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Code for design of blast resistant control building in petrochemical industry

石油化工控制室抗爆设计规范

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Announcement on publishing national standard *Code for Design of Blast Resistant Control Room in Petrochemical Industry*

Now approve *Code for Design of Blast Resistant Control Room in Petrochemical Industry* as national standard, numbered as GB 50779-2012, implemented in since December 1, 2012. Among which, Article 5.5.1 is the mandatory provision and shall be strictly implemented.

The Code is published and distributed by China Planning Press organized by standard rating research institute of our department.

Ministry of Housing and Urban-Rural Development of the People's Republic of China

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Foreword

This Code, based on the requirements of the *Notice on Issuing the 2007 Construction Standards formulation and Revision Plan of the former Ministry of Construction (second batch)* (JB [2007] No.126), was jointly prepared and completed by the Luoyang Petrochemical Engineering Corporation, SINOPEC, and other relevant units.

During preparation of this code, the preparation group carefully summarizes practical experience through extensive investigation and research, refers to relevant international and foreign advanced standards, and finalizes the draft through examination on the basis of extensively soliciting opinions.

This Code is divided into six chapters and two annexes. Main technical content includes: General provisions, Terms and Symbols, Basic Provisions, Architecture Design, Structure Design, Ventilation and air Conditioning Design, etc.

The provisions written in bold-face in this Code are the mandatory provisions, which shall be strictly implemented.

Ministry of Housing and Urban-Rural Development is responsible for the management of this Code and interpretation of the mandatory provisions, the China Petrochemical Corporation is responsible for the daily management, and the Luoyang Petrochemical Engineering Corporation, SINOPEC is responsible for the explanation of the specific technical contents. If you have any comments and suggestions during the implementation process, please send them to the Luoyang Petrochemical Engineering Corporation, SINOPEC (Address: No.27, West Zhongzhou Road, Luoyang, Henan Province; Postal Code: 471003), for the future reference in revisions.

Chief editorial units, participated units, main drafters and main examiners of the Code:

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Sinopec Ningbo Engineering Company Limited

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1 General provisions

1.0.1 In case of blast resistance design of the petrochemical engineering control building, in order to implement the relevant national policies and guidelines, unify the technical requirements, and to be safe and reliable, technologically advanced and economical, hereby we prepare this Code.

1.0.2 This Code applies to the construction, structure and ventilation of the newly constructed petrochemical industry control building with blast resistant requirements and the blast resistant design of air conditioning professional.

1.0.3 Blast resistant design of petrochemical industry control room shall meet the Code, but still should be consistent with provisions of existing relevant national standards.

2 Terms and symbols

2.1 Terms

2.1.1 Blast resistant door

The door for special construction that can resist the explosive blast from outside the building;

2.1.2 Blast resistant access door

Blast resistant and protective door that can meet the requirements for the staff normal into and out of the building;

2.1.3 Blast resistant equipment door

Blast resistant and protective door that can meet the requirements for the large-scale equipment into and out of the building;

2.1.4 Blast resistant window

External window for special construction that can resist the explosive blast from outside the building;

2.1.5 Air lock

The built-in front room that is located in the staff access to prevent outdoor harmful gases from entering the interior and to maintain indoor positive pressure.

2.1.6 Blast resistant valve

Special air wave that installed on the opening of the blast resistant building and can resist the blast shock wave from outside the building;

2.1.7 Shock wave

The longitudinal wave generated by explosion in the air, which has strong discontinuity surface of air parameter. Referred to as shock wave;

2.1.8 Positive pressure of shock wave

The pressure value that applies to each surface of the object around by shock wave and exceeds the surrounding atmospheric pressure in the shock wave compressed zone.

2.1.9 Dynamic pressure

When the shock wave is propagated in the air, due to the large velocity of the gas molecules inside the shock wave, it will generate a clearly directional effect which is very similar to the air pressure.

2.1.10 Stagnation pressure

The pressure value for the intersection point between the extension cord of the effective curve of positive overpressure plus dynamic pressure and the vertical coordinates in the front wall blast load effective curve.

2.1.11 Ductility ratio

The ratio between the elastic-plastic displacement and elastic limit displacement of the structural members;

2.2 Symbols

2.2.1 Material performance

E_{cd}—Dynamic elastic modulus of concrete;

E_s—Elastic modulus of rebar;

f_{dc}—Dynamic strength design value of the concrete;

f_{du}—Dynamic strength limit value of rebar;

f_{dy}—Dynamic strength design value of rebar;

f_u—Strength limit value of rebar;

f_{yk}—Strength standard value of rebar;

f'_{ck}—Compressive strength standard value of concrete;

f_y—Yield strength of rebar.

2.2.2 Action, action effects and carrying capacity

C—Structure or structural members shall reach the specified limit value of the normal use.

F_t—The force acting on the members (function of time);

P—Shock load of members;

P_a—The effective overpressure of shock wave acting on the side walls and roof;

P_{atm}—Environmental standard atmospheric pressure;

P_b—The effective overpressure of shock wave acting on the backwall;

P_r—Peak reflected pressure;

P_s—Stagnation pressure;

P_{so}—Blast shock wave peak incident overpressure;

q_0—Peak dynamic pressure;

Q_d—Static loads equivalent to positive pressure of shock wave and action time;

R_u—Limit resistance of structural members provided on a given section and reinforcement;

S_{GK}—The load effect value calculated by permanent load standard value G_k;

S_{QiK}—The load effect value calculated by variable load standard value Q_{ik};

S_{BK}—Blast load effect value;

γ_G—Permanent load partial coefficient;

γ_{Qi}—Variable load partial coefficient;

γ_B—Blast load partial coefficient.

2.2.3 Geometric parameter;

A_s—Area of member reinforcement;

b—Section width of member;

d—Section effective depth of member;

D—Width of the building in the shock wave forward direction;

I_a—The average inertia moment of the member's section;

I_{cr}—Inertia moment of concrete cracking section;

I_g—The gross section inertia moment of the concrete members on the centroidal axis,

excluding the impact of rebar;

K—Stiffness of member;

L—Dimensions of the building parallel to the direction of the shock wave;

L_1—Length of the structural member in the shock wave forward direction;

S—The minimum distance from the stagnation pressure point to the edge of the buildings;

X_m—Elastic-plastic deflection of the structural member;

X_y—Elastic limit deflection of the structural member;

Y—Particle displacement.

2.2.4 Calculating coefficient and others

a—Particle motion acceleration;

C_e—Equivalent peak pressure coefficients;

I_w—Impulse of positive pressure;

K_L—Load or stiffness transfer coefficient;

K_{Lm}—Transfer coefficient;

K_m—Mass transfer coefficient;

C_d—Drag force coefficient;

γ_{dif}—Dynamic loading increase coefficient of material;

L_w—Length of shock waves;

L_0—Span of the member

M_e—Equivalent mass

m—Quality of members;

γ_{sif}—Strength increase coefficient of material;

T_d—Action time of shock load that equivalent to triangular load;

T_n—Particle vibration cycle;

t_a—The time that the shock wave reaching the backwall;

t_c—Duration time of reflecting pressure;

t_d—Action time of the positive pressure;

t_e—Equivalent action time of front wall valent action time of front wall positive pressure;

t_r—The overpressure rising time of the sidewall and roof effective shock wave;

t_{rb}—The pressure rising time of the backwall effective shock wave;

U—Wave velocity;

ρ—Reinforcement ratio of non-pre-stressed tension reinforcement;

ρ'— Reinforcement ratio of non-pre-stressed compression reinforcement;

μ—Ductility ratio of the structural member;

[μ]—Allowable ductility ratio of the structural member;

θ—Elastic-plastic corner of the structural member;

[θ]—Elastic-plastic corner allowable value of the structural member;

$\triangle$ —Deformation at mid-span;

ψ_{ci}—The combination value coefficients of variable load Q_i;

α—Energy absorption coefficient;

τ—Duration time coefficient.

3 Basic provision

3.0.1 The plan layout of the blast resistance control room shall comply with relevant provisions of the current national standard *Fire Prevention Code of Petrochemical Enterprise Design*, GB 50160. The room shall be arranged in non-blast hazardous areas. The plan layout shall be adjusted according to the results of the safety analysis (assessment) report, and meanwhile shall comply with the following requirements:

1 Blast resistance control room shall be arranged on one side of the process plant, and class A and B plants shall not be arranged around it at the same time. In addition, the space for arranging the control room shall not be lower than the terrace of the adjacent plants.

2 Blast resistant control room should be set up independently, and it can not be constructed together with the non-blast resistant building.

3 The blast resistant control room should be set up safe exit for staff in at least two directions, and it should not be directly faced with the Class A and B process plants.

3.0.2 The control room that is designed according to the Code shall be used continuously after the general repair for partial damage due to one blast load effect.

3.0.3 The building plane of blast resistant control room should be rectangular and the number of layers should preferably be 1.

3.0.4 Blast resistant control room shall preferably use cast-in-place reinforced concrete structure.

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