

SUMMARY

Training Steel Quality and Specification

A. FUNCTION AND BENEFIT OF STEEL

Steel is considered as national power due to its effect on economy. Steel has backward linkage to raw material sources, energy, human resources, harbour and road. It also has big effect on forward linkage in terms of infrastructures development and many kind of manufacture industries.

B. PROCESS & TECHNOLOGY OF STEEL PRODUCTION

Process & technology of steel production is mainly classified into two type namely gas based rute and coal based rute.

Gas based rute uses natural gas to reduce iron ore (iron ore pellet) in direct reduction process of iron making. The products of such a direct reduction process is in form solid which is called sponge or Direct Redution Iron (DRI). Then sponge is melted in electric arc furnaces, added alloys in secondary metallurgy and casted in continuous caster to produce steel.

Meanwhile, coal based technology uses coal (coking coal) to produce liquid iron in blast furnace and melt it using oxygen in converter.

Gas based technology is good for small capacity up to a million ton a year. This rute becomes more popular at countries with having low natural gas price. Coal based technology is known has clasic technolgy but still effectice to produce iron and steel at low cost.

C. STEEL CLASSIFICATION

Steel is classified into 5 types based on manufacturing method (open hearth, basic oxygen furnace and electric arc furnace), carbon content (carbon steel, low alloy steel, and corrosion resistance steel) form of products (ingot, flate and long, products), micro structure (ferritic, pearlite, martensite and austenite steel) and end used (structural and non structural steel)

D. STEEL PROPERTIES

Steel properties consist of yield and tensile strength, toughness, ductility, hardness, weldability), hardenability, heat treatability, wear-resistance and bullet-proof

E. EFFECT OF ELEMENTS ON STEEL PROPERTIES

Strength is influnced by the content of alloying elements in steel such as carbon (C), chromium (Cr), manganese (Mn), molybdenum (Mo), nickel (Ni) and silicon (Si), Tantalum (Ta), Tungsten and Vanadium (V).

Hardenability is influenced by Boron (B), Carbon (C), Chromium (Cr), Manganese (Mn), Molybdenum (Mo), Phosphorus (P) and Titanium (Ti).

Toughness is influenced by Calcium (Ca), Cerium (Ce), Chromium (Cr), Magnesium (Mg), Molybdenum (Mo), Nickel (Ni), Niobium (Nb), Tantalum (Ta), Tellurium, Vanadium (V) and Zirconium (Zr).

Machinability is influenced by Lead (Pb), Manganese (Mn), Phosphorus (P), Selenium (Se), Sulfur (S) and Tellurium (Te).

Detail effect of element on steel quality was explained including its effect on process such as deoxidiser, inclusion, solid solution and sulfides.

F. QUALITY COST

Quality cost is considered to be any cost that the company would not have incurred if the quality of the product or service were perfect

G. PROCESS CONTROL

Process Control in Steel Making

Process control in melting: type and amount of raw material, chemical composition, temperature and tap to tap time.

Process control in secondary metallurgy: Deoxydation, Desulphurization, Decarburization via Vacuum Degasser, Alloying (chemical composition), Inclusion shaped control and temperature control

Process control in casting: temperature control and all casting parameter

Inspection: Surface quality, Internal quality by sulphur print/ macro-etch and Shape/dimension,

Process Control in Rolling Mill

Process control in reheating furnace: Temperature setting, Soaking time, Air pressure, Appearance of slab

Process control in roughing mill: Width setting , % thickness reduction, Temperature, Pass schedule, Rolling speed

Process control in finishing mill: % final thickness reduction, Temperature, Pass Schedule, Automatic Gauge Control, Rolling speed, Cooling mode.

Process control in down coiler: Shape & surface defect, Dimension, Weighing, Sampling

H. STANDARD OF STEEL

Sour Gas Pipe: pipelines for sour earth gas or crude oil (vulnerable of acid attack):

Standard Reference :

- API 5L-A, B
- API 5L-X42, X46, X52, X56, X60, X65, X70
- DNV 450, 485
- API5CT H40, J55, K55

Boiler and Pressure Vessel: medium-large welded pressurized boiler or vessel for chemical or other industrial plants which operated at elevated temperature. High strength, excellent weldability, high temperature resistance (no creep or spalling)

Standard Ref. :

- ASTM A 285 Grade A, B, C
- ASTM A 414 Grade A, B, C, D, E, F, G

- ASTM A 516 Grade 55, 60, 65, 70
- Or equivalents

Gas Cylinder / LPG Bottle: small-medium welded gas cylinder for liquefied natural or petroleum gas for industry or home appliances. Medium-high strength, good toughness, excellent weldability.

Standard Ref. :

- JIS G 3116 SG 255, 295, 325
- DIN EN 10120 P245NB, P265NB
- SNI 07-3018-2006 BjTG Or equivalents

General & Weld Structure: Medium-high strength and good weldability

Standard Reference:

JIS G 3101 SS 400, SS 490, SS 540

JIS G 3106 SM 400A, B, C, SM490YA, YB, SM520B, C, SM570

JIS G 3136 SN 400A, B, C, SN 490A, B, C

DIN 17100 St 37, St 44, St 50, St 52

BS 4360 43A, B, C, 50A, B, C

ASTM A570 Gr. 30, 33, 36, 40, 45, 50

Weatherng Steel: Welded plates for special structural uses which need higher wheathering corrosion resistances for cargo containers, electricity poles, bridges, buildings, industrial machinery, and other exposed structural applications.

High strength, good weldability, higher corrosion resistance compare to ordinary structural steel plates.

Standard Reference:

- JIS G 3125 SPAH
- Corten Steel A, B, C
- BTKC A, B, C (Baja Tahan Korosi Cuaca)
- SNI 07-1580-1989

Ship Building: Thick welded plates for ship buildings and constructions including repair and equipments ; offshore installations and other marine structures. Steel properties: Medium-high strength, good weldability, good fatigue resistance

Standard Reference:

- Lloyd's Register Grade A
- Germanicher Lloyd Grade A, B
- ABS Grade A, AH32, AH36
- BKI Grade A, B
- BV Grade A, B
- NK Grade KA, KA32, KA36
- DNV Grade A
- Or equivalents

Cold Rolled for General Purposes: general uses of steel sheet such as: sheet cover, drums, office cabinets & appliances, and also for zinc or zincalume coated roofing-ducting sheets. Characteristics: Low strength, low-medium formability & bendability, good weldability.

Available Specifications:

- JIS G 3141 SPCC-1D (as-rolled)
- JIS G 3141 SPCC-SD (annealed)
- Or equivalents

Cold Rolled for Automotive and Parts: structural and non-structural, exposed and un-exposed automobile body, wheel rims, motorcycle frames, fuel tanks, oil filters, air filters, lamp reflector, etc. Characteristics: Low-medium strength, good-excellent formability & drawability, good weldability, excellent surface appearances & cleanliness

Available Specifications:

- JIS G 3141 SPCC-SD, SPCD-SD, SPCEN-SD
- EN 10130 DC 01, 03, 04, 05, 06
- DIN 1623 St 12, St 13, St 14, IF 18
- Or equivalents

Cold Rolled for Tin Mill Black Plate: blackplate for tinplate applications: general can, chemical can, food can, etc. Characteristics: Low-medium strength, good formability & bendability, good surface appearances & cleanliness, good weldability

Available Specifications:

- JIS G 3303 SPB-MR T2.5
- JIS G 3303 SPB-MR T3
- JIS G 3303 SPB-MR T4
- Or equivalents

Cold Rolled for Steel Frame Housing: light gauge steel for structural and non-structural housing frame: roof frame, wall frame, window frame, floor frame, etc. Characteristics: Medium-high strength, low formability & bendability, good weldability

Available Specifications:

- JIS G 3141 SPCC-1D
- JIS G 3141 SPCC-2D
- JIS G 3141 SPCC-SD
- SPC G300
- SPC G550 (High tensile)

- Or equivalents

Steel Bars, Sections and Wire Rods.

Characteristics: low-medium plain carbon-manganese steel.

Available for specifications:

- Wire Rods: JIS G 3505 SWRM
- Steel Bars: JIS G 3112 SR, SD

Wire Rods for General Wire

Characteristics: Low-medium strength, good formability & drawability, good weldability

Available Specifications:

- JIS G 3505 SWRM 6, 8, 10
- JIS G 3505 SWRM 12, 15, 17, 20, 22
- Or equivalents

Wire Rods for Bolts and Nuts

Characteristics: Low-medium strength, good formability & drawability, excellent cleanliness, good weldability .

Available Specifications:

- JIS G 3507 SWRCH 8A
- JIS G 3507 SWRCH 10A
- JIS G 3507 SWRCH 18A

Wire Rod for Electrode Wire

Characteristics: low strength, medium formability & drawability, special chemical compositions, good weldability

Available Specifications:

- JIS G 3523 SWRY 11
- JIS G 3523 SWRY 21
- Or equivalents