FLASH BUTT WELDING

Flash butt welding was introduced to the industry in the 1930's with the main application being the welding of railway rails in factories and only in the 1960's where the first mobile units developed.

The welding process is sub-divided into pre-flashing, pre-heating, flashing and upsetting. Pre-flashing is used to handle problems when the two surfaces to be joined are not parallel. Pre-heating is carried out under low welding pressure. When the welding joint has been heated to a certain temperature, flashing starts and the surface material is burned off, resulting in an even and clean joint surface. The flash consists of molten and oxidized material. After flashing, upsetting starts and presses the two surfaces together with high force to produce a good joint.

Preheating

The rail ends are brought into contact to allow a low voltage high amperage current flow which preheats the rail ends. Lower voltages are preferred to minimize crater damage on the rail ends. The movable rail is alternatively moved backward and forward producing a series of electrical contacts with the fixed rail end. The objective is to heat the rail faces uniformly by flashes up to the bright red hot stage. The rail ends are brought in and out of contact a number of times depending on the specifications of the welding plant, the section and the metallurgy of the rail. This pre-heating cycle is executed in a fully controlled automatic mode once the parameters are selected

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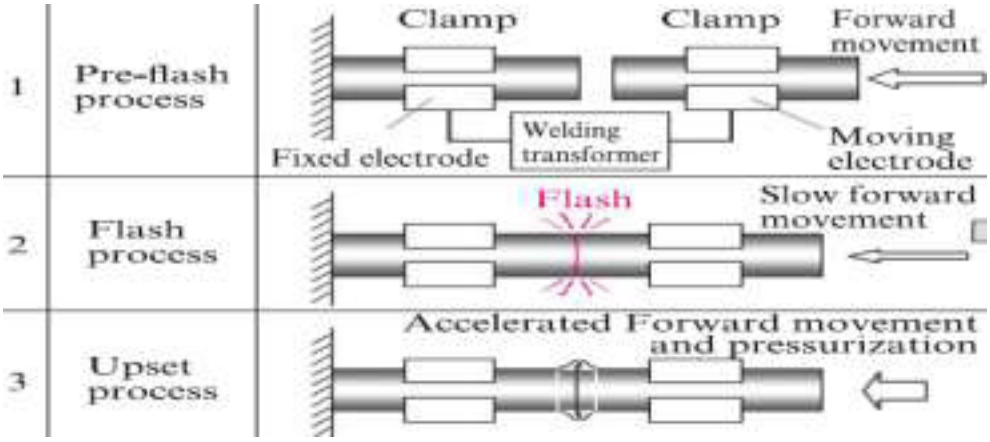


Pre flashing

Relevant to the specifications of rail and welding machine, controls shall be adjusted so that at the end of this phase weld interface has good overall contact.

Flashing

Flashing consists of moving the rail in continuous manner initially at a fixed speed but during the last few seconds, at an accelerated rate. The flashing speed is so arranged that the rail ends burn-off without short circuiting or giving rise to an open circuit condition.

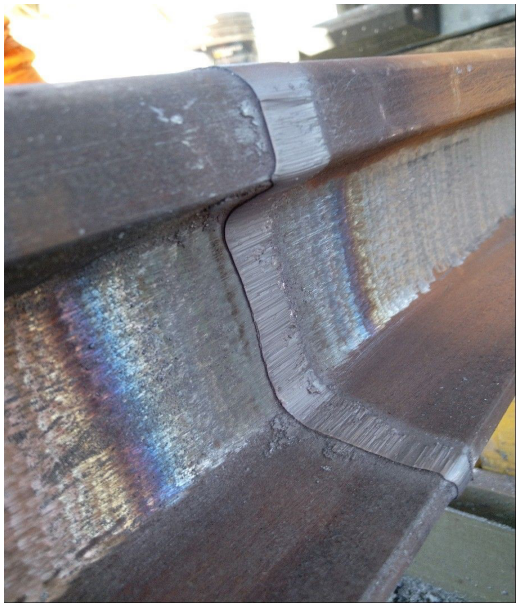
Upsetting

Immediately following flashing, the pattern movement is accelerated so that the rail ends are butted together to a stage of fusion under force. The welding current automatically gets cut off at the end of the upsetting operation. The joint should be left undisturbed in clamped position for ten seconds after the welding cycle.

Welding of higher UTS and higher section rails on low butting load plant by increasing the number of pre-heats causes very pronounced heat affected zone (HAZ) and is detrimental to the service life of the joints.

Stripping

The stripper is an integral part of the welding plant, to strip the hot upset metal around the rail section in a way that minimum grinding is required to achieve final finished profile at weld.



After stripping

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PRECAUTIONS TO AVOID DEFECTS IN FLASH BUTT WELDED RAIL JOINTS

Oxide inclusion

The rail end faces and the adjoining surface of the rail profile to a width of about 25mm all round shall be cleaned properly by portable grinders or brushing machine or shot blasting to remove loose scale, rust, scabs, dust, paint etc. Oil and grease, if present shall be removed.

Lack of fusion

Preheating cycle and time, flashing and butting (upsetting) stroke shall be strictly maintained during welding to avoid this defect.

Defect in rails

Rail ends having cracks and other visible rolling defects should be cropped before welding. Notches and chisel marks adjacent to the weld joints. During stripping by chiseling and finishing by grinding, care should be taken that notches, dents or chisel marks are not formed on the rail surface as such flaws may act as stress raisers in service leading to premature failure.

Copper penetration/arching on rail foot bottom surface

During flash butt welding, the two copper blocks below the rails get worn out and grooved/dented due to rail movement. After the flashing/burning off operations, loose oxides of metal are deposited on the copper blocks. Due to the above reasons, current flow between the rail foot surfaces and the copper block is not continuous resulting in arcing and formation of local melting/denting and even copper penetration at the rail foot surface. Such affected area results in premature fracture. Loose oxide/metal shall be cleaned by brushing the copper block surfaces and the copper blocks shall be periodically reconditioned or replaced with new ones.

Usage

When welding is carried out in-situ, minimum 20 minutes time after trimming is required to pass the load through the weld with proper packing and support below the joint.

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