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Storage/Retrieval Machine

巷道堆垛起重机

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Table of Contents

Foreword 4
1 Scope 5
2 Normative References 5
3 Terms and Definitions 7
4 Basic Parameters 8
5 Basic Compositions 8
5.1 Lower beam 8
5.2 Upright column 9
5.3 Upper beam 9
5.4 Pallet 9
5.5 Operating mechanism 9
5.6 Lifting mechanism 9
5.7 Load handling device 10
5.8 Rail 10
5.9 Control system 10
5.10 Others 10
6 Technical Requirements 10
6.1 General requirements 10
6.2 Manufacturing and installation requirements 12
6.3 Performance requirements 22
7 Test Methods 24
7.1 Preparation before the test 24
7.2 Test instrument and test load 24
7.3 Working performance test of fork 25
7.4 Operating performance test 25
7.5 Lifting performance test of pallet 26
7.6 Static load test 26
7.7 Dynamic load test 26

7.8 Static stiffness test 27
7.9 Safety performance test 27
7.10 Determination of noise 28
7.11 Operational performance test 29
7.12 Assessment of availability 30
8 Inspection Rules 31
8.1 Exit-factory inspection 31
8.2 Type inspection 32
9 Marking, Packaging, Transportation and Storage 32

Storage/Retrieval Machine

1 Scope

This Standard specifies the terms and definitions, basic parameters, basic composition, technical requirements, test methods, inspection rules, marking, packaging, transportation and storage of storage/retrieval machine.

This Standard applies to storage/retrieval machine (hereinafter referred to as "stackers") used in three-dimensional warehouses.

2 Normative References

The following documents are essential to the application of this document. For the dated documents, only the versions with the dates indicated are applicable to this document; for the undated documents, only the latest version (including all the amendments) is applicable to this document.

GB/T 191 Packaging – Pictorial Marking for Handling of Goods

GB/T 699-2015 Quality Carbon Structural Steels

GB/T 700-2006 Carbon Structural Steels

GB/T 1231 Specifications of High Strength Bolts with Large Hexagon Head, Large Hexagon Nuts, Plain Washers for Steel Structures

GB/T 1243 Short-pitch Transmission Precision Roller and Bush Chains, Attachments and Associated Chain Sprockets

GB/T 3077 Alloy Structure Steels

GB/T 3098.1 Mechanical Properties of Fasteners - Bolts, Screws and Studs

GB/T 3098.2 Mechanical Properties of Fasteners - Nuts

GB/T 3323-2005 Radiographic Examination of Fusion Welded Joints in Metallic Materials

GB/T 3632 Sets of Torshear Type High Strength Bolt Hexagon Nut and Plain Washer for Steel Structures

GB 5226.1 Electrical Safety of Machinery - Electrical Equipment of Machines - Part 1: General Requirements

GB/T 6074 Leaf Chains Clevises and Sheaves - Dimensions Measuring Forces and Tensile Strengths

GB/T 6417.1 Classification and Explanation of Imperfections in Fusion Welded Joints

GB/T 8918 Steel Wire Ropes for Important Purposes

GB/T 8923.1-2011 Preparation of Steel Substrates before Application of Paints and Related Products - Visual Assessment of Surface Cleanliness - Part 1: Rust Grades and Preparation Grades of Uncoated Steel Substrates and of Steel Substrates after Overall Removal of Previous Coatings

GB/T 9286-1998 Paints and Varnishes - Cross Cut Test for Films

GB/T 9439-2010 Grey Iron Castings

GB/T 10095.1-2008 Cylindrical Gears - System of Accuracy - Part 1: Definitions and Allowable Values of Deviations Relevant to Corresponding Flanks of Gear Teeth

GB/T 10095.2-2008 Cylindrical Gears - System of Accuracy - Part 2: Definitions and Allowable Values of Deviations Relevant to Radial Composite Deviations and Runout Information

GB/T 10096-1988 Accuracy of Rack

GB/T 11352-2009 Carbon Steel Castings for General Engineering Purpose

GB/T 13306 Plates

GB/T 13384 General Specifications for Packing of Mechanical and Electrical Product

GB 50254 Code for Construction and Acceptance of Low-Voltage Apparatus Electric Equipment Installation Engineering

GB 50256 Code for Construction and Acceptance of Electric Device of Crane Electrical Equipment Installation Engineering

JB/T 5319.1 Storage/Retrieval Machine – Vocabulary

JB/T 5323-2017 Welded Type Steel Structure Rack for Tiered Warehouse Facility – Technical Conditions

JB/T 6392-2008 Rail Wheels for Crane

JB/T 9005.1 Casting Sheaves for Cranes - Groove Profiles

JB/T 9005.2 Casting Sheaves for Cranes - Selected Series and Matching of Diameters

consultation between the user and the manufacturer.

6.1.2 Materials

6.1.2.1 When the important components (including the upper beam, the lower beam, the upright column, the pallet and the lifting mechanism) of the stacker are made of steel, the material shall be selected with a mechanical property no lower than Q235-B specified in GB/T 700-2006.

6.1.2.2 The material of main parts (such as wheels, gears, pulleys, drums, forks, etc.) shall be determined according to their functional requirements. Selection principle: The mechanical properties of iron castings shall be no lower than HT200 specified in GB/T 9439-2010; the mechanical properties of steel castings shall be no lower than ZG230-450 specified in GB/T 11352-2009; and the mechanical properties of forgings shall be no lower than 45 steel specified in GB/T 699-2015.

6.1.3 Welding

6.1.3.1 There shall be no obvious defects visible by visual inspection specified in GB/T 6417.1 on the outside of the welding seam.

6.1.3.2 The quality grade of the butt welds in the main stress-bearing parts of important components shall be no lower than Grade II specified in GB/T 3323-2005.

6.1.4 Common parts

6.1.4.1 Lifting wire rope

6.1.4.1.1 The round strand wire rope specified in GB/T 8918 shall be used for the steel wire rope.

6.1.4.1.2 The wire rope shall be made of at least 114 wire rope strands. The tensile strength of the steel wire is 1570 N/mm^2 ~ 1960 N/mm^2.

6.1.4.1.3 Wire rope safety factor: It shall be no less than 5 when there is no lift cab; and it shall be no less than 9 when there is a lift cab.

6.1.4.2 Chains and sprockets

6.1.4.2.1 The chain shall generally adopt the short-pitch precision roller chain specified in GB/T 1243 or the plate chain specified in GB/T 6074.

6.1.4.2.2 The tooth shape and tolerance of the sprocket shall comply with the provisions of GB/T 1243.

6.1.4.2.3 The teeth and grooves of the sprocket shall not have surface defects that can cause damage to the chain.

6.1.4.2.4 All moving chains and sprockets shall be easy to lubricate.

6.1.4.2.5 Lifting chain safety factor: It shall be no less than 5 when there is no lift cab; and it shall be no less than 10 when there is a lift cab.

6.1.4.3 Buffer

For a stacker with a forced speed limiting device, the buffer shall be selected according to the actual maximum speed (but no lower than 70% of the rated speed) that may occur after forced deceleration; for a stacker without a forced speed limiting device, the buffer shall be selected at 100% rated speed.

6.1.4.4 Material of high-strength bolt pair and pin

The materials of high-strength bolts, nuts and washers shall comply with the provisions of GB/T 1231 or GB/T 3632. For torsional shear type high-strength bolts larger than M24 and high-strength bolt pairs larger than M30, their materials shall comply with the provisions of GB/T 3098.1 and GB/T 3098.2. In addition to selecting the bolt pair materials that comply with the provisions of GB/T 1231, 40Cr for Grade 8.8, and 35CrMo, 42CrMo, etc. for Grade 10.9 that comply with the provisions of GB/T 3077 can also be used.

The material that mainly bears the connecting pin should be 45 steel that complies with the provisions of GB/T 699-2015, and 40Cr, 35CrMo, 42CrMo steel that comply with the provisions of GB/T 3077; and conduct necessary heat treatment.

6.1.5 Surface coating

6.1.5.1 Surface rust removal treatment shall be carried out before coating, and the surface rust removal quality grade shall reach Level-Sa2 or Level-St2 as specified in GB/T 8923.1-2011.

6.1.5.2 The adhesion of the paint film shall not be lower than the Grade 2 quality requirements specified in GB/T 9286-1998.

6.1.6 Safety signs

The safety signs should be painted on both sides of the pallet. Safety signs are yellow and black ramps. The width of the yellow and black ramps is equal, generally 100 mm. Depending on the size of the machine and the location of the safety sign, different widths can be used. On the smaller surface, there shall be no less than two ramps for each color. The ramp is generally at a 45° angle to the horizontal. The oblique direction of the yellow and black ramps is symmetrical with the centerline of the machine as the axis of symmetry.

6.2 Manufacturing and installation requirements

6.2.1 Metal structural parts

6.2.1.1 The lifting guide rails of stacker are allowed to be soldered in sections. After assembly,

The stacker shall set various safety protection devices and measures according to the requirements in Clause 6 of JB/T 11269-2011.

6.3.8 Noise

The sound pressure level noise of the stacker should not exceed 80 dB CA).

6.3.9 Operation performance

The stacker shall be able to complete its operation according to the operation mode and control mode specified in the design requirements.

6.3.10 Availability

6.3.10.1 The availability of the stacker refers to the probability that the stacker is in a state of normal operation and no accidental drop at any given point in the operation period. Availability is generally calculated based on test records for 2 consecutive working days.

6.3.10.2 The availability of the stacker shall be no less than 97%.

7 Test Methods

7.1 Preparation before the test

7.1.1 The inspection of appearance quality shall conform to the design drawings and the requirements of this Standard.

7.1.2 The inspection of assembly accuracy shall conform to the design drawings and the requirements of this Standard, which shall be recorded.

7.1.3 All lubrication points and reducers shall be filled with grease or lubricating oil as required.

7.1.4 The inspection of all electrical circuits shall meet the requirements of 6.2.8.

7.2 Test instrument and test load

Test instrument includes steel ruler, steel tape (with accuracy not exceeding ±0.1%), jack, theodolite, stopwatch (with accuracy no greater than 0.01s), fifth wheel meter, sound level meter (with accuracy not exceeding ±2 dB). All instruments and utensils shall be verified by qualified organization and can only be used within the validity period.

The test load shall be suitable for the actual situation of the load handling device, and the weight accuracy range shall be within ±2%. The test load of the static load test is 1.25 times the rated lifting capacity; and the test load of the dynamic load test is 1.1 times the rated lifting capacity.

7.3 Working performance test of fork

The test procedures are as follows:

a) Based on the base zero plane of the warehouse, measure the lowest working position and the highest working position of the upper plane of the fork when it is no-load.

b) For the stacker with location for lifting and lowering, one row of racks can be selected arbitrarily during the test; and determine the access position of the upper plane of the fork against each layer of cargo compartments.

c) Based on the middle position of the fork, extend the fork left and right, and measure the working stroke of the fork by a steel tape.

d) Drive the stacker to the access of the warehouse platform, take the rated lifting capacity and return to the middle position, and then lift the pallet to the middle position of the height of the upright column. Set up a steel ruler at one end of the upper fork, use the theodolite to take a reading; and then re-take the reading on the steel ruler when the fork is extended to the maximum stroke. The difference between the two readings is the fork deflection value. Use the same method to measure the deflection value at the other end of the upper fork.

e) In the case of no-load and rated lifting capacity, respectively, measure the speed of extending fork left and right; measure three times each; and take the average value.

f) In the case of no-load and rated lifting capacity, respectively, measure the left and right parking accuracy and the parking accuracy of returning to the middle position, each of which shall be measured three times.

g) Add a heavy object of rated lifting capacity to the fork, and set the blocking force in accordance with the provisions of Table 1 in the front of the fork extending direction; and then operate the fork.

7.4 Operating performance test

The test procedures are as follows:

a) Take a section in the middle of the laneway to measure the length and make a mark. When the stacker has no load and rated lifting capacity, pass through this measurement section at high speed and low speed, respectively; and measure its speed; measure three times each; and take the average value;

b) The stacker operates at high speed and low speed respectively under no-load and rated lifting capacity; and implements braking; measures the braking distance and time; and calculates the respective acceleration and deceleration:

c) The stacker with automatic parking device operates at high speed under no-load and rated

7.8 Static stiffness test

The test load of the static stiffness test is the rated lifting capacity of the stacker plus additional loads (such as driver and passenger), and the test is performed when the pallet is raised to the upper limit of the upright column. The test procedures are as follows:

a) Fix a steel ruler on the top of the upright column along the horizontal direction of the operating rail, and load it to the test load;

b) When the pallet is at the bottom position and the upper limit position, use the theodolite to measure the two readings on the steel ruler, respectively; and the difference between the two readings is the static stiffness value.

7.9 Safety performance test

7.9.1 Test procedures

In the case of no-load and rated lifting capacity, respectively, test one by one according to the requirements of Clause 6 in JB/T 11269-2011; check the safety performance of the lifting and operating terminals, and whether the position of each safety device meets the design requirements, and whether each corresponding switch action is reliable, etc.; each item needs to be tested three times.

7.9.2 Speed limit anti-fall device test

7.9.2.1 Test the performance of the speed limit protection device: The pallet of the stacker descends at the rated speed. When it is about 1.5m off the ground, artificially prevent the action of the speed limiter. Locked the pallet reliably on the lifting guide rail by the braking clamp device. Test shall be respectively carried out once according to the no-load and rated lifting capacity.

7.9.2.2 Test the performance of the broken rope protection device: Lower the pallet that has carried the rated lifting capacity to an appropriate position; fix the pallet with the fixing device; loosen the lifting wire rope; and then remove the fixing device to test whether the pallet can be reliably locking on the lifting guide rail by means of a broken rope catcher.

7.9.3 Overload protection device test

7.9.3.1 When the mechanical overload protection device is used, if the load exceeds 25% of the rated lifting capacity, the overload protection device shall act; the stacker shall be stopped in time; and an audible/visual alarm shall be issued.

7.9.3.2 When the electronic overload protection device is used, if the load exceeds 10% of the rated lifting capacity, the stacker shall be stopped in time; and an audible/visual alarm shall be issued.

7.9.4 Loose rope protection device test

When the pallet is no-load and lowered to the lowest position, gradually lift the pallet with a jack; the loose rope protection device shall act; and an audible/visual alarm shall be issued.

7.9.5 For stackers with automatic control of fork operation

7.9.5.1 The cargos on the forks are artificially deflected to exceed the specified values of the operating width in the direction of the fork extending; and check that the stacker and the forks should not be able to move.

7.9.5.2 Manually take the no-load stacker from the unloaded cargo compartment and check that the fork shall not extend; if the loaded stacker is artificially store cargo to the loaded cargo compartment, check that the fork shall not extend.

7.9.5.3 When the fork is extended to the maximum stroke or reset to the center, the limitator shall be able to act automatically.

7.9.6 Emergency stop button test

When the emergency stop button is pressed, the main power supply of the stacker shall be cut off in time.

7.9.7 Electrical interlock test

7.9.7.1 When the door of the driver's cab on the stacker is not closed, start the stacker, and the power supply shall not be connected.

7.9.7.2 When a stacker that can be operated at multiple points is operated at one location, it shall not be possible to operate the stacker at any other locations. Test one by one, making sure all operating points are interlocked.

7.9.7.3 For stackers that can be controlled manually, semi-automatically or automatically, choose one control method; and the other control methods shall be prohibited at the same time.

7.9.7.4 When the forks of the stacker are moved away from the original position, and the operation and lifting of the stacker are manipulated, the operation of the stacker and the high-speed lifting movements affecting safety shall be prohibited.

7.10 Determination of noise

The test procedures are as follows:

a) Fully automatic stacker without an airborne operation station or ground operation station:

--- Measuring position: the position closest to the stacker from the peripheral safety passage, and the height is 1.60 m from the ground or working platform passage:

--- The measurement shall last for a complete cycle of walking and lifting, and the stacker

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