FREE CUTTING STEELS

Certification of quality

- Surface condition : Free from harmful defects.
- Macro etch test - (ASTM-E-381)
- Spark/Spectral test - 100% bars
- As rolled hardness - Free Cutting Steels ≤ 150 BHN
- Inclusion rating - (ASTM - E-45) 2.5 max each - B,C,D
- Micro structure - Sulphide morphology (Aspect ratio)

International Specifications of Free Cutting Steels

Country	Grade	Chemistry						
			C	Mn	Si	P	S	Pb
IS (Indian)	11C10S25	Min Max	0.08 0.15	0.80 1.20	- 0.10	- 0.06	0.20 0.30	- -
BS (British)	220M07	Min Max	- 0.15	0.90 1.30	- -	- 0.07	0.20 0.30	- -
EN (British)	ENIA-Pb	Min Max	0.07 0.15	0.80 1.20	- 0.10	0.040 0.090	0.26 0.35	0.15 0.35
AISI (American)	12L14	Min Max	- 0.15	0.85 1.15	- 0.10	0.04 0.09	0.26 0.35	0.15 0.35
JIS (Japanese)	SUM24L	Min Max	- 0.15	0.85 1.15	- 0.10	0.04 0.09	0.26 0.35	0.10 0.35
DIN (German)	9SMn28K	Min Max	- 0.16	0.86 1.35	- 0.06	- 0.11	0.24 0.36	0.15 0.35
ASTM (American)	1215	Min Max	- 0.09	0.75 1.05	- -	0.040 0.090	0.260 0.350	- -

International Specifications of Semi Free Cutting Steels

Country	Grade	C	Mn	Si	P	S	Al
DIN (German)	SU1A28	-/0.18	0.70/1.05	-/0.45	-/0.060	0.08/0.15	0.020/0.050
	R10S10U	-/0.18	0.70/1.05	-/0.45	-/0.060	0.08/0.15	0.020/0.050
	45S20U	0.39/0.53	0.66/1.15	0.07/0.33	-/0.065	0.15/0.28	-
SAE (American)	SAE1117	0.14/0.20	1.00/1.30	-	0.040 Max	0.080/0.130	-
	SAE1118	0.14/0.20	1.30/1.60	-	0.040 Max	0.080/0.130	-
	SAE1137	0.32/0.39	1.35/1.65	-	0.040 Max	0.080/0.130	-
	SAE1141	0.37/0.45	1.35/1.65	-	0.040 Max	0.080/0.130	-
	SAE1144	0.40/0.48	1.35/1.65	-	0.040 Max	0.240/0.330	-
EN (British)	EN8M	0.35/0.45	1.00/1.30	0.25 Max	0.060 Max	0.120/0.200	-

Sizes and conditions of Supply

Condition of Supply	Shapes	Sizes
1. Black	Hex Round WRD	15.5 mm - 38 mm A/F 5.5 mm - 100 mm dia 5.5 mm - 38 mm dia
2. Drawn	Hex Round	14 mm - 36 mm A/F 10 mm - 50 mm dia
3. Peeled & Ground	Round	10 mm - 90 mm dia

Industry Serviced by Sunflag's Free Cutting Steels

- Automobile - through manufacture of various machined components
- Auto components and spares manufacturers
- Textile machinery manufacturers
- Engineering Industry - Viz. Manufacturers of machine tools
- Power production industry

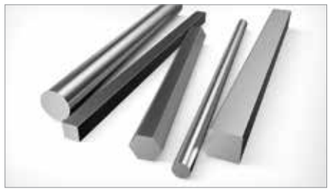
FREE CUTTING STEEL

SUNFLAG STEEL

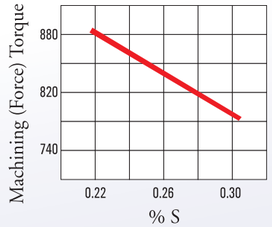
BIS Approved
NABL Accreditated Chem & Mech Labs.
ISO 9001 & IATF 16949 Certified by UL DQS
ISO 14001 & OHSAS 18001 Certified by TUV Nord
AD 2000 Merkblatt WO /PED Certified by TUV Nord

Quality requirement for free cutting steel

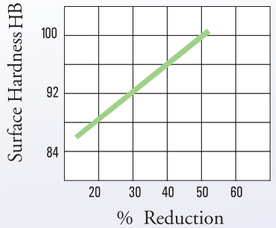
- Uniform distribution of MnS
- Hardness
- Microstructure
- Dimentional quality
- Straightness



Typical Co-relation of Machining Parameters with Elemental Levels



Effect of 'S' content on the machining torque.



Free machining steels are generally used after cold processing such as drawing, peeling, grinding etc. The extent of cold work employed in converting black bar of free machining steel into bright bar, decides its surface hardness, which in turn is responsible for its machining performance.

FREE CUTTING STEELS

Salient Features of Process

PROCESS	EQUIPMENT	KEY PROCESS CHARACTERISTICS	EFFECT ON PRODUCT QUALITY
PRIMARY MELTING	EAF WITH EBT AND LOAD CELL ELECTRIC ARE FERVOCE WITH ELECTRIC BOTTOM TAPPING AND LOAD CELL	• GOOD CARBON BOIL • SLAG FREE TAPPING • LM WEIGHT MONITORING • LIQUID METAL	• FREE FROM UNDESIRABLE TRAMP ELEMENTS • LOW TRAMP ELEMENTS DUE TO USE OF OWN VIRGIN • RAW MATERIAL, SUCH AS DRI, PIG IRON. LOW PHOSPHORUS LEVEL TO IMPROVE COLD FORGEABILITY. • LOW N2 LEVEL AT TAPPING STAGE, • CONTROLLED FEO IN SLAG TO ENSURE LOW O2 FOR SUBSEQUENT STEEL REFINING
SECONDARY REFINING	LADLE REFINING FURNACE WITH COMPUTRISED FERROALLY FEEDING SYSTEM	• ARGON PURGING • MICROPROCESSOR BASED FERROALLOY ADDITION SYSTEM • CONTROLLED POWER INPUT	• ACHIEVEING FINAL PRODUCT CHEMISTRY WITH HIGH REPETABILITY. • PREDICTABLE ALLOY RECOVERY AND LESS FORMATION OF DEOXIDATION OF PRODUCTS. HIGH BASICITY FOR DEEP DESUL PHURISATION AND INCLUSION REMOVAL. FACILITY FOR TRIM ADDITION TO ACHIEVE CLOSE RANGE OF TARGET CHEMISTRY.
DEGASSING	STATIC TANK TYPE VACUUM DEGASSING	• HIGH SUCTION CAPACITABILITY TO • ACHIEVE VACUUM <1 m bar • ARGON PURGING/RINSING	• REDUCTION IN DISSOLVE GAS LEVELS O2,N2,H2 • SIGNIFICANT REDUCTION IN SULPHUR LEVEL • COMPLETE HOMOGENISATION OF CHEMISTRY AND TEMPERATURE FOR SMOOTH CASTING.
WIRE INJECTION	3 STRAND WIRE INJECTION EQUIPMENT FOR CARBENSULPHOR AND ALLUMINIUM	FINE ADJUSTMENT OF C & S & ALLUMINIUM	PRECISE CONTROL OF C ,S AND ALUMINIUM.
CASTING	CONTINOUS CASTER 3 STRANDS WITH AMLC/EMS, SUBMERGED NOZZLE CASTING AND LEVEL 2 AUTOMATION	• BASIC REFRACTORIES. • CONTROL ON SUPER HEAT, • CASTING SPEED, • UNIFORM SECONDARY COOLING, • STABLE CASTING	• IMPROVED SURFACE QUALITY OF BLOOMS • NO MACROINCLUSIONS DUE TO CLOSED STREAM CASTING THROUGH AMLC • CAST BLOOM FREE FROM HARMFUL SURFACE AND SUB SURFACES DEFECTS
BILLET INSPECTION	• OPTICAL EMMISSION SPECTROMETER • GAS ANALYSERS • MACRO TEST • AUTO GRINDING OF SURFACE • MAGNA FLUX ON ROLLED BILLET	• CHEMISTRY, • GAS LEVELS , • INTERNAL AND SURFACE QUALITY AS PER CUSTOMER SPEC	CONFORMANCE TO CUSTOMER SPECIFICATION.
BAR AND SECTION ROLLING MILL	• WALKING HEARTH REHEATING FURNACE, • AIR:FUEL RATIO CONTROL, • 24 STDS FIXED PASS LAY OUT WITH 10 STD FINISHING BLOCK OF TUNGSTON CARBIDE ROLL GROOVE, • VARIABLE REDUCTION MILL (VRM) WITH HOUSINGLESS STANDS AND HIGH STIFFNESS	• ROLLING TEMPERATURE, CONTROL FURNACE RESIDENCE TIME, • PRIMARY SCALE REMOVAL, • OVAL-ROUND PASS SEQUENCE AND INTERSTAND TENSION CONTROL WITH LOOPERS. • INPUT OUTPUT TEMERATURE CONTROL, • PLANNED PASS SCHEDULING • HORIZONTAL VERTICAL HORIZONTAL STAND CONFIGURATION IN VRM	• UNIFORM SURFACE APPEARANCE, • CLOSE DIMENSIONAL TOLERENCE, • FREEDOM FROM HARMFUL SURFACE DEFECTS , • COMPACT LAYING OF TURNS LEADING TO COMPACT COILS, • CONTROL ON SURFACE DECARBURISATION. • CAPABILITY TO ROLL ROUND 15-56 MM, COIL 5.5-38MM , HEX 13.3-38 MM AND FLAT IN DIFFERENT SIZES. • DIMENSIONAL TOLERENCES OF 1/4 TH OF STANDARD "DIN 1013" WITH MINIMUM SIZE VARIATION ALONG THE LENGTH OF BAR
BLOOMING MILL	• WALKING HEARTH REHEATING FURNACE, • THERMAL IMAGING CAMERA, • AIR:FUEL RATIO CONTROL, • HYDRAULIC SCALE BREAKER , • 2 HIGH REVERSABLE MILL WITH MECHANISED FEEDING • AUTOSCREWDOWN MECHANISM WITH HOT SAW CONTROLLED COOLING FACILITY	• ROLLING TEMPERATURE, • FURNACE RESIDENCE TIME	• FLEXIBILITY TO ROLL SQUARES AND ROUNDS • FREE FROM HARMFUL SURFACE DEFECTS • DIMENSIONAL CONTROL AS PER TOLERENCE, • PROPER END CUTTING, • GOOD STRAIGHTNESS IN AS ROLLED CONDITION
ALLOY STEEL MILL	• PLC CONTROLLED PUSHER TYPE FURNACE, • THREE HIGH ROUGHING STAND, • TWO THREE HI INTERMEDICATE STAND AND • TWO HIGH FINISHING STAND, • HOT SAW FACILITY AND RAKETYPE COOLING BED	• GOOD TEMPERATURE CONTROL, GOOD FINISH QUALITY	• DEFINE ROLL PASS DESIGN, BOX PASSES, • DI & SQ FOLLOWED BY OVAL ROUND SEQUENCE IN INTERMEDIATE AND FINISHING.