma/Visuele controle met zeepsop aan de verbindingen

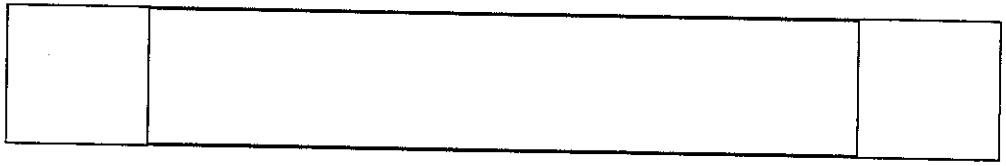
Contrôle d'aspect / Look control
- O few curlings without any consequence
- O curlings without any consequence
- O look flaw without any consequence
- O with repairing without any consequence

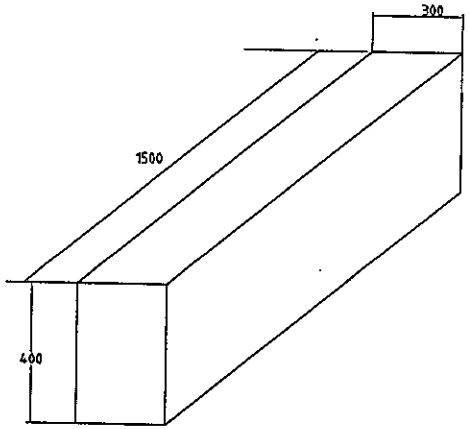
Remarque/Notice :
Observaciones/Opmerkingen :

Nom/Name RAQ : H BLOND Apellido/Naam RAQ	Controleur/Controleur Controlador/controleur	Décision/Opinion RAQ Decision/Beslissing RAQ	Visa/Visa Visa/Goedgekeur
Date/date Fecha/datum	Date/date Fecha/datum		









A	18/06/02	MD	EMISSION INITIALE	FJ
REV	DATE	DRAWN BY	OBSERVATION	CHECKED BY

TOLERANCES GENERALES SUR PARTIES METALLIQUES:ISO 2768-MK (SAUF INDICATIONS PARTICULIERES)

ETAT DE SURFACE:Ra 3.2 (SAUF INDICATIONS)	FINITION: CHANFREINS 0.5 A 45° RAYONS DE 0.5 PARTOUT SAUF IND	DIMENSIONS: H13,h13 FILETAGE:ISO 6H,6g/GAZ A,H	TYPE: DEFINITION
ECHELLE: 1/10			MATIERE: CARTON 5mm
N° : MF0522-00			PROTECTION: XXXX
			TRAITEMENT: XXXX

CARBOARD.BOX 1500X300X400MM

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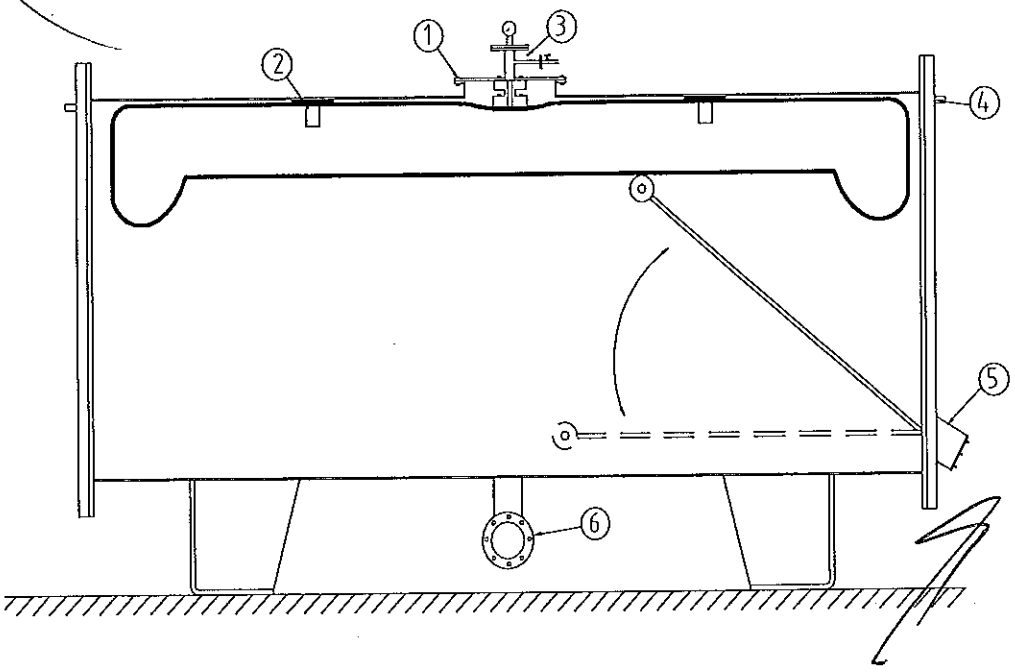
FORMAT A3

Musthane

Technical intelligence for flexible forces

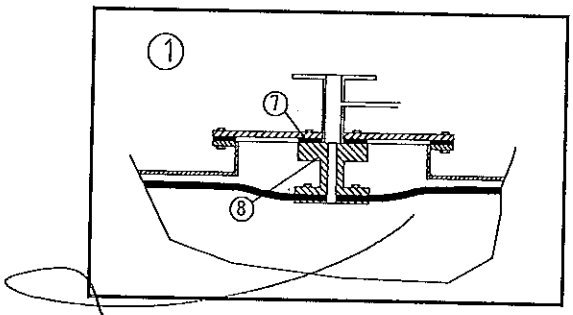
INSTALLATION OF THE MUSTBALANCE MBT

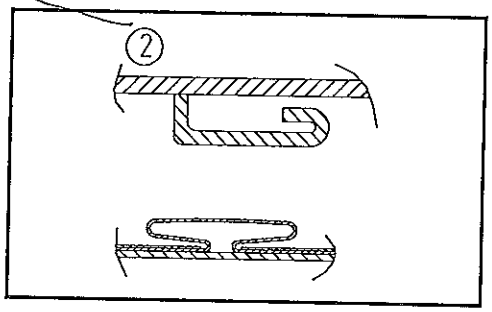
- Push the MBT into the conservator through the open end or inspection hatch in the end of the conservator.
- Suspend the MBT from hooks (2) in the ceiling of the conservator using the loops
- Fit the MBT flange (8) on the conservator flange using a ring* (7) to ensure airtightness of the system
- Close the open end of the conservator
- Fill the MBT to a pressure of 10kPa (0,1 bar). Close the filling valve (3) while leaving the system pressurised. A relief hole (4) must be on the oil filled side of the conservator so that the MBT can freely expand.
- The MBT will gradually stabilise. After 6 hours, adjust the air pressure again to 10kPa (0,1 bar). A 24 hours leak test is then to be made on the MBT. After 24 hours check the pressure reading again. If the pressure has not dropped significantly, the test is correct. The temperature should be as stable as possibly during the leakage testing period.

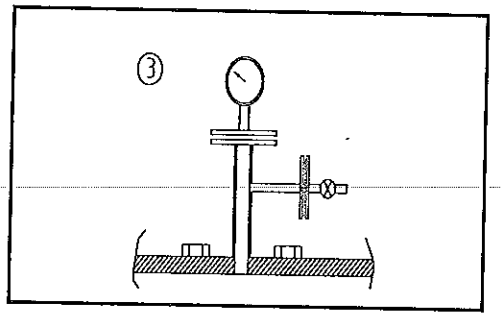


FILLING THE CONSERVATOR

- Check that the air pressure in the MBT is 10kPa (0,1 bar). If not, increase the pressure to the correct level and close the air-filling valve.
- Open the air vent valves (4) in both ends of the conservator.
- Open the valve (6) between the conservator and transformer tank and pump in more oil so that the oil rises to the conservator. The pumping speed should be suitably slow so that the pressure within the MBT does not exceed 13 kPa (0,13 bar). Stop pumping, when oil begins to come out of the vent valves and close the vent screws.
- Adjust the pressure in the MBT to normal by opening the plug in the flange or air filling valve from which the pressure hose is removed.
- Reopen the valve (6) between the conservator and the transformer tank and continue filling with oil until the oil level indicator gives the correct reading according to the temperature of transformer.



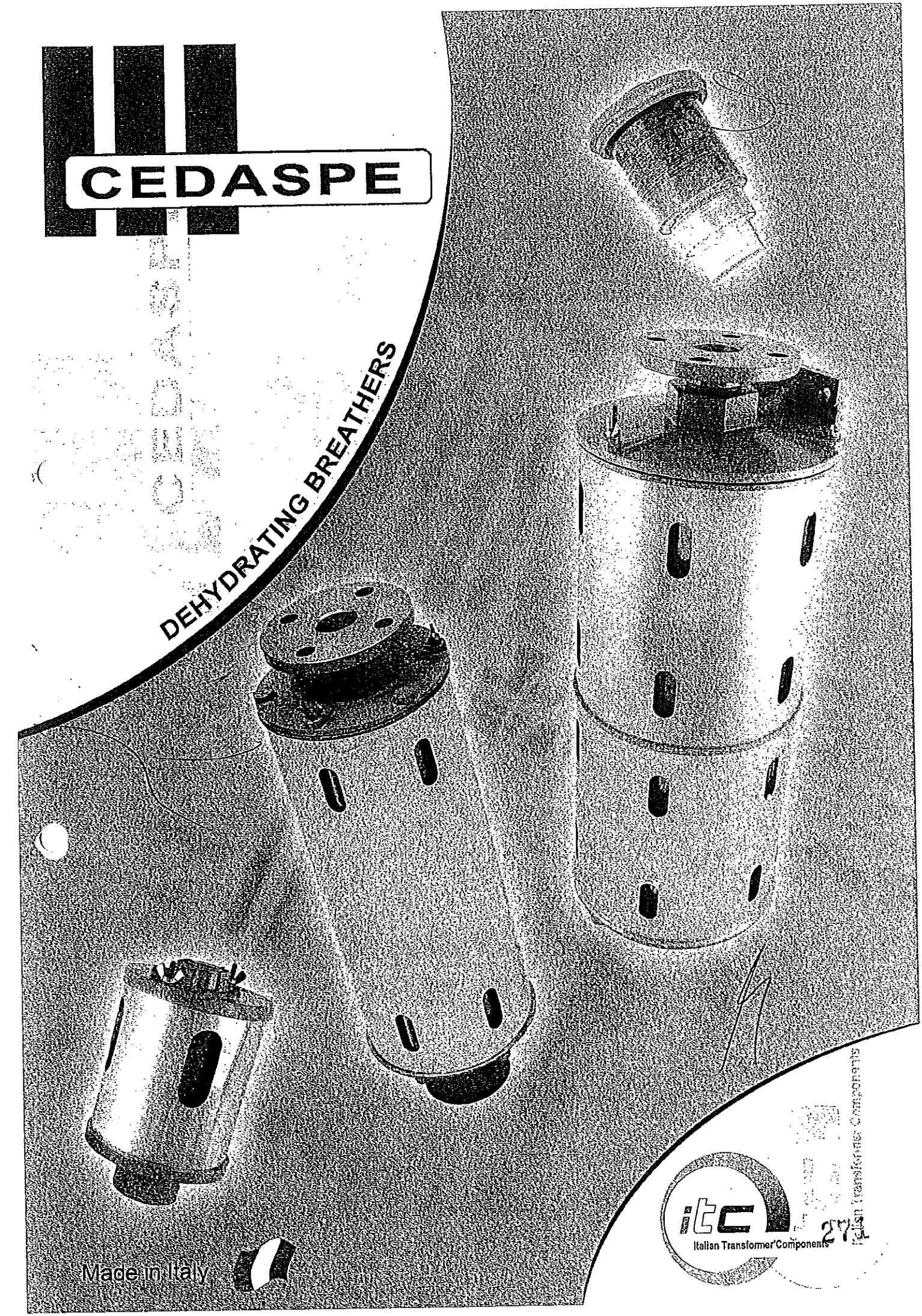




* MUSTHANE can also supply compression rings for contact with transformer oil. Their advantages: excellent mechanical properties, resistance to temperature and aging.

CEDASPE

DEHYDRATING BREATHERS



Made in Italy

itc
Italian Transformer Components

27

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R.E.A. MI 729991 - IMPORT - EXPORT MI 142410 - REG. IMPR. 132446/3344/46 TRIB. MI

CEDASPE S.p.a.

AIR DEHYDRATING BREATHERS
threaded and/or flanged connection, single unit and modular assy
type VE 05 - 10 - 15 - 30 - 50 - 80 - 100 - 150
for power transformers

1. GENERAL INFORMATION
Air dehydrating breathers are transparent hollow cylinder tubes which contain chemically pure silicium salt (silicagel) with coloured indicator. The air breathed inside the transformer due to the thermal contraction of the oil mass, passes through the silicagel.
The silicagel absorbs the humidity, indicating the saturation degree by changing colour as follows:

YELLOW/ORANGE	silicagel completely dry
AMBER	silicagel partly humid
CYAN	silicagel saturated with humidity

The salt contained in the breather, when saturated, may be easily removed and regenerated by heating it, inside a ventilated oven, at 120° - 150°C, until the colour becomes orange again.
The specific property of the silicagel is its high absorption power of humidity. This is total until the salt has absorbed water for about 15% of its weight, and saturation is reached when the salt has absorbed water for 30 to 40 % of its weight.

2. TECHNICAL FEATURES
The upper and lower parts are made in a non-porous corrosion-proof aluminium alloy casting. The hollow cylinder is made of plexiglas and it is protected by a stainless steel cylinder, with windows which allow the visual control of the silicagel colour.
In the bottom side of the breather, an hydraulic valve prevents continuos air contact with the silicagel and allows the air to pass in both direction (inlet or outlet) only when there is pressure deficiency or excess inside the transformer.
Pressure values for air passage into the dehumidifier are:

0.003 kg/cm^2 inlet , or 0.005 kg/cm^2 outlet

The hollow container and the hydraulic valve are separated by a drilled plate with a labyrinth system, which have the double purpose of diffusing inlet air uniformly, and of avoiding that any salt dust may damage the closing system.

3. DRAWINGS AND TECHNICAL DATA
A table on the drawings in the following pages shows, the general overall dimensions, the silicagel contained inside the cylinder, the max oil quantity, contained inside the transformer on which the breather must be installed, calculated for normal conditions, as below indicated, using the formula at paragraph 5:

Average air temperature	20°C
Average air humidity	60%
Average thermal cycle "Δ t "	20°C
Average duration of thermal cycle T	8 hours
Maintenance interval M	90 days

Different environment conditions of the site where the transformer is installed may influence the maintenance interval, when the choice of the size of the breather has been made.

4. PROTECTION OF OUTER SURFACES
Outer surfaces in aluminium alloy are covered with a double coat of high protective paint against all weather conditions, and temperature between - 40°C and + 100°C. All the screws are made in mild steel zinkplated; upon request in stainless steel.

5. CHOICE OF THE BREATHER SIZE (or of the maintenance interval)
The choice of the breather size (or maintenance interval) is directly related to the quantity of the breather silicagel contain. The mass of silicagel necessary for the proper functioning is given approximately by a function of 6 variable quantities, listed here following:

- Mass of oil "V" inside the transformer , denominated in dm3 or in litres.
- Average temperature of the air in the environment where the transformer is installed, denominated in °C
- Average Humidity of the air in the environment where the transformer is installed, denominated in %.
- Average thermal cycle "Δt" of the transformer, denominated in °C, to be calculated as difference between the minimum and the maximum temperatures reached by the oil inside the transformer within a time period.
- Average duration of thermal cycle "T" denominated in hours, to be calculated as the time interval between two thermal cycles.
- Maintenance interval "M" denominated in days.

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R.E.A. MI 729391 - IMPORT - EXPORT MI 142410 - REG. IMPR. 13214/3344/45 TRIB. MI

CEDASPE S.p.a.

From the saturated steam table for water (see next pages), depending from the average temperature and humidity of the air, it is possible to calculate the quantity of water "A"(denominated in grams) for each m3 of air which enter inside the transformer.
Now, using the following formula, we are ready to calculate the quantity of silicagel (denominated in Kg) necessary for the proper functioning of the transformer:

Mass of silicagel =(127,056 x 10-9 x V x Δ t x A x M) : T [kg]

It is important to note that the result of above formula is only a first approximation value, due to the simplification related to the average values considered as constant values for the duration of the thermal cycles between two following maintenance intervals
It is also evident that shortening the maintenance interval, the average conditions used in the formula simulate more exactly the true conditions of the transformer during its working life (i.e. the average temperature of the air for 30 days in January has a statistic scattering degree lower than the average temperature for 90 days in Dec/Jan/Feb); same comments must be done for humidity, thermal cycle duration and temperature
Only two data may be easily fixed without doubt: mass of oil inside the transformer and maintenance interval.
For a better understanding, we show here following three examples of the choice of quantity of silicagel necessary for the same transformer installed in three different places, but with the same thermal cycle and maintenance interval; the following conditions shall be the same in all the tree cases:

- Average thermal cycle "Δ t " 20°C
- Average duration of thermal cycle T 8 hours
- Maintenance interval M 90 days
- Mass of oil V 10000 dm^3

The mass of silicagel necessary foe a good functioning of the transformer will be:
1° CASE: Transformer installed in normal European condition:
- Average air temperature 20°C
- Average humidity 60%
- Silicagel mass 2,95 kg

Suggested size of the breather: size VE30
2° CASE: Transformer installed in tropical climate:
- Average air temperature 30°C
- Average humidity 90%
- Silicagel mass 7,77 kg

Suggested size of the breather: size VE80
3° CASE: Transformer installed in desert condition:
- Average air temperature 35°C
- Average humidity 40%
- Silicagel mass 4,50 kg

Suggested size of the breather: size VE50

7. MANUFACTURING PROGRAM

We propose a full range of dehydrating breathers for power transformers, starting from 1 kg silicagel contain up to 15 kg; additionally, using 4 different sizes of modular unit, it is possible to assembly breathers in racks with high silicagel contain.
All our models are identified with two letters 'VE' followed by two figures which represent the quantity (denominated in hg) of silicagel contain, with this scale in kg 1;1,5;3;5;8;10;15.
All these breathers can be connected to the tube coming from the conservator by means of a threaded connection or by means of a flange.
Starting from size VE50 all the breathers are fitted with a side support which enable to make a bolted connection to a transformer wall or to a rack.
When there is a need of silicagel contain higher than kg 15, we propose a modular assy using multiple units of 5,8,10,15 kg silicagel contain each, as shown at page 5.50; the modular unit follow the same identification littering of the normal breathers adding the letter 'M' at the end
The dehydrating breathers, complete with salts are despatched in sealed packages in order to avoid alteration of the dry state of silicagel. Upon request, we supply also empty breathers with silicagel filling packed separately in ermetic bags, or even without filling, if the customer wants to manage silicagel separately from the breathers.
When they are mounted on the transformer, it is necessary to remove the protective plugs and pour mineral oil up to the mark on the jar.

8. ORDER INSTRUCTIONS

As said, the identification of a model start with two letters VE followed by two figures which represent the weight of silicagel inside the breather and the letter M for the modular unit.
Few example, to make it completely clear:
VE 50 Breather with 5 kg silicagel contain
VE150 Breather with 15 kg silicagel contain
VE100M Modular unit with 10 kg silicagel contain
Special instruction must be indicated separately.

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CEDASPE s.p.a.

9. SATURATED STEAM TABLE FOR WATER

Showing the mass of water, in gram (10^{-3} kg), contained in one cubic meter of air (related to the air temperature and the air humidity).

	AIR TEMPERATURE	*AIR HUMIDITY [%]*								
°C	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
0	0.49	0.98	1.47	1.96	2.45	2.94	3.43	3.92	4.40	4.90
5	0.68	1.36	2.04	2.72	3.40	4.08	4.76	5.44	6.10	6.80
10	0.94	1.87	2.82	3.76	4.70	5.64	6.58	7.52	8.50	9.40
15	1.28	2.56	3.84	5.12	6.40	7.68	8.96	10.20	11.50	12.80
20	1.72	3.44	5.16	6.88	8.60	10.30	12.00	13.80	15.50	17.20
25	2.29	4.58	6.87	9.16	11.45	13.70	16.00	18.30	20.60	22.90
30	3.02	6.04	9.05	12.10	15.10	18.10	21.10	24.10	27.20	30.20
35	3.94	7.88	11.80	15.80	19.70	23.60	27.60	31.50	35.40	39.40
40	5.08	10.20	15.30	20.40	25.40	30.50	35.60	40.70	45.80	50.90
50	8.27	16.50	24.80	33.10	41.40	49.60	57.80	66.20	74.40	82.70
60	13.00	26.00	39.00	52.00	65.00	78.00	91.00	104.00	117.00	130.00

10. AIR DEHYDRATING BREATHER TYPE TV75 & VE05 (page 5.40)

They are small sized dehydrating breathers, particularly fit for assembling on small distribution transformers
The type VE05 follows the same manufacturing principles of the bigger sizes like the type VE10.
The type TV75 (or TV74) is the cheapest model of our breathers: its top flange is made in corrosion proof aluminium alloy.
The silicagel housing is made of cellulose triacetate (cellidor by Bayer), suitable for mineral oil; only upon request, this breather can be fitted with a stainless steel cylindrical protection.

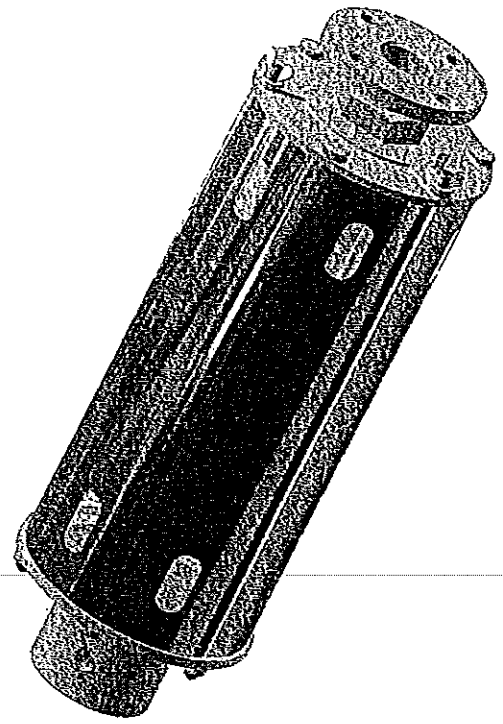


Fig. A1
– Tipo TV
– *Type TV*

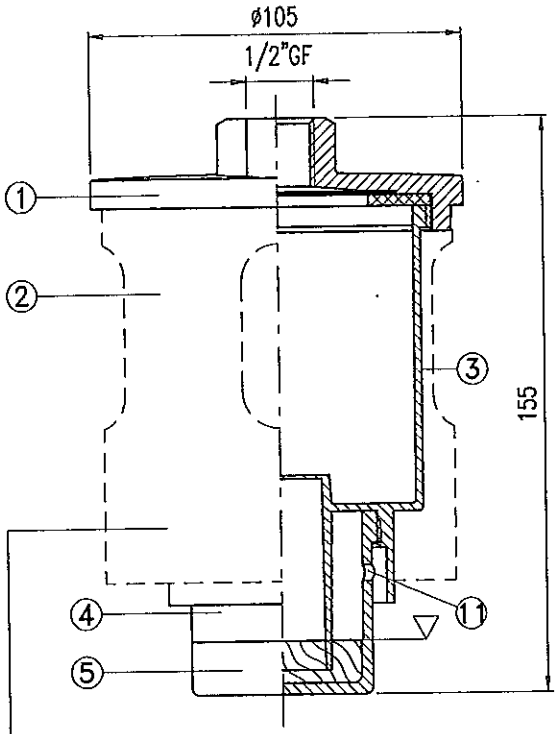
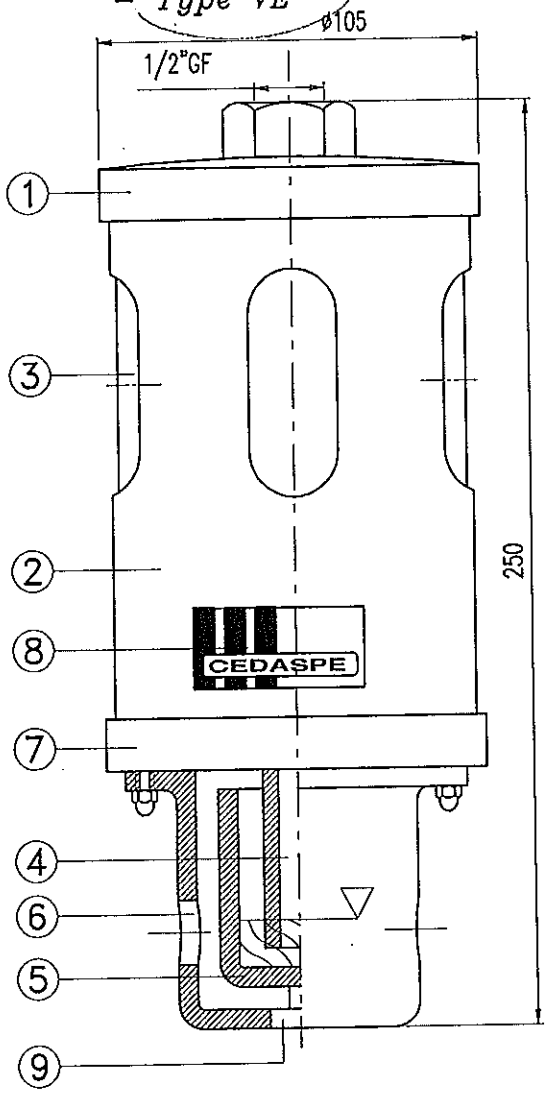


Fig. B1
– Tipo VE
– *Type VE*



Pos	Descrizione
1	Coperchio
2	Protezione acciaio Inox
3	Contenitore trasparente di sali
4	Pescante
5	Coppa olio (trasparente)
6	Spia olio e presa d'aria
7	Coperchio Inferiore
8	Targhetta d'identificazione
9	Scarico condensa
11	Presa d'aria

Pos	*Description*
1	*Top cap*
2	*Stainless steel housing*
3	*Gel container (transparent)*
4	*Fishig out cylider*
5	*Oil cup (transparent)*
6	*Oil window and air intake*
7	*Bottom cap*
8	*Data plate*
9	*Drain hole*
11	*Air intake*

Dim. in mm; Scala 1:2

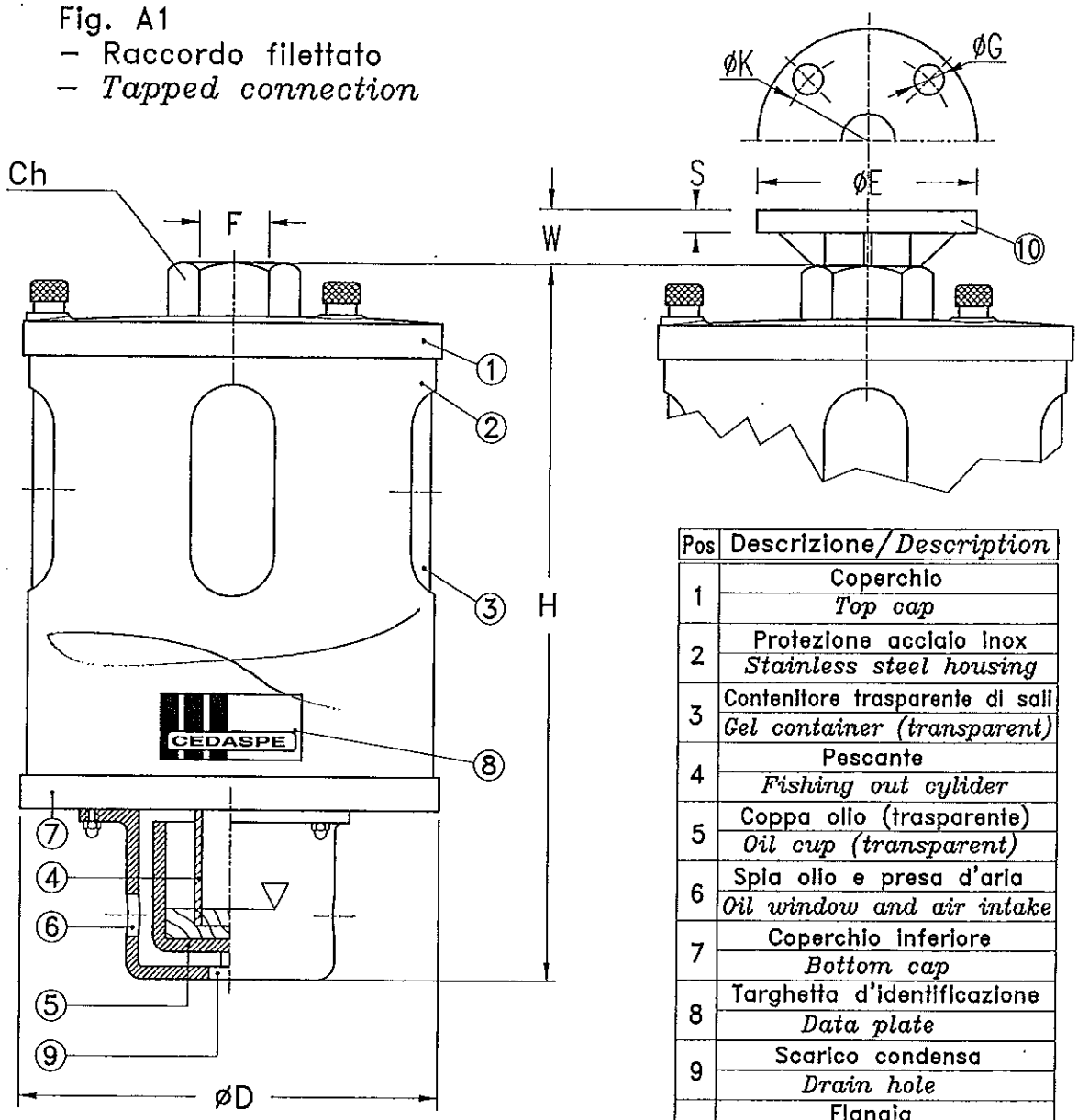
Tipo *Type*	Olio nel trasf. *Transf. oil* Kg	Silicagel *Q.ty* Kg	Silicagel *Vol.* dm³	NOTE:
TV75NE	700	0,25	0,35	senza protezione Pos. 2 Fig. A1 – *w/out stainless steel housing*
TV76NE				con protezione Pos. 2 Fig. A1 – *with stainless steel housing*
VE05	1500	0,50	0,65	con protezione Pos. 2 Fig. B1 – *with stainless steel housing*

CEDASPE

Essicatori d'aria per trasformatori di distribuzione
Dehydrating breathers for distribution transformers

Fig. B1
– Raccordo flangiato
– *Flanged connection*

Fig. A1
– Raccordo filettato
– *Tapped connection*



Pos	Descrizione/*Description*
1	Coperchio *Top cap*
2	Protezione acciaio inox *Stainless steel housing*
3	Contenitore trasparente di sali *Gel container (transparent)*
4	Pescante *Fishing out cylider*
5	Coppa olio (trasparente) *Oil cup (transparent)*
6	Spia olio e presa d'aria *Oil window and air intake*
7	Coperchio inferiore *Bottom cap*
8	Targhetta d'identificazione *Data plate*
9	Scarico condensa *Drain hole*
10	Flangia *Flange*

▽ Livello olio
Oil level

Tipo *Type*	Olio nel trasf. *Transf. oil* kg	H mm	D mm	F	Silicagel *Q.ty* Kg	Silicagel *Vol.* dm³	Ch mm	W mm	S mm	E mm	G mm	K mm
VE10	3500	245	140	1"G	1,00	1,35	46	25	10	100	11.5	75
VE15	5000	300			1,50	2,00						
VE30	10000	370	190	1 1/2"G	3,00	4,00	65	30	12	150	18.0	110
VE4-EL	22000	530			5,00	7,00						

CEDASPE

Essicatori d'aria per trasformatori di potenza
Dehydrating breathers for power transformers

Fig. A1
– Raccordo filettato
– *Tapped connection*

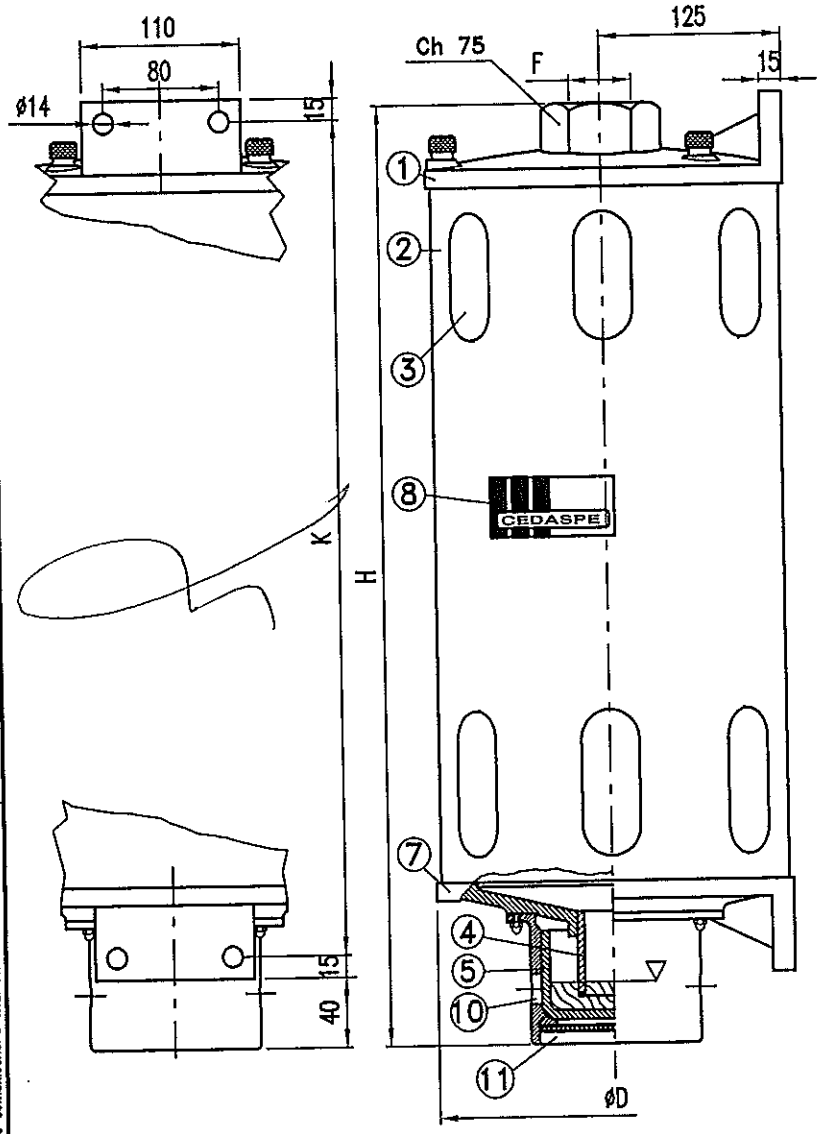
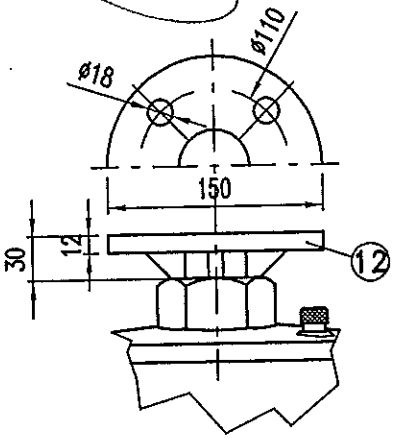


Fig. B1
– Raccordo flangiato
– *Flanged connection*



Pos	Descrizione/*Description*
1	Coperchio / *Top cap*
2	Protezione acciaio inox / *Stainless steel housing*
3	Contenitore trasparente di sali / *Gel container (transparent)*
4	Pescante / *Fishing out cylider*
5	Coppa olio (trasparente) / *Oil cup (transparent)*
7	Coperchio inferiore / *Bottom cap*
8	Targhetta d'identificazione / *Data plate*
9	Scarico condensa / *Drain hole*
10	Spia olio / *Oil window*
11	Presa d'aria / *Air intake*
12	Flangia / *Flange*

▽ Livello olio
Oil level

Tipo *Type*	Olio nel trasformatore *Transformer oil*	H	D	K	F	Silicagel *Q.ty* kg	Silicagel *Vol.* dm³
VE50	17500 Kg	390 mm	245 mm	320 mm	1 1/2"G (*)	5,00	6,70
VE80	28000 Kg	485 mm		410 mm		8,00	10,70

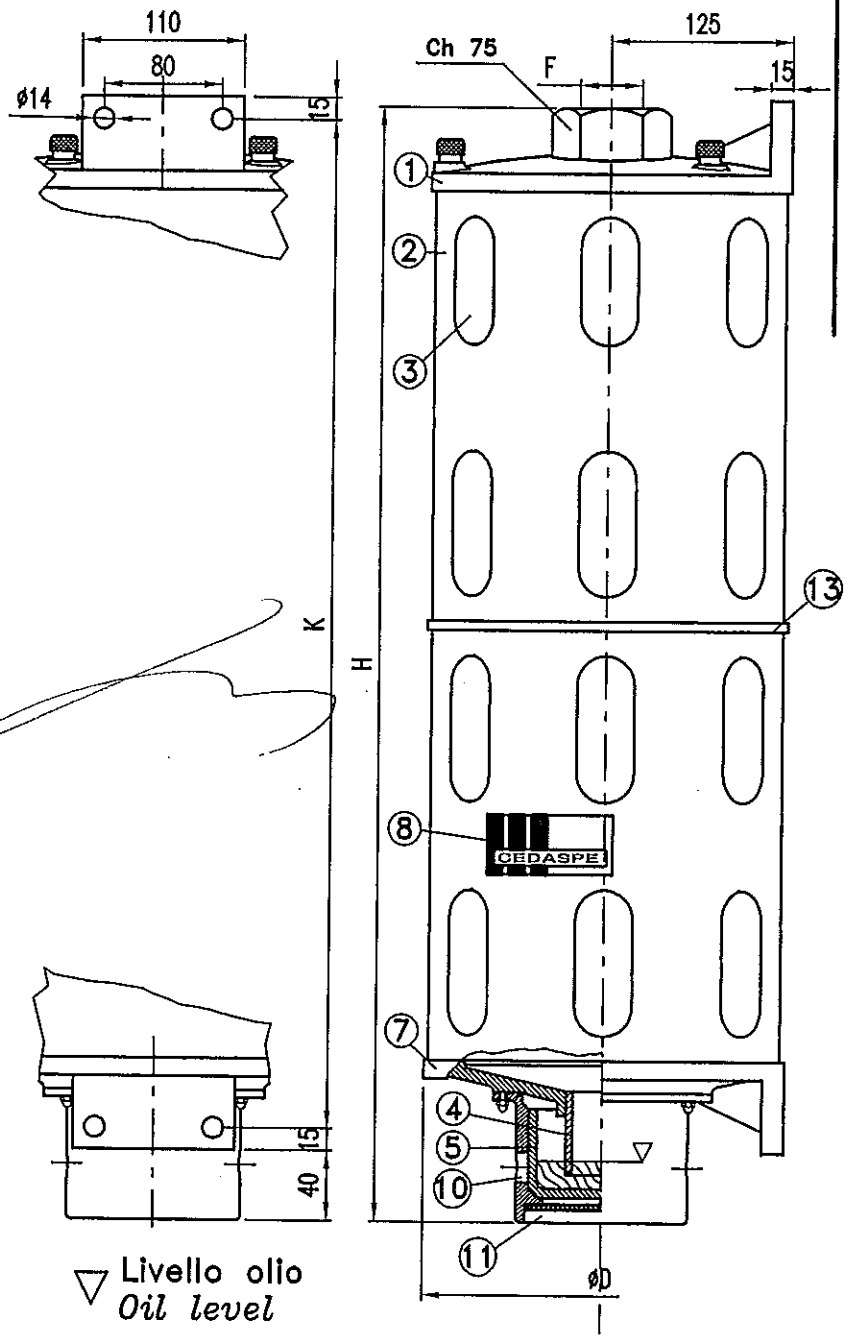
(*) 2"G Solo su richiesta/*Upon request*

Dim. in mm; Scala 1:5

CEDASPE

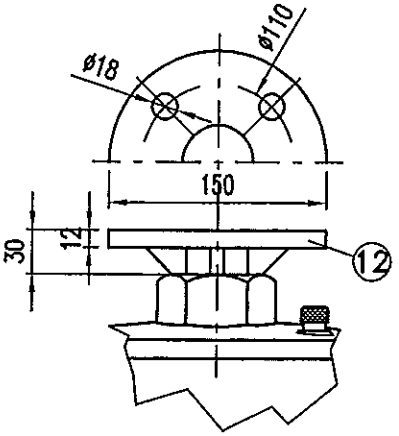
Essicatori d'aria per trasformatori di potenza
Dehydrating breathers for power transformers

Fig. A1
– Raccordo filettato
– *Tapped connection*



▽ Livello olio
Oil level

Fig. B1
– Raccordo flangiato
– *Flanged connection*



Pos	Descrizione/*Description*
1	Coperchio *Top cap*
2	Protezione acciaio inox *Stainless steel housing*
3	Contenitore trasparente di sali *Gel container (transparent)*
4	Pescante *Fishing out cylider*
5	Coppa olio (trasparente) *Oil cup (transparent)*
7	Coperchio inferiore *Bottom cap*
8	Targhetta d'identificazione *Data plate*
9	Scarico condensa *Drain hole*
10	Spia olio *Oil window*
11	Presa d'aria *Air intake*
12	Flangia *Flange*
13	Flangia intermedia *Frame*

Tipo *Type*	Olio nel trasformatore *Transformer oil*	H	D	K	F	Silicagel *Q.ty* kg	Silicagel *Vol.* dm^3
VE100	35000 Kg	650	245 mm	578 mm	1 1/2"G (*)	10,00	13,50
VE150	56000 Kg	830 mm		758 mm		15,00	21,00

Dim. in mm; Scala 1:5

(*) 2"G Solo su richiesta/*Upon request*

CEDASPE

Essicatori d'aria per trasformatori di potenza
Dehydrating breathers for power transformers

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Fig. A1
– Raccordo filettato
– *Tapped connection*

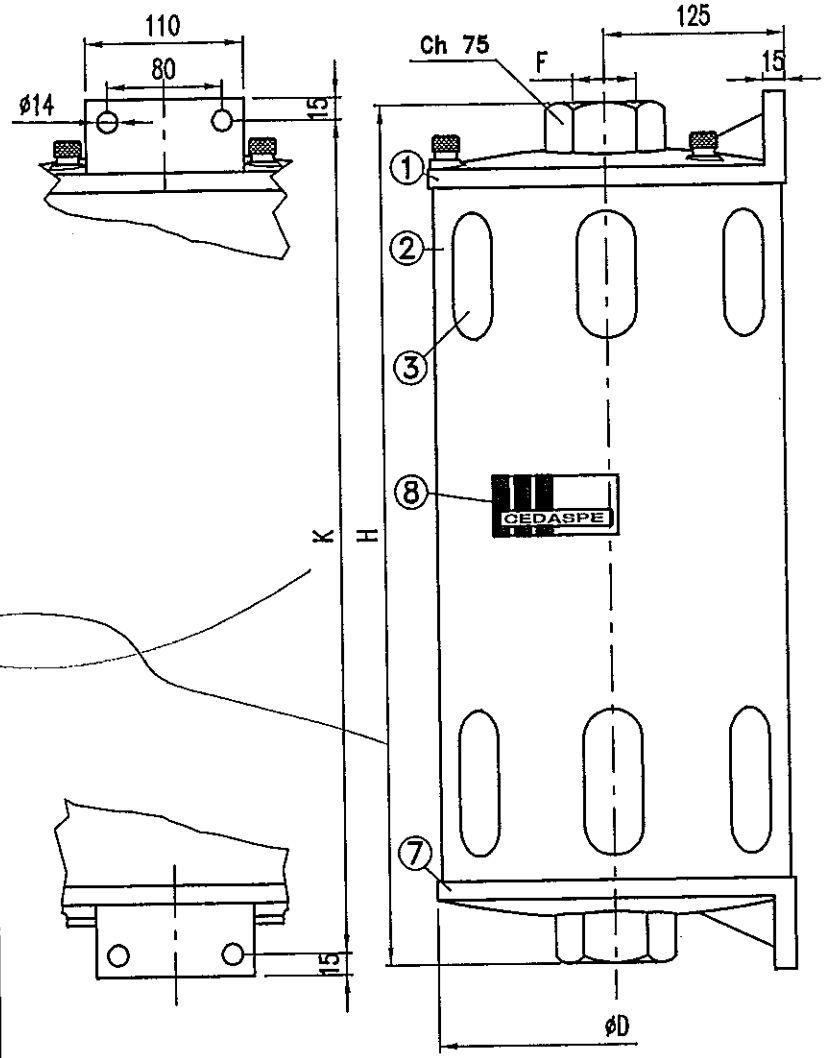
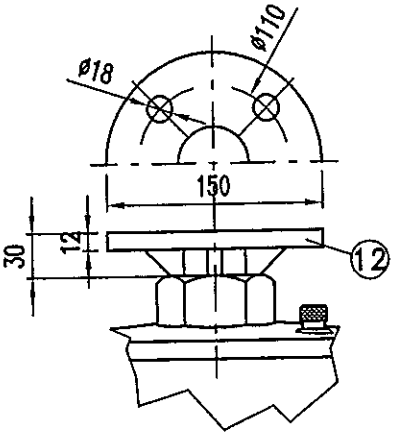


Fig. B1
– Raccordo flangiato
– *Flanged connection*



Pos	Descrizione/*Description*
1	Coperchio *Top cap*
2	Protezione acciaio inox *Stainless steel housing*
3	Contenitore trasparente di sali *Gel container (transparent)*
7	Coperchio inferiore *Bottom cap*
8	Targhetta d'identificazione *Data plate*
12	Flangia *Flange*

Tipo *Type*	H	D	K	F	Silicagel	
					Q.ty Kg	*Vol.* dm³
VE50M	345 mm	245 mm	320 mm	1 1/2"G (*)	5,00	6,70
VE80M	435 mm		410 mm		8,00	10,70
VE100M	605 mm		578 mm		10,00	13,50
VE150M	785 mm		758 mm		15,00	21,00

(*) 2"G Solo su richiesta/*Upon request*

Dim. in mm; Scala 1:5

CEDASPE

Modulo per montaggio multiplo essiccatori
Module for multiple assembly of dehydrating breathers

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Fig. A1
– Montaggio orizzontale
– *Horizontal assembly*

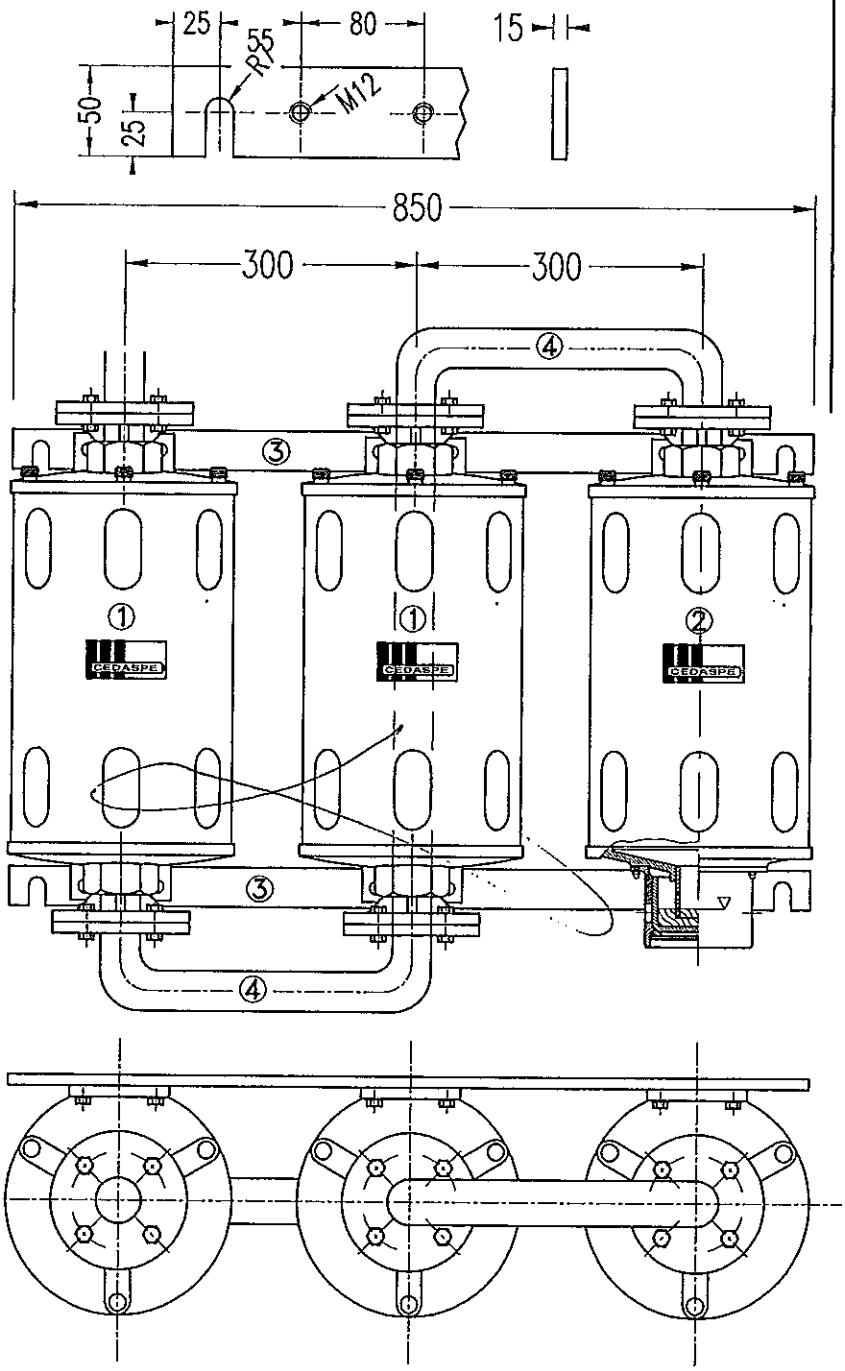
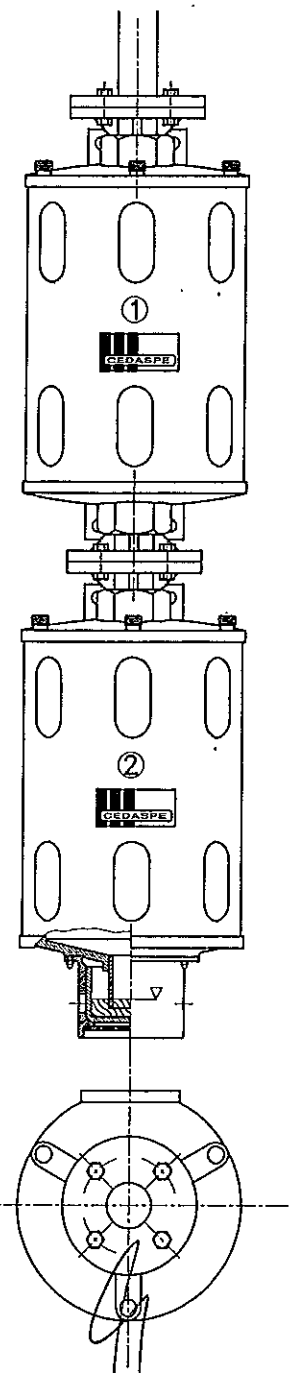


Fig. B1
– Montaggio verticale
– *Vertical assembly*



1	Breather module	VE50M pag 5.49 VE80M pag 5.49 VE100M pag 5.49 VE150M pag 5.49	
2	Breather	VE50 pag 5.47 VE80 pag 5.47 VE100 pag 5.48 VE150 pag 5.48	
3	Holder	Not supplied	
4	Connecting pipe	Not supplied	

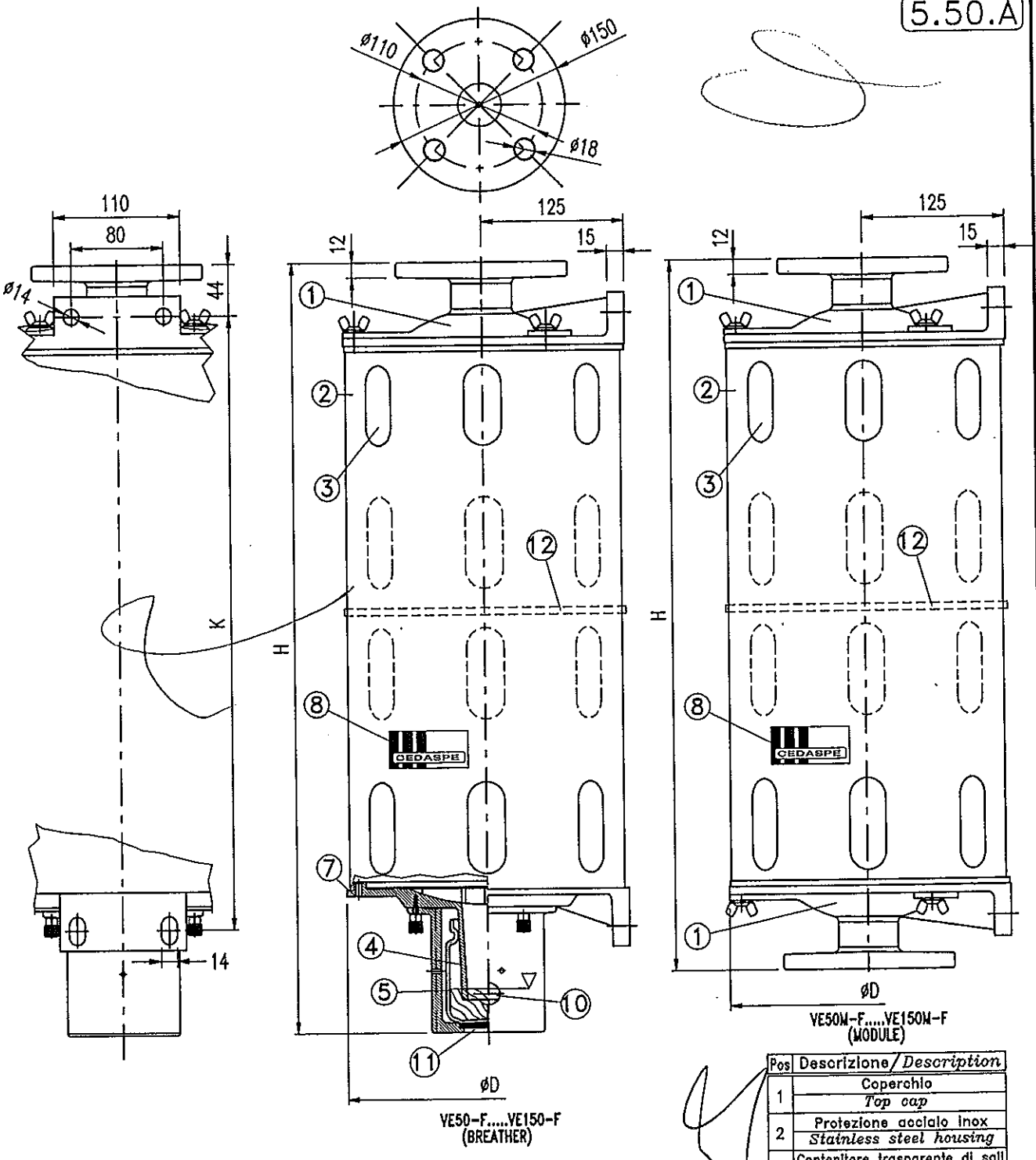
1	Modulo essiccatore	VE50M pag 5.49 VE80M pag 5.49 VE100M pag 5.49 VE150M pag 5.49	
2	Essiccatore	VE50 pag 5.47 VE80 pag 5.47 VE100 pag 5.48 VE150 pag 5.48	
3	Supporto	Non fornito	
4	Tubo collegamento	Non fornito	

Dim. in mm; Scala 1:8

CEDASPE

Esempio montaggio multiplo essiccatori

Example of multiple assembly of dehydrating breathers



▽ Livello olio
Oil level

Tipo *Type*	Olio nel trasformatore *Transformer oil*	H	D	K	Silicagel *Q.ty* kg	Silicagel *Vol.* dm³
VE50-F	17500 Kg	453 mm	247 mm	317 mm	5,00	6,70
VE50M-F		410 mm				
VE80-F	28000 Kg	548 mm		427 mm	8,00	10,70
VE80M-F		505 mm				
VE100-F	35000 Kg	716 mm		567 mm	10,00	13,50
VE100M-F		673 mm				
VE150-F	56000 Kg	896 mm		747 mm	15,00	21,00
VE150M-F		853 mm				

Pos	Descrizione/*Description*
1	Coperchio *Top cap*
2	Protezione acciaio inox *Stainless steel housing*
3	Contenitore trasparente di sali *Gel container (transparent)*
4	Pescante *Fishing out cylider*
5	Coppa olio (trasparente) *Oil cup (transparent)*
7	Coperchio inferiore *Bottom cap*
8	Targhetta d'identificazione *Data plate*
9	Scarico condensa *Drain hole*
10	Spia olio *Oil window*
11	Presa d'aria *Air intake*
12	Flangia intermedia *Frame (VE100/150)*

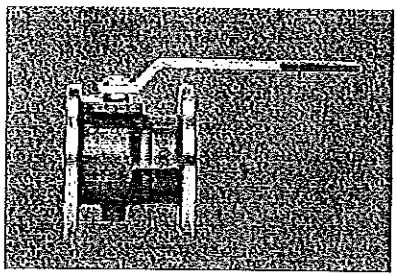
Dim. in mm; Scala 1:5

CEDASPE

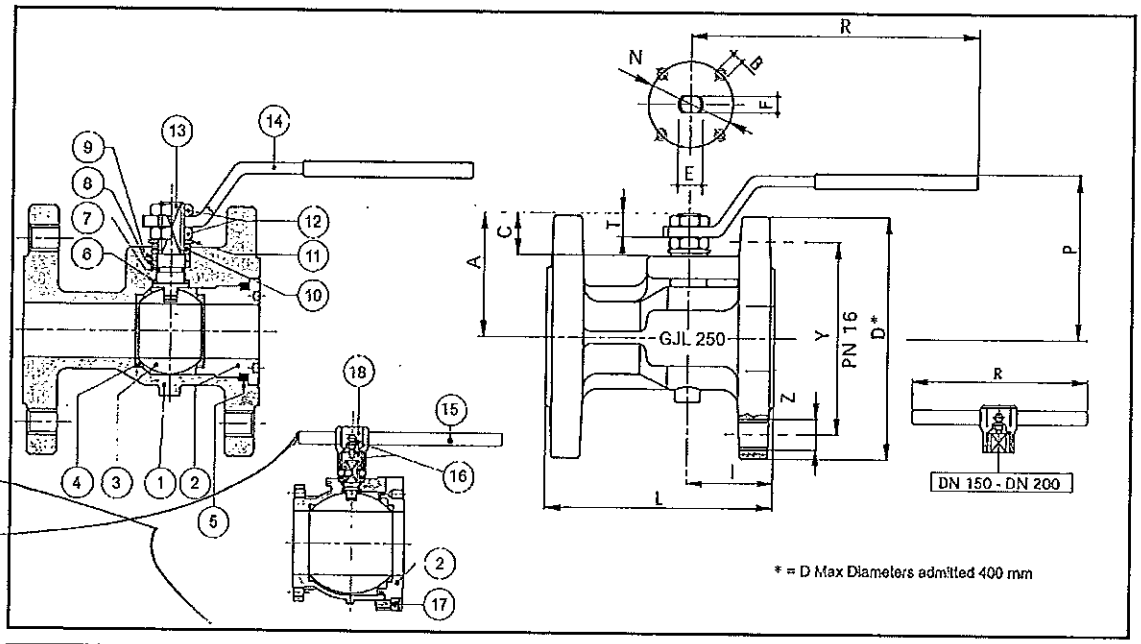
Essiccatori d'aria per trasformatori di potenza
Dehydrating breathers for power transformers
New model VE50.....150-F

VALPRES SERIE [illegible] Art. 730000

T.A. LUFT | Valvola Notificata ISPESL



Full bore flanged ball valve, PN 16 in cast iron, from DN 25 to DN 200. Face to face dimension from DN 25 to DN 150 according to DIN 3202 F4 and DN 200 according to DIN 3202 F5.



* = D Max Diameters admitted 400 mm

POS.	PART NAME	MATERIALS	N°P.
1	BODY	EN-GJL 250	1
2	END CONNECTION	ASTM A105	1
3	BALL	CW617N UNI EN 12165	1
4	BALL SEAT	P.T.F.E.	2
5	RING	BUNA	1
6	THRUST WASHER	P.T.F.E.	1
7	O-RING	BUNA	1
8	STEM SEAT	P.T.F.E.	1
9	PACKING GLAND	CARBON STEEL	1
10	END STOP	[illegible]	2 - 1
11	SPRING WASHER	CARBON STEEL	2
12	NUT	CARBON STEEL	2
13	STEM	A182-F304	1
14	HANDLE	CARBON STEEL	1
15	HANDLE DN 150-200	CARBON STEEL	1
16	SCREW	CARBON STEEL	1
17	SCREW	CARBON STEEL	8
18	BODY HANDLE DN 150	EN-GJL-250	1

SPECIFICATIONS

SERIE	73
THREAD ENDS	PN 6 - 10 - 16
NOMINAL DIAMETRE	From DN 25 to DN 200
MANEUVER	90° rotation of the lever
PAINTING	Epoxy painting Rel 3002
TESTING	100% tested
OPERATOR	UNI 7070 handle with blue P.V.C. cover

APPLICATION

Assembly in flanged pipe system
Other specifications in the Technical Specifications catalogue
Nominal pressure (PN) in bar
For temperature > 80°C see diagram in the Technical Specifications catalogue
KV: flow coefficient in m³/h at differential pressure of 100 kPa
Vacuum: Maximum 10^{-3} torr.
Temperature range: -20°C +120°C OR Buna + 150°C Viton®
Direction of flow: both directions
We recommend the valve use in fully open or closed, not in mid position, and to manoeuvre the valve at least twice a year.

DN		D	Y	Z	I	L	R	P	A	C	T	E	F	N	B	KV	PN	Kg
1"	25	115	85	4xM12	42	125	174,5	79	69	19,5	11,5	12	8	-	-	43	16	3,1
1"1/4	32	140	100	4xM16	47	130	174,5	85,5	64,5	18,5	10,5	12	8	-	-	69	16	4,8
1"1/2	40	150	110	4xM16	49	140	250,5	103	78	24	12,5	16	10	-	-	230	16	6,1
2"	50	165	125	4xM16	52	150	250,5	110	85	24	12,5	16	10	-	-	265	16	7,8
2"1/2	65	185	145	4xM16	65	170	321,5	125,5	103	28	18	20	14	-	-	540	16	11,4
3"	80	200	160	8xM16	66	180	321,5	137,5	114	28	18	20	14	70	M 8	873	16	14,1
4"	100	220	180	8xM16	89	190	381,5	168	137	32,5	20,5	24	18	102	M10	1390	16	20
5"	125	250	210	8xM16	100	200	381,5	178,5	159,5	32,5	21,5	24	18	102	M10	1707	16	30,4
6"	150	285	240	8xM20	105	210	700	237	201,5	51,5	30	42	30	125	M12	2024	16	44,5
8"	200	340*	295	12xø22	200	400	700	279	244	52	30	42	30	125	M12	2720	16	100

OPTIONS AVAILABLE

- 730001 PN 10 flange from DN 80 to DN 200
- 730002 PN 6 flange from DN 40 to DN 80
- 730003 Ball and stem AISI 304-CF8 from DN 40 to DN 200
- 730004 P.T.F.E., Viton® stem seal
- 730005 Without holes
- 730008 Drilled ISO 5211
- 730014 Stem extension lever A37 blue
- 730015 For oxygen

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Nytro Lyra X

SAFETY DATA SHEET

Date of printing	2016-02-19
Date of issue/ Date of revision	2016-02-19
Date of previous issue	2015-09-17
Version	2

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

1.1 Product identifier

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

1.2 Identified uses

Identified uses
Use in formulations in lubricants- Industrial Use as lubricant in open and closed systems - Professional Distribution of substance - Industrial Formulation and (re)packing of substances and mixtures - Industrial Manufacture of substance - Industrial Functional Fluids - Industrial Functional Fluids - Professional

Uses advised against	Reason
This product must not be used in applications other than those recommended in Section 1, without first seeking the advice of the supplier.	-

1.3 Details of the supplier of the safety data sheet

Supplier/Manufacturer	Head office: Nynas AB P.O. Box 10700 SE-121 29 Stockholm SWEDEN +46 8 602 12 00 (Office hours 8 am - 4.30 pm (CET)) www.nynas.com
e-mail address of person responsible for this SDS	ProductHSE@nynas.com

1.4 Emergency telephone number

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

National advisory body/Poison Centre

Telephone number 020 - 99 60 00 (Kemiakuten, 24h service)

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	50 - 100	Asp. Tox. 1, H304	[1]
Distillate (petroleum), hydrotreated light	REACH #: 01-2119487077-29	0 - 50	Asp. Tox. 1, H304	[1]

SECTION 3: Composition/information on ingredients

paraffinic Lubricating oils (petroleum), C20-50, hydrotreated neutral oil-based	EC: 265-158-7 CAS: 64742-55-8 REACH #: 01-2119474889-13 EC: 276-738-4 CAS: 72623-87-1 Index: 649-483-00-5	0 - 50	Asp. Tox. 1, H304	[1]
Distillate (petroleum), hydrotreated heavy paraffinic	REACH #: 01-2119484627-25 EC: 265-157-1 CAS: 64742-54-7 Index: 649-467-00-8	0 - 50	Asp. Tox. 1, H304	[1]
Lubricating oils (petroleum), C15-30, hydrotreated neutral oil-based	REACH #: 01-2119474878-16 EC: 276-737-9 CAS: 72623-86-0 Index: 649-482-00-X	0 - 30	Asp. Tox. 1, H304	[1]
2,6-di-tert-butyl-p-cresol	REACH #: 01-2119555270-46 EC: 204-881-4 CAS: 128-37-0	<0.4	Aquatic Acute 1, H400 (M=1) Aquatic Chronic 1, H410 (M=1) See Section 16 for the full text of the H statements declared above.	[1]

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.

SECTION 4: First aid measures

	Loosen tight clothing such as a collar, tie, belt or waistband.
Protection of first-aiders	No action shall be taken involving any personal risk or without suitable training. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Before attempting to rescue casualties, isolate area from all potential sources of ignition including disconnecting electrical supply. Ensure adequate ventilation and check that a safe, breathable atmosphere is present before entry into confined spaces.

4.2 Most important symptoms and effects, both acute and delayed

Potential acute health effects

Eye contact	Eye contact may cause redness and transient pain.
Inhalation	Inhalation of oil mist or vapours at elevated temperatures may cause respiratory irritation.
Skin contact	No known significant effects or critical hazards.
Ingestion	May be fatal if swallowed and enters airways.

4.3 Indication of any immediate medical attention and special treatment needed

Notes to physician	Due to low viscosity there is a risk of aspiration if the product enters the lungs. Treat symptomatically.
Specific treatments	Always assume that aspiration has occurred.

SECTION 5: Firefighting measures

5.1 Extinguishing media

Suitable extinguishing media	Use dry chemical, 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. Clothing for fire-fighters (including helmets, protective boots and gloves) conforming to European standard EN 469 will provide a basic level of protection for chemical incidents.

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SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

For non-emergency personnel	Avoid breathing vapour or mist. Keep non-involved personnel away from the area of spillage. Alert emergency personnel. Except in case of small spillages, the feasibility of any actions should always be assessed and advised, if possible, by a trained, competent person in charge of managing the emergency. Stop leak if safe to do so. Avoid direct contact with the product. Stay upwind/keep distance from source. In case of large spillages, alert occupants in downwind areas. Eliminate all ignition sources if safe to do so. Spillages of limited amounts of product, especially in the open air when vapours will be usually quickly dispersed, are dynamic situations, which will presumably limit the exposure to dangerous concentrations. Note : recommended measures are based on the most likely spillage scenarios for this material; however, local conditions (wind, air temperature, wave/current direction and speed) may significantly influence the choice of appropriate actions. For this reason, local experts should be consulted when necessary. Local regulations may also prescribe or limit actions to be taken.
For emergency responders	Small spillages: normal antistatic working clothes are usually adequate. Large spillages: full body suit of chemically resistant and thermal resistant material should be used. Work gloves providing adequate chemical resistance, specifically to aromatic hydrocarbons. Note : gloves made of PVA are not water-resistant, and are not suitable for emergency use. Safety helmet, antistatic non-skid safety shoes or boots. Goggles and /or face shield, if splashes or contact with eyes is possible or anticipated. Respiratory protection : A half or full-face respirator with filter(s) for organic vapours (and when applicable for H2S) a Self Contained Breathing Apparatus (SCBA) can be used according to the extent of spill and predictable amount of exposure. If the situation cannot be completely assessed, or if an oxygen deficiency is possible, only SCBA's should be used.
6.2 Environmental precautions	Water polluting material. May be harmful to the environment if released in large quantities. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air). Prevent product from entering sewers, rivers or other bodies of water. If necessary dike the product with dry earth, sand or similar non-combustible materials. In case of soil contamination, remove contaminated soil and treat in accordance with local regulations. In case of small spillages in closed waters (i.e. ports), contain product with floating barriers or other equipment. Collect spilled product by absorbing with specific floating absorbents. If possible, large spillages in open waters should be contained with floating barriers or other mechanical means. If this is not possible, control the spreading of the spillage, and collect the product by skimming or other suitable mechanical means. The use of dispersants should be advised by an expert, and, if required, approved by local authorities.

6.3 Methods and material for containment and cleaning up

Small spill	Stop leak if without risk. Absorb spilled product with suitable non-combustible materials.
Large spill	Large spillages may be cautiously covered with foam, if available, to limit vapour cloud formation. Do not use water jet. When inside buildings or confined spaces, ensure adequate ventilation. Transfer collected product and other contaminated materials to suitable containers for recovery or safe disposal.
6.4 Reference to other sections	See Section 1 for emergency contact information. See Section 8 for information on appropriate personal protective equipment. See Section 13 for additional waste treatment information.

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SECTION 7: Handling and storage

The information in this section contains generic advice and guidance. The list of Identified Uses in Section 1 should be consulted for any available use-specific information provided in the Exposure Scenario(s).

General information

Obtain special instructions before use. Keep away from heat/sparks/open flames/ hot surfaces. - No smoking. Use and store only outdoors or in a well-ventilated area. Hazard of slipping on spilt product. Avoid release to the environment.

7.1 Precautions for safe handling

Protective measures

Do not ingest. Do not breathe dust/fume/gas/mist/vapours/spray. Avoid contact with eyes, skin and clothing.

Prevent the risk of slipping. Take precautionary measures against static discharge. Avoid splash filling of bulk volumes when handling hot liquid product.

Avoid release to the environment.

Nota : See Section 8 for information on appropriate personal protective equipment. See section 13 for waste disposal information.

Advice on general occupational hygiene

Ensure that proper housekeeping measures are in place. Contaminated materials should not be allowed to accumulate in the workplaces and should never be kept inside the pockets. Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Wash hands thoroughly after handling. Change contaminated clothes at the end of working shift. See also Section 8 for additional information on hygiene measures.

7.2 Conditions for safe storage, including any incompatibilities

Storage area layout, tank design, equipment and operating procedures must comply with the relevant regional, national or local legislation. Storage installations should be designed with adequate bunds in case of leaks or spills. Cleaning, inspection and maintenance of internal structure of storage tanks must be done only by properly equipped and qualified personnel as defined by national, local or company regulations.

Store separately from oxidising agents.

Recommended materials for containers, or container linings use mild steel, stainless steel. Not suitable : Some synthetic materials may be unsuitable for containers or container linings depending on the material specification and intended use. Compatibility should be checked with the manufacturer.

Keep only in the original container or in a suitable container for this kind of product. Keep container tightly closed and sealed until ready for use. Do not store in unlabelled containers. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Empty containers may contain harmful, flammable/combustible or explosive residue or vapours. Do not cut, grind, drill, weld, reuse or dispose of containers unless adequate precautions are taken against these hazards. Store locked up. Protect from sunlight.

7.3 Specific end use(s)

Recommendations: Not available.

Industrial sector specific solutions: Not available.

SECTION 8: Exposure controls/personal protection

The list of Identified Uses in Section 1 should be consulted for any available use-specific information provided in the Exposure Scenario(s).

8.1 Control parameters

Occupational exposure limits

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SECTION 8: Exposure controls/personal protection

Product/ingredient name	Exposure limit values
Oil mist	*[Air contaminant]* **AFS 2011:18 (Sweden, 12/2011).** TWA: 1 mg/m³ 8 hours. Form: mist and fume STEL: 3 mg/m³ 15 minutes. Form: mist and fume

Recommended monitoring procedures

If this product contains ingredients with exposure limits, personal, workplace atmosphere or biological monitoring may be required to determine the effectiveness of the ventilation or other control measures and/or the necessity to use respiratory protective equipment. Reference should be made to monitoring standards, such as the following: European Standard EN 689 (Workplace atmospheres - Guidance for the assessment of exposure by inhalation to chemical agents for comparison with limit values and measurement strategy) European Standard EN 14042 (Workplace atmospheres - Guide for the application and use of procedures for the assessment of exposure to chemical and biological agents) European Standard EN 482 (Workplace atmospheres - General requirements for the performance of procedures for the measurement of chemical agents) Reference to national guidance documents for methods for the determination of hazardous substances will also be required.

DNELs/DMELs

Product/ingredient name	Type	Exposure	Value	Population	Effects
Distillate (petroleum), hydrotreated light naphthenic	DNEL	Long term Inhalation	5,4 mg/m³	Workers	Local
Distillate (petroleum), hydrotreated light paraffinic	DNEL	Long term Inhalation	5,4 mg/m³	Workers	Local
Distillates (petroleum), hydrotreated heavy paraffinic	DNEL	Long term Inhalation	5,4	Workers	Local

PNECs

Product/ingredient name	Compartment Detail	Value	Method Detail
2,6-Di-tert-butyl-p-cresol	Soil	1.04 mg/kg wwt	Equilibrium Partitioning
	Sewage Treatment Plant	100 mg/l	Assessment Factors
	Sediment	1.29 mg/kg wwt	Equilibrium Partitioning
	Secondary Poisoning	16.7 mg/kg	Assessment Factors
	Marine water	0.4 µg/l	Assessment Factors
	Fresh water	4 µg/l	Assessment Factors

PNEC Summary

The Hydrocarbon Block Method has been used to calculate environmental exposure with the Petrorisk model.

8.2 Exposure controls

Appropriate engineering controls

Mechanical ventilation and local exhaust will reduce exposure via the air. Use oil resistant material in construction of handling equipment. Store under recommended conditions and if heated, temperature control equipment should be used to avoid overheating.

Individual protection measures

Hygiene measures

Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Ensure that eyewash stations and safety showers are close to the workstation location. Wash contaminated clothing before reuse.

Eye/face protection

Recommended: safety glasses with side-shields

Skin protection

Hand protection

4 - 8 hours (breakthrough time): nitrile rubber

Body protection

Wear protective clothing if there is a risk of skin contact. Change contaminated clothes at the end of working shift.

Other skin protection

Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

SECTION 8: Exposure controls/personal protection

Respiratory protection	Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator. Use a properly fitted, particulate filter respirator complying with an approved standard if a risk assessment indicates this is necessary.
Environmental exposure controls	Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

Appearance

Physical state	Liquid.
Colour	Light yellow
Odour	Odourless/Light petroleum.
Odour threshold	Not available.
pH	Not applicable.
Melting point/freezing point	-48°C
Initial boiling point and boiling range	>250°C
Flash point	Closed cup: >140°C [Pensky-Martens.]
Evaporation rate	Not available.
Flammability (solid, gas)	Not available.
Upper/lower flammability or explosive limits	Not available.
Vapour pressure	160 Pa @ 100 °C
Density	0.87 g/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): 0.093 cm^2/s (9.3 cSt)
Explosive properties	Not available.
Oxidising properties	Not available.
DMSO extractable compounds for base oil substance(s) according to IP346	< 3%

SECTION 10: Stability and reactivity

10.1 Reactivity	No specific test data related to reactivity available for this product or its ingredients.
10.2 Chemical stability	Stable under normal conditions.
10.3 Possibility of hazardous reactions	Under normal conditions of storage and use, hazardous reactions will not occur.
10.4 Conditions to avoid	Oxidising agent.
10.5 Incompatible materials	Keep away from extreme heat and oxidizing agents.
10.6 Hazardous decomposition products	Incomplete combustion is likely to give rise to a complex mixture of airborne solid and liquid particulates, gases, including carbon monoxide, 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)
Distillate (petroleum), hydrotreated light paraffinic	LC50 Inhalation Dusts and mists	Rat - Male, Female	>5.53 mg/l	4 hours	EMBSI 1988a (similar material)
	LD50 Dermal	Rabbit	>5000 mg/kg	-	API 1982 (similar material)
	LD50 Oral	Rat	>5000 mg/kg	-	API 1986a (similar material)
Lubricating oils (petroleum), C20-50, hydrotreated neutral oil-based	LC50 Inhalation Dusts and mists	Rat - Male, Female	>5.53 mg/l	4 hours	EMBSI 1988a (similar material)
	LD50 Dermal	Rabbit	>5000 mg/kg	-	API 1982 (similar material)
	LD50 Oral	Rat	>5000 mg/kg	-	API 1986a (similar material)
Distillate (petroleum), hydrotreated heavy paraffinic	LC50 Inhalation Dusts and mists	Rat	>5.53 mg/l	4 hours	EMBSI 1988a (similar material)
	LD50 Dermal	Rabbit	>5000 mg/kg	-	API 1982 (similar material)
	LD50 Oral	Rat	>5000 mg/kg	-	API 1986a (similar material)
Lubricating oils (petroleum), C15-30, hydrotreated neutral oil-based	LC50 Inhalation Dusts and mists	Rat - Male, Female	>5.53 mg/l	4 hours	EMBSI 1988a (similar material)
	LD50 Dermal	Rabbit	>5000 mg/kg	-	API 1982 (similar material)
	LD50 Oral	Rat	>5000 mg/kg	-	API 1986a (similar material)
2,6-di-tert-butyl-p-cresol	LD50 Dermal	Rat	>5000 mg/kg	-	Supplier's information
	LD50 Oral	Rat	>5000 mg/kg	-	Supplier's information

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

Irritation/Corrosion

Product/ingredient name	Result	Species	Score	Observation	Remarks
Distillate (petroleum), hydrotreated light naphthenic	Skin - Non-irritant to skin.	Rabbit	0 to 0.8	24 to 72 hours	UBTL 1984e (similar material)
	Eyes - Non-irritating to the eyes.	Rabbit	0.17 to 0.33	24 to 72 hours	UBTL 1984i (similar material)
Distillate (petroleum), hydrotreated light paraffinic	Skin - Non-irritant to skin.	Rabbit	0 to 0.8	24 to 72 hours	UBTL 1984e (similar material)
	Eyes - Non-irritating to the eyes.	Rabbit	0.17 to 0.33	24 to 72 hours	UBTL 1984i (similar material)
Lubricating oils	Skin - Non-irritant to skin.	Rabbit	0 to 0.8	24 to 72	UBTL 1984e

SECTION 11: Toxicological information

(petroleum), C20-50, hydrotreated neutral oil-based				hours	(similar material)
	Eyes - Non-irritating to the eyes.	Rabbit	0.17 to 0.33	24 to 72 hours	UBTL 1984i (similar material)
Distillate (petroleum), hydrotreated heavy paraffinic	Skin - Non-irritant to skin.	Rabbit	0 to 0.8	24 to 72 hours	UBTL 1984e (similar material)
	Eyes - Non-irritating to the eyes.	Rabbit	0.17 to 0.33	24 to 72 hours	UBTL 1984i (similar material)
Lubricating oils (petroleum), C15-30, hydrotreated neutral oil-based	Eyes - Non-irritating to the eyes.	Rabbit	0.17 to 0.33	24 to 72 hours	UBTL 1984i (similar material)
2,6-di-tert-butyl-p-cresol	Eyes - Redness of the conjunctivae	Rabbit	0.5	-	Supplier's information
	Eyes - Iris lesion	Rabbit	0	-	Supplier's information
	Eyes - Oedema of the conjunctivae	Rabbit	0.1	-	-

Skin	No known significant effects or critical hazards.
Eyes	No known significant effects or critical hazards.
Respiratory	No known significant effects or critical hazards.

Sensitisation

Product/ingredient name	Route of exposure	Species	Result	Remarks
Distillate (petroleum), hydrotreated light naphthenic	skin	Guinea pig	Not sensitizing	UBTL 1984j,k,l (similar material)
Distillate (petroleum), hydrotreated light paraffinic	skin	Guinea pig	Not sensitizing	UBTL 1984j,k,l (similar material)
Lubricating oils (petroleum), C20-50, hydrotreated neutral oil-based	skin	Guinea pig	Not sensitizing	UBTL 1984j,k,l (similar material)
Distillate (petroleum), hydrotreated heavy paraffinic	skin	Guinea pig	Not sensitizing	UBTL 1984j,k,l (similar material)
Lubricating oils (petroleum), C15-30, hydrotreated neutral oil-based	skin	Guinea pig	Not sensitizing	UBTL 1984j,k,l (similar material)

Skin	No known significant effects or critical hazards.
Respiratory	No known significant effects or critical hazards.

Mutagenicity

Product/ingredient name	Test	Experiment	Result	Remarks
Distillate (petroleum), hydrotreated light naphthenic	OECD 473 473 In vitro Mammalian Chromosomal Aberration Test	Experiment: In vitro Subject: Mammalian-Animal Metabolic activation: with and without	Negative	-
Distillate (petroleum), hydrotreated light	OECD 473 473 In vitro	Experiment: In vitro	Negative	-

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SECTION 11: Toxicological information

paraffinic	Mammalian Chromosomal Aberration Test	Subject: Mammalian-Animal		
Lubricating oils (petroleum), C20-50, 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 heavy paraffinic	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	-
2,6-di-tert-butyl-p-cresol	476 In vitro Mammalian Cell Gene Mutation Test	Experiment: In vitro Subject: Mammalian-Animal Cell: Somatic	Negative	-
	473 In vitro Mammalian Chromosomal Aberration Test	Experiment: In vitro Subject: Mammalian-Animal Cell: Germ	Negative	-

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

Carcinogenicity

Product/ingredient name	Result	Species	Dose	Exposure	Remarks
Distillate (petroleum), hydrotreated light naphthenic	Negative - Dermal	Mouse - Female	0.22 to 0.25 ml	78 weeks; Various	Doak, 1983, McKee, 1989 (similar material)
Distillate (petroleum), hydrotreated light paraffinic	Negative - Dermal	Mouse - Female	0.22 to 0.25 ml	78 weeks; Various	Doak, 1983, McKee, 1989 (similar material)
Lubricating oils (petroleum), C20-50, hydrotreated neutral oil-based	Negative - Dermal	Mouse - Female	0.22 to 0.25 ml	78 weeks; Various	Doak, 1983, McKee, 1989 (similar material)
Distillate (petroleum), hydrotreated heavy	Negative - Dermal	Mouse - Female	0.22 to 0.25 ml	78 weeks; Various	Doak, 1983, McKee, 1989 (similar material)

SECTION 11: Toxicological information

paraffinic Lubricating oils (petroleum), C15-30, hydrotreated neutral oil-based	Negative - Dermal	Mouse - Female	0.22 to 0.25 ml	78 weeks; Various	Doak, 1983, McKee, 1989 (similar material)

Conclusion/Summary: The base oil(s) in this product is based on an severely hydrotreated distillate. The product should not be regarded as a carcinogen.

Reproductive toxicity

Teratogenicity

Product/ingredient name	Result	Species	Dose	Exposure	Remarks
Distillate (petroleum), hydrotreated light naphthenic	Negative - Dermal	Rat	0 to 2000 mg/kg mg/kg/day	-	(similar material)
Distillate (petroleum), hydrotreated light paraffinic	Negative - Dermal	Rat	0 to 2000 mg/kg mg/kg/day	-	-
Lubricating oils (petroleum), C20-50, hydrotreated neutral oil-based	Negative - Dermal	Rat	0 to 2000 mg/kg mg/kg/day	-	-
Distillate (petroleum), hydrotreated heavy paraffinic	Negative - Dermal	Rat	0 to 2000 mg/kg mg/kg bw/day	-	1987 (similar material)
Lubricating oils (petroleum), C15-30, hydrotreated neutral oil-based	Negative - Dermal	Rat	0 to 2000 mg/kg mg/kg/day	-	-

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

Aspiration hazard

Product/ingredient name	Result
Distillate (petroleum), hydrotreated light naphthenic	ASPIRATION HAZARD - Category 1
Distillate (petroleum), hydrotreated light paraffinic	ASPIRATION HAZARD - Category 1
Lubricating oils (petroleum), C20-50, hydrotreated neutral oil-based	ASPIRATION HAZARD - Category 1
Distillate (petroleum), hydrotreated heavy paraffinic	ASPIRATION HAZARD - Category 1
Lubricating oils (petroleum), C15-30, hydrotreated neutral oil-based	ASPIRATION HAZARD - Category 1

Information on likely routes of exposure: Not available.

Potential acute health effects

Eye contact: Eye contact may cause redness and transient pain.

Inhalation: Inhalation of oil mist or vapours at elevated temperatures may cause respiratory irritation.

Skin contact: No known significant effects or critical hazards.

Ingestion: May be fatal if swallowed and enters airways.

Potential chronic health effects

Product/ingredient name	Result	Species	Dose	Exposure
2,6-Di-tert-butyl-p-cresol	Chronic NOAEL Oral	Rat	25 mg/kg	28 days; 7 days per week

General: No known significant effects or critical hazards.

Carcinogenicity: The base oil(s) in this product is based on an severely hydrotreated distillate. The product should not be regarded as a carcinogen.

Mutagenicity: No known significant effects or critical hazards.

Teratogenicity: No known significant effects or critical hazards.

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SECTION 11: Toxicological information

Product/ingredient name: No known significant effects or critical hazards.

Fertility effects: No known significant effects or critical hazards.

Other information: Not available.

Specific hazard

SECTION 12: Ecological information

12.1 Toxicity

Product/ingredient name	Result	Species	Exposure
Distillate (petroleum), hydrotreated light naphthenic	Acute LL50 >10000 mg/l	Aquatic invertebrates.	96 hours
	Acute LL50 >100 mg/l	Fish	96 hours
	Acute NOEL >100 mg/l	Algae	72 hours
	Chronic NOEL 10 mg/l	Aquatic invertebrates.	21 days
Distillate (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
Lubricating oils (petroleum), C20-50, hydrotreated neutral oil-based	Acute LL50 >10000 mg/l	Aquatic invertebrates.	96 hours
	Acute LL50 >100 mg/l	Fish	96 hours
	Acute NOEL >100 mg/l	Algae	72 hours
	Chronic NOEL 10 mg/l	Aquatic invertebrates.	21 days
Distillate (petroleum), hydrotreated heavy paraffinic	Acute EL50 >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
2,6-di-tert-butyl-p-cresol	Acute EC50 0.61 mg/l	Daphnia - Magna	48 hours
	Acute IC50 >0.4 mg/l	Algae - Desmodesmus Subspicatus	72 hours
	Chronic NOEC 0.316 mg/l	Daphnia - Magna	21 days

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

12.2 Persistence and degradability

Product/ingredient name	Test	Result	Dose	Inoculum
2,6-di-tert-butyl-p-cresol	OECD 301C 301C Ready Biodegradability - Modified MITI Test (I)	4.5 % - 28 days	-	-

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SECTION 12: Ecological information

Product/ingredient name	Aquatic half-life	Photolysis	Biodegradability
Distillate (petroleum), hydrotreated light naphthenic	-	-	Inherent
Distillate (petroleum), hydrotreated light paraffinic	-	-	Inherent
Lubricating oils (petroleum), C20-50, hydrotreated neutral oil-based	-	-	Inherent
Distillate (petroleum), hydrotreated heavy paraffinic	-	-	Inherent
Lubricating oils (petroleum), C15-30, hydrotreated neutral oil-based	-	-	Inherent
2,6-di-tert-butyl-p-cresol	-	-	Not readily

Conclusion/Summary: Inherently biodegradable.

12.3 Bioaccumulative potential

Product/ingredient name	$LogP_{ow}$	BCF	Potential
Distillate (petroleum), hydrotreated light naphthenic	2 to 6	<500	low
Distillate (petroleum), hydrotreated light paraffinic	2 to 6	<500	low
Lubricating oils (petroleum), C20-50, hydrotreated neutral oil-based	2 to 6	<500	low
Distillate (petroleum), hydrotreated heavy paraffinic	2 to 6	<500	low
Lubricating oils (petroleum), C15-30, hydrotreated neutral oil-based	2 to 6	<500	low
2,6-di-tert-butyl-p-cresol	5.1	>500	high

Conclusion/Summary: The product has a potential to bioaccumulate.

12.4 Mobility in soil

Mobility: High mobility in soil predicted, based on log Kow > 3.0.

12.5 Results of PBT and vPvB assessment

Not applicable.

Not applicable.

12.6 Other adverse effects: Insoluble in water. Spills may form a film on water surfaces causing physical damage to organisms. Oxygen transfer could also be impaired.

SECTION 13: Disposal considerations

The information in this section contains generic advice and guidance. The list of Identified Uses in Section 1 should be consulted for any available use-specific information provided in the Exposure Scenario(s).

13.1 Waste treatment methods

Product

Methods of disposal: Where possible (e.g. in the absence of relevant contamination), recycling of used substance is feasible and recommended. This substance can be burned or incinerated, subject to national/local authorizations, relevant contamination limits, safety regulations and air quality legislation. Contaminated or waste substance (not directly recyclable): Disposal can be carried out directly, or by delivery to qualified waste handlers. National legislation may identify a specific organization, and/or prescribe composition limits and methods for recovery or disposal.

Hazardous waste: Yes.

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SECTION 13: Disposal considerations

European waste catalogue (EWC)

Waste code	Waste designation
13 03 07*	mineral-based non-chlorinated insulating and heat transmission oils

Packaging

Methods of disposal: The generation of waste should be avoided or minimised wherever possible. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible.

SECTION 14: Transport information

International transport regulations

	ADR/RID	ADN	IMO/IMDG Classification	ICAO/IATA Classification
14.1 UN number	Not regulated.	Not regulated.	Not regulated.	Not regulated.
14.2 UN proper shipping name	-	-	-	-
14.3 Transport hazard class(es)	-	-	-	-
14.4 Packing group	-	-	-	-
14.5 Environmental hazards	No.	No.	No.	No.
Additional information	-	-	-	-

14.6 Special precautions for user: **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

14.7 Transport in bulk according to Annex I of MARPOL 73/78 and the IBC Code: Oils

SECTION 15: Regulatory information

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture

EU Regulation (EC) No. 1907/2006 (REACH)

Annex XIV - List of substances subject to authorisation

Annex XIV

None of the components are listed.

Substances of very high concern

None of the components are listed.

Annex XVII - Restrictions on the manufacture, placing on the market and use of certain dangerous substances, mixtures and articles: Not applicable.

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SECTION 15: Regulatory information

Other EU regulations

Seveso Directive

This product is not controlled under the Seveso Directive.

International lists

National inventory

Australia	All components are listed or exempted.
Canada	All components are listed or exempted.
China	All components are listed or exempted.
Japan	**Japan inventory (ENCS)**: All components are listed or exempted. **Japan inventory (ISHL)**: Not determined.
Malaysia	Not determined.
New Zealand	All components are listed or exempted.
Philippines	All components are listed or exempted.
Republic of Korea	All components are listed or exempted.
Taiwan	All components are listed or exempted.
United States	All components are listed or exempted.

15.2 Chemical safety assessment	Chemical Safety Assessments for all substances in this product are either Complete or Not applicable.

SECTION 16: Other information

Revision comments	Not available.

▼ Indicates information that has changed from previously issued version.

ADN = European Provisions concerning the International Carriage of Dangerous Goods by Inland Waterway
ADR = The European Agreement concerning the International Carriage of Dangerous Goods by Road
ATE = Acute Toxicity Estimate
CLP = Classification, Labelling and Packaging Regulation [Regulation (EC) No. 1272/2008]
CMR = Carcinogen, Mutagen or Reproductive toxicant
CSA = Chemical Safety Assessment
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 Aquatic Chronic 3, H412	Calculation method Calculation method

Sweden

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SECTION 16: Other information

Full text of abbreviated H statements	H304	May be fatal if swallowed and enters airways.
	H400	Very toxic to aquatic life.
	H410	Very toxic to aquatic life with long lasting effects.
	H412	Harmful to aquatic life with long lasting effects.
Full text of classifications [CLP/GHS]	Aquatic Acute 1, H400	ACUTE AQUATIC HAZARD - Category 1
	Aquatic Chronic 1, H410	LONG-TERM AQUATIC HAZARD - Category 1
	Aquatic Chronic 3, H412	LONG-TERM AQUATIC HAZARD - Category 3
	Asp. Tox. 1, H304	ASPIRATION HAZARD - Category 1
Date of printing	2016-02-19	
Date of issue/ Date of revision	2016-02-19	
Date of previous issue	2015-09-17	
Version	2	

Notice to reader

To the best of our knowledge, the information contained herein is accurate. However, neither the above-named supplier, nor any of its subsidiaries, assumes any liability whatsoever for the accuracy or completeness of the information contained herein.
Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.

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Identification of the substance or mixture

Product definition	Mixture
Product name	Nytro Lyra X

Section 1 - Title

Short title of the exposure scenario	Use in formulations in lubricants- Industrial (2,6-di-tert-butyl-p-cresol)
List of use descriptors	**Identified use name:** Use in formulations in lubricants- Industrial **Process Category:** PROC01, PROC02, PROC03, PROC04, PROC05, PROC08a, PROC08b, PROC09 **Substance supplied to that use in form of:** As such **Sector of end use:** SU03, SU10 **Subsequent service life relevant for that use:** No. **Environmental Release Category:** ERC02 **Market sector by type of chemical product:** PC17, PC24, PC25
Environmental contributing scenarios	
Health Contributing scenarios	

Number of the ES	Not applicable.
Industry Association	Not applicable.
Generic exposure scenario	Not applicable.
Processes and activities covered by the exposure scenario	Covers the use of formulated lubricants within closed or contained systems including incidental exposures during material transfers, operation of machinery/engines and similar articles, equipment maintenance and disposal of wastes.
Additional information	Industrial

Section 2 - Exposure controls

Product characteristics	solid Melting/Freezing Point (°C): 69.8
Concentration of substance in mixture or article	≤100%
Amounts used	Annual site tonnage 22 t/a
Frequency and duration of use	Continuous release(d/a): 300
Environment factors not influenced by risk management	Local freshwater dilution factor 10 Receiving surface water flow is 18000 m³/d. Local marine water dilution factor 100
Other given operational conditions affecting environmental exposure	Not applicable.
Technical conditions and measures at process level (source) to prevent release	% Release fraction to wastewater from process (initial release prior to RMM) 0.2 % Release fraction to air from process (initial release prior to RMM)0,05 % Release fraction to soil from process (initial release prior to RMM) 0
Technical on-site conditions and measures to reduce or limit discharges, air emissions and releases to soil	On-site wastewater treatment required. Ensure all waste water is collected and treated via a waste water treatment plant. Floors should be impervious, resistant to liquids and easy to clean.
Organisational measures to prevent/limit release from site	Ensure operatives are trained to minimise exposures.

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Section 2 - Exposure controls

Conditions and measures related to municipal sewage treatment plant	Size of industrial sewage treatment plant (m3/d): 2000,
Conditions and measures related to external treatment of waste for disposal	No special measures are required. General information, See section 13 for waste disposal information.
Conditions and measures related to external recovery of waste	See section 13 for waste disposal information.

Contributing scenario controlling worker exposure for 0:	
Product characteristics	Melting/Freezing Point (°C): 69.8
Concentration of substance in mixture or article	Covers percentage substance in the product up to 1%.
Physical state	Liquid
Frequency and duration of use	Exposure duration per day: 4 h (half shift). Exposure duration per year: 230 d
Human factors not influenced by risk management	Respiratory (m^3/d): 10 Body weight: 70 kg
Other given operational conditions affecting workers exposure	The product should be handled at room temperature. Indoor
Technical conditions and measures at process level (source) to prevent release	No special measures required.
Technical conditions and measures to control dispersion from source towards the worker	Handle only in a place with local exhaust ventilation (or other adequate ventilation). Efficiency of at least 90 %
Organisational measures to prevent/limit releases, dispersion and exposure	Ensure operatives are trained to minimise exposures.
Conditions and measures related to personal protection and hygiene	
Personal protection	Wear protective clothing. See Section 8 of the safety data sheet (personal protective equipment). PROC 05; PROC08a: Wear protective gloves. Efficiency of at least 90 %

Section 3 - Exposure estimation and reference to its source

Website:	Not available.

Exposure estimation and reference to its source - Environment: 2:	
Exposure assessment (environment):	Used EUSES model.(v2.1).
Exposure estimation	Risk characterisation ratio (PEC/PNEC): <1

Exposure estimation and reference to its source - Workers: 1:	
Exposure assessment (human):	Used ECETOC TRA model (May 2010 release).2.0
Exposure estimation	Risk characterisation ratio DNELs <1

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

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

Environment	Not available.
Health	Not available.

Environment	Not applicable.
Health	Wear protective gloves/protective clothing/eye protection/face protection. Wear respiratory protection. See Section 8 for information on appropriate personal protective equipment.

Identification of the substance or mixture

Product definition	Mixture
Product name	Nytro Lyra X

Section 1 - Title

Short title of the exposure scenario	OLD - Use as lubricant in open and closed systems- Professional (2,6-di-tert-butyl-p-cresol)
List of use descriptors	**Identified use name:** Use as lubricant in open and closed systems - Professional **Process Category:** PROC01, PROC02, PROC03, PROC04, PROC05, PROC07, PROC08a, PROC08b, PROC09, PROC10, PROC11, PROC13 **Substance supplied to that use in form of:** As such **Sector of end use:** SU22 **Subsequent service life relevant for that use:** No. **Environmental Release Category:** ERC08a, ERC08d, ERC09a, ERC09b **Market sector by type of chemical product:** PC17, PC24
Environmental contributing scenarios	
Health Contributing scenarios	
Number of the ES	Not applicable.
Industry Association	Not applicable.
Generic exposure scenario	Not applicable.
Processes and activities covered by the exposure scenario	Covers the use of formulated lubricants in closed and open systems including transfer operations, operation of engines and similar articles, reworking on reject articles, equipment maintenance and disposal of waste oil.
Additional information	Professional

Section 2 - Exposure controls

Product characteristics	solid Melting/freezing point 69.8
Concentration of substance in mixture or article	≤2%
Amounts used	Annual site tonnage ≤0.16 t/a (Closed system) ≤0.03 t/a open systems
Frequency and duration of use	Continuous release(d/a): 300
Environment factors not influenced by risk management	Local freshwater dilution factor 10 Receiving surface water flow is 18000 m³/d. Local marine water dilution factor 100
Other given operational conditions affecting environmental exposure	Not applicable.
Technical conditions and measures at process level (source) to prevent release	% Release fraction to wastewater from process (initial release prior to RMM) 0.2 % Release fraction to air from process (initial release prior to RMM) 0.01 % Release fraction to soil from process (initial release prior to RMM) 1
Technical on-site conditions and measures to reduce or limit discharges, air emissions and releases to soil	On-site wastewater treatment required. Ensure all waste water is collected and treated via a waste water treatment plant. Floors should be impervious, resistant to liquids and easy to clean.
Organisational measures to prevent/limit release from site	Ensure operatives are trained to minimise exposures.

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Section 2 - Exposure controls

Conditions and measures related to municipal sewage treatment plant	Size of industrial sewage treatment plant (m3/d): 2000 , Removal Efficiency (total) 94%
Conditions and measures related to external treatment of waste for disposal	No special measures are required. See section 13 for waste disposal information.
Conditions and measures related to external recovery of waste	See section 13 for waste disposal information.

Contributing scenario controlling worker exposure for 0:	
Product characteristics	Melting/Freezing Point (°C): 69.8
Concentration of substance in mixture or article	≤2%
Physical state	solid
Dust	Solid, medium dustiness
Frequency and duration of use	Exposure duration per year: 230 days Exposure duration per day: 8 h (full shift).
Human factors not influenced by risk management	Respiratory m³/d: 10
Other given operational conditions affecting workers exposure	The product should be handled at room temperature. Lubricants (Closed system)
Technical conditions and measures at process level (source) to prevent release	No special measures required.
Technical conditions and measures to control dispersion from source towards the worker	Handle only in a place with local exhaust ventilation (or other adequate ventilation).
Organisational measures to prevent/limit releases, dispersion and exposure	Ensure operatives are trained to minimise exposures.
Conditions and measures related to personal protection and hygiene	
Personal protection	Wear protective clothing. See Section 8 of the safety data sheet (personal protective equipment).

Section 3 - Exposure estimation and reference to its source

Website:	Not available.

Exposure estimation and reference to its source - Environment: 2:	
Exposure assessment (environment):	Used EUSES model. (v2.1)
Exposure estimation	Risk characterisation ratio (PEC/PNEC): <1

Exposure estimation and reference to its source - Workers: 1:	
Exposure assessment (human):	Used ECETOC TRA model (May 2010 release).
Exposure estimation	Risk characterisation ratio DNELs <1

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

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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.

Industrial

Identification of the substance or mixture

Product definition	Mixture
Product name	Nytro Lyra X

Section 1 - Title

Short title of the exposure scenario	Distribution of substance- Industrial (Other Lubricant Base Oils, IP346<3%, H304)
List of use descriptors	**Identified use name:** Distribution of substance - Industrial **Process Category:** PROC01, PROC02, PROC03, PROC04, PROC08a, PROC08b, PROC09, PROC15 **Substance supplied to that use in form of:** Substance **Sector of end use:** SU03 **Subsequent service life relevant for that use:** No. **Environmental Release Category:** ERC04, ERC05, ERC06a, ERC06b, ERC06c, ERC06d, ERC07, ESVOC SpERC 1.1b.v1 **Market sector by type of chemical product:** Not applicable. **Article category related to subsequent service life:** Not applicable.
Environmental contributing scenarios	**Distribution of substance**
Health Contributing scenarios	**Distribution of substance**

Number of the ES	9.3.1b
Industry Association	Concawe 2012
Generic exposure scenario	01a
Processes and activities covered by the exposure scenario	Bulk loading (including marine vessel/barge, rail/road car and IBC loading) of substance within closed or contained systems, including incidental exposures during its sampling, storage, unloading, maintenance and associated laboratory activities.
Additional information	Industrial

Section 2 - Exposure controls

Product characteristics	Substance is complex UVCB.. Predominantly hydrophobic
Amounts used	Fraction of EU tonnage used in region 0.1 Regional use tonnage 8.5E+5 Fraction of Regional tonnage used locally 1 Maximum daily site tonnage 1.7E+4
Frequency and duration of use	Continuous release Emission days 100
Environment factors not influenced by risk management	Local freshwater dilution factor 10 Local marine water dilution factor 100
Other given operational conditions affecting environmental exposure	Release fraction to air from process (initial release prior to RMM) 1.0E-4 Release fraction to wastewater from process (initial release prior to RMM) 1.0E-7 Release fraction to soil from process (initial release prior to RMM) 0.00001
Technical conditions and measures at process level (source) to prevent release	Common practices vary across sites thus conservative process release estimates used.
Technical on-site conditions and measures to reduce or limit discharges, air emissions and releases to soil	Risk from environmental exposure is driven by freshwater sediment. If discharging to municipal sewage treatment plant, no on-site wastewater treatment required.
Risk management measures - Air	Treat air emission to provide a typical removal efficiency of 90

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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 municipal sewage treatment plant, provide the required on-site wastewater removal efficiency of 0
Organisational measures to prevent/limit release from site	Do not apply industrial sludge to natural soils. Sewage sludge should be incinerated, contained or reclaimed.
Conditions and measures related to municipal sewage treatment plant	Estimated substance removal from wastewater via on-site sewage treatment94.7 Total efficiency of removal from wastewater after on-site and off-site (municipal 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.

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Section 2 - Exposure controls

Drum and small package filling
No other specific measures identified.

Equipment cleaning and maintenance
Drain down and flush system prior to equipment break-in or maintenance.

Storage
Store substance within a closed system.

Conditions and measures related to personal protection and hygiene

Personal protection	See Section 8 of the safety data sheet (general health and safety measures). See Section 8 of the safety data sheet (personal protective equipment).

Section 3 - Exposure estimation and reference to its source

Website:	Not applicable.

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 Lyra X

Section 1 - Title

Short title of the exposure scenario	Formulation & (re)packing of substances and mixtures- Industrial (Other Lubricant Base Oils, IP346<3%)
List of use descriptors	**Identified use name:** Formulation and (re)packing of substances and mixtures - Industrial **Process Category:** PROC01, PROC02, PROC03, PROC04, PROC05, PROC08a, PROC08b, PROC09, PROC14, PROC15 **Substance supplied to that use in form of:** Substance **Sector of end use:** SU10 **Subsequent service life relevant for that use:** No. **Environmental Release Category:** ERC02, ESVOC SpERC 2.2.v1 **Market sector by type of chemical product:** Not applicable. **Article category related to subsequent service life:** Not applicable.
Environmental contributing scenarios	**Formulation and (re)packing of substances and mixtures**
Health Contributing scenarios	**Formulation and (re)packing of substances and mixtures**

Number of the ES	9.4.1b
Industry Association	Concawe 2012
Generic exposure scenario	02
Processes and activities covered by the exposure scenario	Formulation, packing and re-packing of the substance and its mixtures in batch or continuous operations, including storage, materials transfers, mixing, 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 days300
Environment factors not influenced by risk management	Local freshwater dilution factor 10 Local marine water dilution factor 100
Other given operational conditions affecting environmental exposure	Release fraction to air from process (initial release prior to RMM)2.5E-3 Release fraction to wastewater from process (initial release prior to RMM)5.0E-6 Release fraction to soil from process (initial release prior to RMM) 0.0001
Technical conditions and measures at process level (source) to prevent release	Common practices vary across sites thus conservative process release estimates used.
Technical on-site conditions and measures to reduce or limit discharges, air emissions and releases to soil	Risk from environmental exposure is driven by freshwater sediment. Prevent discharge of undissolved substance to or recover from onsite wastewater. If discharging to municipal sewage treatment plant, no on-site wastewater treatment required.

Section 2 - Exposure controls

Risk management measures - Air	Treat air emission to provide a typical removal efficiency 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 municipal sewage treatment plant, provide the required on-site wastewater removal efficiency of 0
Organisational measures to prevent/limit release from site	Do not apply industrial sludge to natural soils. Sewage sludge should be incinerated, contained or reclaimed.
Conditions and measures related to municipal sewage treatment plant	Not applicable as there is no release to wastewater. Estimated substance removal from wastewater via on-site sewage treatment 94.7 Total efficiency of removal from wastewater after on-site and off-site (municipal treatment plant) 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.

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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.

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

Health	The CLP hazard statement H304: May be fatal if swallowed and enters airways (the DPD risk phrase R65: Harmful: may cause lung damage if swallowed) relates to potential for aspiration , a non-quantifiable hazard determined by physico-chemical properties (i.e. kinematic viscosity) that can occur during ingestion and also if it is vomited following ingestion. A DNEL (derived no effect levels) cannot be derived. This general qualitative CSA (chemical safety assessment) approach aims to reduce/ avoid contact or incidents with the substance. However, implementation of risk management measures (RMMs) and operational conditions (OCs) need to be proportional to the degree of concern for the health hazard presented by the substance. Exposures should be controlled to at least the levels that represent an acceptable level of risk such that the implementation of the chosen RMMs will ensure that the likelihood of an event 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.

Identification of the substance or mixture

Product definition	Mixture
Product name	Nytro Lyra X

Section 1 - Title

Short title of the exposure scenario	Manufacturer of substance- Industrial (Other Lubricant Base Oils, IP346<3%, H304)
List of use descriptors	**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 days300
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 municipal sewage treatment plant, no on-site wastewater treatment required.

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Section 2 - Exposure controls

Risk management measures - Air	Treat air emission to provide a typical removal efficiency of 90
Risk management measures - Water	Treat on-site wastewater (prior to receiving water discharge) to provide the required removal efficiency of84.8 If discharging to municipal sewage treatment plant, provide the required on-site wastewater removal efficiency of 0
Organisational measures to prevent/limit release from site	Do not apply industrial sludge to natural soils. Sewage sludge should be incinerated, contained or reclaimed.
Conditions and measures related to municipal sewage treatment plant	Estimated substance removal from wastewater via on-site sewage treatment94.7 Total efficiency of removal from wastewater after on-site and off-site (municipal 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.

315

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 Lyra X

Section 1 - Title

Short title of the exposure scenario	Uses in Functional fluids - Industrial (Other Lubricant Base Oils, IP346<3%, H304)
List of use descriptors	**Identified use name:** Functional Fluids - Industrial **Process Category:** PROC01, PROC03, PROC08a, PROC08b, PROC02, PROC04, PROC09 **Substance supplied to that use in form of:** Substance **Sector of end use:** SU03 **Subsequent service life relevant for that use:** No. **Environmental Release Category:** ERC07, **Market sector by type of chemical product:** Not applicable. **Article category related to subsequent service life:** Not applicable.
Environmental contributing scenarios	**Functional Fluids**
Health Contributing scenarios	**Functional Fluids**

Number of the ES	9.37.1b
Industry Association	Concawe 2012
Generic exposure scenario	13a
Processes and activities covered by the exposure scenario	Use as functional fluids e.g. cable oils, transfer oils, coolants, insulators, refrigerants, hydraulic fluids in industrial equipment including maintenance and related material transfers.
Additional information	Industrial

Section 2 - Exposure controls

Product characteristics	Substance is complex UVCB. Predominantly hydrophobic
Amounts used	Fraction of EU tonnage used in 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 days20
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 municipal sewage treatment plant, no on-site 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 municipal sewage treatment plant, provide the required on-site wastewater removal efficiency of0
Organisational measures to prevent/limit release from site	Do not apply industrial sludge to natural soils. Sewage sludge should be incinerated, contained or reclaimed.
Conditions and measures related to municipal sewage treatment plant	Estimated substance removal from wastewater via on-site sewage treatment94.7 Total efficiency of removal from wastewater after on-site and off-site (municipal 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.

Professional

Identification of the substance or mixture

Product definition	Mixture
Product name	Nytro Lyra X

Section 1 - Title

Short title of the exposure scenario	Uses in Functional fluids - Professional (Other Lubricant Base Oils, IP346<3%, H304)
List of use descriptors	**Identified use name:** Functional Fluids - Professional **Process Category:** PROC01, PROC02, PROC03, PROC08a, PROC09, PROC20 **Substance supplied to that use in form of:** Substance **Sector of end use:** SU22 **Subsequent service life relevant for that use:** No. **Environmental Release Category:** ERC09a, ERC09b, ESVOC SpERC 9.13b.v1 **Market sector by type of chemical product:** Not applicable. **Article category related to subsequent service life:** Not applicable.
Environmental contributing scenarios	**Functional Fluids**
Health Contributing scenarios	**Functional Fluids**

Number of the ES	9.38.1b
Industry Association	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 days365
Environment factors not influenced by risk management	Local freshwater dilution factor 10 Local marine water dilution factor 100
Other given operational conditions affecting environmental exposure	Release fraction to air from process (initial release prior to RMM)0.05 Release fraction to wastewater from process (initial release prior to RMM)0.025 Release fraction to soil from process (initial release prior to RMM)0.025
Technical conditions and measures at process level (source) to prevent release	Common practices vary across sites thus conservative process release estimates used.
Technical on-site conditions and measures to reduce or limit discharges, air emissions and releases to soil	Risk from environmental exposure is driven by freshwater sediment. If discharging to municipal sewage treatment plant, no on-site wastewater treatment required.
Risk management measures - Air	Treat air emission to provide a typical removal efficiency ofN/A

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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 municipal sewage treatment plant, provide the required on-site wastewater removal efficiency of0
Organisational measures to prevent/limit release from site	Do not apply industrial sludge to natural soils. Sewage sludge should be incinerated, contained or reclaimed.
Conditions and measures related to municipal sewage treatment plant	Estimated substance removal from wastewater via on-site sewage treatment94.7 Total efficiency of removal from wastewater after on-site and off-site (municipal 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

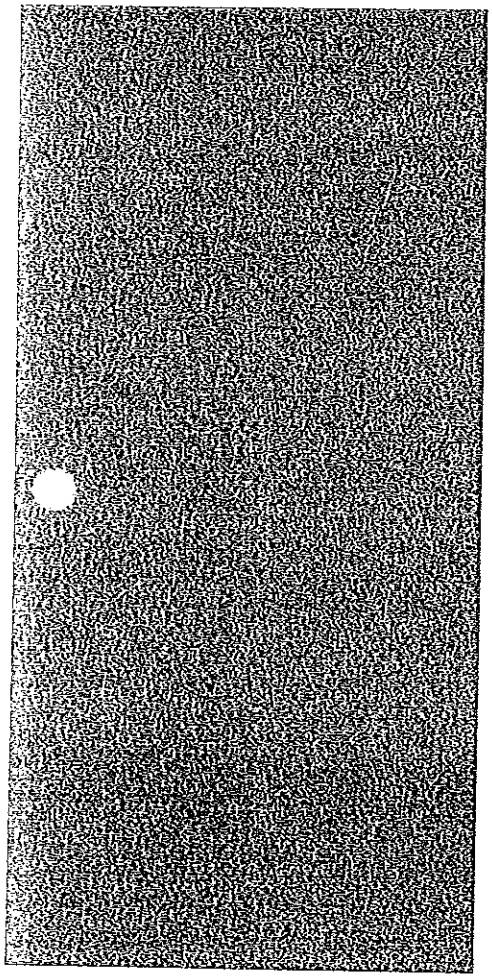
For any substance, classifies as H304 (R65), these measures should be communicated via the safety data sheet by use of the following phrase: Do not ingest. If swallowed then seek immediate medical assistance.

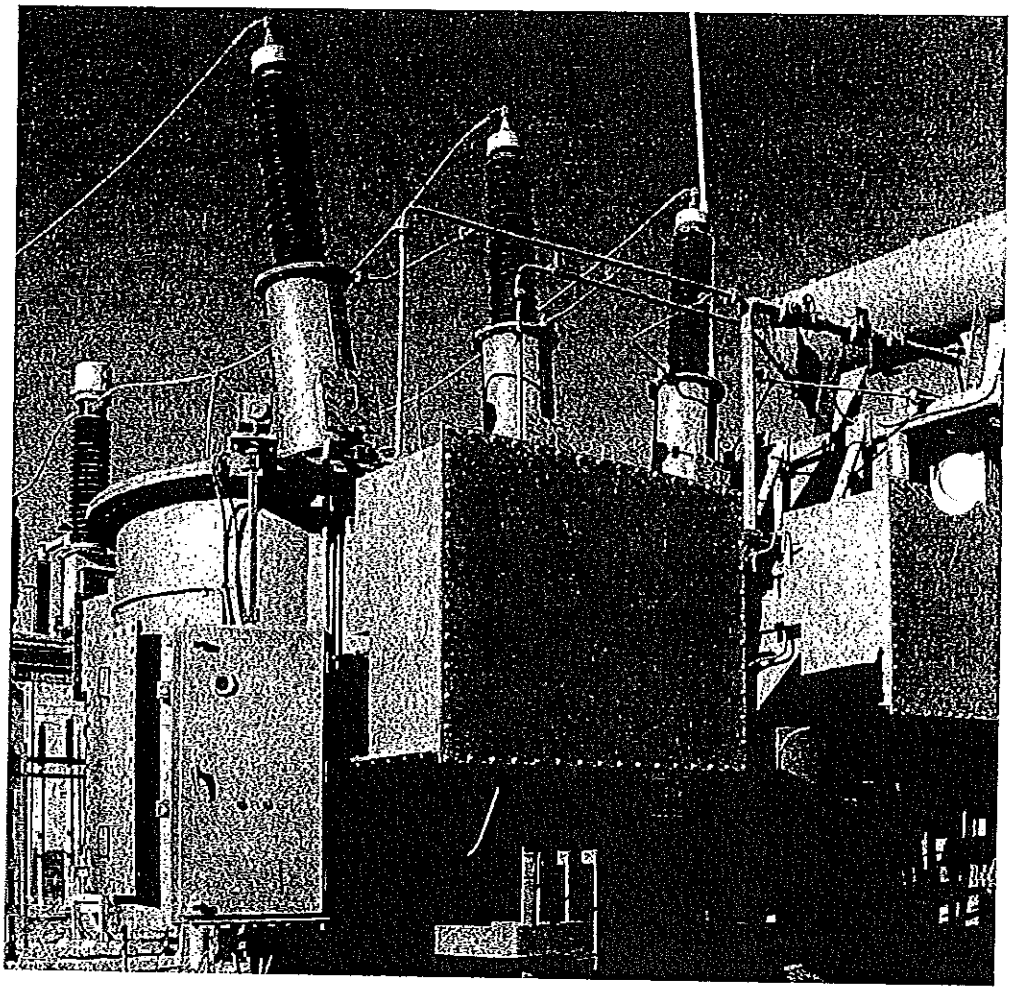
Predicted exposures are not expected to exceed the DN(M)EL when the risk management measures/operational conditions outlined in section 2 are implemented.

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.

LUMASENSE®
TECHNOLOGIES





LumaSMART

Fluoroptic-Based Winding Hot Spot Temperature Sensor for Generation, Transmission and Distribution Transformers

LumaSMART is the fifth generation Fluoroptic®-based thermometry system from LumaSense. By providing direct and real-time winding hotspot measurements, utilities can:

- Implement Dynamic Loading
- Extend the Life of Transformers
- Reduce Costly Failures
- Maximize Safe Performance

Exceptional Reliability and Accuracy in Winding Hot Spots Temperature Monitoring

LumaSense Technologies' LumaSMART winding hot spot temperature system is the most advanced and reliable real-time monitoring solution available today. LumaSense is the leader in Fluoroptic® (FOT) Technology, with decades of proven expertise. The LumaSMART FOT hot spot monitoring systems provide accurate, real-time temperature readings for protection and control of your critical power transformer assets.

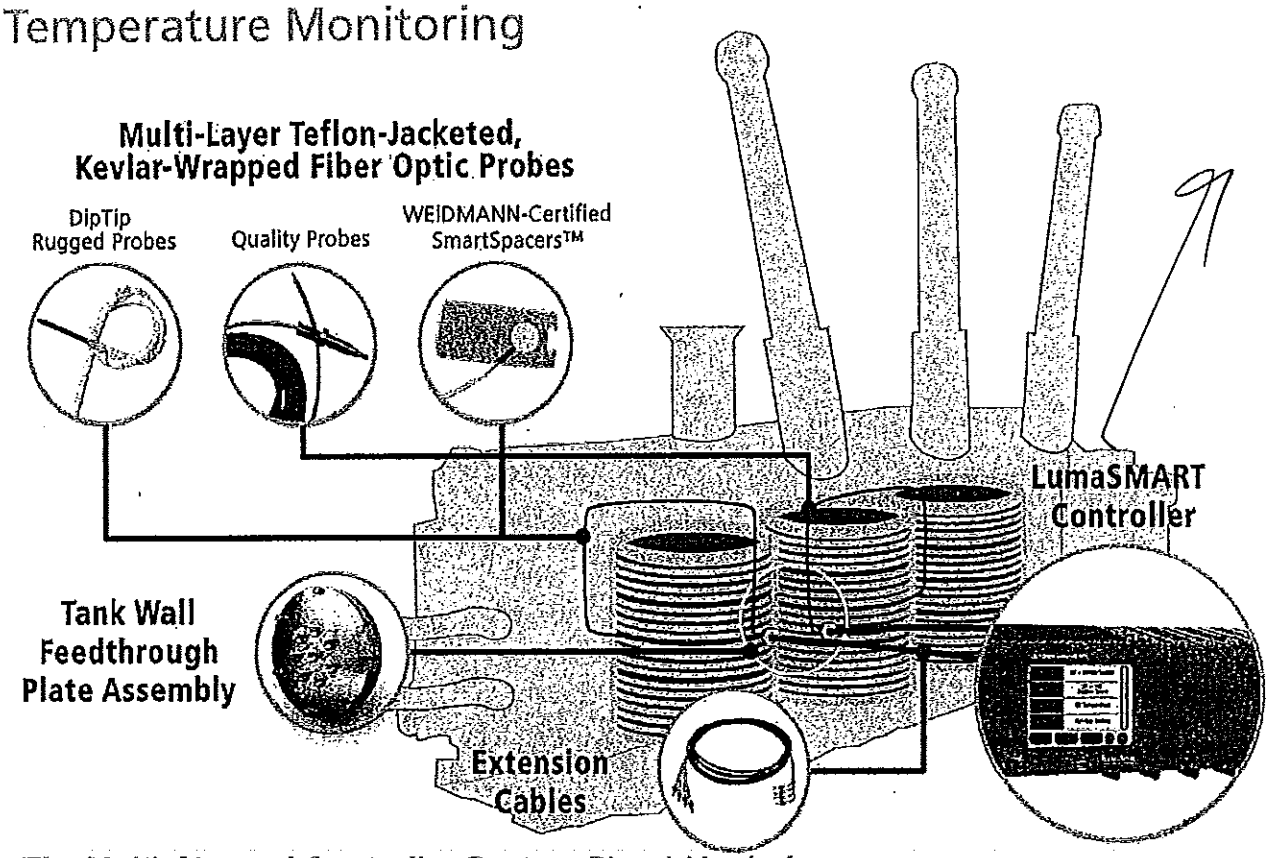
LumaSense's PFA teflon-jacketed Fluoroptic probes are considered the standard in the industry. **Featuring five-layer protection in their fiber optic encapsulation for 99% installation success,** they are specially designed to withstand harsh environments without deteriorating physically or affecting the accuracy of the temperature measurement.

LumaSense Technologies' LUXTRON brand is the world leader in fiber optic temperature measurement in transformers. With more than 30 years of fiber optic experience, LumaSense continues to lead the way in innovation of new, robust technology.

Measuring Hot Spot Winding Temperature

Transformers often take the brunt of an overload condition. **Monitoring the transformer winding hot spot is critical to safeguard your transformer from damage and extend its usage.** Transformer life is directly related to the life of the internal paper insulation. The insulating paper's life is directly affected by its exposure to high temperature. The highest temperature on the windings is the Winding Hot Spot, where the insulating paper will deteriorate first. Conventional methods simulate or calculate this temperature, but do not accurately measure it. The only true way of knowing the actual temperature is through real-time fiber optic measurement. Our reliable, accurate monitors quickly detect and respond to hot spot conditions, triggering alarms and relays to protect your most valuable assets.

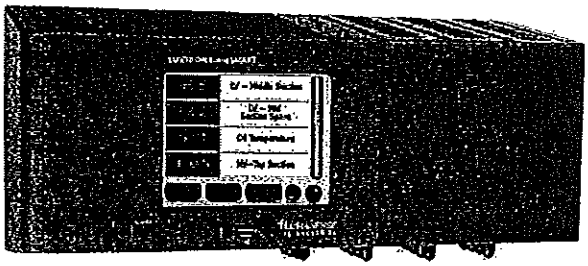
Smart Grid Power Transformer Hot Spots Temperature Monitoring



The Multi-Channel Controller System Should Include:

- LumaSMART Multi-Channel Smart Controller
- Fluoroptic Probes
  - Quality Probes
  - DipTip Rugged Probes
- Extension Cables
  - Single Fiber Extension
  - Four-Fiber Extension
- Tank Wall Feedthrough Plate Assembly
  - Stainless Steel Bolted Plate
  - Individual Tank Wall Feedthroughs
- Optional Accessories
  - NEMA 4 Enclosure
  - WEIDMANN-Certified SmartSacers™
  - NEMA 12 Tank Wall Cover Box
  - Internal and External Plug Assemblies
  - LUXTRON 812 Handheld Unit

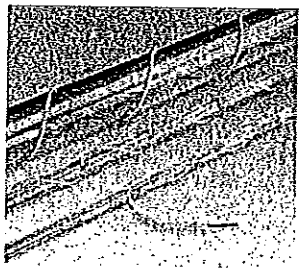
The LumaSMART Controller



LumaSense Technologies' LumaSMART controller is the newest innovation from the leader in FOT technology. Building on the proven performance of the ThermAsset2, this monitor provides all of the capabilities of its predecessor while adding smart grid capabilities, an innovative touch screen and extended channel and relay capabilities.

- Easily adaptable to user-specific needs with 4 to 16 channels and 0, 8 or 16 Form-C programmable relays
- ±2°C accuracy over the entire temperature range for the life of transformer with no calibration
- No drift, no calibration required
- Analog outputs and Modbus, DNP3, ASCII and IEC61850 communication capability standard
- RS-232C and RS-485, Ethernet and USB serial outputs
- Light source lasts the life of the transformer
- Interactive touch screen display for alarms, notifications and set-up
- Equipped with 2GB standard data storage for transformer lifetime memory storage
- On-board diagnostics troubleshooting guidance

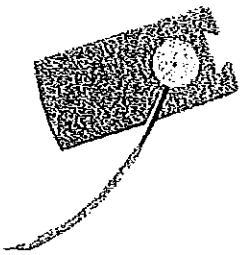
Fluoroptic Probes



The measurement performance of LUXTRON probes exceeds common temperature sensors in environments with high voltage, radio frequency interference (RFI), electromagnetic interference (EMI) or corrosive and above boiling point liquids. Our robust probes are designed for ease of installation and have a greater than 99% installation success rate.

- Industry standard LUXTRON Quality Probes™ and DipTip Rugged Probes™
- Viton O-ring connector for protection against leaks
- PFA Teflon®-jacketed design with Kevlar® construction
- Immune to RF and EMI and Electrically Non-Conductive
- Most robust, well-built fiber optic probes on the market
- Insulated with five layers for superior protection
- DipTip Rugged Probes don't require double installations
- Dielectrically tested to ensure safe, accurate performance
- Chemically inert and compatible with many aggressive chemicals
- Intrinsically safe, stable and drift-free
- Available in various lengths (1m to 16m standard)

WEIDMANN-Certified SmartSpacers™
Our sensor tips can be supplied with WEIDMANN-certified SmartSpacers. All WEIDMANN-certified components including adhesives and assemblies meet strict manufacturing process controls and are shipped with a certificate of compliance outlining that the component has met the five-part WEIDMANN certification process. Available with LumaSense DipTip Rugged Probes™.

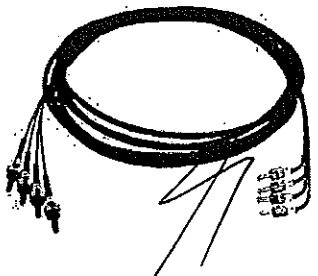


Extensions

LumaSense offers multiple fiber optic extensions options to connect the probes from the tank wall plate to the instrument.

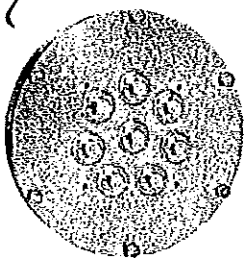
Single Fiber Extension
- Hard Clad Silica fiber jacketed in PVC and Kevlar®
- Available in lengths of 5, 10, 15 or 20 meters or custom lengths by request up to 50 meters
- SMA connector includes Viton O-ring for protection against leaks

Four-Fiber Extension
- Four fiber cable subunits and a central Kevlar® strength member in one PVC outer jacket
- Each subunit features Hytrel® and Kevlar® over Hard Clad Silica fiber
- Available in lengths of 5, 10, 15 or 20 meters or custom lengths by request up to 50 meters
- Viton O-ring connectors for protection against leaks
- Available in low temperature construction also



Tank Wall Plate Assembly

LumaSense provides welded tank wall feedthrough plate assemblies. Each tank wall plate features our proprietary welded feedthroughs on a stainless steel plate, with a carbon steel backing ring and Viton O-ring for maximum protection against leaks.



Technical Data

Performance

Number of Channels	4 to 16 (in increments of 2)
Temperature Range	-30 to 230°C
Accuracy	±2°C over entire temperature range for life of transformer without calibration
Display Response Time	1 sec
Measurement Resolution	0.1°C
Precision	±0.5°C
Light Source Life Span	Life of the transformer
EMI/RFI Susceptibility	Complete Immunity

Interface

Display	5.7-inch interactive touch screen
Probe Signal Strength Readout	Accessible for all channels
Diagnostics	On-board self diagnostics and troubleshooting guide

Environmental Specifications

Operating Temperature	-30 to 70°C
Storage Temperature	-35 to 75°C

Communication

Analog Output	Choice of 4-20mA or 0-1mA
Serial Output	RS-232C and RS-485, Ethernet, USB
Relays	0, 8 or 16 Form-C programmable relays
System Status Relay	1 Form-C relay
Communications	Modbus ASCII, Modbus RTU, DNP3.0, ASCII and IEC61850 Standard
Probes	Accepts LUXTRON Rugged and Quality Probes
Data Storage	2 GB of data at 1 minute intervals on all channels, as well as error codes and relay statuses. Retains approximately 40 years of data.

Electrical

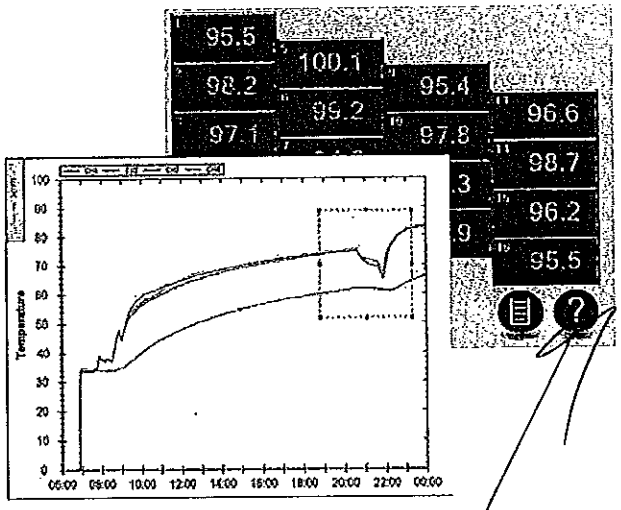
Input Power	90 to 264 VAC or 127 to 370 VDC, 47 to 63 Hz
Surge Protection	4000V (IEEE C37.90.1-2002)
Consumption	108 W (maximum)

Physical

Mounting	Rack, panel or wall mount available

Innovative On-Board Software

The LumaSMART's innovative on-board software gives a color-coded visual display of all connected probes. Using the touch screen exclusively offered by LumaSense, you can customize channel labels, configure alarms and relays and download data logs. In addition, the diagnostic feature allows you to easily test your configured relay settings by simulating alarm conditions. Our software also allows for trending and data analysis of temperatures measured.



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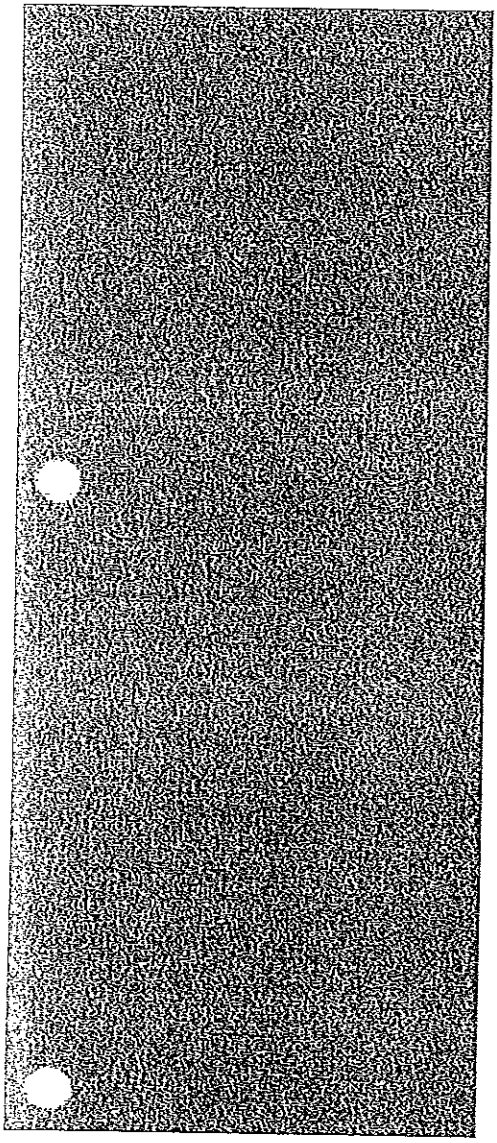
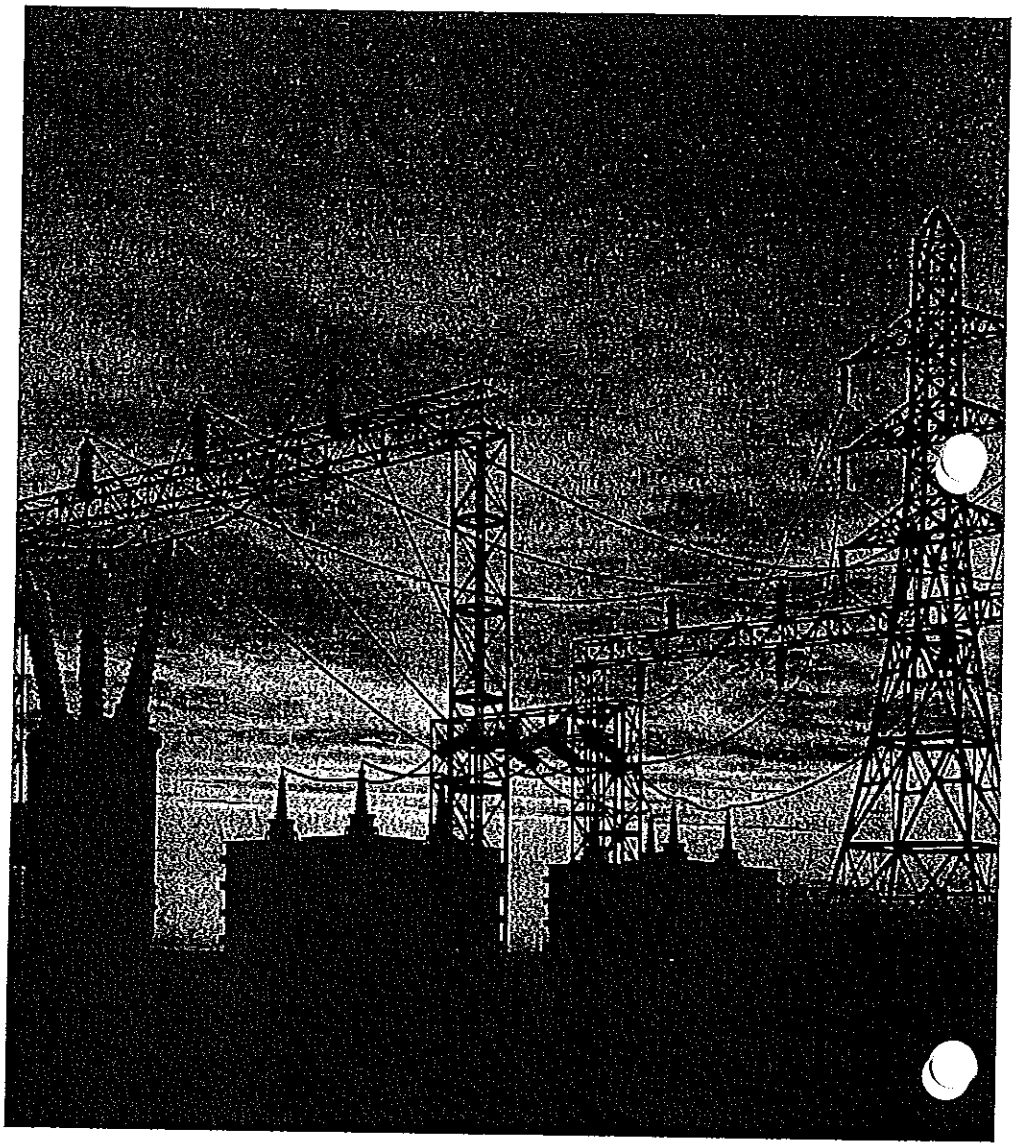
TECHNOLOGIES





SmartDGA® Monitoring Solutions

Cost-effective and accurate gas detection solutions based on Non-Dispersive Infrared (NDIR) sensor technology to measure fault gases in transformers or load tap changers (LTCs)

- Identify potential faults prior to failures and reduce unplanned outages and associated cost
- Reduce the number and frequency of LTC maintenance cycles, thereby increasing uptime and maximum efficiency of the LTC
- Proactively investigate premature aging or the cause of faults of a transformer

Protect critical assets through comprehensive analysis of transformer fault conditions with online SmartDGA® monitors

SmartDGA® Instruments

The SmartDGA® family of instruments is the industry's most cost effective Dissolved Gas Analysis (DGA) solution, designed to be the most flexible and to provide the best user experience available.

Each model has been designed using state-of-the-art Non-Dispersive Infrared (NDIR) technology. The continuous online DGA values reported by the SmartDGA® instrument quickly identify potential fault conditions through monitoring of key gas levels, rates, and ratios.

Each SmartDGA® package includes the instrument, mounting hardware, connection cable, the SmartDGA EZHub™ unit, and SmartDGA Viewer Software.

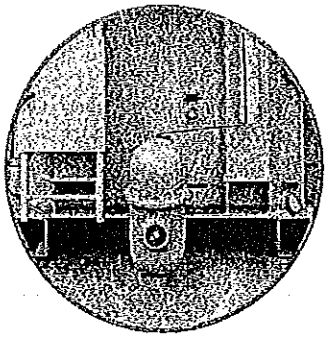
- **SmartDGA Gauge™** is the industry's first dedicated online Load Tap Changer (LTC) condition monitor. The Gauge measures and records Methane, Acetylene, and Ethylene plus moisture to assess LTC health.
- **SmartDGA Guard™** provides a cost effective early warning monitoring system of potential transformer failures. The Guard measures and records Hydrogen, Acetylene, Carbon Dioxide, and Carbon Monoxide plus moisture to provide an early diagnostics tool.
- **SmartDGA Guide™** provides comprehensive online DGA results that enable diagnostic techniques. The Guide measures and reports nine (9) DGA gases plus moisture in an instrument that vastly reduces total cost of ownership of an online monitoring system.

Key Functional Features

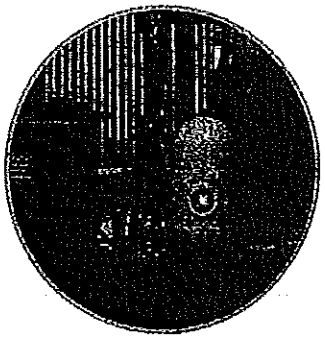
- Versatile mounting configurations – including single and dual valve mount. Inline mounting is available for LTC filter system or non-valve mounting for a transformer.
- Extremely cost effective – total cost of ownership is a fraction of the cost of other instruments and installation can be accomplished in just hours.
- No consumables, carrier gases, or scheduled calibration required.
- Sunlight visible indicators for Caution, Warning, and Alarm conditions. Status Relay notification and corrective action triggering to ensure optimal system operations.
- Communications supported via all major protocols common in the electric power industry such as Modbus RTU, DNP 3.0, and IEC 61850 with the optional iCore.

40+ Years of Experience with NDIR

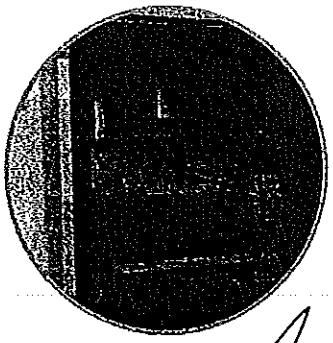
With over 40 years of experience, LumaSense is the industry leader in the use of Non-Dispersive Infrared (NDIR) technologies and has deployed thousands of systems in the field. Our ANDROS® brand pioneered NDIR gas analysis for automotive emissions and patient monitoring. This NDIR technology is the heart of our suite of SmartDGA® products.



Industry leading installation options including on-transformer installation of a full nine gas monitor using a single valve.

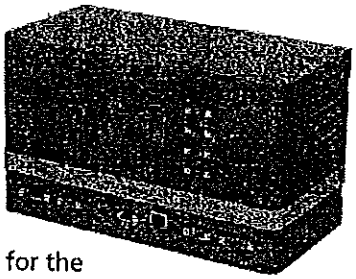


Mount the instrument anywhere using the compact off-transformer mounting kit when space at the transformer is limited or policy prohibits direct mounting to the transformer.



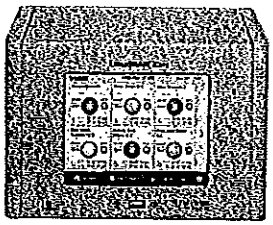
Separate supporting electronics can be mounted up to 30 meters away in a separate enclosure. This allows for a compact sensor that can be conveniently mounted anywhere.

SmartDGA EZHub™



The SmartDGA EZHub™ unit is the central intelligence for the SmartDGA® system. A fully configured unit is capable of handling the power and communication needs for the SmartDGA® system. The EZHub can support a Gauge instrument for the LTC and a Guard or Guide instrument for the transformer. All interface functions and interconnects are provided in the EZHub device as well as internal memory, and four (4) relays with bright LED indicators to indicate Caution, Warning, and Alarm gas level, rate, and ratio conditions. The fourth relay provides status information on the SmartDGA system itself.

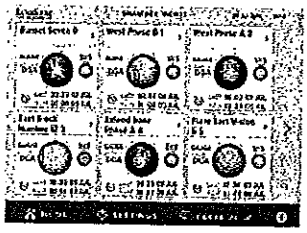
LumaSMART *i*Core™ (Optional)



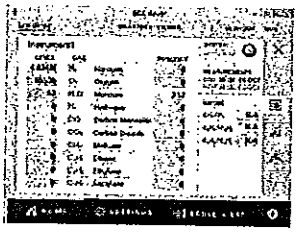
The LumaSmart *i*Core™ controller provides a local interactive touch screen display of DGA data collected from the SmartDGA EZHub™ using the DGA Viewer™ software. The DGA Viewer™ software allows for on-site viewing of DGA data collected from the SmartDGA® instruments. The software provides a local means to set and create operational levels for caution, warning and alarm conditions. Additionally, the LumaSmart *i*Core™ device provides communications to external systems using RS485 or Ethernet. Each LumaSmart *i*Core™ device enables connectivity to multiple EZHub™ units (up to a maximum of 4 using either the Ethernet or RS485 connection).

DGA Viewer™ software

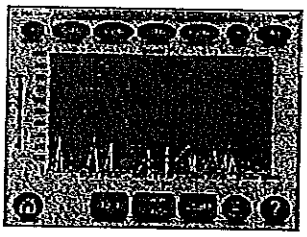
The DGA Viewer™ software allows users to configure systems using various set-up tools and view data being captured by the SmartDGA® instrument.



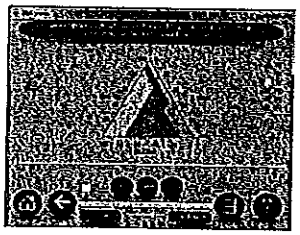
DGA Dashboard
The DGA Viewer™ software displays all connected instruments with status as well as the last and next sampling times.



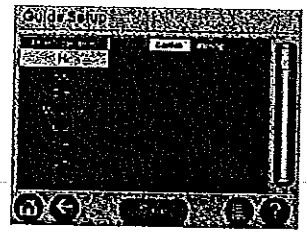
Details Screen
Review Gas levels and PPM/day as well as Ratios in a single screen. The last and next measurement date and times are also visible.



Trends
The Trends screen displays all detected gases via a trend graph over a user-selectable period of time. Each gas can be individually displayed or all 9 gases can be displayed at once.



Duval Triangle
Visual diagnostic tool divided into fault zones based on the types of electrical and thermal faults as defined in Duval triangle type 1 and 2 for transformers and LTCs respectively.



Device Configuration
Customized gas detection levels of Caution, Warning, and Alarm values. Included are user-configurable settings for each gas Rate of Change detection levels. Ratio setpoint activation is also available.

SmartDGA™ System Technical Data

Instrument Specifications

NDIR Gas Phase Sensor Accuracy	± 5% or ± LDL, whichever is greater
Reporting Rate	Every 24 hours - default, user selectable from approximately 3 hours to 7 days.
Measurement Range	Minimum value is the lower detectable limit, maximum value is the upper limit of accurate response
Moisture Accuracy	± 3 ppm or ± 2% RS
Oil Pressure	up to 45 psig (3 bar)
Enclosure Rating	IP 55
Sunlight visible indicators for condition codes Note: Indicators normally flash on for 5 seconds, off for 15 seconds	• Green - Normal • Yellow - Caution • Blue - Warning • Red - Alarm • Red/Blue - System Status Error • Green/Yellow - Loss of Communication

Environmental

	SmartDGA® Instrument	SmartDGA EZHub™	LumaSMART iCore™
Operating Temperature*	-50 to 55 °C	-50 to 55 °C	-40 to 70 °C
Storage Temperature	-50 to 70 °C	-50 to 70 °C	-40 to 75 °C
Storage Humidity (non-condensing)	1–99% RH	1–99% RH	1–99% RH
Dimensions (L x H x D)	20.9" x 8.6" dia.	10.3" x 5.7" x 6"	8.7" x 7.4" x 6.6"
Weight	~18.74 lbs	6.61 lbs	11.02 lbs

Standards Compliance

The SmartDGA system underwent thorough testing and complies with the following standards.

Emissions / Immunity	EN 61000-6-5 (2001) EN 61000-6-4 (2007) +A1 EN 61000-3-2 (2006) +A1 EN 61000-3-3 (2008)
Environmental / Vibration	ETSI EN 300 019-2-4
Surge Protection	4000V (IEEE C37.90.1-2002)

Standard Accessories (included in system order)

- Mounting Hardware - includes single valve, dual valve or off transformer installation kit
- Connection Cable - 10 m standard (additional lengths and cold weather options available)
- DGA Viewer™ software

SmartDGA® Instrument Gas Measurements (Min-Max)

Gas	Gauge	Guard	Guide
Acetylene (C_2H_2)	0.5–50,000 ppm	0.5–10,000 ppm	0.5–10,000 ppm
Ethylene (C_2H_4)	2–50,000 ppm		2–50,000 ppm
Carbon Monoxide (CO)		10–10,000 ppm	10–10,000 ppm
Moisture (RS)	1–99%	1–99%	1–99 %
Hydrogen (H_2)		5–10,000 ppm	5–10,000 ppm
Carbon Dioxide (CO_2)		10–20,000 ppm	10–20,000 ppm
Methane (CH_4)	2–50,000 ppm		2–50,000 ppm
Ethane (C_2H_6)			2–20,000 ppm
Oxygen (O_2)			500–50,000 ppm
Nitrogen (N_2)			5,000–100,000 ppm

EZHub™ & LumaSMART iCore™ Specifications

Power Supplied to EZHub & iCore	90 ~ 264 VAC, 127 ~ 370 VDC, 47 ~ 63 Hz, 6.5 A max
Power Supplied to Instrument	48 VDC ~ 4.16 A max
Memory	Up to 40+ years worth of data storage available with optional iCore
Data Export *(Available with EZHub and iCore/PC)*	Export of results to date in a single file onto a USB memory stick. When using iCore/PC, user can select date range; when using EZHub port, all data is exported
Available Communications *(Available with EZHub)*	Proprietary communications via RS485 and Ethernet connections to DGA Viewer software
Optional Communications *(ModBus available with PC, others available with iCore)*	IEC61850 Edition 2, DNP3 IEEE Std 1815-2012, ModBus RTU V1.02, ModBus TCP/IP 1.0b protocols for up to 3 EZHubs
EZHub Alarm Contacts	(3) programmable relay outputs (Type C, NO/NC) for caution, warning, & alarm (1) alarm relay output for system status (Type C, NO/NC)
Relay Contact Ratings	Single phase alarm relays (8 A, 250 VAC; 5 A, 30 VDC)

Optional Accessories

- LumaSMART iCore™ controller
- NEMA4x Enclosure (for SmartDGA EZHub™ and/or iCore)

*For operating temperatures less than -20 °C, the cold weather cable is required. Additional heating of oil transfer lines may be required for operation in cold locations. The unit will generate a system fault if the mineral oil temperature is outside of standard fluid limits of -20 and 120 °C. For operating in environments where the temperature routinely exceeds 40 °C, the high temperature accessory is recommended to prevent premature aging and reduction of component lifetime. Temperatures are based upon air temperatures for unit installation in shaded location.

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SmartDGA Brochure-EN - Rev. 03/31/2017

HYUNDAI
HEAVY INDUSTRIES CO. - BULGARIA

TEST REPORT

ROUTINE TESTS OF POWER TRANSFORMER

Laboratory Complex "Transformers"
Section "Transformer Test Station"
41, Rojen Blvd.
1271 Sofia, Bulgaria
tel. +359 2 382 989; fax: +359 2 936 07 42

Type *ATMTPV 160000 / 220*	P.O. № 476/CE/STG/DP-I/F243/4740-49/ 31.10.2002
Tr. № *112741*	Customer: National Transmission & Dispatch Co. Ltd "WAPDA" - PAKISTAN
Project № *32809*	Standard document: IEC 60076-1/93; IEC 60296

RATINGS

Index	*Cooling*	*HV winding*	*LV winding*	*Tertiary winding*
Output, kVA	ONAF2	160000	160000	30000
	ONAF1	125000	125000	30000
	ONAN	100000	100000	30000
Current, A	ONAF2	419.89	699.82	1574.59
	ONAF1	328.04	546.73	1574.59
	ONAN	262.43	437.39	1574.59
Voltage, kV		220 ± 13 x 0.769%	132	11
Insulation level: line terminals		SI/LI/AC 850/950/395	LI/AC 650/275	LI/AC 110/38
neutral terminal		LI/AC 325/140		-

		Terminals	*Tap*	*Short-circuit impedance, %*
Frequency –	*50 Hz*	HV – LV	14	12.5 (125 MVA)
Number of phases -	*3*	HV – Tw	14	45.0 (125 MVA)
Type of mounting -	*outdoor*	LV - Tw	-	25.0 (125 MVA)
Type of regulation –	*on load*	Connection - *YNa0d1*		
Operation duty -	*continuous*			

Tested by:
1. /I. Terziev/
2. /N. Vladimirov/

Chief of Department:
/M. Mateev, MSEE /

Inspectors:
/Ir. R.C.A.M. Koevoets/
/Ch. Abdul Hameed /

Sofia, 05.09.2003

ВЕРНО
С ОРИГИНАЛА

1. Measurement of the voltage ratio and check of the phase displacement

1.1 Measurement of voltage ratio (HV / LV)

REATED VALUES				MEASURED VALUES		
Tap	*Voltage, V*		$\frac{U_{HV}}{U_{LV}}$	*Deviation, %*		
	U_{HV}	U_{LV}		*ANa-AmNa*	*BNa-BmNa*	*CNa-CmNa*
1	242000		1,833	0,12	0,14	0,13
2	240304		1,820	0,15	0,15	0,15
3	238612		1,808	0,11	0,11	0,12
4	236920		1,795	0,13	0,11	0,10
5	235228		1,782	0,12	0,02	0,13
6	233536		1,769	0,12	0,08	0,12
7	231844		1,756	0,11	0,08	0,09
8	230152		1,744	0,07	0,07	0,10
9	228460		1,731	0,09	0,06	0,09
10	226768		1,718	0,07	0,08	0,05
11	225076		1,705	0,03	0,01	0,05
12	223384		1,692	0,02	0,05	0,04
13	221692		1,679	0,03	0,05	0,02
14	220000	132000	1,667	0,01	0,01	0,02
15	218308		1,654	-0,02	0,02	0,02
16	216616		1,641	0,00	-0,02	0,01
17	214924		1,628	-0,01	-0,03	0,04
18	213232		1,615	-0,04	-0,04	-0,03
19	211540		1,603	-0,03	-0,03	-0,04
20	209848		1,590	-0,04	-0,06	-0,05
21	208156		1,577	-0,08	-0,07	-0,04
22	206464		1,564	-0,07	-0,06	-0,06
23	204772		1,551	-0,11	-0,10	-0,09
24	203080		1,538	-0,10	-0,09	-0,10
25	201388		1,526	-0,12	-0,09	-0,11
26	199696		1,513	-0,12	-0,14	-0,13
27	198000		1,500	-0,12	-0,13	-0,11

Admissible deviation of the voltage ratio - $\leq \pm 0.5$ %

1.2 Check of the phase displacement (HV / LV) – *YNa0*

1.3 Measurement of voltage ratio (HV / Tw)

REATED VALUES				MEASURED VALUES		
Tap	Voltage, V		$\frac{U_{HV}}{U_{TW} \times \sqrt{3}}$	Deviation, %		
	U_{HV}	U_{TW}		ANa-TATB	BNa-TBTc	CNa-TcTA
1	242000	11000	12,702	0,23	0,23	0,25
2	240304		12,613	0,25	0,23	0,25
3	238612		12,524	0,20	0,23	0,22
4	236920		12,435	0,24	0,19	0,23
5	235228		12,346	0,25	0,11	0,26
6	233536		12,257	0,21	0,21	0,23
7	231844		12,169	0,21	0,20	0,19
8	230152		12,080	0,19	0,16	0,18
9	228460		11,991	0,19	0,18	0,20
10	226768		11,902	0,17	0,16	0,15
11	225076		11,813	0,11	0,12	0,15
12	223384		11,725	0,13	0,15	0,14
13	221692		11,636	0,12	0,15	0,14
14	220000		11,547	0,12	0,10	0,12
15	218308		11,458	0,08	0,11	0,15
16	216616		11,369	0,09	0,07	0,12
17	214924		11,281	0,11	0,05	0,13
18	213232		11,192	0,10	0,04	0,07
19	211540		11,103	0,06	0,05	0,07
20	209848		11,014	0,08	0,04	0,08
21	208156		10,925	0,01	0,02	0,07
22	206464		10,837	0,05	0,06	0,02
23	204772		10,748	0,00	0,02	0,03
24	203080		10,659	0,02	0,03	-0,01
25	201388		10,570	0,01	0,01	-0,03
26	199696		10,481	0,01	-0,04	-0,04
27	198000		10,392	-0,03	-0,02	-0,02

Admissible deviation of the voltage ratio - $\leq \pm 0,5$ %

1.4 Check of the phase displacement (HV / Tw) – *YNd1*

1.5 Measurement of voltage ratio (LV / Tw)

REATED VALUES				MEASURED VALUES		
Tap	Voltage, V		$\frac{U_{LV}}{U_{TW} \times \sqrt{3}}$	Deviation, %		
	U_{LV}	U_{TW}		AmNa-TATB	BmNa-TBTc	CmNa-TcTA
-	132000	11000	6,928	0,09	0,10	0,09

Admissible deviation of the voltage ratio - $\leq \pm 0,5$ %

1.6 Check of the phase displacement (LV / Tw) – *YNd1*

2. Measurement of the winding resistance with D.C.

2.1 HV winding

Tap	Terminals	Voltage, V	Current, A	Resistance, Ω at θ_m	Resistance, Ω at 75 °C	
1	ANa	2,860	5	0,5720	0,6820	θ_m = 25,0 °C
	BNa	2,866	5	0,5732	0,6834	
	CNa	2,874	5	0,5748	0,6853	
2	ANa	2,844	5	0,5688	0,6782	
	BNa	2,854	5	0,5708	0,6806	
	CNa	2,858	5	0,5716	0,6815	
3	ANa	2,830	5	0,5660	0,6748	
	BNa	2,836	5	0,5672	0,6763	
	CNa	2,840	5	0,5680	0,6772	
4	ANa	2,816	5	0,5632	0,6715	
	BNa	2,820	5	0,5640	0,6725	
	CNa	2,822	5	0,5644	0,6729	
5	ANa	2,798	5	0,5596	0,6672	
	BNa	2,800	5	0,5600	0,6677	
	CNa	2,804	5	0,5608	0,6686	
6	ANa	2,778	5	0,5556	0,6624	
	BNa	2,782	5	0,5564	0,6634	
	CNa	2,786	5	0,5572	0,6644	
7	ANa	2,760	5	0,5520	0,6582	
	BNa	2,764	5	0,5528	0,6591	
	CNa	2,770	5	0,5540	0,6605	
8	ANa	2,742	5	0,5484	0,6539	
	BNa	2,748	5	0,5496	0,6553	
	CNa	2,754	5	0,5508	0,6567	
9	ANa	2,726	5	0,5452	0,6500	
	BNa	2,734	5	0,5468	0,6520	
	CNa	2,734	5	0,5468	0,6520	
10	ANa	2,714	5	0,5428	0,6472	
	BNa	2,718	5	0,5436	0,6481	
	CNa	2,722	5	0,5444	0,6491	
11	ANa	2,696	5	0,5392	0,6429	
	BNa	2,700	5	0,5400	0,6438	
	CNa	2,704	5	0,5408	0,6448	
12	ANa	2,678	5	0,5356	0,6386	
	BNa	2,680	5	0,5360	0,6391	
	CNa	2,686	5	0,5372	0,6405	
13	ANa	2,660	5	0,5320	0,6343	
	BNa	2,664	5	0,5328	0,6353	
	CNa	2,670	5	0,5340	0,6367	
14	ANa	2,640	5	0,5280	0,6295	
	BNa	2,642	5	0,5284	0,6300	
	CNa	2,648	5	0,5296	0,6314	
27	ANa	2,860	5	0,5720	0,6820	
	BNa	2,868	5	0,5736	0,6839	
	CNa	2,874	5	0,5748	0,6853	

2.2 LV winding

-	AmNa	1,7000	5	0,3400	0,4054	θ_m = 25,0 °C
	BmNa	1,7020	5	0,3404	0,4059	
	CmNa	1,7080	5	0,3416	0,4073	

2.3 Tertiary winding

-	TATB	0,0648	5	0,01296	0,0155	θ_m = 25,0 °C
	TBTC	0,0640	5	0,01279	0,0152	
	TCTz	0,0635	5	0,01269	0,0151	

ВЯРНО С ОРИГИНАЛА

ХЕВИ ИНДЪСТРИС КО БЪЛГАРИЯ АД

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3. Measurement of the short-circuit impedance and load losses

3.1 Test HV/LV

3.1.1 Results of the measurement

Tap	Current – Im, A	Voltage – Um, kV	Losses – Pm, kW	Losses – $Pm_{corr.}$, kW
1	203,830	19,880	82,000	88,699
14	217,250	17,330	75,600	81,084
27	239,070	15,760	89,600	94,367

$f = 50$ Hz
$\theta_w = 26{,}0$ °C

3.1.2 Related to the rated values

Tap	Related to Ir		Related to 75 °C			Us.c, %
	P s.c, kW	Us.c, kV	Ir^2R, kW	Padd, kW	Ps.c, kW	
Output: 160 MVA						
1	311,080	37,230	244,567	88,547	333,114	15,38
14	302,892	33,495	214,022	103,305	317,327	15,23
27	359,389	30,756	247,519	127,127	374,646	15,53

Guaranteed output *160 MVA* : Ps.c = *334,00* kW ;

Output: 125 MVA						
1	189,870	29,086	149,269	54,048	203,317	12,02
14	184,872	26,168	130,626	63,055	193,681	11,89
27	219,351	24,028	151,072	77,591	228,663	12,14

Guaranteed output *125 MVA* : Ps.c = *226,00* kW ; Us.c = *12,5* %

Output: 120 MVA						
1	174,983	27,923	137,566	49,810	187,376	11,54
14	170,379	25,121	120,385	58,113	178,498	11,42
27	202,153	23,067	139,227	71,508	210,735	11,65

Guaranteed output *120 MVA* : Ps.c = *211,00* kW;

Output: 100 MVA						
1	121,511	23,268	95,536	34,583	130,119	9,61
14	118,316	20,934	83,604	40,351	123,955	9,52
27	140,383	19,222	96,688	49,656	146,344	9,71

Guaranteed output *100 MVA* : Ps.c = *151,00* kW;

Output: 93,75 MVA						
1	106,797	21,814	83,965	30,397	114,362	9,01
14	103,990	19,626	73,478	35,468	108,946	8,92
27	123,387	18,021	84,979	43,646	128,625	9,10

Guaranteed output *93,75 MVA* : Ps.c = *135,00* kW;

Output: 80 MVA						
1	77,770	18,615	61,142	22,136	83,278	7,69
14	75,727	16,748	53,505	25,830	79,335	7,61
27	89,843	15,378	61,879	31,779	93,658	7,77

Guaranteed output *80* MVA : Ps.c = *104,00* kW;

3.1.2 Related to the rated values

Tap	Related to Ir		Related to 75 °C			Us.c, %
	P s.c, kW	Us.c, kV	Ir²R, kW	Padd, kW	Ps.c, kW	
Output: 75 MVA						
1	68,352	17,451	53,738	19,456	73,194	7,21
14	66,551	15,700	47,026	22,697	69,723	7,14
27	78,963	14,417	54,386	27,930	82,316	7,28

Guaranteed output *75* MVA : Ps.c = *91,00* kW;

Output: 62,5 MVA						
1	47,467	14,543	37,319	13,510	50,829	6,01
14	46,218	13,084	32,658	15,763	48,421	5,95
27	54,835	12,014	37,769	19,395	57,164	6,07

Guaranteed output *62,7* MVA : Ps.c = *65,00* kW;

Output: 50 MVA						
1	30,360	11,635	23,882	8,649	32,531	4,81
14	29,581	10,467	20,900	10,090	30,990	4,76
27	35,098	9,611	24,171	12,417	36,588	4,85

Guaranteed output *50* MVA : Ps.c = *48,00* kW;

3.2 Test HV/ Tw

3.2.1 Results of the measurement

Tap	Current – Im, A	Voltage – Um, kV	Losses – Pm, kW	Losses – $Pm_{corr.}$, kW*	
1	45,970	14,573	25,380	23,763	*f = 50 Hz*
14	45,460	11,710	20,770	19,394	θ_m = *26,0 °C*
27	50,510	10,433	22,020	20,575	

3.2.2 Related to the rated values

Tap	Related to Ir		Related to 75 °C			Us.c, %	
	P s.c, kW	Us.c, kV	Ir²R, kW	Padd, kW	Ps.c, kW		
Output 30 MVA							*125 MVA*
1	57,598	22,688	48,389	14,193	62,582	9,38	39,08
14	58,167	20,280	49,605	13,810	63,415	9,22	38,42
27	61,717	18,069	53,581	13,981	67,562	9,13	38,04

Guaranteed output *30* MVA : Ps.c = *72,00* kW; 125 MVA: Us.c = *45,0* %

Output 22,5 MVA							
1	32,402	17,017	27,219	7,986	35,205	7,03	
14	32,722	15,211	27,903	7,771	35,674	6,91	
27	34,716	13,552	30,139	7,864	38,003	6,84	

Guaranteed output *22,5* MVA : Ps.c = *43,00* kW;

Output 15 MVA						
1	14,404	11,346	12,098	3,552	15,650	4,69
14	14,538	10,139	12,401	3,450	15,851	4,61
27	15,429	9,035	13,395	3,495	16,890	4,56

Guaranteed output *15* MVA : Ps.c = *22,00* kW;

3.3 Test LV/ Tw

3.3.1 Results of the measurement

Tap	Current – Im, A	Voltage – Um, kV	Losses – Pm, kW	Losses – $Pm_{corr.}$, kW*	$f = 50$ Hz $\theta_m = 26{,}0$ °C
	104,030	6,104	36,700	36,156	

3.3.2 Related to the rated values

Tap	Related to Ir		Related to 75 °C			Us.c, %	
	P s.c, kW	Us.c, kV	Ir^2R, kW	Padd, kW	Ps.c, kW	30 MVA	125 MVA
	Output 30 MVA						
-	57,658	7,696	58,861	6,820	65,681	5,83	24,29

Guaranteed output 30000 kVA : Ps.c = 79,00 kW ; 125000 kVA: Us.c = 25,0 %

	Output 22,5 MVA					
-	32,429	5,772	33,109	3,834	36,943	4,37

Guaranteed output 22,5 MVA : Ps.c = 47,00 kW

	Output 15 MVA					
-	14,415	3,848	14,715	1,706	16,421	2,92

Guaranteed output 15 MVA : Ps.c = 24,00 kW

3.4 Short-circuit impedance given in Ohms per phase for different pair of windings

Test	Tap	Us.c., Ohm/ph		Test	Tap	Us.c., Ohm/ph		Test	Tap	Us.c., Ohm/ph	
		Measured	Guaranteed			Measured	Guaranteed			Measured	Guaranteed
HV-LV	1	56,31	59,5	HV-Tw	1	183,03	215,0	LV-Tw	-	33,86	34,8
	14	46,06	48,4		14	148,72	174,3				
	27	38,06	40,9		27	119,25	140,5				

3.5 Calculation of the three-winding combined load losses

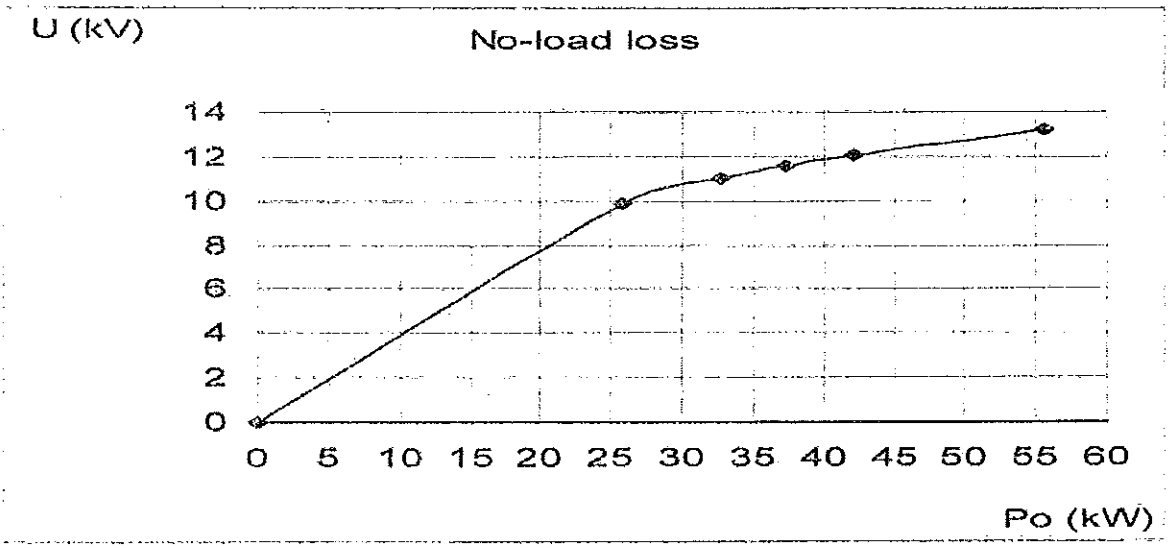
Output, MVA	Tap	Losses, kW		Output, MVA	Tap	Losses, kW		Output, MVA	Tap	Losses, kW	
		Calculated	Guaranteed			Calculated	Guaranteed			Calculated	Guaranteed
160	1	319,808	382	120	1	179,892	239	80	1	79,952	121
	14	311,424	348		14	175,176	217		14	77,856	109
	27	380,113	403		27	213,813	248		27	95,028	122
125	1	207,289	264	93,75	1	116,600	159	62,5	1	51,822	83
	14	203,437	242		14	114,433	145		14	50,859	75
	27	247,304	278		27	139,109	165		27	61,826	84
100	1	146,437	177	75	1	82,371	118	50	1	36,609	62
	14	144,897	170		14	81,504	108		14	36,224	56
	27	174,393	194		27	98,096	121		27	43,598	62

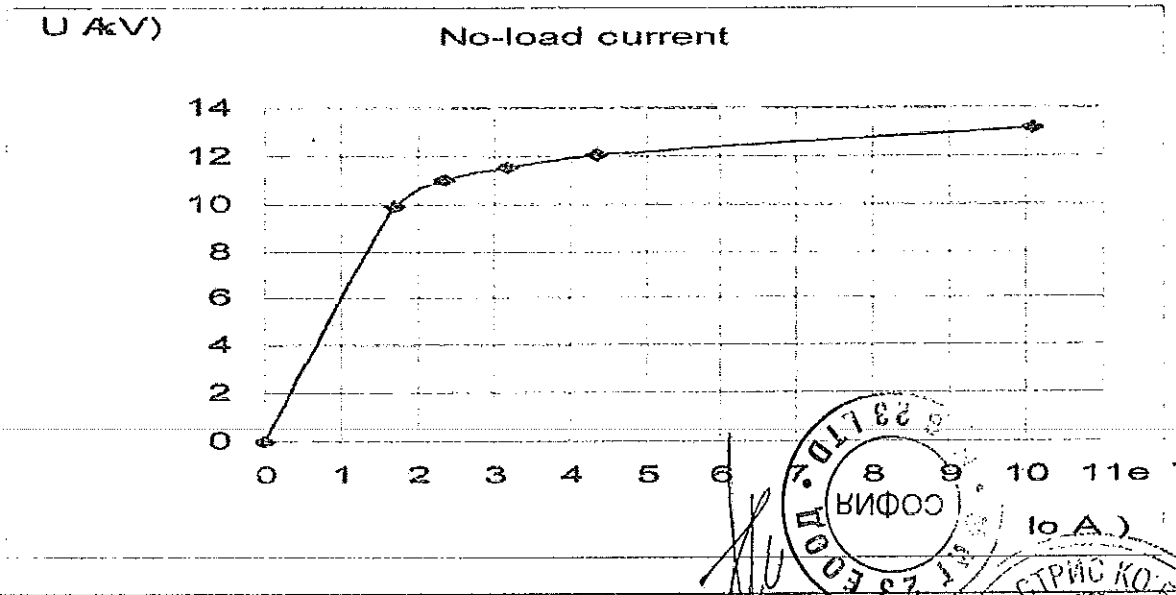
* Correction is necessary to be made because of the error of the instrument transformers

4. Measurement of the no-load losses and current

Tap	U_m/U_r	*f, Hz*	*Voltage* *Uav, kV*	*Voltage* *Ueff, kV*	*Current* *Io, A*	*Current* *Io, %*	*Losses* *Pom, kW*	*Losses* *Po, kW*
14	0,90	50	9,899	9,918	1,686	0,020	25,74	25,70
	1,00	50	10,990	10,990	2,342	0,028	32,74	32,74
	1,05	50	11,552	11,558	3,186	0,038	37,30	37,30
	1,10	50	12,098	12,062	4,365	0,052	42,00	42,15
	1,20	50	13,200	13,090	10,102	0,120	55,06	55,66

Guaranteed for: U_m/U_r=*1,00*; Po = 31,00 kW; i_0 = 0,083 %
U_m/U_r=*1,05*; Po = 37,40 kW; i_0 = 0,109 %
U_m/U_r=*1,10*; Po = 45,50 kW; i_0 = 0,163 %





5. Determination of the breakdown voltage of the transformer oil

№ of breakdown	1	2	3	4	5	6	Mean value, kV	θm , °C
Breakdown voltage, kV	75	76	75	75	75	75	75	26,0

6.1 Measurement of the insulation characteristics* – 25.08.2003

Insulation clearance	R_{15}, MΩ	R_{60}, MΩ	tgδ, %	Cs.c, pF	θm , °C
Tertiary / HV+ LV + Tank	1783	3500	0,268	19587	26,0
HV + LV/ Tertiary + Tank	2400	3200	0,205	13091	
HV + LV + Tertiary/ Tank	1564	2611	0,251	21839	
Test Voltage, kV	2,5 kV (D.C.)		10 kV (A.C.; 50 Hz)		

6.2 Measurement of the insulation characteristics – 05.09.2003

Insulation clearance	R_{15}, MΩ	R_{60}, MΩ	tgδ, %	Cs.c, pF	θm , °C
Tertiary / HV+ LV + Tank	1194	2554	0,274	19608	30,0
HV + LV/ Tertiary + Tank	1706	2379	0,208	13088	
HV + LV + Tertiary/ Tank	1092	1758	0,264	21849	
Test Voltage	2,5 kV (D.C.)		10 kV (A.C.; 50 Hz)		

7. Separate-source voltage withstand test

Frequency - 50 Hz

Duration - 60 s

HV line terminals withstood	140 kV
LV line terminals withstood	140 kV
Neutral terminal withstood	140 kV
Tw line terminals withstood	38 kV

8. Checking the operation of the on-load tap-changing device inbuilt into the transformer - *normal operation*

Used measuring devices

№	Device	Type	Serial number
1	Instrument transformer	ТЛ 35 5, 10, 20 / 5	81017
2	Instrument transformer	ТЛ 35 5, 10, 20 / 5	81013
3	Instrument transformer	ТЛ 35 5, 10, 20 / 5	81018
4	Instrument transformer	ТЛ 35 50, 100, 200 / 5	81019
5	Instrument transformer	ТЛ 35 50, 100, 200 / 5	81026
6	Instrument transformer	ТЛ 35 50, 100, 200 / 5	81028
7	Instrument transformer	И 510 3, 6, 10, 15/ 0,1	43
8	Instrument transformer	И 510 3, 6, 10, 15/ 0,1	19
9	Instrument transformer	НК 24 20 / 0,1	00020
10	Instrument transformer	НК 24 20 / 0,1	00017
11	AC-Power Analyzer	Norma D5155	V069812 I
12	Insulation tester	Unilap ISO 5 kV	S02490314628
13	C and tgδ Bridge	Tettex 2808	39255
14	Voltage divider	MCF 75/350 P	881913
15	Voltage divider	MCF 135/200 P	873104
16	Amplitude voltmeter	MU7	884484
17	Amplitude voltmeter	MU7	884486
18	Voltmeter	M2018	4722
19	Ampzremeter	Д 5014	59227
20	Amplitude voltmeter device	WPOT 0.25/75	858405

* The measurement is not actual

ВЯРНО С ОРИГИНАЛА

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LABORATORY COMPLEX "TRANSFORMERS"
LABORATORY "TRANSFORMER"

TÜV CERT EN ISO 9001

Chief of laboratory
complex "Transformers":
M.Sc.El.Eng.M.Mateev:

total pages: 4

T E S T C E R T I F I C A T E
№ T056/29.08.2003

TEMPERATURE RISE TEST

TEST OBJECT: Transformer type ATMTPY 160000/220

Doc. № 32809

Ser. № 112738 Ser. № 112741

Manufacturer: HYUNDAI HEAVY INDUSTRIES Co., Bulgaria

R A T E D D A T A :

Output, kVA	160000/160000/30000
Voltage, kV	220±13x0.769%/132/11
Current, A	419.9/699.8/1574.6
Frequency, Hz	50
Vector group of connection	YNa0d1
Cooling type	ONAN/ONAF1(12 fans)/ONASF2(24 fans)
Mounting	outdoor
Voltage regulation	on-load tap-changer type MR № 586903

Contractor	HYUNDAI HEAVY INDUSTRIES Co., Bulgaria
Owner	"WAPDA", Islamic republic Pakistan
Contract	476/CE/STG/DP-I/F-243/4740-49/31.10.2002
Standard	IEC 60076

ВЕРНО
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Temperature rise test has been performed according to IEC 60076-2/93 recommendation. Temperature rise test is carried out by the ~~short-~~ circuit method with energised HV winding at tap 27.

The test has been performed on transformer ser.№ 112738 in June 2003 with the next results:

Output Cooling	Losses for oil	Current for winding	Air temperature	Temperature rise, K				
				Measured			Guaranteed	
KVA - -	W	A	°C	top oil, av.oil	HV w. av,** h.spot	LV w. av,*** h.spot	top oil,	winding average h.spot
179200 *ONAF2	477834	522.53	23.4	53.3 39.2	53.2 71.4	56.8 76.1	60 -	65 78
169600 ONAF2	431135	494.54	23.4	48.0 35.3	48.2 64.7	51.5 68.9	55 -	60 73
160000 *ONAF2	387007	466.55	23.4	43.2 31.8	43.5 58.4	46.5 62.3	50 -	55 68
140000 *ONAF1	303328	408.23	20.0	47.3 34.7	45.8 61.7	49.3 66.3	60 -	65 78
132500 ONAF1	274826	386.36	20.0	42.8 31.4	41.6 56.1	44.8 60.7	55 -	60 73
125000 *ONAF1	247891	364.49	20.0	38.6 28.3	37.6 50.7	40.6 54.5	50 -	55 68
112000 *ONAN	204923	326.58	21.8	40.2 28.6	38.4 52.9	41.8 57.3	60 -	65 78
106000 ONAN	186681	309.09	21.8	37.3 26.6	35.4 48.9	38.6 52.9	55 -	60 73
100000 *ONAN	169443	291.59	21.8	34.5 24.6	32.7 45.1	35.4 48.7	50 -	55 68
30000 ONAF2		87.477	22.1		Wind/oil 16.2	48.0 64.3		55 68

* The results are calculated
** Serial part of the winding HV
*** Winding LV (common part of HV)

No load losses, W - 29980
Cupper losses at 75°C for tap 27 and 160 MVA, W - 357027
Number of the radiators - 18
Number of the working fans at 85%Un (353V) for ONAF2 - 24
Number of the working fans at 85%Un (353V) for ONAF1 - 12 inside

Because the transformer do not meet the requirements of all type tests, after 2 months there was another transformer, ser.№ 112741, type test. It was tested in 26 of august 2003 with the heaviest duty (ONAF 2) to confirm the results for the first type tested transformer. The results of this ~~test~~ transformer, ser.№ 112741 are:

Output Cooling	Losses for oil	Current for winding	Air temperature	Temperature rise, K				
KVA	W	A	°C	Measured			Guaranteed	
-				top oil, av.oil	HV w. av,** h.spot	LV w. av,*** h.spot	top oil,	winding average h.spot
179200	502696	522,53	28,8	52,3	55,5	54,5	60,0	65,0
*ONAF2				39,6	72,9	71,6	-	78,0
169600	453692	494,54	28,8	47,2	50,3	49,4	55,0	60,0
ONAF2				35,8	66,1	64,9	-	73,0
160000	407386	466,55	28,8	42,4	45,4	44,5	50,0	55,0
*ONAF2				32,1	59,6	58,5	-	68,0

* The results are calculated
** Serial part of the winding HV
*** Winding LV (common part of HV)

No load losses, W - 32740
Cupper losses at 75°C for tap 27 and 160 MVA, W - 374646
Number of the radiators - 18
Number of the working fans at 85%Un (353V) for ONAF2 - 24
Number of the working fans at 85%Un (353V) for ONAF1 - 12 inside

Temperature rise of secondary winding of CT type TMB 70, 800/5 above top oil, during duty ONAF2 (169.6 MVA) - 5.8K.
The densities of the currents of others CT are applied in a table to this protocol.

REMARK: av.oil - oil temperature rise in the middle of the tank
w.av. - average temperature rise of the winding
h.spot - temperature rise of hottest spot of the winding

Gas analysis of the oil before and after temperature rise tests did not show changes of chemical structure of the oil, which means there are not inadmissible local temperatures. The protocols of gas analysis are applied to this protocol and the values have are compare at the next table:

Gas,	Transformer № 112738		Transformer № 112741		
	Before test, Report №304 06.06.03	After test, Report №318 09.06.03	Before test, Report №491 27.08.03	After test, Report №492 27.08.03	Standard IEC60599 1999 y.
H_2, ppm	13.4	12.6	7.8	15.8	75-150
CH_4, ppm	1.3	1.4	0.9	1.7	35-130
C_2H_6, ppm	0.4	0.4	0.3	0.6	50- 70
C_2H_4, ppm	1.5	1.6	1.2	2.2	110-250
C_2H_2, ppm	1.4	1.0	0.1	2.0	80-270
CO, ppm	16.4	28.0	-	-	400-850
CO_2, ppm	86.9	147.6	-	-	(6-3-12) *1000
Total, %	1.57	2.70	1.44	4.37	

The power consumption of cooling system:

- one working fan at 353V (85%Un), - , 0.65A, 1471r.p.m.
- one working fan at 415V (100%Un), 226.1W, 0.79A, 1477r.p.m.
- one working fan at 457V (110%Un), - , 1.01A, 1483r.p.m.
- 12 working fans at 415V , 2.72kW, 10.19A
- 24 working fans at 415V , 5.49kW, 20.52A
- 32 working fans at 415V , 7.42kW, 27.26A

MEASUREMENT EQUIPMENT:

Temperature test system:	type ES Pt 100
Voltmeters, Ampermeters:	type M-1104, ser. № 7520/1971
	type M-2018, ser. № 3492/1981
	type M-2018, ser. № 1986 (1893)
Power analyzer:	type D-5155, ser. № V069812-I

CONCLUSION: The transformer type ATMTPY 160000/220, Doc. № 32809, Ser. № 112738 and № 112741 meets the requirements of contract № 476/CE/STG/DP-I/F-243/4740-49/31.10.2002 for temperature-rise test.

Tested by:
/Dipl.Eng. Hr. Hristov/

Chief of laboratory "Transformers":
/M.Sc.Dipl.Eng.Al.Raykov"

The above tested values were witnessed by :

Mr. Engr. Ch.Abdul Hameed, inspector of "WAPDA", Pakistan:
August 2003

Mr. Ir. R.C.A.M. Koevoets, inspector of "KEMA" laboratory:
June/August 2003

ВЯРНО С ОРИГИНАЛА

THE TEST REPORT IS VALID WITH ORIGINAL STAMP ONLY!

Bushing current transformers of transformer type АТМТРУ 160000/220						
Terminals of АМВТРУ 160000/220		Current transformers				
Signature	Maximum current, A	Type , doc. №	Rated data	terminals	Winding , mm2	dencyty of the current, A/mm2
A	470.3	ТМВ 69, 38154.00.00	600÷1200/1	1S1-1S3-1S2	1.2272	0.815
			600÷1200/1	2S1-2S3-2S2	1.2272	0.815
			600/1,5	3S1-3S2	1.3700	1.095
B	470.3	ТМВ 69, 38154.00.00-01	600÷1200/1	1S1-1S3-1S2	1.2272	0.815
			600÷1200/1	2S1-2S3-2S2	1.2272	0.815
C	470.3	ТМВ 69, 38154.00.00-01	600÷1200/1	1S1-1S3-1S2	1.2272	0.815
			600÷1200/1	2S1-2S3-2S2	1.2272	0.815
Am	783.8	ТМВ 70, 38155.00.00-02	600÷1200/1	1S1-1S3-1S2	1.2272	0.815
			600÷1200/1	2S1-2S3-2S2	1.2272	0.815
			800/1,5	3S1-3S2	1.3700	1.095
Bm	783.8	ТМВ 70, 38155.00.00	600÷1200/1	1S1-1S3-1S2	1.2272	0.815
			600÷1200/1	2S1-2S3-2S2	1.2272	0.815
			800/5	3S1-3S2	3.5280	1.417
Cm	783.8	ТМВ 70, 38155.00.00-01	600÷1200/1	1S1-1S3-1S2	1.2272	0.815
			600÷1200/1	2S1-2S3-2S2	1.2272	0.815
Na	-	ТМВ 71, 38156.00.00	600÷1200/1	1S1-1S3-1S2	1.2272	0.815
			600÷1200/1	2S1-2S3-2S2	1.2272	0.815
TA	1574.6	ТМВ 56, 38139.00.00-13	1200/1	1S1-1S2	0.9850	1.015
			1200/1	2S1-2S2	0.9850	1.015
TB	1574.6	ТМВ 56, 38139.00.00-13	1200/1	1S1-1S2	0.9850	1.015
			1200/1	2S1-2S2	0.9850	1.015
TC	1574.6	ТМВ 56, 38139.00.00-13	1200/1	1S1-1S2	0.9850	1.015
			1200/1	2S1-2S2	0.9850	1.015

ЦЛЕМ

НАЦИОНАЛНА ЕЛЕКТРИЧЕСКА КОМПАНИЯ ЕАД

ПРЕДПРИЯТИЕ "МРЕЖИ ВИСОКО НАПРЕЖЕНИЕ"
ЦЕНТРАЛНА ЛАБОРАТОРИЯ ЗА ЕНЕРГЕТИЧНИ МАСЛА
Тел. 950 23 05; факс: 950 23 07

ИЗПИТАТЕЛЕН ПРОТОКОЛ
№ 304/06.06.2003

НАИМЕНОВАНИЕ НА ПРОДУКТА –Трансформаторно масло, доставено от Хюндай Хеви Индъстрийз Ко-България

ОТ КЪДЕ Е ВЗЕТА ПРОБАТА –проба от АТМТРУ 220 kV, фабр. № 112738, преди загряване

Газ-хроматографски анализ на разтворените газове в трансформаторното масло

№	ГАЗ	КОНЦЕНТРАЦИЯ
1	H_2 (водород), ppm	13,4
2	CH_4 (метан), ppm	1,3
3	C_2H_6 (етан), ppm	0,4
4	C_2H_4 (етилен), ppm	1,5
5	C_2H_2 (ацетилен), ppm	1,4
6	CO (въглероден оксид), ppm	16,4
7	CO_2 (въглероден диоксид), ppm	86,9
8	Общо газосъдържание, %	1,57

Извършил анализа:
/С. Сотирова/

Р-л ЦЛЕМ:
/Р.Катеринов/

before temperature-rise test

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ВЯРНО С ОРИГИНАЛА

ЦЛЕМ
НАЦИОНАЛНА ЕЛЕКТРИЧЕСКА КОМПАНИЯ ЕАД
ПРЕДПРИЯТИЕ "МРЕЖИ ВИСОКО НАПРЕЖЕНИЕ"
ЦЕНТРАЛНА ЛАБОРАТОРИЯ ЗА ЕНЕРГЕТИЧНИ МАСЛА
Тел. 950 23 05; факс: 950 23 07

ИЗПИТАТЕЛЕН ПРОТОКОЛ
№ 318/09.06.2003

НАИМЕНОВАНИЕ НА ПРОДУКТА –Трансформаторно масло, доставено от Хюндай Хеви Индъстрийз Ко-България

ОТ КЪДЕ Е ВЗЕТА ПРОБАТА –проба от АТМТРУ 220 kV, фабр. № 112738, след двойно загряване

Газ-хроматографски анализ на разтворените газове в трансформаторното масло

№	ГАЗ	КОНЦЕНТРАЦИЯ
1	H_2 (водород), ppm	12,6
2	CH_4 (метан), ppm	1,4
3	C_2H_6 (етан), ppm	0,4
4	C_2H_4 (етилен), ppm	1,6
5	C_2H_2 (ацетилен), ppm	1,0
6	CO (въглероден оксид), ppm	28,0
7	CO_2 (въглероден диоксид), ppm	147,6
8	Общо газосъдържание, %	2, 7

Извършил анализа: /С. Сотирова/

Р-л ЦЛЕМ: /Р.Катеринов/

after temperature test

ВЯРНО С ОРИГИНАЛА

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ЦЛЕМ

НАЦИОНАЛНА ЕЛЕКТРИЧЕСКА КОМПАНИЯ ЕАД

ПРЕДПРИЯТИЕ "МРЕЖИ ВИСОКО НАПРЕЖЕНИЕ"
ЦЕНТРАЛНА ЛАБОРАТОРИЯ ЗА ЕНЕРГЕТИЧНИ МАСЛА
Тел. 950 23 05; факс: 950 23 07

ИЗПИТАТЕЛЕН ПРОТОКОЛ
№ 491/27.08.2003

НАИМЕНОВАНИЕ НА ПРОДУКТА –Трансформаторно масло, доставено от Хюндай Хеви Индъстрийз Ко-България

ОТ КЪДЕ Е ВЗЕТА ПРОБАТА – Пробата е взета от трансформатор тип AMTRY 160/220, № 112741, преди теста.

Газ-хроматографски анализ на разтворените газове в трансформаторното масло

№	ГАЗ	Концентрация
1	H_2 (водород), ppm	7.8
2	CH_4 (метан), ppm	0.9
3	C_2H_6 (етан), ppm	0.3
4	C_2H_4 (етилен), ppm	1.2
5	C_2H_2 (ацетилен), ppm	1.1
6.	Общо газосъдържание, %	1,44

Извършил анализа: /С. Сотирова/

Р-л ЦЛЕМ: /Р.Катеринов/

before temperature - rise

ВЯРНО С ОРИГИНАЛА

350

ЦЛЕМ

НАЦИОНАЛНА ЕЛЕКТРИЧЕСКА КОМПАНИЯ ЕАД

ПРЕДПРИЯТИЕ "МРЕЖИ ВИСОКО НАПРЕЖЕНИЕ"
ЦЕНТРАЛНА ЛАБОРАТОРИЯ ЗА ЕНЕРГЕТИЧНИ МАСЛА
Тел. 950 23 05; факс: 950 23 07

ИЗПИТАТЕЛЕН ПРОТОКОЛ
№ 492/27.08.2003

НАИМЕНОВАНИЕ НА ПРОДУКТА –Трансформаторно масло, доставено от Хюндай Хеви Индъстрийз Ко-България

ОТ КЪДЕ Е ВЗЕТА ПРОБАТА – Пробата е взета от трансформатор тип AMTRY 160/220, № 112741, след теста.

Газ-хроматографски анализ на разтворените газове в трансформаторното масло

№	ГАЗ	Концентрация
1	H_2 (водород), ppm	15.8
2	CH_4 (метан), ppm	1.7
3	C_2H_6 (етан), ppm	0.6
4	C_2H_4 (етилен), ppm	2.2
5	C_2H_2 (ацетилен), ppm	2.0
6.	Общо газосъдържание, %	4.37

Извършил анализа: /А. Гатева/

Р-л ЦЛЕМ: /Р.Катеринов/

after temperature-rise test

ВЕРНО С ОРИГИНАЛА

HYUNDAI HEAVY INDUSTRIES Co., Bulgaria
41, Rojen Blvd. *1271 Sofia, Bulgaria
tel. (+359 2) 382989*Telefax: (+359 2) 936 07 42*Telex:22923
LABORATORY COMPLEX "TRANSFORMERS"
LABORATORY "TRANSFORMER"

TÜV CERT EN ISO 9001

Chief of laboratory
complex "Transformers": M.Sc.El.Eng.M.Mateev

total pages: 3

REPORT OF SOUND LEVEL MEASUREMENT № T058/28.08.2003

Contract number and site: 476/CE/STG/DP-I/F-243/4740-49/31.10.2002, "WAPDA", Islamic republic Pakistan
Manufacturer HYUNDAI HEAVY INDUSTRIES Co., Bulgaria Place of measurement Sofia Date 28.08.2003
Place of manufacture Sofia Measurement specification
Details of transformer: ATMTPY 160000/220
Serial No. 112741 MVA 160 Voltage ratio 220/132/11 kV
Connections YNa0d1
Tapping range ± 13 x 0.769 %
Details of measuring instrument:
Make Br&K Type 2203 Serial No.672097
Microphone Type MK 221 Serial No.6083
Calibration data of instrument and microphone 25.04.2001

Test conditions:
Excitation voltage 11 kV Frequency 50 Hz Tap position 14

Transformer with 24working fans.

A-weighted sound pressure levels L_{pA}

Plan position	1/3 H dB(A) 1	2	3	Plan position	2/3 H dB(A) 1	2	3
1	74.0	50	74.0	1	74.0	50	74.0
2	74.5	50	74.5	2	74.0	50	74.0
3	75.0	50	75.0	3	73.5	50	73.5
4	74.0	50	74.0	4	73.5	50	73.5
5	74.0	50	74.0	5	73.0	50	73.0
6	73.5	50	73.5	6	73.0	50	73.0
7	72.0	50	72.0	7	72.5	50	72.5
8	71.0	50	71.0	8	71.0	50	71.0
9	72.0	50	72.0	9	71.5	50	71.5
10	72.5	50	72.5	10	72.5	50	72.5
11	72.5	50	72.5	11	72.5	50	72.5
12	73.0	50	73.0	12	72.5	50	72.5
13	74.0	50	74.0	13	73.0	50	73.0
14	74.0	50	74.0	14	73.0	50	73.0
15	73.5	50	73.5	15	73.0	50	73.0
16	74.0	50	74.0	16	74.0	50	74.0
17	71.0	50	71.0	17	71.5	50	71.5
18	71.5	50	71.5	18	70.0	50	70.0
19	70.5	50	70.5	19	70.5	50	70.5
20	72.0	50	72.0	20	72.0	50	72.0
				Energy average			72.8

1= noise of the equipment; 2=background noise; 3=corrected noise of the equipment
Guaranteed sound pressure level at 2 m L_{pA} 80dB(A)

ВЯРНО С ОРИГИНАЛА

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Contract number and site: 476/CE/STG/DP-I/F-243/4740-49/31.10.2002, "WAPDA", Islamic republic Pakistan
Manufacturer HYUNDAI HEAVY INDUSTRIES Co., Bulgaria Place of measurement Sofia Date 28.08.2003
Place of manufacture Sofia Measurement specification
Details of transformer: ATMTPY 160000/220
Serial No. 112741 MVA 160 Voltage ratio 220/132/11 kV
Connections YNa0d1
Tapping range ± 13 x 0.769 %
Details of measuring instrument:
Make Br&K Type 2203 Serial No.672097
Microphone Type MK 221 Serial No.6083
Calibration data of instrument and microphone 25.04.2001

Test conditions:
Excitation voltage 11 kV Frequency 50 Hz Tap position 14

A-weighted sound pressure levels L_{pA} **Transformer with 12working fans.**

1/3 H				2/3 H			
Plan	dB(A)			Plan	dB(A)		
position	1	2	3	position	1	2	
1	70.0	50	70.0	1	70.0	50	70.0
2	71.0	50	71.0	2	70.0	50	70.0
3	71.0	50	71.0	3	69.0	50	69.0
4	71.0	50	71.0	4	70.0	50	70.0
5	71.0	50	71.0	5	69.0	50	69.0
6	69.5	50	69.5	6	69.5	50	69.5
7	68.5	50	68.5	7	68.0	50	68.0
8	67.5	50	67.5	8	68.0	50	68.0
9	68.5	50	68.5	9	69.0	50	69.0
10	70.0	50	70.0	10	70.0	50	70.0
11	69.0	50	69.0	11	69.0	50	69.0
12	70.0	50	70.0	12	70.0	50	70.0
13	70.5	50	70.5	13	69.5	50	69.5
14	69.5	50	69.5	14	69.5	50	69.5
15	69.5	50	69.5	15	69.0	50	69.0
16	69.5	50	69.5	16	69.5	50	69.5
17	67.5	50	67.5	17	68.0	50	68.0
18	68.0	50	68.0	18	68.0	50	68.0
19	68.0	50	68.0	19	68.0	50	68.0
20	70.0	50	70.0	20	70.0	50	70.0
				Energy average			69.4

1= noise of the equipment; 2=background noise; 3=corrected noise of the equipment
Guaranteed sound pressure level at 2 m L_{pA} 70dB(A)A-weighted
sound

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Contract number and site: 476/CE/STG/DP-I/F-243/4740-49/31.10.2002, "WAPDA", Islamic republic Pakistan
Manufacturer HYUNDAI HEAVY INDUSTRIES Co., Bulgaria Place of measurement Sofia Date 28.08.2003
Place of manufacture Sofia Measurement specification
Details of transformer: ATMTPY 160000/220
Serial No. 112741 MVA 160 Voltage ratio 220/132/11 kV
Connections YNa0d1
Tapping range ± 13 x 0.769 %
Details of measuring instrument:
Make Br&K Type 2203 Serial No.672097
Microphone Type MK 221 Serial No.6083
Calibration data of instrument and microphone 25.04.2001

Test conditions:
Excitation voltage 11 kV Frequency 50 Hz Tap position 14

A-weighted sound pressure levels L_{pA}
pressure levels L_{pA}

Transformer without working fans.

Plan position	1/3 H dB(A) 1	2	3	Plan position	2/3 H dB(A) 1	2	3
1	61.0	50	61.0	1	62.0	50	62.0
2	62.5	50	62.5	2	62.5	50	62.5
3	60.0	50	60.0	3	60.5	50	60.5
4	61.5	50	61.5	4	63.0	50	63.0
5	61.5	50	61.5	5	61.0	50	61.0
6	63.0	50	63.0	6	62.5	50	62.5
7	64.0	50	64.0	7	62.5	50	62.5
8	64.0	50	64.0	8	65.0	50	65.0
9	66.0	50	66.0	9	63.0	50	63.0
10	64.5	50	64.5	10	64.5	50	64.5
11	61.0	50	61.0	11	57.0	50	57.0
12	60.0	50	60.0	12	61.0	50	61.0
13	61.0	50	61.0	13	58.0	50	58.0
14	62.0	50	62.0	14	59.0	50	59.0
15	60.0	50	60.0	15	61.0	50	61.0
16	59.0	50	59.0	16	64.0	50	64.0
17	62.0	50	62.0	17	60.0	50	60.0
18	65.0	50	65.0	18	61.0	50	61.0
19	64.0	50	64.0	19	62.0	50	62.0
20	63.0	50	63.0	20	63.0	50	63.0
				Energy average			62.4

1= noise of the equipment; 2=background noise; 3=corrected noise of the equipment
Guaranteed sound pressure level at 0.3 m L_{pA} 69dB(A)

TESTED BY: Hr Hristov:

Chief of laboratory:
M.Sc.Dipl.Eng.Al.Raykov:

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The above tested values were witnessed by :

Mr. Engr. Ch.Abdul Hameed, inspector "WAPDA", Pakistan:

Mr. Ir. R.C.A.M. Kreeft, inspector of "KEMA" laboratory:

ВЯРНО С ОРИГИНАЛА

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LABORATORY COMPLEX "TRANSFORMERS"
LABORATORY "TRANSFORMER"

TÜV CERT EN ISO 9001

Chief of laboratory
complex "Transformers":
M.Sc.El.Eng.M.Mateev:

total pages: 3

TEST CERTIFICATE
№ T057/29.08.2003

SPECIAL TEST

TEST OBJECT: Transformer type ATMTPY 160000/220

Doc. № 32809

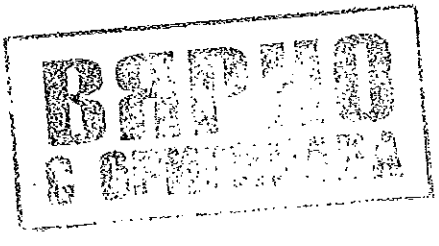
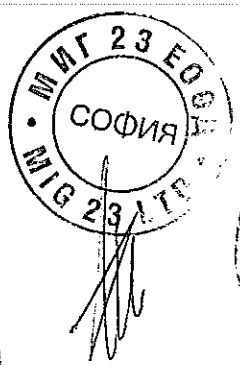
Ser. № 112741

Manufacturer: HYUNDAI HEAVY INDUSTRIES Co., Bulgaria

RATED DATA:

Output, kVA	160000/160000/30000
Voltage, kV	220±13x0.769%/132/11
Current, A	419.9/699.8/1574.6
Frequency, Hz	50
Vector group of connection	YNa0d1
Cooling type	ONAN/ONAF1(12 fans)/ONAF2(24 fans)
Mounting	outdoor
Voltage regulation	on-load tap-changer type MR № 586903

Contractor	HYUNDAI HEAVY INDUSTRIES Co., Bulgaria
Owner	"WAPDA", Islamic republic Pakistan
Contract	476/CE/STG/DP-I/F-243/4740-49/31.10.2002
Standard	IEC 60076


№	TEST		Guaranteed	Measured	y/n
1.	ZERO SEQUENCE IMPEDANCE AT TAP 14 ON 125 MVA BASE (IEC 60076-1/93, point 10.7.):				yes
1.1.	Supplied from HV winding:				
	with short circuit LV w.	%	appr.10 (*21a)	10.34	
	with open LV w.	%	appr.36 (*21c)	32.49	
1.2.	Supplied from LV winding:				
	with open HV w.	%	appr.20 (*21b)	22.77	
	with short circuit HV w.	%	-	7.23	
	* Point of Schedule of technical data				
2.	HARMONICS OF NO-LOAD CURRENT OF TERTIARY WINDING WITH RATED FREQUENCY AND NOMINAL INDUCTION (IEC 60076-1/93, point 10.6.): Harmonic level in % of the fundamental component:				yes
	phase A				
	harmonic 3 (150 Hz)	%	-	4.75	
	harmonic 5 (250 Hz)	%	-	28.0	
	harmonic 7 (350 Hz)	%	-	6.71	
	harmonic 11 (550 Hz)	%	-	3.43	
	harmonic 13 (650 Hz)	%	-	1.44	
	harmonic 15 (850 Hz)	%	-	1.44	
	harmonic 17 (950 Hz)	%	-	3.36	
	phase B				
	harmonic 3 (150 Hz)	%	-	35	
	harmonic 5 (250 Hz)	%	-	28.8	
	harmonic 7 (350 Hz)	%	-	6.57	
	harmonic 11 (550 Hz)	%	-	3.36	
	harmonic 13 (650 Hz)	%	-	1.58	
	harmonic 15 (850 Hz)	%	-	3.08	
	harmonic 17 (950 Hz)	%	-	1.87	
	phase C				
	harmonic 3 (150 Hz)	%	-	61.6	
	harmonic 5 (250 Hz)	%	-	56.4	
	harmonic 7 (350 Hz)	%	-	11.9	
	harmonic 11 (550 Hz)	%	-	7.32	
	harmonic 13 (650 Hz)	%	-	3.58	
	harmonic 15 (850 Hz)	%	-	6.16	
	harmonic 17 (950 Hz)	%	-	9.7	

3.	CHECK OF CALIBRATION AND FUNCTIONING OF TEMPERATURE INDICATORS	-	Proper working	Work properly	yes
4.	CHECK OF THE PROPER INSTALATION AND FUNCTION OF THE BUCHHOLZ RELAY	-	Proper working	Work properly	yes

MEASUREMENT EQUIPMENT:

Power analyzer:	type D-5155,	ser. № V069812-I
Signal Analyzer Br&K	type 2033	ser. № ZN0203

CONCLUSION: The transformer type ATMTPY 160000/220, Doc. № 32809, Ser. № 112741 meets the requirements of contract № 476/CE/STG/DP-I/F-243/4740-49/31.10.2002 for special tests.

Tested by:

Dipl.Eng. Hr. Hristov:

Dipl.Eng. I. Terziev:

Chief of laboratory Transformers:
M.Sc.Dipl.Eng.Al.Raykov:

The above tested values were witnessed by :

Mr. Engr. Ch.Abdul Hameed, inspector of "WAPDA", Pakistan:

Mr. Ir. R.C.A.M. Koevoets, inspector of "KEMA" laboratory:

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THE TEST REPORT IS VALID WITH ORIGINAL STAMP ONLY !

ВЕРНО
С ОРИГИНАЛА

RAAD VOOR ACCREDITATIE

Dutch Accreditation Council RvA
PO Box 2768 NL-3500 GT Utrecht

The Dutch Accreditation Council RvA, by law appointed as the national accreditation body for The Netherlands, hereby declares that accreditation has been granted to:

KEMA Nederland B.V.
High-Voltage Laboratory
Arnhem

The organisation has demonstrated to be able to generate technical valid results in a competent way and work according to a management system.

This accreditation is based on an assessment against the requirements as laid down in ISO/IEC 17025:2005.

The accreditation covers the activities as specified in the authorized annex bearing the registration number.

The accreditation is valid provided that the organisation continues to meet the requirements.

The accreditation with registration number:

L 218

is granted on 26 March 2014

This declaration is valid until

1 April 2018

The accreditation has been granted for the first time on

17 November 1994

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The Chief Executive

Ir. J.C. van der Poel

Annex to ISO/IEC 17025:2005 declaration of accreditation for registration number: **L 218**

RAAD VOOR ACCREDITATIE

of **KEMA Nederland B.V.**
High-Voltage Laboratory
Arnhem

This annex is valid from: **26-03-2014** to **01-04-2018**

Replaces annex dated: **26-10-2011**

No.	Material or product	Type of activity	Internal reference number
1	Coils and/or windings of rotating electrical machines	AC voltage test Lightning impulse voltage test	IEC 60034
2	Power transformers	AC voltage test Lightning impulse voltage test Temperature-rise test Capacitance and tan δ measurement Power measurement DC resistance measurement Temperature measurement Sound level measurement R.I.V. measurement Partial discharge measurement SFRA measurement Verification of voltage ratio and phase displacement Low ambient test on dry-type transformer Thermal shock test on dry type transformer Condensation test on dry-type transformer Humidity penetration test on dry-type transformer Inspection of the active part	IEC 60076-1, -2, -3, -10, -11, -13, -15, -16, -18 CISPR 16 STL Guide to IEC 60076 NEN-EN 50464-1 NEN-EN 50541-1 IEEE Std. C57.12.00 IEEE Std. C57.12.90 IEEE Std. C57.12.91
3	AC Metal-enclosed switchgear and controlgear above 1 kV and ≤ 52 kV and prefabricated substations	AC voltage test Lightning impulse voltage test Partial discharge measurement Temperature-rise test Temperature measurement DC resistance measurement Verification of degree of protection R.I.V. measurement	IEC 62271-200 STL Guide to IEC 62271-200 IEC 62271-202 STL Guide to IEC 62271-202 IEEE C37.20.2 IEEE C37.21 ANSI C37.54 ANSI C37.55 IEC 60529

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This annex has been approved by:

Ir. J.C. van der Poel
Chief Executive

Annex to ISO/IEC 17025:2005 declaration of accreditation for registration number: **L 218**

RAAD VOOR ACCREDITATIE

of **KEMA Nederland B.V.**
High-Voltage Laboratory
Arnhem

This annex is valid from: **26-03-2014** to **01-04-2018** Replaces annex dated: **26-10-2011**

No.	Material or product	Type of activity	Internal reference number
4	AC Insulation-enclosed switchgear and controlgear above 1 kV and ≤ 52 kV	AC voltage test Lightning impulse voltage test Partial discharge measurement Temperature-rise test Temperature measurement DC resistance measurement Verification of degree of protection R.I.V. measurement	IEC 62271-201 IEC 60529
5	Gas-insulated metal-enclosed switchgear for rated voltages above 52 kV	AC voltage test Lightning impulse voltage test Switching impulse voltage test Partial discharge measurement Temperature-rise test Temperature measurement DC resistance measurement R.I.V. measurement	IEC 62271-203 STL Guide to IEC 60517 IEEE Std C37.122
6	High-voltage AC circuit breakers	AC voltage test Lightning impulse voltage test Switching impulse voltage test Partial discharge measurement Temperature-rise test Temperature measurement DC resistance measurement R.I.V. measurement Test under wet conditions	NEN-EN-IEC 62271-100 STL Guide to IEC 62271-100 IEEE Std C37.09 IEEE Std C37.013 NEN-EN 50152-1
7	High-voltage AC disconnectors and earthing switches	AC voltage test Lightning impulse voltage test Switching impulse voltage test Temperature-rise test Partial discharge measurement DC resistance measurement R.I.V. measurement Test under wet conditions Temperature measurement	IEC 62271-102 STL Guide to IEC 62271-102 IEEE Std C37.34 IEEE Std C37.41
8	High-voltage AC switches	AC voltage test Lightning impulse voltage test Partial discharge measurement Temperature-rise test Temperature measurement DC resistance measurement Verification of degree of protection	NEN-EN-IEC 62271-103 STL Guide to IEC 60265-1 NEN-EN-IEC 62271-104 IEEE Std C37.74

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Annex to ISO/IEC 17025:2005 declaration of accreditation for registration number: **L 218**

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High-Voltage Laboratory
Arnhem

This annex is valid from: **26-03-2014** to **01-04-2018** Replaces annex dated: **26-10-2011**

No.	Material or product	Type of activity	Internal reference number
9	High-voltage AC contactors	AC voltage test Lightning impulse voltage test Partial discharge measurement Temperature-rise test Temperature measurement DC resistance measurement Verification of degree of protection	NEN-EN-IEC 62271-106
10	Automatic circuit reclosers and fault interrupters	AC voltage test Lightning impulse voltage test Partial discharge measurement Temperature-rise test Temperature measurement DC resistance measurement Verification of degree of protection	IEC 62271-111/ IEEE Std C37.60
11	Busducts	AC voltage test Lightning impulse voltage test Partial discharge measurement Temperature-rise test Temperature measurement DC resistance measurement Verification of degree of protection	IEEE Std C37.23
12	High-voltage AC switch-fuse combinations and high-voltage AC fuses	AC voltage test Lightning impulse voltage test Partial discharge measurement Temperature-rise test Temperature measurement DC resistance measurement Verification of degree of protection	IEC 62271-105 IEEE Std C37.41 IEEE Std C37.74 NEN-EN-IEC 60282-1 IEC 60282-2 STL Guide to IEC 60282-1 STL Guide to IEC 60282-2

Annex to ISO/IEC 17025:2005 declaration of accreditation for registration number: **L 218**

RAAD VOOR ACCREDITATIE

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High-Voltage Laboratory
Arnhem

This annex is valid from: **26-03-2014** to **01-04-2018** Replaces annex dated: **26-10-2011**

No.	Material or product	Type of activity	Internal reference number
13	Insulators and insulated bushings	AC voltage test Lightning impulse voltage test Partial discharge measurement Test under wet conditions Thermal-mechanical performance test Electro-mechanical failing load test R.I.V. measurement Pollution tests Temperature measurement Visible corona test Steep front wave flashover test Porosity test Visual and dimensional test Galvanizing test Thermal shock test Thermal cycle test Water absorption test Impact test Test of housing: tracking and erosion tests	IEC 60137 IEEE Std C57.19.00 IEEE Std C57.19.01 IEC 60168 IEC 60383 IEC 60507 IEC 60660 IEC 61109 IEC 62217 ANSI C29.1, -2, -6, -7, -12, -13 CAN/CSA C411.1
14	Cables	AC voltage test DC voltage test Lightning impulse test Heat cycle voltage test Capacitance and tan δ measurement Partial discharge measurement Insulation resistance measurement DC resistance measurement Temperature measurement Condition test of XLPE cable Water penetration test Bending test	IEC 60055 IEC 60141 IEC 60502 IEC 60840 IEC 62067 NEN-HD 620 NEN-HD 632 NEN 3619 BS 6622 BS 7835 BS 7870 BS 7912 BS 7970
15	Cable accessories	AC voltage test DC voltage test Lightning impulse voltage test Heat cycle voltage test Temperature measurement Partial discharge measurement Insulation resistance measurement Test under wet conditions Pollution tests R.I.V. measurement Water penetration test Impact test	IEC 60502-4 IEC 60055 IEC 60840 IEC 62067 HD 629-1 HD 629-2 NEN-HD 632 IEEE Std 48 IEEE Std 404

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Annex to ISO/IEC 17025:2005 declaration of accreditation for registration number: **L 218**

RAAD VOOR ACCREDITATIE

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High-Voltage Laboratory
Arnhem

This annex is valid from: **26-03-2014** to **01-04-2018** Replaces annex dated: **26-10-2011**

No.	Material or product	Type of activity	Internal reference number
16	Current transformers	AC voltage test Lightning impulse voltage test Switching impulse voltage test Temperature-rise test Capacitance and tan δ measurement Partial discharge measurement Accuracy test Test under wet conditions Temperature measurement Inspection of active part	NEN-EN-IEC 60044-1 NEN-EN-IEC 60044-6 IEC 60044-8
17	Voltage transformers	AC voltage test Lightning Impulse voltage test Switching impulse voltage test Temperature-rise test Capacitance and tan δ measurement Partial discharge measurement Temperature measurement Accuracy test Test under wet conditions Leakage test Inspection of active part	IEC 61869-1 IEC 61869-3 IEC 61869-5 IEC 60044-7
18	Capacitors	AC voltage test Lightning impulse voltage test Capacitance and tan δ measurement Temperature measurement Test under wet conditions Thermal stability test Short-circuit discharge test Endurance test Sealing test Self-healing test Destruction test Ageing test	IEC 60358 IEC 60831 IEC 60871
19	Surge arresters	AC voltage test Lightning impulse voltage test Switching impulse voltage test Current impulse test Pollution tests Partial discharge measurement Temperature measurement Ageing test R.I.V. measurement	IEC 60099 IEEE Std C62.11

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Annex to ISO/IEC 17025:2005 declaration of accreditation for registration number: **L 218**

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Arnhem

This annex is valid from: **26-03-2014** to **01-04-2018** Replaces annex dated: **26-10-2011**

No.	Material or product	Type of activity	Internal reference number
20	Reactors	AC voltage test Lightning impulse voltage test Switching impulse voltage test Temperature-rise test Impedance measurement AC resistance measurement Power measurement DC resistance measurement Temperature measurement Acoustic sound level measurement Verification of voltage ratio and phase displacement check	IEC 60076-6 IEEE Std C57.21
21	Compression and mechanical connectors	Temperature-rise test Temperature measurement DC resistance measurement Mechanical tests	IEC 61238-1
22	Protection relays & substation automation equipment	Functional requirements	IEC 60255-1 IEC 60255-8 IEC 60255-12 IEC 60255-13 IEC 60255-16 IEC 60255-127 IEC 60255-151 IEEE C37.112
		Product safety requirements	IEC 60255-1 IEC 60255-27
		EMC requirements	IEC 60255-1 IEC 60255-26 IEC 60255-22 series IEC 60255-11 IEC 61000-4-2 IEC 61000-4-3 IEC 61000-4-4 IEC 61000-4-5 IEC 61000-4-6 IEC 61000-4-8 IEC 61000-4-9 IEC 61000-4-10 IEC 61000-4-11 IEC 61000-4-16 (only 50 Hz) IEC 61000-4-17 IEC 61000-4-18 IEC 61000-4-29 IEEE C37.90 IEEE C37.90.1 IEEE C37.90.2 IEEE C37.90.3

ВЯРНО С ОРИГИНАЛА

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Annex to ISO/IEC 17025:2005 declaration of accreditation for registration number: **L 218**

RAAD VOOR ACCREDITATIE

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High-Voltage Laboratory
Arnhem

This annex is valid from: **26-03-2014** to **01-04-2018** Replaces annex dated: **26-10-2011**

No.	Material or product	Type of activity	Internal reference number
	Protection relays & substation automation equipment	Energizing quantities	IEC 60255-1
		Climatic environmental tests	IEC 60255-1 IEC 60068-2-2 tests Bd, Bb IEC 60068-2-1 tests Ad, Ab IEC 60068-2-14 test Nb IEC 60068-2-78 test Cab IEC 60068-2-30 test Db
		Mechanical environmental tests	IEC 60255-1 IEC 60255-21 series
23	Electrical Energy Meters	Tests of - insulation properties, - accuracy requirements, - disturbances of long duration, - electrical requirements, - electromagnetic compatibility, - the effect of climatic environments, - mechanical requirements.	IEC 62052-11 and IEC 62053-11/21/22/23 EN 50470-1/2/3 - Directive 2004/22/EC, annex I, B, F and MI-003

Remark
"in accordance with" is applicable for all standards.

ВЯРНО
С ОРИГИНАЛА

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СТОЛИЧНА РЕГИОНАЛНА ЗДРАВНА ИНСПЕКЦИЯ

София 1000, ул."Цар Симеон" № 169 А, п.к 1303
Тел./факс 931 13 39 e-mail aok@srzi.bg

ОРГАН ЗА КОНТРОЛ ОТ ВИДА А

СЕРТИФИКАТ ЗА КОНТРОЛ
No 170578 / 13.04.2017 г

1. Идентификация на клиента:
   "Хюндай Хеви Индъстрис Ко България" АД / бул. "Рожен" №41, гр. София Ивайло Паунов Райков - отговорник качество, Заявление №170578 / 21.03.2017 г.
2. Идентификация на контролирания обект/продукт:
   Завод за производство на трансформатори и стъпални регулатори - обект в експлоатация бул. "Рожен" №41, гр. София
3. Контролирани параметри:
   Химични агенти във въздух на работна среда
   Химични агенти във въздух на работна среда-прах
   Взел пробата/извършил контрола: Камелия Тегаркова - изп. пробовземач ФХИЖС
4. **ЗАКЛЮЧЕНИЕ:**
   КОНТРОЛИРАНИЯТ ПАРАМЕТЪР НА ПРАХА ИНХАЛАБИЛНА ФРАКЦИЯ СЪОТВЕТСТВА НА ИЗИСКВАНИЯТА НА НАРЕДБА №13, ОБН., ДВ, БР. 8/2004 г.
   КОНТРОЛИРАНИТЕ ХИМИЧНИ АГЕНТИ ВЪГЛЕРОДЕН ОКСИД, АЗОТЕН ДИОКСИД И МАСЛЕНИ АЕРОЗОЛИ СЪОТВЕТСТВАТ НА ИЗИСКВАНИЯТА НА НАРЕДБА №13, ОБН., ДВ, БР. 8/2004 г.

Приложение: **Неразделна част от настоящия "Сертификат за контрол", съдържащ общо 7 страници, са Протокол /и No No:**

170578-3-10201 / 11.04.2017 г. / 2 стр.
170578-3-10501 / 11.04.2017 г. / 4 стр.

"ХЮНДАЙ ХЕВИ ИНДЪСТРИС КО БЪЛГАРИЯ" АД

ВЯРНО С ОРИГИНАЛА

Зам. ръководител на Орган за контрол от вида А: **д-р В. Люцканова**

(подпис)

Извършил оценка на съответствието:

(подпис)

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МИНИСТЕРСТВО НА ЗДРАВЕОПАЗВАНЕТО
СТОЛИЧНА РЕГИОНАЛНА ЗДРАВНА ИНСПЕКЦИЯ
УЛ. "ВРАНЯ" № 20
ДИРЕКЦИЯ "ЛАБОРАТОРНИ ИЗСЛЕДВАНИЯ"
ОРГАН ЗА КОНТРОЛ ОТ ВИД А
УЛ. "ЦАР СИМЕОН" № 169 А

ПРОТОКОЛ
ОТ КОНТРОЛ НА ПРАХ В РАБОТНА СРЕДА

№ 170578-3-10201 11.04.2017 г.
ден месец година

1. ОБЕКТ: Завод за производство на трансформатори и стъпални регулатори / обект в експлоатация

2. АДРЕС: бул. "Рожен" №41, гр. София

3. ЗАЯВИТЕЛ: Ивайло Паунов Райков - отговорник качество, Заявление №170578 / 21.03.2017 г. / "Хюндай Хеви Индъстрис Ко България" АД / бул. "Рожен" №41, гр. София

4. КОНТРОЛИРАНИ ПАРАМЕТРИ: Инхалабилна фракция

5. РАБОТНО МЯСТО № 1 : Цех Трансформатори - заварки, Участък "Монтаж"

заети лица /бр./	24	наблюдавани лица /бр./	10	професия	монтьори	експозиция /ч./	4	работно време /ч./	8

ДАТА НА ПРОБОВЗЕМАНЕ: 05.04.2017 г.

7. ВЗЕЛ ПРОБАТА: Камелия Тегаркова - изпълнител пробовземач

8. ТЕХНОЛОГИЧЕН ПРОЦЕС: заваряване на намотки - прекъснат
/непрекъснат; прекъснат/

9. ВИД НА СЪОРЪЖЕНИЕТО: /машина, инсталация/ оксижен

10. ИЗПОЛЗВАНИ СУРОВИНИ И МАТЕРИАЛИ: медни намотки, метали

11. ВЕНТИЛАЦИЯ: естествена аерация
/вид, състояние /

12. НОРМАТИВНИ ИЗИСКВАНИЯ: НАРЕДБА №13, обн., ДВ, бр. 8/2004 г.

13. МЕТОД ЗА КОНТРОЛ: БДС 2200:1985; БДС EN 689:2001; БДС EN 482:2012+A1:2015

14. СРЕДСТВА ЗА ИЗМЕРВАНЕ:

ПРОБОВЗЕМНА АПАРАТУРА	2Ах20Б	идент. № 1
АНАЛИТИЧНА АПАРАТУРА	МПФД-8	идент. № 11473, СК №832/10.09.2016 г.
	Везна електронна ACCULAB ATILON ATL 224-1 ED2245	идент. № 22309926, СК №41/19.05.2015 г.
	Термометър живачен	идент. № усл. №4А, СК №82Ј/16.10.2015 г.
	Барометър анероиден	идент. № 3272, СК №33-ИН/04.08.2016 г.
	Сепаратор (микроциклон) за 20 l/min	идент. № №SG-9, СП №124/11.11.2016 г.
	Електронен секундомер	идент. № усл. №1, СК №0783/06.06.2016 г.
ТИП ПРОБОВЗЕМЕН ФИЛТЪР	ФПП-15	

15. НАЧИН НА ПРОБОВЗЕМАНЕ: стационарно
/стационарно, персонално/

16. ВИД ПРАХ: прах железен (оксиди, агломерати, шлака, стомана, чугун), съдържащ под 2% св. кр. силициев диоксид в респирабилната фракция

17. РЕЗУЛТАТИ ОТ КОНТРОЛА:

КАСЕТА №	Инхалабилна фракция	14										
	Респирабилна фракция	15										
ДЕБИТ АСПИРИРАН ВЪЗДУХ dm^3 / min	Инхалабилна фракция	20										
	Респирабилна фракция	20										
ПРОДЪЛЖИТЕЛНОСТ НА ПРОБОВЗЕМАНЕ /min/	Инхалабилна фракция	180										
	Респирабилна фракция	180										

"ХЮНДАЙ ХЕВИ ИНДЪСТРИС КО БЪЛГАРИЯ" АД

С ОРИГИНАЛА

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ПОКАЗАТЕЛИ								Средно-претеглена концентрация mg/m³	ГРАНИЧНИ СТОЙНОСТИ		КРАТНОСТ	ХИГИЕННА ОЦЕНКА	
									[mg/m³]	[бр.вл./cm³]		ВОДЕЩ ПАРАМЕТЪР	НИВО
ПРИВЕС, mg	Инхалабилна фракция	1,1											
	Респирабилна фракция	0,6											
Vo, dm³	Инхалабилна фракция	3129,8											
	Респирабилна фракция	3129,8											
МАСОВА КОНЦЕНТРАЦИЯ, mg / m³	Инхалабилна фракция	0,35						0,18±0,002	6,0		0,03	инх. фр.	
	Респирабилна фракция	0,19						0,09±0,004				респ. фр.	
	% респирабил-на фракция	50,0											
СВОБОДЕН КРИСТАЛЕН [illegible]ИЦИЕВ [illegible]КСИД, mg/m³	Инхалабилна фракция												
	Респирабилна фракция												
СВОБОДЕН КРИСТАЛЕН СИЛИЦИЕВ ДИОКСИД, %	Инхалабилна фракция												
	Респирабилна фракция												
АЗБЕСТОВ ПРАХ	% на азбеста												
	бр. влакна/cm³												

Забележка: Резултатите от изследванията се отнасят само за контролираната проба.
Извлечения от протокола не могат да се размножават без писменото съгласие на ОКА.
Настоящият протокол е неразделна част от "СЕРТИФИКАТ ЗА КОНТРОЛ". **№ 170578 / 2017 г.**
Информацията, получена в процеса на контролната дейност е конфиденциална.

ПРОВЕЛ КОНТРОЛА И ИЗВЪРШИЛ ОЦЕНКА НА СЪОТВЕТСТВИЕТО: **ЕМ. ПОПОВА**
(фамилия, подпис)

(от

НАЧАЛНИК ОТДЕЛ ФХИЖС: **В. ЙОРДАНОВА**
(фамилия, подпис)

"ХЮНДАЙ ХЕВИ ИНДЪСТРИС БЪЛГАРИЯ" АД

ВЯРНО С ОРИГИНАЛА

МИНИСТЕРСТВО НА ЗДРАВЕОПАЗВАНЕТО
СТОЛИЧНА РЕГИОНАЛНА ЗДРАВНА ИНСПЕКЦИЯ
УЛ. "ВРАНЯ" № 20
ДИРЕКЦИЯ "ЛАБОРАТОРНИ ИЗСЛЕДВАНИЯ"
ОРГАН ЗА КОНТРОЛ ОТ ВИД А
УЛ. "ЦАР СИМЕОН" № 169 А

ПРОТОКОЛ
ОТ ХИМИЧЕН КОНТРОЛ НА ХИМИЧНИ АГЕНТИ ВЪВ ВЪЗДУХА НА РАБОТНАТА СРЕДА

№ 170578-3-10501 11.04.2017 г.
ден месец година

1. ОБЕКТ: Завод за производство на трансформатори и стъпални регулатори / обект в експлоатация

2. АДРЕС: бул. "Рожен" №41, гр. София

3. ЗАЯВИТЕЛ: Ивайло Паунов Райков - отговорник качество, Заявление №170578 / 21.03.2017 г. / "Хюндай Хеви Индъстрис Ко България" АД / бул. "Рожен" №41, гр. София

4. КОНТРОЛИРАНИ ПАРАМЕТРИ: Въглероден оксид
Азотен диоксид

5. ДАТА НА ПРОБОНАБИРАНЕ: 05.04.2017 г.

№	Работно място	Брой работници	Експозиция в часове	Вентилация
1.	Цех трансформаторен - заварки	24	4	естествена аерация

6. ВЗЕЛ ПРОБИТЕ: Камелия Тегаркова - изпълнител пробовземач

7. ПРИСЪСТВАЛ ПРЕДСТАВИТЕЛ НА ОБЕКТА: Евдокия Филипова - охрана на труда
/име, фамилия/

8. НОРМАТИВНИ ИЗИСКВАНИЯ: НАРЕДБА №13, обн., ДВ, бр. 8/2004 г.

9. МЕТОДИ ЗА КОНТРОЛ: БДС EN 689:2001; БДС EN 482:2012+A1:2015; Методически указания за определяне на токсични газове и пари във въздуха на работната среда по линейно-колориметрични методи, книга 2, изд. МА, НИХПЗ, Сдружение "Хигитест", 1987 г.; ОКА7.1ПК3-1

10. СРЕДСТВА ЗА ИЗМЕРВАНЕ:

Дрегеров мех — идент. № 12923 СП №95/02.09.2016 г.
инд. тръбички — идент. № 3711-2 /2017; 2211-2/2015

11. УСЛОВИЯ ПРИ ПРОБОНАБИРАНЕ:

Химичен агент / Показател	Азотен диоксид			Въглероден оксид														
Брой проби по интервали	1³	1³	1³	2³	2³	2³												
Час на интервала	II		IV	VI														
Дебит на аспириране – dm³/min	1/10			1/10														
Vt - dm³	1			1														
Vo - dm³	0,9			0,9														
Атмосферно налягане – Hgmm	714																	
Температура - C°	22																	
Експозиция в часове	1	2	1	1	2	1												

"ХЮНДАЙ ХЕВИ ИНДЪСТРИС КО БЪЛГАРИЯ" АД

ВЯРНО

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12. РЕЗУЛТАТИ ОТ КОНТРОЛА:

№	Химичен агент	Метод за контрол	Концентрация на химичния агент в mg/m ^{3} на интервали			Средно-претеглена концентрация mg/m^3	Гранична стойност mg/m ^{3}
			I инт.	II инт.	III инт.		
1	Въглероден оксид	Методично указание "Хигитест" 87 г.	8,5	7,7	7,7	3,95±0,42	10,0
2	Азотен диоксид	Методично указание "Хигитест" 87 г.	1,03	0,7	0,9	0,42±0,25	4,0

Забележка: Резултатите от изследванията се отнасят само за контролираната проба.
Извлечения от протокола не могат да се размножават без писменото съгласие на ОК.
Настоящият протокол е неразделна част от "СЕРТИФИКАТ ЗА КОНТРОЛ" **№ 170578 / 2017 г.**
Информацията, получена в процеса на контролната дейност е конфиденциална.

ПРОВЕЛ КОНТРОЛА ИЗВЪРШИЛ ЕМ. ПОПОВА
(фамилия, подпис)

ОЦЕНКА НА СЪОТВЕТСТВИЕТО:

да

НАЧАЛНИК ОТДЕЛ ФХИЖС: В. ЙОРДАНОВА
(фамилия, подпис)

"ХЮНДАЙ ХЕВИ ИНДЪСТРИС КО БЪЛГАРИЯ" АД

ВЯРНО С ОРИГИНАЛА

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МИНИСТЕРСТВО НА ЗДРАВЕОПАЗВАНЕТО
СТОЛИЧНА РЕГИОНАЛНА ЗДРАВНА ИНСПЕКЦИЯ
УЛ. "ВРАНЯ" № 20
ДИРЕКЦИЯ "ЛАБОРАТОРНИ ИЗСЛЕДВАНИЯ"
ОРГАН ЗА КОНТРОЛ ОТ ВИД А
УЛ. "ЦАР СИМЕОН" № 169 А

ПРОТОКОЛ
ОТ ХИМИЧЕН КОНТРОЛ НА ХИМИЧНИ АГЕНТИ ВЪВ ВЪЗДУХА НА РАБОТНАТА СРЕДА

№ 170578-3-10501 11.04.2017 г.
ден месец година

1. ОБЕКТ: Завод за производство на трансформатори и стъпални регулатори / обект в експлоатация

2. АДРЕС: бул. "Рожен" №41, гр. София

3. ЗАЯВИТЕЛ: Ивайло Паунов Райков - отговорник качество, Заявление №170578 / 21.03.2017 г. / "Хюндай Хеви Индъстрис Ко България" АД / бул. "Рожен" №41, гр. София

4. КОНТРОЛИРАНИ ПАРАМЕТРИ: Маслени аерозоли

5. ДАТА НА ПРОБОНАБИРАНЕ: 05.04.2017 г.

№	Работно място	Брой работници	Експозиция в часове	Вентилация
2.	Цех трансформатори - при вакуум филтър преса - хале "Монтаж"	10	4	естествена аерация

6. ВЗЕЛ ПРОБИТЕ: Камелия Тегаркова - изпълнител прабовземач

7. ПРИСЪСТВАЛ ПРЕДСТАВИТЕЛ НА ОБЕКТА: Евдокия Филипова - охрана на труда
/име, фамилия/

8. НОРМАТИВНИ ИЗИСКВАНИЯ: НАРЕДБА №13, обн., ДВ, бр. 8/2004 г.

9. МЕТОДИ ЗА КОНТРОЛ: БДС EN 689:2001; БДС EN 482:2012+A1:2015; БДС 16406:1986; ОКА7.1ПК3-2

10. СРЕДСТВА ЗА ИЗМЕРВАНЕ:

Аспиратор	идент. № 96/98022
Везна електронна ACCULAB ATILON ATL 224-1 ED2245	идент. № 22309926, СК №41/19.05.2015 г.
UV-VIS "Lambda 25"	идент. № 101N6012605, СК№2/23.10.2015 г.
МПФД-8	идент. № 16954,СК№830/10.09.2016 г.
Термометър живачен	идент. № 4А, СК №82J/16.10.2015 г.
Барометър анероиден	идент. № 3272,СК №33-ИН/04.08.2016 г.

. УСЛОВИЯ ПРИ ПРОБОНАБИРАНЕ:

Химичен агент / Показател	Маслени аерозоли																		
Брой проби по интервали	1[3]	1[3]	1[3]																
Час на интервала	II	IV	VI																
Дебит на аспириране – dm³/min	10/10																		
Vt - dm³	10																		
Vo - dm³	9																		
Атмосферно налягане – Hgmm	714																		
Температура - C°	20°																		
Експозиция в часове	1	2	1																

"ХЮНДАЙ ХЕВИ ИНДЪСТРИС КО БЪЛГАРИЯ" АД

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12. РЕЗУЛТАТИ ОТ КОНТРОЛА:

№	Химичен агент	Метод за контрол	Концентрация на химичния агент в mg/m ^{3} на интервали			Средно-претеглена концентрация mg/m^3	Гранична стойност mg/m ^{3}
			I инт.	II инт.	III инт.		
1	Маслени аерозоли	БДС 16406	под ГКО	под ГКО	под ГКО	под ГКО	5,0

Забележка: Резултатите от изследванията се отнасят само за контролираната проба.
Извлечения от протокола не могат да се размножават без писменото съгласие на ОК.
Настоящият протокол е неразделна част от "СЕРТИФИКАТ ЗА КОНТРОЛ" **№ 170578 / 2017 г.**
Информацията, получена в процеса на контролната дейност е конфиденциална.

ПРОВЕЛ КОНТРОЛА И ИЗВЪРШИЛ ОЦЕНКА НА СЪОТВЕТСТВИЕТО: **ЕМ. ПОПОВА**
(фамилия, подпис)

да

НАЧАЛНИК ОТДЕЛ ФХИЖС: **В. ЙОРДАНОВА**
(фамилия, подпис)

"ХЮНДАЙ БЪЛГАРИЯ" АД

ВЯРНО С ОРИГИНАЛА

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ФК13-1-1

ОРГАН ЗА КОНТРОЛ от вида С при НАЯ КОНСУЛТ ООД
гр. София, ж.к. „Овча купел 1", бл. 430, тел. 02 423 80 87,
GSM: 0896 300 159, факс: 02 956 12 35, e-mail: naia2007@abv.bg
Сертификат за акредитация рег. № 86 ОКС/ 02.02.2016 г., валиден до 30.04.2017 г.,
издаден от ИА БСА, съгласно изискванията на стандарт БДС EN ISO/IEC 17020:2012

СЕРТИФИКАТ ЗА КОНТРОЛ
№ 2917/ 22.03.2017 г.

1. Идентификация на клиента:
„Хюндай Хеви Индъстрис Ко. България" АД –
гр. София, бул. „Рожен" № 41

2. Идентификация на контролирания обект:
Завод за производство на трансформатори и стъпални регулатори – гр. София, бул. „Рожен" № 41

3. Контролирани параметри:
3.1. Температура на въздуха, относителна влажност на въздуха и скорост на движение на въздуха

4. Заключение (оценка на съответствието) от извършения контрол:
4.1. **Контролираните параметри на микроклимата - температура на въздуха, относителна влажност на въздуха и скорост на движение на въздуха в обект** – завод за производство на трансформатори и стъпални регулатори – гр. София, бул. „Рожен" № 41 **съответстват** на допустимите гранични стойности съгласно изискванията на Наредба № РД-07-3/ 18.07.2014 г. (ДВ, бр. 63/2014 г.).

Приложение: Протокол № 2917-1 от 22.03.2017 г. е неразделна част от **сертификата за контрол,** общо 4 стр.

ВЯРНО
С ОРИГИНАЛА

Дата: 22.03.2017 г.

Ръководител на органа за контрол: .....
(инж. Огнян Георгиев)

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ОРГАН ЗА КОНТРОЛ от вида С при НАЯ КОНСУЛТ ООД

гр. София, ж.к. „Овча купел 1", бл. 430, тел. 02 423 80 87,
GSM: 0896 300 159, факс: 02 956 12 35, e-mail: naia2007@abv.bg
Сертификат за акредитация рег. № 86 ОКС/ 02.02.2016 г., валиден до 30.04.2017 г.,
издаден от ИА БСА, съгласно изискванията на стандарт БДС EN ISO/IEC 17020:2012

ПРОТОКОЛ
№ 2917-1/ 22.03.2017 година
ОТ КОНТРОЛ НА ПАРАМЕТРИТЕ НА МИКРОКЛИМАТ

1. Клиент: **„Хюндай Хеви Индъстрис Ко. България" АД – гр. София, бул. „Рожен" № 41**
(идентификация на клиента)

2. Обект: **Завод за производство на трансформатори и стъпални регулатори – гр. София, бул. „Рожен" № 41**
(наименование, вид на обекта, подобект, адрес)

3. Вид на обекта: **на обект в експлоатация**
(на нов или в употреба/експлоатация обект/съоръжение)

4. Основание за контрола: **Заявка № 1629 от 20.03.2017 г.**
(заявка/възлагателно писмо №.../дата..., договор №.../дата...)

5. Контролиран параметър:
5.1. Температура на въздуха, °C
5.2. Относителна влажност на въздуха, φ%
5.3. Скорост на движение на въздуха, m/s

6. Нормативни актове:
6.1. Метод за контрол: БДС 16686
6.2. Нормативни изисквания: Наредба № РД-07-3/ 18.07.2014г. (ДВ, бр. 63/2014г.)

7. Условия при контрола:
7.1. Период на годината: студен
/студен, топъл/

7.2. Източници на абнормен микроклимат: *няма*
7.3. Вид на използваното отопление: *Централно парно за позиции № 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12 и 13; кондиционери за позиции № 14, 15, 16, 17, 19, 20, 21, 22, 23, 24, 25 и 26; калорифер за позиция № 18*
7.4. Наличие на вентилация: *Да*
7.5. Наличие на климатична инсталация: *Не*

ВЯРНО С ОРИГИНАЛА

8. Резултати от контрола:

№ по ред	Място на контрол (цех, участък, помещение) и наименование на работното място	Категория работа	Температура на въздуха, T°C		Относителна влажност на въздуха, φ%		Скорост на движение на въздуха, m/s	
			Изчислени стойности	Норма	Изчислени стойности	Норма	Изчислени стойности	Норма
1	2	3	4	5	6	7	8	9
Цех „МЗЦ" – участък „Греди"								
1.	Контролна точка - начало	СТФР	20,5 -21,2	15-23	35,8-38,8	30-75	0,08-0,10	До 0,4
2.	Контролна точка - край	СТФР	20,4 -21,0	15-23	35,7-37,4	30-75	0,07-0,09	До 0,4

1	2	3	4	5	6	7	8	9
Цех „МЗЦ" – малко хале								
3.	Контролна точка - начало	СТФР	21,0 -21,8	15-23	35,4-38,7	30-75	0,06-0,08	До 0,4
4.	Контролна точка - край	СТФР	21,0 -21,9	15-23	35,9-38,6	30-75	0,07-0,10	До 0,4
Цех „МЗЦ" – голямо хале								
5.	Контролна точка - начало	СТФР	18,4 -19,2	15-23	36,6-40,0	30-75	0,12-0,15	До 0,4
6.	Контролна точка - среда	СТФР	18,6 -19,2	15-23	37,9-40,7	30-75	0,12-0,14	До 0,4
7.	Контролна точка - край	СТФР	18,3 -19,0	15-23	36,9-39,8	30-75	0,13-0,16	До 0,4
ЕМА – ЛАБОРАТОРИЯ „СТЪПАЛЕН РЕГУЛАТОР"								
8.	Зала „Типови изпитвания"	СТФР	20,3 -20,8	15-23	35,4-38,6	30-75	0,07-0,10	До 0,4
9.	Зала „Високоволтови изпитвания"	СТФР	17,8 -18,5	15-23	38,2-41,6	30-75	0,07-0,09	До 0,4
Цех „Трансформатори" - Участък „Монтаж"								
10.	Контролна точка - начало	СТФР	19,9 -20,7	15-23	33,2-37,0	30-75	0,15-0,19	До 0,4
11.	Контролна точка - край	СТФР	20,2 -20,9	15-23	34,3-37,6	30-75	0,09-0,11	До 0,4
Цех „Трансформатори" - Участък „Вакуумисти"								
12.	Вакуум филтър преса	СТФР	20,6 -21,4	15-23	31,7-34,6	30-75	0,08-0,10	До 0,4
13.	Парокотелна централа	ЛФР	24,0 -24,5	18-25	33,5-35,5	30-75	0,03-0,06	До 0,2
Цех „СТЪПАЛЕН РЕГУЛАТОР" – Офис Отдел „Технологичен"								
14.	Контролна точка - ляво	ЛФР	22,3 -23,1	18-25	35,2-38,6	30-75	0,03-0,05	До 0,2
15.	Контролна точка - дясно	ЛФР	22,5 -23,2	18-25	34,4-37,5	30-75	0,04-0,06	До 0,2
ОТДЕЛ „ЕСР"								
16.	Механична Работилница	СТФР	21,1 -22,1	15-23	32,6-35,0	30-75	0,04-0,07	До 0,4
17.	Електро Работилница	СТФР	20,4 -21,3	15-23	32,0-35,6	30-75	0,03-0,05	До 0,4
18.	Компресорно помещение	СТФР	19,6 -20,6	15-23	34,9-37,6	30-75	0,16-0,20	До 0,4
Административна сграда - етаж 3								
19.	Офис отдел „ЕСР"	ЛФР	21,9 -22,9	18-25	35,4-38,6	30-75	0,03-0,05	До 0,2
Административна сграда - етаж 4								
20.	Офис ЕМА – контролна точка ляво	ЛФР	23,0 -24,1	18-25	34,6-37,8	30-75	0,02-0,05	До 0,2
21.	Офис ЕМА – контролна точка дясно	ЛФР	23,0 -24,0	18-25	34,6-38,4	30-75	0,03-0,07	До 0,2
22.	Офис Отдел „Продажби трансформатори" – контролна точка ляво	ЛФР	22,9 -23,9	18-25	36,0-38,6	30-75	0,02-0,04	До 0,2
23.	Офис Отдел „Продажби трансформатори" – контролна точка дясно	ЛФР	22,7 -23,9	18-25	34,1-37,9	30-75	0,03-0,05	До 0,2
24.	Офис "Бизнес развитие"	ЛФР	23,4 -24,2	18-25	35,0-37,9	30-75	0,02-0,04	До 0,2
25.	Офис "Продажби стъпални регулатори"	ЛФР	23,0 -23,9	18-25	35,7-38,9	30-75	0,03-0,06	До 0,2
26.	Офис "Главен Юрисконсулт"	ЛФР	21,4 -22,4	18-25	31,8-34,7	30-75	0,03-0,04	До 0,2

ВЯРНО С ОРИГИНАЛА

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9.Забележка:

9.1. Резултатите от контрола се отнасят само за контролирания обект и към датите на контрола.

9.2. Протокол № 2917-1 от 22.03.2017 г. е неразделна част от сертификат за контрол № 2917 от 22.03.2017 г.

9.3. Използвани съкращения в колона 3 „Категория работа": ЛФР – лека физическа работа; СТФР – средно тежка физическа работа.

10. Технически средства за контрол:
10.1.Термоанемометър, тип: Testo 405–V1, идентификационен №41500220/109, СК №09998 от 09.04.2015 г. за измерване на температура и скорост на движение на въздуха;
10.2. Комбиниран уред тип: Testo 410–2, идентификационен №38524398/107, СК №09997 от 09.04.2015 г. за измерване на относителна влажност на въздуха.
(наименование, тип, производител, идентификационен №....., Свидетелство за калибриране СК №.....)

Дати на извършване на контрола: 21.03.2017 г. и 22.03.2017 г.

Извършил контрола:

1. Контролен специалист: ..... /И. Райков/

Ръководител на орган за контрол: ..... /инж. О. Георгиев/

„ЕДАК КОНСУЛТ" ООД * ОРГАН ЗА КОНТРОЛ ОТ ВИДА * гр. София *

„ХЮНДАЙ ХЕВИ ИНДЪСТРИС КО БЪЛГАРИЯ" АД

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ДЕКЛАРАЦИЯ

Долуподписаният Антон Иванов Илиев в качеството ми на представляващ Обединение „МИГ - Хюндай", участник в обществена поръчка с предмет: „„Доставка, демонтаж и монтаж на трифазни маслонапълнени понижаващи силови трансформатори 110kV/ Средно напрежение (СрН) и цялото необходимо помощно оборудване", реф.№ PPD 17-001.

Д Е К Л А Р И Р А М, ЧЕ:

Маслото, използвано при доставка на трифазни маслонапълнени понижаващи силови трансформатори 110kV, предмет на горе указаната обществена поръчка, ще бъде без наличието на полихлорирани бифинили (PCB).

Дата 18.04.2017 г.

Декларатор: _____
/Антон Илиев/

МИГ 23 ЕООД - СОФИЯ - MIG 23 LTD

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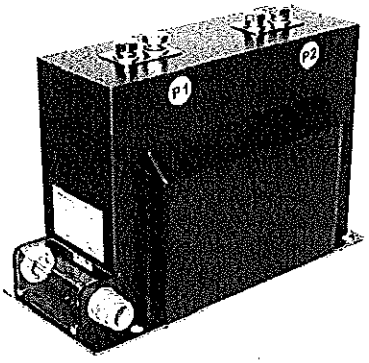
KPB Intra
Instrument Transformers

We measure high voltage for you

Токов измервателен трансформатор, подпорен тип CTS 12 S



Техническо описание

Токовите трансформатори CTS 12 S са предназначени за измерване и защита в разпределителните уредби СН за монтаж на закрито.

Стойността на вторичния ток е 5 A или 1 A с възможност за комбинация. Класовете на точност на веригите за мерене са 0.2S, 0.2, 0.5S, 0.5, 1, 3, на веригите за защита са 5P, 10P и PX. Измервателните трансформатори съответстват на изискванията за клас на точност в рамките на стойностите от 25% до 100% от номиналния товар.

Ограничението на първичния ток е 120% от номиналната стойност I_N, съгласно договора между производител и клиент е възможна доставка на оборудване с други стойности, например 200% от I_N.

Измервателните трансформатори CTS 12 S са конструирани като токови трансформатори с едновиткова или многовиткова първична намотка. Съвременната конструкция на тези измервателни трансформатори позволява превключването не само на вторичната страна, но също на първичната страна. Първичното превключване може лесно да бъде реализирано посредством два болта M8 (Моля, вижте „Ръководството за монтаж и експлоатация". Болтовете и мостовете са част от окомплектовката на измервателния трансформатор).

Вторичната намотка е намотана на магнитна сърцевина, изработена от листова електростомана с ориентирана структура или сплави от никел, желязо и мед (пермалой).

Броят на ядрата може да бъде от 1 до 3 съгласно запитването на клиента и съгласно техническите изисквания и характеристики.

Всички части под напрежение на измервателния трансформатор са изолирани с многокомпонентна смес от епоксидна смола. Този материал изпълнява и двете функции електрическа изолация и механична якост.

Измервателните трансформатори се монтират в произволно положение. Те се закрепват посредством четири болта в отворите на монтажната основа. Клемите за свързване на първичната намотка на измервателните трансформатори са снабдени с болтове M12. Ние препоръчваме да се използват клемови съединения за свързване на въводите на вторичните намотки, отговарящи на сечението на използвания проводник. Клемният блок за свързване на вторичните вериги е снабден с капак с възможност за пломбиране. Вътре в него е комплектът с мостове и малки болтове, осигуряващ възможност за заземяване и шунтиране на изводите на вторичните намотки (Моля, вижте „Ръководството за монтаж и експлоатация").

За използването на измервателните трансформатори CTS 12 S в KRU тип VH-RODEL произвеждаме и доставяме епоксиден адаптор, щифт и специална монтажна основа в случаи,

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където се изисква замяна на стари типове измервателни трансформатори (от различни производители), ние доставяме измервателни трансформатори CTS 12 S на частично променена монтажна основа, която има монтажна стъпка идентична на съществуващата при типовете, които се заменят.
Измервателните трансформатори CTS 12 S отговарят на всички изисквания за изпитвания съгласно IEC 61869-1, IEC 61869-2, IEC 61243-5, IEC 60068-2-11, ГОСТ 7746-2001, ГОСТ 1516.3-96.
По искане на клиента ние осигуряваме официално калибриране.
Възможно е да се консултират други технически параметри с производителя.

Техническа спецификация

Максимално работно напрежение:
12/17.5 kV
Изпитвателно напрежение с промишлена честота 1 мин:
28/38 kV
Изпитвателно напрежение със стандартна импулсна вълна 1,2/50 μs:
75/95 kV
Номинален първичен ток:
5 - 3200 A
Номинален вторичен ток:
5 A or 1 A
Ток на термична устойчивост за 1 сек, Ith:
max 80 kA/1s (31.5 kA/3s)
Ток на динамична устойчивост, Idyn:
max 200 kA
Продължително претоварване по ток, Icth:
120 % In
Клас на точност – за мерене:
0.2S, 0.2, 0.5S, 0.5, 1, 3
Номинален коефициент на безопасност – за мерене:
FS5, FS10
Клас на точност – за защита:
5P, 10P, PX
Номинален коефициент на безопасност – за защита:
5, 10, 15, 20, 25, 30
Номинална мощност:
2,5 - 60 VA
Номинална честота:
50 Hz
Дължина на пътя на утечка:
210 mm
Тегло:
22 kg
Температурен клас:
E

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Работни условия за експлоатация:

Работна температура от -5 до + 40 °C

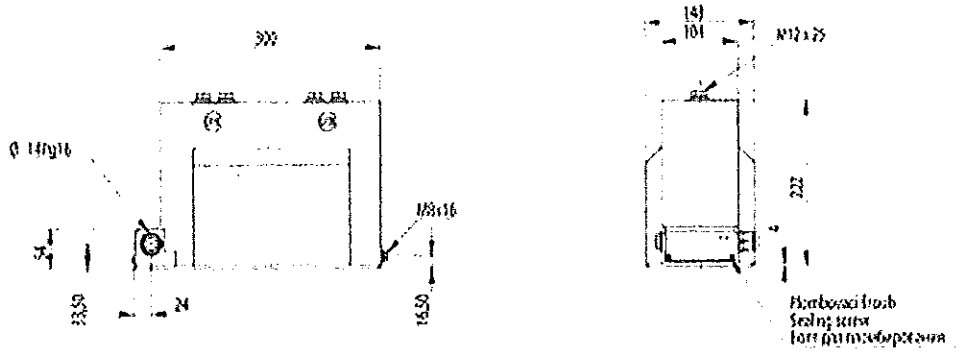
съответства на температурен клас -5/40 съгласно IEC 61869-1

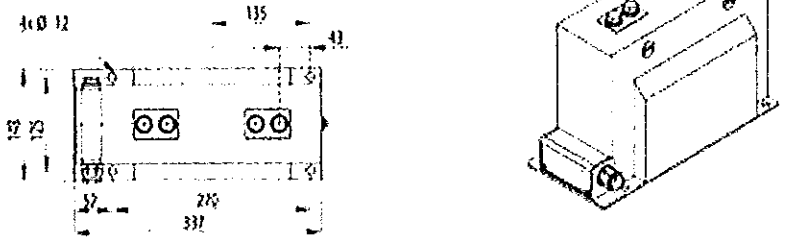
Стандарт:

I IEC 61869-1, IEC 61869-2, IEC 61243-5, IEC 60068-2-11, ГОСТ 7746-2001, ГОСТ 1516.3-96

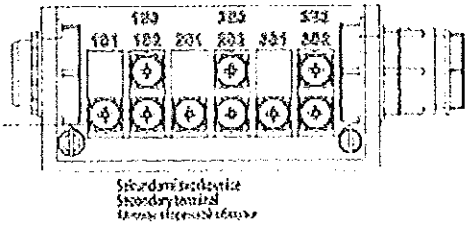
Габаритни чертежи

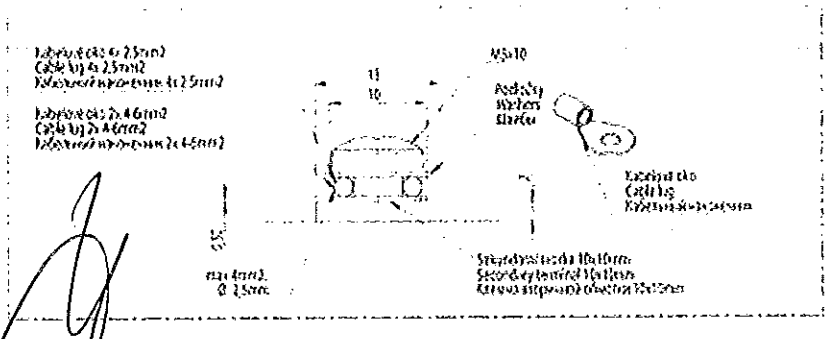
CTS 12 S



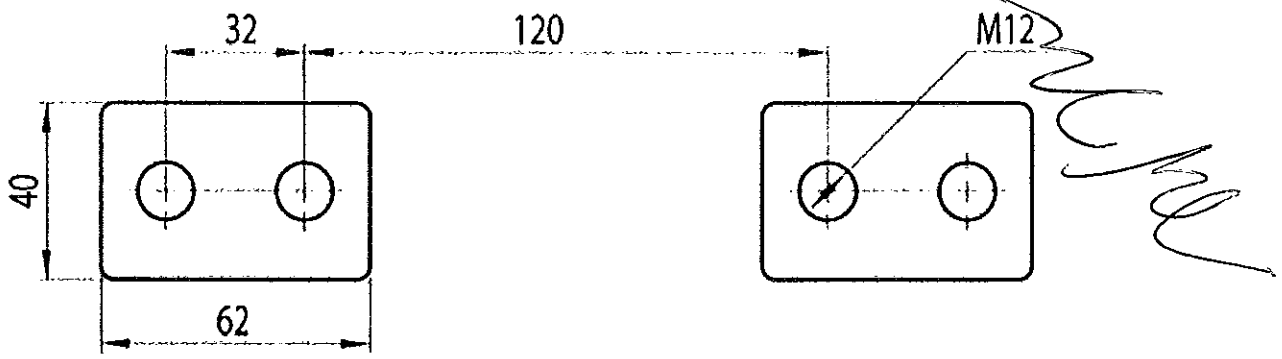


Клемен блок за свързване на вторичните вериги

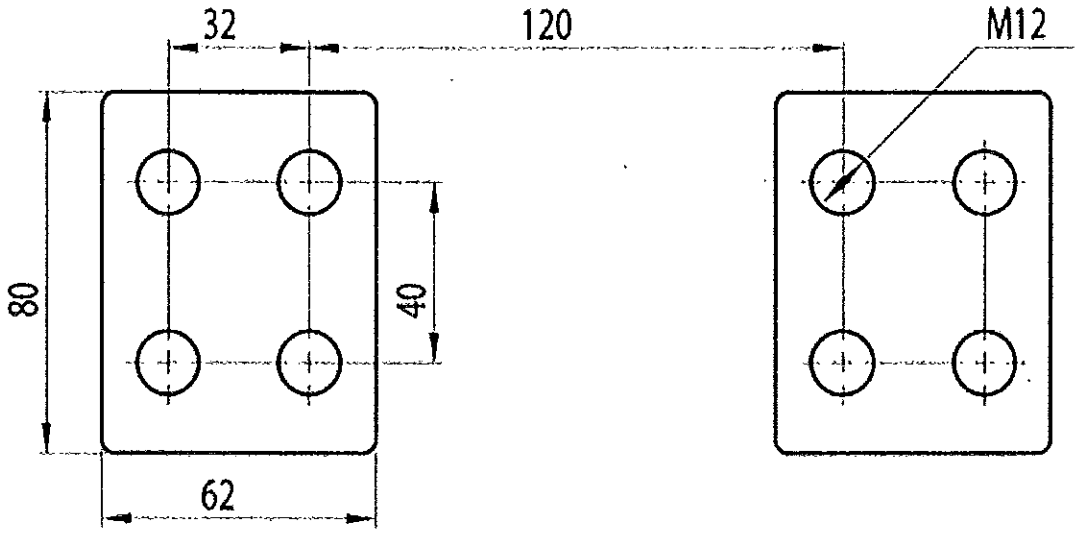




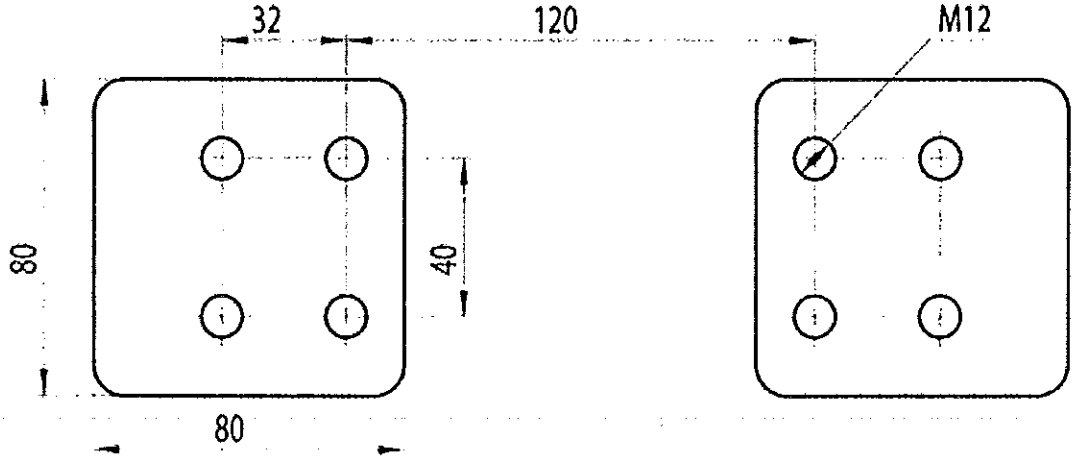
Изпълнение на клемите за свързване на първичната намотка до 1250 А съгласно IEC



Изпълнение на клемите за свързване на първичната намотка от 1250 А до 1750 А съгласно IEC



Изпълнение на клемите за свързване на първичната намотка над 1750 А съгласно IEC



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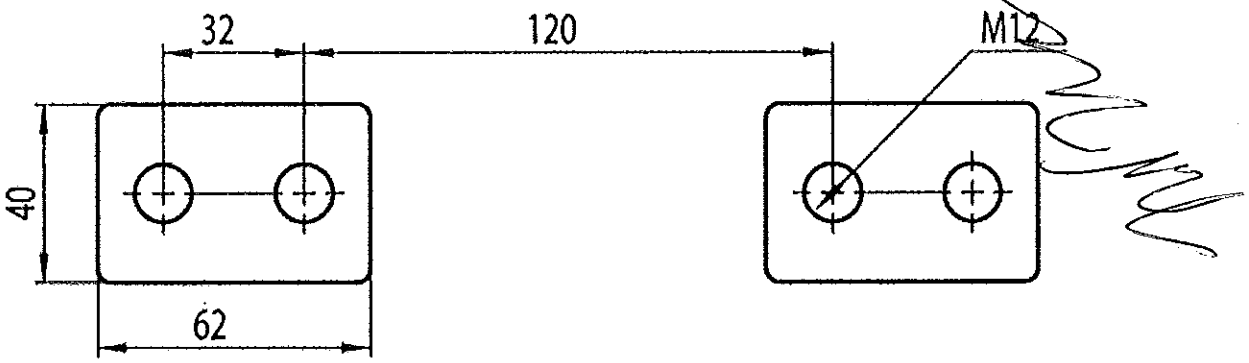
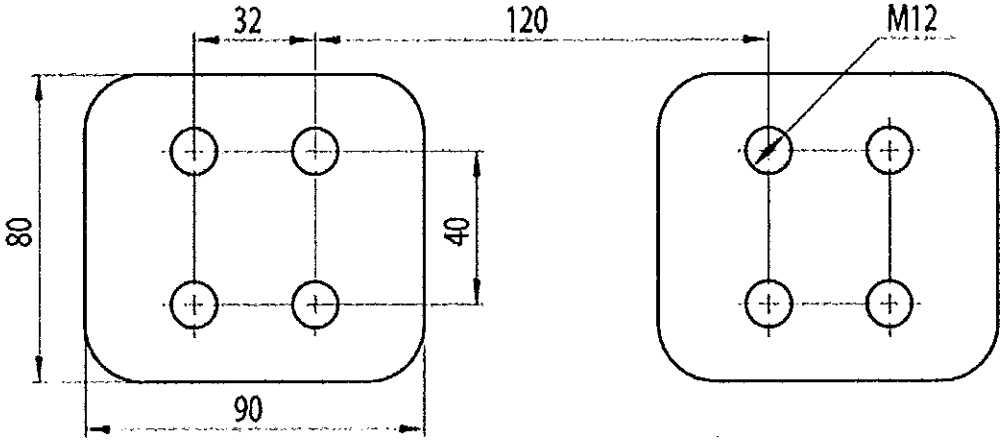
Изпълнение на клемите за свързване на първичната намотка до 1250 А съгласно ГОСТ

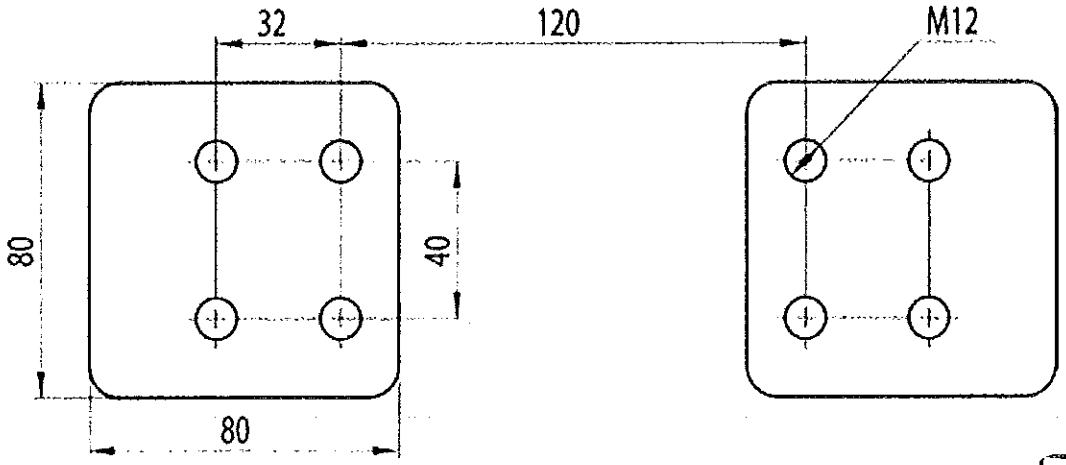


2 x 2 - M12 rámeček/frame/коробка

Изпълнение на клемите за свързване на първичната намотка от 1250 А до 1750 А съгласно ГОСТ

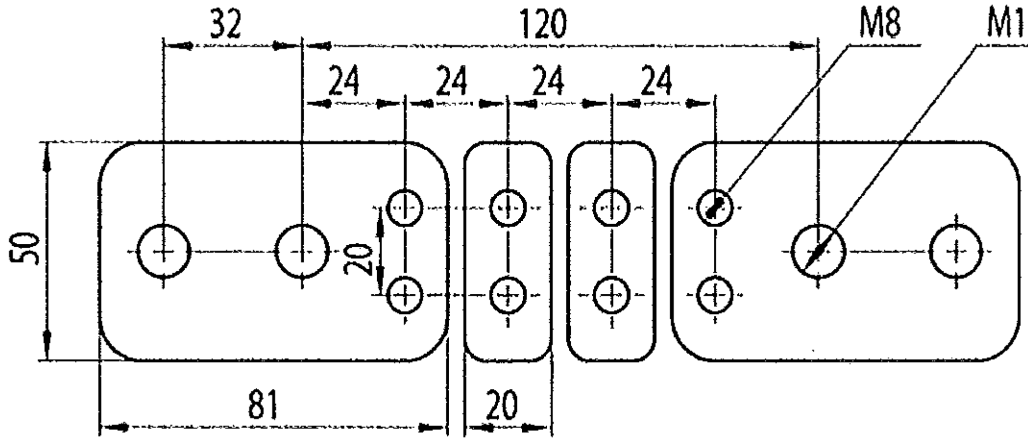


Изпълнение на клемите за свързване на първичната намотка над 1750 А съгласно ГОСТ



ВЯРНО С ОРИГИНАЛА

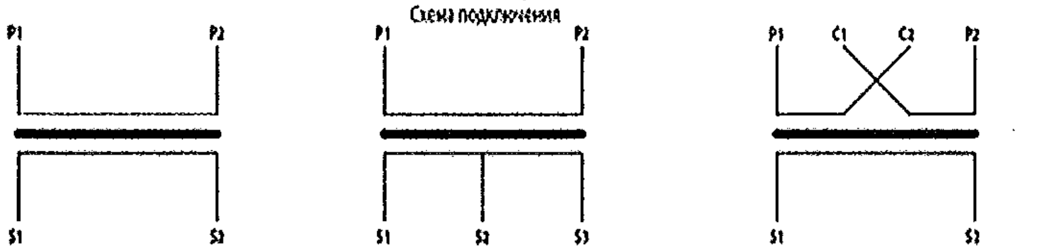
Първично превключване



2 x 2 - M12 přepinatelné / switchable / переключаемый

Схема на свързване

Schéma zapojení
Connection diagram
Схема подключения



Základní zapojení Basic connection Стандартное подключение	Sekundárně přepinatelný Secondary switchable С переключением на стороне вторичной обмотки	Primárně přepinatelný Primary switchable С переключением на стороне первичной обмотки

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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

№ 16.10.5108

Издадено на производител: KPB Intra s.r.o.
Issued to manufacturer: Ždánská 477, 685 01 Bučovice, Česká republika

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

Относно: измервателни токови трансформатори тип CTSxxxx
In Respect of:

Знак за одобрен тип:
Type Approval Mark:

BG 16
5108

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

Срок на валидност: 31.10.2026 г.
Valid until:

Вписва се в регистъра на одобрените за използване типове средства за измерване под №: 5108
Reference №:

ВЯРНО С ОРИГИНАЛА

Дата на издаване на удостоверението за одобрен тип: 31.10.2016 г.
Date:

И. Д. ПРЕДСЕДАТЕЛ:
Паун Илчев

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Приложение към удостоверение за одобрен тип № 16.10.5108

Издадено на производител: KPB Intra s.r.o.
Ždánská 477, 685 01 Bučovice, Česká republika

Относно: измервателни токови трансформатори тип CTSxxxx

1. Описание на типа:

Измервателните токови трансформатори тип CTSxxxx се използват за измерване и защита на електрически мрежи с максимално допустимо работно напрежение до 40,5 kV, при честота 50 Hz.

Измервателните токови трансформатори тип CTSxxxx са еднофазни трансформатори с отлята изолация, изпълнена от епоксиден компаунд. Вторичната намотка е намотана на магнитна сърцевина от ориентирани пластини, изработени от сплав от никел, желязо и мед. Изводите на първичните намотки са разположени в горната част на корпуса във вид на правоъгълни контактни планки с болтово закрепване. Изводите на вторичните намотки са разположени в основата на трансформаторите в клемен блок защитен със свалящ се прозрачен капак. Основата на трансформатора има отвори за закрепване на трансформатора на мястото за експлоатация.

Конструкцията на измервателните токови трансформатори позволява превключване на обхватите и на двете страни - вторична и първична страна.

Вторичното превключване се осъществява посредством комутиране на части на вторичната бобина.

Първичното превключване е с лесен монтаж, свързвайки два моста във веригата посредством болтове M8 (и болтовете, и мостовете са част от комплекта на измервателния трансформатор). Изводите на вторичните намотки са от 1 до 4.

Металните функционални части на измервателния трансформатор са защитени от корозия с анти-корозионно покритие. Първичните клеми са галванизирани с никел или са посребрени. Вторичните клеми са галванизирани с никел. Монтажните основи са студено поцинковани (измервателни трансформатори за монтаж на закрито) или горещо поцинковани (измервателни трансформатори за монтаж на открито).

2. Технически и метрологични характеристики:

Характеристики	Трансформатори тип CTSx12xx; CTSx17xx; CTSx25xx; CTSx38xx
Максимално работно напрежение, kV	12; 17,5; 24; 25; 36; 38,5; 40,5
Честота, Hz	50
Номинален първичен ток, A	от 5 до 3200
Номинален вторичен ток, A	1 и 5
Клас на точност: - измервателна намотка - защитна намотка	 0,2S; 0,2; 0,5S; 0,5; 1; 3 5P; 10P; PX
Коефициент на сигурност, FS	FS5; FS10
Мощност, VA	до 60

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3. Типово означение: CTSxxxx:

CTS	x	x	x	x
Токов трансформатор, еднофазен	**O** - Обозначение за ТТ за външен монтаж Без **O** - Обозначение за ТТ за вътрешен монтаж	Максимално работно напрежение, kV	Обозначение за размера на корпуса на трансформаторите (с намалена дължина, стандартни, с увеличена дължина, с по-голямо удължение, с по-голямо уширение): **X, S, L, .09L, .41, .23** и др.	**Sct** - Обозначение за корпус на Schneider Electric **W** - Обозначение за допълнителен изолационен борд

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

- Знакът за одобрен тип (марка за залепване) се поставя на лицевата страна на трансформатора, над табелката с технически данни;
- Знакът за първоначална проверка (марка за залепване) се поставя от дясната страна, под знака за одобрен тип.

ВЯРНО С ОРИГИНАЛА

ivep®

Electrotechnical Engineering and Production, joint-stock company
619 00 BRNO, Vídeňská 117

REPORT OF PERFORMANCE No: 80-12849

SUPPORTING TYPE INSTRUMENT CURRENT TRANSFOMERS TYPE CTS12, CTS25

ZKUŠEBNA EVIDOVANÁ VE SDRUŽENÍ ČESKÝCH ZKUŠEBEN ivep 019

Jaromír Mudra,Phd

Brno, Dec. 22 1998

ВЯРНО С ОРИГИНАЛА

ivep®

TEST REPORT No: 80 - 12849
Tested subject: Supporting Type Instrument Current Transformers

Page No.:1

Number of pages: 14

TYPE:

CTS 12
CTS 25

KIND OF TEST: type test

TESTING ACC. TO:
ČSN 35 1360
IEC 185/1987
Appendix 2 to IEC 185-1995-08

RATED VALUES:
Rated primary current 10-3200 A
Rated secondary current 5A or 10A
Highest voltage of the system: 12 kV; 25 kV
Accuracy class: 0.2; 0.5 5P; 10 P
Security factor: < 5
Testing voltage: 35/75 kV 55/125 kV
Rated frequency: 50 Hz
Insulation class: E

TEST REQUEST ISSUED BY:
The Czech Metrology Institute
Okružní 31
638 00 Brno

ORDER NUMBER:
Contract No. 13/Tr. of 01/1996

TESTED SPECIMEN REG. NUMBER:
148/96 to 153/96

ENVIRONMENTAL CONDITIONS:

TEMPERATURE:
ATMOSPHERIC PRESSURE:
AIR HUMIDITY:

PRODUCT MANUFACTURER

KPB Intra, s.r.o.
Fučíkova 860
685 01 Bučovice

TESTED SPECIMENS DELIVERED ON:
May, 1996

THIS TEST REPORT INCLUDES:

TEXT PAGES: 13
TABLES: 8
OSCILLOGRAMMES:
DIAGRAMMES:
DRAWINGS:
PHOTOS:

DISTRIBUTION LIST:

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IVEP
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TEST RESULT:

The supporting type, instrument current transformers of CTS 12 and the CTS 25 types

c o m p l y

with the type test requirements according to the ČSN 35 1360 and IEC 185 standards, the Appendix No. 2 to the IEC 185-1995-08 standard, for current range from 10A to 3200 A.

DATE OF TEST:
June to July 1996

TEST PERFORMED BY:
Vlastimil Rada

MANAGER OF TEST LAB.
[illegible] Mudra, PhD.

EVIDOVANÁ VE SDRUŽENÍ ČESKÝCH ZKUŠEBEN (019)

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On the basis of the Contract No. 13/Tr. 01/1996, concerning the performance of metrology measurement to be conducted by the ČMI Prague, the type tests on instrument current transformers of CTS 12 and CTS 25 type, manufactured by KPB INTRA, s.r.o. Bučovice, were carried through at the IVEP State Testing Metrology Centre, conformably to the ČSN 35 1360 standard, to the IEC Publication No. 185 and the Appendix No. 2 to the IEC 185-1995-08.
The transformers were manufactured in conformity with the drawing numbers T 12001, T 12002, T 25001 and the winding procedures No. 4 120001 to 4 120003, 4 250001, 4 250002, 4 250004. The tests were conducted at the IVEP State Metrology Centre, the IVEP short-circuit test shop and the Běchovice short-circuit testing station.

The following products were subject of the type testing:

CTS 12.L transformer - sample No. 148/96 - prod. No. 1200001
20//5/1 A; 10 VA; accuracy class 0.5 - n < 5
15 VA; accuracy class 10P - n = 5

CTS 12.S transformer - sample No. 149/96 - prod. No. 1200002
200-400//5/5 A; 15 VA; accuracy class 0.2 - n < 5
15 VA; accuracy class 5P - n = 10

CTS 12.S transformer - sample No. 150/96 - prod. No. 1200003
3200//5/1 A; 60 VA; accuraca class 0.2 - n < 5
60 VA; accuracy class 5P - n = 5

CTS 25 transformer - sample No. 151/96 - prod. No. 2500001
10//1/5 A; 10 VA; accuracy class 0.5 - n < 5
15 VA; accuracy class 10P - n = 5

CTS 25 transformer - sample No. 152/96 - prod. No. 2500002
400-800//5/5 A; 15 VA; accuracy class 0.5 - n < 5
15 VA; accuracy class 5P - n = 20

CTS 25 transformer - sample No. 153/96 - prod. No. 2500004
1000//5/5 A; 20 VA; accuracy class 0.5 - n < 5
20 VA; accuracy class 5P - n = 10

Scope of the type test:

1. Verification of proper marking of transformer terminals
2. Measurement of transformer accuracy
3. Measurement of the rated security factor (FS) and the composite error
4. Impulse test
5. Power frequency withstand test
6. Test of interturn insulation
7. Partial discharge measurement
8. Temperature-rise test
9. Short-circuit test
10. Checking of the transformer workmanship and equipment completeness

ВЯРНО С ОРИГИНАЛА

1. Verification of a correct marking of transformer terminals

Polarity check of the primary and secondary winding was performed during the accuracy measurement, by using the polarity indication instrument. The transformers comply with the ČSN 35 1360 requirements, Article No. 120.

2. Measurement of transformer accuracy

The transformer accuracy was verified by using the compensation method, by means of the Hartmann Braun AG measuring bridge of Keller system, MEWK type, production number 6406857 of the instrument, verification sheet No. LPM/451/93.

Additionally the following measuring instruments were used:

Instrument current transformer - comparator; manufactured by Tettex, 4767 type, prod. No. 135233, verification sheet No. CM114/1/078/95

Instrument current transformer - manufactured by Tettex, 4724 type, prod. No. 113033, verification sheet No. CM 114/1/128/95

Current burden: manufactured by Hartman & Braun AG, NBKa type, production No. 3154031, verification sheet No. LPM/451/93

Current burden: manufactured by IVEP a.s. Brno. This burden is an inherent part of the abover current burden No. 3154031; verification sheet No. 250 - tr/04/92

The accuracy measurement was performed in conformity with the ČSN 35 1360 standard, Article No. 61 and 71, and with the IEC 185 standard, Article No. 27 and 37.
The values of current error and that of the phase displacement, before and after the short-circuit test, are given in the following tables.

ВЯРНО С ОРИГИНАЛА

Table No. 1 - Instrument current transformer of CTS 12.L type,
No. of tested sample 148/96
transformer ratio 20//5/1 A; 10 VA; accuracy class 0.5
" 15 VA; accuracy class 10P

	I_N	5%	10%	20%	100%	120%	P_N VA
winding 1S1-1S2	I [%]	+0.34	+0.33	+0.32	+0.32	+0.32	2.5
	I [']	+16.2	+14.5	+11.9	+5.1	+5.1	
	I [%]	-0.49	-0.40	-0.31	-0.01	0.00	10
	I [']	+21.0	+13.9	+7.9	-3.0	-3.1	
after short-circuit test	I [%]	+0.35	+0.33	+0.32	+0.32	+0.32	2.5
	I [']	+16.0	+14.1	+11.8	+5.0	+4.5	
	I [%]	-0.46	-0.38	-0.29	0.00	0.00	10
	I [']	+20.0	+13.0	+7.0	-3.5	-3.0	
winding 2S1-2S2	I [%]				+0.87		7.5
	I [']				+6.5		
	I [%]				+0.30		15
	I [']				+3.0		
after short-circuit test	I [%]				+0.83		7.5
	I [']				+6.9		
	I [%]				+0.25		15
	I [']				+3.0		

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ВЯРНО С ОРИГИНАЛА

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Table No. 2 - Instrument current transformer of CTS 12.S type,
No. of tested sample 149/96
transformer ratio 200-400//5/5 A; 10 VA; accuracy class 0.2
" 15 VA; accuracy class 5P

	I_N	5%	10%	20%	100%	120%	P_N VA
winding 1S1-1S2 200//5/5A	I[%]	+0.13	+0.13	+0.12	+0.11	+0.11	3.75
	I[′]	+7.1	+6.5	+6.0	+4.2	+4.5	
	I[%]	-0.19	-0.15	-0.12	-0.04	-0.05	15
	I[′]	+10.8	+8.0	+5.0	+2.5	+3.5	
after short-circuit test	I[%]	+0.12	+0.12	+0.12	+0.11	+0.12	3.75
	I[′]	+6.8	+5.9	+5.0	+4.1	+2.0	
	I[%]	-0.13	-0.12	-0.09	-0.03	-0.02	15
	I[′]	+8.1	+6.2	+4.1	+1.5	+1.2	
winding 2S1-2S2	I[%]				-0.32		7.5
	I[′]				+5.9		
	I[%]				-0.46		15
	I[′]				+5.0		
winding 1S1-1S2 400//5/5A	I[%]	+0.12	+0.12	+0.12	+0.11	+0.11	3.75
	I[′]	+6.9	+6.5	+5.9	+4.0	+3.9	
	I[%]	-0.16	-0.16	-0.13	-0.03	-0.02	15
	I[′]	+10.0	+8.1	+5.8	+2.0	+1.1	
winding 2S1-2S2 400//5/5A	I[%]				-0.32		7.5
	I[′]				+5.9		
	I[%]				-0.47		15
	I[′]				+5.0		

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ВЯРНО С ОРИГИНАЛА

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Table No. 3 - Instrument current transformer of CTS 12.S type,
No. of tested sample 150/96
transformer ratio 3200//5/5 A; 60 VA; accuracy class 0.2
" 60 VA; accuracy class 5P

	I_N	5%	10%	20%	100%	120%	P_N VA
winding 1S1-1S2	I[%]	-0.02	+0.01	+0.03	+0.05	+0.07	15
	I[']	+8.0	+5.8	+4.0	+2.0	+1.1	
	I[%]	-0.29	-0.21	-0.14	-0.05	-0.02	60
	I[']	+10.0	+6.5	+3.6	+2.0	0.0	
after short-circuit test	I[%]	-0.03	-0.01	+0.02	+0.04	+0.06	15
	I[']	+8.9	+6.8	+4.0	+2.1	+1.9	
	I[%]	-0.30	-0.23	-0.15	-0.05	-0.04	60
	I[']	+10.9	+7.0	+3.9	+1.9	+0.9	
winding 2S1-2S2	I[%]				+0.24		30
	I[']				+0.5		
	I[%]				+0.18		60
	I[']				-0.5		
after short-e circuit test	I[%]				+0.22		30
	I[']				+2.0		
	I[%]				+0.15		60
	I[']				0.0		

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Table No. 4 - Instrument current transformer of CTS 25 type,
No. of tested sample 151/96
transformer ratio 10//1/5 A; 10 VA; accuracy class 0.5
" 15 VA; accuracy class 10P

	I_N	5%	10%	20%	100%	120%	P_N VA
winding 1S1-1S2	I[%]	+0.51	+0.50	+0.48	+0.47	+0.47	2.5
	I[']	+20.9	+17.0	+14.2	+7.2	+6.9	
	I[%]	-0.67	-0.46	-0.35	+0.04	+0.03	10
	I[']	+35.5	+24.0	+17.0	+1.9	+2.0	
after short-circuit test	I[%]	+0.51	+0.49	+0.48	+0.47	+0.47	2.5
	I[']	+19.5	+17.0	+14.0	+7.5	+7.0	
	I[%]	-0.59	-0.44	-0.33	+0.04	+0.05	10
	I[']	+30.9	+23.0	+15.9	+0.5	+1.1	
winding 2S1-2S2	I[%]				-0.82		7.5
	I[']				+12.5		
	I[%]				-1.25		15
	I[']				+11.5		
after short-circuit test	I[%]				-0.81		7.5
	I[']				+11.9		
	I[%]				-1.24		15
	I[']				+11.0		

ВЯРНО С ОРИГИНАЛА

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Table No. 5 - Instrument current transformer of CTS 25 type,
No. of tested sample 152/96
transformer ratio 400-800//5/5 A; 15 VA; accuracy class 0.5
" 15 VA; accuracy class 5P

	I_N	5%	10%	20%	100%	120%	P_N VA
winding 1S1-1S2 400//5/5A	I[%]	-0.05	-0.04	-0.05	-0.05	-0.05	3.75
	I[']	+5.8	+5.0	+4.0	+2.1	+2.0	
	I[%]	-0.21	-0.19	-0.17	-0.12	-0.12	15
	I[']	+7.9	+5.9	+4.0	+1.1	+1.1	
winding 2S1-2S2 400//5/5A	I[%]				-0.09		7.5
	I[']				+2.0		
	I[%]				-0.13		15
	I[']				+2.1		
winding 1S1-1S2 800//5/5A	I[%]	-0.03	-0.03	-0.04	-0.04	-0.05	3.75
	I[']	+5.0	+4.5	+3.8	+1.9	+1.5	
	I[%]	-0.22	-0.21	-0.18	-0.12	-0.10	15
	I[']	+8.5	+7.1	+4.9	+0.8	0.0	
after short-circuit test	I[%]	-0.04	-0.04	-0.04	-0.05	-0.06	3.75
	I[']	+5.5	+5.0	+4.0	+2.1	+1.3	
	I[%]	-0.20	-0.19	-0.17	-0.12	-0.11	15
	I[']	+7.9	+6.1	+3.9	+1.1	+0.5	
winding 2S1-2S2 800//5/5A	I[%]				-0.09		7.5
	I[']				+2.1		
	I[%]				-0.10		15
	I[']				+2.1		
after short-circuit test	I[%]				-0.09		7.5
	I[']				+2.1		
	I[%]				-0.13		15
	I[']				+2.1		

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МИГ 23 ЕООД СОФИЯ MIG 23 LTD

Table No. 6 - Instrument current transformer of CTS 25 type,
No. of tested sample 153/96
transformer ratio 1000//5/5 A; 20 VA; accuracy class 0.5
" 20 VA; accuracy class 5P

	I_N	5%	10%	20%	100%	120%	P_N VA
winding 1S1-1S2	I [%]	+0.15	+0.20	+0.24	+0.30	+0.31	5
	I [']	+9.2	+7.5	+5.5	+2.1	+2.1	
	I [%]	-0.30	-0.22	-0.12	+0.06	+0.08	20
	I [']	+12.2	+9.2	+6.0	0.0	-0.3	
winding 2S1-2S2	I [%]				+0.43		10
	I [']				+1.5		
	I [%]				+0.39		20
	I [']				+1.8		

The instrument current transformers of CTS 12 and CTS 25 types, the sample numbers 148/96 to 153/96 comply with the requirements of ČSN 35 1360 and IEC 185 standards. The measured current and phase displacement errors, measured before and after the short-circuit test, correspond with accuracy class indication on the transformer nameplate.

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3. Measurement of the rated security factor (FS) and the composite error

This measurement was performed in accordance with the indirect method, as described by the ČSN 35 1360 standard, Article No. 107b; 108e and by the IEC 185 Publication, Articles No. 31 and 39b.
The respective values of instrument security factor and the composite error are given in tables 7 or 8, respectively.

Table No. 7

Type	Sample number	Secondary winding ratio	Burden	Security factor to ČSN 35 1360	IEC 185
CTS 12.L	148/96	20//5/1 A 1S1-1S2	10 VA	2.56	2.15
CTS 12.S	149/96	200-400//5/5 A 1S1-1S2	15 VA	2.87	2.45
CTS 12.S	150/96	3200//5/1 A 1S1-1S2	60 VA	3.1	2.55
CTS 25	151/96	10//1/5 A 1S1-1S2	10 VA	2.21	1.96
CTS 25	152/96	400-800//5/5 A 1S1-1S2	15 VA	2.64	2.10
CTS 25	153/96	1000//5/5 A 1S1-1S2	20 VA	4.12	3.40

Table No.8

Type	Sample number	Secondary winding ratio	Burden	Security factor	Composite error
CTS 12.L	148/96	20//5/1 A 2S1-2S2	15 VA	5	1.40%
CTS 12.S	149/96	200-400//5/5 A 2S1-2S2	15 VA	10	0.94%
CTS 12.S	150/96	3200//5/1 A 2S1-2S2	60 VA	5	0.10%
CTS 25	151/96	10//1/5 A 2S1-2S2	15 VA	5	0.88%
CTS 25	152/96	400-800//5/5 A 2S1-2S2	15 VA	20	5.0%
CTS 25	153/96	1000//5/5 A 2S1-2S2	20 VA		0.01%

The instrument current transformers of CTS 12 and CTS 25 types, the sample numbers 148/96 to 153/96 comply with the requirements of ČSN 35 1360 and IEC 185 standards. The instrument security factor values and the composite errors correspond with data shown on the transformer rating plate.

4. Impulse test

This test was performed in accordance with the ČSN 35 1360 standard, Article No. 110, and with IEC 185 Publication, Clause 14.
The tested samples No. 148/96 to 150/96, of the CTS 12 type series, passed the test by 15 positive and 15 negative 75 kV impulses, without a flashover.
The tested samples No. 151/96 to 153/96, of the CTS 25 type series, passed the test by 15 positive and 15 negative 125 kV impulses, without a flashover.

Detailed description and the test resuls are given in the IVEP Brno test report No. 82 - 0495.

5. Power frequency withstand test

a) Power frequency test between the primary and the secondary winding.

This test was performed conformably to the ČSN 35 1360 standard, Article No. 112, and the IEC 185 Publication, Clause 17, by using the testing AC voltage of 35 kV/1 minute (on testing sample numbers 148/96 to 150/6 of the CTS 12 series) and by using the testing AC voltage of 55 kV/1 minute (on testing sample numbers 151/96 to 153/96 of the CTS 25 series), with a satisfactory result. The description and the test results are given in the IVEP Brno 82-0495 test report.

b) Power frequency test on secondary windings

This test was performed by means of the testing power supply device, registration number 00770, by using a 3 kV AC testing voltage applied during 1 minute between the terminals of each secondary winding, and between each of the secondary windings and earthed parts.
The tested samples of sample numbers 148/96 to 153/96, of the CTS 12 and CTS 25 type series, did pass the test with satisfactory result.
Tested specimens No. 148/9 to 152/96 exposed to a short-circuit test at the IVEP Brno and Běchovice testing stations, were repeatedly subjected to the above power frequency test, with test voltage levels reduced to 90 per cent of the rated value. The tested specimens of the CTS 12 and CTS 25 did comply with the ČSN 35 1360, Art. 116h, and the IEC 185, Clause 12c requirements.

6. Test of interturn insulation

The specimens No. 148/96 to 149/96; 151/96 to 153/96, and the 150/96 (with 1S1 - 1S2 secondary winding) were subjected to the interturn insulation test with 120 % rated primary current, and the 150/96 specimen (with 2S1 - 2S2 secondary winding) to a test voltage of č.5 kV_{max}, during a time period of 1 minute.
The testing voltage on the open-end secondary winding was measured by means of a peak voltmeter with SME 2 capacitive divider. The CTS 12 and CTS 25 type, instrument current transformers passed the ČSN 35 1360, Art. 144 requirements, and that of the Appendix No. 2 of IEC 185-1995-08 Publication, by using the "A" testing procedure.
The specimens No. 148/96 to 152/96 did comply with the ČSN 35 1360, Art. 116h, and the IEC 185 Publication, Clause 12c requirements on a repeated interturn insulation test with reduced test voltage level (because of a previous short-circuit test carried out at the IVEP Brno and Běchovice test stations).

7. Partial discharge measurement

This kind of measurement was performed conformably to the Appendix No. 2 of IEC-1995-08 Publication, for both network earthing modes. The test results are given in the IVEP Brno test report No. 82-0495.
The values of partial discharges, measured on the instrument current transformers of CTS 12 and CTS 25 type, comply with the prescribed values for the highest operated voltages of U_m = 12 kV and U_m = 25 kV, in both the impedance earthed and the effectively-earthed neutral systems.
After carrying through the short-circuit tests at the IVEP Brno and Běchovice testing stations the following partial discharge values were measured:

Specimen No. 148/96 - CTS 12.L - prod. No. 1200001
1.2 U_m - Q = 2pC = satisfactory result
1.2 $U_m/\sqrt{3}$ - Q = 0.6pC = satisfactory result

Specimen No. 149/96 - CTS 12.S - prod. No. 1200002
1.2 U_m - Q = 1pC = satisfactory result
1.2 $U_m/\sqrt{3}$ - Q = 0.6pC = satisfactory result

Specimen No. 150/96 - CTS 12.S - prod. No. 1200003
1.2 U_m - Q = 40 pC = satisfactory result
1.2 $U_m/\sqrt{3}$ - Q = 0.5pC = satisfactory result

Specimen No. 151/96 - CTS 25 - prod. No. 2500001
1.2 U_m - Q = 2pC = satisfactory result
1.2 $U_m/\sqrt{3}$ - Q = 0.5pC = satisfactory result

Specimen No. 152/96 - CTS 25 - prod. No. 2500002
1.2 U_m - Q = 1.5pC = satisfactory result
1.2 $U_m/\sqrt{3}$ - Q = 0.5pC = satisfactory result

ВЯРНО С ОРИГИНАЛА MIG 23 LTD СОФИЯ

8. Temperature rise test

This test was performed on specimens No. 148/96; CTS 12.L; 20//5/1 A and No. 152/96; CTS 25; 400-800//5/5A, with the test current of 120 % of rated value and the 15 VA rated secondary burden.

The temperature rise was measured by using the method of resistance increase in the secondary winding. The temperature of primary windings was measured by the "Thermophil" electronic temperature meter. At an average, test-site ambient temperature of 23°C the following temperature rise and winding temperatures were identified:

Specimen No. 148/96 - CTS 12.L
temp. rise 1S1 - 1S2 - 5.9 K
2S1 - 2S2 - 6.5 K
Primary winding temperature = 28°C

Specimen No. 152/96 - CTS 25
temp. rise 1S1 - 1S2 -23.6 K
2S1 - 2S2 -24.6 K
Primary winding temperature = 55°C

The values of temperature rise and the temperature values comply with the ŠN 35 1360, Art. 39, and IEC 185, Clause 9 and 13 requirements for the "E" insulation Class.

9. Short-circuit test

This test was performed on specimens No. 148/96 to 22//5/1 A; 149/95 to 200-400//5/5 A; 151/96 to 10//1/5 A, and carried out at the IVEP Brno short-circuit testing station (see the test report No. 88-0086).

Additionally, the specimens No. 150/96 to 3200//5/1A; 152/96 to 400-800//5/5 A were subject to a short-circuit test at the Běchovice testing station (see the test report No. 96-079).

Based on the repeated accuracy measurement, the repeated insulation tests of primary and secondary windings, the partial discharge test and the visual inspection of the transformer body after passing the short-circuit test, the test results to ČSN 35 1360, Art. 116 and IEC 185, Clause 12 requirements may be considered to be satisfactory.

ВЯРНО С ОРИГИНАЛА
MIG 23 ЕООД
MIG 23 LTD
СОФИЯ

8. Temperature rise test

This test was performed on specimens No. 148/96; CTS 12.L; 20//5/1 A and No. 152/96; CTS 25; 400-800//5/5A, with the test current of 120 % of rated value and the 15 VA rated secondary burden.

The temperature rise was measured by using the method of resistance increase in the secondary winding. The temperature of primary windings was measured by the "Thermophil" electronic temperature meter. At an average, test-site ambient temperature of 23°C the following temperature rise and winding temperatures were identified:

Specimen No. 148/96 - CTS 12.L
temp. rise 1S1 - 1S2 - 5.9 K
2S1 - 2S2 - 6.5 K
Primary winding temperature = 28°C

Specimen No. 152/96 - CTS 25
temp. rise 1S1 - 1S2 -23.6 K
2S1 - 2S2 -24.6 K
Primary winding temperature = 55°C

The values of temperature rise and the temperature values comply with the ŠN 35 1360, Art. 39, and IEC 185, Clause 9 and 13 requirements for the "E" insulation Class.

9. Short-circuit test

This test was performed on specimens No. 148/96 to 22//5/1 A; 149/95 to 200-400//5/5 A; 151/96 to 10//1/5 A, and carried out at the IVEP Brno short-circuit testing station (see the test report No. 88-0086).

Additionally, the specimens No. 150/96 to 3200//5/1A; 152/96 to 400-800//5/5 A were subject to a short-circuit test at the Běchovice testing station (see the test report No. 96-079).

Based on the repeated accuracy measurement, the repeated insulation tests of primary and secondary windings, the partial discharge test and the visual inspection of the transformer body after passing the short-circuit test, the test results to ČSN 35 1360, Art. 116 and IEC 185, Clause 12 requirements may be considered to be satisfactory.

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ВЯРНО С ОРИГИНАЛА

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THE INSTITUTE OF TECHNICAL STANDARDIZATION, METROLOGY AND STATE TESTING

Ref. N. 3825/09/02

Prague, 27 November 2009

RESOLUTION

The Institute of Technical Standardization, Metrology and State Testing, pursuant to § 13 section 1 letter c) and § 16 of Act N. 505/1990 Sb. on metrology as amended (hereinafter "the Act"), made the following resolution in the administration procedure:

Applicant:

IVEP, a.s.
Brno, Videňská 117a, post code 619 00
Company N.: 00566993

Is granted

AUTHORIZATION

to certify measuring devices within the scope listed in the Appendix hereto. The Applicant shall keep **an official sign K with reference N. 20.** The use of the sign shall be regulated by § 9 and § 16 of the Act and by § 6 of Directive 262/2000 Sb. as amended. Conditions of the Authorization containing the basic requirements and obligations to be observed by the authorized centre in certification of the identified measuring devices are listed in the Appendix hereto and make an integral part hereof.

Justification:
This Resolution fully approves of the application for the renewal of Resolution of Authorization of 23 November 2009 submitted by the Applicant in relation with the change of the business name and replaces the Resolution by the Institute ref. N. 752/00/20 of 21 December 2000.

Advice:
An appeal may be lodged against this Resolution within 15 days of the service hereof at the Ministry of Trade and Industry through the Institute of Technical Standardization, Metrology and State Testing.

Seal: The Institute of Technical Standardization, Metrology and State Testing -1-

Signature
Ing. Milan Holeček, Chair

Appendix: Terms of the Authorization

ВЯРНО С ОРИГИНАЛА

MIG 23 LTD 23 ЕООД СОФИЯ

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I certify that this true copy consisting of 1 sheet literally corresponds with the original document from which it was made, consisting of 1 page and 1 sheet.
Dated in Brno, Příkop 8 on 20/5/2010

Seal: JUDr. Alice Sedláková, Notary Public in Brno
Marcela Nová, notarial secretary, signature

ВЯРНО С ОРИГИНАЛА
MIG 23 ЕООД
СОФИЯ
MIG 23 LTD.

OPIS

ÚŘAD PRO TECHNICKOU NORMALIZACI, METROLOGII A STÁTNÍ ZKUŠEBNICTVÍ

Č.j. 3825/09/02 V Praze 27. listopadu 2009

ROZHODNUTÍ

Úřad pro technickou normalizaci, metrologii a státní zkušebnictví podle § 13 odst. 1 písm. c) a § 16 zákona č. 505/1990 Sb., o metrologii, ve znění pozdějších předpisů (dále jen „zákon") ve správním řízení rozhodl takto:

Žadateli

IVEP, a.s.

Brno, Vídeňská 117a, PSČ 619 00

IČ 00566993

se uděluje

AUTORIZACE

pro ověřování stanovených měřidel v rozsahu uvedeném v příloze k tomuto rozhodnutí.

Žadateli se ponechává úřední značka K s evidenčním číslem 20, na jejíž použití se vztahují § 9 a § 16 zákona a § 6 vyhlášky č. 262/2000 Sb., ve znění pozdějších předpisů.

Podmínky autorizace, obsahující základní požadavky a povinnosti, které je autorizované metrologické středisko povinno při ověřování stanovených měřidel dodržovat, jsou uvedeny v příloze k tomuto rozhodnutí, která tvoří jeho nedílnou součást.

Odůvodnění:

Tímto rozhodnutím se v plném rozsahu vyhovuje žádosti o vystavení nového rozhodnutí o autorizaci ze dne 23.11.2009, kterou žadatel podal v souvislosti se změnou názvu společnosti, a nahrazuje rozhodnutí Úřadu č.j. 752/00/20 ze dne 21.12.2000.

Poučení:

Proti tomuto rozhodnutí lze podat odvolání do 15 dnů ode dne jeho doručení k Ministerstvu průmyslu a obchodu ČR prostřednictvím Úřadu pro technickou normalizaci, metrologii a státní zkušebnictví.

Úřad pro technickou normalizaci, metrologii a státní zkušebnictví

Ing. Milan Holeček
předseda

Příloha: Podmínky autorizace

ВЯРНО С ОРИГИНАЛЕ

Já, níže podepsaná tlumočnice jazyka anglického jmenovaná Krajským soudem v Hradci Králové pod číslem Spr. 2945/97 tímto stvrzuji, že překlad souhlasí s textem připojené listiny.

I, the undersigned interpreter of the English language, appointed by the Regional Court in Hradec Králové under the number Spr. 2945/97, hereby certify that this translation corresponds with the accompanying text.

Počet stran originálu ....2.....
Počet stran překladu ....2.....
Číslo překladu ....1951../10

No. of original pages ....2.....
No.of pages after translation....2
Translation recorded under No....1951./10

V Pardubicích dne
14. května 2010

Dated in Pardubice, the Czech Republic, on 14. May 2010

.....
Mgr. Yveta Linhartová
Tlumočník anglického jazyka
Interpreter of the English language

Mgr. Yveta Linhartová
Tlumočník anglického jazyka

МИГ 23 ЕООД
СОФИЯ
MIG 23

ВЯРНО С ОРИГИНАЛА

405

Д Е К Л А Р А Ц И Я

за конфиденциалност и извършен оглед на обект по предмета на поръчката

Долуподписаният/-ната/ Антон Иванов Илиев, в качеството ми на представляващ Обединение „МИГ - Хюндай", участник в процедура за възлагане на обществена поръчка с реф. № PPD 17-001 и предмет:

Доставка, демонтаж и монтаж на трифазни маслонапълнени понижаващи силови трансформатори 110kV/Средно напрежение (СрН) и цялото необходимо помощно оборудване,

Д Е К Л А Р И Р А М, ЧЕ:

1/ Представител на участника, когото представлявам е извършил оглед на обект: п/ст „Младост" и съм запознат със съществуващото положение.

2/ Няма да разпространявам поверителна информация, във връзка с извършения оглед на обекта на Възложителя, като ми е известно, че за поверителна се счита всяка информация, относно пропускателния режим в обекта, организацията на работната сила и работния процес, наличното оборудване и техническите схеми на функционирането му, системите за защита и сигурност в обекта и всичко, което е свързано с наличното оборудване, съоръжения и тяхното функциониране в съответния обект.

3/ Прилагам документ за извършен оглед, съставен на място в подстанцията.

Приложение: съгласно текста

Дата 18.04.2017г.

Декларатор: _____

/Антон Илиев/

МИГ 23 ЕООД • МИГ 23 • СОФИЯ

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HYUNDAI
HEAVY INDUSTRIES CO. BULGARIA

41, ROJEN Blvd., 1271 SOFIA, BULGARIA

Tel : (+359 2) 80 33 220;
Fax : (+359 2) 80 33 311;
E-mail: woojh@hhi-co.bg

Д Е К Л А Р А Ц И Я

за конфиденциалност и извършен оглед на обект по предмета на поръчката

Долуподписаният/-ната/ Дже Хи У, в качеството ми на представляващ фирма „Хюндай Хеви Индъстрис КО.България" АД, участник в процедура за възлагане на обществена поръчка с реф. № PPD 17-001 и предмет:

Доставка, демонтаж и монтаж на трифазни маслонапълнени понижаващи силови трансформатори 110kV/Средно напрежение (СрН) и цялото необходимо помощно оборудване,

Д Е К Л А Р И Р А М, ЧЕ:

1/ Представител на участника, когото представлявам е извършил оглед на обект: п/ст „Младост" и съм запознат със съществуващото положение.

2/ Няма да разпространявам поверителна информация, във връзка с извършения оглед на обекта на Възложителя, като ми е известно, че за поверителна се счита всяка информация, относно пропускателния режим в обекта, организацията на работната сила и работния процес, наличното оборудване и техническите схеми на функционирането му, системите за защита и сигурност в обекта и всичко, което е свързано с наличното оборудване, съоръжения и тяхното функциониране в съответния обект.

3/ Прилагам документ за извършен оглед, съставен на място в подстанцията.

Приложение: съгласно текста

Дата 13.04.2012 г.

Декларатор: _____

/име, подпис и печат/

407

ДЕКЛАРАЦИЯ

за извършен оглед на ПС „Младост“ 110/Ср.Н

Долуподписаният/-ната/ Антон Иванов Илиев
в качеството ми на представляващ „МИГ 23“ ЕООД,
кандидат за участие в процедура за възлагане на обществена поръчка с предмет: „Доставка, демонтаж и монтаж на трифазни маслонапълнени понижаващи силови трансформатори 110kV/Средно напрежение (СрН) и цялото необходимо помощно оборудване“ и реф. № PPD 17-001

ДЕКЛАРИРАМ:

Извърших оглед на обекта, предмет на обществената поръчка и се запознах със съществуващото положение, включително с действащите електрически съоръжения и спецификата на ПС „Младост“ 110/Ср.Н.

Дата 27.03.17 г.

Декларатор: ____________
/име, подпис и печат/
Антон Илиев

Служител на Възложителя допуснал до оглед кандидата:

Нинко Енов - р-л ЕО - ...
име и фамилия *длъжност* *подпис*

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СЕРТИФИКАТ № 23637/11/S

CERTIFICATE No.

Удостоверява, че системата за управление на качеството на
IT IS HEREBY CERTIFIED THAT THE QUALITY MANAGEMENT SYSTEM OF

ХЮНДАЙ ХЕВИ ИНДЪСТРИС КО. БЪЛГАРИЯ АД
HYUNDAI HEAVY INDUSTRIES CO. BULGARIA

БУЛ. РОЖЕН 41, СОФИЯ 1271, БЪЛГАРИЯ
41, ROZHEN BLVD., 1271 SOFIA, BULGARIA

ЗА СЛЕДНИТЕ ОПЕРАТИВНИ СТРУКТУРИ / *IN THE FOLLOWING OPERATIONAL UNITS*

БУЛ. РОЖЕН 41, СОФИЯ 1271, БЪЛГАРИЯ
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Съответства на стандарт
IS IN COMPLIANCE WITH THE STANDARD

ISO 9001:2008

EA:19

С област на приложение / *FOR THE FOLLOWING FIELD(S) OF ACTIVITIES*

КОНСТРУИРАНЕ, ПРОИЗВОДСТВО, ТЪРГОВИЯ И СЕРВИЗ НА ТРАНСФОРМАТОРИ, СТЪПАЛНИ РЕГУЛАТОРИ, АПАРАТИ ВИСОКО НАПРЕЖЕНИЕ И РЕЗЕРВНИ ЧАСТИ.

Информация за изключенията от изискванията на стандарта може да бъде намерена в наръчника по качество

DESIGN, PRODUCTION, SALE AND SERVICING OF TRANSFORMERS, TAP CHANGERS, HIGH VOLTAGE APPARATUSES AND SPARE PARTS.

Reference is to be made to the Quality Manual for details regarding the exemptions from the requirements of the standard

Валидността на този сертификат зависи от годишните / шестмесечните одити и от цялостния преглед на системата за управление на всеки три години.
The validity of this certificate is dependent on an annual / six monthly audit and on a complete review, every three years, of the management system.
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The use and validity of this certificate are subject to compliance with the RINA document : Rules for the certification of Quality Management Systems

Ing. Michele Francioni
(Chief Executive Officer)

Първо издание *First Issue*	10.08.2011
Настоящо издание *Current Issue*	30.07.2014
Валидност до *Expiry Date*	27.07.2017

RINA Services S.p.A.
Via Corsica 12 - 16128 Genova Italy

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Организацията е сертифицирана по гореуказаните стандарти от 4/9/2009.

This Organisation is certified for the above standard since 4/9/2009.

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SGA N° 002 D DAP N° 001 H
PRD N° 002 B PRS N° 066 C
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www.cisq.com

ВЯРНО С ОРИГИНАЛА

FoM CERSIGE-08/2013

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CERTIFICATE No.

Удостоверява, че системата за управление по отношение на околната среда на
It is hereby certified that the Environmental Management System of

ХЮНДАЙ ХЕВИ ИНДЪСТРИС КО. БЪЛГАРИЯ АД
HYUNDAI HEAVY INDUSTRIES CO. BULGARIA

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41, ROZHEN BLVD., 1271 SOFIA, BULGARIA

ЗА СЛЕДНИТЕ ОПЕРАТИВНИ СТРУКТУРИ / *IN THE FOLLOWING OPERATIONAL UNITS*

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IS IN COMPLIANCE WITH THE STANDARD

ISO 14001:2004

С ОБЛАСТ НА ПРИЛОЖЕНИЕ / *FOR THE FOLLOWING FIELD(S) OF ACTIVITIES*

EA:19

КОНСТРУИРАНЕ, ПРОИЗВОДСТВО, ТЪРГОВИЯ И СЕРВИЗ НА ТРАНСФОРМАТОРИ, СТЪПАЛНИ РЕГУЛАТОРИ, АПАРАТИ ВИСОКО НАПРЕЖЕНИЕ И РЕЗЕРВНИ ЧАСТИ.

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The use and the validity of this certificate are subject to compliance with the RINA document: Rules for the Certification of Environmental Management Systems
Валидността на този сертификат зависи от годишните / шестмесечните одити и от цялостния преглед на системата за управление на всеки три години.
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Първо издание *First Issue*	10.08.2011
Настоящо издание *Current Issue*	30.07.2014
Валидност до *Expiry Date*	27.07.2017

Ing. Michele Francioni
(Chief Executive Officer)

RINA Services S.p.A.
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CERTIFICATE No.

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It is hereby certified that the Occupational Health and Safety Management System of

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HYUNDAI HEAVY INDUSTRIES CO. BULGARIA

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The use and validity of this certificate are subject to compliance with the RINA document: Rules for the Certification of Occupational Health and Safety Management Systems

Първо издание *First Issue*	11.08.2011
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Валидност до *Expiry Date*	27.07.2017

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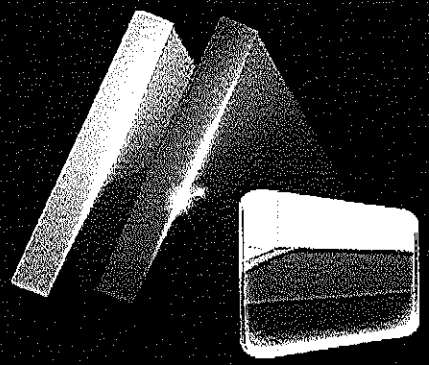
Организацията е сертифицирана по гореуказаните стандарти от 3/9/2008.
This Organisation is certified for the above standard since 3/9/2008.

ВЯРНО С ОРИГИНАЛА

CORPORATE PRESENTATION

HYUNDAI
HEAVY INDUSTRIES CO. BULGARIA

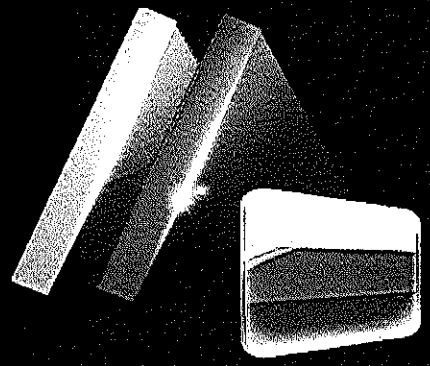
Contents



HYUNDAI
HEAVY INDUSTRIES CO. BULGARIA

Chapter I

I Bulgaria Overview



HYUNDAI
HEAVY INDUSTRIES CO. BULGARIA

Bulgaria Overview

Global Leader

1 | Area

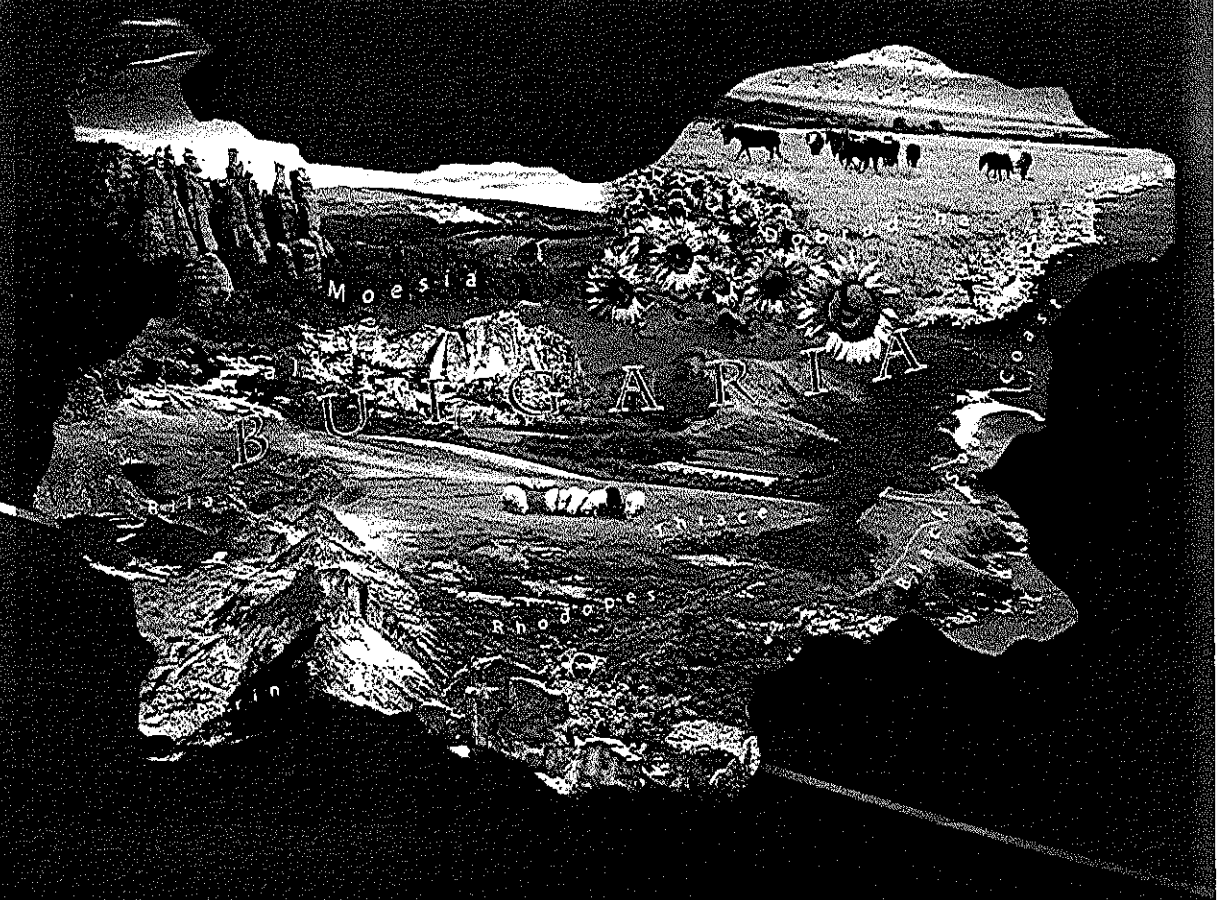
- Land - 111,000 km²

2 | Capital

- Sofia

3 | Population

- People - 7,400,000
- Density - 66,2 per km²

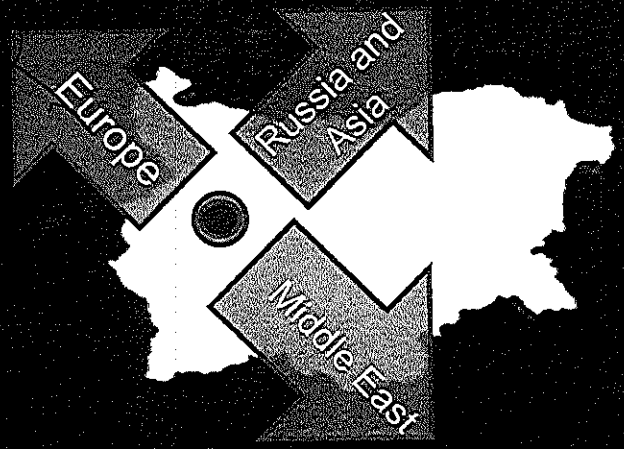


4 | Economy

- Export driven economy
- Fixed Exchange Rate between BGN and EURO
- Double Taxation Relief Agreements between BG, EU and USA

Location & Advantages

Global Leader



1 | Strategic Location

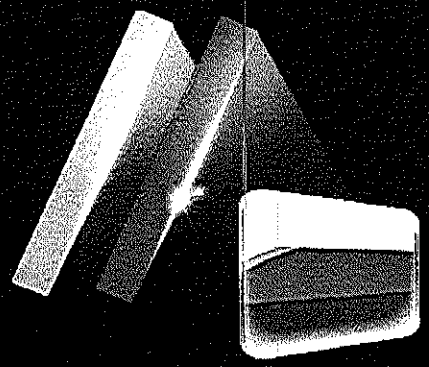
- Located in Eastern Europe (Central Balkans)
- 5 Trans-European Corridors pass through the country.
- Vital connections to Western Europe, Russia, Asia and Middle East

2 | Advantages

- Flexibility in production
- Reliability and quick deliveries
- Competitive labor cost
- High Quality

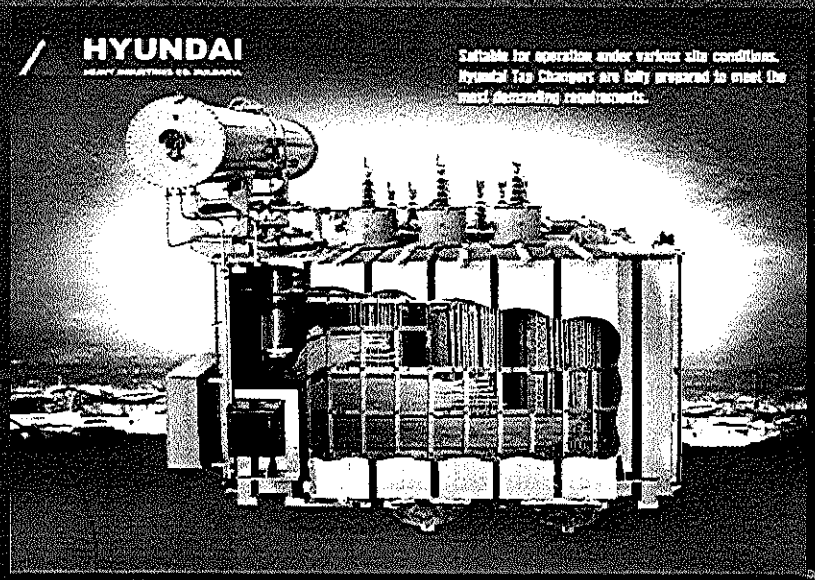
Chapter II

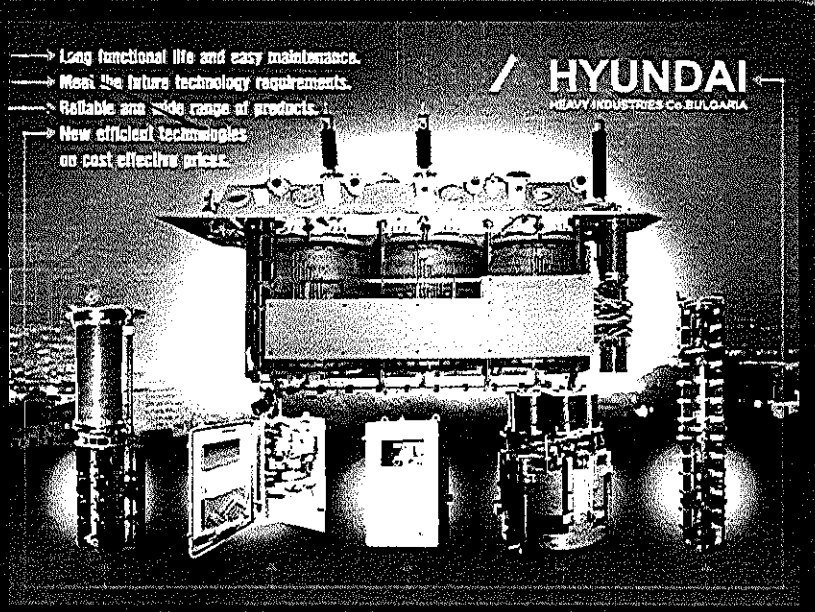
II Company Overview



Company Introduction

Global Leader





1 LOCATION

« 41, ROJEN BLVD. SOFIA, BULGARIA

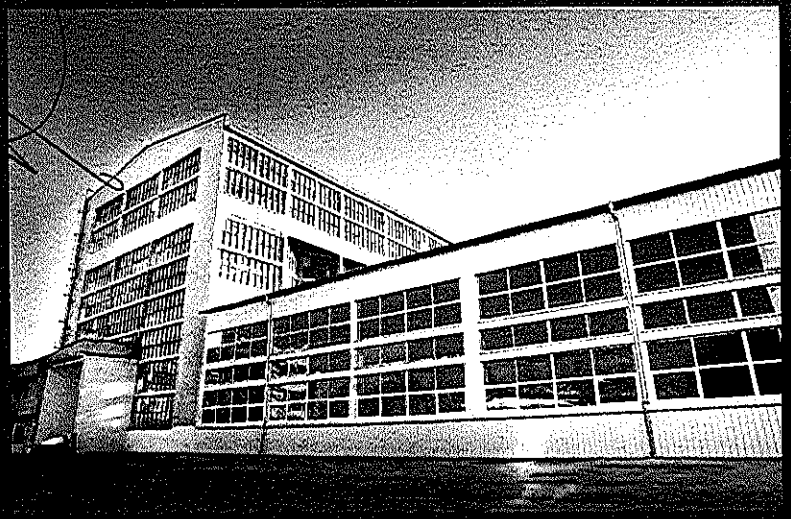
2 FACTORY AREA

« FACTORY (SOFIA) - 237,208 m²

Buildings	Size (m²)
Administrative	1,657
Metal Welding Workshop	3,981
Transformer Workshop	20,491
Warehouse	4,169
Test laboratories	6,185
Production Facilities	5,096
Tap Changer Workshop	9,075
Others	15,217

Company Introduction

Global Leader



1 First Steps

- In 1997 Hyundai Heavy Industries Ltd., Electro Electric Systems took over the Bulgarian state owned Elprom-Trafo Company

2 Company Mission

- HHIB is focused on sales, new markets, development, new business partners and clients
- To be a reliable, highly efficient and competitive partner

3 Future Goals

- HHIB has an ambitious development program to increase the capacity, efficiency and quality of the company

Company History

Global Leader

1949

The organization was established by merging several small factories producing Electrical apparatuses, Transformers and Electrical motors into a State Power Engineering Plant **"Vasil Kolarov"**

1951

Establishment of three main workshops Electrical Apparatuses, Electrical Motors, Transformers and four subsidiary workshops the structure of the plant was changed.

1958

The three main workshops were divided to separate manufacturing divisions: Electrical Apparatuses, Transformers and Electrical motors

1975

The company name was changed to ELPROM-ENERGO. The same year a new Research Institute for Industrial electrical design and construction was founded

1991

The production of ELPROM-ENERGO was divided to five newly established independent companies. The Institute was closed and the production of Transformers and Electrical Apparatuses was transferred to ELPROM-TRAFO

1997

The company was privatized. Hyundai Heavy Industries Co. Korea became the main holder of the Organization shares. The company name was changed to HYUNDAI ELPROM TRAFO JSC

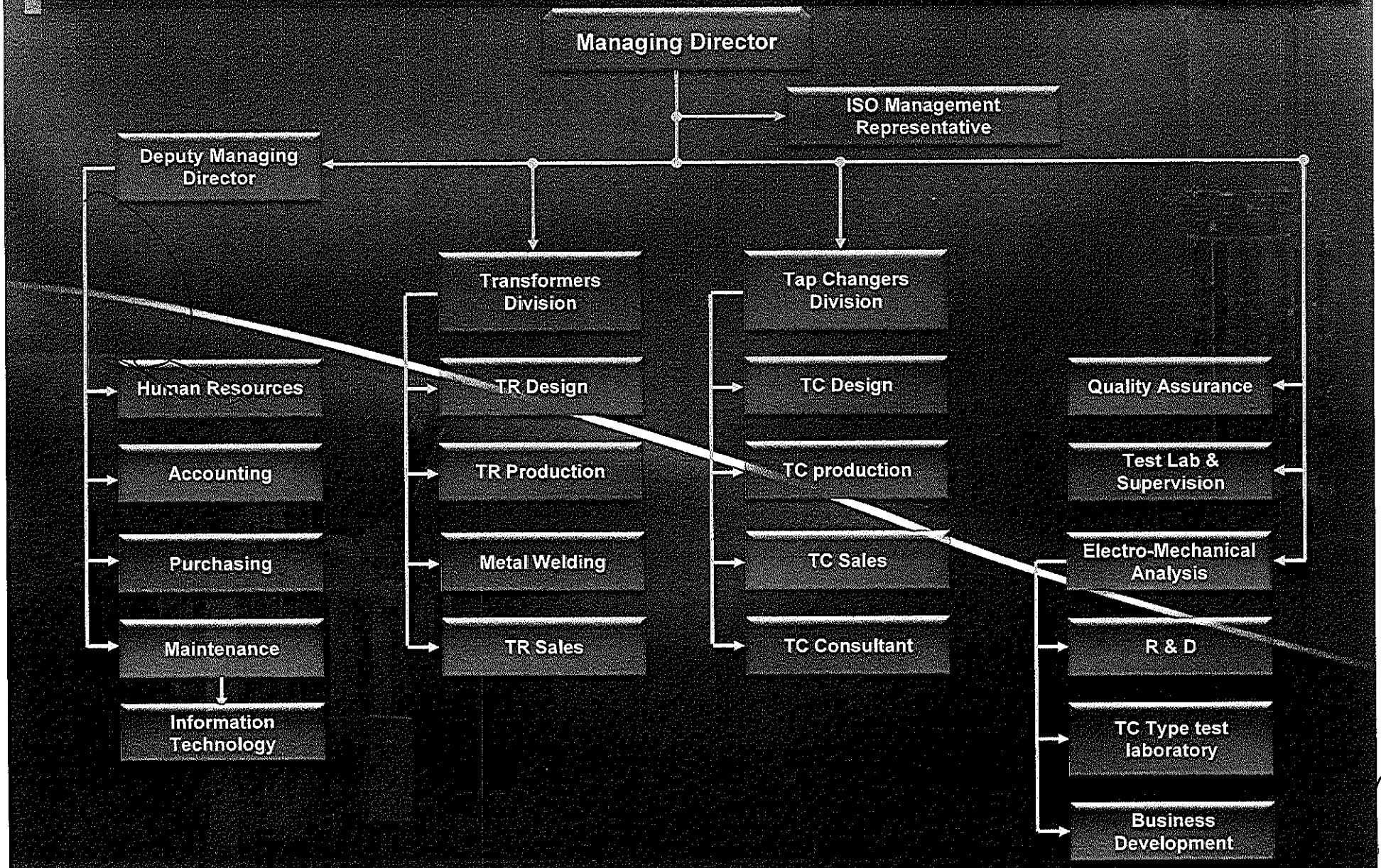
2001

The company name was changed to **"Hyundai Heavy Industries Co. Bulgaria" JSC**

HYUNDAI
HEAVY INDUSTRIES CO. BULGARIA

Company Organization Chart

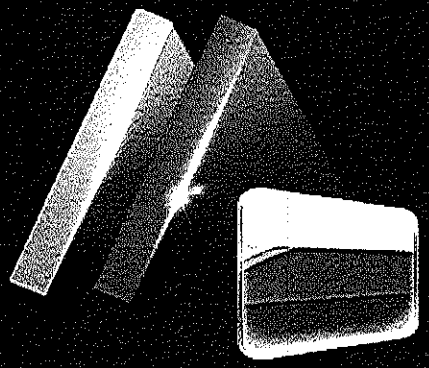
Global Leader



HYUNDAI HEAVY INDUSTRIES CO. BULGARIA

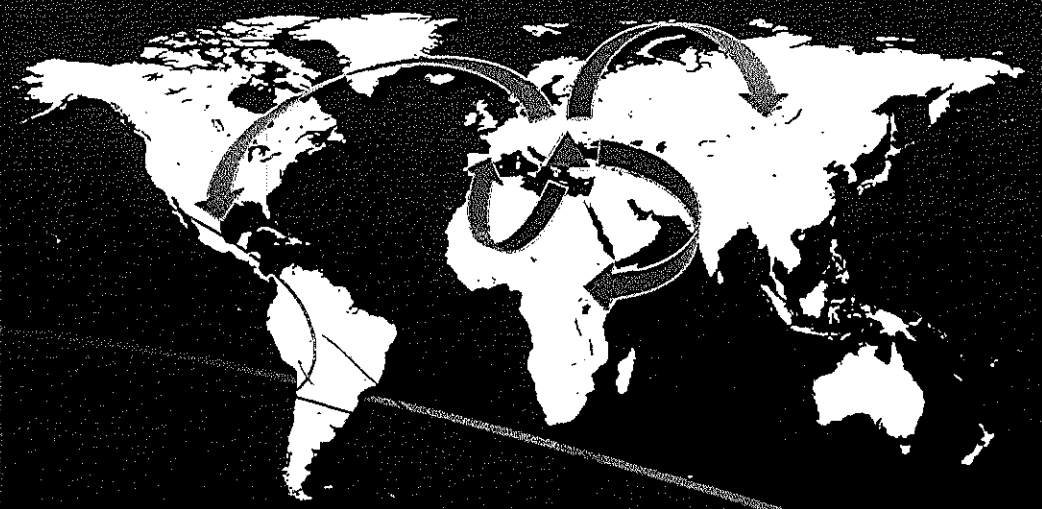
Chapter III

III Company Products



Company Markets and Experience - Transformers

Global Leader



TRANSFORMERS

MANUFACTURED

Power Transformers - 2 250 UNITS

Power Transformers - 75 000 MVA

- Annual production capacity 5 000 MVA
- Transformer rated capacity up to 250 MVA
- Transformer rated voltage up to 400 kV

America

Brazil
Cuba
Dominican Republic
Panama
Jamaica
Venezuela

Europe

Albania
Bosnia & Herzegovina
Cyprus
Denmark
Estonia, Finland
France, Greece
Iceland, Ireland
Kosovo
Lithuania
Netherlands
Norway, Moldova
Romania
Russia
Spain, UK
Ukraine

Africa

Algeria
Cape Verde
Egypt
Equatorial Ghana
Guinea
Kenya
Mali
Morocco
Mozambique
Nigeria
Sudan
Tanzania
Tunisia

Asia

Bahrain
Bangladesh
India
Iraq
Jordan
Kuwait
Kazakhstan
Lebanon
Malaysia
Oman
Pakistan
Saudi Arabia
Syria
Turkey
Turkmenistan
UAE

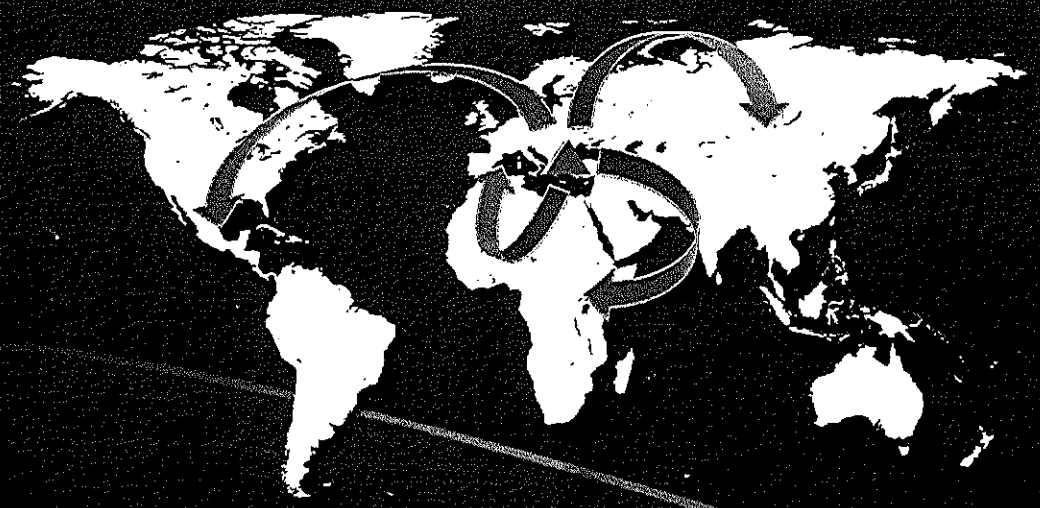
HHIB Transformers have successfully passed type tests

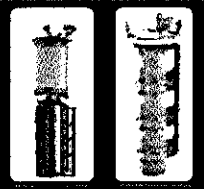
- KEMA - Netherlands
- ICMET Craiova - Romania

HYUNDAI
HEAVY INDUSTRIES CO. BULGARIA

Company Markets and Experience – Tap-Changers

Global Leader





TAP-CHANGERS

MANUFACTURED

Tap Changers - More than 65 000 units

- Annual production capacity 2 000 units

The OLTCs have successfully passed type tests

- KEMA - Netherlands
- CESI - Italy
- ZKU – Czech Republic

The OLTCs have been awarded with Golden medals from International Fairs

- Leipzig - Germany
- Zagreb - Croatia

America

Cuba
Dominican Republic
Jamaica
Mexico
Brazil
USA

Europe

Albania, Austria
Belarus, Cyprus
Bosnia & Herzegovina,
Czech Republic
Estonia, Finland,
France, Greece,
Hungary, Italy
Kosovo, Poland
Lithuania, Spain
Macedonia, UK
Moldova, Norway
Netherlands,
Ukraine, Portugal
Romania, Russia
Turkey, Slovakia
Switzerland

Africa

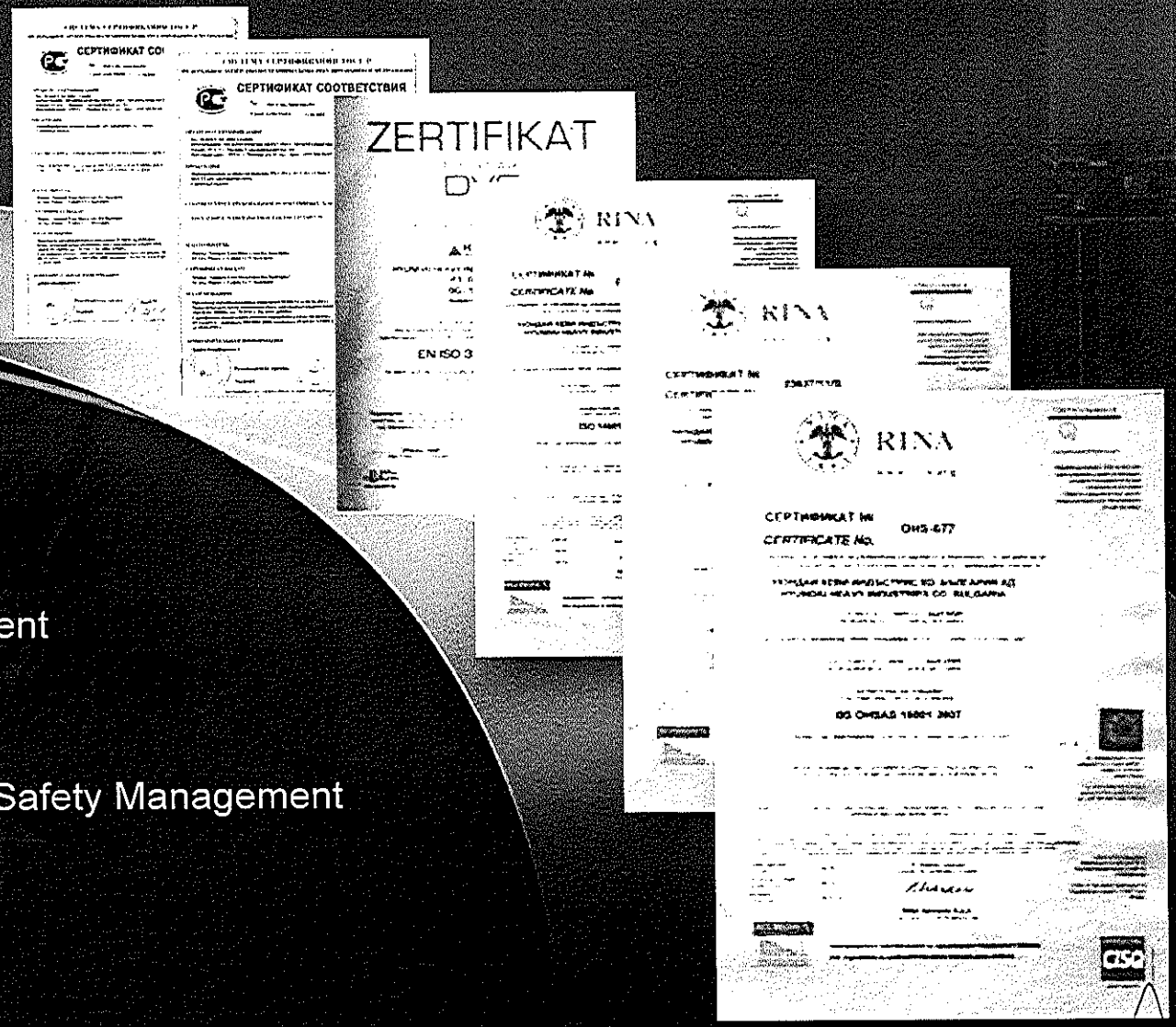
Egypt
Equatorial Guinea
Ghana
Mali
Morocco
Tanzania
Tunisia

Asia

Bahrain
China
Dubai
India
Iran, Iraq
Jordan
Korea
Lebanon
Pakistan
Saudi Arabia
Syria
Thailand
UAE
Uzbekistan
Vietnam
Mongolia

Certificates & Standards

Global Leader



ISO 9001

- Quality Assurance

ISO 14001

- Environment Management

OHSAS 18001

- Occupational Health & Safety Management

EN ISO 3834-2

- Welding Quality

Certificates & Standards

Certificate	Authority	Scope
CE Marking	EU Membership	All Products*
EN	EU	All Products*
BDS	BDS (Bulgaria)	All Products*
DIN	DIN (Germany)	All Products*
ANSI C 57.12.00	ANSI (USA)	All Products*
ISO 9001	RINA	All Products*
ISO 14001	RINA	All Products*
OHSAS 18001	RINA	All Products*
ISO 3834-2	DVS Zert	All Products*
KEMA	KEMA (Netherlands)	OLTC & Transformers
IEC 60076	IEC	Power Transformers
GOST P 52719-2007	GOST (Russia)	Power Transformers
GOST 12.2.007.2-75		
GOST 12.2.024-87		
GOST 1516.3-96		
IEC 60214	IEC	OLTC
KERI	KERI (Korea)	OLTC
ZKU	ZKU HV Laboratory	OLTC
CESI	CESI (Italy)	OLTC
GOST 12.2.007.0-75	GOST (Russia)	OLTC
GOST 12.2.007.2-75		
GOST 1516.3-96		
MP	Minproekt (Bulgaria)	MDU
SAMEL90	SAMEL90 (Bulgaria)	MDU
CTEC	CTEC (Bulgaria)	MDU

*All Products – OLTC, OCTC, MDU, HDU, Transformers

THANK YOU

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HYUNDAI
HEAVY INDUSTRIES CO. BULGARIA

HHIB performance records for power transformers for years 2000 - 2017

№	Location	Project	Rated power, MVA	Rated Voltages, kV	Units	Year of delivery
1	Bulgaria	AD Tranz	6,67	110/27,5	4	2000
2	Bulgaria	HPP Batak	15	121/10,5	1	2000
3	Bulgaria	HPP Batak	40,5	110/21/10,5	1	2000
4	Bulgaria	HPP Pestera	35	220/105	1	2000
5	Albania	Jacobsen Elektro AS - Norway	100	410/220/30	3	2001
6	Jordan	NEPCO	10	33/11	2	2001
7	Nigeria	NEPA	7,5	33/11	4	2001
8	Nigeria	NEPA	15	33/11	15	2001
9	Oman	AIC - Egypt	120	132/11,5	3	2001
10	Egypt	EETC, S/S El-Eslah	125	220/66/22	2	2002
11	Egypt	REA	25	66/22	3	2002
12	Syria	PEEGT, S/S Swedieh	45,5	230/11,5/6,6	1	2002
13	Bulgaria	HPP St. Kladenetz	45	121/10,5	1	2002
14	Egypt	EETC	125	220/66/11	4	2003
15	Egypt	EETC	125	220/66/11	3	2003
16	Egypt	EETC	125	220/66/22	2	2003
17	Egypt	EETC	125	220/66/22	1	2003
18	Egypt	EETC	75	220/66/22	1	2003
19	Egypt	Trust Chemical Co.	125	220/20/20	2	2003
20	Egypt	EETC	125	220/66/11	1	2003
21	Nigeria	NEPA	7,5	33/11	1	2003
22	Pakistan	WAPDA	160	220/132/11	5	2003
23	Egypt	EETC	125	220/66/11	2	2004
24	Egypt	EETC	125	220/66/11	2	2004
25	Estonia	Gaur	40	347/6,3-6,3 kV	1	2004
26	Jordan	EDCO	10	33/11	2	2004
27	Jordan	EDCO	4	33/3,3	1	2004
28	Albania	KESH, Vlora	25	110/20 kV	2	2004
29	Egypt	EETC	125	220/66/11	1	2004
30	Egypt	EETC	150	220/132/11	1	2004
31	Eq. Guinea	Jacobsen Elektro AS - Norway	25	20(15)/11	1	2004
32	France	Solvey - Dombasle	25	10,75(21,5)/11/4,5	2	2004
33	France	Solvey - Dombasle	19	11/(22)/10,5	2	2004
34	Bulgaria	HPP Beli Iskar	10	121/6,3	1	2004
35	Bulgaria	HPP Kardzhali	72	121/10,5	1	2004
36	Bulgaria	HPP Ivailovgrad	70	121/10,5	1	2004

№	Location	Project	Rated power, MVA	Rated Voltages, kV	Units	Year of delivery
37	Bulgaria	DSD/RWE	40	32/6,3	3	2004
38	Bulgaria	DSD/RWE	40	220/32	1	2004
39	Albania	KESH - HPP Vau i Dejes	60	242/10,5	1	2005
40	Albania	KESH - HPP Koman	170	242/13,8	1	2005
41	Albania	KESH	120	220/115/37,6	2	2005
42	Egypt	EETC	50	132/36/12	1	2005
43	Jordan	CEGCO	80	132/13,8	1	2005
44	Iraq	Wärtsilä Finland Oy	45	35/11	2	2005
45	Jamaica	Wärtsilä Finland Oy	65	150/11	1	2005
46	Nigeria	NEPA	7,5	33/11	1	2005
47	Nigeria	NEPA	15	33/11	1	2005
48	Bulgaria	EDC Sofia	40	110/21/10,5	2	2005
49	Bulgaria	NEK	40	110/21/16,3	2	2005
50	Bulgaria	HPP Tarmasch	6	115/3,6	1	2005
51	Bulgaria	HPP Pastra	6	115/6,3	1	2005
52	Bulgaria	NEK	40	110/21/16,3	1	2005
53	Ghana	Jacobsen Elektro AS - Norway	26	33/11	15	2005
54	Lithuania	ELGA UAB	10	110/10	2	2005
55	Albania	KESH - HPP Vau i Dejes	60	242/10,5	1	2005
56	Bulgaria	HPP Beli Iskar	11	121/6,3	1	2005
57	Bulgaria	Asarel Meded	8	110/6,3	1	2005
58	Bulgaria	Solvey - Deven	12,5	20/6,3	3	2005
59	Bulgaria	Solvey - Deven	20/16	22/6,3	2	2005
60	Bulgaria	Siemens	10	110/27,5	2	2005
61	Bulgaria	Va-Tech Hydro	50	121/10,5	2	2005
62	Norway	MiniHydro AS	5,5	66/6,6	2	2006
63	India	Hyundai Motors	40	210/11	2	2006
64	Cuba	HHIK	8,5	34,5/4,16	18	2006
65	Cuba	HHIK	8,5	13,8/4,16	19	2006
66	Dominica	HHIK	8,5	12,47/4,16	1	2006
67	Malaysia	Wilson Transformer	50	138/11	2	2006
68	Malaysia	Wilson Transformer	6,3	11/6,93	2	2006
69	Saudi Arabia	Mitsubishi Heavy Industries, Japan	19	13,8/4,16	2	2006
70	Finland	Vaasa Engineering Oy	20	110/6,3	1	2006
71	Bahrain	SIDEM, France	42	21/11/11	1	2006
72	Bahrain	SIDEM, France	42	15,75/11/11	1	2006
73	Bahrain	SIDEM, France	6,9	11/2,1/0,42	1	2006
74	Cuba	HHIK	25	115/6.6	11	2006

№	Location	Project	Rated power, MVA	Rated Voltages, kV	Units	Year of delivery
75	Cuba	HHIK	12,5	34,5/6,6	6	2006
76	Bulgaria	ENEL Maritza East 3	40	15,75/6,3-6,3	3	2006
77	Bulgaria	NEC - Slanchev Bryag	40	110/21	2	2006
78	Greece	Athena SA	64	150/11	2	2007
79	Greece	Athena SA	12,5	11/6,3	2	2007
80	Iceland	RST Net, Iceland	45	132/34,5	1	2007
81	Bulgaria	NEK	70	121/10,5	1	2007
82	Finland	Vaasa Engineering Oy	10	115/21	1	2007
83	Bulgaria	Solvey - Deven	20	21/6,3	2	2007
84	Bulgaria	Solvey - Deven	12,5	21/6,3	2	2007
85	Bulgaria	Lindegaz	12	110/6	1	2007
86	Bulgaria	ABB	25	110/21/6,3	1	2007
87	Tanzania	Wärtsilä Finland Oy	55	140/11	1	2007
88	Bulgaria	Chelopech	30	110/10,5/6,3	1	2007
89	Bulgaria	TPP Pleven	45	110/11,5/6,3	1	2007
90	Bulgaria	CEZ Bulgaria	40	110/21/21	1	2007
91	The Netherlands	Siemens AG Power Generation	37	31,5/10,5	1	2007
92	Ghana	Volta River Authority	66	161/34,5	2	2007
93	Ghana	Volta River Authority	33	161/34,5	1	2007
94	Ghana	Volta River Authority	25	161/36/11,5	1	2007
95	Ghana	Volta River Authority	33	161/34,5/6,63	1	2007
96	Bulgaria	NEK	40	110/21(6,3)	1	2007
97	Bulgaria	NEK	31,5	110/35/10,5	1	2007
98	Bulgaria	NEK	50	110/21(6,3)	3	2007
99	Bulgaria	Alstom Power Turbo - Systems	60	20/10,5	2	2007
100	Bulgaria	Alstom Power Turbo - Systems	100	20/10,5-10,5	2	2007
101	Spain	Alstom Power Turbo - Systems	35	21/6,75/4,7	1	2007
102	Spain	Alstom Power Turbo - Systems	30	21/6,75/5,6	1	2007
103	Bulgaria	NEK	40	110/21(6,3)	1	2007
104	Venezuela	CADAFE	36	115/13.8	6	2007
105	Pakistan	Wärtsilä Finland Oy - Attok Refinery	85	132/15	3	2008
106	Ghana	Volta River Authority	33	161/34,5/11,5	1	2008
107	Ghana	Volta River Authority	20	69/34,5/11,5	1	2008
108	Ghana	Volta River Authority	33	161/74,5/11,7	1	2008
109	Morocco	Siemens AG Power Generation	22,4	15/6,8/6,8	2	2008
110	Bulgaria	NEK	50	110/21/10,5	2	2008
111	Bulgaria	NEK	50	110/21(6,3)	1	2008
112	Saudi Arabia	SIDEM, France	16	13,8/4,16-4,16	6	2008

№	Location	Project	Rated power, MVA	Rated Voltages, kV	Units	Year of delivery
113	Saudi Arabia	FLUOR / Hyundai Corporation	31,5	34,5/14,5	2	2008
114	Greece	Aluminium S.A. Greece / PPC	170	150/15,75	2	2008
115	UK	Alstom Power Turbo - Systems	40	21/6,75/5,6	4	2008
116	Bulgaria	NEK	23	121/10,5	1	2008
117	UK	Alstom Power Turbo - Systems	35	21/11,5/5,6	3	2008
118	India	Alstom Power Turbo - Systems	35	19/6,75/5,6	1	2008
119	Ireland	Alstom Power Turbo - Systems	32	21/11,5/5,9	1	2008
120	Bulgaria	Neohim	25	110/6,3	1	2008
121	Bulgaria	NEK	50	110/35/10,5	1	2008
122	Ghana	Gold Fields Ghana Ltd. - Tarkwa S/S	33	161/34,5	2	2008
123	Bulgaria	NEK	50	110/21/(6,3)	2	2008
124	Greece	Transport Alstom, France	15	150/27,5	4	2008
125	Egypt	EPPC	75	220/11-11	2	2008
126	Egypt	EETC - Zafarana SS	125	220/22/22	2	2009
127	UAE	Alstom Power Turbo - Systems	100	21/11,5/11,5	3	2009
128	UAE	Alstom Power Turbo - Systems	45	21/11,5/3,6	5	2009
129	Bulgaria	NEK	70	121/10,5	1	2009
130	Bulgaria	NEK	50	110/21/(6,3)	6	2009
131	Bulgaria	AES Maritza East I	40	110/21	1	2009
132	Bulgaria	Devnja Cement	40	110/6,3/6,3	1	2009
133	Bulgaria	Siemens Bulgaria	10,5	110/27,5	2	2009
134	Egypt	EETC - Bahteem S/S	125	220/72,5/12	3	2009
135	Cuba	HHIK	12,5	115/6,6	3	2009
136	Egypt	EETC - Bahteem S/S	40	66/11	3	2009
137	France	Alstom Power Turbo - Systems	30	21/6,9/5,6	1	2009
138	Egypt	EETC - Sharm El-Sheikh (3) S/S	40	66/22	4	2009
139	Egypt	EETC	125	220/66/11	6	2009
140	Egypt	EETC - Kafr El Zayad S/S	125	220/66/11	2	2009
141	Egypt	EETC - Kafr El Zayad S/S	40	66/11	3	2009
142	Bulgaria	AES GEO Energy - Kavarna	100	110/33	2	2009
143	Bulgaria	Terna	10,5	110/27,5	4	2009
144	Bulgaria	CEZ Bulgaria	63	110/10,5/10,5	1	2009
145	Tunisia	Alstom Power Turbo - Systems	35	21/6,75/5,6	1	2009
146	Bulgaria	Maritza East 2	210	242/18	1	2009
147	Bulgaria	S/S Suvorovo	70	110/20(6,3)	1	2010
148	The Netherlands	Alstom Power Turbo - Systems	45	20/10,5/5,6	3	2010
149	Egypt	EETC - El Zafarana	125	220/22/22	2	2010
150	Egypt	EETC - Abu Kabeer	125	220/66/11	3	2010

№	Location	Project	Rated power, MVA	Rated Voltages, kV	Units	Year of delivery
151	Mali	Wärtsilä Finland Oy	60	150/30	1	2010
152	Kosovo	KEK / TPP "Kosovo B"	48	24/6,6/6,6	1	2010
153	UK	Alstom Power Turbo - Systems	34	21/6,75/3,5	5	2010
154	Romania	Rodax A.T.E.E. - Greece	40	17/6,9	2	2010
155	Bulgaria	ENEL Maritza East 3	40	15,75/6,3-6,3	1	2010
156	Bulgaria	NEK	50	110/21/6,3	5	2010
157	Bulgaria	NEK	50	110/21/10,5	1	2010
158	Egypt	EETC - Baghdad S/S	125	220/66/22	2	2010
159	Egypt	EETC - Bahteem S/S	125	220/66/11	1	2010
160	Egypt	EETC - Damnhor Power Station	125	220/66/11	1	2010
161	Albania	Fushe Kruja Cement Factory Sh.P.K	35	220/6,3	1	2010
162	Finland	E.ON - Vaasa Engineering Oy	25	115/21	1	2010
163	Bulgaria	Granatoid	20	115/6,3	1	2010
164	Bulgaria	Granatoid	20	110/21/5	1	2010
165	Bulgaria	Granatoid	2	64/5,25	3	2010
166	Egypt	Global Energy	40	66/22	3	2010
167	Bulgaria	Seul Marine - Korea	15	110/20	4	2010
168	Turkey	Rodax A.T.E.E. - Greece	32	19/6,3	2	2010
169	Jamaica	Wärtsilä Finland Oy	55	72,5/11	2	2010
170	Venezuela	Wärtsilä Finland Oy	36	34,5/13,8	2	2010
171	Cape Verde	Wärtsilä Finland Oy	15	20/11	2	2010
172	Egypt	EETC - Obour S/S	125	220/66/22	3	2011
173	Bulgaria	Maritza East 2	210	242/18	2	2011
174	Egypt	EETC - Naga Hammadi S/S	125	220/66/11	1	2011
175	Egypt	EETC - Al Bostan S/S	125	220/66/11	1	2011
176	Egypt	EETC - Suez 2 S/S	125	220/66/11	2	2011
177	Bulgaria	Ideco - Insigma	20	15,75/6,3 kV	2	2011
178	Egypt	Kharafi National - EDEPC, Al Shabab PP	8	15/6,6 kV	8	2011
179	Egypt	Kharafi National - EDEPC, Damietta PP	8	15/6,6 kV	4	2011
180	Egypt	Kharafi National - EDEPC, Al Shabab PP	165	220/15 kV	8	2011
181	Tanzania	SEMCO Maritime, Denmark	40	220/11 kV	2	2011
182	Egypt	EETC - El Mattar S/S	125	220/66/11	3	2011
183	Egypt	EETC - Quesna S/S	125	220/66/11	1	2011
184	Egypt	EETC - El Zakazeek S/S	125	220/66/11	1	2011
185	Egypt	EETC - El Mahalla S/S	125	220/66/11	1	2011
186	Egypt	EETC - El Kalubia S/S	125	220/66/11	1	2011
187	Turkey	Rodax A.T.E.E. - Greece	21	20/10,5	2	2011
188	Denmark	Nordvestjysk Elforsyning	20	60/10	1	2011

№	Location	Project	Rated power, MVA	Rated Voltages, kV	Units	Year of delivery
189	Finland	Vaasa Engineering Oy	16	117/21	1	2011
190	Morocco	Siemes AG Power Generation	22.4	15/6,8/6,8	1	2011
191	Kosovo	KEK	40	110/21(10,5)/10,5	2	2011
192	Bulgaria	CEZ Bulgaria	63	110/21/10,5	1	2011
193	Egypt	Kharafi National - EDEPC, West Damietta PP	165	220/15 kV	4	2011
194	Egypt	Kharafi National - EDEPC, West Damietta PP	8	15/6,6 kV	4	2011
195	Bulgaria	Electric city OOD - Bulgaria	22	121/6,3 kV	1	2011
196	Bulgaria	E.ON Bulgaria	50	115/21(10,5)	1	2011
197	Russia	Eurocontact - Russia	7.5	15,75/11	2	2011
198	Egypt	Degla CFM - El Gammal S/S	75	220/22	2	2011
199	Greece	Terna S.A. / PPC	24	150/11	7	2012
200	Finland	Herrfors Nät - Verkko Oy Ab	25	117/21	1	2012
201	Finland	VEO - Westenergy Vaasa	16	117/10,5	1	2012
202	Bulgaria	TPP Maritza East 2	32	110/6,3-6,3	1	2012
203	Kuwait	Alstom Power - Switzerland	40	19/6,8	2	2012
204	Turkmenistan	Energostroymontazh Ltd. - Russia	25	115/38,5/11	2	2012
205	Bangladesh	Wärtsilä Finland Oy	24	33/11	1	2012
206	Bulgaria	Toshel - 92 Ltd.	15	120/20(12)	2	2012
207	Bulgaria	Plama - Pleven	25	110/21(6,3)	1	2012
208	Kosovo	KEK / TPP "Kosovo A"	240	230/15,75	1	2012
209	Greece	EFACEC / PPC	50	150/21	6	2012
210	Estonia	Wärtsilä Finland Oy / Elering	73	115/15	2	2012
211	Kosovo	KEK / ABB Germany - "Pristina" 7 S/S	40	110/10,5(21)/10,5	2	2012
212	Kazakhstan	HHIK / KEGOC	200	220/110/10	1	2012
213	Kazakhstan	HHIK / KEGOC	125	220/110/10	1	2012
214	Kazakhstan	HHIK / KEGOC	125	220/110/6	1	2012
215	Kazakhstan	HHIK / KEGOC	25	220/35/10	3	2012
216	Kuwait	OTV France / SIDEM, France	60	132/11,5	2	2012
217	UK	Wärtsilä Finland Oy - Island of Guernsey	22	34,5/11	1	2012
218	Egypt	EETC - Abu Ghaleb S/S	125	220/66/11	2	2012
219	Egypt	EETC - Ashmoon S/S	125	220/66/11	3	2012
220	Egypt	EETC - Abu Ghaleb S/S	40	66/11	4	2012
221	Egypt	EETC - Ashmoon S/S	40	66/11	4	2012
222	Denmark	Nordvestjysk Elforsyning	20	60/10	1	2012
223	Albania	ABB Austria - HPP Ternoves	11	110/6,3	1	2012
224	Bulgaria	Technip, Italy	63	110/15,75	2	2012
225	Bulgaria	E.ON Bulgaria	12,5	21/10,5	1	2012
226	Macedonia	EVN Macedonia - Kumanovo	50	110/21/10,5	1	2012

№	Location	Project	Rated power, MVA	Rated Voltages, kV	Units	Year of delivery
227	Estonia	Alstom Power System S.A. - France	60	35/11-11	1	2013
228	Iraq	ALSTOM Projects India Ltd.	8	15/6,75	4	2013
229	Iraq	ALSTOM Projects India Ltd.	6,8	6,6/0,42	2	2013
230	Algeria	Metka, Greece - Sonelgaz	46	220/11,5-11,5	12	2013
231	Estonia	Alstom Power System S.A. - France	60	18/11-11	1	2013
232	Bulgaria	TPP Sofia	50	115/10,5	1	2013
233	Bulgaria	TPP Sofia	15	10,5/5,3	1	2013
234	Bulgaria	TPP Sofia	6.3	10,5/6,3	1	2013
235	Estonia	Wärtsilä Finland Oy / Elering	73	347/15	3	2013
236	Bulgaria	Siemens - Bulgaria	12,5	110/27,5	4	2013
237	Ghana	Enclave Power Company	33	161/34,5	1	2013
238	Ghana	Enclave Power Company	33	161/11,5	1	2013
239	Macedonia	EVN Macedonia - Kumanovo	50	110/21/10,5	1	2013
240	Jordan	Metka - Greece, Samra project	175	132/15	1	2013
241	Kosovo	KOSTT	40	110/21(10,5)/10,5	1	2013
242	Jordan	Metka - Greece, Samra project	185	135/15	1	2013
243	Mozambique	Wärtsilä Finland Oy / MGEPP	73	275/15	4	2013
244	Armenia	EFACEC / Matur S/S	40	110/35/10	2	2013
245	Egypt	ABB Egypt / BMIC S/S	40	66/11	2	2013
246	Egypt	EETC	125	220/66/11	3	2013
247	Brazil	EFACEC/Eletronorte-Santa Maria S/S	100	230/138-13,8	1	2013
248	Switzerland	Alstom Switzerland	30	21/11,3/5,9	2	2013
249	Switzerland	Alstom Switzerland	15	11/5,9	2	2013
250	Switzerland	Alstom Switzerland	20	22/11,3	1	2013
251	Ukraine	Penstock UK - TPP Harkov	63	115/6,3-6,3	1	2013
252	Kosovo	KEK / TPP "Kosovo A"	20	15,75/6,3	1	2013
253	Brazil	EFACEC / Rondonopolis S/S	100	230/138/13,8	1	2013
254	Brazil	EFACEC / Cauipe S/S	100	230/69	1	2013
255	Brazil	Wärtsilä Finland Oy / Nova Venecia	13	13,8/4,16	1	2013
256	Iraq	SEMCO Maritime, Denmark	10	11/6,6	1	2013
257	Ghana	Zakhem Construction Ghana Ltd.	17	11,5/2,1/6,9	2	2013
258	Bulgaria	Toshel EOOD	10	110/20/(6,3)	1	2013
259	Bulgaria	Toshel EOOD	10	110/6,3/(6,3)	1	2013
260	Kenya	Wärtsilä Finland Oy	55	66/11	2	2014
261	Jordan	Metka - Greece, Samra project	185	135/15	1	2014
262	Ghana	GRIDCo / Jacobsen Elektro, Norway	33	161/34,5	3	2014
263	Brazil	EFACEC / Itabaiana S/S	100	230/69	1	2014
264	Brazil	EFACEC / Natal III S/S	150	230/69	1	2014

№	Location	Project	Rated power, MVA	Rated Voltages, kV	Units	Year of delivery
265	Ghana	Enclave Power Company	66	161/34,5	1	2014
266	Ghana	Enclave Power Company	33	161/11,5	1	2014
267	Bulgaria	Energoremont Holding - TPP Sofia	15	115/6,3	1	2014
268	Switzerland	Alstom Switzerland - Birr project	20	19-22/3,6	1	2014
269	Venezuela	Wärtsilä Finland Oy - Pequiven III	20	24/13,8	1	2014
270	Greece	Aluminium S.A. Greece	36,6	15/17,354	1	2014
271	Greece	Aluminium S.A. Greece	31,5	18/2 x 0,895	1	2014
272	Egypt	Inter Machinex Ltd. / KIMA	12,5	30/0,15	1	2014
273	Albania	Fushe Kruja Cement Factory Sh.P.K	35	220/6,3	1	2014
274	Georgia	Çalik Enerji - Gardabani CCPP	110	220/11	1	2014
275	Georgia	Çalik Enerji - Gardabani CCPP	100	220/11	2	2014
276	Georgia	Çalik Enerji - Gardabani CCPP	15	11/6,3	2	2014
277	Germany	Alstom Switzerland - GuD Niehl 3	30	21/6,45/5,9	1	2014
278	Cape Verde	Wärtsilä Finland Oy	15	20/11	2	2014
279	Cape Verde	Wärtsilä Finland Oy	7	20/11	2	2014
280	Kosovo	KOSTT - SS Skenderaj	40	110/21(10,5)/10,5	1	2014
281	Moldova	GNF Spain	40	15,75/6,3-6,3	1	2014
282	Bulgaria	Maritza East 2	40	15,75/6,3-6,3	2	2014
283	Panama	Constructora Urbana, S.A.	6	13,2/0,48	1	2014
284	Armenia	EFACEC Austria - S/S Kashen	16	110/35/6	1	2014
285	Kosovo	KOSTT - SS Prishtina 2	40	110/21(10,5)/10,5	1	2014
286	Iraq	ALSTOM Middle East FZE	20	15/6,3	2	2015
287	Iraq	ALSTOM Middle East FZE	6,8	6/1,8/0,42	2	2015
288	Bulgaria	Aktor S.A. - Helector S.A. MBT plant	10	110/20(6,3)	1	2015
289	Turkey	Gama, Turkey - Kırıkkale	34	17/6,9	2	2015
290	Egypt	ABB Egypt - El-Markby steel	15	66/22	1	2015
291	Egypt	ABB Egypt - El-Markby steel	65	66/33	1	2015
292	Mexico	ALSTOM Power Inc.	15	20/2,8	1	2015
293	Ghana	Jacobsen Elektro AS, Norway/GRIDCo	33	161/11,5	1	2015
294	Bulgaria	TPP Gorna Orjahovitza	6,3	21/6,3	1	2015
295	Egypt	Oraskom - EDEPC, Assuit SCPP	165	220/15	8	2015
296	Egypt	Oraskom - EDEPC, Assuit SCPP	16	15/6,9	8	2015
297	Egypt	Oraskom - EDEPC, West Damietta SCPP	165	220/15	4	2015
298	Egypt	Oraskom - EDEPC, West Damietta SCPP	10	15/6,9	4	2015
299	Egypt	Arcosteel - Egypt	80	220/22,5	1	2015
300	Indonesia	Wartsila Finland Oy - Arun project	60	157/11	4	2015
301	Dominican Republic	Technimont, Italy - Power Plant CDEEE	47,5	22/6,9	4	2015
302	Bulgaria	Energo-pro - HPP Spanchevo	34	121/10,5	1	2015

№	Location	Project	Rated power, MVA	Rated Voltages, kV	Units	Year of delivery
303	Greece	TERNA - Tithorea	15	150/27,5	1	2015
304	Greece	TERNA - Agios Giorgios project	75	150/21	2	2015
305	Dominican Republic	Technimont, Italy - Power Plant CDEEE	47,5 MVA	138/6,9	1	2015
306	Ukraine	Kvant Servis - TPP Harkov	63	115/6,3-6,3	1	2015
307	Panama	SEMCO Maritime, Denmark - Patacon PP	10,5	13,8/13,8	1	2015
308	Bulgaria	PSS Bulgaria - HPP Pasarel	25	118/10,5	1	2015
309	France	Alstom Power System S.A. - France	12	15/6,9	1	2016
310	Ghana	Enclave Power Company - DAWA project	66	330/34,5	2	2016
311	Bulgaria	TPP Maritza East 2	32/16-16	16/6,3-6,3	2	2016
312	UK	Air Products Plc. - UK	20	22/7	2	2016
313	The Netherlands	Siemens AG - Attero Moerdijk	150	150/15,75	1	2016
314	The Netherlands	Siemens AG - Attero Moerdijk	30	15,75/10,5	1	2016
315	British Virgin Islands	Wärtsilä Finland Oy - BVIEC Phase V	35	34,5/13,2	2	2016
316	British Virgin Islands	Wärtsilä Finland Oy - BVIEC Phase V	15	34,5/13,2	1	2016
317	Egypt	EL-Sewedy PSP/EDEPC - Al Shabab CCPP	125	220/66	2	2016
318	Kosovo	KEK / TPP "Kosovo A"	240	230/15,75	1	2016
319	Zambia	Wärtsilä Finland Oy - Ndola Energy Phase II	75	66/15	2	2016
320	Bulgaria	AMYLUM Bulgaria	25	110/6,3	1	2016
321	Bulgaria	PSS Bulgaria - HPP Pasarel	20	118/10,5	1	2016
322	Latvia	JSC „Augstsprieguma tikls" - SS "Jecabpils"	10	115/21/6,3	1	2016
323	Bulgaria	Energoremont Holding - TPP Sofia	15	110/6,3	1	2016
324	Ukraine	Kvant Plus	25	115/38,5/11	1	2016
325	Albania	MIG 23 - Bistrica	80	160/115/(6,6)	1	2016
326	Bosnia & Herzegovina	Bicakcic d.o.o., BiH - Ilijas foundry	25	110/20	1	2016
327	UK	Wärtsilä Finland Oy - Island of Guernsey	22	34,5/11	1	2016
328	Ukraine	Kvant Plus - SS "Ilci"	40	115/38,5/11	1	2016
329	Indonesia	Wärtsilä Finland Oy - Jiipe 23 MW PP	30	20/11	1	2016
330	Saudi Arabia	Wärtsilä Finland Oy - Yamama Cement Plant	35	33/13,8	6	2016
331	Finland	Tecnicas Reunidas, Spain - Kilpilahti	50,5	117/10,5	2	2016
332	Ukraine	Kvant Plus - TPP Zmiev	32	15,75/6,3-6,3	1	2016
333	Armenia	EFACEC Austria - S/S Kashen	20	110/35/6	1	2016
334	Egypt	Borg al Arab Plant	25	22/11	2	2017
335	Saudi Arabia	Wärtsilä Finland Oy - Yamama Cement Plant	35	33/13,8	4	2017
336	Saudi Arabia	Wärtsilä Finland Oy - Yamama Cement Plant	15	33/13,8	1	2017
337	Greece	CNI - S/S Agiorgitika	50	150/21	1	2017
338	Argentina	Wärtsilä Finland Oy - Central Termica Pilar	63	138/13,2	2	2017
339	UK	Vaasa Engineering Oy - Nordbord Inverness	15	33/11	2	2017
340	Latvia	JSC „Augstsprieguma tikls" - SS "Koknese"	10	115/21	1	Under manufacturing

№	Location	Project	Rated power, MVA	Rated Voltages, kV	Units	Year of delivery
341	Kazakhstan	HHIK - Karabatan CCPP	63	115/11	6	Under manufacturing
342	Kazakhstan	HHIK - Karabatan CCPP	45	110/10,5	2	Under manufacturing
343	Latvia	AS "Augstsprieguma tīkls" - SS „Daugavpils"	125	330/115/10,5	1	Under manufacturing
344	Spain	SerIDOM Servicios Integrados Idom SAU	135	161/11,5/11,5	1	Under manufacturing
345	Spain	SerIDOM Servicios Integrados Idom SAU	72	161/11,5	1	Under manufacturing
346	Spain	SerIDOM Servicios Integrados Idom SAU	66	22/6,6/11,5	2	Under manufacturing
347	Bulgaria	EVN Bulgaria - S/S Tsaratsovo	50	110/20	1	Under manufacturing
348	Turkey	Exergy, Italy-Kuyucak Jeotermal Elektrik Uretim	26	154/11	1	Under manufacturing
349	Albania	DOKO sh.p.k - Elbasan	42	110/10,5	2	Under manufacturing
350	Venezuela	Wärtsilä Finland Oy - Petro Miranda	22	34,5/13,8	2	Under manufacturing
351	Argentina	GE Switzerland - Tucuman PP	12	15,75/6,75	1	Under manufacturing
352	Philippines	Wärtsilä Finland Oy - Masbate Gold Extension	7	13,8/4,16	1	Under manufacturing
353	Armenia	EFACEC Austria - S/S HVEN 4	25	110/10	2	Under manufacturing
354	Argentina	Wärtsilä Projects Oy - Central Loma La Lata	63	138/13,2	2	Under manufacturing
355	Ghana	Elecnor, Spain - Kumasi S/S (GRIDCo)	200	330/161/34,5	2	Under manufacturing
356	Ghana	Eiffage Energie - Kintampo S/S (GRIDCo)	200	330/161/34,5	2	Under manufacturing
357	Kosovo	KOSTT - S/S Pristina 6	40	110/10(20)	2	Under manufacturing
358	Kosovo	KOSTT - S/S Mitrovica	40	110/10(20)	2	Under manufacturing
359	Kosovo	KOSTT - S/S Drenasi	40	220/35/10(20)	2	Under manufacturing
360	Bosnia & Herzegovina	Bicakcic d.o.o., BiH - S/S Hak	40	110/36.75/10,5(21)	1	Under manufacturing
361	Ukraine	Kvant Plus - S/S Central Kievenergo	63	115/11-11	2	Under manufacturing
362	Greece	TERNA - Vermio project	50	150/21	1	Under manufacturing
363	Greece	TERNA - Aliveri project	50	150/21	1	Under manufacturing
364	Greece	TERNA - Ptolemais Unit V	125	16,.25/15,75/10,5	2	Under manufacturing
365	Greece	TERNA - Ptolemais Unit V	125	21/15,75/10,5	1	Under manufacturing
366	UK	Wärtsilä Finland Oy - Centrica, Brigg	62	132/11/11	1	Under manufacturing
367	UK	Wärtsilä Finland Oy - Centrica, Peterborough	62	132/11/11	1	Under manufacturing
368	Armenia	Cobra, Spain - Yerevan	200	220/110	1	Under manufacturing
369	Armenia	Cobra, Spain - Yerevan	27,5	110/35/6	2	Under manufacturing
	TOTAL				**763**	

SIEMENS

Technical Datasheet

Siemens H-Pos: 100; 3EK7 150-5CD4 — **Cage design**

System Information		
Nominal System Voltage (Un)	10,5	kV
Highest Voltage of Equipment (Um)	12,0	kV
Basic Insulation Level (BIL)	145	kV
Maximum altitude of installation (a.s.l.)	1000	m
Neutral system earthing	isolated	
Power Frequency	48 ... 62	Hz
Electrical data		
Applied Standard	IEC 60099-4	
Arrester classification		
Designation	DH	
Nominal discharge current (In, 8/20 µs)	10	kA
Wth	4,5	kJ/kV
Rated voltage (Ur)	15,0	kV
Maximum continuous operating voltage (Uc / MCOV)	12,0	kV
Line discharge class	2	
Long duration impulse current withstand (2 ms)	550	A
High current impulse withstand (4/10 µs)	100	kA
Rated short circuit current (0,2 s)	20,0	kA
Maximum residual voltage at :		
10 kA 1/2 µs	46,4	kV
5 kA 8/20 µs	39,0	kV
10 kA 8/20 µs	41,9	kV
20 kA 8/20 µs	48,2	kV
40 kA 8/20 µs	55,7	kV
500 A 30/60 µs	32,3	kV
1 kA 30/60 µs	33,5	kV
2 kA 30/60 µs	35,2	kV
Temporary overvoltage for 1 s	16,1	kV
Temporary overvoltage for 10 s	15,0	kV
Energy discharge capability - thermal	4,40	kJ/kV_r
Energy discharge capability - impulse	2,70	kJ/kV_r
Power Frequency withstand voltage (1min, wet)	67,0	kV
Lightning Impulse withstand voltage (1,2/50 µs)	144	kV
Mechanical data		
Height (H)	240	mm
Minimum creepage distance	605	mm
Weight (G)	2,4	kg
Color of housing	grey	
Specified long-term load SLL (F_{stat})[3]	1450	N
Specified short-term load SSL (F_{dyn})[3]	2080	N
Accessories		
Line terminal	Clamp, washer, nut M12	
Ground terminal	Washer, nut M12	

[3] Values without accessories

AL: N
ECCN: N

ВЯРНО С ОРИГИНАЛА

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SIEMENS

Technical Datasheet

Siemens H-Pos: 200; 3EK7 270-5CH4 — **Cage design**

System Information		
Nominal System Voltage (Un)	20,0	kV
Highest Voltage of Equipment (Um)	21,0	kV
Basic Insulation Level (BIL)	145	kV
Maximum altitude of installation (a.s.l.)	1000	m
Neutral system earthing	isolated	
Power Frequency	48 ... 62	Hz
Electrical data		
Applied Standard	IEC 60099-4	
Arrester classification		
Designation	DH	
Nominal discharge current (In, 8/20 µs)	10	kA
Rated voltage (Ur)	27,0	kV
Maximum continuous operating voltage (Uc / MCOV)	21,6	kV
Line discharge class	2	
Long duration impulse current withstand (2 ms)	550	A
High current impulse withstand (4/10 µs)	100	kA
Rated short circuit current (0,2 s)	20,0	kA
Maximum residual voltage at :		
10 kA 1/2 µs	71,8	kV
5 kA 8/20 µs	62,4	kV
10 kA 8/20 µs	75,0	kV
20 kA 8/20 µs	77,2	kV
40 kA 8/20 µs	89,3	kV
500 A 30/60 µs	51,0	kV
1 kA 30/60 µs	53,7	kV
2 kA 30/60 µs	56,4	kV
Temporary overvoltage for 1 s	31,0	kV
Temporary overvoltage for 10 s	29,0	kV
Energy discharge capability - thermal	4,40	kJ/kV_r
Energy discharge capability - impulse	2,70	kJ/kV_r
Power Frequency withstand voltage (1min, wet)	113	kV
Lightning Impulse withstand voltage (1,2/50 µs)	242	kV
Mechanical data		
Height (H)	400	mm
Minimum creepage distance	1 230	mm
Weight (G)	3,9	kg
Color of housing	grey	
Specified long-term load SLL $(F_{stat})^3$	870	N
Specified short-term load SSL $(F_{dyn})^3$	1250	N
Accessories		
Line terminal	Clamp, washer, nut M12	
Ground terminal	Washer, nut M12	

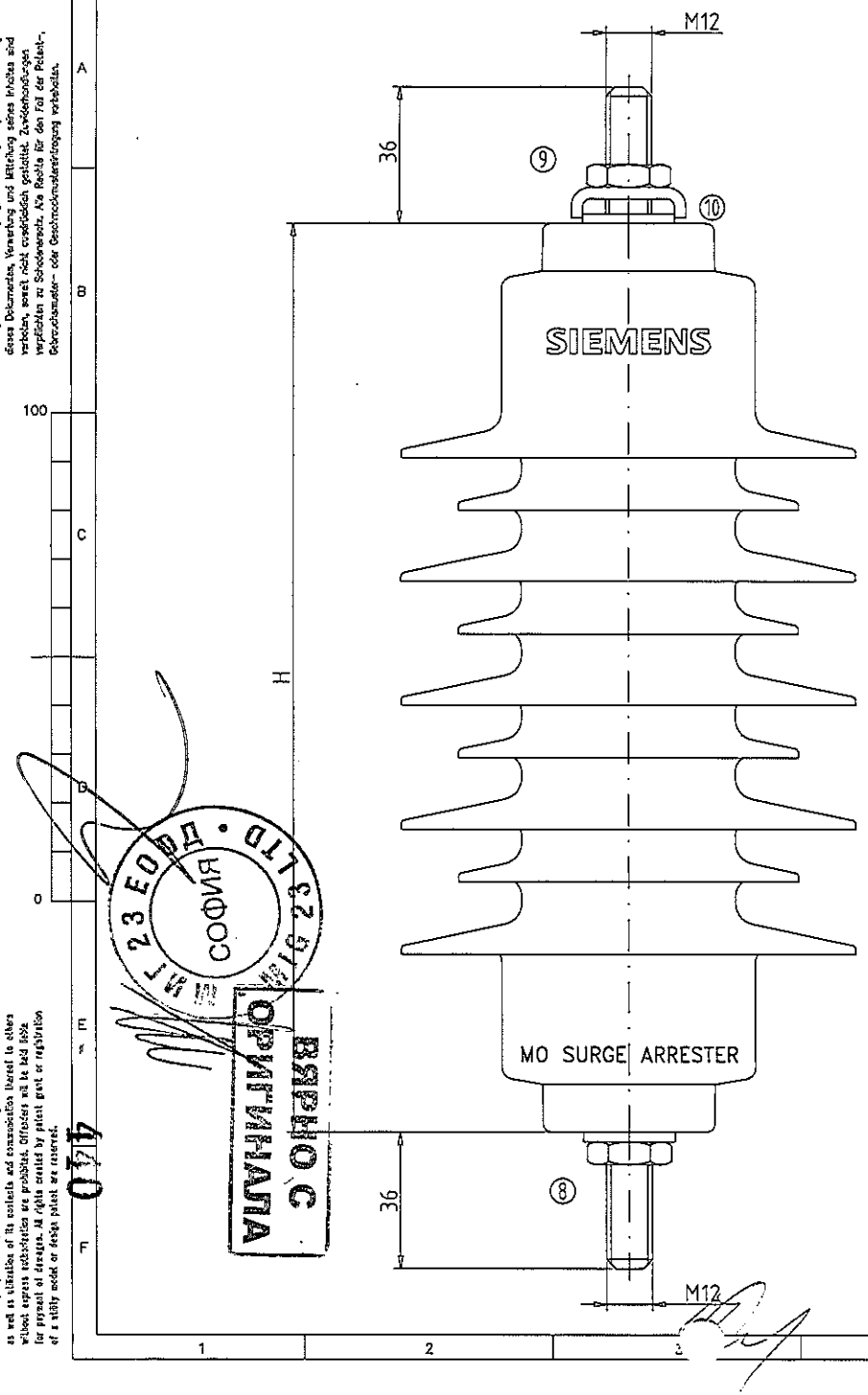
[3] Values without accessories

AL: N
ECCN: N

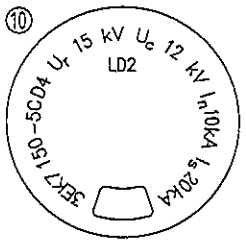
ВЯРНО С ОРИГИНАЛА

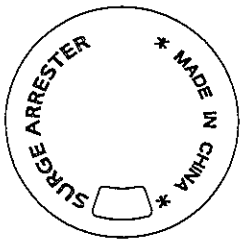
① Type	② U_r kV	③ U_c kV	H mm	④ G kg	⑤ n	⑥ SLL N	SSL N	⑦ k mm
3EK7 150-5CD4	15	12	240	2,4	1	1450	2080	605

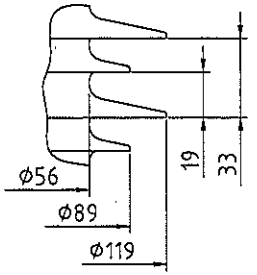
1. Type
2. Rated voltage
3. Continuous operating voltage
4. Total weight, approx.
5. Number of units
6. Max. permissible pull at insulator top, Values without accessories
7. Min. creepage distance
8. Washer, nut M12
9. Clamp, washer, nut M12
10. Name plate



Remarks
Frequency: 48 ... 62 Hz
Altitude above sea level: up to 1000 m
Material and color of insulator: directly molded silicone housing, grey







SA 24 and 12kV_CEZ Bulgaria — Siemens EOOD

Index	Remark	Ä.d.	Date
			30.03.2017

First issue		Current update	CAD-drawing
30.03.2017	Date		
Symphorianus	Handled by		
H.-J. Westphal	Checked		
	Section leader		
	Standard		

AL: N
ECCN: N

Surge arrester 3EK7

f. type — type

SIEMENS

EM HP AR / 27128611.0100 — drawing number — B01 — Sheet no. — Index

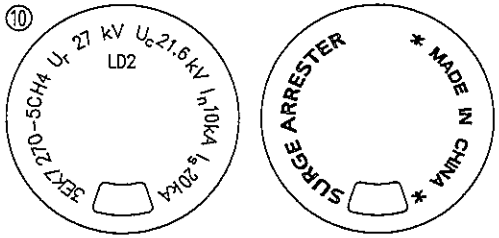
Replacement for — Superseded by

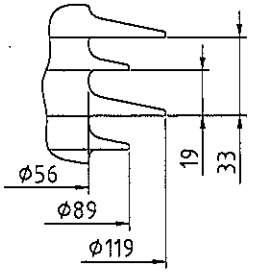
file: 27128611-0100.dwg

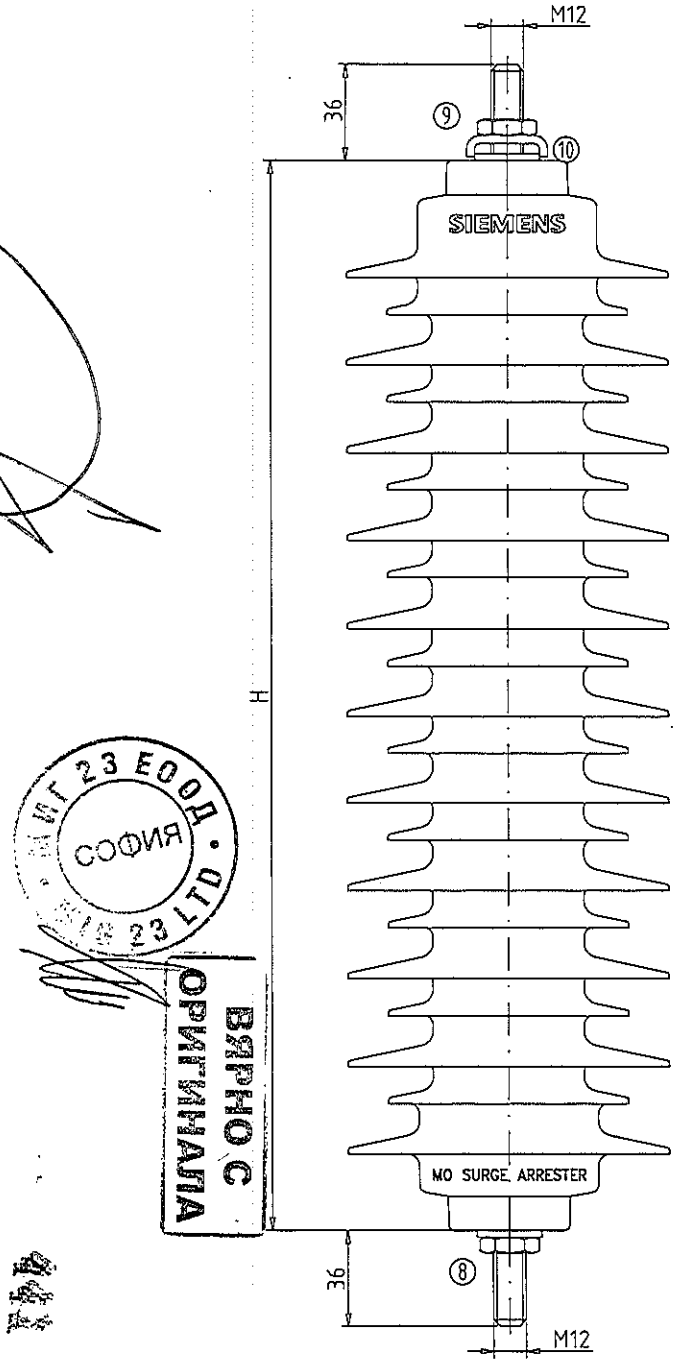
① Type	② U_r kV	③ U_c kV	H mm	④ G kg	⑤ n	⑥ SLL N	⑥ SSL N	⑦ k mm
3EK7 270-5CH4	27	21.6	400	3,9	1	870	1250	1230

1. Type
2. Rated voltage
3. Continuous operating voltage
4. Total weight, approx.
5. Number of units
6. Max. permissible pull at insulator top, Values without accessories
7. Min. creepage distance
8. Washer, nut M12
9. Clamp, washer, nut M12
10. Name plate

Remarks
Frequency: 48 ... 62 Hz
Altitude above sea level: up to 1000 m
Material and color of insulator: directly molded silicone housing, grey







SA 24 and 12kV_CEZ Bulgaria — Siemens EOOD

Index	Remark	Ä.d.	Date
			30.03.2017

First issue		Current update	CAD-drawing
30.03.2017	Date		
Symphorianus	Handed by		
H.-J. Westphal	Checked		
	Section leader		
	Standard		

AL: N
ECCN: N

Surge arrester 3EK7

f. type — type

SIEMENS

EM HP AR / 27128611-0200 / B01-

drawing number — Sheet no. — Index

Replacement for — Superseded by

file: 27128611-0200.dwg

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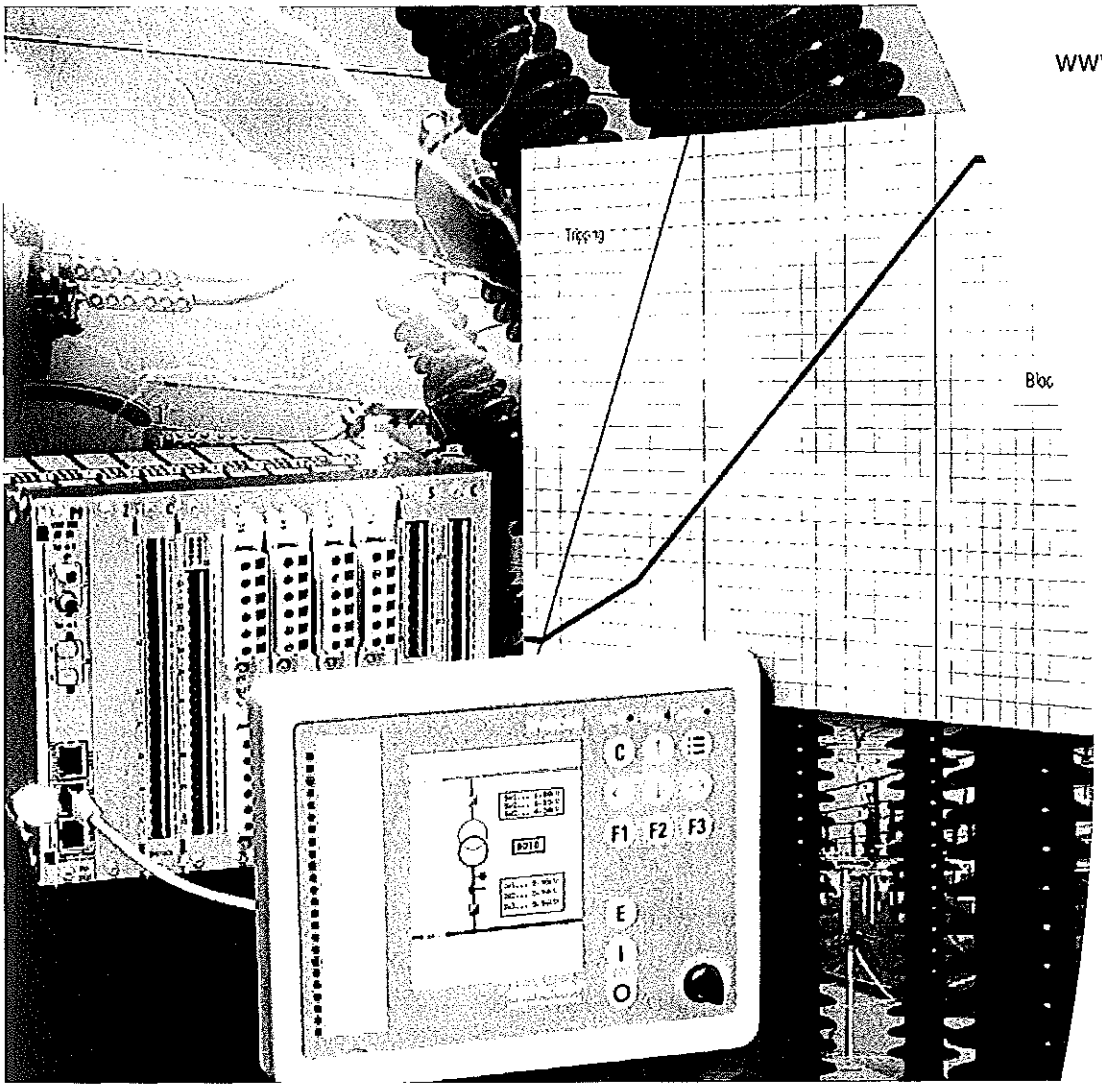

SPRECON®-E-P DQ..6-SERIES

PROTECTION DEVICES AND COMBINED PROTECTION AND CONTROL DEVICES WITH TRANSFORMER DIFFERENTIAL PROTECTION

ВЯРНО С ОРИГИНАЛА

MIG 23 EOOД СОФИЯ MIG 23 LTD

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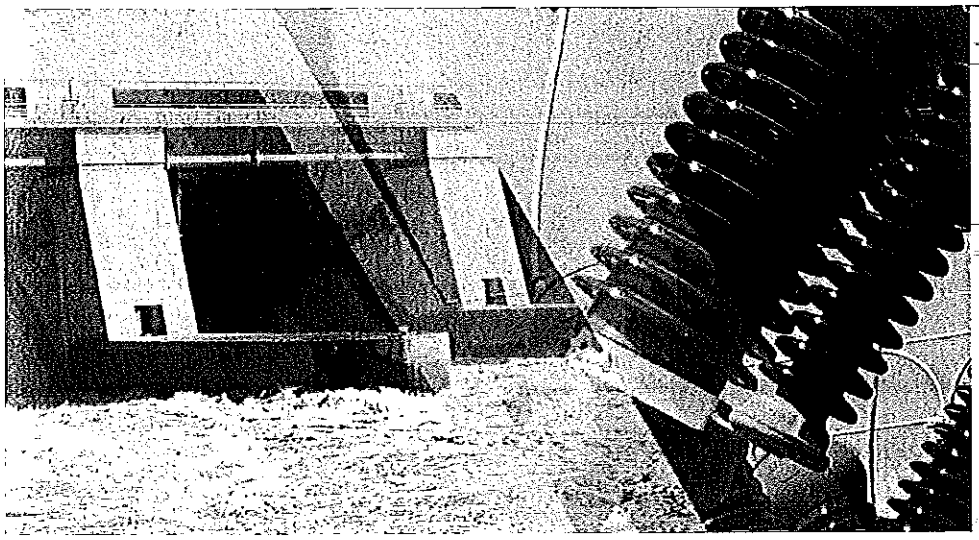
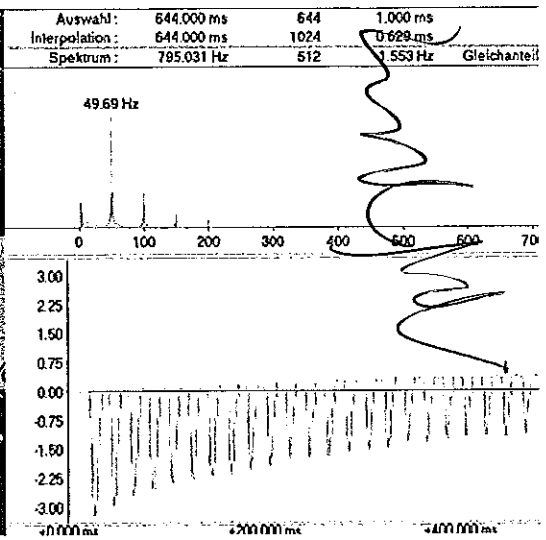
sprecher automation





SPRECON-E-P DQ..6-SERIES

INTRODUCTION

SPRECON-E-P DQ..6 devices provide differential protection for transformers. The devices include standardised hardware modules and firmware. They all provide protection functions of the same range. The series consists of:

- SPRECON-E-P DQ..6-1 (Protection device)
- SPRECON-E-P DQ..6-2 (One-box solutions with combined protection and control)

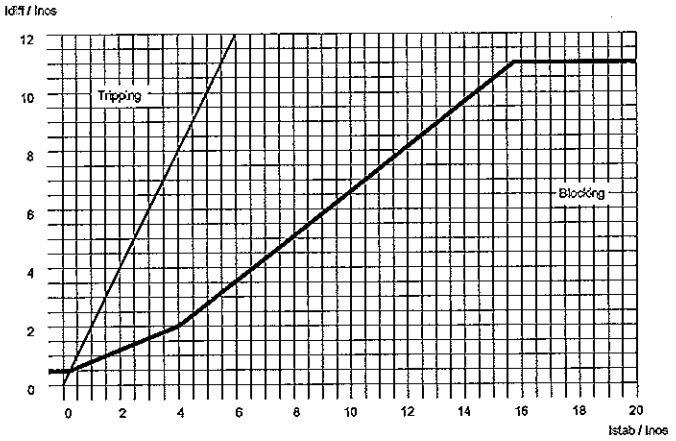
One-box solutions are distinguished from protection devices by additional control functions. Beside typical protection functions and measured-value collection, protection devices also feature control of circuit-breakers. The one-box solutions allow protection and measurement as well as control and monitoring of secondary systems.

The multifunctional SPRECON-E-P devices feature a clear separation of control and protection functions which allows either combined or separated operations of control and protection functions:

- Separated data models
- Separated control and protection firmware
- Separated control and protection configuration
- Separated passwords
- No testing of protection function at feeder nor primary circuit disconnection required on updating control parameters or firmware

RANGE OF FUNCTIONS

The devices are accentuated by a technologically fully developed and commercially optimised design. They allow realisations of sophisticated and compact solutions with clear economical benefits through highest possible flexibility and scalability.

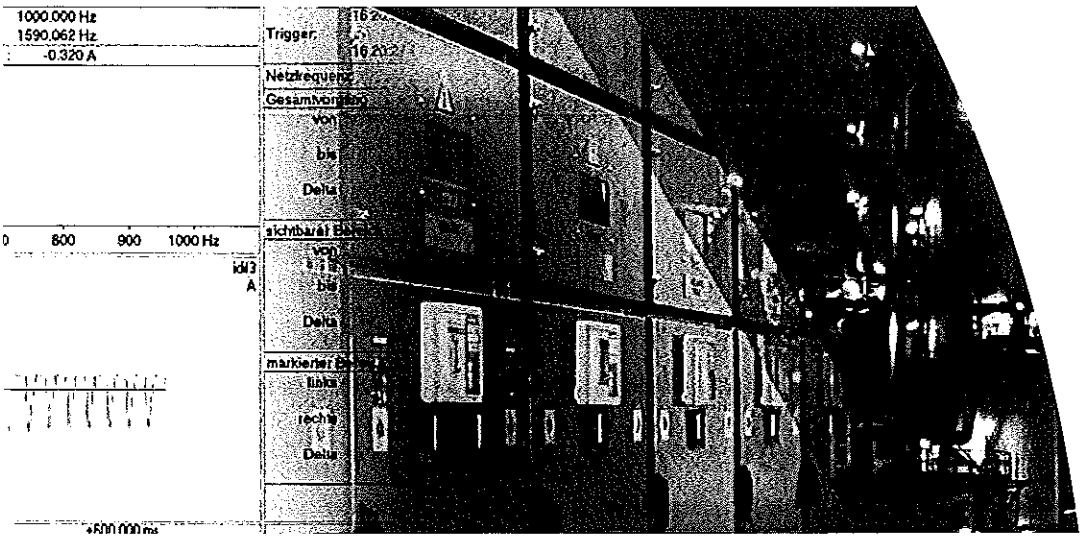


Current stabilised differential protection

AREAS OF APPLICATION

The SPRECON-E-P DQ..6 devices are multifunctional devices for protection, control and automation of energy stations. They can be applied as main protection units of transformers in different neutral-point connections at medium or high voltage levels.

In addition to the characteristic-stabilised differential protection for phase currents, SPRECON-E-P DQ..6 also comes with characteristic-stabilised ground differential protection, zero-sequence filtering, inrush and overexcitation stabilisation as well as overcurrent protection per winding. Furthermore, motor protection, a thermal image as well as overvoltage and undervoltage protection secure the use within medium voltage motor applications.



The implementation of standard and proprietary protocols allows close collaboration with controlling systems of various manufacturers. All necessary protection and control functions are integrated in the devices.

CONFIGURATION

All functions can be configured separately. By separating protection configuration from control configuration, all different kinds of requirements of different applications can be met.

The protection-specific functions are separately configured or deactivated depending on the respective application. Irrelevant functions are hidden and inactive which allows simple and structured configuration of the devices.

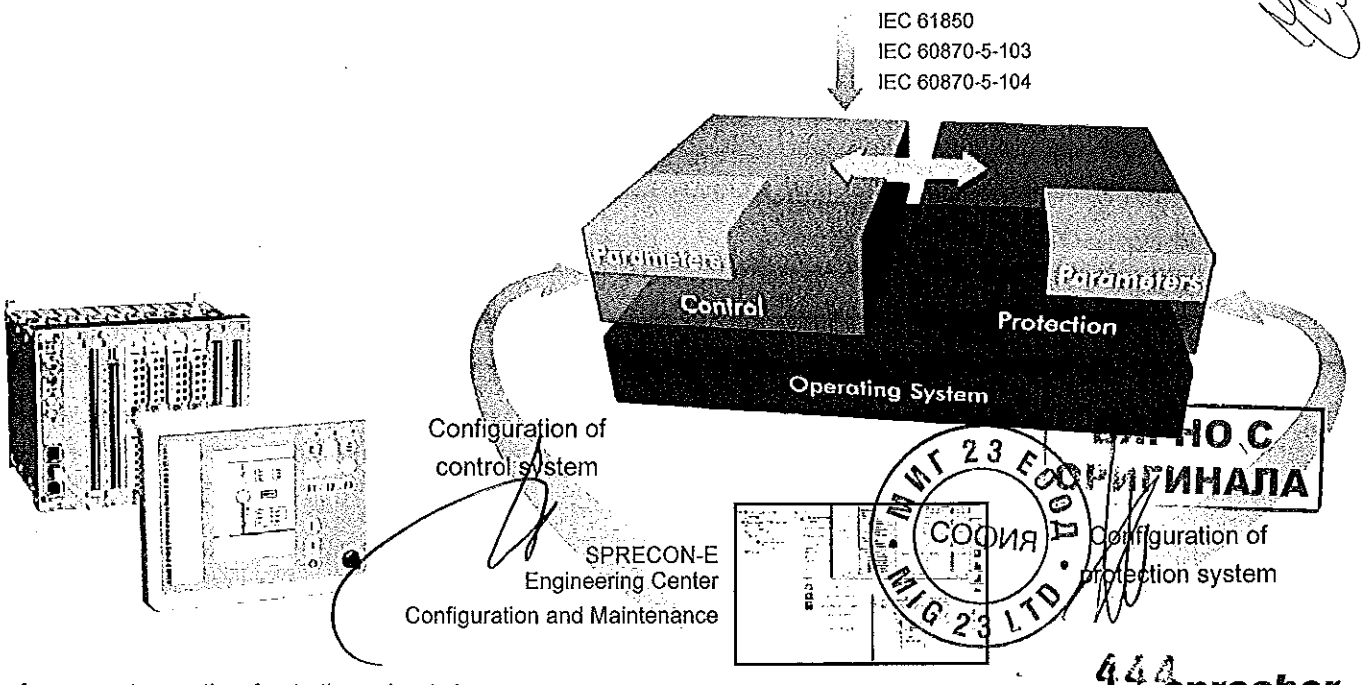
All configured bays are type-oriented stored in a database. They can be therefore copied and re-used as well as easily re-adapted, which facilitates configuration of large-scale systems.

OPERATING

In order to meet the requirements of efficient system management, all operations can be accomplished with the detachable HMI control panel. Hence, protection configurations can be locally carried out beside usage of the operating program "COMM-3".

All relevant information about processes and devices is shown on the full-graphical display of the control panel. Additionally, configurable LEDs are available for signalling.

Separated navigation keys allow clear user guidance through the various pages and submenus. Furthermore, they facilitate simple configuration of extensive protection and control functions.



Principle of consequent separation of protection and control

sprecher automation

SPRECON-E-P DQ..6 – Technical Data (Excerpt)

sprecher automation

www.sprecher-automation.com

Dimensions & Weight
- Dimensions: 212x176x257mm (WxHxD) incl. connections
- Weight: < 7kg

General Functions
- Remote maintenance and configuration
- Time synchronisation (DCF77, GPS, station & remote control)

Communication
- IEC 60870-5-103/-104, IEC 61850
- RS232, RS422/485, fibre-optic, 10/100 Mbit Ethernet
- 2 additional optical Ethernet interfaces for redundant ring
- Connection via leased or dialup line
- Wireless communication (external GSM or wireless modem)
- Integration of stand-alone devices via station bus (counter, metering devices, protection relays, AVR, Petersen coil controller, etc.)

Implemented Protection Functions	Reference		Type						
	IEEE C37.2	IEC 61850-7-4	D2Q6		D2QU6	D3Q6		D3QU6	
Number of current and voltage inputs			7I	8I	7I+1U	11I	12I	10I+1U	11I+1U
Neutral-Point current sensitivity			1x	1x/1x or 1x/20x	1x	1x/1x or 1x/20x	1x/1x/ 20x	1x	1x/1x or 1x/20x
Differential protection, number of ends	87T	PDIF	2	2	2	3	3	3	3
Ground differential protection, number of ends	87N	PDIF	1	2	1	2	2	1	2
Switch on protection (SOTF, SOP)	50, 50N	PIOC	x	x	x	x	x	x	x
Amplitude and vector group matching			x	x	x	x	x	x	x
Zero-sequence filtering			x	x	x	x	x	x	x
Phase-rotation adaption			x	x	x	x	x	x	x
I_L>DT/IDMT, three stages per end, number of ends	50, 51	PTOC	2	2	2	3	3	3	3
'DT/IDMT, three stages per end, per of ends	50N,51N, 51Ns	PTOC	2	2	2	3	3	3	3
Inrush restraint		PHAR	x	x	x	x	x	x	x
Overvoltage protection (U>), two stages*	59	PTOV			x			x	x
Undervoltage protection (U<), two stages*	27	PTUV			x			x	x
Frequency protection (f< four stages, f>two stages)*	81	PTUF, PTOF			x			x	x
Negative sequence protection I_{neg}>, three stages, assignable to end	46	PTOC	x	x	x	x	x	x	x
Overload protection (2 images, assignable to end)	49, 49N	PTTR	x	x	x	x	x	x	x
Starting protection, locked rotor protection (motor protection), assignable to end*	49R, 66, 48, 51LR	PMRI/PMSS	x	x	x	x	x	x	x
Underload protection (motor protection)*	37	PTUC	x	x	x	x	x	x	x
Lockout*, number of ends	86	PMRI	2	2	2	3	3	3	3
Circuit breaker failure prot. (CBF), two stages per end, number of ends	50BF	RBRF	2	2	2	3	3	3	3
Current annunciation stages (3x $I_{L>a>}$, 3x $I_{E>a>}$), assignable to end			x	x	x	x	x	x	x
Circuit breaker tripping by up to 6 external signals		(PTRC)	x	x	x	x	x	x	x
Trip circuit supervision, number of ends	74TC		2	2	2	3	3	3	3
'ameter sets			4	4	4	4	4	4	4
gic + time stages for optocoupler inputs			x	x	x	x	x	x	x
Virtual binary inputs/control input			15/15	15/15	15/15	15/15	15/15	15/15	15/15
Logic + hold time for output relays			x	x	x	x	x	x	x
Measurands, short report			x	x	x	x	x	x	x
Event logging, non-volatile		RDRE	x	x	x	x	x	x	x
Disturbance data recording, non-volatile		RADR, RBDR	x	x	x	x	x	x	x
Statistics			x	x	x	x	x	x	x
Measurand checks, self supervision			x	x	x	x	x	x	x
Assistance for test and putting into operation			x	x	x	x	x	x	x

** implemented in structure 4602 and higher*

Additional Protection Functions
- Pulse shaper stage (programmable logic)
- Separation of protection data from control data
- Nominal current selection (1/5 A) via terminal connection
- Settings via control panel and PC through menu-assisted plain-text messaging

Control Functions
- Control and monitoring of switching devices and process elements
- Power output with high making/breaking capacity (option)
- Command output either directly or by SBO (select before operate)
- Control of transformer tap changers or Petersen coils
- Configurable automatic functions
- Switching device interlocking
- Group-assigned indication and measured-value blocking
- Threshold value monitoring
- Maximum demand value calculation
- Maximum value calculation (non-return pointer)
- Configurable transmission modes for measured values
- Metered value capturing
- Operating hours counter, switching operations counter
- Event recording

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ВЯРНО С ОРИГИНАЛА

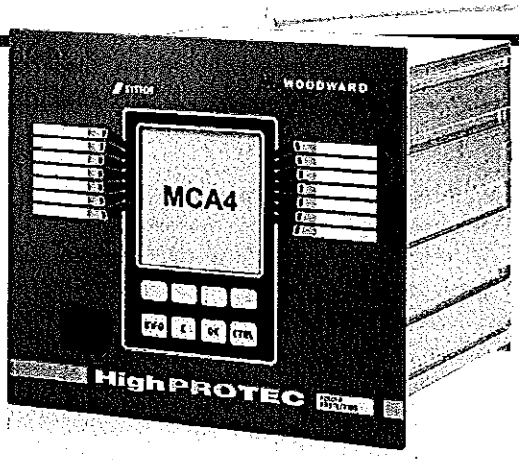
HighPROTEC-2 | ТЕХНОЛОГИЯ ЗА ЗАЩИТА НАПРАВЕНА ПРОСТО

MCA4-2 | РЕЛЕЙНА ЗАЩИТА И УПРАВЛЕНИЕ ЗА ИЗВОД, МРЕЖА И ГЕНЕРАТОР

WOODWARD

NEW FEATURES

- DNP 3.0
- Multiple Communication with one device
- ANSI Menu structure
- Page Editor
- New front plate with USB
- IEC61850 with LC interface



Приложение

MCA4 е прецизно и надеждно реле за защита, управление и мониторинг на извод, мрежа и генератор. Като последно поколение серия от SEG/Woodward, MCA4 включва всички ANSI и IEC стандарти за постигане на съвместимост с постоянно променящите се изисквания при взаимосвързаност на мрежите. Гъвкавостта по отношение на хардуер, софтуер, приложение, потребителски интерфейс и комуникации, прави MCA4 подходяща при днешните изисквания, а също така и в бъдеще. Хардуерът е проектиран да работи при всички номинални стойности, в комбинация с функции по защита и управление.
Софтуерът за параметризиране и анализ Smart view е подходящ за всички HighPROTEC устройства.

Подробен пакет защита (1)

- → Шест елемента фазна МТЗ посочна или непосочна (ANSI/IEC/51C/51V).
- → Четири елемента земна защита (2) непосочна или посочна.
- → Два елемента защита от небалансиран товар.
- → Напреженова защита (2) шест елемента, по избор: V<, V>, V<(t).
- → Шест елементна супервизия по небаланс на напрежение.
- → Гъвкав четвърти напреженов вход. (2) Избор от VE> или VX (за синхро-чек).
- → Проверка по синхронизъм (синхро-чек) Генератор-Система или Система-Система.
- → Всеки от шестте елемента на честотната защита може да се използва като: f<, f>, ROCOF, vector surge...
- → Шест елемента мощностна защита, всеки може да се използва като: P>, P<, Pr, Q>, Q<, Qr, S>, S<
- → Два елемента защита по cos phi (PF)

Качество на енергията

- → THD защита (общо хармонично изкривяване)

Управление на потребление/ Върхови стойности

Върхови ст-ти на ток и мощност. Средно потребление на ток и енергия

Пакет при взаимосвързване на мрежи

Този пакет е обобщен под отделно меню

- → Разпределение на товара в зависимост от посоката .
- → FRT (LVRT): Настройваеми FRT-профили, координирани с АПВ.
- → QV-Защита: Защита по Мин. напреж.- Реактивна мощност
- → Автоматична защита по честота:
- → Шест елемента конфигурируеми като: f<, f>, df/dt (ROCOF), Vector Surge CB-Intertripping
- → Проверка по синхронизъм
- → (Генератор-мрежа, мрежа-мрежа), опции напр. при захранена линия-незахранена шина

Супервизия по средноквадратични стойности

- → Настройваеми (VDE-AR 4105)

Регистратори

- → Авариен: 120 s енергонезависими
- → Повреди: 20 повреди
- → Събития: 300 събития
- → Аналогови ст-ти: 4000 енергонезависими въвеждания

Помощни инструменти

- → Софтуер за параметризиране и анализ Smart view
- → Включен редактор на едноличейна мнемо схема

Поддръжка

- → USB връзка
- → Програмируем дисплей (Single-Line,
- → ...) Програмируеми входове
- → Копиране и сравняване на параметри
- → Конвертируеми конфиг. файлове
- → Сработване и деактивир. на изходи
- → Симулатор на повреди: ток и напреж.
- → Графики на изключвателни х-ки
- → 7 езика избираеми в релето

Опции за комуникация

- → IEC61850
- → Profibus DP
- → Modbus RTU или Modbus TCP
- → IEC60870-5-103
- → DNP 3.0 (RTU, TCP, UDP)

Управление

- → на до шест съоръжения (прекъсвачи, разединители или земни ножове)
- → Износване на прекъсвача

Логики

- → до 80 логически уравнения за защита, управление и мониторинг

Синхронизация по време

- → SNTP, IRIG-B00X, Modbus, IEC60870-5-103

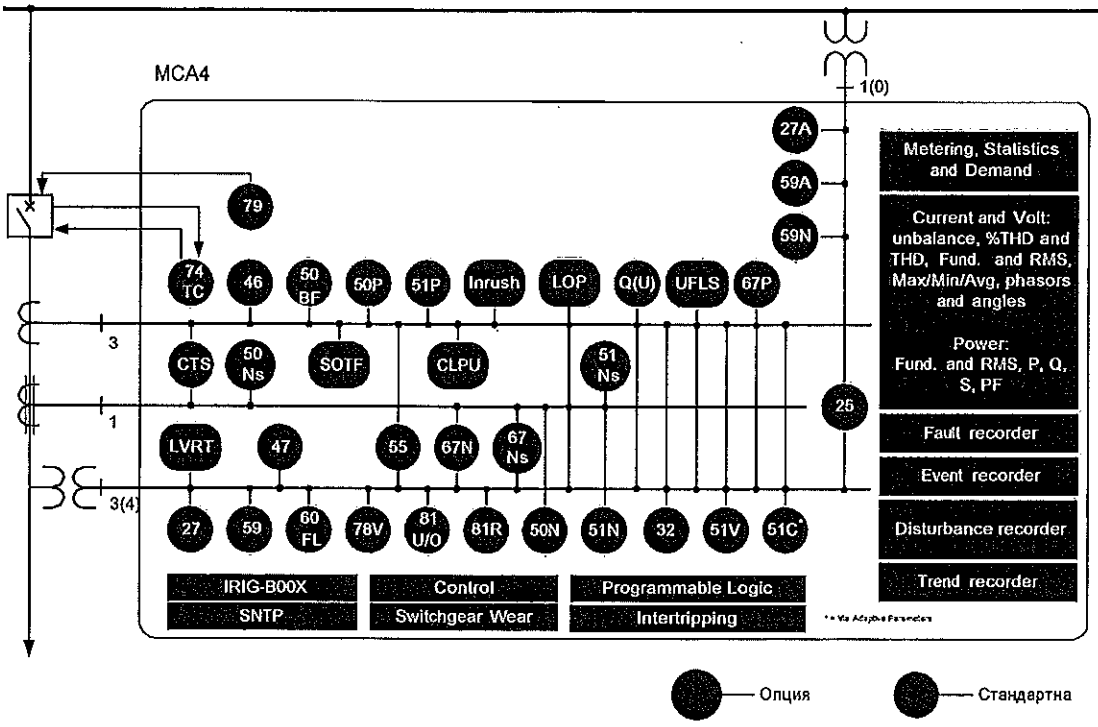
(1) Базирани на моментни, средни или I2 стойности

(2) Базирани на моментни или средни стойности

Преглед на функциите

	Елементи	ANSI
Защитни функции		
I, MTO, MT3, всички елементи могат да бъдат конфигурирани като посочни или непосочни. Множество опции за ресет (мигновени, време независими, ресет характеристики съгл. IEC и ANSI).	6	50P, 51P, 67P
Контролирана по напрежение максималнотокова защита посредством адаптивни параметри		51C
Зависима от напрежението максималнотокова защита		51V
Максималнотокова защита при обратен фазов ред		51Q
I2>, защита от небалансиран товар с оценка на токовете на обратна последователност	2	46
IB, защита от претоварване с термична реплика и отделни стойности за аларма и изключване	1	49
IH2/In, регистриране на намагнитващ товар и оценка по 2ри хармоник	1	Inrush
IG, земна отсечка, земна защита, всички елементи могат да бъдат конфигурирани като посочни или непосочни. Множество опции за ресет (мигновени, време независими, ресет характеристики съгл. IEC и ANSI)..	4	50N, 51N, 67N
V<, V>, V(t)<, мин.- и макс. напреженова защита, време зависима мин.напреженова защита	6	27, 59
Супервизия по асиметрия на напрежението (V012) V1, мин. и макс. напрежение на права последователност V2, макс. напрежение на обратна последователност	6	47
Всеки от шестте елемента честотна защита се използва като: f< fs, df, dt, ROCOF, DF/DT, vector surge, ...	6	81U/O, 81R, 78
VX, защита остатъчно напрежение или напрежение на шини за Synch Check	2	25 or 59N
AR, Автоматично повторно включване (АПВ)	1	79
ExP, Функции външна аларма и изключване	4	
PQS, Мощностна защита	6	32, 37
PF, Фактор на мощност	2	55
FRT, блокировка по минимално напрежение (опция координиране с АПВ)	27 (t)	27 (t, AR)
Q(V),Защита (зависима по мин.напрежение посочна реактивна мощност с деактивиране на АПВ)		
UFLS (разпределение на товара в зависимост от посоката на активна мощност)		
10-минутна супервизия на средно-квадратични ст-ти: настройваема съгл. VDE-AR 4105		
Synch Check		25
Управление и логики		
Управление: Индикация на позицията, супервизия на времето и взаимни блокировки за до 6 съоръжения		
Логики: до 80 броя, всяка с по 4 входа, избираеми логически уравнения и таймери		
Функции по супервизия		
CBF, Защита от повреда на прекъсвача	1	50BF
TCS,следене на изключвателната верига	1	74TC
LOP,загуба на потенциал	1	60FL
FF,повреда на предпазител чрез цифров вход	1	60FL
CTS,следене състоянието на токов трансформатор	1	60L
CLPU,студен старт	1	
SOTF, превкл. върху к.с.	1	
Супервизия на потребление и върхови ст-ти (ток и мощност)		
THD супервизия		
Износване на прекъсвач		
Регистратори: Авариен, Повреди, Събития, Аналогови ст-ти		

Преглед на функциите по Ansi



Одобрения

CE

сертификат съгл. UL508 (Индустриален)

сертификат съгл. CSA-C22.2 No. 14 (Индустриален)

сертификат съгл. EAC (Euraslan Conformity)

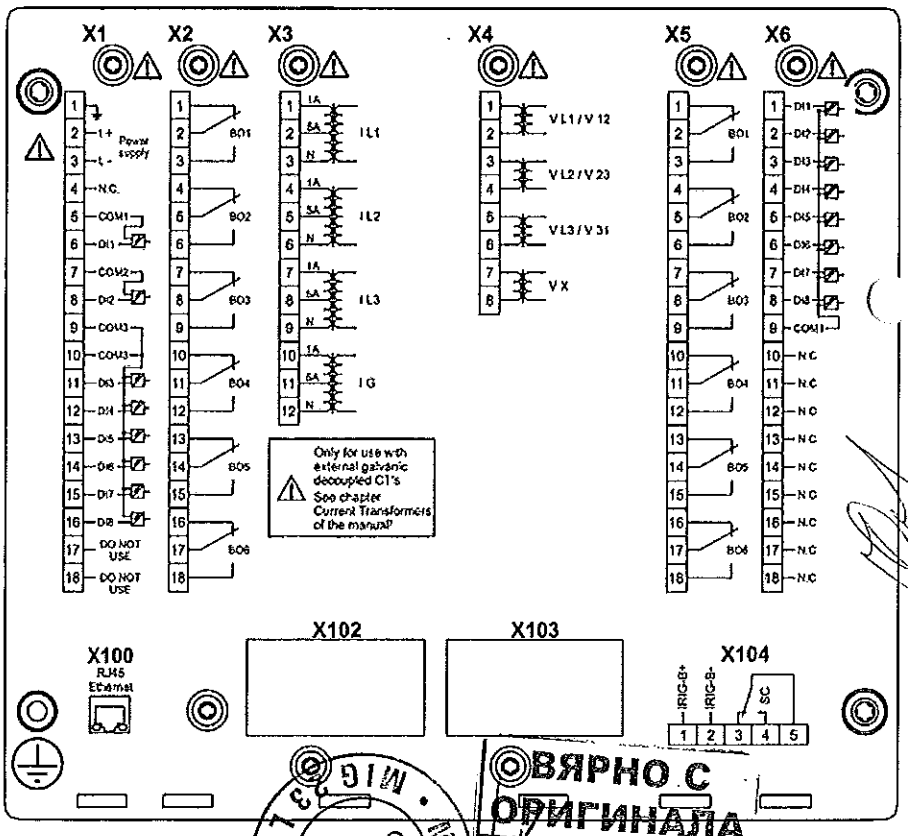
Типово одобрени (и сертифицирани) съгл IEC60255-1 и IEC61850

сертификат съгл. "BDew-Richtlinie für Erzeugungsanlagen am Mittel-spannungsnetz, Ausgabe Juni 2008" (Германски стандарт)

съответства на IEEE 1547-2003
подобрена по IEEE 1547a-2014

съответства на ANSI C37.90-2005

Схема на свързване *(примерна)*



Форма за поръчка MCA4-2

Посочна защита на извод	MCA4 -2				
Версия 2 с USB връзка, разширена комуникация и потребителски опции					
Цифрови входа	Цифрови изхода	корпус	широк диспл.		
8	7	B2	X	A	
16	13	B2	X	D	
Хардуерен вариант 2					
Фазов ток 5 A/1 A, Земен ток 5 A/1 A				0	
Фазов ток 5 A/1 A, Чувств. земен ток 5 A/1 A				1	
Корпус и монтаж					
Вграден					A
Вграден 19" (релеен шкаф)					B
Комуникационен протокол					
Без протокол					A
Modbus RTU, IEC60870-5-103, DNP3.0 RTU | *RS485/клеморед*					B*
Modbus TCP, DNP3.0 TCP/UDP | *Ethernet 100 MB/RJ45*					C*
Profibus-DP | *оптика/ST-конектор*					D*
Profibus-DP | *RS485/D-SUB*					E*
Modbus RTU, IEC60870-5-103, DNP3.0 RTU | *оптика/ST-конектор*					F*
Modbus RTU, IEC60870-5-103, DNP3.0 RTU | *RS485/D-SUB*					G*
IEC61850, Modbus TCP, DNP3.0 TCP/UDP | *Ethernet 100MB/RJ45*					H*
IEC60870-5-103, Modbus RTU, DNP3.0 RTU | *RS485/клеморед* Modbus TCP, DNP3.0 TCP/UDP | *Ethernet 100 MB/RJ45*					I*
IEC61850, Modbus TCP, DNP3.0 TCP/UDP | *Optical Ethernet 100MB/LC duplex connector*					K*
Modbus TCP, DNP3.0 TCP/UDP | *Optical Ethernet 100MB/LC duplex connector*					L*
Опция за замърсена среда					
Без					A
Защитно покритие					B
Език на менюто (във всяко устройство)					
English/German/Spanish/Russian/Polish/Portuguese/French					

* За всяка опция на комуникацията се използва само един протокол.
Smart view може да се използва паралелно през Ethernet интерфейс (RJ45).

Софтуерът за параметризиране и анализ Smart view е включен в доставката на HighPROTEC устройствата.

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Токови входове	4 (1 A и 5 A) с автоматично закъсяване
Напреженови входове	4 (0–800 V)
Цифрови входове	Праговете на заработване се настр. чрез софтуера
Захранване	Широкообхватно захранване 24 V_{DC} - 270 V_{DC} / 48 V_{AC} - 230 V_{AC} (-20/+10%)
Клеми	Всички клеми са изваждаеми
Тип на покритието	IP54
Размери на корпуса (Ш x В x Д)	19" монтаж: 212.7 mm x 173 mm x 208 mm 8.374 in. x 6.811 in. x 8.189 in. Вграден монтаж: 212.7 mm x 183 mm x 208 mm 8.374 in. x 7.205 in. x 8.189 in.
Тегло (максимално)	прибл. 4.2 kg / 9.259 lb

ВЯРНО С ОРИГИНАЛА

Заповядайте информация свържете се с:

DOK-Fly-MCA4-2E_Rev.D | Subject to alterations, errors excepted.

sprecher automation

Your reference:
Our reference: BC/Mn
Extension: 610
Date: 02.03.2017

DECLARATION OF MANUFACTURER

We, Sprecher Automation GmbH, a reputable manufacturer of digital protection relays, established under laws of Austria, having our head office at Franckstrasse 51, 4018-Linz/Austria, herewith declares that the offered protection relays and bay controllers type SPRECON-E-C/P support the following communication protocols:

- IEC 60870-5-103
- IEC 61850
- MODBUS RTU
- MODBUS TCP/IP

for optical or electrical connection.

Kind regards

SPRECHER AUTOMATION GMBH

Christian Brauner
Department Manager
Sales Vienna

ВЯРНО С ОРИГИНАЛА

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FN 216578 y, Handelsgericht
IdNr.: ATU53171106
Bank: Allgemeine Sparkasse OÖ.
Account Nr.: 32100-085088, Bankcode 20320
IBAN: AT092032032100085088
Swift: ASPKAT2L

Превод от английски език

Декларация от производителя

Ние, Шпрехер Аутомейшън ГмбХ, реномиран производител на цифрови релейни защити, основани под законите на Австрия и имащи главен офис на Франкштрасе 51, 4018-Линц/Австрия, с настоящото декларираме, че оферираните релейни защити и полеви контролери тип SPRECON-E-C/P поддържат следните комуникационни протоколи:

IEC 60870-5-103
IEC 61850-5
MODBUS RTU
MODBUS TCP/IP

за оптична или електрическа връзка.

Сърдечни поздрави,

Шпрехер Аутомейшън ГмбХ

/подпис и печат/

ВЯРНО С ОРИГИНАЛА

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Declaration of conformity

We, Woodward Kempen GmbH, a reputable manufacturer of digital relay protections, established under laws of Germany, and having a head office at Krefelder Weg 47, 47906 Kempen, Germany, herewith

Certify

That

The offered protection relays type MCA4-2, MRDT4-2 support the following communication protocols:

IEC 60870-5-103, IEC 61850-5, MODBUS RTU, MODBUS TCP/IP

for optical or electrical connection.

Signed for and on behalf of Woodward Kempen GmbH

Maciej Madej

Sales Support Engineer

ВЯРНО С ОРИГИНАЛА

МИГ 23 ООД • MIG 23 LTD • СОФИЯ

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Превод от английски език

Декларация за съответствие

Ние, Уудуорд Кемпен ГмбХ, реномиран производител на цифрови релейни защити, основани според законите на Германия и имащи главен офис на Крефелдер Вег 47, 47906 Кемпен, Германия, с настоящото

Декларираме

че

Оферираните от нас релейни защити, тип MCA4-2, MRDT4-2 поддържат следните комуникационни протоколи:

IEC 60870-5-103, IEC 61850-5, MODBUS RTU, MODBUS TCP/IP

за оптична или електрическа връзка.

Подписано за и от името на Уудуорд Кемпен ГмбХ,

/подпис и печат/

ВЯРНО С ОРИГИНАЛА

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ДЕКЛАРАЦИЯ

за приемане на условията в проекта на договор

Долуподписаният/-ната/ Антон Иванов Илиев в качеството ми на представляващ Обединение „МИГ - Хюндай" (името на участника) участник в обществена поръчка с предмет: „„Доставка, демонтаж и монтаж на трифазни маслонапълнени понижаващи силови трансформатори 110kV/ Средно напрежение (СрН) и цялото необходимо помощно оборудване", реф.№ PPD 17-001, обособена позиция № 1 /ОП1/ , подстанция /ПС/ "Младост".

(*посочва се № и наименование на обособената позиция*)

Д Е К Л А Р И Р А М, ЧЕ:

Приемам условията в проекта на договор, приложен в документацията за участие.

Дата 18.04.2017г.

Декларатор: _____ /Антон Илиев/

МИГ 23 ЕООД София MIG 23 LLC

Забележка:

Когато участник подава оферта за повече от една обособена позиция, настоящата декларация се представя в комплекта документи на техническо предложение за съответната обособена позиция, за която участва.

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Д Е К Л А Р А Ц И Я

за срока на валидност на офертата

Долуподписаният/ -ата Антон Иванов Илиев,

(собствено, бащино, фамилно име)

притежаващ/а лична карта №641903354, издадена на 01.02.2011г. от МВР – гр. София,

адрес: гр. София, ж.к. Света Троица, бл. 339Б, ет.4, ап.14 ,

(постоянен адрес)

в качеството ми на Управител

(посочва се длъжността)

на Обединение „МИГ – Хюндай",

(посочете наименованието на участника)

участник в процедура за възлагане на обществена поръчка с предмет:

„Доставка, демонтаж и монтаж на трифазни маслонапълнени понижаващи силови трансформатори 110kV/Средно напрежение (СрН) и цялото необходимо помощно оборудване ",

(наименование на поръчката)

Обособена позиция № 1 (ОП1), подстанция /ПС/ „Младост"

(*посочва се № и наименование на обособената позиция*)

Д Е К Л А Р И Р А М, ЧЕ:

С подаване на настоящата оферта, направените от нас предложения и поети ангажименти са валидни за срока, посочен в обявлението, считано от крайния срок за подаване на офертите.

Дата 18.04.2017г.

Декларатор: _____

/Антон Илиев/

МИГ 23 ЕООД СОФИЯ

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