Watco Companies, LLC CWR Plan

Procedures for the Installation,

Adjustment, Maintenance and

Inspection of CWR as Required by

49 CFR 213.118

Procedures for the Installation, Adjustment, Maintenance and Inspection of CWR For by Watco Transportation Services LLC as Required by 49 CFR 213.118

(See Appendix B for all applicable Watco railroads)

Appendices

Appendix B: Lists individual railroads managed by Watco Transportation Services L.L.C. which have adopted these procedures.

Procedures for the Installation, Adjustment, Maintenance and Inspection of CWR For Watco Railroads as Required by 49 CFR 213.118

This document details Watco'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.

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

1. Rail neutral temperature (RNT) is the temperature at which rail is neither in tension nor compression. Designated rail laying temperatures have been established based on geographic and average yearly ambient temperature to provide specific Desired Rail Neutral Temperature (DRNT) to prevent track buckling. Rail Installation temperatures may be slightly higher or lower than the DRNT but are to be within the designated rail installation range. Installation should be completed at +/-20° F rail neutral temperature. (See chart below for rail neutral temperature by geographical region).

State/RR	Desired Rail Neutral Temperature
Alabama – ABS, AUTR, BHRR	110°
Arkansas – ARS	110°
Florida – JXPT	110°
Georgia – SVHO	110°
Idaho – BVRR, EIRR	100°
Illinois – DREI, CERR	100°
Indiana – GDLK	100°
Kansas – KAW, KORR, SKOL	105°
Louisiana – BRSR, LAS	115°
Michigan – AA, GDLK	100°
Mississippi - MSR	110°
Missouri – ARS	105°
New Mexico – TXNR	115°
New York – ITHA	95°
North Carolina – BLU	100°
Ohio – AA, KNWA	100°
Oklahoma – SLWC, SKOL	110°
Oregon – PCC	100°
South Dakota - RWRR	100°
Texas – AWRR, LBWR, PVS, TIBR, TXNR	115°
West Virginia – KNWA	100°

Washington – PCC	100°
Wisconsin – WSOR	100°

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 in Chapters 1 and 3 of this CWR Plan to compensate for this temperature difference.

1.3 Installing CWR

Most commonly thought of as laying rail out-of-face; however, distances as short as a few hundred feet might be installed.

- The rail should be in a stress free state when laid in the bed.
- If fastened down at this time, the Rail Neutral Temperature (RNT) is established, and equal to the Rail Temperature (RT).
- If the RT is lower than the desired RNT, the temperature differential is calculated, and the required expansion is determined based on the temperature differential and rail length.
- The rail is then uniformly expanded. The actual length and expansion are then used to determine the new RNT.

Follow these general requirements when installing CWR:

- Refer to the designated rail laying temperature in your geographical your area.
- Take the rail temperature and calculate the expansion required before making adjustments.
- Record the rail laying temperature, location and date on your railroads' approved forms. These records may be retained in an electronic format as per 49 CFR §213.241.
- Use rail heaters or rail expanders (if necessary) to adjust the rail to the correct length when the actual rail temperature is less than the designated rail laying temperature.
- If the rail temperature exceeds the designated rail installation safe range. The installation must stop until the rail temperature returns within range, or provisions for later readjustment must be made before the arrival of cold weather.
- Heat the rail evenly and uniformly so that the rail expansion occurs evenly. The proper expansion must be achieved at each reference station throughout its length.
- Take the temperature at the location where the anchors or clips are being applied to restrain the rail.
- 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 25 mph must be placed.
- When tight rail conditions exist, be governed by Chapter 7.

Chapter 2 Rail Anchoring Requirements

Where the anchoring function is otherwise provided, such as resilient rail fasteners that give necessary toe load to restrain rail and bridges where the structure design precludes the use of anchors (e.g. bridges, with rail expansion joints, track designed to transfer the axial forces to the bridge structure, etc.), 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.

2.1 Standard Box Pattern

When installing CWR, box anchor every other tie except as outlined in Section 2.2 or where resilient rail fastener restrains the axial forces.

2.2 Solid Box Pattern

When installing CWR, box anchor every effective tie at specific locations listed below to provide additional restraint against rail movement. This table does not apply to locations where rail is affixed with resilient fasteners on every tie.

Condition	Action
Turnouts Rail crossings Joints where CWR abuts jointed rail, severe grade, and sharp curves	Anchor every tie for 195’ in each direction.
Bolted joint installed during CWR installation when using heater, rail stretcher or sufficient ambient temperature.	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:

2. Ballast deck bridges should be anchored with the same pattern as in section 2.1 and 2.2.

3. Open deck bridges- should be anchored according to Engineering Instruction 06-20.

a. Solid box anchors every tie across open-deck bridges and 195 feet each side of bridge headwalls. (See Appendix 11)
b. On open-deck steel bridges 150 feet long or less, apply anchors to all ties fastened to the steel structure.

4. Installation should be completed at +/-20° F rail neutral temperature. (See Appendix 10 for rail neutral temperature by geographical region).

Maintenance or Rail Repair

2.4 Legacy Patterns

On CWR installations completed before September 21, 1998, pre-existing railroad standard anchor patterns 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 engineering instruction. 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, documenting provisions for later adjustments (if applicable) and reapply anchors.

Chapter 3 Maintaining a Desired Rail Neutral Temperature Range

The track owner has the responsibility to quantify the rail neutral temperature of ALL CWR track.

Using the following track maintenance procedures to properly maintain the RNT reduces the risk of buckles in hot weather as well as pull-a parts and broken rails in cold weather. These procedures include a RNT readjustment method outlined in Section 3.1 or in cases

when that method is not applicable, a conventional RNT de-stress/adjustment method as outlined in Section 3.2.

The use of reference marks, applied in the appropriate manner as outlined in the appendices of this plan, are required for locations described in both Sections 3.1 and 3.2.

The proper method of measurement of rail movement in CWR is critical in correctly tracking RNT changes where work activities have been performed. The reference mark drawings (See Appendices) show how to correctly apply pre-cut/break reference marks and marking the distance for a rail cut verses a rail break. The objective is to reference the rail distance before the separation occurred.

Each reference mark location must be written on the web of the rail with a permanent paint marker; will include the following:

- Pre-cut/break reference marks and the distance (for a break subtract gap distance),
- Rail temperature at the time of separation,
- Length of gap caused by the rail pull back during the cut or break, and
- Date and milepost location.
- When tight rail conditions exist, be governed by Section 7.1.

3.1 Maintaining DRNT through a Readjustment Methodology

Readjustment Methodology

This procedure applies to rail separations occurring in CWR where the replacement rail is usually 100’ or less. It is important to understand, for this procedure to work as intended, the expected thermal forces must still be present prior to the rail separation. Meaning, if the rail has some other means of releasing the thermal force buildup or the thermal forces have been previously released by some other means, Section 3.2 would have to be used.

When rail is cut or breaks and the rail temperature is equal to or above the Pre-Cut/Break RNT, no gap will be produced, and more rail may have to be cut out to remove the rail. In such cases the current RNT would be equal to the current rail temperature.

When rail is cut or breaks and the rail temperature is below the Pre-Cut/Break RNT, the expected thermal forces will produce a gap. The Pre-Cut/Break RNT can then be calculated by referencing the Rail Temperature (RT) with the gap size, using the Pre-Cut/Break Chart appropriate for the location (See Pre-Cut/Break Chart(s) in the Appendices).

The RT, gap size (if any), and the original reference mark length (prior to separation of the rail) must be placed on the web of the rail and recorded.

Now that the estimated Pre-Cut/Break RNT is known, it can be determined if the location is within the prescribed rail installation safe range (DRNT +/-20°F) for the area.

The amount of temperature differential between the estimated Pre-Cut/Break RNT and the Desired Rail Neutral Temperature (DRNT) for that geographic area, provides the information needed to calculate the amount of rail that needs to be added or removed for returning the location back to within the designated rail installation safe range (DRNT +/- 20°F). The amount can be referenced in the Temperature Differential Chart (See the Appendices).

If the location's estimated Pre-Cut/Break RNT is found to be within the designated rail installation safe range, then the amount of rail returned to the track and pulled together would be equal to the amount of rail originally removed. If the amount of rail pull necessary to close the gap distance is less than 1", it can be pulled though the anchors; however, if the pull is greater than 1", it would require anchor removal and reinstallation for the length of the estimated affected zone created by the initial rail separation pull back.

If the location is found to be outside the rail installation safe range, additional rail will have to be added or removed to make the necessary adjustments back to within the rail installation safe range. These RNT adjustments can or cannot always be completed at the time of the initial rail repair. By accurately recording the needed information, proper adjustments can be applied later (prior to becoming pull-apart or buckle prone conditions).

If possible, at the time of the initial rail replacement and the rail can be cut to a length that would allow for: closing the gap, the additional temperature differential amount, plus weld widths (if welded). This would be performing a completed RNT adjustment at the time of repair; many times, all of these processes cannot be completed during the initial repair.

Record all work performed on the proper form(s), noting the new reference mark distance, and thus, how those changes have affected the new calculated RNT based on the amount of reference mark distance change and the estimated Pre-Cut/Break temperature. A shorter distance increases the RNT, a longer distance will lower the RNT from that estimated Pre-Cut/Break RNT.

If for any reason the amount of rail needed to make the proper adjustment cannot be removed during the initial work (such as in the case of cutting a rail that fills the gap), by recording the RT, the gap size produced by the cut/break and the original distance of the reference marks (prior to the rail being cut or broken); the proper adjustments can then be made later when returning to complete the work in a case such as this (assuming the gap was filled). The rail temperature at the time of the separation would be the new RNT. Locations such as this would have to be monitored and corrected prior to becoming a hazard for buckle or pull-apart prone conditions. A record of the rail neutral temperature changes must be maintained during all work activities to these locations up to and including the final adjustment process.

Records will be maintained for one year after the final adjustment has been completed.

Record all activities and any other required information on the designated paper or electronic form(s) for determining the Pre-Cut/Break RNT, the temperature differential required for returning the location back to within the designated RNT safe range, and the new calculated RNT after each work activity.

Rail that has been cut or broken for any reason must be readjusted within the designated rail neutral temperature (DRNT+/-20°F) safe range. If the rail has not been readjusted to

at least DRNT -20°F before the rail temperature exceeds the values in Figure 1 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.

Understand that track buckles can be extreme and, in some cases, not passable at any speed. When protecting buckle prone conditions as described in this Chapter, it should not be confused with protecting known tight track conditions or locations that have evidence of the loss of lateral resistance between the ties and ballast (See Chapter 7).

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

Note: If both rails are cut (e.g. installing a short track panel), the above table will not apply. The adjustments, slow orders, and inspections described above will instead apply at a rail temperature 70°F above the lowest rail temperature at the time of the separations.

Locations not adjusted to back to within the rail installation safe range (DRNT +/-20°), must be adjusted prior to becoming a buckle or pull-apart prone condition; however, no location shall exceed 365 days from its initial installation.

When welding rail ends together, the weld gaps and rail consumption during all associated work must be taken into consideration when determining the amount of rail added or removed to return the location back to within the designated rail neutral temperature safe range.

3.2 De-Stressing Rail

Rail can be de-stressed by removing rail, it is primarily performed in unison with both rails, but in a few limited cases (when the opposite rail is known to be properly adjusted) it can be performed on one rail. This procedure can be further used to re-establish the RNT back to within the rail installation safe range (DRNT +/- 20°F).

- Use a designated safe procedure to cut the rail, with at least two tie checks between the opposing rail cuts. It is possible that the rail is under extreme compression and may move unexpectedly both vertically as well as laterally. Cut rail to be de-stressed and/or adjusted.
- Remove or reposition anchors or clips for a minimum of 390 feet in both (10 rail lengths) directions from the cut or up to a restriction that prevents rail movement (i.e., bridge, switch). Make sure the rail can move freely though the plates so that all the thermal forces are released.

Method #1 is performed at a rail temperature that is within the designated rail installation safe range.

- The section of track (both rails) to be destressed/adjusted is cut; the anchors and any other restraints have been removed for the minimum distance in each direction until the rail stops expanding (tapping the rail along its length to assure that the rail is moving freely through the plates).
- After all thermal forces have been released and the movement has stopped, the rails can then be rejoined, and the anchors reinstalled. This restores both rails to an RNT equal to the rail temperature at the time of the rails being rejoined.

Method #2 is performed at a rail temperature that is outside the rail installation safe range (DRNT +/- 20°F).

- Referencing the current rail temperature with the amount of change needed to reach the desired rail neutral temperature, the temperature differential is found; then the required expansion is determined based on the temperature differential amount and the total rail length amount being adjusted (a minimum of 390’ each way would be a total of 780’).
- The rail is then uniformly expanded by heating or pulling the required amount of distance needed to return the location back to within designated rail installation safe range.
- After the expansion is completed and the rails are joined back together, the anchors are reinstalled.
- Record the location and new RNT on the prescribed de-stressing/adjustment form.

Locations designated for RNT conventional adjustment and not brought into the safe range will be governed by the remedial actions as described in the Section 3.1 table. However, if 100 feet or more of rail has been installed, de-stressed or adjusted below the safe range, the remedial actions in Section 1.3 will apply.

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° and the rail temperature is more than 50°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 ambient temperatures above or forecasted above the designated temperature as described in the section 3.1 table. 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 are 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. These are minimum requirements. More restrictive restrictions may be necessary, such as extending the duration, reducing the maximum speed or removing the track out of service. Team members that are qualified under CFR 213.7(c) are to use sound judgment when determining speed restrictions.

When ambient temperature is BELOW 80 degrees, or is forecasted within the next 24 hours to remain BELOW the designated temperature for each geographical area, follow the guidelines below:

Activity	Maximum Speed	Minimum Duration
Out of face installation of ties Undercutting Laying track/switch panels Constructing track Out of face surfacing and lining	25 mph	1 freight train or 2 passenger trains
Spot maintenance Installing ties (no more than 5 ties in 39 feet and no more than 3 consecutive ties) Surfacing/lining (maximum length of 19’6”)	25 mph	1 freight train or 2 passenger trains

When ambient temperature is ABOVE 80 degrees, or is forecasted within the next 24 hours to remain ABOVE the designated temperature for each geographical area, follow the guidelines below:

Activity	Maximum Speed	Minimum Duration
Out of face installation of ties Undercutting Laying track/switch panels Constructing track Out of face surfacing and lining	10 mph	1 freight train or 2 passenger trains
Spot maintenance Installing ties (no more than 5 ties in 39 feet and no more than 3 consecutive ties) Surfacing/lining (maximum length of 19'6")	10 mph	1 freight train or 2 passenger trains

The above speed restrictions should be maintained during the work process and the minimum duration listed above after completion of work.

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

6.5 Rail Joint Conditions

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

Rail joint condition	Action[1]
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 track3	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

Once 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.

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 are 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 Embedded 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. Locations that have been buried for an extended period of time must still be inspected

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 taken by the person making the inspection
- Name and signature of inspector

Track subject to inspections under 49 CFR § 213.119, must comply with:

- Track Inspections (49 CFR § 213.233),
- Inspections of switches, turnouts, track crossings, lift rail assemblies or other transition devices on moveable bridges (49 CFR § 213.235), if applicable,
- Periodic and follow-up CWR Joint Inspections (49 CFR § 213.119 (g)).

Chapter 7 Extreme Weather Inspections

7.1 Hot Weather Inspections

On main tracks, hot weather inspections must be performed and documented as directed by the Vice President of Engineering when the temperature is forecasted to reach 90°F.

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 the ambient temperature.

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 and sidings, cold weather inspections must be performed as directed or when the rail temperature is forecast to drop 100°F below the rail laying temperature.

Inspectors will inspect for:

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

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
- Maintaining a desired rail neutral temperature range
- Monitoring curve movement following track surfacing and lining
- Placing temporary speed restrictions on account of track work
- Rail joint inspections
- Insufficient ballast
- Extreme weather inspections
- Recordkeeping

Chapter 9 Recordkeeping

9.1 Report of CWR Installations

Records necessary to provide an adequate history of installing (Chapter 1) and achieving rail neutral temperature using this procedure will be maintained for at least one year. These records will include the date of installation, location, rail and length, initial rail temperature, designated RNT, expansion, and adjusted RNT. (Forms in appendices)

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 for at least one year after corrections or adjustments are made:

- Record of each designated cut or break location using the Readjustment Methodology including the items as indicated on the paper or electronic form required in Section 3.1 and within 365 days the final RNT.
- Rail added or removed at locations above.
- Record of each designated cut or break location using conventional adjustment in Section 3.2 including the rail temperatures and within 365 days the final RNT.
- 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.

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

Appendices to Submitted CWR Provisions
Appendix 1

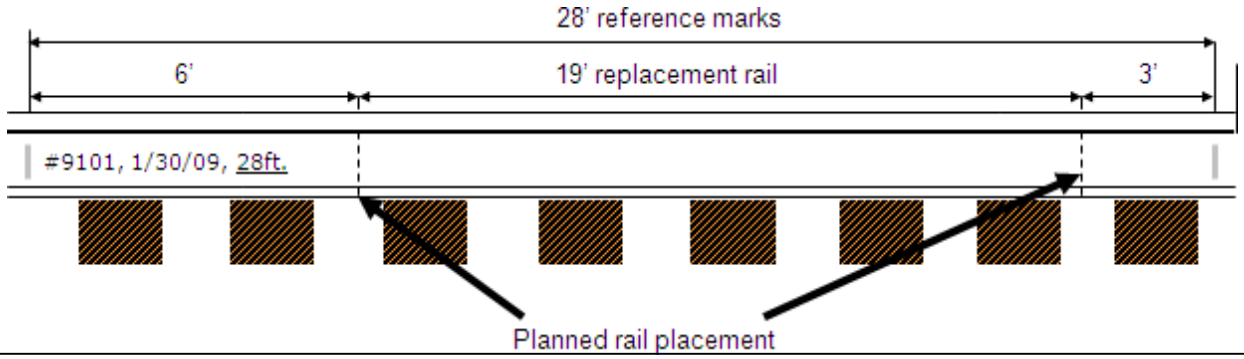
Placing Rail Reference Marks

Placing rail reference marks is a method of correctly and accurately measuring the amount of rail added or removed in CWR territory.

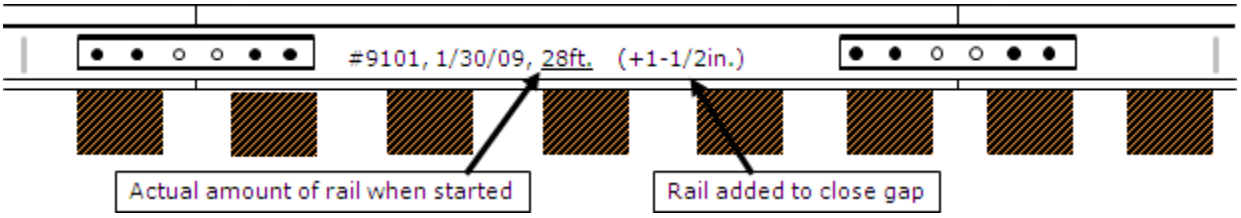
Reference marks must be utilized when rail separations occur in CWR for any reason. Use the following guidelines when placing reference marks.

- Use a permanent white metal marker or paint stick (not soapstone or chalk) to record reference marks. The markings must also be legible and clearly understood.
- Reference marks should be at least 3' from where the cut is made so that joint bars will not cover the marks.
- The distance between reference marks, the gang number, and the date must be written on the web of the rail in a railroad wide uniform manner.
- Perform the calculations outlined in section 3 of the CWR plan for determining the Pre-Cut/Break RNT.
- In this example, the adjustment could not be made, so the gap was filled by adding rail, lowering the RNT. The RT, the Gap Size, and Reference Mark distance will have to be maintained so that a proper adjustment can be performed at a later date. The new RNT is equal to the current RT in this case.
- Document the location through production reporting and arrange for later
- adjustment if needed. ·
- Any lowered RNT temporary repairs must be corrected when making permanent repairs.

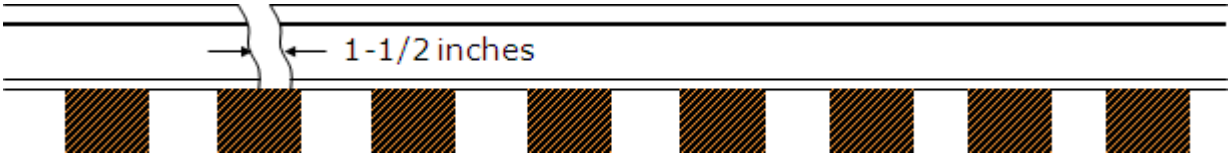
When adding a replacement rail to repair a rail defect that has not separated, determine where to cut the rail to ensure that the cuts align with the tie cribs. Measure at least 3 feet from each rail cut mark, before the rail is cut, and place reference marks on the web of the rail to record the total distance between the reference marks.



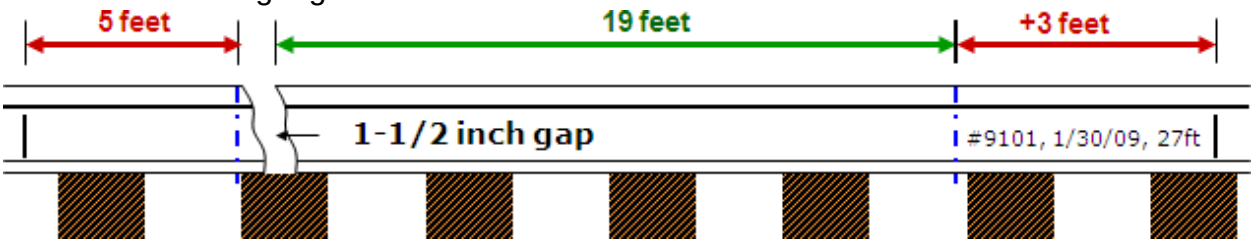
In the example below, when the rail was cut, the rail gapped open 1 ½". The replacement rail was installed and after the joint bars were applied the distance between the reference marks is now 28 feet 1 ½ inches. Document the 1 ½" added as a (+) measurement. The 1 ½" of rail added must be removed when the permanent repair is made.



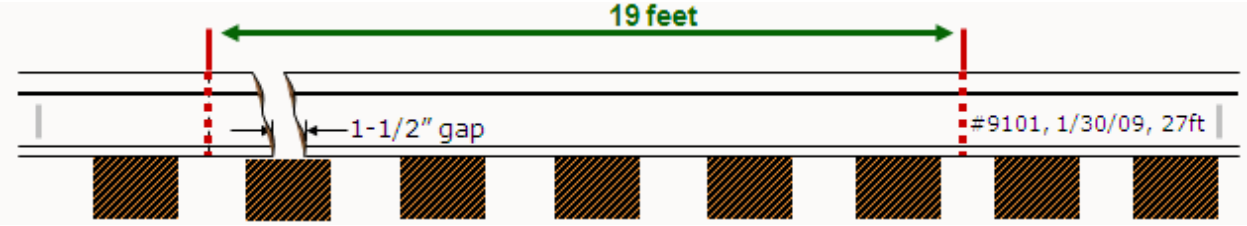
In cases of pull-a-parts and service failures where the rail has gapped open, the distance marked on the web of the rail must not include the gap in the rail. The reference marks should always indicate the original distance, (amount of rail) between the marks before the break or pull-apart occurred. In this example the gap is 1 ½" wide and the break is crooked.



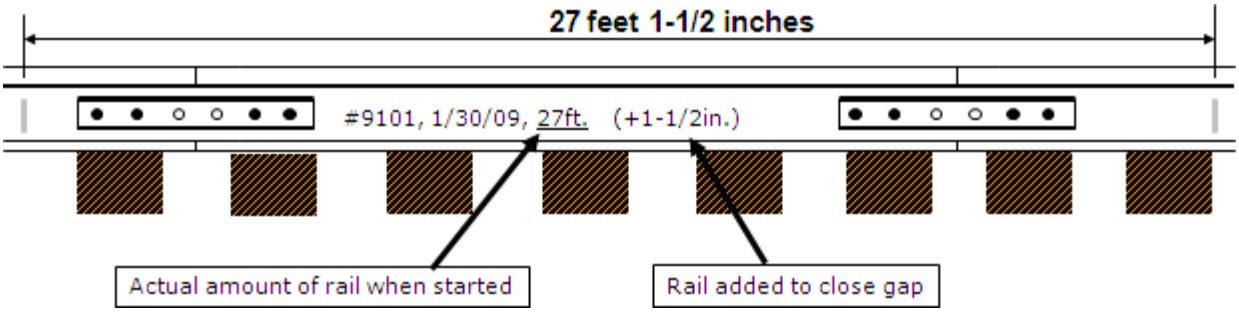
To properly apply reference marks, measure back from one end of the break at least 3 feet and mark the rail. Measure in the other direction from the opposite end of the break the length of replacement rail plus an additional 3 feet and mark the rail. In this example there is 27' of rail between the reference marks. Record this on the web of the rail along with the date and gang #.



Mark the rail to place the saw cuts for the replacement rail in the cribs.



Once the repair is completed, measure the distance between the reference marks and record the measurement on the web of the rail.



Appendix 2

Watco Engineering Instruction 6-20

Anchoring Rail

Rail anchors prevent rail from moving longitudinally relative to the ties. Be careful to ensure that the anchor is fully driven but not overdriven. Apply the following anchor policy to all new and second-hand (SH) rail relays. You are not required to apply additional anchors to rail currently in track to comply with this standard unless conditions warrant.

1. Anchoring CWR

Anchor continuous welded rail as follows:

- Box anchor the rail anchors for 195 feet on each side of permanent bolted joints, railroad crossings, and open-deck bridges. Do not apply anchors opposite of joint bars.
- Box anchor the rail anchors for 195 feet ahead of a switch point and behind the heel of a frog on both the main track and the turnout side.
- Elsewhere, box anchor every second tie.
- Maintain anchors so they bear against the edge of either the tie or tie plate.

2. Transition Anchoring

Where conventional bolted rail joins continuous welded rail, box anchor every tie for 195 feet in both directions.

3. Anchoring Turnouts

Where possible, anchor a turnout with eight anchors on each switch tie. Apply this pattern to both welded and bolted turnouts, except where elastic fasteners are used.

4. Anchoring Bridges

Anchor rail on bridges as follows:

- Anchor rail on ballast deck bridges with the same pattern as the rail adjacent to the bridge.
- On open-deck timber bridges, apply anchors to all ties fastened to stringers.
- On open-deck steel bridges 150 feet long or less, apply anchors to all ties fastened to the steel structure.
- On other structures, apply anchors as directed by Watco Manager of Bridges.

5. Maintaining Anchors

Maintain anchors as follows:

- When applying anchors in prescribed pattern and rail movement is evident:
    - Inspect the anchors to ensure that they have full bearing against the side of the ties, they are the proper size and dimension for the rail section, and they are not defective or weakened by overdriving.
    - If any of the above conditions exist, reset the anchors, replace the anchors, or apply additional anchors as needed.
    - If investigation reveals a poor tie condition, insufficient ballast, corroded rail base, or excessive longitudinal rail stress, correct these track conditions before deciding to add additional anchors.
- When removing anchors from the track for spot maintenance or repair, immediately reapply the anchors to conform to the prevailing anchor pattern for the track being repaired.
    - Be careful when applying anchors (either by machine or by hand). Ensure that the anchors have full bearing against the tie. Do not overdrive or overapply the anchors.
    - Adjust anchors by using anchor machines or hand tools, but do not drive anchors along the base of the rail with a hammer. To adjust anchors using hand tools, remove the anchor and reapply it against the tie.
- Periodically inspect existing anchors.
    - Reset anchors that do not have full bearing against a tie.
    - Replace faulty or missing anchors to establish proper anchor pattern.
- After applying an anchor to the rail, apply an anchor to the opposite rail with bearing on the same side of the same tie. Anchor the rail adjacent to the insulated joint plugs welded into the track as though no joint exists.
- Fully box anchor each tie that is adjacent to a field weld.

Appendix 3

Continuous Welded Rail Adjustment Table

Continuous Welded Rail Adjustment Table								
Temperature Differential (°F)	**Amount of Adjustment Required (Inches) for a Length of CWR**							
	Station 1		**Station 2**	**Station 3**		**Station 4**		**Station 5**
	360 feet	**660 feet**	**720 feet**	**1,080 feet**	**1,320 feet**	**1,440 feet**	**1,520 feet**	**1,600 feet**
5	1/4	1/4	1/4	1/2	1/2	1/2	1/2	3/4
10	1/4	1/2	1/2	3/4	1	1	1-1/4	1-1/4
15	1/2	3/4	3/4	1-1/4	1-1/2	1-3/4	1-3/4	2
20	1/2	1	1-1/4	1-3/4	2	2-1/4	2-1/2	2-1/2
25	3/4	1-1/4	1-1/2	2-1/4	2-1/2	2-3/4	3	3-1/4
30	3/4	1-1/2	1-3/4	2-1/2	3	3-1/2	3-3/4	4
35	1	1-3/4	2	3	3-3/4	4	4-1/4	4-1/2
40	1-1/4	2	2-1/4	3-1/2	4-1/4	4-1/2	5	5-1/4
45	1-1/4	2-1/4	2-1/2	3-3/4	4-3/4	5	5-1/2	5-3/4
50	1-1/2	2-1/2	2-3/4	4-1/4	5-1/4	5-3/4	6-1/4	6-1/2
55	1-3/4	2-3/4	3-1/4	4-3/4	5-3/4	6-1/4	6-3/4	7
60	1-3/4	3	3-1/2	5	6-1/4	6-3/4	7-1/4	7-3/4
65	1-3/4	3-1/4	3-3/4	5-1/2	6-3/4	7-1/4	8	8-1/2
70	2	3-3/4	4	6	7-1/4	8	8-1/2	9

Appendix 4

TRACK DISTURBANCE REPORT

Date of Disturbance: _____ Railroad Name:_____

Track Name:_____

Location: from MP _____ to MP _____

Alignment: (T/C)_____ Degree of Curve

Side of Rail (facing ascending milepost) (L, R, B)_____

Temperature: Ambient Rail Desired Rail Neutral_____

Type of Disturbance: Rail Laid: (fill out Rail Laying Report) _____

Rail Plug Installed: (Gap produced by rail pullback)

Reference Mark Length before:

Reference Mark Length after:

Welds Made (Y/N) (how many)

Weld Made (rail separation) (Gap produced by pullback)

Reference Mark Length before:

Reference Mark Length after:

Turnout Installed:

Track Panel Installed:

Ties Installed:

Surfacing out-of-face or spot surfacing

Track cribbed, undercut, washout

Track Buckle:

Pull-apart:

Other: (describe) _____

Disturbance Corrected:_____

Adjusted Rail: Date _____ Rail Temperature _____ Adjusted RNT_____

Reference mark distance: Before _____ After _____ Rail Temperature_____

Ballast Restored: Date _____

Ballast Compacted: Mechanical _____ Time and Tonnage_____

Alinement restored: Date _____ Stakes Monitored: _____RNT Adjusted:_____

Restored Anchor pattern to standard or added to prevent movement: _____

Other: _____

Speed Restriction place: (date and speed)_____Speed Restriction removed: (date) _____

Name:_____ Date:_____

Rail Neutral Temperature at Pull Apart or Break Chart (Pre-Cut/Break Chart)

Example only. A different chart for each track type (wood or concrete) and rail size (136 or 115) used. The chart must start at the DRNT.

RAIL NEUTRAL TEMPERATURE AT PULL APART OR BREAK

RAIL GAP (INCHES)

RAIL TEMP (F)	0.5	1.0	1.5
100	124	134	142
95	119	129	137
90	114	124	132
85	109	119	127
80	104	114	122
75	99	109	117
70	94	104	112
65	89		107
60	84		102
55	79		97
50	74	84	92
45	69	79	87
40	64	74	82
35	59	69	77
30	54	64	72
25	49	59	67
20	44	54	62
15	39	49	57
10		44	52
5		39	47
0		34	42
-15	9	19	27
-20	4	14	22

1

2

ΔT= (initial RNT - Tbreak)

Step 1

If rail break at 25°F and pull-apart with a gap size of **1.5** inches, the rail neutral temp (RNT) at break is 67°F *(see the blue arrows)*

Step 2

Assumed the initial RNT of 100°F prior rail cut and drop to 67°F after cut, then ΔT = (RNT – Tbreak) = 100°F - 67°F = 33°F. *(see the blue dash arrow)*

Step 3

For the influence zone of 780 feet after the cut *(industry accepted length)*, the additional rail to remove for adjustment is **1.75** inches.

Step 4

The total remove adjustment are: gap size after rail break + from the thermal adjustment chart + account for weld width = 1.5 in. + 1.75 in. + 1 in. = 4.25 inches to returned to target RNT of 100°F giving a temperature difference of 33°F to adjust.

THERMAL ADJUSTMENT CHART Rail expansion base

Change in Temperature	Change in Length
5	1/4"
10	1/2"
15	7/8"
20	1-1/8"
25	1-3/8"
30	1-5/8"
35	1-7/8"
40	2-1/8"
45	2-1/2"
50	2-3/4"
55	3"
60	3-1/4"
65	3-1/2"
70	3-7/8"

1-3/4"

3

RNT = 100 Degrees

Example:

1) If the rail temperature is 25 and pulls apart 1-1/2" it has a RNT of 67 Degrees.

2) If the territory requires a RNT of 100, an additional 33 degrees or 1-3/4" must be removed for proper adjustment.

3) Remove or adjust anchors on both sides of cut or joint.

4) Heat or pull rail 1-1/2" to close gap plus the additional 1-3/4" to adjust CWR to 100 degrees.

5) Remove additional rail to account for weld width if welding.

4

All numbers populating this form are used as examples only. The railroad must determine the expansion rate best used for their particular situation, but it must be within industry accepted best practices.

Input parameters (sample tables)

Rail size: 115 RE (5-1/2 inch base rails)

Longitudinal resistance values for fastener condition:

1) EOTA average 20 lb./in
ETA average 30 lb./in or CTEF weak 30 lb./in

Rail Neutral Temperature at Pull Apart or Break Chart (Pre-Cut/Break Chart)

The chart must start at the DRNT (Desired Rail Neutral Temperature)

Rail Size 115-lb. A.R.E.M.A: Every Other Tie Anchored										
Rail Temp (°F)	Gap Size (inches)									
	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
100	126	137	146	153	159	165	170	175	179	184
95	121	132	141	148	154	160	165	170	174	179
90	116	127	136	143	149	155	160	165	169	174
85	111	122	131	138	144	150	155	160	164	169
80	106	117	126	133	139	145	150	155	159	164
75	101	112	121	128	134	140	145	150	154	159
70	96	107	116	123	129	135	140	145	149	154
65	91	102	111	118	124	130	135	140	144	149
60	86	97	106	113	119	125	130	135	139	144
55	81	92	101	108	114	120	125	130	134	139
50	76	87	96	103	109	115	120	125	129	134
45	71	82	91	98	104	110	115	120	124	129
40	66	77	86	93	99	105	110	115	119	124
35	61	72	81	88	94	100	105	110	114	119
30	56	67	76	83	89	95	100	105	109	114
25	51	62	71	78	84	90	95	100	104	109
20	46	57	66	73	79	85	90	95	99	104
15	41	52	61	68	74	80	85	90	94	99
10	36	47	56	63	69	75	80	85	89	94
5	31	42	51	58	64	70	75	80	84	89
0	26	37	46	53	59	65	70	75	79	84
-5	21	32	41	48	54	60	65	70	74	79
-10	16	27	36	43	49	55	60	65	69	74
-15	11	22	31	38	44	50	55	60	64	69
-20	6	17	26	33	39	45	50	55	59	64

THERMAL ADJUSTMENT CHART **Rail expansion based on a 780' effected zone length (390' or 10 rail lengths each side of separation)**

Change in Temperature (°F)	Change in Length (inches)
5	1/4"
10	1/2"
15	7/8"
20	1-1/8"
25	1-3/8"
30	1-5/8"
35	1-7/8"
40	2-1/8"
45	2-1/2"
50	2-3/4"
55	3"
60	3-1/4"
65	3-1/2"
70	3-7/8"

RNT = 100 Degrees

Example:

1) If the rail temperature is 25 and pulls apart 1-1/2" it has a RNT of 71 Degrees.

2) If the territory requires a RNT of 100, an additional 29 degrees or 1-5/8" must be removed for proper adjustment.

3) Remove or adjust anchors on both sides of cut or joint.

4) Heat or pull rai l 1-1/2" to close gap plus the additional 1-5/8" to adjust CWR to 100 degrees.

5) Remove additional rail to account for weld width if welding

All numbers populating this form are used as examples only. The railroad must determine the expansion rate best used for their particular situation, but it must be within industry accepted best practices.

Rail Neutral Temperature at Pull Apart or Break Chart (Pre-Cut/Break Chart)

The chart must start at the DRNT (Desired Rail Neutral Temperature)

Rail Size 115-lb. A.R.E.M.A: Every Tie Anchored / Concrete Tie Elastic Fastener										
Rail Temp (°F)	Gap Size (inches)									
	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
100	132	146	156	165	173	179	186	192	197	203
95	127	141	151	160	168	174	181	187	192	198
90	122	136	146	155	163	169	176	182	187	193
85	117	131	141	150	158	164	171	177	182	188
80	112	126	136	145	153	159	166	172	177	183
75	107	121	131	140	148	154	161	167	172	178
70	102	116	126	135	143	149	156	162	167	173
65	97	111	121	130	138	144	151	157	162	168
60	92	106	116	125	133	139	146	152	157	163
55	87	101	111	120	128	134	141	147	152	158
50	82	96	106	115	123	129	136	142	147	153
45	77	91	101	110	118	124	131	137	142	148
40	72	86	96	105	113	119	126	132	137	143
35	67	81	91	100	108	114	121	127	132	138
30	62	76	86	95	103	109	116	122	127	133
25	57	71	81	90	98	104	111	117	122	128
20	52	66	76	85	93	99	106	112	117	123
15	47	61	71	80	88	94	101	107	112	118
10	42	56	66	75	83	89	96	102	107	113
5	37	51	61	70	78	84	91	97	102	108
0	32	46	56	65	73	79	86	92	97	103
-5	27	41	51	60	68	74	81	87	92	98
-10	22	36	46	55	63	69	76	82	87	93
-15	17	31	41	50	58	64	71	77	82	88
-20	12	26	36	45	53	59	66	72	77	83

THERMAL ADJUSTMENT CHART **Rail expansion based on a 780' effected zone length (390' or 10 rail lengths each side of separation)**

Change in Temperature (°F)	Change in Length (inches)
5	1/4"
10	1/2"
15	7/8"
20	1-1/8"
25	1-3/8"
30	1-5/8"
35	1-7/8"
40	2-1/8"
45	2-1/2"
50	2-3/4"
55	3"
60	3-1/4"
65	3-1/2"
70	3-7/8"

RNT = 100 Degrees

Example:

1) If the rail temperature is 25 and pulls apart 1-1/2" it has a RNT of 81 Degrees.

2) If the territory requires a RNT of 100, an additional 19 degrees or 1-1/8" must be removed for proper adjustment.

3) Remove or adjust anchors on both sides of cut or joint.

4) Heat or pull rai l 1-1/2" to close gap plus the additional 1-1/8" to adjust CWR to 100 degrees.

5) Remove additional rail to account for weld width if welding

All numbers populating this form are used as examples only. The railroad must determine the expansion rate best used for their particular situation, but it must be within industry accepted best practices.

Input parameters (sample tables)

Rail size: 136 RE (6 inch base rails)

Longitudinal resistance values for fastener condition:

1) **EOTA average 20 lb./in**
2) **ETA average 30 lb./in or CTEF weak 30 lb./in**

Rail Neutral Temperature at Pull Apart or Break Chart (Pre-Cut/Break Chart)

The chart must start at the DRNT (Desired Rail Neutral Temperature)

Rail Size 136-lb. A.R.E.M.A: Every Other Tie Anchored										
Rail Temp (°F)	Gap Size (inches)									
	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
100	124	134	142	149	154	160	164	169	173	177
95	119	129	137	144	149	155	159	164	168	172
90	114	124	132	139	144	150	154	159	163	167
85	109	119	127	134	139	145	149	154	158	162
80	104	114	122	129	134	140	144	149	153	157
75	99	109	117	124	129	135	139	144	148	152
70	94	104	112	119	124	130	134	139	143	147
65	89	99	107	114	119	125	129	134	138	142
60	84	94	102	109	114	120	124	129	133	137
55	79	89	97	104	109	115	119	124	128	132
50	74	84	92	99	104	110	114	119	123	127
45	69	79	87	94	99	105	109	114	118	122
40	64	74	82	89	94	100	104	109	113	117
35	59	69	77	84	89	95	99	104	108	112
30	54	64	72	79	84	90	94	99	103	107
25	49	59	67	74	79	85	89	94	98	102
20	44	54	62	69	74	80	84	89	93	97
15	39	49	57	64	69	75	79	84	88	92
10	34	44	52	59	64	70	74	79	83	87
5	29	39	47	54	59	65	69	74	78	82
0	24	34	42	49	54	60	64	69	73	77
-5	19	29	37	44	49	55	59	64	68	72
-10	14	24	32	39	44	50	54	59	63	67
-15	9	19	27	34	39	45	49	54	58	62
-20	4	14	22	29	34	40	44	49	53	57

THERMAL ADJUSTMENT CHART **Rail expansion based on a 780' effected zone length (390' or 10 rail lengths each side of separation)**

Change in Temperature (°F)	Change in Length (inches)
5	1/4"
10	1/2"
15	7/8"
20	1-1/8"
25	1-3/8"
30	1-5/8"
35	1-7/8"
40	2-1/8"
45	2-1/2"
50	2-3/4"
55	3"
60	3-1/4"
65	3-1/2"
70	3-7/8"

RNT = 100 Degrees

Example:

1) If the rail temperature is 25 and pulls apart 1-1/2" it has a RNT of 67 Degrees.

2) If the territory requires a RNT of 100, an additional 33 degrees or 1-3/4" must be removed for proper adjustment.

3) Remove or adjust anchors on both sides of cut or joint.

4) Heat or pull rai l 1-1/2" to close gap plus the additional 1-3/4" to adjust CWR to 100 degrees.

5) Remove additional rail to account for weld width if welding

All numbers populating this form are used as examples only. The railroad must determine the expansion rate best used for their particular situation, but it must be within industry accepted best practices.

Rail Neutral Temperature at Pull Apart or Break Chart (Pre-Cut/Break Chart)

The chart must start at the DRNT (Desired Rail Neutral Temperature)

Rail Size 136-lb. A.R.E.M.A: Every Tie Anchored / Concrete Tie Elastic Fastener										
Rail Temp (°F)	Gap Size (inches)									
	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
100	130	142	152	160	167	173	179	184	189	194
95	125	137	147	155	162	168	174	179	184	189
90	120	132	142	150	157	163	169	174	179	184
85	115	127	137	145	152	158	164	169	174	179
80	110	122	132	140	147	153	159	164	169	174
75	105	117	127	135	142	148	154	159	164	169
70	100	112	122	130	137	143	149	154	159	164
65	95	107	117	125	132	138	144	149	154	159
60	90	102	112	120	127	133	139	144	149	154
55	85	97	107	115	122	128	134	139	144	149
50	80	92	102	110	117	123	129	134	139	144
45	75	87	97	105	112	118	124	129	134	139
40	70	82	92	100	107	113	119	124	129	134
35	65	77	87	95	102	108	114	119	124	129
30	60	72	82	90	97	103	109	114	119	124
25	55	67	77	85	92	98	104	109	114	119
20	50	62	72	80	87	93	99	104	109	114
15	45	57	67	75	82	88	94	99	104	109
10	40	52	62	70	77	83	89	94	99	104
5	35	47	57	65	72	78	84	89	94	99
0	30	42	52	60	67	73	79	84	89	94
-5	25	37	47	55	62	68	74	79	84	89
-10	20	32	42	50	57	63	69	74	79	84
-15	15	27	37	45	52	58	64	69	74	79
-20	10	22	32	40	47	53	59	64	69	74

THERMAL ADJUSTMENT CHART **Rail expansion based on a 780' effected zone length (390' or 10 rail lengths each side of separation)**

Change in Temperature (°F)	Change in Length (inches)
5	1/4"
10	1/2"
15	7/8"
20	1-1/8"
25	1-3/8"
30	1-5/8"
35	1-7/8"
40	2-1/8"
45	2-1/2"
50	2-3/4"
55	3"
60	3-1/4"
65	3-1/2"
70	3-7/8"

RNT = 100 Degrees

Example:

1) If the rail temperature is 25 and pulls apart 1-1/2" it has a RNT of 77 Degrees.

2) If the territory requires a RNT of 100, an additional 23 degrees or 1-1/4" must be removed for proper adjustment.

3) Remove or adjust anchors on both sides of cut or joint.

4) Heat or pull rai l 1-1/2" to close gap plus the additional 1-1/4" to adjust CWR to 100 degrees.

5) Remove additional rail to account for weld width if welding

All numbers populating this form are used as examples only. The railroad must determine the expansion rate best used for their particular situation, but it must be within industry accepted best practices.

Appendix 6

Rail Installation Adjustment Report

Railroad: _____ Subdivision: _____

Track Supervisor: _____ Force or Gang: _____ Employee taking measurements: _____

Date	Mile Post Location	Side (L/R)	Track	Actual Rail Temp.	Desired Rail Temp.	Temp. Differential	Required Adjustment	Adj. at Station 1	Adj. at Station 2	Adj. at Station 3	Adj. at Station 4	New Adjusted RNT	Rail information

Walking Joint Bar Inspections

Railroad: _____

Division: _____

Track Supervisor: _____

Subdivision	Track	Milepost	Side (L or R)	Joint Identifier	Rail Size	Joint Type	Date Inspected	Conditions Found

Curve Alignment Reference Form

CURVE ALIGNMENT REFERENCE FORM

WORK DIRECTION

TRACK ID:

(LOW TO HIGH MP)

MILEPOST BEGIN:

(HIGH TO LOW MP)

MILEPOST END:

DEGREE OF CURVE:

TEAM NAME:

TYPE OF FASTENERS

Rail Anchors

Pandrol Platers

Other

	DATE:				
	RAIL TEMPERATURE:				
	RECORDER:				
No.	**DESCRIPTION**	**MEASUREMENT 1 BEFORE WORK**	**MEASUREMENT 2 AFTER WORK**	**MEASUREMENT 3 FOLLOW UP**	**MEASUREMENT 4 FOLLOW UP**

NOTES:

References should be marked fixed objects or wood stakes if practicable. Number reference points in sequence in the direction of work.

In "Description", note TS, SC, CS, ST, and identify reference.

Measure from the field side of the near rail to the face of fixed object or stake. References should be spaced no more than:

- 100 feet on curves 9 degrees and above
- 200 feet on 9 degree to 4 degree curves
- 400 feet on 4 degree to 2 degree curves
- 800 feet on 2 degree to 1 degree curves

Reference stakes must be clear of maintenance activities, walking areas, and tie ends.

Appendix 9

CWR Rail Adjustment Chart Example

C=12 X0.0000065LT

C=CHANGE IN LENGTH IN INCHES
LENGTH OF RAIL IN FEET

T=CHANGE IN TEMPERATURE IN DEGREES

CHANGE IN RAIL LENGTH

TO CHANGE IN TEMPERATURE

	CHANGE IN TEMPERATURE IN DEGREES FAHRENHEIT															
LENGTH OF RAIL - FEET	**5**	**10**	**15**	**20**	**25**	**30**	**35**	**40**	**45**	**50**	**55**	**60**	**65**	**70**	**75**	**80**
100	0	0-1/8	0-1/8	0-1/8	0-1/4	0-1/4	0-1/4	0-1/4	0-3/8	0-3/8	0-3/8	0-1/2	0-1/2	0-1/2	0-5/8	0-5/8
200	0-1/8	0-1/8	0-1/4	0-3/8	0-1/2	0-1/2	0-1/2	0-5/8	0-3/4	0-3/4	0-7/8	0-7/8	1	1-1/8	1-1/8	1-1/4
300	0-1/8	0-1/4	0-3/8	0-1/2	0-5/8	0-3/4	0-7/8	1	1	1-1/8	1-1/4	1-3/8	1-1/2	1-5/8	1-3/4	1-7/8
400	0-1/8	0-3/8	0-1/2	0-5/8	0-3/4	1	1-1/8	1-1/4	1-3/8	1-1/2	1-3/4	1-7/8	2	2-1/8	2-3/8	2-1/2
500	0-1/4	0-3/8	0-5/8	0-3/4	1	1-1/8	1-3/8	1-1/2	1-3/4	2	2-1/8	2-3/8	2-1/2	2-3/4	2-7/8	3-1/8
600	0-1/4	0-1/2	0-3/4	0-7/8	1-1/8	1-3/8	1-5/8	1-7/8	2-1/8	2-3/8	2-5/8	2-3/4	3	3-1/4	3-1/2	3-3/4
700	0-1/4	0-1/2	0-7/8	1-1/8	1-3/8	1-5/8	1-7/8	2-1/8	2-1/2	2-3/4	3	3-1/4	3-1/2	3-7/8	4-1/8	4-3/8
800	0-3/8	0-5/8	1	1-1/4	1-1/2	1-7/8	2-1/8	2-1/2	2-3/4	3-1/8	3-3/8	3-3/4	4	4-3/8	4-5/8	5
900	0-3/8	0-3/4	1	1-3/8	1-3/4	2-1/8	2-1/2	2-3/4	3-1/8	3-1/2	3-7/8	4-1/4	4-5/8	4-7/8	5-1/4	5-5/8
1000	0-3/8	0-3/4	1-1/8	1-1/2	2	2-3/8	2-3/4	3-1/8	3-1/2	3-7/8	4-1/4	4-5/8	5-1/8	5-1/2	5-7/8	6-1/4
1100	0-3/8	0-7/8	1-1/4	1-3/4	2-1/8	2-5/8	3	3-3/8	3-7/8	4-1/4	4-3/4	5-1/8	5-5/8	6	6-3/8	6-7/8
1200	0-1/2	0-7/8	1-3/8	1-7/8	2-3/8	2-3/4	3-1/4	3-3/4	4-1/4	4-5/8	5-1/8	5-5/8	6-1/8	6-1/2	7	7-1/2
1300	0-1/2	1	1-1/2	2	2-1/2	3	3-1/2	4	4-5/8	5-1/8	5-5/8	6-1/8	6-5/8	7-1/8	7-5/8	8-1/8
1400	0-1/2	1-1/8	1-5/8	2-1/8	2-3/4	3-1/4	3-7/8	4-3/8	4-7/8	5-1/2	6	6-1/2	7-1/8	7-5/8	8-1/4	8-3/4
1440	0-1/2	1-1/8	1-5/8	2-1/4	2-3/4	3-3/8	3-7/8	4-1/2	5	5-5/8	6-1/8	6-3/4	7-1/4	7-7/8	8-3/8	9
1500	0-5/8	1-1/8	1-3/4	2-3/8	2-7/8	3-1/2	4-1/8	4-5/8	5-1/4	5-7/8	6-3/8	7	7-5/8	8-1/4	8-3/4	9-3/8
1600	0-5/8	1-1/4	1-7/8	2-2/1	3-1/8	3-3/4	4-3/8	5	5-5/8	6-1/4	6-7/8	7-1/2	8-1/8	8-3/4	9-3/8	10

All continuous welded rail with a rail temperature below the rail installation safe range will be adjusted.

Example: When laying a rail 1300 feet long, with a rail temperature of 45°F. Reference the desired rail neutral temperature for the area in which it will be installed (in this example we will use 100°F).

The desired Temperature = 100°F The
Rail Temperature = 45°F
The difference between the two = 55°F
Cross-reference the line with 1300' with the column with 55° = 5-5/8 inche5

Divide the rail length into four equal parts (325') and place a plate/base reference marks (make sure the plate is secured to prevent movement). Expand the rail making sure that the required amount is achieved at each station (1-13/32" per station).

Station 1 = 1-13/32", Station 2 = 2-13/16", Station 3 = 4-7/32", Station 4 = 5-5/8"

Be sure that the rail is headed, or expanded evenly throughout its length. Also, allow for weld additions or consumption when calculating cuts. Record all information on the proper form(s).

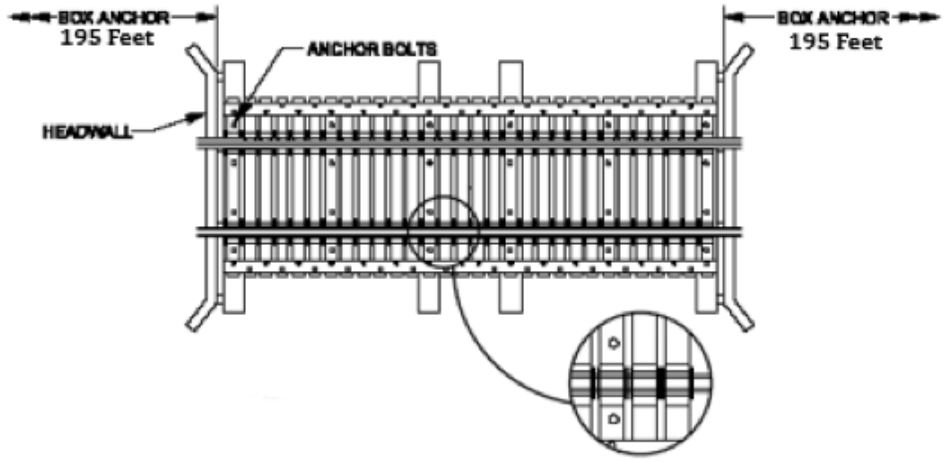
Appendix 10

Geographic Desired Rail Neutral Temperature

State/RR	Desired Rail Neutral Temperature
Alabama – ABS, AUTR, BHRR	110°
Arkansas – ARS	110°
Florida – JXPT	110°
Georgia – SVHO	110°
Idaho – BVRR, EIRR	100°
Illinois – DREI, CERR	100°
Indiana – GDLK	100°
Kansas – KAW, KORR, SKOL	105°
Louisiana – BRSR, LAS	115°
Michigan – AA, GDLK	100°
Mississippi - MSR	110°
Missouri – ARS	105°
New Mexico – TXNR	115°
New York – ITHA	95°
North Carolina – BLU	100°
Ohio – AA, KNWA	100°
Oklahoma – SLWC, SKOL	110°
Oregon – PCC	100°
South Dakota - RWRR	100°
Texas – AWRR, LBWR, PVS, TIBR, TXNR	115°
West Virginia – KNWA	100°
Washington – PCC	100°
Wisconsin – WSOR	100°

OPEN DECK BRIDGES

Engineering Instruction 06-20



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 Engineering Instruction 06-20.**
   a. **Solid box anchors every tie across open-deck bridges and 195 feet each side of bridge headwalls.**
   b. **On open-deck steel bridges 150 feet long or less, apply anchors to all ties fastened to the steel structure.**

3. **Installation should be completed at +/-20° F rail neutral temperature. (See Appendix 10 for rail neutral temperature by geographical region).**

Appendix B - Watco Railroads

Listed individual railroads managed by Watco which have adopted these procedures.

- Alabama Southern Railroad (ABS) November 20, 2005
- Ann Arbor (AA) *Effective January 26, 2013*
- Arkansas Southern Railroad (ARS) October 9,2005
- Austin Western Railroad (AWRR) October 21, 2015
- Autauga Northern Railroad (AUTR) Effective April 9, 2011
- Baton Rouge Southern Railroad (BRSR) November 28, 2008
- Birmingham Terminal Railway (BHRR) *Effective February 1, 2012*
- Blue Ridge Southern (BLU) *Effective July 26, 2013*
- Cicero Central Railroad (CERR) *Effective September 23, 2015*
- Decatur and Eastern Illinois Railroad (DREI) September 2018
- Eastern Idaho Railroad (EIRR)
- Grand Elk Railroad (GDLK) March 8, 2009
- Ithaca Central Railroad (ITHR) December 8, 2018
- Jacksonville Port Railroad (JXPT) March 1, 2017
- Kanawha River Railroad (KNWA) July 29, 2016
- Kansas & Oklahoma Railroad (KORR)
- Kaw River Railroad (KAW) June 2004
- Louisiana Southern Railroad (LAS) September 25, 2005
- Lubbock and Western Railroad (LBWR) July 2015
- Mississippi Southern Railroad (MSR) April 4, 2005
- Palouse River & Coulee City Railroad (PCC)
- Ringneck & Western Railroad (RWRR) Effective May 25, 2021
- Savannah and Old Fort Railroad (SVHO) August 30, 2019
- South Kansas & Oklahoma Railroad (SKOL)
- Stillwater Central Railroad (SLWC)
- Texas and New Mexico (TXNR) July 2015
- Timber Rock Railroad (TIBR)
- Vicksburg Southern Railroad (VSOR) January 8, 2006
- Wisconsin & Southern Railroad Co. (WSOR) *Effective January 1, 2012*