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## Kalmar Group Standard

# KGS 40903

Part

**Method Standard**

Name

**Fork arm - Quenching & Tempering Steel - In Quenched & Tempered Condition**

Group

**R&D Standards**

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## 1 Scope

This Kalmar Group Standard hereinafter referred to as KGS cover material requirements for fork arm steel.

## 2 Purpose

This KGS set the requirements on fork arm steel to ensure proper performance of the fork arm in conjunction with a forklift truck.

## 3 Responsibilities

Principal Systems Engineer - Mechanics & Analysis - R&D/FLT defines the requirements in this KGS. That role is also to ensure that the requirements are visible in drawings..

Sourcing - ensures that the selected supplier can meet the applicable requirements in this KGS.

## 4 Definitions

R&D Research & Development

FLT ForkLift Truck

Fork arms can also be named Fork Blank in the Forklift truck business

## 5 Records / references / attachments

EN 10002-1 Tensile Strength Part 1

EN ISO 6506-1 Brinell hardness test Part 1

EN ISO 148-1 Charpy pendulum impact test Part 1: Test method

EN 10021 General technical delivery conditions for steel products

ISO 683-1 Heat-treatable steels, alloy steels and free-cutting steels Part 1

EN 1011-2 Recommendations for welding of metallic materials Part 2

KGS - 40902 Fork arm quenching & tempering steel - In quenched & tempered condition

## 6 Procedure description / Requirements

### 6.1 Impact Strength

Material requirements for Impact Strength: 27 J at -20°C, KV

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## 6.2 Sampling and Impact Strength

Specimens longitudinal to the grain shall be taken in relation to the fork arm section in accordance with the location of test pieces in bars and wire rods specified in ISO 683-1. These shall preferably be taken from an area between the top and bottom hooks, but it is also permissible to take specimens from a specially provided extension of the fork shank above the top hook, or from a separate piece of semi-finished material of adequate size (i.e. length at least twice the width) which has the same cross-section, has been taken from the same material batch and has received the same heat treatment as the fork arm itself.

## 6.3 Testing

Testing and sampling should be made according to the following standards:

Tensile Strength: EN 10002-1

Hardness: EN ISO 6506-1

Impact Strength: EN 148-1

General technical delivery conditions for steel products: EN 10021

## 6.4 Welding

The specified quenched and tempered steels do have limited suitability for the various welding processes. The behavior of this steel during and after welding depends not only on the material but also on the dimensions, shape and on the manufacturing and service conditions of the fork arm.

General requirements for arc welding are given in EN 1011-2.

As a rule, material for fork arms needs preheating before welding.

## 6.5 Indication on Drawing

Example:

Steel type: SPEC K1 - 800

Material Standard: KGS 40903

## 6.6 Material Requirements

**Table 1 - Steel types and the compositions**

Steel	C%	Si%	Mn%	P%	S%	Cr%	B%	Mo%	Ni%
SPEC K1 (30 Mn5)	0.27-0.34	< 0.60	1.20-1.50	0.020	0.015	-	-	-	-
SPEC K2 (RO-651)	0.28-0.33	0.15-0.40	0.95-1.10	0.030	0.015	1.00-1.20	-	0.15-0.25	-
SPEC K3 (34CrNiMo 6)	0.30-0.38	0.10-0.40	0.50-0.80	Max 0.035	Max 0.025	1.30-1.70	-	0.15-0.30	1.30-1.70
SPEC K4 (15B35H M)	0.27-0.35	0.15-0.35	1.00-1.50	Max 0.020	Max 0.025	0.25-0.65	0.0005 - 0.005	Max 0.25	Max 0.40
SPEC K5 (HRO 774)	0.30-0.38	0.10-0.25	0.50-0.70	Max 0.010	Max 0.008	1.10-1.40	-	0.50-0.60	3.0 -3.3

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**Table 2 - Steel types and strength**

Steel	Condition	Delivery form	Tensile strength			Thickness	Hardness interval
			ReH <sup>1</sup> MPa min	Rm <sup>2</sup> MPa	A5 <sup>3</sup> % min	t <sup>4</sup> mm max	HB <sup>5</sup>
SPEC K1 - 800	Quenched and Tempered	Fork arm	800			65	
SPEC K2 - 830	Quenched and Tempered	Fork arm	830	950-1050	18	135	293-311
SPEC K2 - 883	Quenched and Tempered	Fork arm	883	1000-1150	16	60	311-341
SPEC K3 - 830	Quenched and Tempered	Fork arm	830	900-1200	13	200	285-311
SPEC K3 - 883	Quenched and Tempered	Fork arm	883			150	311-341
SPEC K4 - 830	Quenched and Tempered	Fork arm	830	Min 950	15	200	269-341
SPEC K4 - 995	Quenched and Tempered	Fork arm	995	Max 1250	15	200	302-341
SPEC K5 -1180	Quenched and Tempered	Fork arm	1180			150	388-429
SPEC K5 -1250	Quenched and Tempered	Fork arm	1250	1420	15	110	420-450

<sup>1</sup>ReH, Upper yield strength  
<sup>2</sup>Rm, Tensile strength  
<sup>3</sup>A5, The percentage elongation after fracture  
<sup>4</sup>t, Thickness  
<sup>5</sup>HB, Brinell hardness