31CrMoV9, 30CrMoV9, 1.7707, 1.8519 - Special steels Datasheet

31CrMoV9 is a low-alloy steel offers good mechanical properties, including high strength and toughness. It has a high hardenability and can be heat treated to achieve desired properties. The steel is typically used in applications where high strength, resistance to wear and fatigue, and good toughness are required. steel is boiler grade, low-alloyed, used in the energy industry for the parts working in high temperatures below 540 °C. The material is often used in the manufacture of screws, nuts, parts of turbines and other equipment for the energy industry.

Chemical Composition

Grade	Chemical Composition WT %									
	C	Mn	Si	P	S	Cr	Ni	Mo	V	Cu
33H3MF	0.29 - 0.36	0.5 - 0.8	0.17 - 0.37	max. 0.035	max. 0.035	2.4 - 2.8	max. 0.3	0.35 - 0.45	0.2 - 0.3	max. 0.3
30H2MF	0.26 - 0.34	0.4 - 0.7	0.15 - 0.40	max. 0.035	max. 0.035	2.3 - 2.7	-	0.15 - 0.25	0.1 - 0.2	max. 0.3
31CrMoV9, 1.8519	0.27 - 0.34	0.4 - 0.7	max. 0.40	max. 0.025	max. 0.035	2.3 - 2.7	-	0.15 - 0.25	0.1 - 0.2	-
30CrMoV9, 1.7707	0.26 - 0.34	0.4 - 0.7	max. 0.40	max. 0.035	max. 0.035	2.3 - 2.7	max. 0.6	0.15 - 0.25	0.1 - 0.2	-
30Ch3MF, 30Х3МФ	0.27 - 0.34	0.3 - 0.6	0.17 - 0.37	max. 0.035	max. 0.035	2.3 - 2.7	max. 0.3	0.2 - 0.3	0.06 - 0.12	max. 0.3

Mechanical Properties

The mechanical properties of 31CrMoV9, a high-strength low-alloy steel, are as follows:

1. Tensile Strength: The tensile strength of 31CrMoV9 is typically in the range of 1000-1300 MPa.

2. Yield Strength: The yield strength of 31CrMoV9 is usually about 800 MPa.

3. Elongation: The elongation at break for this steel is typically around 10-15%.

4. Hardness: The hardness of 31CrMoV9 can range from 280-320 HB (Brinell hardness).

5. Impact Toughness: The impact toughness of this steel is typically high, with an average value of 30-40 J/cm².

It is important to note that these values can vary depending on the heat treatment and manufacturing process used for the steel.

Mechanical properties of 31CrMoV9, 1.8519 +QT steel

- **Annealed softened delivery condition +A**
  - Hardness, HB: <248
- **Heat-treated condition +QT**
  - Tensile strength, R_m: 850 - 1300 MPa
  - The yield point, R_e: > 650 MPa

  - Elongation, A:> 9%
  - Impact resistance, KV: > 25J
- **Hardness of surface after nitriding**, HV1: 800

Mechanical properties of 30CrMoV9, 1.7707 +QT steel

- Tensile strength, R_m: >800 MPa
- The yield point, $R_{p0,2}$: >590 MPa
- Elongation, A:> 8%
- Impact resistance, KV: > 20J

Physical Properties

1. Density: The density of 31CrMoV9 is typically around 7.85 g/cm³.

2. Melting Point: The melting point of this steel is approximately 1420-1460°C.

3. Thermal Expansion: The coefficient of thermal expansion for 31CrMoV9 is around 11.5 x 10^-6/°C.

4. Electrical Conductivity: The electrical conductivity of this steel is relatively low.

5. Magnetic Properties: 31CrMoV9 is generally non-magnetic in nature.

These physical properties provide an understanding of the behavior of the material at different temperatures and its electrical and magnetic characteristics.

Heat Treatment

1. Annealing: Annealing involves heating the steel to a temperature between 850-900°C and holding it at that temperature for a specific time. It is followed by slow cooling in a furnace or by air cooling. Annealing helps to reduce internal stresses, improve machinability, and enhance the overall ductility of the steel.

2. Normalizing: Normalizing is performed by heating the steel to a temperature between 860-900°C and allowing it to cool in still air. This process results in a uniform microstructure and improved mechanical properties.

3. Quenching and Tempering: This heat treatment process involves heating the steel to a temperature between 850-900°C and then rapidly cooling it in oil or water (quenching). This step is followed by tempering, which involves heating the steel to a temperature between 550-650°C and holding it at that temperature for a specific time. This process imparts high strength and hardness to the steel while maintaining a certain level of toughness.

Welding Properties

1. Weldability: 31CrMoV9 steel has good weldability, which means it can be easily welded using various conventional welding methods. This includes processes such as arc welding (MIG, TIG, or SMAW), as well as resistance welding. 2. Preheating: Preheating is generally recommended when welding 31CrMoV9 steel to minimize the risk of cracking and improve weld quality. The recommended preheating temperature typically ranges from 200-300°C. 3. Post-weld Heat Treatment: After welding, it is often necessary to perform a post-weld heat treatment (PWHT) on 31CrMoV9 steel to relieve residual stresses and improve the material's properties. The specific PWHT temperature and duration depend on the desired properties and the specific application requirements. 4. Filler Materials: When welding 31CrMoV9 steel, it is important to select appropriate filler materials that match or closely resemble the base metal's composition and mechanical properties. Commonly used filler materials include matching or similar grade steels or low-alloy steels. 5. Weld Quality and Inspection: Proper welding techniques and procedures are important to ensure good weld quality and integrity. Non-destructive testing methods like visual inspection, ultrasonic testing, radiographic testing, or dye penetrant testing may be employed to verify the quality of the weld.

Machining Properties

31CrMoV9 is a low-alloy steel that is commonly used in the manufacturing industry. It exhibits good machinability, which refers to its ability to be easily shaped and processed using various machining techniques. Some of the machining properties of 31CrMoV9 include:1. Cutting: 31CrMoV9 can be easily cut using tools such as saws, shears, or laser cutting machines. It has good response to cutting forces and can be efficiently shaped into desired forms.2. Drilling: It can be drilled using standard drilling processes. However, due to its higher hardness compared to regular carbon steels, the cutting speed and feed rate may need to be adjusted to ensure optimal results.3. Milling: 31CrMoV9 can be milled using conventional milling machines. It is important to use sharp cutting tools and maintain proper coolant flow to prevent excessive heat buildup and tool wear.4. Turning: It can be turned on lathes with appropriate cutting tools. The use of carbide inserts is recommended for improved tool life and productivity.5. Grinding: 31CrMoV9 can be ground to achieve precise dimensions and surface finishes. It is important to use appropriate grinding wheels and cooling methods to prevent overheating and maintain the desired hardness and integrity of the material.6. Welding: While not specifically a machining operation, welding is often a subsequent process after machining. 31CrMoV9 can be welded using appropriate techniques such as gas metal arc welding (GMAW) or shielded metal arc welding (SMAW). Preheating and post-weld heat treatment may be required to reduce the risk of cracking and maintain the desired material properties.It is important to note that the specific machining properties of 31CrMoV9 may vary depending on factors such as the heat treatment condition, material thickness, and the specific machining parameters used. Therefore, it is advisable to consult the material manufacturer's guidelines or seek expert advice for optimal machining practices.

Similar or Equivalents Steel Grade

30 CrMoV 9, 31 CrMoV 9, 31CrMoV9, 30CrMoV9, 1.7707, 1.8519, 30Ch3MF, 30H2MF, 30Kh3MF, 30Х3МФ