



JAPANESE
INDUSTRIAL
STANDARD

Translated and Published by
Japanese Standards Association

JIS D 6027 : 2011

(JIVA/JSA)

**Fork-lift trucks—Fork-arm extensions
and telescopic fork arms—Technical
characteristics and strength**

ICS 53.060

Reference number : JIS D 6027 : 2011 (E)

PROTECTED BY COPYRIGHT

D 6027 : 2011

Date of Establishment: 2011-04-25

Date of Public Notice in Official Gazette: 2011-04-25

Investigated by: Japanese Industrial Standards Committee

Standards Board

Technical Committee on Logistics and Distribution
of Goods

JIS D 6027 : 2011, First English edition published in 2012-12

Translated and published by: Japanese Standards Association
4-1-24, Akasaka, Minato-ku, Tokyo, 107-8440 JAPAN

In the event of any doubts arising as to the contents,
the original JIS is to be the final authority.

© JSA 2012

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from the publisher.

Printed in Japan

HT/SW

PROTECTED BY COPYRIGHT

Contents

	Page
Introduction	1
1 Scope	1
2 Normative reference	1
3 Terms and definitions	1
4 Symbols	2
5 Requirements for rated capacity and rated load centre distance of fork arms	2
5.1 Parent fork arm	2
5.2 Fork-arm extensions	3
5.3 Telescopic fork arms	3
6 Requirements for fork-arm extensions	3
6.1 Length of fork-arm extensions	3
6.2 Retaining device of fork-arm extensions	3
6.3 Strength of fork-arm extensions	3
6.4 Strength of retaining device of open-section fork-arm extensions	5
6.5 Lateral clearance of fork-arm extensions	6
7 Requirements for strength of telescopic fork arms	6
7.1 General	6
7.2 Test on retracted telescopic fork arms	6
7.3 Test on extended telescopic fork arms	7
7.4 Requirement	8
8 Information for use	8
8.1 Fork-arm extensions	8
8.2 Telescopic fork arms	8
9 Marking	8
9.1 Fork-arm extensions	8
9.2 Telescopic fork arms	8
Annex JA (informative) Comparison table between JIS and the corresponding International Standard	10

Foreword

This translation has been made based on the original Japanese Industrial Standard established by the Minister of Health, Labour and Welfare and the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee according to the proposal for establishment of Japanese Industrial Standard submitted by Japan Industrial Vehicles Association (JIVA)/Japanese Standards Association (JSA) with the draft being attached, based on the provision of Article 12 Clause 1 of the Industrial Standardization Law.

This JIS document is protected by the Copyright Law.

Attention is drawn to the possibility that some parts of this Standard may conflict with a patent right, application for a patent after opening to the public or utility model right. The relevant Ministers and the Japanese Industrial Standards Committee are not responsible for identifying the patent right, application for a patent after opening to the public or the utility model right.

Fork-lift trucks—Fork-arm extensions and telescopic fork arms—Technical characteristics and strength

Introduction

This Japanese Industrial Standard has been prepared based on the first edition of ISO 13284 published in 2003 with some modifications of the technical contents.

Portions with dotted underlines are the matters in which the contents of the corresponding International Standard have been modified. A list of modifications and explanations is given in Annex JA.

1 Scope

This Standard specifies the technical characteristics and strength requirements for fork-arm extensions and telescopic fork arms to be mounted on fork-lift trucks (hereafter referred to as "fork lifts") as defined in JIS D 6201.

NOTE: The International Standard corresponding to this Standard and the symbol of degree of correspondence are as follows:

ISO 13284:2003 *Fork-lift trucks—Fork-arm extensions and telescopic fork arms—Technical characteristics and strength requirements* (MOD)

The symbols which denote the degree of correspondence in the contents between the relevant International Standard and JIS are IDT (identical), MOD (modified), and NEQ (not equivalent) according to ISO/IEC Guide 21-1.

2 Normative reference

The following standard contains provisions which, through reference in this text, constitute provisions of this Standard. For standard with the year indication, only the edition of the indicated year shall be applied and the revisions (including amendments) made thereafter shall not be applied.

JIS D 6201:1999 *Glossary of terms relating to fork lift trucks*

NOTE: Corresponding International Standard: ISO 5053:1987 *Powered industrial trucks—Terminology* (MOD)

3 Terms and definitions

For the purpose of this Standard, the terms and definitions given in JIS D 6201 and the following apply.

3.1 rated capacity of fork arm

mass of the load, in kilograms, which each of paired fork arms is capable of holding at a certain load centre distance

3.2 parent fork arm

fork arm having the rated capacity at the rated load centre distance, blade length and blade cross-section for which a fork-arm extension is specifically designed

3.3 test load

applied load for verifying the strength of fork-arm extension and telescopic fork arms by physical testing

3.4 design load

applied load for verifying the strength of fork-arm extension by calculation

4 Symbols

The symbols shall be as follows.

b	fork arm blade width (mm)
C	rated capacity of each parent fork arm (kg)
C_E	rated capacity of each fork-arm extension (kg)
C_R	rated capacity of each retracted telescopic fork arm (kg)
D	rated load centre distance of each parent fork arm (mm)
D_E	rated load centre distance of each fork-arm extension (mm)
D_R	rated load centre distance of each retracted telescopic fork arm (mm)
F_{EX}	design load for open- and closed-section fork arm extensions (N)
F_{TS}	test load for fork-arm extensions (N)
F_{TR}	test load for retracted telescopic fork arms (N)
F_{TE}	test load for extended telescopic fork arms (N)
L	blade length of the parent fork arm or of the fully retracted telescopic fork arm (mm)
L_1	blade length of the fork-arm extension or of the fully extended telescopic fork arm (mm)
L_2	$0.9 L_1 - L$ (mm)
M	stress modulator
R	safety factor
S	total lateral clearance between the parent fork and the fork-arm extension (mm)
Y_a	actual material yield of fork-arm extension or telescopic fork arm material (MPa)
Y_m	minimum material yield of fork-arm extension or telescopic fork arm material (MPa)
Z	section modulus of the extension of the fork-arm tip
g	gravitational acceleration (9.8 m/s^2)

5 Requirements for rated capacity and rated load centre distance of fork arms

5.1 Parent fork arm

The rated capacity (C) and rated load centre distance (D) for the parent fork arm shall comply with table 1.

Table 1. Rated capacity and rated load centre distance of fork arms

Rated capacity of fork arm C kg	Less than 500	500 or over to and excl. 2 500	2 500 or over to and excl. 7 500	7 500 or over to and excl. 12 000	12 000 or over
Rated load centre distance D mm	400	500 (600)	600	900	1 200
NOTE: The value in parentheses is optional.					

5.2 Fork-arm extensions

The rated capacity (C_E) and rated load centre distance (D_E) for each fork-arm extension shall be proportional to the rated capacity (C) and rated load centre distance (D) for the parent fork arm, i.e:

$$C_E \leq \frac{C \times D}{D_E} \dots\dots\dots(1)$$

5.3 Telescopic fork arms

The rated capacity (C_R) and rated load centre distance (D_R) for each telescopic fork arm shall both be as specified in table 1, when the telescopic fork arm is in the fully retracted mode. In extended mode, the rated capacity should be specified by the manufacturer.

6 Requirements for fork-arm extensions

6.1 Length of fork-arm extensions

Unless otherwise agreed, the blade length (L) of the parent fork arm and the relation between the blade length (L) of parent fork arm and blade length (L_1) of fork-arm extension shall conform to formulae (2) and (3):

$$L \geq 750 \text{ mm} \dots\dots\dots(2)$$

$$L \geq 0.6 L_1 \dots\dots\dots(3)$$

Extensions beyond this limit shall be agreed between the fork-lift or fork-arm manufacturer and the user, and be subjected to hazard analysis. Such fork-arm extensions shall be marked accordingly (see 8.1).

6.2 Retaining device of fork-arm extensions

Fork-arm extensions shall be designed to prevent accidental disengagement from the parent fork arm.

6.3 Strength of fork-arm extensions

6.3.1 General

The yield strength of fork-arm extensions shall be designed and tested using a safety factor (R), and shall satisfy the design and requirements specified in 6.3.3 and 6.3.4.2, respectively.

6.3.2 Design load and test load

The design load (F_{EX}) shall be calculated from formula (4):

$$F_{EX} = \frac{g \times R \times C \times D}{0.5 \times L_1} \quad \text{.....(4)}$$

where, $R : \geq 3$

The test load (F_{TS}) shall be calculated from formula (5):

$$F_{TS} = \frac{g \times R \times C \times D}{0.5 \times L_1} \times \frac{Y_a}{Y_m} \quad \text{.....(5)}$$

where, $R : = 3$

To determine the actual yield point, a preliminary test shall be conducted.

Prior to testing the extensions, an equivalent sample shall be tensile-tested. The resulting yield value shall be compared to the minimum yield specified for the material used. This factor shall be used to increase the test load to ensure that a minimum-yield material will provide the safety factor (R).

6.3.3 Design

The design of the fork-arm extension shall be based on the extension's ability to withstand the $0.5 F_{EX}$ load over the distance of L_2 .

Namely, it shall be verified that the applied load of $0.5 F_{EX}$ does not produce stresses in excess of the minimum material yield stress of the component parts, i.e. formula (6) shall be satisfied.

$$Y_m > \frac{g \times 0.5 \times F_{EX} \times L_2}{Z \times M} \quad \text{.....(6)}$$

where, M : stress modulator which is ≤ 1 and usually 0.4 and 0.8, depending upon the material thickness and the design parameters

NOTE: The modulator is required due to the buckling which promotes stresses higher than calculated using the standard formulae. The value of the modulator can be determined by comparing the actual load required to promote yielding to the theoretical load.

6.3.4 Test

6.3.4.1 Procedure

For open-section and closed-section fork-arm extensions, a parent fork arm having the minimum blade length specified in 6.1 shall be restrained in a manner identical to that when used on a fork lift.

The test load $0.5 F_{TS}$ shall be applied, gradually and without shock, at the specified distance from the fork-arm shank front face as shown in figure 1, and maintained for 30 s. This procedure shall be repeated two times.