

Cold Forging Quality Steels



**SUN FLAG
STEEL**

ISO-9001 & ISO/TS-16949 Co.

NABL Accredited

AD 2000 - Merkblatt W0 certified from TUEV Nord

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Cold Forging Process

- This process is mainly used for manufacturing fasteners and similar components.
- Cold forging and cold extrusion are the two main processes used for manufacturing these type of components.
- These components are mainly used in the automotive industry.
- The starting raw material for these components is in the form of wire rods.
- The cold forging or cold extrusion process imparts following advantages to the components manufacturing:
 1. Good surface finish
 2. High as forged strength
 3. No trimming and scaling loss
 4. Better yield
 5. Ready to use surface quality especially for process of plating which is necessary to ensure corrosion resistance.
 6. Good productivity, which is essential due to large volume requirements.

Material quality requirements

- These process characteristics necessitate a proper manufacturing quality of cold forging quality wire rods. The important features of these quality requirements are as under:
 1. Excellent surface quality ensuring zero defect situation so that forged components have no defects.
 2. Good control over ovality to ensure smooth forging process.
 3. Good control over mechanical properties such as tensile strength and reduction area to ensure proper cold forgeability and productivity.
 4. Completely descaled surface to avoid forging defects such as scale pits and resultant surface roughness.
 5. Suitable metallurgical structure to ensure proper machinability level.
 6. Good and uniform response to heat treatment since the components are always treated in bulk.

Salient features of the manufacturing process of cold forging quality steels.

Process Step

Iron making - DRP - MBF
Melting in Arc Furnace

Refining at Ladle Refining Station

Vacuum Degassing

Continuous Casting

Bloom inspection & Conditioning & Cogged billet inspection & Conditioning for obtaining a defect free surface prior to rolling

Final Rolling

Garret Coiling

Block Mill

Inspection & Clearances
Finishing

Despatch of final coil in ready to use condition.

Actions

- Use of right raw material free of undesirable tramp elements.
- Low tramp levels due to use of own virgin raw materials such as DRI, Pig Iron.
- Low phosphorous level (0.015% max.) to improve cold forgeability.
- Low N₂ level at tapping stage. • Low transfer sulphur.
- Foamy slag melting. • Controlled FeO in slag to ensure low O₂ steel for refining.
- Controlled and predetermined tapping addition to ensure near finish aim chemistry.
- Controlled sequence of addition to ensure proper alloy recoveries and formation of de-oxidation products favourable to finished steel quality.
- Control of Sulphur level to lowest possible value. • Making a good basic slag.
- Trimming additions to ensure final aim chemistry well within aim limits.
- Substantial reduction in the gas levels O₂, N₂, H₂
- Significant reduction in Sulphur level.
- Complete homogenization of chemistry and temperature for smooth casting.
- Definite lifting temperature to ensure correct super heat level while casting.
- Complete shrouding of metal streams from ladle to tundish and tundish to mould.
- Mould powder refining for better, final cleanliness.
- Controlled casting parameters of casting speed, primary/ secondary cooling to obtain a sound internal quality.
- Control of heating & soaking zone temperatures to control decarburisation.
- Primary de-scaling after discharge of billet from the reheating furnace.
- Frequent checking of intermediate as well as finished samples for ensuring defect free rolling.
- Modern Morgardshammar Garret Coiler installed in February 2002.
- Equipment designed to avoid surface defects and obtain a high density coil.
- Drum type coilers made of nodular cast iron to minimize friction between the drum and the rod.
- Morgardshammar block mill commissioned in Sept'06.
- Equipment designed to facilitate variant air cooling parameters, water quenching.
- 200% cold upset test for clearance of coils (i.e samples from both ends of all coils).
- Pickle, phosphatate & pinch draw.



Category	SAE / AISI	DIN	IS	EN
Low Carbon & Medium Carbon Grades	1006	-	-	-
	1008	-	-	-
	1010	CK-10	C10	-
	1012	CK-10	C10	EN2A
	1015	CK-15	-	EN32B
	1018	-	C-15Mn75	EN2C
	1020	C-20	C-25Mn75	EN3A
	1025	-	-	-
	1040	-	-	-
1045	-	-	-	
Carbon Manganese	1541	36Mn7	37C15	EN15
Boron Grades	10B21	-	21C10BT	-
	15B25	-	26C10BT	-
	15B41	-	-	-
Crome-Moly	4135	-	-	-
	4140	-	40CR ₂ MO ₃	EN-19

Wire Rods Rolled Inhouse :

Sizes (mm) : 5.5, 6.0, 7.0, 7.5, 8.0, 8.5, 9.0, 9.5, 10, 11, 12, 13, 14, 15, 16, 16.3, 17.3, 18.5, 20, 21, 22, 23, 24, 25.4, 26, 27.5, 28, 30, 32, 33, 34, 36 mm dia.

Metallurgical Specifications :

Surface defect depth less than 0.5% of diameter
Decarburisation depth less than 0.5% of diameter
Cold upsetability 85% min. all materials

Dimensional Specifications (As rolled)*

Diameter Range	Ovality	Permissible Tolerance
5.5-9.0 mm	0.2 mm max	± 0.15 mm
10-25 mm	0.3 mm max	± 0.20 mm
26-36 mm	0.4 mm max	± 0.30 mm

* In specific cases stricter specifications can be met.

Particulars	Block Route (5.5 mm to 11mm dia)	Garret Route (12 mm to 36 mm dia)
Supply Condition	Hot Rolled	Hot Rolled
Coil Weight	1000 kgs	1000 kgs
Coil Inner Diameter	800 mm	800 mm
Coil Outer Diameter	1200 mm	1500 mm
Coil Height	900 mm	1100 mm
Coiling Direction	Counter Clockwise	Counter Clockwise
Binding	Strap	Strap



**CHEMICAL COMPOSITIONS OF TYPICAL
COLD FORGING QUALITY GRADES :**
1. CARBON STEELS

Sr.	Grade	C%	Si%	Mn%	S% Max	P% Max	Cr%	B%	Mo%	Pb%	Ni%	Others
1.1	AISI 1006	0.06 Max	0.10 max	0.25- 0.40	0.05	0.04						
1.2	AISI 1008	0.10 max	0.10 max	0.30- 0.50	0.05	0.04						
1.3	AISI 1010	0.08- 0.13	0.10 max	0.30 0.60	0.05	0.04						
1.4	VS 14250	0.10- 0.14	0.13 max	0.21- 0.45	0.04	0.03						
1.5	VS 13111	0.07- 0.11	0.07 max	0.20- 0.40	0.04	0.03						
1.6	AISI 1015	0.13- 0.18	0.15 max	0.30- 0.60	0.05	0.04						
1.7	AISI 1018	0.15- 0.20	0.05- 0.10	0.60- 0.90	0.05	0.04						
1.8	EN1A	0.08- 0.15	0.10 max	0.85- 1.15	0.26- 0.35	0.04- 0.09				0.25- 0.35		
1.9	EN1A	0.07- 0.15	0.10 max	0.80- 1.20	0.20- 0.30	0.060 max						

2. BORON STEELS

Sr.	Grade	C%	Si%	Mn%	S% Max	P% Max	Cr%	B%	Mo%	Pb%	Ni%	Others
2.1	AISI 10B21M	0.18- 0.23	0.30 max	0.80- 1.10	0.03	0.03	0.10- 0.20	0.0005- 0.003				
2.2	AISI 15B25	0.23- 0.28	0.30 max	0.90- 1.30	0.03	0.03	0.10- 0.20	0.0005- 0.003				
2.3	DIN 19MnB4M	0.20- 0.25	0.15- 0.30	0.80- 1.10	0.03	0.03	0.30- 0.40	0.0006- 0.003				
2.4	AISI 15B41	0.36- 0.44	0.15- 0.30	1.35- 1.65	0.03	0.03	0.10- 0.20	0.0006- 0.003				
2.5	AISI 10B36M	0.34- 0.39	0.15- 0.30	0.80- 1.10	0.03	0.03	0.20- 0.40	0.0006- 0.003				
2.6	DIN 36CrB4	0.34- 0.38	0.10 max	0.60- 0.90	0.015	0.015	0.90- 1.20	0.0015- 0.005				
2.7	AISI 51B35M	0.34- 0.40	0.15- 0.30	0.35- 0.50	0.025	0.025	0.90- 1.15	0.0006- 0.003	0.10 max		0.15 max	

3. ALLOY STEELS

Sr.	Grade	C%	Si%	Mn%	S% Max	P% Max	Cr%	B%	Mo%	Pb%	Ni%	Others
3.1	SCM 415 H	0.12- 0.18	0.15- 0.35	0.55- 0.90	0.03	0.03	0.85- 1.25		0.15- 0.35		0.25 max	
3.2	SCM 435	0.32- 0.39	0.15- 0.30	0.55- 0.90	0.03	0.03	0.80- 1.25		0.15- 0.35		1.30- 1.80	
3.3	AISI 4135	0.33- 0.38	0.15- 0.30	0.70- 0.90	0.04	0.035	0.80- 1.10		0.15- 0.25		0.25 max	
3.4	EN 24	0.35- 0.45	0.10- 0.35	0.45- 0.70	0.04	0.035	0.90- 1.40		0.15- 0.35		1.3 - 1.8	
3.5	AISI 4140	0.38- 0.43	0.15- 0.30	0.75- 1.00	0.04	0.035	0.80- 1.10		0.15- 0.25			
3.6	AISI 4140 M	0.38- 0.43	0.15- 0.30	0.75- 1.00	0.005	0.015	0.80- 1.10		0.15- 0.25			
3.7	AISI 5140	0.38- 0.43	0.15- 0.30	0.70- 0.90	0.04	0.035	0.70- 0.90					
3.8	AISI 1541	0.36- 0.44	0.15- 0.30	1.35- 1.65	0.05	0.04						