



**NIPPON KOSHUHA ALLOY TOOL STEEL**

**COLD WORK DIE STEEL**

KOSHUHA BRAND	EQUIVALENT STEEL GRADE		CHEMICAL COMPOSITION %							APPLICATION
	JIS	AISI	C	Cr	Mo	W	V	Co	Ni	
K3M	SKS93	—	1.0	—	—	—	—	—	—	SHEAR BLADE, BLANKING DIE, PRESS DIE
KS3	SKS3	01	1.0	0.8	—	0.8	—	—	—	PRESS DIE, CUTTER, ROLL
KRT5	—	—	0.9	2.8	0.4	—	0.2	—	—	ROLL, SHEAR BLADE
KD12	SKD12	A2	1.0	5.0	1.0	—	0.4	—	—	PRESS DIE, ROLL, PLASTIC MOLD
KD11	SKD11	—	1.5	12.0	1.0	—	0.4	—	—	PRESS DIE, FORMING ROLL, THREADING ROLL DIE
KD11V	—	D2	1.5	12.0	1.0	—	0.9	—	—	PRESS DIE, FORMING ROLL, THREADING ROLL DIE
KOQ	—	—	1.5	12.0	1.0	—	0.7	0.5	—	FORMING ROLL, PRESS DIE, SENDZIMIR ROLL
KDCO	—	D5	1.5	12.0	1.0	—	0.4	3.0	—	FORMING ROLL, PRESS DIE, THREADING ROLL PLATE

**HOT WORK DIE STEEL**

KTV	SKT4	6F2	0.55	1.0	0.4	—	0.1	—	1.7	EXTRUSION TOOL
TD3	—	—	0.45	3.3	1.0	—	0.3	—	—	PRESS DIE, EXTRUSION TOOL
KD5	SKD5	H21	0.3	2.5	—	9.5	0.4	—	—	PRESS DIE, EXTRUSION TOOL
KDA	SKD61	H13	0.4	5.0	1.3	—	0.6	—	—	PRESS DIE, DIE CASTING DIE, EXTRUSION TOOL
KDB	SKD62	H12	0.4	5.0	1.4	1.4	0.5	—	—	PRESS DIE, EXTRUSION TOOL, HOT WORK BLADE
KDH1	SKD7	H10	0.35	3.0	3.0	—	0.5	—	—	
KDHC	—	—	0.3	3.0	3.0	—	0.5	3.0	—	PRESS DIE, EXTRUSION TOOL, DIE CASTING DIE FOR COPPER ALLOY
KDF	SKD8	H19	0.4	4.2	0.4	4.5	2.0	4.2	—	

**HIGH SPEED DIE STEEL**

HM9T	—	M1	0.8	4.0	8.5	2.5	1.3	0.8	—	CUTTING TOOL, PUNCHING DIE, CUTTER, BLANKING DIE
H51	SKH51	M2	0.85	4.0	5.0	6.0	2.0	—	—	
HM35	SKH55	M35	0.85	4.0	5.5	6.0	2.0	5.0	—	HIGH SPEED CUTTING TOOL FOR HARD MATERIAL, PUNCHING DIE, BLANKING DIE
HM36	SKH56	M36	0.85	4.0	5.5	6.0	2.0	8.0	—	
MV10	SKH57	—	1.2	4.0	3.7	10.0	3.5	10.0	—	HIGH SPEED CUTTING TOOL FOR HARD MATERIAL, CUTTING TOOL, TAP
HM3	SKH58	M7	1.0	4.0	8.7	2.0	2.0	—	—	
HM42	SKH59	M42	1.1	4.0	9.5	1.5	1.2	8.0	—	HIGH SPEED CUTTING TOOL FOR HARD MATERIAL, PUNCHING DIE



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*Koshuha-Creator of the Fine Tool Steels  
for the 21st Century*

**KD11**

**MICRO FINE STEEL**

A.I.S.I. D2, JIS SKD11 Equivalent

MICROFINE "KD11" was developed for the purpose of giving long life to dies. It is a homogeneous, fine, clean steel, made from strictly selected raw materials. The production process is based on Koshuha's skilled forging and rolling techniques—production technology accumulated over our long years of experience—along with the most modernized ladle refining equipment. (ASEA-SKF Furnace)

It is an ideal steel with extra toughness and non-directionality produced through a unique controlled hot working and heat treatment process.

**SPECIAL PROPERTIES**

- Mechanical properties in transverse direction (T) are 10–20% better than those of conventional steel.
- Rotating bending fatigue strength is 20kgf/mm<sup>2</sup> higher than conventional steel, and its life is three times longer.
- Non-metallic inclusions are few—less than one third of conventional steel.
- MICROFINE steel has good machinability since carbide is precipitated finely and homogeneously.

**APPLICATIONS & SUGGESTED HARDNESS**

**TYPICAL APPLICATIONS & HARDNESS**

APPLICATION	HARDNESS (HRC)
PRESS DIE FOR GENERAL USE	58 ~ 62
COLD FORMING DIE	58 ~ 62
COLD WORKING ROLL	60 ~ 63
THREADING ROLLING DIE	58 ~ 62
SHEAR BLADE	58 ~ 62
PLSTIC MOLD	56 ~ 60
GAUGE	60 ~ 64
BRICK MOLD	58 ~ 62

**CHEMICAL COMPOSITION**

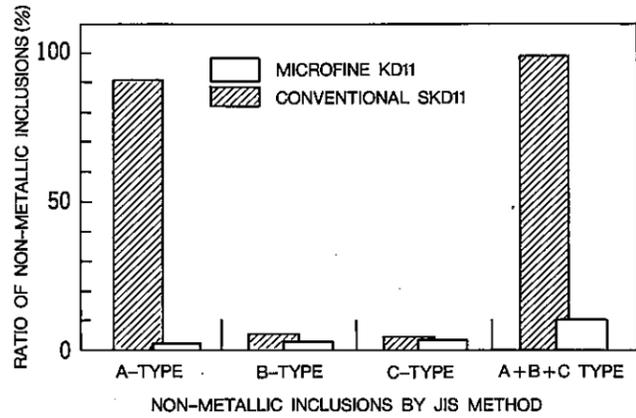
KOSHUHA BRAND	wt (%)							EQUIVALENT GRADE
	C	Si	Mn	Cr	Mo	V		
KD11	1.5	0.3	0.4	12.0	1.0	0.4	JIS SKD11 A.I.S.I. D2	



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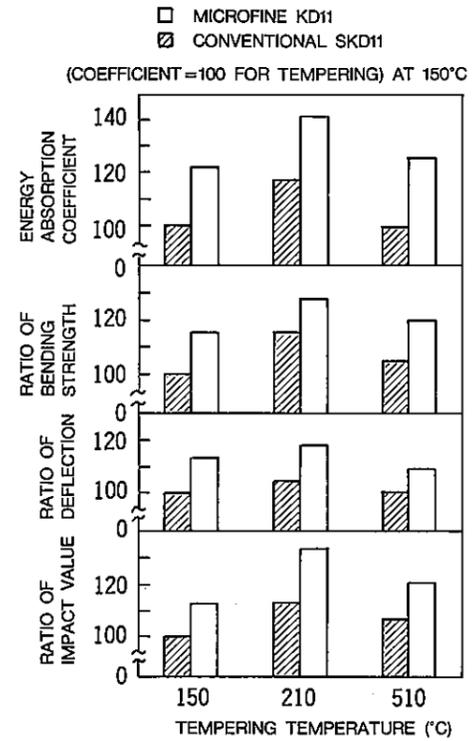
# COMPARATIVE PROPERTIES OF MICRO FINE STEEL

## NON-METALLIC INCLUSIONS IN STEEL



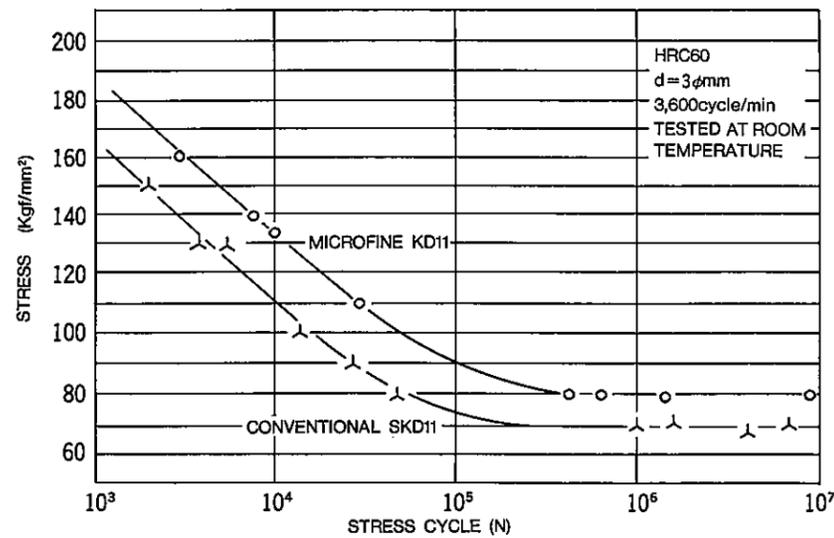
MICROFINE KD11 LEVEL OF NON-METALLIC INCLUSIONS

## MECHANICAL PROPERTIES



MICROFINE KD11 MECHANICAL PROPERTIES

## ROTATING BENDING FATIGUE STRENGTH



COMPARISON OF ROTATING BENDING FATIGUE STRENGTH BETWEEN MICROFINE KD11 AND CONVENTIONAL STEEL

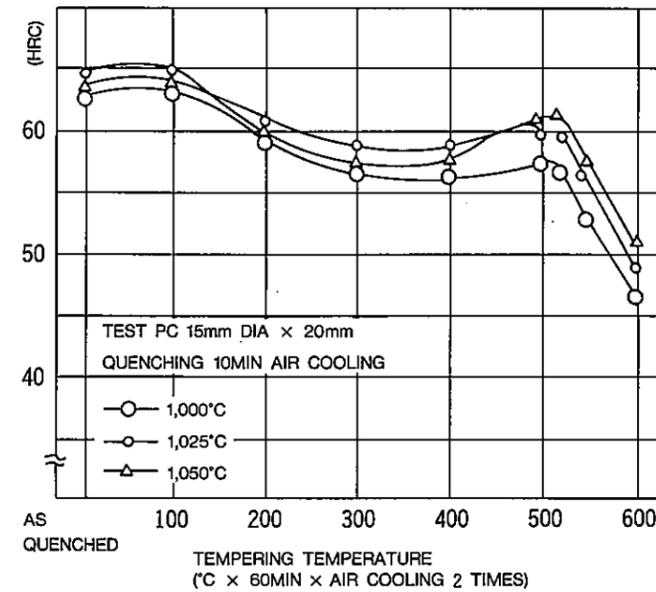
## HEAT TREATMENT PROPERTIES

### 1) HEAT TREATMENT CONDITIONS

TRANSFORMATION POINT MS POINT		800°C ~ 830°C 195°C (HARDENING TEMPERATURE 1,025°C)	
		TEMPERATURE & COOLING CONDITIONS	KEEPING TIME
QUENCHING	PREHEATING	800°C ~ 850°C	30min/25mm THICKNESS
	HARDENING	1,000°C ~ 1,050°C AIR COOLING (OIL COOLING)	20min/25mm THICKNESS
TEMPERING	TEMPERING	150°C ~ 250°C AIR COOLING 500°C ~ 530°C AIR COOLING	60min/25mm THICKNESS
	TEMPERING HARDNESS	(150°C ~ 250°C) : HRC 60 MIN, (500°C ~ 530°C) : HRC 58 MIN.	

TEMPERING AT LOW TEMPERATURE (150-250°C) IS USED IF WEAR RESISTANCE IS PREFERRED, TEMPERING AT HIGHER TEMPERATURE (MORE THAN 500°C) IS USED FOR TOUGHNESS AND NON-DEFORMATION BY HEAT TREATMENT. THE STEEL MUST BE TEMPERED TWO OR THREE TIMES CONSECUTIVELY.

### 2) HARDNESS: AS QUENCHED AND TEMPERING CURVE



MICROFINE KD11 HARDNESS/AS QUENCHED AND TEMPERING CURVE

## APPLICATION EXAMPLES

DIE	MATERIAL USED	CONVENTIONAL STEEL GRADE	LIFE OF MICROFINE KD11 AFTER ACTUAL USE
COLD PRESS DIE (AUTOMOBILE PARTS)	S45C	SKD11	1.5 TIMES
COLD PRESS DIE (ELECTRIC PARTS)	Al	SKD11	3.0 TIMES