work Safe! Bulletin

No. 203
July 2001

MANUAL MATERIAL HANDLING DEVICES

(hand carts, trucks & wagons)

Manual Material Handling Devices (MMHDs) are used to ease the transferring of material from one location to another. These MMHDs are pushed or pulled by workers. Workers may exert an initial force to get the device moving, a sustained force to keep the device moving and possibly a braking force to stop the device from continuing to move.

Common Manual Material Handling Devices

Health and Safety Issues

MMHDs are linked to various health and safety incidences. In 1999, in Manitoba there were 239 incidences totaling 4705 lost working days involving non-powered industrial vehicles, carts, dollies and hand trucks. These occurred primarily in the manufacturing, health care, retail, mining, transportation, service and construction industries. The injuries that occurred included musculoskeletal sprains and strains, contusions, crushes and fractures. The nature of these injuries included overexertion in pushing and pulling, bodily reaction, struck by and struck against. The cause of these injuries may be associated with a mismatch between the job demands and the capabilities of the worker (poor ergonomics) congested work areas, poor housekeeping, a lack of training on proper handling techniques and a lack of maintenance on these devices.

Optimal MMHD Design Considerations

1) Manual or Powered Material Handling Device
   If the task requires loads in excess of 227kg (500lb), the loads are moved more than 200 times a day or are moved more than 33m (100ft), then a powered material handling device is recommended.

2) Floor Surface
   The floor surface should be dry, smooth, and clear of obstructions and have less than a 4% grade (rise over run). The type of floor surface will determine the type of wheel or castor that is to be used. This will have a direct effect on how easy it is to move a MMHD.

3) Wheels and Castors
   The right type of wheel is vital to the ease with which the MMHD will be pushed or pulled. The larger and harder the wheel, the easier it is to move. There can be a range of 8-17kg (16-35lbs) of force required to push a 247kg (540lb) cart when different castors are used. Compared to a steel wheel, a hard rubber wheel can be 1.9 times harder to push, a polyurethane wheel can be 5.9 times and a soft rubber wheel can be 14 times harder to push. Care must also be taken not to overload the weight limit of the wheels, to maintain the bushings and bearings and to replace damaged wheels.

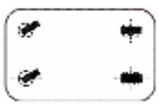
(Over)

4) Vertical and Horizontal Handles
Handles should be placed so they permit comfortable postures for the workers and provide good leverage for maneuverability. If a MMHD has two fixed wheels and two swivel wheels, then the handles should be placed on the swivel end only. If a MMHD is to be pulled, then a T bar handle is to be used with a minimum height of 91cm (36”). For pushing tasks, handle heights should be between 91-112cm (36-44”) and should be located near the center of gravity of the loaded MMHD. Vertical bar handles can accommodate various sizes of workers by allowing them to chose the most comfortable position for the hands. A horizontal bar handle makes maneuverability easier and allows workers to determine their own grip location according to their own size and strength.

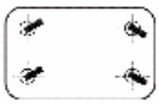
5) MMHD Dimensions
MMHD’s that are longer than 1.3m (4’) or wider than 1m (3’) cannot be turned easily in most aisle ways. These devices should have a clear route to their destination or have extra wide aisle ways. MMHD’s should not be higher than 140cm (55”) so that most workers can see over them. MMHD’s with a capacity of more than 500kg (1100lbs) should have a braking system to help prevent collisions. MMHD shelves should be between 51 and 114cm (20 and 45”) above the floor. This will help to prevent shoulder, knee and back injuries. Avoid shelves or any barriers that make workers adopt awkward postures to grasp objects.

6) Job Demands
When optimal job demands are encountered, the maximum amount of force to start, continue to push and stop a MMHD is 24.5, 12 and 40kg (50lb, 25lb and 80lbs). These limits can be obtained if the handles are in a proper position, the wheels are appropriate and well maintained and the floor surface is free of cracks, depressions, drains, caked materials and or debris. There are ergonomic tools that can determine a safe force limit to push or pull which accounts for the frequency, duration, speed, and distance and endurance requirements of the job. Contact Workplace Safety and Health Division for more information.

7) MMHD Wheel Configurations



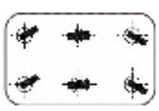
2 Swivel Castors and 2 Fixed Castors
Provides good load capacity, good maneuverability and accurate steering. The MMHD should normally be pushed with the fixed castors leading. Each wheel’s capacity should not exceed the total weight / 3.



4 Swivel Castors
Provides good load capacity and excellent maneuverability for winding aisles and for side motion. May be difficult to guide in straight aisles. Not recommended for ramps. Each wheel’s capacity should not exceed the total weight / 3.

1 swivel Castor and 2 Fixed Castors
Used for lightly loaded MMHDs requiring good maneuverability. The MMHD should be fairly small in size and it is essential that the load be evenly distributed to ensure stability. Each wheel’s capacity should not exceed the total weight / 3.

4 Fixed Castors Centrally Pivoting
For moderate loads suitable for long, straight aisles with occasional changes in direction. The fixed castors can be replaced by wheels mounted onto a central axle. The two end castors are mounted in such a way as to pivot the MMHD on the central wheels. However, the end castors are subjected to shock loads if the MMHD is tipped or the load is not evenly distributed. The entire load rests on the 2 central, fixed castors / wheels. Each wheel’s capacity should not exceed the total weight / 2.



4 Swivel Castors and 2 Fixed Castors centrally pivoting
Very high load capacity and good maneuverability and stability. This configuration is best used with very long MMHDs designed to carry heavy loads. The fixed castors can be replaced by wheels mounted onto a central axle. The base of the unit must be of a strong construction. The swivel castors are mounted in such a way as to pivot the trolley on the central wheels. However, the swivel castors are subjected to shock loads if the MMHD is tipped or the load is not evenly distributed. The entire load thus rests on the 2 central, fixed castors / wheels. Each wheel’s capacity should not exceed the total weight / 2.