



Handling steel plate for fabrication

Steel plate, used in the construction of vessels and machinery, presents problems in safe handling and storing at the fabricators' plants and warehouses. This data sheet discusses safe handling practices for steel plate of more than 8 1/16 inches in width and from 3/16 or more inches in thickness.

Hazards

1. The greatest hazard in handling steel plates is dropping the load because of slipped or failed lifting attachments, overloaded equipment or improperly balanced loads. In addition, personnel may be struck by swinging hooks, chains or cables.
2. Associated hazards include:
 - Handling of lifting devices
 - Contact with sharp edges of plates
 - Loss of control of heavy material or equipment as it is lifted and being moved
 - Electrical shock from powered hoists or lifting electromagnets

Equipment for handling

3. Overhead traveling cranes, jib cranes, mobile cranes or forklift trucks are generally used to

unload steel plate and to handle it throughout the fabrication process. In addition, small material handling cars and dollies are used.

4. Lifting devices used with cranes include electromagnets, vacuum pods, automatic wedge clamps, screw clamps, hooks and slings and horizontal plate lifting clamps. Careful selection of the proper lifting device will ensure maximum safety where personnel may be injured or equipment damaged by a falling load.
5. Electromagnets provide the quickest and most economical method of unloading and handling steel plates. The hazard of dropping plates is generally great enough to restrict their usage to open storage areas and other locations where personnel are not at risk from a dropped or shifted load. Occasionally they can be adapted for use in the shop areas where personnel and equipment will not be endangered should a load be dropped.
6. Capacities should be clearly indicated on the magnets. Crane operators and rigging personnel must be familiar with the weight of the lift so that magnet capacities are not exceeded. Electromagnets must be equipped with battery backup in case of power outage.

7. For a vacuum pod-lifting device to hold properly, plate surfaces must be clean and free from all foreign matter. A reserve vacuum tank should be attached to assist the lowering of the load in the event of vacuum pump failure.
8. When not in use, vacuum pod lifting devices must be stored in manner to prevent pod deformation. Once the vacuum pod has become deformed, it will no longer grip properly and must be removed from service. Inspect vacuum pods before use.
9. Automatic wedge clamps are generally used when plates are to be lifted by their edges. Automatic clamps may be used with either wire ropes or chains. Clamps with either one or two pairs of gripping jaws may be used for lifting. Make sure all clamps are equipped with lock-closing devices that cannot be inadvertently disengaged. All clamps with two pairs of jaws must be attached with the jaws trued to the surface of the plate. (Clamps with a single pair of jaws automatically align themselves.)
10. Serrations of the wedged-clamped jaws and the cups must be inspected frequently and kept clean and sharp. Paint or other foreign matter will reduce the grip capacity of the jaws.
11. Screw clamps must be tight enough that the cup of the setscrew cuts into the plate. The cups must be examined frequently to make sure that none is broken or filled with dirt, scale or other foreign material. In order for clamps to grip securely, plates must be clean (i.e., free of oil, grease, mud and other foreign material).
12. For very thick plates, clamps may be impractical. In this case, lifting lugs can be attached to the plate using proper welding procedure. The size and weight of the plate must be taken into consideration in determining the number of lifting lugs required. Generally, lugs positioned to lift a horizontal load should not be used to lift a vertical load and vice versa. When long plates are to be moved, it is usually necessary to use a spreader beam in the hookup.

Crane safety

13. A plate or tag showing the safe load limit must be posted on every crane, and it must be clearly visible to rigging personnel on the ground. Charts showing safe load limits for both wire rope slings and alloy steel chain slings used should be readily available and easily accessible for the crane operators and rigging personnel. Crane operators must be trained in accordance with OSHA Regulations.
14. All electric crane and hoist installations must conform to the requirements of the *National Electrical Code*. Only qualified personnel should work on the electrical systems. Where possible, use only enclosed runway conductors.
15. Crane parts subject to impact, wear and rough usage should have a safety factor of five to one. (A factor of safety is the number of times that the breaking strength exceeds the safe load limit.)
 - The load hook;
 - Hoisting cables, gears and other parts subject to wear;
 - All other parts, including the structural steel;
 - The frequency of inspections of the crane and its equipment, plus the record-keeping, must conform to OSHA (and state, if any) requirements.

Lifting and transporting plates

16. Personnel involved in the moving of steel plate must be properly trained. They should be aware of and instructed in the hazards involved. These hazards include:
 - Location of hands and feet while moving plates;
 - Attaching lifting devices to plates;
 - Swinging hooks;
 - Chains and cables.
17. Center crane hooks over loads before lifts are made. Place lifting devices so that (a) loads will be balanced and (b) minimum damage to the plate will occur from lifting attachments.

18. Before a lift is made and while it is in progress, a siren, bell, horn or other audible signals and visual flashing lights must be used to warn workers to stay out from under the load. Loads must never be carried over workers.
19. Signalmen must use only standard signals to guide riggers and crane operators. (See *Accident Prevention Manual for Industrial Operations*, 14th edition, *Engineering and Technology volume*, 2015.) Improvised signals are prohibited.
20. Crane operators must use extreme caution when making lifts, and they must never rely on limit switches to stop loads. Limit switches must be maintained in good operating condition and must be tested at the start of each shift. If a switch fails to function, remove the crane from service immediately and do not use it until the necessary repairs have been made.
21. When cars or dollies are used to transport plate, the workers moving the load must sound a horn or other audible signal. If it is not possible to utilize audible signal devices, have a signalman in front of the car or dolly while it is being moved.

Storage yards

22. To provide adequate working space, provide a minimum of 4 feet of clearance along either side of railroad tracks in the material storage yard. Also, provide a clearance of at least 30 inches from the outside rails of an opening buggy track. If the

Table 1.

Plate Thickness (in inches)	Allowable Overhang (in approximate feet)
1/4 to 1/2	6
More than 1/2 to 3/4	9
More than 3/4 to 1	12
More than 1	15

30 inch clearance cannot be maintained, “close clearance” signs must be installed.

23. All access lanes used by trucks should be at least 11 feet wide. When practical, make walkways a minimum of 30 inches wide when used for access to the forward (marked ends) of piled materials.

Storage areas

24. Be sure storage areas are level, well-compacted or paved, and free of obstructions. When used non-permanent skids must be adequate to support the maximum anticipated loads. Inspect support skids for stability during weather conditions involving either heavy rainfall or freezing and thawing (when ground heave or settlement may occur).

Timber blocking and cribbing

25. Use sound lumber for receiving or shipping yard blocking. Recommended sizes include three by four inches, four by four inches, four by six

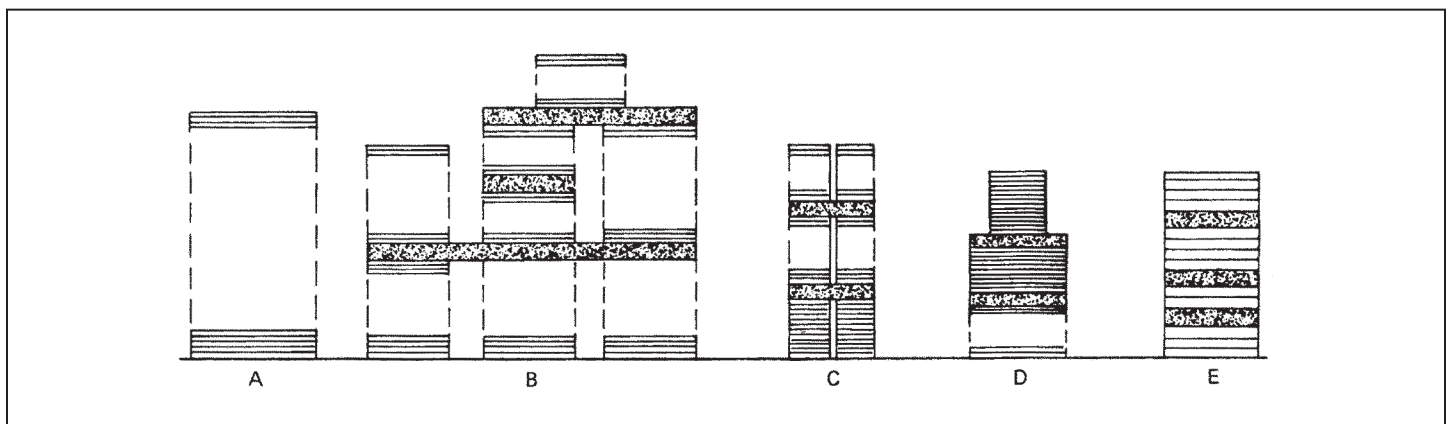


Figure 1. Various ways of stacking flat plates (6 to 30 inches wide): A (solid), B (multiple), C (blocked and tiered), D (single tiered) and E (single blocked).

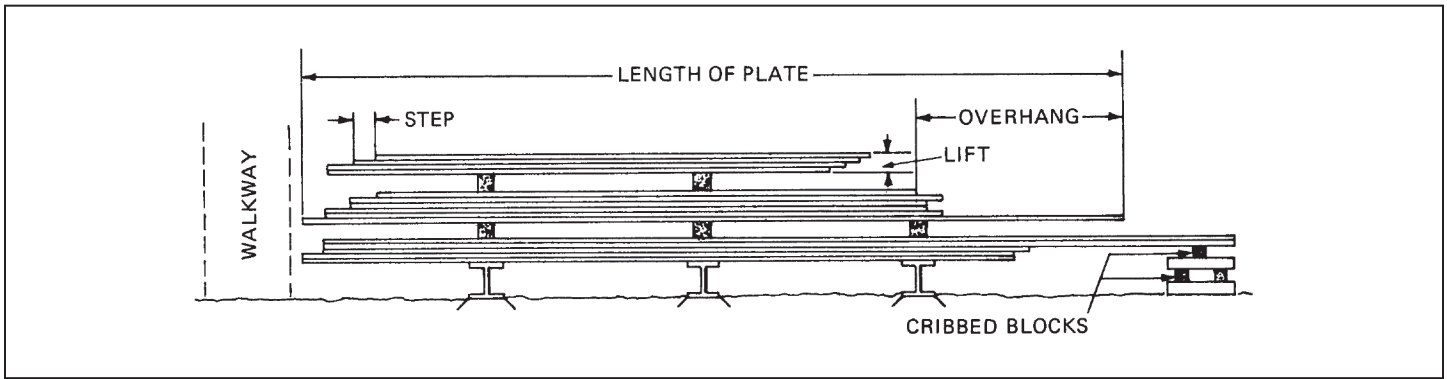


Figure 2. The offset or “step” method of stacking plates to reveal identification marks. Note the use of cribbed blocks to support two plates that have significant overhang.

inches and six by eight inches, with the lengths as needed.

- 26.** Generally, blocks are placed directly over points of skid support. Place rectangular shaped blocks that support steel with their long dimension horizontal. Do not extend blocking beyond the piles of steel so as to interfere with adjacent lifts.

Piling steel plate

- 27.** It is important to practice good use of yard storage in piling material to obtain both the greatest yield (in tons per square foot) that is compatible with good safety practice and the most expeditious handling to and from the shop. This can be best accomplished by constructing solid single piles. (See *Safety Requirements for Shops fabricating Structural Steel and Steel Plate*, ANSI Z 229.1-1982 for general rules that list recommended limits for the pile’s height and

methods of nesting, interlocking and blocking different shapes and sizes of structural and plate material.)

- 28.** Plates that are 6 to 30 inches wide can be stacked safely in a variety of ways (Figure 1). Plates up to approximately 12 inches wide are usually received in banded or wired bundles. Never lift or pull banded or wired bundles by the strap or wire. They should remain this way unless they need to be broken to sort for handling. Follow proper precautions when cutting steel banding.
- 29.** Be sure the widths and lengths of the plates in any one lift are approximately the same size for safe handling. For pile stability, it is recommended that, before lifting, the width and length of the plates from the bottom to the top of the pile be diminished, as in a pyramidal arrangement. Vertically align head (marked) end of plates when

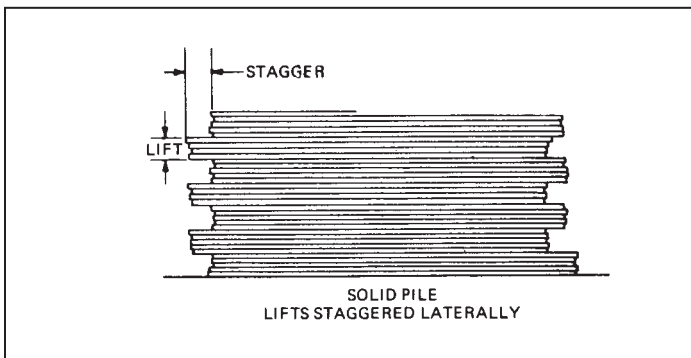


Figure 3. For plates more than 30 inches wide, each lift of a solid pile can be staggered laterally.

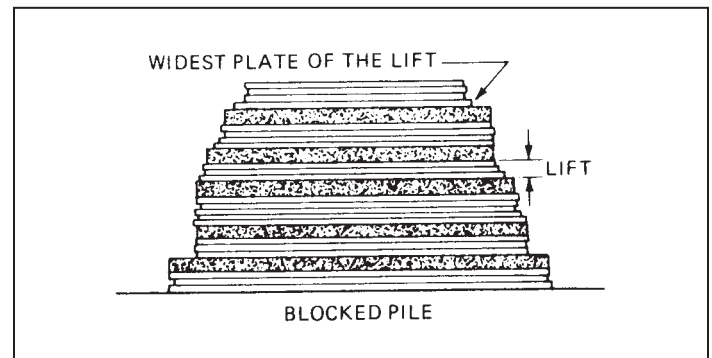


Figure 4. When the widths of the plates vary, the bottom plate of each lift should be the widest.

adjacent to walkways. Plate may be offset or stepped endwise to uncover identification marks (Figure 2).

- 30.** Spacing of 7 to 10 feet between skids is usually sufficient to support plates without excessive sagging. When plates are unsupported by the skids and extending beyond the tail end of a pile, support them from the ground or pavement by cribbed blocks (Figure 2). This is necessary when the plate overhangs more than 25 percent of its length and when the overhang exceeds the value given in Table 1. Do not set the cribbed blocks on end to support overhanging plates either from the ground or from plates below.
- 31.** Plates over 30 inches wide can form stable piles to any convenient height. If piled solid, succeeding lifts may be staggered laterally to aid handling (Figure 3).
- 32.** Where width variations occur and plates are handled with hooks, place the widest plate at the bottom of the lift. Extend the edges of this plate beyond the edge of the plates above it (Figure 4). If magnets or vacuum pods are used

for lifting, plates can be piled solid without spacers. If lifting clamps are used, place wood strips or blocks between plates to permit easy clamp entry.

- 33.** Pile plates and slabs too short to span skids safely on temporary timber, and tier these piles with timber blocks between each plate or lift of plates. Small inventories of plate can be stored on edge in racks as shown in Figure 5.

Housekeeping and inspection

- 34.** Sound housekeeping and inspection procedures will contribute greatly to the prevention of accidents. Good housekeeping on crane runways, in crane cabs, and in storage areas is especially important. Check all work areas regularly to ensure that good housekeeping practices are being followed.
- 35.** All equipment must be inspected on a regular basis as outlined in Federal OSHA or state regulations. Defective equipment must be removed from service and properly tagged out. Make sure recordkeeping meets all federal and state requirements.

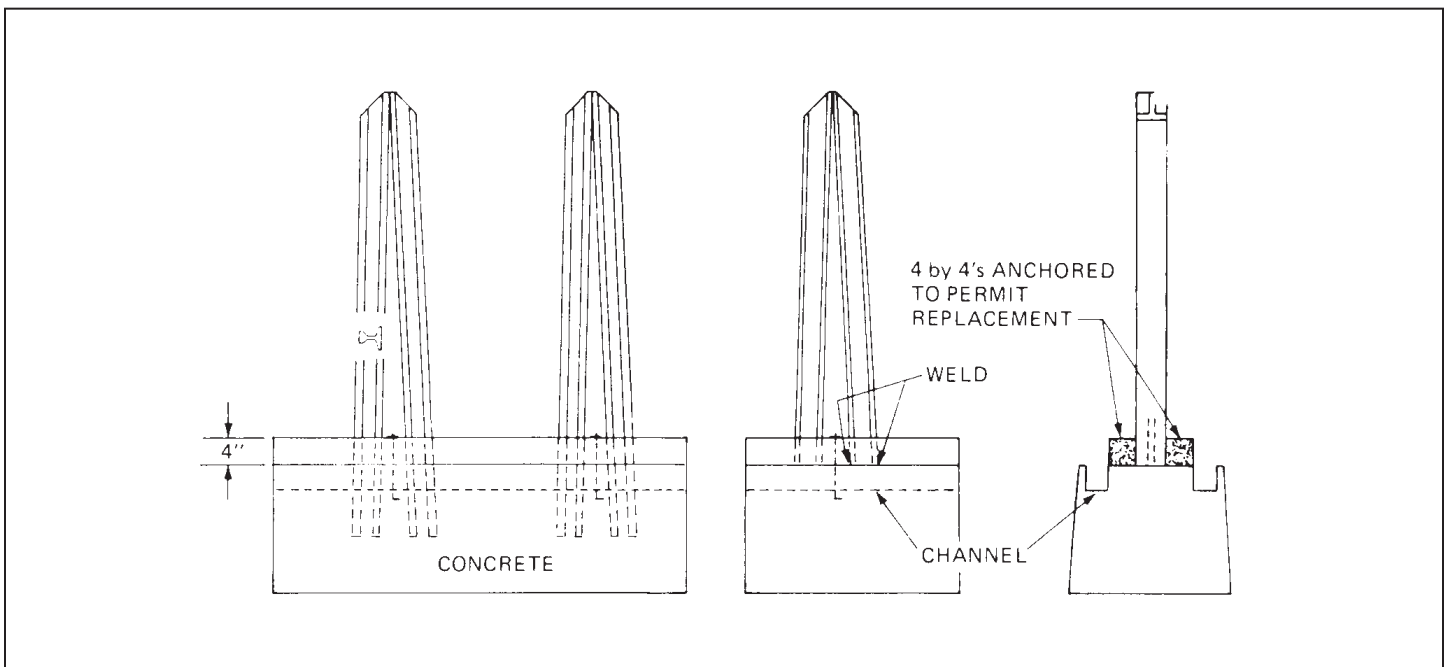


Figure 5. Racks for stacking plates on edge.

36. Hammers, steel wedges, pry bars and other hand tools must be maintained in safe working condition. Hammers with cracked handles or loose heads must either be repaired immediately or be tagged “out of service.” Inspect steel wedges for mushroomed heads and dull or chipped points at regular intervals. Remove from use pry bars that have been moderately bent.

Personal protective equipment

37. Unloading and moving steel plate is largely overhead work, so hard hats must be worn at all times. Foot protection must also be worn. Safety shoes with metatarsal guards are recommended. Shin and leg protective devices may also be advisable.

38. As a matter of general practice, eye protection must be worn. In storage areas, coverall goggles can help prevent eye injuries caused by windblown scale and dust. If welding is to be done in the vicinity, safety glasses with side shields or goggles with a shade-two filter lens should be worn to provide protection from stray flashes and reflected radiation. Wherever possible, shield welding operations.

39. For protection against burrs, sharp edges and similar hazards presented by the steel plates, use hand protection such as leather gloves or arm guard hand leathers. These gloves can be metal reinforcements.

40. Depending upon the hazards created by nearby operations, other specific items of protective apparel may be needed. For instance, if the noise level is sufficiently high and cannot be reduced, hearing protection must be used.

Sources of information

American National Standards Institute, ASME, Two Park Avenue, New York, NY 10016-5990: *Slings*, ANSI/ASME B30.9-2010.

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