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A Review Paper of Various Industrial Material Handling Systems

Riyaz Ahmed [1], Laukik Raut[2], A.S.Sharma [3]

[1] Student, [2] Professor, Department of Mechanical Engineering, G.H.Raisoni College of Engineering, Nagpur
[3]Director, Consolidated Hoists Private Limited, Pune, India, India

Abstract - *The main aim of this paper is to study various material handling equipment & systems used in an Industry for various material handling, and Study various Modern Technique. Material Handling and is required by many safety regulations, national consensus standards and manufacturers . It is the purpose of the daily condition usage to ensure that the overall equipment mechanical and electric components of the equipment have been maintained in a safe and serviceable condition and are functioning properly according to the original equipment manufacturer's specifications. It is the purpose of the inspection test to ensure by actual test that the equipment is capable of safely lifting and moving the rated load through all designed motions. The inspection and load test do not take into account the duty factor of the equipment.*

INTRODUCTION

Material handling involves short-distance movement within the confines of a building or between a building and a transportation vehicle. It uses a wide range of manual, semi-automated, and automated equipment and includes consideration of the protection, storage, and control of materials throughout their manufacturing, warehousing, distribution, consumption, and disposal. Material handling can be used to create time and place utility through the handling, storage, and control of material, as distinct from manufacturing, which creates form utility by changing the shape, form, and makeup of material

For the safety and ease in productivity of your employees and workplace, it's of critical importance to know that new or newly repaired or modernized material handling equipment is in proper working order—before you put it into service. This section defines required pre-service operational testing and load testing.

How to load test your equipment ? Generally, load testing of any equipment is required by safety regulation and standards to make sure the equipment is installed right according the designing specifications. The owners and operators of equipment should be pay attention to the following:

All material handling equipment should be installed on designing specifications. All such should be proof tested once every four years after original proof testing. All equipment should be proof tested and operationally tested after modifications and repairs. The inspection and load test do not take into account the duty factor of the equipment. The frequency of performing a load test can vary depending on regulatory jurisdiction. The CCAA recommends that Load testing be performed at least once every four years. Please keep in mind that the original equipment manufacturer may have more stringent Requirements and these requirements must take precedence. A certification issued is not a license to use a equipment beyond the original designed duty factor. Owners and operators should always be aware of the equipment's duty factor.

OBJECTIVE

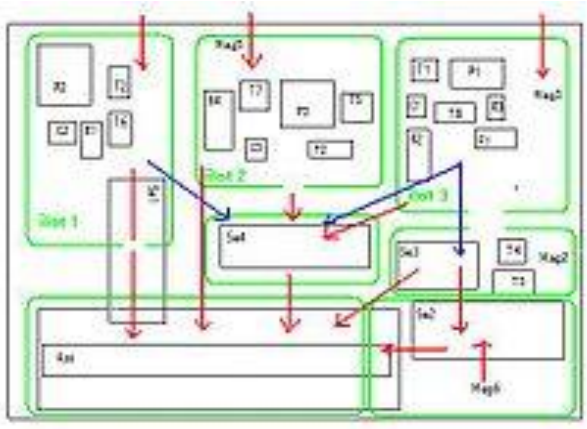
The main goal here is to study the various types of material handling.

[1] Role of material handling
[2] Design of material handling systems
[3] The unit load concept
[4] In-process handling
[5] Distribution
[6] Types of material handling
[7] Manual handling
[8] Automated handling

ROLE OF MATERIAL HANDLING

Material handling plays an important role in manufacturing and logistics, which together represent over 20% of the economy. Almost every item of physical commerce, was transported on a conveyor or lift truck or other type of material handling equipment in manufacturing plants, warehouses, and retail stores. While material handling is usually required as part of every production worker's job, over 650,000 people work as dedicated "material moving machine operators" and have a median annual wage of $31,530 (May 2012). These operators use material handling equipment to transport various goods in a variety of industrial settings including moving construction materials around building sites or moving goods onto ships.

DESIGN OF MATERIAL HANDLING SYSTEMS



Material flow diagram between activities in a layout
Material handling is integral to the design of most production systems since the efficient flow of material between the activities of a production system is heavily dependent on the arrangement (or *layout*) of the activities. If two activities are adjacent to each other, then material might easily be handed from one activity to another. If activities are in sequence, a conveyor can move the material at low cost. If activities are separated, more expensive industrial trucks or overhead conveyors are required for transport. The high cost of using an industrial truck for material transport is due to both the labor costs of the operator and the negative impact on the performance of a production system (e.g., increased work in process) when multiple units of material are combined into a single transfer batch in order to reduce the number of trips required for transport.

THE UNIT LOAD CONCEPT

Production batch can be split into a smaller transfer batch containing several unit loads, each of which can contain multiple parts. A unit load is either a single unit of an item, or multiple units so arranged or restricted that they can be handled as a single unit and maintain their integrity. Although granular, liquid, and gaseous materials can be transported in bulk, they can also be contained into unit loads using bags, drums, and cylinders. Advantages of unit loads are that more items can be handled at the same time (thereby reducing the number of trips required, and potentially reducing handling costs, loading and unloading times, and product damage) and that it enables the use of standardized material handling equipment. Disadvantages of unit loads include the negative impact of batching on production system per load, and the cost of returning empty containers/pallets to their point of origin.

Stretch-wrapping machine used to form a unit load

IN-PROCESS HANDLING

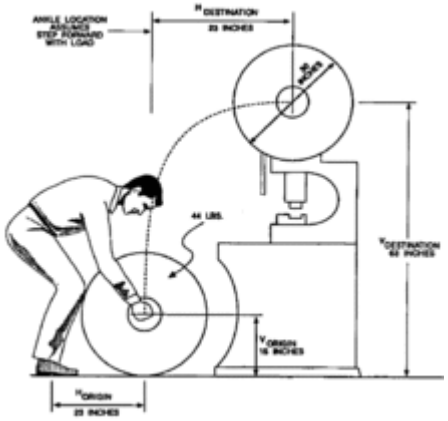
Unit loads can be used both for in-process handling and for distribution (receiving, storing, and shipping). Unit load design involves determining the type, size, weight, and configuration of the load; the equipment and method used to handle the load; and the methods of forming (or building) and breaking down the load. For in-process handling, unit loads should not be larger than the production batch size of parts in process. Large production batches (used to increase the utilization of bottleneck activities) can be split into smaller *transfer batches* for handling purposes, where each transfer batch contains one or more unit loads, and small unit loads can be combined into a larger transfer batch to allow more efficient transport.

DISTRIBUTION

Narrow-aisle lift truck used in distribution Selecting a unit load size for distribution can be difficult because containers/pallets are usually available only in standard sizes and configurations; truck trailers, rail boxcars, and airplane cargo bays are limited in width, length, and height; and the number of feasible container/pallet sizes for a load may be limited due to the existing warehouse layout and storage rack configurations and customer package/carton size and retail store shelf restrictions. Also, the practical size of a unit load may be limited by the equipment and aisle space available and the need for safe material handling.

TYPES OF MATERIAL HANDLING

MANUAL HANDLING



NIOSH Lifting Equation applied to loading punch press stock task

Manual handling refers to the use of a worker's hands to move individual containers by lifting, lowering, filling, emptying, or carrying them. It can expose workers to physical conditions that can lead to injuries that represent a large percentage of the over half a million cases of musculoskeletal disorders reported in the U.S. each year, and often involve strains and sprains to the lower back, shoulders, and upper limbs. Ergonomic improvements can be used to modify manual handling tasks to reduce injury. These improvements can include reconfiguring the task and using positioning equipment like lift/tilt/turn tables, hoists, balancers, and manipulators to reduce reaching and bending. The NIOSH (National Institute for Occupational Safety and Health) 1991 Revised Lifting Equation can be used to evaluate manual lifting tasks. Under ideal circumstances, the maximum recommended weight for manual lifting to avoid back injuries is 51 lb (23.13 kg). Using the exact conditions of the lift (height, distance lifted, weight, position of weight relative to body, asymmetrical lifts, and objects that are difficult to grasp), six multipliers are used to reduce the maximum recommended weight for less than ideal lifting tasks.

AUTOMATED HANDLING

Whenever technically and economically feasible, equipment can be used to reduce and sometimes replace the need to manually handle material. Most existing material handling equipment is only semi-automated because a human operator is needed for tasks like loading/unloading and driving that are difficult and/or too costly to fully automate, although ongoing advances in sensing, machine intelligence, and robotics have made it possible to fully automate an increasing number of handling tasks. A rough guide to determine how much can be spent for automated equipment that would replace one material handler is to consider that, with benefits, the median moving machine operator costs a company $45,432 per year. Assuming a real interest rate of 1.7%and a service life of 5 years for the equipment with no salvage value ,a company should be willing to pay up to purchase automated equipment to replace one worker. In many cases, automated equipment is not as flexible as a human operator, both with respect to not being able to do a particular task as well as a human and not

being able to be as easily redeployed to do other tasks as needs change.

MATERIAL HANDLING SYSTEMS

One of the basic components of any manufacturing system is its Material Handling Systems. We shall first study the different types of material handling systems that are currently in use. Next, we shall pick a common type of MH system, a conveyor, and look at some details of how to go about designing a conveyor system for a factory.

Definition: Material Handling refers to activities, equipment, and procedures related to the moving, storing, protecting and controlling of materials in a system.

Why study MH ?

In a typical factory, MH accounts for 24% of all employees, 55% of the space, and 87% of the production time.
It accounts for between 15% to 70% of the cost of a product.

DEFINITION:

Material Handling Means Providing

The Right Amount Of

The Right Material

At The Right Place

At The Right Time

In The Right Position

In The Right Sequence

For The Right Cost

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