

## **Pallets – An efficient and safe way of material handling**

**By R.R.Singh, Sc. 'D', TED**

Stacking, Storage and movement of goods and materials are essential elements of almost all the businesses. But, unfortunately many serious as well as fatal accidents are also witnessed while goods are being stacked or destacked and put into or taken out of storage.

Various methods of storage and stacking systems are used in the industry now days. Material handling equipment are also extremely diverse, ranging from hand trolleys to various types of forklifts trucks to sophisticated warehouse robots. It makes material handling all the more interesting and challenging.

It is the responsibility of the employer to take all reasonable steps to ensure that all goods, materials, substances and equipment in the workplaces are stacked, stored, secured and kept that they do not constitute a danger to persons in their vicinity during the course of daily operations and in the event of an earthquake. Such steps should ensure that these items cannot, whether of their own accord, or by virtue of any external force (intentionally applied or otherwise), so flow, move, roll or collapse, as to constitute a danger to persons in their vicinity. All workers who are or may be responsible for stacking, storing, securing, or keeping any goods, materials, substances, or equipments should be fully trained in safe methods of doing so. Keeping in view the great diversity of goods and materials to be stored and the wide range of storage methods and handling equipment in use now, it has become imperative that a safe system of work is developed that will integrate the three main components of material handling i.e. people, materials and machinery within a safe and healthy working environment.

Pallets are an integral part of any basic materials handling and storage system common to a wide range of stores and warehouses. A pallet (sometimes called a skid) is a flat transport structure that supports goods in a stable fashion while being lifted by a forklift, pallet jack, or other jacking device. A pallet is the foundation of a unit load design, which can be as simple as placing the goods on a pallet, and securing them with straps or stretch-wrapped plastic film, or as exotic as a ULD mini container. Containerization for transport has spurred the use of pallets because the containers have the clean, level surfaces needed for easy pallet movement. Most pallets can easily carry a load of 1,000 kg.

### **Development of the pallet**

The pallet was developed in stages. Spacers were used between loads to allow fork entry, progressing to the placement of boards atop stringers to make skids. Eventually boards were fastened to the bottom to create the pallet. The addition of bottom boards on the skid, which appeared by 1925, resulted in the modern form of the pallet. With the bottom deck, several problems common to the single faced skid were addressed. For example, the bottom boards provided better weight distribution and reduced product damage; they also provided better stacking strength and rigidity. Lift truck manufacturers promoted the idea of using more vertical area of a plant for stock storage.

In size, skids started narrow in order to pass through ordinary doors. As facilities were rebuilt, many organizations optimized their buildings for larger pallets in order to reduce labor costs. The earliest referenced U.S. patent on a skid is Hallowell's 1924 "Lift Truck Platform." In 1939, Carl Clark patented a recognizably modern pallet, although with steel stringers. In World War II, palletized material handling was rapidly perfected in order to transfer Allied war materials. The patent activity picked up again after the war, as inventors claimed items they improvised for the war effort. The first four direction pallet was claimed in 1945 by Robert Braun. At the end of 1948, Sullivan Stemple claimed the basic idea of a pallet designed to be used with a fork lift; the pallet was to be stamped from steel. During World War II, to reduce the resupply time of warships, the first modern disposable four-way block pallet was developed, and patented in early 1949 by Norman Cahners, a U.S. Navy Supply Officer in the ordnance depot at Hingham, Massachusetts. The first completely modern 2-direction stringer pallet was described in 1949 by Darling Graeme.

## **Types of pallets**

Although pallets come in all manner of sizes and configurations, all pallets fall into two very broad categories: "stringer" pallets and "block" pallets.

### **Stringer pallet**

Stringer pallets use a frame of three parallel pieces of timber (called stringers). The top deckboards are then affixed to the stringers to create the pallet structure. Stringer pallets are also known as "two-way" pallets, since a pallet-jack may only lift it from two directions instead of four. Forklifts can lift a stringer pallet from all four directions, though lifting by the stringers is more secure.

### **Block pallet**

Block pallets are typically stronger than stringer pallets. Block pallets utilize both parallel and perpendicular stringers to better facilitate efficient handling. A block pallet is also known as a "four-way" pallet, since a pallet-jack may be used from any side to move it.

### **Materials used**

The cheapest pallets are made of softwood and are often considered expendable, to be discarded as trash along with other wrapping elements, at the end of the trip. These pallets are simple stringer pallets, and liftable from two sides.

Slightly more complex hardwood block pallets, plastic pallets and metal pallets can be lifted from all four sides. These costlier pallets usually require a deposit and are returned to the sender or resold as used. Many "four way" pallets are color coded according to the loads they can bear, and other attributes. Wooden pallet construction specifications can depend on the pallet's intended use: general, FDA, storage, chemical, export; the expected load weight; type of wood desired: recycled, hard, soft, kiln Dried or combo (new & recycle); and even the type of fasteners desired to hold the pallet together: staples or nails.

Paper pallets are often used for light loads, but engineered paper pallets are increasingly used for loads that compare with wood. Paper pallets are also used where recycling and easy disposal is important.

Plastic pallets are often made of new HDPE or recycled PET (drink bottles). They are usually extremely durable, lasting for a hundred trips or more, and resist weathering, rot, chemicals and corrosion. They often stack. Plastic pallets are exempt by inspection for biosafety concerns, and easily sanitize for international shipping. HDPE is impervious to most acids and toxic chemicals clean from them more easily. Some plastic pallets can collapse from plastic creep if used to store heavy loads for long periods. Plastic pallets cannot easily be repaired, and can be ten times as expensive as hardwood, so they are often used by logistics service providers who can profit from their durability and stackability.

Steel pallets are strong and resist plastic creep. They are used for heavy loads, high-stacking loads, long term dry storage, and loads moved by abusive logistic systems. They are often used for military ammunition.

Aluminum pallets are stronger than wood or plastic, lighter than steel, and resist weather, rotting, plastic creep and corrosion. They are sometimes used for air-freight, long-term outdoor or at-sea storage, or military transport.

### **Standardization of Pallets**

A lot of efforts have been made in the field of standardization of pallets, but a lot still remains to be done. Since pallets may be subjected to a variety of uses depending upon the industry in which they are

used a single standard on pallets is difficult to be established and enforced. However, the dimensions and strength requirements have been standardized by many national standardization bodies.

### **Dimensions of Pallets**

In a pallet measurement, the first number is the stringer length, the second is the deckboard length. Square or nearly-square pallets help a load resist tipping.

Two-way pallets are designed to be lifted by the deckboards. So, in a warehouse, the deckboard side faces the corridor. So, for optimal cubage in a warehouse, the deckboard dimension should be the shorter. This also helps the deckboards be more rigid.

Four-way pallets, or pallets for heavy loads, or general-purpose systems that might have heavy loads, are best lifted by their more rigid stringers. So, a warehouse has the stringer side facing the corridor. So, for optimal cubage in a warehouse, the stringer dimension should be the shorter. Pallet users want pallets to easily pass through buildings, stack and fit in racks, forklifts, pallet jacks and automated warehouses. To avoid shipping air, pallets should also pack tightly inside containers and vans. The most commonly used pallet sizes are 1000 mm x 1000 mm, 1200 mm x 1000 mm etc.

### **ISO Technical Committee 51: Pallets for unit load method of materials handling**

At international standardization level, ISO TC 51 of International Organization for Standardization is actively engaged in the work of standardization of pallets in general use in the form of platforms or trays on which goods may be packed to form unit loads for handling by mechanical devices. This Technical Committee works in conjunction with other Technical Committees focused on transportation infrastructure to develop interrelated standards. The ISO Standards formulated on pallets are as follows:

1. ISO 445:2008

Pallets for materials handling – Vocabulary

2. ISO 6780:2003

Flat pallets for intercontinental materials handling -- Principal dimensions and tolerances

3. ISO 8611-1:2011

Pallets for materials handling -- Flat pallets -- Part 1: Test methods

4. ISO 8611-2:2011

Pallets for materials handling -- Flat pallets -- Part 2: Performance requirements and selection of tests

5. ISO 8611-3:2011

Pallets for materials handling -- Flat pallets -- Part 3: Maximum working loads

6. ISO/DTS 8611-4

Pallets for materials handling -- Flat pallets -- Part 4: Procedure for predicting creep responses in stiffness tests for plastic pallets using regression analyses

7. ISO 12776:2008

Pallets -- Slip sheets

8. ISO 12777-1:1994

Methods of test for pallet joints -- Part 1: Determination of bending resistance of pallet nails, other dowel-type fasteners and staples

9. ISO 12777-2:2000

Methods of test for pallet joints -- Part 2: Determination of withdrawal and head pull-through resistance of pallet nails and staples

10. ISO 12777-3:2002

Methods of test for pallet joints -- Part 3: Determination of strength of pallet joints

11. ISO 13194:2011

Box pallets -- Principal requirements and test methods

12. ISO 15629:2002

Pallets for materials handling -- Quality of fasteners for assembly of new and repair of used, flat, wooden pallets

13. ISO 18333:2002

Pallets for materials handling -- Quality of new wooden components for flat pallets

14. ISO 18334:2010

Pallets for materials handling -- Quality of assembly of new wooden pallets

15. ISO/AWI 18597

Dolly pallets -- Principal requirements and test methods

16. ISO 18613:2003

Repair of flat wooden pallets

### **Indian Standards on Pallets**

Transport Engineering Department of Bureau of Indian Standards, the national standards body of India is also actively involved in formulation of Indian Standards on Pallets. Following Standards on pallets have been formulated so far by Freight Containers and Pallets Sectional Committee, TED 12 of BIS:

1	IS 3971:2005	Pallets for materials handling - Vocabulary (second revision)
2	IS 4300:1989	Box pallets for through transit of goods - specification (first revision)
3	IS 5325:1989	Box pallets for through transit of goods - Methods of test (first revision)
4	IS 6219:1989	Methods of test for general purpose flat pallets for through transit of goods (second revision)
5	IS 6865:1973	Specification for pallets for use in ISO series 1 freight containers
6	IS 7276:1989	Non-expendable general purpose, flat pallets for through transit of goods - Specification (second revision)
7	IS 7804:1983	Guide for palletization of tea chests (first revision)
8	IS 8005:1976	Classification of unit loads

9	IS 8006:1988	Recommendations for handling of timber pallets (first revision)
10	IS 9208:1979	Guide for palletization of mica for export
11	IS 9340:1993	Expendable pallets - Specification (first revision)
12	IS 11076:1984	Guide for palletization of cashew kernels for export
13	IS 11982:1987	Design rating and safe working load for general purpose flat pallet for through transit of goods
14	IS 11983:1987	Guidelines for marking of general purpose flat pallets for through transit of goods
15	IS 13546:1992	General purpose flat pallets for through transit of goods - Performance requirements
16	IS 13608:1993	Sheet pallets - Specification
17	IS 13609:1992	Pallets - Quality of timber – Guidelines
18	IS 13664:1993	Polly pallets for bag storage godowns – Specification
19	IS 13714:1993	Dunnage pallets - Ware housing – Specification
20	IS 13823:1993	Guidelines for palletization - General cargo

### **Benefits of Using Pallets**

Pallets are crucial part of any supply chain. They ensure the shipping of products efficiently with minimal damage to goods. Pallets make it easy to move heavy stacks. Loads with pallets under them can be hauled by forklift trucks of different sizes, or even by hand-pumped and hand-drawn pallet jacks. Movement is easy on a wide, strong, flat floor.

Organizations using standard pallets for loading and unloading can have much lower costs for handling and storage, with faster material movement than businesses that do not. The exceptions are establishments that move small items such as jewelry or large items such as cars. But even they can be improved. For instance, the distributors of costume jewelry normally use pallets in their warehouses and car manufacturers use pallets to move components and spare parts. The current trend in any supply chain management is use of returnable pallets system in which a company using pallets does not need to own and maintain an inventory of pallets.

### **Unit load and returnable pallet system**

A **unit load** combines individual items or items in shipping containers into single "units" that can be moved easily with a pallet jack or forklift truck. A unit load packs tightly into warehouse racks, intermodal containers, trucks, and boxcars, yet can be easily broken apart at a distribution point, usually a distribution center.

Returnable pallet system is a system operated by pallet rental companies where the pallet users need not own the pallets and have merely to pay the rent for using pallets. In this way pallets are used by multiple users which permit the economical and efficient utilization of resources. EPal system in Europe is being successfully implemented in various countries of Europe.

The advantages accruing from a returnable pallet system are:

- ◆ Reduction in costs by focusing on the cost per use of the returnable pallet.
- ◆ Disposal of the pallets is the responsibility of the pallet rental company; not the customer and thus a savings in disposal
- ◆ The system ensures that the pallets are properly maintained which reduces the possibility of damage or injury caused by low quality an inferior pallets.
- ◆ The system allows managers and executives to focus on their core business and let the pallet rental company take care of its logistics, tracking and collection.

For the pallets to be of best possible use, it is important that pallets are of sound construction, and be of adequate strength for the loads and conditions under which they are used. Where pallet loads are stacked tier on tier, the lower pallets should be of suitable strength and in good condition and the unit loads must be able to support the weight above.

The stability of stacked pallets or unit loads should be maintained by suitable bonding, avoiding excessive stack heights to ensure that the contents of any pallet or unit load can not collapse. The stability and structural strength of each pallet or unit load should be assured by bonding, taping, shrink wrapping or other means. When pallet or unit loads of cartons or sacks are stacked, care should be taken that they are not damaged by equipment. Pallets or other supports used for forming unit loads should be regularly inspected for damage and wear. Items which could cause damage to material should be taken out of use until repaired, or be destroyed. An approach of care and caution can put pallets to the place it deserves in the material handling and logistics area.