

HARMONY™ the optimum solution

for higher performance

At a time when we are all seeking to preserve our way of life, the production of equipment whilst ensuring safety and protecting the environment is our prime objective.

- Excellent classification according to standard HD 464 S1 (tests carried out in laboratory of KEMA Netherlands):

- **F₁ Fire behaviour.**

Harmony is non-flammable and self-extinguishing

- **C₂ Insensitive to thermal shocks.**

Harmony withstands to loads and overloads changes.

Dielectric tests and measurements of partial discharges ≤ 10 pC.

- **E₂ Insensitive to corrosive environments.**

Harmony resists to polluted environments and humidity.

- Well adaptation to disturbed electrical environments.
- Recycle of components.

General specifications

Three-phase cast-resin dry-type transformers 50/60 Hz, Insulation class F, cooled naturally by air AN, for continuous service.

Protection class IP00 for indoor installation. (Insulation outdoors, cooling AF, available on request).

- **LV winding**

LV winding generally consists of aluminium foils pre-impregnated with hot polymerised resin. If necessary, ventilation ducts can be added, consisting of a pre-formed stainless steel or aluminium element.

- **HV winding**

HV winding is of copper conductor generally and completely impregnated and cast under vacuum into moulds. Based on the strong woven glass reinforcement the thickness of the insulation laminate between air and winding could be reduced to minimum so cooling is very effective.

Standards

The HARMONY™ transformers are in accordance with standards:

- IEC 726 and IEC 76-1 to 76-5
- HD 464.S1+A2 and HD 538.1 S1
- NF C 52-726 and NF C 52-115
- VDE 0532 part 6
- DIN 42523
- ANSI C57.12.01

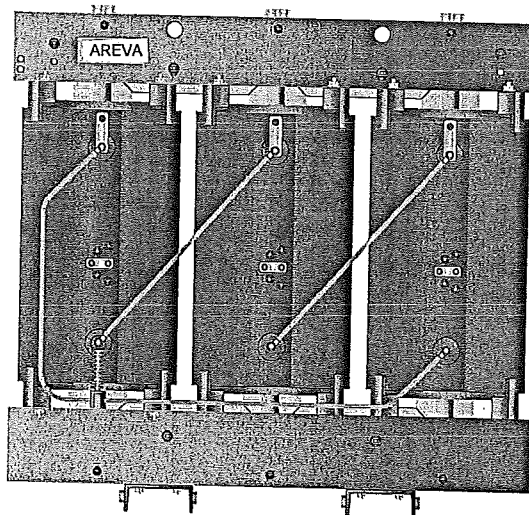


Figure -1

Electrical characteristics -Dimensions and weights

Rated power	Losses	High Voltage	Short-circuit Voltage	Type	No-load losses	Short-circuit losses		Sound power/sound pressure level 1 m distance	Weights	Dimensions			
S _N			U _z		P _o	P _k at 75°C at 120°C		L _{WA} /L _{PA}		a1	b2	h1	e
kVA		kV	%		W	W	W	dB(A)	kg	mm	mm	mm	mm
160	Normal	10	4	HAR 160-10N4	610	2350	2700	62/52	850	1130	660	1290	520
		20		HAR160-20N4	870	2200	2500	62/52	900	1320	660	1300	520
		10	6	HAR160-10N6	580	2350	2700	62/52	780	1130	660	1260	520
		20		HAR160-20N6	650	2350	2700	62/52	920	1320	660	1260	520
	Reduced	10	4	HAR160-10R4	440	2350	2700	54/44	900	1130	660	1290	520
		20		HAR160-20R4	580	2200	2500	54/44	1090	1320	660	1320	520
		10	6	HAR160-10R6	410	2500	2900	54/44/	800	1130	660	1260	520
		20		HAR160-20R6	480	2500	2900	54/44	970	1320	820	1290	520
250	Normal	10	4	HAR250-10N4	880	3050	3500	65/55	1000	1150	660	1310	520
		20		HAR250-20N4	1100	3000	3450	65/55	1150	1290	660	1340	520
		10	6	HAR250-10N6	780	3200	3700	65/55	1050	1270	660	1310	520
		20		HAR250-20N6	880	3300	3800	65/55	1120	1330	660	1330	520
	Reduced	10	4	HAR250-10R4	600	3050	3500	57/47	1080	1180	660	1320	520
		20		HAR250-20R4	800	3000	3450	57/47	1270	1330	660	1360	520
		10	6	HAR250-10R6	560	3300	3800	57/47	1060	1260	660	1310	520
		20		HAR250-20R6	650	3300	3800	57/47	1160	1330	660	1340	520
400	Normal	10	4	HAR400-10N4	1200	4250	4900	68/57	1380	1270	840	1520	670
		20		HAR400-20N4	1450	4250	4900	68/57	1580	1410	840	1560	670
		10	6	HAR400-10N6	1050	4600	5300	68/57	1390	1310	840	1520	670
		20		HAR400-20N6	1200	4800	5500	68/57	1460	1410	840	1520	670
	Reduced	10	4	HAR400-10R4	880	4250	4900	60/49	1410	1270	840	1520	670
		20		HAR400-20R4	1100	4250	4900	60/49	1580	1410	840	1560	670
		10	6	HAR400-10R6	820	4800	5500	60/49	1410	1310	840	1520	670
		20		HAR400-20R6	940	4800	5500	60/49	1460	1410	840	1520	670
630	Normal	10	4	HAR630-10N4	1500	6350	7300	70/58	2030	1450	840	1610	670
		20		HAR630-20N4	2000	6000	6900	70/58	2160	1590	895	1610	670
		10	6	HAR630-10N6	1400	6600	7600	70/58	1930	1540	840	1570	670
		20		HAR630-20N6	1650	6800	7800	70/58	2120	1690	840	1580	670
	Reduced	10	4	HAR630-10R4	1150	6350	7300	62/50	2050	1450	840	1610	670
		20		HAR630-20R4	1600	6000	6900	62/50	2180	1590	895	1620	670
		10	6	HAR630-10R6	1100	6800	7800	62/50	1930	1540	840	1570	670
		20		HAR630-20R6	1250	6800	7800	62/50	2170	1690	840	1590	670
800	Normal	10	4	HAR800-10N4	1900	7400	8500	72/60	2120	1450	840	1610	670
		20		HAR800-20N4	2400	7300	8400	72/60	2410	1590	840	1630	670
		10	6	HAR800-10N6	1700	7650	8800	72/60	2140	1590	840	1580	670
		20		HAR800-20N6	2000	8200	9400	72/60	2280	1690	840	1610	670
	Reduced	10	4	HAR800-10R4	1400	7500	8600	64/52	2120	1450	840	1610	670
		20		HAR800-20R4	1900	7150	8200	64/52	2410	1590	840	1630	670
		10	6	HAR800-10R6	1300	8200	9400	64/52	2140	1590	840	1580	670
		20		HAR800-20R6	1500	8200	9400	64/52	2280	1690	840	1610	670

Rated power	Losses	High Voltage	Short-circuit Voltage	Type	No-load losses	Short-circuit losses		Sound power/sound pressure level 1 m distance L_{WA}/L_{PA}	Weights	Dimensions			
S_N						P_k				a1	b2	h1	e
kVA		kV	%		W	W	W	dB(A)	kg	mm	mm	mm	mm
1000	Normal	10	4	HAR1000-10N4	2200	8700	10000	73/60	2660	1590	1020	1860	820
		20		HAR1000-20N4	2800	8350	9600	73/60	2930	1640	1020	1890	820
		10	6	HAR1000-10N6	2000	8700	10000	73/60	2610	1650	1020	1670	820
		20		HAR1000-20N6	2300	9550	11000	73/60	2790	1820	1020	1680	820
	Reduced	10	4	HAR1000-10R4	1650	8700	10000	65/52	2800	1590	1020	1880	820
		20		HAR1000-20R4	2400	8700	10000	65/52	2930	1640	1020	1890	820
		10	6	HAR1000-10R6	1500	8700	10000	65/52	2630	1650	1020	1680	820
		20		HAR1000-20R6	1800	9550	11000	65/52	2790	1820	1020	1680	820
1250	Normal	10	6	HAR1250-10N6	2300	10450	12000	75/62	3220	1720	1020	1880	820
		20		HAR1250-20N6	2700	11900	13700	75/62	3270	1860	1020	1890	820
	Reduced	10	6	HAR1250-10R6	1800	10000	11500	67/54	3220	1720	1020	1890	820
		20		HAR1250-20R6	2100	11300	13000	67/54	3380	1860	1020	1890	820
1600	Normal	10	6	HAR1600-10N6	2800	12250	14000	76/63	3620	1810	1020	1850	820
		20		HAR1600-20N6	3100	14000	16000	76/63	3910	1930	1020	2050	820
	Reduced	10	6	HAR1600-10R6	2100	12250	14000	68/54	3680	1810	1020	1860	820
		20		HAR1600-20R6	2400	14000	16000	68/54	3950	1930	1020	2050	820
2000	Normal	10	6	HAR2000-10N6	3500	14850	17000	79/65	4750	1960	1270	2320	1070
		20		HAR2000-20N6	4000	16500	19000	79/65	4870	2010	1270	2470	1070
	Reduced	10	6	HAR2000-10R6	3000	14850	17000	70/56	4750	1960	1270	2320	1070
		20		HAR2000-20R6	3500	16500	19000	70/56	4870	2010	1270	2470	1070
2500	Normal	10	6	HAR2500-10N6	4300	18350	21000	81/67	5120	1960	1270	2340	1070
		20		HAR2500-20N6	5000	20100	23000	81/67	5830	2110	1270	2520	1070
	Reduced	10	6	HAR2500-10R6	3400	18350	21000	71/57	5120	1960	1270	2340	1070
		20		HAR2500-20R6	3600	20100	23000	71/57	5830	2110	1270	2520	1070

The stated values as power, losses, short-circuit voltage (U_z) and sound level are valid for cooling type AN. For special constraints, it can be increased by 40% by adding forced ventilation (AF). Details available on request. The mentioned weights and dimensions are indicated for HV Um 12 kV or 24 kV and LV 400 V. For all other characteristics, these dimensions are not valid: details available on request.

Table -1

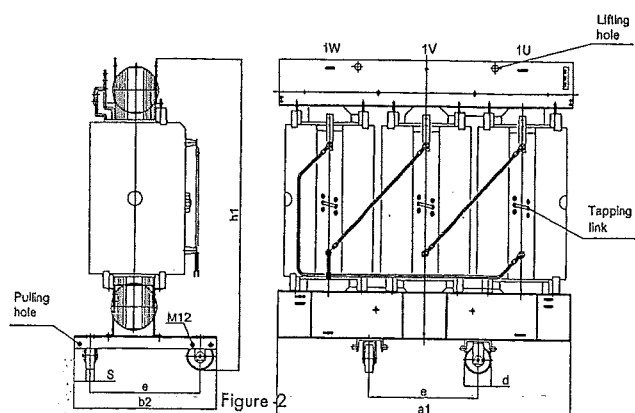


Figure 2

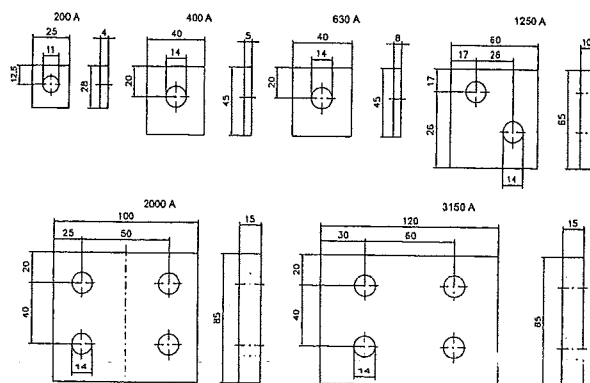


Figure -3

Wheel dimensions

Power (kVA)	ØD	S
160 ÷ 800	125	40
1000 ÷ 1600	160	50
2000 ÷ 2500	200	70

Layout and connection guide

The connections of HV and LV side are carried out as copper connectors, dimensions are according to current carrying capacity, see above.

Off-circuit tapings are situated on the HV side.

The safety distances dependent on voltages must be kept.

Check that the ventilation system of the premises fully dissipates all losses. For correct installation of transformers we refer to the relevant VDE-instructions, especially to VDE 0101 "Establish of electrical power plants with rated voltage over 1 kV and for the design of buildings with ventilation acc. to AG1 work sheet J11" of the working area for "Electro-technical plants" of Arbeitsgemeinschaft Industriebau e.V. (AG) 51143 Köln-Porz.

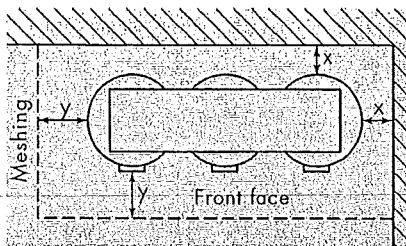


Figure - 4

Minimum distances to walls

Insulation	Solid walls (Rep.X)	Walls consisting of meshing (Rep.Y)
kV	mm	m m
7,2	90	300
12	120	300
17,5 or 24	220	300

At the installation the authority instructions for the accessible of the transformer cell must be followed.

Choice of HV and LV connections

6 possibilities are proposed.

Details on all other configurations available on request.

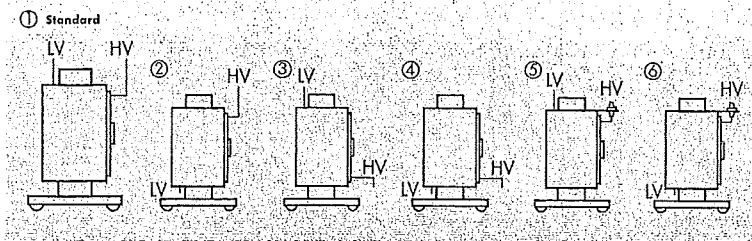


Figure 5 and 6 : HV connection by plug-in terminals.
Figure 5

Transformer with enclosure

At the indoor installation the minimum clearances to the walls of the room must be kept. There must be a safety accessibility to HV and LV connection side.

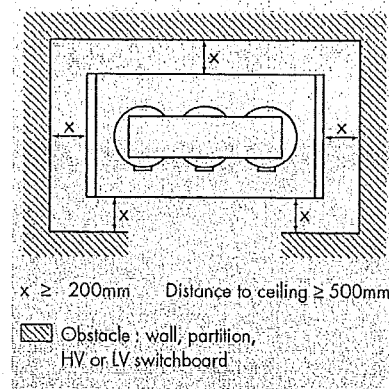


Figure 6

The supply and exhaust air rate of the room must be measured !

Equipment

Transformer-enclosure

Protection class:

Standard: IP 20, IP 21, IP 23

Higher protection classes on request

Enclosure with PELA-test on request

Material:

Standard: Sheet steel, anti corrosion treatment, top coat RAL 7032

Galvanised version, stainless steel, other colours on request

Design:

Standard:

HV-/LV – enclosure are screwed. Enclosure parts are packed one by one on to the pallet. Assembly is provided by the customer. The fixing is applied on to the bottom of the installation site.

HV-/LV – cable feed is from bottom through the cable ducts or double floor.

Option:

Enclosure and transformer can be supplied as a unit...

- Lifting after opening the cover *)
- Lifting by means of lifting lugs on the cover *)

HV-/LV- enclosures designed as doors. *)

Prodproof version

*) Prices on request

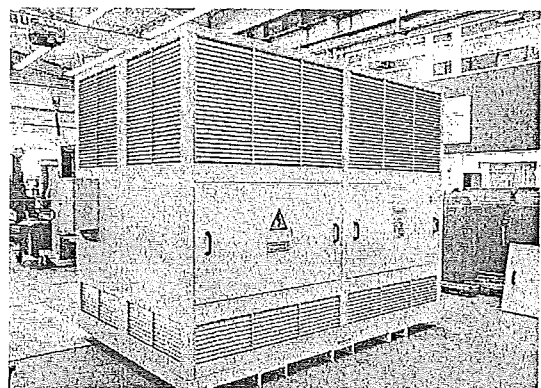
Standard equipment

- 3 HV connecting lugs at top of windings
- 4 LV connecting lugs at top of clamping steel
- Off-circuit voltage regulation tap changer links.
- 4 swivel rollers.
- 4 lifting lugs
- 2 earthing terminal, (at bottom on wheel type, arranged diagonal)
- 1 rating plate, (secured to end face, on the upper clamping steel)
- High-Voltage danger notices against touching of coils
- 2 PTC thermistor detectors per limb
Device Type: ZIEHL MSF 220 KAC/DC for alarm and tripping
(other device types on request)

Optional equipment

- 3 plug-in bushings with straight or elbow
- HV or (and) connecting lugs at bottom.

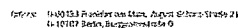
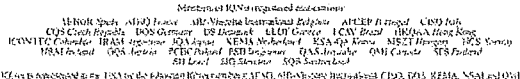
Example: Special enclosure (without wheels)



Scope of Service

Commissioning

For specific questions to problems, repair and service, please contact one of our sales offices close to you.



Standard type:

Each HARMONY Transformer is equipped on principle with a temperature protection system and is composed of **6 thermistors** (two per phase) and **one protection relay**. (see picture 1, picture 2)

In this system, for F insulation class transformers the settings are as following:

- **WARNING** = 130 °C
- **TRIPPING** = 150 °C

For H insulation class transformers the settings are as following:

- **WARNING** = 150 °C
- **TRIPPING** = 170 °C

(see wiring scheme 1).

The protection relay is placed in the switch panels or in a separate panel. The placing on the transformer is not allowed as the permissible ambient temperature of the relay is limited with max. 55 °C.

Technical specifications and dimensions of the protection relay and the thermistors are written down in page 4.

If the control voltage of the protection relay shall be provided from the **L.V. side** of the transformer which is to be protected, a protection relay that is equipped with a **time relay** is used. (see wiring scheme 2).The time relay ensures that when the transformer is put into operation (only for this moment) the switching signal is put into operation with a delay of 2 sec.

This system is an alternative to the above mentioned temperature control system .
It can be delivered at special wish and is due to extra pay.

Following items are optional :

- Different rated voltages of the protection relay (see p.4/4)
- Fan control system when additional ventilation with fans
- Temperature protection and fan control system with PT-100 temperature sensors and a temperature monitoring relay.
- Temperature protection and fan control system with thermocouple temperature sensors and a temperature monitoring relay.
- Monitoring of the temperature of coils or cores by using digital thermometer (with PT-100 sensor).
- Temperature protection control system with FOT (Fibre Optical Temperature rise switch; Luxmatic AG)
- Temperature protection system with the core temperature measurement using thermistors and a protection relay or using PT -100 temperature sensors and a temperature monitoring relay.

All rights of this document are reserved to AREVA. To duplicate and to pass over to third persons without previous permission is forbidden. This document is subject to change.

Prepared by:

ADH-E

S.DEMİRKAYA

İ. GÖKÇEN

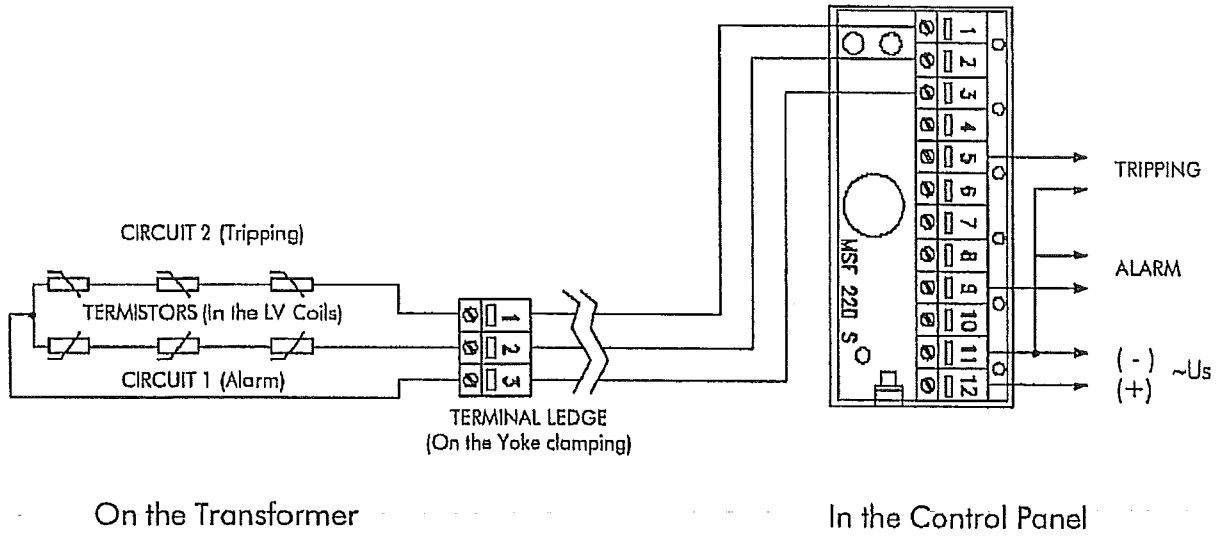
03/2005

AREVA

Diagram illustrating the thermistor assembly. The assembly consists of a cylindrical component labeled "LV COIL". A "Thermistor" is mounted on the top surface of the coil. The "LV Coil terminal" is also shown, connected to the coil.

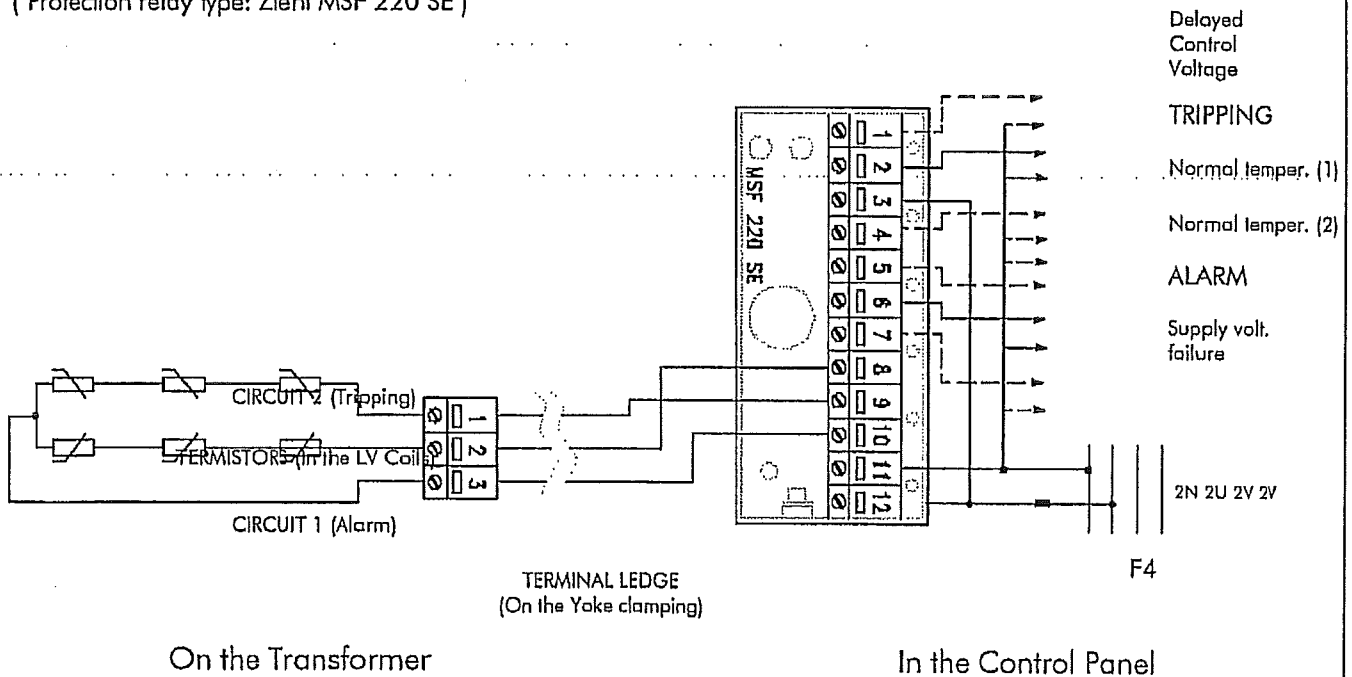
Wiring scheme 1:

Current supply of the protection relay from a separate network:
(Protection relay type: Ziehl MSF 220 S)



Wiring scheme 2:

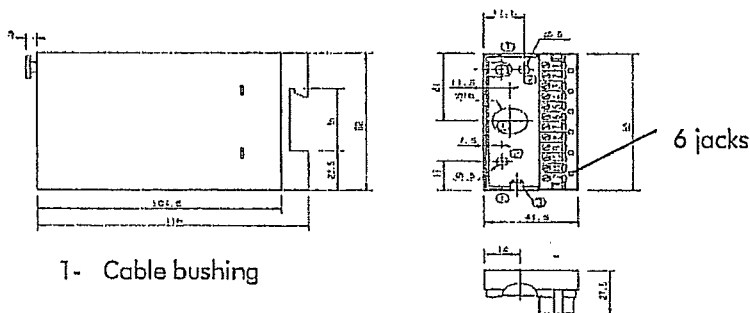
Current supply of the protection relay from the L.V. side of the transformer that is to be protected:
(Protection relay type: Ziehl MSF 220 SE)



Technical Specifications:

Protection relay:							
Type:		Ziehl MSF 220 S + MSF 220					
Rated Voltage	Uc:	24...220 V DC	110 V AC	220-240 V AC			
Frequency		----	50/60	50/60			
Operating			-15%...+10%	-10%...+10%			
Range							
Power consumption		< 5W	< 3 VA	< 3 VA			
Total resistance of the							
Thermistor sets		<= 1500 Ω					
Protection class		Enclosure : IP 30					
		Terminals : IP 20					
Placing		In MV- or LV- distribution panels (not at the transformer)					
Continuous operating current I _{th}		5A	5A	5A			
Rated operating current I _e		3A DC 13 24V		V			
Permissible ambient temperature		-20 °C...+15 °C					
Thermistors:							
Type		Ziehl K130 / K150 / K170					
Testing voltage		2500 V					
Response temperatures		130/150/170 °C					
Response tolerances:		Response tolerance of the protection System: \pm 5K					
Restarting temp.:		About 5K below of the response temperature					
When U_m > 1.1kV, a special temperature protection system is used							

Dimensional Drawing:



Goal: Information about installation, start up and maintenance of HARMONY-cast resin transformers.

Valid for: ADH-E , ADH-E2 , ADH-I , ADH-L , ADH-AS.

Method: These operating instructions are prepared in 3 languages (Turkish, German, and English).
The numbers of the cards are given below:

Language	Drawing no.	Code no.
Turkish	E 5802 082-R1	417575
German	E 5802 082-R2	416717
English	E 5802 082-R3	417576

- Its code number, which language is mentioned in the order, will be written into the order of transformer production and data sheet, as an additional data.

- This operating instruction, which is classified as supply, will be ordered according to the minimum stock amount.

- This operating instruction is put before transport on the transformer.

Note : The content of the operating instructions are given on the pages 2/3 and 3/3.

Responsibility: ADH-T, ADH-T1, ADH-T2, ADH-I, ADH-I4, ADH-AS.

Bu dökümanın her hakkı AREVA'ya ait olup, saklıdır. Önceden izin alınmadan çoğaltılması ve üçüncü kişilere açık tutulması yasaktır. Bu döküman değişikliğe tabidir..										
Hazırlayan Bölüm: ADH-T	Haz.: S.DEMIRKAYA				Kont.: I.GÖKÇEN					
ATT 959/A	07.96	09.96	04.96	09.98	10.98	10.99	02/01	09/02	12/03	03/04

Operating Instructions



Installation, start up and maintenance recommendation of HARMONY-cast resin transformers

1. After Transport, Before Installation

- 1.1) If any transportation damages are found, it shall be reported to the Transportation Company, AREVA factory or AREVA agent locally.
- 1.2) The transformer shall be lifted and carried by the lifting lugs.
- 1.3) During loading and/or unloading of the transformer by crane, swaying movements should be avoided. As knocks against walls or other objects may cause damage to the HV-windings or may cause damage to spacers.
- 1.4) The rollers shall be fitted.
- 1.5) The transformer shall be pulled from the pulling eyes on the lower frame. It shall not be moved by pushing on to the coils in any case!
- 1.6) The off-loading has to be done carefully.
- 1.7) Dust which accumulates on transformer during transport or storage should be cleaned by using compressed air.
- 1.8) The storehouse shall be a covered place, which shall not be cooler than -25°C. Transformers in storage must be protected from the direct sunlight and condensation water.

2. Installation

- 2.1) The transformer room must be dry and clean, the flowing of the water must be prevented.
- 2.2) Adequate ventilation is to be provided for heat dissipation.
- 2.3) For indoor installation care must be taken to place transformers at a distance from the wall in keeping with insulation level mentioned in the rating plate as well as the requirements stipulated in standards.
- 2.4) The spacing of the HV cables should be according to standards.
- 2.5) If the LV terminal is aluminium, The necessary precautions will be taken for the copper cable or copper bus bar connection.
- 2.6) The connection cables for transformer auxiliary shall be fixed rigidly to cable channels adequately isolated from active parts as per the requirements of standards.
- 2.7) Check all the screws on HV coils and on LV connections, if necessary tighten according to the following table.
- 2.8) The requirements of the local authority have to be complied with in addition to the instructions given here.

- Max. Torsional moment of bolts for HV-tapping's in the HV-winding:

M8: 12 Nm	M10: 19 Nm	M12: 32 Nm	M16: 81 Nm
-----------	------------	------------	------------

- Max. Torsional moment of HV and LV-copper connections of bus-bars and cables:

M8: 20 Nm	M10: 43 Nm	M12: 72 Nm	M16: 175 Nm
-----------	------------	------------	-------------

3. Start up *)



- 3.1) Check the transformer data given in the rating plate.
 3.2) Control the earthing of the transformer on the upper frame.
 3.3) Check the phase connections.
 3.4) Bolts for the tapping's and HV terminations have to be checked to comply with torsional moment requirements.
 3.5) The cleanness of the HARMONY – transformer can be checked by using a 2500 V megger, to check insulation resistance of HV/earth, LV/earth and HV/LV.
 The approximate values of resistances are:

HV/Earth > 2000 MΩ	LV/Earth > 2000 MΩ	HV/LV > 2000 MΩ
--------------------	--------------------	-----------------

- 3.6) All metal parts, cable remains or tools must be removed prior to switching on the transformer.
 3.7) Tap changing can be proceeded as below:
 - The transformer is off-circuit.
 - Move up the tapping link.
 - Choose the appropriate position number for the end work regulation referring to the rating plate.
 - Mount the tapping link acc. to the position plate, which is located right down the rating plate.
 (Look for the max. torsional moment)
 3.8) Check the function of temperature protection system.
 3.9) **Attention!!!** Avoid any contact with HARMONY-cast resin transformer during services.

Should there be any uncertainties, please contact AREVA factory or AREVA agent locally.

4. Maintenance recommendation *)

- 4.1) In principle HARMONY-cast resin transformers are maintenance free if the cooling air is not prevented from circulating around the HARMONY transformers fitted with enclosure.
 Once in a time, visual inspection (Please respect the electrically safety distances), depending on the environmental conditions, without disconnecting the transformer should be made. Should maintenance be needed on customer wishes, please proceed as follows:
 4.2) Prior to starting maintenance work, the transformer should be de-energised.
 4.3) All terminations should be earthed and short-circuited.
 4.4) Under normal working and environmental conditions checking of firmness of terminations and tapping links and cleaning of transformer with dry compressed air or nitrogen once a year is necessary. The frequency of cleaning depends on the pollution of environment.
 4.5) Check the painting of iron parts, and if necessary touch up.
 4.6) Check the torque moments for earthing, tap charging screws and for HV-connections.
 (Look for the max. Torsional moment)
 4.7) Check the function of temperature protection system.

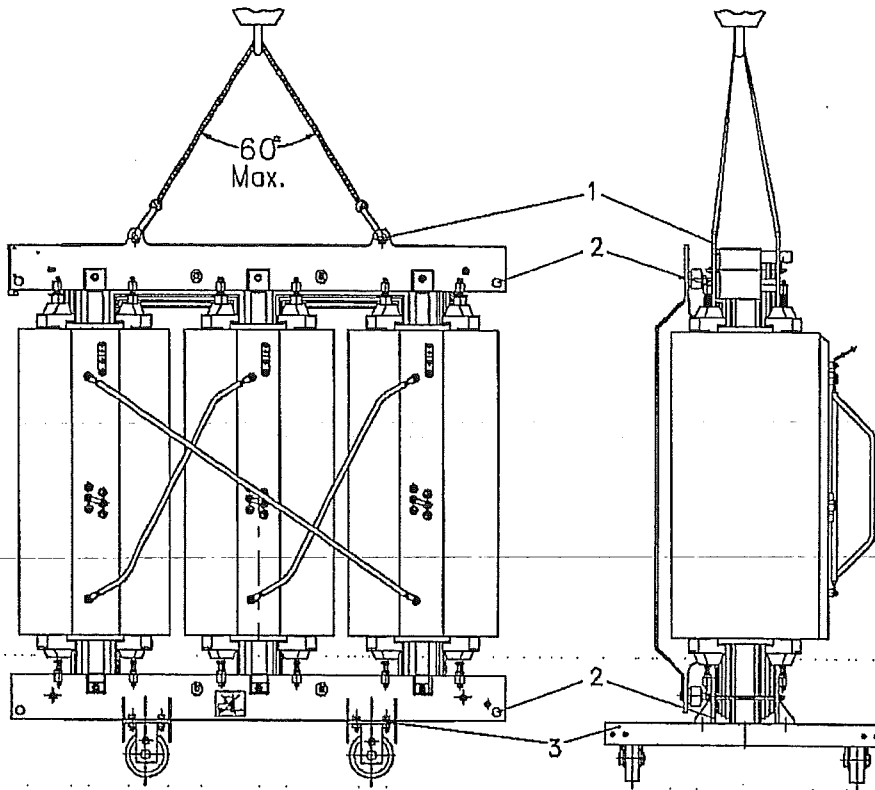
***) Transformer installation and start up shall only be done by competent technical staff.**

Attention!!!! This operation instruction should be displayed at a convenient position in the storage depot.

AREVA T&D Enerji End. A.S. Baris Mah. E5 altı, 1801. Sk. No:104, 41410
 Gebze-Kocaeli/Turkey Tel: +90 (262) 648 33 00, Fax: +90 (262) 642 19 86

The HARMONY cast resin transformer is an electrical component, therefore it is important to transport and to handle it according to the following instructions.

The HARMONY transformer has lifting lugs (1), pulling lugs (2) and lashing lugs (3).



The HARMONY transformers should always be lifted at the lifting lugs (1) provided for this purpose or at the sub-frame, when offloading and moving them into position. If a transformer is being moved on its wheels do not push or pull on the coils, use the lugs provided on the sub-frame (3) or the clamping beams (2).

The packing of the transformer shall be opened in a covered area.

If any transportation damages are found, it shall be reported to the Transportation Company, AREVA factory or AREVA agent locally.

During loading and/or unloading of the transformer by crane, swaying movements should be avoided. As knocks against walls or other objects may cause damage to the HV-windings or may cause damage to spacers.

All rights of this document are reserved to AREVA. To duplicate and to pass over to third persons without previous permission is forbidden. This document is subject to change.

Departmant: ADH-E

S. DEMIRKAYA

I. GÖKÇEN

The rollers shall be fitted.

The off-loading has to be done carefully.

Wooden spacers between the upper yoke and the coils must be removed before starting up of the transformer.

Wood shavings and dust, which accumulates on transformer, should be cleaned by using compressed air.

If the transformer is not to be installed immediately, it must be stored in a covered area protected from direct sunlight and condensation water. The temperature at the place of storage must not fall under -25°C (unless agreed otherwise). It will not be necessary to dry out the windings before the transformer is set to work.

During transport and storage of the transformer it is important to take care that no inadmissible impacts and vibrations affect the transformer.

The limit (acceleration due to gravity $g = 9.81 \text{ m/s}^2$) during the normal transport conditions are according the following table.

Transport type	Acceleration			Oscillation Frequency Hz
	Vertical	Horizontal		
		Lengthwise	In width	
Train	0.3g	0.5g	0.4g	2-16
Truck	0.5g	0.3g	0.6g	2-32
Ship	0.5g	-	0.3g	-

These values are admissible acceleration values for the HARMONY cast resin transformers.

As seen in the above table, acceleration values are not much different from each other at the following normal transport conditions

- * Normal highway conditions and appropriate speed for highway traffic rules (over-speed can cause up to 1.2g acceleration values)

Worse transport conditions (bad highways, climatic effects, etc.) require special design.

N2612 0059

Page: 1/1

**Painting instruction for Cast Resin Dry
Type Transformers (Steel Parts)
Type: N****Type N:** Painting Method For Normal Environmental Conditions.**Painting method:** Carried out with flood, spray, paint or roller.**1. Surface preparation**

The surfaces are prepared according to DIN EN ISO 12944, Part 4. They are blasted with steel granulate in a degree of Sa 2 ½ standard-cleanness .

2. Surface coating

Sharp edges and sides Paint based on Epoxy, with two components, drying in open air

Carried out paints Alternative 1-DYO : High Build Epoxy 537-7652
Alternative 2-AKZO : Kemipox Enamel BS 02-B-001

Primer coat Paint based on phosphate with Epoxy-Resin, two components, drying in open air.
Dry film thickness = **100 µm**

Carried out paints Alternative 1-DYO : 537-1667 Epoxy primer
Alternative 2-AKZO : BA 11-B836 Epoxy primer

Finishing coat Paint based on Acryl or Polyurethan with Miox and two components, drying in open air.
Dry film thickness = **45 µm**

Carried out paints Alternative 1-DYO : 113-7698 Sadokril Enamel
Alternative 2-AKZO : BS-14-MX Finishing coat with Miox

Total dry film thickness = 145 µm

Colour RAL 7032 (for steel parts mounted to the Enclosure)
RAL 3020 (for steel parts of the Transformer)

All rights of this document are reserved to AREVA. To duplicate and to pass over to third persons without previous permission is forbidden. This document is subject to change.

Prepared by: ADH-E

S. DEMİRKAYA

İ. GÖKÇEN

AREVA/GEBZE 981

05/00

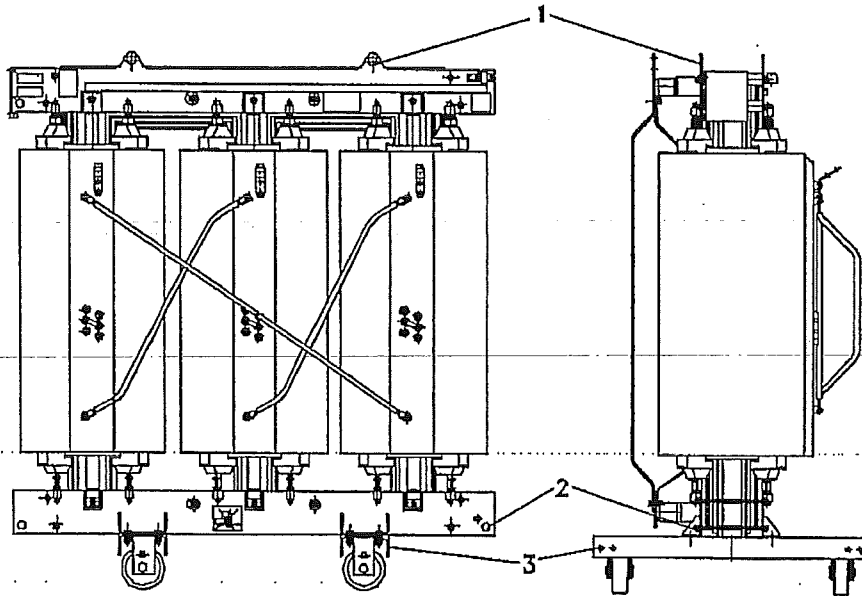
08/04

02/05

The HARMONY cast resin transformer is an electrical component, therefore it is important to transport and handle it according to the suggested instructions.

I . General principles for transport and storage

- The HARMONY transformer has lifting lugs (1), pulling lugs (2) and lashing lugs (3).



- The HARMONY transformers should always be lifted at the lifting lugs (1) provided for this purpose, when offloading and moving them into position.
- If a transformer is being moved on its wheels do not push or pull on the coils, use the lugs provided on the sub-frame (3) or the clamping beams (2).
- Transformer shall not be moved by pushing or pulling against the coils.
- The packing of the transformer shall be opened in a covered area.
- If any transportation damages are found, it shall be reported to the Transportation Company, AREVA factory or AREVA agent locally.

All rights of this document are reserved to AREVA. To duplicate and to pass over to third persons without previous permission is prohibited. This document is subject to change.

Prepared Dept. : ADH-E

S. DEMİRKAYA

I. GÖKÇEN

ATT 959/A

12/99

03/05

- Dust, which accumulates on the transformer during transport and storage should be cleaned by using compressed dry air.
- If the transformer is not to be installed immediately, it must be stored in a covered area protected from direct sunlight and condensation water. The temperature at the place of storage must not fall under -25°C (unless agreed otherwise).
- It will not be necessary to dry out the windings before the transformer is set to work.
- During transport and storage of the transformer it is important to take care that no inadmissible impacts and vibrations affect the transformer.
- The limit (acceleration due to gravity $g = 9.81 \text{ m/s}^2$) during the normal transport conditions are according the following table.

Transport type	Acceleration			Oscillation Frequency Hz
	Vertical	Horizontal		
		Lengthwise	In width	
Train	0.3g	0.5g	0.4g	2-16
Truck	0.5g	0.3g	0.6g	2-32
Ship	0.5g	-	0.3g	-

These values are admissible acceleration values for the HARMONY cast resin transformers.

- As seen in the above table, acceleration values are not much different from each other at the normal transport conditions.
- Normal highway conditions and appropriate speed for highway traffic rules have to be obeyed. (over-speed can cause up to 1.2g acceleration values)
- Worse transport conditions (bad highways, climatic effects, etc.) require special design.

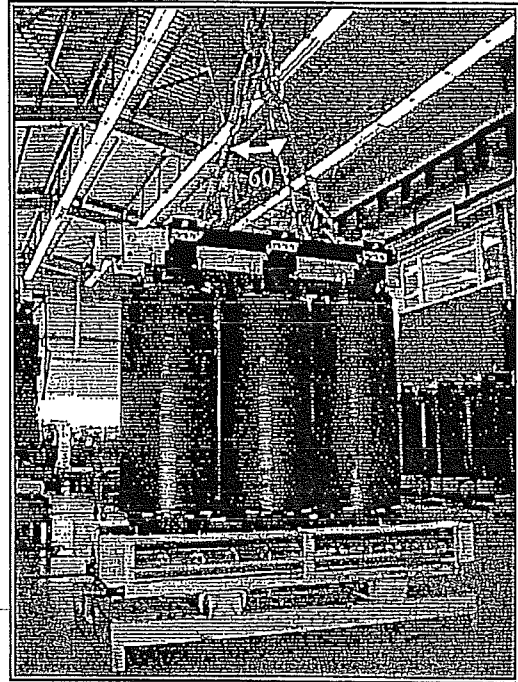
II . After transport unloading and storage.

1. STORAGE

1.1. OFF-LOADING

1.1.1. With crane or mobile crane

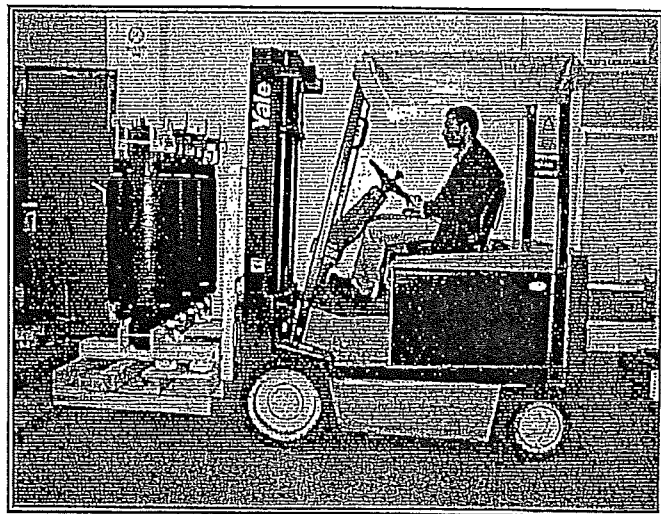
- In every situation, the transformer has to be lifted by the using the lifting lugs on upper yoke clamping.
- The angle between lifting cables can not be greater than 60° .
- The off-loading to the ground has to be done carefully.
- During loading and unloading of the transformer by crane, swaying movements should be avoided. As knocks against walls or other objects may cause damage to the HV-windings or may cause damage to spacers.



1.1.2. With fork-lift

(Using of forklift, only when crane is not available)

- This method can only be used when transformer is mounted on wooden palette.
- Fork-Lift's forks has to placed under the wooden palette.
- Lifting has to be done slowly.
- Transformer has to stand vertically on the forklift's forks (Do not move the transformer with forward or backward slope).
- The off-loading to the ground has to be done carefully.



1.2. CARRYING

1.2.1. With crane or mobile crane

See section 1.1.1

1.2.2. With Fork-lift

See section 1.1.2

1.3. STACKING

1.3.1. With crane or mobile crane

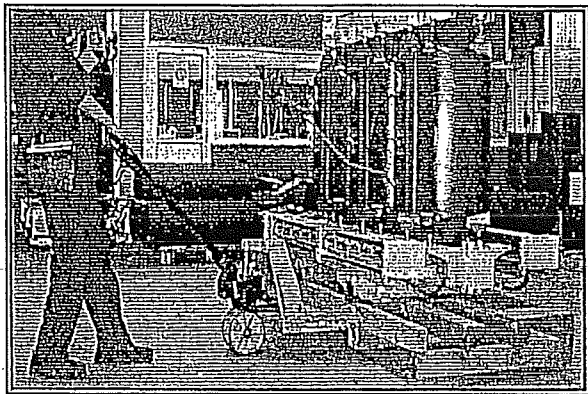
See section 1.1.1

1.3.2. With Fork-lift

See section 1.1.2

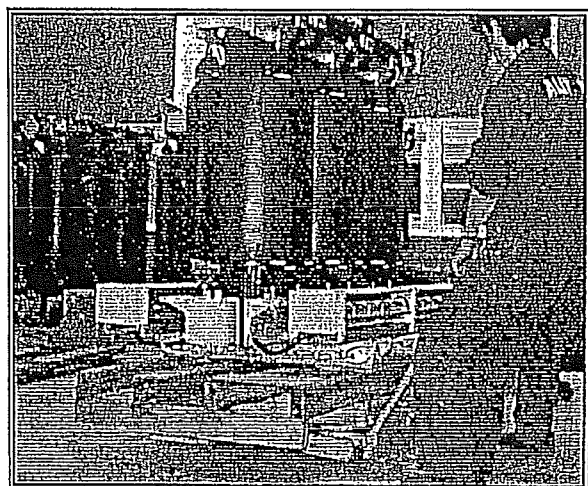
1.3.3. With trans-palette

- This method can only be used when transformer is mounted on wooden palette.
- Generally usage for transformers of small sizes (Weight \approx 1 ton).
- Do not use a trans-palette on slopes or any other non-horizontal grounds.



Note :

Trans-palette with copped wheel can be used for transformers up to \approx 5 ton.



2. MOVING FROM STORAGE

2.1. LOADING

2.1.1. With crane or mobile crane

See section 1.1.1

2.1.2. With Fork-lift

See section 1.1.2

2.2. CARRYING

2.2.1. With crane or mobile crane

See section 1.1.1

2.2.2. With Fork-lift

See section 1.1.2

III . Placing and mounting

1. UNLOADING

1.1 With crane or mobile crane

See section 1.1.1

1.2 With Fork-lift

See section 1.1.2

2. CARRYING TO MOUNTING PLACE

2.1 With crane or mobile crane

See section 1.1.1

2.2 With Fork-lift

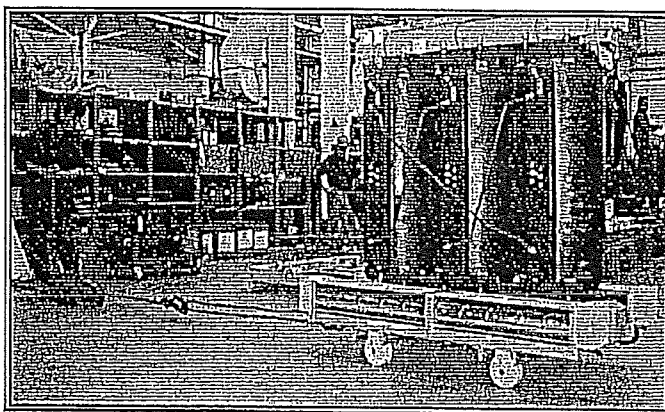
See section 1.1.2

2.3. With trans-palette

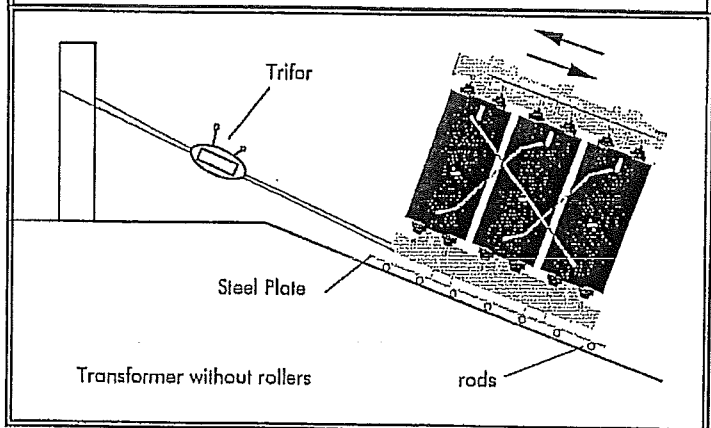
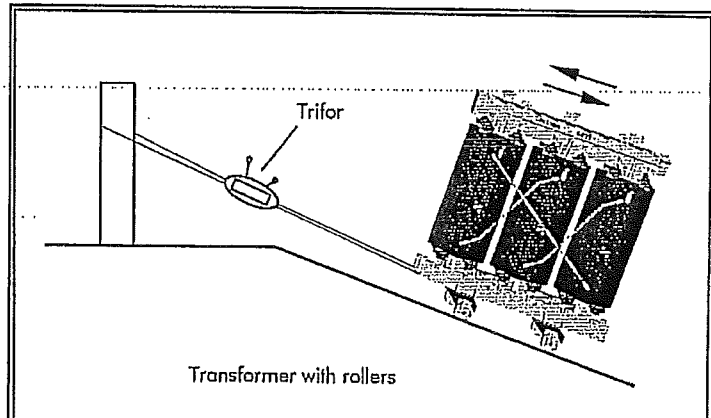
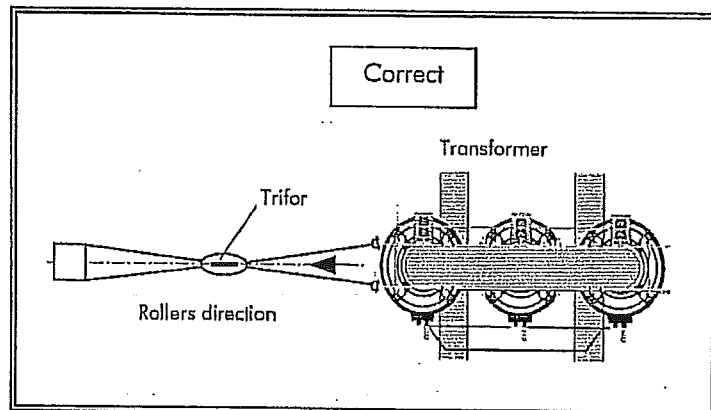
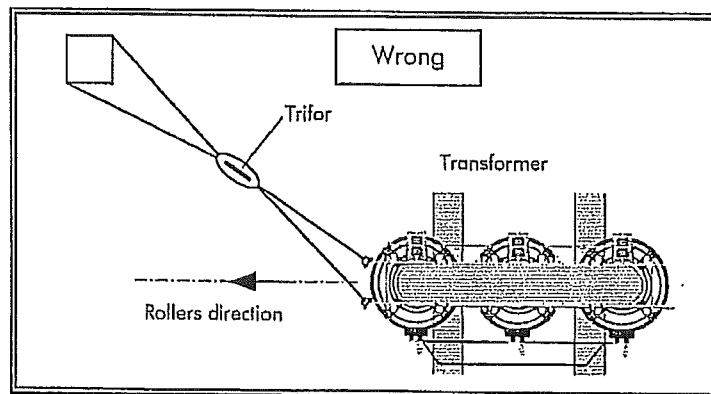
See section 1.3.3

2.4. Pulling with Trifor

- This method can be used safely for transformer with mounted wheels.
- Pulling of the transformer can only be done in the rolling direction of the wheel.
- Steel rope of Trifor must be connected to a stable and reliable point.



- The other steel rope of the Trifor must be connected to the pulling lugs of the bottom yoke clamping ($\phi 30$ hole) or connected to the lashing lugs of the wheelbase ($\phi 30$ hole).
- Pulling of the steel rope should only be done in horizontal direction, without any angle (If not done correctly, transformer can fall or wheel cage can be broken).
- When the ground is not smooth, flat iron strips of ≈ 250 mm width, ≈ 2.5 meter length and ≈ 5 mm thickness are put under each of the rolling direction of the wheels.
- On slopes or any other non-horizontal grounds (upward or downward) steel rope of Trifor must be connected to a stabile and reliable point on upperside. Transformer must be pulled upward or released downward slowly and carefully.
- If transformer is without wheels; Depending on the size of the transformer, transformer can be moved on slopes with appropriate rods (diameter: 20 – 30 mm and length ≈ 1 metre) and appropriate steel plates ($\approx 100 \times 200$ cm, thickness ≈ 10 mm, by means of Trifor. This method can also be used on horizontal surfaces.

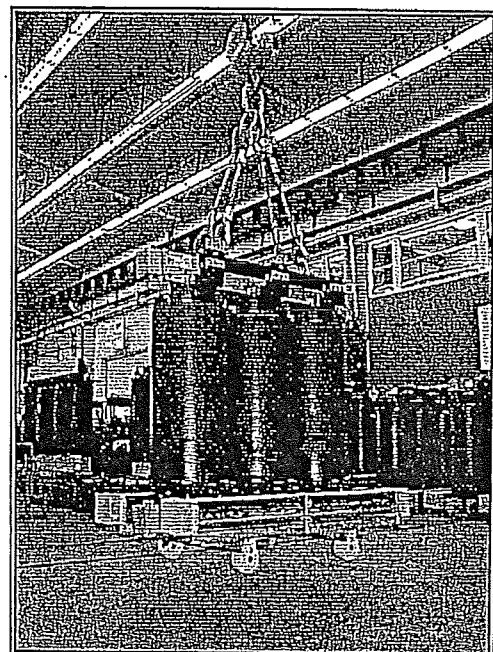
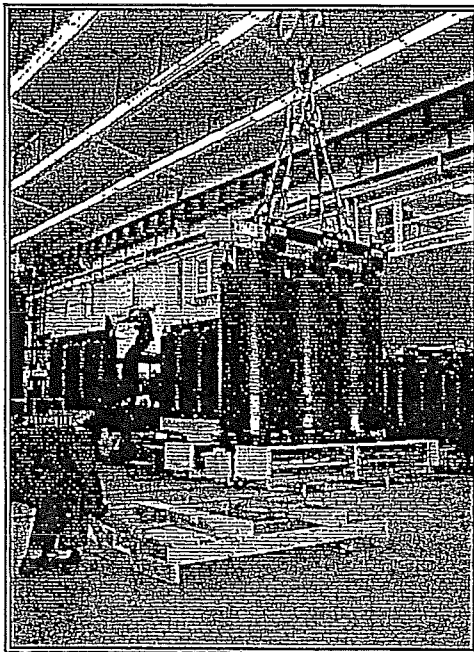
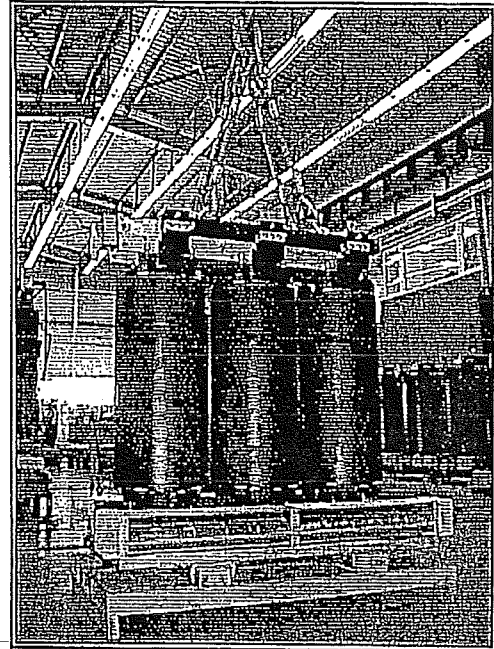


3. MOUNTING

3.1. WHEEL MOUNTING

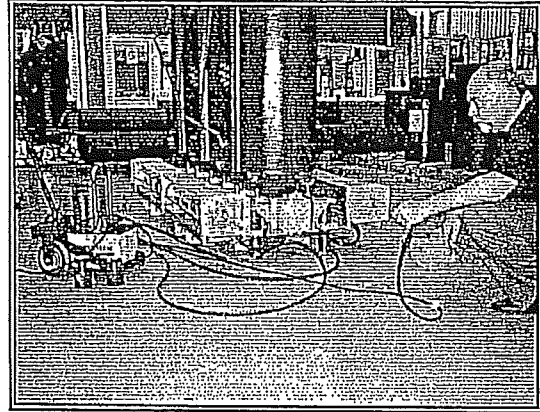
3.1.1 By lifting with crane

- Transformer is lifted approx. 250 mm, by using the lifting lugs on the upper yoke clamping.
- Take off the wooden palette by demounting the bolts.
- Wheels are mounted to the wheelbase profiles. Direction of all wheels must be same.
- Off-loading to the ground has to be done carefully.
- Transformer is ready for pulling to any desired directions.



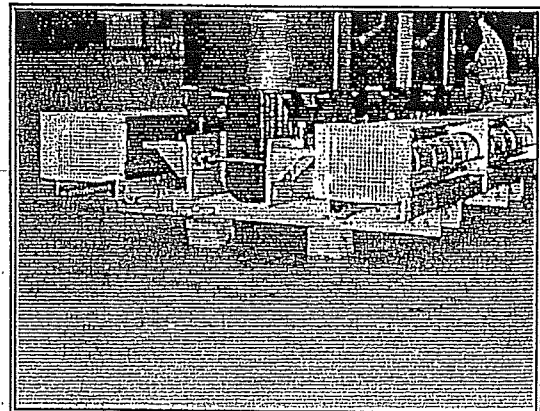
3.1.2. By lifting with jack

- Put the jacks under the jacking pads at the left or right side of the transformer (Jacking capacity can be 2 or 3 ton). Wooden palette can be cut for accessing the jacking pads.

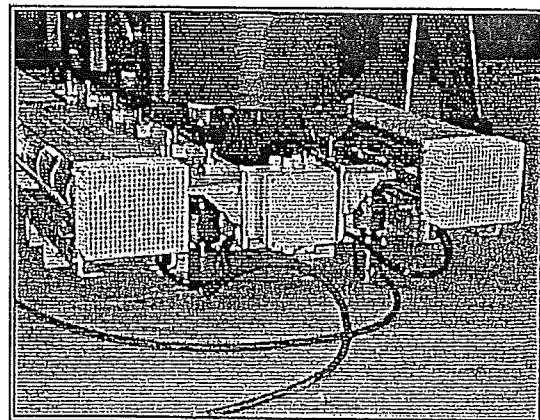


- Lift one side of the transformer 80 – 100 mm, by using two jacks

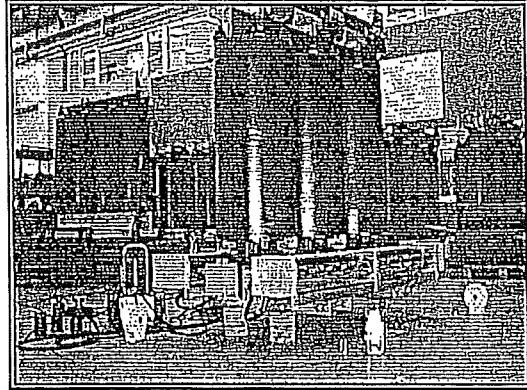
Note: Make sure that the yoke clamping and/or fan don't touch the ground or wooden palette on the opposite side of jacking. If they touch the wooden palette, cut that part of the palette.



- Remove the wooden parts of the palette under the U-profile of the wheelbase.
- Mount the wheels (in required direction). Principle, wheels are mounted in the long side direction.
- For fixing the transformer, put wooden spacers next to the mounted wheels before mounting the other wheels on the other side.
- Lower the jacks.

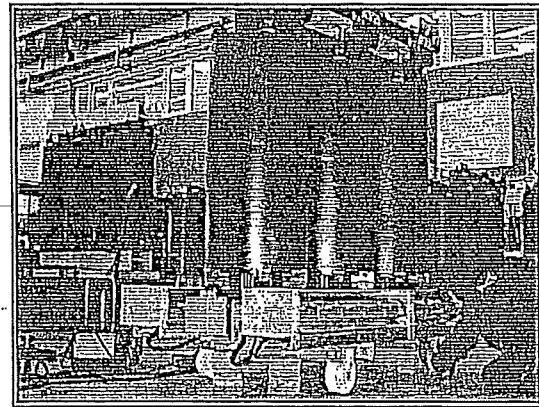


- Put the jacks at the other side of the transformer, and mount the wheels according to previous steps.

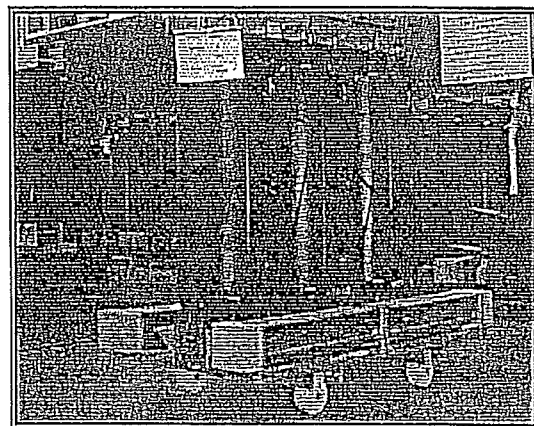


- Lower the jacks. This side of the transformer shall stand on wheels now.

- Put the jacks again under the side, where you mounted the wheels first. Remove the fixed wooden spacers and any remaining parts of wooden palette.



- Lower the jacks, now transformer will stand on all four wheels. Transformer is ready for moving by means of Trifor or any other similar method.



3.2. TRANSFORMER MOUNTING

- Transformer mounting will be done according to operating instruction, and additional card information on transformer.