TEMPORARY RAIL CLAMPING SYSTEMS

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Contents

Scope

This booklet has been produced for the guidance of track staff whose duties require them to install temporary rail clamping systems.

Introduction

Temporary rail joints and rail clamping are vital methods used by track engineers, to permit efficient relaying techniques and help maintainers to deal safely with rail defects. In many cases trains are only able to continue to run at reduced speeds by using this equipment. Together, the clamps and plates are known as Temporary Rail Clamping Systems.

There are various types of equipment now approved for use in the UK and various installation methods. Consequently it is important that users fully understand the distinctive features and uses of each type.

These guidelines are intended to support training and provide a ready reference for track engineering staff. They must not be considered to be a complete set of instructions. This is because they do not contain all of the conditions listed in Network Rail Standards. Employers will have method statements applicable for these techniques which should include manufacturers' fitting instructions.

Various Network Rail Standards* provide mandatory timescales for the removal of Temporary Clamping Systems from the rail. These timescales must be adhered to unless written dispensation is provided by the relevant Network Rail Track Engineer.

Company standards and method statements must always take priority over the contents of this booklet.

The making of a rail joint is Safety Critical Work. This includes temporary rail joints. It must only be done by, or under the direct supervision of, someone with relevant current certification of competence.

The following pages detail equipment and techniques currently approved for use on Network Rail infrastructure in the UK.

* RT/CE/S/032 Joining of Rails by Aluminothermic Welding (Table 1)
* RT/CE/S/102 Track Construction Standards (Section 4.5)
* RT/CE/S/103 Track Inspection Requirements (Appendices C,D and E)

Uses for Temporary Rail Clamping Systems

Clamping systems may be used for dealing with:

- Rail Defects
- Defective Welds
- Rail Breaks
- Temporary Joints

In every case they are a temporary solution. They cannot be relied upon as a permanent fix.

The Standards[1] for many **rail defects** require them to be clamped, this is in order to provide additional support until the defect is repaired or removed. With clamped plates in place the defect is less likely to fail completely providing the repair is carried out within the mandated timescale. If the defect did cause the rail to break then the clamped plates would hold the broken rail ends in line.

The same applies to **defective welds**[2].

When a **broken rail** is discovered the immediate action is to protect traffic. This normally means blocking the line, though in certain circumstances trains may be allowed to pass at **5mph** with a watchmen present. Approved clamping systems allow trains to pass at up to **20mph** depending on the type and location of the break.

The conditions and allowable speed of trains over the break are set out in the Network Rail standards[3].

Temporary Rail Clamping Systems should ideally be removed for tampers, regulators and stoneblowers because they obstruct the machines' tools and prevent the packing of the sleepers either side of the temporary rail clamping system.

The removal of clamps and plates should only take place in the possession arranged for the works and under no circumstances should clamps be removed whilst trains are running, leaving the defect unsupported.

Following the on track machine works, the clamps and plates should be re-fitted immediately before the possession is given up. Rail defects have been known to break during the lifting of track for tamping and stoneblowing and if the temporary clamping system is not removed to permit the works, the sleepers missed during the works should be packed at the first opportunity to prevent voiding

[1] RT/CE/S/103 Appendix D details the actions required for various rail defects.
[2] RT/CE/S/032 contains timescales for the removal of defective welds
[3] RT/CE/S/103 Appendix C

Temporary Rail Joints Available Speeds

When a **temporary rail joint** is made, using rails at least 4.5m long, trains may pass at up to **50mph** provided that the following conditions[4] are met.

1. the clamping system is approved;
2. both rail ends have been sawn or disc cut;
3. the rail heads are in line horizontally and vertically;
4. the gap does not exceed 10mm, and
5. there are no voids for 2 sleepers on each side of the joint.

The three types of clamp shown on page 5 are all approved for 50mph running under the above circumstances.

If any one of the conditions cannot be met then the speed shall be limited to 20mph, 5mph or the line blocked.

It is important to monitor the size of the gap, as overnight cooling will increase the gap between the rail ends.

Higher speeds can be obtained with fully bolted joints using high tensile bolts – up to **90mph or 125mph** if tight-jointed at both ends in CWR.

Temporary rail joints are often used to allow work to progress efficiently between consecutive possession. Rerailing and resleepering work is frequently carried out in a series of separate possessions with trains running in between. In these circumstances, the use of temporary clamped joints may permit best use of possession time as well as allowing trains to run at up to 50mph reducing delays.

The details of which speeds are allowed according to the circumstances are listed in RT/CE/S/102.

In each case the additional handback speed is a benefit in passing traffic through the affected area.

At 20mph or above, emergency or temporary speed restriction equipment can be used instead of stopping each train at a signal and verbally warning the driver.

The ability to increase linespeeds through temporary works can have a significant effect on reducing train delays over a section of line.

The person responsible for fitting the temporary rail clamping system and imposing temporary speed restrictions must be fully aware of the requirements of the Network Rail standards governing their application.

[4] RT/CE/S/102 Clause 4.5 details conditions for various speeds.

Types of Clamps

There are three types of rail clamps currently approved for use on Network Rail infrastructure. They are:

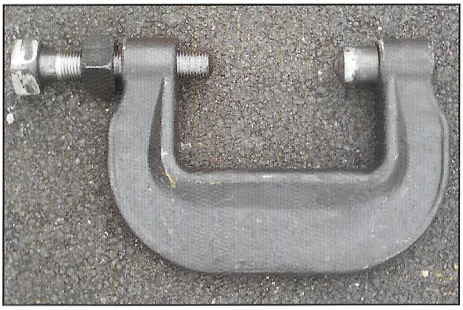


Fig 1. The G Clamp

4 G-Clamps are required for each pair of plates.
Different sizes are available

*Fig 2. The **T**rack **M**aintenance **E**quipment TRJ Clamp (Fascetta's)(for FB rail)*

2 TRJ Clamps are required for a pair of plates

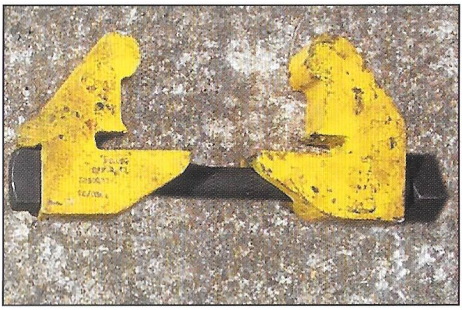


Fig 3. The Robel Clamp

Only 1 clamp is needed for a pair of fishplates except where joggled plates are used, then 2 clamps are required.
2 clamps are also required per pair of fishplates on Bullhead rail.

Different types of clamps must not be mixed on the same clamp plates.

The G-Clamp

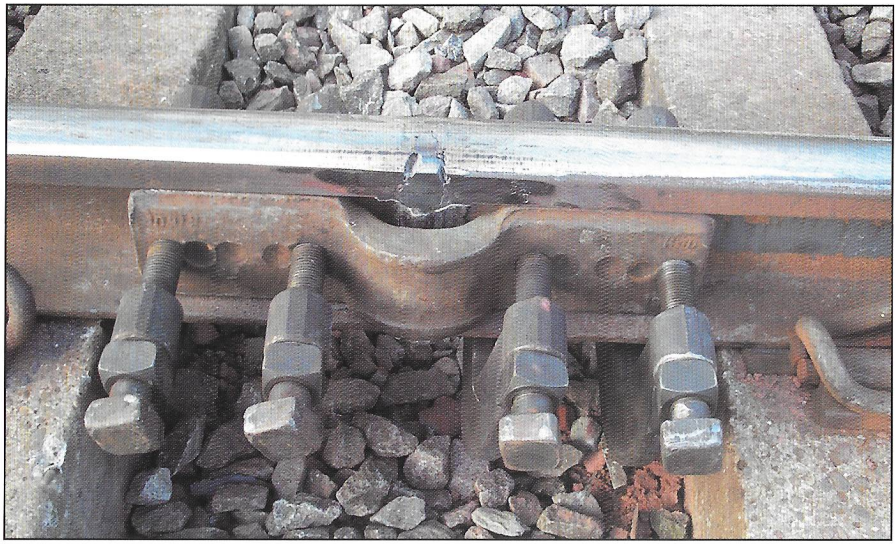


Fig 4. G-Clamps used with joggled plates to protect a defective weld.

The G-Clamp has been in use for many years and is the most versatile clamp but also the heaviest option.

It has a bolt that must be tightened against the fishplate and a locking nut that must be tightened next. Both of these should be tightened with a standard length (30") fishbolt spanner.

Replacement bolts can be obtained from the manufacturer.

The bolt and locking nut are designed to be tightened to 375 Nm (275 lb.ft)

G-Clamps must be used with emergency clamp plates or bridging pieces. These have dimples into which the bolts of the clamps fit. They may not be used with normal fishplates that have fishbolt holes unless dimple plugs are also used.

A dimple plug is used to convert a fishbolt hole to a dimple for the G-Clamp to fit into.

For temporary rail joints and clamping defective welds four G-Clamps must be used with each pair of fishplates.

Under exceptional circumstances three clamps may be used with emergency bridging pieces. In this case, two must be on the running-on side of the break.

The Track Maintenance Engineering TRJ (Fascetta) Clamp

Fig 5 TRJ clamps (Flatbottom version)

The TRJ Clamp is the simplest and lightest of the three options. It comes in two versions; one for Flatbottom and one for Bullhead rail sections.

The bolts are of high tensile steel so they have a raised V on the head. They are 290mm long and 1" (25mm) diameter with 80mm of thread. They must be tightened to a torque of 300 - 350ft.lbs or 400 - 460Nm.

The nuts have a nylon locking ring in them. There is also a standard washer - which must always be used. Replacement nut and bolt assemblies are available from the suppliers (NRS Cat No 57/150028).

The correct nut and bolt assembly must be used with the TRJ Clamp - and under no circumstances should standard track bolts be used instead of the bolts supplied. Standard bolts have a 2" thread (57mm).

Nuts fitted with Nylon locking rings are designed to be used repeatedly provided the nut is not removed from the bolt fully. In this case the nut should be disposed of as scrap and a new nut fitted.

To aid identification the clamp is stamped with the manufacturer's part number (eg F791/96), name and telephone number.

Fig 6 stamp marks on a Flatbottom TRJ clamp.

Two TRJ Clamps must be used with a pair of ordinary fishplates or emergency clamp plates. They may not be used with emergency bridging pieces. There must be one clamp on each side of the defect or joint.

Particular attention must be given to ensuring that:

- the fishplates correctly mate to the fishing surfaces
- the clamps are square to the rail
- the clamps do not bind on the rail foot.

The Robel Clamp

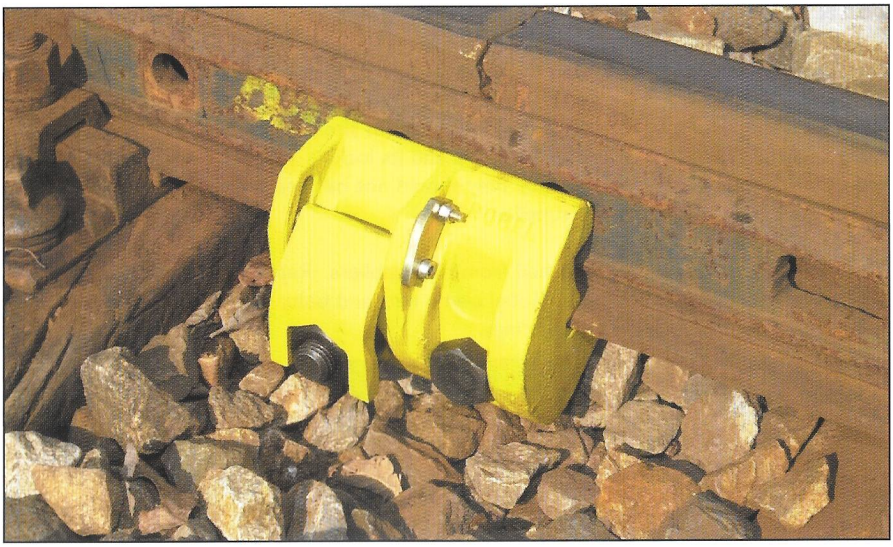


Fig 7 The Robel 68.05L Clamp (Photo provided by Robel from non UK rail system)

There are four types of Robel clamps but only three are fitted with BR-style square nuts for use in the UK. All three are approved for use on Network Rail infrastructure.

One difference is that some have flaps to capture the head of the nut as shown above. Network Rail approved versions all have these flaps.

Some have both bolts the same way around for use where there are electrified conductor rail systems. These do not require the spanner to be used on the live rail side of the clamp.

Others, as used on Bullhead rail sections, have nibs on the inside of the clamping jaw to locate in fish bolt holes of the fishplates:

Model	NRS Cat No	RT Approved	Nut flaps	Same side nuts for 3rd rail areas?	Suit BH
68.05	none	no	no	no	no
68.05L	57/054322	yes	yes	no	no
68.05SR	57/054323	yes	yes	yes	no
68.05SR/BH	57/054324	yes	yes	yes	yes

Only one clamp is used on a typical defect or broken rail. Two will need to be used when joggled clamp plates are needed at defective welds. Two are also needed for Bullhead rail sections.

The clamps must not be used without fishplates.

On receipt from the supplier and prior to first use on site, the clamp should be tested by fitting to a rail. This is to ensure that the flap and its locking arm close correctly. If Robel clamps are found not to lock correctly they should not be used on site but should be quarantined and returned to the supplier

Replacement bolt sets can be obtained from the suppliers. Replacement studs for the Bullhead version are also available. Robel clamp nuts and bolts may be used repeatedly since they do not have nylon locking rings.

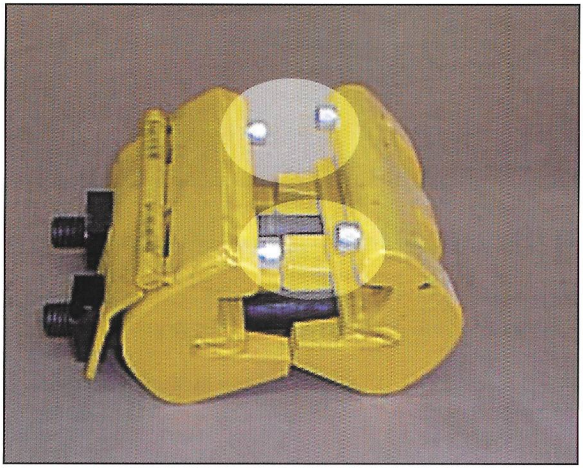


Fig 8. Robel Type 68.05 SR/BH

The studs highlighted above are designed to fit into the fishbolt holes of the Bullhead fishplate.

Types of Plates

The plates selected must always be compatible with the rail section to be clamped.

When making a joint out of two non-identical rail sections, the head of the rails must be level. This means that suitable lift fishplates must be used

It is also important to ensure that the sidewear on both rails is the same if this is not the case then grinding must be carried out. This grinding must graduate the sidewear on the less worn rail over at least 1.5 metres to match that on the worn rail.

Plates for use with rail clamps form three groups:

1. Emergency Fishplates (with no bolt holes)
    a. straight
    b. joggled

Fig 9. A joggled emergency fishplate

2. Ordinary Fishplates (Dimple Plugs must be used with G-clamps)
    a. stepped
    b. straight

3. Emergency Bridging Pieces

Plates vary to suit different rail sections; Bullhead and Flatbottom including CEN 60E1.

It is important to remember that the fit of the fishplate to the rail is critical. The temporary clamped joint will be ineffective if the wrong plates are used.

Emergency Bridging Pieces

Fig 10. An emergency bridging piece

Bridging pieces are designed to span across gaps between the rail ends.

Provided the necessary conditions[5] are met, bridging pieces may be used for gaps up to 165mm.

Fishplated temporary joints and bridging pieces may only be used for open gaps up to 75mm. This may be increased up to 165mm if a short length of rail (a dolly) is used to fill the gap. This piece of rail dolly must be of a suitable profile and must have sawn or disc cut ends.

Bridging pieces **must** be used in pairs to avoid the risk of a twist fault greater than 1 in 200. This risk arises because the upper plate of the bridging piece, which the wheels travel over, is 10-12mm thick. Consequently when only one bridging piece is fitted a check for twist must always be carried out.

The Bradley EBP shown is accepted for use by Network Rail (Cert No PA05/096, NRS Catalogue Number 57/054010). It can be used will all common rail types except that it is not suitable for 98lb FB or 95lb Bullhead when headwear exceeds 15mm. There is also a version for use with 60 E1 rail.

[5] RT/CE/S/103 Appendix C details the conditions for various break types

Tools

For installing temporary rail clamps a standard length (30") fishbolt spanner is required. These spanners are designed to apply the correct level of torque (tightening force) for a fishbolt. Each of the three types of clamps is supplied with nuts/bolt that fit a fishplate spanner.

For clamped defects, it is good practice to check the tightness with a torque wrench set to the appropriate torque setting. For temporary rail joints the use of a torque spanner is mandatory.

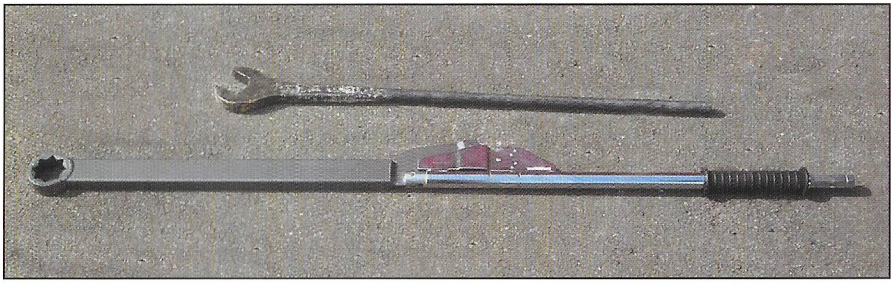


Figure 11. A fishplate spanner and a torque wrench

A shovel will also be required to empty out enough ballast to install the clamps under the rail.

Sleeper spacing may have to be adjusted to fit plates and clamps in the correct place. In this event other tools will be required such as panpullers and bars.

When bridging pieces are being used a cross level is needed to check for twist.

Tools checklist:

Minimum

- fishbolt spanner
- shovel
- torque spanner
- crosslevel

If sleepers need to be respaced

- bar
- fastening tools (panpuller etc.)
- Rail Jack

Other tools may be required depending on site conditions

Clamp Type	Rail Profiles							Nr per pair of plates	Use with Bridging Piece?	Use with normal fishplates	Certificate of Acceptance	NRS Catalogue Number	Torque Required
	Bullhead		Flat bottomed										
	Other BH	BS 95R	BR98	BR109	BS110A	BS 113A	CEN 60 E1						
G-Clamp	Y	Y	Y	Y	Y	Y	Y	4	YES	NO	PA 05/663	57/054006	274lb ft or 375 Nm
TME Ltd													
TME-TRJ-B	Y	Y		Y	Y	Y	Y	2	NO	YES	PA 05/014	57/054321	both 300 - 350lb.ft or 400 - 460Nm
Bullhead								2	NO	YES	PA 05/575	57/054325	
Robel													
68.05L			Y	Y	Y	Y	Y	1-2*	NO	YES	PA 05/015	57/054322	all 225lb.ft or 300Nm
68.05SR			Y	Y	Y	Y	Y	1-2*	NO	YES	PA 05/015	57/054323	
68.05SR/BH		Y						2	NO	YES	PA 05/015	57/054324	

* 2 Robel clamps are needed with joggled plates.

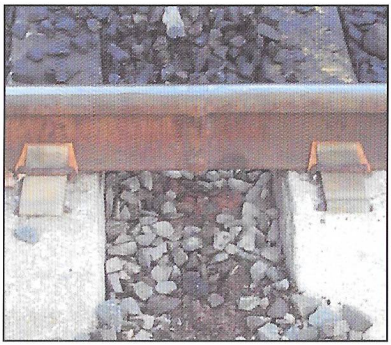
Installation Method

In every case a safe system of work must be established before going on the track. Any requirements to protect traffic must be established and implemented. Always refer to method statements and manufacturer's fitting instructions.

When sleeper re-spacing is necessary the stability of CWR track may be compromised if the rail temperature exceeds 32°C or is below -7°C. In this case the local track maintenance engineer must be advised so that the necessary precautions can be put in place.

Any clamping installations which persistently work loose must be fully replaced. If loosening continues the root cause of the problem (eg voiding/hammer) must be identified and eliminated.

Basic tools for fitting rail clamps



Hole opened out under rail at location of clamping system

Clamps and plates located in four foot

Clamps fitted correctly to both rails prior to tightening

Installation Method (continued)

Clamps tightened to correct torque setting following fitting

Incorrectly Installed and Maintained Clamps

Emergency Fishplates fitted incorrectly on site. (Left hand plate is upside down)

The result of a patroller failing to tighten during routine patrols.

For clamping a rail defect or defective weld:

1. Check to see if sleeper respacing is necessary (see figure 12 below). The clamp plates must be located centrally on the defect and there must be sufficient room to apply the clamps.

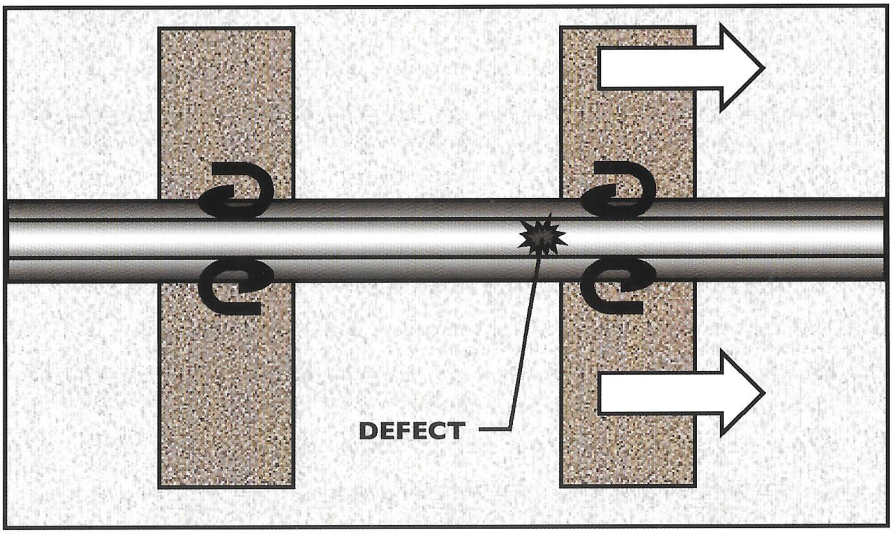


Figure 12 The RH sleeper will have to be moved so that the plates and clamps can be mounted centrally around the defect.

2. Clear sufficient ballast from under the rail to allow the clamps to be fitted.
3. Offer the plates to the rail one on each side. Check that they are the right way up and not leaning. For defective aluminothermic rail welds the plates will need to be the joggled type to fit around the weld collar.
4. While holding the plates in position apply the clamps and part-tighten the nuts.
5. Visually check for proper fit of the plates and clamps.
6. Tighten the clamps a bit at a time, each nut in sequence using a standard length (30") fishbolt spanner.
7. Check the clamps during every routine track inspection, and tighten as required.

For clamping a broken rail:

1. Assess the type of break and the size of any gap between the rail ends. RT/CE/S/103 Appendix C should be referred to for this assessment. If in doubt about the break's suitability for clamping then seek advice before proceeding.
2. Determine which speed (Line blocked, 5mph or 20mph) will be achievable and what must be done to the break to permit that speed. Arrange for appropriate equipment and tools to be brought to site if they're not already there. Determine if a watchman is required and where appropriate make arrangements for one to be provided.
3. On electrified lines (overhead line equipment or conductor rail systems) temporary bonds must be fitted around the break in accordance with the relevant Working Instructions.
4. Check to see if sleeper respacing is necessary. The clamp plates must be located centrally on the break and there must be sufficient room to apply the clamps.
5. Clear sufficient ballast from under the rail to allow the clamps to be fitted.
6. Check that the rail and plates' fishing surfaces are free of debris, sand etc.
7. Offer the plates to the rail, checking that they are the right way up and not leaning. Joggled type plates are required to fit around the weld collar of aluminothermic welds.
8. While holding the plates in position apply the clamps and part-tighten the nuts.
9. Visually check for proper fit of the plates and clamps.
10. Visually check the rail ends for proper alignment of the head.
11. Tighten the clamps a bit at a time, each nut in sequence using a long fishbolt spanner. Tap the plates lightly with a hammer to check that they are properly seated.
12. Check the four sleepers around the joint for voids and pack them as necessary.
13. Next use a torque spanner to check that the correct torque is achieved:
14. If one bridging piece has been used then check for twist.

	G-Clamp	TRJ Clamp	Robel Clamp
Torque Setting	275 lb ft 375 Nm	300 - 350 lb ft 400 - 460 Nm	225 lb ft 300 Nm

15. Block adjacent lines before allowing one train at 5mph or less and observe the behaviour of the joint. Repack the sleepers and retighten the clamps as required.

Consult with signal box staff about the work. They may prefer to open sooner at 5mph or to allow the line to remain blocked for longer if 20mph can then be achieved. It may be preferable to replace the broken rail with a closure rail to achieve 50mph or even higher speeds. 50mph may be achievable by using temporary clamped rail joints on a closure.

For making a temporary rail joint:

1. On electrified lines (overhead line equipment or conductor rail systems) temporary bonds must be fitted around the joint in accordance with the relevant Network Rail standards
2. Check to see if sleeper re-spacing is necessary. The clamp plates must be located centrally on the joint and there must be sufficient room to apply the clamps.
3. Clear sufficient ballast from under the rail to allow the clamps to be fitted.
4. Check that the rail and plates' fishing surfaces are free of debris, sand etc.
5. Offer the plates to the rail, checking that they are the right way up and not leaning.
6. While holding the plates in position apply the clamps and part-tighten the nuts.
7. Visually check for proper fit of the plates and clamps.
8. Visually check the rail ends for proper alignment of the head. The step between the rail heads must not exceed 1.0mm. If sidewear is present it must be blended in over 1.5m.
9. Tighten the clamps a bit at a time, each nut in sequence using a standard length (30") fishbolt spanner. Tap the plates lightly with a hammer to check that they are properly seated.
10. Check the four sleepers around the joint for voids and pack them as necessary.
11. Next use a torque spanner to check that the correct torque is achieved, in accordance with the manufacturers instructions.
12. Monitor the joint especially for gap size and voiding.
13. The threads of the clamp bolts should be lubricated to facilitate retightening and eventual removal.

Temporary Joint Timescales

Temporary situation rails 4.5m or longer

Joint type	Permissible speed	Time limit
Fully bolted with high – tensile bolts	90 mph (125mph permitted if tight - jointed at both ends of the rail and in CWR)	14 days, or 28 days with Network Rail approval
Back – Hole bolted	50 mph	14 days, with extension to 28 days (see note 2 below)
Clamped (see note 1below)	50 mph if gap up to 10mm 20 mph if gap between 10 – 50 mm Speed shall be reduced to 5 mph if gap exceeds 50mm, and line be blocked if gap subsequently exceeds 75mm	7 days, with extension to 21 days (see note 2 below)
Fly – Fished, with gap up to 50mm	20 mph with Watchman, but speed shall be reduced to 5 mph if Watchman is subsequently withdrawn. Line shall be blocked if gap at Fly-Fished joint exceeds 50mm	48 hours, but with a 24 hourly inspection if Watchman is withdrawn

Notes

1) Joints fitted with emergency clamped fishplates and a Network Rail approved clamping system (e.g. four G-Clamps, or certain proprietary clamps) shall be limited to 20 mph unless all the following circumstances apply, in which event the speed may be 50 mph.
   1. both rail ends have been sawn or disc cut;
   2. abutting rail heads are in line;
   3. gap between rail ends does not exceed 10mm (in order to control the gap it may be necessary to impose more frequent inspections or, in CWR to install temporary adjustment switches
   4. there are no voids under the 2 sleepers each side of the joint (i.e. 4 sleepers total).
2) Any extension beyond 14 days for back-hole joints or 7 days for clamped joints shall be subject to Network Rail Zonal/Regional Track Engineer approval and shall be dependant upon either;
   - Removal being planned and dated, and additional controls being implemented and documented, or
   - Speed being reduced to 5 mph for the duration of the extension period.

RT/CE/C/017 CEN60EI Rail – Components and Process

Composite tight joints, connecting BS 113A to CEN60EI, are available from Corus S&C in both 4 and 6 hole versions, allowing for differing degrees of wear on the BS 113A rail. These joints are only intended for use in progressive renewals.

Tight joints should not be used in preference to welding. Where used, however, they are subject to the following axle loads and speeds with timescales as laid down in RT/CE/S/102.

Arrangement	Axle Load	Permitted Train Speed
Back 4 holes bolted	25t	50 mph
Back 4 holes bolted, centre holes clamped	25t	80 mph
6 holes bolted	25t	80 mph

Temporary situation rails shorter than 4.5m

Rails shorter than 4.5 metres, between fishplated or clamped joints, shall not be used except in connection with passing trains over broken or defective rails, in which case the rail shall be at least 2.0 metres long and supported by at least 3 sound and well packed bearers.

A speed of 20 mph is permitted provided that :

- The rail is securely clamped or back-hole bolted (not fly-fished) to the adjacent rail at both ends;
- Neither joint gap exceeds 10mm (the speed shall be reduced to 5 mph if either gap subsequently exceeds 10mm and the line shall be blocked if the gap subsequently exceeds 50mm)

A speed of 50 mph is permitted if the rail is fitted with fully-bolted fishplated joints at both ends.

These arrangements are subject to a time limit of 48 hours with a 24 hourly inspection during that period.

Manual Handling

All tools and equipment should be handled carefully to avoid personal injury. The circumstances for slips, trips and falls and also injuries involving strains, trapping hands and fingers are created by the necessary weight of the equipment and the nature of the track environment.

An additional factor can be hurried work owing to the urgency of the job at hand.

Lifting and carrying techniques should be considered before proceeding with the task.

Reference should be made to the individual company method statement and risk assessments for the work being undertaken.

Suitable personal protective equipment must include high visibility clothing, safety footwear and gloves.

Some of the weights of the various items are shown below.

Item	Weight lbs	Weight kg
Clamps		
G-Clamps	20lbs	9.1kg
TRJ	20lbs	9.1kg
Robel	38lbs	17.3kg
Plates		
Heavy duty fishplate	20lbs	10.0kg
Joggle plate	23lbs	10.5kg
Bridging piece	29lbs	13.2kg
Tools		
Fishbolt spanner	9lbs	4.1kg
Torque wrench	15lbs	6.8kg
Shovel	6lbs	2.7kg

For a typical joint the combined weights of clamps and plates are:

	G Clamps	TRJ Clamps	Robel Clamp	Robel Clamps At weld or on BH rail
Weight	56kg	38kg	37kg	55kg

Reference materials

Railway Group Standards

- GE/RT8000 Rule Book
- GC/RT5022 Rails and Rail Joints
- Working Instructions DC Electrified Lines
- Working Instructions AC Electrified Lines

Network Rail Company Standards

- RT/CE/S/011 Continuous Welded Rail (CWR) Track
- RT/CE/S/032 Joining of Rails by Aluminothermic Welding
- RT/CE/S/102 Track Construction Standards
- RT/CE/S/103 Track Inspection Requirements
- RT/CE/S/104 Track Maintenance Requirements
- RT/CE/C/017 CEN60EI Rail - Components and Processes

Other reference material

- PWI British Railway Track Plain Line Maintenance

Notes