

The Thermit® SkV-E Welding Process, with Single Use Crucible (SUC)

The SkV-E Welding Method:

The Thermit **SkV-E** Welding method, developed in consultation with Network Rail, forms our platform for a new generation of Thermit Weld, focussing on ease of use with maximum flexibility and reliability. It was designed specifically as a direct replacement for our traditional SkV-F method which has been the principal welding method deployed in the U.K. for over 30 years, and from the onset was intended for use with our Single Use Crucible (SUC).

New manufacturing equipment has been installed which incorporates new technology to enable a duplex mould to be automatically produced which has a refractory facing material to improve surface finish and aid cleaning for inspection.

The Welding process is now tested and approved in accordance with the European Specification Pr EN 14730 pt 1.

By combining the benefits of the process with our new Single Use Crucible, we can offer a welding method which provides:

- **Maximum Performance**
 - Immune to common weld faults
 - The finished weld can be easily cleaned for final inspection
 - Factory prepared crucible, portion and tapping system
- **Ease of Use**
 - No preparation of the crucible, and no handling of the portion
 - Preheater position is pre-set.
 - Moulds are designed for precision fit to the new rail profile, with simple adjustment for worn rail
 - Weight of the equipment is reduced with the SUC.
 - Robust Steel Crucible steel reduces risk of damage
 - No hazardous materials - No unusual fume or smell
- **Maximum Flexibility**
 - Choice of Putty or Sand Luting materials
 - Choice of Crucible
 - Mechanically or thermally cut rail ends.
 - Available for a wide range of Rail profiles and degrees of wear

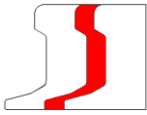


The Single Use Crucible (SUC)





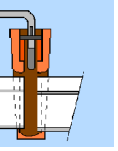
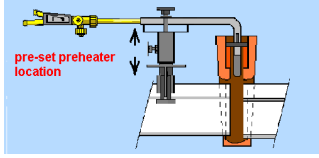


Our SUC has been designed as a robust, lightweight alternative to the conventional re-usable crucible offering significant benefits in terms of weld quality, ease of use, and reduced weight.

The crucible is supplied ready for use and charged with the portion which will not require any preparation prior to ignition. The SUC system has been designed for use with the Duplex moulds with the refractory facing material and should not be used with any other type.

- Factory manufactured – no preparation required by the welder.
- Sealed for protection from moisture or impurities
- Does NOT require drying before use
- Manufactured from non-hazardous materials
- No special transport or disposal requirements
- Supplied with the portion inserted ready for use
- Sturdy steel jacket minimizes the risk of damage prior to use
- After use the container may be filled with all the weld debris for disposal.



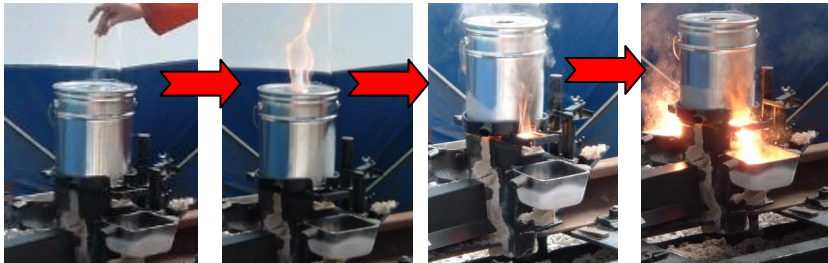
Detailed welding procedures for specific rail types are provided in our Operating manual, but the key stages are shown below

- The **SkV-E** process uses the same equipment as is required for the traditional Thermit welding methods, and welder re-training is minimal.
 
- After the rails have been accurately aligned the preformed moulds are fitted, adjusting as necessary to accommodate rail wear. The gap between the rail head and the moulds is blocked using one or more corrugated card inserts provided with the moulds.
 
- The preheater is located into the mould and fitted on its stand. Preheating may be by either oxy-propane or oxy-acetylene.
 
- The rail ends may be flame or mechanically cut. The rail gap is set by means of the distance gauge which may be used for both propane and acetylene preheating..
 
- Moulds are then sealed to the rail with a refractory luting material (luting sand or putty).
 
- The operating pressures are set using gauges attached to the preheater
 
- On completion of the preheat the crucible is positioned over the moulds and the Portion is ignited. On completion of the Thermit reaction the Thermit steel is automatically discharged into the mould
 
- When cooled the weld is trimmed with the aid of a hydraulic shear, after which the rail head is ground to profile
 

SUC in use:

The crucible is located on top of the moulds either by using the SUC mould shoes or by using a our crucible locating frame, which fits on top of the mould.

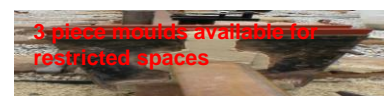
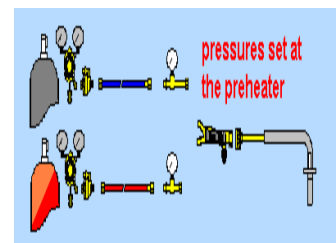
On completion of the preheat and removal of the preheater, the crucible is fitted in position and the central plastic seal is removed. The igniter is lit and inserted into the hole in the lid and pushed into the portion through the refractory cover.

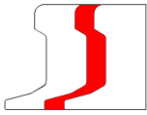


On completion of the reaction the Thermit steel automatically discharges into the mould. After a couple of minutes the crucible can be lifted off the moulds and placed in a safe position

When cold the steel lid may be removed to enable the container to be filled with the welding debris and removed from site.

Example of welding parameters	56E1(BS113A) and 54E1(BS110A)	
	oxy propane	oxy acetylene
Rail Gap	28 – 32	28 - 32
preheat		
oxygen pressure (bar)	3.0	2.0
fuel gas pressure (bar)	0.7	0.4
preheat time (mins)	3.0	6.0
portion size	1012	1012
tapping time (secs)	20-35	20-35
delay to trim (mins)	5.0	5.0



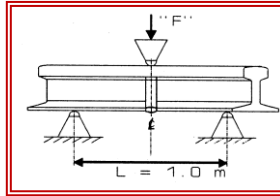


Technical Specification

The SkV-E process has been tested and approved by Network Rail in accordance with prEN 14730 pt 1 for process and product acceptance.

Strength

Aluminothermic welds are usually bend tested to fracture supported between 1 metre centres. Typical Bend test results for welds manufactured in 56E1 rail are shown with the requirements from common international standards



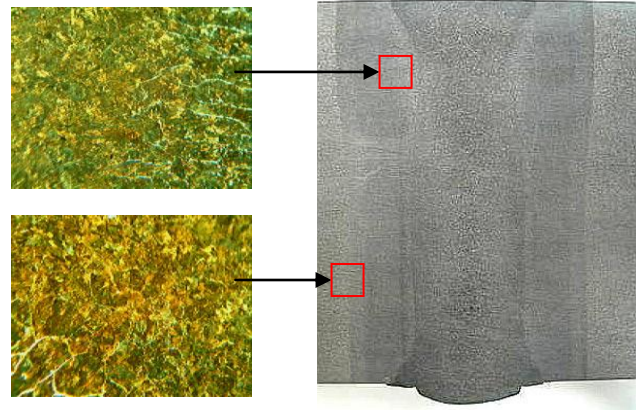
		56 E1
Thermit	min	1000
	typ	1100 – 1250
AREA	min	1110
prEN14730	min	995
SNCF	min	870

Metallurgy

The SkV-E welding process has been specifically designed for maximum fusion in the rail foot in order to make the weld invulnerable to imperfections such as isolated gas pores, “black holes”, and partial collar fusion. The weld width and heat affected zone along the centreline of the weld can be revealed by sectioning and macro-etching. The SkV-E weld has a minimum fusion of 42 mm in the lower half of the rail with at least 6 mm of rail end fusion.

Depth below running surface (mm)	Acetylene		Propane	
	WELD	HAZ	WELD	HAZ
0	58-65	19-22	57-64	19-21
30	35-38	29-33	33-36	28-32
80	42-45	24-28	43-45	23-25
140	43-45	24-27	42-45	23-35
Base	59-63	15-18	56-60	14-18

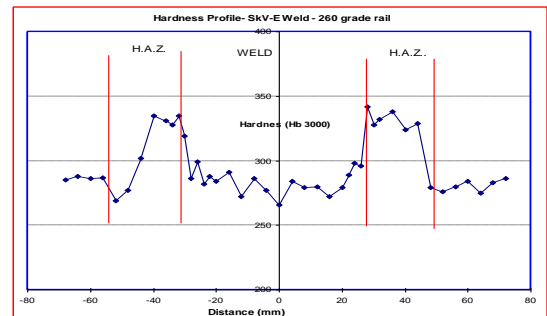
Applied load “F” at Fracture



Weld Hardness

The resistance to wear across the welded joint is influenced by the variation in hardness across the weld and heat affected zone. The SkV-E weld is characterised by its narrow HAZ on the running surface which helps minimise preferential wear.

Portion	Rail	Hardness (BHN)
Z80	220 ,260	240-295
Z80A	220,260	277-311
Z90	260Mn	285-321
SHTS	350 Ht	311-363
MH	350Ht	331-375



Process Application:

Our SkV-F process is being systematically replaced by the SkV-e and SkV-E moulds are currently available for the following rail profiles. For applications where parts are not shown, please call for availability

For Further information Please Call:

Thermit Welding (GB) Ltd
On 01708 522626

Or Email:
rsj @ thermitwelding .co.uk

RAIL PROFILE	SkV-E				
	std	Stepped (1)			3 piece
		*	**	***	
54 E1	241000	241010	241020	241030	241150
56 E1	241100	241110	241120	241130	241150
60 E1	241200	241210	Call		
BS 80A					
BS 90A					
BS 95Rbh	240800	240810	240820	240830	
BS 110A	241000	241010	241020	241030	241150
BS 113A	241100	241110	241120	241130	241150
BR 98 lb	call	call	call		
UIC 54	241000	241010	241020		241150
UIC 60	241200	241210			
BS113a/110a comp		221510	221520		