Procedures for the Installation,

Adjustment, Maintenance and

Inspection of CWR as Required by

49 CFR 213.119

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NOTE: The appendices listed above are not a part of the Union Pacific submitted CWR procedures but have been sent to FRA as critical reference documents. Any revisions to these accompanying appendices must immediately be forwarded to FRA for inclusion with the submitted plan.

Procedures for the Installation, Adjustment, Maintenance and Inspection of CWR as Required by 49 CFR 213.119

This document details the Railroad's policy on installing, adjusting, maintaining and inspecting Continuous Welded Rail (CWR) track. Each chapter details how the Railroad applies its standards and procedures to comply with FRA standards. The following requirements apply to CWR installation on all main tracks and sidings. These requirements also apply to all tracks other than main tracks or sidings operating at speeds above class 1.

Chapter 1 CWR Installation Procedures

Rail length that exceeds 400 feet is considered CWR. Rail installed as CWR remains CWR, regardless of whether a joint or plug is installed into the rail at a later time.

1.1 Desired Rail Neutral Temperature

Rail neutral temperature is the temperature at which a rail is neither in tension nor compression. Designated rail laying temperatures have been established to provide a high rail neutral temperature to prevent track buckling. When laying or adjusting CWR use the rail laying temperatures shown in **Table 7- J.**

1.2 Temperature Differential

The difference between the designated rail laying temperature and the actual rail temperature taken at the time of installation is called the temperature differential. CWR laying and adjusting procedures have been established to compensate for this temperature difference.

1.3 Installing CWR

Follow these general requirements when installing CWR:

Refer to **Table 7- J** for the designated rail laying temperature for your area. Rail lengths may be used in lieu of feet in calculating adjustments.

Take the rail temperature and calculate the expansion required before making adjustments.

Record the rail laying temperature, location and date on approved forms. These records may be retained in an electronic format per 213.241. (**Refer to Record of Heat Control.)**

Rail does not need to be adjusted when the actual rail temperature exceeds the designated rail laying temperature.

Use rail heaters or rail expanders to adjust the rail to the correct length when the actual rail temperature is less than the designated rail laying temperature. Heat the rail evenly and uniformly so that the rail expansion occurs evenly and uniformly throughout its length. If rail is laid at a temperature more than 40° F below the designated rail laying temperature, rail must be adjusted or a speed restriction of 40 mph must be placed prior to rail temperature above designated rail laying temperature. When tight rail conditions exist, be governed by Chapter 7.1.

Chapter 2 Rail Anchoring Requirements

Where the anchoring function is otherwise provided, rail anchors may be omitted. Anchors may not be applied where they will interfere with signal or other track appliances, where they are inaccessible for adjustment or inspection or on rail opposite a joint. Anchor pattern may be varied as reasonable to avoid placing anchors against deteriorated ties.

Installation

The following anchoring requirements apply to CWR installation on all main tracks and sidings. These anchoring requirements also apply to all tracks other than main tracks or sidings operating at speeds above class 1.

2.1 Standard Box Pattern

When installing CWR, box anchor every other tie except as outlined in Section 2.2.

2.2 Solid Box Pattern

When installing CWR, box anchor every effective tie at specific locations listed below to provide additional restraint against rail .

Condition	Action
Turnouts Rail crossings Joints where CWR abuts jointed rail	Anchor every tie for 195’ in each direction.
Bolted joint installed during CWR installation when using heater, rail stretcher or sufficient ambient temperature. << **Effective January 01, 2010** >>	Within 60 days, weld joint, **OR** install joint with 6 bolts, **OR** anchor every tie for 195’ in each direction.

2.3 Bridge Pattern

When installing CWR, follow these bridge anchoring requirements:

1. Ballast deck bridges should be anchored with the same pattern as in section 2.1 and 2.2.
2. Open deck bridges should be anchored according to (**Standard Drawing 0461C.)**

Maintenance or Rail Repair

2.4 Legacy Patterns

On CWR installations completed before September 21, 1998, existing anchoring may remain if rail is restrained to prevent track buckles, but rail must be adjusted (by increasing or decreasing the length of rail or by lining on curves) or anchors added to rail if restraint is not sufficient.

2.5 Anchor Pattern after Repair

When repairs result in a joint being added to CWR, the anchor pattern shall match the existing pattern in track. At least every other tie will be box anchored for a distance of 195 feet in each direction unless anchoring is otherwise provided or if it would conflict with **Standard Drawing 0416C**. When repairs are made to a stripped joint or failed joint bar, the adjustment or addition of anchors will be as prescribed in the following table.

Condition	Action
Bolted joint in CWR experiencing service failure (stripped joint) or failed bar(s) with gap* present *Gap exists if it cannot be closed by drift pin	1. Weld joint, **OR** 2. Remediate joint conditions (per Chapter 6.5), replace bolts (new, in-kind or stronger), **and** weld joint within 30 days, **OR** 3. Replace failed bar(s), install 2 additional bolts **and** adjust anchors, **OR** 4. Replace failed bars, bolts (if broken or missing) **and** anchor every tie for 195' in both directions, **OR** 5. Add rail

Chapter 3 Preventive Maintenance on Existing CWR Track

Performing track buckling maintenance can reduce the risk of buckles. When tight rail conditions exist, be governed by Chapter 7.1.

3.1 Maintaining Desired Rail Installation Temperature Range

A record of rail neutral temperature will be maintained where rail has pulled apart, broken or been cut for defect removal. Record the length of the rail end gap and rail temperature in addition to the other required information on the **Designated Rail Separation Form** for determining rail neutral temperature.

Rail that has pulled apart, broken or been cut for defect removal at rail temperatures at or below 60°F must be readjusted to within the subdivision rail laying temperature minus 20° (RLT-20°) safe range. If the rail has not been readjusted to at least RLT -20° before rail temperatures exceed the values in the TABLE below, a speed restriction of 25 mph will be placed, or a speed restriction of 40 mph will be placed with a required daily inspection made during the heat of the day.

Rail break or cut Temperature (°F)	Rail temperature (°F) at which to readjust or apply slow order
60	135
50	130
40	125
30	120
20	115
10	110
0	105
-10	100
-20	95
-30	90
-40	85

After January 01, 2010, known rail neutral temperature locations not adjusted to within RLT -20° safety range must ultimately be adjusted within 365 days of installation. If rail is added for any reason, measure and record the amount of rail added so that adjustments can be made, if necessary.* This measurement may be made by the use of reference marks. The use of reference marks includes:

- Marking the locations where rail is to be cut
- Marking the rail outside the limits of the joint bars
- Measure the distance between the reference marks and mark it on the rail or otherwise record it
- Install the rail and re-measure the distance between reference marks
- Record the difference and document the location

Refer to Placing Rail Reference Marks Document

When welding rail ends together, the required weld gap or rail consumption must be taken into consideration when determining the amount of rail adjustment.

*Where rail has been added to re-establish the desired RLT this requirement need not apply.

3.2 De-Stressing Rail

Rail can be de-stressed by cutting rail out or by re-aligning a curve. When cutting rail out, use this procedure:

1. Use a designated safe procedure to cut rail. It's possible that the rail is under compression and may move unexpectedly. Cut rail to be de-stressed.
2. Remove or reposition anchors or clips for a minimum of 195 feet in both directions from the cut or up to a restriction that prevents rail movement.
3. Wait until the rails stop moving. The rail ends may need to be trimmed more than one time to allow for expansion.
4. Take the rail temperature.
5. Use **Table 7- J** to compare the rail temperature with the designated rail laying temperature for the territory. This is known as the temperature differential.
6. If the actual rail temperature is lower by more than 20°F from the designated rail laying temperature for the territory, use **Table 4-H** to determine the rail length to be removed based on the total distance the anchors or clips have been removed.

7. If the rail temperature is the rail laying temperature, no additional adjustments are needed.
8. Weld the joint or apply joint bars.
9. Replace the rail anchors or clips.

Chapter 4 Monitoring Curve Movement Following Track Surfacing and Lining

4.1 Staking of Curves

Before surfacing and lining a curve on main tracks, stake curve if it is more than 3^{o} and the rail temperature is more than 50^{o}F below the designated rail laying temperature (or is forecasted to be in the next 24 hours).

To stake a curve prior to surfacing and lining, place at least 3 reference points uniformly spaced around the curve. These reference points shall be no more than 200 feet apart.

4.2 Inspecting for Curve Movement

Inspect for curve movement periodically after the work, especially during periods of large temperature changes. Where curve has been staked per Section 4.1 and curve has shifted inward more than a maximum of 3 inches, the curve must be lined out prior to rail temperatures above or forecasted above the designated rail laying temperature in **Table 7 - J.** If curve is not lined out or de-stressed a speed restriction of 40 mph or less must be placed. When tight rail conditions exist, be governed by Chapter 7.1.

Chapter 5 Placing Temporary Speed Restrictions on Account of Track Work

Place a temporary speed restriction anytime the roadbed or ballast section is disturbed as required in Section 5.4, except where the maximum authorized speed of the track is equal to or less than the required restriction.

5.1 General Requirements

Speed restrictions ensure safe train operations until the affected track stabilizes. Restrictions need to stay in place to allow the ballast to consolidate, rail compressive forces to equalize and the sub grade to compact. Take more restrictive measures when conditions warrant.

5.2 Responsibility for Placing Speed Restrictions

During the work or before returning the track to service, the supervisor or foreman in charge must ensure that:

Gage, surface and alignment have been established.

Crib and shoulder ballast is in place or lateral constraint is otherwise provided.

The rail is anchored per Sections 2 or 3.

5.3 Speed Restriction Length

To minimize running rail and other dynamic forces, trains must have time to brake and adjust slack before entering the disturbed track. For heavy grades, sharp curves or substandard track conditions, extend speed restrictions farther from the work limits, if needed.

5.4 Speed Restrictions for Track Work

When the following track work has been performed, place a speed restriction that complies with the guidelines below.

When rail temperature is above or forecasted above railroad designated temperature within the next 24 hours per **Table 7 - J:**

Activity	Maximum Speed	Minimum Duration
Out-of-face installation of ties Undercutting Laying track/switch panels Constructing track Out-of-face surfacing and lining	30 mph freight 40 mph passenger	8 freight trains or 16 passenger trains **OR** an equivalent combination*
Spot Maintenance • Installing ties (no more than 5 ties in 39 ft and no more than 3 consecutive ties) • Surfacing/lining (maximum length of 19’6”)	30 mph freight 40 mph passenger	1 train
Mechanically-stabilized track performed after any of the activities listed above	30 mph freight 40 mph passenger	1 train

- 2 passenger trains are equivalent to 1 freight train

When rail temperature is at or below and is forecasted to remain at or below railroad designated temperature within the next 24 hours per **Table 7 - J**:

Activity	Maximum Speed	Minimum Duration
Out-of-face installation of ties Out-of-face surfacing and lining Undercutting Laying track/switch panels Constructing track Exception: Spot maintenance does not require a speed restriction.	30 mph freight 40 mph passenger	1 train
Mechanically-stabilized track performed after any of the activities listed above	40 mph freight	1 train

When rail temperature is less than 80ºF, a speed restriction is not required.

Chapter 6 Rail Joint Inspections

CWR Joint means any joint directly connected to CWR.

6.1 Class of Track

All CWR joints within the following classes must be inspected on foot:

- Class 2 on which passenger trains operate, and
- Class 3 and higher

6.2 Frequency of Inspections

CWR joints shall be inspected on foot at the following minimum frequencies:

Minimum Number of Inspections Per Calendar Year[1]					
	Freight Trains operating over track with an annual tonnage of:			Passenger Trains operating over track with an annual tonnage of:	
	less than 40 mgt	40 to 60 mgt	greater than 60 mgt	less than 20 mgt	greater than or equal to 20 mgt
Class 5 & above	2x	3x [2]	4x[2]	3x [2]	3x [2]

Class 4	2x	3x [2]	4x [2]	2x	3x[2]
Class 3	1x	2x	2x	2x	2x
Class 2	0	0	0	1x	1x
Class 1	0	0	0	0	0
Excepted Track	0	0	0	n/a	n/a

4x = Four times per calendar year, with one inspection in each of the following periods: January to March, April to June, July to September, and October to December; and with consecutive inspections separated by at least 60 calendar days.
3x = Three times per calendar year, with one inspection in each of the following periods: January to April, May to August, and September to December; and with consecutive inspections separated by at least 90 calendar days
2x = Twice per calendar year, with one inspection in each of the following periods: January to June and July to December; and with consecutive inspections separated by at least 120 calendar days.
1x = Once per calendar year, with consecutive inspections separated by at least 180 calendar days.

[1] Where a track owner operates both freight and passenger trains over a given segment of track, and there are two different possible inspection interval requirements, the more frequent inspection interval applies.
[2] When extreme weather conditions prevent a track owner from conducting an inspection of a particular territory within the required interval, the track owner may extend the interval by up to 30 calendar days from the last day that the extreme weather condition prevented the required inspection.

6.3 Identification of Joints

Each CWR joint requiring action as outlined in section 6.5 shall be identified in the field with a highly visible marking. In addition, such joints shall also be identified as to location by specifying the subdivision, milepost, track number and rail (north, south, etc.).

6.4 Switches, Track Crossings, Lift Rail Assemblies or Other Transition Devices on Moveable Bridges

Joints within or adjacent to switches, track crossings, lift rail assemblies or other transition devices on moveable bridges are exempt from the periodic joint inspection requirements provided they are inspected monthly during the required monthly walking inspection of these devices.

Therefore, inspect these locations on a minimum monthly basis and include in the inspection and report on the following:

At switches:

- All joints from and including the insulated joints at the signals governing movement entering and leaving the control point or interlocking.
- If there are no signals at the switch location, include as a minimum all joints from

the point of the switch to the heel of the frog.

At cross-overs:

- All joints in track between switches.

At track crossings:

- All joints from and including the insulated joints at the signals governing movement entering and leaving the control point or interlocking.
- If there are no signals at the track crossings, include as a minimum all joints that are between or connected to the crossing frogs.

At lift rail assembles or other transition devices on movable bridges:

- All joints immediately attached to the rail assembly or transition device.

Should a cracked or broken joint bar be discovered during the monthly inspection of any of the above locations, a Fracture Report must be completed as per section 6.7.

6.5 Rail Joint Conditions

When inspecting CWR joints on foot in track listed in 6.1, inspectors must watch for (but not be limited to) the following rail joint conditions outlined in the table below. When such conditions are found, the appropriate action must be taken as outlined.

Rail joint condition	Action[1]
Visible cracks in joint bar	Replace bar
Loose bolts	Tighten bolts
Bent bolts	Replace bolts OR Reinspect as per 6.2
Missing bolts [2]	Replace bolts
Tie(s) not effectively supporting joint	Tamp tie(s) Replace or repair tie(s) OR Conduct follow-up inspections every other week until repaired/removed
Broken or missing tie plate(s)	Replace tie plate(s) OR Conduct follow-up inspections every other week until repaired/removed
Deteriorated insulated joint	Replace/repair joint OR Conduct follow-up inspections every other week until repaired/removed
Rail end batter (More than 3/8" in depth and more than 6" in length measured with a 24” straight-edge)	Repair by welding joint or removing rail OR Conduct follow-up inspections every other week until repaired/removed
Rail end mismatch reaches limits specified by 49 CFR 213.115	Weld or grind

Longitudinal rail movement greater than 2"	Add or adjust rail anchors, tighten bolts, add or remove rail at appropriate time OR Conduct follow-up inspections every other week until repaired/removed
Wide rail gap greater than 1.5"	Adjust rail gap and secure joint OR Conduct follow-up inspections every other week until repaired/removed
Joint vertical movement (profile) that exceeds 75% of the allowable threshold for the designated class of track[3]	Surface joint OR Conduct follow-up inspections every other week until repaired/removed
Joint lateral movement (in a curve or spiral) that reaches 3/4"[3]	Correct lateral movement OR Conduct follow-up inspections every other week until repaired/removed

1 Action may also consist of placing a speed restriction or removing the track from service.
2 A minimum of 2 bolts per rail must be in place at each joint.
3 Joint lateral and vertical movement is the apparent visible movement measured at the joint.

6.6 Embedded Joints

Permanently Embedded Locations

Where such locations exist, it is not necessary to disassemble or remove the track structure (e.g., remove pavement or crossing pads) to conduct an inspection of CWR joints. Make every effort, to the extent practicable, to inspect the visible portion of joints in these structures.

Temporarily Buried Locations

Joints may sometimes be temporarily buried (e.g., where ballast or similar material is in the middle of the track and along the track) and therefore unavailable for inspection. Where CWR joints are buried (e.g., by ballast), wait for the completion of the track work before conducting joint bar inspections.

6.7 Inspection Records

On-Foot Periodic and Follow-up Inspection Reports

Document each on-foot periodic and follow-up inspection on the date of the inspection by noting the following information:

- Date
- Limits of the inspection

- Location and nature of CWR joint conditions specified in section 6.5
- Corrective or Remedial action
- Name and signature of inspector

Fracture Reports

Track subject to inspections under **213.119(g)(5)(i),** must have a Fracture Report completed for every cracked or broken CWR joint bar that is discovered during the course of an inspection conducted to comply with:

- Track Inspections (213.233),
- Inspections of switches, turnouts, track crossings, lift rail assemblies or other transition devices on moveable bridges (213.235),
- Periodic and Follow-Up CWR Joint Inspections (213.119(g)).

The Fracture Report shall be prepared on the date the cracked or broken joint bar is discovered.

Refer to Fracture Report Form

Chapter 7 Extreme Weather Inspections

For purposes of forecasting or initiating extreme weather inspections and conversions of rail temperature in relation to ambient temperatures use the following conversions:

- In hot weather rail temperature is equal to ambient temperature plus 30°F.
- In cold weather rail temperature is equal to ambient temperature.

7.1 Hot Weather Inspections

On main tracks hot weather inspections must be performed as directed by the **Director Track Maintenance** when the temperature is forecast to exceed the **Level 1** temperature for the territory **per table 7- J**.

Perform inspections during the heat of the day - primarily between 12 noon and 6 p.m.

Inspectors will inspect for signs of tight rail conditions, including:

- Kinky or wavy rail
- Rail canting or lifting out of tie plates
- Shiny marks on the base of the rail indicating that the rail is running through anchors and spikes
- Gaps in ballast at the ends of ties
- Churning ballast and ties

When tight rail conditions are present such as above, a speed restriction of 25 mph or less must be placed or track removed from service until repair or adjustment is made.

Inspectors will pay special attention to the following locations:

- Recently disturbed track

- Track at the bottom of sags
- Locations where heavy braking occurs
- Fixed track structures, such as turnouts and bridges
- Locations where rail has been repaired or welds made

7.2 Cold Weather Inspections

On main tracks, cold weather inspections must be performed as directed by the **Director Track Maintenance** when the rail temperature is forecast to drop 100°F below the rail laying temperature per **Table 7-J**.

Inspectors will inspect for:

- Broken rails
- Pull-aparts
- Wide gap between rail-ends
- Bent bolts
- Curve movement
- Canted rail
- Cracked or broken joint bars (conventional and insulated)

Chapter 8 Training

All employees responsible for the inspection, installation, adjustment or maintenance of CWR track must complete training on CWR procedures every calendar year**.** In addition, they shall be provided a copy of these procedures and accompanying documents**.** Engineering **Directors and Managers** will maintain lists of those employees qualified to supervise restorations and inspect track in CWR territory. The qualified employee lists will be made available to the FRA upon request. Training programs will address the following:

- CWR installation procedures
- Rail anchoring requirements when installing CWR
- Preventive maintenance on existing CWR track
- Monitoring curve movement following track surfacing and lining
- Placing temporary speed restrictions **on** account track work
- Rail joint inspections
- Insufficient ballast
- Extreme weather inspections
- Recordkeeping

Chapter 9 Recordkeeping

9.1 Report of CWR Installations

Rail temperature, location and date of CWR installations must be recorded on the prescribed form and must be retained for at least one year after installation.

Refer to Record of Heat Control

9.2 Report Maintenance Work in CWR

Because track maintenance can disturb the lateral and longitudinal resistance of the track, records of the following must be kept until corrections or adjustments are made:

- Rail that is added for any reason, including repair of broken or defective rail, pull-aparts and welding of rail joints.
- Where curve has been staked and has shifted inward more than a maximum of 3 inches.
- CWR installation or maintenance work that does not conform to these written procedures.
- A record of rail neutral temperature will be maintained where rail has pulled apart, broken or been cut for defect removal.

Director Track Maintenance and Manager Track Maintenance must monitor these records to ensure necessary corrections and adjustments are made.