

The core principle of aluminothermic welding involves igniting a specially formulated welding portion to rapidly produce high-temperature molten steel. This exothermic reaction releases intense heat over a short period, melting the preheated rail ends. The rail ends then fuse seamlessly with the molten metal. Upon natural cooling, the weld zone solidifies into a robust, unified structure. This procedure ensures the joint complies with or exceeds the mechanical performance standards specified for aluminothermic welds, such as DIN EN 14730-1.

Driven by rapid development and speed upgrades in modern railway systems, aluminothermic welding has been widely adopted for continuous rail connections, advancing track construction technology. Furthermore, this highly efficient technique is extensively utilized in industrial and mining facilities for the seamless welding of crane rails. Typical application sites include overhead crane systems, coking plants, freight yards, shipyards, and port terminals.

The implementation of thermite welding effectively mitigates long-standing issues associated with traditional jointed rails, including impact damage to lifting equipment, rails, ballast beds, and large structural beams. It significantly enhances operational safety and reduces maintenance costs, yielding substantial economic benefits. Ultimately, this technology improves overall workflow efficiency and extends the service life of the rail infrastructure, providing reliable support for continuous industrial operations.

How aluminothermic welding works



Welding Process Parameters with Thermite Used

item value type	Oxygen Pressure (MPa)	LPG Pressure (MPa)	Flame Core Length (mm)	Preheat Time (min)	Oxygen Flow (L/h)	Reserved Rail Gap (mm)
50kg	0.4	0.07	15-20	4	3500	26±2
60kg	0.4	0.07	15-20	5	3500	26±2
18kg 24kg	0.4	0.07	15-20	3	3500	26±2
38kg 43kg	0.4	0.07	15-20	4	3500	26±2
Qu70 Q80	0.4	0.07	15-20	5	3500	26±2
Qu100	0.4	0.07	15-20	9	3500	26±2
Qu120	0.4	0.07	15-20	12	3500	26±2
A55	0.4	0.07	15-20	4	3500	26±2
A65	0.4	0.07	15-20	4.5	3500	26±2
A75	0.4	0.07	15-20	5	3500	26±2
A100	0.4	0.07	15-20	9	3500	26±2
A120 A150	0.4	0.07	15-20	15	3500	26±2

Features and advantages of aluminothermic welding process

- The current interception at the welding joint is equal to that of the wire
- The welding joint is permanent and will not cause high resistance due to looseness or corrosion
- The solder joint is like copper, but tougher than copper itself and is not susceptible to corrosives
- The solder joint can withstand repeated large surge (fault) currents without degradation
- The welding operation is simple and easy to use
- Lightweight and easy to carry
- No external power or heat source is required when welding
- Visual checks can be done to examine welding quality
- Can be used to weld copper, copper alloy, copper-plated steel, various alloy steels including stainless steel and high resistance heating heat source materials

Precautions for aluminothermic welding under special conditions

- If the air temperature is below 15 °C, the welding head should be covered with a blanket or other covering for 10 minutes.
- If the rail temperature is below 15 °C, use a welding torch to heat each side for about 1-2 minutes (depending on the size of the rail) up to reach 37 °C.

The main process of thermit welding

1. Inspect & clean up the rail end → 2. Alignment of rail ends → 3. Place the sand mould → 4. Apply the luting sand → 5. Check the welding materials → 6. Preheating → 7. Pouring → 8. Demount the mold & remove the cross → 9. Grinding → 10. Testing (MPI/UT)



Inspect & clean up the rail end



Alignment of rail ends



Place the sand mould



Apply the luting sand



Check the welding materials



Preheating

The main process of thermit welding

1. Inspect & clean up the rail end → 2. Alignment of rail ends → 3. Place the sand mould → 4. Apply the luting sand → 5. Check the welding materials → 6. Preheating → 7. Pouring → 8. Demount the mold & remove the dross → 9. Grinding → 10. Testing (MPI/UT)



Pouring



Demount the mold & remove the dross



Grinding



Testing (MPI/UT)



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