

**SECTION G**  
**TECHNICAL SPECIFICATIONS**

**SECTION 240**  
**RAILROAD**

**240-1.01 DESCRIPTION.** The Contractor shall be responsible for all railroad trackwork and construction items associated with this project to the limits shown. All work on ARRC property shall be conducted in strict accordance with the requirements contained in the Standard Specifications for Work on Railroad Property. Unless otherwise specified, all track materials and work methods shall comply with the applicable standards contained herein.

**240-1.02 SUMMARY OF WORK.** The work involved in this project consists of, but is not necessarily limited to, the following activities:

1. Construction of two new 32' Railroad Crossing surfaces in Anchorage, AK on Electron Drive.

**240-1.03 DEFINITIONS.**

1. ARRC. Alaska Railroad Corporation.
2. AREMA. American Railway Engineering and Maintenance-of-Way Association.
3. W.C.L.I.B. West Coast Lumberman's Inspection Bureau.
4. FRA. Federal Railroad Administration.
5. DOT&PF. Department of Transportation and Public Facilities

**240-1.04 REFERENCED STANDARDS.**

1. ARRC Standard Plans.
2. AREMA Manual for Railway Engineering
3. AREMA Portfolio of Trackwork Plans
4. Alaska DOT&PF Standard Specifications for Highway Construction 2017 Edition
5. All standards listed in each section of these specifications but referenced thereafter by a basic designation only (e.g., AREMA), form a part of the specifications to the extent indicated by the reference. The most recent edition of the standard at the time of advertising shall apply.

**240-1.05 REFERENCED DRAWINGS.** The following Alaska Railroad Standard Plan Drawings are incorporated by reference herein and made a part of these specifications:

- 1.22-03 Main Track Construction Wood Tie Spacing and Rail Anchoring for 39' and 78' Rail Lengths,
- 2.21-03 Main Line Ballast Sections
- 2.78-06 Modular Crossing

**240-1.06 STORAGE.** Storage facilities shall be in areas designated by the Project Manager or Owner's Representative.

**240-1.07 CLEAN-UP.** At the end of each day's work, the job site shall be cleaned up and left in a neat and workman-like condition.

Before calling for a final inspection the entire premises shall be cleaned up to the satisfaction of the Project Manager.

All track materials that become the property of the contractor shall be removed immediately unless otherwise approved by the Project Manager.

**240-1.08 SURVEYING.** All surveying work necessary for the performance of this project shall be furnished by others.

**240-1.09 OWNERSHIP.** All track materials and crossing materials replaced by new materials will become the property of the Contractor, except as noted on the plans or in the specifications.

## SECTION 241

### RAILROAD BALLAST

**241-1.01 DESCRIPTION.** This work shall consist of furnishing, placing, tamping, and shaping railroad ballast and surfacing and lining new and existing track and turnouts, in conformance with the lines, grades and thickness' shown on the Plans.

**241-2.01 MATERIALS.** Prepared ballast shall be crushed shot rock or crushed pit-run rock, composed of hard, strong and durable particles, free from injurious amounts of deleterious substances and conforming to the following requirements:

AREMA mainline ballast Type 4A

Size	2-1/2"	2"	1-1/2"	1"	3/4"	3/8"	No. 200
Passing (%)	100	90-100	60-90	10-35	0-10	0-3	0-0.4

#### Manufacturing, Handling, Delivery, and Stockpiling of Material:

The ballast shall be manufactured, handled, delivered, stockpiled, and placed in such a manner that it is kept clean and free from segregation. Stockpiling of ballast will only be allowed over firm stable base areas. In order to minimize segregation ballast shall be stockpiled in more or less horizontal layers with no dumping over the sides of the stockpile allowed. Travel of construction machinery and other vehicles over the top of the stockpiles shall be kept at a minimum. Contractor will be responsible for the control of dust when hauling to and from stockpile.

### CONSTRUCTION REQUIREMENTS

**241-3.01 GENERAL.** Ballast dumped on subgrade prior to track or crossing construction shall be kept free from material tracked in by construction equipment. Ballast dumped on skeleton track and turnouts shall be distributed uniformly during the dumping operation to minimize the carrying or regulating required to provide the designed ballast section.

Contractor shall submit his plan for handling and placing ballast. This plan shall include source, type of equipment to be used (e.g., HyRail dump truck), location of stockpiles, and method of distribution.

#### **241-3.02 BALLAST PLACEMENT.**

1. Ballast shall be placed to the lines and grades indicated. The average thickness shall be within one-quarter inch of the thickness shown on the drawings. Ballast shall not be placed on soft, muddy, or frozen areas. Where the prepared subgrade (roadbed) is soft, muddy, rutted, exhibits severe depressions, or is otherwise damaged, the ballast shall not be placed until the damaged subgrade has been repaired and the Engineer has approved the area.

2. Forming of ruts that would impair proper drainage shall be prevented when distributing ballast from trucks and off track equipment. Any ruts formed greater than one (1) inch shall be leveled and graded to drain.
3. Ballast shall be unloaded as close as possible to the point of use so that unnecessary handling is prevented. Excess ballast shall be picked up and redistributed at the Contractor's expense. Ballast shall be handled in such a manner as to ensure it remains clean of deleterious materials and within specifications.
4. Minimum Ballast Depth: The minimum depth of ballast below the bottom of the tie shall be 12 inches.

### **241-3.03 TRACK TAMPING, SURFACING AND FINAL DRESSING.**

1. This work shall consist of shaping, tamping, surfacing and dressing of the ballast section on all new track and runoffs except that which is included in other work items.
2. PRELIMINARY SURFACING: The preliminary alignment and surfacing gangs shall follow the unloading of the ballast. Rail and tie installation, spiking, bolt tightening, and ballast placement shall be complete prior to commencement of surfacing and alignment work.
3. LIFTS: The track, after being aligned, shall be brought to grade, surfaced in lifts not to exceed 4 inches each and tamped. When using jacks, they shall be placed close enough together to prevent undue bending of rail or stress of rail and joint. Both rails shall be raised at one time and as uniformly as possible, except where superelevation is required. The track shall be lifted so that after a period of not less than 5 train operations after the last lift, it will be necessary to give the track a final lift of between 1 and 2 inches to bring it to grade.
4. Raising and tamping of track shall be performed with an automatic, vibratory, squeeze type power tamper with 16 tamping heads, capable of raising both rails simultaneously and maintaining cross level. The tamper shall be a Jackson 6300 Series, or approved equal, truss type tamper with lift, line and surface capability. The compacting equipment selected by the Contractor shall be subject to inspection and acceptance by the Engineer. Every tie in the track shall receive two or more full insertions of the tamping heads. Ballast shall be power-tamped under both sides of ties from each end to a point fifteen (15) inches inside each rail for 8 foot-6 inch ties and eighteen (18) inches for 10 foot ties. The center shall be filled with ballast, but tamping shall not be permitted in the center of the tie between the above stated limits. Both ends of the ties shall be tamped simultaneously and tamping inside and outside of the rail shall be done at the same time. Tamping tools shall be worked opposite each other on the same tie. Ballast under switch ties and road crossing ties shall be tamped the entire length of each tie but care must be taken not to "center bind ties". All ties shall be tamped to provide solid bearing against the base of the rail after the track or turnout is raised to grade at final surfacing. All down ties shall be brought up to the base of rail and shall be machine tamped. The resultant track surface and alignment shall be uniform and smooth. Tamping of track in snow or frozen ballast conditions shall not be permitted.
5. Contractor shall prepare for the Engineer's review and approval a detailed tamping procedure covering tamping equipment and methods. The specification shall include a complete description of equipment to be used and variables that can be adjusted such as:

- a. Number of insertions of tamping tools per tie.
  - b. Number of passes of tamping machine.
  - c. Depth of penetration.
  - d. Lifting capacity.
  - e. Lining capacity.
  - f. Year, make and model of tamping machine.
6. **SUPERELEVATION:** Curves shall be superelevated as shown on the Plans. Superelevation shall be obtained by raising the outside rail of the curve. The inside rail shall be maintained at grade. Full superelevation shall be carried throughout each curve, unless otherwise directed or shown on the drawings. Superelevation runoff to tangent shall be at a uniform rate, and shall extend at least the full length of the spirals.
  7. **REPLACEMENT OF TIES:** After tamping has been completed and the jacks removed, any damaged ties shall be removed and replaced. All ties pulled loose or replaced shall be restored to their proper position, re-spiked and re-tamped to provide full bearing against the rail, at no cost to the owner.
  8. **RUNOFF OF TRACK RAISES:** The runoff at the end of a raise shall not exceed one quarter (1/4) inch in sixty two (62) feet per CFR 49 part 213 Subpart C Track Geometry of track unless otherwise noted on the plan or approved by the Engineer. The track shall be surfaced 300' either side of the end of the crossing.
  9. **FINAL SURFACING:** After preliminary surfacing has been completed, grade and line stakes shall be checked and the track brought to final grade and alignment.
  10. **FINAL TAMPING:** Track shall be brought to grade and the ballast re-tamped in the manner described for preliminary surfacing, except that the tamping distance inside the rail shall be decreased from 12 to 10 inches for eight (8) foot ties, fifteen (15) to thirteen (13) inches for eight (8) foot-six (6) inch ties, and eighteen (18) to sixteen (16) inches for nine (9) foot and ten (10) foot ties.
  11. After final tamping is complete, ballast shall be dressed to the section indicated with a Fairmont C154BR ballast regulator, or approved equal, and all ballast removed from the top of crossties, tie plates and base of rail by the ballast regulator broom.
  12. Surplus ballast remaining after final surfacing and dressing of the ballast section shall be distributed or otherwise disposed of as directed by the Engineer.
  13. Upon completion of the work, the Contractor shall remove all rubbish, waste, and discarded materials generated by the work from the project area and dispose of in an approved manner as directed by the Engineer. Areas where the Contractor has worked, including but not limited to, project areas, material storage sites, and borrow or disposal areas shall be left in a clean, well-graded, and well-drained condition.
  14. One hundred–eighty (180) calendar days after the track has been accepted and put into operation, the Contractor shall perform, at no additional cost, necessary resurfacing adjustments to leave the track in alignment and on grade.

- 15. Completed track shall meet the following tolerances. Track not meeting the tolerances specified below shall be repaired to meet these requirements, at no additional cost.
  - a. **Gage:** Track gage shall be within plus or minus 1/8 inch of standard gage.
  - b. **Alignment:** Alignment shall be measured as the deviation of the mid-offset of a 62 ft line, with the ends of the line at points on the gauge side of the line rail, 5/8 inch below the top of the railhead. Either rail may be used as the line rail on tangent track; however, the same rail shall be used for the entire length of the tangent. The outside rail in a curve is always the line rail. Alignment on tangents shall not deviate from uniformity more than 1/2 inch. Alignment on curves shall not deviate from uniformity more than 3/8 inches.
  - c. **Track Surface:** Track surface shall meet the following requirements:
    - (1) The runoff at the end of a raise shall not exceed 1/4 inch for any sixty two (62) feet per CFR 49 part 213 Subpart C Track of rail.
    - (2) The deviation from design profile on either rail at the mid-ordinate of a 62 ft chord shall not exceed 1/4 inch.
    - (3) Deviation from design elevations on spirals shall not exceed 1/2 inch.
    - (4) Deviation from zero cross level at any point on tangent or from designated superelevation on curves or spirals shall not exceed 1/8 inch.
    - (5) The difference in cross level between any two points less than 62 ft apart on tangents, and on curves between spirals shall not exceed 1/8 inch.

**241-4.01 METHOD OF MEASUREMENT.** The work will be measured for payment under Section 241-5.01.

**241-5.01 BASIS OF PAYMENT.** Payment for Railroad Ballast includes the complete, in-place ballast material matching the typical cross section. No payment will be made for excess ballast, its recovery, and disposal.

Payment for Track Tamping, Surfacing and Final Dressing is for all trackwork, including runoffs, that are final surfaced, lined, dressed and broomed, and complete to finish tolerances. Payment will be made after inspection and acceptance.

Payment will be made under:

<b>PAY ITEM</b>		
<b>Item Number</b>	<b>Item Description</b>	<b>Unit</b>
241 (1)	Railroad Ballast	Ton
241 (2)	Track Tamping, Surfacing and Final Dressing	LS

## SECTION 242 TRACKWORK

**242-1.01 DESCRIPTION.** This work consists of furnishing and constructing track to the alignment and limits shown on the Plans. This work will also include removal of existing track and crossing materials at the proposed railroad crossings.

**242-2.01 MATERIALS.** The material shall conform to the current AREMA "Manual for Railway Engineering" and as detailed in this specification.

1. ARRC shall provide new premium/high strength rail: rail shall be 115 RE rail section, ends blank, in 80 foot in lengths, delivered to the jobsite. Rail shall either be head hardened or fully heat treated. Rail conforms to the latest revision of the AREMA Manual for Railway Engineering, Volume 1, Chapter 4, Rail, Specification for Steel Rail with the clarifications listed below.
2. Angle Joint Bars: ARRC shall provide angle joint bars shall be new 36 inch, headfree, standard toeless, 6 holes for use with 115 RE rail with hole spacing to fit rail drilling per AREMA Volume 1, Chapter 4, Section 2.8. Joint bars shall be quenched or medium carbon steel, rolled steel only, heat #16. Hole diameter shall be 1-1/8 in.
3. Rail Anchors: ARRC shall provide rail anchors for installation in wood tie areas only. Use new rail anchors sized to conform to the rail and "Specifications for Rail Anchors" in Chapter 5, Part 7 of the AREMA Manual. Use Unit V, drive-on type rail anchors for 115 RE, NO SUBSTITUTE. For 115 RE, width 1-3/32 in. x thickness 21/32 in. and weight 1.8 lb. Application shall be by a standard sledgehammer without the use of special tool or an anchor applicator to drive on. Packaging shall be in 50# bags containing 28 each with 75 bags per pallet, banded.
4. Tie plates for 5-1/2 in. rail base: ARRC shall provide PANDROL TPL-P26M, 5.5 x 7-3/4 in. x 15 in. with four 1 in. round holes and two 11/16 in. square holes. 1:40 cant.
5. Tie plates for 5-1/2 in. rail base for 115 RE Rail: ARRC shall provide 7-3/4 in. x 14 in. x 5-1/2 in. with A-8 punching, 3/4 in. square holes, 1:40 cant.
6. eClips: ARRC shall provide PANDROL Part Number ECL-2055 (right hand) for use with 141 RE or 115 RE rail and Pandrol tie plates. Shall be PANDROL Part Number E-2063 for concrete tie applications with angle joint bars.
7. J-Clips: ARRC shall provide j clips for use on wood ties with angle joint bars. Shall be PANDROL Part Number J-clip.
8. Screw spikes: ARRC shall provide new, PANDROL, 15/16 in. x 6 in. SQ HD, Washer Type Part No. 6619, 1.1 pound each. For use with 13/16-in. socket. Packaged 50 to bag. Requires 3/4-in. diameter x 6-in. deep pre-bore in hardwood ties.
9. Track Bolts, Nuts & Washers: ARRC shall provide bolts and nuts shall be new and manufactured in accordance with AREMA Volume 1, Chapter 4, Section 1.4 and 2.9. Bolts shall be 1-1/16 in. diameter x 6 inches long for a full nut, lockwasher and 2 threads exposed after tightening, but not to exceed a 1 in. exposure after tightening.
10. Nutlock, (a.k.a. Spring Washer) ARRC shall provide new, to fit 115 RE rail with thread diameter of 1-1/16 in. Product must conform to current AREMA Specifications Volume 1, Chapter 4, Section 2.10 for Spring Washers and ARRC Standard Plan #7.0. Packaging shall be in 50# pails containing 125 each, 36 pails per pallet.

11. Wooden Cross Ties: ARRC shall provide new cross ties treated 7-in. x 9-in. x 10 ft. Cross ties shall be manufactured in accordance with the current AREMA Manual for Railway Engineering, Chapter 3; W.C.L.I.B. Grading Rules #17, paragraph 192b; and this specification. Hardwood ties shall be used.
- a. Timber: Cross ties shall be sawn from sound, straight live timber, free from any defect that might impair durability and/or strength. Multiples or combinations will not be accepted. Cross ties shall be cut square at the ends and have all bark that impairs treatability entirely removed.
  - b. Stump Pull: Stump pulls will be graded the same as holes or splits in the end of a tie. Cross ties with a stump pull that goes into the interior more than 5 in. will be rejected.
  - c. Wane: Cross ties shall have a minimum 8 in. face. Minimum face specifications apply to the entire length of the cross tie. All wane shall be free of bark.
  - d. Knots: A knot exceeding in diameter 1/4 of the width of the surface on which it appears will be rejected if it occurs in the rail bearing area. Outside the rail bearing area, knots will be accepted up to a diameter of 1/3 of the surface on which they appear. A cluster of knots will be judged as being a large knot in damaging effect. Rail bearing area shall be defined as 20 in. to 40 in. from center of tie.
  - e. Cross Grain: Any cross tie with cross grain exceeding one in fifteen will be rejected.
  - f. Straightness: A cross tie will be considered straight when (1) a straight line along the top from middle of one end to middle of the other end is not closer than 3 in. from either side of tie, and (2) when a straight line along a side from middle on one end to the middle of the other end is everywhere more than 2 ½ in. from top or bottom of the tie.
  - g. Bark: Any cross tie containing more than a minimal amount of ingrown bark will be rejected.
  - h. Saw Kerf: A saw kerf is not required.
  - i. Mill of Manufacture Certification: A mill certification is required indicating that inspections have been performed and that the product is in conformance with specifications. The mill certification must also indicate the species of wood. All ties that pass the inspection will be clearly marked and identified as ARRC ties; unmarked ties will not be accepted.
  - j. Treatment: All treatment shall meet the specifications of the American Wood Preservers Association Standards Book C6 and the following guidelines. A treatment report shall be accurately completed for all charges and at a minimum shall contain the following:
    - (1) Charge number
    - (2) Date
    - (3) Wood species and size
    - (4) Total retort time in hours
    - (5) Conditioning time in hours
    - (6) Pressing time in hours



- (7) Retention in pounds per cubic meter
- (8) Average penetration to be shown for oak
- (9) Initial air time, if applicable
- (10) Gauge readings and times
- (11) Treating operator's signature
- (12) Seasoned condition (dry or green), if green show moisture content.
- (13) Final Vacuum
- (14) Wright of solution at 100 °F
- (15) Work tank number and cylinder number

The preservative shall consist of a mixture of 50 percent by volume of creosote oil and 50 percent by volume of residuum oil; 50/50 coal tar solution may also be used. Final readings shall be entered on the treating report. Treating reports and charts shall become a permanent record maintained by the treating company with open access to ARRC personnel.

- k. Care of Treated Wood: Extreme care shall be used in handling treated cross ties to avoid damage to the edges of the timbers or breaking through the treated portions and exposing untreated wood. The use of peavies, cant hooks, pickaroons, long hooks or pointed tools shall be such as not to break through the treated portion of the wood. If damage during handling which could potentially impair the longevity of material service life, this material shall then be retreated at the vendor's expense. All cost associated with retreatment, including oil, shall be the responsibility of the vendor.
- l. Boring: All cross ties shall be bored and adzed in conformance to the ARRC Standard Tie Boring and Adzing Plan 1.13. Adzing may be deleted if vendor will certify that ties furnished will be flat and provide a uniform bearing surface for the tie plates.
- m. Anti-splitting Devices: All hardwood cross ties shall have steel multi-nail anti-splitting end plates in accordance with the current AREMA Manual of Railway Engineering, Chapter 3, Section 1.8 titled "Ties and Wood Preservation", Section 1.9.2.3 titled "Nail Plates", and Section 1.10.3 titled "Nail Plates".
- n. Species: Acceptable hardwood species are Red Oak, White Oak, Hickory, Black Walnut, Gum, Beech, Ash, White Heart Sycamore, Hackberry and Hard Maple.

**242-3.01 CONSTRUCTION REQUIREMENTS.** Track construction shall be performed in accordance with the current ARRC Standards, AREMA Manual for Railway Engineering and as specified in this document. Scope of construction includes but is not limited to, unloading and distribution of track material, distribution and spacing of cross ties, laying, bolting and spiking rail, field welding of jointed rail, placing rail anchors, raising, aligning and tamping track, and shaping ballast to the design section. The rail for the crossing panels shall be box anchored to the ties prior to moving the panels.

Construction procedures and methods shall be employed that keep the railroad sub-ballast and ballast sections from becoming rutted or disturbed and any operation that causes damage shall be stopped immediately. Alternate construction methods shall be instituted.

All existing track and crossing material removed will become the property of the Contractor, unless stated otherwise in these documents. These materials shall be removed from the ARRC right-of way.

**242-3.02 TRACK ALIGNMENT AND GEOMETRY.** The track shall be constructed to the alignment and profile indicated, or as adjusted by the Project Manager, within the tolerances specified. Contractor shall designate right or left rail, while facing in the direction of increasing stationing, to control the grade of all tangent tracks on a contract-wide basis. Low rail on curves shall be the profile grade rail. High rail on curves shall be the line rail.

**242-3.03 TOLERANCES.** Deviations from indicated gage, cross level, horizontal line, profile grade, and tie spacing shall conform to the following requirements:

1. Gage: Shall be 4 ft-8 ½ in. plus or minus 1/8 in.
2. Cross Level and Superelevation: Shall be plus or minus 1/8 in. from level on tangent or design superelevation on curve.
3. Deviation from Horizontal Alignment: Plus or minus ¼ in. in a 62 ft chord. Plus or minus ½ in. total except in road crossings where total deviation shall be plus or minus ¼ in.
4. Deviation from Profile Grade: Shall not exceed plus or minus ¼ in. in 62 ft chord or a total of plus or minus ½ in.
5. Tie Spacing: Distance between centerline on adjacent ties shall be 19 ½ in. for wooden cross ties and 24 in. for concrete ties and not vary more than plus or minus 1 in. from the indicated spacing, with the additional requirements that 48 wooden ties shall be installed per 78 ft of track.
6. Acceptance: Final track alignment will be accepted only after ARRC traffic has used the new track and alignment for 3 weeks.

**242-3.04 CROSS TIE DISTRIBUTION.** Contractor shall receive cross ties from ARRC's Anchorage Warehouse and transport them to the work area in accordance with the AREMA "Handling of Ties from the Tree into the Track" for wooden ties and "Recommended Practices for Shipping, Handling, Application and Use" for concrete ties. Ties shall be placed on a smooth, compacted surface as specified herein, spaced as shown within specified tolerances, and laid normal to the centerline of track with heartwood face down. Line ends of ties in trackage shall be aligned uniformly on the right side of track when facing increased stationing.

**242-3.05 TIE PLATES AND SCREWS.** Tie plates shall be attached to the cross ties with line and hold-down screws to the indicated patterns. Contractor may pre-plate cross ties prior to distribution. If Contractor chooses to pre-plate the cross ties, he shall furnish any additional material required at no added cost to Owner. Contractor shall use a jig to compensate for fabrication tolerances to achieve track gage tolerances.

**242-3.06 RAIL LAYING.** Rail shall be laid in accordance with the details and procedures that follow:

1. Rail Distribution: Rails shall be distributed along the roadbed with the head of the rail up and in such a manner and using equipment that will prevent damage to them. Dropping rails from the sides of railcars or trucks will not be permitted. Where continuous welded rail is to be used, the use of the rollers is recommended to facilitate its unloading and reduce the risk of dislocating ties and tie pads. Rail shall not be brought into contact with the tie ends during installation. Where rail heaters are used, care should be taken to prevent damage to pads and insulators.

2. Rail Laying: The base of the rail and surface of the tie and tie plate shall be cleaned prior to laying. Rails shall be laid one at a time without bumping or striking. Rail ends shall be brought squarely together against the expansion shims and completely bolted before spiking. Rails shall be laid so that the joints in opposite rails are staggered not less than 20 ft apart, plus or minus 24 in., except closer joints may be required at turnouts or roadway crossings. Rails of less than standard length shall be used to space the joints on curves. Rails shorter than 15 ft shall not be used. Rail shall be laid or welded so that no joints are in grade crossings.
  
3. Rail Cutting and Drilling: Rails shall be cut square and clean by means of rail saws. Holes for complete bolting of cut rail shall be precisely marked, center punched, and drilled using an exact template for alignment. In no instance shall marking through or drilling through joint bars be allowed. Holes shall be deburred. New holes shall not be drilled between two holes already drilled. Burning or cutting of rails or bolt holes by means of an acetylene torch will not be permitted. All cut rail ends shall be beveled at the head and be hardened to conform to AREMA "Manual Specifications for Steel Rails", Supplementary Requirement S1.
  
4. Rail Joints: The fishing surface of the rails and joint-bars shall be wire-brushed to remove rust before assembly. Allowance for rail expansion shall be made at all joints by the use of expansion shims placed between the ends of adjacent rails. The proper expansion allowance shall be determined by the use of the following table. Refer to AREMA chapter 5, paragraph 5.3.1 for shim thickness to use for 39 ft rail.

Rail Temperature °F	Shim Thickness in inches for 78 ft- 80 ft rail
Below 35	5/16
35-47	1/4
48-60	3/16
61-73	1/8
74-85	1/16
Over 85	None

For shorter lengths of rail, proportionate shim thickness shall be used. The temperature of the rails shall be determined by the use of an AREMA standard rail thermometer, placed on the base of the rails close to the web on the side shaded from the sun. Sufficient time shall be allowed to accurately record the temperature. Care shall be taken to assure that shims are not squeezed or damaged during installation of shims or rails. Shims shall be removed from between rail ends as soon as the bolts have been tightened and the rail anchors applied. All track bolts shall be installed when the rail is laid and tightened before spiking.

Final bolt tension shall be between 20,000 and 30,000 lbs. Bolts shall be tightened once, at the time of rail installation. Final tension shall be checked and adjusted as necessary just prior to final acceptance per AREMA chapter 5, paragraph 5.5.2.

5. Rail Anchoring: Rail anchors shall be located 300' each side of the crossing Pandrol plated ties as indicated on ARRC standard plan No. 1.22-03. Under CWR on wood ties every other tie shall be box anchored. The rail anchors shall be placed uniformly along the rail length. Rail anchors shall be installed to the gage side of the rail against the same tie face on the opposite rail. Rail anchors shall grip the base of the rail firmly and shall have full bearing against the face of the tie. Rail anchors shall not be moved by

driving them along the rail. Where PANDROL Clips are used rail anchors are not required except in crossings.

6. Mainline tie-in points: When tying into jointed rail on wood ties, every tie in the jointed rail for a minimum distance of 300 feet beyond the tie-in point shall be box anchored. When tying into CWR on wood ties every tie for a minimum distance of 100 feet beyond the tie-in point shall be box anchored. Field welds for rail on wood ties shall be box anchored for 100 feet on either side of the weld.

#### **242-3.07 THERMITE WELDING.**

1. Rails shall be cut square and clean by means of rail saws and cleaned a minimum distance of six (6) inches from the end with a torch (take care not to overheat the rail) and wire brush to free the area of grease, rust, and other foreign materials, along with any other recommendations of the welding kit manufacturer.
2. No holes shall be permitted in the rail.
3. All welds giving fault indication by ultrasonic inspection, magnetic particle inspection or visible inspection shall be replaced at no expense to ARRC. This includes the addition of a rail plug and the additional welds.
4. Any additional work associated with attempting and failing to make a successful weld, resulting in a rail plug and two welds shall be at Contractor's expense.
5. Contractor shall inform the Owner's Representative daily of the location of completed welds to facilitate the testing and inspection by the Owner's Representative. All thermite welds performed under this contract shall be listed on a Daily Thermite Welding Report.
6. See attached CWR Form for reporting thermite welds.
7. Contractor and Owner's Representative will visually inspect all welds for surface cracks. Welds with surface cracks visible to the eye shall not be acceptable.
8. Contractor shall furnish all equipment and material required in the production of thermite welds. Note: ARRC shall furnish Orgo Thermite welding kits and materials required to perform the thermite welds.
9. **Contractor shall have a current thermite welding certificates for performing Orgo Thermite welds. Contractor must present certificates prior to starting work.**
10. **Welding shall be done in accordance with Chapter 4, Part 2 of AREMA Manual, articles "Thermite Welding Rail Joints and Specifications for Fabrication of Continuous Welded Rail", except as modified by these specifications.**
  - a. The faces of the rail ends shall be arranged at right angles by cutting or grinding and shall be further cleaned to remove all scale and rust.
  - b. The ends of the rails to be welded shall be properly gapped and aligned to produce a weld, which shall conform to the specified alignment tolerances. No dip in the rails shall be allowed. Refer to Section 242-3.08 for "Detail of Max. Vertical Offset" and "Tolerances for Thermite Welds".
  - c. Before preheating check the rail temperature with a rail thermometer if the rail temperature is below thirty five (35) degrees Fahrenheit, the following procedures shall be followed to ensure that a proper preheat is made.

- i. Both rails must have supplemental heat applied to raise the rail temperature to provide for controlled cooling.
  - ii. The length of rail to be supplementally heated shall be between thirty (30) and thirty six (36) inches for rail temperatures from thirty five (35) down to fifteen (15) degrees Fahrenheit.
  - iii. A rail puller shall be placed on the rail to maintain the correct gap and crown unless temperature conditions are such that the possibility of rail movement is eliminated.
  - iv. If a change in rail temperature is anticipated while the weld is being poured or while it is cooling, the rail expander should be adjusted to compensate for any stresses, which would occur at the weld due to a change in temperature.
  - v. Depending upon the type of change expected, one of the following procedures will assist in preventing temperature induced stresses from affecting the quality of the weld:
    1. Rail temperature is low and a raise in temperatures is anticipated the rail expander should be set to expand the gap and enough pressure built up to cause a slight increase in the gap. This should prevent any subsequent decrease in gap width.
    2. Rail temperature is high and a drop in temperature is anticipated the rail expander should be set up to pull and enough pressure built up to cause a slight subsequent decrease in width.
    3. Whenever either of the above procedures is required, the final gap width shall be as stated in the manufacturer's instructions for the rail weight being welded.
11. The rail puller shall remain on the rail until the weld is complete and has cooled to seven hundred (700) degrees Fahrenheit. This is verified when the center of the weld around its entire periphery will not melt a 700 degree Fahrenheit temperature stick.
  12. When the rail puller is removed it shall be released in a gradual manner.
  13. Rail ends shall be preheated prior to welding to a sufficient temperature and for a sufficient time to ensure full fusion of the weld metal to the rail ends without cracking of the rail or weld, per manufacturer's instructions.
  14. The mold shall be left in place after tapping for a sufficient time to permit complete solidification of the molten metal and proper slow cooling to prevent cracking and provide a complete weld with the proper hardness and ductility.
  15. The completed weld shall be finished by mechanically controlled grinding to conform to the same requirements specified for shop welding including grinding under the base.
  16. Wearing protective clothing and safety equipment is required during welding operations.
  17. Never dump hot slag on wet soil, wet ballast or into water.

18. On curves where the slag basin is placed on the low side, the plug portion of the mold shall be filled so that it is horizontal when placed in the mold and will cause the molten metal to flow equally to both sides of the mold.
19. Thermite welds shall not be made within three (3) feet of another thermite weld or within twelve (12) inches of a plant weld or within two and one half (2-1/2) feet from the end of a bonded joint without written approval by the Owner's Representative.
20. Contractor shall re-space cross ties as necessary to prevent a weld from sitting on a tie. The cost incurred by Contractor to re-space the crossties will be considered incidental to the cost of completing a thermite weld. It is acceptable to cut the rail in order to prevent a weld from sitting on a tie.
21. Contractor shall tamp and dress track, as necessary, to provide firm support at the weld.
22. Contractor shall plug and re-drive all necessary spikes.
23. Contractor shall properly re-apply and adjust anchors as necessary to conform to anchor pattern.
24. Contractor shall clean up all waste from the field welding process and shall dispose of all superfluous materials.
25. If Contractor chooses to weld joints prior to the rail being laid, de-stressed and anchored, then joints will need to be spaced approximately every fourteen hundred (1,400) feet to provide for the thermal adjustment that will occur before it is anchored. Any variance from this shall have the written approval of the Owner's Representative. If approval has not been given and Contractor has welded the rail then Contractor shall, at its cost, cut and re-weld the rail at approximately fourteen hundred (1,400) foot intervals.
26. No payment will be made for additional welds created by avoidable plugging, without written authority of the Owner's Representative.

#### **242-3.08 WELD FINISHING AND TOLERANCES.**

1. Welded joints in the finished track shall be brought to a true surface and alignment by means of a proper grinding or planing machine (shear). Finish grinding shall be performed with an approved profile grinder operated by a skilled workman grinding evenly and leaving the joints in a smooth and satisfactory condition. Finishing shall eliminate all cracks. Mechanically controlled grinding in conformance with the following requirements shall finish the completed weld:
  - a. Maximum vertical offset: The maximum vertical offset in the vertical plane shall be no greater than 0.060 inches measured 1 inch from the weld fusion line.
  - b. Combined vertical offset and crown: The maximum combined vertical offset and crown shall be no greater than 0.060 inches.
  - c. Dip camber: No dip camber is allowed. Contractor shall remove and replace any sections of rail with dip camber at his own expense.
  - d. Horizontal offset: The maximum horizontal alignment offset shall be no greater than 0.030 inches.

- e. Horizontal offset and kink (to gage side of rail): The maximum horizontal alignment offset and kink shall be no greater than 0.030 inches.
- f. Horizontal offset and kink (to field side of rail): The maximum horizontal alignment offset and kink shall be no greater than 0.015 inches.
- g. Measurements shall be made with an approved 36-inch straight edge and taper gauge.

**242-3.09 WELD QUALITY.** Each completed weld shall have full penetration and complete fusion and be entirely free of cracks or fissures. Welds shall meet the acceptance criteria given in AWS D1.1.

Quality control testing is required on all welds. The contractor shall supply the ARRC with certified ultrasonic weld test results prior to the demolition of the existing crossing and prior to the installation of the crossing into the mainline.

Contractor shall guarantee welds for a period of 12 months after final acceptance date.

**242-3.10 WELD NUMBERING.** The Contractor shall semi-permanently mark a sequential weld number on the rail immediately adjacent to the weld, using a quality lead paint marker at the time the weld is made. Welds shall be numbered sequentially in the order in which they are made. The Owner will provide the Contractor with the initial weld number. Defective welds, which are replaced, shall be assigned a new sequential number by adding a letter to the defective weld number (e.g., defective weld 347 would be replaced by 347A).

**242-3.11 WELDING SUPERVISION.** A certified welder shall perform welding under the direct supervision of an experienced welding supervisor or foreman and be certified by the manufacturer of the welding equipment.

**242-3.12 WEATHER CONDITIONS.** Welding shall not be performed in rain, snow, or other inclement weather without adequate protection of the welding from the elements. If using field welds, welding shall not be performed below minimum ambient temperature recommended by the manufacturer.

**242-3.13 NOT USED.**

**242-3.14 TRACK CONSTRUCTION SUBMITTALS.**

1. **Thermite Welding Procedures:** A detailed statement covering the step-by-step procedures to be employed in making the welds, including a complete description of each of the following items, as applicable, and any other essential characteristics included in the welding procedures.
  - a. The manufacturer's trade name for the welding process.
  - b. The method used for cutting and cleaning the rail ends. Flame cutting of rail ends shall not be allowed.
  - c. The minimum and maximum spacing between rail ends.
  - d. The method used for maintaining the rails in alignment during welding.
  - e. The method used for preheating, including time and temperature.

- f. The tapping procedure, including the minimum time required to cool the weld under the mold insulation.
  - g. The method used, including a description of special tools and equipment, for removing the upset metal and finishing the weld to the final contour.
  - h. Quality control procedures to be followed.
  - i. The contractual agreements with any subcontractor employed by the Contractor in doing the work.
2. **Record of Field Weld:** A welding record of each field weld on forms provided by the ARRC. The original copies of the form bearing the signatures and initials of personnel involved shall be submitted as part of the Project Record Documents.

**242-4.01 METHOD OF MEASUREMENT.** Railroad trackwork will be measured by the foot along the centerline of track beginning at the centerline of the first cross tie and ending at the centerline of the last cross tie and includes all other track materials (OTM) such as joint bars, spikes, tie plates and miscellaneous materials not identified by a separate unit price elsewhere in these specifications.

Welds and Ultrasonic testing and certification of the welds are incidental to trackwork and no separate pay item will be made.

**242-6.01 BASIS OF PAYMENT.** The accepted quantity of trackwork will be paid for at the contract unit price, as a lump sum pay item shown in the bid schedule, complete in place.

Pay Item	Pay Unit
242(1) Track Installation	LS



## SECTION 243

### TRACKWORK REMOVAL

**243-1.01 DESCRIPTION.** This work consists of dismantling and removing track and crossings from the existing roadbed. This work also includes grading and reshaping the existing railroad embankment to natural contours. All removed trackwork materials, unless otherwise specified on the plans or in these specifications, shall become the property of the contractor.

#### 243-2.01. NOT USED

### CONSTRUCTION REQUIREMENTS

**243-3.01 GENERAL.** Remove all trackwork and grade crossings that are retired from service as a result of the new track construction.

**243-3.02 ROADBED CLEANUP AND SHAPING.** After all track material has been removed and debris and tie remnants removed, the remaining ballast shall be excavated and removed in preparation of the subgrade.

**243-3.03 MISCELLANEOUS MATERIALS.** Spikes, bolts, nuts, and washers and other miscellaneous track parts such as gauge rods shall become the property of the contractor.

**243-4.01 METHOD OF MEASUREMENT.** Trackwork removal shall be measured by the track-foot along the centerline of track beginning at the centerline of the first crosstie and ending at the centerline of the last cross tie for each track removed. Removal of crossings, pavement, and miscellaneous railroad materials shall be incidental to this work and will not be measured for payment.

**243-5.01 BASIS OF PAYMENT.** The accepted quantity of work will be paid for at the contract unit price, per track foot from the center of the first cross tie to the center of the last. All required grading and shaping of existing track embankment and removal of existing crossings shall be subsidiary to Item 243 (1) Trackwork Removal.

Payment will be made under:

Pay Item	Pay Unit
243(1) Trackwork Removal	LS

**SECTION 244  
RAILROAD CROSSINGS**

**244-1.01 DESCRIPTION.** Construct modular crossing per ARRC Standard Plan 2.78-06 including all work associated with the crossing.

**244-1.02 MATERIALS.** Use material conforming to Subsection 693-1.04 Referenced Standards and the following:

**CONSTRUCTION REQUIREMENTS.**

**244-2.01 Railroad Crossing – Modular.**

Construct modular crossing in accordance with the requirements of 240 Railroad, Section 241 Railroad Ballast, Section 242 Trackwork, Section 243 Track Removal, and AREMA Manual Part 8.

The Contractor shall:

- a. Remove existing modular crossing.
- b. Remove existing tracks and ties as required for the new track panel;
- c. Excavate and remove existing crushed stone ballast at the crossing;
- d. Install new, non-jointed 115 RE rail within the road crossing and for at least 19.5 feet on either side of the crossing;
- e. Resurface tracks and raise to design line and grade at the modular crossing;
- f. Install modular crossing panels per the manufactures recommendations.

**244-3.01 METHOD OF MEASUREMENT.**

Railroad Crossing - Modular. Completed in place and accepted.

**244-4.01-5.01 BASIS OF PAYMENT.**

Railroad Crossing – Modular. All work to provide a complete and functional railroad crossing is included in the Railroad Crossing - Modular, including but not limited to, removal items, excavation, backfill, mainline and industry trackwork, modular crossing panels, miscellaneous track materials, and as described below:

1. Crossing Panel Installation: Payment includes removing the existing crossing panels, constructing a new modular crossing on the mainline track.

Payment will be made under:

<b>Pay Item</b>	<b>Pay Unit</b>
244 (1) Crossing Panel Installation	LS

