DRAFT TANZANIA STANDARD

Industrial, commercial and garage doors and gates - Mechanical aspects - Requirements and test methods

TANZANIA BUREAU OF STANDARDS

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0 National Foreword

The Tanzania Bureau of Standards is the statutory national standards body for Tanzania, established under standards Act No. 3 of 1975, amended by Act No. 2 of 2009.

This draft Tanzania Standard is being prepared by BCDC 15 Doors and Windows technical committee under the supervision of the Building and Construction Divisional Committee (BCDC).

On preparation of this document adaption was made to EN 12604:2017 - *Industrial, commercial and garage doors and gates - Mechanical aspects - Requirements and test methods*.

This document has been prepared to meet the needs of manufacturers and users, with the primary purpose of providing design and performance for mechanical aspects of industrial, commercial and garage doors and gates used by vehicles accompanied or driven by persons.

This Standard does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with this standard cannot confer immunity from legal obligations

Industrial, commercial and garage doors and gates - Mechanical aspects - Requirements and test methods.

1 Scope

This draft Tanzania Standard specifies mechanical requirements and test methods for manually operated doors, gates and barriers, intended for installation in areas in the reach of persons, and for which the main intended use is giving safe access for goods and vehicles accompanied or driven by persons in industrial, commercial or residential premises.

This Standard also covers manually operated vertically moving commercial doors such as rolling shutters and rolling grilles, used in retail premises which are mainly provided for goods protection.

This document applies only to doors which are not part of the load carrying structure of the building.

It does not apply to:

- lock gates and dock gates;
- doors on vehicles;
- doors mainly for the retention of animals unless they are at the site perimeter;
- doors intended for pedestrian use;
- railway barriers.

Whenever the term "door" is used in this document, it is deemed to cover the full scope of types and variances of doors, gates and barriers defined by the scope of this Standard.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 12433-1. Industrial, commercial and garage doors and gates - Terminology - Part 1: Types of doors
EN 12433-2, Industrial, commercial and garage doors and gates- Terminology- Part 2: Parts of doors
EN 12385-4, Steel wire ropes - Safety- Part 4: Stranded ropes for general lifting applications

EN 12600:2002, Glass in building -Pendulum test- Impact test method and classification for flat glass

EN 13241, Industrial, commercial, garage doors and gates - Product standard, performance characteristics

EN 13411-2, Terminations for steel wire ropes -Safety- Part 2: Splicing of eyes for wire ropes slings

EN 13411-3, Terminations for steel wire ropes - Safety- Part 3: Ferule secured eyes

EN 13411-6, Terminations for steel wire ropes - Safety- Part 6: Asymmetric wedge socket clevis

EN 61032:1998, Protection of persons and equipment by enclosures - Probes for verification (IEC 61032:1997)

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 12433-1, EN 12433-2 and EN 13241 apply.

4 Safety requirements and/or protective measures

4.1 General

The number of full operational cycles for which the door is designed/constructed, shall take into account the planned maintenance and replacement of parts subject to wear and fatigue.

4.2 Design and construction

4.2.1 *Operability*

The door and its components. including its fixing and assembling means as specified by the manufacturer for attachment to a building or structure, shall be designed so that elastic or permanent deformations under operational forces or torques which occur during normal use do not affect the

operation and the safety of the door.

The minimum safety factors for calculation purposes to be used for stress due to all loads for the design of the door are given in Table 1.

Table 1 Safety factors for materials for calculation purposes

Safety factor for yield stress	Safety factor for breaking stress
2.0 minimum	3.5 minimum

For components where testing is carried out instead of calculation the safety factor before yield shall be 1.1.

4.2.2 *Glazing*

Glazing elements in the door shall be so designed that they remain fully secured under normal operating conditions.

In order to avoid occurrence of sharp splinters, cutting edges or other dangerous parts, the glazing material shall comply at least with the requirements of class 3 of EN 12600:2002 and the glazing material shall not break

Door leaves made primarily from glazing material shall be clearly recognizable, e.g., by visible separations, permanent marking, suitable labels or by using coloured materials.

4.3 Protection against unintentional and uncontrolled movements

4.3.1 *Guides and end stops*

The guides (and where appropriate the door leaf as well as any other moving part of a door system) shall be designed and constructed in such a way that unintentional disengagement or derailment are prevented during normal operation, or in case of contact with a stationary obstacle, or in case of failure of a suspension element.

The movement of the door leaf shall be limited by end stops. Mechanical end stoppers in the terminal positions of the door movement shall withstand the energy developed by the possible impact of the door leaf.

4.3.2 *Unintentional movements due to wind*

When relevant, the door shall incorporate means suitable to prevent movement of the door due to the influence of wind. These means shall be effective at the relevant terminal position(s).

4.3.3 *Uncontrolled movements of vertically operating doors*

A vertically operating door leaf shall come to a stop and stay in position when released in any position during the opening or closing movement in normal operation.

4.3.4 *Safeguarding against dropping of vertically operating door leaves*

Vertically operating door leaves shall be safeguarded against dropping when in normal use or when a failure of a single element of the suspension or balancing system occurs. The failure of the connection between drum and curtain of a rolling door shall also be taken into consideration if the door when in the fully closed position does not cover at least half of the circumference of the roller.

The door shall not be able to close uncontrolled if a component fails. The design of the door shall also ensure that in case of a single failure the resulting short-term transient loads will not cause secondary mechanical failures of other elements of the door. Elements of the suspension or balancing system which could fail during operation of a door are balancing springs, counterweights, steel wire ropes, pulley, drums, chains, straps, belts and their attaching parts.

Rigid parts such as shafts or levers, provided that they are dimensioned and designed for the maximum load and foreseeable overload, need not be considered as a potential cause of the suspension or balancing system failure.

Safeguarding against dropping can be achieved by either using an anti-drop safety device or by other design features incorporated into the door. Safeguarding against dropping shall fulfil the following requirements:

a) in the event of a failure in the door suspension or balancing system, the main edge of the door leaf shall not move downwards more than 300 mm even in case of bouncing:

b) after the door leaf has been stopped by the anti-drop safeguarding, it shall be held safely in the same position, as long as no further action in accordance with the user instructions is carried out. User instructions shall clearly specify when a competent person is needed to further operate the stopped door;

c) the anti-drop safeguarding shall be automatically activated in the event of a suspension or balancing system failure;

d) an anti-drop safeguarding shall be designed to take the full dynamic load of the door leaf;

e) further, any component affected by the action of the anti-drop safeguarding shall be designed to bear the resulting dynamic forces;

f) parts of the anti-drop safeguarding or other door components may need to be replaced after activation of the anti-drop safeguarding. Unless activation of the anti-drop safeguarding does not cause any deformation and/or damage which impairs further operation of the door and of the anti-drop safeguarding, instructions for use shall specify parts to be replaced and whether the replacement can be carried out by the user.

The requirements of this paragraph can be disregarded if the following two requirements are simultaneously fulfilled:

— the maximum out-of-balance of the door leaf static force occurring at the primary closing edge of the door does not exceed 200 N when there is a suspension or balancing component failure; and

— the failed component is clearly visible or detectable during normal operation of the door.

4.3.5 *Safeguarding against dropping of hinged doors*

Hinged door leaves shall be safeguarded against dropping when in normal use or when a failure of a single element of the fixing system occurs. The door leaf shall not be able to move uncontrolled if a component fails.

In case a hinge or other supporting means breaks or is damaged, the anti-drop safety device shall be able to keep the leaf in position with a maximum displacement of 300 mm from the rotation axis.

The door shall also be fitted with a device which avoids that the door leaf, during the opening or closing movement, can be lifted more than 50 % of the length of the pin of the hinges or any other supporting means ("anti-lifting" device).

4.4 Forces for manual operation

A door shall be able to open or close with a force not exceeding 150 N for doors for residential use and 260 N per person for industrial/commercial use, wind or other environmental factors not being considered. These forces can be exceeded to start the movement.

4.5 Devices for manual operation

Doors shall be fitted with suitable devices, such as handles or pull cords, on the inner and outer sides of the door to enable them to be moved, unless the basic design affords sufficient safe hand-hold. If a door is only operated from one side, it is acceptable that only that side is equipped with such devices.

4.6 Finger protection

Gaps, other than between the main closing edge and the secondary edge, in which the distance between door leaf components is reduced during the leaf movement and where the test probe B of EN 61032:1998 can be inserted shall be eliminated or safeguarded up to a height of 2.5 m above floor level or other permanent access level.

Sharp edges shall be eliminated or safeguarded to avoid the risk of cutting when operating the door.

Edges with radius of at least 2 mm and, for combined radius (sum of the 2 radii), of at least 6 mm (e.g., at least 2 mm+ 4 mm or 3 mm+ 3 mm) are considered to be safe.

If during normal use of the door the gap created within single coils of springs is greater than 8 mm, the path of those springs shall be safeguarded up to 2.5 m above floor level or any other permanent access

level.

4.7 Specific requirements for parts used in suspension and balancing systems

4.7.1 *General*

Commonly used parts in suspension and balancing systems are balancing springs, counterweights, steel wire ropes, pulley, drums, chains, straps and belts.

4.7.2 *Springs*

Springs shall be so arranged that one spring cannot cause faulty operation of another. Precautions shall be taken to prevent ejection of springs or spring coils in case of breaking.

4.7.3 *Counterweights*

The path of counterbalancing weights shall be safeguarded up to 2.5 m above floor level or any other permanent access level. If counterweights are fully beyond their covering during any part of the door operation, the guide shall ensure their re-entry into their covers again. In this case counterweights shall be prevented from breaking using appropriate material and/or construction.

Where more than one rope is fastened to one counterweight they shall be individually fixed to the counterweight.

4.7.4 *Steel wire ropes, chains, straps*

4.7.4.1 General

When vertically operating doors have steel wire ropes, chains, straps connected directly to the door leaf, a minimum of two independent steel wire ropes, chains, straps shall be used.

Where two or more steel wire ropes, chains, straps are used, it shall be ensured that. in normal working conditions, the loads are shared in a pre-determined way.

The guaranteed minimum breaking strength of such steel wire ropes, chains, straps shall be confirmed by a technical documentation/declaration or certificate from the supplier/manufacturer of these elements.

These types of steel wire ropes, chains, straps shall be so arranged that they can be inspected over their full length eventually after removal of covers.

Drawing in points of steel wire ropes, chains, straps that can be reached in normal operation shall be safeguarded up to a height of 2.5 m above floor level or another permanent level.

4.7.4.2 Steel wire ropes, pulleys and drums

Steel wire rope shall be made in accordance with EN 12385-4.

Each steel wire rope shall have a safety factor not smaller than 6 (minimum guaranteed breaking strength in relation to the static load of one rope).

Steel wire rope pulleys and drums shall have a pitch circle diameter measured at the centre of the rope (P.C.D.) at least equal to 18 times the rope diameter unless a smaller P.C.D. is declared by the steel wire rope load carrying manufacturer.

Steel wire rope drums shall be grooved.

Terminations other than spliced terminations in accordance with EN 13411-2, or ferule secured eyes in accordance with EN 13411-3 or wedge socket devices in accordance with EN 13411-6, shall have a breaking load giving a safety factor not less than 6, or a minimum of two full turns of steel wire rope are left on the drum in the terminal position.

Where steel wire ropes enter grooves on drums, the design shall ensure that the winding of the steel wire rope onto the drum cannot become mis-threaded.

Steel wire rope pulleys and drums shall be so designed that the steel wire rope cannot jump out of the pulley/drum.

4.7.4.3 Straps

Each strap shall have a safety factor not smaller than 6 (minimum breaking strength in relation to the static load of one strap).

Where straps enter grooves on drums, the design shall ensure that the winding of the strap onto the drum cannot become mis-threaded.

4.7.4.4 Chains and chain wheels

A suspension chain shall have a safety factor not smaller than 6 (minimum breaking strength in relation to the static load on one chain).

The design shall prevent the chain from disengaging from chain wheels. Chain wheels shall not have teeth with undercut flanks.

4.8 Pass doors

Pass doors shall be so designed and positioned that they cannot leave unintentionally their safe position when the main door, in which they are installed, is operated in normal use.

Parts of doors shall not cause any tripping hazard. Height differences up to 5 mm which occur in the traffic area are not considered dangerous.

When height differences greater than 5 mm are needed due to technical reasons, e.g. thresholds of pass doors, the raised parts shall be clearly visible themselves or shall be made so by warning signs, e.g. yellow-black stripes.

4.9 Additional requirements for doors operating by gravity or other self-closing mechanism

Doors operating by the use of gravity or self-operating mechanism shall nut expose any person being crushed or entangled to forces causing injury or damage.

The operating speed of doors which operate solely by gravity shall not exceed 0.3 m/s. The force of the door impacting the human body or part of it shall not exceed 200 N. If this is not possible, then an audio-visual warning device shall be fitted to the door which acts immediately the door begins to close.

5 Verification of the safety requirements and/or protective measures

5.1 General

For practical reasons more than one test sample may be used.

The test sample should be representative of a family and/or type of doors.

The test sample is specified by the manufacturer and can be the complete door or an artificial load.

The tests shall be performed at an ambient temperature of (20 ± 10) °C and humidity between 20% and 90%. Other values of temperature or humidity shall be considered if they are declared by the manufacturer.

Tests are carried out in the most unfavourable conditions with the test sample installed and adjusted according to the manufacturer instructions.

Test and verifications shall be recorded and records filed with the relevant documentation of the door.

5.2 Design and construction

5.2.1 *Operability*

The door is operated in normal use and 10 cycles are carried out. The door continues to operate without any impairment of operability (e.g., throttling of the movement, increased noise, increased friction, etc) or safety.

Manufacturer technical documentation/declarations or calculations are checked to verify the relevant minimum safety factors have been taken into consideration during the design of the door. If no technical documentation/declaration or calculation are available the safety factors are checked carrying out the relevant tests on the door materials.

5.2.2 *Glazing*

If transparent elements are included in leaves it is verified by visual check that they remain fully secured after the operability test.

Documentation is checked to verify that glazing fulfils the requirements of 4.2.2.

It is verified by visual check that door leaves made of glazing are clearly recognizable.

5.3 Protection against unintentional and uncontrolled movements

5.3.1 *Guides and end stops*

The verification is carried out using as test body a box made by hard material (e.g. wood, metal, etc.} with dimensions 400 mm x 400 mm x 400 mm.

For horizontally moving doors the test body is to be put on the floor in the running direction of the main closing edge next to the secondary closing edge.

For vertically moving doors the test body is put on the floor at each side of the opening, next to the guide.

The door leaf shall travel once with a speed of not less than 0.3 m/s against the test body. Verify that the impact does not cause derailment or permanent deformation of the door leaf. Verify the door leaf can still be operated as in normal use.

Door leaves with mechanical end stops shall travel twice to their terminal positions with a speed of 0.3 m/s. Verify that the impact does not cause derailment or permanent deformation of the door leaf or damage or permanent deformation of the end stops. Verify the door can still be operated as in normal use.

5.3.2 *Unintentional movements due to wind*

Verify by visual inspection that means to hold the leaf in position are effective at the relevant terminal position(s) of the door.

5.3.3 *Uncontrolled movements of vertically operating doors*

The door leaf shall be released during 5 opening and 5 closing movements, each time at different positions. Verify by visual inspection the leaf comes to a stop and stays in position.

5.3.4 *Safeguarding against dropping of vertically operating door leaves*

Test is carried out with the anti-drop safeguarding in the most unfavourable situation, e.g., in a position where the blocking elements have the longest distance to reach the blocking position.

The test can he carried out using the complete door or a test rig. The rigidity of the test rig shall he representative of the most unfavourable condition of installation as described in the installation instructions. The test sample shall represent the most unfavourable mass or load for the family and/or type of doors.

Faults are applied one at the time and the downward distance the door leaf moves before coming to a stop is measured.

The test is repeated two more times in order to check the repeatability of the system. When required by the instructions, relevant parts of the anti-drop safeguarding and/or of the door are replaced before each test.

During each test it is verified the anti-drop safeguarding is automatically activated after the fault is applied.

After each test it is verified the door is held safely in the same position, as long as no further action in accordance with the user instructions is carried out.

For anti-drop safeguarding which are not required to be replaced after activation to verify repeatability and strength of the anti-drop safeguarding and to verify that activation of the anti-drop safeguarding is not causing any deformation and/or damage which impairs further operation of the door, seven further tests are carried out.

5.3.5 *Safeguarding against dropping of hinged doors*

Test is carried out with the anti-drop safeguarding installed according to the installation instructions.

Faults of hinges or other supporting means are applied one at the time and maximum displacement of the door leaf is measured. When the fault is applied, it is also checked the door leaf cannot move uncontrolled.

Check by visual inspection and measurement the effectiveness of the "anti-lifting" device.

5.4 Forces for manual operation

Locate the door leaf in each of the closed, middle and open positions.

Check by measurement that the forces required to move the door leaf from any of the above positions are according to 4.4.

5.5 Devices for manual operation

Check that the devices provided enable the door leaf movement and can be held by the user without risk of crushing, trapping or cutting.

5.6 Finger protection

Verify that the test probe B of EN 61032:1998 cannot be inserted in gaps in which the distance between door components is reduced during the leaf movement or that the gaps are protected up to 2.5 m.

Protection against sharp edges shall be inspected according to the requirements in 4.6.

5.7 Specific requirements for parts used in suspension and balancing systems

5.7.1 *Springs*

Check by inspection that operation of or damage to one spring cannot cause faulty operation of another spring in the system.

Check by inspection that in the event of a spring breakage measures are provided to ensure that the spring remains in place and that a spring coil cannot be ejected.

5.7.2 *Counterweights*

Check by inspection counterbalancing weights to ensure that requirements of 4.7.3 are met.

5.7.3 *Steel wire ropes, chains, straps*

5.7.3.1 General

For steel wire ropes, chains and straps check by inspection that requirements of 4.7.4 are met.

5.7.3.2 Steel wire ropes, pulleys and drums

For steel wire ropes, pulleys and drums check by inspection or test that requirements of 4.7.4.2 are met

5.7.3.3 Straps

For straps check by inspection that requirements of 4.7.4.3 are met.

5.7.3.4 Chains and chain wheels

For chains check by inspection that requirements of 4.7.4.4 are met.

5.8 Pass doors

When the door is operated check by inspection that the pass-door is held in the safe position and may not move unintentionally.

Requirements for thresholds are checked by inspection.

5.9 Warning signs and/or devices

Check, if mechanical hazards cannot be avoided within the basic design of the door or eliminated by use of suitable guards, that the hazard locations or remaining risks are identified by suitable warning signs and/or devices.

Annex.A
(informative)
Guidelines for a safe construction

The guidelines below may prove useful in achieving a safe construction.

To avoid the derailment of sliding doors, the following may be considered:

— during the opening or closing movement the lifting of the door should be max 75 % of the depth of the slot of the wheel. Lifting should be measured at the support with the leaf in open and closed position and at 50 % of the travelling;

The system to keep the leaf in position should have the following characteristics:

— anti-loosening system of the fixing means (e.g., bolts);

— sufficient rigidity of the fixing system. The deformation of the fixing of the guiding system should be ≤ 5 mm after application of a static load of 500 kg for 60 s applied to the centre of the end of the support;

— redundancy with a second system keeping the leaf in place in case of damage/malfunctioning of the first system;

— anti-derailment system that stops the movement of the door or allows the door continuing the movement in a safe way in case of a wheel coming off the rail.

The guiding system of a sliding door should have a shape such to avoid the leaf falling off in case a roller breaks or gets damaged.

Sliding doors leaf with a width ≥ 3m and a weight ≥ 100 kg when operated in a non-accompanied way should stop within a distance ≤ 300 mm or the kinetic energy of the "released" leaf should be ≤ 10 J.

The test method to verify the above can be: the door is moved with a force of 300 N for 2.5 m and then "released". Either the door stops within 300 mm or the kinetic energy measured at the "releasing" point is ≤ 10 J.

When a rolling door is in the fully closed position, at least half of the circumference of the roller should be covered. This also applies where sections of reduced width are used.

When the design of the rolling door does not allow this, the strength of the connection roller-curtain should be justified by calculation.

A lateral movement between the section/laths should not cause any damage or danger or should be prevented.

Annex.B
(informative)
Examples of mechanical protection and safety distances

- **At sectional doors between sections**

a) Flexible guide, following the movement of the door leaves.

b) Design of door leaves panels whereby variable openings do not occur.

c) Openings sealed with rubber/flexible material.

d) A safety distance of at least 25 mm preventing injuries to fingers measured in compressed state.

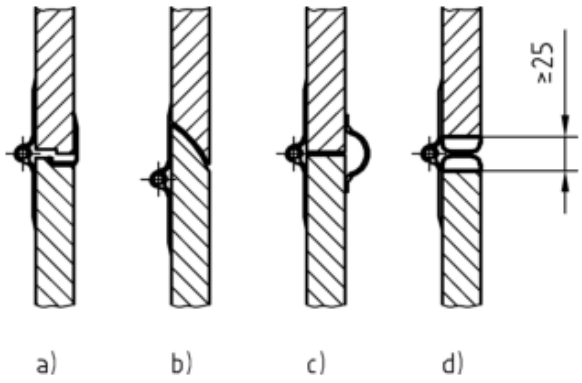
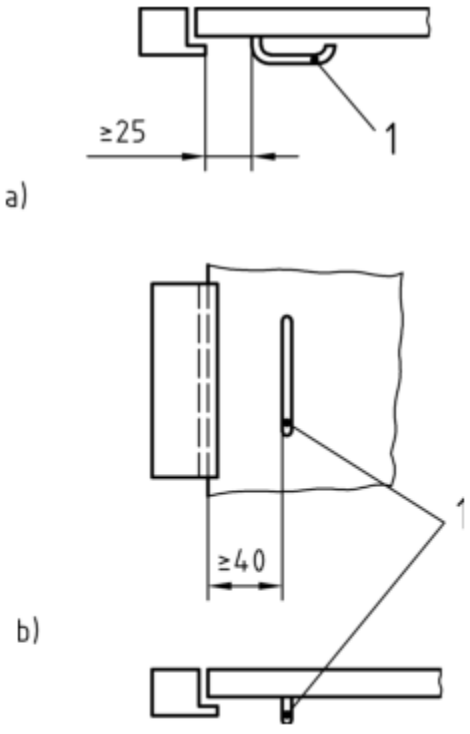


Figure B-1 Safeguarding at sectional doors

- **At hinged doors**

a) Safety distance between horizontal handle and door frame.

b) Safety distance between vertical handle and door frame.



Key
1 handle

Figure B-2 Safeguarding at hinged doors