

Building : Oxygen apparatus No. 9
Place : U. S. Steel Košice s.r.o.
Investor : U. S. Steel Košice s.r.o.
Done by : RNDr. Jozef Terezka
Date : June 2005

Seal :

T 80

Project of fire safety (PO)

1. Introduction

Fire safety at the stage of projecting the building of "Oxygen apparatus No. 9 – U. S. Steel Košice s.r.o. " is designed according to the regulation of the Department of Interior of the Slovak republic (MV SR) No.94/2004 Coll. in continuation with the provisions STN 92 0201-1/Z1 to STN 92 0201-4/Z1 and relating STN.

2. Characteristics of the building

The subject-matter of treating the fire safety, in the scope of the given building, is the proposition of **the distribution plant T80 building site**. The distribution plant T80 is partly a one-floor (the areas of transformers) and partly a two-floor building (the areas of distribution rooms) with one underground floor (the cable area). An integral part of the building site is also a transit cable channel. It is designed as an adjoining building to an existing building of a distribution plant T40, from which it will be detached by fire dividing structures with required fire-resistance. The constructural and dispositional design of the given areas as well as their location is stated in the structural design of the project.

3. List of norms and instructions employed

STN 92 0201-1/Z1, STN 92 0201-2/Z1, STN 92 0201-3/Z1, STN 92 0201-4/Z1, STN 73 0872, STN 73 0873/Z4, STN 73 0875, STN 38 2156/Z1, STN 33 3240/Z1, regulation MV SR č. 94/2004 Coll., regulation MV SR č. 95/2004 Coll., regulation MV SR č. 699/2004 Coll. and relating STN and instructions.

4. Initial basis

- PBS-PO design from the design of the given building for building approval 08/2004, arch. No. 13523.PO_{s/a} (technical report), elaborated by the ITES plant, U. S. Steel Košice s.r.o.
- the copy of ORHaZZ in Košice statement to the project documentation for building approval No. ORHZ-792/OPP-2004 dated on 5th August 2004
- partial situation of the building
- elaborated building design of the given buildingsite – groun-plans, skiagraphies

5. Technical design from the point of fire safety

5.1. Fire cells, fire risk, level of fire safety, marginal parametres

Fire safety in the scope of the project continues on and in the full extent takes into regard the PBS - PO design which was elaborated in the scope of the project for the building approval and which was approved by the ORHaZZ in Košice No. ORHZ-792/OPP-2004 dated on 5th August 2004.

From the point of view of the fire safety, the designed building is viewed as a production building in accordance with the provisions § 1 section 1) j) of the MV SR regulation No. 94/2004 Coll.. The designed building is divided into individual independent **fire section (FS)** in accordance with the provisions §3 and supplement No. 1 of the MV SR regulation No. 94/2004 Coll., in accordance

with the STN 33 3240/Z1 provisions and in accordance with the STN 38 2156 provisions (for the cable area in the distribution plant T80 including the transit cable channel) with the following values of fire and economic risks and levels of fire safety (LFS):

- distribution plant T80

FS P1.1 – room No. 001 – cable area, which is in accordance with the provisions art. 110 STN 38 2156/Z1, LFS V in accordance with the provisions art. 111 STN 38 2156/Z1

$S = 202,7 \text{ m}^2 < 750 \text{ m}^2$ – art. 112 STN 38 2156/Z1

FS P1.2 – transit cable channel, (from the proposed distribution plant T80 to the connection on the existing cable bridge and existing cable shaft), which is in accordance with the provisions art. 110 STN 38 2156/Z1, LFS Vin accordance with the provisions art. 111 STN 38 2156/Z1

$S = 54 \text{ m}^2 < 750 \text{ m}^2$ – art. 112 STN 38 2156/Z1

FS N1.2/N2 – room No. 01 – equalisation, room No. 02 – low-voltage distribution room, room No. 03 – electrical room (rozvodňa), room No. 101 – middle-voltage distribution room (including inserted balconies above room No. 01, 02, 04 to 08 – see layer 1-1), which is in accordance with 1h) from the supplement 1 of the MV SR regulation No. 94/2004 Coll.

$\tau_e = 35 \text{ min}$ – art. 3.5.1, pol. 8a) tab. L.1 supplement L STN 92 0201-1/Z1

$p_1 = 1,4, p_2 = 0,150$ – pol. 5.29 tab. I.1 supplement I STN 92 0201-1/Z1

$k_5 = 1,41$ - art. 4.5, tab. 15 STN 92 0201-1/Z1 – $n_{pn} = 2$ – art. 2.2.8 STN 92 0201-2/Z1 (a two-floor above-the-ground building, $h = 6,6 \text{ m}$)

$k_6 = 1,0$ - čl. 4.6 STN 92 0201-1/Z1, fire-proof structures – art. 2.6.2 STN 92 0201-2/Z1

$k_7 = 2,0$ - čl. 4.7 STN 92 0201-1/Z1

$k_8 = k_5 \cdot k_6/2,4 = 1,41 \cdot 1,0/2,4 = 0,583$ – čl. 4.3 STN 92 0201-2/Z1

$c_v = 1,0$

$P_1 = p_1 \cdot c_v = 1,4 \cdot 1,0 = 1,4$

$P_2 = p_2 \cdot S \cdot k_5 \cdot k_6 \cdot k_7 = 0,150 \cdot 361,06 \cdot 1,41 \cdot 1,0 \cdot 2,0 = 152,73$

$\tau_{e,k_8} = 35 \cdot 0,583 = 20,41 \text{ min}$ - according art. 3.2, tab. 2 STN 92 0201-2/Z1 for FS N1.2/N2 is LFS I

FS N1.3 – room No. 04 – batteries

FS N1.4 – room No. 05 – reserve

FS N1.5 – room No. 06 – transformers

FS N1.6 – room No. 07 – reactor I

FS N1.7 – room No. 08 – reactor II

$\tau_e = 30 \text{ min}$ – art. 3.5.1, pol. 9b) tab. L.1 supplement L STN 92 0201-1/Z1

$p_1 = 1,4, p_2 = 0,150$ – pol. 5.29 tab. I.1 supplement I STN 92 0201-1/Z1

$k_5 = 1,0$ - art. 4.5 STN 92 0201-1/Z1 – $n_{pn} = 2$ – čl. 2.2.8 STN 92 0201-2/Z1 (a two-floor above-the-ground building, eventually FS, $h = 6,6 \text{ m}$)

$k_6 = 1,41$ - art. 4.6 STN 92 0201-1/Z1, fire-proof structures – art. 2.6.2 STN 92 0201-2/Z1

$k_7 = 2,0$ - art. 4.7 STN 92 0201-1/Z1

$k_8 = k_5 \cdot k_6/2,4 = 1,0 \cdot 1,41/2,4 = 0,583$ – art. 4.3 STN 92 0201-2/Z1

$c_v = 1,0$

$P_1 = p_1 \cdot c_v = 1,4 \cdot 1,0 = 1,4$

$P_2 = p_2 \cdot S \cdot k_5 \cdot k_6 \cdot k_7 = 0,150 \cdot 12,6 \cdot 1,41 \cdot 1,0 \cdot 2,0 = 5,33$

$\tau_{e,k_8} = 30 \cdot 0,583 = 17,49 \text{ min}$ - acc. art. 3.2, tab. 2 STN 92 0201-2/Z1 for FS N1.3 to N1.7 is LFS I

FS N1.8 – m. č. 09 – transformer I

FS N1.9 – m. č. 10 – quenching choke I

FS N1.10 – m. č. 11 – transformer II

$\tau_e = 30 \text{ min}$ – art. 3.5.1, pol. 9b) tab. L.1 supplement L STN 92 0201-1/Z1

$p_1 = 1,4$, $p_2 = 0,150$ – pol. 5.29 tab. I.1 supplement I STN 92 0201-1/Z1

$k_5 = 1,0$ – art. 4.5 STN 92 0201-1/Z1 – $n_{pn} = 1$ – art. 2.2.8 STN 92 0201-2/Z1 (a one-floor building, eventually FS, $h = 0 \text{ m}$)

$k_6 = 1,0$ – art. 4.6 STN 92 0201-1/Z1, fire-proof structures – art. 2.6.2 STN 92 0201-2/Z1

$k_7 = 2,0$ – art. 4.7 STN 92 0201-1/Z1

$k_8 = k_5$, $k_6/2,4 = 1,0$, $1,0/2,4 = 0,416$ – art. 4.3 STN 92 0201-2/Z1

$c_v = 1,0$

$P_1 = p_1 \cdot c_v = 1,4 \cdot 1,0 = 1,4$

$P_2 = p_2 \cdot S \cdot k_5 \cdot k_6 \cdot k_7 = 0,150 \cdot 12,6 \cdot 1,0 \cdot 1,0 \cdot 2,0 = 3,78$

$\tau_e \cdot k_8 = 30 \cdot 0,416 = 12,5 \text{ min}$ – acc. art. 3.2, tab. 2 STN 92 0201-2/Z1 for FSN1.8 až N1.10 is LFS I

5.2. Building structures

Building structures ensuring the stability of the designed building (including the fire dividing structures) are fire-resistant – the level of flammability A, eventually the structures of the class A1 according to the fire reaction, i.e. the building, or individual fire sections have fire-resistant constructive system (whole) in accordance with § 13 section 2 of the MV SR regulation No. 94/2004 Coll. and in accordance with art. 2.6.2 STN 92 0201-2/Z1. The very description of building structures is stated in the building design of this project. Calculation (required) values of fire resistance of the building structures for individual fire sections are in accordance with provisions art. 2.3.6, tab. 1 STN 92 0201-2/Z1 as follows :

Distribution plant T80

FS P1.1, P1.2 – LFS V

pol. 1a) – 180/D1

pol. 2a) – 90/D1 – between No. 001- cable area and cable channel, between cable channel and input into existing transposition of cable channels on ground-plan – 2,350 m (door) and cover in ceiling structure between No. 001 – cable area and the distribution room (No. 03 on ground-plan +- 0,000 m)

pol. 3a)1. – 180

pol. 5a) – 180

pol. 4, 6 to 10 – not present in individual fire sections

FS N1.2/N2, N1.3 to N1.10 – SPB I

pol. 1b) – 30

pol. 1c) – 30

pol. 2b, c) – 30/D3 – cover between No. 03 – distribution room and cable area, between staircase and cable area, door between No. 03 – distribution room, No. 101 – low-voltage distribution room and existing areas of the T40 distribution plant

pol. 3a)2. – 30

pol. 3a)3. – 30

pol. 4 – 30

pol. 5b) – 30

pol. 5c) – 30

pol. 6 to 10 – not present in individual fire sections, eventually are not required

The actual values of fire resistance of the building structures are adequately in compliance with the required values, except for the bearing steel structure of inserted balconies which is necessary to protect on the required fire resistance of 30 minutes (with PYROTHERM plaster etc. – see building design).

Among the proposed fire sections P1.1 and P1.2, there will be fire door designed min. of the type EW-90/D1-C (between No. 001 – cable area and cable channel and btw. cable channel and existing transposition of existing cable channels), fire cover in ceiling above No. 001 – cable area min. of the type EW-90/D1 (does not have to be equipped with automated closing device in acc. With

provisions art. 5.6.8 STN 92 0201-2/Z1) and fire door of the type EW-30/D3-C between the proposed fire section N1.2/N2 and existing areas of T40 distribution plant (from No.01) – see building design of this project. At the flat inspection of the given building, certificates from individual building components and structures will be presented in accordance with the law No. 90/1998 Coll. concerning building components.

The proposed fire sections will be mutually divided by fire dividing structures with required fire resistance including fire covers of openings. The passages of distributions and installations through fire dividing structures will be sealed in accordance with the requirements art. 117 STN 38 2156. At the mouth of cable channel to T80 distribution plant areas and to existing bridge and transposition of existing cable channels, there will be fire partitions placed in accordance with propositions art. 113, 115 STN 38 2156/Z1.

5.3.Exits

The escape of persons from individual fire sections is designed by unprotected exits (UE) coming to either directly or through adjoining fire sections, eventually T40 distribution plant areas, to an esplanade. The actual length and width of the unprotected exits and their design are in compliance with requirements of the MV SR regulation No. 94/2004 Coll. and STN 92 0201-3/Z1, art. 3.1, 3.2, 6.1c, 7.1, 8.1, 9.1.1, 10.1, 10.6, 11.1 to 11.3, 13, 14 and relating articles and requirements STN 38 2156/Z1, art. 144 to 149 and relating articles.

Distribution plant T80

FS P1.1, P1.2

$t_{ud} = 3,8 \text{ min}$ – tab. 5 STN 92 0201-3/Z1 (2 UE, $p_1 = 1,4$)

$v_u = 20 \text{ m.min}^{-1}$, $K_u = 25 \text{ persons.min}^{-1}$ – tab. 6 STN 92 0201-3/Z1, exit through flatland and stairs up

$E . s = 10$ - art. 9.3.2 STN 92 0201-3/Z1

$s = 1,0$ – tab. 7 STN 92 0201-3/Z1 – UE, persons able to move independently, actual way of evacuation

$u = \text{choice } 1,0$, actual No. $u_{\min} = 1,5$ (door 0,8 m wide) - suitable

$l_{ud} = v_u / 0,75 \cdot (t_{ud} - E . s / K_u \cdot u) = 20 / 0,75 \cdot (3,6 - 10 / 40 \cdot 1,0) = 89,33 \text{ m}$

$l_{\text{real . max.}} = 50 \text{ m} < l_{ud}$ – suitable – measured in acc. with art. 10.3.1 STN 92 0201-3/Z1

FS N1.1/N2

$t_{ud} = 3,8 \text{ min}$ – tab. 5 STN 92 0201-3/Z1 (2 UE, $p_1 = 1,4$)

$v_u = 25 \text{ m.min}^{-1}$, $K_u = 30 \text{ persons.min}^{-1}$ – tab. 6 STN 92 0201-3/Z1, exit through flatland and stairs down

$E . s = 10$ - art. 9.3.2 STN 92 0201-3/Z1

$s = 1,0$ – tab. 7 STN 92 0201-3/Z1 – UE, persons able to move independently, actual way of evacuation

$u = \text{choice } 1,0$, actual No. $u_{\min} = 1,5$ (door 0,8 m wide) - suitable

$l_{ud} = v_u / 0,75 \cdot (t_{ud} - E . s / K_u \cdot u) = 25 / 0,75 \cdot (3,6 - 10 / 40 \cdot 1,0) = 111,66 \text{ m}$

$l_{\text{kreal . max.}} = 20 \text{ m} < l_{ud}$ – suitable – measured in acc. with art. 10.3.1 STN 92 0201-3/Z1

FS N1.3 to N1.10

$t_{ud} = 2,36 \text{ min}$ – tab. 5 STN 92 0201-3/Z1 (1 UE, $p_1 = 1,4$)

$v_u = 30 \text{ m.min}^{-1}$, $K_u = 40 \text{ persons.min}^{-1}$ – tab. 6 STN 92 0201-3/Z1, exit through flatland

$E . s = 10$ - art. 9.3.2 STN 92 0201-3/Z1

$s = 1,0$ – tab. 7 STN 92 0201-3/Z1 – UE, persons able to move independently, actual way of evacuation

$u = \text{choice } 1,0$, actual No. $u_{\min} = 1,5$ (door 0,8 m wide) - suitable

$l_{ud} = v_u \cdot (t_{ud} - E . s / K_u \cdot u) = 30 \cdot (2,36 - 10 / 40 \cdot 1,0) = 63,3 \text{ m}$

$l_{\text{skut . max.}} = 10 \text{ m} < l_{ud}$ – suitable – measured in acc. with art. 10.3.1 STN 92 0201-3/Z1

5.4. Distance separations

gem. BGR 133

geringe Brandlast / m² Fläche - 1 Rolle /

ca. 100 m² $\hat{=}$ 1x 2x 3x
Schaumlöschdecke
(6l = 10 LE)

$\hat{=}$ 1x
Pulver
(6kg = 10 LE)

(Preis: \approx 306 / Stück)

Distance separations for individual fire section are designated according to the provisions STN 92 0201-4/Z1 and are as follows:

Distribution plant T80

FS P1.1, P1.2

- without fire opened areas, $d_{\max} = 0$ m

FS N1.2/N2, N1.3 to N1.7

$d_{\max} = 0,6$ m (p_0 - without fire opened areas, eventually to 20 %, $l_u = 18,9$ m, $h_u = 6$ m, $\tau_e = 30$ a 35 min) $< d_{\text{skut.}}$ - suitable

FS N1.8 to N1.10

$d_{\max} = 12,2$ m ($p_0 = 100$ %, $l_u = 26,685$ m, $h_u = 6$ m, $\tau_e = 30$ min) $< d_{\text{skut.}}$ - suitable

The designated distance separations are smaller than the actual (or proposed) including the distance from the existing adjoining buildings – suitable according to provisions of the MV SR regulations No. 94/2004 coll. and STN 92 0201-4/Z1 – see the situational drawing of the building and drawings of individual floors of the building.

5.5. Zariadenia pre protipožiarny zásah

There is no need to install an internal fire water supply in the areas of individual FS in accordance with the provisions § 3 section 2, § 6 section 1, § 10 section 2 b) of the regulation MV SR No. 699/2004 Coll. consecutive to the provisions art. 12a, 56aa STN 73 0873/Z4 (inadmissible fire extinction with water, extended areas of individual FS are less than 1000 m³).

The intercept point of the values P_1 , P_2 of individual FS is located under the line picture 1 STN 92 0201-1/Z1 (in the section of admissible values), i.e. the designed fire section are suitable from the point of

- proposed activity (kind and nature)
- marginal area
- constructive system
- number of floors

and no fire devices (electrical fire alarm, stable fire extinguishers, automatic heat and burning products exhausting devices etc.) are necessary and measures in accordance with art. 4.4 STN 92 0201-1/Z1.

Automatic EFA device installation in individual FS is not required in accordance with the provisions § 88 of the MV SR regulation No. 94/2004 Coll., in accordance with the STN 38 2156/Z1 provisions and in accordance with the provisions art. 8a STN 73 0875 – values \underline{N} for individual fire sections are lower than 3:

$$N_{\max} = (1,4 \cdot 1,1 + 0,9 \cdot 0,6) \cdot 1,1 = 2,3$$

The installation of emergency exit lighting, stable fire extinguisher and internal broadcasting in the building, or in individual fire sections is not required in accordance with the provisions § 73, § 87, § 90 of the MV SR regulations No. 94/2004 Coll. and in accordance with the STN 38 2156/Z1 provisions.

It is necessary to locate 16 portable fire extinguishers altogether (PFE) in the areas of the building – dry with 6 kg ABC-E powder discharge in accordance with the STN 92 0202-1 provisions and the MV SR regulation No. 719/2002 Coll. and namely in the following areas:

Distribution plant T80

- in room No. 001 – cable area – 4PHP $\triangleq 202,65 \text{ m}^2 = \text{max. risk} \Rightarrow 3 \times \text{Pu}$
- in room No. 02 – low-voltage distribution room – 1 PHP $= 28,25 \text{ m}^2$
- in room No. 03 – distribution room – 2PHP $= 88,16 \text{ m}^2$

101

2 min
3 x Pu (všetky)

- in room No. 101 - low-voltage distribution room – 2PHP = 216,40 m²
- in room No. 04 to room No. 11- in every room 1PHP – 7PHP
- FS P1.1 : $M_c = 1,2 \cdot (S \cdot p_1)^{1/2} = 1,2 \cdot (202,7 \cdot 1,4)^{1/2} = 20,2 \text{ kg} - 4 \text{ PHP}$
- FS N1.1/N2 : $M_c = 1,2 \cdot (S \cdot p_1)^{1/2} = 1,2 \cdot (361,06 \cdot 1,4)^{1/2} = 27 \text{ kg} - 5 \text{ PHP}$
- FS N1.3 to N1.10 – in every FS 1 PHP in acc. with tab. 2 STN 92 0202-1 – 7 PHP

The proposal of PFE is in accordance with propositions § 89 of the MV SR regulation No. 94/2004 Coll. and in accordance with STN 92 0202-1 propositions. When placing the PFE, it is necessary to follow the propositions of the MV SR regulation No. 719/2002 Coll.. The financial matter and PFE and tables arrangement will be fully provided by the investor. It is necessary to place the heading „Exit“ („Únikový východ“), or „Escape direction“ („Smer úniku“) at the escape ways and exits. At the entrances to the buildings, or individual fire sections, it is necessary to place the following headings:

- „Do not extinguish with water or foam fire extinguishers“
- („Nehas vodou ani penovými hasiacimi prístrojmi“)
- „Staff only“
- („Nepovolaným vstup zakázaný“.)

The access of fire-fighting vehicles to the entrances will be enabled on the existing and designed communications which are to be, as to their realisation and design, in compliance with requirements § 82 of the MV SR regulation No. 94/2004 Coll. The access areas and inner intervention ways are not required in accordance with propositions § 83 section 1 a), § 84, § 86 of the MV SR regulation No. 94/2004 Coll.. Outer intervention ways for the T80 distribution plant will be formed by fire ladder in accordance with propositions § 86 of the MV SR regulation No. 94/2004 Coll..

The requirement of fire water needed for fire-fighting intervention for individual fire sections designed in the given building is not defined and required in accordance with propositions § 3 section 2, § 6 section. 1, § 10 section 2 b) of the MV SR regulation No. 699/2004 Coll. consecutive to propositions art.12a STN 73 0873/Z4 (inadmissible fire extinguishing with water).

There are existing outer water distributions in the U.S.Steel area, on which there are placed outer fire hydrants as well as existing fire-extinguishing water pumping stations.

The basic extinguishing appliance for the designed areas of individual fire sections in the scope of the project is based on CO₂, eventually based on ABC – E powders. Fire-fighting intervention for the designed building will be provided by the fire-fighting unit ZHÚ U. S. Steel Košice s.r.o. and consequently by the fire-fighting unit of “Okresného riaditeľstva Hasičského a záchranného zboru” in Košice.

6.Heating, ventilation, electrical installation

The areas of individual fire sections will be heated by aero-technology (cooling + heating), eventually in electrical form which is designed in accordance with the provisions of the MV SR regulation No. 95/2004 Coll.. Ventilation in areas of individual fire sections will be in natural form and in addition to this, the areas of distribution rooms in the distribution plant T80 will be ventilated in artificial way. The designed devices, or piping always serve only for 1 fire section, they are its integral part and do not cross the fire dividing structures to other FS – without requirements from the point of view of fire safety in accordance with propositions of the MV SR regulation No. 94/2004 Coll. and in accordance with the STN 73 0872 propositions.

The space for electrical installation and the design of the electrical installation itself including earthing, protective connection, measurements and adjustments etc. is stated in designing electrical installations of individual buildings in the scope of this project.

7.Requirement

It is obligatory for the operator to follow all the conditions stated in this project.

Košice, June 2005

Done by : RNDr. Jozef Terezka