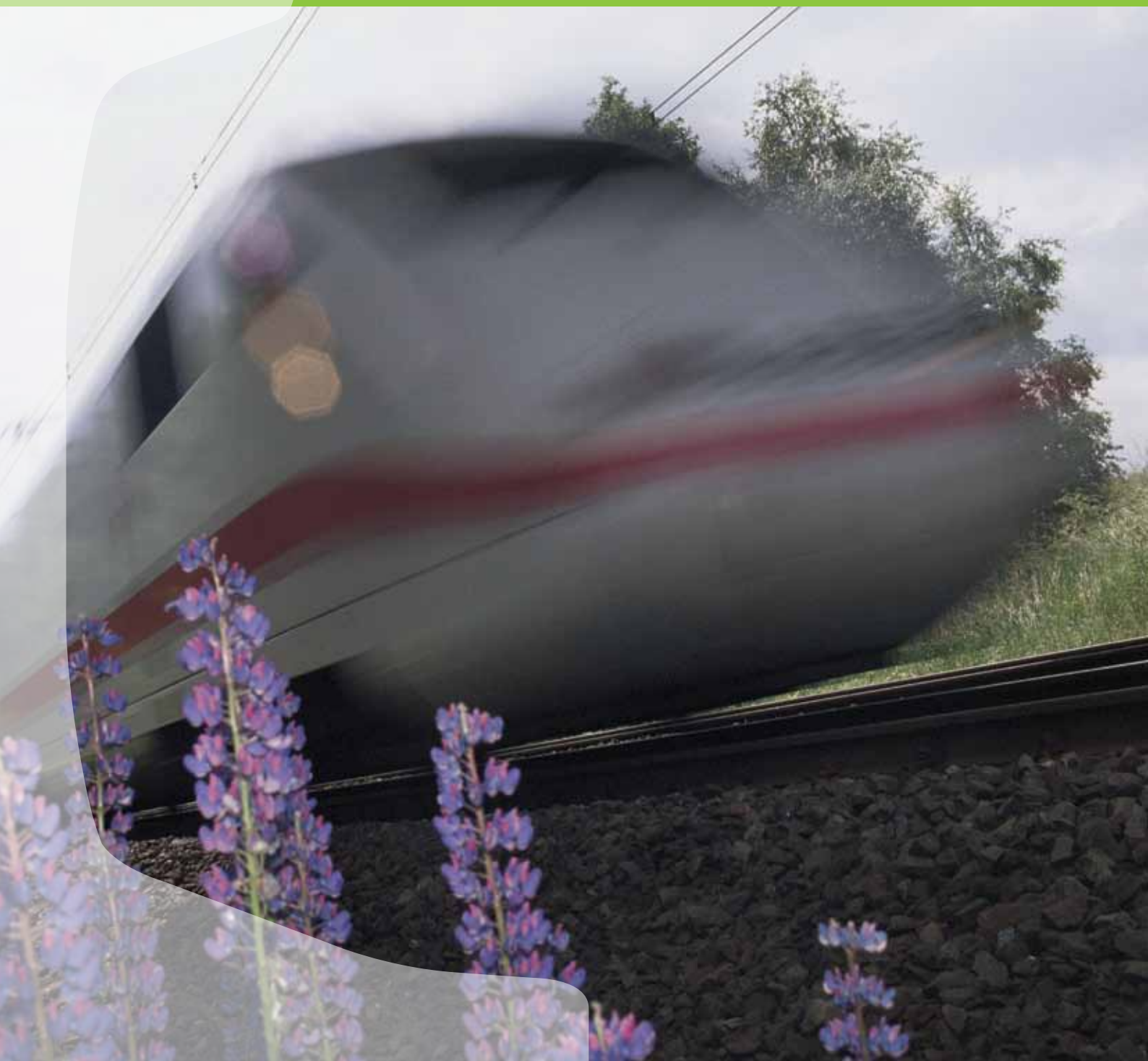
Thermit Welding (GB)

The Thermit® Head Repair (HR) Process



The Thermit®
Head Repair (HR) Process

The HR Welding Method

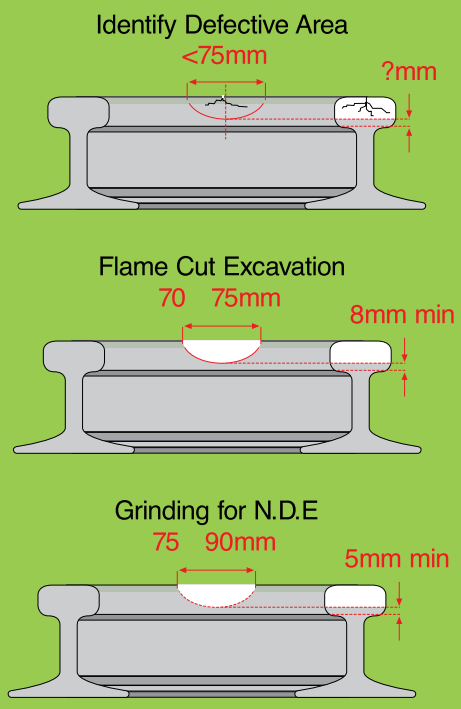
With the support of Network Rail, Thermit Welding (GB) Ltd has developed an alumino-thermic weld repair process for the repair of rail head defects in plain line including small isolated flaws which have been detected either by visual inspection or by the Ultrasonic Test Vehicles (UTU).

The process has been designed as a quick, cost effective alternative to conventional arc welding methods, with multiple repairs being possible within the normal welding shift.

Particular attention has been paid to minimizing costs and delivery issues by wherever possible aligning the method with equipment, consumables, and welding practice used for the conventional SkV-E welding process. Therefore the Thermit HR weld has been developed to incorporate:

- Defect removal by Flame cutting and grinding
- Conventional low pressure preheating – same parameters as standard SkV-E
- Single Use Crucible
- Standard Network Rail Approved Thermit Portions
- Normal Thermit Welding, Trimming and Profile grinding practice.

Specimen No.	Load (kN)	Load (kN)
Plain Rail - 113A - 3mm Wear	1040	8.3
Repair No.1 - BS 113A - 3mm Wear	771	6.2
Repair No.2 - BS 113A - New	1000	12.5
Repair No.3 - BS 113A - New	880	10.9



Repair Method

Preparation

The area to be repaired is marked on the rail ,and excavated using a purpose designed flame cutting template and torch.

Size of defective area:
- Full head width
- 70mm length
- Depth up to 25mm (depending on head profile)

The flame cut surface is then ground to prepare the surface for N.D.E. either using dye penetrant or magnetic particle. If any cracks remain after the excavation has been prepared that cannot be ground out, the rail is to be repaired and then reported for removal.

Final excavation – 75-90mm length

Assembly of the welding equipment

Most of the equipment is that used for the standard SkV-E process. The rail is released from its fastening either side of the repair area, and raised using wedges to produce a central lift of 0.5 - 1.0mm over a 1 metre span. A standard universal mounting and preheater mounting is fitted and the preheater height checked.

Preheater height : 70mm above centre of excavation
The HR moulds are checked for fit – minor adjustments may be made to accommodate head wear – and inserted into their shoes. The moulds are sealed to the rail with traditional luting materials. The central core plug is tested for fit and placed by the repair.

Preheating

Apart from the special HR preheater, the process using standard preheating equipment, and conventional SkV oxy- propane pre-set pressures:

- O: 3.0 bar, P: 0.7 Bar
- preheat time: 2.5 mins

Welding

On completion of the preheat, the burner is removed and the Single Use crucible, pre-charged with the Thermit® Portion, is positioned between the locating pegs on the mould shoes, and ignited. On completion of the reaction, the Thermit steel automatically discharges into the moulds.

Solidification and Profile Finishing

The welded repair is allowed to cool for 6 - 6.5 mins. after which the excess material is removed using an aluminothermic weld trimmer. After a further 30 minutes, the rail is fastened down, and the trimmed surface ground to profile.

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Technical Specification

The Thermit HR process has been approved by Network Rail for a trial installation. During the approval process repairs have been subject to radiography and ultrasonic inspection to prove that original defects had been removed and that the repair weld is defect free.

Weld Metallurgy and Hardness

Weld Hardness
The resistance to wear across the weld is influenced by the variation in hardness across the weld and heat affected zone. The HR process uses standard welding portions and produces a narrow HAZ on the running surface which helps minimise preferential wear.

Strength (Bend Test)
HR welds in three point slow bend test with the head in tension between 1.0m centres.

Materials and Equipment
(Excluding Oxy fuel gas cylinders and fittings)

Position Within The Prepared Section	Hardness Results (HV 30kg)		
Weld Metal - Centre - Z 80 Portion	277	291	294
Weld Metal - Fusion Face	320	334	308
Weld/HAZ Interface	318	321	315
Within Weld HAZ/Parent Interface	261	264	271
Parent Rail Steel	271	276	274

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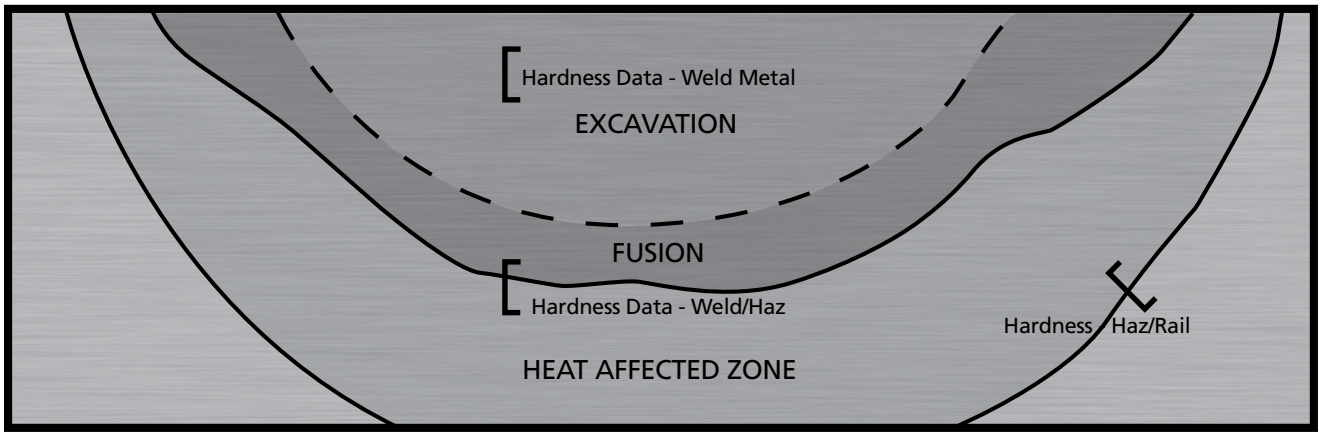

Item	Description	TW Part Number
Consumables	HR Mould (set)	230000
	6kg SUC Portion	450006
	5kg Luting Sand	300905
	Igniters	304000
Welding Equipment	HR Cutting Guide	110400
	Cutting Torch	106100
	Angle Grinder	141703
	Wedges	139200
	Straightedge	139200
	HR Mould Shoes	126800
	Mould Cover	128600
	Universal Mounting	116300
	Preheater Burner Holder	118520
	HR Preheating Burner	100800
	Alumino-thermic Weld Trimmer	
Ancillary	Profile Grinding Equipment	
	Dye Penetrant, Magnetic Particle Flaw Detection	

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