Customer: **AIR LIQUIDE.**
57, Ave Carnot - B.P. 313
94503 Champigny Cedex
FRANCE

Contractor: **AREVA ENERGIETECHNIK, Gmbh.**
Königsbrücker Straβe 124
010 99 Dresden
GERMANY

Designer: **VUJE, a.s., divízia 1200**
Okružná 5
918 64 Trnava
SLOVAKIA

Name of building

ASU No.9 -USS Košice/SK

Realization project
Electricparts

Documentation:	Index:
PART F – TRANSFORMER 110/6,3KV	A5
	Annex No. 02

Designed:	Approved:	Date:	Sheets
Ing.Vladimír Kuchta	Ing.Vladimír Kuchta	08/2005	8

TECHNICAL REPORT

2

Content of the Technical report:

Content:

1. Subject and scope of the Project 3
1.1 Subject of the Project 3
1.2 Scope of the Project 3
1.3 The Project doesn't deal with 3
2. List of used Abbreviations 3
3. Regulations and Standards 3
4. Basic operating data 4
4.1 Description of an electric devise according to a health hazard margin 4
4.2 Distribution systems 4
4.3 Protection against electric shock injury 4
4.3.1. Protection during a regular operation (living parts): 4
4.3.2. Protection in case of a failure (non-living parts): 4
4.4. Grade of electric power supply signification 4
4.5. Methods of electric power supply 5
4.6. Short-circuit data 5
4.7. Grounding 5
4.8. Specification of types of surroundings 6
4.9. Protection against overloading and short-circuit 6
4.10. Metrology analyse 6
4.11. Safety and protection of health at work 6
5. Technical description 7

1. Subject and scope of the Project

1.1 Subject of the Project

Subject of the Project is a site of the transformers T1, T2 with output of 40MVA in building .

1.2 Scope of the Project

The project's scope is an assembly of two transformers T1, T2 at a transformers site. The scope of the Project involves a connection of supply for cooling cables, including cabling of auxiliary circuits and their laying to target devices for switching off, alarm signalling and failure signalling. The scope of the project involves also a delivery and installation of cumulative transformers for frame protection of transformers. To this section also belongs a part from the grounding line at surface to the grounding network in the earth. This part involves the supporting structures for laying of cables for supply of transformers for compensation of grounding currents.

1.3 The Project doesn't deal with

The project doesn't deal with 110kV cable terminals and cables and theirs supporting structures (chairs). The project also doesn't deal with 6kV cable lines from the transformers to the 6kV distributor including band lines on insulators and supporting construction (chairs) of these lines. It also doesn't deal with an external grounding network.

2. List of used Abbreviations

RIS	Controlling information system
STN	The Slovak technical standard
T01	External switch room 110 kV
T02	Internal switch room 110 kV
T1	Transformer 110/6,3 kV, 40 MVA, Siemens-Končar
T2	Transformer 110/6,3 kV, 40 MVA Siemens-Končar

3. Regulations and Standards

The project documentation is processed according to regulations and STN standards in force at time of an elaboration of this realization project.

Particularly the following standards:

STN 33 3210	Distributing devises
STN 33 3220	Common provisions for electric stations
STN 33 2000-4-41	Electric systems of buildings Section 4: Safety assurance Chapter 41: Protection against electric shock injury
STN 33 2000-5-54	Electric systems of buildings Section 5: Selection and erection of electric devises Chapter 54: Grounding systems and protective systems.
STN 33 3240	Site of transformers.

STN 33 2000-3 Electric systems of buildings
Section 3: Assignment of basic features.

4. Basic operating data

4.1 Description of an electric devise according to a health hazard margin

The designed electric devises are according to the Reg. No.718/2002 Coll. MPSVaR SR, art. III., technical electric devices group A, section b) technical devises for transformation of electric power with input above 250kVA.

In terms of this Reg. §11, this devise is subject to the official testing.

4.2 Distribution systems

a) 3~50Hz 110 000 V/TT (the transformers´ input voltage)
b) 3~50Hz 6 300 V/IT (the transformers´ output voltage)
c) 3/PEN~400/231V 50Hz/TN-C (the supply voltage of motor drives of the transformers´ cooling systems)
d) 2 = DC 220 V/IT (voltage of the control coils of the cooling contactors)
e) 2 = DC 48 V/IT (voltage of the failure signalling)

4.3 Protection against electric shock injury

4.3.1. Protection during a regular operation (living parts):

- it is given by a constructional execution and set-up of living parts of the electrical device.

According to STN 33 2000-4-41 standard, the following protective measures solves the protection:

a) Positioning out of hand – the National enclosure NC.2.3
b) Positioning out of hand – the National enclosure NC.2.3
c) Isolation of living parts art. 412.1, by restrains and covers art. 412.2
d) Isolation of living parts art. 412.1, by restrains and covers art. 412.2
e) By low voltage PELV art. 411.1

4.3.2. Protection in case of a failure (non-living parts):

a) Automatic power supply switch-off in the network TT according to art. 413 and the National enclosure NC.3.2
   - An overall cross-section of a protective system must be 240mm^2
b) Automatic power supply switch-off in the network IT according to art. 413.1, 413.1.2, 413.1.5 and the National enclosure NC.3.3
c) Automatic power supply switch-off in the network TN according to art. 413.1, 413.1.2,
d) Automatic power supply switch-off in the network IT according to art.413.1.3
e) By low voltage PELV art. 411.1

4.4. Grade of electric power supply signification

Signification of electric power supply has a grade No.1

4.5. Methods of electric power supply

The field of outlet No.15 110kV of the switch room T02 serves for the power supply of transformer T2 with output 40MVA and a ratio 110/6,3 kV and the field of outlet No.21 110kV serves for the switch room T01 of the transformer T1.

4.6. Short-circuit data

Whereas the 110 kV switch rooms are existing, the data is taken from a project EZ-ELEKTROSYSTÉMY Bratislava, the field No.6 to be equiped following:

T02		T01
I_{ks}	= 17,8 kA	I_{th} = 18,4 kA
I_{km}	= 37,3 kA	I_{dyn} = 46 kA

T01 of network 6,3kV

parameters of transformer : S = 40 MVA nominal output

$u_k = 10,7\%$

short-circuit of transformer $Z_T = u_k/100 \times U_n^2/S = 10,7/100*(6,3*10^3)^2/40*10^6$

$\mathbf{Z_T = 0,106\ \Omega}$

short-circuit of network 110kV $Z_S = (c*U_{n1}/\sqrt{3}*I_{ks})*(U_{n2}/U_{n1})^2 =$

$Z_S = (1,1*110*10^3/\sqrt{3}*17,8*10^3)*(6,3*10^3/110*10^3)^2$

$\mathbf{Z_S = 0,013\ \Omega}$

consequential short-circuit impedance $Z_V = Z_T + Z_S = 0,106 + 0,013 =$

$\mathbf{Z_V = 0,119\ \Omega}$

Initial signification grade of electrical energy supply

$I_{ks} = c*U_{n2}/\sqrt{3}*Z_V = 1,05*6,3*10^3/\sqrt{3}*0,119$

$\mathbf{I_{ks} = 32,1\ kA}$

T02 of network 6,3kV

Parameters transformer : S = 40 MVA nominal output

$u_k = 10,7\%$

short-circuit of transformer $Z_T = u_k/100 \times U_n^2/S = 10,7/100*(6,3*10^3)^2/40*10^6$

$\mathbf{Z_T = 0,106\ \Omega}$

short-circuit of network 110kV $Z_S = (c*U_{n1}/\sqrt{3}*I_{ks})*(U_{n2}/U_{n1})^2 =$

$Z_S = (1,1*110*10^3/\sqrt{3}*18,4*10^3)*(6,3*10^3/110*10^3)^2$

$\mathbf{Z_S = 0,012\ \Omega}$

consequential short-circuit impedance $Z_V = Z_T + Z_S = 0,106 + 0,012 =$

$\mathbf{Z_V = 0,118\ \Omega}$

Initial signification grade of electrical energy supply

$I_{ks} = c*U_{n2}/\sqrt{3}*Z_V = 1,05*6,3*10^3/\sqrt{3}*0,118$

$\mathbf{I_{ks} = 32,4\ kA}$

4.7. Grounding

On the major grounding network, which is not a subject of this project, will be by the independent drop-ins connected following:

a) Neutrals of the transformers 110 kV, a drop-in will be placed separately by a connecting line on the supports 22 kV to a collecting hole in the earth in front of the T1, T2.

b) Containers of the transformers through the additive current transformers.
c) Structures and coverings of 110 kV cables.
d) Structures and gratings of 6kV cables.

Outer grounding network must fulfil the requirements, that a contact voltage and stepping voltage mustn't be higher than 125V, or 125V/√t according to switch off time in compliance with STN 33 2000-4-41, scheme NC.1.

Specification of a cross-section of a guard wire

$S = I_{ke} . \omega . \sqrt{t_k} / k$
$S = 18\,400 . 0,7 . \sqrt{0,5} / 58,5$
$S = 155\ mm^2$

I_{ke} - equivalent heating short-circuit current 18,4 kA
ω - coefficient of probability 0,7
t_k - duration of short circuit (protective time +cut off time) 0,5
k - coefficient for Fe and definite temperature 200^0C is 58,5

At the transformers site must be used the guard wire FeZn 2 x 30 x 4 mm.

4.8. Specification of types of surroundings

Specification of surrounding for a new location of the transformers must be done commissionally in accordance with the standards STN 33 0300 and STN 33 2000-3.

4.9. Protection against overloading and short-circuit

The outlet 110kV on transformers 40 MVA is protected by the over-current protection – 7SJ61 and by the differential protection – 7SD610.
Furthermore, the transformers themselves are protect by sensors that are installed on them. They are:

- gas relay 2.grade
- oil temperature
- pressure valve
- return valve.

These also lead to the transformers switch-off.

4.10. Metrology analyse

During a testing and putting into operation is necessary to use the measuring devices of a grade at least 2,5%

4.11. Safety and protection of health at work

Requirements on qualification of personnel operating electric devises

Personnel operating electric devices must be acquainted with regulations relating to their work, eventually to be trained for that type of work.

About safety regulations during operation and work with electric devises deal the standards STN 34 3100, STN 34 3101 and the set of standards STN 33 2000 (mod IEC 60364). The designed electric devise can operate personnel at least with specialized skills, which is instructed in accordance with §20 of the Regulation No.718/2002 Coll. This personnel acquaintance, training, first aid included, warning and their knowledge examination

must be verified by a memorandum that will be signed by a worker in charge together with instructed personnel.

The persons that will operate the electric devise must be informed about operating of the devise and its function.

The operating person can only touch those parts that are designated for operation. There must be always a free approach to the operating parts. In case of the electric devise damage or failure that could jeopardize the safety or health of personnel, the person who such status identifies must make the measures and provide a prevention or reduction of risk of injury, fire or other risks.

Requirements on qualification of personnel working with the electric devises

Personnel working with electric devices must be acquainted according to respective regulations. With electric devises can work only personnel with specialized skills in terms of §21 Reg. No.718/2002 Coll. and experience in terms of the Reg. No.718/2002 Coll., the Appendix No.11, the Article d). These personnel must have completed specialized education and after their training must take an exam in the frame of a defined regulation. The company must provide an examination of the personnel at least once in tree years.

During an inspection and work with devise vvn as well as vn, the devise must be switched off, grounded and locked against a re-activation.

General requirements on safety and protection of health at work

The general operating regulations in force must be extended with local operating instructions of devise, to which they are supposed to serve. During operating and work with the electric devise must be provided following measurements:

- safety schemes,
- safety and auxiliary tools,
- technically-organizing measures: works on directive B, securing workplace,
- protection against accidents.

Electro-technical devise must be kept in a state that responds with regulations of manufacturers of equipment and electro-technical standards.
Operation and maintenance of devise must be aimed towards error-free operation and protection of health at work and consists of following actions:

- regular examination and inspection of physical state of devise,
- regular inspection of functionality of devise,
- regular maintenance.

Content of the technical devise accompanying documentation must be in terms of Reg. No.: 718/2000 Coll., Appendix No.:3

5. Technical description

5.1 Layout (general arrangement) of the transformers T1, T2 40MVA is stated in the drawing V 02-1240/2005/9738/F/05 and a cross-section in the drawing V 02-1240/2005/9738/F/06 and 07.

5.2 Functional connection of the auxiliary circuits of cooling, protective and signalling circuits and also regulation of the transformers voltage, is recorded in the manufacturing documentation of the transformers.

5.3 Grounding line on the surface in the area of the transformers T1, T2 site and its connection to the outer grounding network is stated in the drawing V 02-1240/2005/9738/F/08. The connection of drop-ins is described in the Article 4.7.

5.4 Cabling of the transformers will be placed in the cable channels, which will be placed on the gravel bed, and through transmission steel tubes will be connected with a main cable channel.

5.5 The construction works, the construction project and the construction itself must be done in accordance with the construction works stated in drawings V 02-1240/2005/9738/F/09, 10, 11.

In Trnava, 08/2005

Ing.Vladimír Kuchta
Certificate No. 0046INA1999EZPAE1.0
Authorization No. 3398*Z*5-3