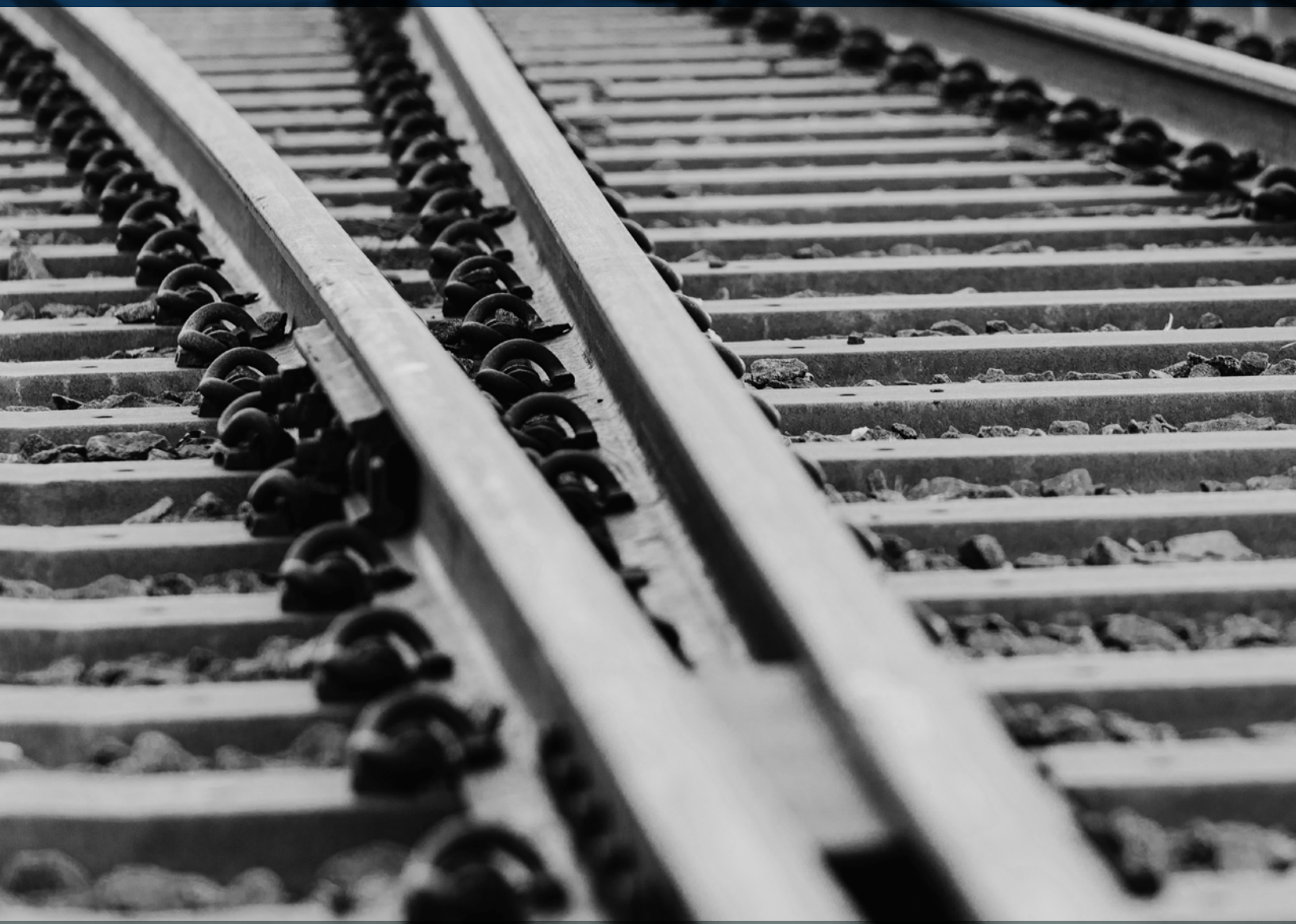
NARSTCO

THE PREFERRED STANDARD

ASSEMBLY INSTRUCTIONS FOR
STEEL TIES AND TURNOUTS



NARSTCO Corporate Office

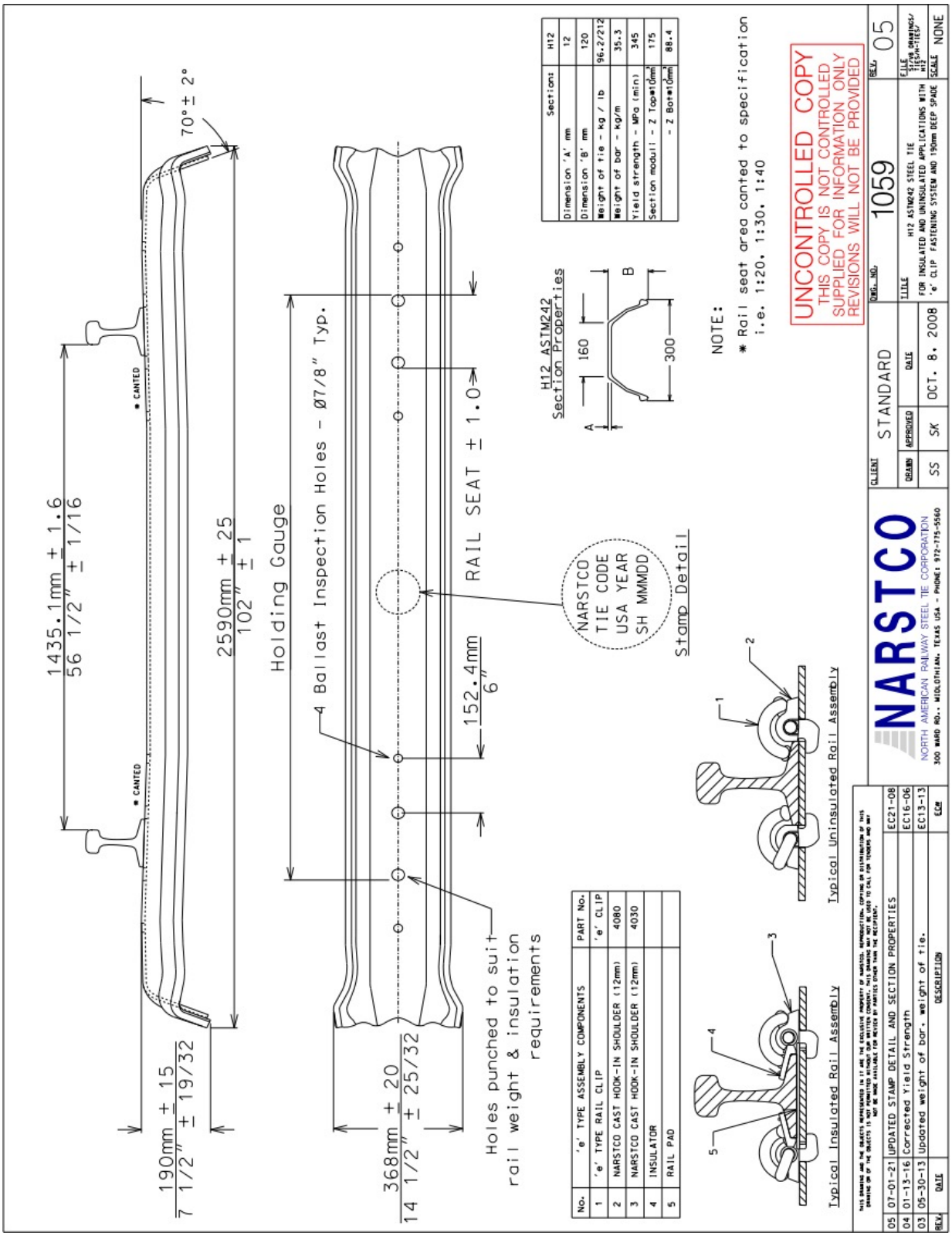
300 Ward Road | Midlothian, TX 76065

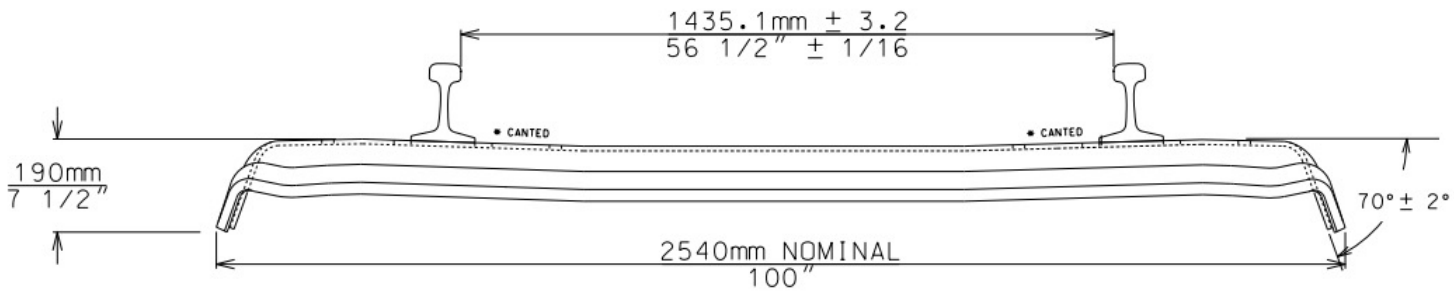
Tel: 972.775.5560 | Fax: 972.775.5514

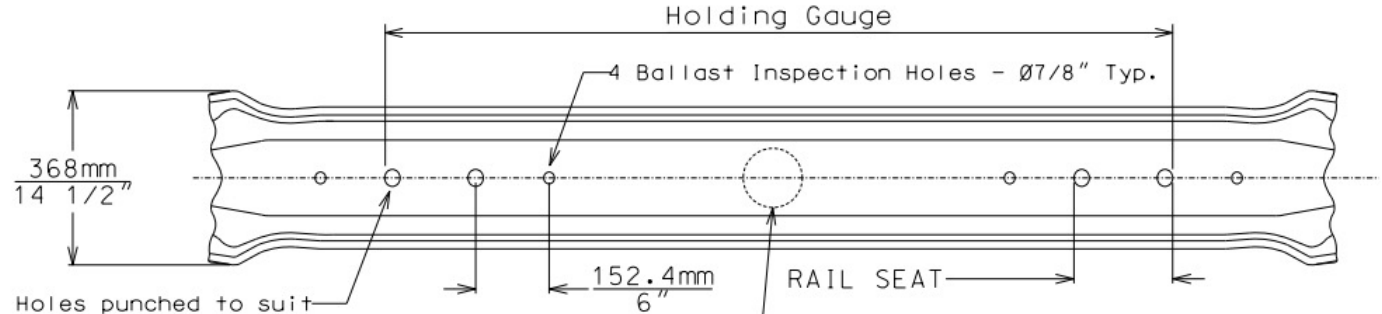
Additional information on our products and contacts is available on www.narstco.com

INDEX

SECTION 1 – Sample Drawings for Ties & Turnout Assembly Details





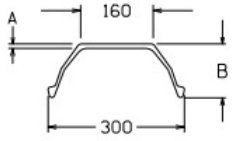


No.	'e' TYPE ASSEMBLY COMPONENTS	PART No.
1	'e' TYPE RAIL CLIP	'e' CLIP
2	NARSTCO CAST HOOK-IN SHOULDER (10mm)	4020
3	NARSTCO CAST HOOK-IN SHOULDER (10mm)	4010
4	INSULATOR	
5	RAIL PAD	

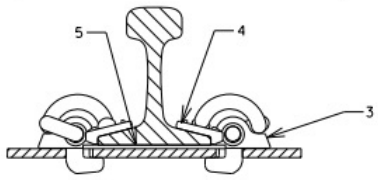
NARSTCO
TIE CODE
USA YEAR
SH MMMDD

Stamp Detail

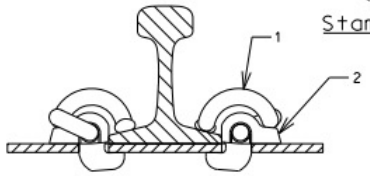
H10 ASTM242
Section Properties



Section:	H10
Dimension 'A' mm	10
Dimension 'B' mm	118
Weight of tie - kg / lb	81.8/180
Weight of bar - kg/m	30.8
Yield strength - MPa (min)	345
Section moduli - Z Top*10^{3}mm^3	153
- Z Bot*10^{3}mm^3	79.7



Typical Insulated Rail Assembly



Typical Uninsulated Rail Assembly

NOTE:

* Rail seat area canted to specification
i.e. 1:20, 1:30, 1:40

UNCONTROLLED COPY
THIS COPY IS NOT CONTROLLED
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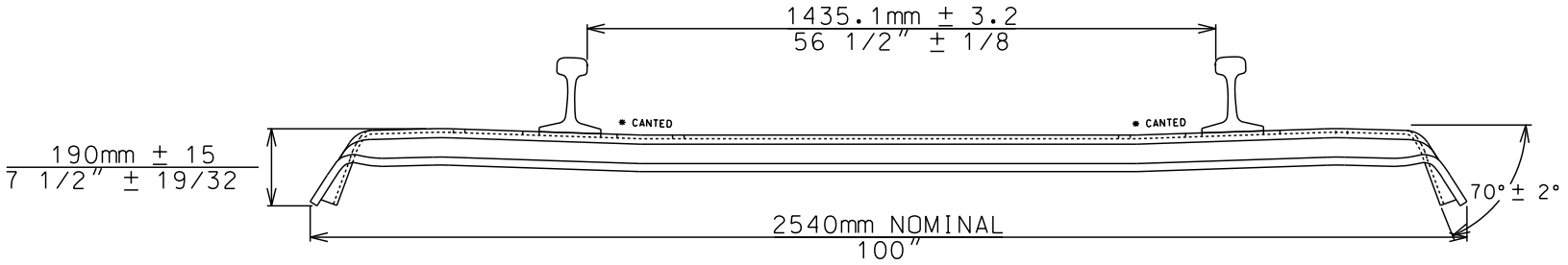
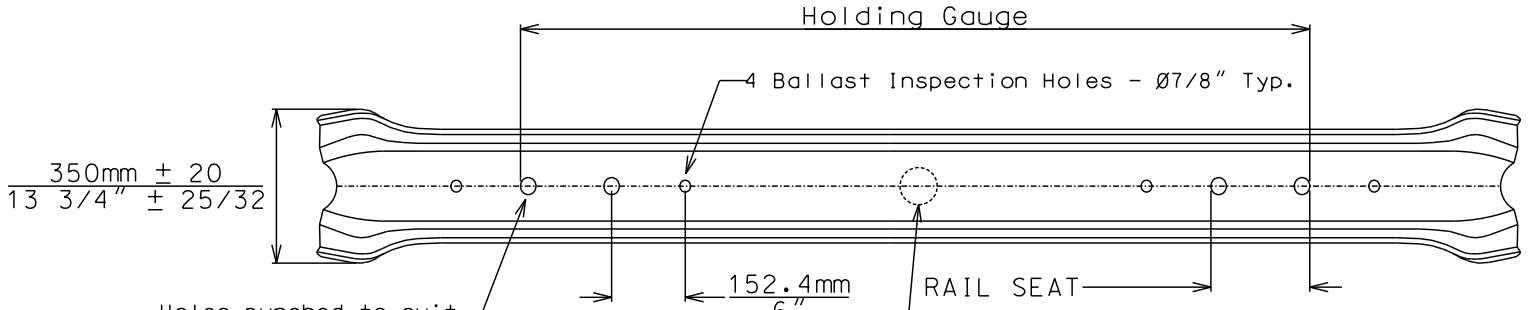
REV.	DATE	DESCRIPTION	ECN
06	4-30-21	UPDATED STAMP DETAIL AND SECTION PROPERTIES	EC21-04
05	4-15-16	Section properties updated	EC16-21
04	8-15-14	Rail gage tolerance updated	EC14-11

NARSTCO
300 WARD RD., MIDLOTHIAN, TEXAS USA - PHONE: 972-775-5560

CLIENT	STANDARD			DWG. NO.	1068	REV.	06
DRAWN	APPROVED	DATE	TITLE	H10 ASTM242 STEEL TIE FOR INSULATED AND UNINSULATED APPLICATIONS WITH 'e' CLIP FASTENING SYSTEM AND 190mm DEEP SPADE		FILE	S:/V8 DRAWINGS/TIES/H-TIES/H10
SS	SK	JULY 30, 2010				SCALE	NONE



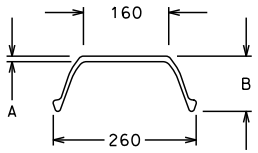


No.	'e' TYPE ASSEMBLY COMPONENTS	PART No.
1	'e' TYPE RAIL CLIP	'e' CLIP
2	NARSTCO CAST HOOK-IN SHOULDER (10mm)	4020
3	NARSTCO CAST HOOK-IN SHOULDER (10mm)	4010
4	INSULATOR	
5	RAIL PAD	

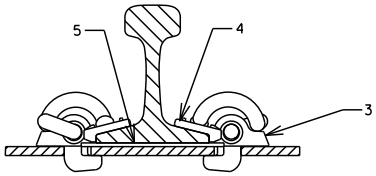
NARSTCO
TIE CODE
USA YEAR
SH MMMDD

Stamp Detail

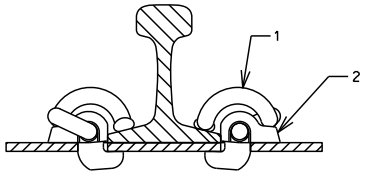
M10 ASTM242
Section Properties



Section:	M10
Dimension 'A' mm	10
Dimension 'B' mm	100.3
Weight of tie - kg / lb	71/156
Weight of bar - kg/m	26.7
Yield strength - MPa (min)	345
Section moduli - Z Top*10³mm³	115.2
- Z Bot*10³mm³	51.8



Typical Insulated Rail Assembly



Typical Uninsulated Rail Assembly

NOTE:

* Rail seat area canted to specification i.e. 1:20, 1:30, 1:40

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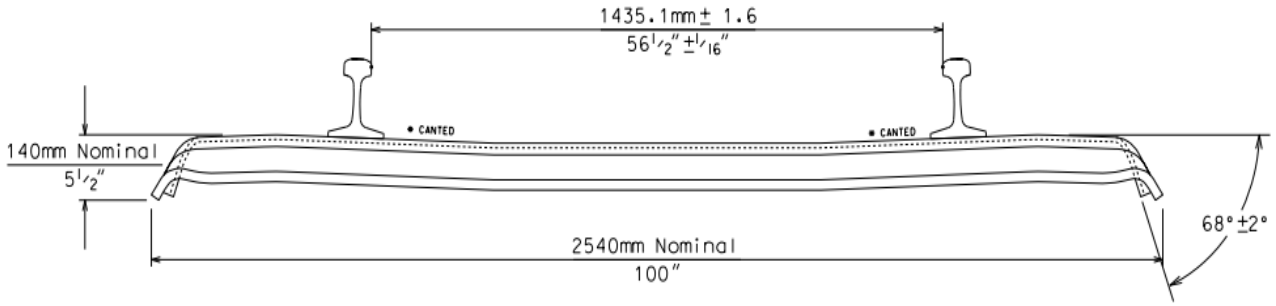
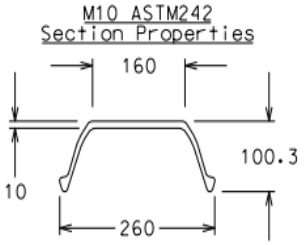
REV.	DATE	DESCRIPTION	EC#

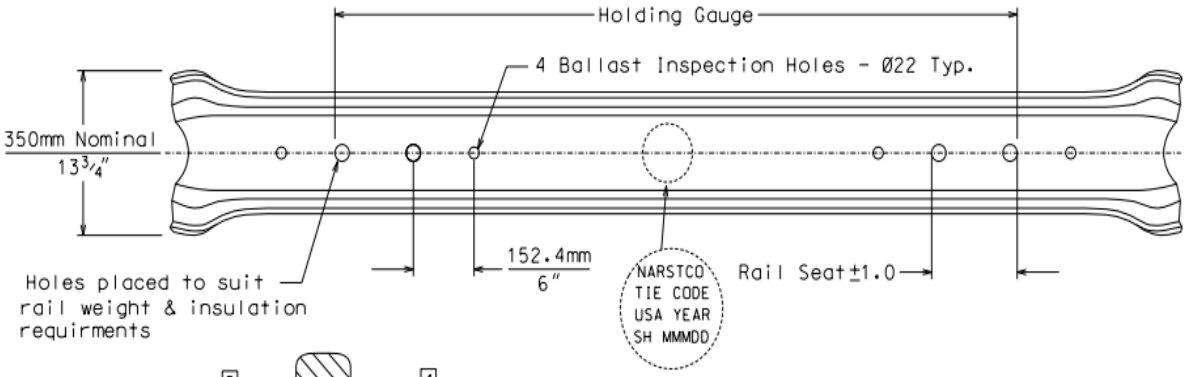
NARSTCO
300 WARD RD., MIDLOTHIAN, TEXAS USA - PHONE: 972-775-5560

CLIENT	STANDARD		DWG. NO.	1602	REV.	00
DRAWN	APPROVED	DATE	TITLE	M10 ASTM242 STEEL TIE FOR INSULATED AND UNINSULATED APPLICATIONS WITH 'e' CLIP FASTENING SYSTEM AND 190mm DEEP SPADE	FILE	S:/V8 DRAWINGS/TIES/M-TIES/M10
ZM	SS	FEB 9, 2022			SCALE	NONE



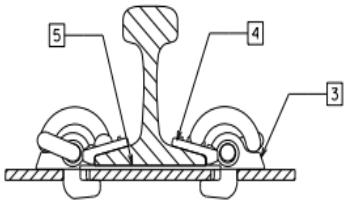


Weight of tie - kg / lb	70/154
Weight of bar - kg/m	26.7
Yield strength - MPa (min)	345
Section moduli - Z Top*10³mm³	115.2
- Z Bot*10³mm³	51.8



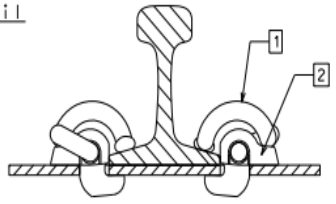
Stamp Detail

No.	'e' TYPE ASSEMBLY COMPONENTS	PART No.
1	'e' TYPE RAIL CLIP	'e' CLIP
2	NARSTCO CAST HOOK-IN SHOULDER (10mm)	4020
3	NARSTCO CAST HOOK-IN SHOULDER (10mm)	4010
4	INSULATOR	
5	RAIL PAD	



Typical Insulated Rail Assembly

NOTE: M8 TIE NOT AVAILABLE WITH INSULATED RAIL ASSEMBLY



Typical Uninsulated Rail Assembly

* Rail seat area canted to specification
i.e. 1:20, 1:30, 1:40

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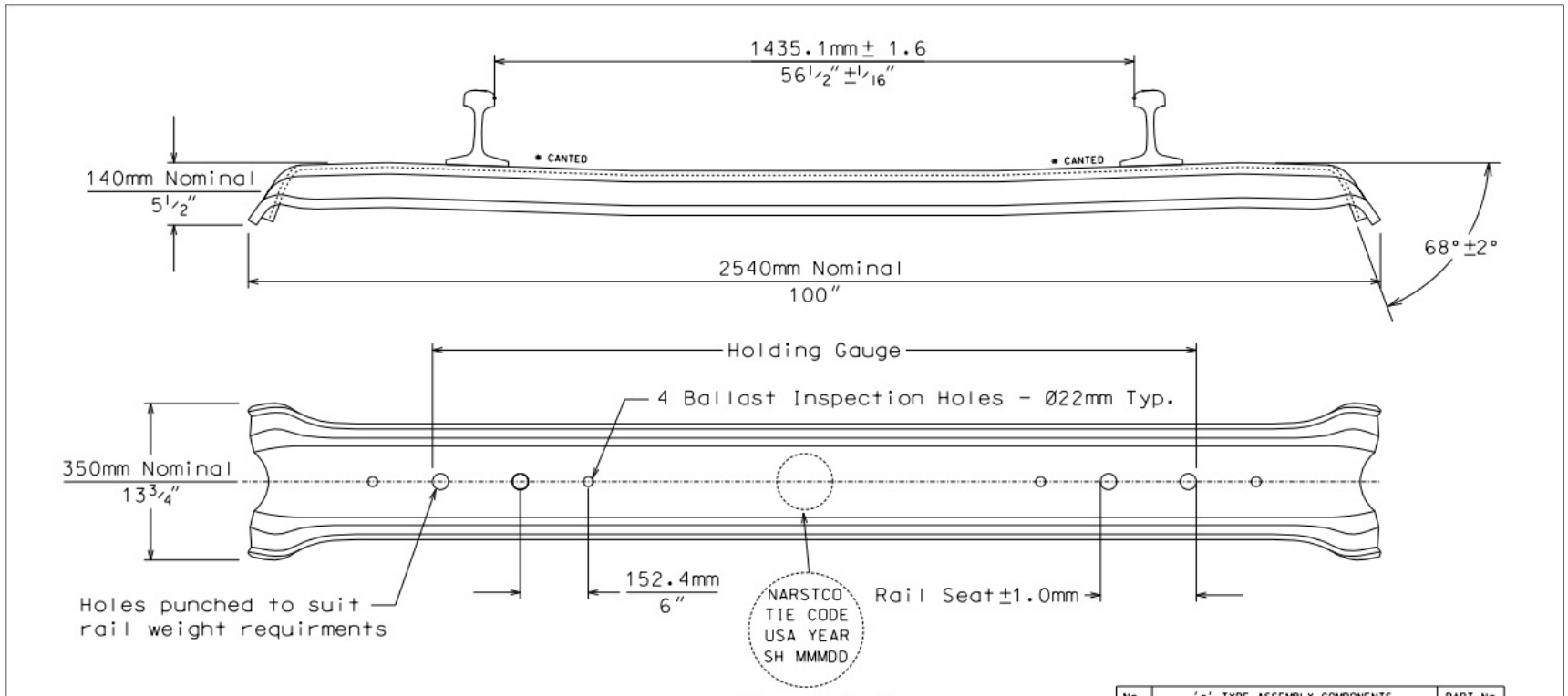
REV.	DATE	DESCRIPTION	EC#
01	4/30/21	UPDATED STAMP DETAIL AND SECTION PROPERTIES	EC21-04

NARSTCO
300 Ward Road, Midlothian, TX USA - Phone: 972-775-5560

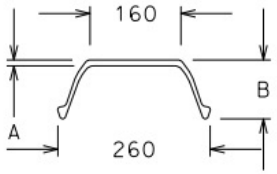
CLIENT			DWG. NO.	REV.
STANDARD			1586	01
DRAWN	APPROVED	DATE	TITLE	FILE
ZM	LF	JAN 27 2020	M10-SECTION ASTM242 STEEL CROSS TIE. INSULATED AND UNINSULATED APPLICATIONS WITH CAST HOOK-IN SHOULDERS FOR 'e' TYPE CLIPS.	SCALE NONE



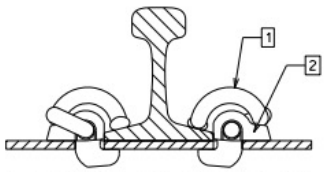
Stamp Detail

No.	'e' TYPE ASSEMBLY COMPONENTS	PART No.
1	'e' TYPE RAIL CLIP	Ne1
2	NARSTCO CAST HOOK-IN SHOULDER (8mm)	4040

M8 ASTM242
Section Properties



Section:	M8
Dimension 'A' mm	8
Dimension 'B' mm	98.3
Weight of tie - kg / lb	58/128
Weight of bar - kg/m	22.2
Yield strength - MPa (min)	345
Section moduli - Z Top*10mm³	97.4
- Z Bot*10mm³	45.7



Typical Uninsulated Rail Assembly

* Rail seat area canted to specification i.e. 1:20, 1:30, 1:40

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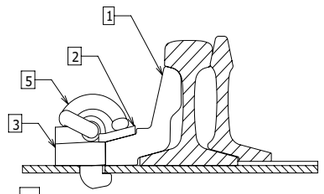
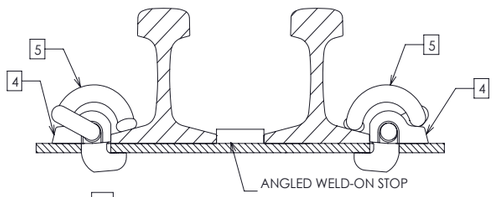
REV.	DATE	DESCRIPTION	
01	4/30/21	UPDATED STAMP DETAIL AND SECTION PROPERTIES	21-04

NARSTCO
NORTH AMERICAN RAILWAY STEEL TIE CORPORATION
300 Ward Road, Midlothian, TX USA - Phone: 972-775-5560

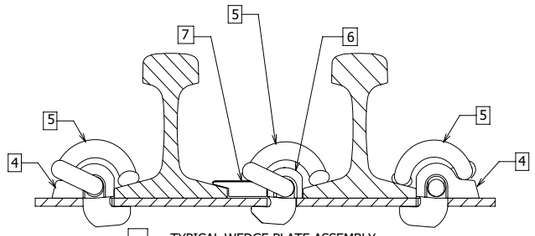
CLIENT			DWG. NO.	REV.
STANDARD			1567	01
DRAWN	APPROVED	DATE	TITLE	FILE
SS	LF	APRIL, 1 2009	M8 SECTION ASTM242 STEEL TIE FOR UNINSULATED APPLICATIONS WITH CAST HOOK-IN SHOULDERS FOR 'e' TYPE CLIPS.	SCALE NONE



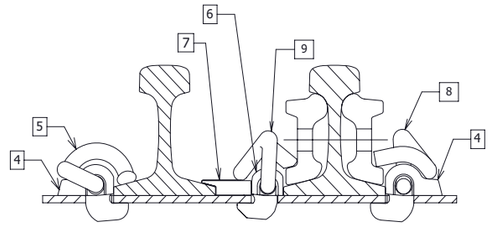
A TYPICAL RAIL BRACE ASSEMBLY



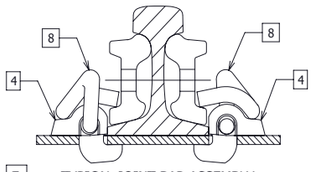
B TYPICAL AWOS ASSEMBLY



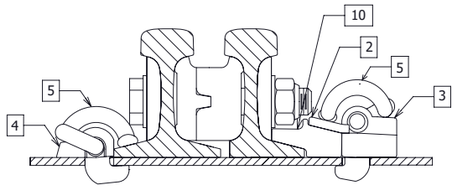
C TYPICAL WEDGE PLATE ASSEMBLY



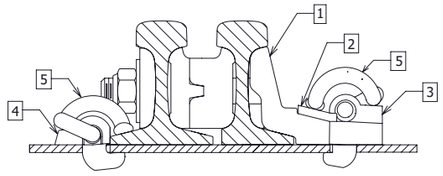
D TYPICAL WEDGE PLATE WITH JOINT BAR



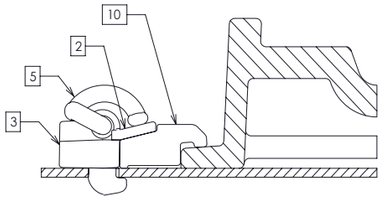
E TYPICAL JOINT BAR ASSEMBLY



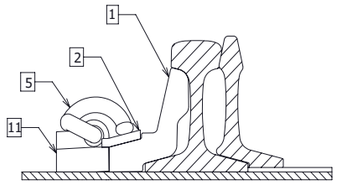
F TYPICAL GUARDRAIL FROG CLAMP ASSEMBLY
(LOCATION SHOWN ON TURNOUT DRAWING)



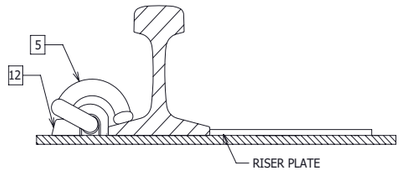
G TYPICAL GUARDRAIL BRACE ASSEMBLY
(LOCATION SHOWN ON TURNOUT DRAWING)



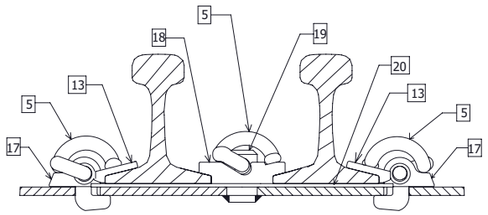
H TYPICAL S.M.S.G. FROG ASSEMBLY
(NOTE: SEE TYPICAL FROG CLAMP DRILLING DETAIL)



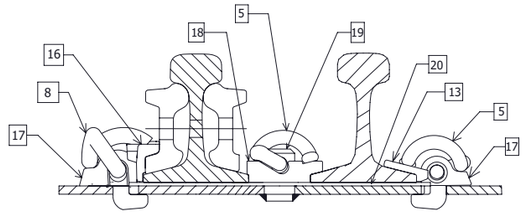
I TYPICAL RAIL BRACE ASSEMBLY



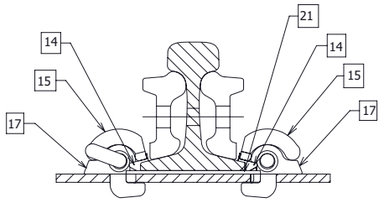
J TYPICAL WELD-ON SHOULDER AND RISER PLATE ASSEMBLY



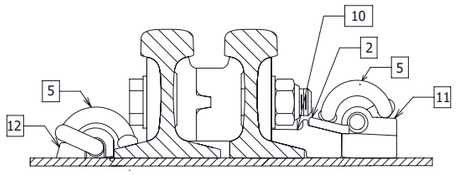
K TYPICAL WEDGE PLATE ASSEMBLY



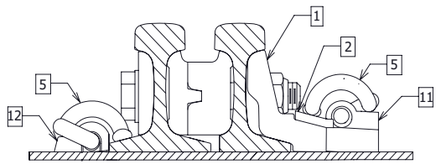
L UNINSULATED JOINT BAR/WEDGE PLATE ASSEMBLY
FOR INSULATED TRACK



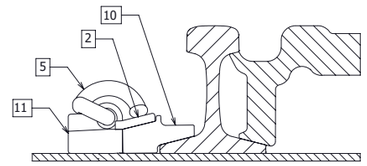
M TYPICAL INSULATED POLY JOINT BAR
ASSEMBLY FOR INSULATED TRACK



N TYPICAL GUARDRAIL FROG CLAMP ASSEMBLY
(LOCATION SHOWN ON TURNOUT DRAWING)

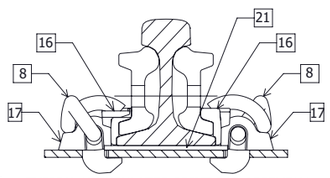


O TYPICAL GUARDRAIL BRACE ASSEMBLY
(LOCATION SHOWN ON TURNOUT DRAWING)



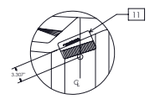
P TYPICAL R.B.M. FROG CLAMP ASSEMBLY
(NOTE: SEE TYPICAL BWOS WELDING DETAIL)

ITEM NO.	TURNOUT COMPONENTS	PART NO.
1	ADJUSTABLE RAIL BRACE	8014/8020
2	RAIL BRACE SERRATED WASHER	8015
3	RAIL BRACE HOOK-IN-SHOULDER	8016
4	NARSTCO HOOK-IN-SHOULDER	4020
5	'e'CLIP ('e' TYPE CLIP)	'e' CLIP
6	WEDGE PLATE HOOKIN-SHOULDER	3220
7	WEDGE PLATE	3221-3225
8	'J' CLIP	NJ1
9	L/H 'e' CLIP	NE2
10	FROG CLAMP (R.B.M./S.M.S.G.)	8017/8018
11	RAIL BRACE WELD-ON SHOULDER	BWOS
12	WELD-ON SHOULDER	WOS
13	HEAVY DUTY RAIL INSULATOR	HD-10
14	INSULATED JOINT INSULATOR	J6790
15	INSULATED JOINT CLIP	e2063
16	JOINT BAR INSULATOR	N8J-HD
17	NARSTCO HOOK-IN-SHOULDER (INSULATED)	4010
18	INSULATED WEDGE PLATE	
19	UNINSULATED / INSULATED WEDGE PIN	SA-0009/SA-0010
20	CUSTOM INSULATED PAD	
21	NARSTCO INSULATING PAD (5.5"/6")	IN-0029/IN-0030



Q TYPICAL UNINSULATED JOINT BAR ASSEMBLY
FOR INSULATED TRACK

TYPICAL FROG CLAMP DRILLING DETAIL



FROG CLAMP DRILLING PROCEDURE
IN PRACTICE:
- LOCATE 8018 FROG CLAMP AS SHOWN IN DETAIL
- PLACE ANNULAR CUTTER AGAINST FROG CLAMP ON TIE CENTER
- ENERGIZE MAGNET AND REMOVE FROG CLAMP
- DRILL HOLE
- PLACE HOOK-IN SHOULDER 8016 IN HOLE AND DRIVE FROG CLAMP 8018 IN FROM RIGHTHAND SIDE
- INSTALL SERRATED WASHER AND THEN CLIP.

TIE BUNDLE LABEL FORMAT

NARSTCO
1. B2220 1 OF 1
2. #8-115lb
3. JULY 2020 XX

1. BATCH NO. FOR QUALITY ASSURANCE IDENTIFICATION AND SEQUENTIAL NUMBER IN BATCH.
2. TURNOUT NUMBER AND RAIL WEIGHT.
3. MONTH PRODUCED, YEAR PRODUCED, AND ENGINEER'S INITIALS.

SECTION 2 – Steel Tie Track Materials and Construction

2.1 Guidelines for Distribution of Bundles along Subgrade, per Bundle Size and Curvature:

M8 and M10 ties are normally shipped in bundles of 20. H12 ties and Deep-Spade H10 ties are shipped in bundles of 15.

Degree of curvature	Bundles of 15 ties	Bundles of 20 ties
Tangent and up to 4˚	Bundle every 30 feet	Bundle every 40 feet
4˚ to 12˚	Bundle every 27 feet	Bundle every 36 feet
Over 12˚	Bundle every 25 feet	Bundle every 33 feet

2.2 Spacing of Steel Ties Center-to-Center:

Degree of curvature	Spacing center-to-center
Tangent and up to 4˚	Every 24 inches
4˚ to 12˚	Every 22 inches
Over 12˚	Every 20 inches

For tangent track, use a string line or paint line to align the ties. Place the ties at right angles to the string line, at 24 inch centers. In order to ensure proper spacing, it is recommended that the tie center measurements be marked with paint every 24 inches along the string line **(see track construction photo #1)**. Adjust the tie spacing on curves over 4 degrees as required.

Track Construction Photo #1

2.3 Install Hook-In Shoulders on all Ties:

Refer to Table 1 below to determine the proper hook-in shoulder to be used. **CAUTION: Different hook-in shoulders are used with different types of steel ties. Care must be taken to ensure that material is managed on the job site so that the proper hook-in shoulders are installed as required.**

Tie Type	Hook-In Shoulder Part No.
M8 Non-insulated	4040
M10 Non-insulated	4020
M10 Insulated	4010
H10 Non-insulated	4020
H10 Insulated	4010
H12 Non-insulated	4080
H12 Insulated	4030

2.4 Install the Rail onto the rail seats of Steel Ties:

(Note: if relay or second hand rail with curve wear is used, the curve wear must be placed on the field side of the Steel Tie). Once the rail is in position, install the e-clips **(see track construction photo #2)**, gauge side clips first. Clips should be installed with an 8 lb. (minimum weight) sledge hammer. **Spike mauls should not be used to apply e-clips.** If required, the end of the Steel Tie should be nipped to ensure that the base of the rail sits flat on the rail seat. If one end of the Steel Tie must be raised more than 2 inches to install an e-clip, both ends of the Steel Tie should be raised using track jacks so that the Steel Tie is level.

Track Construction Photo #2

2.5 Installing Jointed Rail:

When jointed rail is installed, appropriate expansion gaps should be used at the joints as required, in accordance with the railroad's Standard Practice Policy. Rail joints on opposite rails should be staggered by at least 12 feet, or in accordance with the railroad's Standard Practice Policy. Joint clips (j-clips) should be installed at rail joints, gauge-side clips first **(see track construction photo #3)**. Rail should be laid so that joints fall between and not on top of Steel Ties unless:

a) Track speed 15 MPH or less

b) Rail joints are new-rail-to-new-rail or relay rail joint mismatches are built up to AREMA specifications

Track Construction Photo #3

2.6 CWR Rail:

For CWR the rail must be de-stressed after surfacing and lining, prior to placing the track in service.

2.7 Insulated Ties:

E-Clip Fasteners

The component installation sequence for insulated ties is as follows, shoulder hole locations will be different from non-insulated ties:

a) Place Hook-in shoulders in the H.I.S. holes

b) Install the insulating pads on the rail seats

c) Install the rail

d) Place the insulator against the base of the rail

e) Apply e-clips

(See track construction photo #4 next page)

Track Construction Photo #4

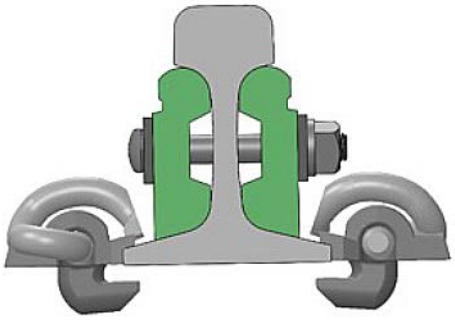
Safelok Fasteners

Safelok clips can be used for insulated and standard non-insulated ties installed in a similar fashion as the E-clip system. Our safelok system can be used to convert non-insulated ties to insulated, allowing sections of track to be upgraded to insulated signal circuits without replacing ties. Conversion would need the pads, insulators and safelok fastening system **(see track construction photo #5)**.

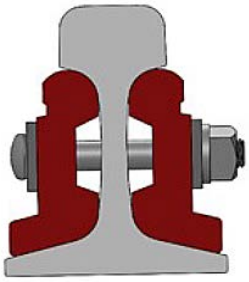
Track Construction Photo #5

Insulated Joint Bars

When using insulated poly joint bars, the bars must be toeless to accommodate an e-clip fastener and insulator.



Toeless Poly Joint Bar



Poly Joint Bar with Toe

2.8 Transition Ties:

Longer steel ties are available, if required, for use at transition locations, such as bridges and crossings **(see Track Construction Photo #5 – Bridge Approach Ties and Track Construction Photo #6 – Crossing Approach Ties)**.

Track Construction Photo #5 and #6

SECTION 3 – Steel Tie Turnout Materials and Assembly

3.1 Components:

The components for each Steel Tie turnout are shipped in large component sacks (see turnout assembly photo #1), with the NARSTCO job number (Example: B1577) and the individual Steel Tie turnout designation (Example: 4 of 4) painted on the outside of the component sack. Copies of this installation manual, the appropriate Steel Tie turnout drawing and annular cutter bits are included in the Set 1 component sack unless specified differently by customer.

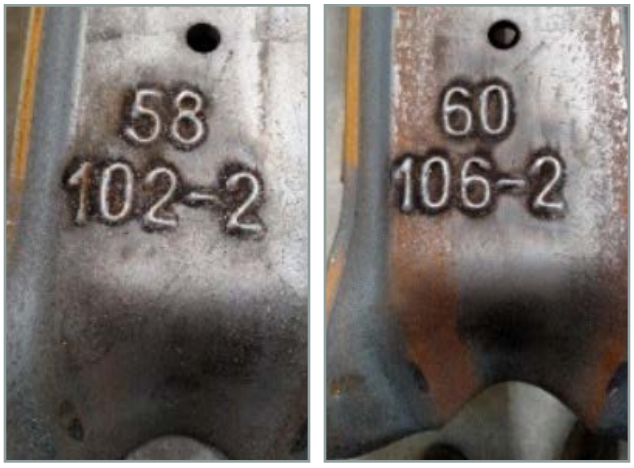
Turnout Assembly Photo #1

3.2 Drawings:

The drawing shows a list of all NARSTCO components and indicates the quantity of each component supplied. Normally, NARSTCO does not supply rails, switch points, frogs, heel blocks, switch rods, connecting rods and switch stands.

3.3 ID Marks:

On the straight line side of each steel turnout tie is a welded mark (or welded stainless steel tag) which identifies the tie number and the distance (in feet and inches) from the point of switch to the center of said tie (see turnout assembly photo #2). Cases like equilaterals where there is no straight side, layout instructions will be supplied.



Turnout Assembly Photo #2

Tie Spacing NOTES:

a) If there is a negative number on the tag or the welded-on ID, (Example: -1-6) this indicates that the tie is to be placed ahead of the point of switch or ahead of Tie No. 1.

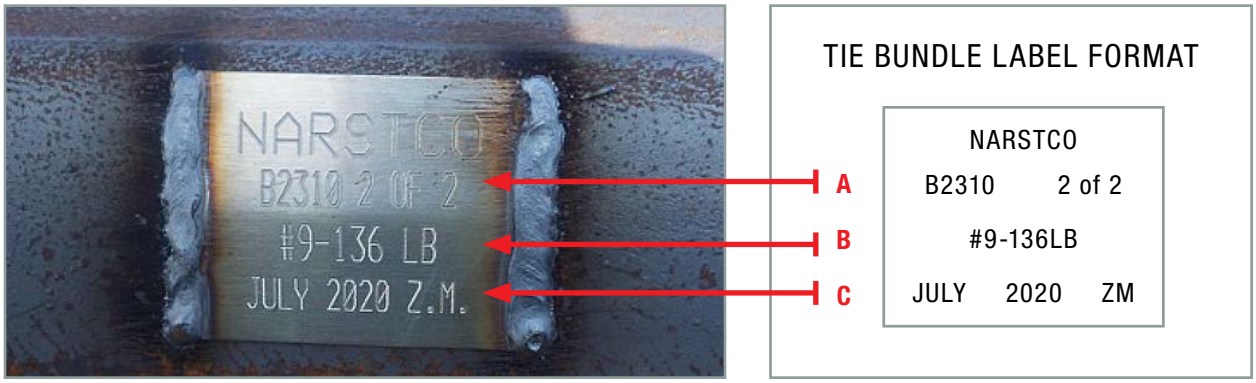
b) The welds or tags on BNSF/UPR Common Standard Steel Tie turnouts show the distance (in feet and inches) from the center of Steel Tie No. 1 to the center of each Steel Tie. The center of Steel Tie No. 1 is normally located 4 inches from the point of switch for BNSF/UPR Common Standard turnouts.

3.5 Tie Bundle Labels:

For shipping purposes, Steel Tie turnout ties are banded in several bundles. Each bundle is marked with a painted letter (A, B, C, D, etc.). The top Steel Tie in each bundle will have a steel tag:

- "A" showing the job number BXXXX and the set number out of total number of sets ordered
- "B" showing the turnout number and the rail size the turnout was manufactured for
- "C" showing the month then year manufactured, followed by the project engineers initials

A typical Tie Bundle Label Format is shown in the following picture and drawing:

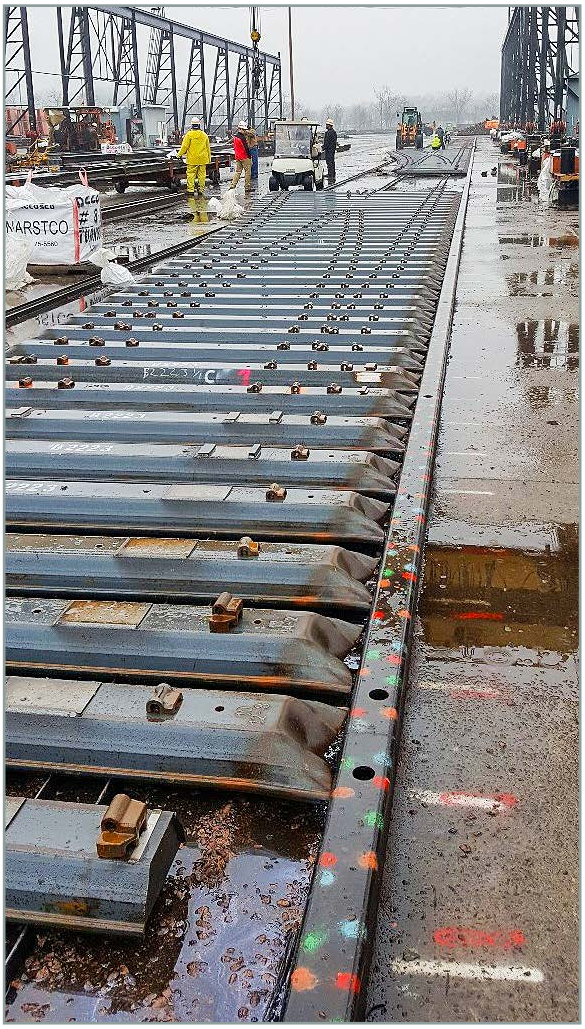


3.6 Turnout Layout and Assembly:

a) Lay out a base line for the entire length of the turnout, using a tape or a string line. For non-insulated turnouts, this line should be located 4'-3" from the centerline of the track along the straight side of the turnout.

- Mark this line on the ground using spray paint
- Mark the point of switch (or center of Tie No. 1 for BNSF/UP turnouts)
- Mark the position of the center of each tie on the ground, using spray paint

b) Lay out each Steel Tie along the base line with ties centered on the paint marks (see turnout assembly photo #3). **All ID welds or stainless steel tags must be on the end of the Steel Tie closest to the base line (straight side of the turnout).**



Turnout Assembly Photo # 3

c) Install **ALL** hook-in shoulders (except the wedge plate hook-in shoulder, see Sect 3.6, par. m, pg. 18) in position on the Steel Ties. **(see turnout assembly photo #4)**
The larger hook-in shoulders used with rail braces and frog clamps should be installed on the appropriate Steel Ties in switch point, guard rail and frog areas.
The locations where these larger hook-in shoulders are to be installed are shown on the detailed turnout drawing.

NOTE: In most cases, holes for the **frog clamps** are drilled in the field during turnout assembly after the following steps are complete:

- The frog has placed in position and frog gauge has been verified
- All adjacent rails are bolted and clipped in place

Turnout Assembly Photo #4

d) Place the straight stock rail in position on the Steel Ties.
Mark the point of switch and the center of each Steel Tie on the top of the rail, measuring from the point of switch (or from the center of Tie No. 1 for BNSF/UPR turnouts).
Take care to ensure that the Steel Ties are at right angles to the straight stock rail.

e) Clamp the straight stock rail in position with e-clips, using an 8 lb. (minimum weight) sledge hammer. Ensure that the Steel Ties are centered on the marks on top of the rail.
Spike mauls should not be used to apply e-clips.
In order to ensure that the rail is properly seated on the Steel Tie, a bar should be used to nip the Steel Tie against the base of rail.

f) To install rail braces, the Steel Tie should be level and the base of the rail should be flat on the rail seat. If necessary, track jacks should be used at both ends of the Steel Tie.
Care must be taken to ensure that the base of the stock rail is tight against the riser slide plate (which is welded to the top of the Steel Tie).
The wedge-shaped rail braces should be driven into place with a sledge hammer and secured in place with a serrated washer and an e-clip.
After installation of the rail brace, serrated washer and e-clip, check to ensure that the base of the stock rail is properly seated on the top of the Steel Tie against the riser slide plate and has not moved up onto the riser slide plate **(see turnout assembly photo #5**).

Turnout Assembly Photo #5

g) Place the remaining rail past the stock rail along the straight side on the Steel Ties to the end of the turnout. (NOTE: In order to avoid variance in rail gauge due to rail head eccentricity, all rails throughout the Steel Turnout should be placed so that all branding is facing in the same direction.) Install joint bars and bolts at the joints.
Once the straight rail is installed, mark the center of all Steel Ties on top of the straight rail.
Fasten the straight side rail in position with e-clips, using a sledge hammer, ensuring that the Steel Ties are centered on the marks on top of the rail.

h) Place the bent stock rail and switch point in place, such that the switch points are squarely opposite each other, using a large square or by the triangulation method.
Mark the point of switch and the center of each tie on the top of the switch point, measuring from the point of switch (or from the center of Steel Tie No. 1 for BNSF/UPR turnouts).
Fasten the bent stock rail in position with e-clips, using a sledge hammer, ensuring that the Steel Ties are centered on the marks on top of the rail.

i) Place the straight closure rail on the Steel Ties.
Install the heel block or floating heel joint.
Once the straight closure rail is installed, mark the center of all Steel Ties past the heel block on top of the rail.
Fasten the straight closure rail in position with e-clips, using a sledge hammer, ensuring that the Steel Ties are centered on the marks on top of the rail.

j) Install the switch point and heel block on the straight side. Place the curved closure rail in position and complete assembly of the heel block or joint bars. At this point, before e-clips are installed to secure the curve closure rail in place, check to ensure that the end of the straight closure rail and the curved closure rail are properly positioned to place the frog. When pre-cut straight and curve closure rails are supplied, the rail ends may not be even after installation. If this is the case, use a front end loader or other piece of equipment to push against the end of the straight or bent stock rail in order to shift the turnout slightly to even up the rail ends at the frog.
When the turnout is completely square, the curve closure rail can be clamped in position with e-clips.

k) When horizontal switch rods are used, single-hole non-adjustable side jaw clips (AREMA Drawing 222-03) are required.
Horizontal switch rods with the bolts through the side jaw clips, inserted from the bottom up, **should be installed before the stock rails are clipped into place (see illustration #1). Adjustable four-hole side jaw clips or transit clips cannot be used with steel tie turnouts**.

Illustration #1 – One-Hole Side Jaw Switch Rod Clip

l) For BNSF/UPR turnouts, the huck bolts on vertical switch rods must be installed such that huck bolts face away from the ½" point of frog.

m) For most Steel Tie Turnouts, wedge plates are used on two to four Steel Ties past the heel of the switch point (see illustration #2).

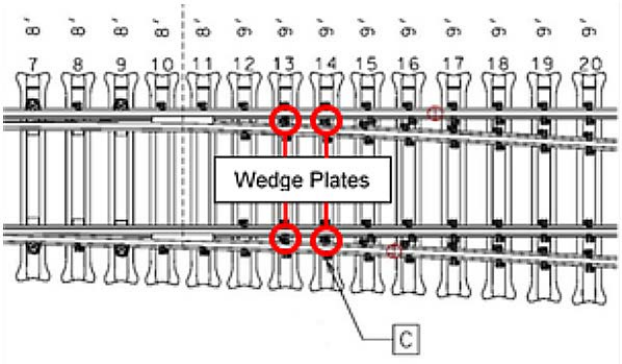
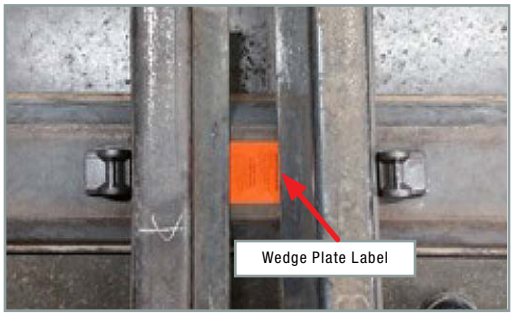


Illustration #2 – WEDGE PLATE LOCATIONS

n) Using the Turnout Components Table on the layout drawing, locate the ties that require wedge plates. The wedge plate ties will have orange labels covering the wedge plate hook-in shoulder holes. **(see wedge plate illustration #1)**



Wedge Plate Illustration #1

NOTE: The quantity and location of wedge plates vary based on the design of the particular turnout or crossover. Puncture the orange wedge plate hook-in shoulder-hole label with a punch or a bar. Using the Steel Tie Number and the "S" or "T" markings, identify each wedge plate and its installation location. NOTE: "S" marking is for the straight side and the "T" is for the turnout side of the tie. **(see wedge plate illustration #2)**

Wedge Plate Illustration #2: ID

o) Place the wedge plate hook-in shoulder into the tie **with the hook facing away from the stock rail** (the hook should be located under the wedge plate and not the stock rail). Place the wedge plate into the area between the wedge plate hook-in shoulder and the closure rail **(see turnout assembly photo #6)**. Using an e-clip, secure the wedge plate into place.

Turnout Assembly Photo #6

p) Place the frog in position.
Install the remaining rails and clamp into position. For RBM frogs, the guard rails should be installed after the frog is in position.
Guard rails should be positioned in accordance with the dimension from the end of the guard rail to the point of frog as shown on the appropriate drawing.
Guard rails are secured in place on the gauge side of the running rail using a combination of frog clamps and rail braces.
There is a detail on the drawing showing which Steel Ties the rail braces are used, and the Steel Ties on which frog clamps are used. **Note:** Only AREMA "T-rail" type guard rails can be used on Steel Ties.

In most cases, the holes for the frog clamp assemblies are field drilled.
After the turnout assembly is complete, with the frog securely in place, check gauge on both sides of the frog. The Steel Ties in the frog area can then be field drilled, using an electric powered magnetic base drill and 1-7/16" annular cutter bit (see section 4 – Field Drilling Holes at the Frog).
For some special orders, the holes for the frog clamps are pre-punched.
DANGER: Do not permit any part of your body nor any material between the magnetic base drill and the frog.

3.7 Switch Stand Installation:

The switch stand should be installed and adjusted in accordance with the switch stand manufacturer's installation instructions. For most turnouts, the holes required to secure the switch stand to the Steel Tie headblock are drilled in the field. To install most switch stands:

1) Center the switch stand on the removable plates
2) Connect the switch stand to the connecting rod
3) Connect the connecting rod to the No. 1 switch rod (previously attached to the switch points)
4) The switch points should be centered at the halfway throw position
5) If the connecting rod has a clevis, the clevis should be centered on the threads and any shims or adjustment in the switch stand should be centered
6) Put the switch stand handle in the halfway throw position
7) Check to make sure the switch stand is still centered on the removable plates
8) Mark the locations for drilling
9) Remove the switch stand
10) Drill the mounting holes with the provided annular cutter. Be sure to use cutting fluid.
11) Remove the four factory bolts from the Steel Tie headblock and insert the switch stand bolts up through the steel plates
12) Reattach the plates to the Steel Tie headblock and tighten the four factory bolts
13) Set the switch stand on the bolts and tighten.

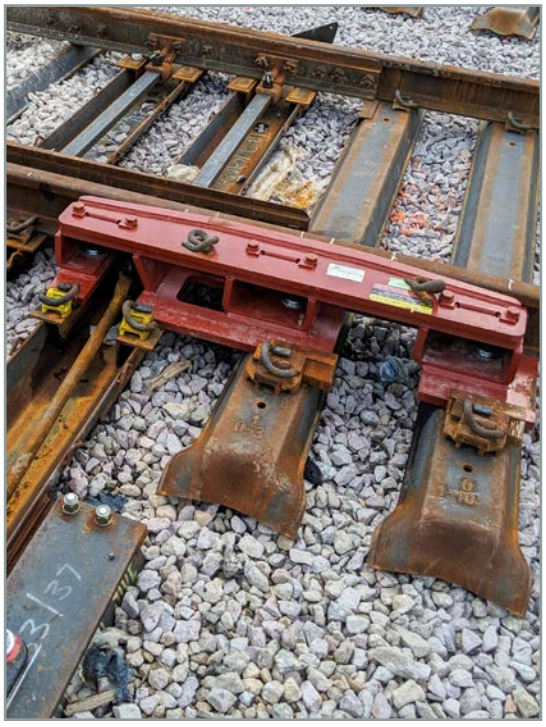
The same magnetic base drill used to drill the holes for the frog clamp assemblies should be used for the switch stand holes. The size of the drill bit required for the switch stand holes should be chosen to accommodate the switch stand hold down bolts supplied in the turnout component sack.
(Refer to the table on the next page which indicates the number and size of fastenings supplied with common types of switch stands.)

Type of Switch Stand	Bolt Diameter and Length	Quantity of Bolts Supplied	Bolt Hole Diameter
36EH, A&K EZ THRU 22	7/8” x 3”	10	1”
36E, 22E, 56B	7/8” x 3”	10	1”
36E – Canadian Pacific	3/4” x 3”	10	1”
22E	7/8” x 3”	10	1”
22E – Canadian Pacific	3/4” x 3”	10	1”
ARS Type	7/8” x 3”	6	1”
51A (for switch stand)	5/8” x 3”	6	3/4”
51A (for latches)	5/8” x 2 ½”	8	3/4”
CSX Standard	7/8” x 3”	8	1”
	5/8” x 3”	6	3/4”
	5/8” x 2 ½”	8	3/4”
Nortrak Automator	7/8” x 4”	10	1”

Switch Stand Fastenings

3.8 Switch point guards:

Switch Point Guards should be installed in accordance with the turnout drawing, prior to distributing ballast. Note: for uninsulated Steel Tie Turnouts, two yellow #4010 hook-in shoulders are supplied for use on channel headblock tie with the point guard. The #4010 hook-in shoulders should be inserted in the holes in the headblock tie before the point guard is installed **(see turnout assembly photo #7)**.



Turnout Assembly Photo # 7 – Switch Point Guard

3.9 Turnout Construction Location

Steel Tie Turnouts can either be assembled in place (new construction), or they can be assembled at a convenient location adjacent to an existing turnout to be replaced, and moved into place using excavators or other equipment **(see turnout assembly photo #8)**.

Turnout Assembly Photo # 8

3.10 Moving a Turnout

When moving assembled turnouts, the point area should be blocked with wood to prevent the base of the stock rail shifting out of position against the riser slide plates. Rail braces should be checked and adjusted if necessary and the Steel Ties should be checked to make sure they have not moved off their mark once the Steel Tie Turnout is in its final position.

3.11 Turnout Proximity to Other Turnouts

When Steel Tie Turnouts are located within 200 feet of each other, additional Steel Transition Ties are sometimes supplied for installation between the Steel Tie Turnouts. Steel Turnout Ties and Steel Transition Ties have flat rail seats. Steel Track ties are supplied with a canted rail seat.

SECTION 4 – Field-drilling Holes at the Frog

4.1 Magnetic Base Drill

An electric powered magnetic base drill and a 1-7/16” Hougen Rotabroach annular cutter should be used to drill the holes for installation of the frog clamp assemblies.

NOTE: Hougen Manufacturing Trak-Star Model MD50 magnetic base drills and Hougen Manufacturing annular cutter bits (1-7/16” for frogs and 1”, 7/8” or ¾” for switch stands) are available for purchase from NARSTCO. Additional information on Trak-Star drills and Hougen annular cutter bits is available at www.trak-star.com.

a) Place a frog clamp on the Steel Tie to be drilled **(see field-drilling photo #1)**. The clamp should be tight against the base of the frog. The left edge of the clamp should line up with the top edge of the Steel Tie as shown below.

Field-Drilling Photo #1

b) Place the magnetic base drill in position on the Steel Tie with the annular cutter in the center of the Steel Tie, against the frog clamp **(see field-drilling photo #2)**.

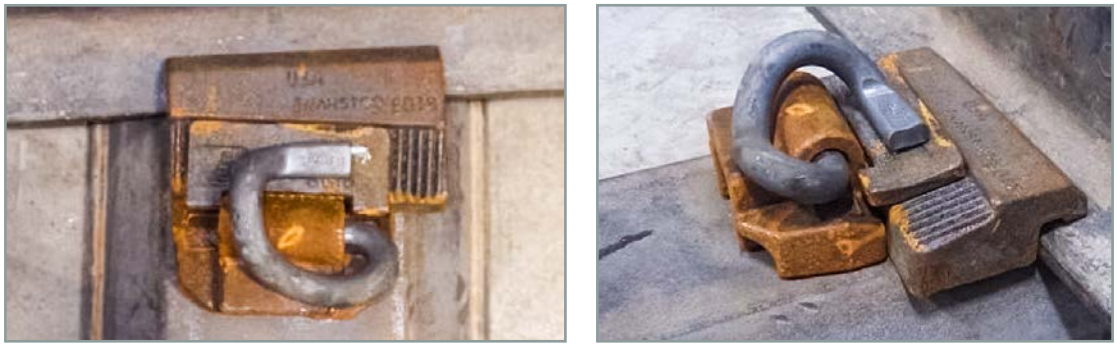
Field-Drilling photo #2

c) Refer to your Drill Instruction & Safety Manual. Activate the magnetic base. Check to ensure the magnet is activated by trying to move the drill.
Once the drill is secured in place, **remove the frog clamp**, turn on the drill **(see field-drilling photo #3). DANGER: Do not permit any part of your body nor any material between the magnetic base drill and the frog. Use an appropriate cutting fluid (Do Not Use Oil) while drilling the hole**. Start drilling slowly to avoid damaging the cutter bit. When the hole is completed, retract the cutter and ensure that the steel plug from the Steel Tie is removed or has fallen out.

\

Field-Drilling Photo #3

d) Clean the top of the Steel Tie by cautiously removing the sharp metal shavings, install the proper hook-in shoulder, drive the frog clamp into place using a sledge hammer, and apply a serrated washer and e-clip **(see field-drilling photo #4 & #5)**.



Field-Drilling Photo #4 & #5

SECTION 5 – Steel Ties Encased in Concrete & Asphalt

Steel Ties that are to be encased in concrete are supplied without end spades to allow the concrete to flow under the Steel Ties during construction. Normally a base concrete slab is poured to an elevation just below the bottom of the Steel Ties.

The Steel Ties are laid out in position and the track is constructed in the normal manner (as described in Section 2 of this installation manual). Small shims can be used under the Steel Ties to set the final elevation of the track. Pre-formed rail seal can be installed to provide the required flange way **(see steel ties encased in concrete photo group**). Once the track is set at its final elevation, the final concrete pour can be completed.

Steel Ties Encased in Concrete – Photo Group

Steel Ties can be used **with asphalt** as seen in pictures below. Track is typically installed similar to ballasted track where the ties are surfaced and tamped to their final position. The asphalt is then placed on top of the ties and ballast to the top of rail. It is recommended that the track has traffic ran over before asphalt is placed to allow any settling to take place.

Steel Ties Covered in Asphalt – Photo Group

SECTION 6 - Bumping Posts

NARSTCO bumping post tie sets come with ten ties that can accommodate any size center rails **(see bumping post photo #1)**. When installing, place all shoulders first followed by running rails, bumping post, and center rails.

Bumping Post Photo #1

SECTION 7 - Concrete Panels

NARSTCO crossing ties come standard at 10 foot in length and can accommodate most concrete panels. The ties will be placed at 18" spacing, surfaced and tamped per section 10. Once surfaced, place bearing pads on ties, and set panels in place. Each panel will be welded together with stitch welds and fixed to the ties with end restraints. Reference panel manufacturer drawings for welding and restraint install procedures. Concrete panels can also be accommodated through NARSTCO turnouts.

Concrete Crossing Panel Photo Group #1

SECTION 8 – Derails

NARSTCO provides steel ties for Western-Cullen Hays hinged and sliding derails with optional crowders. Details and derail switch stands are typically drilled in the field, below are the recommended steps.

a) Set derail ties in a flat area and insert hook-in shoulders, set two four foot rails on the ties, and install the rail braces on the derail side.

b) Set derail, crowder, switch machine, and connect the connecting rod to the stand and derail. Make adjustment to the rod and adjust any rod adjustment clevis to the center position.

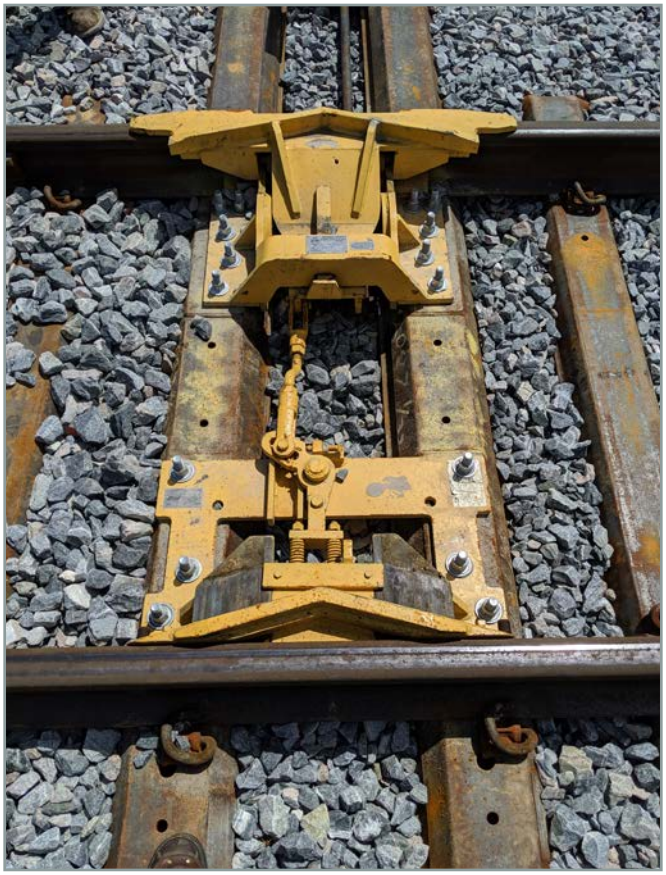
c) Mark locations of the hold down holes for derail, stand and crowder if applicable.

d) Once marked, remove equipment and drill all hold down holes.

e) Remove rail braces and rail sections, turn ties over, and insert bolts tacking the bolt heads to the underside of the ties. It is recommended that the nuts are started on the bolts to protect the threads from damage while transporting and dumping ballast.

f) Place derail ties in final position with rail installed and surface/tamp the ties into final position.

g) Remove nuts and place derails, stand, and crowder in place. Bolt and adjust as needed to secure equipment in place.



Derail Photo #1

SECTION 9 – Surfacing and Lining – New Construction

9.1 Ballast

Physical and chemical properties of ballast supplied for use with Steel Ties should meet the requirements of the **American Railway Engineering and Maintenance-of-Way Association (AREMA) Manual for Railway Engineering – Part 2 Ballast.**

9.2 Ballast Gradations:

The following ballast gradations, **listed in Table 1-2-2 of the AREMA ballast specifications**, are recommended for Steel Ties:

- Yard Tracks – AREMA Gradation No. 4A or No. 4
- Yard Leads – AREMA Gradation No. 4A or No. 4
- Turnouts in Yards – AREMA Gradation No. 4A or No. 4
- Turnouts in Yard Leads – AREMA Gradation No. 4A or No. 4
- Main Tracks (Including Turnouts) – AREMA Gradation No. 3 or No. 4A
- AREMA #5 should be used for cover ballast only and not for Steel Tie support.

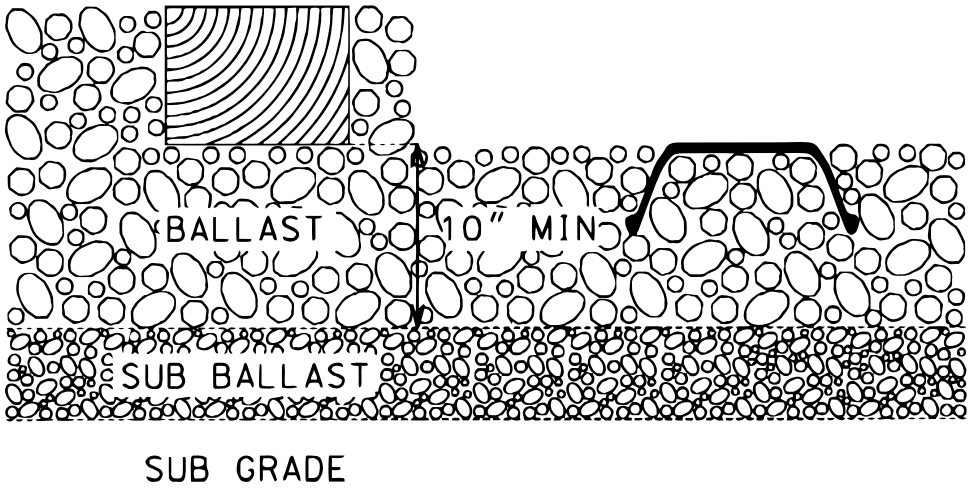
Size No. Gradation Size No.	Nominal Opening	Percent Passing						
		2 - 1/2”	2”	1 - 1/2”	1”	3/4”	1/2”	3/8”
#3	2” - 1”	100	95-100	35-70	0-15		0-5	
#4A	2” - 3/4”	100	90-100	60-90	10-35	0-10		0-3
#4	1 1/2” - 3/4”		100	90-100	20-55	0-15		0-5

Ballast Gradations

9.3 Ballast Depth:

Steel Ties can be distributed directly on the finished subgrade. In order to reduce the number of surfacing passes required, a 4 to 6 inch layer of ballast can be distributed and compacted prior to Steel Tie distribution and track assembly.

Ten inches (10”) of ballast is recommended under Steel Ties **(See Ballast Drawing #1)**. Ballast depth may be specified by the railroad, consultant or engineer. If a layer of ballast is distributed and compacted prior to Steel Tie distribution, final ballast depth under the ties should be 10 inches or more if not specified by railroad, consultant or engineer. Note: Ballast drawing #1 also shows the difference in ballast needed for steel ties vs wood ties.



Ballast Drawing #1

Surfacing and Lining

9.4 New Construction:

For new construction, ballast should be unloaded and regulated such that the ballast is level with the top of the rail and should extend twelve inches past the ends of the Steel Ties.

9.5 Tamper Requirements:

A tamping machine equipped with traversing vibratory work heads and sixteen tamping tools must be used for surfacing Steel Tie track.

9.6 Tamping Tools:

The tamping tool paddles must be in good condition. Paddles worn beyond normal wear limits must be replaced before surfacing Steel Tie track. Worn paddles will not move sufficient ballast to fill the pods on the underside of the Steel Ties, nor will they provide sufficient compaction to consolidate the ballast under the Steel Ties.

9.7 Insertion Depth:

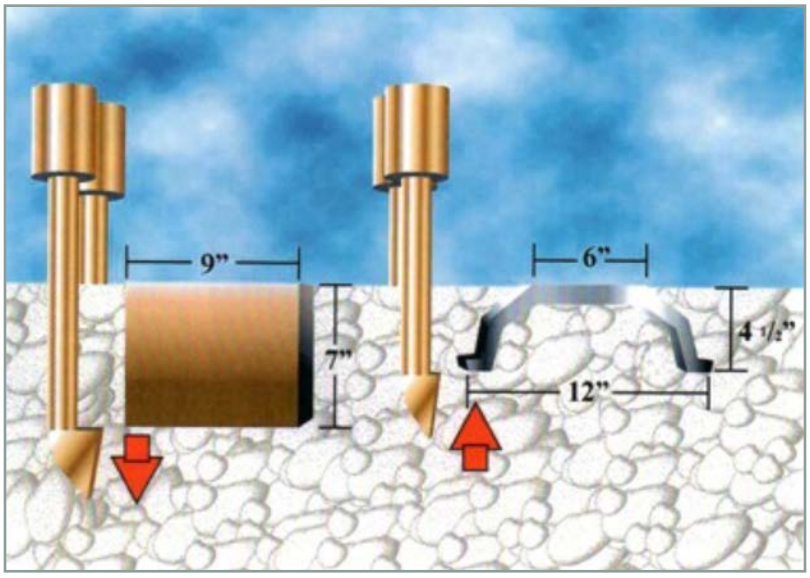
For surfacing steel ties, the maximum depth of insertion of the tamping tools must be adjusted such that the top of the tamping tool paddle is ½" to ¾" below the bottom of the Steel Tie. **Depth of tool insertion should be carefully checked before surfacing Steel Ties (See Surfacing & Lining Photos #1 and #2 on next page).**

Surfacing & Lining Photo # 1

Surfacing & Lining Photo # 2

9.8 Depth Difference:

There is approximately a 2-1/2” difference between the depth of a 7” x 9” wood tie and a Steel Tie (Ballast Drawing #2 – Tamping Tool Depth).



Ballast Drawing #2 – Tamping Tool Depth

The limit switches on the tamper should be adjusted so that the depth of insertion for Steel Ties is 2-1/2” less than the depth of insertion for 7” x 9” wood tie surfacing. Appropriate tamping tool insertion depth adjustments should be made for wood ties that are not 7” deep. **This is critical for proper Steel Tie surfacing and lining. If tamping tool insertion is set too deep (not adjusted from the setting for wood tie construction), proper compaction of the ballast under the Steel Ties will not be achieved.**

9.9 Tamping Sequence:

A complete tamping sequence consists of tool insertion, squeeze and withdrawal. To fill the pods on the underside of the Steel Ties with properly compacted ballast during the final surfacing lift, four complete tamping sequences (tool insertion, squeeze and withdrawal) are required under the rails. Then the traversing work head must be moved to the center of the Steel Tie, and three complete tamping sequences are needed in the center of the Steel Tie. This must be repeated for each large ballast lift.

9.10 Center Tools:

For larger projects, where a **Model 6700 tamper** is used, it is recommended that additional tamping tools be mounted on the tamper in the center of the track. This will achieve center tamping at the same time as rail seat tamping is done. Check with your equipment manager to determine if the equipment in use on your job site can be modified in this manner. **(See Surfacing & Lining Photo #3 on next page.)**

Surfacing & Lining Photo # 3

9.11 Tool Spacers:

Tamper tool spacers (available from the tamper manufacturer) should be installed to space the tamper tools further apart, so that the tools do not contact the ties during the squeeze cycle.

9.12 Inspection Holes:

During surfacing, the ballast inspection holes, which are located on either side of the rail seats, must be regularly checked to confirm that the Steel Tie pods are full of ballast.

9.13 Lining Track:

Lining track should be done while lifting and tamping and should be completed prior to the final surfacing lift. For the final surfacing lift, which is normally less than one inch, three insertions under the rail seats and one insertion in the center of the tie is recommended. Lining Steel Ties after tamping will cause a gap to form adjacent to the end spades. If this gap is not filled immediately by tamping, the Steel Ties will develop a “memory” effect and are likely to return to their previous alignment.

9.14 Ballast Compaction:

After completion of tamping and prior to regulating, it is suggested that Steel Tie track be compacted with an on track ballast compactor or track stabilizer.

9.15 Regulating Ballast:

After final surfacing, ballast should be regulated and additional ballast distributed if necessary, to ensure that the cribs between the ties are full of ballast to a level one inch above the top of the Steel Ties, and to ensure proper ballast shoulder width. In order to avoid knocking off the e-clips, the ballast regulator broom and plow blades should be adjusted so that the broom elements and plow blades do not contact the e-clips during regulating.

9.16 Surfacing Turnouts:

When tamping Steel Tie Turnouts, it is suggested that surfacing commence from the point of switch towards the frog. If surfacing in the opposite direction is necessary, track jacks must be used on the turnout side from the last long tie to the toe of the frog to assist the machine with lifting. After the Steel Tie Turnout is brought to final line and surface, it is recommended that the tamper be used to squeeze all ties under the rail seat area without jacking or raising the track. Inspection holes should be used to ensure the proper compaction of ballast under the ties.

9.17 Speed Restrictions:

An appropriate speed restriction, in accordance with the railroad standard practice instructions, should be in place for newly tamped Steel Tie track. Steel Ties require a longer settling in period than wood or concrete ties, therefore, some spot resurfacing may be required during the first three to six months in order to achieve complete track stability.

9.18 Transition Locations:

a) At transition points from Steel Tie to wood tie sections, when entering the wood tie section, tamp the first 15 wood ties, then back up and tamp the last 12 Steel Ties again, without lifting. Next, move forward skipping the 15 wood ties previously surfaced and carry on surfacing again from the 16th wood tie.

b) At transition points from Steel Tie to concrete tie sections, when entering the concrete tie section, tamp the first 15 concrete ties, then back up and tamp the last 12 Steel Ties again, applying a nominal ½” maintenance lift. Next, move forward skipping the first 15 concrete ties previously surfaced and carry on surfacing again from the 16th concrete tie.

SECTION 10 – Steel Tie Installation and Maintenance – Existing Tracks

10.1 Standard Equipment:

Any standard equipment used for handling and installing wood ties can be used for Steel Ties as well.

10.2 Interspersed Installation:

Steel Ties can be installed out-of-face or interspersed with wood ties in existing tracks. Suggested interspersed ties range from 1:2 in curves up to 1:4 in tangent, please reach out to a NARSTCO rep to verify based on field conditions.

10.3 Surfacing Interspersed Ties:

When Steel Ties are interspersed with wood ties, two full surfacing passes should be made. With the first pass, surface the entire track in accordance with normal procedures. For the second pass, only tamp the Steel Ties, without lifting the track. It is important that the tamping tools are set at the proper insertion depth for Steel Ties. Two insertions at the rail seats are required. Center tamping of the Steel Ties is not required for this final pass. This procedure will result in uniform compaction under all ties. **Steel Ties should always be tamped last.**

10.4 Ballast Regulating:

Once track has been disturbed during tie installation, ballast should be unloaded and regulated to restore the ballast section.

10.5 Ballast Compaction:

Ballast should be compacted or stabilized or an appropriate slow order should be put in place, in accordance with the Railroad's Standard Practice Policy, prior to restoring the track to service.

10.6 Settling-in Period:

Steel Ties require a longer settling in period than wood or concrete ties. As a result, some spot resurfacing may be required during the first 3 to 6 months in order to achieve complete track stability.

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