

# 4F-T™ SYSTEM

4 Foot Flared TREND® Terminal

## *Product Manual*



Release 03/26c

**MASH TL3 COMPLIANT**

[www.ingalcivil.com.au](http://www.ingalcivil.com.au)

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## MASH TL3 COMPLIANT

### Introduction

The 4 Foot Flared TREND® (4F-T™) Terminal system has been tested pursuant to American Association of State Highway and Transportation Officials (AASHTO) Manual for Assessing Safety Hardware (MASH) specifications. The 4F-T™ system has been submitted for Federal-aid reimbursement eligibility on the National Highway System to the Federal Highway Administration (FHWA).



**The local highway authority, distributors, owners, contractors, lessors, and lessees are RESPONSIBLE for the assembly, maintenance, and repair of the 4F-T™ System. Failure to fulfill these RESPONSIBILITIES with respect to the proper assembly, maintenance, and repair of the 4F-T™ system could result in serious injury and/or death.**

**IMPORTANT:** These instructions are for standard assembly specified by the appropriate highway authority. In the event the specified system assembly, maintenance, or repair would require a deviation from standard assembly parameters, contact a Ingal Civil Products representative.

The instructions contained in the manual supersede all previous information and manuals. All information, illustrations, and specifications in this manual are based on the latest 4F-T™ system information available to Ingal Civil Products at the time of printing. Ingal Civil Products reserves the right to make changes at any time. Please visit [www.ingalcivil.com.au](http://www.ingalcivil.com.au) to confirm that you are referring to the most current revision.

### Customer Service Contacts

Ingal Civil Products is committed to the highest level of customer service. Feedback regarding the 4 Foot Flared TREND® (4F-T™) Terminal system, its assembly procedures, supporting documentation, and performance is always welcome. Additional information can be obtained from the contact information below:

#### Ingal Civil Products

Telephone: 1300 446 425  
E-mail: [sales@ingalcivil.com.au](mailto:sales@ingalcivil.com.au)  
Internet: [www.ingalcivil.com.au](http://www.ingalcivil.com.au)

### Abbreviations and Acronyms

4F-T™	4 Foot Flared TREND® Terminal
AASHTO	American Association of State Highway and Transportation Officials
CFR	Code of Federal Regulation
FHWA	Federal Highway Administration
HBA®	Hinged Breakaway Post
MASH	Manual for Assessing Safety Hardware 2nd Edition Published in 2016 (2020 Errata)
MGS	Midwest Guardrail System
MUTCD	Manual on Uniform Traffic Control Devices
NCHRP	National Cooperative Highway Research Program
NHS	National Highway System
Nm	Newton-Meters
OSHA	Occupational Safety & Health Administration
PPE	Personal Protective Equipment
SYTP®	Steel Yielding Terminal Post
TL-3	Test Level-3



## Limitations and Warnings

Ingal, in compliance with AASHTO MASH, contracts with ISO 17025 A2LA accredited testing laboratories to perform crash tests, evaluate tests, and submit the test results to the FHWA for review.

4F-T™ System was tested to MASH-2nd Edition (2016), with 2020 Errata TL-3 criteria and may be used in Test Level 1, Test Level 2, and Test Level 3 applications – when installed at the full Test Level 3 system length of 10.48 m. These tests typically evaluate product performance defined by MASH involving specific vehicles on roadways, lightweight cars (approximately 1,100 kg) and full size pickup trucks (approximately 2,270 kg) at 100 kph.

**The 4F-T™ System is tested pursuant to the test matrix criteria of MASH as designated by AASHTO and FHWA. The FHWA/AASHTO tests are not intended to represent the performance of systems when impacted by every vehicle type or in every impact condition existing on the roadway. Every departure from the roadway is a unique event.**

Ingal expressly disclaims any warranty or liability for injury or damage to persons or property resulting from any impact, collision or harmful contact with its products, other vehicles, or nearby hazards or objects by any vehicle, object or person, whether or not the products were assembled in consultation with Ingal or by third parties.

The 4F-T™ System is intended to be assembled, delineated, and maintained within the state/specifying agency and federal guidelines. It is important for the state/specifying agency to select the most appropriate product configuration for its site specifications.

The state/specifying agency's evaluation of the site layout, vehicle population type and speed, traffic direction, and visibility are some of the elements that require evaluation in the selection of a highway product. For example, curbs could cause an untested effect on an impacting vehicle.

After an impact with the system, debris must be removed from the area immediately in compliance with the most applicable state/specifying agency policy and/or guidance. The specified 4F-T™ System must be evaluated and restored to its original specified condition or replaced as the state/specifying agency determines/requires, as soon as possible. Product selection, approval, proper installation, and maintenance of any highway product is the sole responsibility of the state/specifying agency.

Under NO circumstances shall the rail within the 4F-T™ System be curved between Post 1 and Post 9.

All metric dimensions are “soft conversions” and as such should be considered as reference only.

**WARNING: Do not assemble, maintain, or repair the 4F-T™ System until you have read this manual thoroughly and completely understand it. Ensure that all Danger, Warning, Caution, and Important statements within the manual are completely followed. Please call Ingal at 1800 803 795 if you do not understand any portion of these instructions or this manual.**

**WARNING: Safety measures incorporating appropriate traffic control devices and PPE specified by the state/specifying agency must be used to protect all personnel while at the assembly, maintenance, or repair site. Work gloves, eye protection, safety-toe shoes, and back protection shall be used.**

**WARNING: Ensure that the assembly site meets all appropriate MUTCD and the state/specifying agency standards.**

**WARNING: Use only Ingal parts that are specified by Ingal for use with the 4F-T™ System for assembling, maintaining, or repairing the 4F-T™ System. Do not utilize or otherwise commingle parts from other systems, even if those systems are other Ingal systems. Such configurations have not been tested, nor have they been approved for use. Assembly, maintenance, or repairs using unspecified parts or accessories is strictly prohibited. Failure to follow this warning could result in serious injury or death in the event of a vehicle impact with such an UNACCEPTED system.**

**WARNING: Do NOT modify the 4F-T™ System in any way.**

**IMPORTANT: Ingal makes no recommendation whether use or reuse of any part of the 4F-T™ System is appropriate or acceptable after impact. It is the responsibility of the state/specifying agency and its engineers to make that determination.**

**IMPORTANT: It is the responsibility of owner, state/specifying agency, or specifier to inspect the 4F-T™ System after assembly is complete to ensure the instructions provided in this manual have been strictly followed.**

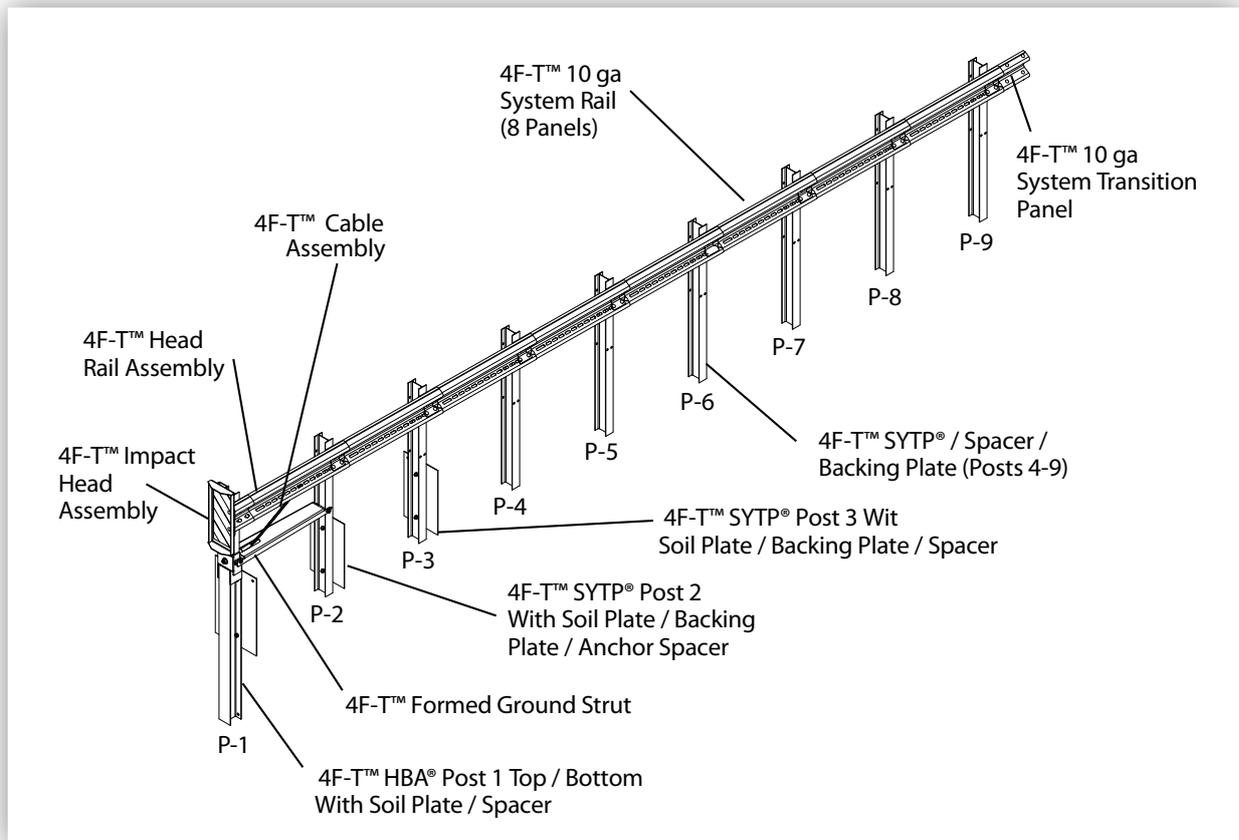
## 1.0 System Overview

The 4F-T™ System is a flared, single-sided, energy-absorbing, redirective and gating end terminal system. The system is the first four foot flared end terminal to meet the evaluation criteria set forth in AASHTO MASH. The system may be used to terminate strong post W-beam guardrail with mounting heights measuring 705 mm to 787 mm utilising a state/specifying agency approved transition.

The 4F-T™ System consists of one (1) 4F-T™ Impact Head, eight (8) 4F-T™ 10 ga System Rail, one (1) HBA® Post with Soil Plate at post location 1, eight (8) SYTP® at post locations 2-9, one (1) 4F-T™ 10 ga System Transition Panel, eight (8) 4F-T™ Steel Spacer Blocks, one (1) 4F-T™ Anchor Spacer Block, eight (8) 4F-T™ Backing Plates, one (1) 4F-T™ Formed Ground Strut, one (1) 4F-T™ Cable Assembly, Soil Plates at posts 2 & 3, and various other fastener and hardware components.

GAUGE CONVERSIONS	
10 Gauge	3.43mm
12 Gauge	2.67mm

Specifications	
System Weight	579 kg
System Length	10.47 m
System Offset (EzyGuard to traffic edge of impact head)	1.22 m
Post Spacing	1.27 m
System Width (at impact head)	260 mm
System Height (except impact head)	787 mm, +25 mm/-0 mm
Beginning Length-of-Need ("BLON") established during MASH Test 3-35 at Post #4	3.81 m from Post 1



Reference Drawing: 4FT-STD-001

## 2.0 Recommended Tools

### Documentation

- Assembly Manual (Current Version)
- System Drawing SS 4380 (Current Version)
- 4F-T™ Transition Drawings: SS 4381, SS 4382 (Current Version).

### Personal protective equipment (PPE)

- Eye Protection
- Work Gloves
- Safety-Toe Shoes
- Hard Hat
- Reflective Vest

### Miscellaneous

- Traffic Control Equipment and Plan per state/ specifying agency standards and the MUTCD
- SAE Combination Wrench Set

- Socket Set & Socket Wrench
- Hammer
- Chalk Line
- Tape Measure
- Marking Paint and Pen
- Straight Edge
- Level
- Plumb Line
- Post Pounder (commonly used for driving posts)
- Auger
- Soil Tamper
- 5/8" Alignment Tool (Drift Pin)
- Locking Pliers and/or pipe wrench
- Calibrated Torque Wrench (or other tool), capable of measuring 135 Nm (+/- 7 Nm)

Note: The provided list of tools is a general recommendation and should not be considered an exhaustive list. Depending on specific site conditions and the complexity of the assembly, the required tools may vary. Decisions as to what tools are needed to perform the job are entirely the responsibility of the state/specifying agency and the selected contractor performing the assembly of the system at the state/specifying agency's site.

## 3.0 Site Preparation

The 4F-T™ System may be specified for use by the appropriate state/specifying agency in conjunction with strong post W-beam guardrail systems on the shoulder or median of a roadway. The decision to specify the system for a particular project is the responsibility of the state/specifying agency design engineer who must ensure that the most appropriate end terminal has been selected for the specific site conditions.

The 4F-T™ System is designed to be attached to strong post W-beam guardrail systems that have been accepted under MASH or NCHRP Report 350 crash test criteria that use either no offset blocks, 203mm offset blocks or 305mm offset blocks. Some options may require transitions.

 Ingal does not direct grading. Proper site grading must be accomplished before assembly of the 4F-T™ System in accordance with local specifying agency guidelines and/or the AASHTO Roadside Design Guide (see Appendix A), whichever is more stringent. Failure to follow this warning could result in serious injury or death in the event of a vehicle impact or collision.

 Do not attach the 4F-T™ System directly to a rigid barrier (i.e. concrete barrier, wall or bridge pier) without the use of a state/specifying agency approved transition.

 The 4F-T™ System can be aesthetically stained/ treated, after Hot Dipped Galvanizing, with reactive color treatment. The 4F-T™ may NOT be powder coated or painted.

 Under **NO** circumstances shall the rail within the 4F-T™ be curved, between Post 1 and Post 9. Ensure all 4F-T™ post spacings are 1.270m on center.

## 4.0 Offset Requirements Within A Curve



Utilizing a 4F-T™ on a tight convex/radius could cause the 4F-T™ to encroach onto the shoulder.

If the state/specifying agency has an established guidance or policy for the installation of flared guardrail end terminals, it should be followed.

**Note:** The AASHTO Roadside Design Guide, 4th Edition (2011) - Chapter 10 provides limited general guidance in regard to Roadside Safety in an Urban or Restricted Environments, which may be of use to the design engineer.

## 5.0 System Post Placement

The 4F-T™ System posts are inserted into the state/specifying agency approved “strong” soil using an auger or post pounding equipment used for placement. If an auger is used, ensure diameter is large enough to allow for proper compaction of state/specifying agency approved fill material. All system posts are to be assembled within established standard construction tolerances, including being reasonably plumb. Compaction for all posts must be within the state/specifying agency guidelines.



It is the responsibility of the installer to ensure all above & below ground utilities as well as drainage structures are located, marked, and identified prior to using an auger or post pounding tool in accordance with state/specifying agency guidelines. Failure to follow this warning could result in serious injury or death.

## 6.0 Rigid Pavement and Underground Obstructions

If rigid pavement (e.g. concrete or asphalt) of **any thickness** is encountered within post locations 3-9, follow the state/specifying agency guidance or policy in regards to standard guardrail installation methods for such conditions. If a state/specifying agency does NOT have such guidance or policy, the 4F-T™ designer’s recommendation is to ensure a proper “leave-out” area (the specified size of open space as defined in the AASHTO Roadside Design Guide) and/or per the state/specifying agency is provided around the posts and filled with state/specifying agency approved backfill material.

If solid rock is encountered at post locations 3-9, refer to the state/specifying agency guidelines and/or the AASHTO Roadside Design Guide for requirements for embedment depth in the rock and size of the hole. If solid rock is encountered at post locations 1-2, auger a hole in the rock large enough for full post embedment and proper compaction of state/specifying agency approved backfill material.

**For alternate footing designs when encountering rock/underground obstructions for post location 1, see Appendix B for guidance.**



**Drilling Holes Into Rock:** It is the responsibility of the installer to consult OSHA silica respiratory standard 29 CFR 1910.134 for debris removal and ensure compliance.

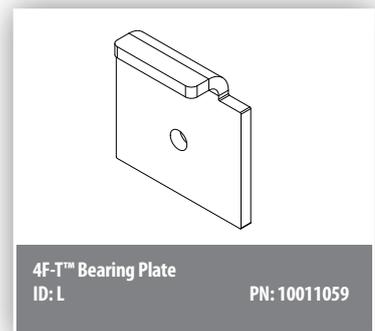
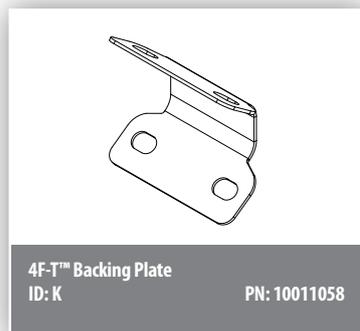
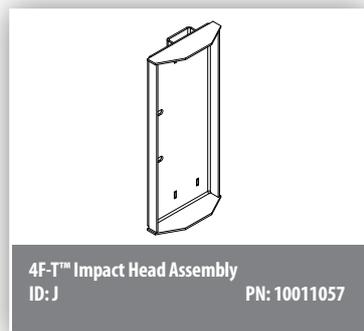
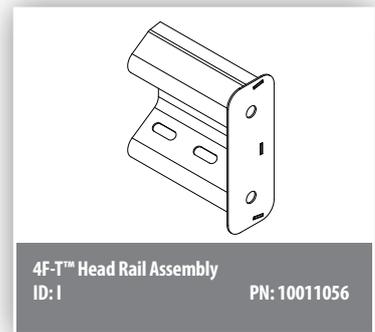
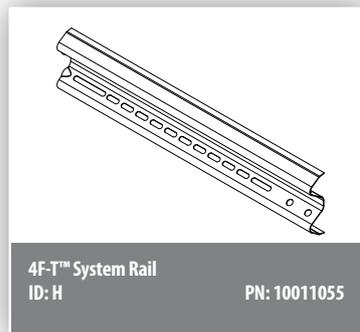
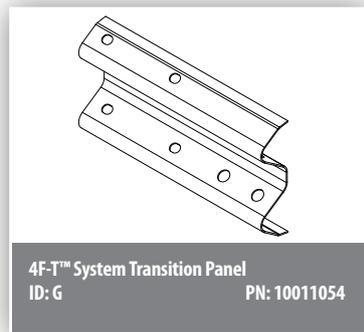
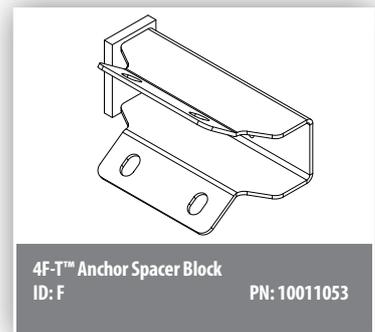
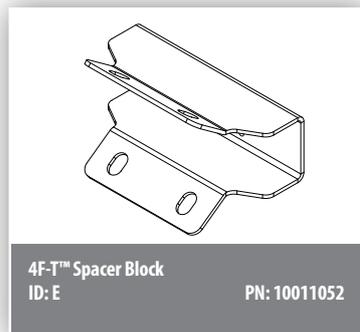
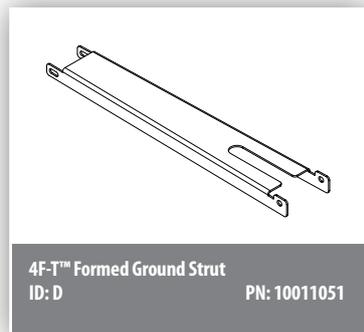
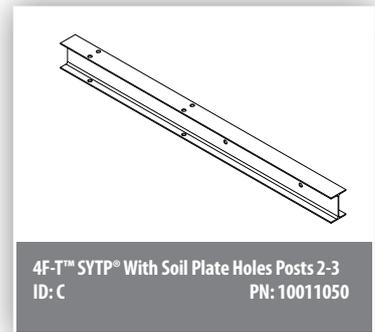
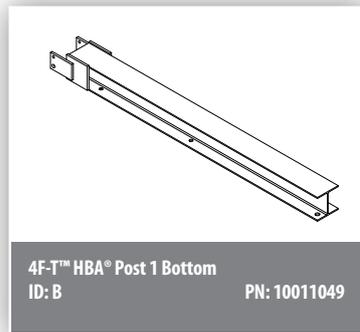
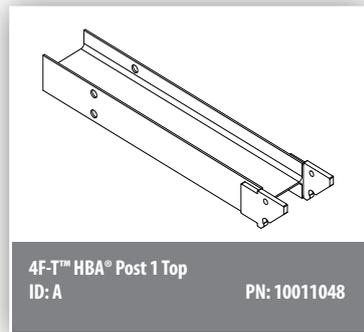
## 7.0 Inspect Shipment

Before assembling the 4F-T™ System, carefully unpack and inspect all components for signs of damage. Check the received parts against the packing list supplied with the system to verify that all parts were received. If parts are damaged or missing from the shipment or unspecified, do NOT attempt to assemble the system; contact Ingal Civil immediately.

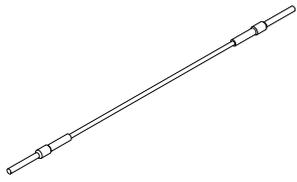
## 8.0 4F-T™ System Components/Hardware

Below is a pictorial depiction of the components/hardware for 4F-T™. Please see the Ingal drawings and page 11 of this manual for specific lists of components/hardware and quantities required for the 4F-T™.

**Note:** The following components/hardware are not shown to scale.



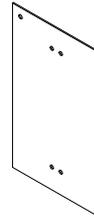
# 4F-T™ SYSTEM 4 Foot Flared TREND® Terminal



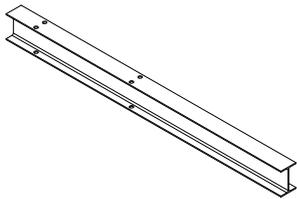
4F-T™ Cable Assembly 1.778m  
ID: M PN: 10011060



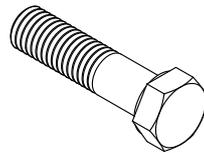
4F-T™ Soil Plate for Posts 2-3  
ID: N PN: 10011061



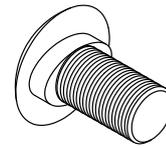
4F-T™ Soil Plate for Post 1  
ID: O PN: 10011062



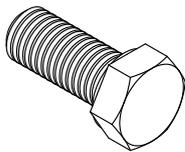
SYT Post 1830mm (4 holes)  
ID: P PN: 10001402



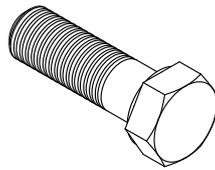
M12 x 50 Hex Bolt  
ID: B1 PN: 10011090



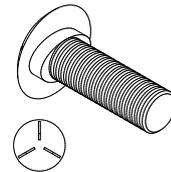
M16 x 32 GR Bolt  
ID: B2 PN: 10001248



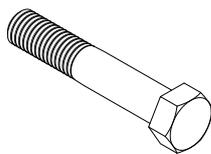
M16 x 40 Hex Bolt  
ID: B3 PN: 10004513



M16 x 50 Hex Bolt  
ID: B4 PN: 10004062



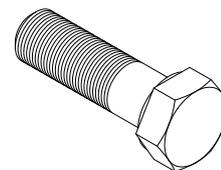
M16 x 50 GR Bolt  
ID: B5 PN: 10004030



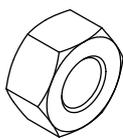
M16 x 90 Hex Bolt  
ID: B6 PN: 10010126



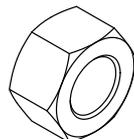
M16 x 200 Hex Bolt  
ID: B7 PN: 10010126



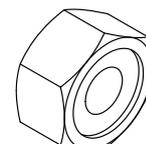
M20 x 65 Hex Bolt  
ID: B8 PN: 10009526



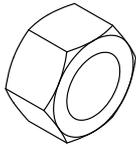
M12 Nut to suit B1  
ID: N1 PN: 10011090



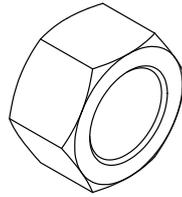
M16 Nut to suit B5  
ID: N2 PN: 10001254



Oversized M16 nut to suit B2, B3, B4, B6, B7  
ID: N3 PN: 10001239



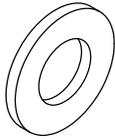
M20 Nut to suit B8  
ID: N4 PN: 10009526



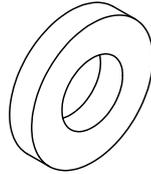
Nut to suit Cable  
ID: N5 PN: 10011060



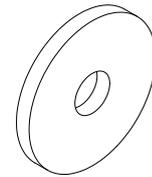
M12 Washer to suit B1  
ID: W1 PN: 10001689



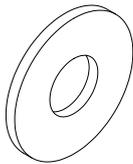
M16 washer to suit B4, B7  
ID: W2 PN: 10009527



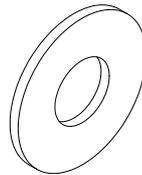
M16 35 O.D. x 6mm to suit B5  
ID: W3 PN: 10007653



M16 54 OD x 16 ID x 6mm Round Washer  
to suit B5  
ID: W4 PN: 10011091



M20 Round Washer to suit B8  
ID: W5 PN: 10009526



25 mm Round Washer  
ID: W6 PN: 10011060



Chevron for 4F-T Black and Yellow - LHS  
ID: UU PN: 10010082



Chevron for 4F-T Black and Yellow - RHS  
ID: VV PN: 10010083



Chevron for 4F-Terminal Black and White  
- LHS  
ID: WW PN: 10010084



Chevron for 4F-Terminal Black and White  
- RHS  
ID: XX PN: 10010085



Head Cover for 4F-T with Chevrons  
- Black and Yellow  
ID: YY PN: 10011092



Head Cover for 4F-T with Chevrons  
- Black and White  
ID: ZZ PN: 10011093

# 4F-T™ SYSTEM 4 Foot Flared TREND® Terminal

ID	4F-T™ COMPONENTS/HARDWARE	INGAL PN	QUANTITY
A	4F-T™ HBA® Post 1 Top	10011048	1
B	4F-T™ HBA® Post 1 Bottom	10011049	1
C	4F-T™ SYTP® With Soil Plate Holes Posts 2-3	10011050	2
D	4F-T™ Formed Ground Strut	10011051	1
E	4F-T™ Spacer Block	10011052	8
F	4F-T™ Anchor Spacer Block	10011053	1
G	4F-T™ System Transition Panel	10011054	1
H	4F-T™ System Rail	10011055	8
I	4F-T™ Head Rail Assembly	10011056	1
J	4F-T™ Impact Head Assembly	10011057	1
K	4F-T™ Backing Plate	10011058	8
L	4F-T™ Bearing Plate	10011059	1
M	4F-T™ Cable Assembly 1.778m	10011060	1
N	4F-T™ Soil Plate for Posts 2-3	10011061	2
O	4F-T™ Soil Plate for Post 1	10011062	1
P	SYT Post 1830mm (4 holes)	10001402	6
B1	M12 x 50 Hex Bolt	10011090	2
B2	M16 x 32 GR Bolt	10001248	8
B3	M16 x 40 Hex Bolt	10004513	4
B4	M16 x 50 Hex Bolt	10004062	9
B5	M16 x 50 GR Bolt	10004030	38
B6	M16 x 90 Hex Bolt	10010126	4
B7	M16 x 200 Hex Bolt	10010126	1
B8	M20 x 65 Hex Bolt	10009526	2
N1	M12 Nut to suit B1	10011090	2
N2	M16 Nut to suit B5	10001254	38
N3	Oversized M16 nut to suit B2, B3, B4, B6, B7	10001239	26
N4	M20 Nut to suit B8	10009526	2
N5	Nut to suit Cable	10011060	2
W1	M12 Washer to suit B1	10001689	2
W2	M16 washer to suit B4, B7	10009527	10
W3	M16 35 O.D. x 6mm to suit B5	10007653	36
W4	M16 54 OD x 16 ID x 6mm Round Washer to suit B5	10011091	2
W5	M20 Round Washer to suit B8	10009526	2
W6	Washer to suit Cable	10011060	2



**WARNING: Use only Ingal Civil Products parts that are specified by Ingal Civil Products for use with the 4F-T™ System. Do not utilise or otherwise commingle parts from other systems even if those systems are other Ingal Civil Products or Systems.**

ID	Motorcyclist Cover for 4F-T		
YY	Motorcyclist Cover for 4F-T - Full Cover - Yellow with Chevrons - Black & Yellow	10011092	1
ZZ	Motorcyclist Cover for 4F-T - Full Cover - Yellow with Chevrons - Black & White	10011093	1

- 4F-T Terminals are supplied with a Left Hand Side & a Right Hand Side Chevron unless otherwise requested at the time of ordering.
- Head Covers to suit 4F-T are available with Left Hand Side Chevron applied.
- A Right Hand Side Chevron is also supplied with Head Covers if required.
- This should be applied on top of the Left Hand Side Chevron.
- Do not remove the Left Hand Side Chevron.



CONFIG. 1  
B/Y LHS  
PN. 10011082



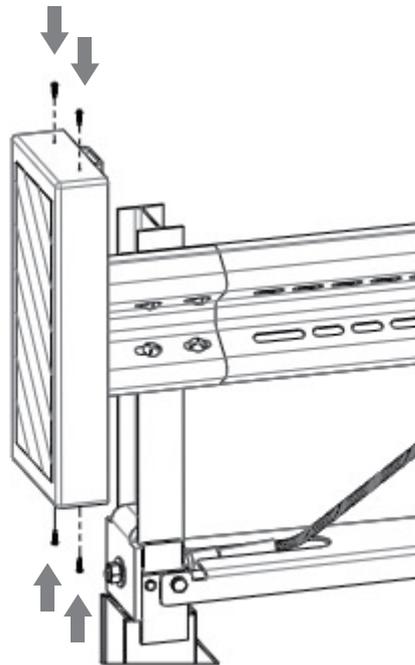
CONFIG. 2  
B/Y RHS  
PN. 10011083



CONFIG. 3  
B/W LHS  
PN. 10011084



CONFIG. 4  
B/Y RHS  
PN. 10011085



Locating Tek Screws to secure Head Cover

## 9.0 ASSEMBLY STEPS



To ensure an accurate assembly of the 4F-T™ System, it is recommended that steps be completed in order; however, some contractors have pre-assembled some steps. **ALL STEPS MUST BE COMPLETED.**



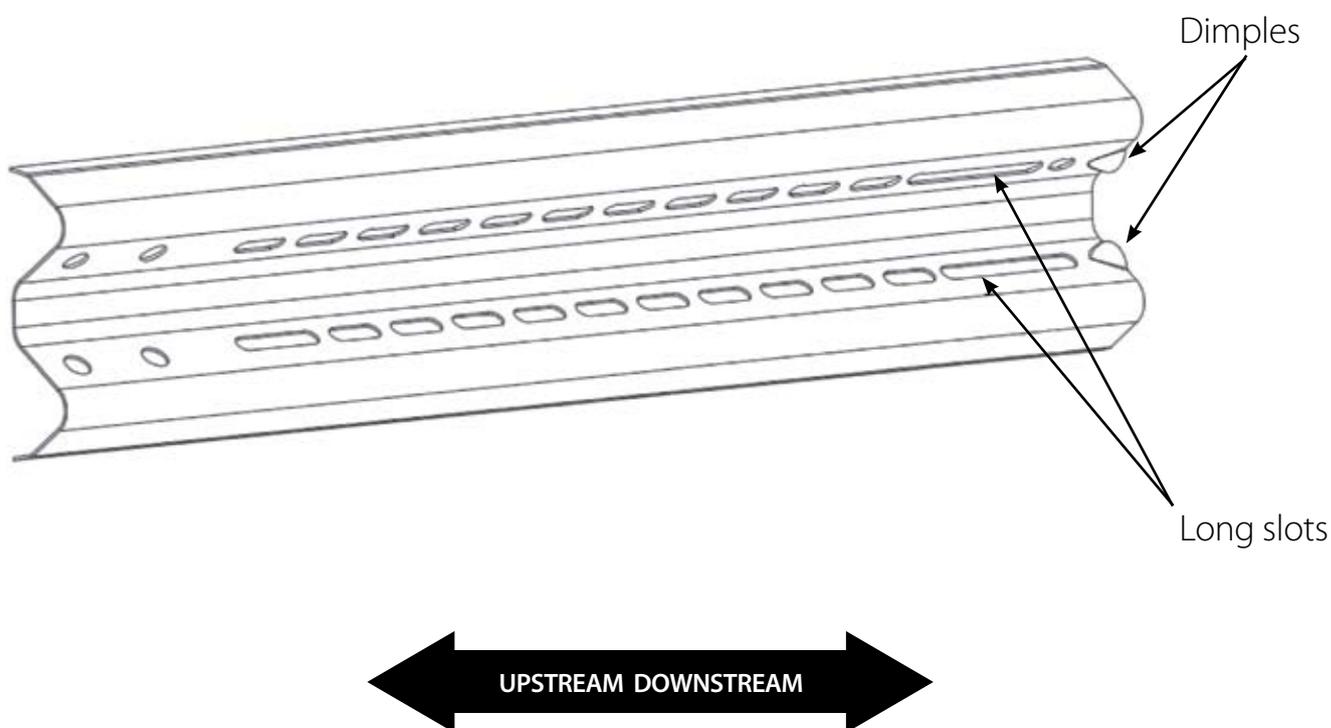
Below ground portions in some assembly steps are not shown for clarity. It is acceptable to weld the soil plates to the posts in Steps 3 and 4. After welding, wire brush the weld to remove loose slag, then apply a zinc rich paint, consistent with ASTM A780 or as instructed by state/specifying agency. In areas known for difficulty with below grade soils, washers (not included) may be added under the bolt head and/or the nut when installing the soil plates to posts, in Steps 3 and 4.



Indicates importance of reading instructions. Failure to follow all steps can result in improper performance, system failure, and/or serious injury or death in the event of a vehicle impact with the system.

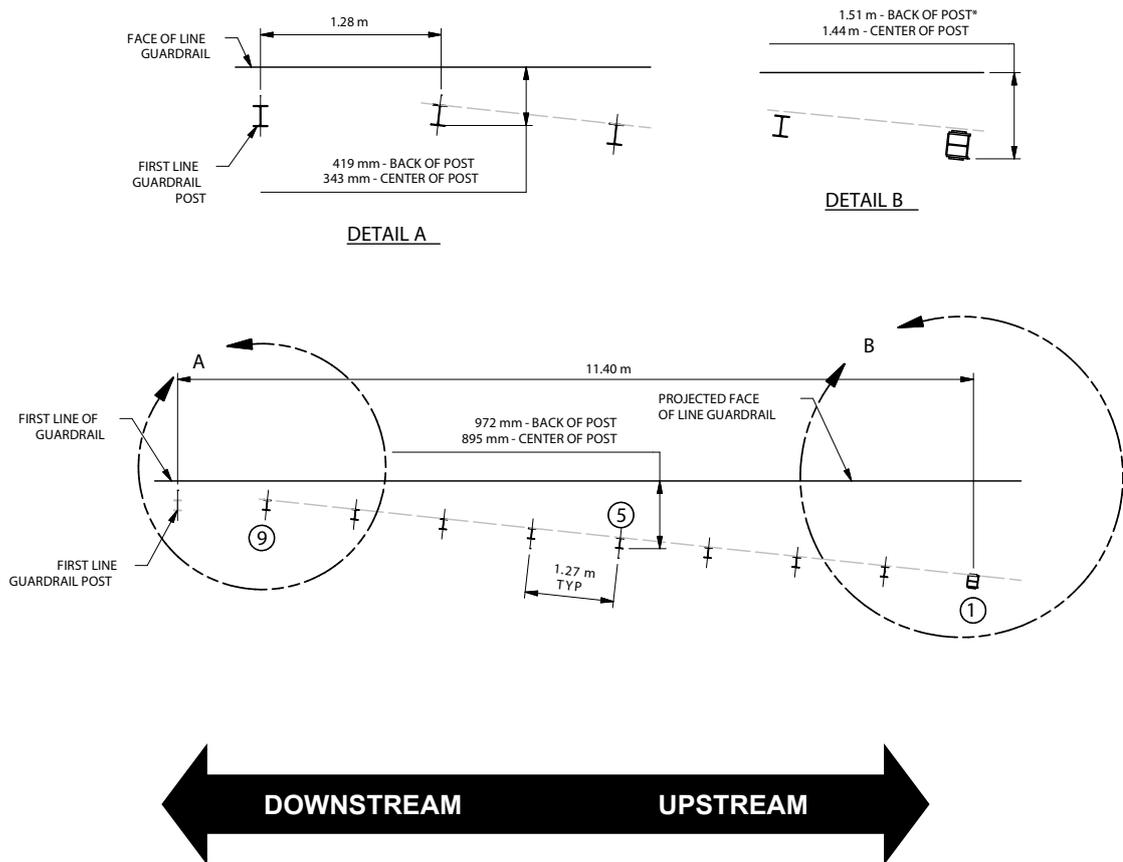
## System Guardrail Identification/Orientation

Note: The dimples and long slots in the 4F-T™ 10 ga System rail panel are always located **downstream**.



## STEP 1A

## POST LAYOUT FOR LEFT SIDE APPLICATION



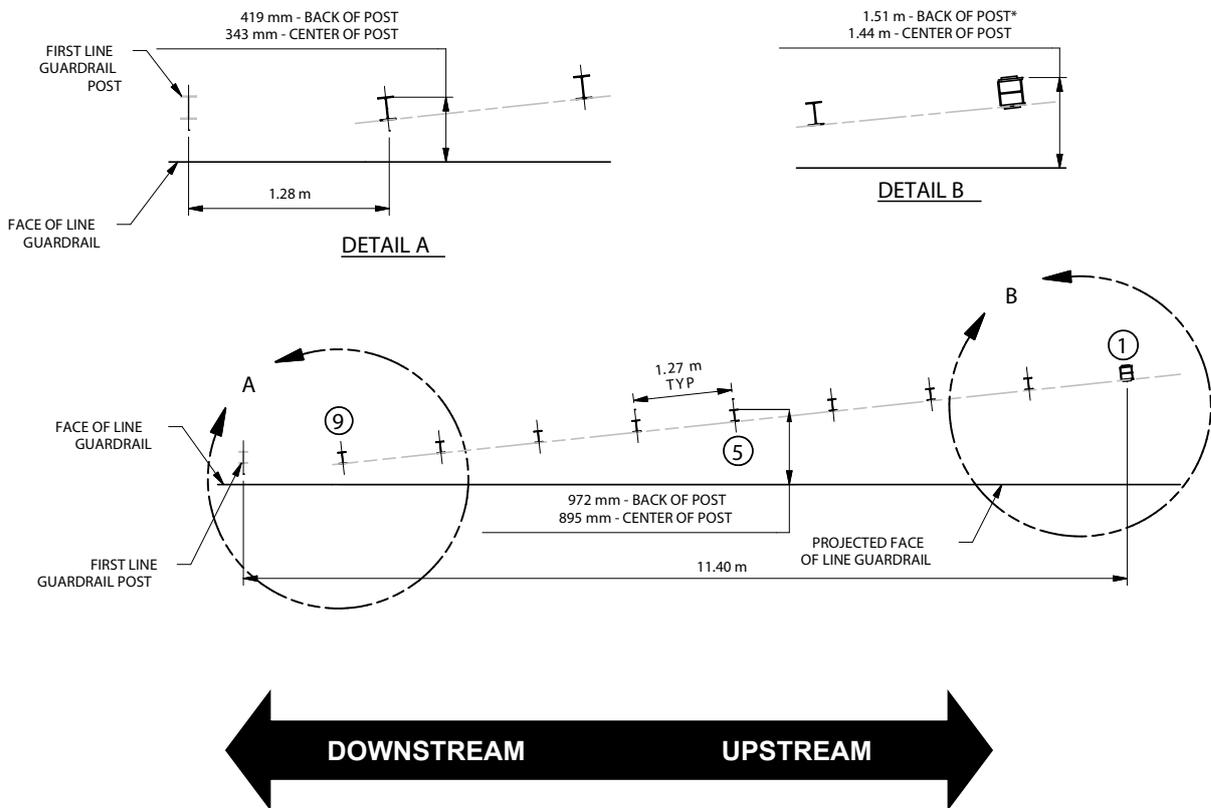
### PARTS


### ⚠ INSTRUCTIONS

1. Locate the 4F-T™ System post locations as shown in the above diagram.
2. ⚠ Proper site grading must be accomplished in accordance with state/specifying agency guidelines and/or the AASHTO Roadside Design Guide, whichever is more stringent. Failure to follow this warning could result in serious injury or death in the event of a vehicle impact with the system.
3. **Under NO circumstances** shall the rail within the 4F-T™ be curved between Post 1 and Post 9. Ensure the 4F-T™ System Posts 1-9 locations are in a straight line.

## STEP 1B

## POST LAYOUT FOR RIGHT SIDE APPLICATION



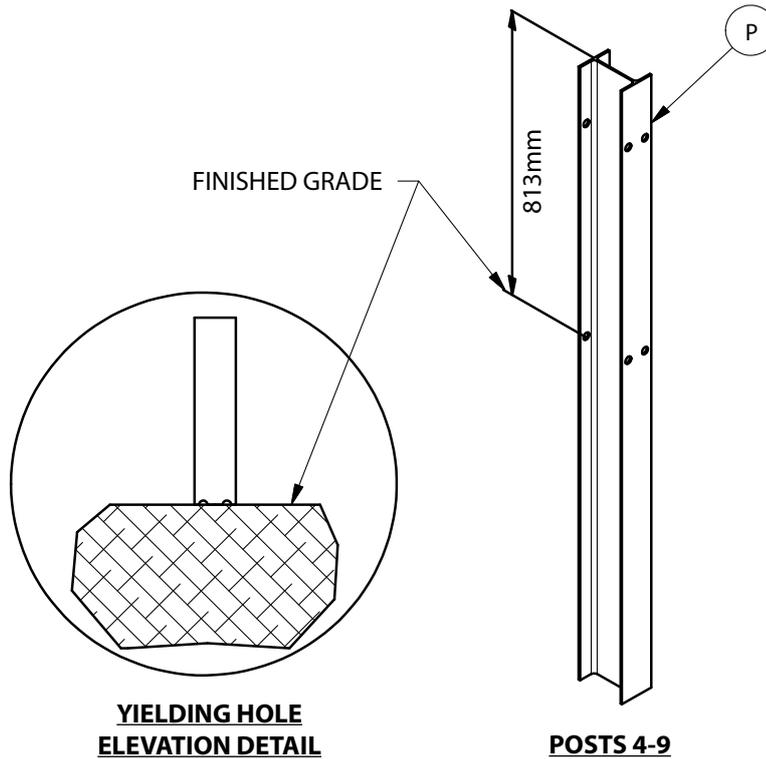
### PARTS


### ⚠ INSTRUCTIONS

1. Locate the 4F-T™ System post locations as shown in the above diagram.
2. ⚠ Proper site grading must be accomplished in accordance with state/specifying agency guidelines and/or the AASHTO Roadside Design Guide, whichever is more stringent. Failure to follow this warning could result in serious injury or death in the event of a vehicle impact with the system.
3. **Under NO circumstances** shall the rail within the 4F-T™ be curved between Post 1 and Post 9. Ensure the 4F-T™ System Posts 1-9 locations are in a straight line.

## STEP 2

### ASSEMBLE SYTP® (POSTS 4-9)



### PARTS

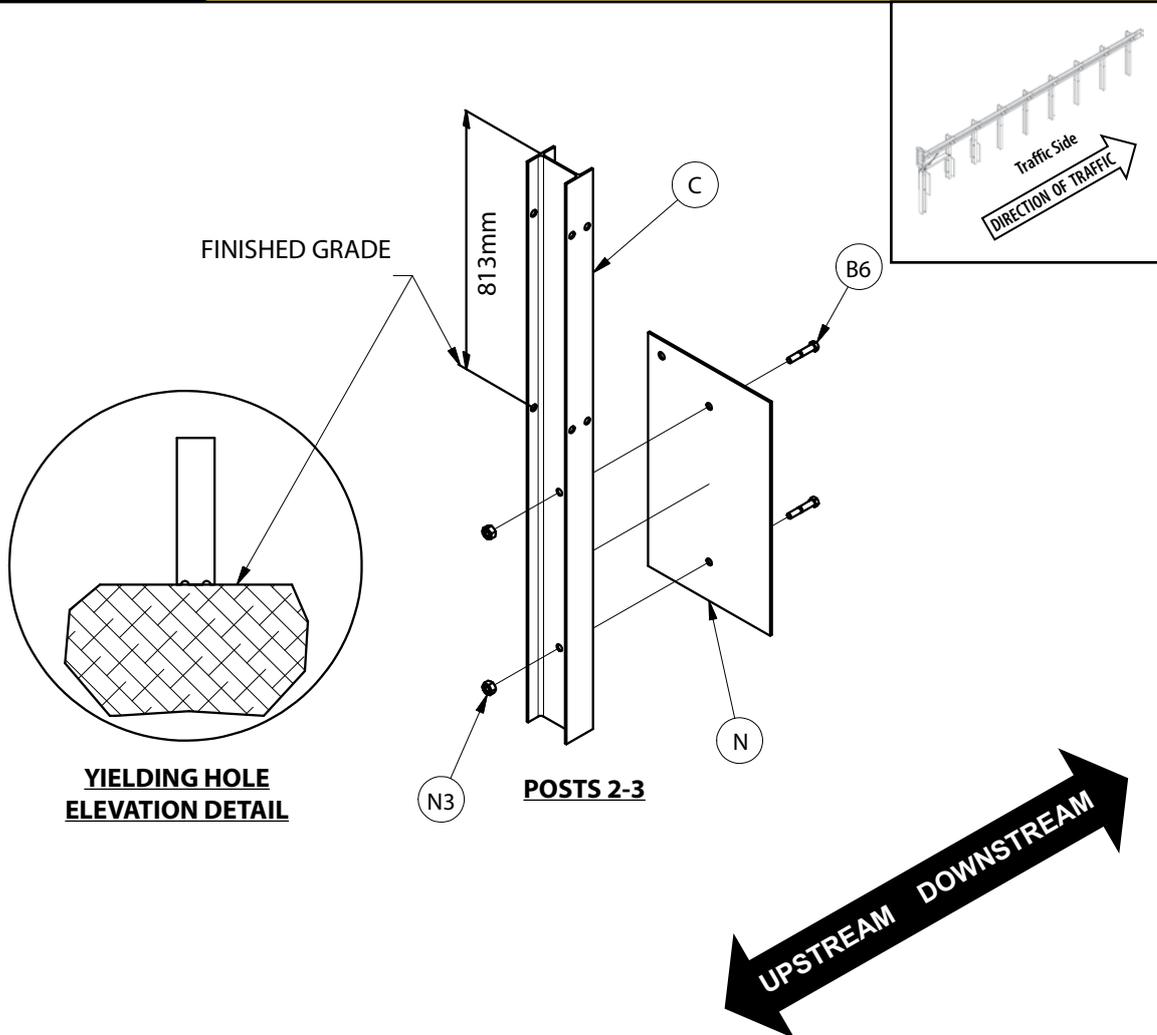
P	SYT Post 1830mm (4 holes)	10001402	6 EA

### ⚠ INSTRUCTIONS

1. Assemble the 1.83 m 4F-T™ SYTP® (Part P) as shown above at the locations established in Step 1A or Step 1B.
2. Ensure the center of the 4F-T™ SYTP® holes are approximately at finished grade (+25 mm, -0 mm). Finished grade measurements should be taken from the traffic side of the post.

## STEP 3

### ASSEMBLE SYTP® WITH SOIL PLATE (POSTS 2-3)



#### PARTS

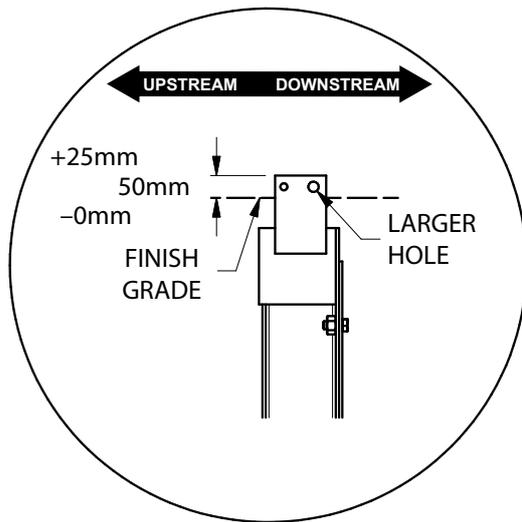
C	4F-T™ SYTP® With Soil Plate Holes Posts 2-3	10011050	2 EA
N	4F-T™ Soil Plate for Posts 2-3	10011061	2 EA
B6	M16 x 90 Hex Bolt	10010126	4 EA
N3	Oversized M16 nut to suit B2, B3, B4, B6, B7	10001239	4EA

#### ⚠ INSTRUCTIONS

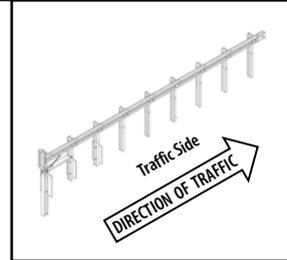
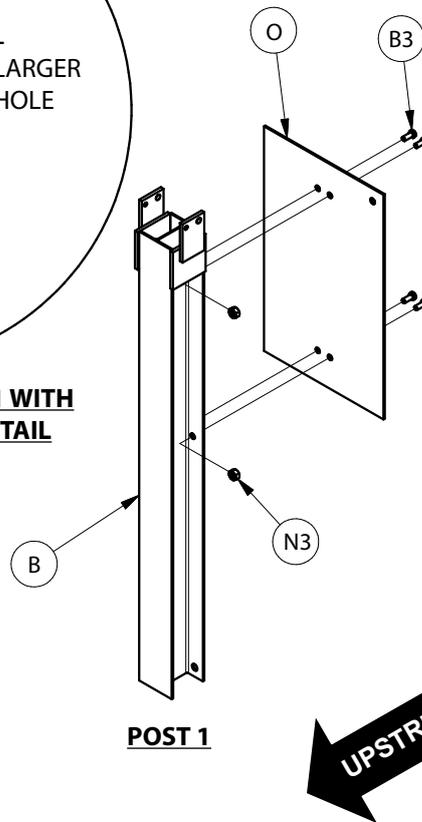
1. Assemble the 4F-T™ Soil Plate (Part N) to the **downstream** side of the 1.83 m 4F-T™ SYTP® (Part C) as shown above using specified hardware (Parts B6, N3).
2. Ensure the nut is on the **upstream** side of the post web.
3. Tighten all threaded hardware to a snug position with a minimum of two (2) bolt threads protruding beyond the nut. Finished grade measurements should be taken from the traffic side of the post.
4. Assemble the 1.83 m 4F-T™ SYTP® with Soil Plate as shown above at locations established in Step 1A or 1B.
5. Ensure the center of the 4F-T™ SYTP® holes are approximately at finished grade (+25 mm, -0 mm).

## STEP 4

### ASSEMBLE 4F-T™ HBA® POST 1 BOTTOM WITH SOIL PLATE (POST 1)



**4F-T™ BOTTOM HBA® POST 1 WITH SOIL PLATE ELEVATION DETAIL**



#### PARTS

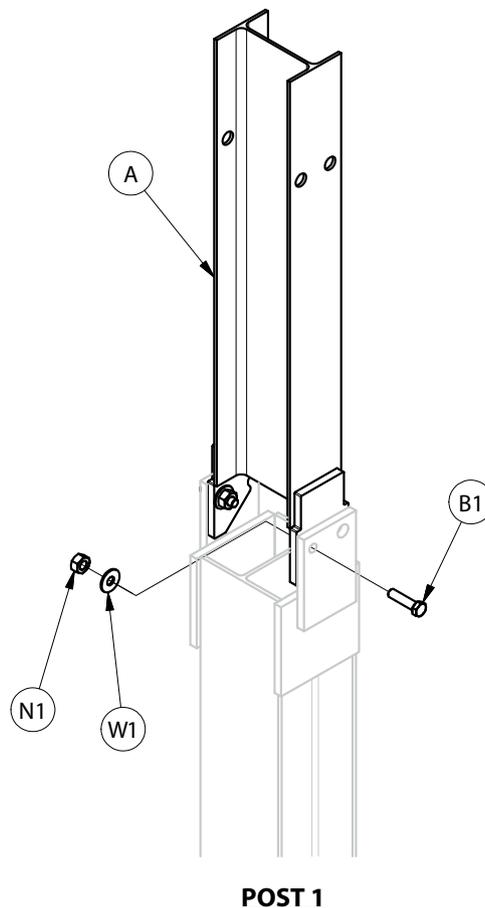
B	4F-T™ HBA® Post 1 Bottom	10011049	1 EA
O	4F-T™ Soil Plate for Post 1	10011049	1 EA
B3	M16 x 40 Hex Bolt	10004513	4 EA
N3	Oversized M16 nut to suit B2, B3, B4, B6, B7	10001239	4 EA

#### ⚠ INSTRUCTIONS

1. Assemble the 4F-T™ Soil Plate (Part O) to the **downstream** side of the 1.83 m 4F-T™ HBA® Post 1 Bottom (Part B) as shown above using the specified hardware (Parts B3, N3).
2. Ensure the nut is on the **inside** of the post flange.
3. Tighten all threaded hardware to a snug position with a minimum of two (2) bolt threads protruding beyond the nut.
4. Assemble the 1.83 m 4F-T™ SYTP® with Soil Plate as shown above at locations established in Step 1A and 1B. Finished grade measurements should be taken from the traffic side of the post.
5. Ensure the top of the 4F-T™ HBA® Post 1 Bottom is 50 mm (+25 mm, -0 mm) above the finished grade.

## STEP 5

### ASSEMBLE 4F-T™ HBA® POST 1 TOP TO HBA® POST 1 BOTTOM



#### PARTS

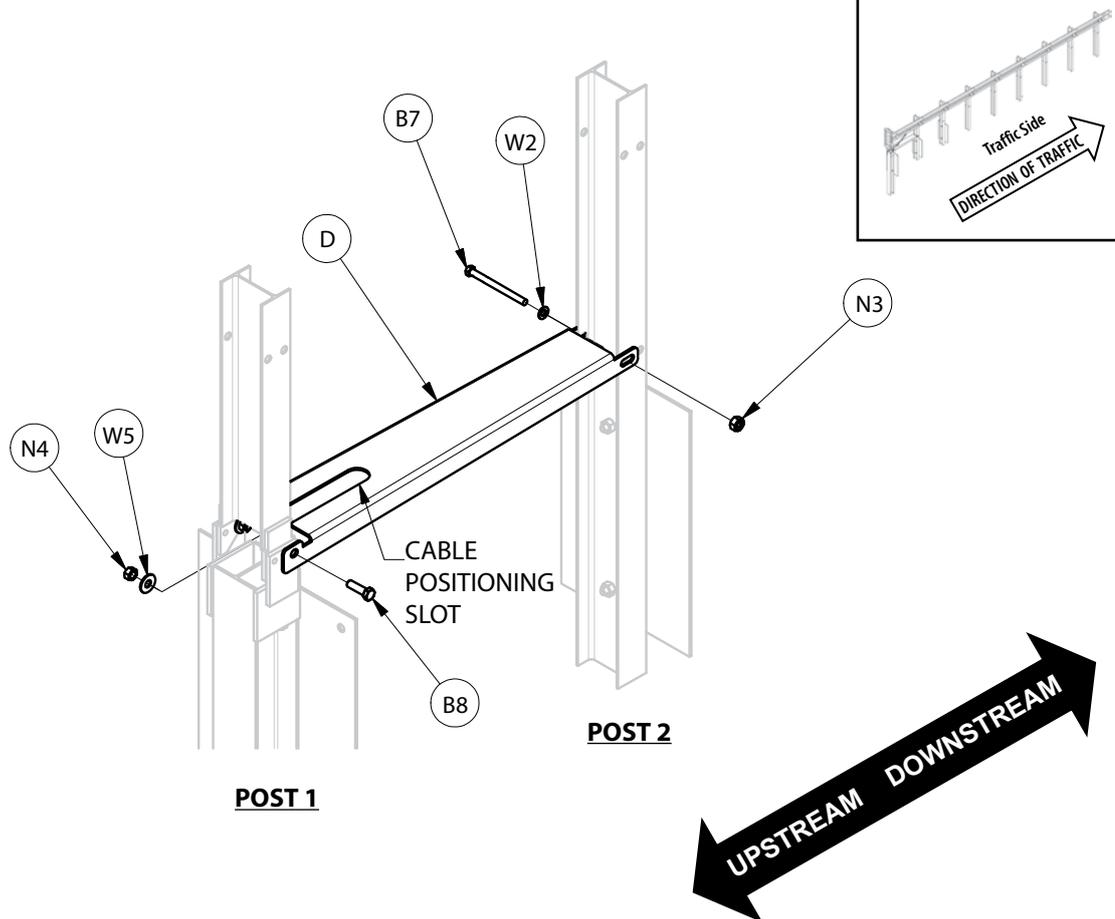
A	4F-T™ HBA® Post 1 Top	10011048	1 EA
B1	M12 x 50 Hex Bolt	10011090	2 EA
N1	M12 Nut to suit B1	10011090	2 EA
W1	M12 Washer to suit B1	10001689	2 EA

#### ⚠ INSTRUCTIONS

1. Assemble the 4F-T™ HBA® Post 1 Top (Part A) to the 4F-T™ HBA® Post 1 Bottom as shown above using specified hardware (Parts B1, N1, W1)
2. Ensure the nuts and washers are on the **inside** of the welded plates of the 4F-T™ HBA® Post 1 Top.
3. Hand tighten all threaded hardware. Hardware to be tightened in Step 6.

## STEP 6

### ASSEMBLE 4F-T™ FORMED GROUND STRUT



#### PARTS

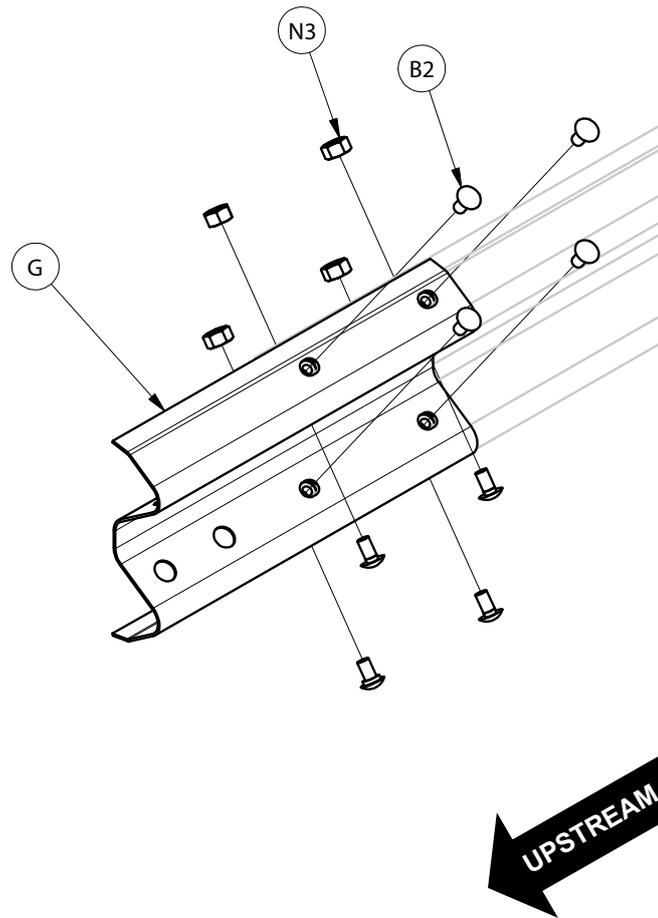
D	4F-T™ Formed Ground Strut	10011051	1 EA
B7	M16 x 200 Hex Bolt	10010126	1 EA
B8	M20 x 65 Hex Bolt	10009526	2 EA
N3	Oversized M16 nut to suit B2, B3, B4, B6, B7	10001239	1 EA
N4	M20 Nut to suit B8	10009526	2 EA
W2	M16 washer to suit B4, B7	10009527	1 EA
W5	M20 Round Washer to suit B8	10009526	2 EA

#### ⚠ INSTRUCTIONS

1. Assemble the 4F-T™ Formed Ground Strut (Part D) as shown above.
2. Assemble 4F-T™ Formed Ground Strut to Post 1 using shown hardware (Parts B8, N4, W5).
3. Assemble 4F-T™ Formed Ground Strut to Post 2 using shown hardware (Parts B7, N3, W2).
4. Ensure the cable positioning slot in the 4F-T™ Formed Ground Strut is **upstream**.
5. Ensure the flat portion of the 4F-T™ Formed Ground Strut is up.
6. Ensure the 4F-T™ HBA® Post 1 Top is reasonably plumb.
7. Ensure the nut on post 2 is on the top of the post.
8. Tighten all threaded hardware (including hardware assembled in Step 5) to a snug position with a minimum of two (2) bolt threads protruding beyond the nut.

## STEP 7A

## ASSEMBLE 4F-T™ 10 GA SYSTEM TRANSITION



### PARTS

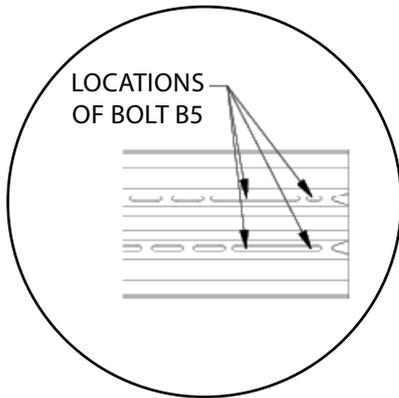
G	4F-T™ System Transition Panel	10011054	1 EA
B2	M16 x 32 GR Bolt	10001248	8 EA
N3	Oversized M16 nut to suit B2, B3, B4, B6, B7	10001239	8 EA

### ⚠ INSTRUCTIONS

1. Assemble the 4F-T™ 10 ga System Transition Panel (Part G) as shown above to the **downstream** guardrail using specified hardware (Parts B2, N3).
2. For both **downstream** and **upstream** installations, ensure the 4F-T™ 10 ga System Transition Panel is lapped to the outside of the first line guardrail panel.
3. Tighten all threaded hardware to a snug position with a minimum of two (2) bolt threads protruding beyond the nut.

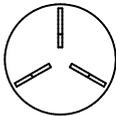
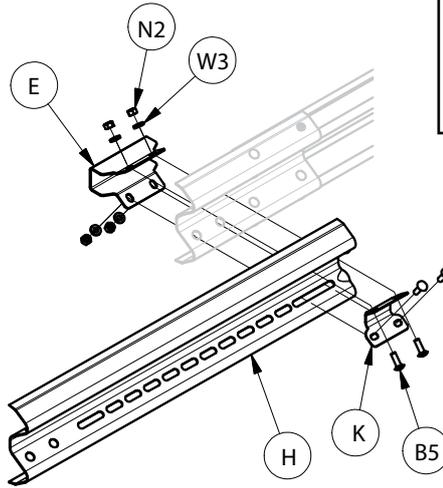
## STEP 7B

### ASSEMBLE 4F-T™ 10 GA SYSTEM RAIL PANEL AT SYTP® LOCATIONS 9-8

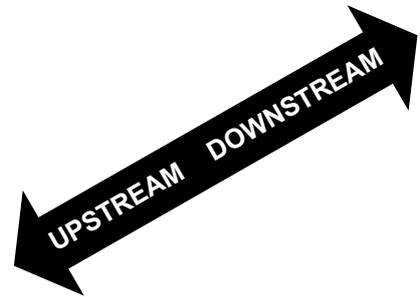


LOCATIONS OF BOLT B5

**BOLT LOCATION  
DETAIL**



**10004030  
TOP VIEW**



### PARTS

E	4F-T™ Spacer Block	10011052	1 EA
H	4F-T™ 10 System Rail	10011055	1 EA
K	4F-T™ Backing Plate	10011058	1 EA
B5	M16 x 50 GR Bolt	10004030	4 EA
N2	M16 Nut to suit B5	10001254	4 EA
W3	M16 35 O.D. x 6mm to suit B5	10007653	4 EA

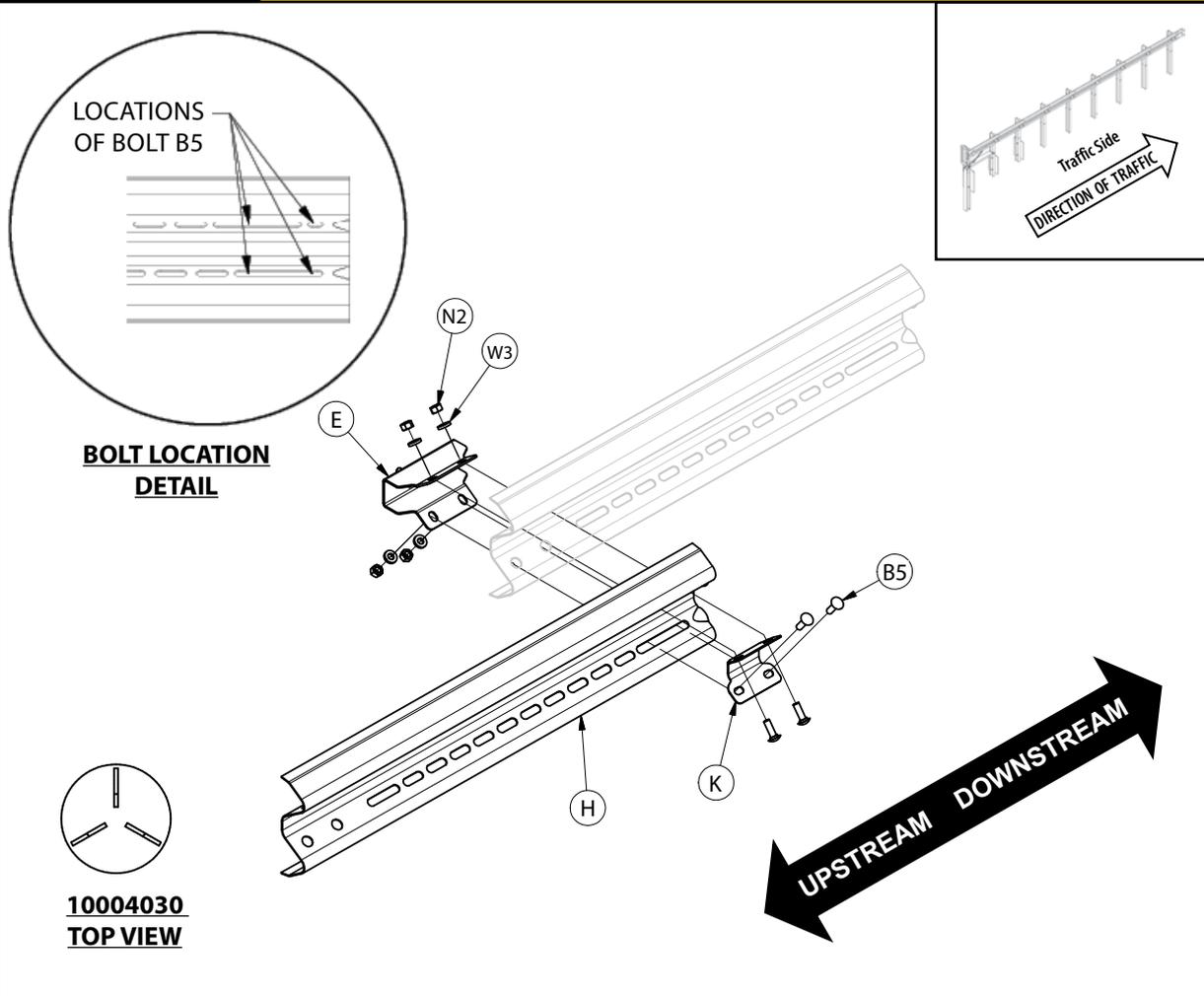
### ⚠ INSTRUCTIONS

1. Assemble one (1) 4F-T™ 10 ga System Rail (Part H), the 4F-T™ Backing Plate (Part K) and 4F-T™ Spacer Block (Part E) to the 4F-T™ 10 ga Transition Panel as shown above using specified hardware (Parts B5, N2, W3).
2. Ensure the 4F-T™ 10 ga System Rail is lapped to the **outside** of the 4F-T™ 10 ga Transition Panel and the **downstream** 4F-T™ 10 ga System Rail.
3. Ensure the M16 x 50 GR Bolt (Part B5) passes through the slots shown in detail.
4. Ensure the 4F-T™ Backing Plate (Part K) is on the outside of the 4F-T™ 10 ga System Rail.
5. Assemble all hardware loosely **ensuring the bolt is seated** for this step.

**Note:** For alignment purposes the 4F-T™ 10 ga System Rail may need to be pulled out to where the bolts are bottomed out on the slotted holes before attaching to the posts.

## STEP 7C

### ASSEMBLE 4F-T™ 10 GA SYSTEM RAIL PANEL AT SYTP® LOCATIONS 8-7



### PARTS

E	4F-T™ Spacer Block	10011052	1 EA
H	4F-T™ System Rail	10011055	1EA
K	4F-T™ Backing Plate	10011058	1EA
B5	M16 x 50 GR Bolt	10004030	4 EA
N2	M16 Nut to suit B5	10001254	4 EA
W3	M16 35 O.D. x 6mm to suit B5	10007653	4 EA

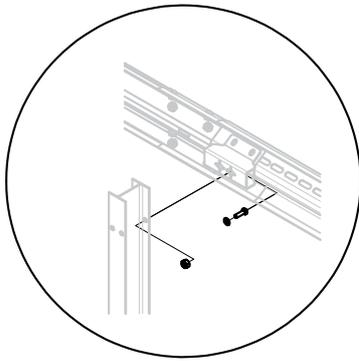
### ⚠ INSTRUCTIONS

1. Assemble one (1) 4F-T™ 10 ga System Rail (Part H), the 4F-T™ Backing Plate (Part K) and 4F-T™ Spacer Block (Part E) to the 4F-T™ 10 ga System Rail as shown above using specified hardware (Parts B5, N2, W3).
2. Ensure the upstream 4F-T™ 10 ga System Rail is lapped to the outside of the downstream 4F-T™ 10 ga System Rail.
3. Ensure the M16 x 50 GR Bolt (Part B5) passes through the slots shown in detail.
4. Ensure the 4F-T™ Backing Plate (Part K) is on the outside of the 4F-T™ 10 ga System Rail.
5. Assemble all hardware loosely ensuring the bolt is seated for this step.

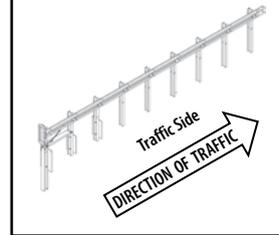
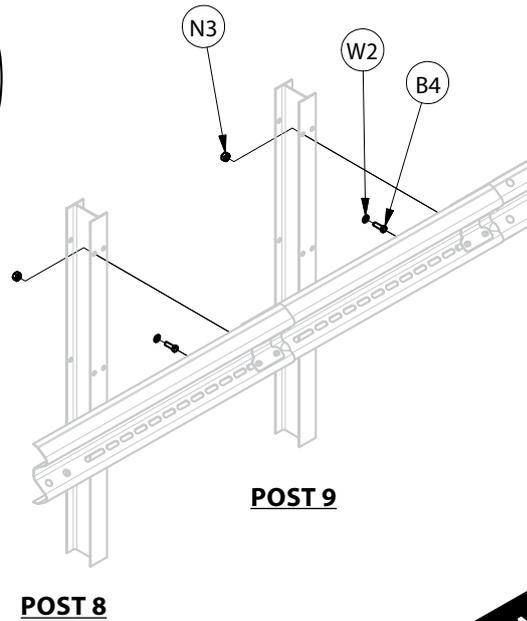
**Note:** For alignment purposes the 4F-T™ 10 ga System Rail may need to be pulled out to where the bolts are bottomed out on the slotted holes before attaching to the posts.

## STEP 8

### ASSEMBLE 4F-T™ 10 GA SYSTEM RAIL PANELS / 4F-T™ (POSTS 9-8)



**SPACER BLOCK  
ATTACHMENT TO  
SYTP 8-9**



### PARTS

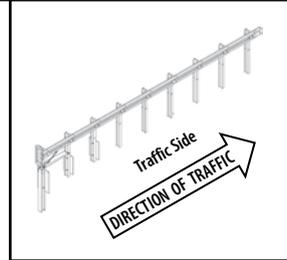
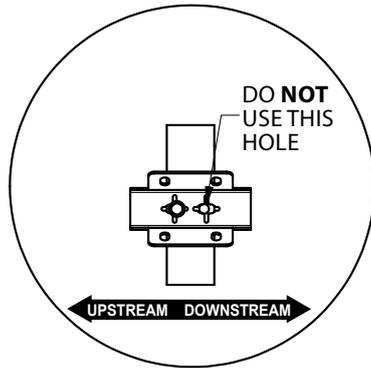
B4	M16 x 50 Hex Bolt	10004062	2 EA
N3	Oversized M16 nut to suit B2, B3, B4, B6, B7	10001239	2 EA
W2	M16 washer to suit B4, B7	10009527	2 EA

### ⚠ INSTRUCTIONS

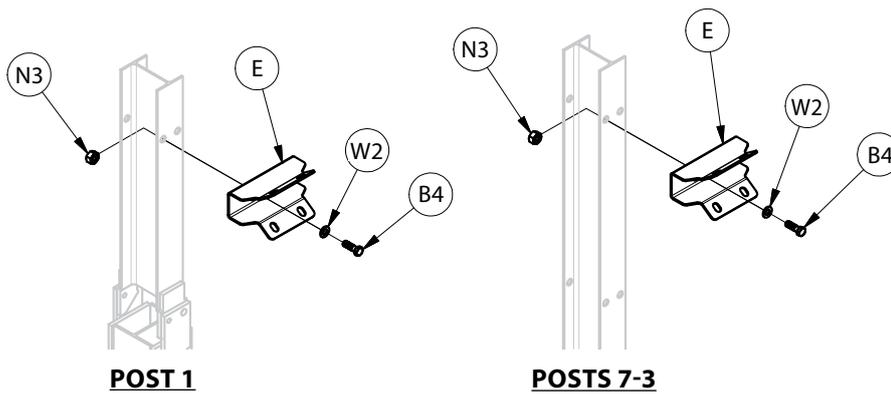
1. Assemble by mechanically pushing on the 4F-T™ 10 ga System Rail Panels towards SYTP® 8 until the 4F-T™ Spacer Block is in contact with SYTP® 8.
2. Assemble the 4F-T™ Spacer Block to the SYTP® 8 using the **upstream** hole in the post as shown above using specified hardware (Parts B4, N3, W2). Assemble the hardware hand tight.
3. Assemble by mechanically pushing on the 4F-T™ 10 ga System Rail Panels towards SYTP® 9 until the 4F-T™ Spacer Block is in contact with SYTP® 9, as shown above.
4. Assemble the 4F-T™ Spacer Block to the SYTP® 9 using the **upstream** hole in the post as shown above using specified hardware (B4, N3, and W2). Assemble the hardware hand tight. Finished grade measurements should be taken from the traffic side of the guardrail.
5. Ensure first line post in **downstream** guardrail has not leaned back more than 76 mm.
6. Ensure all guardrail is approximately 787 mm (+25 mm, -0 mm) above finished grade.

## STEP 9

### ASSEMBLE 4F-T™ SPACER BLOCK TO POSTS 1 (HBA®) and 7-3 (SYTP®)



#### ORIENTATION OF THE SPACER BLOCK DETAIL



#### PARTS

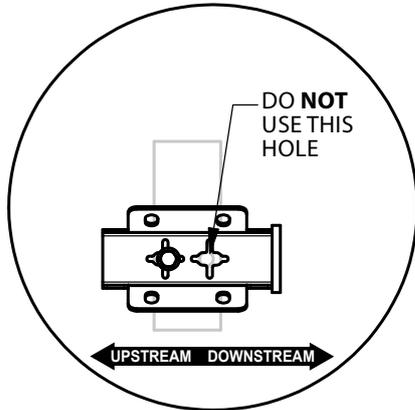
E	4F-T™ Spacer Block	10011052	6 EA
B4	M16 x 50 Hex Bolt	10004062	6 EA
N3	Oversized M16 nut to suit B2, B3, B4, B6, B7	10001239	6 EA
W2	M16 washer to suit B4, B7	10009527	6 EA

#### ⚠ INSTRUCTIONS

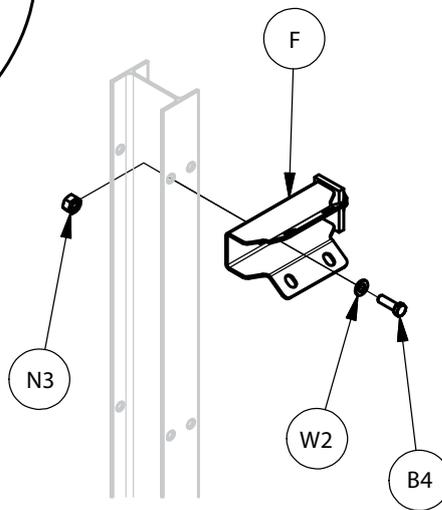
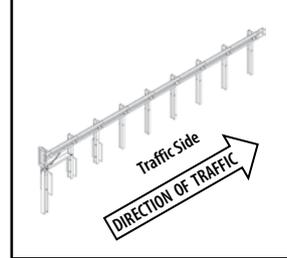
1. Assemble the 4F-T™ Spacer Block (Part E) to the 4F-T™ HBA® Post 1 Top and 4F-T™ SYTP® 7-3 as shown above with the specified hardware (Parts B4, N3, W2).
2. Ensure the **upstream** slotted hole in the 4F-T™ Spacer Block is bolted to the 4F-T™ HBA® Post 1 Top and 4F-T™ SYTP® 7-3 using the **upstream** hole in the posts.
3. Assemble all hardware loosely.

## STEP 10

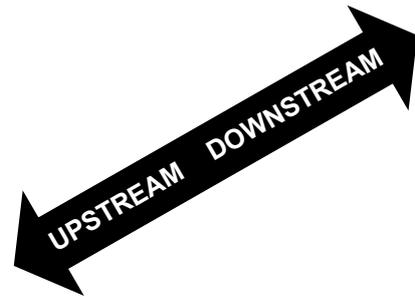
### ASSEMBLE 4F-T™ ANCHOR SPACER BLOCK TO SYTP® 2



**ORIENTATION OF THE ANCHOR SPACER BLOCK DETAIL**



**POST 2**



#### PARTS

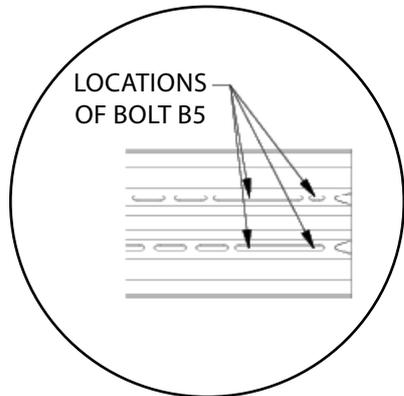
F	4F-T™ Anchor Spacer Block	10011053	1 EA
B4	M16 x 50 Hex Bolt	10004062	1 EA
N3	Oversized M16 nut to suit B2, B3, B4, B6, B7	10001239	1 EA
W2	M16 washer to suit B4, B7	10009527	1 EA

#### ⚠ INSTRUCTIONS

1. Assemble the 4F-T™ Anchor Spacer Block (Part F) to 4F-T™ SYTP® 2 as shown above with the specified hardware (Parts B4, N3, W2).
2. Ensure the upstream slotted hole in the 4F-T™ Anchor Spacer Block is bolted using the upstream hole in the 4F-T™ SYTP® 2.
3. Ensure the welded plate of the 4F-T™ Anchor Spacer Block is on the downstream side of the 4F-T™ SYTP® 2.
4. Assemble all hardware loosely.

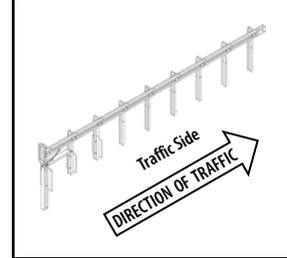
## STEP 11

## ASSEMBLE 4F-T™ 10 GA SYSTEM RAIL TO SYTP® 7-2

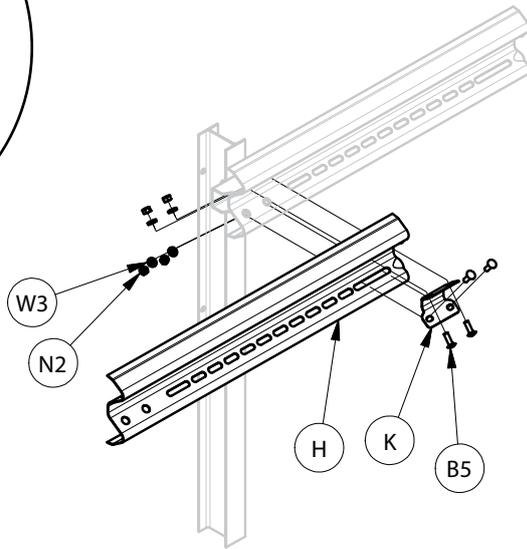


LOCATIONS OF BOLT B5

**BOLT LOCATION  
DETAIL**



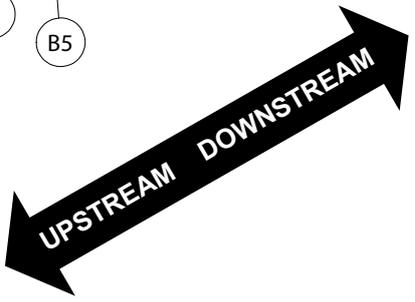
Traffic Side  
DIRECTION OF TRAFFIC



**POSTS 7-2**



**10004030  
TOP VIEW**



**UPSTREAM DOWNSTREAM**

### PARTS

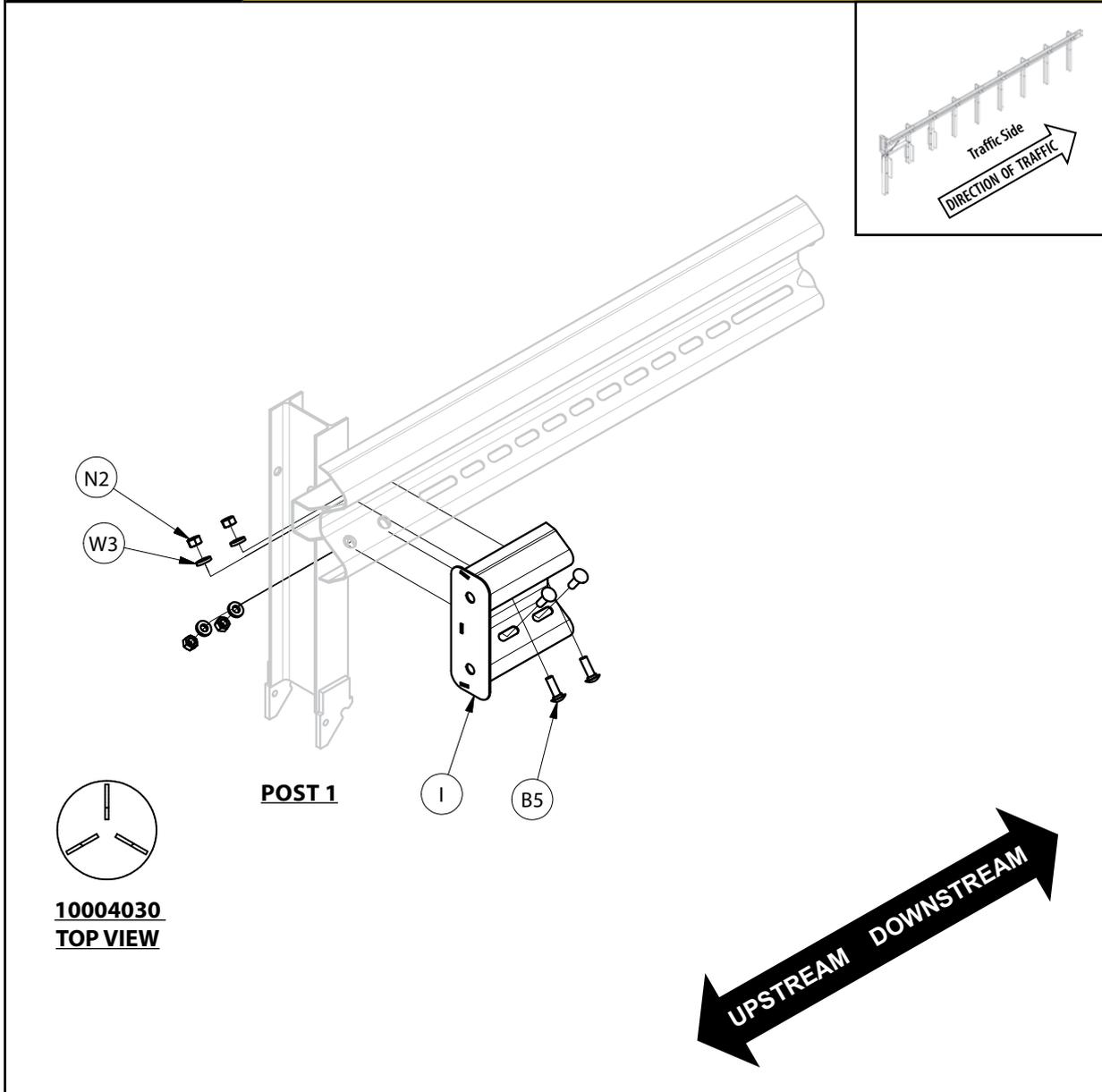
H	4F-T™ System Rail	10011055	6 EA
K	4F-T™ Backing Plate	10011058	6 EA
B5	M16 x 50 GR Bolt	10004030	24 EA
N2	M16 Nut to suit B5	10001254	24 EA
W3	M16 35 O.D. x 6mm to suit B5	10007653	24 EA

### ⚠ INSTRUCTIONS

1. Assemble the 4F-T™ 10 ga System Rail (Part H) and the 4F-T™ Backing Plate (Part K) as shown above using specified hardware (Parts B5, N2, W3) at SYTP® locations 7-2.
2. Ensure the 4F-T™ 10 ga System Rail is lapped to the outside of the downstream 4F-T™ 10 ga System Rail.
3. Ensure the M16 x 50 GR Bolt (Part B5) passes through the slots shown in detail.
4. Ensure the 4F-T™ Backing Plate (Part K) is on the outside of the 4F-T™ 10 ga System Rail.
5. Assemble all hardware loosely ensuring the bolt is seated for this step.
6. Guardrail is approximately 787 mm (+25 mm, -0 mm) above finished grade.
7. Finished grade measurements should be taken from the traffic side of the guardrail.
8. Repeat instructions 1-6 for all post locations.

## STEP 12

### ASSEMBLE 4F-T™ 10 GA SYSTEM RAIL AND 4F-T™ HEAD RAIL ASSEMBLY



**10004030**  
**TOP VIEW**

#### PARTS

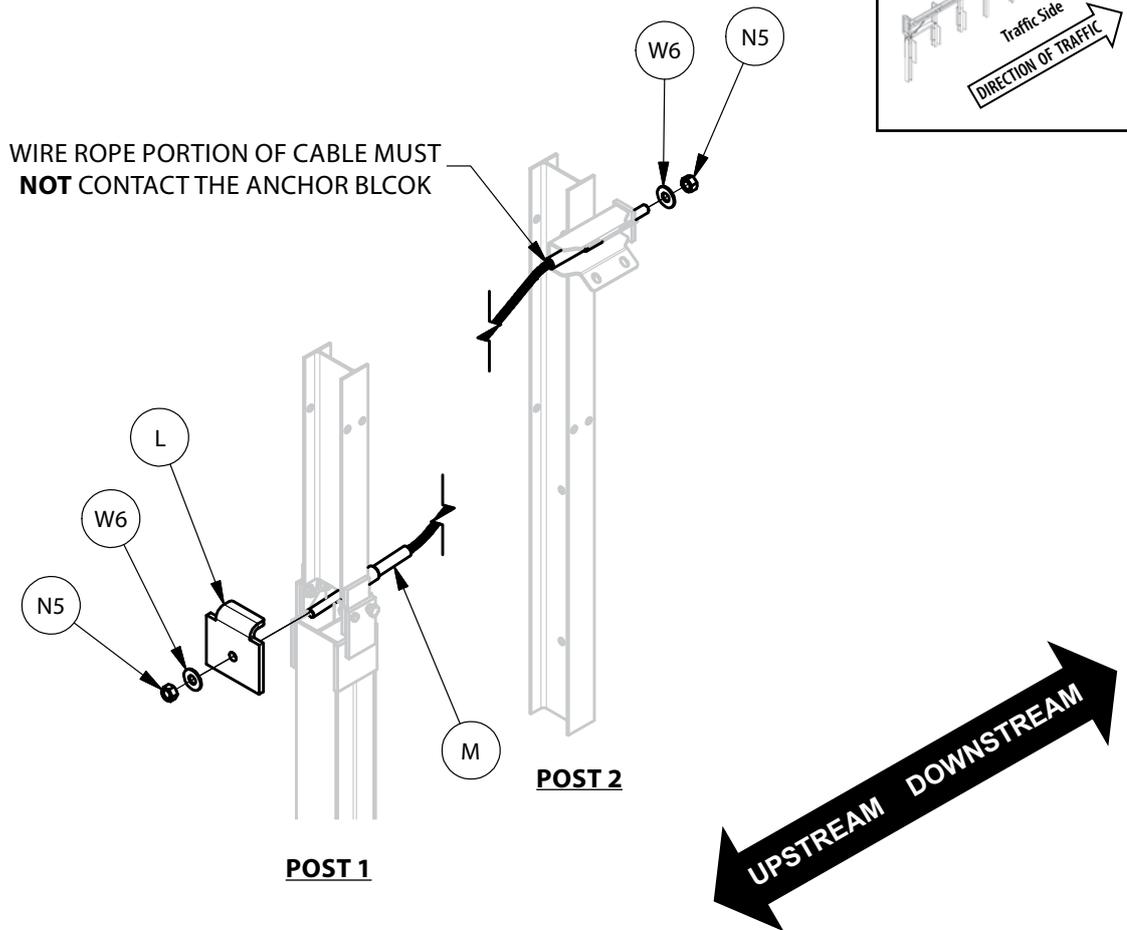
I	4F-T™ Head Rail Assembly	10011056	1 EA
B5	M16 x 50 GR Bolt	10004030	4 EA
N2	M16 Nut to suit B5	10001254	4 EA
W3	M16 35 O.D. x 6mm to suit B5	10007653	4 EA

#### ⚠ INSTRUCTIONS

1. Assemble the 4F-T™ Head Rail Assembly (Part I) and the 4F-T™ 10 ga System Rail to the 4F-T™ Spacer Block at Post 1 (HBA®) as shown above using the specified hardware (Parts B5, N2, W3).
2. Ensure the 4F-T™ Head Rail Assembly is lapped to the outside of the **downstream** 4F-T™ 10 ga System Rail.
3. Assemble all hardware loosely **ensuring the bolt is seated** for this step.

## STEP 13

## ASSEMBLE THE 4F-T™ CABLE ASSEMBLY TO POSTS 1 AND 2



### PARTS

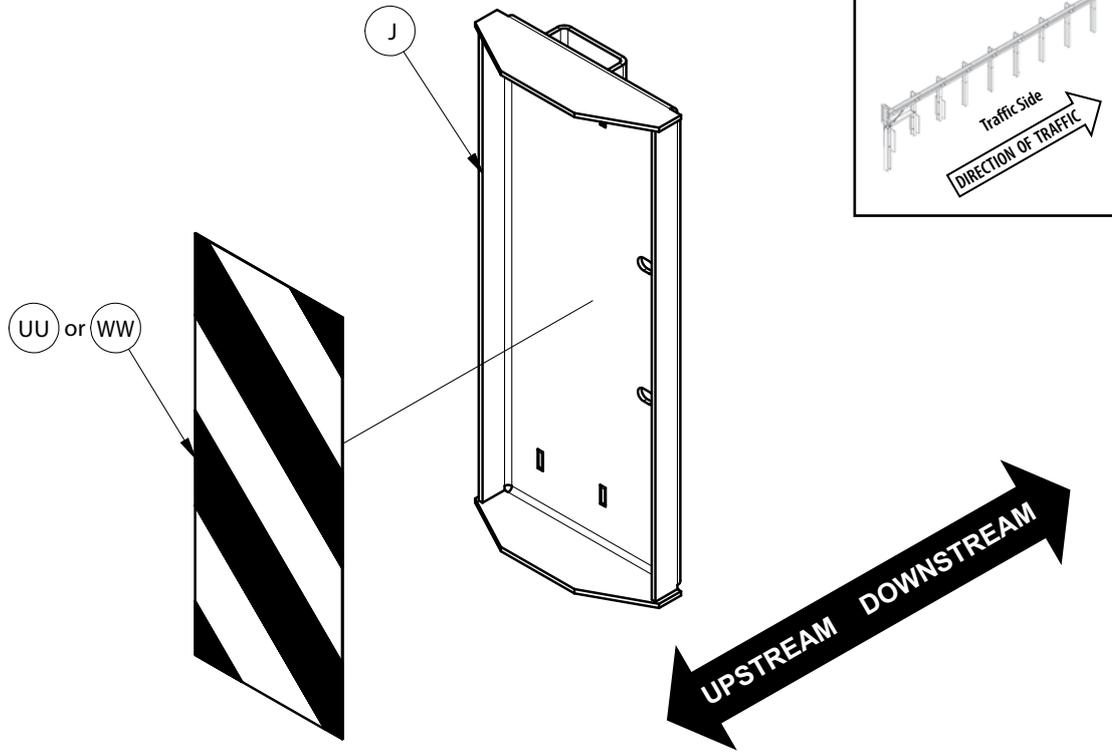
L	4F-T™ Bearing Plate	10011055	1 EA
M	4F-T™ Cable Assembly 1.778m	10011060	1 EA
N5	Nut to suit Cable	10011060	2 EA
W6	Washer to suit Cable	10011060	2 EA

### ⚠ INSTRUCTIONS

1. Assemble the 4F-T™ Cable Assembly (Part M) to the 4F-T™ Anchor Spacer Block at SYTP® 2 as shown above using specified hardware (Parts N5, W6).
2. Ensure the 4F-T™ Cable Assembly is inserted in the 4F-T™ Anchor Spacer Block so the wire rope portion of the cable will not rub on the edge.
3. Assemble the 4F-T™ Cable Assembly and the 4F-T™ Bearing Plate (Part L) as shown above using the specified hardware (Parts N5, W6); remove excess slack from the cable. Cable will be tightened in Step 16.
4. Ensure the 4F-T™ Bearing Plate is placed on the threaded end of the 4F-T™ Cable Assembly and the bent part of the Plate is **up** and facing the 4F-T™ HBA® Post 1 Top.

## STEP 14

### ATTACHING THE CHEVRON TO 4F-T IMPACT HEAD ASSEMBLY



#### PARTS

J	4F-T™ Impact Head Assembly	10011056	1 EA
UU	Chevron for 4F-T Black and Yellow - LHS	10010082	1 EA
VV	Chevron for 4F-T Black and Yellow - RHS	10010083	1 EA
WW	Chevron for 4F-T Black and White - LHS	10010084	1 EA
XX	Chevron for 4F-T Black and White - RHS	10010085	1 EA
YY	Head Cover for 4F-T with Chevrons- Black and Yellow	10011092	1 EA
ZZ	Head Cover for 4F-T with Chevrons- Black and White	10011093	1 EA

#### ⚠ INSTRUCTIONS

1. For Left Hand Side applications, attach the Chevron UU or WW to the 4F-T Impact Head Assembly as shown above. Use Chevron VV or XX for Right Hand Side applications.

2. If the Head Cover has been ordered, attach to the 4F-T Impact Head after Step 16 has been completed as per the image shown on Page 12.

The Head Cover is supplied with a Left Hand Chevron already fixed, 4 x Tek Screws and a Right Hand Chevron.

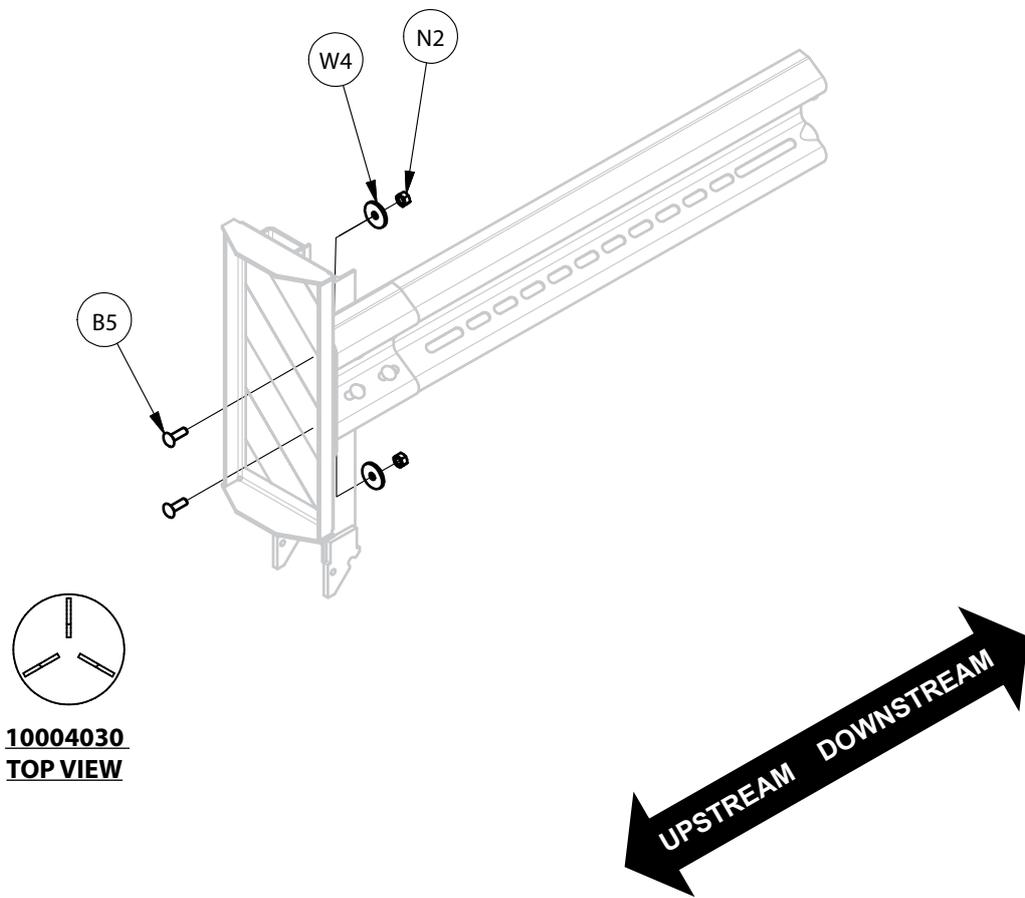
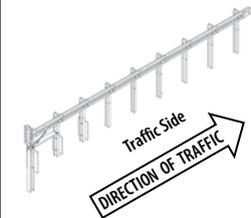
**If installed in a Right Hand Side application, do not remove the Left Hand Chevron.** Attach the Right Hand Chevron on top of the Left Hand Chevron.

**Note:** Ingal Civil Products supplies Chevrons as shown on Page 12 where specified by client. Ingal Civil Products offers Head Covers with Chevrons attached at an additional charge.

**Note:** Ingal Civil Products offers specific reflective sheeting options for an additional charge. Ingal Civil Products makes no guarantees it meets the minimum specifications, comply with MUTCD requirements or comply with state/specifying agency requirements.

## STEP 15

## ASSEMBLE THE 4F-T™ IMPACT HEAD ASSEMBLY



### PARTS

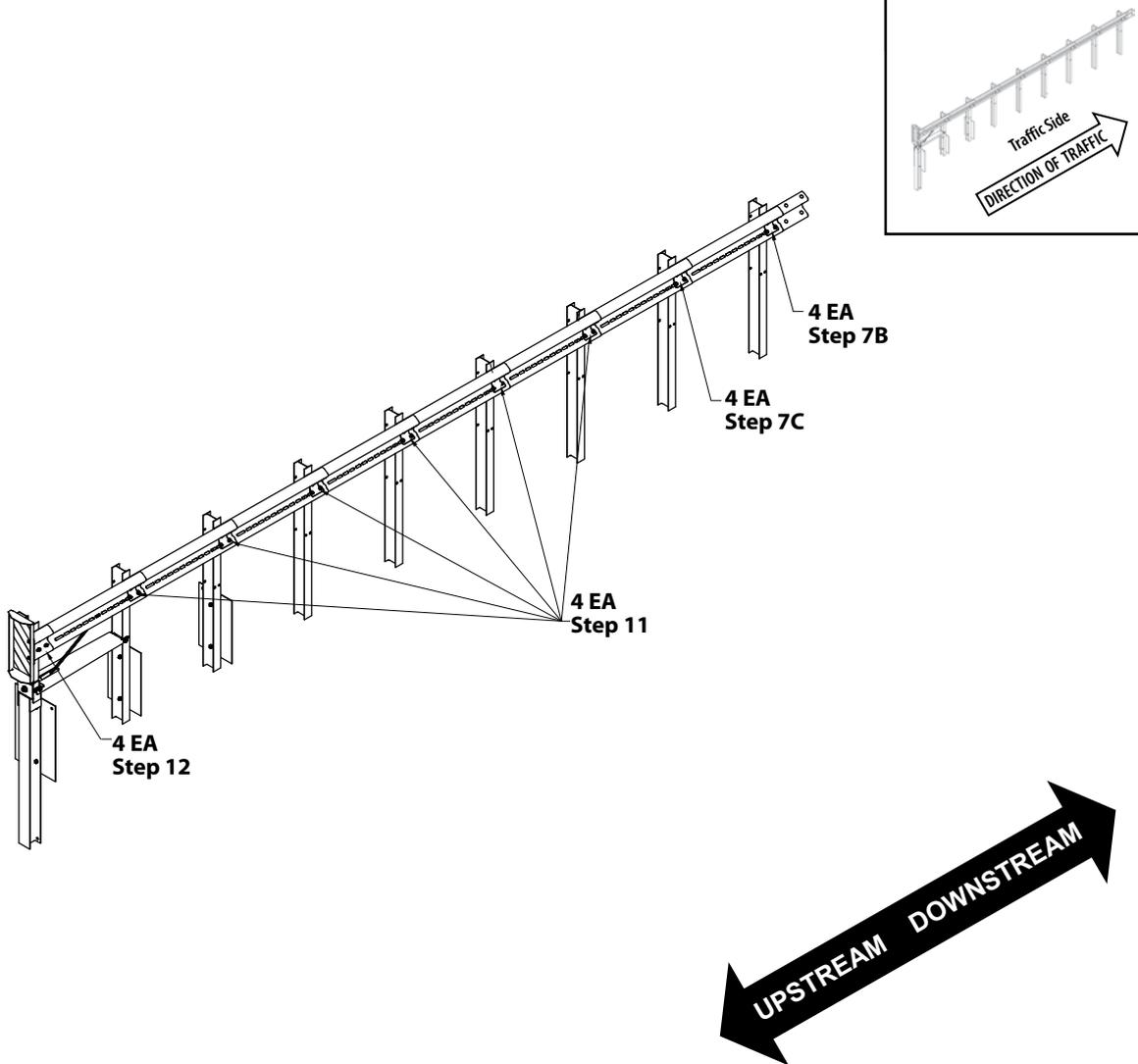
B5	M16 x 50 GR Bolt	10004030	2 EA
N2	M16 Nut to suit B5	10001254	2 EA
W4	M16 54 OD x 16 ID x 6mm Round Washer to suit B5	10011091	2 EA

### ⚠ INSTRUCTIONS

1. Assemble the 4F-T™ Impact Head Assembly to the 4F-T™ Head Rail Assembly as shown above using specified hardware (Parts B5, N2, W4).
2. Tighten all threaded hardware to a snug position with a minimum of two (2) bolt threads protruding beyond the nut.  
**Note:** All bolts are typically installed through the delineation sheeting.
3. Ensure steel delineator posts are a minimum of 914mm in front (upstream) of the 4F-T™.

## STEP 16

### 4F-T™ BOLT TIGHTENING/TORQUING AND ANCHOR CABLE TENSION



#### PARTS


#### ⚠ INSTRUCTIONS

1. Ensure all post bolts are tightened to a snug position with a minimum of two (2) bolt threads protruding beyond the nut.
2. ⚠ Ensure all hardware in steps 7B, 7C, 11, and 12 are seated and torqued to 135 Nm ( $\pm 7$  Nm), Four (4) at post locations 1-9.
3. Restrain the Cable swage while tightening nuts at the end being tightened to avoid twisting the Cable.
4. Tighten the Cable until it is taut. The Cable is considered taut when it does not deflect more than 25 mm when pressure is applied by hand in an up or down direction.

## 10.0 4F-T™ Assembly/Repair Checklist (File with Project/Maintenance Records)

Performed by: \_\_\_\_\_

Date: \_\_\_\_\_

Location: \_\_\_\_\_

1. Ensure proper site grading complies with state/specifying agency guidelines and/or AASHTO Roadside Design Guide, whichever is more stringent.	<input type="checkbox"/>
2. Ensure required traffic control is in place to conduct 4F-T™ assembly.	<input type="checkbox"/>
3. Ensure only Ingal Civil Products provided 4F-T™ parts are used for the assembly of the 4F-T™ and that all parts are free of damage.	<input type="checkbox"/>
4. Under <b>NO</b> circumstances shall the rail within the 4F-T™ be curved between Post 1 and Post 9. Ensure all 4F-T™ post spacings are 1.270 m on center.	<input type="checkbox"/>
5. Ensure the soil around all posts is properly compacted. When leave outs are necessary, use only state/specifying agency approved backfill material within the leave out area.	<input type="checkbox"/>
6. Ensure Soil Plates are installed on the <b>downstream</b> side of Posts 1-3.	<input type="checkbox"/>
7. Ensure the 4F-T™ HBA® Post 1 Top and Bottom are oriented correctly with the 12.7mm bolt holes located <b>upstream</b> of the 19mm bolt holes. The portion of the 4F-T™ HBA® Bottom Post 1 is 150 mm (+25 mm, -0 mm) above the finished grade.	<input type="checkbox"/>
8. Ensure the center of the SYTP® yielding holes at Posts 2-9 are approximately centered at finished grade.	<input type="checkbox"/>
9. Ensure the 4F-T™ Formed Ground Strut is attached to Post 1 & 2 and oriented correctly – the flat portion is <b>up</b> and cable positioning slot is <b>upstream</b> .	<input type="checkbox"/>
10. Ensure 4F-T™ Spacer Blocks (standard and anchor) are approximately centered and bolted to the post using the <b>Upstream</b> hole of the 4F-T™ Spacer Block and SYTP® post.	<input type="checkbox"/>
11. Ensure the 4F-T™ 10 System Rail panels are oriented with the <b>long slots</b> and <b>dimples</b> assembled <b>downstream</b> .	<input type="checkbox"/>
12. Ensure the 16mm heavy flat washers ( <b>6mm thick</b> ) are placed between the nuts and spacers at Posts 1-9.	<input type="checkbox"/>
13. Ensure all 4F-T™ 10 System Rail Guardrails are lapped to the <b>outside</b> of the <b>downstream</b> rail panels.	<input type="checkbox"/>
14. Ensure all 4F-T™ 10 System Rail are installed 787 mm (+25 mm, -0 mm) from finished grade.	<input type="checkbox"/>
15. Ensure all 4F-T™ fasteners identified in Step 16 are <b>torqued</b> to 135 Nm, (+/-7 Nm).	<input type="checkbox"/>
16. Ensure the 4F-T™ Backing Plate is assembled on the <b>outside</b> of the 4F-T™ 10 ga System Rail Panels at Posts 2-9.	<input type="checkbox"/>
17. Ensure all 4F-T™ fasteners that are <b>NOT</b> required to be <b>torqued</b> are tightened to a snug position with a minimum of two (2) bolt threads protruding beyond the nut.	<input type="checkbox"/>
18. Ensure the 4F-T™ Bearing Plate bend is located at the top of the plate, facing Post 1 and the cable is taut.	<input type="checkbox"/>
19. Ensure the wire rope portion of the 4F-T™ Anchor Cable is <b>NOT</b> in contact with the 4F-T™ Anchor Spacer at Post 2.	<input type="checkbox"/>
20. Ensure delineation is placed on the 4F-T™ Impact Head per MUTCD and/or state/specifying agency.	<input type="checkbox"/>
21. Ensure that the first line post (Post 10), not included, is not leaning back more than 76 mm.	<input type="checkbox"/>
22. Ensure any steel delineator posts are a minimum of 914 mm <b>upstream</b> from the 4F-T™ Impact Head.	<input type="checkbox"/>

## 11.0 4F-T™ System Routine Inspection Checklist (File with Project/Maintenance Records)

Performed by: \_\_\_\_\_

Date: \_\_\_\_\_

Location: \_\_\_\_\_

Valtir recommends the state/specifying agency develop and administer their own end terminal inspection program, based on location of unit, volume of traffic and impact history.



**IMPORTANT: The 4F-T™ System and all of its components shall be inspected for damage after every impact. Repair using only Ingal Civil Products parts that are specified for use within the 4F-T™ System.**

If no end terminal inspection program exists, Valtir recommends visual drive-by inspections at least once every month and walk-up inspections every six (6) months. These inspections shall, **at a minimum**, consist of:

### Visual Drive-By Inspections (Recommended Frequency: Monthly)

Check for damage caused by vehicle impacts.	<input type="checkbox"/>
Check for damage caused by impacts from snowplow, mowing or roadway operations.	<input type="checkbox"/>
Check for misalignment.	<input type="checkbox"/>
Check for missing system components.	<input type="checkbox"/>
Check for vandalism.	<input type="checkbox"/>
Check for damage caused by adverse weather conditions (i.e. erosion, weight of snow, UV).	<input type="checkbox"/>
Check that the Anchor Cable is taut and the Bearing Plate is properly positioned.	<input type="checkbox"/>

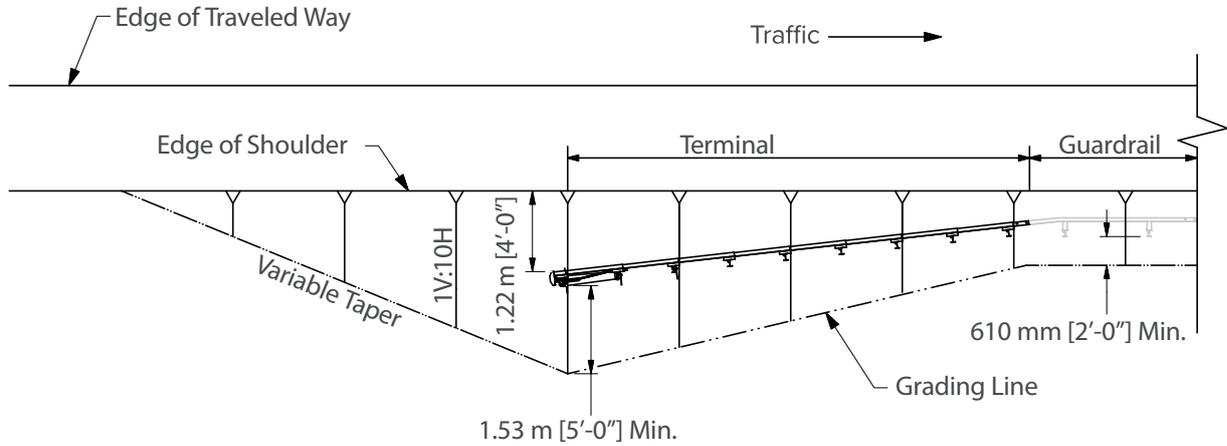
### Walk-Up Inspections (Recommended Frequency: Every Six (6) Months)

**Walk-Up Inspections include ALL Visual Drive-By Inspection items (listed above) as well as the items listed below.**

Ensure required traffic control is in place to conduct walk-up inspection.	<input type="checkbox"/>
Clear and dispose of any debris or trash found on the 4F-T™ site, which may interfere with the performance of the 4F-T™ System.	<input type="checkbox"/>
Check that fasteners are fully tightened. See Step 16 for torqued nut locations. All other locations are to be tightened to a snug position with a minimum of two (2) bolt threads protruding beyond the nut.	<input type="checkbox"/>
Check for erosion to the site grading around the system.	<input type="checkbox"/>
Ensure the height of the system is being maintained at approximately 31" [787 mm] from finished grade.	<input type="checkbox"/>
Ensure the 4F-T™ 10 GA System Rail Panels are lapped correctly allowing each of the upstream guardrail panels to translate over the downstream guardrail panels.	<input type="checkbox"/>

If any of the above items are identified during the inspection process, swift action shall be taken to correct and return the 4F-T™ System to proper condition outlined in the 4F-T™ System assembly manual, latest edition.

## 12.0 Appendix A: Grading Detail



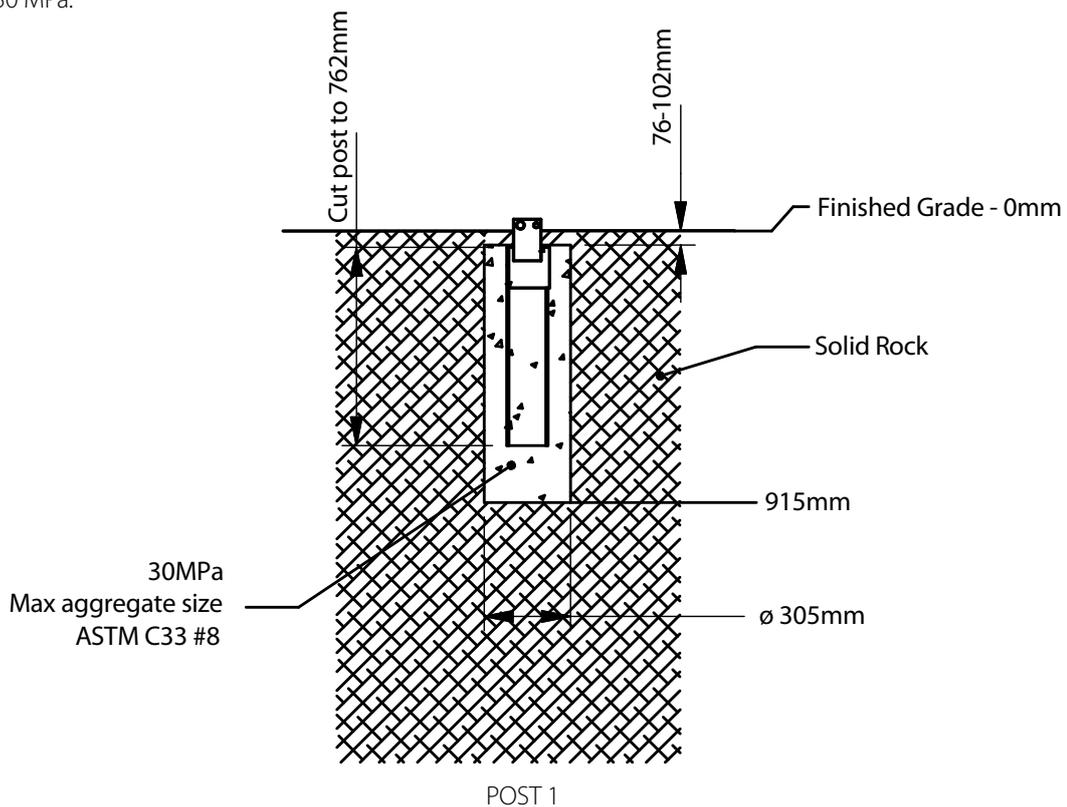
Reference: AASHTO Roadside Design Guide (Current Edition), for flared terminals.

## 13.0 Appendix B: Alternative Footings Detail

The following cases provide alternate footing designs when the HBA® Bottom Post 1 cannot be installed due to solid rock, underground utilities, or underground structure.

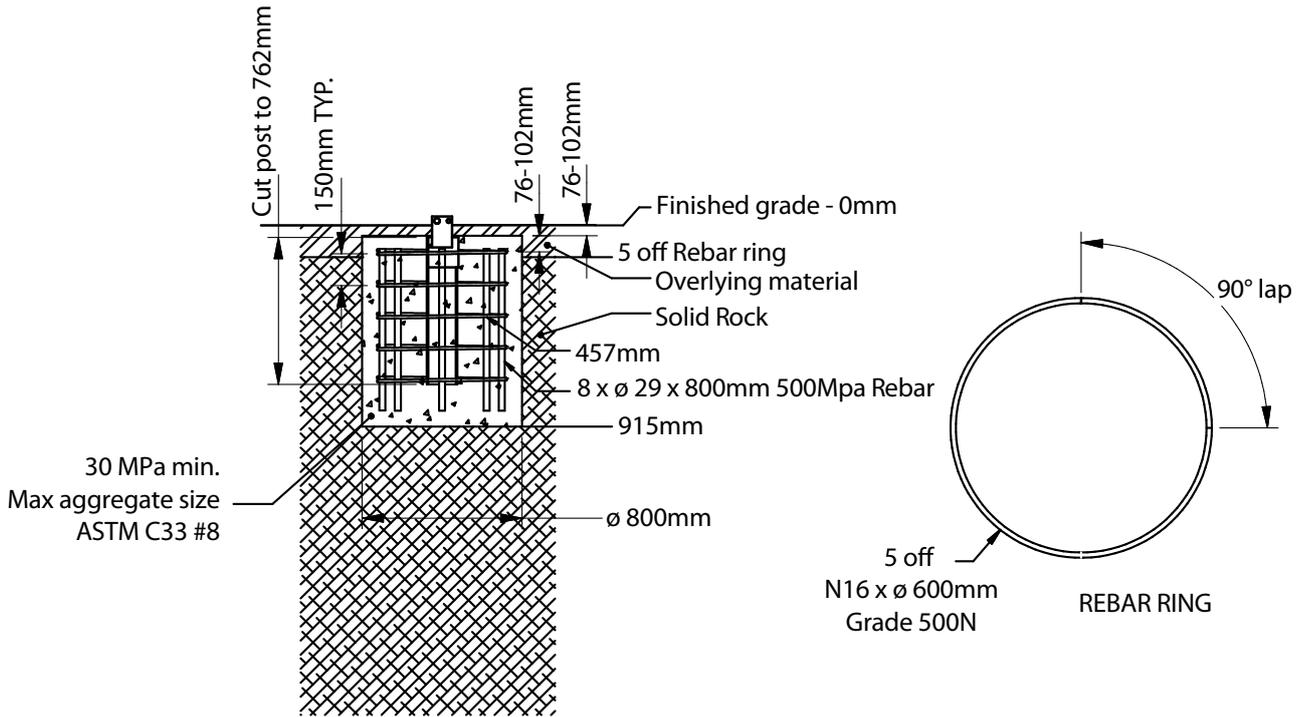
### Case 1: Solid rock is encountered within 0 mm to 152 mm below grade.

At post location 1, make a 305 mm diameter hole into the rock a depth of 914 mm below finished grade. Cut the HBA® Bottom Post to a length of 762 mm. Assemble the post in the hole with the top of the post 1, 50 mm (+25 mm, -0 mm) above finished grade, see Detail A. Orient the post per Step 4 with the large hole on the downstream side of the post. Fill the hole to within 76 mm from the surface with 30 MPa concrete. Do not attach the HBA® Top Post until the concrete reaches 30 MPa.



**Case 2: Solid rock is encountered between 152 mm and 914 mm below finished grade.**

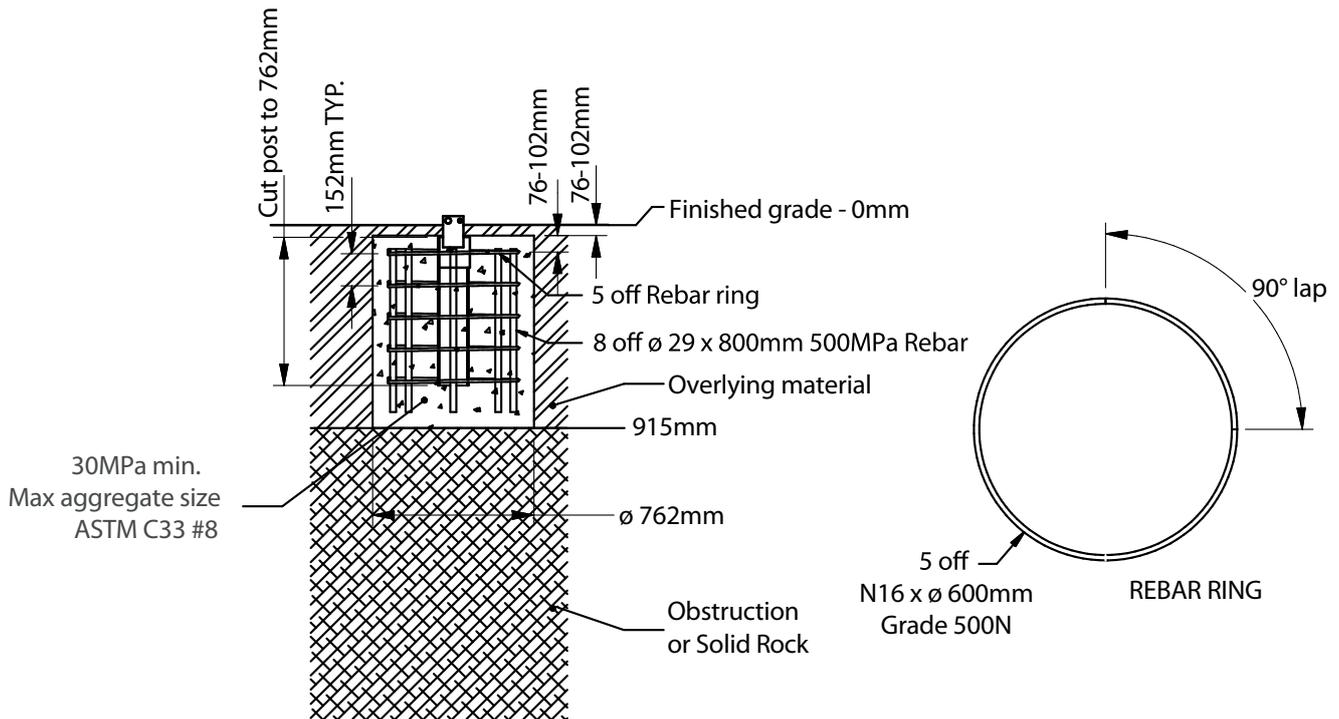
At post location 1, make a 762 mm diameter hole into the rock a depth of 914 mm below finished grade. Cut the HBA® Bottom Post to a length of 762 mm. Assemble a rebar cage as shown in Detail B, and insert into the hole 152 mm below finished grade. Assemble the HBA® Bottom Post in the hole with the top of the post 1, 50 mm (+25 mm, -0 mm) above grade. Orient the post per Step 4 with the large hole on the downstream side of the post. Fill the hole to within 76 mm from the surface with 30 MPa concrete. Do not attach the HBA® Top Post until the concrete reaches 30 MPa.



POST 1

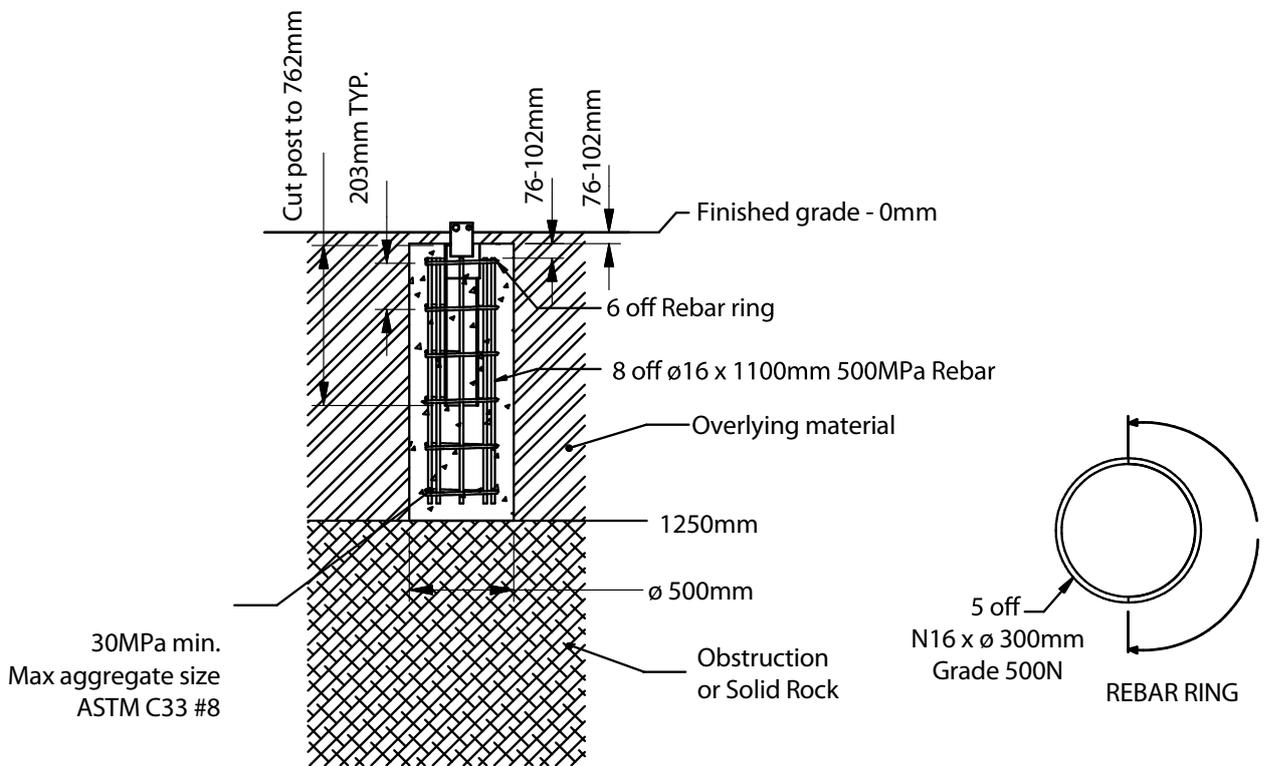
**Case 3: Underground obstruction is encountered between 914 mm and 1.22 m below the finished grade.**

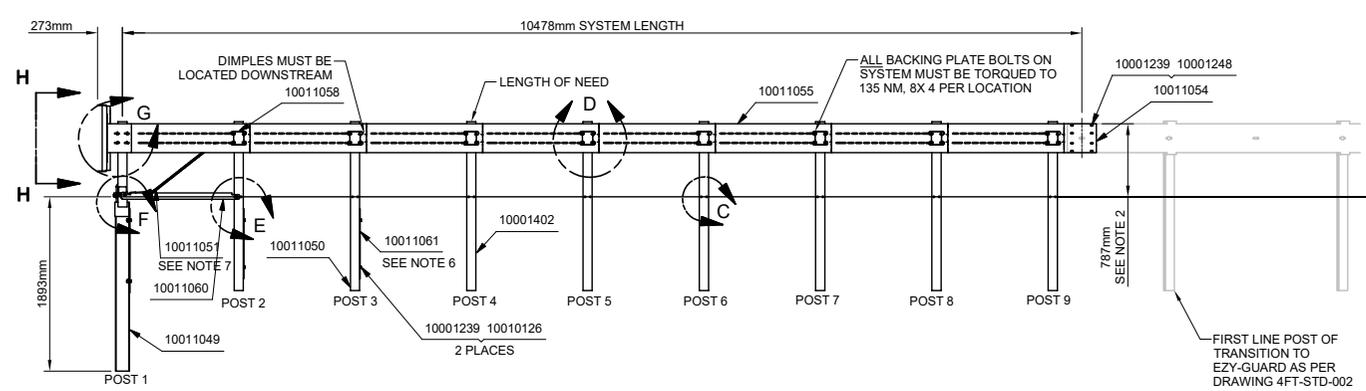
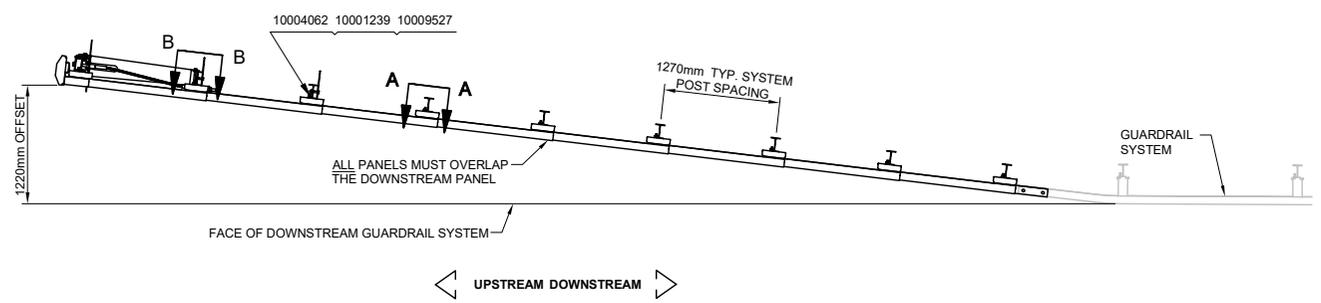
At post location 1, make a 762 mm diameter hole with a depth of 914 mm below finished grade. Cut the HBA® Bottom Post to a length of 762 mm. Assemble a rebar cage as shown in Detail C, and insert into the hole 152 mm below finished grade. Assemble the HBA® Bottom Post in the hole with the top of the post 1, 50 mm (+25 mm,-0 mm) above finished grade. Orient the post per Step 4 with the large hole on the downstream side of the post. Fill the hole to within 76 mm from the finished grade with 30 MPa concrete. Do not attach the HBA® Top Post until the concrete reaches 30 MPa.



**Case 4: Underground obstruction is encountered between 1.22 m and 1.83 m below the finished grade.**

At post location 1, make a 457 mm diameter hole with a depth of 1.22 m below finished grade. Cut the HBA® Bottom Post to a length of 762 mm. Assemble a rebar cage as shown in Detail D, and insert into the hole 152 mm below finished grade. Assemble the HBA® Bottom Post in the hole with the top of the post 1, 50 mm (+25 mm, -0 mm) above finished grade. Orient the post per Step 4 with the large hole on the downstream side of the post. Fill the hole to within 76 mm from the finished grade with 30 MPa concrete. Do not attach the HBA® Top Post until the concrete reaches 30 MPa.





COMPONENTS LIST		
PART NO.	DESCRIPTION	QTY.
10011048	4F-T™ HBA@ POST 1 TOP	1
10011049	4F-T™ HBA@ POST 1 BOTTOM	1
10011050	4F-T™ SYTP® W/ SOIL PLATE HOLES	2
10011061	4F-T™ SOIL PL. 6MM X 457MM X 762MM	1
10011062	4F-T™ SOIL PL. 6MM X 559MM X 914MM	2
10011052	4F-T™ SPACER BLOCK	8
10011053	4F-T™ ANCHOR SPACER BLOCK	1
10011054	4F-T™ 10 GA TRANSITION PANEL	1
10011055	4F-T™ 10 GA SYSTEM RAIL	8
10011056	4F-T™ HEAD RAIL ASSEMBLY	1
10011058	4F-T™ BACKING PLATE	8
10011059	4F-T™ BEARING PLATE	1
10011060	4F-T™ CABLE ASSY 19 MM X 1.778 M	1
10011051	4F-T™ FORMED GROUND STRUT	1
10011057	4F-T™ IMPACT HEAD ASSEMBLY	1
10001402	SYT POST 1830MM (4 HOLES)	6
10011090	M12 NUT TO SUIT B1	2
10001239	OVERSIZED M16 NUT	26
10001248	M16 X 32 GR BOLT	8
10001254	M16 NUT TO SUIT B5	38
10004062	M16 X 50 HEX BOLT	9
10001892	M16 X 200 HEX BOLT	1
10009526	M20 ROUND WASHER TO SUIT B8	2
10009526	M20 NUT TO SUIT B8	2
10009526	M20 X 65 HEX BOLT	2
10002161	WASHER TO SUIT CABLE	2
10007549	NUT TO SUIT CABLE	2
10009527	M16 WASHER TO SUIT B4, B7	10
10011090	M12 X 50 HEX BOLT	2
10004513	M16 X 40 HEX BOLT	4
10010126	M16 X 90 HEX BOLT	4
10001689	M12 WASHER TO SUIT B1	2
10004030	M16 X 50 GR BOLT	38
10007653	M16 35 O.D. X 6MM TO SUIT B5	36
10011091	54 OD X 16 ID X 6MM RND WASHER	2
SEE TABLE	CHEVRON / DELINEATION	REF

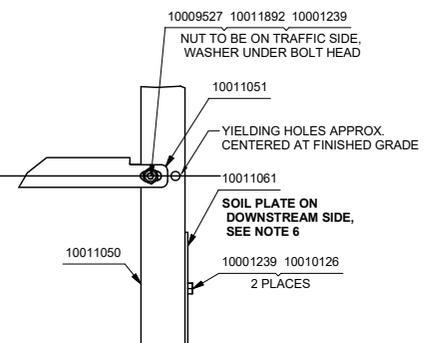
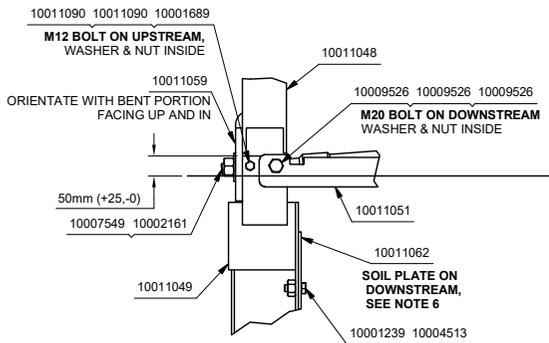
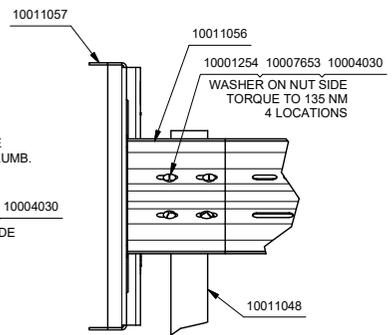
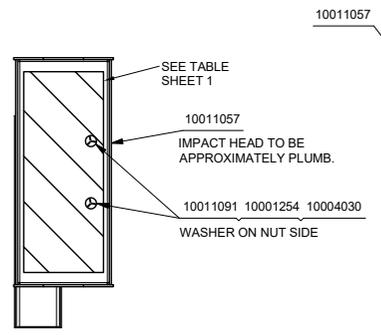
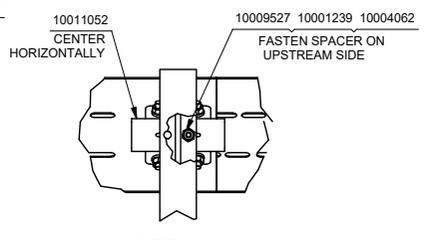
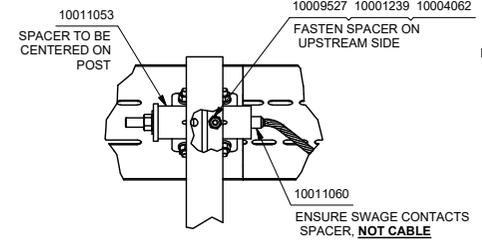
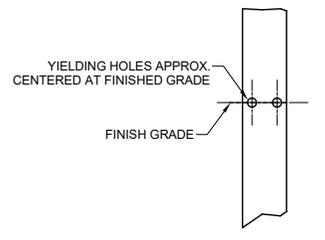
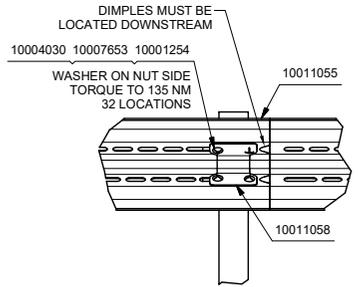
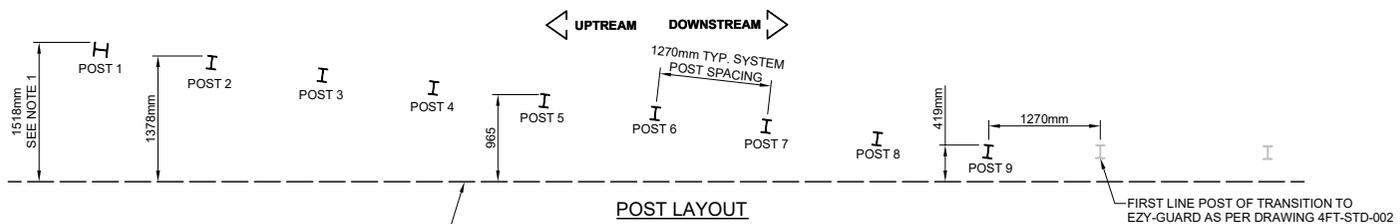
TABLE	
PART NO.	DESCRIPTION
10010802	CHEVRON BLACK & YELLOW-LHS
10010803	CHEVRON BLACK & YELLOW-RHS
10010804	CHEVRON BLACK & WHITE-LHS
10010805	CHEVRON BLACK & WHITE-RHS
10011092	COVER W/ CHEVRON B&Y
10011093	COVER W/ CHEVRON B&W

- NOTES:
- PROPER SITE GRADING MUST BE ACCOMPLISHED BEFORE ASSEMBLY AND IN ACCORDANCE WITH STATE/SPECIFYING AGENCY GUIDELINES AND/OR THE AASHTO ROADSIDE DESIGN GUIDE.
  - GUARDRAIL INSTALLATION HEIGHT TO BE 767mm ABOVE FINISHED GRADE, +25mm, -0mm.
  - UNDER NO CIRCUMSTANCES SHALL THE 4F-T SYSTEM PANELS BE CURVED OR RADIUSUED.
  - ALL FASTENERS NOT REQUIRED TO BE TORQUED SHALL BE TIGHTENED TO A SNUG POSITION WITH A MINIMUM OF 2 BOLT THREADS PROTRUDING BEYOND THE NUT.
  - ONLY ATTACH THE 4F-T DIRECTLY TO OTHER STRONG POST SINGLE SIDED W-BEAM GUARDRAIL SYSTEMS, SEE MANUAL FOR DETAILS.
  - ENSURE ALL SOIL PLATES ARE POSITIONED ON THE DOWNSTREAM SIDE OF POST 1, 2 & 3. OPTIONAL GALVANIZING HOLE LOCATION MAY VARY.
  - TIGHTEN ANCHOR CABLE UNTIL TAUT. CABLE IS CONSIDERED TAUT WHEN IT DOES NOT DEFLECT MORE THAN 1" WHEN HEAVY PRESSURE IS APPLIED BY HAND IN AN UP OR DOWN DIRECTION. RESTRAIN THE CABLE WITH PIPE WRENCH OR LOCKING PLIERS WHILE TIGHTENING NUT WITH A WRENCH TO PREVENT CABLE FROM TWISTING.
  - REFER TO 4F-T ASSEMBLY MANUAL FOR ADDITIONAL INFORMATION.

REV	DATE	DESCRIPTION	DRAWN	CHECKED	APPROVED	DRAWING NUMBER	REFERENCE DRAWINGS	NAME	DATE	PROJECT	TITLE	INGAL CIVIL PRODUCTS PART No.	DRAWING No.
1	01-03-2026	ICP PART NUMBER ADDED	KZ	HF	KZ			VALTIR	24-01-2024	INGAL CIVIL PRODUCTS	4-FT™ 4 FOOT FLARED TREND TERMINAL SHEET 1	INGAL CIVIL PRODUCTS PART No.	ICP-4FT-001
										SCALE	N.T.S. @ A3		
										ISSUE FOR	INFORMATION ONLY		

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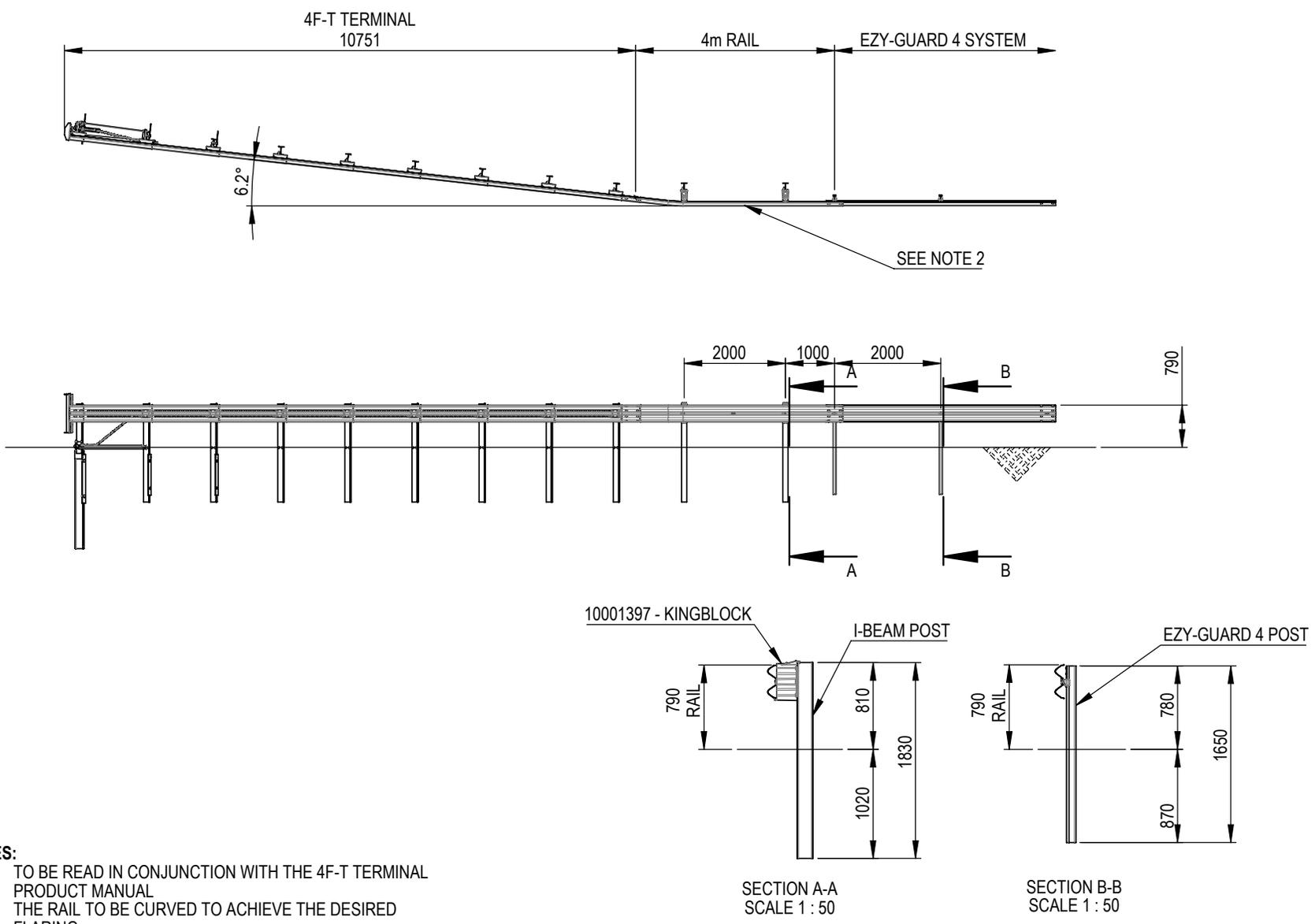
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NOTES:  
1. DIMENSION DOES NOT INCLUDE WELDED PLATES.

REV	DATE	DESCRIPTION	DRAWN	CHECKED	APPROVED	DRAWING NUMBER	REFERENCE DRAWINGS	NAME	DATE	PROJECT	INGAL CIVIL PRODUCTS PART No.
1	01-03-2026	ICP PART NUMBER ADDED	KZ	HF	KZ			VALTIR	24-01-2024	4-FT™ 4 FOOT FLARED TREND TERMINAL SHEET 2	ICP-4FT-001
<p>REVISIONS</p>								<p>INGAL CIVIL PRODUCTS A valmont COMPANY</p> <p>DRAWING AND CONTENTS ARE COPYRIGHT TO INGAL CIVIL PRODUCTS AND CAN ONLY BE USED WITH PRIOR WRITTEN CONSENT FROM INGAL CIVIL PRODUCTS</p> <p>57-65 ARDS ROAD PH. +61 2 9827 3333 MINTO, N.S.W 2566 www.ingalcivil.com.au</p>		<p>PROJECT</p> <p>TITLE</p>	
<p>REFERENCES</p>								<p>SCALE N.T.S. @ A3</p> <p>ISSUE FOR INFORMATION ONLY</p>		<p>DRAWING No.</p> <p>ICP-4FT-001</p>	

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- NOTES:**
1. TO BE READ IN CONJUNCTION WITH THE 4F-T TERMINAL PRODUCT MANUAL
  2. THE RAIL TO BE CURVED TO ACHIEVE THE DESIRED FLARING

REVISIONS						<p>INGAL CIVIL PRODUCTS A valmont COMPANY</p>	PROJECT	INGAL CIVIL PRODUCTS PART No.
						DRAWING AND CONTENTS ARE COPYRIGHT TO INGAL CIVIL PRODUCTS AND CAN ONLY BE USED WITH PRIOR WRITTEN CONSENT FROM INGAL CIVIL PRODUCTS	TITLE 4F-T TO EZY-GUARD TRANSITION	DRAWING No. 4FT-STD-002
						57-65 AIRDS ROAD MELBO, N.S.W 2566	PH: +61 2 9827 3333 www.ingalcivil.com.au	Rev. 0

FOLDER: C:\USERS\KZ717943\ONE\DRIVE - VALMONT INDUSTRIES, INC.\SOLIDWORKS MODEL IN PROGRESS\4F-T\MODEL1



# INGAL

## CIVIL PRODUCTS

A **valmont** COMPANY

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