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NATIONAL STANDARD OF THE PEOPLE'S REPUBLIC OF CHINA

GB 50040-2020

Replacing GB 50040-1996

Standard for design of dynamic machine foundation

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1 General

1.0.1 This standard is formulated in order to ensure the technical performance and engineering quality of power machine foundation design, to achieve advanced technology, reasonable economy, safety and applicability, and to meet environmental requirements.

1.0.2 This standard is applicable to the non-vibration-isolation design of power machine foundations such as rotary machines, reciprocating machines, impact machines, presses, crushers and mills, vibration test benches, and metal cutting machine tools.

1.0.3 In addition to this standard, the design of the power machine foundation shall also comply with the current relevant national standards.

2.1.1 machine-foundation system

The general term for the power machine foundation and the machines, auxiliary equipment and filling soil on the foundation.

2.1.2 equivalent load equivalent load

Static loads equivalent to the dynamic loads acting on the original vibrating system.

2.1.3 frame foundation frame foundation

The foundation is formed by the connection of top beams, columns and bottom slabs.

2.1.4 wall foundation

The foundation is formed by the connection of the roof, vertical and horizontal walls and the bottom plate.

2.1.5 Foundation stiffness

The ability of the foundation to resist deformation is the ratio of the force (moment) applied to the foundation to its deformation (angular deformation).

2.1.6 rotary machine

A mechanical device that has rotating parts such as a rotor and works by rotating at a constant speed.

2.1.7 reciprocating machine reciprocating machine

A mechanical device consisting of a crank (crankshaft), a connecting rod, and a reciprocating piston.

2.1.8 Impact machine

A hammer with a certain mass is used to periodically perform free-fall motion within a certain height to produce a mechanical device with a more obvious pulse function characteristic vibration load.

2.1.9 vibration test stand vibration test stand

It is a standard test equipment for simulating the real vibration environment effect to test the mechanical properties of various industrial products and engineering facilities.

2.1.10 metal cutting machine tool metal cutting machine tool

Machines that process metal workpieces by cutting, special processing, etc. to obtain the required geometric shape, dimensional accuracy and surface quality.

2.2.1 Action and action response.

Fvz-the vertical vibration load of the machine;

Fvx, Fvy - the horizontal vibration load of the machine;

Mf-the turning disturbance moment of the machine in the x-f direction coupling vibration of the base group horizontally along the x-axis and rotating around the y-axis;

Mtheta--the rotation disturbance moment of the machine in the y-theta direction coupling vibration of the basis set horizontally along the y-axis and rotating around the x-axis;

Mpsi-the torsional vibration disturbance moment of the machine;

uz-the vertical vibration displacement at the center of gravity of the foundation group or at the foundation control point;

ux, uy-horizontal vibration displacement at the center of gravity of the foundation group or at the foundation control point;

uf-the x-f direction coupled vibration rotary vibration angular displacement of the base group along the x-axis horizontally and rotating around the y-axis;

utheta--the y-theta direction coupling vibration rotary vibration angular displacement of the base group along the y-axis horizontally and rotating around the x-axis;

upsi-the torsional vibration angular displacement of the basis set;

uzz--the vertical vibration displacement generated by the vertical vibration of the basis set along the z-axis;

uzf--the vertical vibration displacement generated by the x-f coupling vibration of the base group horizontally along the x-axis and rotating around the y-axis;

uxf--horizontal vibration displacement generated by the x-f coupling vibration of the base group horizontally along the x-axis and rotating around the y-axis;

uztheta--the vertical vibration displacement generated by the y-theta coupling vibration of the basis set horizontally along the y-axis and rotating around the x-axis;

uytheta--horizontal vibration displacement generated by the y-theta coupled vibration of the basis set horizontally along the y-axis and rotating around the x-axis;

uxpsi, uypsi--horizontal vibration displacement generated by fundamental set torsional vibration;

omega-circular frequency of machine disturbance;

omeganz-the vertical natural circular frequency of the basis set;

omeganx, omegany-horizontal natural circular frequency of the basis set;

omeganf--the natural circular frequency of the basis set rotating around the y-axis;

omegantheta--the natural circular frequency of the basis set rotating around the x-axis;

omeganpsi-basis set torsional natural circular frequency;

omeganf1, omeganf2-the natural circular frequencies of the first and second mode shapes of the x-f-direction coupled vibration of the basis set horizontally along the x-axis and rotating around the y-axis;

omegantheta1, omegantheta2-the natural circular frequencies of the first and second mode shapes of the y-theta direction coupling vibration of the basis set horizontally along the y-axis and rotating around the x-axis;

a--Basic vibration acceleration;

upsilon--Basic vibration velocity.

2.2.2 Calculation indicators.

Cz-compressive stiffness coefficient of natural foundation;

Cf, Ctheta--Bending stiffness coefficient of natural foundation;

Cx, Cy--shear stiffness coefficient of natural foundation;

Cpsi--the torsional stiffness coefficient of natural foundation;

Cpz-the equivalent compressive stiffness coefficient of pile tip soil;

Cptau-the equivalent shear stiffness coefficient of each layer of soil around the pile;

Kz-compressive stiffness of natural foundation;

Kf, Ktheta-bending stiffness of natural foundation;

Kx, Ky--shear stiffness of natural foundation;

Kpsi - torsional stiffness of natural foundation;

Kpz-the compressive stiffness of the pile foundation;

Kpf, Kptheta--bending stiffness of pile foundation;

Kpx, Kpy - pile foundation shear stiffness;

Kppsi--torsional stiffness of pile foundation;

zetaz-vertical damping ratio of natural foundation;

zetah1, zetah2-the damping ratio of the first and second mode shapes of the horizontal gyration coupling vibration of the natural foundation;

zetapsi--torsional damping ratio of natural foundation;

zetapz-the vertical damping ratio of the pile foundation;

zetaph1, zetaph2--the damping ratio of the first and second vibration modes of horizontal rotary coupling vibration of pile foundation;

zetappsi-the torsional to damping ratio of the pile foundation;

[u]--allowable vibration displacement of foundation;

[upsilon]--allowable vibration speed of foundation;

[a]--allowable vibration acceleration of foundation;

m - the mass of the basis set.