TECHNICAL NOTE

	FEDERATION OF EUROPEAN MATERIALS HANDLING Product Group Industrial Trucks	**FEM** **4.005**
	Industrial trucks – 90° stacking aisle width	1.2005 (E)

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Féderation Européenne de la Manutention (Product Group Industrial Trucks)

Available in German (D), English (E), and French (F)

0 Introduction

Information for the calculation of the stacking aisle width has been included until now in the illustrated terminology of FEM IV and in the technical note, FEM IV-TN01. This information does not, however, cover all the peripheral conditions included in this new guideline. TN01 is replaced by this guideline.

1 Scope

In this guideline, the calculation 90° stacking aisle width has been defined for all major industrial truck types.

Note This method of calculation, due to its simplistic nature may not necessarily represent the true stacking aisles width achievable. More complex methods are available and may be more suitable particularly when long or wide loads are being handled. BITA guidance note GN9 is an example of such a method.

2 Normative references

ISO 5053, *Power-driven industrial trucks — Definitions*

3 Terms and definitions

In addition to the terms defined in accordance with ISO 5053, the following definitions also apply:

3.1
stacking aisle width (90° stacking aisle width)
is the aisle width required under the most favourable conditions for stacking operations with the industrial truck positioned at right angles to the aisle. Accordingly, the load is swung into position only within the stacking aisle width, with exception of the industrial trucks that can only pick up loads from the floor and lay them down. For these trucks, the swinging operation is planned to be carried out above the lay-down location and has therefore been taken into account in the calculation of the stacking aisle width

3.2
maneuvering allowance
manoeuvring allowance is the dimension by which the aisle width calculated from the dimensions of the industrial truck and the load is increased. Accordingly, inaccuracies in steering operations, as well as in the load dimensions and load application are taken into account

4 Calculation of the stacking aisle width

4.1 Peripheral conditions

200 mm are uniformly used as the manoeuvring allowance. This makes it easier to compare a variety of industrial truck designs and sizes with one another. Due to other factors, it may be required to increase the manoeuvring allowance. Other important factors are:

— floor not skid-proof;

— load units not rigid;

— large load dimensions which make precise driving approaches more difficult;

— operator skills.

For pedestrian controlled trucks, the tiller is in the driving position, but approximately at the highest point.

4.2 Influence of industrial truck design and load dimensions

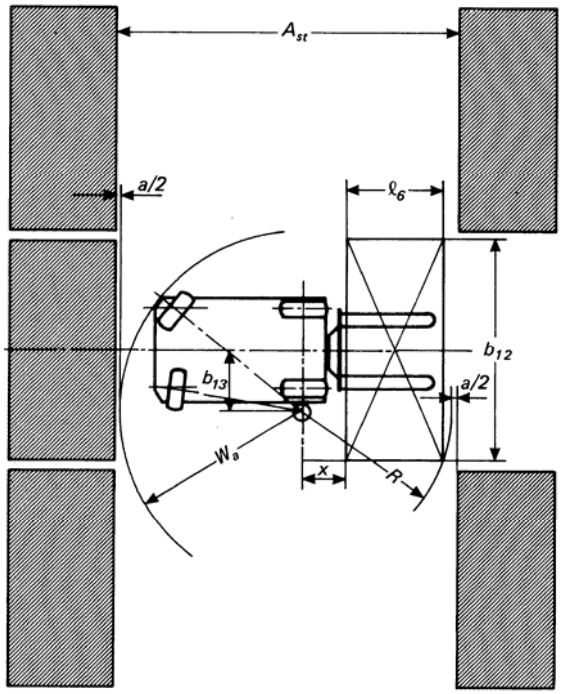
According to measurement circumstances of truck and load, the aisle width is created from four possible geometrical situations:

— regarding the truck side either radius W_a or with wide loads the truck load corner radius R;

— regarding the load the length as far as to the outer load side b_{12} or the diagonal of outer load corner, radius R;

— on three wheel trucks the diagonal usually lies outside the pivot point. Since the deviation is only minimal the centre is used;

— for low lift trucks, the normal case is the use with standard pallets. Therefore the same dimensions as for the standard pallets apply for the load dimensions.



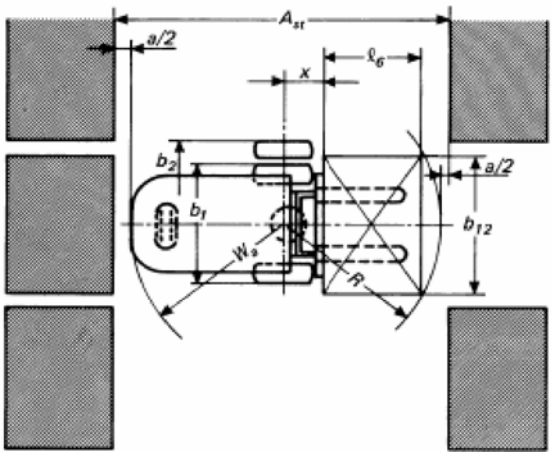
$$R = \sqrt{(l_6 + x)^2 + \left(\frac{b_{12}}{2} - b_{13}\right)^2}$$

$$A_{st} = W_a + x + l_6 + a \quad \text{if} \quad \frac{b_{12}}{2} < b_{13}$$

$$A_{st} = W_a + R + a \quad \text{if} \quad \frac{b_{12}}{2} > b_{13} \quad \text{and} \quad \left(\frac{b_{12}}{2} + b_{13}\right) < W_a$$

$$A_{st} = \frac{b_{12}}{2} + b_{13} + R + a \quad \text{if} \quad \left(\frac{b_{12}}{2} + b_{13}\right) > W_a$$

Figure 1 — Four wheel fork-lift truck (point of rotation outside of axle centre)

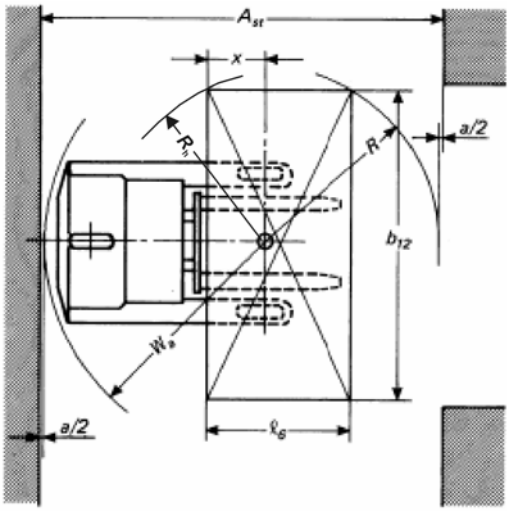


$$R = \sqrt{(l_6 + x)^2 + \left(\frac{b_{12}}{2}\right)^2}$$

$$A_{st} = W_a + R + a \quad \text{if} \quad \frac{b_{12}}{2} < W_a$$

$$A_{st} = \frac{b_{12}}{2} + R + a \quad \text{if} \quad \frac{b_{12}}{2} > W_a$$

Figure 2 — Three wheel fork-lift truck (point of rotation in centre of axle)



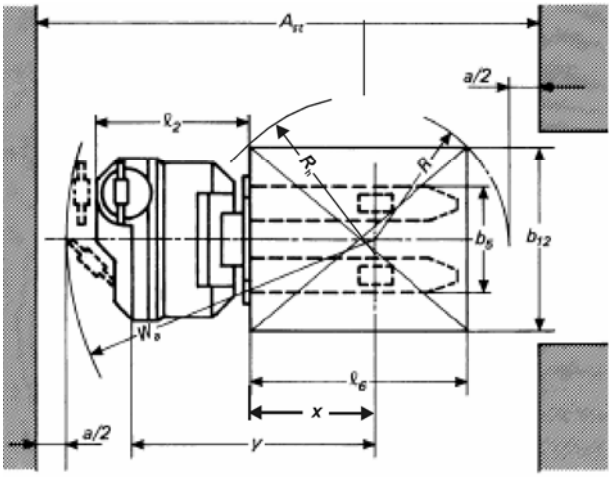
$$R = \sqrt{(l_6 - x)^2 + \left(\frac{b_{12}}{2}\right)^2}$$

$$R_h = \sqrt{x^2 + \left(\frac{b_{12}}{2}\right)^2}$$

$$A_{st} = W_a + R + a \quad \text{if} \quad R_h < W_a$$

$$A_{st} = R_h + R + a \quad \text{if} \quad R_h > W_a$$

Figure 3 — Reach truck (point of rotation in centre of axle)



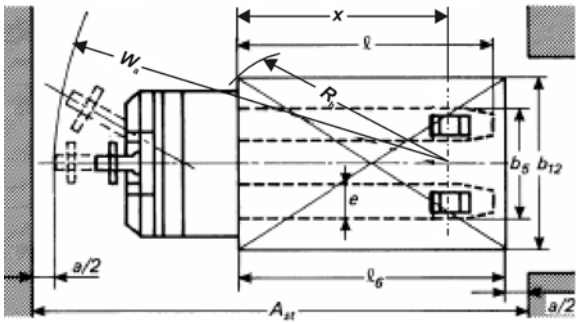
$$R = \sqrt{(l_6 - x)^2 + \left(\frac{b_{12}}{2}\right)^2}$$

$$R_h = \sqrt{x^2 + \left(\frac{b_{12}}{2}\right)^2}$$

$$A_{st} = W_a + R + a \text{ if } R_h < W_a$$

$$A_{st} = R_h + R + a \text{ if } R_h > W_a$$

Figure 4 — High lift pallet truck



$$R_h = \sqrt{x^2 + \left(\frac{b_{12}}{2}\right)^2}$$

$$A_{st} = W_a + l_6 - x + a \text{ if } R_h < W_a$$

$$A_{st} = R_h + l_6 - x + a \text{ if } R_h > W_a$$

Figure 5 — Low lift pallet truck

5 Specification in the technical documents

The load length l_6 shall be used as 2xc, whereby c is the standardised load centre distance. If several load centre distances are standardised, the smaller value must be selected. If no load centre is specified, the value mentioned for the rated capacity shall be used.

The width of the load predominantly intended for each type of industrial truck shall be used as the load width. Accordingly, the standardised dimensions of the load units (pallets, containers) and the specifications for the load length shall be observed.

Taking into account the stacking aisle width specifications mentioned above, pallet sizes of

- 1,000 mm × 1,200 mm (width) or
- 800 mm × 1,200 mm (width)

shall be planned to be used for industrial trucks with a rated capacity of up to 10,000 kg.

6 Stacking aisle as traffic route

If the aisle is also used as a traffic route it shall be checked whether the safety distances are in accordance with guidelines in 89/654 EC. These safety distances may vary in different countries.

7 Bibliography

BITA GN9, *90° stacking aisle widths — British Industrial Truck Association*