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# **CODE OF PRACTICE**

FOR THE

**THERMIT<sup>®</sup>**

QUICK WELDING PROCEDURES

FOR CRANE RAILS SKS

Multiple-Use & Single - Use Crucible Systems



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**THERMIT AUSTRALIA PTY. LTD.**

A member of the **Goldschmidt-Thermit-Group**

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## 1. Safety First

When THERMIT welds are carried out, the safety regulations of the competent authorities must be observed!

Special attention must to be paid to the following:

1. Store igniters separate from portions and never keep them in pockets of clothes.
2. Protect welding portions, crucibles and moulds against moisture. Never let reacting welding portions or hot reaction products come into contact with water, never use water for fire extinguishing purposes; in case of need cover with dry sand.
3. Observe safety distances during the THERMIT reaction; specified safety clothing and PPE must be worn during all welding and grinding operations.
4. Hot slag pans must always be deposited in a safe position on a dry and none inflammable ground.
5. Prior to use, a check should be made that Oxygen and Fuel gas preheating equipment is free of leaks, this should be done using the approved leak detection spray or soapy water and brush technique.
6. Before the preheating burner is lit first open oxygen valve and then gas valve. To close down the preheating burner, first turn off gas valve and then oxygen valve.

In case of flame - flashback, which is noted by the high shrill hissing sound, quickly close the oxygen valve and then the gas valve.

7. Safety goggles or clear high impact visors must be worn during grinding work. Never use grinding equipment without safety guards. Protect surrounds from grinding sparks.

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Remember Always Work Safe**

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## Welding Crane Rails

All safety regulations of the relevant Authorities must be observed. When working at height, specified regulation safety harnesses must be used. If no walking paths are installed, regulation scaffolding is required.

## 2. Weld Materials

The following welding materials are required in sufficient quantities and have to be stored in their containers a dry place until use:

- THERMIT welding portions
- Moulds Units for relevant rail profile
- Igniters
- Long – life crucibles or Single-Use crucibles
- Crucible thimbles (Long - Life Crucibles only)
- Oxygen
- Propane

### Storage of Portions

Store portions in a dry place and keep them protected against moisture.

On the welding site, the portions should remain in their packaging and containers until use.

Never use welding portions which are moist or have become damp, even after having been dried out!

### Igniters

**Store igniters separate from the portions – never store in portion containers.**

### Moulds

Store mould units in a dry place and keep in their packaging and containers until use.

### Luting Sand

The luting sand must be uniformly moist throughout (6 per cent earth moist).

Dry luting sand may be prepared with water (600mls per 5Kg bag), one day prior to use.

### Crucibles

Long – Life Crucibles (LLC) and - Single Use crucibles (SUC) must be stored in a dry place and protected against damage and moisture during transportation.

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## Long - Life Crucible Only

For mounting the crucible extension ring, sealing paste from the tube is pressed onto the upper circular rim of the crucible and the extension ring is positioned on top. The opened clamping ring is fitted around the joint between crucible and extension ring and is fastened with the screw. The surplus protruding sealing paste should be spread evenly to ensure a good seal.

Before use, the Long - Life crucible, has to be dried inside with a very soft soaking preheating burner flame until the steel outer shell has reached a temperature of 100 °C.

## Crucible Thimbles\_(Long - Life Crucibles Only)

The crucible automatic tapping thimbles must be stored in a dry place and protected from moisture.

## Oxygen and Propane

Use oxygen and propane for flame cutting and rail-end preheating operations.

## 3. Preparation

### Welding at low rail temperature

When ever rail temperatures below 0 °C are recorded, preheat both rail ends to a well hand warm temperature over a distance of 0.50 – 1.0 m (2 to 3 feet). Keep luting sand plastic by applying heat.

Clean rail ends before welding, remove surface rust, protective paint or any foreign matter by carefully grinding approximately 50mm back along from each rail end around the whole of the rail profile, including the underfoot of the rail.

### Welding Gap

Use the supplied Setting Gauge and set the welding gap as specified in the **Weld Data Sheet**.

## 4. Alignment

When crane rails are installed on a fully supported track system lateral and height alignment must be obtained. If welded in situ outside of track, rail should be positioned and securely supported on 100mm high squared timber. The supports should be spaced out approximately at 1.5M intervals along the rails and 300mm back from each rail end and centre line of the weld gap. Rails that are already in situ and fastened have to be unclipped or removed until a free height of 100mm underneath the rail foot can be achieved.

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The joint to be welded must lie in a straight position over a distance of 1m. In special cases, a free height of 40mm underneath the rail foot is acceptable. All existing base plates or supports should be covered up for heat protection.

Lateral alignment and height alignment is made with steel wedges or an Alignment Frame and Flat Jacks and set in accordance to 1-m-straight edge and crown taper measuring gauge with maximum 1mm on the top running surface.

**Refer to the Weld Data Sheet.**

### **5. Weld Universal Clamping Device**

Use the setting gauge to position the rail clamp, attach and firmly clamp to the head of the rail without canting,

### **6. Preheating Burner Tip Height**

Set the adjustable pre heater support with attached preheating burner into position to the required height above the rail table, using the setting gauge set the preheating burner tip height in accordance with the relevant **Weld Data Sheet**.

### **7. Fitting of Moulds and Underfoot Base Plates**

Before fitting Underfoot Base Plate and Sand Moulds check them for damage. Pouring channels and air vents must be clear. First fit the Underfoot Base Plate into the Adjustable Underfoot Support Clamp, locate and position underneath the foot of the rail centrally to the weld gap. Clamp the Base Plate securely to the underfoot of the rail by way of the adjustable locking nut, ensure that the base plate is a firm fit against the underfoot of the rail.

Before fitting the moulds carefully seal the underfoot base plate to the underfoot of the rail with luting sand, ensuring a good firm seal along the both sides. After fitting and sealing of the underfoot-base plate, fit the sand moulds by fitting the first mould half on the outside of the rail, central to the welding gap. Take second mould half and remove sand bridge by slight blow. Here the slag pan has to be fitted.

Slightly tighten the swivel arm screws of the rail clamp evenly on both sides of the mould. Take luting cards from the portion carton and slide them along the head of the rail between the two mould halves use two of them on top of each other for covering the railhead and the weld gap, also cover the side riser holes of the moulds.

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## 8. Luting up (sealing) the Sand Moulds

Luting is the name given to the process by which a sealing material is packed between the mould shoes, the sand moulds and the rail.

Thermit luting material is a mixture of bentonite and special high quality sand, supplied with the sand moulds in a pre-mixed dry condition.

To prepare the dry luting material water is added and then thoroughly mixed until a suitable consistency is obtained. The mixture should be moist but not wet, 6% earth moisture.

A guide to the correct consistency of sand can be obtained by employing a drop test. After thoroughly mixing, a handful of luting sand is compressed and dropped onto a flat surface from a height of approximately 500mm. The correct mix will cause the ball to break open; if the mix is too wet, the ball will splatter.

Before commencing luting operations the luting cards must be fitted. The luting cards are supplied with the Thermit welding consumables and are used to protect the rail head and weld gap. Slide two luting cards along the head of the rail between the sand moulds and the top of the rail head. This placement of the luting cards prevents luting sand from falling into the weld gap during luting operations, which can result in sand inclusion and porosity in the foot area of the weld. Failure to use the supplied luting cards will also cause sand burns and pitting on the rail head. Luting cards are also used to cover the side riser holes of the moulds.

Commence luting under the rail foot, taking care that the luting sand is pressed firmly on the correct side of the luting groove under the foot of the rail. Luting then continues on both sides of the moulds towards the head of the rail. Again luting sand must be pressed firmly into the luting strip of the mould shoes. The gap between the rail head and the mould is luted up with the aid of a luting tool or spatula.

A layer of luting sand is then pressed firmly onto the outside pouring lips of the mould shoes as well as the rail clamp arm T screws to protect the threads. Alternately for purpose designed moulds luting putty can be supplied, which is conveniently packed in plastic sealed packs in the weld kits or mould units.

The slag pans are then fitted to the lugs on the outside of the mould shoes. Protect the rail head outside of the moulds with a set of large and small rail protecting covers.

## 9. Loading the Crucible

Always use dry crucibles. Never prepare the crucible over the fitted mould.

### Single-Use Crucible (SUC)

After removing the single-use crucible container lid and prior to loading, check crucible inner wall is free from damage, and also ensure preinstalled thimble in base of crucible is clear of obstruction. This may require turning the crucible container upside down to empty out and remove any loose sand particles.

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### Long-Life Crucible (LLC) Only

It is no longer necessary to remove the slag from the inside of the crucible wall. Only when the capacity of the crucible is too much reduced by adhering slag, the circular slag collar in the upper part of the crucible has to be removed carefully (after about 8 to 10 reactions).

When the crucible thimble is exchanged, clean the thimble throat carefully by using the thimble drift.

When the long-life crucible is worn out, the extension ring and the clamping ring are removed, if still in sound condition they can be re fitted to a new long-life crucible.

### 10. Inserting the Automatic Tapping Thimble (Long-Life Crucibles Only)

Insert the automatic tapping thimble into the crucible throat, using the thimble applicator and ensure correct seating by giving light taps with the palm of the hand on the top of the thimble applicator handle. Carefully distribute the plugging sand evenly around the edge of the thimble, and then carefully remove applicator.

Always ensure thimbles do not remain in hot crucibles for extended periods, as this could cause premature tapping. Do not preheat crucible with thimble inserted.

### 11. Charging the Crucible

Before charging the crucible with a Thermit portion, each portion bag should be checked to ensure the correct portion has been selected. They are individually identified by the following information: Rail size, type of portion and process, batch number, date of manufacture and portion number.

Before opening the Thermit portion bag the packaging should be carefully inspected for damage. If damage is noted the portion should not be used.

To ensure thorough mixing open the portion bag and carefully pour the portion powder into a dry clean 20lt bucket, then carefully tip and mix into another dry clean 20lt bucket. This operation should be carried out a **minimum** of 3 x 3 times into each bucket. Finally, carefully pour the whole contents through the fingers with a sifting action into the crucible, leaving the mixture cone shaped. Cover the crucible with a crucible cap to protect the Thermit portion against moisture. The ignition tape must be on standby.

### 12. Positioning of Crucible (Long-Life Crucible Only)

Position the loaded crucible and crucible stand onto the long post of the rail clamp and swing it - as a test -over the centre of the moulds and the pouring plug.

The distance between the base of the crucible and the top of the mould should be about 20- 25mm.

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Now carefully swing the crucible back away from the moulds into the standby position ready to commence the preheating operations.

### 13. Positioning of Crucible (Single-Use Only)

Central placement and positioning of the single-use crucible is done automatically by the alignment lugs on the top of the mould shoes. The pouring height off 25mm is also preset by the crucible container support lugs.

### 14. Preheating operations

Before igniting the preheating burner, first fully open the oxygen valve and about 3 seconds later the propane valve.

Adjust the preheating burner flame, giving flare cones of approx. 15 to 20 mm length and a neutral flame. The oxygen valve adjustment control knob always remains fully open.

After the slag pans have been dried for a short period, position the preheating burner with the preheating burner support attached onto the rail clamp short centre post and above the centre of the moulds and slightly tighten the adjusting screw.

Take care the preheating burner is set at the correct height. With correct setting of the preheating burner flame, approx. 35 cm long flames should rise from the air vents in the moulds.

During preheating, observe that the correct gas working pressures are set on the regulator valves (**Refer to the Weld Data Sheet**)

**The preheating burner flame must never be an oxidizing flame.**

During preheating take care that both rail sections are heated uniformly. If necessary, correct the flame setting.

### 15. Duration of Preheat

Preheat is completed as soon as the total cross section of both rails has uniformly reached a temperature of at least 950 to 1000 °C (yellow colour).

The preheating time must be checked with a stopwatch.

For a guide to the relevant preheating times refer to the **Weld Data Sheet**.

Wearing shade 5 welding goggles or visor, a final visual check of the rail ends should also be made to ensure the rail ends have been preheated uniformly.

Before the pre heat is completed, the sealing of the moulds must again to be carefully checked.

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### 16. Fitting of the Pouring Plug

After preheat is completed an prior to ignition of the THERMIT portion, remove the preheating burner from the moulds and use a pair of fire tongues for placing the dried pouring plug into the respective space in the top of the mould halves. Slightly press down the pouring plug into top of moulds ensuring correct seating.

### 17. Ignition of THERMIT Portion

Position the crucible centrally over the top of the moulds and correctly seated pouring plug.

Ignite the THERMIT portion with the igniter.

After ignition of the THERMIT portion maintain specified safe working distance during the reaction and pour.

When the Thermit reaction is complete the thimble automatically releases the charge at the correct moment. On completion of the pour the crucible is carefully swung to the side of the moulds.

### 18. Removal of Crucible

Carefully remove the empty crucible and crucible assembly and place it in the designated Hot Work containment area .

Empty the slag pans only after the slag has cooled down!

**Never place the slag in water or on any damp surface.**

### 19. Removal of Mould Protectors

Observe the waiting time given in the **Weld Data Sheet** and then carefully release the rail clamp tee screws, rail clamp and mould shoes.

### 20. Removal of Moulds

Using a hot set, scarf the moulds on each side level with the top of the rail surface. Then remove mould upper part by carefully tapping then carefully pushing mould residue onto a shovel positioned on the adjacent side. Clean the running surface and head risers from sand residue.

The base plate and base plate support clamp can be left in position and should be removed after the weld shearing operations

### 21. Trimming of the weld

A Hot Work Crate” must be place in the established Hot Work Area and used to store **all** waste materials during welding operations and prior to removal from the work site.

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A hot set and wire brush should be used to clean away sand and sand mould residue prior to weld trimming operations. Removal of the excess weld metal on the head of the rail is carried out by trimming with a Thermit hydraulic weld shear. The risers must not be bent back either before or after trimming the rail head. Leave the risers on the rail foot. Remove them only using a hammer by tapping them in towards the rail web when completely cold.

### 22. Removal of alignment wedges or frames

Approximately 15 to 20 minutes after trimming the weld remove the steel alignment wedges or alignment frame and jacks from under the rail. Ensure sleepers are correctly spaced and that ballast has been returned to the cribs and sleeper rings. Also ensure that adjacent sleepers are properly packed and rail correctly fastened.

### 23. Grinding of the weld

Under normal conditions all welds are ground on the day they are installed, using the specially designed rail profile grinder. Welds should not be finished ground until they have cooled to the rail temperature. If the minimum cooling time is not observed the weld will develop a hollow upon cooling.

Before beginning the final grind, make sure that the locking wheel is in the “locked” position so that the stone does not move. To ensure that a good straight surface without hollows is achieved, use a 1 metre straight edge frequently during preliminary grinding. Both the gauge face and running surface must be ground flush.

On completion of final grinding operations the welded rail should be checked for correct surface straightness and proper alignment. The final measurements must comply with the relevant Authorities specified tolerances.

Wearing the appropriate PPE, finally remove all excess sand and cast weld residue from the weld reinforcement area including underneath the rail base with the use of a blunt chisel and wire brush or similar type tools.

### 24. SAFETY DEPENDS ON YOU

When Thermit welds are carried out safety regulations of the welding authorities must be observed and special attention paid to the following:

Igniters stored separately from portions, and never kept in pockets or clothes. Welding portions, crucibles and moulds must be protected against moisture. Never let reacting portions or hot reaction products come into contact with water.

Never use water for fire extinguishing purposes -cover with dry sand.

Observe work safety distances at **all times** during the Thermit reaction and pour.

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Remember, safety clothing and equipment must be used and worn at all times when carrying out welding, trimming and grinding operations.

Hot slag pans must always be deposited in a safe position on dry and not flammable ground.

Ensure that regular Oxygen and Fuel Gas Equipment maintenance checks are carried out. Prior to use make sure the gas equipment is free from leaks and that the coupling nut of the pre-heater is tightened.

Before the pre-heater is lit first open the oxygen valve and then the gas valve. When turning off the pre-heater first turn off the gas valve and then the oxygen valve. In case of a flame flashback which is noted by a sure hissing sound quickly close the oxygen valve and then the gas valve. Safety clear visors must be worn during all grinding work. Never use grinding equipment without safety guards. Protect surrounds from grinding sparks.

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