



STRUCTURAL DESIGN

ENCLOSED BUILDING **EXPOSURE B**

**MAXIMUM 30'-0" WIDE X 20'-0" EAVE HEIGHT- BOX EAVE
FRAME AND BOW FRAME**

18 December 2017

Revision 4

M&A Project No. 16022S/17300S

Prepared for:

**Tubular Building Systems, LLC
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Prepared by:

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ENGINEERING AND CONSULTING, INC.

DRAWN BY: LT

CHECKED BY: PDH

PROJECT MGR: WSH

CLIENT: TBS

TUBULAR BUILDING SYSTEMS
30'-0" x 20'-0" ENCLOSED BUILDING EXP. B
PE SEAL COVER SHEET

DATE: 12-18-17

SCALE: NTS

DWG. NO: SK-3

JOB NO
160225/172005

SHT. 1

REV: 4

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**TUBULAR BUILDING SYSTEMS
30'-0"x20'-0" ENCLOSED BUILDING EXP. B**

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SHT. 2

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JOB NO
16822S/17380S

REV: 4

INSTALLATION NOTES AND SPECIFICATIONS

1. DESIGN IS FOR A MAXIMUM 30'-0" WIDE x 20'-0" EAVE HEIGHT ENCLOSED STRUCTURES.
2. DESIGN WAS DONE IN ACCORDANCE WITH THE 2017 FLORIDA BUILDING CODE (FBC) 6TH EDITION, 2012 INTERNATIONAL BUILDING CODE (IBC), AND 2015 IBC.
3. DESIGN LOADS ARE AS FOLLOWS:
 - A) DEAD LOAD = 15 PSF
 - B) LIVE LOAD = 12 PSF
 - C) GROUND SNOW LOAD = 10 PSF
4. LOW ULTIMATE WIND SPEED 105 TO 140 MPH (NOMINAL WIND SPEED 81 TO 108 MPH) MAXIMUM RAFTER/POST AND END POST SPACING = 5.0 FEET.
5. HIGH ULTIMATE WIND SPEED 141 TO 170 MPH (NOMINAL WIND SPEED 109 TO 132 MPH) MAXIMUM RAFTER/POST AND END POST SPACING = 4.0 FEET.
6. LOW HAZARD RISK CATEGORY I (WIND).
7. WIND EXPOSURE CATEGORY 3
8. SPECIFICATIONS APPLICABLE TO 29 GAUGE METAL PANELS FASTENED DIRECTLY TO 2 1/2" x 2 1/2" x 14 GAUGE TUBE STEEL (TS) FRAMING MEMBERS. FOR VERTICAL PANELS, 29 GAUGE METAL PANELS SHALL BE FASTENED TO 18 GAUGE HAT CHANNELS (UNLESS OTHERWISE NOTED).
9. AVERAGE FASTENER SPACING ON-CENTERS ALONG RAFTERS OR PURLINS, AND POSTS, INTERIOR = 9" OR END = 6", (MAX.)
10. FASTENERS CONSIST OF #12-14x3/4" SELF-DRILLING FASTENER (SDF), USE CONTROL SEAL WASHER WITH EXTERIOR FASTENERS. SPECIFICATIONS APPLICABLE ONLY FOR MEAN ROOF HEIGHT OF 20 FEET OR LESS, AND ROOF SLOPES OF 14" (3:12 PITCH) OR LESS. SPACING REQUIREMENTS FOR OTHER ROOF HEIGHTS AND/OR SLOPES MAY VARY.
11. GROUND ANCHORS SHALL BE INSTALLED THROUGH BASE RAIL WITHIN 6" OF EACH RAFTER COLUMN ALONG SIDES.
12. GROUND ANCHORS (SOIL NAILS) CONSIST OF #4 REBAR W/WELDED MUT x 30" LONG IN SUITABLE SOIL CONDITIONS MAY BE USED FOR LOW (≤ 108 MPH NOMINAL) WIND SPEEDS ONLY. OPTIONAL ANCHORAGE MAY BE USED IN SUITABLE SOILS AND MUST BE USED IN UNSUITABLE SOILS AS NOTED.
13. OPTIONAL BASE RAIL ANCHORAGE MAY BE USED FOR LOW AND MUST BE USED FOR HIGH WIND SPEEDS.
14. WIND FORCES GOVERN OVER SEISMIC FORCES. SEISMIC PARAMETERS ANALYZED ARE:
 - SOIL SITE CLASS = D
 - RISK CATEGORY I/II/III
 - R = 3.25 $I_e = 1.0$
 - $S_{DS} = 1.522$ $V = C_{sW}$
 - $S_{M1} = 0.839$

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30'-0"x20'-0" ENCLOSED BUILDING EXP. B**

DATE: 12-18-17

SHT. 3

SCALE: NTS

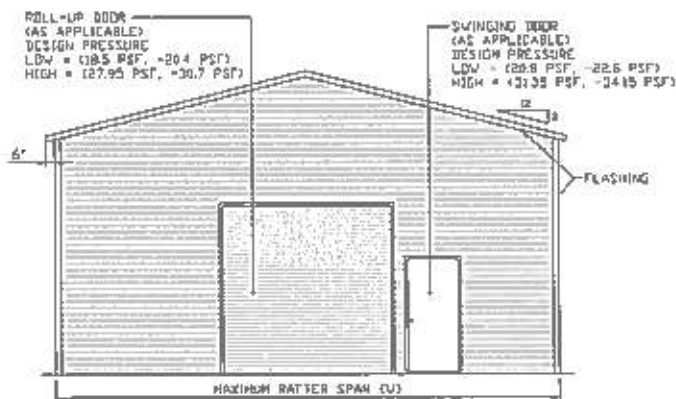
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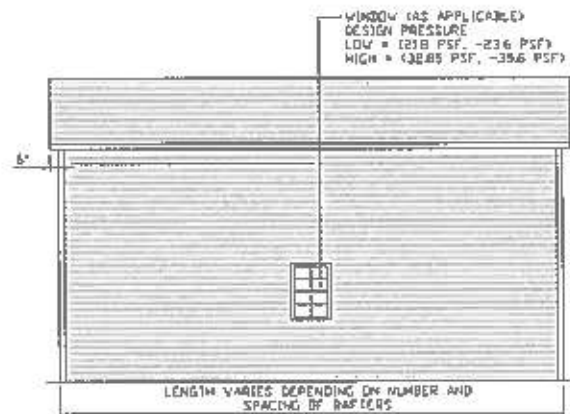
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BOX EAVE FRAME RAFTER ENCLOSED BUILDING



TYPICAL END ELEVATION-HORIZONTAL ROOF

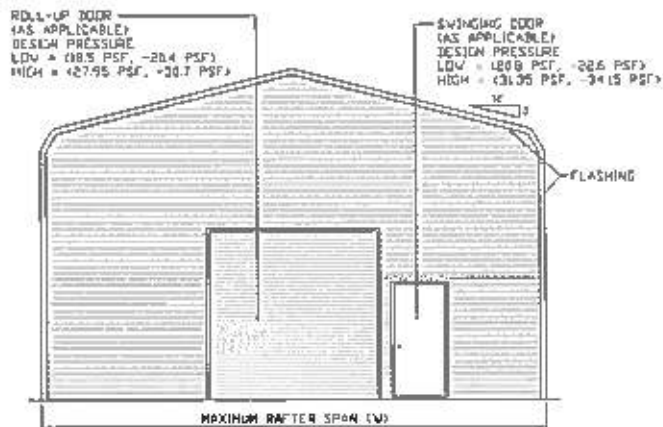
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TYPICAL SIDE ELEVATION-HORIZONTAL ROOF

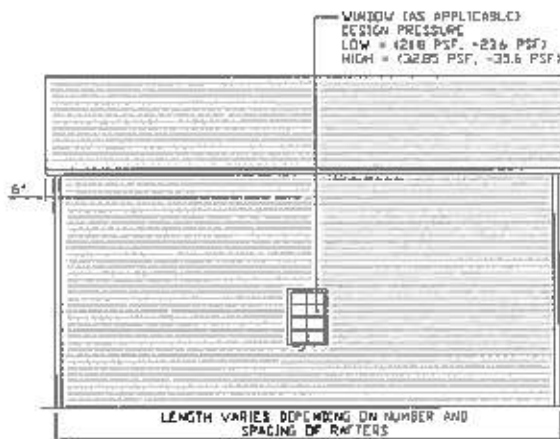
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BOW FRAME RAFTER ENCLOSED BUILDING



TYPICAL END ELEVATION

SCALE: NTS



TYPICAL SIDE ELEVATION

SCALE: NTS

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**TUBULAR BUILDING SYSTEMS
30'-0" x 20'-0" ENCLOSED BUILDING EXP. B**

DATE: 12-18-12

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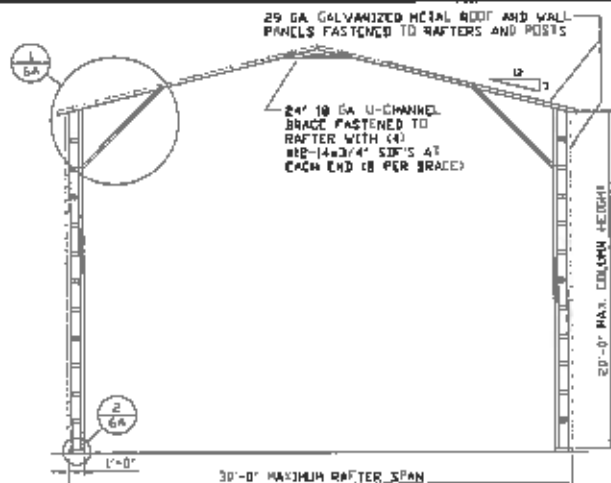
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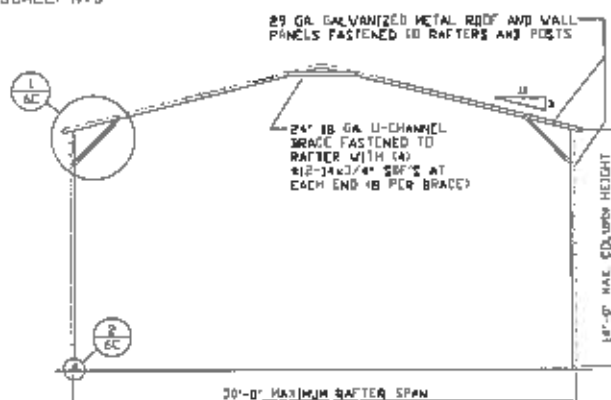
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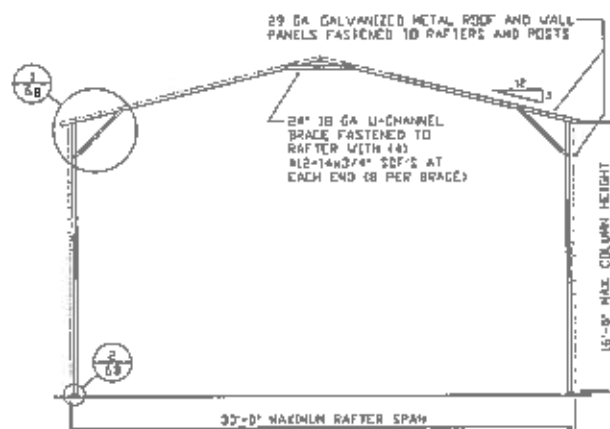
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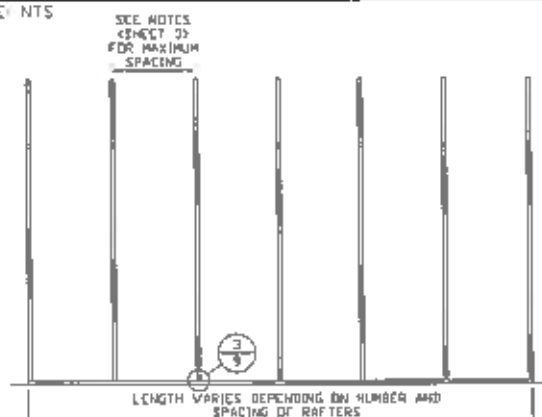
TYPICAL RAFTER/COLUMN END FRAME SECTION
SCALE: NTS



TYPICAL RAFTER/COLUMN END FRAME SECTION
SCALE: NTS



TYPICAL RAFTER/COLUMN END FRAME SECTION
SCALE: NTS



TYPICAL RAFTER/COLUMN SIDE FRAMING SECTION
SCALE: NTS

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**TUBULAR BUILDING SYSTEMS
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DATE: 12-18-17

SHT. 5

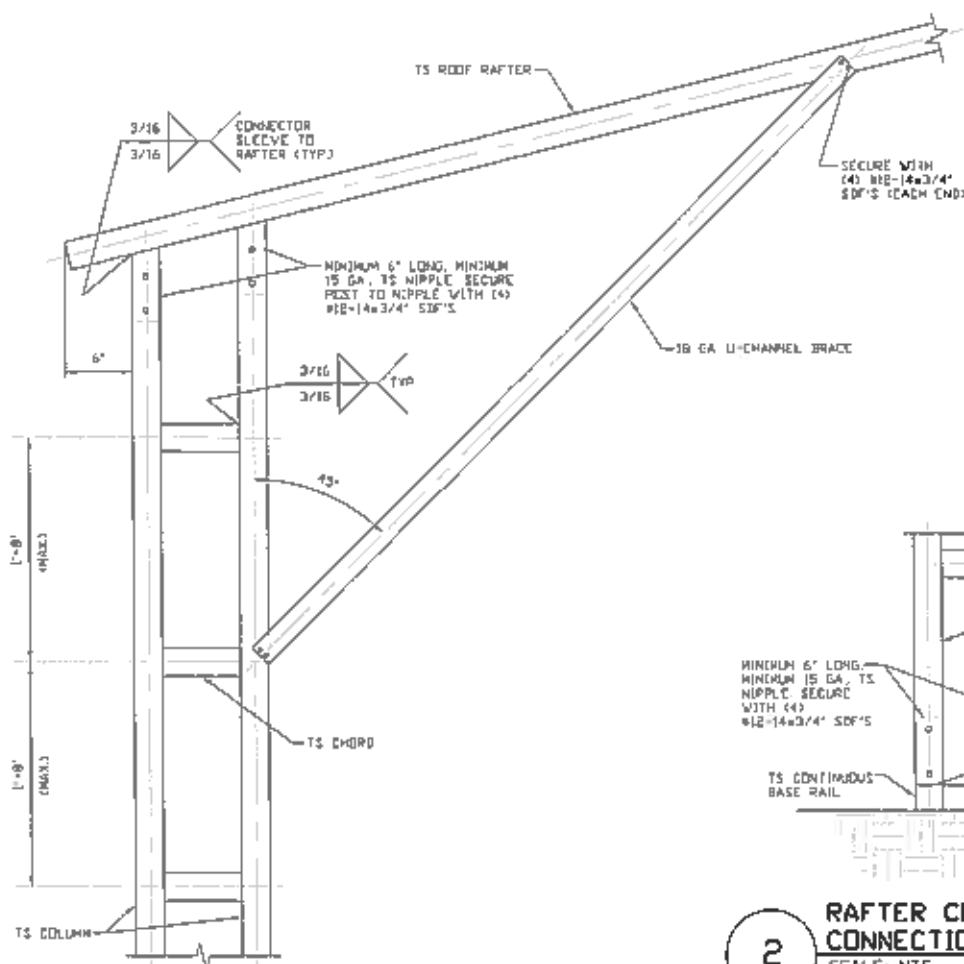
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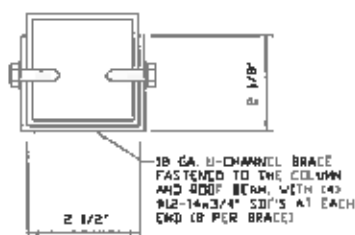
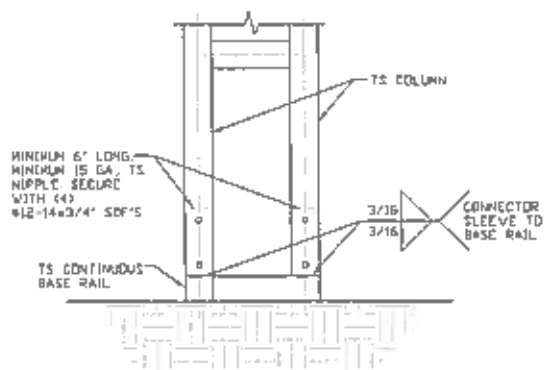
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**BOX EAVE RAFTER COLUMN
CONNECTION DETAIL
FOR HEIGHTS 16'-0" < TO ≤ 20'-0"**
SCALE: NTS

**2 RAFTER COLUMN/BASE RAIL
CONNECTION DETAIL**
SCALE: NTS



BRACE SECTION
SCALE: NTS

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**TUBULAR BUILDING SYSTEMS
30'-0"x20'-0" ENCLOSED BUILDING EXP. B**

DATE: 12-18-17

SHT. 6A

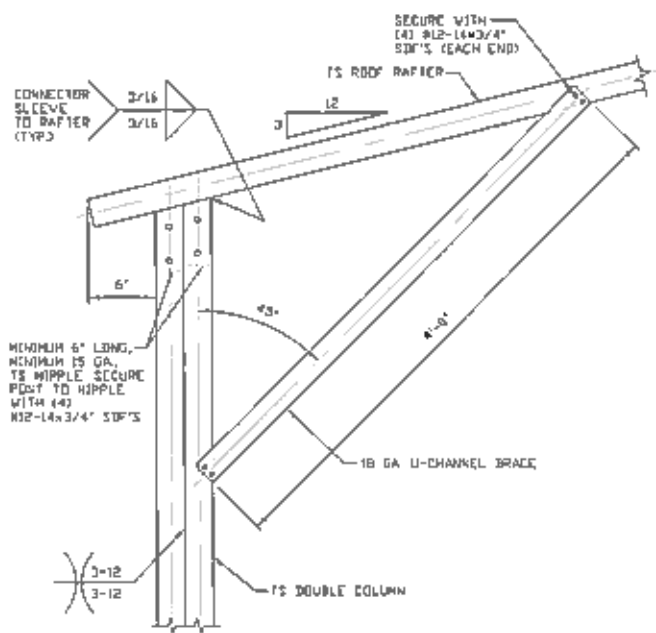
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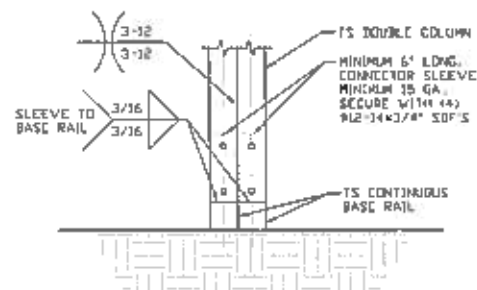
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REV. 4

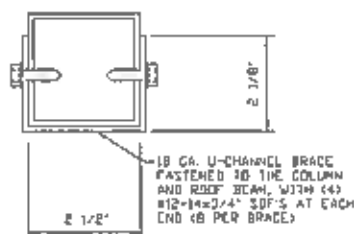
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1 BOX EAVE RAFTER COLUMN
CONNECTION DETAIL
FOR HEIGHTS 14'-0" < TO ≤ 16'-0"
SCALE: NTS



2 RAFTER COLUMN/BASE RAIL
CONNECTION DETAIL
SCALE: NTS



BRACE SECTION
SCALE: NTS

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SHT. 6B

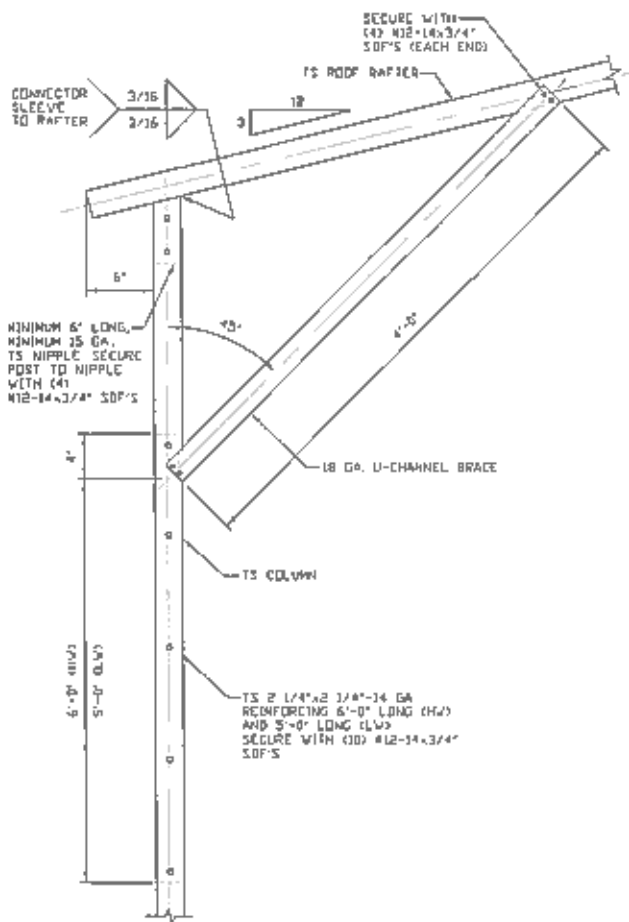
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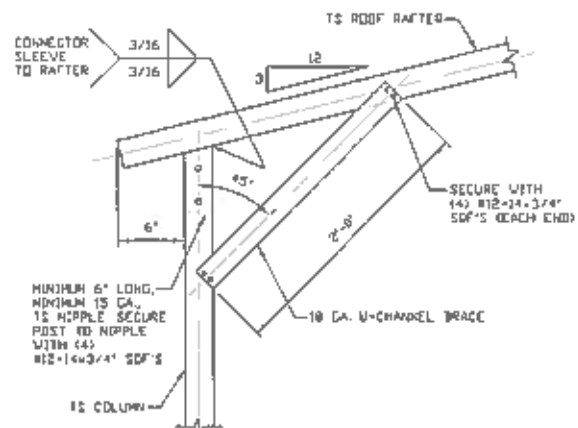
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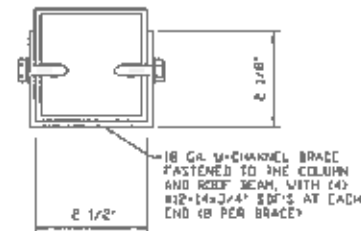
1A

**BOX EAVE RAFTER COLUMN
CONNECTION DETAIL
FOR HEIGHTS 10'-0" < TO ≤ 14'-0"**
SCALE: NTS

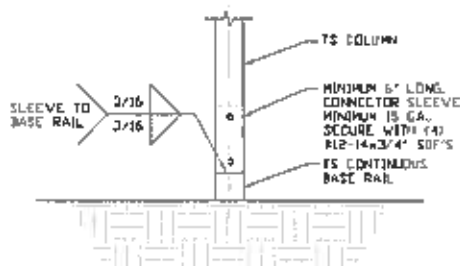


1B

**BOX EAVE RAFTER COLUMN
CONNECTION DETAIL
FOR HEIGHTS ≤ 10'-0"**
SCALE: NTS



BRACE SECTION
SCALE: NTS



2

**RAFTER COLUMN/BASE RAIL
CONNECTION DETAIL**
SCALE: NTS

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30'-0" x 20'-0" ENCLOSED BUILDING EXP. B**

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SHT. 6C

SCALE: NTS

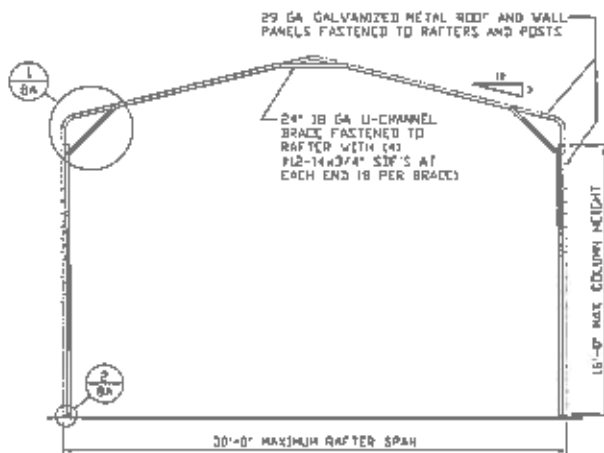
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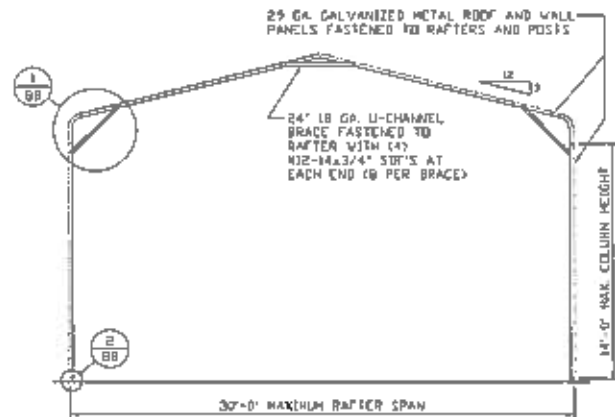
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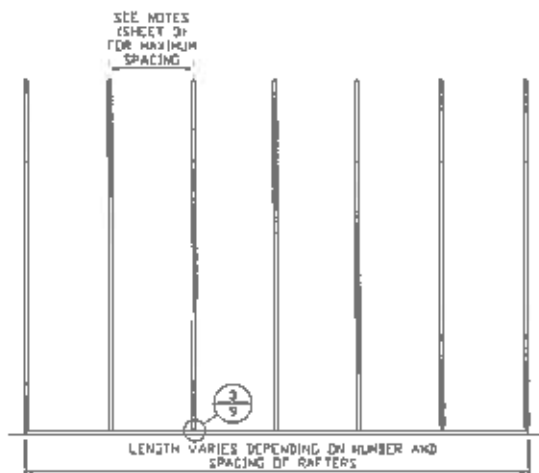
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TYPICAL RAFTER/COLUMN END FRAME SECTION
SCALE: NTS



TYPICAL RAFTER/COLUMN END FRAME SECTION
SCALE: NTS



TYPICAL RAFTER/COLUMN SIDE FRAMING SECTION
SCALE: NTS

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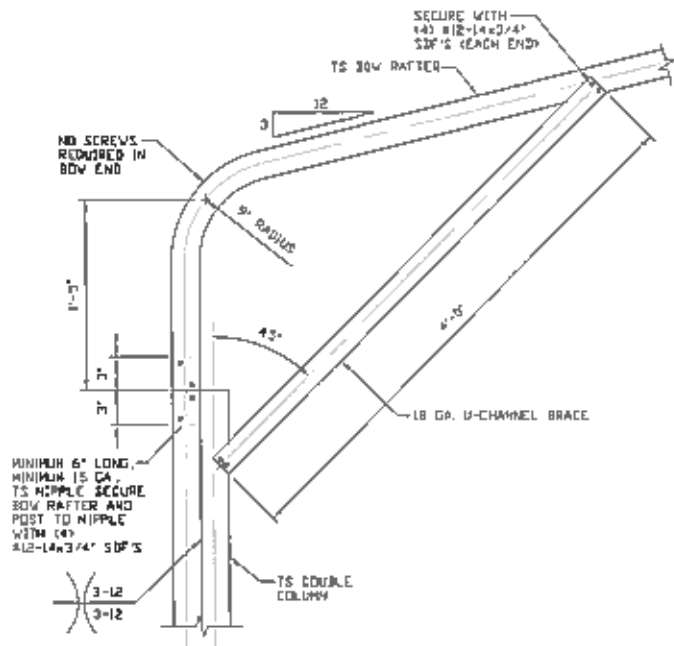
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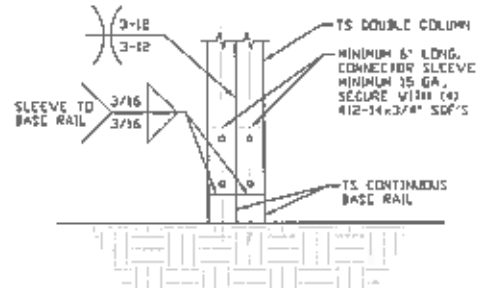
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JOB NO
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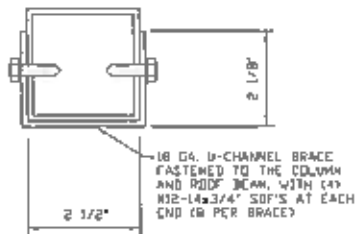
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1 BOX EAVE RAFTER COLUMN
CONNECTION DETAIL
FOR HEIGHTS 14'-0" < TO ≤ 16'-0"
SCALE: NTS



2 RAFTER COLUMN/BASE RAIL
CONNECTION DETAIL
SCALE: NTS



BRACE SECTION
SCALE: NTS

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SHT. 8A

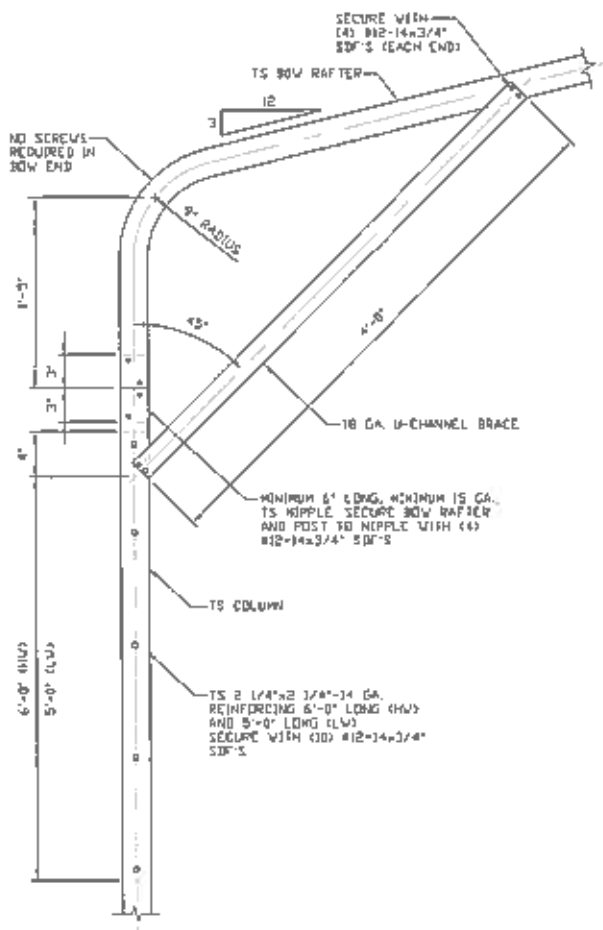
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DWG. NO. SB-3

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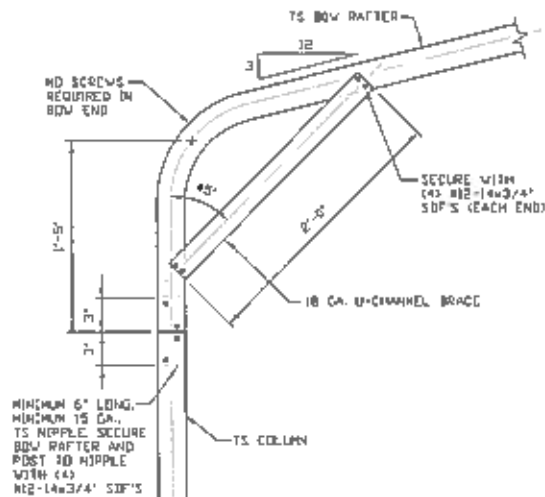
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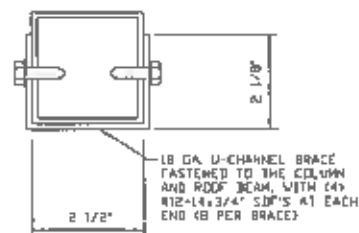
1A

**BOX EAVE RAFTER COLUMN
CONNECTION DETAIL
FOR HEIGHTS 10'-0" < TO ≤ 14'-0"**
SCALE: NTS

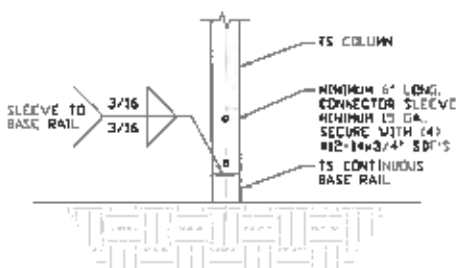


1B

**BOX EAVE RAFTER COLUMN
CONNECTION DETAIL
FOR HEIGHTS ≤ 10'-0"**
SCALE: NTS



BRACE SECTION
SCALE: NTS



2

**RAFTER COLUMN/BASE RAIL
CONNECTION DETAIL**
SCALE: NTS

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**TUBULAR BUILDING SYSTEMS
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SHT. 68

SCALE: NTS

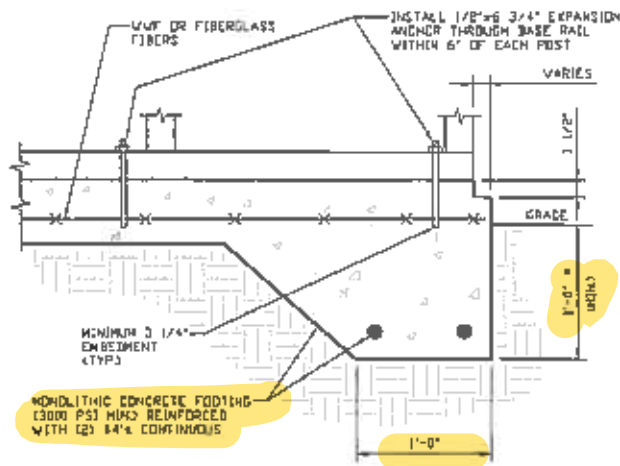
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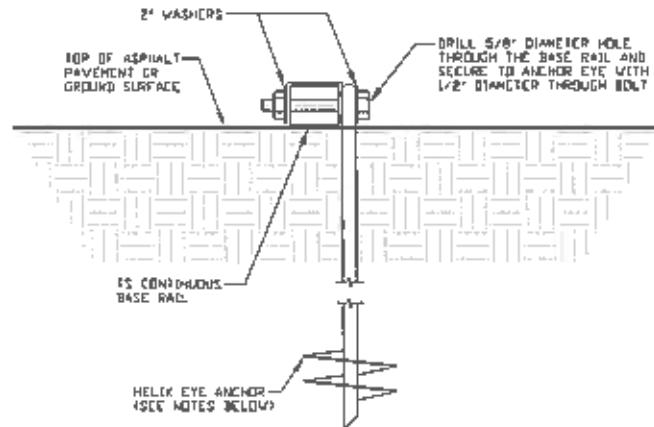
BASE RAIL ANCHORAGE OPTIONS FOR LOW AND HIGH WIND SPEED



3A

CONCRETE MONOLITHIC SLAB BASE RAIL ANCHORAGE

SCALE: NTS
(MINIMUM ANCHOR EDGE DISTANCE IS 4")
* COORDINATE WITH LOCAL CODES/ORD.



3B

GROUND BASE HELIX ANCHORAGE

SCALE: NTS (CAN BE USED FOR ASPHALT)

GENERAL NOTES

CONCRETE:

CONCRETE SHALL HAVE A MINIMUM SPECIFIED COMPRESSIVE STRENGTH OF 3,000 PSI AT 28 DAYS.

COVER OVER REINFORCING STEEL:

FOR FOUNDATIONS, MINIMUM CONCRETE COVER OVER REINFORCING BARS SHALL BE PER ACI-318.
3 INCHES IN FOUNDATIONS WHERE THE CONCRETE IS CAST AGAINST AND PERMANENTLY IN CONTACT WITH THE EARTH OR EXPOSED TO THE EARTH OR WEATHER, AND 1 1/2 INCHES ELSEWHERE.

REINFORCING STEEL:

THE TURNDOWN REINFORCING STEEL SHALL BE ASTM A615 GRADE 60. THE SLAB REINFORCEMENT SHALL BE WELDED WIRE FABRIC MEETING ASTM A185 OR FIBERGLASS FIBER REINFORCEMENT.

REINFORCEMENT MAY BE BENT IN THE SHOP OR THE FIELD PROVIDED:

1. REINFORCEMENT IS BENT COLD.
2. THE DIAMETER OF THE BEND, MEASURED ON THE INSIDE OF THE BAR, IS NOT LESS THAN SIX-BAR DIAMETERS.
3. REINFORCEMENT PARTIALLY EMBEDDED IN CONCRETE SHALL NOT BE FIELD BENT.

HELIX ANCHOR NOTES:

1. FOR VERY DENSE AND/OR CEMENTED SANDS, COARSE GRAVEL AND COBBLES, CALICHE, PRELOADED SILTS AND CLAYS USE MINIMUM (2) 4" HELICES WITH MINIMUM 30 INCH EMBEDMENT.
2. FOR CORAL USE MINIMUM (2) 4" HELICES WITH MINIMUM 30 INCH EMBEDMENT.
3. FOR MEDIUM DENSE COARSE SANDS, SANDY GRAVELS, VERY STIFF SILTS, AND CLAYS USE MINIMUM (2) 4" HELICES WITH MINIMUM 30 INCH EMBEDMENT.
4. FOR LOOSE TO MEDIUM DENSE SANDS, FIRM TO STIFF CLAYS AND SILTS ALLUVIAL FILL USE MINIMUM (2) 6" HELICES WITH MINIMUM 50 INCH EMBEDMENT.
5. FOR VERY LOOSE TO MEDIUM DENSE SANDS, FIRM TO STIFFER CLAYS AND SILTS, ALLUVIAL FILL USE MINIMUM (2) 8" HELICES WITH MINIMUM 60 INCH EMBEDMENT.

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**TUBULAR BUILDING SYSTEMS
30'-0"X30'-0" ENCLOSED BUILDING EXP. B**

DATE: 12-18-17

SHT. 9A

SCALE: NTS

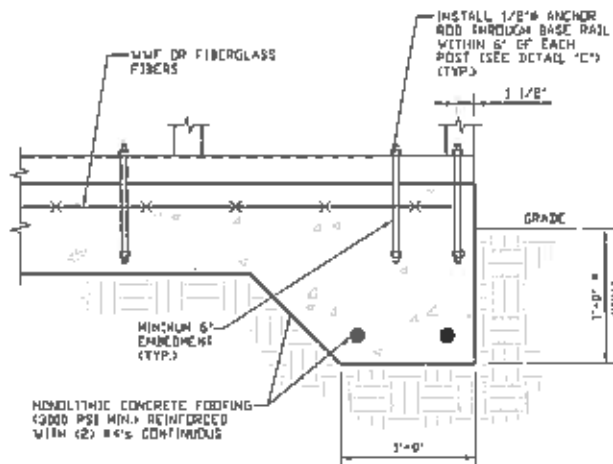
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160225/173005

REV: 4

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OPTIONAL FOUNDATION ANCHORAGE FOR LOW & HIGH WIND SPEED

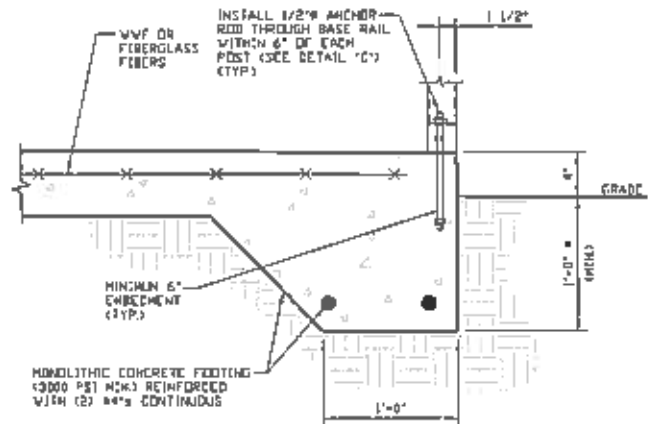


1A

CONCRETE MONOLITHIC SLAB BASE RAIL ANCHORAGE

SCALE: NTS

(MINIMUM ANCHOR EDGE DISTANCE IS 1 1/2")
* COORDINATE WITH LOCAL CODES/ORD.



1B

CONCRETE MONOLITHIC SLAB BASE RAIL ANCHORAGE

SCALE: NTS

(MINIMUM ANCHOR EDGE DISTANCE IS 1 1/2")
* COORDINATE WITH LOCAL CODES/ORD.

GENERAL NOTES

CONCRETE:

CONCRETE SHALL HAVE A MINIMUM SPECIFIED COMPRESSIVE STRENGTH OF 3,000 PSI AT 28 DAYS

COVER OVER REINFORCING STEEL:

FOR FOUNDATIONS, MINIMUM CONCRETE COVER OVER REINFORCING BARS SHALL BE PER ACI-318.

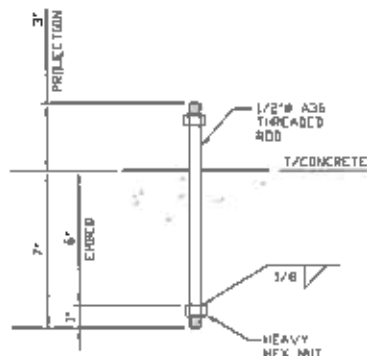
3 INCHES IN FOUNDATIONS WHERE THE CONCRETE IS CAST AGAINST AND PERMANENTLY IN CONTACT WITH THE EARTH OR EXPOSED TO THE EARTH OR WEATHER, AND 1 1/2 INCHES ELSEWHERE.

REINFORCING STEEL:

THE TURNDOWN REINFORCING STEEL SHALL BE ASTM A615 GRADE 60. THE SLAB REINFORCEMENT SHALL BE WELDED WIRE FABRIC MEETING ASTM A185 OR FIBERGLASS FIBER REINFORCEMENT.

REINFORCEMENT MAY BE BENT IN THE SHOP OR THE FIELD PROVIDED:

1. REINFORCEMENT IS BENT COLD.
2. THE DIAMETER OF THE BEND, MEASURED ON THE INSIDE OF THE BAR, IS NOT LESS THAN SIX-BAR DIAMETERS.
3. REINFORCEMENT PARTIALLY EMBEDDED IN CONCRETE SHALL NOT BE FIELD BENT.



1C

ANCHOR ROD THROUGH BASE RAIL DETAIL

SCALE: NTS

**MOORE AND ASSOCIATES
ENGINEERING AND CONSULTING, INC.**

DRAWN BY: LT

CHECKED BY: PJM

PROJECT MGR: WSM

CLIENT: TBS

**TUBULAR BUILDING SYSTEMS
30'-0" x 20'-0" ENCLOSED BUILDING EXP. B**

DATE: 12-10-17

SHT. 90

SCALE: NTS

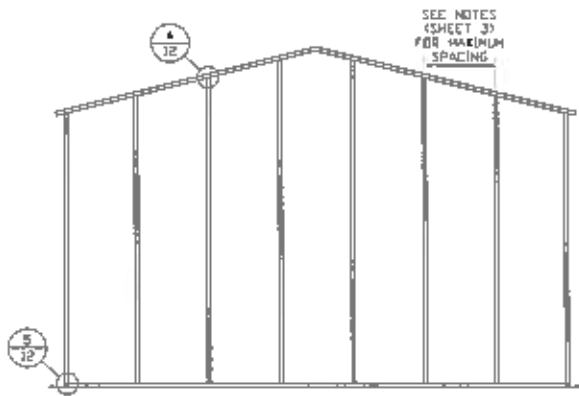
DWG. NO: SK-3

JOB NO:
160225/173005

REV. 4

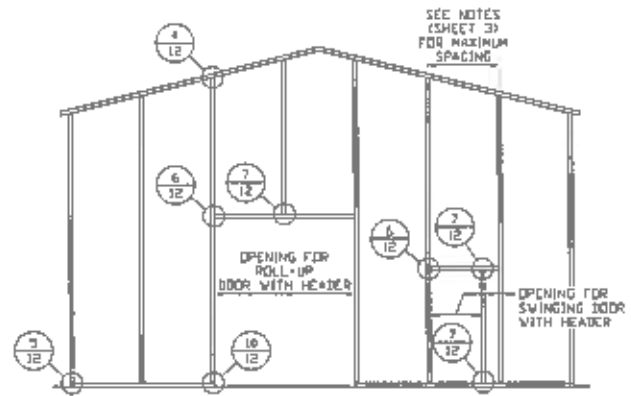
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BOX EAVE RAFTER END WALL AND SIDE WALL OPENINGS



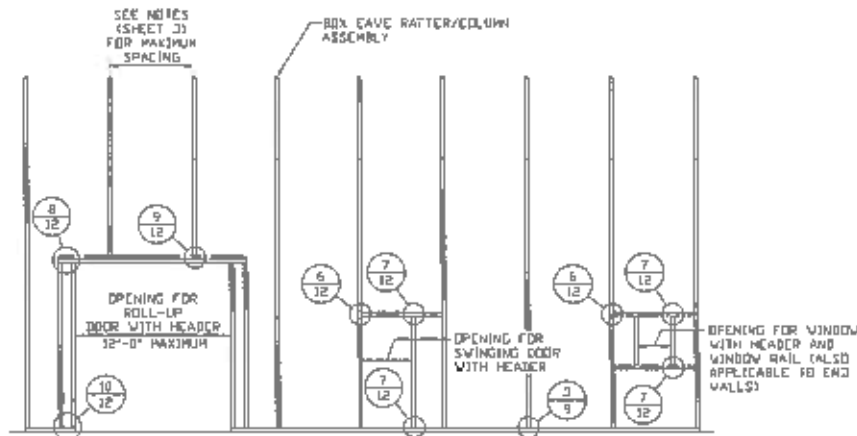
**TYPICAL BOX EAVE RAFTER
END WALL FRAMING SECTION**

SCALE: NTS



**TYPICAL BOX EAVE RAFTER END
WALL OPENINGS FRAMING SECTION**

SCALE: NTS



**TYPICAL BOX EAVE RAFTER SIDE
WALL OPENINGS FRAMING SECTION**

SCALE: NTS

**MOORE AND ASSOCIATES
ENGINEERING AND CONSULTING, INC.**

DRAWN BY: LT

CHECKED BY: PDH

PROJECT MGR: WSH

CLIENT: TBS

**TUBULAR BUILDING SYSTEMS
30'-0" x 20'-0" ENCLOSED BUILDING EXP. B**

DATE: 12-18-17

SHT. 10

SCALE: NTS

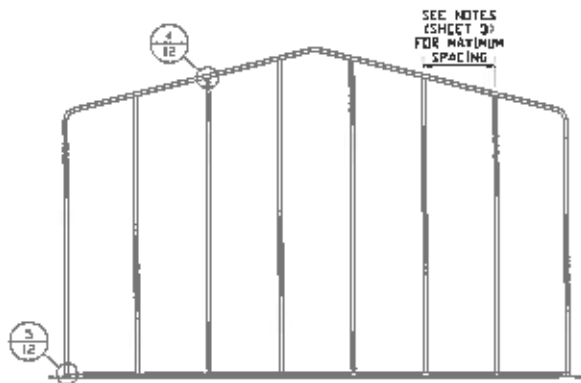
DWG. NO: SK-3

**JOB NO:
160825/173005**

REV: 4

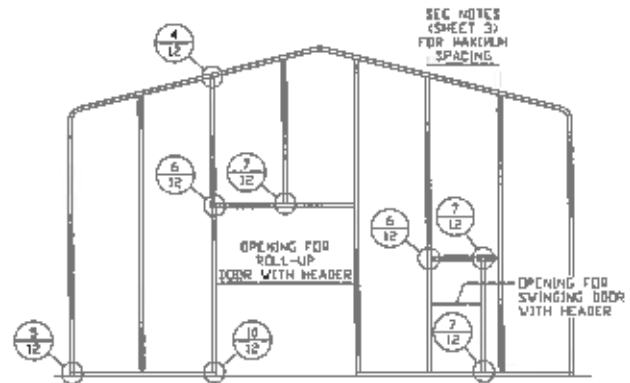
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BOW RAFTER END WALL AND SIDE WALL OPENINGS



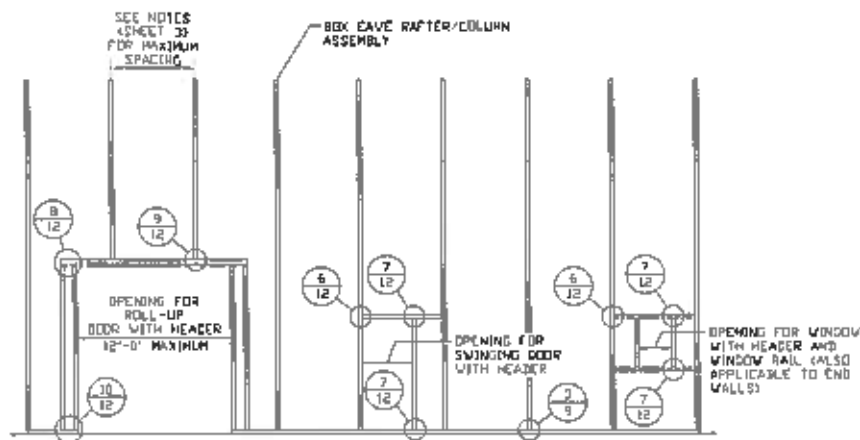
**TYPICAL BOX EAVE RAFTER
END WALL FRAMING SECTION**

SCALE: NTS



**TYPICAL BOX EAVE RAFTER END
WALL OPENINGS FRAMING SECTION**

SCALE: NTS



**TYPICAL BOX EAVE RAFTER SIDE
WALL OPENINGS FRAMING SECTION**

SCALE: NTS

**MOORE AND ASSOCIATES
ENGINEERING AND CONSULTING, INC.**

DRAWN BY: LT

CHECKED BY: PDH

PROJECT MGR: WSK

CLIENT: TBS

**TUBULAR BUILDING SYSTEMS
30'-0"x20'-0" ENCLOSED BUILDING EXP. B**

DATE: 12-18-17

SHT. 11

SCALE: NTS

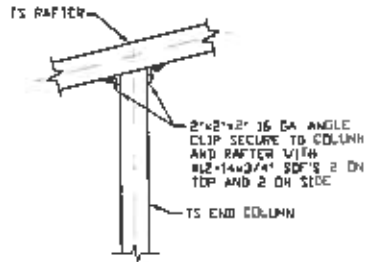
BVL NO: SX-3

**JOB NO:
160225/173005**

REV: 4

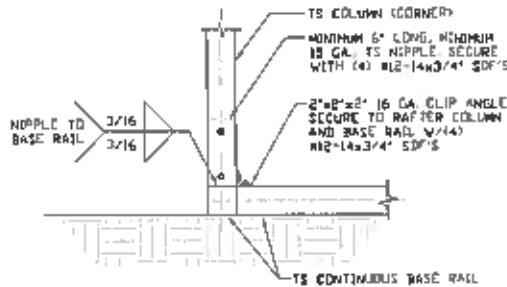
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BOW AND BOX EAVE RAFTER WALL OPENING DETAILS



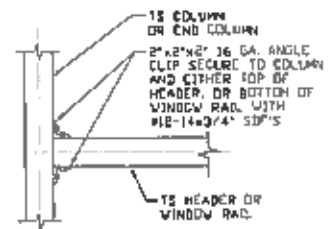
4 **END COLUMN/RAFTER CONNECTION DETAIL**

SCALE: NTS



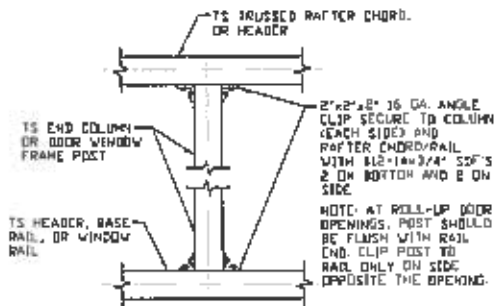
5 **END COLUMN/BASE RAIL CONNECTION DETAIL**

SCALE: NTS



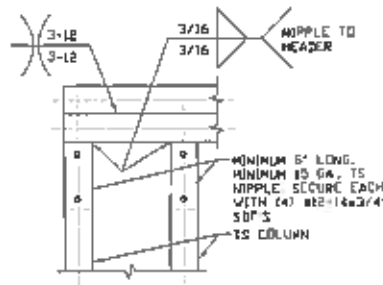
6 **HEADER OR WINDOW RAIL TO COLUMN CONNECTION DETAIL**

SCALE: NTS



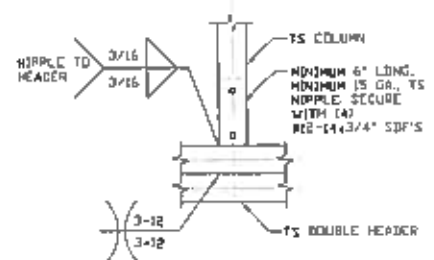
7 **COLUMN TO HEADER, BASE RAIL, OR WINDOW RAIL CONNECTION DETAIL**

SCALE: NTS



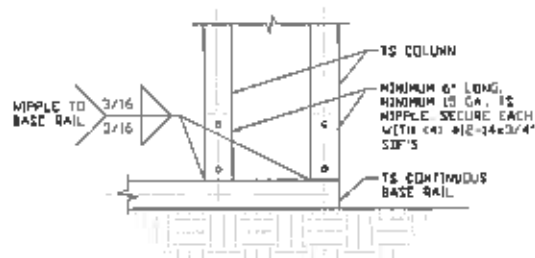
8 **DOUBLE HEADER/COLUMN CONNECTION DETAIL**

SCALE: NTS



9 **COLUMN/DOUBLE HEADER CONNECTION DETAIL**

SCALE: NTS



10 **COLUMN/BASE RAIL CONNECTION DETAIL**

SCALE: NTS

**MOORE AND ASSOCIATES
ENGINEERING AND CONSULTING, INC.**

DRAWN BY: LT

CHECKED BY: PDM

PROJECT NO: WSH

CLIENT: TBS

**TUBULAR BUILDING SYSTEMS
30'-0"X20'-0" ENCLOSED BUILDING EXP. B**

DATE: 12-18-17

SHT. 12

SCALE: NTS

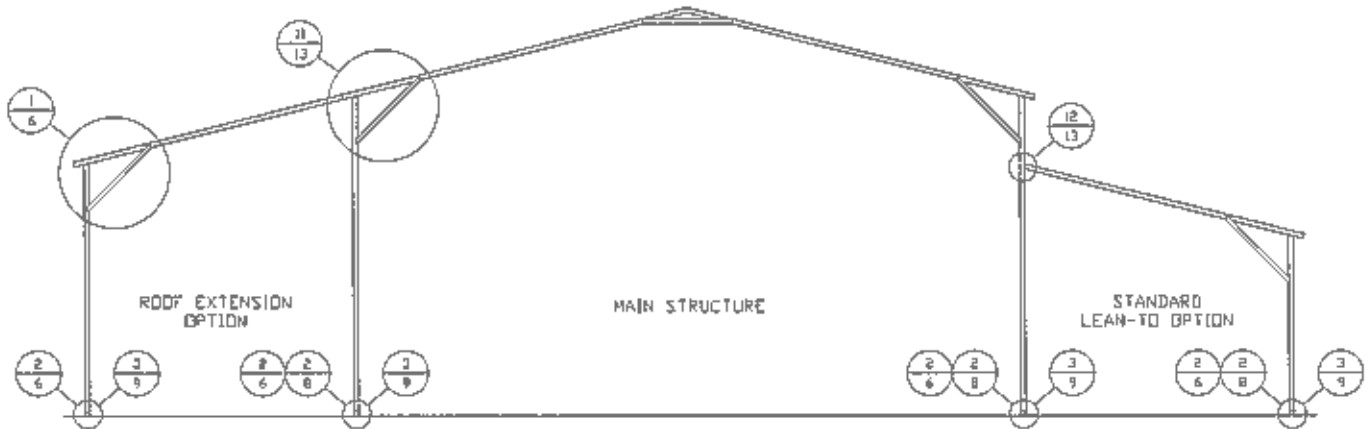
DWG. NO: SK-3

JOB NO:
164225/173005

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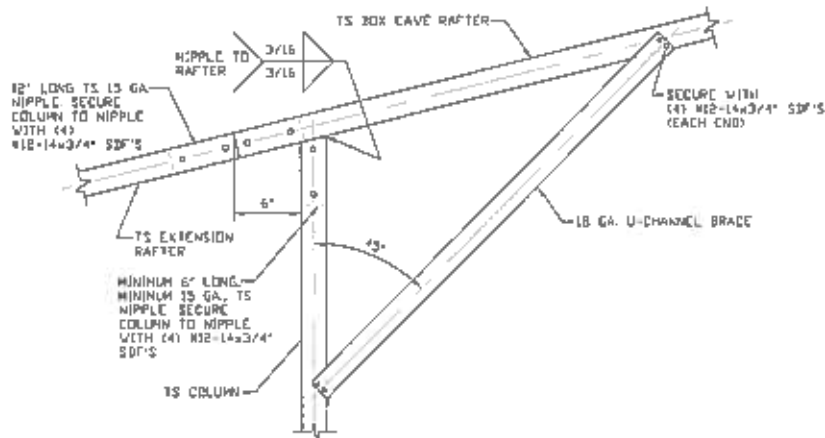
BOX EAVE RAFTER LEAN-TO OPTIONS



TYPICAL BOX EAVE RAFTER LEAN-TO OPTIONS FRAMING SECTION (BOTH OPTIONS SHOWN)

SCALE: NTS

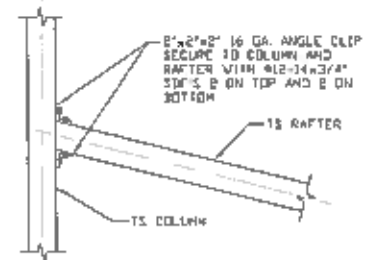
MAXIMUM WIDTH OF SINGLE MEMBER RAFTER LEAN-TO IS 16'-0".



11A

SIDE EXTENSION RAFTER/COLUMN DETAIL

SCALE: NTS



12

LEAN-TO RAFTER TO RAFTER COLUMN CONNECTION DETAIL

SCALE: NTS

**MOORE AND ASSOCIATES
ENGINEERING AND CONSULTING, INC.**

DRAWN BY: LT

CHECKED BY: PDH

PROJECT NGR: WSH

CLIENT: TBS

**TUBULAR BUILDING SYSTEMS
30'-0"X20'-0" ENCLOSED BUILDING EXP. B**

DATE: 12-18-17

SHT. 13

SCALE: NTS

DWG. NO: SX-3

JOB NO:
160225/173005

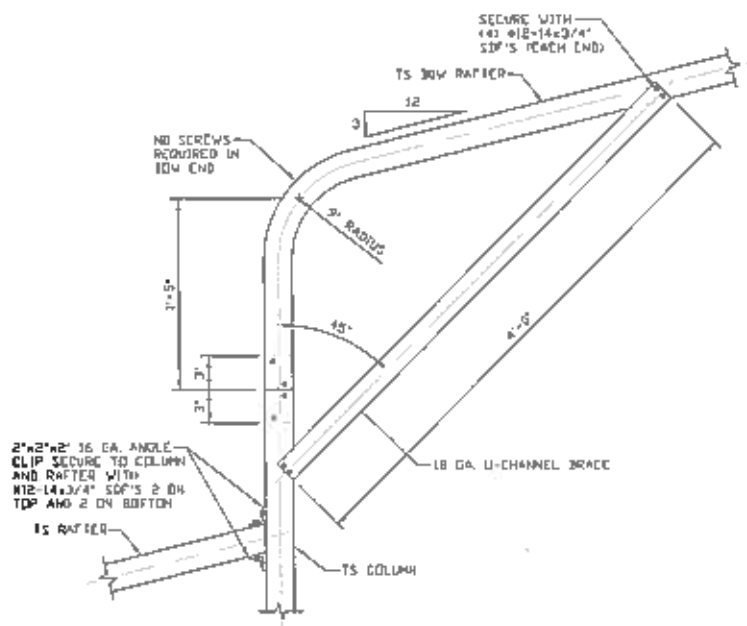
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The diagram illustrates a lean-to roof structure. The 'STANDARD LEAN-TO OPTION' is shown on the left, featuring a gabled roof with a peak load of 13/14. The 'MAIN STRUCTURE' is shown on the right, featuring a flat roof. Various load values are indicated at different points: 7/8 at the peak of the lean-to, 2/6 and 3/9 at the base of the lean-to, 2/6 and 2/8 at the base of the main structure, and 2/6, 2/8, and 3/9 at the base of the main structure. The diagram also shows the internal framing and the connection between the lean-to and the main structure.

SCALE: NTS

MAXIMUM WIDTH OF SINGLE MEMBER AFTER LEAN-TO IS 16'-0"



13

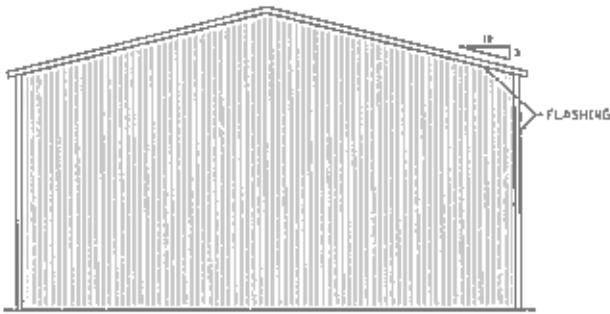
SIDE EXTENSION RAFTER/COLUMN DETAIL

SCALE: NTS

REV. 4

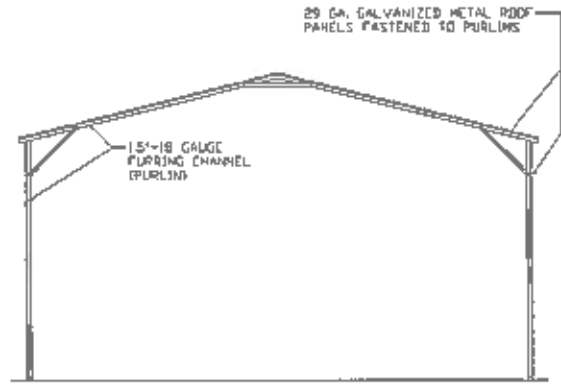
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BOX EAVE RAFTER VERTICAL ROOF/SIDING OPTION



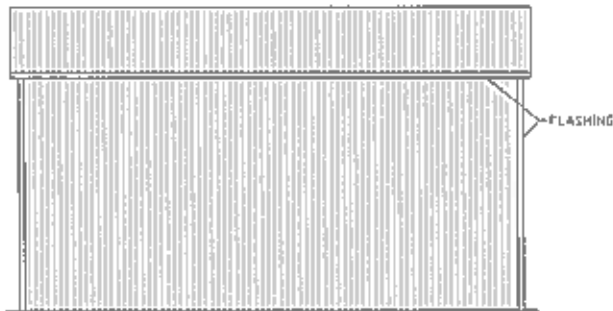
**TYPICAL END ELEVATION
VERTICAL ROOF/SIDING OPTION**

SCALE: NTS



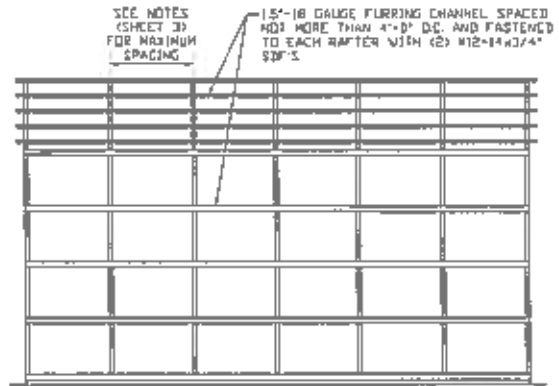
**TYPICAL SECTION VERTICAL
ROOF/SIDING OPTION**

SCALE: NTS



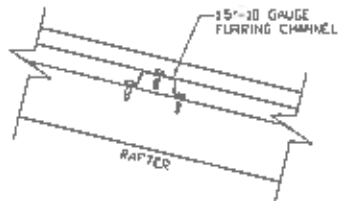
**TYPICAL SIDE ELEVATION
VERTICAL ROOF/SIDING OPTION**

SCALE: NTS



**TYPICAL FRAMING SECTION
VERTICAL ROOF/SIDING OPTION**

SCALE: NTS



ROOF PANEL ATTACHMENT

(ALTERNATE FOR VERTICAL ROOF PANELS)
SCALE: NTS

**MOORE AND ASSOCIATES
ENGINEERING AND CONSULTING, INC.**

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CHECKED BY: PDH

PROJECT MGR: VSM

CLIENT: TBS

**TUBULAR BUILDING SYSTEMS
30'-0"X20'-0" ENCLOSED BUILDING EXP. B**

DATE: 12-18-17

SHT. 15

SCALE: NTS

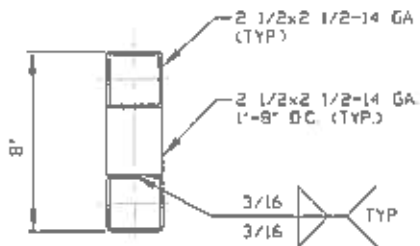
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JOB NO
16822S/17300S

REV: 4

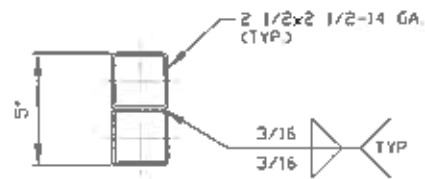
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OPTIONAL DOOR HEADER



**HEADER DETAIL FOR DOOR
OPENINGS 12'-0" < LENGTH ≤ 15'-0"**

SCALE: NTS



**HEADER DETAIL FOR DOOR
OPENINGS LENGTH ≤ 12'-0"**

SCALE: NTS

**MOORE AND ASSOCIATES
ENGINEERING AND CONSULTING, INC.**

DRAWN BY: LT

CHECKED BY: PDH

PROJECT MGR: WSH

CLIENT: TBS

**TUBULAR BUILDING SYSTEMS
30'-0"x20'-0" ENCLOSED BUILDING EXP. B**

DATE: 12-18-17

SHT. 16

SCALE: NTS

BVL NO: SK-3

JOB NO:
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