

Regulation IO – 7.0: General Commodity Storage

7.1 Wood/Lumber/Board Storage

7.2 Flat Glass

7.3 Steel Formwork/ Plates/Coils

7.4 Paper Storage

7.5 General Requirements

7.1 Wood/Lumber/Board Storage

7.1.1 Ground and environmental conditions:

- 7.1.1.1 The ground where stacks are to be assembled shall be flat and even with a slope of no more than 2°, ideally with a top surface of asphalt, interlock or concrete, and well maintained with no potholes.
- 7.1.1.2 The ground should be strong enough to withstand the load of both stacks and machinery, be well consolidated, and its stability should not be affected by weather conditions such as heavy rain. Good drainage should be provided.
- 7.1.1.3 Clear any obstacles such as waste timber or unused bearers from the stacking area as they may make stacks unstable.
- 7.1.1.4 Stacks which are outside may be affected by wind, so where possible construct them so a small cross section is facing the prevailing wind direction. Check external stacks after high winds. Securely attach any protective sheeting.

7.1.2 Bearers:

- 7.1.2.1 Bearers support packs of timber, keeping them off the ground and allowing space for fork-lift trucks to lift the pack. They also support the timber within the pack.
- 7.1.2.2 Select bearers carefully. They should be straight and identical in length and cross-section (preferably square). If they are rectangular in section they are most stable when the long edge is horizontal.
- 7.1.2.3 The length of the bearer should be equal to the width of the pack. If too long they protrude, encouraging climbing of the stack, or can be easily struck by passing vehicles. Short or offset bearers do not fully support the pack above and increase the load on banding.



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7.1.2.4 Bearers should be in good condition and should be destroyed if rotten, damaged or split. They should be made of a material strong enough to withstand the environment where the stack is constructed.

7.1.2.5 Position the bearers carefully to prevent timber in the supported pack from sagging and to avoid offsets in the stack. Figure 1 shows the effect of a short or offset bearer. The tip line of the stack moves inwards from the edge since part of the width of the stack is not supported.

7.1.2.6 The same problem occurs if bearers are placed to run the length of the pack as shown in Figure 2. In this case the supported width of the pack is from the outside edge to outside edge of the bearers and the stack is less likely to be stable.

7.1.3 Banding:

7.1.3.1 Before banding look at the requirements of the band and what will happen to the banded pack. Consider whether the timber is likely to expand or contract due to the surrounding storage conditions or treatment (i.e. timber with a high moisture content will shrink and the banding may come loose and need to be reapplied).

7.1.3.2 Select a banding material that is suitable for the demands to which it will be subjected. For example, 12 mm wide polypropylene banding should not be used to band timber packs with cross-sections of greater than 0.5 m² and masses greater than 400 kg. Use polyester or steel instead.

7.1.3.3 To ensure a tight and secure pack is achieved, assemble packs carefully, minimizing the space between timbers.

7.1.3.4 Take care when applying bands. Apply them squarely (i.e. Parallel to the plane of the end face) close to columns of sticks within the pack. They should be tight to the face of the pack and not be applied over the ends of protruding sticks or bearers. Banding fasteners also need to be suitable for the pack and banding material.

7.1.3.5 Wear eye protection when banding is being removed. When cutting tensioned metal banding, use safety cutters.

7.1.3.6 Periodic inspection will highlight deficiencies in the banding, for example, loose bands and loss of pack shape. If problems are detected, the packs concerned should be rebanded.



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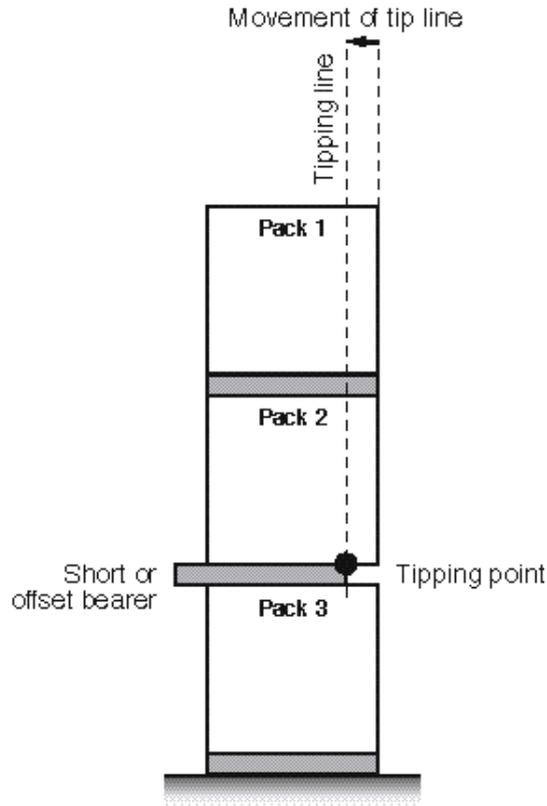


Figure 1- Schematic showing the movement of the tip line and tip point due to a short or offset bearer



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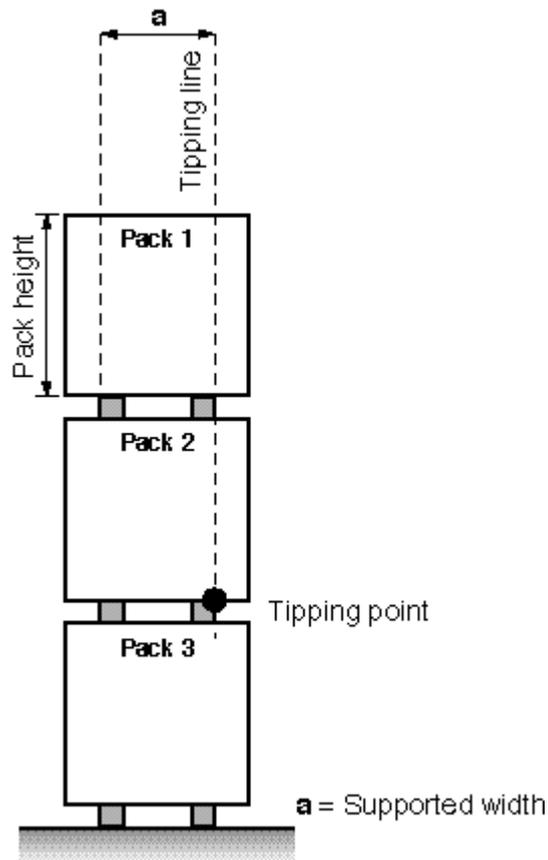


Figure 2-Supported width

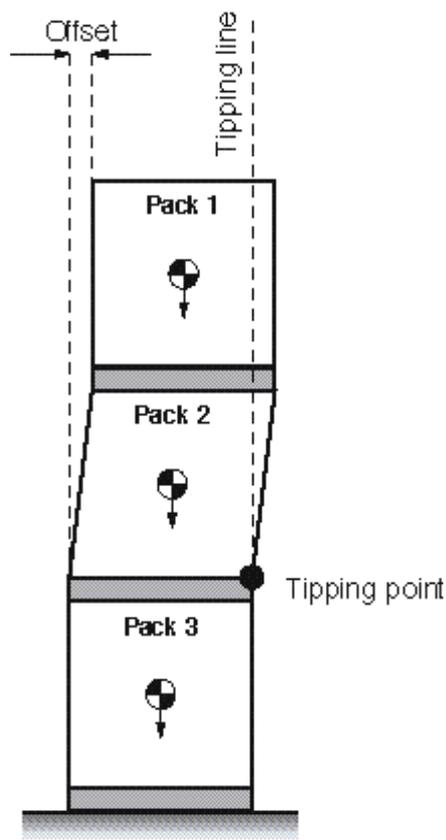
7.1.4 Pack characteristics:

- 7.1.4.1 Where possible the timber in the pack should all be of the same cross-section and length. Do not leave timber protruding from the end faces of the pack for the purpose of climbing the stack.
- 7.1.4.2 Out-of-square or lozenge-shaped packs affect the stability of the stack and cause an increase in tension in the banding material. Figure 3 shows how a lozenge-shaped pack shifts the centre of gravity of packs above.
- 7.1.4.3 Packs can also ball or roll (Figure 4), moving the tipping line inwards, having the effect of reducing the width of the pack (i.e. only part of the width of the pack is supported). This makes the stack far less stable.



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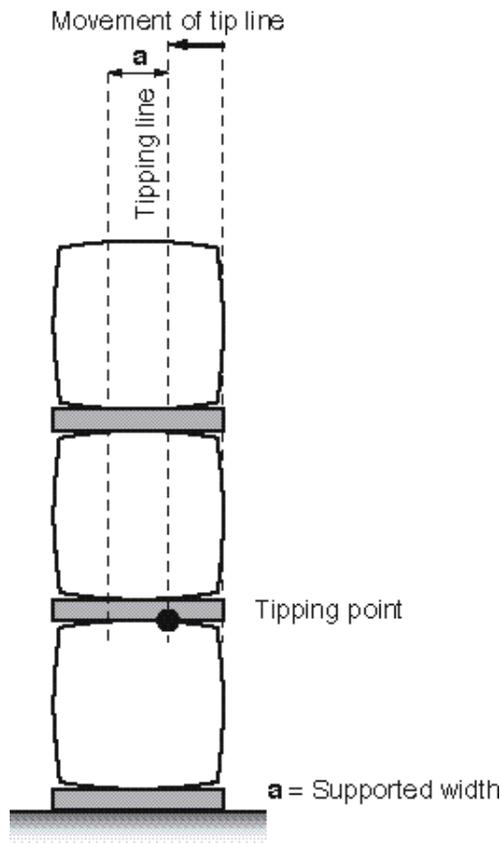
- 7.1.4.4 Do not stack collapsed or partially collapsed packs or transport them off site - reassemble them. If identified in a stack, remove and rectify them using an established safe system of work.
- 7.1.4.5 Keep the tops of packs level which will help to form a vertical stack. If the top row is not complete, any bearer placed on top should be flat and supported by timbers placed at the edge of the pack.
- 7.1.4.6 Separating sticks (dunnage) can be beneficial within the pack, helping to form a tight square pack and preventing balling or rolling. Like bearers, stick length should equal pack width. Sticks may increase the tendency for the pack to lozenge and this should be monitored.



[Figure 3- The effect of out-of-shape packs on stability - lozenge packs](#)



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[Figure 4-The effect of out-of-shape packs on stability - balled packs](#)

7.1.5 Stack height and stacking practices:

In an indoor environment, the maximum height of the stack should not be more than four times the shortest width of the pack (i.e. a ratio of 4:1). Outside where wind may affect the stack, the ratio should be reduced to 3:1. These ratios are general guidelines - the actual stacking height should be determined after considering the results of your risk assessment. For example, where there is a risk of vehicle strikes against the stack, the stack is on a slope of more than 2°, or there is frequent public access, then the ratios should be reduced to 3:1 indoors and 2:1 outside. However, if these and other risks are absent (e.g. in a tightly packed kiln or outside on level concrete in a sheltered area) these ratios may be increased. Short or offset bearers, and balled or rolled racks, may result in the supported width of the stack being less than it appears and the stack height should be reduced. See the 'Bearers' and 'Pack characteristics' sections.

7.1.6 Safe working practices:



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7.1.6.1 Un-stacking

- 7.1.6.1.1 Before un-stacking, examine the stack to see how it was constructed and to check for signs of instability or faults such as broken bands, bearers or sticks, and pack balling. It is important to identify any packs which are bridging other stacks or packs.
- 7.1.6.1.2 Take down packs tier by tier. Move only one at a time. Do not leave isolated single stacks. Do not remove individual pieces of timber from packs until they are on the ground and the working area is safe.
- 7.1.6.1.3 If you need access to the top of the stack, use a mobile elevating work platform, suitable work platform on a fork-lift truck, or secured ladder. It should not be necessary to work at height directly on top of the stack. If such work has to be done then it must be strictly controlled and only done when all other options are not reasonably practicable.

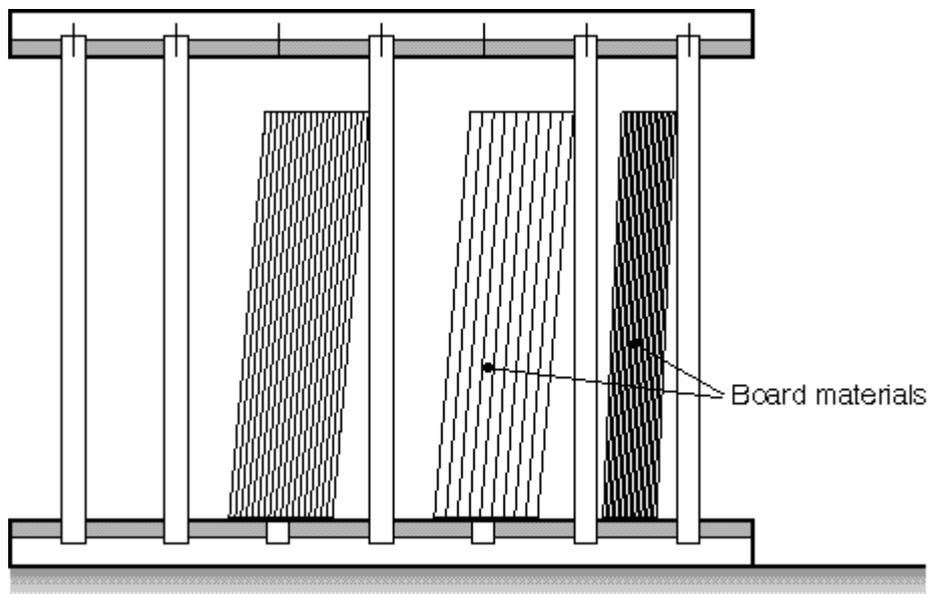
7.1.6.2 Stacking timber and board material

- 7.1.6.2.1 Position centre of gravity of stacked packs directly above one another. Packs should not be offset so they protrude from the stack.
- 7.1.6.2.2 Consider the size and shape of packs before stacking. Place smaller/lighter packs on top of larger/heavier packs. Packs should not bridge across two stacks or cross other packs. Do not allow loose material on top of stacks.
- 7.1.6.2.3 Stacks should not lean against or be supported by other stacks.
- 7.1.6.2.4 If fork-lift truck or side-loader forks protrude beyond the load being lifted, they may strike packs behind.
- 7.1.6.2.5 Store boards and similar flat articles (i.e. doors or windows) flat on a level surface. Use suitable pallets, wood or chipboard battens, or a purpose-built racking system.
- 7.1.6.2.6 Never stack boards on edge without adequate support as they can tip out of control from a vertical position. It is common for boards that have just been delivered, and propped up temporarily, to topple before they are moved to the storage area. Staff should be told about the dangers of propping boards without support, and erecting warning signs in the delivery area may help.
- 7.1.6.2.7 An alternative to storing the materials flat is the 'pigeon hole' or 'toast rack' system (Figure 5). Boards are stored in compartments preventing sideways movement and allowing the removal of individual boards.



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7.1.6.2.8 Fix racking securely to the floor, mark it with maximum load information and regularly check it for damage. Protect exposed corners at the ends of aisles with, for example, bollards or stanchions.



[Figure 5-Pigeon hole stacking](#)

7.2 Flat Glass

7.2.1 The ground where stacks are to be assembled shall be flat and even with a slope of no more than 2° , ideally with a top surface of asphalt, interlock or concrete, and well maintained with no potholes.

7.2.2 The ground should be strong enough to withstand the load of stacks.

7.2.3 Adequate safe clearances shall be maintained from warehouse walls and adequate space for handling equipment to be used safely.

7.2.4 Flat Glass should be stored in dry conditions with the aid of racking.

7.2.5 The glass should not be in contact with any substance harder than itself.

7.2.6 The angle of inclination is critical and should be at least 3° from the vertical on static racks and $5^\circ - 6^\circ$ for transportable racks, pallets and stillages.

7.2.7 Glass stored on its edge should be supported as evenly as possible over its surface



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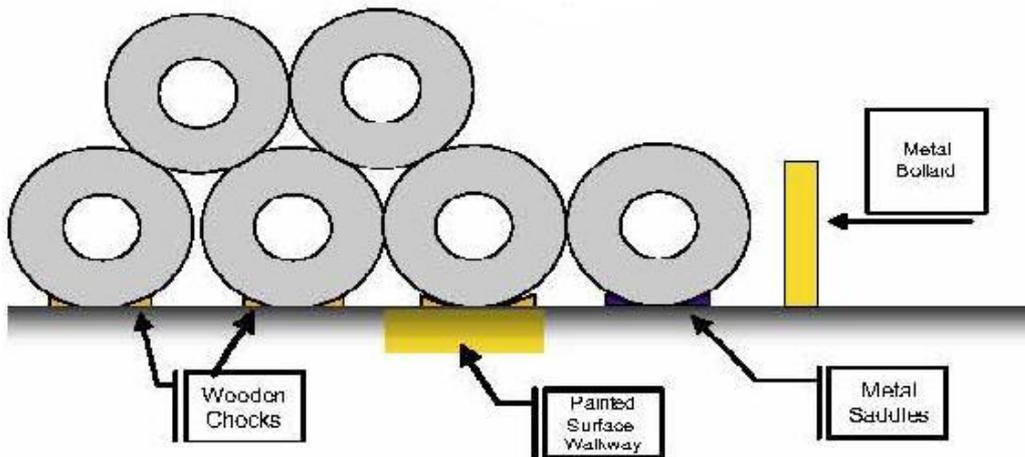
- 7.2.8 Mesh fencing or other barriers should be provided at the sides of racks to contain any glass that may suddenly vent and fall out sideways during handling.
- 7.2.9 Depending on the size and substance of the glass to be carried there are single-, double-, and multi-handed techniques. Equipment available for use might include straps or slings, suction pads (Josters), warehouse trucks and glass carrier.

7.3 Steel Formwork/ Plates/Coils

- 7.3.1 The ground where stacks are to be assembled shall be flat and even with a slope of no more than 2°, ideally with a top surface of asphalt, interlock or concrete, and well maintained with no potholes.
- 7.3.2 The ground should be strong enough to withstand the load of both stacks and machinery, be well consolidated, and its stability should not be affected by weather conditions such as heavy rain. Good drainage should be provided.
- 7.3.3 Adequate safe clearances shall be maintained from walls/fence and adequate space for handling equipment to be used safely.
- 7.3.4 Clear any obstacles such as waste timber or unused bearers from the stacking area as they may make stacks unstable.
- 7.3.5 Use suitable wood/metal battens and no undue bow or sag. Bearers support packs of steel form work/plates, keeping them off the ground and allowing space for fork-lift trucks to lift the pack.
- 7.3.6 Ensure that safe stacking methods (i.e. no fouling other materials) are implemented.
- 7.3.7 Select a banding material that is suitable and sufficient strength for the demands to which it will be subjected. Banding fasteners also need to be suitable for the pack and banding material.
- 7.3.8 Without fixed support, sheets and plates should only be stacked horizontally.
- 7.3.9 Particular care in the stocking of oiled sheets.
- 7.3.10 Special recommended considerations relating to the storage of coil, slit coil and general steel bars. See Figure for recommended storage practice.
- 7.3.11 Supported' or 'racked' (i.e. subject to permanent or semi-permanent storage e.g. Toast racking, Tree racking etc.) should be level and adequate in strength with sufficient space.
- 7.3.12 Racks to be of sound design and construction; designed to prevent materials falling and for them to be adequately supported along their lengths.
- 7.3.13 Maximum weight capacity to be displayed.



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[Figure 1 Recommended Steel Coil Storage](#)

7.4 Paper Storage

7.4.1 Storage Considerations: impair

- 7.4.1.1 Stacking of bales shall be impaired by variation in bale size and in bale shape and density.
- 7.4.1.2 Loose bales, soft bales, and bales that are poorly tied /in the warehouse shall not be stacked as they are required to be reworked for safe storage.
- 7.4.1.3 The bales shall be segregated according to size and stack-ability by uniformity.
- 7.4.1.4 The stack height shall be determined by the size and stability of these bales and shall varies from about four to six high.
- 7.4.1.5 Bales in the wall are often placed so that a bale's center is over the juncture of two bales below it, forming an interlocking pattern for additional stability. The other bales are then stacked against the retaining wall bales, which gives them added support. Smaller bales shall be placed nearer the top of the stacks.
- 7.4.1.6 Adequate safe clearances shall be maintained from warehouse walls and adequate space for handling equipment to be used safely.
- 7.4.1.7 Unloading/ Transporting Equipment - Fork trucks should be sized to handle up to three bales at a time and are generally be designed for heavy-duty industrial applications.



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Additional items to consider are type of mast, reinforced cabs to protect the driver from falling bales, fuels compatible with the warehouse environment, floor conditions and type of tires to be provided for safety and non-marking.

7.4.2 Roll Paper:

- 7.4.2.1 Paper of all grades shall be wound up to reels at the end of the paper machine. As these reels may have diameters of 1.5m to 2.5 m and a weight of several tons, storage & handling should be of very safe manner.
- 7.4.2.2 The individual rolls may be considered for storing vertically on end directly on the floor. Storing the rolls on-side shall require pallets or in special rack systems.
- 7.4.2.3 Storage heights shall be assessed based on the size & dia of the roll paper in order to have safe storage practice.
- 7.4.2.4 Handling within the storage areas shall be of mainly by special clamp type fork lift trucks.

7.5 General Requirements

- 7.5.1 All workers should be provided with adequate personal protective equipment.
- 7.5.2 Storage arrangement should consider how fork-lift trucks and other vehicles operate in and around the storage area.
- 7.5.3 Arrange storage areas to give good visibility for pedestrians and vehicles. It may be necessary to position mirrors around the area or provide extra mirrors on vehicles to reduce blind spots.
- 7.5.6 Pedestrians should use designated walkways, segregated from vehicles where possible, and be excluded from active stacking areas. Stacking areas should have adequate lighting.
- 7.5.7 A one-way traffic system and speed restrictions may add to site safety.
- 7.5.8 Roadways or aisles should be clearly defined and strong enough to withstand the weight of loaded vehicles.
- 7.5.9 Make sure roads/aisles are maintained (i.e. repair pot holes). Fit reversing alarms to vehicles with restricted rear vision.
- 7.5.10 Stack condition should be regularly monitored by adequately trained staff that can identify stack faults.