

Submittal Review



Submittal: Pre-selection Submittal 1-R1

**Contractor
Submittal Ref.:**

**Clarifier Submittal
Tanks 5 & 6 - Spec
Section 11451 -
WesTech Job #
24946A, B, C**

Project Name: WWTP Rehab Secondary Clarifiers **Review Date:**

January 29, 2024

Project No: T001630A

Client:

City of Brantford

Reviewers: Graham Seggewiss (GS)
Rebecca Pringlemeir (ARP)
Tim Barichello (TB)
Nathan Sherwood (NS)
Jameson Palmer (JP)

Submittal Status:

1 – No Comment
2 – As Noted
3 – Revise & Resubmit
4 – Not Reviewed
5 - Rejected

Item	Reference	Reviewer	Comment Status	Comment
1.	Torque Monitor	TB	2	Please confirm that the torque transmitter will be handed over to the contractor for installation in the contractor supplied starter panel.
2.	Torque Monitor	TB	2	Please confirm LS1 contacts are to be used for a warning alarm and LS2 contacts for motor shutdown.
3.		ARP	1	No comment

Notes:

1. The Contractor's responsibility for errors and omissions in a submittal is not relieved by the Engineer's review of the submittal. Review by the Engineer is for general conformance with the design concept and compliance with the Contract documents.
2. The Engineer's review does not relieve the Contractor of their responsibility to meet all contractual requirements. Deviations must be noted on the cover sheet of the Contractor's submission.



LETTER OF TRANSMITTAL

WestTech®	1486 ST PAUL AVE. GURNEE, IL 60031 US	Phone: 801-265-1000 Fax: 801-265-1080	Document No. 22035
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Requested Ship Date: 12/01/23 Required Del Date:	Group: 06 Status:	Job No.: 24946A Job Name: BRANTFORD WWTP, ONTARIO, CA Project Manager: ABDULLAH SAMAD
Re: SUBMITTAL		

from: ABDULLAH SAMAD WESTECH ENGINEERING, LLC 3665 SOUTH WEST TEMPLE SALT LAKE CITY, UT 84115	to: J. GRAHAM DEGGEWISS CIMA+ 900-101 Frederick Street Kitchener, ON N2H 6R2 CA
Ph/Fax: 847-775-2416 / 801-265-1080 Email/Cell: asamad@westech-inc.com /	Ph/Fax: 519-536-3788 / Email/Cell: Graham.Seggewiss@cima.ca /

We are sending you: ☒ Attached ☐ Under Separate Cover **Via:** ☐ Best Way ☒ Other EMAIL
the following items:

☐ Shop Drawings ☒ Submittal Drawings ☐ O&M Manuals ☐ Specifications
☒ Copy of Letter ☐ Change Order ☐ Other

Copies	Number	Rev	Description
1	24946A	A	SUBMITTAL - SPEC SECTION 11450
CLARIFIERS - TANK # 2, 3 & 4			
WEIRS - TANKS # 3 & 4			
DENSITY CURRENT BAFFLES - TANKS 1, 2, 3 & 4			

These are transmitted as checked below:

☒ For Approval ☐ Approved as Submitted ☐ For Bids Due
☐ For Your Use ☐ Approved as Noted ☐ Prints Returned After Loan to WEI
☐ As Requested ☐ Returned for Corrections ☐ Returned 0 Approved Prints
☐ For Review and Comment ☐ Returned 0 Corrected Prints ☐ Other

☒ Please Return Submittal By **12/15/23** to Avoid Delaying Project.

Remarks:

CIMA+	SHOP DRAWING REVIEW
	PRODUCT OR EQUIPMENT
NATURE AND EXTENT OF REVIEW: The technical specifications of the product or equipment have been reviewed to verify conformity with the Contract Plans and Specifications.	
DATE (dd/mm/yyyy) 06/03/2024	
THE DESIGN AND FABRICATION OF THE PRODUCT HAS NOT BEEN VERIFIED: This review does not relieve the manufacturer or Contractor of any responsibility for compliance with the specifications, or for coordination with other products or equipment to be incorporated into the Works. See remarks on the document (if any).	
NO COMMENT <input checked="" type="checkbox"/> AS NOTED <input checked="" type="checkbox"/> REVISE AND RESUBMIT <input type="checkbox"/> REJECTED <input type="checkbox"/>	
REVIEWER'S NAME Graham Seggewiss	REV. NO. 1
SIGNATURE 	

X
Signed

November 29th, 2023

Graham Seggewiss
CIMA+
500-5935 Airport Road
Mississauga, Ontario L4V 1W5

Re: Response to submittal review comments Tanks 2-4 – Spec Section 11450 – WesTech Job # 24946A

Graham,

Please find below the WesTech's response to submittal return dated November 3rd, 2023. The submittal has been updated where needed.

1. Vendor has proposed an alarm switch, cutout switch, and backup cutout switch at 100%, 120%, and 140%, respectively, of the design running torque.
Vendor to confirm these recommended setpoints do not have any impact on equipment operation (prior to cut out) or warranty.
WesTech Comment: Confirmed.
2. Warranty shall be two (2) years beyond project substantial completion.
WesTech Comment: Warranty is updated in the submittal.
3. Delete the supply of the local control panel. The local control panel shall be supplied under the installing contractor's scope of supply.
Submit a suggested electrical wiring diagram incorporating all proposed control and safety mechanisms for engineer review.
WesTech Comment: The local control station information has been removed from the submittal. Torque Control wiring information is provided on page 88 of the submittal.
4. Confirm wind on the handrail on the platform was considered.
WesTech Comment: Confirmed.
5. Confirm bridge model considers one end as a roller support.
WesTech Comment: Confirmed.
6. Confirm 38mm sched 40 al pipe @ 1800 c/c can hold the loads described in the OBC. for the posts and rail.
WesTech Comment: Confirmed.
7. For all structural design provide stamp from engineer licensed in Ontario.
WesTech Comment: Stamped calculations and drawings are now included in the submittal.
8. 304L SS is required in spec, not 304 SS. Please update all including bridge, structural members, feedwell, weirs and baffles.
WesTech Comment: Per email from Graham Seggewiss dated November 21st, 2023, no change to the material is required.
9. Warning about anchors is noted. Comment will be returned in separate submittal.
WesTech Comment: Per email from Graham Seggewiss dated November 9th, 2023, any modifications to the existing concrete will be outside of WesTech's submittal. No change to the submittal is required. The anchor calculations are included in the submittal.

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Submittal Package

Revision: A

For:

Brantford WWTP
Secondary Clarifiers Rehabilitation
Brantford, Ontario, Canada

Equipment:

Three (3) 70 ft [21.34m] Diameter COP™ Clarifier Mechanisms
Specification Section: 11450
WesTech Model Number: COPC2G

WesTech Contact:

Project Manager: Abdullah Samad
Phone: 847.775.2416
Email: asamad@westech-inc.com

WesTech Job Number 24946A
December 2023



For:

Brantford WWTP
Secondary Clarifiers Rehabilitation
Brantford, Ontario

Equipment:

Three (3) 70 ft [21.34m] Diameter COP™ Clarifier Mechanisms
WesTech Model Number: COPC2G

Engineer:

CIMA+
500-5935 Airport Road
Mississauga, Ontario L4V 1W5
Phone: 905.695.1005

Contractor:

TBD

WesTech Agent:

C&M Environmental Technologies
2160 Dunwin Dr
Mississauga, Ontario L5L 5M8
Contact: Rob Anderson
Phone: 705.725.9377
Email: robanderson@cmeti.com

Manufacturer:

WesTech Engineering, LLC®
3665 South West Temple
Salt Lake City, Utah 84115
Phone: 801.265.1000
Fax: 801.265.1080
24 Hour Emergency Assistance: 800.265.1000

WesTech Contact:

Project Manager: Abdullah Samad
Phone: 847.775.2416
Email: asamad@westech-inc.com

WesTech Job Number 24946A

December 2023

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WESTECH® Product Line Card

Water and Wastewater Treatment Equipment and Solutions

- *Municipal*
- *Industrial*
- *Minerals*
- *Services and Operations*



Aerators - Water

ATOMERATOR™ Pressurized Aerator
Cascade Aerator
Forced and Induced Draft Aerator



Anaerobic Digestion

Ana-Flo™ UASB – Upflow Anaerobic Sludge Blanket
Digester Cover - Radial Beam and Truss Style
DuoSphere™ Dual Membrane Gasholder
ExtremeDuty™ Mechanical Sludge Mixer
Sludge Heating System



Biological Treatment

BioDoc™ Rotary Distributor
HydroDoc™ Rotary Distributor
LANDY-7 Slow Speed Surface Aerator
OxyStream™ Oxidation Ditch
PakTOR™ Packed Bed Reactor
STM-Aerotor™ IFAS System



Clarification

Adsorption Clarifier® System
Backwash Clarifier
Conventional Clarifier
CONTRAFast® Thickening Clarifier
CONTRAFLO® Solids Contact Clarifier
COP™ Spiral Blade Clarifier
COP™ Suction Header Clarifier
Flocculating Clarifier
Metallurgical Clarifier
Pin Bed Clarifier
RapiSand™ Ballasted Flocculation
Sludge Sucker™ Sludge Removal System
Solids CONTACT CLARIFIER™
Suction Header Clarifier
Suction Pipe Clarifier
SuperSettler™ Inclined Plate Clarifier
Zickert Shark™ Sludge Removal System



Combined Sewer Overflow

WWETCO FlexFilter™



Dewatering

Filter Press
Horizontal Belt Filter
Rotary Vacuum Drum Filter
Vacuum Disc Filter



Dissolved Air Flotation (DAF)

Circular / Rectangular DAF Units
Dissolved Gas Flotation (DGF)
Dissolved Nitrogen Flotation (DNF)
R5 DAF Pre-Engineered Unit



Drives

Cage Drive
Drives with Lift
Dual Drive
Shaft Drive
Replacement, Retrofit, and Rebuild Options



Flocculation

Axial Blade Flocculators
Horizontal Paddle Flocculators
Vertical Paddle Flocculators



Filtration - Granular Media

CentROL® Gravity Filter
ESSD® Washtroughs
Gravity Filtration System
LAZERFLO™ Low-Profile Underdrain
Manganese ANTHRA/SAND™
MULTIBLOCK® Filter Underdrain
MULTICELL® Horizontal Pressure Filter
MULTICRETE™ II Filter Underdrain
MULTIWASH® Filtration Process
MULTIWASH® PRO Trough
Pressure Filters [Vertical and Horizontal]
SuperSand™ Continuous Backwash Filter



Filtration - Specialty

Ion Exchange System
Granular Activated Carbon Contactor (GAC)
SuperDisc™ Disc Filter
SuperDrum™ Drum Filter
WWETCO FlexFilter™



Headworks Grit Removal and Screening

CleanFlo™ SHEAR™ Rotary Drum Screen
Grit Collector
Shafted Grit Screw Classifier
Vortex Grit Chamber



Industrial Screening

Linear Screen
Resin / Carbon Interstage Screen
WTR Cup and Drum Screen
WTR Fish Recovery and Return Screen
WTR Stationary Screen
WTR Talon Rake™ and Bar Screen
WTR Traveling Water Screen



Membrane Filtration

AltaPac™ Ultrafiltration Membrane System
Electrodeionization (EDI)
Nanofiltration and Reverse Osmosis System
Ultrafiltration Membrane System
VersaFilter™ Open-Platform Membrane System



Oil/Water Separation

Oil/ Water Separators
Dissolved Air Flotation (DAF)



Package Treatment Systems

AERALATER® Iron and Manganese Removal System
AltaPac™ Ultrafiltration Membrane Package System
Aquarius® Package Water Treatment Plant
Multi-Tech™ Pressurized Package System
RapiSand Plus™ Package Treatment Plant
Trident® HS Package Treatment Plant
Trident® HSC Package Treatment Plant
Trident® HSR Package Treatment Plant
Trident® Package Treatment Plant
Tri-Mite® Package Treatment Plant
Water Boy™ Package Treatment System



Tankage

Anchor Channel Tanks
Bolt Together Tanks
Elevated Tanks
Field Erection
Shop-Built Tanks



Thickening

AltaFlo™ High-Rate Thickener
CONTRAFast® Thickening Clarifier
Conventional Sludge Thickener
Deep Bed™ Paste Thickener
EvenFlo® Feedwell
HiDensity™ Paste Thickener
HiFlo™ High-Rate Thickener
MudMax™ Bed-Level Instrument
Rotary Drum Thickener
TOP™ Thickener Optimization Package
Titan™ Traction Thickener



WesTech Services and Operations

Mobile and Rental Solutions
Plant Operations and Services
Systems Integration
Pilot Plants
Aftermarket Services
Laboratory Services

Many of these products are available as mobile/rental equipment or pilot plants.

Submittal Introduction

Submittal Introduction

1. This submittal is being furnished for the approval of the mechanical and electrical equipment (if applicable) as outlined under the specification section referred to in the Letter of Clarification.
2. A complete outline of materials to be supplied is listed herein. The General Arrangement drawings enclosed represent our complete scope of supply. All other materials not specifically included on the drawings, or the body of this submittal, are to be supplied by other than WesTech Engineering, LLC.
3. Document and data requirements (i.e. Operation and Maintenance Manuals) covered elsewhere in the specifications shall follow promptly and with the content to satisfy the specifications.
4. A copy of all “approved/approved as corrected” and/or “revised” General Arrangement Drawings (Shop Drawings) and Equipment Erection/Assembly Drawings will be included in the Installation, Operation & Maintenance Manuals.
5. Approval to proceed will not be recognized by WesTech until clouded dimensions (if applicable) are confirmed or supplied.
6. Re-Submittals: The enclosed information will not be duplicated in any future re-submittals, unless:
 - a. Items/sections have been commented on and need clarification or revision for the re-submittal.
 - b. Specifically requested by the Engineer or Contractor on the return Letter of Transmittal that the entire submittal must be duplicated.
7. To be environmentally aware, this submittal may utilize double-sided printing to conserve paper.

Letter of Clarification

Letter of Clarification

The purpose of this Letter of Clarification is to state any departure WesTech will take from the given specifications. This letter of clarification includes specification section 11450 updated per addendum 1,2,3 and associated contract drawings. The right side of the page is a copy of the specification section with any departures from the given specifications noted on the left side of the page. Any exceptions to the contract drawings are noted on the drawings shown as text boxes. All items with no marks or comments should be considered as “No Exceptions Taken”. This review is also used by WesTech to clarify specifications that might have multiple or vague interpretations.

The enclosed WesTech General Arrangement Drawings may contain clouded dimensions. This indicates information to be confirmed and/or corrected by the Engineer and/or the Contractor at the time this submittal is returned. Submittal will not be considered as approved until all clouded dimensions have been confirmed and/or corrected.

All items not specifically noted in the enclosed General Arrangement drawings as being supplied by WesTech are by others.

1

GENERAL

1.1

DESCRIPTION

WesTech will not be onsite to provide supervision of installation, WesTech can provide assistance during installation by means of IOM manual and remote guidance.

.1

This section covers the Provisional Work including site verification, design, fabrication, factory testing, supply of material, delivery, supervision of the installation, on-site testing, commissioning, training and a coordinated design responsibility for the following:

.1 Three (3) spiral blade type circular clarifier mechanism for the Brantford WWTP Secondary Clarifiers 2 to 4, including:

- .1 Center drive unit, complete with reducer, motor, microswitch overload device, and torque control.
- .2 Full span access bridge and enlarged platform with handrail, grating and toe plate. Bridge shall span across secondary clarifier rings of the existing clarifier structure to the centre influent column.
- .3 Stationary center influent column, anchor bolt template, and grout shield.
- .4 Energy dissipating inlet (EDI).
- .5 Influent feedwell.
- .6 Rotating drive cage and truss arms.
- .7 V-notch effluent weir (Secondary Clarifier 3&4 only).

WesTech to provide half span access bridge as per the specification drawings and proposal.

Center column will act as template for the anchor bolts since epoxy anchors are to be used.
Grout shield not by WesTech.

.2 Density current baffles, anchor bolt template, and associating furnishings for the Brantford WWTP Secondary Clarifiers 1 to 4.

Labor on site by others. Material and equipment not specifically outlined in this submittal as being supplied by WesTech are by others.

.2

Provide all labour, material and equipment to furnish, test and commission spiral type circular secondary clarifier mechanism together with appurtenances suitable for installation in a tank with concrete walls and concrete base slab, as indicated and specified.

.3

The intent is that the clarifier mechanism shall come with industry standard drive unit assembly and EDI components. It is recognized that specific details may vary between proponents and will be assessed as part of the technical proposal evaluations.

.4

Like items of equipment specified herein shall be the end products of one manufacturer in order to achieve standardization for operation, maintenance, spare parts and manufacturer's service.

1.2

GENERAL

Storage, assembly and erection onsite is by others, not WesTech.

.1

Equipment furnished under this section shall be fabricated, assembled, erected, and placed in proper operating condition in full conformity with drawings, specifications, engineering data, instructions and recommendations of the screens manufacturer, unless exceptions are as noted by the Engineer.

.2

Site Verification. The Clarifier Vendor shall field verify all the dimensions of the existing clarifiers onsite following award and prior to submitting shop drawings for the Engineer's review. The vendor shall not rely on the existing drawings for shop drawings or fabrication.

- .3 Coordination. The Clarifier Mechanism shall be installed in the existing secondary clarifiers as shown on the drawings. The Clarifier Vendor shall verify that each component of the system is compatible with all other components of the system; and that all devices for a properly functioning system have been provided. The Contractor is responsible for overall coordination of the equipment package to ensure its compatibility with other equipment. The Contractor shall decommission the existing mechanism completely and dispose of them off-site.
- .4 General Equipment Stipulations. The General Equipment Stipulations shall apply to all equipment furnished under this section.
- .5 Equipment Schedule. Manufacturer's field services, one (1) hard and electronic copy of operation and maintenance manuals, and certificates of compliance shall be provided for all items of equipment furnished under this contract.
- .6 Specific requirements for manufacturer's field services are covered in the quality control section. Specific requirements for operation and maintenance manuals and certificates of compliance are covered in the submittals section.
- .7 Power Supply. Power supply to equipment will be 575 volts, 60 Hz, 3 phase.
- .8 Complete structural calculations signed by a registered professional Engineer, licensed in Ontario (P.Eng.).

Structural calculations sealed by a Professional Engineer licensed in Ontario are included in this submittal.

1.3 APPLICABLE CODES AND STANDARDS

- .1 The following minimum applicable codes, standards and regulations must be adhered to in the design, installation and services provided by the Vendor. In the case of conflicting information among these codes, it is the Vendor's responsibility to inform and obtain written approval from the Engineer of any exceptions hereby taken.
- .2 Requirements from the following organizations shall be considered as a minimum:
- .1 American Iron and Steel Institute (AISI), Heat Treated Steel Specifications
 - .2 American National Standards Institute (ANSI).
 - .3 American Gear Manufacturers' Association (AGMA), Gear Ratings
 - .4 American Society of Testing Materials (ASTM):
 - .1 A36 Structural Steel Specifications
 - .2 A48 Cast Iron Specifications
 - .3 A123 Hot-Dip Galvanized Coatings
 - .4 A153 Hot-Dip Galvanized Bolts
 - .5 A167 Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
 - .6 A276 Stainless Steel Bars and Shapes
 - .7 A283C Steel Plate Specifications

- .8 A304 Bolt Specifications
- .9 A536 Ductile Iron Specifications
- .10 A992 Structural Steel Specifications
- .5 Anti-Friction Bearing Manufacturers' Association (AFBMA), Bearing Life Specifications.
- .6 Canadian Welding Bureau (CWB):
 - .1 CAN/CSA-G40.20: General Requirements for Rolled Welded Structural Quality Steel.
 - .2 CSA/CSA-G40.21: Structural Quality Steels.
 - .3 CSA W47.1: Certification of Companies for Fusion Welding of Steel Structures.
 - .4 CSA W47.2: Certification of Companies for Fusion Welding of Aluminum.
 - .5 CSA W59: Welded Steel Construction.
 - .6 CSA W59.2: Welded Aluminum Construction.
- .7 Ontario Occupational Health and Safety (OH&S) Act and Regulations.
- .8 National Electrical Manufacturer's Association (NEMA), Motor Design Standards and Standards for Control Enclosures
- .9 National Fire Protection Association (NFPA) 820, Fire Protection in Wastewater Treatment and Collection Facilities, latest edition.
- .10 The Society for Protective Coating (SSPC) Standards and Specifications:
 - .1 SP 6: Surface Preparation No. 6 for Commercial Blast Cleaning.
 - .2 SP 10: Surface Preparation No. 10 for Near-White Blast Cleaning.

1.4 RELATED SECTIONS

- .1 Division 1 - General Requirements

1.5 SUBMITTALS

- .1 In accordance with Section 01330 - Submittals
- .2 Complete assembly, installation drawings, motor and anchor bolt base plans, together with detailed specifications and data covering materials, parts, devices, and accessories forming a part of the equipment furnished, shall be submitted in accordance with the submittals section.
- .3 Stainless steel construction protocol to avoid cross contamination with carbon steel.
- .4 Vendor shall identify modifications required, if any, to the existing clarifier tank to accommodate the new clarifier mechanism.

Erection drawings and installation instructions to be provided in the IOM manual one month before shipment.

WesTech's calculations show that the center column anchors will break out concrete due to edge distance at the sludge hopper. We recommend reviewing this and modifying the sludge hopper as necessary. Concrete calculations are not by WesTech.

.5 Shop Drawings shall include, but not limited to the following:

Assembly and installation drawings to be provided in the IOM manual before shipment.

Overall weights and dimensions to be provided in the IOM manual before shipment.

Anchor calculation sealed by a Professional Engineer licensed in Ontario included in this submittal.

To be provided in the IOM manual before shipment.

Per submittal review comment all controls are by others, not WesTech. Local station is removed from the submittal.

- .1 Catalogue cuts or equipment data sheets showing Equipment vendor's complete descriptive information and product literature.
- .2 Complete assembly and installation drawings, together with detailed specifications and data covering material used, and accessories forming a part of the equipment furnished.
- .3 General arrangement layout drawings based on Equipment vendor's onsite field verifications including, as a minimum, tank inside dimensions, side water depth, tank freeboard, slope of tank floor, dimensional location of the equipment, materials list, cut outs, mounting arrangements, electric drive units, and controls.
- .4 Drawings with detailed dimensions showing plan, elevation, layout, and appropriate cross sections of the complete sludge collecting systems, including location of drive units, anchor location, materials of construction, overall weights, and dimensions of largest components requiring removal for maintenance, cross referenced material list, and mechanical connections.
- .5 Drawings with detailed dimensions showing general arrangements, assembly diagrams, and cross sections for entire drive mechanism, including but not limited to motor, gear reducers, speed reducers, turntable assembly, cage drive assembly, and torque switches / sensors.
- .6 Details of sludge scraper and density current baffle components.
- .7 Details of electric drive units including motor data, suggested wiring diagrams, connection sizes and types, operating pressures, control devices, etc.
- .8 Catalogue cuts or equipment data sheets showing the Equipment vendor's complete descriptive information and product literature.
- .9 Equipment make and model, material of construction, weight, electrical requirements, all electrical and mechanical components, and sizes and types of all connections to interfacing components.
- .10 Submit a coordinated plan of assembly, tolerances and anchor bolts, including anchor sizing calculations sealed by a professional engineer registered in Ontario.
- .11 Installation information, including mounting requirements, access, approximate weight of each major piece of equipment sizes and types of electrical connections.
- .12 Provide the following information for each instrument and/or field device application: power supply rating, input/output signal ranges, maximum measured process range, calibrated scale, physical dimensions, electrical and environmental requirements
- .13 Provide application specific catalogue model numbers for each control panel component, field device, field equipment, and accessory options. Include a reference to the respective instrument or equipment tag name in accordance with the P&ID in this document.

Complete equipment bill of material to be provided in the IOM manual.

- .14 Provide a list of equipment vendor's recommended list of spare parts including individual pricing with the shop drawings.
- .15 Detailed structural, mechanical, and electrical drawings showing equipment fabrications and interface with other items; include dimensions, size, and locations of connections to other work, and weights of associated equipment.
- .16 Complete bill of materials of all components and equipment supplied and product data sheets and dimension drawings for all accessories.
- .17 Process, instrumentation and electrical diagrams, as required, for the component parts.
- .18 Functional description of internal and external instrumentation and controls to be supplied, including list of parameters monitored, controlled, or alarmed.

Structural calculations sealed by a Professional Engineer licensed in Ontario included in this submittal.

- .6 Catalogue data, brochures, and other information required to describe equipment. Where catalogue information is submitted, ensure information clearly indicates model number and/or option proposed for this project.
- .7 Structural calculations for design of bridge, and connections. Show design loads. Structural calculations to be signed and sealed by Professional Engineer in the Province of Ontario.

1.6 TEST PROCEDURES

Certificate of design stamped by a Professional Engineer licensed in Ontario included in this submittal.

- .1 The clarifier equipment manufacturer shall furnish as a minimum the following design and description information to establish compliance with these specifications:

Drive calculations stamped by a Professional Engineer licensed in Ontario included in this submittal.

- .1 Certified general arrangement and tank dimensional drawings.
- .2 Certificate of design stamped by a Registered Professional Engineer in the Province of Ontario stating that the equipment to be provided for this project meets or exceeds all design requirements of these specifications. The certificate shall state the respective loads and design criteria.
- .3 Drive mechanism rating calculations, stamped by a Registered Professional Engineer in the Province of Ontario, verifying the compliance of the drive gears and bearings with the specified continuous torque rating and bearing life rating.
- .4 Motor data and catalog information. Electrical drawings as applicable to the supply of the clarifier equipment.
- .5 Microswitch overload device cutsheets and typical wiring diagram.
- .6 Suggested typical electrical schematic wiring diagrams.
- .7 Catalog cut sheets for purchased sub-components.
- .8 Descriptive information shall include the following:
 - .1 Written certification that the proposed drive meets AGMA standards. Drive mechanism calculations prepared by a registered professional engineer shall be submitted for approval along with published torque value of the proposed drive.

- .2 General arrangement of drive unit verifying AGMA torque, overload protection system, housing and gear materials and horsepower. Provide values used for the following AGMA design parameters per AGMA Specification 6034:
 - .1 Pitch diameter of worm gear (in.)
 - .2 Effective face width of gear (in.)
 - .3 Lead angle of threads at mean worm diameter (deg)
 - .4 Normal pressure angle of worm thread (deg)
 - .5 Sliding velocity of worm at mean diameter (fpm)
 - .6 Number of teeth
 - .7 Service factor. Use 1.25
- .3 Provide the following AGMA design parameters per AGMA 2001:
 - .1 Pitch diameter of pinion and spur gear (in.)
 - .2 Face width of narrowest of two mating gears (in.)
 - .3 Pitch line velocity of pinion (fpm)
 - .4 Allowable bending stress (Sat) of pinion and spur gear material (psi)
 - .5 Allowable contact stress (Sac) of pinion and spur gear material (psi)
 - .6 Geometry factor (J) for bending
 - .7 Geometry factor (I) for pitting resistance
 - .8 Load distribution factors Cm and Km
 - .9 Dynamic factors Cv and Kv
 - .10 Life factors Cl and KI at 420,000 cycles of the main gear
 - .11 Number of teeth
 - .12 Reliability factors, Cr and Kr equal to or greater than 1.0
- .4 Complete test procedure for torque testing the clarifier mechanism for the AGMA torque specified.
- .5 Complete assembly drawing of the collector components giving:
 - .1 Type of material used for each component.
 - .2 Connection and mounting details.

To be provided in the IOM manual before shipment.

- .3 Dimension, thicknesses and weights of each component.
 - .6 Factory Testing Reports
 - .7 Operations and maintenance data
 - .8 Parts list complete with a list of recommended spare parts
- .2 The shop drawing shall present the required mechanism dimensions on the structural drawings including plans, sections and details. A typical dimensions or drawings shall not be acceptable.

1.7 QUALIFICATIONS

- .1 Manufacturer's Experience
- .1 It is the intention of this specification to cover minimum acceptable quality for a complete installation with the exception of the motor controls, electrical work and piping requirements. The electrical/mechanism from each manufacturer shall be reviewed by the Engineer if those are equal or equivalent when those are different from them specified herein.
 - .2 The Manufacturer shall have at least ten (10) year experience in design and fabrication of clarifier mechanism as demonstrated by a list of at least 10 successful installations of comparable size (same or larger) with references in Canada or USA. All references shall include valid contact names and phone numbers that can be verified.
 - .3 The Engineer may require evidence, in the form of operating records, from these plants to substantiate any claims concerning the ability of the equipment to perform as required.

1.8 PRODUCT DATA

- .1 Details of storage and off-loading requirements.
- .2 Recommended installation instructions.

To be provided after unit start-up.

- .3 Field test reports:
- .1 Submit field test reports in accordance with Sections 01330.
 - .2 Submit completed Manufacturer's Installation Certification Form.
 - .3 Submit completed Pre-Commissioning Certification Form.

Will be provided one month before shipment.

- .4 Installation, operation, and maintenance manuals:
- .1 Include one (1) copy of both hard and electronic copy of operation and maintenance manuals.
 - .2 Include material under this Section in Owner's manuals in accordance with Section 01330.
 - .3 Submit installation manual prior to shipment of equipment.

1.9 QUALITY ASSURANCE

- .1 Equipment specified shall be the product of one vendor.
- .1 Equipment specified shall be the Manufacturer's standard catalogue product and modified to provide compliance with the drawings, specifications and the service conditions specified and indicated.
- .2 Equipment Manufacturers shall show evidence of quality assurance in manufacturing and supplying equipment essential in details to the equipment herein specified. Before equipment shipment, the vendor's project engineer shall witness and sign off the product to be shipped, and the signoff sheet shall satisfy the requirement of the Owner's Engineer before equipment shipment.
- .3 Provide shop drawings including:
 - .1 Welding: In accordance with latest applicable Canadian Welding Bureau Code.
 - .2 Services of Manufacturer's Representative as specified herein.
- .4 Provide services of factory-trained Service Technician, specifically trained on the type of equipment specified, for on-site services.
 - .1 Service Technician must have a minimum of five (5) years of experience, all within the last seven (7) years, on the type and size of equipment.
 - .2 Supplemental Service Technician, if required, for electrical and controls equipment.

2 PRODUCTS

2.1 SYSTEM DESCRIPTION

- .1 The clarifier mechanisms shall be of the center drive type, supported on a stationary influent column, with the flow entering at the bottom of the influent column and flowing upwards into the energy dissipating inlet.
- .2 The flow shall then proceed into the feedwell through gates near the water level for further energy dissipation and settling.
- .3 The secondary clarifier mechanism shall be designed to remove settled sludge from the bottom of the tank around the periphery of the tank. The clarifier mechanism shall perform the following integrated functions:
 - .1 Dissipate energy and control localized currents.
 - .2 Separate solids from the clear liquid.
 - .3 Evenly withdraw the clear liquid.
 - .4 Transport and thicken settled sludge.
- .4 Center feed influent column, peripheral overflow type with a central driving mechanism rotating a suspended center cage with two (2) spiral blade type sludge removal truss arms.

CFD modeling analysis included under Accessory Equipment - Weirs and Density Current Baffles.

Clause removed per email from J. Graham Seggewiss dated 08/08/2023.

WesTech will provide a secondary cutout switch in lieu of a shear pin as a safety measure that will stop the drive motor in the event the load achieves 140% of the continuous operating torque and shut down the motor in the event the first cutout switch fails prematurely. This redundancy in cutout protection will sufficiently protect the drive unit against peak overloading. The two limit switches will be wired in series to stop the drive motor provided either switch is tripped.

All controls are by others, not WesTech per Submittal review comments.

Material and equipment not specifically outlined in this submittal as being supplied by WesTech are by others.

- .5 The equipment shall be designed to effectively settle mixed liquor suspended solids and collect the settled solids from the basin floor to the sludge collection sump as shown on the drawings. The clarified effluent shall be collected uniformly by the existing peripheral launder.
- .6 Wall-mounted circular density current baffles with mounting capabilities for existing concrete walls of Secondary Clarifiers 1 to 4.

.1 Design peripheral density baffles. Manufacturer shall provide computational fluid dynamics (CFD) modelling analysis to confirm design basis (dimensions and mounting elevations on the clarifier wall). The CFD modelling result shall be provided to the satisfaction of the Owner's Engineer before shop drawing submittal.

~~.2 Manufacturer shall provide field testing of the flow distribution after the first installation of the density current baffles.~~

.7 The equipment furnished for the clarifier mechanism shall include but not be limited to:

- .1 Access bridge and enlarged platform with handrail.
- .2 Grating and toe plate.
- .3 Centre drive unit, complete with reducer, motor, microswitch overload device, shear pin and torque control.
- .4 Lockable local disconnect and start/stop controls.
- .5 Centre drive platform.
- .6 Centre support column with inlet openings.
- .7 Influent feedwell, energy dissipating inlet, and centre cage.
- .8 Rotating drive cage and truss arms equipped with two (2) mechanism blades.
- .9 V-notch effluent weir and assembly fasteners.
- .10 Entire mechanism including structural members and one end of the walkway supported from a centre column.

.8 All other appurtenances for a fully functional system.

.9 Secondary Clarifier Mechanism shall be made by one (1) manufacturer.

.10 Notwithstanding any dimensions, material thickness or any other design criteria relating to the construction of the specified equipment, it remains the responsibility of the manufacturer to supply equipment of suitable characteristics for the intended purpose. This does not relieve the Vendor of the requirement to adhere to this specification, subject to the sole discretion of the Engineer.

2.2 PERFORMANCE AND DESIGN REQUIREMENTS

- .1 Furnish and deliver circular spiral blade type secondary clarifier mechanism for installation in existing Secondary Clarifiers 2 - 4 (Refer to Drawings for details).

Per RFI 001 response plant flow to each clarifier can be assumed based on the clarifier surface area depending on the number of clarifiers, see General Arrangement Drawing for process information on each clarifier.

- .2 Overall Plant Design Criteria:
- .1 Plant Average Daily Flow - 81,800 m3/d
 - .2 Plant Peak Daily Flow - 166,970 m3/d
 - .3 Plant Hourly Flow - 235,212 m3/d
- .3 Secondary Clarifiers 2 -4 Design Criteria and Requirements
- .1 Internal Diameter of the Clarifier -21.34 m (70 feet)
 - .2 Total Weir Length - 66.9 m
 - .3 Clarifier Area - 356.3 m2 (each)
 - .4 Total number of Secondary Clarifier mechanisms to be replaced - three (3)
 - .5 Side Water Depth - 3.05 m
 - .6 Rotating Speed - As per the Clarifier Vendor's recommendation
 - .7 Motor Horsepower - Minimum 3/4 hp
 - .8 Depth and contour as per contract drawings
- .4 The successful bidder shall field verify the dimensions onsite following Contract award and prior to submitting shop drawings for the Engineer's review.

2.3 SEISMIC DESIGN

- .1 The Equipment Manufacturer shall conform to the seismic design requirements of Ontario Building Code 4.1.8.18 for this project and for the Work of this specification Section. Shop drawings shall be stamped by licensed structural engineer in Ontario.
- .2 Provide all equipment, anchorage, supports and foundations designed in accordance with the seismic requirements indicated and specified.
- .3 Additionally, provide with the Certificate of Unit Responsibility, certification for all equipment signed by a registered structural engineer stating that computations were performed and that all components have been sized for the seismic forces specified and indicated.

2.4 COMPONENT CONSTRUCTION

.1 Materials

Clause removed per Addendum No. 1.

→ ~~1 All structural steel shall conform to AISC Steel Construction Manual latest edition. All steel plates shall conform to ASTM A36. All structural steel shapes series of M, MT, S, ST, C, MC, L shall conform to ASTM A36. Structural steel shapes W, WT, HP shall conform to ASTM A992/A572.~~

Clause lines removed per Addendum No. 1.

→ ~~2 All pipe shall be ASTM A53, Grade B. All square and rectangular tubing shall be ASTM A500, Grade B, unless otherwise noted. Steel members in contact with liquids, either continuously or intermittently, shall have a minimum thickness of~~

~~6.35 mm unless otherwise noted. All aluminum shall be type 5052, 6061, 6063, or 2014 alloy unless noted. All stainless steel shall be type 304L unless noted.~~

- .3 Comply with ASTM A276 Stainless Steel Bars and Shapes and A167 Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip to use stainless steel 304L.
- .4 Fabrication
 - .1 Shop fabrication and welding of structural members shall be in accordance with the latest edition of the "Structural Welding Code", AWS D1.1, (AWS D1.2-Aluminum, AWS D1.6-Stainless Steel), of the American Welding Society.
 - .2 All welded connections shall develop the full strength of the connected elements and all joined or lapped surfaces shall be completely seal welded with a minimum 3/16" fillet weld. Intermittent welding shall not be allowed, except on non-ferrous metals.
- .5 Edge Grinding
 - .1 Sharp projections of cut or sheared edges of ferrous metals shall be ground to a radius by multiple passes of a power grinder as required to ensure satisfactory coating adhesion.
- .6 Shop Surface Preparation/Coating
 - .1 All iron and steel surfaces, except the drive unit, shall be field cleaned and painted by the contractor to ensure paint compatibility and assign unit responsibility for the coating system. The drive unit shall be coated with the Vendor's standard enamel paint system.
- .7 Structural Design
 - .1 All steel design shall be in accordance with the AISC Manual of Steel Construction, latest edition and the International Building Code (IBC), latest edition.

These clauses don't apply. Equipment by WesTech except Drive will be all stainless steel.

2.5 MANUFACTURE AND FABRICATION

- .1 Corrosion Protection. All metal surfaces coming into contact with the liquid, other than stainless steel or brass shall be protected by an approved, corrosion resistant coating.
- .2 Welding. All structural butt welds shall be of full penetration. Equipment shall be free of any damages such as indentations and cracks. All welded joints shall be of similar chemistry, corrosion resistance and physical properties to the base metal being welded.
- .3 Edge Grinding. Sharp projections of cut or sheared edges of metals, which will be submerged in operation, shall be ground to a radius.
 - .1 Unless otherwise specified or permitted, the materials used in the fabrication of the equipment furnished under this section shall conform to the following.

Clause removed per Addendum No. 1.

~~.4 Painting and Coating. In accordance with Section 00000 - Painting and Finishing.~~

All gearing will be enclosed in a welded ASTM A36 steel drive housing with an ultimate tensile strength of 58,000 psi rather than castings. Steel has a higher modulus of elasticity and can better absorb shock loads than cast iron. Steel is stronger than cast iron, and does not have problems with blowholes, inclusions, and cracks, as are common in castings. WesTech welded steel housings do not require an interior sealer coat, which is required in cast housings to avoid oil leaks. Refer to the **WesTech Drive Unit** Section of this submittal for more information.

Updated per Addendum No. 1.

WesTech to provide Handrail with Aluminum Pipe 6005A-T61. Please refer to Alloy letter included in the handrail section.

The WesTech drive unit does not use a wormgear reducer, so AGMA section 6034-B92 does not apply. The main gear of the drive unit will be designed in accordance with AGMA section 2001-C95. Using AGMA 2001-C95 and a 20 year life, the service factor of the main gear will be 1.0 with respect to durability and 2.27 with respect to yield. Refer to the **Spur Gear AGMA Calculations** Section of this submittal for more information.

Speed reduction will be accomplished by the use of a direct driven totally enclosed cycloidal type gearless grease lubricated reducer for high efficiency and reliability rather than gear reducers. The ring gear housing and cycloidal discs of cycloidal drives are made of high-carbon chromium bearing steel. The housing is fixed to the drive casing and incases the cycloidal discs. An eccentric bearing on the high speed shaft rolls cycloidal discs around the internal circumference of the stationary gear. The lobes of the cycloid disc engage successively with pins in the fixed ring gear. The movement of the cycloid discs is transmitted then by pins to the low speed shaft. Refer to the **Cycloidal Drive Advantages** Section of this submittal for more information.

Primary and intermediate reduction are combined into one speed reduction unit which will be accomplished by the use of a direct driven cycloidal type gearless grease lubricated reducer for high efficiency and reliability. Refer to the **Cycloidal Drive Advantages** Section of this submittal for more information.

The main spur gear will be forged alloy steel, which is stronger and more durable than cast iron. The pinion gear will be case hardened 8620 HR alloy steel. Refer to the **WesTech Drive Unit** Section of this submittal for more information.

The torque control system measures torque on the drive column as measured from the rotational force of the speed reducer. A visual torque indicator will be provided and oriented so that it may be read from the walkway. It will be calibrated from 0 to 160 percent of the continuous running torque. The drive will be rated for a continuous torque of 29,601 Nm (21,833 ft-lbs). WesTech will provide a secondary cutout switch in lieu of a shear pin as a safety measure that will stop the drive motor in the event the load achieves 140% of the continuous operating torque, or 41,442 Nm (30,566 ft-lbs), and shut down the motor in the event the first cutout switch fails prematurely. This redundancy in cutout protection will sufficiently protect the drive unit against peak overloading. The two limit switches will be wired in series to stop the drive motor provided either switch is tripped.

The alarm switch will be calibrated to 100% of the continuous running torque, or 29,601 Nm (21,833 ft-lbs). The scale on the torque indicator will be calibrated from 0 to 160 percent of the continuous running torque.

2.6 MATERIALS

.1 Unless otherwise specified or permitted, the materials used in the fabrication of the equipment furnished under this section shall conform to the following:

Bridge	Stainless Steel 304L
Structural Members	Stainless Steel 304L
Gear Housing	Gray Cast Iron, ASTM A48
Walkway	Aluminum Grating
Handrail	Sch. 40 Aluminum Pipe 6061-T6
Feedwell	Stainless Steel 304L
Effluent Weirs	Fiberglass or Stainless Steel 304L
Density Current Baffles	Fiberglass or Stainless Steel 304L
Hardware	Stainless Steel 316

2.7 EQUIPMENT DESIGN

.1 Drive Mechanism

- .1 The drive mechanism shall be completely factory assembled and shall consist of a primary and final gear reduction unit in accordance with AGMA Section 6034-B92 for 24-hour continuous duty and 20 year life, based on the AGMA rated torque with a minimum 1.25 service factor.
- .2 The primary reduction shall be a helical or worm gear, heavy-duty gear reducer. All bearings shall be anti-friction type and running in oil in a housing. The housing shall be effectively sealed against contamination. A readily accessible oil filling and level pipe with sight gauge shall be furnished.
- .3 Intermediate reduction unit shall be a helical or worm gear speed reduction with grease and/or oil lubricated anti-friction type bearings in cast iron housing securely bolted on the machined top face of the final reduction unit. Microswitches shall be factory set to sound an alarm when the load on the mechanism reaches 100 percent of the AGMA torque, and stop the motor when the load reaches 120 percent of the AGMA torque.
- .4 Provide internal, full depth involute tooth design, ductile iron, or heat-treated steel spur gear driven by a heat-treated steel pinion from the slow speed shaft of the intermediate reduction unit. Turntable base shall be bolted to the centre column and be designed to support the bridge, internal gear and rotating mechanisms.
- .5 The drive unit shall be equipped with a visual torque indicator and an electro-mechanical overload control device actuated by thrust from the worm shaft or an electronic torque switch that disconnects power to the drive if any overcurrent or overload condition occurs. The pointer shall provide a visual reading of the relative gear output torque on a 0 to 100 percent graduated scale. The continuous torque rating shall be a minimum of 8,000 ft-lbs. The control device shall also activate an alarm switch for warning of impending overload and a motor cutout switch for overload protection. A shear pin shall be provided as redundant back up overload protection. The switches shall be integrated with the facility's SCADA system via 4-20mA signals for alarms, warnings, and torque status for monitoring. The respective switches in the overload control device and the shear pin shall be factory calibrated and set to the following settings;
- .6 Alarm; 40% of scale.

The cutout switch will be calibrated to 120% of the continuous running torque, or 35,522 Nm (26,200 ft-lbs). The scale on the torque indicator will be calibrated from 0 to 160 percent of the continuous running torque.

The backup cutout switch will be calibrated to 140% of the continuous running torque, or 41,442 Nm (30,566 ft-lbs). The scale on the torque indicator will be calibrated from 0 to 160 percent of the continuous running torque.

- .7 Motor cutout; 85% of scale.
- .8 Shear pin; 100% of scale.
- .9 The complete center drive assembly, including the overload protection device, shall be a regularly manufactured in-house product of the clarifier manufacturer. The center drive assembly is a key element in a successful clarifier installation, therefore drive assemblies purchased from third party vendors will not be accepted.
- .10 Major drive components, worm gears and bearings must be designed to allow for separate and individual replacement by plant personnel to facilitate quick and economical repairs.
- .11 Drive components will be located via a machined, registered fit to preserve the alignment of key drive components under all load conditions. Inspection of the completed drive unit shall be accomplished at the clarifier manufacturer's shop, with reports of all tests and certifications of material hardness being made available for review at the Engineer's request prior to shipment to the job site.

.2 Influent Feedwell

- .1 The feedwell shall be a minimum of 4.0 m diameter x 1.5 m side depth supported by structural members attached to the center rotating center shaft.
- .2 The feedwell shall be fabricated of 6 mm stainless steel plate with upper and lower reinforcing rim angles and stiffeners as required.
- .3 A minimum of two (2) scum ports, 4 inches high x 16 inches long, shall be provided equally spaced around the feedwell periphery to allow scum to exit from the feedwell at water level.

Center column acts as influent pipe. The pipe to the center column is not by WesTech.

.3 Influent Pipe

- .1 There shall be provided a 200 mm dia. steel influent pipe, minimum 6 mm wall thickness. The pipe shall include a 125# Class ANSI steel flange for bolting to incoming influent line and shall include an elbow and energy dissipating tee at the inlet.
- .2 The pipe shall include all necessary supports and be located below the rotating feedwell to allow for the rotation of the skimmer assembly.
- .3 The Vendor may provide an alternative design which shall be reviewed by the Engineer.

The clarifier configuration does not utilize a center shaft. A center column and cage will be provided. See General Arrangement drawing included in this submittal for details.

.4 Centre Shaft and Scraper Arms

- .1 The center shaft shall be stainless steel pipe, 150 mm (6") Schedule 40. It shall be provided with connection points for the two sludge removal arms and feedwell supports. The shaft shall be bolted to the worm gear to rotate the attached arms, feedwell and skimmer assembly.
- .2 The minimum angle size used for construction of the center shaft and rake arms shall be 50 mm x 50 mm x 6.4 mm (2" x 2" x 1/4") members.

WesTech to provide 304SS squeegees.

- .3 The clarifier mechanism shall include two (2) sludge removal arms with spiral plow blades of minimum 20 gauge stainless steel and adjustable neoprene squeegees.
- .4 The center shaft and rake arms shall be designed such that calculated stresses do not exceed the AISC allowable stress at twice the drive continuous torque rating.
- .5 It shall be of an all-welded construction made up of structural stainless steel 304L members.

Center column will act as template for the anchor bolts since epoxy anchors are to be used.
Grout shield not by WesTech.

- .6 Equipment Manufacturer shall furnish stainless steel template and grout shield to accurately locate centre pier anchors and allow for grouting beneath the pier and manifold seal plate after final plumbing.

WesTech to provide half span access bridge as per the specification drawings and proposal. The walkway will be a Pony truss bridge as allowed per Addendum No. 1.

.5 Access Bridge, Handrail and Walkway

- .1 The clarifier shall be provided with a 914 mm (36") clear open width walkway extending from the tank wall to the center drive platform. The walkway shall span the tank and be supported by the tank walls. As a minimum the walkway shall be designed to safely withstand all dead loads plus a live load of 22.7 kg (50 pounds) per square foot with a maximum deflection of 1/360, over the entire span. The walkway shall consist of two (2) wide flange beams. These beams shall be sufficiently braced to resist the specified design loads. The walkway decking shall be 32 mm x 5 mm (1-1/4" x 3/16") aluminium grating.
- .2 Provide a short sectional ladder, mounted and anchored on the outer clarifier tank wall and aligned with the bridge walkway. Materials should be similar of access bridge construction.
- .3 A center drive operations platform shall be provided. It shall be a minimum of 2.1 m (7') square to provide clearance around the center assembly and drive control for maintenance and service. The drive platform shall be decked with 10 mm (3/8") aluminium checkered floor plate and have sufficient structural steel supports to meet the specified design load conditions.

Clause updated per Addendum No. 1.

- .4 Handrails with toe plate shall be provided along both sides of the walkway and around the center drive platform. The handrailing shall be ~~38 mm (1 1/2") diameter~~ aluminium pipe, 2-rail design, with fittings factory assembled to posts. Rails are to be shipped to the job site in stock lengths for cutting and fitting. The toe plate shall be a ~~125 mm x 6.4 mm plate or a 125 mm tall~~ aluminium extruded channel. ~~The handrailing shall be in conformance with the handrail specifications found within this set of bid documents and shall be as shown on the drawings. If a pony truss bridge is used, the trusses can serve as handrails.~~

.6 Effluent Weirs

- .1 An adjustable weir shall be provided around the periphery of the tank at the water surface for removal of clarified effluent. The weir shall be fixed once installed to match existing tank hydraulic profiles.
- .2 The fiberglass or SS weir shall be provided based on the contract detailed drawings.
- .3 The weir shall consist of 6 mm (1/4") thick x 230 mm (9") deep fiberglass or SS sections with 65 mm (2-1/2") deep 90 degree V notches at 150 mm (6") intervals.

The weir sections shall be curved and fastened to the launder wall with special large 316L SS washers, anchor bolts, and hex nuts to allow vertical adjustment.

.7 Structural Members

.1 Structural steel shall be of structural stainless steel ~~or conform to ASTM A36~~. Connections shall be shop welded or field bolted. Field welding will not be permitted, except for the bridge splice. All steel structural components shall be designed so that stresses developed do not exceed allowable stresses, as defined by current AISC standards when designed for the AGMA rated torque.

.2 All equipment epoxy inserted anchor bolts shall be stainless steel 316.

CONTROLS

.1 The Equipment Vendor is responsible for developing and updating a comprehensive City of Brantford compliant Process Control Narrative (PCN) specific for their equipment and control system. The PCN shall be submitted along with the shop drawings for the Engineers review. The Engineer will coordinate with the Vendor to add City of Brantford SCADA tags for all equipment.

.2 The Contractor will provide new MCC starter buckets, and NEMA 4X rated local start/stop push button control stations and lockable disconnect switches for the clarifiers. The Clarifier manufacturer shall provide typical and/or suggested electrical wiring diagrams to the Engineer for reference purposes and to ensure proper operation and protection of the clarifier.

.3 Individual controls and monitoring (i.e. over-torque monitoring) devices shall be mounted on the MCC bucket.

.4 Provide controls and SCADA monitoring as indicated on Contract Drawings.

.5 The power cable shall be continuous and of sufficient length to suit termination in the local disconnect mounted near the respective mechanism (no splices are permitted).

.6 Interconnected wiring between local, remote panels and MCC will be supplied and installed by the General Contractor.

2.9

ACCEPTABLE MANUFACTURES

.1 The below Vendor list shall not be construed as automatically acceptable, but the Owner or Engineer shall have the right, in its sole and absolute discretion, to accept or reject the shop drawing if the Vendor selected by the Contractor does not comply with the Contract Drawings and specification requirements herein. Any alternative design, dimensions or configurations shall be reviewed by the Engineer.

.1 Ovivo

.2 WesTech

.3 Envirodyne System INC.

.4 Zima Corporation

Updated per Addendum No. 1.

Per submittal review comments, all controls are by others, not WesTech. Local control station information has been removed from the submittal.

3 EXECUTION

3.1 FIELD TANK DIMENSION MEASUREMENT

- .1 Before shop drawing submittal, the Manufacturer shall conduct a site visit to field review all the existing clarifier tank internal dimensions and elevations, and inspect tank bottom grouting conditions. The site visit shall be minimum of eight (8) hours of on-site time by the Manufacturer's technical support, exclusive of any required travel time. Field visit shall be completed by someone with previous experience dimensioning circular clarifier mechanisms of similar size.
- .2 Inspection report after the site visit shall be submitted to the satisfaction of the Engineer.

Unloading and Storage on site is not by WesTech.

3.2

PRODUCT DELIVERY, STORAGE AND HANDLING

- .1 Shipment is not to be made until the Equipment vendor coordinates shipment to the jobsite with the Installation Contractors, assuring that the equipment will be properly received and stored.
- .2 Arrange for a representative of the Equipment vendor to be present at the job site during the unloading to inspect the delivered equipment and witness the unloading process.
- .3 Provide onsite instruction to the General Contractor for unloading of the power units, local control panels, and all other related equipment.
- .4 Notify the General Contractor of any special items necessary for unloading any of the system equipment, such as blades, etc. Supplying these special items for unloading shall be the responsibility of the General Contractor.
- .5 Provide special instruction, if any, to the General Contractor for storage and pre-installation maintenance

WesTech tech will not be onsite during unloading, WesTech can provide assistance remotely. Contractor will be responsible for unloading, storage and report any shortages.

Not all equipment will be skid mounted or crated due to the parts size.

- .6 All equipment shall be skid mounted or crated to protect against damage during shipment. All parts shall be properly protected so that no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is completed, and the units and equipment are ready for operation.

Decommissioning, disposal and installation is not by WesTech.

3.3

INSTALLATION

- .1 Existing secondary clarifier mechanisms shall be completely decommissioned and disposed of off-site prior to installation by the General Contractor.
- .2 The Manufacturer shall review the installation of the clarifier mechanisms a minimum of three (3) times, as provided for under this pre-selected equipment Contract. A minimum of eight (8) hours of on-site time by the manufacturer's technical support shall be provided for each site visit, exclusive of any required travel time.
- .3 The unit shall be leveled, plumbed, aligned, and wedged into position to fit into concrete structures. Installation procedures shall be as recommended by the manufacturer and the Hydraulic Institute Standards, and as required herein. Grouting shall be as specified in the grout section.
- .4 No stresses shall be transmitted to the scraper blades during installation or field testing.
- .5 After final alignment and bolting, the mechanism shall be adjusted to proper fit if any stress on the blades is observed.

3.4 FIELD QUALITY CONTROL

- .1 After installation by the General Contractor, to be retained by the Owner at a later date, provide field quality control services to test each component and demonstrate compliance with operating requirements as specified in Section 01751.
- .2 Installation Check. The manufacturer shall provide the services of a qualified field representative according to the quality control section to assist during installation of the equipment by the General Contractor. As a minimum, the manufacturer's field representative shall be made available as follows:
 - .1 Installation Inspection 1 trip, 3 days total
 - .2 Startup assistance 1 trip, 3 days total
- .3 Torque Test
 - .1 The clarifier mechanism shall be field torque tested. The testing shall be carried out under the supervision of the equipment manufacturer's representative and as approved by the Engineer before the mechanism is accepted and placed into operation.
 - .2 The torque test shall consist of securing the rake arms by cables to anchor bolts installed by the Contractor in the tank floor at locations specified by the equipment manufacturer. A load shall be applied to the scraper arm in small increments by means of a ratchet lever and cylinder connected to the cable assembly the drive mechanism. The magnitude of the applied load shall be measured by calculating the torque from the distance of the line of action of each cable to the centre line of the mechanism. A reading shall be taken at the drive design torque.
 - .3 The manufacturer's service representative shall verify that the alarm, motor cut-out, and back-up safety motor cut-out switches are properly set and are in proper operation to protect the clarifier mechanism as specified.
- .4 Field Evaluation Tests. A performance test shall be run on the equipment after the installation is completed to ensure the equipment are operating properly as determined by the representative of the equipment manufacturer. The performance test shall be conducted by a capable representative of the manufacturer and accepted by the Engineer. The Owner's operating personnel shall assist the manufacturer's representative in the performance test. A designated representative of the Owner and/or the Engineer shall observe the performance test. As a minimum, the manufacturer's field representative shall be made available as follows:
 - .1 Performance testing 1 trip, 3 days total
- .5 At least two (2) weeks prior to the proposed testing date, the Contractor shall notify the Engineer of the testing date and shall submit a report from the equipment manufacturer detailing the proposed performance testing procedure and analyses. Testing shall be performed between 8:00 a.m. and 5:00 p.m. and shall begin on Monday or Tuesday. If more than one (1) day of testing is required, the testing shall be done on consecutive days. The Engineer's initial observation of tests shall be at the Owner's expense. All costs of subsequent visits by the Engineer to witness or observe additional tests necessary because of failure of the initial tests or inability to conduct the initial tests will be at no extra cost to the Owner.

- .6 Should the equipment not achieve consistent compliance during the tests, then the manufacturer shall modify the equipment and repeat the field evaluation tests. Costs of modifying equipment, reducing or furnishing additional equipment, or subsequent retesting shall be borne by the General Contractor and Manufacturer. Should the equipment fail to meet all the design requirements after retesting, the equipment shall be rejected and shall be replaced by the Construction Contractor at the manufacturer's expense with acceptable equipment at no additional cost to the Owner.

- .7 Performance Test and Field Evaluation Report. The manufacturer shall prepare a formal test report, including all measured data and other recorded data and observations. One (1) electronic copy of the report shall be submitted to the Engineer within 30 days after completion of the tests.

3.5 TRAINING

- .1 In addition to the installation and operation check required by the General Equipment Stipulations and the manufacturer's field services required by the quality control section, the manufacturer shall furnish the services of a competent and experienced operator of the equipment, who is directly employed by the manufacturer, to instruct the Owner's operating personnel in the proper operation and maintenance of the equipment. Training shall be provided as specified in Section 01820 - Demonstration and Training.

3.6 WARRANTY

- .1 Each unit shall be new and shall carry the full Manufacturer's warranty on parts, service, and performance. Warranty shall begin at substantial completion. The warranty shall include replacement of all defective equipment and shall extend two (2) years beyond substantial completion.
- .2 Corrective Work. Any location where corrosion is evident shall be considered a failure of the material or the protection system. Before starting corrective work, the Manufacturer shall submit to the Engineer for review any analysis of the cause of the failure and details of the proposed corrective work. The Manufacturer shall make repairs acceptable to the Engineer at all points where failures are observed within the Warranty Period.
- .3 Inspection. Each unit shall be inspected at the end of the warranty period by representatives of the Owner, the Engineer, and the Manufacturer to identify any failures that may have occurred. The Manufacturer shall establish the date of each inspection and shall notify the Owner at least 30 days in advance. The scheduled inspection shall not relieve the Manufacturer from the obligation to perform corrective work whenever needed.
- .4 The Manufacturer shall prepare and deliver to the Owner an inspection report covering each inspection, indicating the number and type of failures observed, material and part where materials have failed, the percentage of the surface area where corrosion protection system failure has occurred, and the names of the persons making the inspection. Colour photographs illustrating each type of failure shall be included in the report.

END OF SECTION

Manufacturer Information

ISO Certification

ISO 9001:2015 Certification

Certificate US95/0255.00

The most responsive supplier of products and services for liquid-solid separation and the treatment of water and wastewater.

WesTech Engineering, LLC is certified to the ISO 9001:2015 standard with SGS Systems & Services Certification. SGS is an independent ISO registrar, who conducts regular audits of clients' management processes.

ISO 9001:2015 ensures the consistency of quality practices and requires continuous improvement of WesTech's entire management system. Certification therefore assures customers that:

1. WesTech's products and services will consistently meet or exceed an internationally agreed-upon level of quality, and
2. Proactive management practices will enable it to anticipate and address customers' future needs, while paying careful attention to existing installations.

Founded in 1973, WesTech has attained preferred-supplier status with an overwhelming majority of its worldwide customers. As a leading innovator in the development of equipment that lowers overall costs by improving efficiency, reliability, and performance, the firm has been approved by virtually all major consultants for their projects.

WesTech design and support personnel are committed to the success of their projects and customers. Attitudes, behaviors, and decisions are shaped by WesTech's six core values, which are:

- Exhibit honesty and integrity
- Take pride in doing the right things, and in doing them well
- Value our people and their families
- Make and keep commitments
- Achieve productivity through hard work and intelligence
- Provide superior service

The net result of WesTech's continuing ISO certification, combined with its distinctive culture, is that customers can expect to be taken care of by exceptionally responsive associates who consistently deliver superior solutions.

We invite you to learn more about our company, capabilities, and products - and then continually put us to the test. Find out for yourself why we say, "We not only guarantee our equipment, we guarantee peace of mind!"

The management system of

WesTech Engineering, LLC

3665 South West Temple
Salt Lake City, UT 84115, United States

has been assessed and certified as meeting the requirements of

ISO 9001:2015

For the following activities:

**The Design, Supply, Sales, and Service of Water and Waste Water
Treatment and Liquid-Solid Separation Equipment.**

Further clarifications regarding the scope of this certificate and the applicability of
ISO 9001:2015 requirements may be obtained by consulting the organization.

This certificate is valid from 31 March 2021 until 20 October 2023
and remains valid subject to satisfactory surveillance audits.
Recertification audit due a minimum of 60 days before the expiration date.
Issue 13. Certified since June 1995.

The audit leading to this certificate commenced on 30/03/2021.
Previous issue certificate validity date was until 20/10/2023.

This is a multi-site certification.
Additional site details are listed on subsequent pages.

Authorized by:

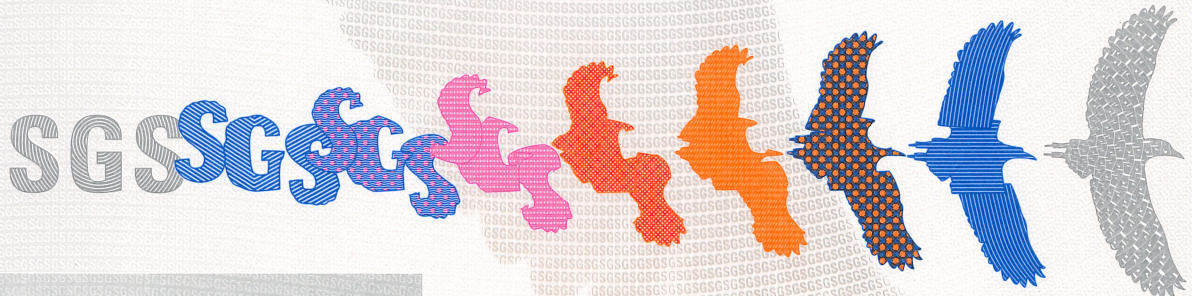
Dan Seal

Dan Seal

Technical Accreditation Manager, Certification &
Business Enhancement North America
SGS North America, Inc.

201 Route 17 North, Rutherford, NJ 07070, USA
t (201) 508-3000 f (201) 935-4555 www.us.sgs.com

This certificate remains the property of SGS and shall be returned upon request





WesTech Engineering, LLC

ISO 9001:2015

Issue 13



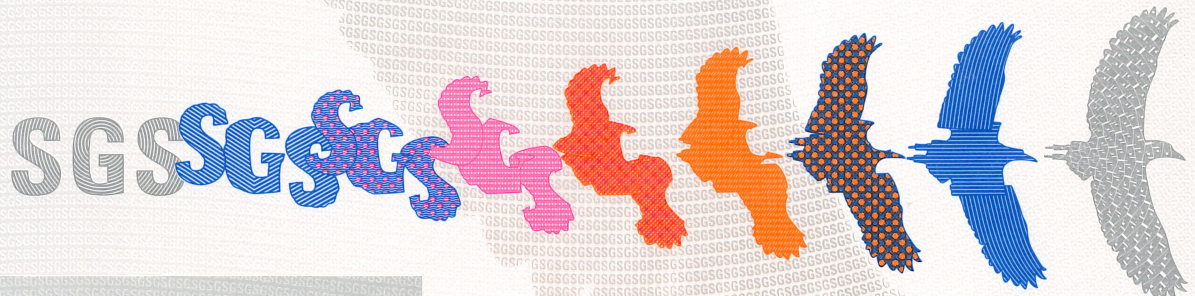
Detailed scope (applicable to all sites):

**The Design, Supply, Sales, and Service of Water and Waste Water
Treatment and Liquid-Solid Separation Equipment.**

Additional facilities:

3625 South West Temple, Salt Lake City, UT 84115, United States

600 Arrasmith Trail, Ames, IA 50010, United States



Warranty

Two Year Warranty

WesTech is meeting a global need for clean water through technology treatment solutions. We are proud that the equipment and systems we design, build, maintain, and operate are making the world a better place and creating a more sustainable environment for future generations.

Equipment manufactured or sold by WesTech Engineering, LLC, once paid for in full, is backed by the following warranty:

Subject to the terms below, WesTech warrants all new equipment manufactured or sold by WesTech Engineering, LLC to be unencumbered and free from defects in material and workmanship, and WesTech will replace or repair, F.O.B. its factories or other location it chooses, any part or parts returned to WesTech which WesTech's examination and analysis determine have failed within the warranty period because of defects in material and workmanship. The warranty period *is two (2) calendar years from substantial completion*. All repair or replacement parts qualifying under this warranty shall be free of charge. Purchaser will provide timely written notice to WesTech of any defects it believes should be repaired or replaced under this warranty. WesTech will reject as untimely any warranty defect claim that purchaser submits more than thirty (30) days after the possible warranty defect first occurred. Unless specifically stated otherwise, this warranty does not cover normal wear, consumables, or coatings. Purchasers are invited to inspect the equipment in the shop for proper surface preparation and coating application prior to shipment. This warranty is not transferable.

This warranty shall be void and shall not apply where the equipment or any part thereof

- a. has been dismantled, modified, repaired, or connected to other equipment, outside of a WesTech factory, or without WesTech's written approval, or
- b. has not been installed in complete adherence to all WesTech's or parts manufacturer's requirements, recommendations, and procedures, or
- c. has been subject to misuse, abuse, neglect, or accident, or has not at all times been operated and maintained in strict compliance with all of WesTech's requirements and recommendations therefor, including, but not limited to, the relevant WesTech Operations & Maintenance Manual and any other of WesTech's specified guidelines & procedures, or
- d. has been subject to force majeure events; use of chemicals not approved in writing by WesTech; electrical surges; overloading; significant power, water, or feed supply fluctuations; or non-compliance with agreed feedwater or chemical volumes, specifications, or procedures.

In any case where a part or component of equipment under this warranty is or may be faulty and the component or part is also covered under the warranty of a third party then the purchaser shall provide reasonable assistance to first pursue a claim under the third-party warranty before making a claim under this warranty from WesTech. WesTech Engineering, LLC gives no warranty with respect to parts, accessories, or components purchased other than through WesTech. The warranties which apply to such items are those offered by the respective manufacturers.

This warranty is expressly given by WesTech and accepted by purchaser in lieu of all other warranties whether written, oral, express, implied, statutory, or otherwise, including without limitation, warranties of merchantability and fitness for particular purpose. WesTech neither accepts nor authorizes any other person to assume for it any other liability with respect to its equipment. WesTech shall not be liable for normal wear and tear, corrosion, or any contingent, incidental, or consequential damage or expense due to partial or complete inoperability of its equipment for any reason whatsoever. The purchaser's exclusive and only remedy for breach of this warranty shall be the repair and or replacement of the defective part or parts within a reasonable time of WesTech's accepting the validity of a warranty claim made by the purchaser.

Installation List

Job No.	Year	Location	Qty	Size	Equipment/Model
19560	2005	KENNER, LA WWTP #3	KENNER LA US 2	85' DIA	COP CLARIFIERS COPC2G
19536	2005	HAGERSTOWN	HAGERSTOWN MD US 1	85' DIA	COP CLARIFIER COPC2
23023	2017	SABINE CREEK REGIONAL WASTEWATER TREATMENT PLANT	ROYSE CITY TX US 1	70' DIA	COP™ Secondary Clarifier COPC2G
23094	2017	MERIDIAN WASTEWATER RESOURCE RECOVERY FACILITY	MERIDIAN ID US 2	80' DIA	SS Primary COP™ Clarifiers COPC2G
23378	2018	TESORO MARTINEZ REPLACEMENT CA	MARTINEZ CA US 1	75' Dia	COP™ CLARIFIER COPC2
23310	2018	METRO CENTRAL WWTP IMPROVEMENTS	HOUSTON TX US 2	75' DIA.	COP™ CLARIFIER COPC2G
23329	2018	MCCAIN FOODS BURLEY, ID	BURLEY ID US 1	70' Dia	COP™ CLARIFIER COPC2G
23467	2018	DECATUR WWTP SECONDARY CLARIFIER REHABILITATION	DECATUR IN US 1	75' DIA	COP™ CLARIFIER COPC2G
23436	2018	OPEQUON WRF	WINCHESTER VA US 2	80' DIA	SECONDARY COP™ RETROFIT COPC2G
23662	2019	TESORO MARTINEZ NORTH CLARIFIER REPLACEMENT	MARTINEZ CA US 1	75 Feet X 75 Feet	COP™ CLARIFIER COPC2
22402	2019	ABQAIQ	AL-JAWHARA DISTRICT AL-KHOBAR SA 2	75' dia	COP CLARIFIER COPC2
23745	2019	MCALPINE CREEK WWMF RELIABILITY & PROCESS IMPROV.	PINEVILLE NC US 4	95' DIA	COP™ Secondary Clarifiers COPC2
23922	2020	FLOYD BRANCH RWWTP PROCESS OPTIMIZATION IMPROVMENTS	RICHARDSON TX US 1	80' DIA	Secondary COP™ Clarifier COPC2G

Job No.	Year		Location			Qty	Size	Equipment/Model
23745	2020	MCALPINE CREEK WWMF RELIABILITY & PROCESS IMPROV.	PINEVILLE	NC	US	2	95' DIA	COP™ Secondary Clarifiers COPC2
24179	2021	CEDAR CITY REGIONAL WWTP	CEDAR CITY	UT	US	1	70' DIA	COP™ Secondary Clarifier COPC2G
24109	2021	INDIANOLA, IA WATER RESOURCE RECOVERY FACILITY	Indianola	IA	US	3	70' DIA	Secondary COP™ Clarifiers COPC2G
24497	2022	FORT KAMEHAMEHA WWTP	HONOLULU	HI	US	1	80'L x 15'W	COP™ CLARIFIER COPC2G
24398	2022	GLENDALE, AZ WEST AREA WRF	GLENDALE	AZ	US	1	80' DIA.	316SS Primary COP™ Clarifier COPC2
24544	2022	FBC MUD NO. 169 CROSS CREEK WWTP	FULSHEAR	TX	US	1	70' DIA	COP™ CLARIFIER COPC2R
Total Qty =						30		

Drive Unit

Professional Engineer Stamp

Professional Engineer Stamp

All drive train, AGMA, and bearing life calculations have been checked and approved by me for the C31 drive units at Brantford WWTP (WesTech Job Number 24946A).



Drive calculations are sealed by a registered professional engineer as required by the project specifications. However, providing this seal does not constitute offering engineering services nor imply licensure in the state where the project is located.

Drive Unit Information

Advantages of WesTech Drives

WesTech is submitting information on our premium drive unit: it may be slightly different from that specified. We request that you approve WesTech's design as it is superior in several ways to other designs. We've listed some of our major components and their distinct advantages below. The WesTech drive has proven itself in thousands of applications worldwide.

Precision Main Bearing/Gear

WesTech has taken advantage of the availability of large diameter precision machined bearings as the foundation of our superior drive design.

These bearings offer the following advantages:

- Fabricated from forged alloy steel, the bearing balls run in fully contoured machined races.
- The raceway is locked; the bearing races cannot separate. This distributes applied loads to all the balls rather than just a few. This feature makes it ideal for heavy duty industrial applications.
- The bearing life is often in excess of 100 years. When properly maintained the main bearing will never need replacement during the life of the equipment.
- The main spur gear is integral with the bearing assembly. This ensures a precision mounting for the gear, eliminating improper wear and increasing gear life.

Drive Housing

WesTech drives use welded steel for the main parts of the drive housing:

- Steel is stronger than cast iron.
- Steel is uniform. Unlike cast iron, there are no problems with blowholes, inclusions, and/or cracks that can compromise the structural integrity of the drive unit.
- Welded steel housings do not require an interior sealer coat, which is required in cast housings to avoid oil leaks.

Speed Reduction

WesTech incorporates direct-driven cycloidal reducers to achieve speed reduction.

- Cycloidal reducers are extremely efficient and save energy.
- Smooth rolling operation virtually eliminates wear and maintenance.
- Reducers are guaranteed to withstand a 500% shock load without failure.
- Direct coupling throughout makes the unit safer and easier to maintain than conventional chain and sprocket type systems.
- Maintenance is accomplished via a single grease fitting. In instances where oil lubrication is required for the cycloidal speed reducer, an oil fill pipe is provided together with an expansion tank/sight gauge.

Torque Control Device

- WesTech's torque control is an electro-mechanical device that measures rotational force directly from the main pinion shaft. NEMA 4x switches (or NEMA 7 for explosion proof applications) are housed in a stainless steel enclosure. A visual indicator is included to show the torque as a percentage of Full Dial Torque.

Advantages of Oil/Grease Lubricated Drives

Advantages of Oil/Grease Lubricated Drives

Maintenance

Oil/Grease lubrication is easily accessible

- All gearing is total enclosed and running in an oil bath
- Level of the oil bath for the main gear/pinion gear and lower support bearing is highly visible. Oil is discharged at the lowest point of the drive with ease.
- The main bearing is grease lubricated via two grease fittings, located 180 degrees from each other. It is sealed from the gear cavity which is a source of wear particles and water. Proper greasing of the main bearing flushes old grease out of bearing critical surfaces (equivalent to periodically changing oil).
- The upper bearing assembly and lift components (where used) are grease lubricated.
- The cycloidal speed reducer is grease lubricated, unless oil lubrication is specified. Grease lubricated cycloidal speed reducers require less maintenance.
- There is no need to replace a slip ring on the lift housing (where used).
- There are no chains or belts to replace or maintain.
- Spare parts are usually in stock if they are needed. Standard industrial type bearings and seals are used to reduce maintenance costs and increase parts availability.
- The moving parts of the drive are self-contained, limiting corrosion.

Drive Train Summary

**WESTECH DRIVE TRAIN SUMMARY
OF UNIT TO BE SUPPLIED**

JOB NO.: 24946A

PAGE 1 OF 1

BY: HU72

CHKD: BO13

DATE: 6/9/2023

DATE: 6/13/2023

STAGE 1 - MAIN GEAR INFORMATION

REQUIRED CONTINUOUS OUTPUT TORQUE OF MAIN GEAR: 21,833 FT-LBS
(AS SPECIFIED)

OUTPUT RPM OF MAIN GEAR: 0.054 RPM

PINION/GEAR RATIO: 5.2 :1

MAIN GEAR EFFICIENCY: 0.96

GEAR TORQUE RATING : 21,833 FT-LBS
(SEE AGMA CALCULATIONS)

SERVICE FACTOR = $\frac{21,833}{21,833} = 1.00 \geq 1.00$ **OK**
(WITH RESPECT TO TORQUE)

STAGE 2 - SPEED REDUCER

REQUIRED OUTPUT TORQUE OF SPEED REDUCER: $\frac{21,833}{5.2 * 0.96} = 4374$ FT-LBS

= 52483 IN-LBS

OUTPUT RPM OF SPEED REDUCER: 0.283 RPM

SPEED REDUCER RATIO: 6177 : 1

SPEED REDUCER EFFICIENCY: 0.90

SPEED REDUCER TORQUE RATING: 70,400 IN-LBS
(SEE CATALOG CUTS)

SERVICE FACTOR = $\frac{70,400}{52,483} = 1.34 \geq 1.25$ **OK**
(WITH RESPECT TO TORQUE)

STAGE 3 - MOTOR

REQUIRED HP OF MOTOR: $\frac{21,833}{5252} * \frac{0.054}{0.96 * 0.90} = 0.26$ HP

OUTPUT RPM OF MOTOR: 1750

MOTOR HP RATING: 1.00

NAMEPLATE SERVICE FACTOR: 1.15

CALCULATED SERVICE FACTOR: $\frac{1.00}{0.26} = 3.81 \geq 1.0$ **OK**

Spur Gear AGMA Calculations

AGMA CALCULATIONS INPUT SHEET

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WesTech Program no. CWP-029
Responsible Person: J. Bonner
Last Updated: 05/31/18

JOB_NO := "24946A"

PAGE NO. 1 OF 7

RUN_BY := "HU72"

DATE_RUN := "06/09/2023"

CHK_BY := "BO13"

DATE_CHK := "06/13/2023"

INPUTS FOR 31" CAGE DRIVE (C 31)

INPUTS

Drive output speed, rpm

$$n_g := .054 \cdot \frac{1}{\text{min}}$$

Expected life in years

$$X_L := 20$$

Life in hours

$$L_i := X_L \cdot 365 \cdot 24 \cdot \text{hr}$$

$$L_i = 1.752 \times 10^5 \cdot \text{hr}$$

Continuous design torque

$$T_{\text{design}} := 21833 \cdot \text{ft} \cdot \text{lbf}$$

Duty cycle

= 24 hours per day

Service factor

= 1.00

DRIVE GEAR DATA

PINION

GEAR

No. of teeth

$$N_1 := 15$$

$$N_2 := 78$$

Diametral pitch

$$P_d := 2.5 \cdot \frac{1}{\text{in}}$$

Pressure angle

$$\phi := 20 \cdot \text{deg}$$

Face width

$$F_1 := 3.25 \cdot \text{in}$$

$$F_2 := 3 \cdot \text{in}$$

$$F := F_2$$

Tooth form

SMI-RECESS ACTION, FULL DEPTH

Spur gear

$$\psi := 0 \cdot \text{deg}$$

$$\cos(\psi) = 1$$

Addendum modification coefficient

$$x_1 := 0.5$$

$$x_2 := -0.5$$

Bending strength geometry factor

$$J_p := 0.4102641$$

$$J_g := 0.3860767$$

Core hardness

300-350 BHN

285-321 BHN

Surface hardness

55-60 Rc

285-321 BHN

Drive with one pinion

$$q_g \equiv 1$$

(NOTE: For Drive with two Pinions $q_g=2$, For Drive with four Pinions $q_g=4$)

BASIC GEAR GEOMETRY:

(Ref: PARAGRAPH 3 AGMA 908-B89)

Gear ratio	$m_G := \frac{N_2}{N_1}$	$m_G = 5.2$		
Pitch radius	$R_1 := \frac{N_1}{2 \cdot \cos(\psi)}$	$R_2 := R_1 \cdot m_G$	$R_1 = 7.5$	$R_2 = 39$
Operating C.D.	$C_r := R_2 - R_1$		$C_r = 31.5$	
Base radius	$R_{b1} := R_1 \cdot \cos(\phi)$	$R_{b2} := R_2 \cdot \cos(\phi)$	$R_{b1} = 7.048$	$R_{b2} = 36.648$
Operating pressure angle	$\phi_r := \arccos\left(\frac{R_{b2} - R_{b1}}{C_r}\right)$		$\phi_r = 20 \cdot \text{deg}$	
Addendum radius	$R_{o1} := \frac{1}{2} \cdot \left(\frac{N_1}{\cos(\psi)}\right) + (1 + x_1)$	$R_{o2} := (0.50) \cdot \left(\frac{N_2}{\cos(\psi)}\right) - (1 + x_2)$	$R_{o1} = 9$	$R_{o2} = 38.5$
Pitch diameter	$d := \frac{2 \cdot C_r}{m_G - 1}$	$d = 15$	$D := d \cdot m_G$	$D = 78$
Base pitch	$p_b := \frac{2 \cdot \pi \cdot R_{b1}}{N_1}$	$p_b = 2.952$		

THE ABOVE VARIABLES MADE DIMENSIONLESS BY MULTIPLYING WITH DIAMETRAL PITCH

$C_6 := C_r \cdot \sin(\phi_r)$	$C_6 = 10.774$
$C_1 := \left[C_6 - \left[(R_{o2})^2 - (R_{b2})^2 \right]^{0.5} \right]$	$C_1 = 1.024$
$C_3 := \frac{C_6}{m_G - 1}$	$C_3 = 2.565$
$C_4 := C_1 + p_b$	$C_4 = 3.976$
$C_5 := \left[(R_{o1})^2 - (R_{b1})^2 \right]^{0.5}$	$C_5 = 5.597$
$C_2 := C_5 - p_b$	$C_2 = 2.645$
$Z := C_5 - C_1$	$Z = 4.574$
$m_p := \frac{Z}{p_b}$	$m_p = 1.549$

FOR SPUR GEARS

$\rho_1 := C_2$	$\rho_1 = 2.645$	$C_\psi := 1$	$m_N := 1$
$\rho_2 := C_6 + \rho_1$	$\rho_2 = 13.419$		
$L_{\min} := F$	$L_{\min} = 3 \cdot \text{in}$		

PITTING RESISTANCE GEOMETRY FACTOR, I

(Ref : PARAGRAPH 4 AGMA 908-B89)

Geometry factor	$I := \frac{\cos(\phi_r) \cdot (C_\psi)^2}{\left(\frac{1}{\rho_1} - \frac{1}{\rho_2} \right) \cdot d \cdot m_N}$	$I = 0.206$
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SURFACE DURABILITY RATING CALCULATIONS

$$S_{ac} := \begin{cases} 225000 \cdot \text{psi} \\ 133765 \cdot \text{psi} \\ 146329 \cdot \text{psi} \end{cases} \begin{cases} Q=0 \text{ WHEN } 225,000 \text{ PSI} = 55-60 \text{ RC}(350\text{BHN}) \\ Q=1 \text{ WHEN } 133,765 \text{ PSI} = 285 \text{ BHN} \\ Q=2 \text{ WHEN } 146,329 \text{ PSI} = 321 \text{ BHN} \end{cases} \begin{matrix} (\text{Ref: Table 3, Paragraph 16 AGMA 2001-C95}) \\ (\text{Fig 8, GR 2; } S_{ac}=349\text{HB}+34300) \\ (\text{Fig 8, GR 2; } S_{ac}=349\text{HB}+34300) \end{matrix}$$

$$d := \frac{N_1}{P_d} \quad d = 6 \cdot \text{in}$$

$$n_P := n_g \cdot m_G \quad n_P = 0.281 \cdot \frac{1}{\text{min}}$$

$$v_t := \pi \cdot n_P \cdot d \quad v_t = 0.441 \cdot \frac{\text{ft}}{\text{min}}$$

DERATING FACTORS:

$$K_O := 1 \quad \text{For uniform load transmission}$$

$$Q_v := 6$$

$$B := 0.25 \cdot (12 - Q_v)^{0.667} \quad B = 0.826$$

$$A := 50 + 56 \cdot (1.0 - B) \quad A = 59.745$$

$$K_v := \left[\frac{\left(A + \sqrt{v_t \cdot \frac{\text{min}}{\text{ft}}} \right)^B}{A} \right] \quad K_v = 1.009$$

$$K_s := 1$$

$$C_{mc} := 1.0 \quad C_{pf} := \left(\frac{F}{10 \cdot d} \right) - 0.0375 + 0.0125 \cdot \frac{1}{\text{in}} \cdot F \quad C_{pf} = 0.05 \quad (\text{Ref: EQ 39: Paragraph 15.3 AGMA 2001-C95})$$

FROM LAYOUT

$$S_1 := 1.01 \quad S := 8.14 \quad \frac{S_1}{S} = 0.124 \quad C_{pm} := 1.0 \quad (\text{Since } S_1/S < 0.175)$$

$$A_1 := 1.27 \cdot 10^{-1} \quad B_1 := 0.158 \cdot 10^{-1} \cdot \frac{1}{\text{in}} \quad C := -1.093 \cdot 10^{-4} \cdot \frac{1}{\text{in}^2} \quad (\text{Ref: EQ 41: Paragraph 15.3 AGMA 2001-C95})$$

$$C_{ma} := A_1 + B_1 \cdot F + C \cdot (F)^2 \quad C_{ma} = 0.173 \quad (\text{Ref: Table 2, Paragraph 15.3 AGMA 2001-C95})$$

$$C_e := 1.0$$

$$C_{mf} := 1.0 + C_{mc} \cdot (C_{pf} \cdot C_{pm} + C_{ma} \cdot C_e) \quad C_{mf} = 1.223 \quad (\text{Ref: EQ 37 Paragraph 15.3 AGMA 2001-C95})$$

$$K_m := C_{mf} \quad K_m = 1.223 \quad (\text{Ref: EQ 36 Paragraph 15.1 AGMA 2001-C95})$$

$$C_f := 1 \quad (\text{Ref: Paragraph 13 AGMA 2001-C95})$$

$$C_H := 1 \quad \text{Surface finish of pinion} \quad f_p > 64 R_a \quad (\text{Ref: Fig 3, Paragraph 14.2 AGMA 2001-C95})$$

$$K_R := 1.0 \quad \text{Fewer than one failure in 100} \quad (\text{Ref: Table 11, Paragraph 18 AGMA 2001-C95})$$

$$K_T := 1.0 \quad \text{For gears operating at less than 250 deg F}$$

$$S_u := 1.0$$

$$C_P := 2300 \cdot \left(\frac{\text{lbf}}{\text{in}^2} \right)^{0.5} \quad \text{For steel gears}$$

$$q_p := 1$$

$$N_{\text{pinion}} := 60 \cdot \frac{\text{min}}{\text{hr}} \cdot L_i \cdot n_P \cdot q_p \quad N_{\text{pinion}} = 2951770$$

$$N_{\text{gear}} := \frac{60 \cdot \frac{\text{min}}{\text{hr}} \cdot L_i \cdot n_P \cdot q_P \cdot q_g}{m_G} \quad N_{\text{gear}} = 567648$$

$$Z_{NP} := 2.466 \cdot N_{\text{pinion}}^{-0.056} \quad Z_{NP} = 1.071$$

$$Z_{NG} := 2.466 \cdot N_{\text{gear}}^{-0.056} \quad Z_{NG} = 1.174$$

THE PITTING RESISTANCE POWER RATING (REF PARAGRAPH 5 AGMA 2001-C95)

Q := 0 (For Pinion surface hardness = 55-60 RC)

$$P_{\text{acp}} := \frac{n_P \cdot F}{126000 \cdot \frac{\text{in} \cdot \text{lbf}}{\text{min} \cdot \text{hp}}} \cdot \frac{I}{K_O \cdot K_V \cdot K_S \cdot K_m \cdot C_f} \cdot \left(\frac{S_{\text{acQ},0} \cdot Z_{NP} \cdot C_H \cdot d}{S_H \cdot K_T \cdot K_R \cdot C_P} \right)^2 \quad P_{\text{acp}} = 0.441 \cdot \text{hp}$$

$$T_{\text{pdur}} := \frac{63000 \cdot \frac{\text{in} \cdot \text{lbf}}{\text{min} \cdot \text{hp}} \cdot P_{\text{acp}}}{n_P} \quad T_{\text{pdur}} = 99038 \cdot \text{in} \cdot \text{lbf} \quad T_{\text{pdur}} = 8253 \cdot \text{ft} \cdot \text{lbf}$$

$$T_{\text{dpoutput}} := m_G \cdot T_{\text{pdur}} \cdot q_g \quad T_{\text{dpoutput}} = 42917 \cdot \text{ft} \cdot \text{lbf}$$

Q := 1 (For Gear hardness = 285 BHN)

$$P_{\text{acgmin}} := \frac{n_P \cdot F \cdot q_g}{126000 \cdot \frac{\text{in} \cdot \text{lbf}}{\text{min} \cdot \text{hp}}} \cdot \frac{I}{K_O \cdot K_V \cdot K_S \cdot K_m \cdot C_f} \cdot \left(\frac{S_{\text{acQ},0} \cdot Z_{NG} \cdot C_H \cdot d}{S_H \cdot K_T \cdot K_R \cdot C_P} \right)^2 \quad P_{\text{acgmin}} = 0.188 \cdot \text{hp}$$

$$T_{\text{dgoutputmin}} := \frac{63000 \cdot \frac{\text{in} \cdot \text{lbf}}{\text{min} \cdot \text{hp}} \cdot P_{\text{acgmin}}}{n_g} \quad T_{\text{dgoutputmin}} = 218937 \cdot \text{in} \cdot \text{lbf} \quad T_{\text{dgoutputmin}} = 18245 \cdot \text{ft} \cdot \text{lbf}$$

Q := 2 (For Gear hardness = 321 BHN)

$$P_{\text{acgmax}} := \frac{n_P \cdot F \cdot q_g}{126000 \cdot \frac{\text{in} \cdot \text{lbf}}{\text{min} \cdot \text{hp}}} \cdot \frac{I}{K_O \cdot K_V \cdot K_S \cdot K_m \cdot C_f} \cdot \left(\frac{S_{\text{acQ},0} \cdot Z_{NG} \cdot C_H \cdot d}{S_H \cdot K_T \cdot K_R \cdot C_P} \right)^2 \quad P_{\text{acgmax}} = 0.225 \cdot \text{hp}$$

$$T_{\text{dgoutputmax}} := \frac{63000 \cdot \frac{\text{in} \cdot \text{lbf}}{\text{min} \cdot \text{hp}} \cdot P_{\text{acgmax}}}{n_g} \quad T_{\text{dgoutputmax}} = 261996 \cdot \text{in} \cdot \text{lbf} \quad T_{\text{dgoutputmax}} = 21833 \cdot \text{ft} \cdot \text{lbf}$$

$$S_{at} := \begin{cases} 65000 \cdot \text{psi} \\ 70000 \cdot \text{psi} \\ 45470 \cdot \text{psi} \\ 49142 \cdot \text{psi} \end{cases} \begin{cases} \mathbf{U=0} \text{ WHEN } 65,000 \text{ PSI} = 55\text{-}60 \text{ RC (300 BHN)} \\ \mathbf{U=1} \text{ WHEN } 70,000 \text{ PSI} = 55\text{-}60 \text{ RC (350 BHN)} \\ \mathbf{U=2} \text{ WHEN } 45,470 \text{ PSI} = 285 \text{ BHN} \\ \mathbf{U=3} \text{ WHEN } 49,142 \text{ PSI} = 321 \text{ BHN} \end{cases}$$

(Ref: Table 4, Paragraph 16 AGMA 2001-C95)
(Ref: Table 4, Paragraph 16 AGMA 2001-C95)
(Fig 9, GR 2; Sat=102HB+16400)
(Fig 9, GR 2; Sat=102HB+16400)

$S_F := 1$ Safety factor

$$Y_{N_{pinion}} := 6.1514 \cdot N_{pinion}^{-0.1192} \quad Y_{N_{pinion}} = 1.042$$

$$Y_{N_{gear}} := 6.1514 \cdot N_{gear}^{-0.1192} \quad Y_{N_{gear}} = 1.268$$

THE BENDING STRENGTH POWER RATING (Ref PARAGRAPH 5 AGMA 2001-C95)

$U := 0$ (For Pinion with core hardness = 300 BHN/ surface hardness = 55-60 RC)

$K_B := 1$

$$P_{atpmin} := \frac{n_p \cdot d}{126000 \cdot \frac{\text{in} \cdot \text{lbf}}{\text{min} \cdot \text{hp}}} \cdot \frac{F}{P_d} \cdot \frac{J_p}{K_s \cdot K_m \cdot K_B} \cdot \frac{S_{at_{U,0}} \cdot Y_{N_{pinion}}}{S_F \cdot K_T \cdot K_R} \quad P_{atpmin} = 0.361 \cdot \text{hp}$$

$$T_{psmin} := \frac{63000 \cdot \frac{\text{in} \cdot \text{lbf}}{\text{min} \cdot \text{hp}} \cdot P_{atpmin}}{n_p} \quad T_{psmin} = 80999 \cdot \text{in} \cdot \text{lbf} \quad T_{psmin} = 6750 \cdot \text{ft} \cdot \text{lbf}$$

$$T_{spoutputmin} := m_G \cdot T_{psmin} \cdot q_g \quad T_{spoutputmin} = 35100 \cdot \text{ft} \cdot \text{lbf}$$

$U := 1$ (For Pinion with core hardness = 350 BHN/ surface hardness = 55-60 RC)

$$P_{atpmax} := \frac{n_p \cdot d}{126000 \cdot \frac{\text{in} \cdot \text{lbf}}{\text{min} \cdot \text{hp}}} \cdot \frac{F}{P_d} \cdot \frac{J_p}{K_s \cdot K_m \cdot K_B} \cdot \frac{S_{at_{U,0}} \cdot Y_{N_{pinion}}}{S_F \cdot K_T \cdot K_R} \quad P_{atpmax} = 0.389 \cdot \text{hp}$$

$$T_{spoutputmax} := \frac{63000 \cdot \frac{\text{in} \cdot \text{lbf}}{\text{min} \cdot \text{hp}} \cdot P_{atpmax} \cdot q_g}{n_g} \quad T_{spoutputmax} = 453594 \cdot \text{in} \cdot \text{lbf} \quad T_{spoutputmax} = 37800 \cdot \text{ft} \cdot \text{lbf}$$

$U := 2$ (For Gear hardness = 285 BHN)

$$P_{atgmin} := \frac{n_p \cdot d}{126000 \cdot \frac{\text{in} \cdot \text{lbf}}{\text{min} \cdot \text{hp}}} \cdot \frac{F}{P_d} \cdot \frac{J_g}{K_s \cdot K_m \cdot K_B} \cdot \frac{S_{at_{U,0}} \cdot Y_{N_{gear}}}{S_F \cdot K_T \cdot K_R} \quad P_{atgmin} = 0.289 \cdot \text{hp}$$

$$T_{sgoutputmin} := \frac{63000 \cdot \frac{\text{in} \cdot \text{lbf}}{\text{min} \cdot \text{hp}} \cdot P_{atgmin} \cdot q_g}{n_g} \quad T_{sgoutputmin} = 337483 \cdot \text{in} \cdot \text{lbf} \quad T_{sgoutputmin} = 28124 \cdot \text{ft} \cdot \text{lbf}$$

$U := 3$ (For Gear hardness = 321 BHN)

$$P_{atgmax} := \frac{n_p \cdot d}{126000 \cdot \frac{\text{in} \cdot \text{lbf}}{\text{min} \cdot \text{hp}}} \cdot \frac{F}{P_d} \cdot \frac{J_g}{K_s \cdot K_m \cdot K_B} \cdot \frac{S_{at_{U,0}} \cdot Y_{N_{gear}}}{S_F \cdot K_T \cdot K_R} \quad P_{atgmax} = 0.313 \cdot \text{hp}$$

$$T_{sgoutputmax} := \frac{63000 \cdot \frac{\text{in} \cdot \text{lbf}}{\text{min} \cdot \text{hp}} \cdot P_{atgmax} \cdot q_g}{n_g} \quad T_{sgoutputmax} = 364737 \cdot \text{in} \cdot \text{lbf} \quad T_{sgoutputmax} = 30395 \cdot \text{ft} \cdot \text{lbf}$$

YIELD STRENGTH RATING CALCULATIONS

(Ref: Fig 16, Paragraph 16.4 AGMA 2001-C95)

$$S_{ay} := \begin{cases} 111800 \cdot \text{psi} \\ 135900 \cdot \text{psi} \\ 104570 \cdot \text{psi} \\ 121922 \cdot \text{psi} \end{cases} \quad \begin{array}{l} \mathbf{Y=0} \text{ WHEN } 111,800 \text{ PSI} = 55\text{-}60 \text{ RC (300 BHN)} \\ \mathbf{Y=1} \text{ WHEN } 135,900 \text{ PSI} = 55\text{-}60 \text{ RC (350 BHN)} \\ \mathbf{Y=2} \text{ WHEN } 104,570 \text{ PSI} = 285 \text{ BHN} \\ \mathbf{Y=3} \text{ WHEN } 121,922 \text{ PSI} = 321 \text{ BHN} \end{array} \quad \begin{array}{l} \text{(Ref: Fig 16, Say=482xHB - 32800)} \\ \text{(Ref: Fig 16, Say=482xHB - 32800)} \end{array}$$

$K_v := 0.75$ For Industrial practice

$$K_{my} := 0.0144 \cdot \frac{1}{\text{in}} \cdot F + 1.07 \quad K_{my} = 1.113$$

$K_f := 1$ (Ref Paragraph 16.3 AGMA 2001-C95)

$Y := 0$ (For Pinion teeth core hardness 300 BHN/ surface hardness 55-60 RC)

(Ref: EQ (45) AGMA2001-C95)

$$T_{pyieldmin} := \left[\frac{F \cdot d}{2 \cdot P_d} \cdot \frac{J_p \cdot K_f}{K_{my} \cdot K_B} \cdot (S_{ayY,0} \cdot K_y) \right] \quad T_{pyieldmin} = 111249 \cdot \text{in} \cdot \text{lbf} \quad T_{pyieldmin} = 9271 \cdot \text{ft} \cdot \text{lbf}$$

$$T_{ypoutputmin} := m_G \cdot T_{pyieldmin} \cdot q_g \quad T_{ypoutputmin} = 48208 \cdot \text{ft} \cdot \text{lbf}$$

$Y := 1$ (For Pinion teeth core hardness 350 BHN and surface hardness 55-60 RC)

$$T_{pyieldmax} := \left[\frac{F \cdot d}{2 \cdot P_d} \cdot \frac{J_p \cdot K_f}{K_{my} \cdot K_B} \cdot (S_{ayY,0} \cdot K_y) \right] \quad T_{pyieldmax} = 135230 \cdot \text{in} \cdot \text{lbf} \quad T_{pyieldmax} = 11269 \cdot \text{ft} \cdot \text{lbf}$$

$$T_{ypoutputmax} := m_G \cdot T_{pyieldmax} \cdot q_g \quad T_{ypoutputmax} = 58600 \cdot \text{ft} \cdot \text{lbf}$$

$Y := 2$

(For Gear teeth core hardness 285 BHN)

$$T_{gyieldmin} := \left[\frac{F \cdot \left(\frac{N_2}{P_d} \right)}{2 \cdot P_d} \cdot \frac{J_g \cdot K_f \cdot q_g}{K_{my} \cdot K_B} \cdot (S_{ayY,0} \cdot K_y) \right] \quad T_{gyieldmin} = 42432 \cdot \text{ft} \cdot \text{lbf}$$

$Y := 3$ (For Gear teeth core hardness 321 BHN)

$$T_{gyieldmax} := \left[\frac{F \cdot \left(\frac{N_2}{P_d} \right)}{2 \cdot P_d} \cdot \frac{J_g \cdot K_f \cdot q_g}{K_{my} \cdot K_B} \cdot (S_{ayY,0} \cdot K_y) \right] \quad T_{gyieldmax} = 49473 \cdot \text{ft} \cdot \text{lbf}$$

	<u>DURABILITY</u>	<u>STRENGTH</u>	<u>YIELD STRENGTH</u>
MAIN GEAR (MAX)	$T_{dgoutputmax} = 21833 \cdot \text{ft} \cdot \text{lbf}$	$T_{sgoutputmax} = 30395 \cdot \text{ft} \cdot \text{lbf}$	$T_{gyieldmax} = 49473 \cdot \text{ft} \cdot \text{lbf}$
(MIN)	$T_{dgoutputmin} = 18245 \cdot \text{ft} \cdot \text{lbf}$	$T_{sgoutputmin} = 28124 \cdot \text{ft} \cdot \text{lbf}$	$T_{gyieldmin} = 42432 \cdot \text{ft} \cdot \text{lbf}$
PINION (MAX)	$T_{dpoutput} = 42917 \cdot \text{ft} \cdot \text{lbf}$	$T_{spoutputmax} = 37800 \cdot \text{ft} \cdot \text{lbf}$	$T_{ypoutputmax} = 58600 \cdot \text{ft} \cdot \text{lbf}$
(MIN)	* $T_{dpoutput} = 42917 \cdot \text{ft} \cdot \text{lbf}$	$T_{spoutputmin} = 35100 \cdot \text{ft} \cdot \text{lbf}$	$T_{ypoutputmin} = 48208 \cdot \text{ft} \cdot \text{lbf}$

* SAME AS PINION (MAX) SINCE AGMA GIVES ONE VALUE OF 'Sac' FOR HARDNESS RANGE.

AGMA GEAR RATING IS BASED UPON MAXIMUM VALUE OF DURABILITY FOR THE MAIN GEAR:

SURFACE DURABILITY RATING $T_{dgoutputmax} = 21833 \cdot \text{ft} \cdot \text{lbf}$ $SF := \frac{T_{dgoutputmax}}{T_{design}}$ **SF = 1** OK

AGMA MOMENTARY GEAR RATING IS BASED UPON MAXIMUM VALUE OF THE MAIN GEAR YIELD

MOMENTARY YIELD RATING $T_{gyieldmax} = 49473 \cdot \text{ft} \cdot \text{lbf}$ $SF := \frac{T_{gyieldmax}}{T_{design}}$ **SF = 2.27** OK

Bearing Life Calculations

THE ATTACHED BEARING LIFE CALCULATIONS UTILIZE A RELATIONSHIP BETWEEN THE BASIC RATING LIFE, THE BASIC DYNAMIC LOAD RATING, AND THE BEARING LOAD AS EXPRESSED BY THE EQUATION:

$$L_{-10} = (C/P)^K$$

WHERE:

L-10 = BASIC RATING LIFE IN MILLIONS OF REVOLUTIONS

*NOTE -

L-10 AND B-10 ARE EQUIVALENT RATINGS. L-10 HAS REPLACED B-10 TO MAKE A WORLDWIDE RATING STANDARD.

B-10 RATING IS NOT USED ANYMORE.

C = BASIC DYNAMIC LOAD RATING, LB

NOTE THE BASIC DYNAMIC LOAD RATINGS HAVE BEEN DETERMINED IN ACCORDANCE WITH THE METHODS PRESCRIBED BY ISO, AFBMA, AND ANSI.

P = EQUIVALENT DYNAMIC BEARING LOAD, LB

$$P = XR + YT$$

WHERE:

R = RADIAL LOAD, (LB)

T = THRUST (AXIAL) LOAD, (LB)

X = 0.56 FOR BALL BEARINGS

= 1.0 FOR CYLINDRICAL ROLLER BEARINGS

Y = 1.40 FOR BALL BEARINGS

= 0.0 FOR CYLINDRICAL ROLLER BEARINGS

K = EXPONENT FOR THE LIFE EQUATION

K = 3 FOR BALL BEARINGS

K = 3.333 FOR ROLLER BEARINGS

BASED ON BOTH LABORATORY TESTS AND PRACTICAL EXPERIENCE, SEEMINGLY IDENTICAL BEARINGS OPERATING UNDER SEEMINGLY IDENTICAL CONDITIONS HAVE DIFFERENT LIVES.

ALL INFORMATION PRESENTED ON DYNAMIC LOAD RATINGS IS BASED ON THE LIFE THAT 90% OF A SUFFICIENTLY LARGE GROUP OF BEARINGS CAN BE EXPECTED TO ATTAIN OR EXCEED.

WesTech Program no. CWP-049
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BEARING LIFE CALCULATIONS L-10

DESIGN TORQUE	=	21,833	FT-LB
GEAR PITCH DIAMETER	=	31.2	INCHES
BEARING BALL RACE DIAMETER	=	35	INCHES
REQUIRED LIFE	=	20	YEARS
F_{tan} = TANGENTIAL LOAD	=	16,794.62	LB
F_{total} = TOTAL LOAD	=	17,872.45	LB

MAIN BEARING

BEARING TYPE : BALL

C	=	53,457	LB	P	=	23,309	LB
X	=	0.56		K	=	3	
Y	=	1.4		L-10	=	12,063,313	REVOLUTIONS
F_{total}	=	17,872.45	LB				
T	=	9,500	LB				
RPM	=	0.054					
LIFE IN HOURS	=	3,690,271	HOURS				
LIFE IN YEARS	=	421	YEARS				

IN CONCLUSION:

REQUIRED LIFE	20	YEARS	
SERVICE FACTOR	21.06	> 1.0	OK

LOWER PINION BEARING

BEARING TYPE : ROLLER

C	=	31,000	LB	P	=	11,914.97	LB
X	=	1		K	=	3.333	
R	=	11,914.97	LB	L-10	=	24,215,350	REVOLUTIONS
RPM	=	0.283					

LIFE IN HOURS = 1,424,554 HOURS

LIFE IN YEARS = 163 YEARS

IN CONCLUSION:

REQUIRED LIFE: 20 YEARS

SERVICE FACTOR: 8.13 > 1.0 **OK**

UPPER PINION BEARING

BEARING TYPE : BALL

C	=	27,200	LB	P	=	4,736.19	LB
X	=	0.56		K	=	3	
Y	=	1.4		L-10	=	189,416,998	REVOLUTIONS
R	=	5,957.48	LB				
T	=	1,000	LB				
RPM	=	0.283					

LIFE IN HOURS = 11,143,131 HOURS

LIFE IN YEARS = 1,272 YEARS

IN CONCLUSION:

REQUIRED LIFE: 20 YEARS

SERVICE FACTOR: 63.60 > 1.0 **OK**

Precision Main Bearing

Precision Main Bearing

WesTech premium drive units for clarifier and thickener mechanisms employ a precision and integral main gear and bearing unit. The summary below explains the reasons why WesTech chooses to use this bearing arrangement.

Forged Alloy Steel

Forged Alloy Steel is stronger and will last longer.

Both the inner and outer races of the bearing are made of 4140 HR Alloy steel. To create a forged ring, a billet of the material is heated up red hot. It is then formed using high pressure rollers to produce the required dimensions. The forging process makes the material grain flow throughout the part. This makes the part several times stronger than a cast part where the liquid metal cools into a grain-like crystal structure, with no particular orientation.

Locked Raceway

Locked Raceway prevents failure and lasts longer.

Since the inner and outer races are locked these bearings are utilized for high load and speed applications, such as: Construction Equipment, Cranes, Wind Power Generators, and Amusement Park Rides. Similar to our equipment, these are applications where failure is not an option. These bearings are manufactured by recognized bearing companies such as Rotek, Kaydon, Gear Products, PSL, Titanus, and Galperti Tech.

Long Life and Load Capacities

Exceptional Long Life and Load Capacities for less maintenance and fewer replacements.

Instead of loading the balls on four points in the vertical and horizontal planes, as with strip liner bearings, the precision bearing utilizes one piece, contoured, ground raceways. Since the inner and outer raceways are locked together the load is evenly transferred in a diagonal direction between the inner and outer raceways.

Calculated bearing life is in the range of five times that for strip liners of the same ball size and diameter. This is often over 100 years. The need for splitting gears and housings is eliminated because of superior service life.

Superior Gear Quality

Superior Gear Quality provides smoother operation and fewer failures.

The majority of all spur-gear driving capacity comes from the stability of mounting and precision tolerance of its bearings. The use of an integral gear with bearing housing makes this precision inherent in the design. Stripliner gears often need to oversize one component to compensate for the lack of strength of another. AGMA 6 or better manufacturing tolerances are held for all gearing, which is ideal for slow speeds.

Fabricated Steel Drive Housing

Fabricated Steel Drive Housing

WesTech's premium drive units for clarifier and thickener mechanisms provide a welded fabricated steel housing to enclose moving parts and serve as a rugged structural frame for gear reduction and overturning loads. The advantages for doing this are listed below.

Strength of Material

Strength of Material gives more robust design.

Steel is a stronger material than cast iron. The modulus of elasticity for A36 steel is typically 150 percent greater than Class 40 cast iron. Steel also has higher yield and ultimate strengths which enhance fatigue resistance and ductility.

Material Characteristics

Material Characteristics yield more consistent quality.

Rolled steel is a very uniform material. The procedures for pouring cast iron produce a varying density of material due to blow holes, sand particles, voids, and cracks. Defects in cast iron cannot always be controlled or even identified by x-ray examination. Seal coating of interior raceway surfaces in cast iron is required to prevent oil leaks.

Structural Design

Structural Design is simplified and more consistent.

The defects of cast iron mentioned above make its structural performance far less consistent and predictable. The safety factors required in design must also be increased to account for material defects of cast iron. In order to provide the equivalent structural performance as steel, cast iron components must be more massive.

Flexibility of Design

Flexibility of Design saves you money.

WesTech encourages the use of our 'Standard' equipment. However, fabrication with structural steel permits a wide variety in the dimensioning of premium component parts to meet specific customer needs. The variety of dimensions economically available in cast iron molds is restricted.

Ease of Repairs

Ease of Repairs for reduced maintenance costs.

While it is rare, repairs to fabricated steel components are much simpler and can usually be made on site. Defective or damaged cast iron housings often require complete replacement or removal from the mechanism and repair at an off-site source.

Motor Information

MAX-E1® FAMILY



AEHH8N, NEMA PREMIUM (1 HP - 500 HP) [EP]

AEHE, HIGH EFFICIENCY [E]

AEHH8NCF, NEMA PREMIUM, FOOTED C-FACE (1 HP - 300 HP) [EP_C]

AEUH8NDC, NEMA PREMIUM, ROUND BODY C-FACE (1 HP - 100 HP) [EPV_C]



Effective 07-08-18
Supercedes 03-24-17

APPLICATIONS:

- | | | |
|------------------|---------------|--|
| ■ Fans & Blowers | ■ Compressors | ■ Any Severe Duty/ Petro-Chem/
Pulp & Paper Application |
| ■ Pumps | ■ Mixers | |
| ■ Crushers | ■ Conveyors | |

FEATURES:

- Output Range: 3/4 - 800 HP
- Speed: 3600, 1800, 1200 & 900 RPM
- Enclosure: Totally Enclosed Fan Cooled (IP54 for 280 Frames and below, IP55 for 280TS Frames and above)
- Voltage: 230/460V (Usable on 208V); 150HP and Larger is 460V Only^(1,2)
- Three Phase, 60 Hz, 1.15 Service Factor (Continuous); 50 Hz, 1.0 Service Factor (Continuous)
- CSA Certified for Class I, Div. 2, Groups B, C, D - Temp Code T3 Minimum^(7,8)
- CSA Certified for Class II, Div. 2, Groups F & G - Temp Code T3 Minimum^(7,8,12) (444T and Above)
- Class F Insulation
- Class B Temperature Rise
- NEMA Design B Torques as a Minimum; Various Ratings also Meet Design C
- Cast Iron Frame, End Brackets & Fan Cover and Main Conduit Box⁽⁹⁾
- Grounding Terminal Inside Main Conduit Box
- Oversized Main Conduit Box Rotatable in 90 Degree Increments - F1 Mounted
- Designed for 40°C Ambient Temperature⁽³⁾
- Designed for 3300 ft. Elevation⁽⁴⁾
- Bi-Directional Rotation; Except 2 Pole "Hybrid" and F# 5000 and Larger Ratings are Counter-Clockwise facing the DE
- 1045 Carbon Steel Shaft
- Aluminum Die Cast Squirrel Cage Rotor Construction for F# 140T - 449T
- Copper/Copper Alloy Rotor Construction for F# 5000 and Larger⁽¹⁰⁾
- Paint System: Phenolic Rust Proof Base Plus Polyurethane Top Coat
- Paint Color: Light Gray - Munsell N5.0
- Double Shielded Bearings Pre-Packed with MULTEMP SRL for F# 140T - 280T (Non-regreasable)
- High Quality Ball (or Roller) Bearings Regreasable with Mobil Polyrex™ EM for F# 280TS and Larger
- Automatic Grease Discharge Fittings on Regreasable Models
- Labyrinth Type Metal Flinger on Both Ends for F# 280TS and Larger
- Cast Iron Inner and Outer Bearing Caps for F#280TS and Larger
- Stainless Steel Nameplate
- New Dual Column Design Nameplate as Standard (60/50 Hz)
- Suitable for Inverter Use per NEMA MG-1 Part 31.4.4.2^(5,6,11)
- Inverter Duty Speed Range: 20:1 Variable Torque, 10:1 Constant Torque (350 HP and Larger are 3:1 Constant Torque)⁽¹¹⁾
- 9 Leads for 5 HP and Smaller;
- 12 Leads for 7.5 HP to 125 HP;
- 6 Leads for 150 HP and Larger
- Motors are U.L. Recognized, CSA Approved, CE Marked. ABS Design Assessment from 250 HP-800 HP⁽¹¹⁾
- Dual Drilled Feet Available on Most Ratings - Longer Frames (i.e. 145T Drilled also for 143T)
- 2-Pole Motors 600 HP and Larger are Form Wound and Insulated Non-Drive End Bearing
- Rubber Dust Flinger on Drive-End for F# 140T - 280T
- Catalog Numbers Ending in "R" Come Standard with Roller Bearings for Belted Applications.

EXTRAS/ OPTIONS:

Please refer to pages 147 - 154 for common modifications that can be performed.

Notes:

- (1) TWMC carries minimal MAX-E1® 575V stock; please check availability to ensure required motors are available. Ratings may be available from our Canadian warehouses at a higher price or from our factory with a longer lead time. Pricing and lead time may vary.
- (2) Motors 7.5 HP & up are Suitable for Wye/Delta Starting.
- (3) Consult a Stock Product Application Specialist for suitability in higher ambient environments.
- (4) Consult a Stock Product Application Specialist for suitability at higher elevations.
- (5) Motor service factor is 1.0 when operated on a VFD.
- (6) Precautions should be taken to eliminate or reduce shaft currents that may be imposed on the motor by the VFD as stated per NEMA MG-1. Part 31.
- (7) Catalog# EP3502, EP3504, EP4002T & EP4004T are "Hybrid" ratings; Not CSA Certified (Self-Certify Only) for hazardous locations, and not dual drilled.
- (8) Catalog# EP3006 also not CSA Certified for Hazardous Locations (Self-Certify Only).
- (9) F# 5000 and with Larger with Pressed Steel Plate Main Conduit Box.
- (10) F# 5007 - 5011 8 Pole Ratings are Aluminum Die Cast Squirrel Cage Rotor Construction.
- (11) EP4002T & EP4004T are hybrid frames and not VFD suitable.
- (12) Various temp codes apply to ratings. Consult a product specialist for accurate code.

DATE
JUNE 21, 2005
CATALOG NO.
EP00145

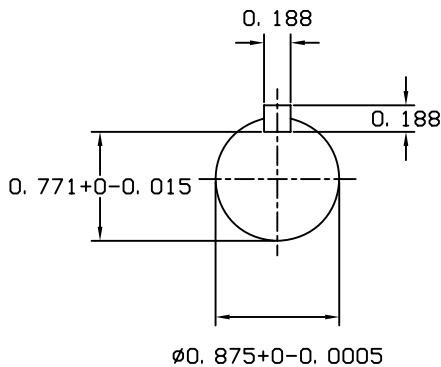
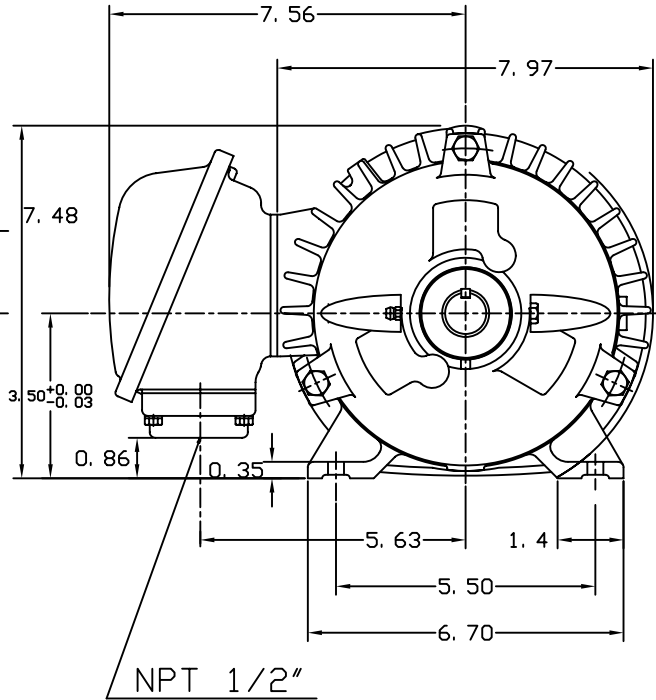
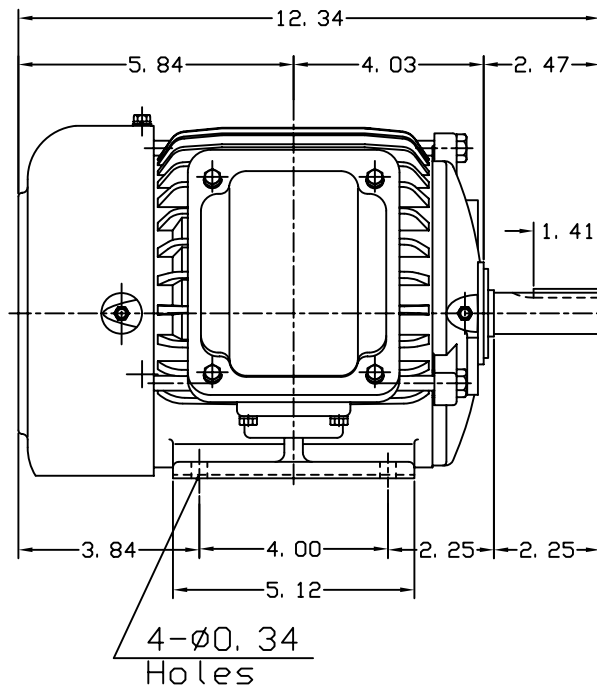
OUTLINE DIMENSIONS 3-PHASE INDUCTION MOTOR

MOTOR TYPE:
AEHH8N
FRAME NO. 143T

Pole	HP	KW	Hz	VOLT	Syn. Speed RPM
4	1	.75	60	575	1800

Ins	Rating	Dimension in	Approx Weight	Bearings
F	CONT.	inch	55 lbs.	DE: 6205ZZ NDE: 6205ZZ

Totally Enclosed Fan-Cooled Type. Squirrel-Cage Rotor.



DWN. J. H. LIANG 11-30-98
CHKD. C. S. LO 12-29-98
APPD. Y. B. HUANG 12-29-98

TEC Westinghouse

DWG NO.
31057H351000

TECO Westinghouse

ISSUED June 28, 2005	PERFORMANCE DATA 3-PHASE INDUCTION MOTOR	ENCLOSURE TEFC
TYPE AEHH8N		CATALOG# EP00145

NAMEPLATE INFORMATION

OUTPUT		POLE	FRAME SIZE	VOLTAGE	HZ	RATED AMBIENT	INS. CLASS	NEMA DESIGN	TIME RATING	SERVICE FACTOR
HP	KW									
1	0.7	4	143T	575	60	40°C	F	C	CONT.	1.15

TYPICAL PERFORMANCE

FULL LOAD RPM	EFFICIENCY				POWER FACTOR			MAXIMUM POWER FACTOR CORRECTION
	FULL LOAD		3/4 LOAD	1/2 LOAD	F. L.	3/4 LOAD	1/2 LOAD	
	MIN. %	NOM. %						
1745	82.5	85.5	84	81.5	73	64.5	51.5	1 KVAR

CURRENTS

NO LOAD			FULL LOAD			LOCKED ROTOR			NEMA KVA CODE LETTER
AT	AT	AT	AT	AT	AT	AT	AT	AT	
VOLT	575 VOLT	VOLT	VOLT	575 VOLT	VOLT	VOLT	575 VOLT	VOLT	
	0.64			1.20			12.00		N

TORQUE

INERTIA

ACCEL TIME

FULL LOAD lb-ft	LOCKED ROTOR %FLT	PULL UP %FLT	BREAK DOWN %FLT	ROTOR WR ² lb-ft ²	NEMA LOAD WK ² lb-ft ²	MAX ALLOWABLE WK ² lb-ft ²	NEMA LOAD WK ² Sec	MAX ALLOWABLE WK ² Sec
3.009	310	280	410	0.086	5.8	46	3.41	26.70

SAFE STALL TIME IN SECONDS

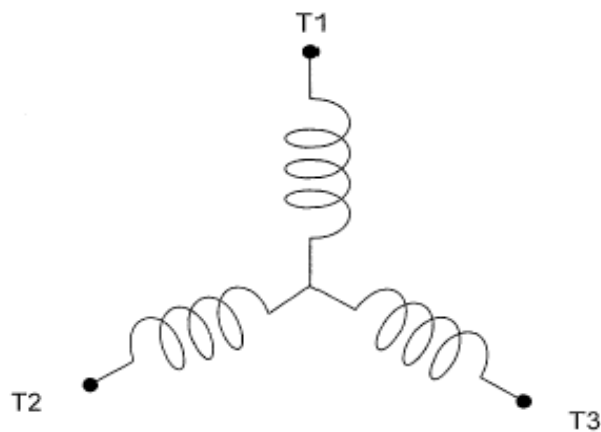
ALLOWABLE STARTS PER HOUR

SOUND PRESSURE LEVEL @ 3 FT dB(A)

COLD	HOT	COLD	HOT	49
71	50	2	1	

APPROVED:	M. PRATER	DRAWING NO.	31057EP00145	REVISION 0
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DATE: July 7, 2005	CONNECTION DIAGRAM	CATALOG NO.: EP00145
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SCHEMATIC - Y CONNECTION

ACROSS THE LINE CONNECTION



575 VOLT CONNECTION

Cycloidal Speed Reducer Information

Cycloidal Speed Reducer Features

WesTech premium drive units for clarifier and thickener mechanisms employ a cycloidal type gearless reducer for high efficiency and reliability. The summary below explains the reasons why WesTech chooses to use cycloidal drives rather than old-fashioned worm and other conventional gearing wherever possible.

Efficiency

Great efficiency even at high ratios means less power input for the same output.

At 87:1 reduction the cycloidal reducer can achieve 95 percent efficiency. This reduction ratio is achieved in one stage using the cycloidal drive reducer. In comparison, an average worm gear reducer with an 87:1 ratio would have a maximum efficiency of 60 percent and would require more than one stage.

Long Life

Long life for less frequent replacements and lowered maintenance budgets.

The long life of the cycloidal drive is due to its unique rolling action where high carbon chromium bearing steel is utilized on the wearing parts. This reducer does not use the sliding engagement that is translated into heat and wear that is used in most other types of gear reducers.

500 Percent Overload Capacity

500% Overload Capacity means unmatched strength.

At least two thirds of the cycloidal drive's teeth (lobes) are engaged at one time. Compare that to a conventional reducer: one or two teeth absorb the shock. Conventional reducer teeth also have a shear point. In the cycloidal drive there is no shear point.

Compactness

Compactness gives you more space to work.

The cycloidal drive is considerably smaller than conventional reducers.

A wide range of ratios available:

- Single stage reduction, ratios from 11: 1 to 87: 1.
- Double stage reduction, ratios up to 7,569: 1.
- Triple stage reduction, ratios up to 658,503: 1.
- Input horsepower ranges from 1/4 HP to 150 HP.
- Both horizontal and vertical mountings are available.

Cycloidal Speed Reducer Operating Principles

The cyclo is a speed reducer without gears that operates differently than the helical or worm gearing that most customers are familiar with. Its main components are the eccentric cam, the cycloidal disc, and the ring gear housing.

The unique, rolling-action operation of these components allows Sumitomo to offer a 500 percent momentary shock capacity. These components have a standard two year warranty. No other manufacturer offers these benefits. Sumitomo has manufactured over 5 million of these reducers since 1939.

The eccentric cam, mounted on the input shaft, rotates inside the bore of the cyclo disc forcing the cycloidal disc to roll inside the ring gear housing. Each complete revolution of the input shaft advances the cyclo discs one tooth in the opposite direction achieving reduction ratios up to:

- 87:1 in a single stage reducer
- 7,569:1 in just two stages

All of the rolling components are manufactured with 52,100 high carbon chromium bearing quality steel. The number of lobes (rather than teeth) on the cyclo disc and the number of rollers in the ring gear housing determine the ratio, i.e., 29:1 reduction will have a cyclo disc with 29 lobes and a ring gear housing with 30 rollers.

Other ratios such as 6, 8, 11, 17, 21, 35, 43, 59, 71, and 87 all have the same characteristics of having one more roller in the ring gear housing than there are lobes on the cyclo disc. The double-eccentric, two-disc cyclo design allows two-thirds of the cyclo lobes to be in contact to transmit torque at any one time.

This relates to a greater load sharing and higher shock capacity than in helical type reducers which have only one or two teeth in contact. It is virtually impossible to break a lobe on a cyclo disc. Applied correctly, negligible wear occurs even after years of operation.

The flanged output shaft is designed with pins and rollers that fit into larger holes machined in the cyclo disc. As the cyclo disc rolls inside the ring gear housing, the output shaft pins are driven in the opposite direction of the input shaft at the reduced output speed.

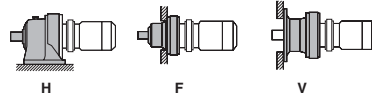
The features and benefits of this design provide for torque ratings from hundreds of inch-pounds to over 500,000 inch-pounds. Many models can be built with grease lubrication for virtually maintenance-free operation. Optional mounting configurations and compact size make the cyclo adaptable to most applications.

NOTE: Motor HP in **GRAY** is to overcome breakaway torque requirements in cold temperatures or high inertia applications. A torque limiting device is recommended to protect the unit or driven machine.

1750 RPM Frame Size Selection Tables

Dimensions:

Pages
Foot Mount (H) 4.21-4.33
F-Flange (F) 4.43-4.51
V-Flange (V) 4.69-4.83



Double Reduction, Ratios 841-7569 H, F, V Housing Styles

Output RPM Ratio	2.08 841	1.74 1003	1.40 1247	1.18 1479	0.946 1849	0.847 2065	0.690 2537	0.575 3045	0.503 3481	0.394 4437	0.341 5133	0.283 6177	0.231 7569	FRAME SIZE
Input HP	1.32	1.10	1.01	1.01	0.60	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	6180DB
Output Torque (in•lbs)	35800	35800	35900	35900	35900	35800	35800	35900	35800	35900	35900	35900	35900	
Overhung Load (lbs)	9370	9370	9370	9370	9370	9370	9370	9370	9370	9370	9370	9370	9370	
Input HP	1.62	1.36	1.10	1.01	1.01	1.01	0.54	0.54	0.54	0.54	0.54	0.54	0.54	6185DB
Output Torque (in•lbs)	44300	44300	44300	44300	44300	44300	44300	44300	44300	44300	44300	44300	44300	
Overhung Load (lbs)	9370	9350	9370	9370	9370	9350	9350	9370	9350	9370	9370	9370	9370	
Input HP	2.07	1.74	1.40	1.18	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	6190DA
Output Torque (in•lbs)	56400	56400	56400	56400	56400	56400	56400	56400	56400	56400	56400	56400	56400	
Overhung Load (lbs)	13200	13200	13200	13200	13200	13200	13200	13200	13200	13200	13200	13200	13200	
Input HP	-	-	-	-	-	-	-	-	-	-	-	-	-	6190DB
Output Torque (in•lbs)	-	-	-	-	-	-	-	-	-	-	-	-	-	
Overhung Load (lbs)	-	-	-	-	-	-	-	-	-	-	-	-	-	
Input HP	2.59	2.17	1.74	1.48	1.18	1.05	1.01	1.01	1.01	1.01	1.01	1.01	1.01	6195DA
Output Torque (in•lbs)	70400	70400	70400	70400	70400	70400	70400	70400	70400	70400	70400	70400	70400	
Overhung Load (lbs)	13200	13100	13200	13100	13200	13100	13100	13100	13100	13100	13100	13100	13100	
Input HP	-	-	-	-	-	-	-	-	-	-	-	-	-	6195DB
Output Torque (in•lbs)	-	-	-	-	-	-	-	-	-	-	-	-	-	
Overhung Load (lbs)	-	-	-	-	-	-	-	-	-	-	-	-	-	
Input HP	2.99	2.95	2.95	2.01	2.01	2.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	6205DA
Output Torque (in•lbs)	81700	80100	82300	74000	82300	82300	82300	77500	82300	77500	82300	77500	77500	
Overhung Load (lbs)	18900	18900	18900	18900	18900	18900	18900	18900	18900	18900	18900	18900	18900	
Input HP	-	2.95	-	2.01	-	-	-	-	-	-	-	-	-	6205DB
Output Torque (in•lbs)	-	82300	-	77500	-	-	-	-	-	-	-	-	-	
Overhung Load (lbs)	-	18900	-	18900	-	-	-	-	-	-	-	-	-	
Input HP	4.11	3.45	2.95	2.08	2.01	2.01	2.01	2.01	2.01	2.01	2.01	2.01	2.01	6215DA
Output Torque (in•lbs)	112000	112000	112000	99800	112000	112000	112000	99800	112000	99800	112000	99800	99800	
Overhung Load (lbs)	23400	23400	23400	23400	23400	23400	23400	23400	23400	23400	23400	23400	23400	
Input HP	-	-	-	-	-	-	-	-	-	-	-	-	-	6215DB
Output Torque (in•lbs)	-	-	-	-	-	-	-	-	-	-	-	-	-	
Overhung Load (lbs)	-	-	-	-	-	-	-	-	-	-	-	-	-	
Input HP	4.89	4.32	3.50	2.95	2.36	2.11	2.01	2.01	2.01	2.01	2.01	2.01	2.01	6225DA
Output Torque (in•lbs)	133000	141000	141000	134000	141000	141000	141000	134000	141000	134000	141000	134000	134000	
Overhung Load (lbs)	32600	32600	32600	32600	32600	32600	32600	32600	32600	32600	32600	32600	32600	
Input HP	-	-	-	-	-	-	-	-	-	-	-	-	-	6225DB
Output Torque (in•lbs)	-	-	-	-	-	-	-	-	-	-	-	-	-	
Overhung Load (lbs)	-	-	-	-	-	-	-	-	-	-	-	-	-	
Input HP	6.15	5.58	4.50	3.17	3.03	2.95	2.95	2.95	2.95	2.95	2.95	2.95	2.95	6235DA
Output Torque (in•lbs)	168000	181000	181000	152000	181000	181000	181000	152000	181000	152000	181000	152000	152000	
Overhung Load (lbs)	40100	40100	40100	40100	40100	40100	40100	40100	40100	40100	40100	40100	40100	
Input HP	-	-	-	-	-	-	-	-	-	-	-	-	-	6235DB
Output Torque (in•lbs)	-	-	-	-	-	-	-	-	-	-	-	-	-	
Overhung Load (lbs)	-	-	-	-	-	-	-	-	-	-	-	-	-	
Input HP	8.39	7.03	5.65	4.19	3.81	3.41	2.95	2.95	2.95	2.95	2.95	2.95	2.95	6245DA
Output Torque (in•lbs)	228000	228000	228000	201000	228000	228000	228000	201000	228000	201000	228000	201000	201000	
Overhung Load (lbs)	46700	46700	46700	46700	46700	46700	46700	46700	46700	46700	46700	46700	46700	
Input HP	-	-	-	-	-	-	-	-	-	-	-	-	-	6245DB
Output Torque (in•lbs)	-	-	-	-	-	-	-	-	-	-	-	-	-	
Overhung Load (lbs)	-	-	-	-	-	-	-	-	-	-	-	-	-	
Input HP	10.6	9.40	7.56	5.73	5.10	4.97	4.97	4.97	4.97	4.97	4.97	4.97	4.97	6255DA
Output Torque (in•lbs)	287000	306000	306000	274000	306000	306000	306000	274000	306000	274000	306000	274000	274000	
Overhung Load (lbs)	58000	58000	58000	58000	58000	58000	58000	58000	58000	58000	58000	58000	58000	
Input HP	-	-	-	-	-	-	-	-	-	-	-	-	-	6255DB
Output Torque (in•lbs)	-	-	-	-	-	-	-	-	-	-	-	-	-	
Overhung Load (lbs)	-	-	-	-	-	-	-	-	-	-	-	-	-	
Input HP	14.9	12.5	10.1	8.13	7.38	7.38	7.38	7.38	7.38	7.38	7.38	7.38	7.38	6265DA
Output Torque (in•lbs)	407000	407000	407000	390000	407000	407000	407000	390000	407000	390000	407000	390000	390000	
Overhung Load (lbs)	61900	61900	61900	61900	61900	61900	61900	61900	61900	61900	61900	61900	61900	
Input HP	22.1	18.5	14.9	12.6	10.1	10.1	10.1	10.1	10.1	10.1	10.1	10.1	10.1	6275DA
Output Torque (in•lbs)	603000	603000	603000	603000	603000	603000	603000	603000	603000	603000	603000	603000	603000	
Overhung Load (lbs)	55800	55800	55800	55100	55800	55800	55800	55100	55800	55100	55100	55100	55100	

Speed Reducers

Selection Tables

A Unique Concept . . .

The word CYCLO . . .

. . . derives from *Kyklos* the Greek word for *circle* and refers to the CYCLO disc, whose outer profile describes a cycloidal curve.

Features & Benefits of the CYCLO concept

• Outstanding Reliability – 2 Year Warranty

CYCLO speed reducers are noted for outstanding reliability and extended operating lifetime – 20 years of problem-free performance is not unusual. This reliability is due in part to the high material specifications, component quality controls and careful assembly procedures. It also results from the *total absence of sliding friction*. Correctly sized and selected CYCLO speed reducers and gearmotors are covered by a two year warranty.

• High Overload Capacity – 500% plus

CYCLO speed reducers have the strength to withstand over-loads that can break the teeth of other reducers.

Here's why:

At least 30% of the CYCLO's unique disc profiles share shock

of overload and the components are in *compression* – so they cannot be sheared off.

Compare that to conventional helical gear reducers, where one or two teeth must absorb the entire shock and are more prone to catastrophic failure.

• Overall Economy

Competitive initial cost, high reliability, long life and minimal maintenance give CYCLO speed reducers superior overall economy when compared to conventional gear boxes.

• Ideal for Highly Dynamic Applications

Since inertia is very low, the CYCLO speed reducer is ideally suitable for frequent start-stop-reversing duties and the combination with a frequency inverter.

• High Efficiency – Even at High Ratios

Torque transmitting parts have rolling action with minimal friction, so the overall efficiency is as high as 95% in single reduction units.

• Compact Size

Reduction ratios from 6:1 to 119:1 are available for the single stage. Triple reduction stages offer ratios up to nearly 1,000,000:1.

Additional Value

Sumitomo, THE ORIGINAL CYCLO, offers these additional benefits:

• Total Quality

Precision manufacturing and unmatched Quality Assurance insure consistent product performance.

• 70 Years of Product Development

The unique CYCLO operating principle was invented by the German engineer Lorenz Braren in 1931 and his ingenious design has continued its progressive development until the present day.



• Over 7,000,000 Units Sold

CYCLO speed reducers are in daily use in industries throughout the world replacing the more conventional helical, worm and spur gear units.

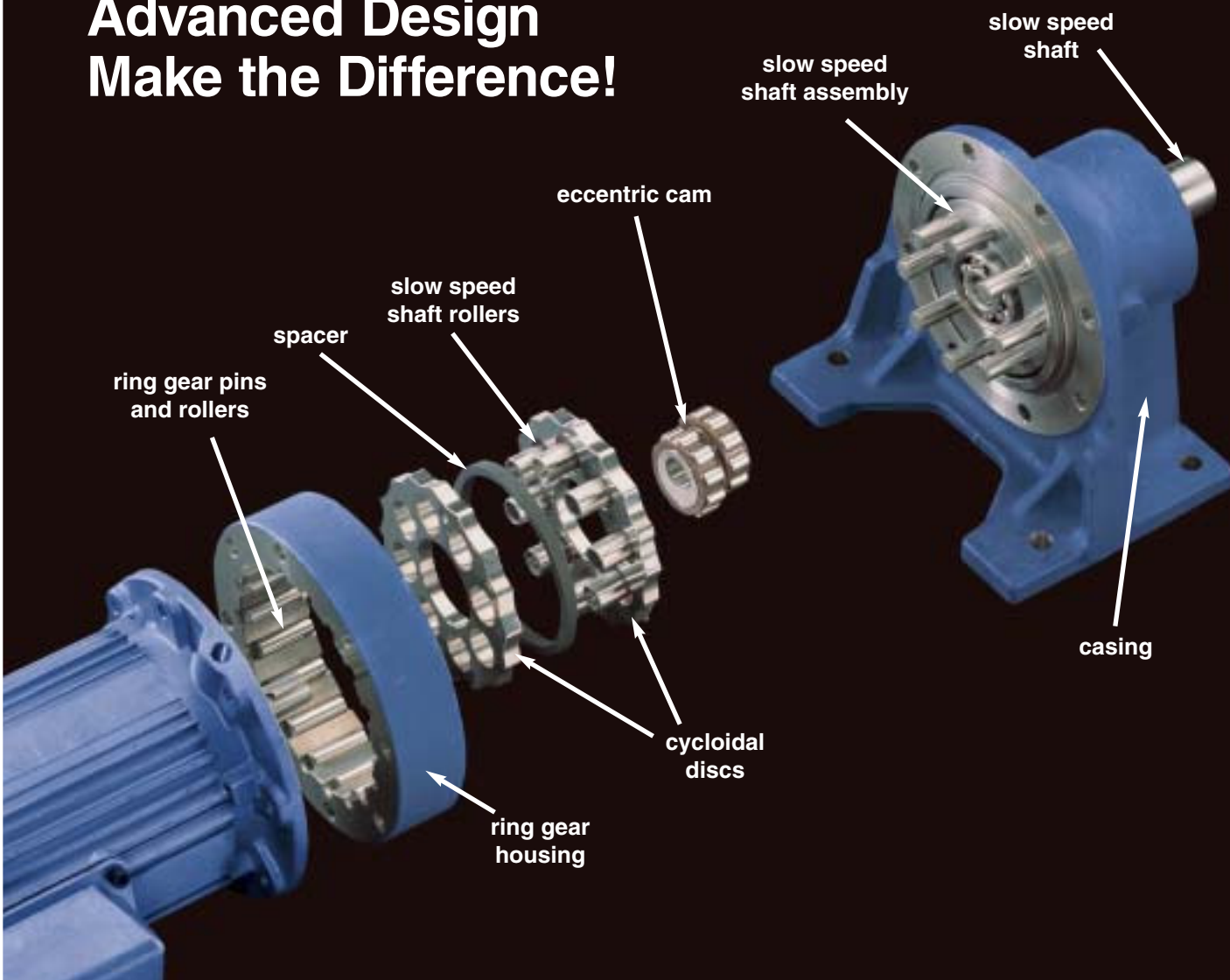
• Many Options . . .

. . . in mechanical and electrical power transmission and control are offered in the complete CYCLO product range. Right Angle, Offset, Hollow Shaft, and Bushing Mounted variations are readily available.

• Worldwide Product Support

Fast, competent technical assistance with selection, installation and after-sales service is available from production and distribution centers throughout the world.

...Fewer Parts & Advanced Design Make the Difference!



Quiet, Dependable, Consistently Long Life

- **Quieter Operation**

Super finishing of rotating components provides smoother rolling action

- **Higher Ratings**

Optimized design imparts more uniform internal load distribution

- **Longer Life**

Improved internal gearometry extends already long life

- **Reduced Backlash**

Decreased internal clearances for high performance requirements

- **Total Dependability**

Torque transmitting parts are made from fully hardened, vacuum degassed bearing grade steel

- **Absolute Consistency**

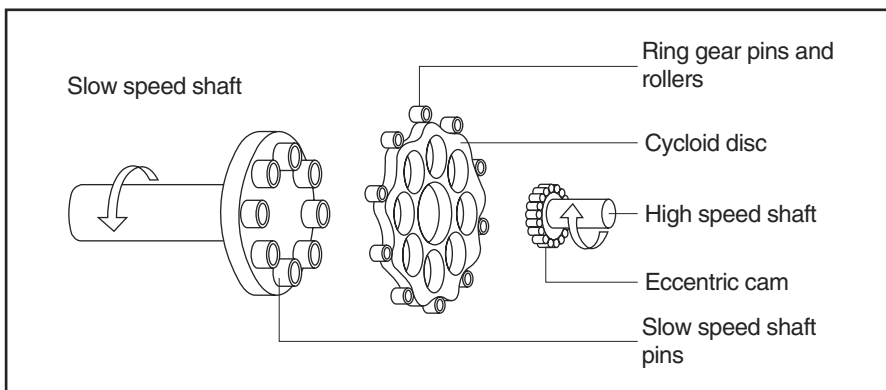
Stringent manufacturing process and assembly controls assure reliability

HOW IT WORKS

The unique SM-CYCLO® speed reducing system is based on an ingeniously simple principle that offers many benefits to the designer and user of power

transmission drives. Basically, the speed reducer has only three major moving parts:

1. **High speed input shaft with integrally mounted eccentric cam and roller bearing assembly**
2. **Cycloid discs**
3. **Slow speed shaft assembly**



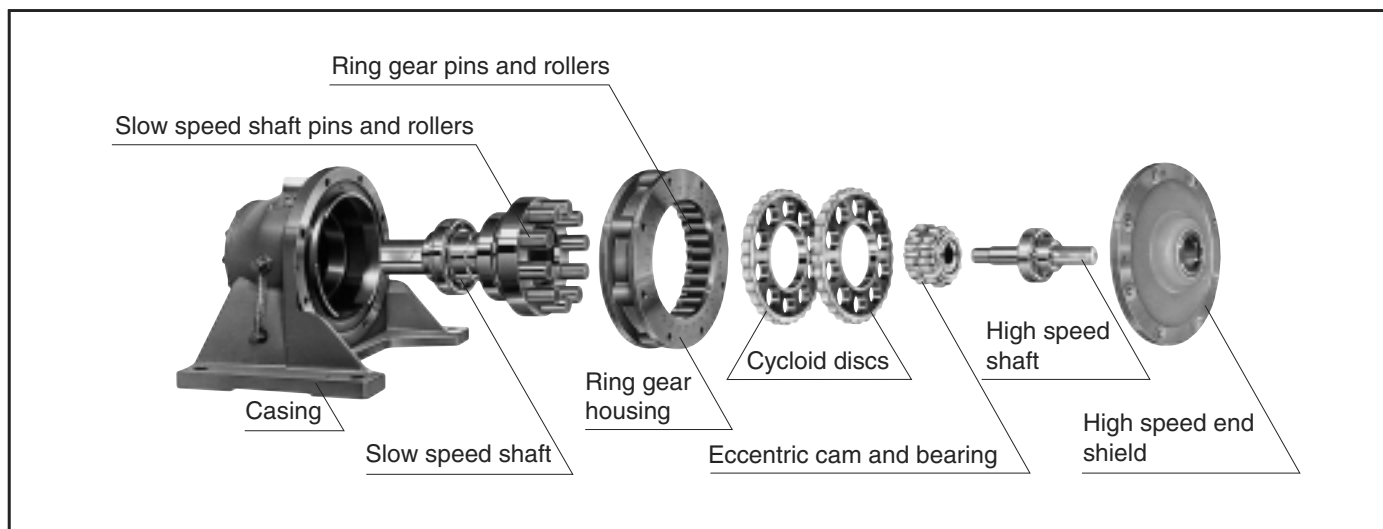
As the eccentric cam rotates, it rolls the cycloid discs around the internal circumference of the stationary ring gear.

The resulting action is similar to that of a wheel rolling around the inside of a ring. As the wheel (cycloid disc) travels in a clockwise path around the ring (ring gear housing), the wheel itself turns slowly on its own axis in a counter-clockwise direction. In the SM-CYCLO® system the cycloidal profile around the outer edge of the disc engages progressively with the rollers of the fixed ring gear housing to produce a reverse rotation at reduced speed. For each complete revolution of the high speed shaft, the cycloid disc turns one cycloidal tooth in the opposite direction. In general, there is one

less cycloidal tooth around the disc than there are pins in the fixed ring gear housing, which results in reduction ratios equal to the number of cycloidal teeth on the disc. (Note: For some ratios, there are two less teeth per cycloid disc than there are pins in the ring gear housing.)

The reduced rotation of the cycloid discs is transmitted to the slow speed shaft by means of drive pins and rollers that engage with holes located around the middle of each disc.

Typically, a two disc system is used with a double eccentric cam which increases the torque capacity and offers an exceptionally smooth, vibration-free drive.

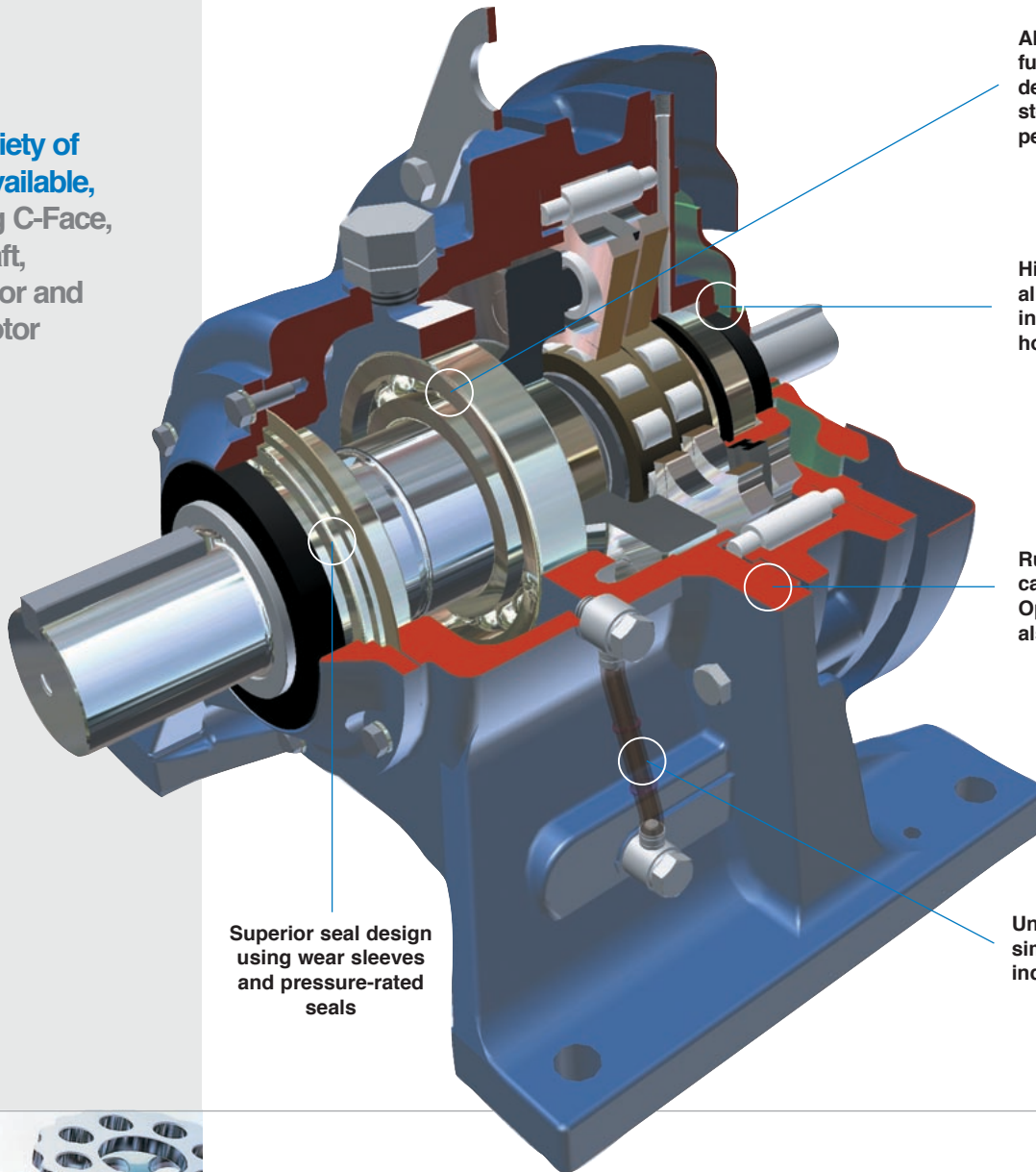




Cyclo® 6000

High Torque Density, High Reliability Cycloidal Speed Reducers and Gearmotors

- ▶ **Wide variety of inputs available,** including C-Face, Free-Shaft, Gearmotor and Brakemotor



All rotating components are fully hardened, vacuum degassed bearing grade steel, for consistent, reliable performance

High power density, all reduction contained in compact ring gear housing

Rugged, shock-resistant cast iron housing. Optional ductile iron also available

Superior seal design using wear sleeves and pressure-rated seals

Unique oil sight gauge for simple, visible lubrication indication

Unmatched Reliability, Exceptional Performance

- ▶ Cyclo® speed reducers and gearmotors are designed to withstand shock loads exceeding 500% of their ratings



Product Description

The Sumitomo Cyclo® drive is **unsurpassed by any other inline drive** available in the market today. **Cyclo®'s unique cycloidal design** has advantages superior to speed reducers using common involute tooth gears. Cyclo® components operate in compression, not in shear. Unlike gear teeth with limited contact points, a Cyclo® has two thirds of its reduction components in contact at all times. Cyclo® speed reducers and gearmotors are **designed to withstand shock loads exceeding 500%** of their ratings, and provide exceptional performance, reliability and long life in the most severe applications.

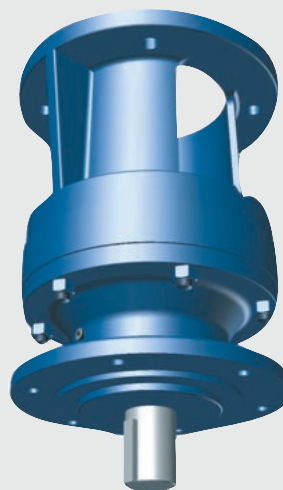
Features & Benefits

- **Highest overload capacity**, exceeding 500%
- **Exceptional life** with a 24 month warranty
- **High efficiency**, even at high reduction ratios
- Versatile, available as inline speed reducer or gearmotor
- Ideal for **severe, high shock** applications
- Optional grease lubrication for **no maintenance**

Specifications

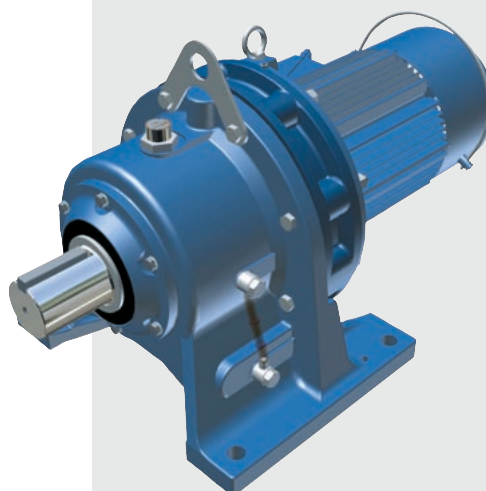
Sizes:	23 models (5lbs to 5000lbs)
Torque Rating:	210 to 603,000 lb in
HP Rating:	.10 to 232 HP
Ratio Range:	3 to 119 (single), 121 to 7569 (double), 8041 to 658,503 (triple)
Mounting:	Foot, Flange, Face Mount
Motor Standards:	NEMA, IEC, JIS, UL, CSA, CE

- **Sumitomo's Cyclo® 6000 has extremely high torque density** and is available as an inline speed reducer or gearmotor



Reducer

- Simple, Compact Design
- Rugged Forged Output Shaft
- Many Mounting Styles
- C-Face, Shovel Base & Top Mount Options



Gearmotor

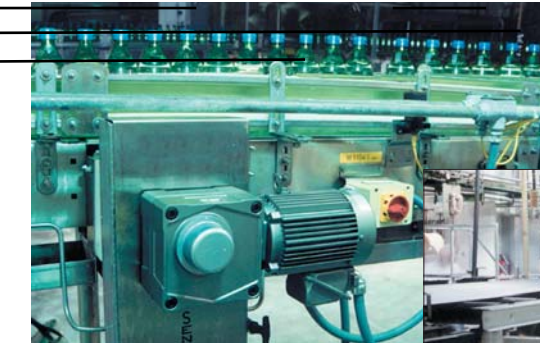
- Connection free design
- Rugged forged output shaft
- Direct acting brake option
- Unmatched durability



► Applications

- Conveyors
- Food Machinery
- Mixers
- Automotive Plants
- Recycling Machines
- Poultry Plants
- Sawmills and Wood Mills
- Wastewater Treatment
- Steel Mills
- Construction Equipment
- Paper Mills
- Processing Plants

Bottling/Baking



Steel hypoid gear technology, maintenance-free grease lubrication and a compact modular housing makes the Hyponic® an efficient performer in the food industry.



A 15-hp Beier mechanical variable speed drive with electric remote control provides an adjustable, steady speed range for this 350-ft. oven band conveyor.

Water Treatment



Each of these Sumitomo Paramax® speed reducers helps pump up to 13 million gallons a day at this state-of-the-art wastewater treatment facility in the City of Clearwater, Florida.



Cyclo® mixer drives are a key component of this award-winning water treatment facility in Hillsborough County, Florida.

Material Handling



Sumitomo Paramax® reducers provide quiet, reliable operation for both the hoist and trolley drive systems in this 35-ton capacity DC Trolley Hoist used for heavy-duty coil handling service.



Custom Designs



In less than 20 minutes, 96 Sumitomo Cyclo® Bevel Buddybox gearmotors help retract the 13,000-ton roof on Seattle's Safeco Field.

The Sumitomo gearmotors, on eight travel truck assemblies, turn 128 36" wheels.

Wood Products

Sumitomo Cyclo® drives are an integral part of this manufacturing plant which produces 150,000 board feet of unfinished strip and plank hardwood flooring each week.

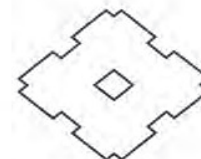


Once flooring is side-matched, it is inspected for defects. This conveyor, driven by Sumitomo Cyclo® drives, carries defective material to the hammer mill.

Steel



After molten steel is formed in the five-strand continuous caster at this steel mill, it is conveyed by Sumitomo Cyclo® drives on the auto-torch conveyors where the steel is cut into billets.



Lubricants

Grease Lubricated Models

Those models listed in Tables A-3 ~ A-6 as grease lubricated are filled with grease before shipment to the customer and are ready for use.

Table A-7. Standard Greases^[1]

Ambient Temperature ^[2]		Cyclo [®] Disc-Type	Cyclo [®] Planetary-Type
°F	°C		
14 to 122	-10 to 50	Exxon Unirex N2 Grease	Shell Gadus S2 V220 0 Grease

Table A-8. Grease Replenishment and Change Interval

Model	Condition		Interval ^[3]
Maintenance Free Type: Single (6060 to 6125) Double Reduction (6065DA to 6125DB)	Replenishment		NOT REQUIRED
	Overhaul ^[4]		Every 20,000 Hours or Every 4 ~ 5 Years
Non- Maintenance Free Type	Replenishment	Less Than 10 Hours Per Day Operation	Every 3 ~ 6 Months
		10 ~ 24 Hours Per Day Operation	Every 500 ~ 1000
	Change	Speed Reducer Mechanism, High Speed Shaft Bearings (Speed Reducer Type)	Every 2 ~ 3 Years
		Slow Speed Shaft Bearings	Every 3 ~ 5 Years

Replenishment and Change Guidelines

Those units designated as maintenance free in Tables A-3 ~ A-6 do not require replenishment when supplied with standard greases. Certain optional greases do require replenishment. Those units will have a Zerk fitting either on the high speed endshield or near the input shaft bearing housing.

Replenish grease to the reduction mechanism with 1/3 to 1/2 of the quantity listed in Table A-9 or A-10 at the interval recommended in Table A-8. Remove the drain plug from gearbox output section. Replenish grease through the Zerk fitting. After inserting the recommended amount of grease run the unit for five or 10 minutes to circulate the grease and purge any excess. Replace the drain plug and return to service.

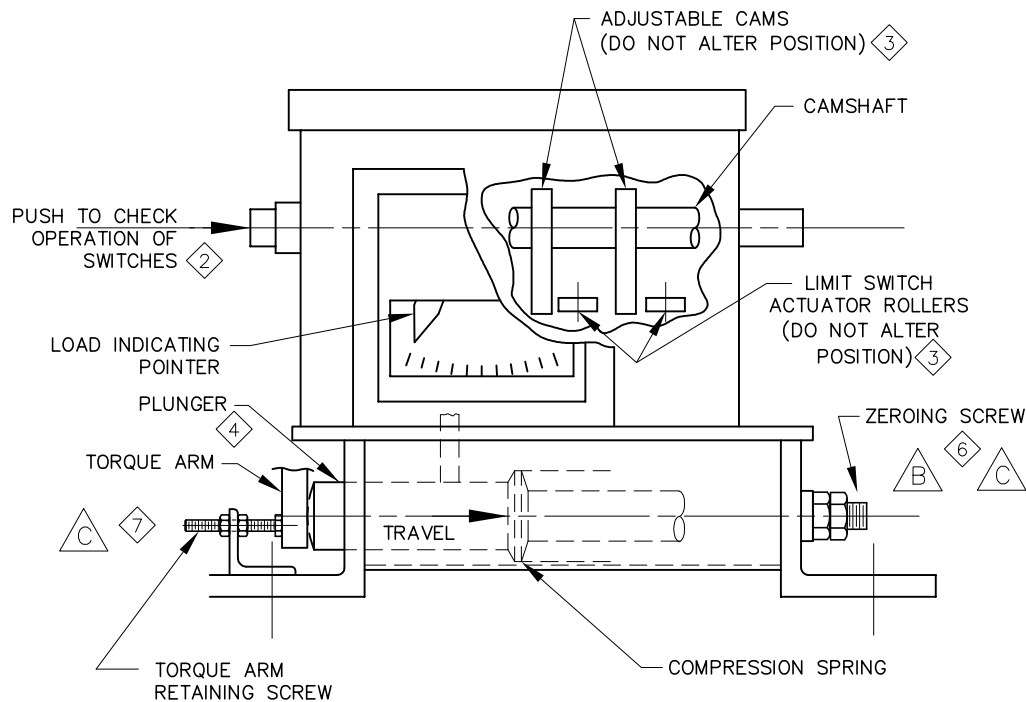
When the unit is disassembled for overhauling, refill with the grease quantities indicated in Table A-9 or A-10. Or alternatively, 80% of the space around the reduction mechanism and slow speed shaft

bearings of single reduction units, and 50% around the reduction mechanism of both the first and second stage of double reduction units.

Apply grease liberally to the central part (i.e., around the eccentric bearings) of the mechanism. Apply grease to both the slow speed and high speed shaft bearings as you would to ordinary bearings at the time or re-assembly.

If excessive grease is added, agitation heating of the grease will raise the operating temperature of the unit. Avoid excessive greasing, but do not supply an insufficient amount of grease. When the grease is insufficient, it will raise the unit's operating temperature due to breakdown of the lubrication films on the eccentric bearing. In this case, if the operating temperature rises, supply grease immediately.

Torque Control Information



- (1) THE TORQUE CONTROL IS AN ELECTRO - MECHANICAL DEVICE DESIGNED TO PROTECT THE DRIVE AND MECHANISM FROM OVERLOAD CAUSED BY EXTREME TORQUE BUILD - UP DUE TO A VARIETY OF UNUSUAL OPERATING CONDITIONS.

THE DEVICE IS ACTUATED BY THE TORQUE ARM OF THE ADAPTER PLATE UPON WHICH THE SPEED REDUCER IS MOUNTED, SUPPORTED BY A PIVOT BEARING, WHICH IS FREE TO ROTATE IN REACTION TO THE TORQUE LOAD BEING IMPOSED UPON THE SPEED REDUCER. THE TORQUE ARM EXERTS A FORCE AGAINST A CALIBRATED COMPRESSION SPRING. AS TORQUE ON THE SCRAPER MECHANISM INCREASES THE SPRING DEFLECTION MOVEMENT IS TRANSMITTED BY A VERTICAL ROD TO THE SHAFT UPON WHICH THE CAMS ARE MOUNTED. THE POSITION OF THE CAMS TO THE ROLLERS OF THE LIMIT SWITCHES HAS BEEN SET IN WESTECH'S SHOP FOR ALARM AND CUTOFF. THE PERCENTAGE OF TORQUE LOAD IS INDICATED BY A POINTER AND A SCALE VISIBLE FROM THE FRONT OF THE UNIT. UNDER NORMAL CONDITIONS TORQUE WILL NOT BE SUFFICIENT TO ACTUATE THE ALARM CONTROLS.

AS THE TORQUE INCREASES AND THE POINTER MOVES TOWARDS THE UPPER PORTION OF THE PERCENTAGE SCALE AN ALARM IS ACTUATED ALERTING THE OPERATOR OF AN IMPENDING OVERLOAD. IF THE OVERLOAD CONDITION IS NOT CORRECTED AND CONTINUES TO BUILD UP UNTIL THE SECOND SWITCH IS ACTUATED, THE DRIVE MOTOR WILL CUT - OUT AND THE MECHANISM WILL AUTOMATICALLY STOP. WITH THE SCRAPER ARMS STOPPED THERE IS NO OVERLOAD FOR THE TORQUE CONTROL TO READ, SO WHILE THE OVERLOAD CONDITION IS BEING CORRECTED, MEANS MUST BE PROVIDED IN THE ELECTRICAL CONTROLS TO PREVENT THE MOTOR FROM COMING ON PREMATURELY.

- (2) TO CHECK THE OPERATION OF SWITCHES, THE CONDITIONS OF AN OVERLOAD MAY BE SIMULATED BY PUSHING THE BRASS ROD COVERED WITH A RUBBER CAP LOCATED ON THE LEFT SIDE OF THE UNIT. THIS IS TO BE DONE AT THE TIME OF START - UP AND WEEKLY AFTER THE MACHINE IS PUT INTO OPERATION.
- (3) DO NOT ALTER THE FACTORY SET POSITION OF LIMIT SWITCH ACTUATORS AS DAMAGE TO THE DRIVE AND MECHANISM CAN OCCUR. THIS ALSO VOIDS ANY WARRANTY.
- (4) SPRAY OIL (WD-40 OR EQUAL) WEEKLY TO LUBRICATE THE PLUNGER FOR FREE MOVEMENT.

A

- (5) TORQUE TRANSMITTER (OPTIONAL) SHALL BE CALIBRATED TO SHOW 4ma AT ZERO TORQUE AND 20ma AT FULL DIAL TORQUE.

- (6) NUTS ON ZEROING SCREW CAN BE ADJUSTED TO BRING LOAD INDICATING POINTER UP TO ZERO. TORQUE ARM RETAINING SCREW SHOULD NOT BE USED TO ADJUST THE POINTER.

- (7) RETAINING SCREW IS INTENDED TO KEEP THE TORQUE ARM IN PLACE AND TOUCHING THE PLUNGER AT THE ZERO POSITION ON THE SCALE. THE RETAINING SCREW/BRAKET IS INTENDED TO BEND OR BREAK IF THE DRIVE IS RUN IN REVERSE. THIS PROTECTS THE MECHANISM FROM MORE COSTLY DAMAGE.

ADDED SECOND NUT TO RETAINING SCREW, ADDED NOTES 6 AND 7	TAP	JJ	11-07	
ADDED SECOND NUT TO ZEROING SCREW	RHS	JAJ	03/06	
NOTE 5 ADDED, OR EQUAL ADDED	DK	JJ	5-04	
REVISION	BY	CHKD	DATE	LTR

TORQUE CONTROL DEVICE

DESCRIPTION

TYPE

SIZE

				NONE	11-03	MPW	NK	JJ
DATE	STD. BY	STD. CHKD.	STD. APPVD	SCALE	DATE	PROJ. BY	PROJ. CHKD.	PROJ. APPVD

ALL COMPONENTS MUST BE FABRICATED AND MACHINED ACCORDING TO WESTECH STANDARD SPECIFICATION (DRAWING P24Z-024A), UNLESS SPECIFICALLY NOTED ON THIS DRAWING.

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Westech

DRAWING NUMBER

7 - 8222 B1

PROJECT NUMBER

REV.

A

REVISION

BY

CHKD

DATE

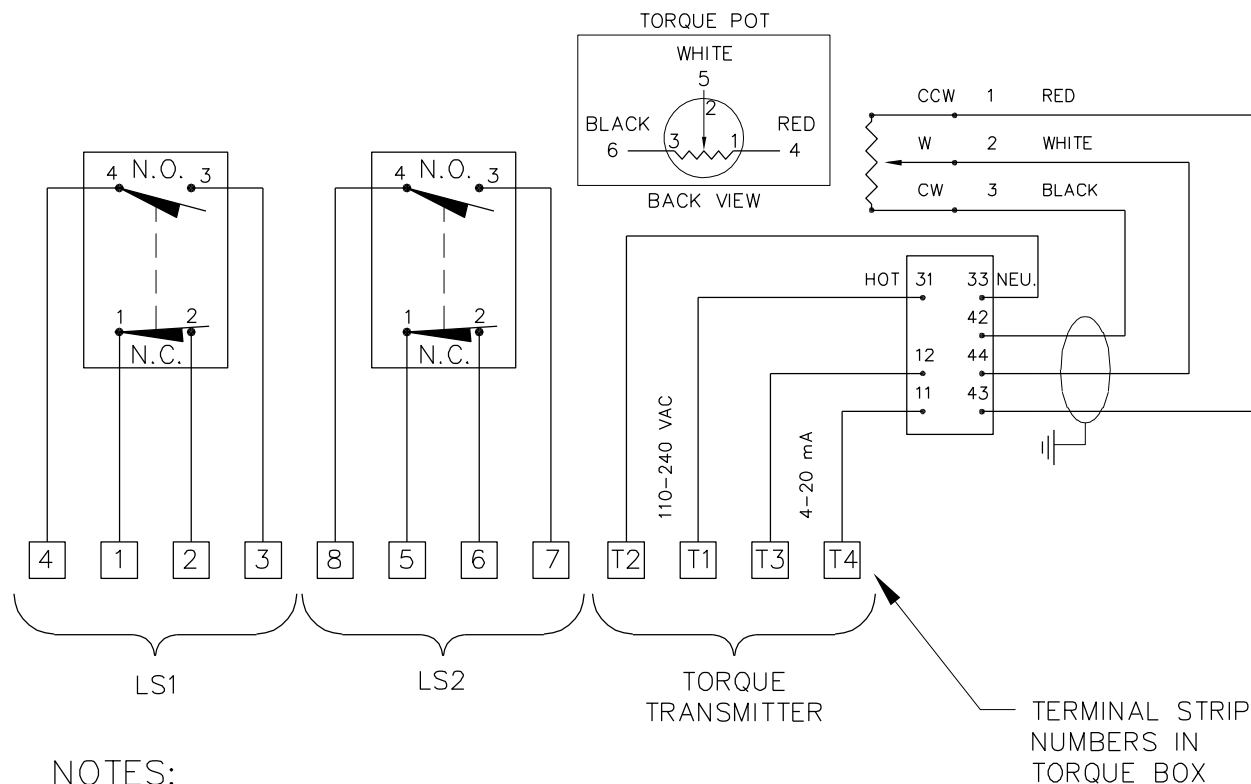
LTR

A

B

C

D



NOTES:

1. FIELD CONNECTIONS MAY BE WIRED TO N.O. OR N.C. CONTACTS DEPENDING ON FIELD REQUIREMENTS.
2. SWITCH FUNCTIONS SHALL CORRESPOND WITH THE SUGGESTED ELECTRICAL SCHEMATIC
3. LIMIT SWITCH TERMINAL ARRANGEMENT IS SEQUENTIALLY TYPICAL FOR 3 OR 4 SWITCH TORQUE BOXES
4. SWITCHES ARE RATED 600 VOLT MAX.
5. MEETS NEMA 1, 3, 4, 4X, 6P, 12 & 13

TORQUE BOX WITH TRANSMITTER

DESCRIPTION

RIGHT HAND

MODEL

SIZE

1, X 1

10/22/19

RU08

PA53

KE32

NONE

DATE

STD. BY

STD.CHKD.

STD.APPVD

SCALE

DATE

PROJ. BY

PROJ.CHKD.

PROJ.APPVD

WestTech

DRAWING NUMBER

TB-076A

PROJECT NUMBER

REV.

0

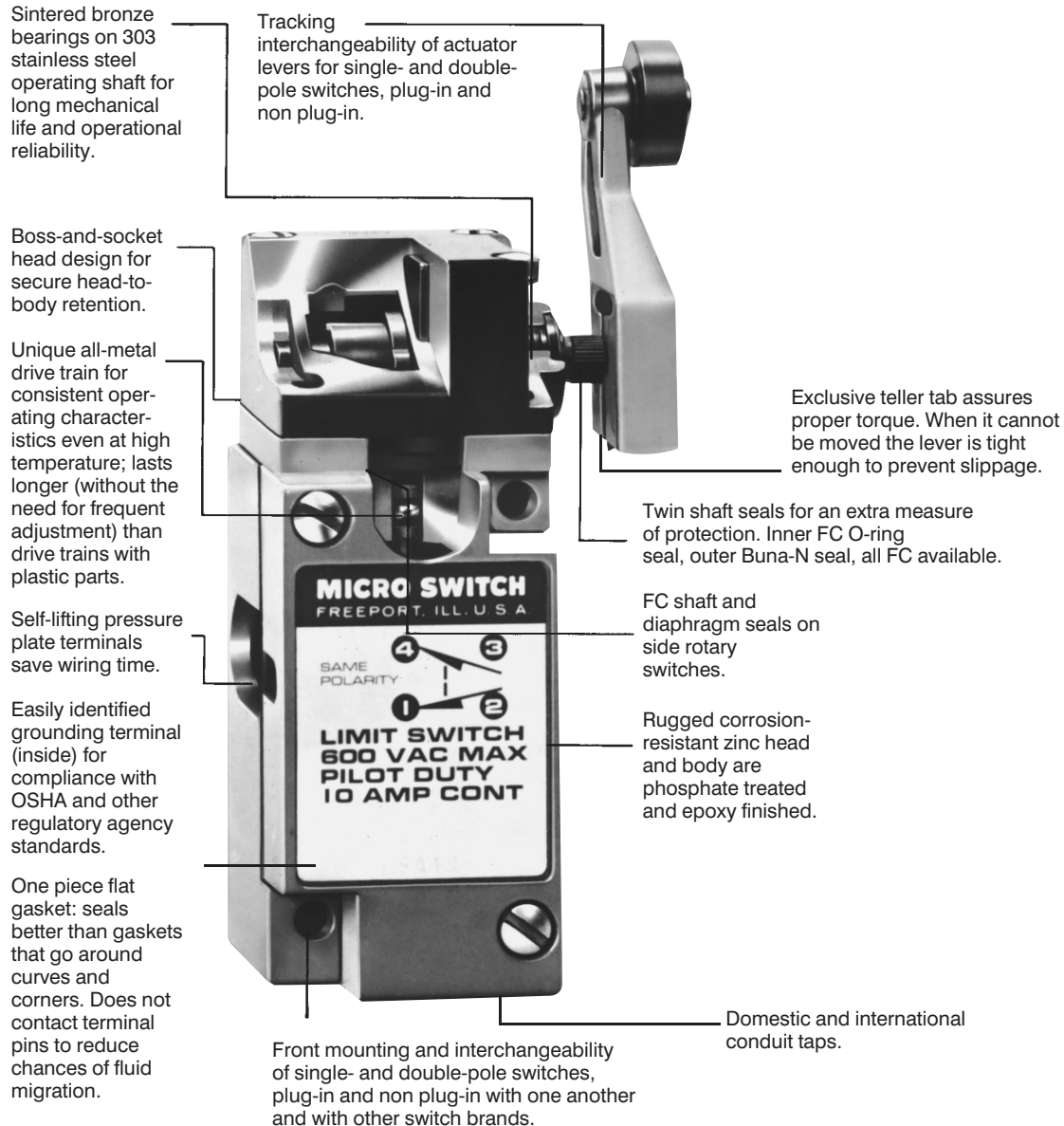
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Heavy Duty Limit Switches

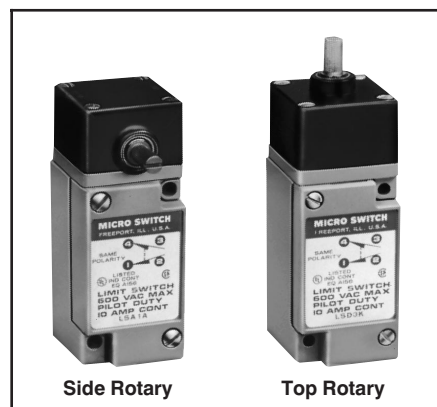
ADDITIONAL FEATURES AND OPTIONS

- Wide variety of operating heads
- Field adjustable operating modes, for reduced inventory
- Convenience of on-the-spot adjustment instructions
- Complete choice of circuitry and electrical rating options, including solid state switching
- Plug-in and non plug-in versions have identical operating characteristics and are dimensionally interchangeable
- Manifold (rear-wire) version
- NEMA 1, 3, 4, 4X, 6, 6P, and 13*
- UL Listed, file #E37138
- CSA Certified, file #LR57326
- Explosion-proof version page A113
- Low temperature versions to -40°F (-40°C) page A42
- Captive head and body screws
- Designed to withstand seismic shock
- Stainless steel (NEMA 4X) version page A47
- Prelead cable or prewired connector types page A42
- Epoxy filled wash down (NEMA 6P) types page A44
- Completely fluorocarbon (FC) sealed versions page A42

* Depending on operating head, prewired connector or cable, enclosure ratings may vary. For enclosure rating information on specific catalog listings, contact the 800 number.



Rotary Actuated Switches



Side Rotary

Top Rotary

Order guides below and on page A35 provide specification and pricing information for side and top rotary switches.

Plug-in body style catalog listings consist of the complete plug-in base receptacle.

Levers are ordered separately. See pages A37-A39 for lever selection.

For rapid response – off the shelf service, all **bold face** listings are normally stocked items.

For low temperature, high temperature or preleading see page A42.

ASSEMBLED CONDITIONS

Catalog listings in order guide below are factory assembled with:

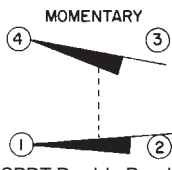
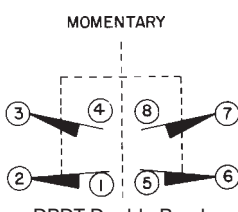

- Shaft of side rotary heads facing front of switch (label side).
- Head adjusted for both clockwise and counterclockwise operation.
- Light on indicator versions wired to N.O. circuit.

Refer to facing page to specify modifications to these assembled conditions.

PRELEADED OR CONNECTORIZED VERSIONS

Refer to page A42.

ORDER GUIDE (Momentary action. UL listed, CSA certified, CE approved. Levers not included. Order separately pages A37-A39.)

Circuitry	Electrical Rating	Body** Style	Catalog Listings					
			Standard	Low Differential	5° Pretravel	Low Torque	Low Differential Low Torque	Top Rotary High Overtravel
Silver contacts	A	Plug-in 1/2" Conduit	LSA1A	LSP1A	LSU1A	LSR1A	LSH1A	LSB1A
Gold cross point contacts	C	Plug-in 1/2" Conduit	LSA1J		LSU1J	—	—	LSB1J
Gold plated contacts	C		LSA1E	LSP1E	—	LSR1E	LSH1E	—
Silver contacts	A*	120 V Ind. lite Plug-In* 1/2" Conduit	LSA5A	LSP5A	LSU5A	LSR5A	LSH5A	LSB5A
	A*	240 V Ind. lite Plug-In 1/2" Conduit	LSA8A	LSP8A	LSU8A	LSR8A	LSH8A	LSB8A
	A*	24 V LED lite 1.5mA max. Auto polarity Plug-in 1/2" Conduit	LSA9A	LSP9A	LSU9A	LSR9A	LSH9A	LSB9A
 SPDT Double Break	A	Non plug-in 1/2" Conduit	LSA3K	LSP3K	LSU3K	LSR3K	LSH3K	LSB3K
Silver contacts	B	Plug-in 3/4" Conduit	LSA2B	LSP2B	LSU2B	LSR2B	LSH2B	LSB2B
 DPDT Double Break	B	Plug-in 1/2" Conduit	LSA6B	LSP6B	LSU6B	LSR6B	LSH6B	LSB6B
	B	120 V Ind. lite Plug-in 3/4" Conduit	LSA2R	LSP2R	LSU2R	LSR2R	LSH2R	LSB2R
	B	Non plug-in 3/4" Conduit	LSA4L	LSP4L	LSU4L	LSR4L	LSH4L	LSB4L
	B	Non plug-in 1/2" Conduit	LSA7L	LSP7L	LSU7L	LSR7L	LSH7L	LSB7L
 SPNC Direct Acting	D	Non plug-in 1/2" Conduit	LSA3N			LSR3N		LSB3N

*Use at voltage indicated for light. Wired to N.O. circuit.

Upper temperature limit for lighted units is 200°F (93°C).

**Plug-in listings include base receptacle.

OPERATING CHARACTERISTICS

Pretravel (degrees max.)		15	9	5	15	9	25
Differential Travel (degrees max.)	SPDT	5	3	3	5	3	10
	DPDT	7	4	4	7	4	12
Overtravel (degrees min.)		60	66	70	60	66	110
Operating Torque (max.)	NM = Newton meters	0,45 Nm 4 in. lbs.	0,45 Nm 4 in. lbs.	0,45 Nm 4 in. lbs.	0,19 Nm 1.7 in. lbs.	0,19 Nm 1.7 in. lbs.	0,28 Nm 2.5 in. lbs.
Operating Temperature Range***		10°F to 250°F -12° to 121°C			30°F to 250°F -1° to 121°C		

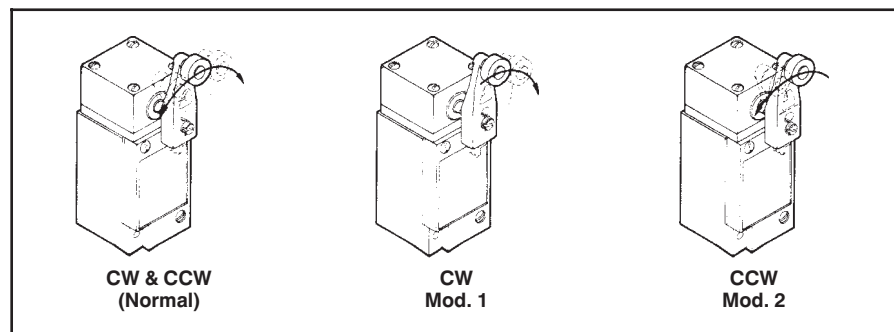
***Completely fluorocarbon-sealed switches are preferred for use in temperatures above 200°F (93°C). Refer to page A42.

Limit/Enclosed

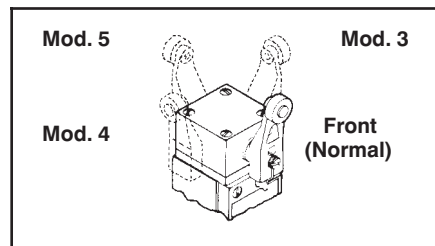
Rotary Actuated Switches

ACTUATION DIRECTION

(Drawings apply to listings on facing page only).



HEAD ORIENTATION



ASSEMBLY MODIFICATIONS

How to order

Momentary action rotary switches can be furnished in other than the normal assembled conditions described on the facing page. To specify modifications, add the number(s) shown below to the catalog listings. Prices are the same as their counterparts shown in the order guide.

Modification number suffixes are:

- 1 Clockwise operation only
- 2 Counterclockwise operation only
- 3 Shaft to right of switch front
- 4 Shaft to left of switch front
- 5 Shaft to back of switch
- 7 Indicator light wired to N.C. circuit

Examples:

Catalog Listing LSA1A23 is an LSA1A switch adjusted for counterclockwise operation only. The operating shaft is to the right side of the switch when viewing it from the front (label side). No lever.

Catalog Listing LSA8A7 is an LSA8A switch with the 240 volt indicator light wired to the N.C. circuit. No lever.

Switches with assembly modifications are not normally stocked and may extend delivery leadtimes.

LEVERS

Levers for rotary actuated switches are normally ordered as separate catalog listings. They also may be ordered by including a suffix to the switch catalog listing and adding the lever price. See pages A34-A39.

SWITCHES FOR SPECIAL APPLICATIONS

HDLS limit switches for special application needs are described on pages A42 and A43. They include: manifold mount, low temperature, complete fluorocarbon-sealed, gravity return, extra low torque and 20 Amp switches.

Adapter plates for interchanging HDLS with LS/200LS limit switches are described on page A49.

ELECTRICAL RATINGS

10 amps continuous carry (except for electrical rating "C"). Circuits on any one pole must be the same polarity.

AC Volts

Pilot duty: 600 VAC, 720VA

Electrical Rating	Circuitry	VAC	Amps at 0.35 Power Factor	
			Make	Break
A*	Single-Pole Double-Throw	120	60	6
		240	30	3
		480	15	1.5
		600	12	1.2
B	Double-Pole Double-Throw	120	30	3
		240	15	1.5
		480	7.5	0.75
		600	6	0.60
D	Single-Pole Single-Throw Normally Closed	120	60	6
		240	30	3
		480	15	1.5
		600	12	1.2
C**	Single-Pole Double-Throw	250 VAC or 60 VDC, .050 amp max.		

DC Volts

Pilot duty: 240 VDC, 30 watts

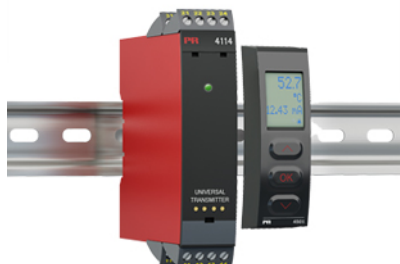
Electrical Rating	Circuitry	VDC	Make and Break Amps	
			Inductive	Resistive
A*	Single-Pole Double-Throw	120	0.25	0.8
		240	0.15	0.4
B	Double-Pole Double-Throw	120	0.25	0.8
		240	0.15	0.4
D	Single-Pole Single-Throw Normally Closed	30	4.3	4.3
		120	1.1	1.1
C**	Single-Pole Double-Throw	250 VAC or 60 VDC, .050 amp max.		

*For switches with indicator light, use only at voltage stated for indicator light.

**These switches have either gold plated or gold cross point contacts. Cross point contacts improve high reliability of contact make when particle contamination is a problem or low energy loads must be carried.

Universal transmitter

4114



- Input for RTD, TC, Ohm, potentiometer, mA and V
- 2-wire supply > 16 V
- FM-approved for installation in Div. 2
- Output for current and voltage
- Universal AC or DC supply



Advanced features

- Programmable by way of detachable display front (4501), process calibration, signal simulation, password protection, error diagnostics and help text available in several languages.

Application

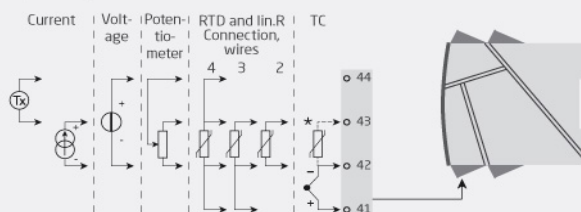
- Linearized, electronic temperature measurement with RTD or TC sensor.
- Conversion of linear resistance variation to a standard analog current / voltage signal, i.e. from solenoids and butterfly valves or linear movements with attached potentiometer.
- Power supply and signal isolator for 2-wire transmitters.
- Process control with standard analog output.
- Galvanic separation of analog signals and measurement of floating signals.
- The 4114 is designed according to strict safety requirements and is therefore suitable for application in SIL 2 installations.

Technical characteristics

- When 4114 is used with the 4501 display / programming front, all operational parameters can be modified to suit any application. As the 4114 is designed with electronic hardware switches, it is not necessary to open the device for setting of DIP-switches.
- A green / red front LED indicates normal operation and malfunction.
- Continuous check of vital stored data for safety reasons.
- 3-port 2.3 kVAC galvanic isolation.

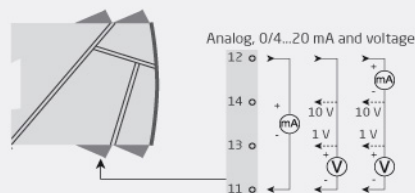
Applications

Input signals:

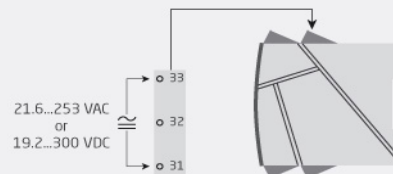


*Order separately: CJC connector 5910.

Output signals:



Supply:



Order:

Type
4114

Environmental Conditions

Operating temperature.....	-20°C to +60°C
Storage temperature.....	-20°C to +85°C
Calibration temperature.....	20...28°C
Relative humidity.....	< 95% RH (non-cond.)
Protection degree.....	IP20

Mechanical specifications

Dimensions (HxWxD).....	109 x 23.5 x 104 mm
Dimensions (HxWxD) w/ 4501/451x.....	109 x 23.5 x 116 / 131 mm
Weight approx.....	155 g
Weight incl. 4501 / 451x (approx.).....	170 g / 185 g
Wire size.....	1 x 2.5 mm ² stranded wire
Screw terminal torque.....	0.5 Nm
Vibration.....	IEC 60068-2-6
2...13.2 Hz.....	±1 mm
13.2...100 Hz.....	±0.7 g

Common specifications

Supply	
Supply voltage, universal.....	21.6...253 VAC, 50...60 Hz or 19.2...300 VDC
Fuse.....	400 mA SB / 250 VAC
Max. required power.....	≤ 2.0 W

Isolation voltage

Isolation voltage, test / working.....	2.3 kVAC / 250 VAC
--	--------------------

Response time

Temperature input (0...90%, 100...10%).....	≤ 1 s
mA / V input (0...90%, 100...10%).....	≤ 400 ms

Auxiliary supplies

2-w. supply (term. 44...43).....	25...16 VDC / 0...20 mA
Programming.....	PR 45xx
Signal / noise ratio.....	Min. 60 dB (0...100 kHz)
Accuracy.....	Better than 0.1% of sel. range
EMC immunity influence.....	< ±0.5% of span
Extended EMC immunity: NAMUR NE21, A criterion, burst.....	< ±1% of span

Input specifications

RTD input

RTD type.....	Pt10/20/50/100/200/250; Pt300/400/500/1000; Ni50/100/120/1000; Cu10/20/50/100
Cable resistance per wire.....	50 Ω (max.)
Sensor current.....	Nom. 0.2 mA
Effect of sensor cable resistance (3-/4-wire).....	< 0.002 Ω / Ω
Sensor error detection.....	Yes
Short circuit detection.....	< 15 Ω

Linear resistance input

Linear resistance min...max.....	0 Ω...10000 Ω
----------------------------------	---------------

Potentiometer input

Potentiometer min...max.....	10 Ω...100 kΩ
------------------------------	---------------

TC input

Thermocouple type.....	B, E, J, K, L, N, R, S, T, U, W3, W5, LR
------------------------	---

Cold junction compensation (CJC) via ext. sensor in

5910.....	20...28°C ≤ ±1°C, -20...20°C / 28...70°C ≤ 2°C
-----------	---

CJC via int. mounted sensor..... ±(2.0°C + 0.4°C * Δt)

Δt = Internal temp.-ambient temp.

Sensor error detection..... Yes

Sensor error current: When

detecting / else..... Nom. 2 μA / 0 μA

Current input

Measurement range.....	0...20 mA
Programmable measurement ranges.....	0...20 and 4...20 mA
Input resistance.....	Nom. 20 Ω + PTC 50 Ω
Sensor error detection: Loop break 4...20 mA.....	Yes

Voltage input

Measurement range.....	0...12 VDC
Programmable measurement ranges.....	0/0.2...1, 0/1...5, 0/2...10 VDC
Input resistance.....	Nom. 10 MΩ

Output specifications

Current output

Signal range.....	0...20 mA
Programmable signal ranges.....	0...20/4...20/20...0/20...4 mA
Load (@ current output).....	≤ 800 Ω
Load stability.....	≤ 0.01% of span / 100 Ω
Sensor error indication.....	0 / 3.5 / 23 mA / none
NAMUR NE43 Upscale/Downscale.....	23 mA / 3.5 mA
Output limitation, on 4...20 and 20...4 mA signals.....	3.8...20.5 mA
Output limitation, on 0...20 and 20...0 mA signals.....	0...20.5 mA
Current limit.....	≤ 28 mA

Voltage output

Signal range.....	0...10 VDC
Programmable signal ranges.....	0/0.2...1; 0/1...5; 0/2...10; 1...0.2/0; 5...1/0; 10...2/0 V
Load (@ voltage output).....	≥ 500 kΩ
of span.....	= of the currently selected measurement range

Observed authority requirements

EMC.....	2014/30/EU
LVD.....	2014/35/EU
EAC.....	TR-CU 020/2011

Approvals

FM.....	3025177
UL.....	UL 508 / C22.2 no. 14
DNV-GL Marine.....	Stand. f. Certific. No. 2.4
EU RO Mutual Recognition Type Approval.....	MRA000000Z
SIL.....	Hardware assessed for use in SIL applications



Display / programming front

4501

- Modification of operational parameters in system 4000 and 9000 devices
- Fixed display for visualisation of process data and status
- Password protection
- Scrolling help text in 7 languages
- Clicks on to the front of the device mounted in the process

ERC

Application

- Communications interface for modification of operational parameters in system 4000 and 9000 devices.
- Can be moved from one device to another of the same type and download the configuration of the first device to subsequent devices.
- Fixed display for visualization of process data and status.

Technical characteristics

- LCD display with 4 lines featuring scrolling help text in 7 languages which guides the user effortlessly through all the configuration steps.
- Programming access can be blocked by assigning a password. The password is saved in the device in order to ensure a high degree of protection against unauthorized modifications to the configuration.

Mounting / installation

- Click 4501 onto the front of the device mounted in the process.
- The display module 4501 is approved and certified as an add-on component to the 4000 and 9000 series of devices. For more information on the 4501 refer to the manual of the specific device in the 4000 or 9000 series where the 4501 is attached.

Structural Calculations

Certificate of Design

Certificate of Design

Project Name: Brantford WWTP

Project Number: 24946A

Specification Section: 11450 Secondary Clarifier Mechanism

The following standards have been utilized in the design of the mechanism:

NBCC 2020

Specification section 11450 with exceptions and clarifications as listed in the Letter of Clarification

The type and strength of materials to be used in the:

304 Stainless Steel

$F_y = 30,000$ psi

$F_u = 75,000$ psi

The loading conditions used in the design of the clarifier:

Horizontal Seismic Load: $0.11 \times \text{Dead Load}$

Platform & Walkway:

Walkway Flooring: 5 psf

Platform Flooring: 6 psf

Handrail: 5 plf

Live Load: 50 psf

Snow Load: 37.6 psf

Wind Load: 12.73 psf

Maximum deflection: $L/360$

Rake Arms & Cage:

Continuous Torque: 21,833 ft-lbs

Design Torque: 43,666 ft-lbs (200% Continuous)

Torque Test: 32,750 ft-lbs (150% Continuous)

EDI Load: 1345 lbs steel; 4902 lbs water

Feedwell Load: 2800 lbs

Spiral Blade Load (Total): 1170 lbs

Column & Walkway Anchors:

See calculations for loadings and design

The mechanism is designed to withstand the design loads as specified.



Rake and Cage

Bentley Software licensed to Westech Engineering Inc CONNECTED User: Jennifer MEIKLE	WESTECH		Job No 24946A	Sheet No 1	Rev 0
	Part Rakes & Cage				
Job Title Brantford WWTP			Ref		
Client			By ME75	Date 08/02/2023	Chd
			File R&C STAAD 24946A 06.1	Date/Time 18-Aug-2023 14:12	

Job Information

	Engineer	Checked	Approved
Name:	ME75	HO93	
Date:	08/02/2023	8/22/23	

pg. 1-24

Project ID	
Project Name	

Comments

Designed to NBCC 2020
 304 Stainless Steel
 Mechanism Design Torque: 43666 ft-lbs
 Max Continuous Torque: 21833 ft-lbs
 Torque Test: 32750 ft-lbs
 Feedwell Diameter: 13.12 ft
 Feedwell Weight: 2800 lbs
 EDI Diameter: 8 ft
 EDI Steel Weight: 1345 lbs
 EDI Water Weight: 4902 lbs
 Spiral Blade Weight: 1170 lbs
 Horizontal Seismic: $EH = 0.11 * Wp$
 These structural calculations represent the minimum member size necessary to satisfy the requirement of the specification. WesTech reserves the option of increasing the member size to facilitate design or fabrication requirements.

Structure Type	SPACE FRAME
----------------	-------------

Number of Nodes	90	Highest Node	309
Number of Elements	246	Highest Beam	1098

Number of Basic Load Cases	16
Number of Combination Load Cases	0

Included in this printout are data for:

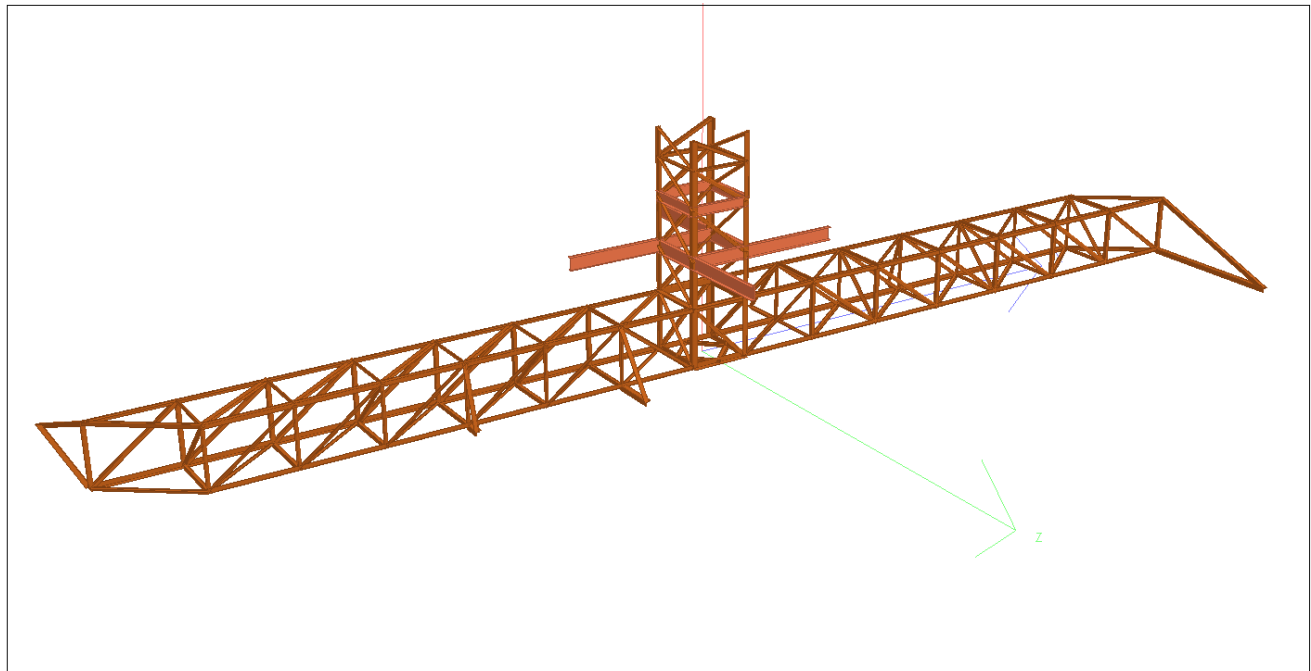
All	The Whole Structure
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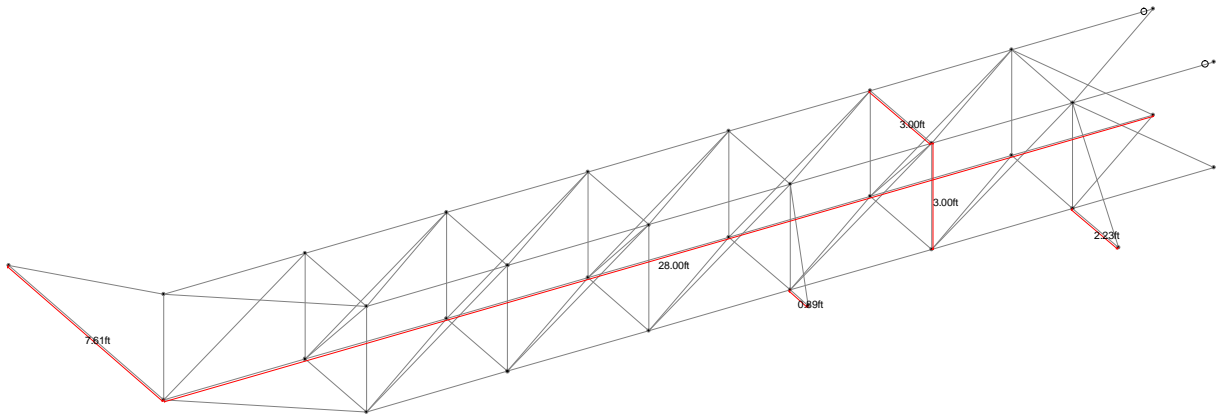
Job Information Cont...

Included in this printout are results for load cases:

Type	L/C	Name
Primary	1	GRAVITY
Primary	2	CONTINUOUS TORQUE
Primary	3	TORQUE TEST
Primary	4	EDI WELL STEEL LOAD
Primary	5	EDI WELL WATER LOAD
Primary	6	FEEDWELL LOAD
Primary	7	SPIRAL BLADE LOAD
Primary	8	EH(Z) SEISMIC LOADS
Primary	9	EH(X) SEISMIC LOADS
Primary	100	1.4D
Primary	101	1.25D + OPERATING
Primary	102	1.25D + CUT-OUT TORQUE
Primary	103	1.0D + EH(X)
Primary	104	1.0D + EH(Z)
Primary	200	D
Primary	201	D + OPERATING

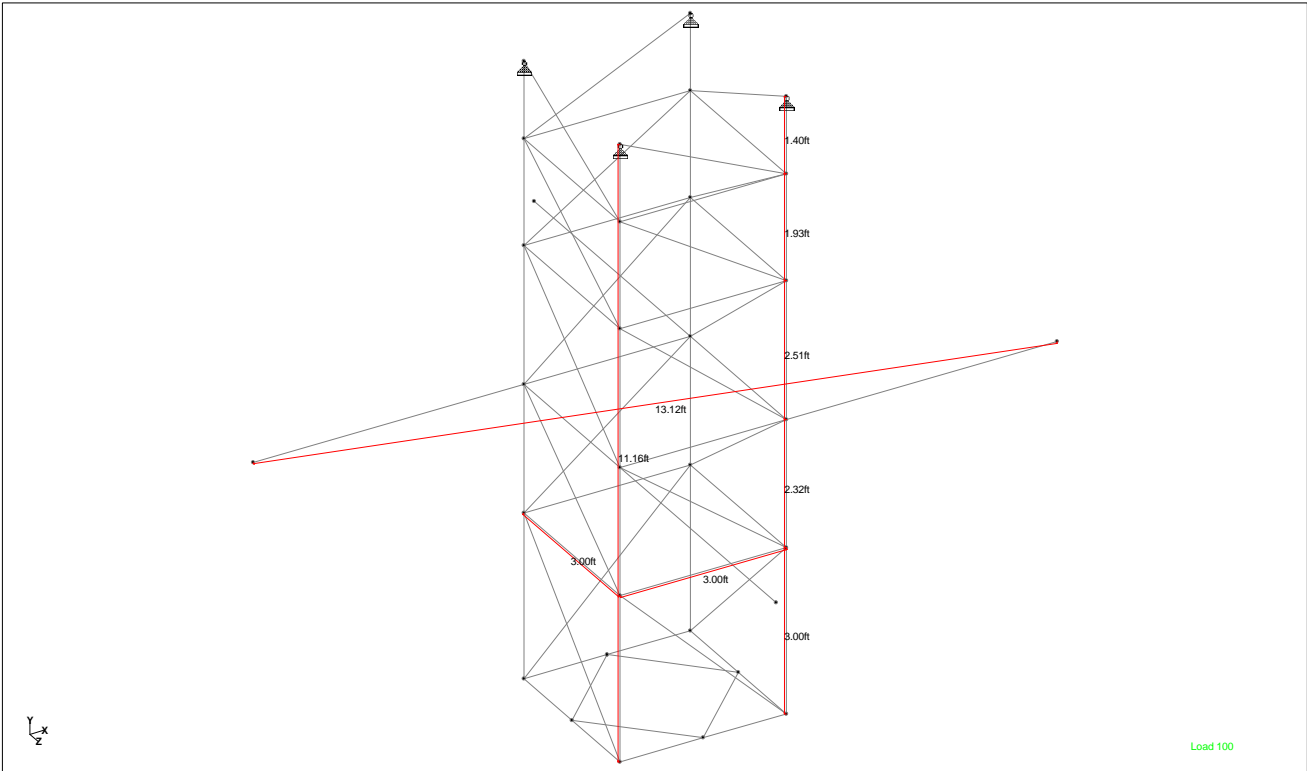


Rake Arms and Cage



Rake Arm Dimensions

Bentley Software licensed to Westech Engineering Inc CONNECTED User: Jennifer MEIKLE	WESTECH		Job No 24946A	Sheet No 4	Rev 0
	Part Rakes & Cage				
Job Title Brantford WWTP			Ref		
Client			By ME75	Date 08/02/2023	Chd
Client			File R&C STAAD 24946A 06.1	Date/Time 18-Aug-2023 14:12	



Cage Dimensions

Section Properties

Prop	Section	Area (in ²)	I _{yy} (in ⁴)	I _{zz} (in ⁴)	J (in ⁴)	Material
1	L30304	1.440	1.982	0.506	0.030599	STAINLESSST
2	L20204	0.944	0.550	0.146	0.020	STAINLESSST
3	L35356	2.500	4.542	1.188	0.120	STAINLESSST
4	L30306	2.110	2.793	0.727	0.102	STAINLESSST
5	L25254	1.190	1.118	0.288	0.025	STAINLESSST
6	L20204	0.944	0.550	0.146	0.020	STAINLESSST
7	C8X11	3.370	1.310	32.500	0.130	STAINLESSST
8	L20204	0.944	0.550	0.146	0.020	STAINLESSST
9	L20204	0.944	0.550	0.146	0.020	STAINLESSST
10	L25254	1.190	1.118	0.288	0.025	STAINLESSST
11	L25254	1.190	1.118	0.288	0.025	STAINLESSST
12	L20204	0.944	0.550	0.146	0.020	STAINLESSST
13	L20204	0.944	0.550	0.146	0.020	STAINLESSST
14	C6X10	3.070	0.860	15.100	0.128	STAINLESSST
15	L30304	1.440	1.982	0.506	0.030599	STAINLESSST
16	L25254	1.190	1.118	0.288	0.025	STAINLESSST

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Part Rakes & Cage

Ref

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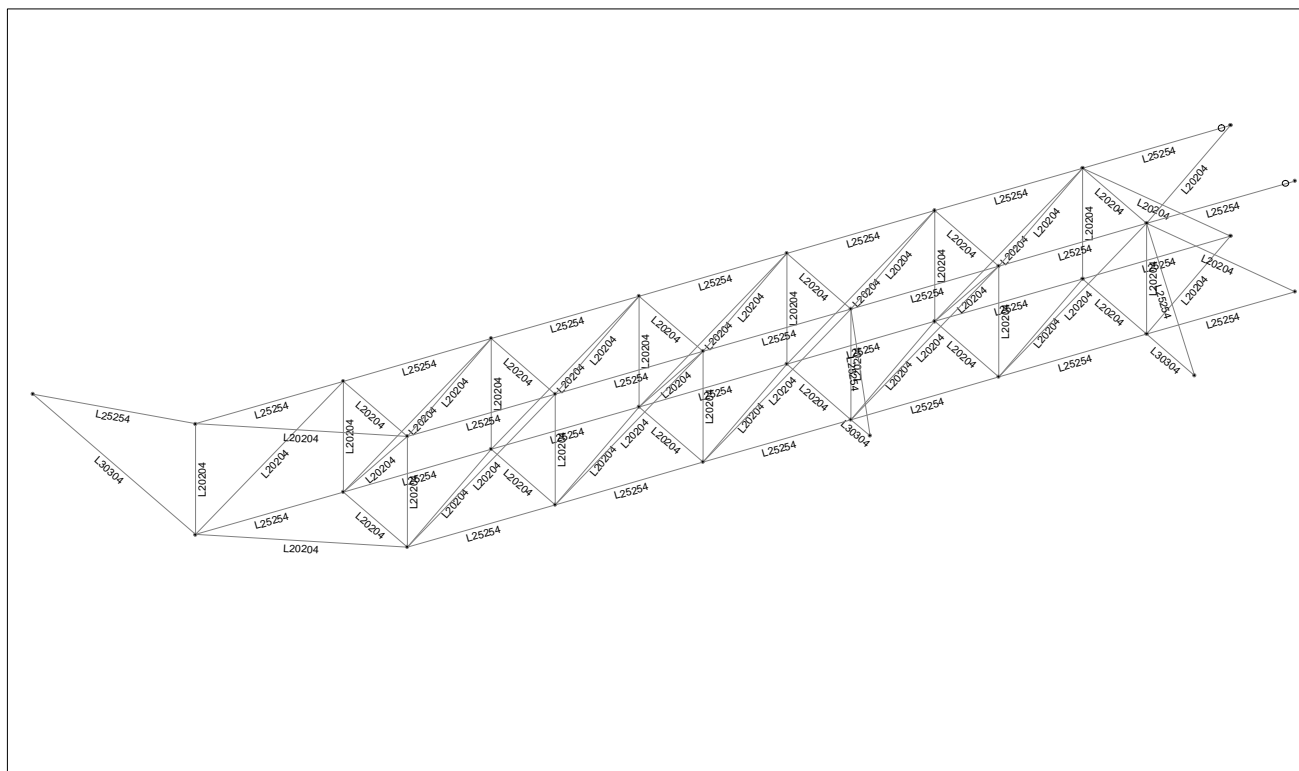
Date 08/02/2023

Chd

Client	
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Rake Arm Member Sizes

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Job Title	Brantford WWTP
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Part Rakes & Cage

Ref

By ME75

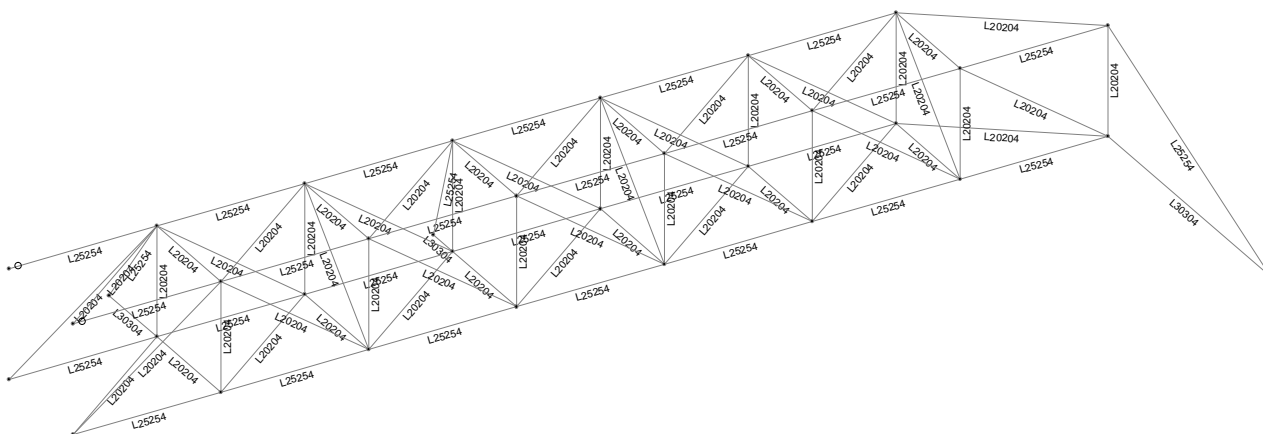
Date 08/02/2023

Chd

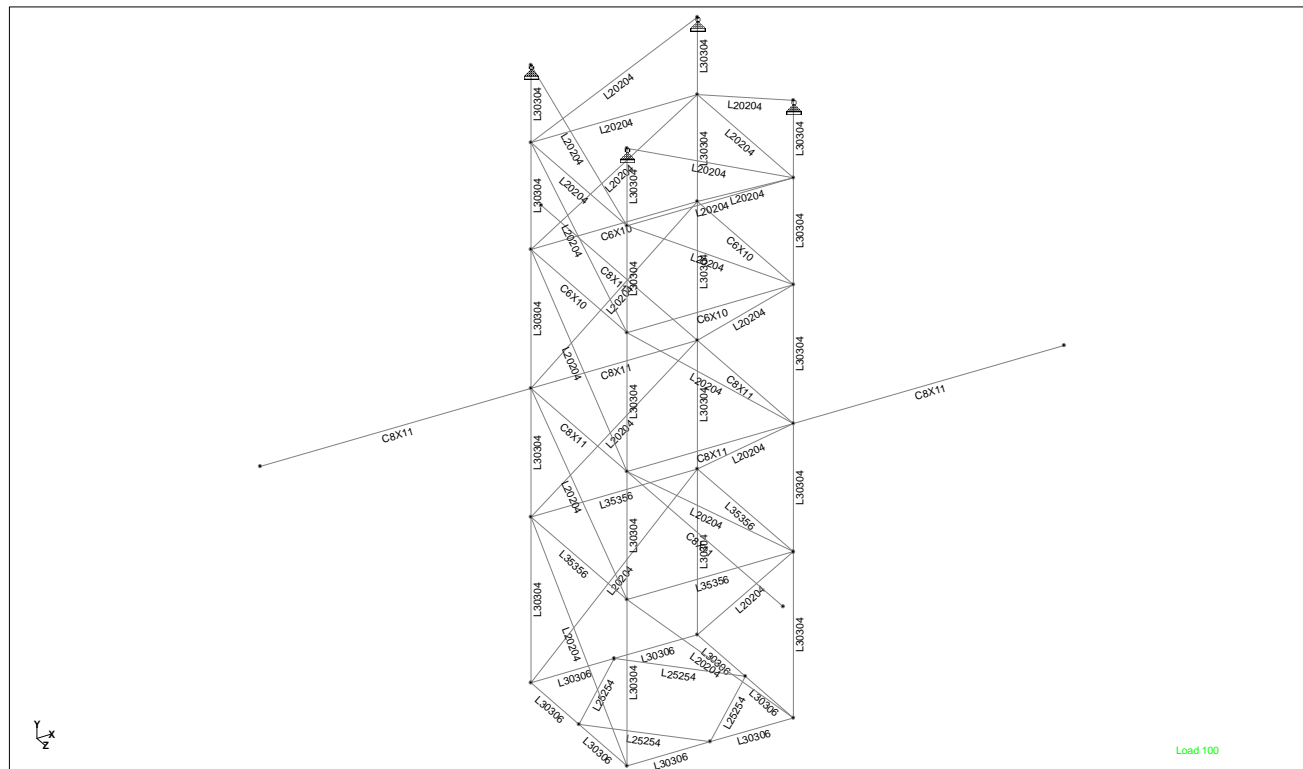
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1 | Date/Time 18-Aug-2023 14:12



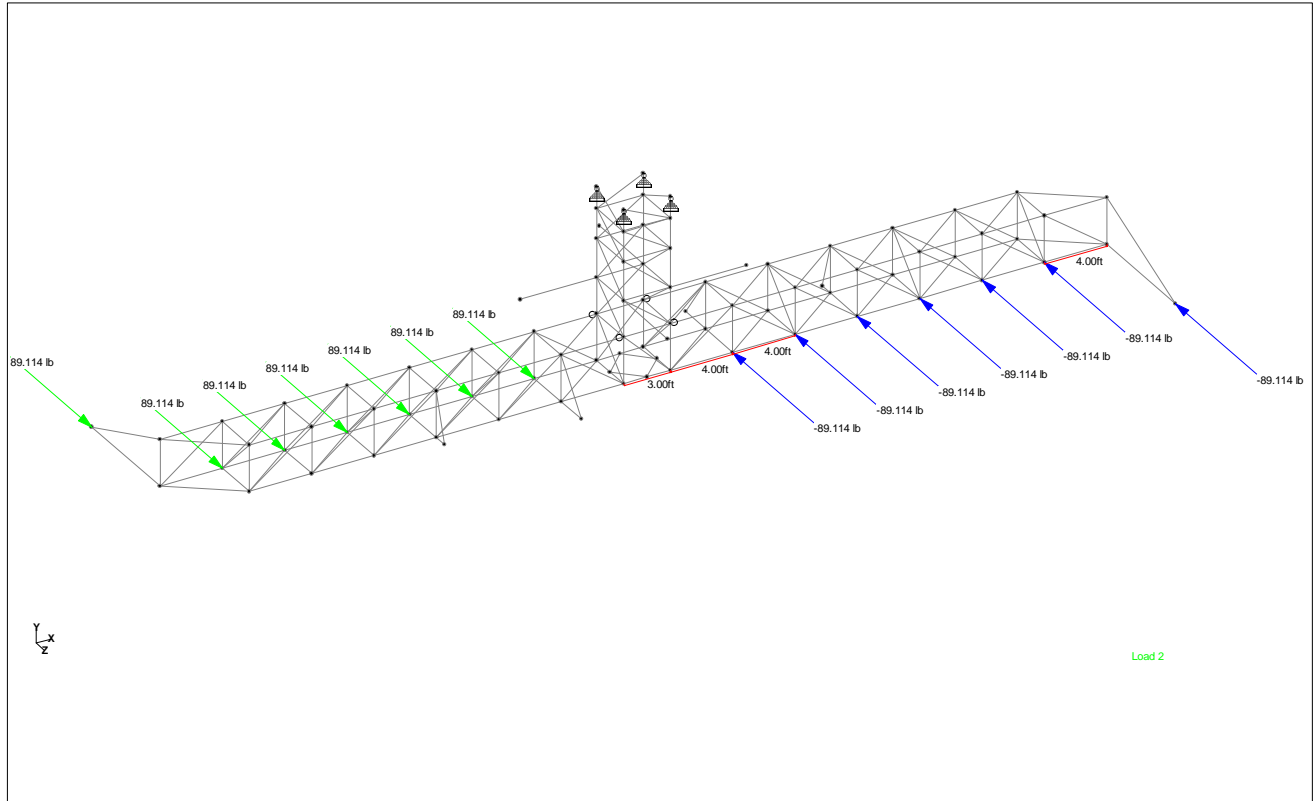
Rake Arm Member Sizes



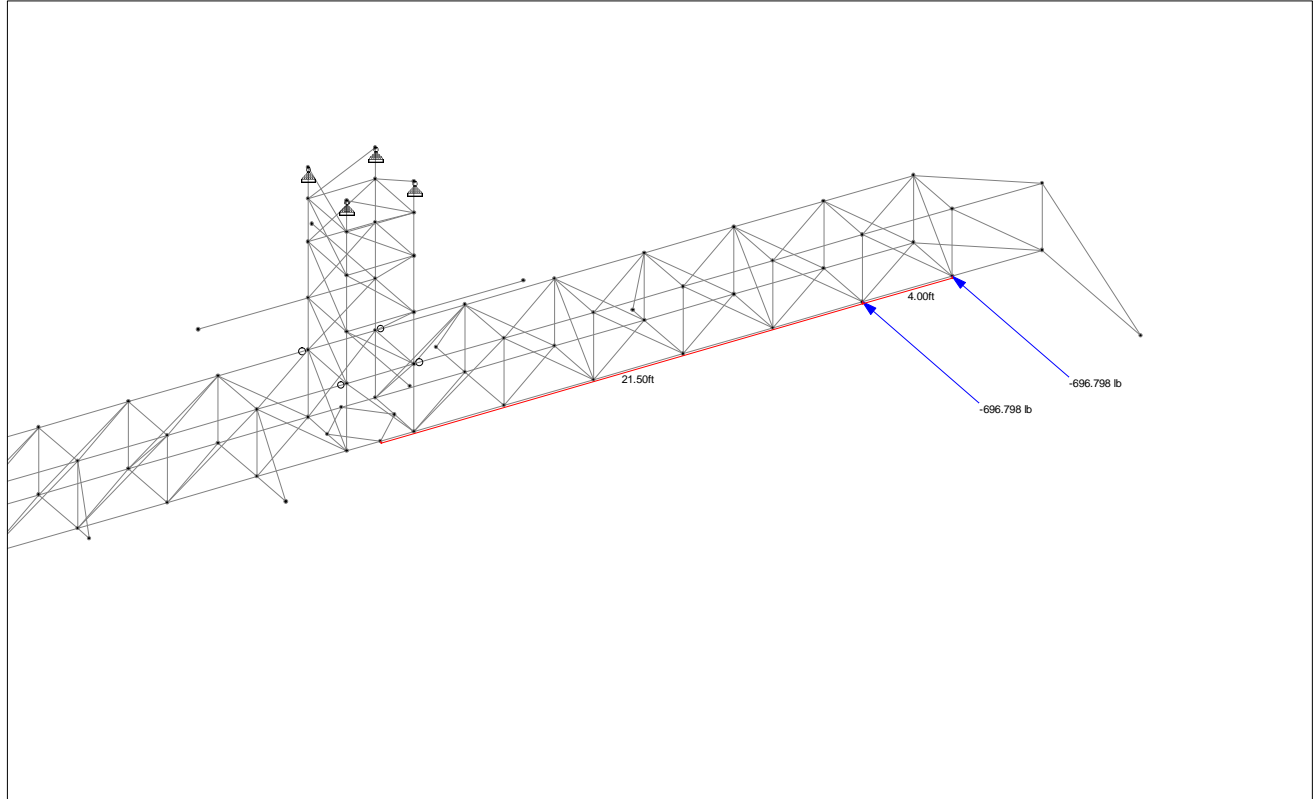
Cage Member Sizes

Primary Load Cases

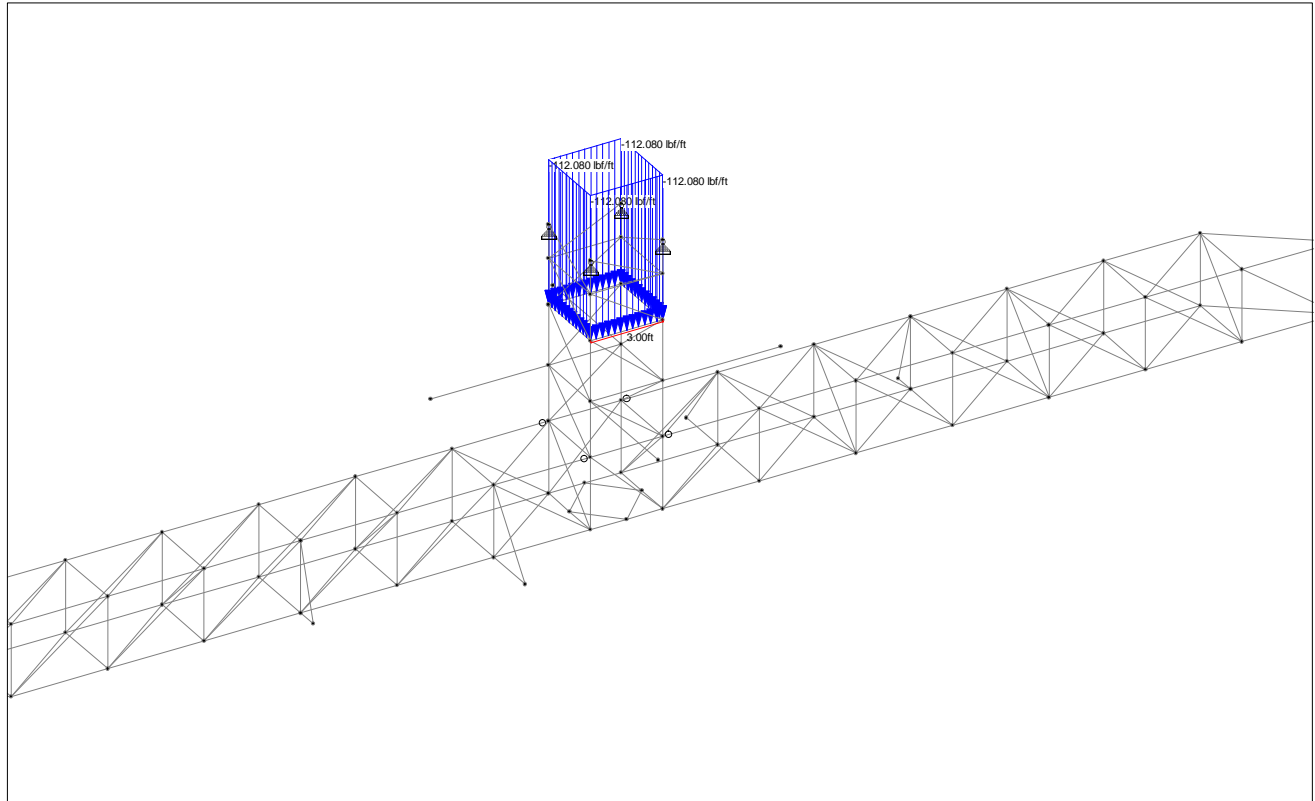
Number	Name	Type
1	GRAVITY	None
2	CONTINUOUS TORQUE	None
3	TORQUE TEST	None
4	EDI WELL STEEL LOAD	None
5	EDI WELL WATER LOAD	None
6	FEEDWELL LOAD	None
7	SPIRAL BLADE LOAD	None
8	EH(Z) SEISMIC LOADS	None
9	EH(X) SEISMIC LOADS	None
100	1.4D	None
101	1.25D + OPERATING	None
102	1.25D + CUT-OUT TORQUE	None
103	1.0D + EH(X)	None
104	1.0D + EH(Z)	None
200	D	None
201	D + OPERATING	None



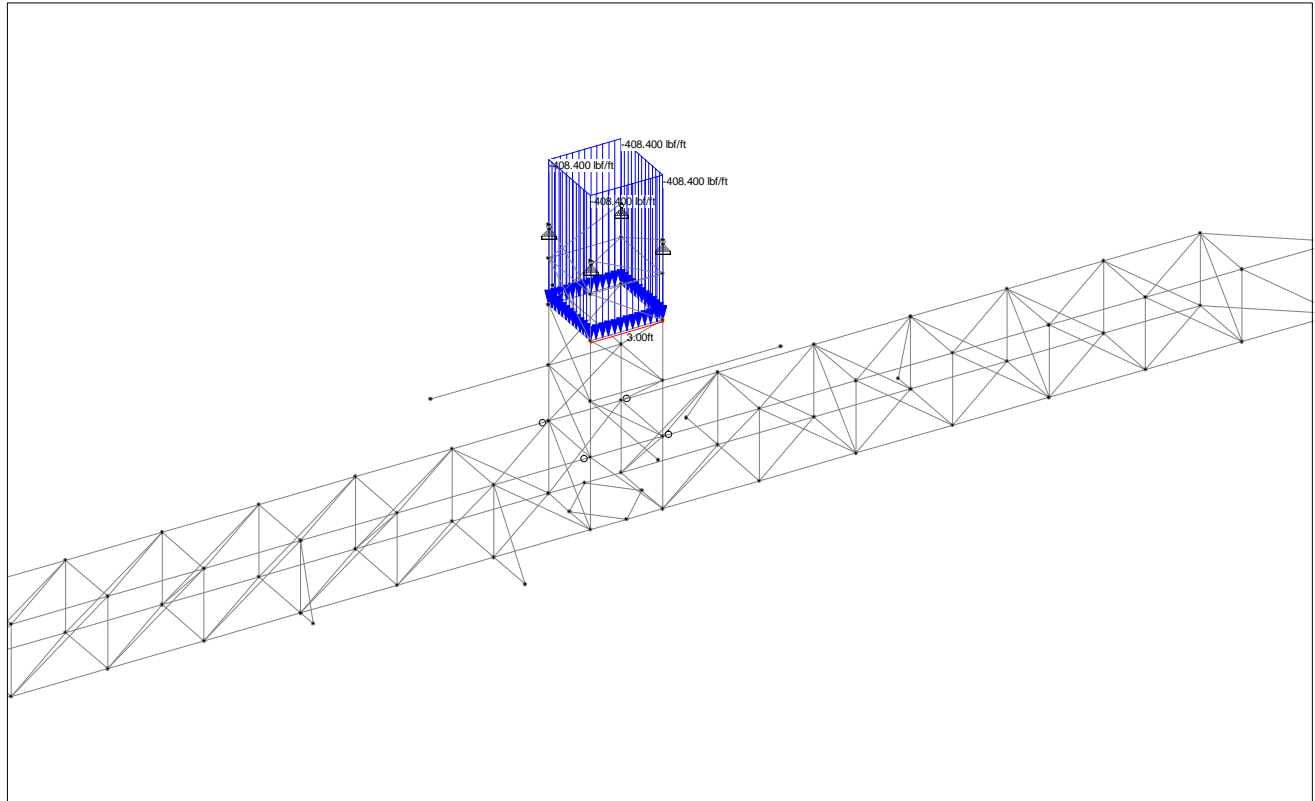
Continuous Torque (21,833 ft-lbs)



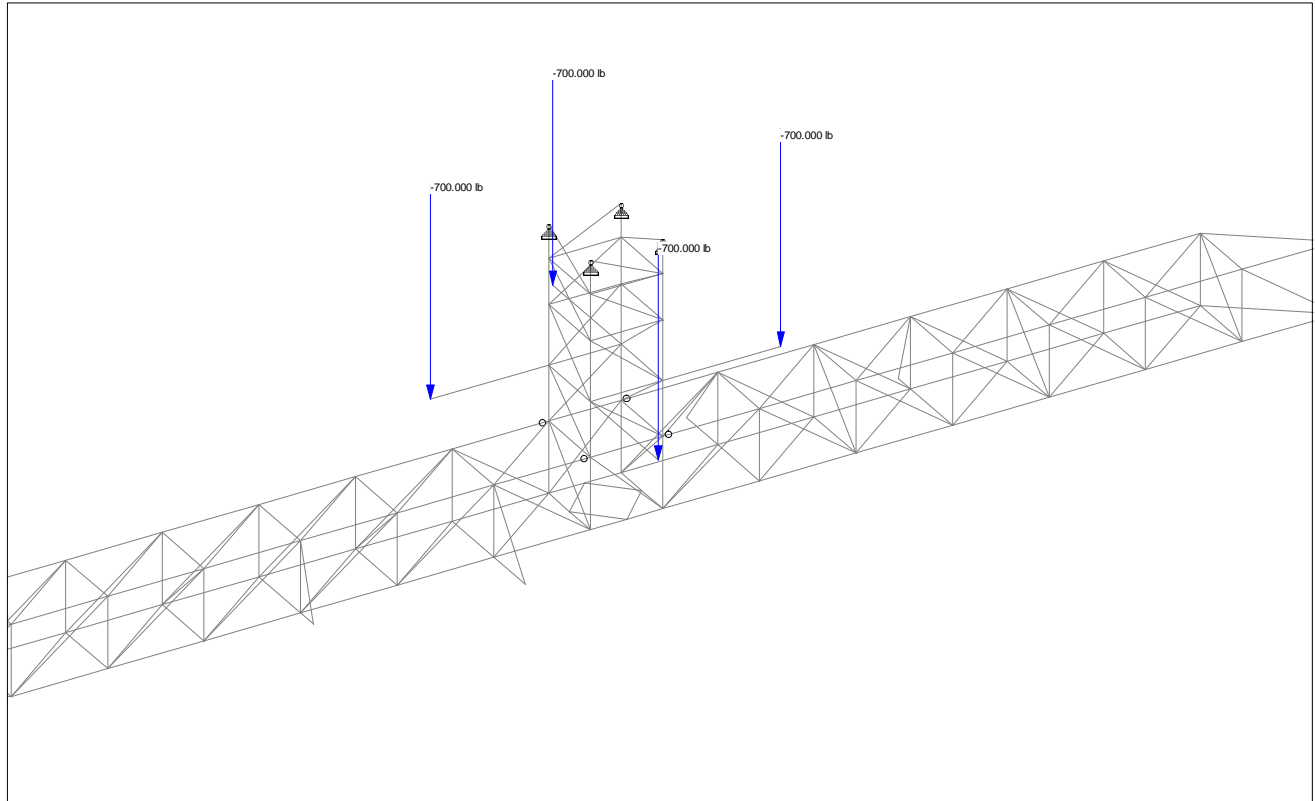
Torque Test (32,750 ft-lbs)



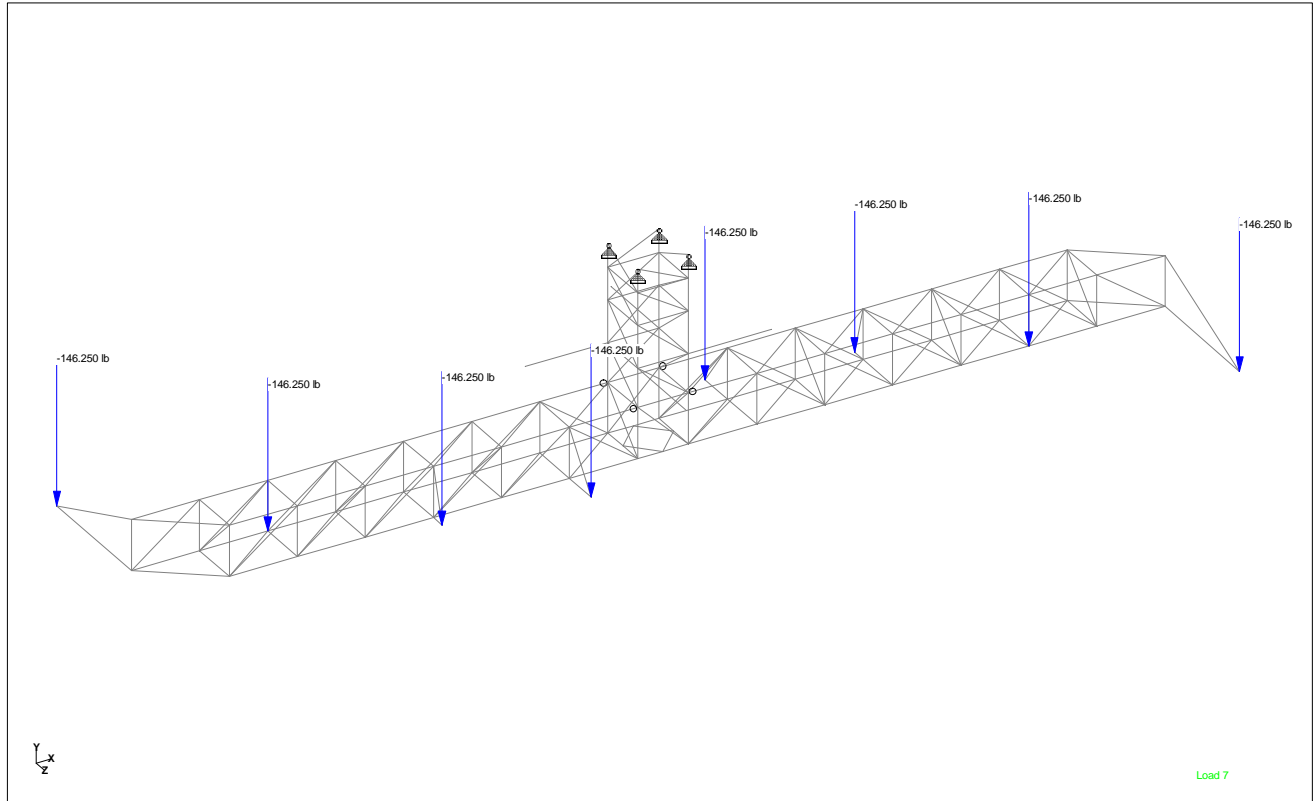
EDI Well Steel Load (1345 lbs)



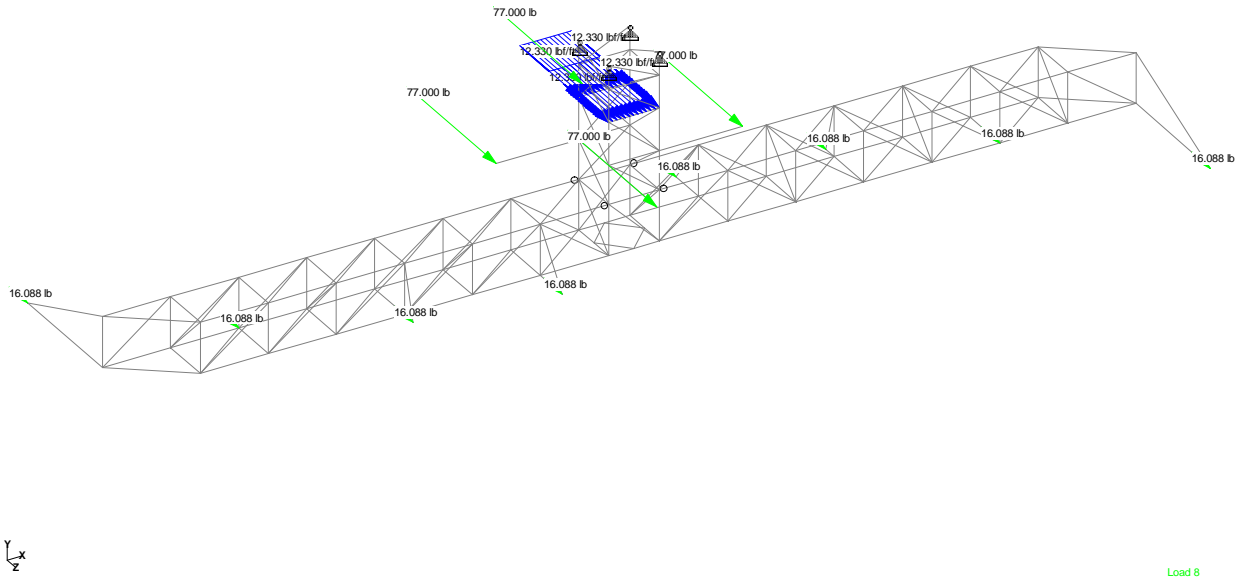
EDI Well Water Load (4900 lbs)



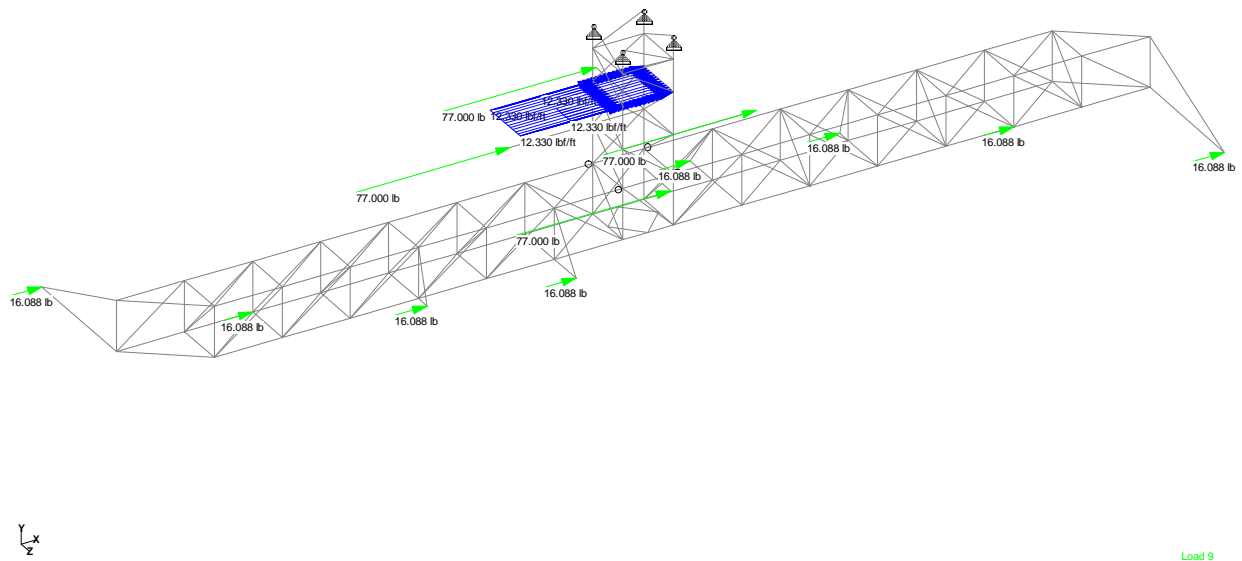
Feedwell Load (2800 lbs)



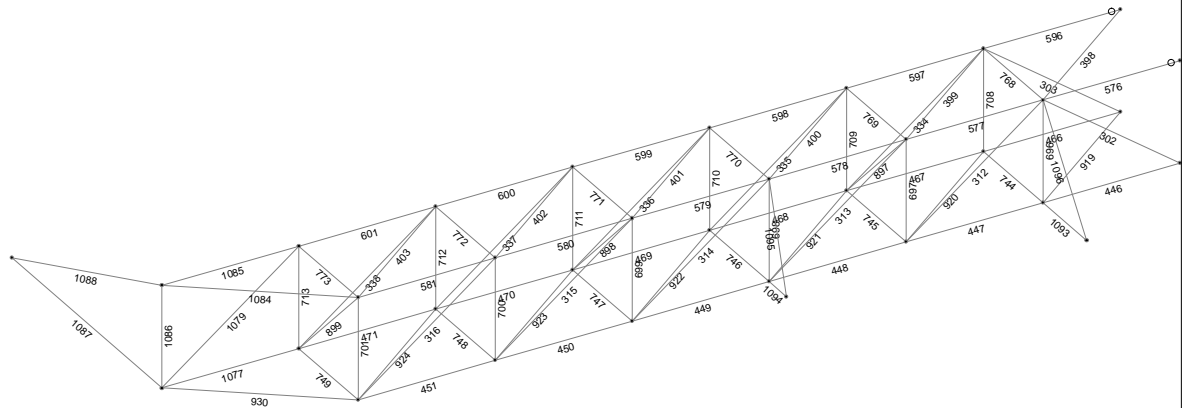
Spiral Blade Load (1170 lbs)



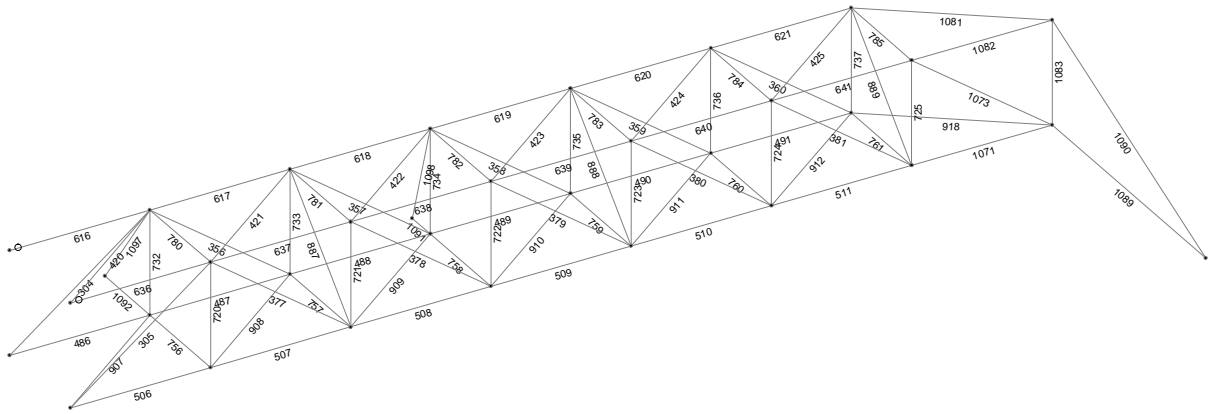
*Seismic Load-Z (0.11*Dead Loads)*



*Seismic Load-X (0.11*Dead Loads)*

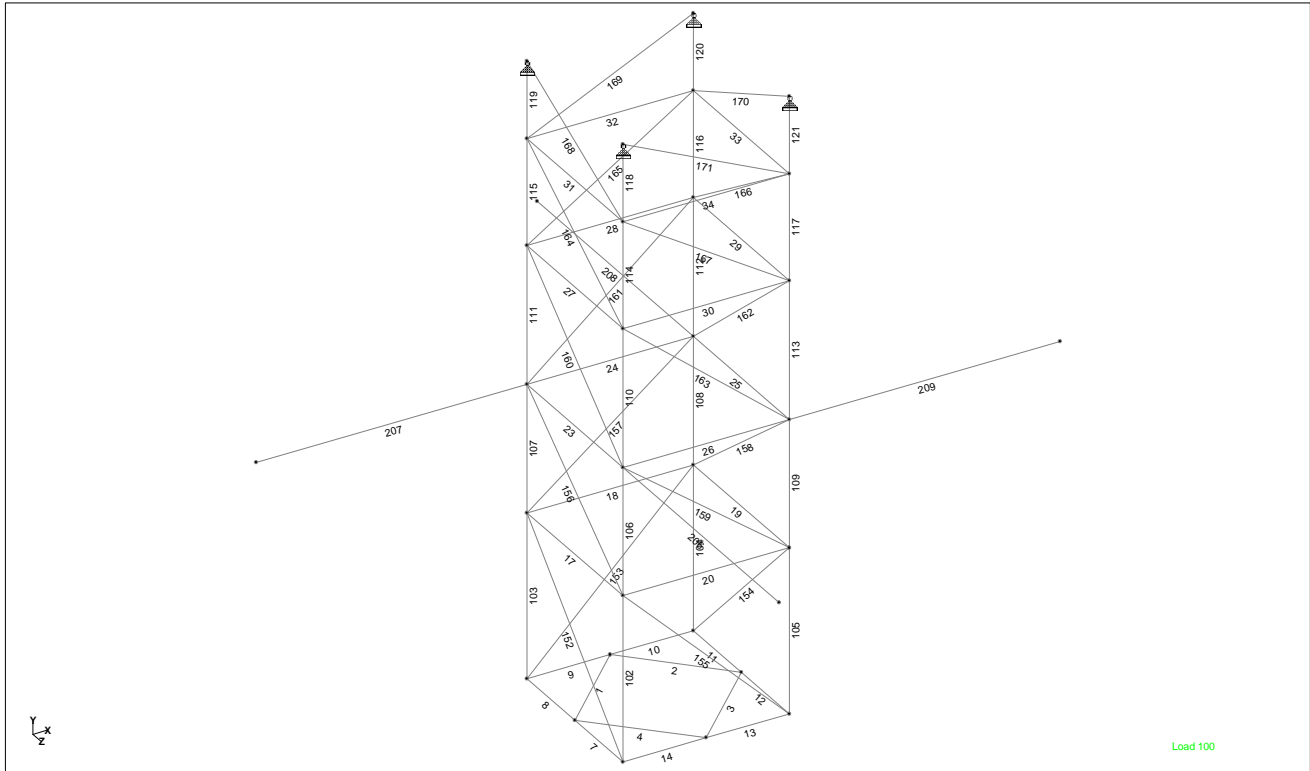


Beam Numbers



Beam Numbers



Bentley Software licensed to Westech Engineering Inc CONNECTED User: Jennifer MEIKLE	WESTECH		Job No 24946A	Sheet No 18	Rev 0
	Part Rakes & Cage				
Job Title Brantford WWTP			Ref		
Client			By ME75	Date 08/02/2023	Chd
			File R&C STAAD 24946A 06.1	Date/Time 18-Aug-2023 14:12	



Beam Numbers



Utilization Ratio

Beam	Analysis Property	Design Property	Actual Ratio	Allowable Ratio	Ratio (Act./Allow.)	Clause	L/C	Ax (in ²)	Iz (in ⁴)	Iy (in ⁴)	Ix (in ⁴)
1	L25254	L25254	0.160	1.000	0.160	Cl. 13.8.4	101	1.190	0.276	1.130	0.025
2	L25254	L25254	0.138	1.000	0.138	Cl. 13.9.1	101	1.190	0.276	1.130	0.025
3	L25254	L25254	0.160	1.000	0.160	Cl. 13.8.4	101	1.190	0.276	1.130	0.025
4	L25254	L25254	0.138	1.000	0.138	Cl. 13.9.1	101	1.190	0.276	1.130	0.025
7	L30306	L30306	0.208	1.000	0.208	Cl. 13.8.4	101	2.110	0.712	2.807	0.099
8	L30306	L30306	0.097	1.000	0.097	Cl. 13.8.4	101	2.110	0.712	2.807	0.099
9	L30306	L30306	0.181	1.000	0.181	Cl. 13.8.4	102	2.110	0.712	2.807	0.099
10	L30306	L30306	0.314	1.000	0.314	Cl. 13.8.4	102	2.110	0.712	2.807	0.099
11	L30306	L30306	0.208	1.000	0.208	Cl. 13.8.4	101	2.110	0.712	2.807	0.099
12	L30306	L30306	0.097	1.000	0.097	Cl. 13.8.4	101	2.110	0.712	2.807	0.099
13	L30306	L30306	0.162	1.000	0.162	Cl. 13.8.4	100	2.110	0.712	2.807	0.099
14	L30306	L30306	0.257	1.000	0.257	Cl. 13.8.4	101	2.110	0.712	2.807	0.099
17	L35356	L35356	0.426	1.000	0.426	Cl. 13.8.4	101	2.500	1.166	4.564	0.117
18	L35356	L35356	0.492	1.000	0.492	Cl. 13.9.1	101	2.500	1.166	4.564	0.117
19	L35356	L35356	0.426	1.000	0.426	Cl. 13.8.4	101	2.500	1.166	4.564	0.117
20	L35356	L35356	0.492	1.000	0.492	Cl. 13.9.1	101	2.500	1.166	4.564	0.117
23	C8X11	C8X11	0.479	1.000	0.479	Cl. 13.8.4	101	3.370	32.500	1.310	0.121
24	C8X11	C8X11	0.481	1.000	0.481	Cl. 13.8.4	101	3.370	32.500	1.310	0.121
25	C8X11	C8X11	0.479	1.000	0.479	Cl. 13.8.4	101	3.370	32.500	1.310	0.121

 	Job No 24946A	Sheet No 19	Rev 0
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Utilization Ratio Cont...

Beam	Analysis Property	Design Property	Actual Ratio	Allowable Ratio	Ratio (Act./Allow.)	Clause	L/C	Ax (in ²)	Iz (in ⁴)	Iy (in ⁴)	Ix (in ⁴)
26	C8X11	C8X11	0.481	1.000	0.481	Cl. 13.8.4	101	3.370	32.500	1.310	0.121
27	C6X10	C6X10	0.338	1.000	0.338	Cl. 13.8.4	101	3.070	15.100	0.860	0.115
28	C6X10	C6X10	0.385	1.000	0.385	Cl. 13.8.4	101	3.070	15.100	0.860	0.115
29	C6X10	C6X10	0.338	1.000	0.338	Cl. 13.8.4	101	3.070	15.100	0.860	0.115
30	C6X10	C6X10	0.385	1.000	0.385	Cl. 13.8.4	101	3.070	15.100	0.860	0.115
31	L20204	L20204	0.752	1.000	0.752	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
32	L20204	L20204	0.966	1.000	0.966	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
33	L20204	L20204	0.752	1.000	0.752	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
34	L20204	L20204	0.966	1.000	0.966	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
102	L30304	L30304	0.300	1.000	0.300	Cl. 13.8.4	101	1.440	0.493	1.996	0.03
103	L30304	L30304	0.215	1.000	0.215	Cl. 13.9.1	101	1.440	0.493	1.996	0.03
104	L30304	L30304	0.300	1.000	0.300	Cl. 13.8.4	101	1.440	0.493	1.996	0.03
105	L30304	L30304	0.215	1.000	0.215	Cl. 13.9.1	101	1.440	0.493	1.996	0.03
106	L30304	L30304	0.852	1.000	0.852	Cl. 13.8.4	101	1.440	0.493	1.996	0.03
107	L30304	L30304	0.651	1.000	0.651	Cl. 13.8.4	101	1.440	0.493	1.996	0.03
108	L30304	L30304	0.852	1.000	0.852	Cl. 13.8.4	101	1.440	0.493	1.996	0.03
109	L30304	L30304	0.651	1.000	0.651	Cl. 13.8.4	101	1.440	0.493	1.996	0.03
110	L30304	L30304	0.749	1.000	0.749	Cl. 13.8.4	101	1.440	0.493	1.996	0.03
111	L30304	L30304	0.774	1.000	0.774	Cl. 13.8.4	101	1.440	0.493	1.996	0.03
112	L30304	L30304	0.749	1.000	0.749	Cl. 13.8.4	101	1.440	0.493	1.996	0.03
113	L30304	L30304	0.774	1.000	0.774	Cl. 13.8.4	101	1.440	0.493	1.996	0.03
114	L30304	L30304	0.459	1.000	0.459	Cl. 13.8.4	101	1.440	0.493	1.996	0.03
115	L30304	L30304	0.623	1.000	0.623	Cl. 13.8.4	101	1.440	0.493	1.996	0.03
116	L30304	L30304	0.459	1.000	0.459	Cl. 13.8.4	101	1.440	0.493	1.996	0.03
117	L30304	L30304	0.623	1.000	0.623	Cl. 13.8.4	101	1.440	0.493	1.996	0.03
118	L30304	L30304	0.252	1.000	0.252	Cl. 13.9.1	102	1.440	0.493	1.996	0.03
119	L30304	L30304	0.237	1.000	0.237	Cl. 13.8.4	102	1.440	0.493	1.996	0.03
120	L30304	L30304	0.180	1.000	0.180	Cl. 13.9.1	101	1.440	0.493	1.996	0.03
121	L30304	L30304	0.234	1.000	0.234	Cl. 13.8.4	101	1.440	0.493	1.996	0.03
152	L20204	L20204	0.450	1.000	0.450	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
153	L20204	L20204	0.184	1.000	0.184	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
154	L20204	L20204	0.450	1.000	0.450	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
155	L20204	L20204	0.184	1.000	0.184	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
156	L20204	L20204	0.388	1.000	0.388	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
157	L20204	L20204	0.739	1.000	0.739	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
158	L20204	L20204	0.388	1.000	0.388	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
159	L20204	L20204	0.739	1.000	0.739	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
160	L20204	L20204	0.471	1.000	0.471	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
161	L20204	L20204	0.688	1.000	0.688	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
162	L20204	L20204	0.471	1.000	0.471	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
163	L20204	L20204	0.688	1.000	0.688	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
164	L20204	L20204	0.515	1.000	0.515	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
165	L20204	L20204	0.631	1.000	0.631	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
166	L20204	L20204	0.515	1.000	0.515	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
167	L20204	L20204	0.631	1.000	0.631	Cl. 13.9.1	101	0.944	0.141	0.554	0.020

 	Job No 24946A	Sheet No 20	Rev 0
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Job Title Brantford WWTP	By ME75	Date 08/02/2023	Chd
Client	File R&C STAAD 24946A 06.1	Date/Time 18-Aug-2023 14:12	



Utilization Ratio Cont...

Beam	Analysis Property	Design Property	Actual Ratio	Allowable Ratio	Ratio (Act./Allow.)	Clause	L/C	Ax (in ²)	Iz (in ⁴)	Iy (in ⁴)	Ix (in ⁴)
168	L20204	L20204	0.573	1.000	0.573	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
169	L20204	L20204	0.738	1.000	0.738	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
170	L20204	L20204	0.573	1.000	0.573	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
171	L20204	L20204	0.738	1.000	0.738	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
206	C8X11	C8X11	0.410	1.000	0.410	Cl. 13.8.4	103	3.370	32.500	1.310	0.121
207	C8X11	C8X11	0.410	1.000	0.410	Cl. 13.8.4	104	3.370	32.500	1.310	0.121
208	C8X11	C8X11	0.410	1.000	0.410	Cl. 13.8.4	103	3.370	32.500	1.310	0.121
209	C8X11	C8X11	0.410	1.000	0.410	Cl. 13.8.4	104	3.370	32.500	1.310	0.121
302	L20204	L20204	0.245	1.000	0.245	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
303	L20204	L20204	0.477	1.000	0.477	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
304	L20204	L20204	0.245	1.000	0.245	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
305	L20204	L20204	0.491	1.000	0.491	Cl. 13.8.4	102	0.944	0.141	0.554	0.020
312	L20204	L20204	0.084	1.000	0.084	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
313	L20204	L20204	0.066	1.000	0.066	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
314	L20204	L20204	0.041	1.000	0.041	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
315	L20204	L20204	0.053	1.000	0.053	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
316	L20204	L20204	0.077	1.000	0.077	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
334	L20204	L20204	0.162	1.000	0.162	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
335	L20204	L20204	0.129	1.000	0.129	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
336	L20204	L20204	0.114	1.000	0.114	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
337	L20204	L20204	0.098	1.000	0.098	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
338	L20204	L20204	0.078	1.000	0.078	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
356	L20204	L20204	0.084	1.000	0.084	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
357	L20204	L20204	0.066	1.000	0.066	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
358	L20204	L20204	0.094	1.000	0.094	Cl. 13.8.4	102	0.944	0.141	0.554	0.020
359	L20204	L20204	0.083	1.000	0.083	Cl. 13.8.4	102	0.944	0.141	0.554	0.020
360	L20204	L20204	0.103	1.000	0.103	Cl. 13.8.4	102	0.944	0.141	0.554	0.020
377	L20204	L20204	0.165	1.000	0.165	Cl. 13.9.1	102	0.944	0.141	0.554	0.020
378	L20204	L20204	0.150	1.000	0.150	Cl. 13.9.1	102	0.944	0.141	0.554	0.020
379	L20204	L20204	0.135	1.000	0.135	Cl. 13.9.1	102	0.944	0.141	0.554	0.020
380	L20204	L20204	0.111	1.000	0.111	Cl. 13.9.1	102	0.944	0.141	0.554	0.020
381	L20204	L20204	0.085	1.000	0.085	Cl. 13.9.1	102	0.944	0.141	0.554	0.020
398	L20204	L20204	0.182	1.000	0.182	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
399	L20204	L20204	0.085757	1.000	0.085757	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
400	L20204	L20204	0.106	1.000	0.106	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
401	L20204	L20204	0.119	1.000	0.119	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
402	L20204	L20204	0.104	1.000	0.104	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
403	L20204	L20204	0.100	1.000	0.100	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
420	L20204	L20204	0.182	1.000	0.182	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
421	L20204	L20204	0.085757	1.000	0.085757	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
422	L20204	L20204	0.106	1.000	0.106	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
423	L20204	L20204	0.119	1.000	0.119	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
424	L20204	L20204	0.104	1.000	0.104	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
425	L20204	L20204	0.100	1.000	0.100	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
446	L25254	L25254	0.555	1.000	0.555	Cl. 13.8.4	101	1.190	0.276	1.130	0.025

 	Job No 24946A	Sheet No 21	Rev 0
	Part Rakes & Cage		
Software licensed to Westech Engineering Inc CONNECTED User: Jennifer MEIKLE	Ref		
Job Title Brantford WWTP	By ME75	Date 08/02/2023	Chd
Client	File R&C STAAD 24946A 06.1	Date/Time 18-Aug-2023 14:12	



Utilization Ratio Cont...

Beam	Analysis Property	Design Property	Actual Ratio	Allowable Ratio	Ratio (Act./Allow.)	Clause	L/C	Ax (in ²)	Iz (in ⁴)	Iy (in ⁴)	Ix (in ⁴)
447	L25254	L25254	0.439	1.000	0.439	Cl. 13.8.4	101	1.190	0.276	1.130	0.025
448	L25254	L25254	0.360	1.000	0.360	Cl. 13.8.4	101	1.190	0.276	1.130	0.025
449	L25254	L25254	0.243	1.000	0.243	Cl. 13.8.4	101	1.190	0.276	1.130	0.025
450	L25254	L25254	0.166	1.000	0.166	Cl. 13.8.4	101	1.190	0.276	1.130	0.025
451	L25254	L25254	0.109	1.000	0.109	Cl. 13.8.4	101	1.190	0.276	1.130	0.025
466	L25254	L25254	0.338	1.000	0.338	Cl. 13.8.4	100	1.190	0.276	1.130	0.025
467	L25254	L25254	0.322	1.000	0.322	Cl. 13.8.4	100	1.190	0.276	1.130	0.025
468	L25254	L25254	0.250	1.000	0.250	Cl. 13.8.4	100	1.190	0.276	1.130	0.025
469	L25254	L25254	0.181	1.000	0.181	Cl. 13.8.4	100	1.190	0.276	1.130	0.025
470	L25254	L25254	0.123	1.000	0.123	Cl. 13.8.4	100	1.190	0.276	1.130	0.025
471	L25254	L25254	0.058	1.000	0.058	Cl. 13.8.4	100	1.190	0.276	1.130	0.025
486	L25254	L25254	0.701	1.000	0.701	Cl. 13.8.4	102	1.190	0.276	1.130	0.025
487	L25254	L25254	0.573	1.000	0.573	Cl. 13.8.4	102	1.190	0.276	1.130	0.025
488	L25254	L25254	0.460	1.000	0.460	Cl. 13.8.4	102	1.190	0.276	1.130	0.025
489	L25254	L25254	0.334	1.000	0.334	Cl. 13.8.4	102	1.190	0.276	1.130	0.025
490	L25254	L25254	0.232	1.000	0.232	Cl. 13.8.4	102	1.190	0.276	1.130	0.025
491	L25254	L25254	0.109	1.000	0.109	Cl. 13.8.4	101	1.190	0.276	1.130	0.025
506	L25254	L25254	0.338	1.000	0.338	Cl. 13.8.4	100	1.190	0.276	1.130	0.025
507	L25254	L25254	0.322	1.000	0.322	Cl. 13.8.4	100	1.190	0.276	1.130	0.025
508	L25254	L25254	0.250	1.000	0.250	Cl. 13.8.4	100	1.190	0.276	1.130	0.025
509	L25254	L25254	0.181	1.000	0.181	Cl. 13.8.4	100	1.190	0.276	1.130	0.025
510	L25254	L25254	0.123	1.000	0.123	Cl. 13.8.4	100	1.190	0.276	1.130	0.025
511	L25254	L25254	0.069	1.000	0.069	Cl. 13.8.4	102	1.190	0.276	1.130	0.025
576	L25254	L25254	0.278	1.000	0.278	Cl. 13.9.1	100	1.190	0.276	1.130	0.025
577	L25254	L25254	0.180	1.000	0.180	Cl. 13.9.1	100	1.190	0.276	1.130	0.025
578	L25254	L25254	0.123	1.000	0.123	Cl. 13.9.1	100	1.190	0.276	1.130	0.025
579	L25254	L25254	0.090	1.000	0.090	Cl. 13.9.1	100	1.190	0.276	1.130	0.025
580	L25254	L25254	0.073	1.000	0.073	Cl. 13.9.1	100	1.190	0.276	1.130	0.025
581	L25254	L25254	0.056	1.000	0.056	Cl. 13.9.1	100	1.190	0.276	1.130	0.025
596	L25254	L25254	0.409	1.000	0.409	Cl. 13.9.1	101	1.190	0.276	1.130	0.025
597	L25254	L25254	0.199	1.000	0.199	Cl. 13.9.1	101	1.190	0.276	1.130	0.025
598	L25254	L25254	0.120	1.000	0.120	Cl. 13.9.1	101	1.190	0.276	1.130	0.025
599	L25254	L25254	0.073	1.000	0.073	Cl. 13.9.1	101	1.190	0.276	1.130	0.025
600	L25254	L25254	0.034	1.000	0.034	Cl. 13.9.1	101	1.190	0.276	1.130	0.025
601	L25254	L25254	0.037	1.000	0.037	Cl. 13.8.4	100	1.190	0.276	1.130	0.025
616	L25254	L25254	0.278	1.000	0.278	Cl. 13.9.1	100	1.190	0.276	1.130	0.025
617	L25254	L25254	0.180	1.000	0.180	Cl. 13.9.1	100	1.190	0.276	1.130	0.025
618	L25254	L25254	0.123	1.000	0.123	Cl. 13.9.1	100	1.190	0.276	1.130	0.025
619	L25254	L25254	0.090	1.000	0.090	Cl. 13.9.1	100	1.190	0.276	1.130	0.025
620	L25254	L25254	0.073	1.000	0.073	Cl. 13.9.1	100	1.190	0.276	1.130	0.025
621	L25254	L25254	0.056	1.000	0.056	Cl. 13.9.1	100	1.190	0.276	1.130	0.025
636	L25254	L25254	0.471	1.000	0.471	Cl. 13.9.1	102	1.190	0.276	1.130	0.025
637	L25254	L25254	0.257	1.000	0.257	Cl. 13.9.1	102	1.190	0.276	1.130	0.025
638	L25254	L25254	0.162	1.000	0.162	Cl. 13.9.1	102	1.190	0.276	1.130	0.025
639	L25254	L25254	0.096	1.000	0.096	Cl. 13.9.1	102	1.190	0.276	1.130	0.025

 	Job No 24946A	Sheet No 22	Rev 0
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Utilization Ratio Cont...

Beam	Analysis Property	Design Property	Actual Ratio	Allowable Ratio	Ratio (Act./Allow.)	Clause	L/C	Ax (in ²)	Iz (in ⁴)	Iy (in ⁴)	Ix (in ⁴)
640	L25254	L25254	0.044	1.000	0.044	Cl. 13.9.1	102	1.190	0.276	1.130	0.025
641	L25254	L25254	0.037	1.000	0.037	Cl. 13.8.4	100	1.190	0.276	1.130	0.025
696	L20204	L20204	0.033	1.000	0.033	Cl. 13.9.1	102	0.944	0.141	0.554	0.020
697	L20204	L20204	0.046	1.000	0.046	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
698	L20204	L20204	0.037	1.000	0.037	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
699	L20204	L20204	0.025321	1.000	0.025321	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
700	L20204	L20204	0.0241	1.000	0.0241	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
701	L20204	L20204	0.037	1.000	0.037	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
708	L20204	L20204	0.063	1.000	0.063	Cl. 13.9.1	102	0.944	0.141	0.554	0.020
709	L20204	L20204	0.140	1.000	0.140	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
710	L20204	L20204	0.127	1.000	0.127	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
711	L20204	L20204	0.115	1.000	0.115	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
712	L20204	L20204	0.088	1.000	0.088	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
713	L20204	L20204	0.056	1.000	0.056	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
720	L20204	L20204	0.057	1.000	0.057	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
721	L20204	L20204	0.150	1.000	0.150	Cl. 13.8.4	102	0.944	0.141	0.554	0.020
722	L20204	L20204	0.143	1.000	0.143	Cl. 13.8.4	102	0.944	0.141	0.554	0.020
723	L20204	L20204	0.129	1.000	0.129	Cl. 13.8.4	102	0.944	0.141	0.554	0.020
724	L20204	L20204	0.104	1.000	0.104	Cl. 13.8.4	102	0.944	0.141	0.554	0.020
725	L20204	L20204	0.056	1.000	0.056	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
732	L20204	L20204	0.026	1.000	0.026	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
733	L20204	L20204	0.046	1.000	0.046	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
734	L20204	L20204	0.037	1.000	0.037	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
735	L20204	L20204	0.034	1.000	0.034	Cl. 13.9.1	102	0.944	0.141	0.554	0.020
736	L20204	L20204	0.028	1.000	0.028	Cl. 13.9.1	102	0.944	0.141	0.554	0.020
737	L20204	L20204	0.041	1.000	0.041	Cl. 13.9.1	102	0.944	0.141	0.554	0.020
744	L20204	L20204	0.162	1.000	0.162	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
745	L20204	L20204	0.123	1.000	0.123	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
746	L20204	L20204	0.136	1.000	0.136	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
747	L20204	L20204	0.112	1.000	0.112	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
748	L20204	L20204	0.088	1.000	0.088	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
749	L20204	L20204	0.028	1.000	0.028	Cl. 13.9.1	103	0.944	0.141	0.554	0.020
756	L20204	L20204	0.179	1.000	0.179	Cl. 13.8.4	102	0.944	0.141	0.554	0.020
757	L20204	L20204	0.155	1.000	0.155	Cl. 13.8.4	102	0.944	0.141	0.554	0.020
758	L20204	L20204	0.175	1.000	0.175	Cl. 13.8.4	102	0.944	0.141	0.554	0.020
759	L20204	L20204	0.173	1.000	0.173	Cl. 13.8.4	102	0.944	0.141	0.554	0.020
760	L20204	L20204	0.170	1.000	0.170	Cl. 13.8.4	102	0.944	0.141	0.554	0.020
761	L20204	L20204	0.048	1.000	0.048	Cl. 13.8.4	102	0.944	0.141	0.554	0.020
768	L20204	L20204	0.048	1.000	0.048	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
769	L20204	L20204	0.051	1.000	0.051	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
770	L20204	L20204	0.049	1.000	0.049	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
771	L20204	L20204	0.041	1.000	0.041	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
772	L20204	L20204	0.036	1.000	0.036	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
773	L20204	L20204	0.014	1.000	0.014	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
780	L20204	L20204	0.069	1.000	0.069	Cl. 13.8.4	102	0.944	0.141	0.554	0.020

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Job Title Brantford WWTP	By ME75	Date 08/02/2023	Chd
Client	File R&C STAAD 24946A 06.1	Date/Time 18-Aug-2023 14:12	

Utilization Ratio Cont...

Beam	Analysis Property	Design Property	Actual Ratio	Allowable Ratio	Ratio (Act./Allow.)	Clause	L/C	Ax (in ²)	Iz (in ⁴)	Iy (in ⁴)	Ix (in ⁴)
781	L20204	L20204	0.051	1.000	0.051	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
782	L20204	L20204	0.049	1.000	0.049	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
783	L20204	L20204	0.041	1.000	0.041	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
784	L20204	L20204	0.036	1.000	0.036	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
785	L20204	L20204	0.017	1.000	0.017	Cl. 13.9.1	103	0.944	0.141	0.554	0.020
887	L20204	L20204	0.075364	1.000	0.075364	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
888	L20204	L20204	0.036	1.000	0.036	Cl. 13.8.4	102	0.944	0.141	0.554	0.020
889	L20204	L20204	0.082	1.000	0.082	Cl. 13.8.4	102	0.944	0.141	0.554	0.020
897	L20204	L20204	0.075364	1.000	0.075364	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
898	L20204	L20204	0.022	1.000	0.022	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
899	L20204	L20204	0.062	1.000	0.062	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
907	L20204	L20204	0.135	1.000	0.135	Cl. 13.9.1	102	0.944	0.141	0.554	0.020
908	L20204	L20204	0.120	1.000	0.120	Cl. 13.9.1	102	0.944	0.141	0.554	0.020
909	L20204	L20204	0.126	1.000	0.126	Cl. 13.9.1	102	0.944	0.141	0.554	0.020
910	L20204	L20204	0.132	1.000	0.132	Cl. 13.9.1	102	0.944	0.141	0.554	0.020
911	L20204	L20204	0.142	1.000	0.142	Cl. 13.9.1	102	0.944	0.141	0.554	0.020
912	L20204	L20204	0.084	1.000	0.084	Cl. 13.9.1	102	0.944	0.141	0.554	0.020
918	L20204	L20204	0.211	1.000	0.211	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
919	L20204	L20204	0.120	1.000	0.120	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
920	L20204	L20204	0.090	1.000	0.090	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
921	L20204	L20204	0.100	1.000	0.100	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
922	L20204	L20204	0.091	1.000	0.091	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
923	L20204	L20204	0.078486	1.000	0.078486	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
924	L20204	L20204	0.062	1.000	0.062	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
930	L20204	L20204	0.211	1.000	0.211	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
1071	L25254	L25254	0.079	1.000	0.079	Cl. 13.9.1	103	1.190	0.276	1.130	0.025
1073	L20204	L20204	0.060	1.000	0.060	Cl. 13.9.1	103	0.944	0.141	0.554	0.020
1077	L25254	L25254	0.093	1.000	0.093	Cl. 13.9.1	103	1.190	0.276	1.130	0.025
1079	L20204	L20204	0.052	1.000	0.052	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
1081	L20204	L20204	0.086	1.000	0.086	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
1082	L25254	L25254	0.086	1.000	0.086	Cl. 13.8.4	103	1.190	0.276	1.130	0.025
1083	L20204	L20204	0.090	1.000	0.090	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
1084	L20204	L20204	0.086	1.000	0.086	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
1085	L25254	L25254	0.082	1.000	0.082	Cl. 13.8.4	103	1.190	0.276	1.130	0.025
1086	L20204	L20204	0.131	1.000	0.131	Cl. 13.8.4	103	0.944	0.141	0.554	0.020
1087	L30304	L30304	0.126	1.000	0.126	Cl. 13.8.4	103	1.440	0.493	1.996	0.03
1088	L25254	L25254	0.080	1.000	0.080	Cl. 13.9.1	100	1.190	0.276	1.130	0.025
1089	L30304	L30304	0.142	1.000	0.142	Cl. 13.8.4	103	1.440	0.493	1.996	0.03
1090	L25254	L25254	0.120	1.000	0.120	Cl. 13.9.1	103	1.190	0.276	1.130	0.025
1091	L30304	L30304	0.016	1.000	0.016	Cl. 13.8.4	100	1.440	0.493	1.996	0.03
1092	L30304	L30304	0.035	1.000	0.035	Cl. 13.8.4	103	1.440	0.493	1.996	0.03
1093	L30304	L30304	0.034	1.000	0.034	Cl. 13.8.4	103	1.440	0.493	1.996	0.03
1094	L30304	L30304	0.017	1.000	0.017	Cl. 13.8.4	103	1.440	0.493	1.996	0.03
1095	L25254	L25254	0.016776	1.000	0.016776	Cl. 13.9.1	100	1.190	0.276	1.130	0.025
1096	L25254	L25254	0.024	1.000	0.024	Cl. 13.9.1	102	1.190	0.276	1.130	0.025

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	Part Rakes & Cage				
Job Title Brantford WWTP			Ref		
			By ME75	Date 08/02/2023	Chd
Client			File R&C STAAD 24946A 06.1	Date/Time 18-Aug-2023 14:12	

Utilization Ratio Cont...

Beam	Analysis Property	Design Property	Actual Ratio	Allowable Ratio	Ratio (Act./Allow.)	Clause	L/C	Ax (in ²)	Iz (in ⁴)	Iy (in ⁴)	Ix (in ⁴)
1097	L25254	L25254	0.023	1.000	0.023	Cl. 13.9.1	103	1.190	0.276	1.130	0.025
1098	L25254	L25254	0.020	1.000	0.020	Cl. 13.9.1	102	1.190	0.276	1.130	0.025

Walkway

Bentley Software licensed to Westech Engineering Inc CONNECTED User: Jennifer MEIKLE	WESTECH		Job No 24946A	Sheet No 1	Rev A
	Part Bridge and Platform				
Job Title Brantford			Ref 0		
			By ME75	Date 8/2/2023	Chd
Client			File STAAD-ww_24946A.std	Date/Time 10-Nov-2023 10:43	

Job Information

	Engineer	Checked	Approved
Name:	ME75	GR00	
Date:	8/2/2023	11/13/2023	

Project ID	
Project Name	

Comments

REV A: Updated wind and snow loads (11/10/2023)
 Designed to NBCC 2020
 Stainless Steel Design
 Maximum allowable deflection = $l/360$
 DIMENSIONS:
 Radius to end of Bridge: 39.95 ft.
 Walkway Width: 3 ft.
 Platform Width: 7 ft.
 Platform Length: 8.5 ft.
 LOADINGS:
 Walkway Flooring: 5 lbs./sq.ft.
 Platform Flooring: 6 lbs./sq.ft.
 Handrail: 5 lbs./lin.ft.
 Walkway Live Load: 50 lbs./sq.ft.
 Horizontal Wind Load: 12.73 lbs./sq.ft. (Rev A)
 Snow Load: 37.594 lbs./sq.ft. (Rev A)
 Seismic Load: 0.11*Weight (Horizontal)
 These structural calculations represent the minimum member size necessary to satisfy the requirement of the specification. WesTech reserves the option of increasing the member size to facilitate design or fabrication requirements.

Structure Type	SPACE FRAME
----------------	-------------


Number of Nodes	34	Highest Node	42
Number of Elements	54	Highest Beam	139

Number of Basic Load Cases	32
Number of Combination Load Cases	0

Included in this printout are data for:

All	The Whole Structure
-----	---------------------

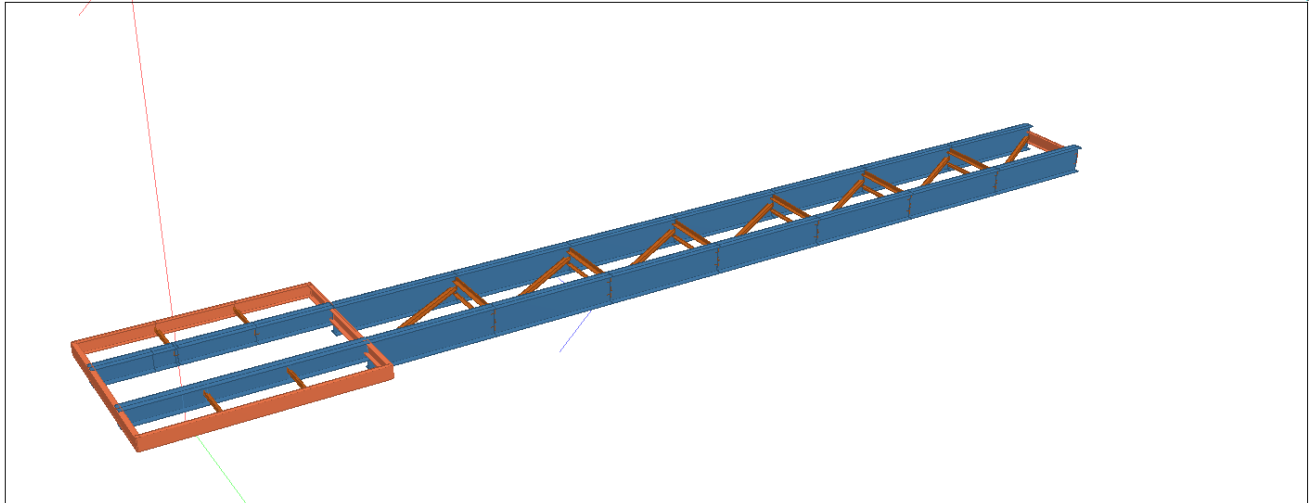


 	Job No 24946A	Sheet No 2	Rev A
	Part Bridge and Platform		
Job Title Brantford	Ref 0		
	By ME75	Date 8/2/2023	Chd
Client	File STAAD-ww_24946A.std	Date/Time 10-Nov-2023 10:43	

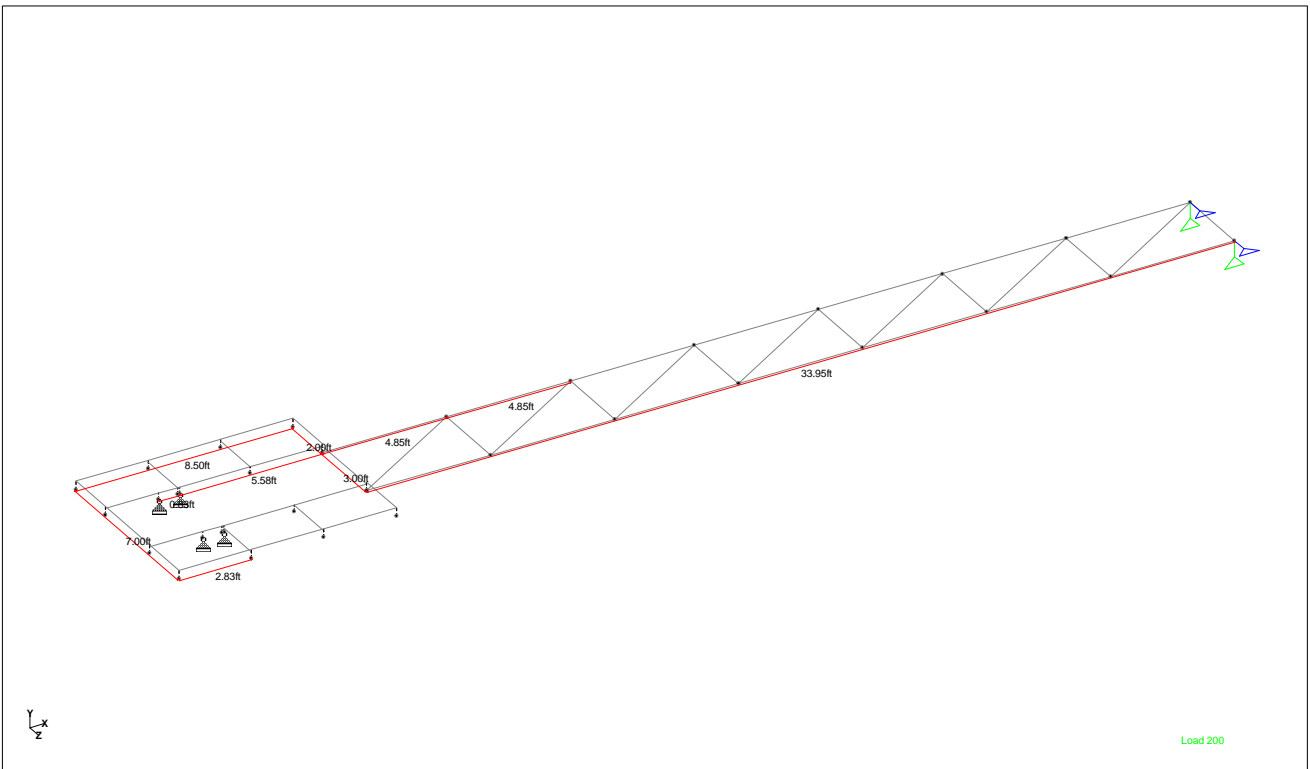
Job Information Cont...

Included in this printout are results for load cases:

Type	L/C	Name
Primary	1	GRAVITY
Primary	2	FLOORING
Primary	3	HANDRAIL
Primary	4	LIVE
Primary	5	WIND(Z)
Primary	6	WIND(X)
Primary	7	SNOW
Primary	8	EH(Z)
Primary	9	EH(X)
Primary	100	1.4D
Primary	101	1.25D + 1.5L + 1.0S
Primary	102	1.25D + 1.5L + 0.4W (Z)
Primary	103	1.25D + 1.5L + 0.4W (X)
Primary	104	1.25D + 1.5S + 1.0L
Primary	105	1.25D + 1.5S + 0.4W (Z)
Primary	106	1.25D + 1.5S + 0.4W (X)
Primary	107	1.25D + 1.4W (Z) + 0.5L
Primary	108	1.25D + 1.4W (X) + 0.5L
Primary	109	1.25D + 1.4W (Z) + 0.5S
Primary	110	1.25D + 1.4W (X) + 0.5S
Primary	111	1.0D + 1.0E (Z) + 0.5L
Primary	112	1.0D + 1.0E (Z) + 0.25S
Primary	113	1.0D + 1.0E (X) + 0.5L
Primary	114	1.0D + 1.0E (X) + 0.25S
Primary	200	DEAD
Primary	201	1.0D + 1.0L + 0.3(Z)W
Primary	300	CAMBER



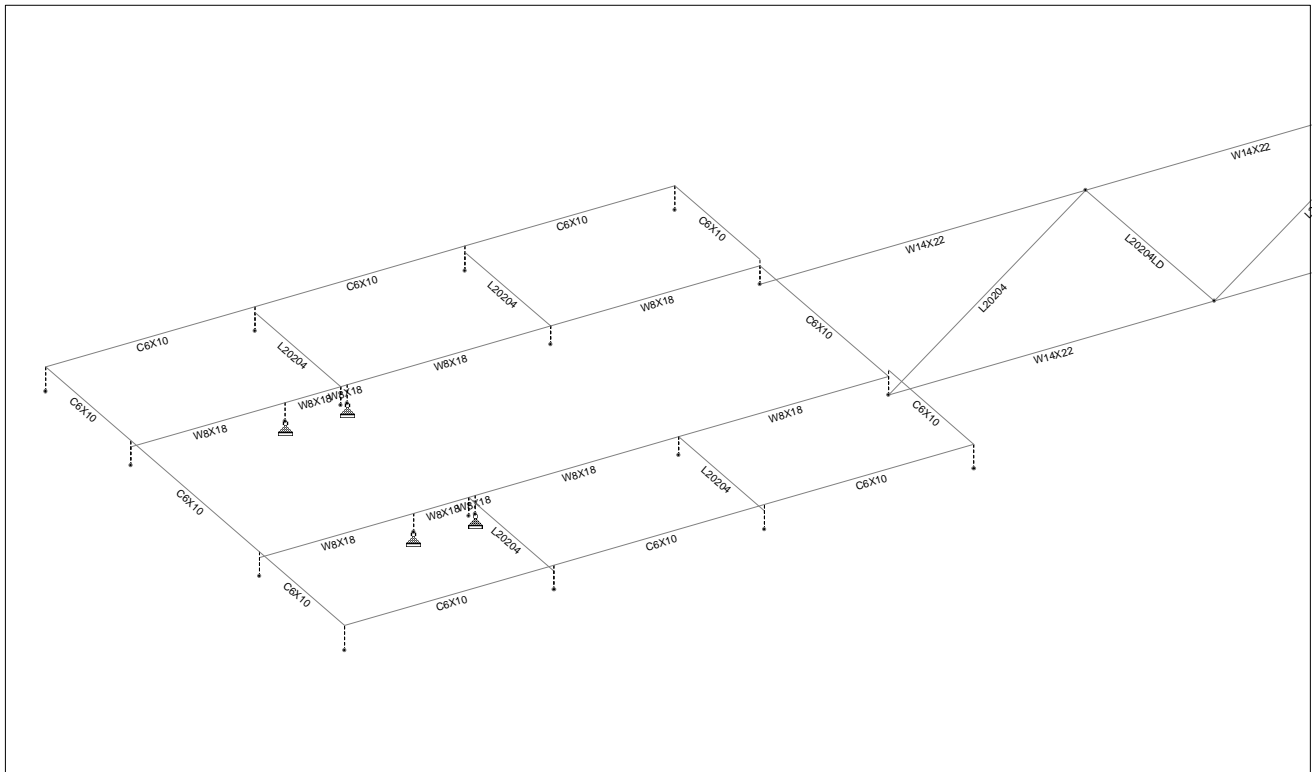
Walkway & Platform



Dimensions

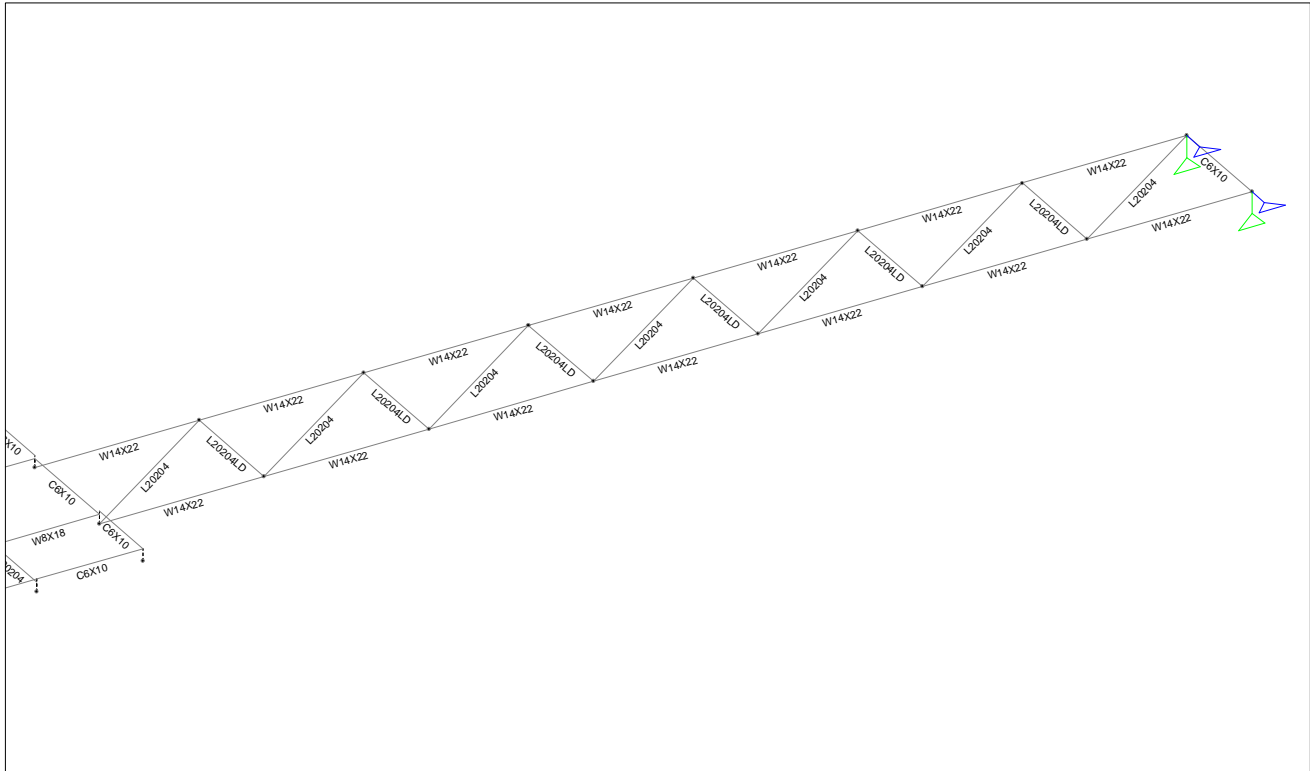
Section Properties

Prop	Section	Area (in ²)	I _{yy} (in ⁴)	I _{zz} (in ⁴)	J (in ⁴)	Material
1	L20204	0.944	0.550	0.146	0.020	STAINLESSST
2	L20204	1.888	25.051	0.695	0.039	STAINLESSST
3	W8X18	5.260	7.970	61.900	0.172	STAINLESSST
4	C6X10	3.070	0.860	15.100	0.128	STAINLESSST
5	L20204	0.944	0.550	0.146	0.020	STAINLESSST
6	W14X22	6.490	7.000	199.000	0.208	STAINLESSST



Member Sizes

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	Part Bridge and Platform				
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Client			By ME75	Date 8/2/2023	Chd
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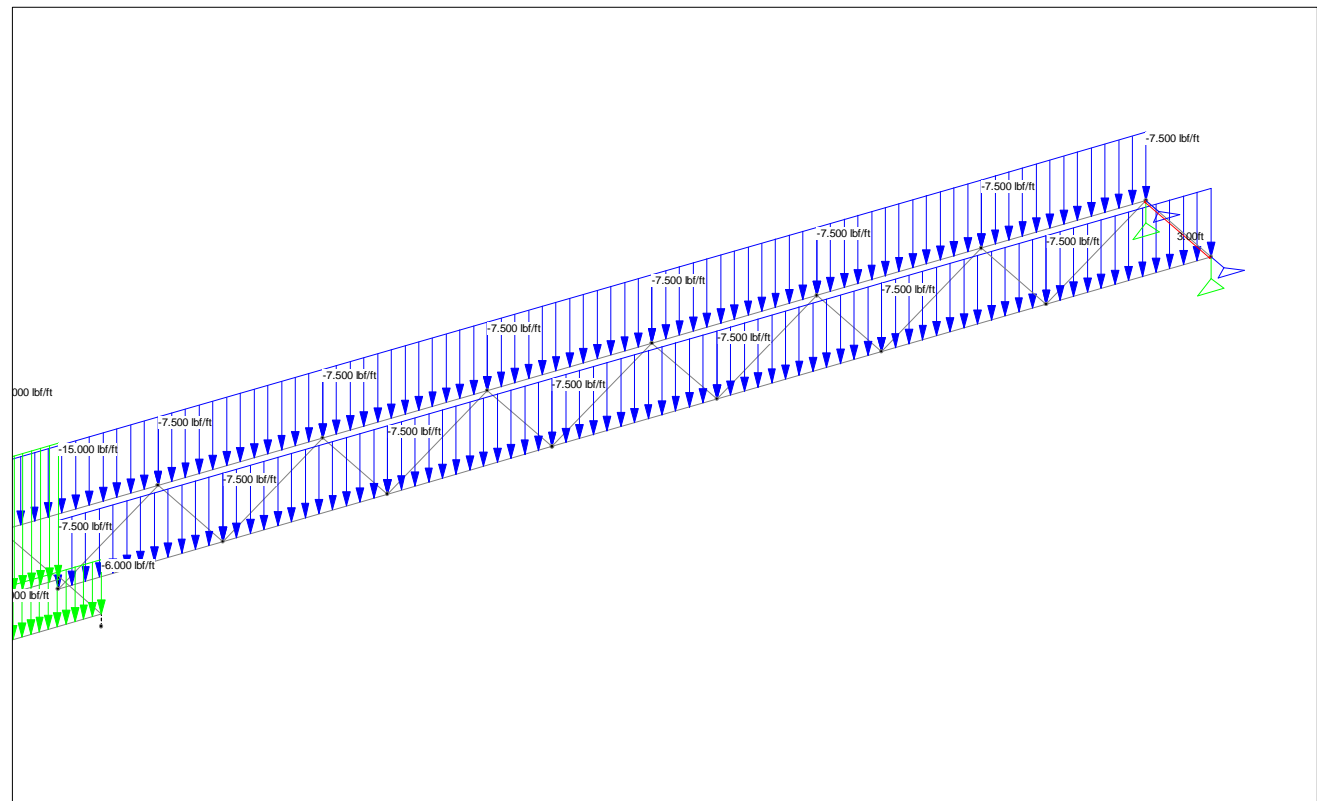
Member Sizes

Primary Load Cases

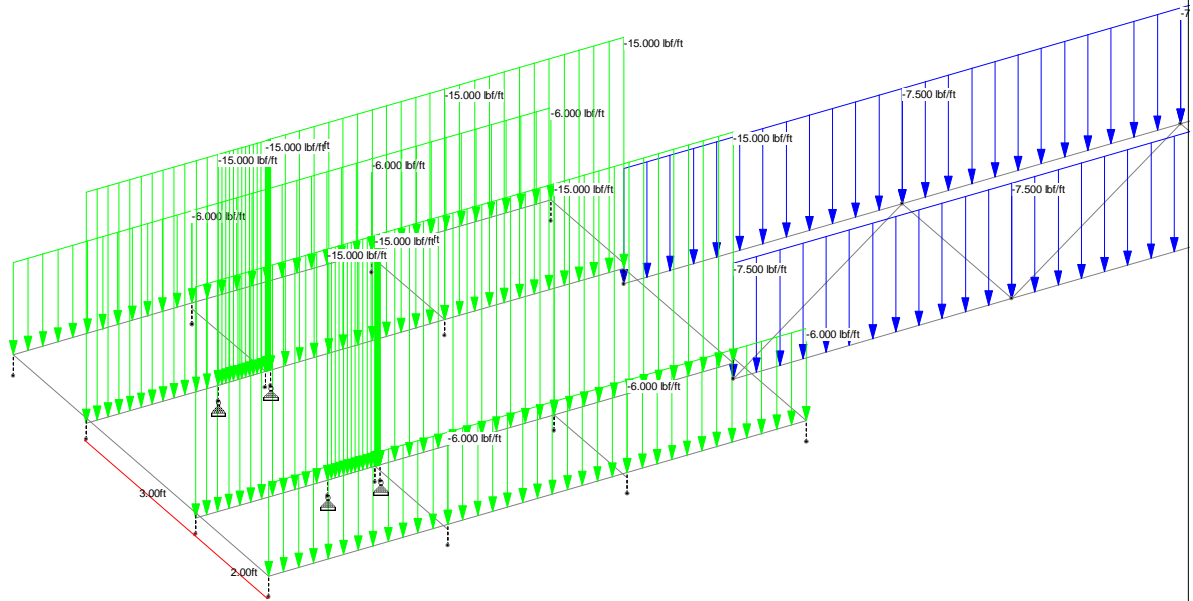
Number	Name	Type
1	GRAVITY	Dead
2	FLOORING	Dead
3	HANDRAIL	Dead
4	LIVE	Live
5	WIND(Z)	Wind
6	WIND(X)	Wind
7	SNOW	Snow
8	EH(Z)	Seismic-H
9	EH(X)	Seismic-H
100	1.4D	None
101	1.25D + 1.5L + 1.0S	None
102	1.25D + 1.5L + 0.4W (Z)	None
103	1.25D + 1.5L + 0.4W (X)	None
104	1.25D + 1.5S + 1.0L	None
105	1.25D + 1.5S + 0.4W (Z)	None
106	1.25D + 1.5S + 0.4W (X)	None
107	1.25D + 1.4W (Z) + 0.5L	None
108	1.25D + 1.4W (X) + 0.5L	None
109	1.25D + 1.4W (Z) + 0.5S	None

Primary Load Cases Cont...

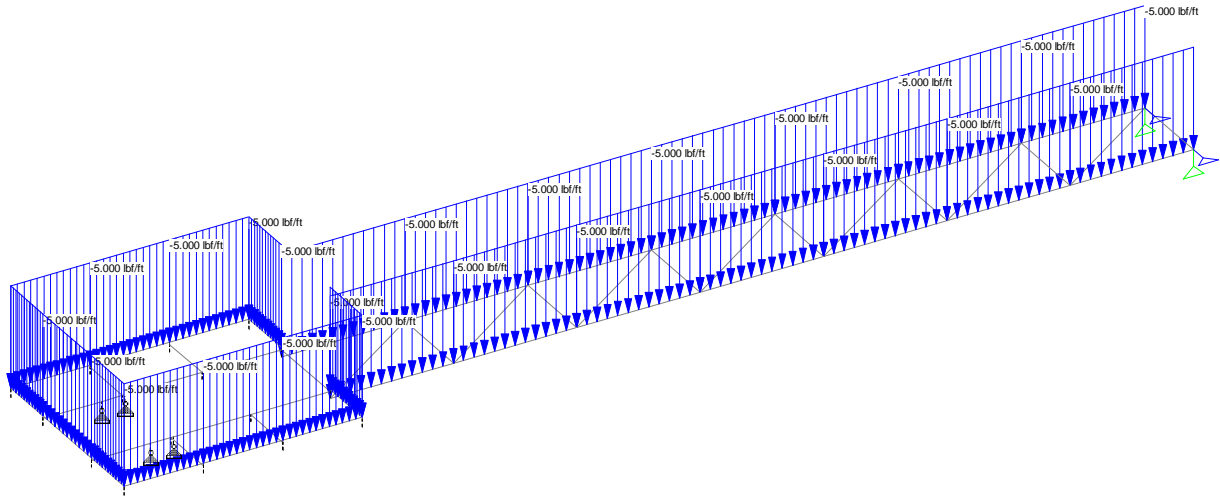
Number	Name	Type
110	$1.25D + 1.4W(X) + 0.5S$	None
111	$1.0D + 1.0E(Z) + 0.5L$	None
112	$1.0D + 1.0E(Z) + 0.25S$	None
113	$1.0D + 1.0E(X) + 0.5L$	None
114	$1.0D + 1.0E(X) + 0.25S$	None
200	DEAD	None
201	$1.0D + 1.0L + 0.3(Z)W$	None
202	$1.0D + 1.0L + 0.35S$	None
203	$1.0D + 1.0(Z)W + 0.35L$	None
204	$1.0D + 1.0(Z)W + 0.35S$	None
205	$1.0D + 1.0S + 0.3(Z)W$	None
206	$1.0D + 1.0S + 0.35L$	None
300	CAMBER	None



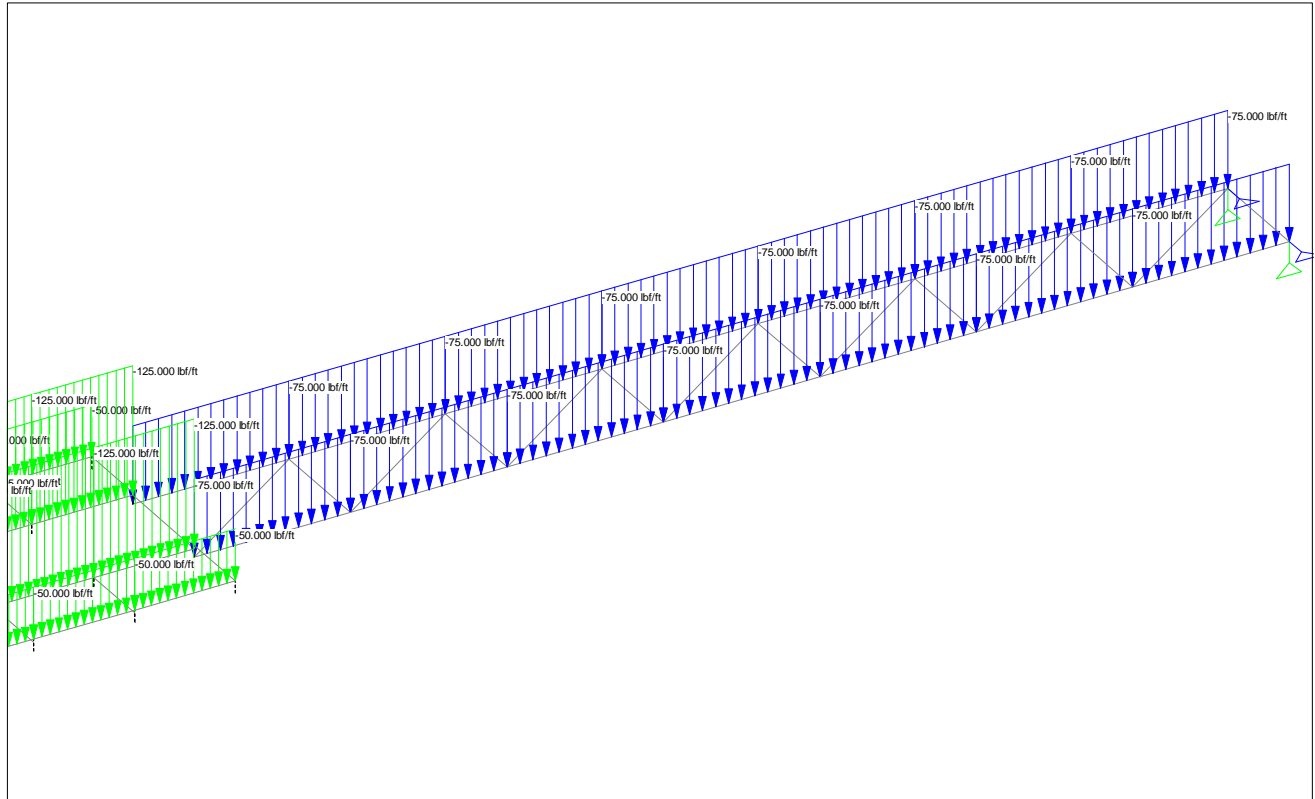
Walkway flooring (5 psf)



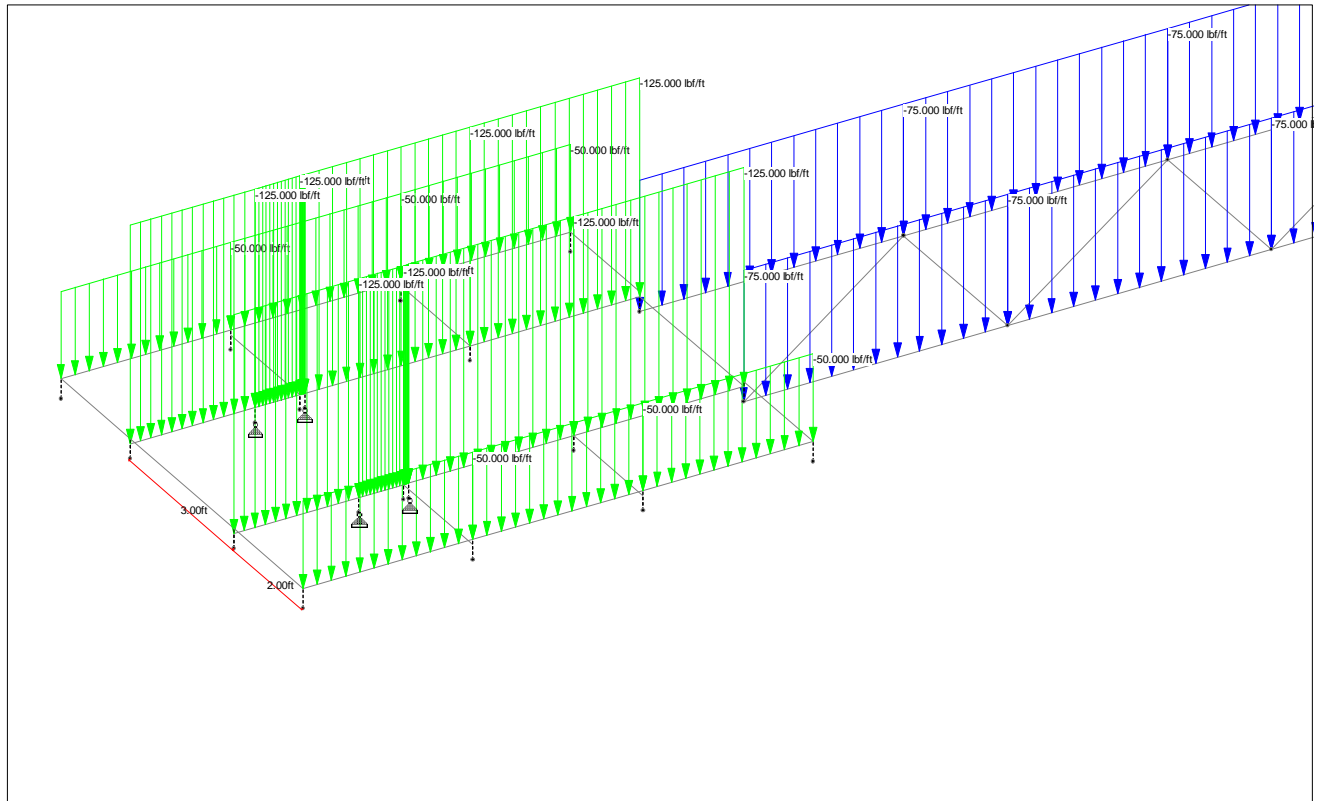
Platform Flooring (6 psf)



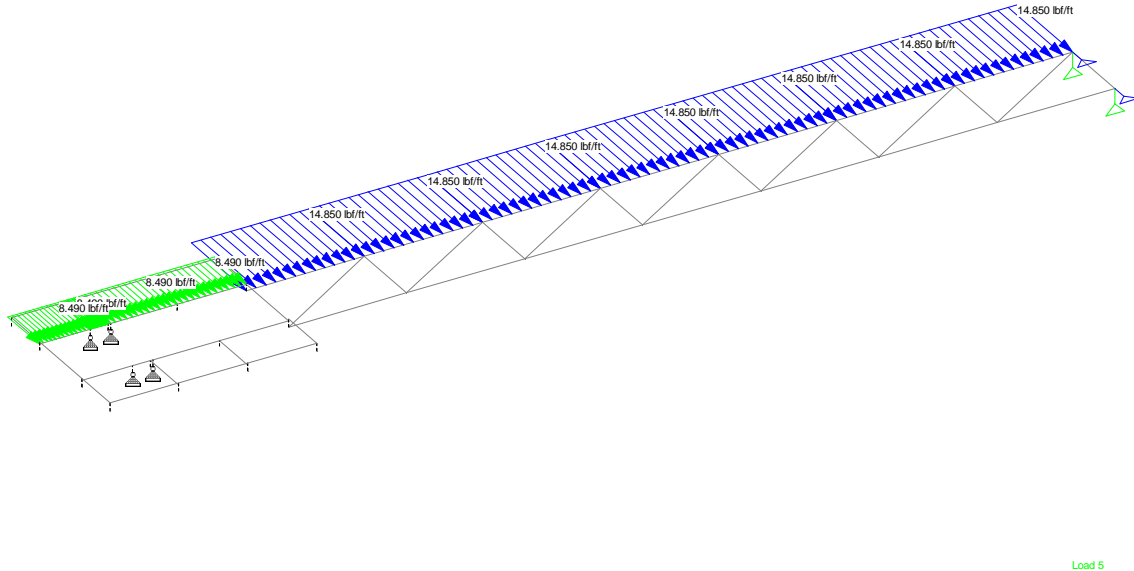
Handrail (5 plf)



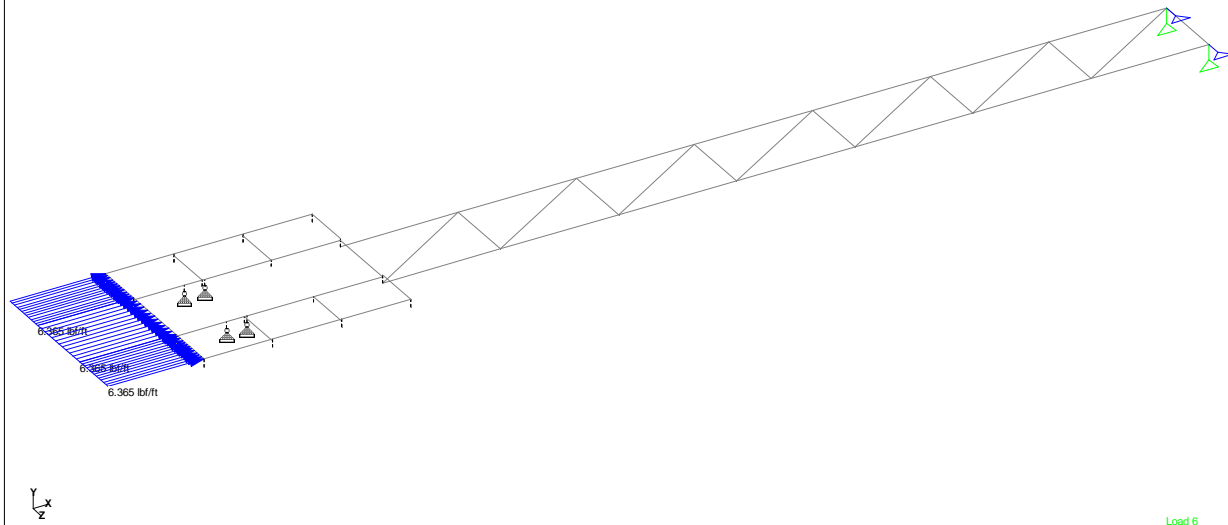
Walkway Live Load (50 psf)



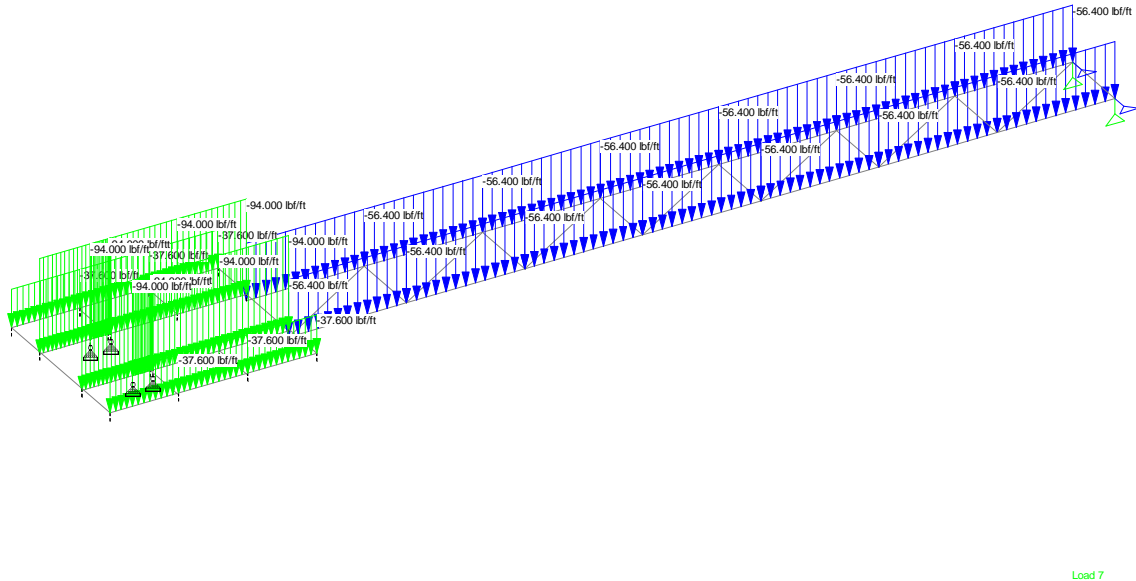
Platform Live Load (50 psf)



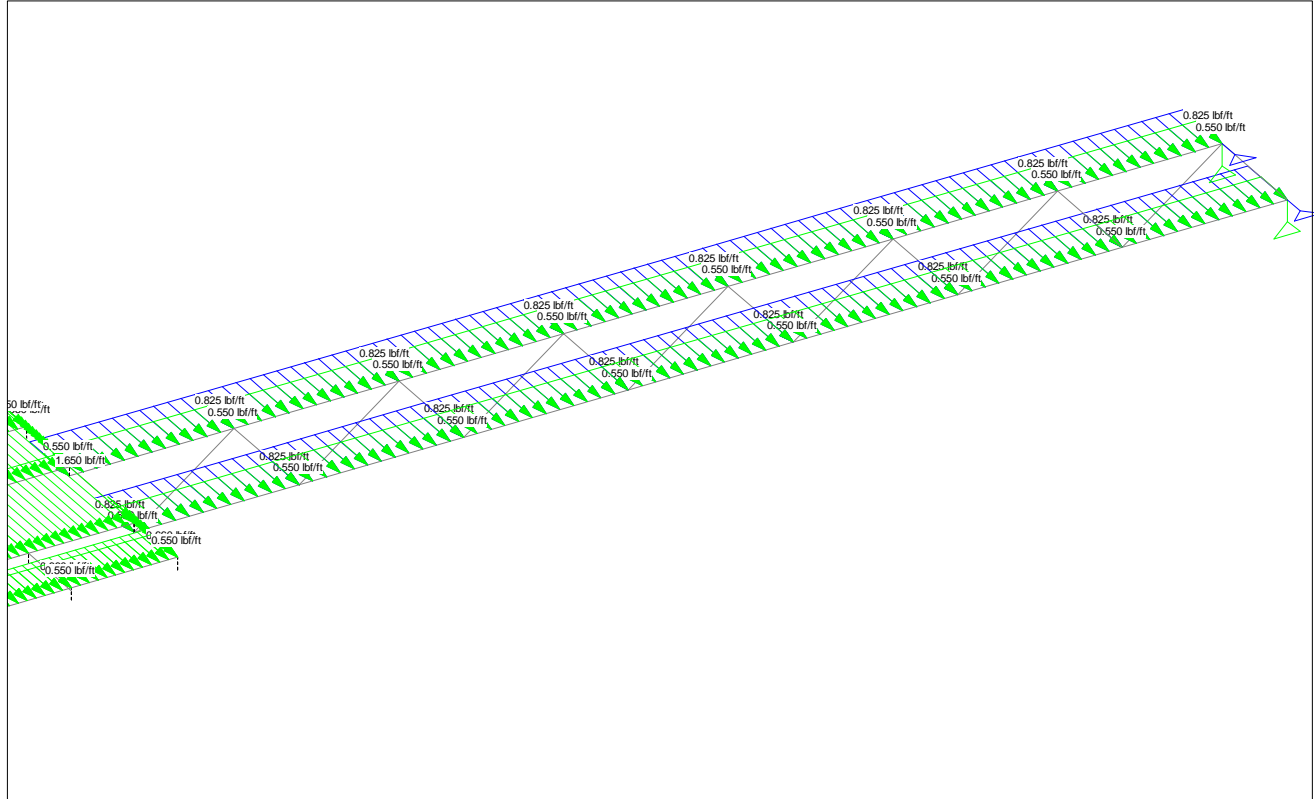
Wind Load-Z (12.73 psf) (Rev A)



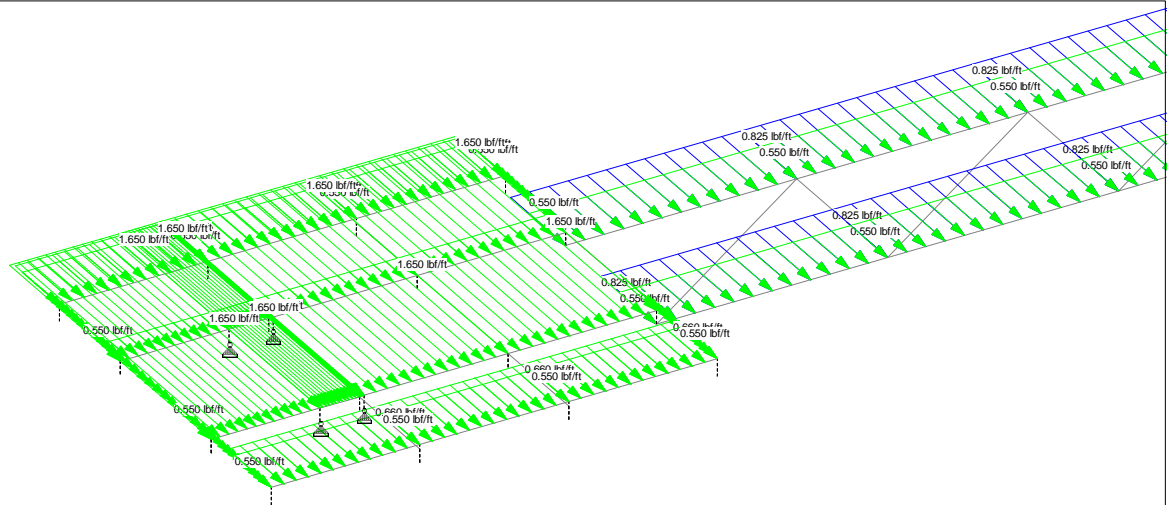
Wind Load-X (12.73 psf) (Rev A)



Snow Load (37.594 psf) (Rev A)



*Seismic Load-Z (0.11*Dead Load)*



*Seismic Load-Z (0.11*Dead Load)*



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24946A

Sheet No
16

Rev
A

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Part **Bridge and Platform**

Job Title **Brantford**

Ref **0**

By **ME75**

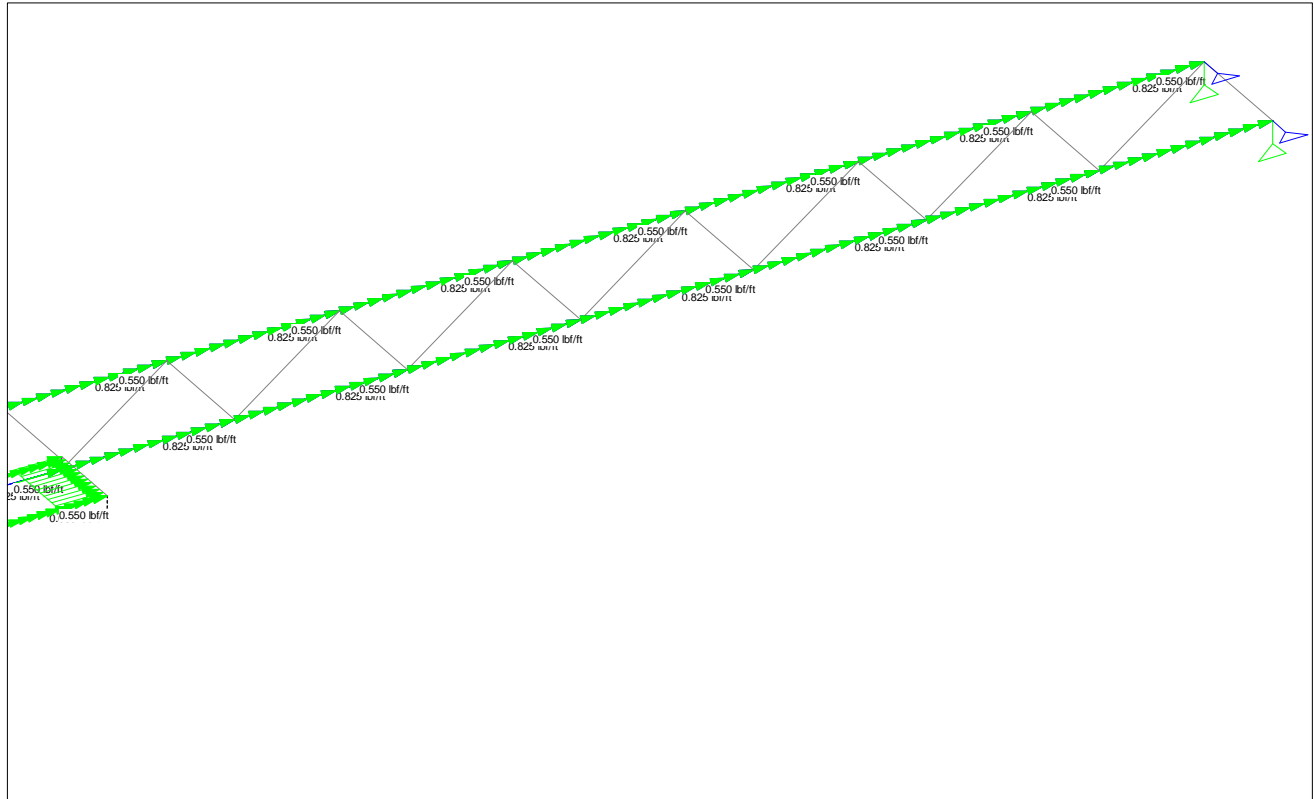
Date **8/2/2023**

Chd

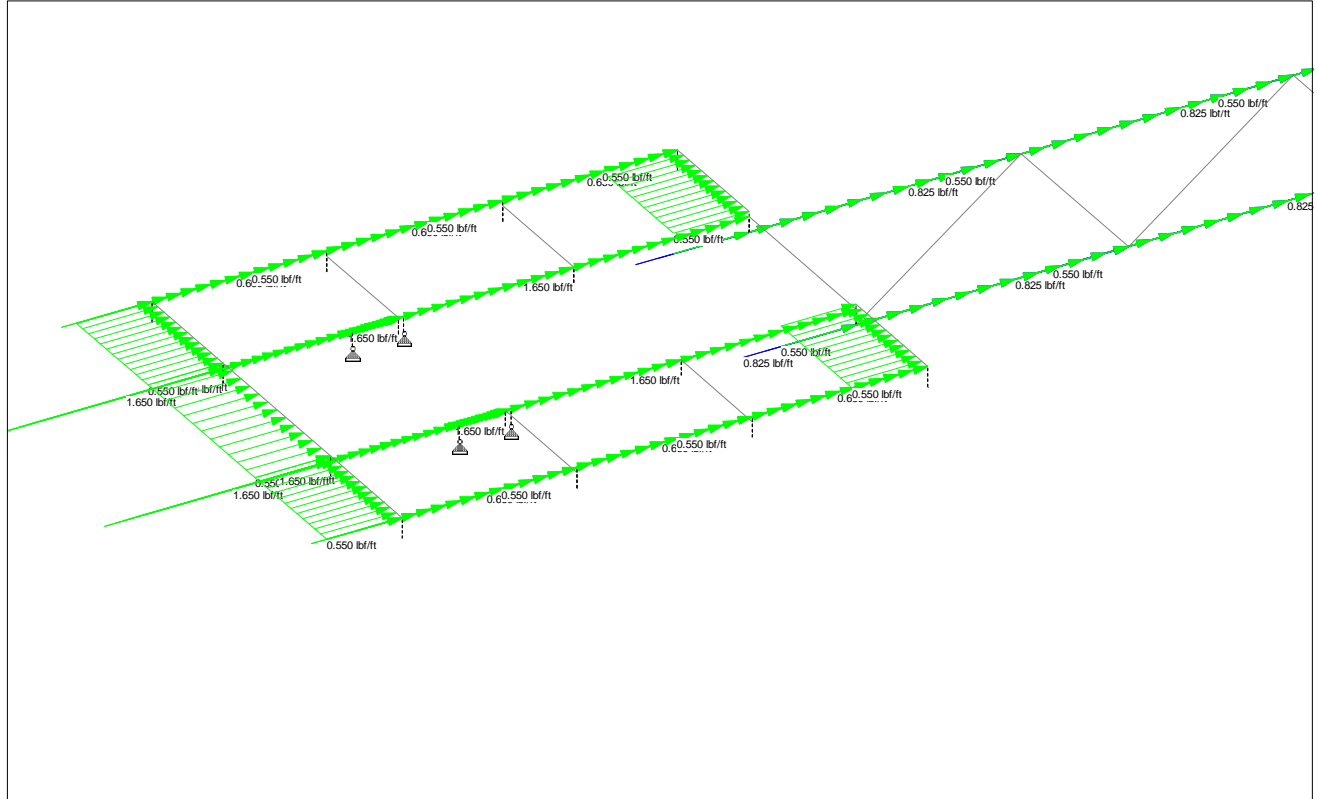
Client

File **STAAD-ww_24946A.std**

Date/Time **10-Nov-2023 10:43**

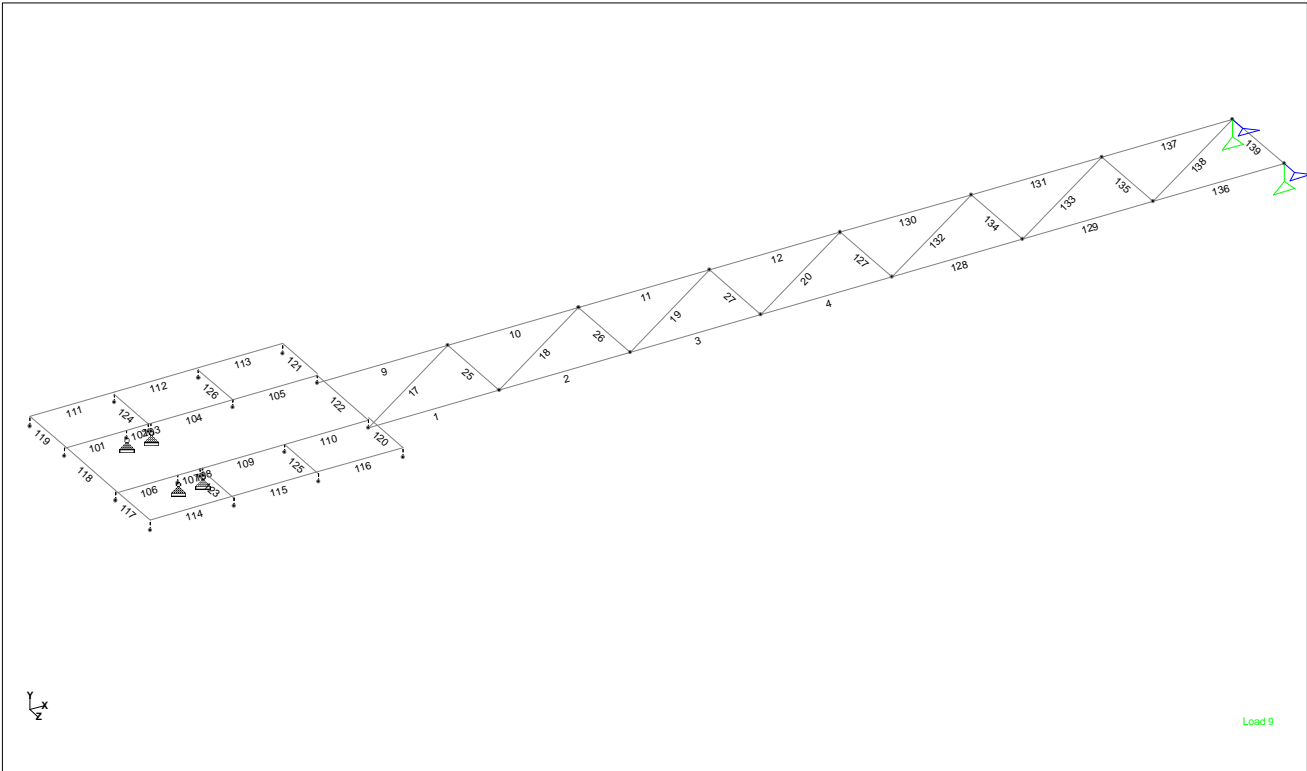


Seismic Load-X (0.11*Dead Load)



*Seismic Load-X (0.11*Dead Load)*



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	Part Bridge and Platform				
Job Title Brantford			Ref 0		
Client			By ME75	Date 8/2/2023	Chd
Client			File STAAD-ww_24946A.std	Date/Time 10-Nov-2023 10:43	



Beam Numbers

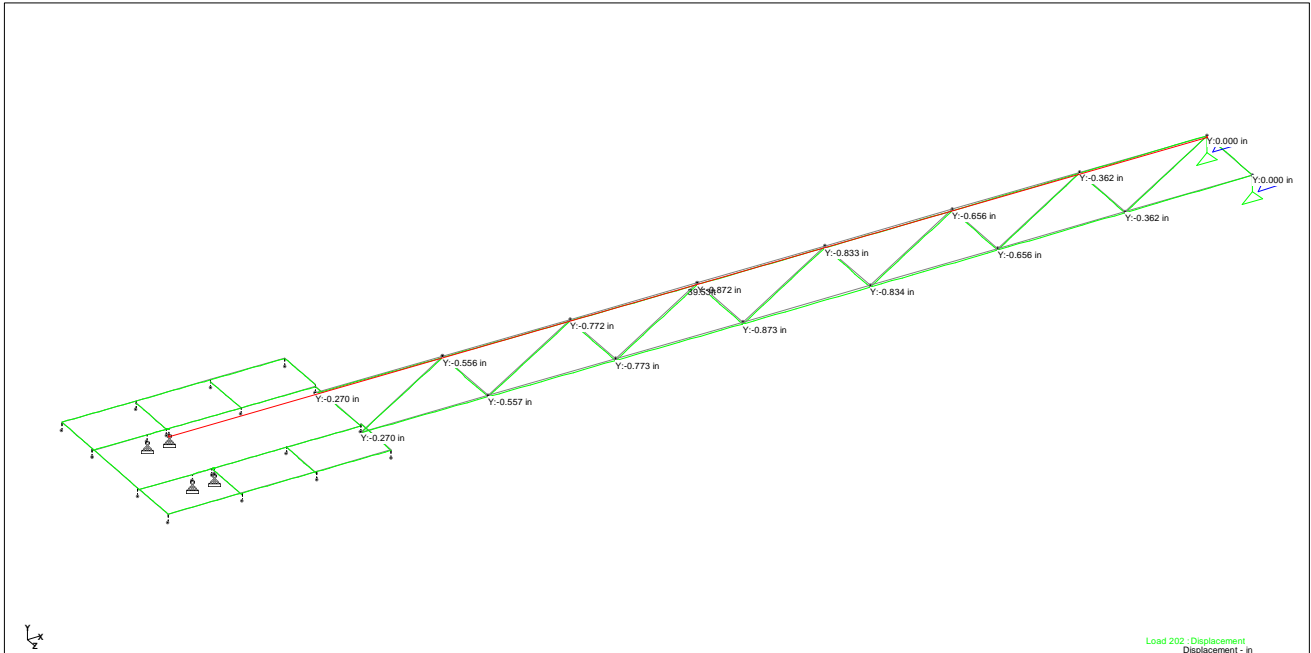
Utilization Ratio

Beam	Analysis Property	Design Property	Actual Ratio	Allowable Ratio	Ratio (Act./Allow.)	Clause	L/C	Ax (in ²)	Iz (in ⁴)	Iy (in ⁴)	Ix (in ⁴)
1	W14X22	W14X22	0.215	1.000	0.215	Cl. 13.8	101	6.490	199.000	7.000	0.208
2	W14X22	W14X22	0.350	1.000	0.350	Cl. 13.8	101	6.490	199.000	7.000	0.208
3	W14X22	W14X22	0.419	1.000	0.419	Cl. 13.8	101	6.490	199.000	7.000	0.208
4	W14X22	W14X22	0.426	1.000	0.426	Cl. 13.8	101	6.490	199.000	7.000	0.208
9	W14X22	W14X22	0.218	1.000	0.218	Cl. 13.8	101	6.490	199.000	7.000	0.208
10	W14X22	W14X22	0.349	1.000	0.349	Cl. 13.8	101	6.490	199.000	7.000	0.208
11	W14X22	W14X22	0.418	1.000	0.418	Cl. 13.8	101	6.490	199.000	7.000	0.208
12	W14X22	W14X22	0.425	1.000	0.425	Cl. 13.8	101	6.490	199.000	7.000	0.208
17	L20204	L20204	0.150	1.000	0.150	Cl. 13.8.4	107	0.944	0.141	0.554	0.020
18	L20204	L20204	0.072	1.000	0.072	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
19	L20204	L20204	0.090	1.000	0.090	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
20	L20204	L20204	0.096	1.000	0.096	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
25	L20204	L20204 LI	0.017	1.000	0.017	Cl. 13.9.1	107	1.888	0.695	24.995	0.039
26	L20204	L20204 LI	0.007	1.000	0.007	Cl. 13.8.4	107	1.888	0.695	24.995	0.039
27	L20204	L20204 LI	0.008	1.000	0.008	Cl. 13.8.4	107	1.888	0.695	24.995	0.039
101	W8X18	W8X18	0.085	1.000	0.085	Cl. 13.8	101	5.260	61.900	7.970	0.172
102	W8X18	W8X18	0.971	1.000	0.971	Cl. 13.4.1.1	101	5.260	61.900	7.970	0.172
103	W8X18	W8X18	0.975	1.000	0.975	Cl. 13.4.1.1	101	5.260	61.900	7.970	0.172
104	W8X18	W8X18	0.801	1.000	0.801	Cl. 13.8	101	5.260	61.900	7.970	0.172

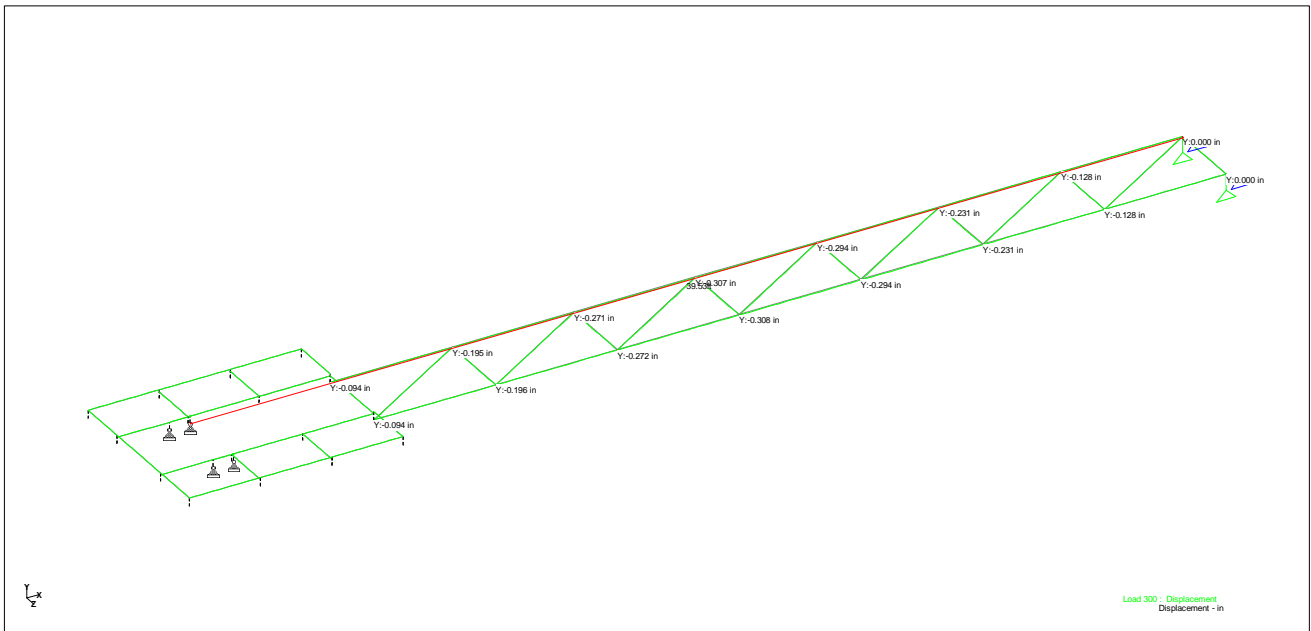
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	Part Bridge and Platform		
Software licensed to Westech Engineering Inc CONNECTED User: Jennifer MEIKLE	Ref 0		
Job Title Brantford	By ME75	Date 8/2/2023	Chd
Client	File STAAD-ww_24946A.std	Date/Time 10-Nov-2023 10:43	

Utilization Ratio Cont...

Beam	Analysis Property	Design Property	Actual Ratio	Allowable Ratio	Ratio (Act./Allow.)	Clause	L/C	Ax (in ²)	Iz (in ⁴)	Iy (in ⁴)	Ix (in ⁴)
105	W8X18	W8X18	0.350	1.000	0.350	Cl. 13.8	101	5.260	61.900	7.970	0.172
106	W8X18	W8X18	0.085	1.000	0.085	Cl. 13.8	101	5.260	61.900	7.970	0.172
107	W8X18	W8X18	0.974	1.000	0.974	Cl. 13.4.1.1	101	5.260	61.900	7.970	0.172
108	W8X18	W8X18	0.978	1.000	0.978	Cl. 13.4.1.1	101	5.260	61.900	7.970	0.172
109	W8X18	W8X18	0.803	1.000	0.803	Cl. 13.8	101	5.260	61.900	7.970	0.172
110	W8X18	W8X18	0.351	1.000	0.351	Cl. 13.8	101	5.260	61.900	7.970	0.172
111	C6X10	C6X10	0.175	1.000	0.175	Cl. 13.9.1	101	3.070	15.100	0.860	0.115
112	C6X10	C6X10	0.157	1.000	0.157	Cl. 13.9.1	101	3.070	15.100	0.860	0.115
113	C6X10	C6X10	0.138	1.000	0.138	Cl. 13.9.1	101	3.070	15.100	0.860	0.115
114	C6X10	C6X10	0.175	1.000	0.175	Cl. 13.9.1	101	3.070	15.100	0.860	0.115
115	C6X10	C6X10	0.156	1.000	0.156	Cl. 13.9.1	101	3.070	15.100	0.860	0.115
116	C6X10	C6X10	0.139	1.000	0.139	Cl. 13.9.1	101	3.070	15.100	0.860	0.115
117	C6X10	C6X10	0.238	1.000	0.238	Cl. 13.9.1	101	3.070	15.100	0.860	0.115
118	C6X10	C6X10	0.176	1.000	0.176	Cl. 13.9.1	107	3.070	15.100	0.860	0.115
119	C6X10	C6X10	0.236	1.000	0.236	Cl. 13.9.1	101	3.070	15.100	0.860	0.115
120	C6X10	C6X10	0.241	1.000	0.241	Cl. 13.9.1	101	3.070	15.100	0.860	0.115
121	C6X10	C6X10	0.238	1.000	0.238	Cl. 13.9.1	101	3.070	15.100	0.860	0.115
122	C6X10	C6X10	0.151	1.000	0.151	Cl. 13.9.1	107	3.070	15.100	0.860	0.115
123	L20204	L20204	0.333	1.000	0.333	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
124	L20204	L20204	0.335	1.000	0.335	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
125	L20204	L20204	0.190	1.000	0.190	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
126	L20204	L20204	0.190	1.000	0.190	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
127	L20204	L20204 LI	0.016	1.000	0.016	Cl. 13.8.4	107	1.888	0.695	24.995	0.039
128	W14X22	W14X22	0.418	1.000	0.418	Cl. 13.8	101	6.490	199.000	7.000	0.208
129	W14X22	W14X22	0.347	1.000	0.347	Cl. 13.8	101	6.490	199.000	7.000	0.208
130	W14X22	W14X22	0.418	1.000	0.418	Cl. 13.8	101	6.490	199.000	7.000	0.208
131	W14X22	W14X22	0.348	1.000	0.348	Cl. 13.8	101	6.490	199.000	7.000	0.208
132	L20204	L20204	0.090	1.000	0.090	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
133	L20204	L20204	0.072	1.000	0.072	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
134	L20204	L20204 LI	0.025	1.000	0.025	Cl. 13.8.4	107	1.888	0.695	24.995	0.039
135	L20204	L20204 LI	0.033	1.000	0.033	Cl. 13.8.4	109	1.888	0.695	24.995	0.039
136	W14X22	W14X22	0.208	1.000	0.208	Cl. 13.8	101	6.490	199.000	7.000	0.208
137	W14X22	W14X22	0.209	1.000	0.209	Cl. 13.8	101	6.490	199.000	7.000	0.208
138	L20204	L20204	0.061	1.000	0.061	Cl. 13.9.1	107	0.944	0.141	0.554	0.020
139	C6X10	C6X10	0.020	1.000	0.020	Cl. 13.8.4	107	3.070	15.100	0.860	0.115



Walkway Deflection, Load Case 202, D+L+0.35S (1.32" max) (Rev A)



Camber

Center Column Anchor Bolts

Center Column Epoxy Anchor Bolt Calculations

Page 1

Job Name: Brantford	By: ME75	Last Saved Date: 08/01/23
Job Number: 24946A	Chk'd: PO07	Date: 8/2/2023

CENTER COLUMN INPUT

Note: Concrete Breakout Strength of Anchor in Shear is not passing.

Column Diameter (D _c) =	610	mm
-------------------------------------	-----	----

ANCHOR BOLT INPUT

Anchor Bolt Type =	Epoxy	
Epoxy Type =	Simpson SET-3G	
Anchor Bolt Material =	316SS	ASTM A193B8
Bolt Tensile Strength (f _{tsa}) =	517	MPa
Bolt Yield Strength (f _{ys}) =	207	MPa
Elastic Modulus (E _s) =	1331	MPa
Number of Anchor Bolts (n) =	8	
Bolt Diameter (d _b) =	19.05	mm
Thread Root Diameter (d _{tr}) =	16.307	mm
Bolt Circle Diameter (d _{bc}) =	965.2	mm
Anchor Bolt Embedment Depth, SELECTED (h _{ef}) =	203	mm
Anchor Bolt Minimum Embedment Depth (h _{ef,min}) =	88.9	mm
Anchor Bolt Maximum Embedment Depth (h _{ef,max}) =	381.0	mm
Distance to Loaded Edge (Edge) =	50.8	mm
Steel Strength Reduction Factor (Tension), (φ _{tension}) =	0.75	
Steel Strength Reduction Factor (Shear), (φ _{shear}) =	0.65	
Temperature Range =	A	



Table 5 of ESR-4057

Table 5 of ESR-4057

Table 3 of ESR-4057

Table 3 of ESR-4057

Max Short Term 160°F, Max Long Term 110°F

Short term temperatures are those that occur over short intervals, such as a day.

Long term temperatures are constant over a significant time period.

DRIVE TORQUE LOADING

Drive Design Torque (Torque) =	29,602	N-m
Drive Momentary Peak Torque (TorqueP) =	59,203	N-m

NBCC 2020

Earthquake Importance Factor, (I _e) =	1.5	NBCC 2020, Table 4.1.8.5.A, Post Disaster
Site Class =	D	Assume D
Mapped Spectral Response Accel, (S _a (0.2)) =	0.205	
Component Amplification Factor (A _r) =	1.00	
Component Response Modification Factor (R _p) =	2.50	
Seismic Coefficient (V _p) =	0.11	

CONCRETE INPUT

Concrete Compressive Strength (f' _c) =	17.2	MPa	Assumed.
Concrete Elastic Modulus (E _c) =	236649	MPa	
Concrete Strength Reduction Factor (R _{conc,tension}) =	1.00		CSA A23.3:19 D.5.3.c (condition B)
Concrete Strength Reduction Factor (R _{conc,shear}) =	1.00		CSA A23.3:19 D.5.3.c (condition B)
Concrete Density Modification Factor (λ) =	1		CSA A23.3:19 8.6.5 (Assumed Normal Density)

LOADS & MOMENTS

Load Description	Vert. Center of Gravity*	Weight**	Bending Moment (COG*Wt*C _g)
Rake Arms	0.873 m	18226 N	1809 N-m
Cage	1.927 m	4162 N	912 N-m
Center Column	2.067 m	5502 N	1293 N-m
Drive	4.436 m	9786 N	4935 N-m
Feedwell	3.114 m	12029 N	4259 N-m
Feedwell supports	4.179 m	1687 N	802 N-m
Walkway	4.401 m	11835 N	5922 N-m
Energy Dissipating Inlet	3.493 m	5692 N	2261 N-m
Total =		68921 N	22193 N-m

* With Respect To Anchor Bolt Elevation

** Component Weights Must Be Verified With Final Design

Maximum tension and compression force on anchor bolts due to overturning loads

P _{max} (TENS & COMP) =	11496	N	P _{max} = (4*M/d _{bc})/n
----------------------------------	-------	---	---

Anchor Bolt Forces, per NBCC 2020				Page 2
Tension Forces (Per Anchor Bolt)				
D =	-8615	N	-W/n	
TQ =	0	N	Torque from Drive (Treated as Dead Load due to well defined limit)	
L =	-2787	N	Tension Due to Live Load	
E _{o1} =	11496	N	P _{max} (Tension Due to Over-Turning Moment)	
E _v =	0	N	Vertical Seismic	
R _d *R _o =	1.3		SFRS Overstrength Factor (CSA A23.3:19 D.4.3.5.3.d.i)	
Combined Tension Forces (Per Anchor Bolt)		Total Tension Force of Anchors (For Use in Concrete Breakout Capacity Checks)		
P _{u1} =	-12061	N	P _{u-tot1} =	-96489 N 1.4(D+TQ) NBCC 2020 Table 4.1.3.2-A
P _{u2} =	-14950	N	P _{u-tot2} =	-119597 N 1.25(D+TQ)+1.5L NBCC 2020 Table 4.1.3.2-A
P _{u3} =	-11934	N	P _{u-tot3} =	-35803 N 0.9(D+TQ)+1.5L NBCC 2020 Table 4.1.3.2-A
P _{u4} =	4937	N	P _{u-tot4} =	6055 N 1.0(D+TQ) + 1.0(E _v + E _{o1} *R _d *R _o) + 0.5L NBCC 2020 Table 4.1.3.2-A
Shear Forces (Per Anchor Bolt)				
D =	0	N	No Shear Due to Dead Load	
TQ =	7667	N	Torque from Drive (Treated as Dead Load due to well defined limit) (Cont. Torque/(dbc/2)/n)	
L =	0	N	No Shear Due to Live Load	
E _n =	980	N	((W*Ca)/n)	
R _d *R _o =	1.3		SFRS Overstrength Factor (CSA A23.3:19 D.4.3.5.3.c.i)	
Combined Shear Forces (Per Anchor Bolt)		Total Shear Force of Anchor Group (For Use in Concrete Breakout Capacity Checks)		
V _{u1} =	10734	N	V _{u-tot1} =	85873 N 1.4(D+TQ) NBCC 2020 Table 4.1.3.2-A
V _{u2} =	9584	N	V _{u-tot2} =	76672 N 1.25(D+TQ) + 1.5L NBCC 2020 Table 4.1.3.2-A
V _{u3} =	6901	N	V _{u-tot3} =	55204 N 0.9(D+TQ)+1.5L NBCC 2020 Table 4.1.3.2-A
V _{u4} =	8941	N	V _{u-tot4} =	71525 N 1.0(D+TQ) + 1.0(E _n *R _d *R _o) + 0.5L NBCC 2020 Table 4.1.3.2-A
V _{u5} =	21468	N	1.4(Peak Torque/Cont. Torque)*TQ	Momentary-Peak Torque or Duty-Rated Torque

Epoxy Anchor Bolt Calculations, per CSA A23.3:19 and Respective ESR Report			Page 3
$N_{UB} = 151176 \text{ N}$ $V_{UB} = 13385 \text{ N}$ $s = 369.37 \text{ mm}$ $C_{IP} = 101.6 \text{ mm}$ $C_{Pier} = 50.8 \text{ mm}$ $C_{a1} = 50.8 \text{ mm}$ $C_{a2} = 227.18 \text{ mm}$	Load Combination Critical Column Vertical Total Load Load Combination Critical Column Horizontal Total Load Anchor Bolt Chordal Spacing Center of Anchor to Edge of Concrete at Influent Opening Center of Anchor to Edge of Concrete at Pier, Edge of Sludge Outlet/Hopper ($\leq 1.5h_{ef}$) Minimum Center of Anchor to Edge of Concrete in Direction of Shear Center of Anchor to Edge of Concrete Orthogonal to Direction of Shear		
Required Edge Distance and Spacing			
$C_{min} = 44.45 \text{ mm}$ $C_{max} = 227.18 \text{ mm}$ $C_{a,min} = 50.80 \text{ mm}$ $S_{min} = 76.20 \text{ mm}$ $h_{min} = 247.65 \text{ mm}$ $h_a = 247.65 \text{ mm}$	Table 2 of ESR-4057 Largest Edge Distance Smallest Edge Distance Table 2 of ESR-4057 Table 2 of ESR-4057 Minimum concrete thickness based on embedment and Table 2 of ESR-4057 Concrete thickness. If unknown, assumes h_{min} .	Selection OK Edge Distance Check Selection OK Anchor Spacing Check	
Grouted Joint? = YES Grout Under Column Flange? (If YES, 0.8 factor applied to shear design) (17.5.1.3) Grout Thickness = 50.80 mm			
Anchor Bolt Physical Properties:			
Anchor Diameter = 19.05 mm Area _{root} = 208.85 mm² $I_x = I_y = 3470.9 \text{ mm}^4$ $Z = 425.702 \text{ mm}^3$ $r = 4.077 \text{ mm}$ $K = 1$ $KL/r = 12.46$ No. of Anchors in Group = 3 No. of Anchors in Group = 8	Slenderness Ratio (< 200) For Group Action in Tension For Group Action in Shear		
Anchor Compressive Stress			
$Stress_C = 14 \text{ MPa}$ $Stress_C = (P_{max} + Wt/N) / A_{root}$ Selection OK Compressive Stress Check 80% yield strength			
Design requirements for tensile loading			
Steel Strength of Anchor in Tension (Single Anchor) $N_{sa} = 84694 \text{ N}$ Nominal Axial Strength (Per Anchor), Table 3 of ESR-4057 $\phi_{tension} N_{sa} = 63521 \text{ N}$ Ratio $P_{u1} = 0.00$ Ratios must be ≤ 1.0 Ratio $P_{u2} = 0.00$ Ratio $P_{u3} = 0.00$ Ratio $P_{u4} = 0.08$ Selection OK Anchor Bolt Selection Check			
Concrete Breakout Strength of Anchor Group in Tension			
D.6.2 $N_{br} = 54717 \text{ N}$ $h_{ef} = 203 \text{ mm}$ $\lambda = 1.0$ $K_{cr} = 7$ $A_{Nc} = 478132 \text{ mm}^2$ $A_{Nco} = 371612 \text{ mm}^2$ $\psi_{ec,N} = 0.96$ $\psi_{ed,N} = 0.75$ $\psi_{c,N} = 1.00$ $\psi_{cp,N} = 1.00$ $N_{cbgr} = 50892 \text{ N}$ $\phi_c = 0.65$ $0.75N_{cbgr} = 38169 \text{ N}$ Ratio $P_{u-tot1} = 0.00$ Ratio $P_{u-tot2} = 0.00$ Ratio $P_{u-tot3} = 0.00$ Ratio $P_{u-tot4} = 0.16$	Nominal Concrete Breakout Strength in tension of single anchor (Eq.D.6) $N_{br} = k_c \phi_c \lambda (f_c)^{0.5} h_{ef}^{1.5} R_{conc_tension}$ Effective Embedment of Anchor Concrete Modification Factor (adhesive anchor concrete failure) (D.4.6) $K_c = 7$ for post-installed anchors (D.6.2.2) Projected Concrete Failure Area (D.6.2.1) $A_{nc} \leq n A_{Nco}$ Maximum Possible Concrete Failure Area (Eq. D.5) $A_{Nco} = 9 h_{ef}^2$ Modification Factor for Eccentricity (Eq D.8) $\psi_{ec,N} = 1 / (1 + (2 e_N / 3 h_{ef})) \leq 1$ Modification Factor for Edge Effects (Eq D.10) $0.7 + 0.3 (C_{a1} / \min(1.5 h_{ef}))$ Modification Factor for Cracked Concrete (D6.2.6) Assume Cracked Concrete Modification Factor for Post-Installed Anchor (D.6.2.7) Assume Cracked Concrete Factored Concrete Breakout Strength in tension for anchor group (Eq. D.4) $N_{cbgr} = (A_{Nc} / A_{Nco}) \psi_{ec,N} \psi_{ed,N} \psi_{c,N} \psi_{cp,N} N_{br}$ Concrete resistance factor, $\phi_c = 0.65$ (per 8.4.2) 0.75 Factor for SFRS (D.4.3.5.4) Ratios must be ≤ 1.0		
Selection OK Anchor Bolt Selection Check			

Epoxy Anchor Bolt Calculations, per CSA A23.3:19 and Respective ESR Report (Continued)				Page 4																																																																																																																														
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<p>Bond Strength of Adhesive Anchor (Group) in Tension</p> <p>D.6.5</p> <table style="width:100%; border-collapse: collapse;"> <tr> <td style="width:15%;">c_{Na}</td> <td style="width:15%; text-align: center;">210.16</td> <td style="width:15%;">mm</td> <td style="width:30%;">Projected Influence Line</td> <td style="width:25%;">(Eq. D.23)</td> <td style="width:20%;">$c_{Na} = 10d_a(\tau_{uncr}/7.60)^{0.5}$</td> </tr> <tr> <td>$\phi_d$</td> <td style="text-align: center;">0.65</td> <td></td> <td>Hole Installation Condition Factor</td> <td>Table 5 of ESR-4057</td> <td></td> </tr> <tr> <td>τ_{uncr}</td> <td style="text-align: center;">14</td> <td>MPa</td> <td>Bond Strength, Uncracked Concrete</td> <td>Table 5 of ESR-4057</td> <td></td> </tr> <tr> <td>A_{Na0}</td> <td style="text-align: center;">176676</td> <td>mm²</td> <td>Nominal Projected Area of Single Anchor</td> <td>(Eq. 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D.29)</td> <td>1.0 for cracked concrete</td> </tr> <tr> <td>c_{ac}</td> <td style="text-align: center;">67.9</td> <td>mm</td> <td>Critical Edge Distance</td> <td>Table 2 of ESR-4057</td> <td></td> </tr> <tr> <td>N_{bar}</td> <td style="text-align: center;">71396</td> <td>N</td> <td>Nominal Bond Strength of Single Anchor</td> <td>(Eq. D.24)</td> <td>$N_{bar} = \lambda_a \cdot \phi_d \cdot \tau_{cr} \cdot \pi \cdot d_a \cdot h_{ef} \cdot R_{conc, tension}$</td> </tr> <tr> <td>$\lambda_a$</td> <td style="text-align: center;">1</td> <td></td> <td>Concrete Modification Factor (assuming normal weight concrete)</td> <td>(D.4.6)</td> <td></td> </tr> <tr> <td>τ_{cr}</td> <td style="text-align: center;">9.03</td> <td>MPa</td> <td>Bond Strength, Cracked Concrete</td> <td>Table 5 of ESR-4057</td> <td></td> </tr> <tr> <td>$\alpha_{N,seis}$</td> <td style="text-align: center;">1</td> <td></td> <td>Seismic Factor for Bond Strength</td> <td>Table 5 of ESR-4057</td> <td></td> </tr> <tr> <td>N_{agr}</td> <td style="text-align: center;">105951</td> <td>N</td> <td>Factored Bond Strength of Anchor Group</td> <td>(Eq. 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D.23)	$c_{Na} = 10d_a(\tau_{uncr}/7.60)^{0.5}$	ϕ_d	0.65		Hole Installation Condition Factor	Table 5 of ESR-4057		τ_{uncr}	14	MPa	Bond Strength, Uncracked Concrete	Table 5 of ESR-4057		A_{Na0}	176676	mm ²	Nominal Projected Area of Single Anchor	(Eq. D.22)	$A_{Na0} = (2c_{Na})^2$	A_{Na}	357856	mm ²	Projected Influence Area of Anchor Group	(D.6.5.1)		$\Psi_{ec,Na}$	0.95		Load Eccentricity Modification Factor	(Eq. D.25)	$\Psi_{ec,Na} = 1/(1+(e'_N/c_{Na})) \leq 1.0$	e'_N	11.43	mm	Tension Load Eccentricity			$\Psi_{ed,Na}$	0.77		Edge Effects Modification Factor	(Eq. D.27)	$0.7+0.3(Ca1, \min/c_{Na}) \leq 1.0$	$\Psi_{cp,Na}$	1.00		Splitting Modification Factor	(Eq. D.29)	1.0 for cracked concrete	c_{ac}	67.9	mm	Critical Edge Distance	Table 2 of ESR-4057		N_{bar}	71396	N	Nominal Bond Strength of Single Anchor	(Eq. 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<p>D.7.2</p> <table style="width:100%; border-collapse: collapse;"> <tr> <td style="width:15%;">V_{br}</td> <td style="width:15%; text-align: center;">3664</td> <td style="width:15%;">N</td> <td style="width:30%;">Nominal Concrete Breakout Strength in Shear (Eq. D.35)</td> <td style="width:25%;"></td> <td style="width:20%;">$V_{br} = 0.58 \cdot (l_d/d_a)^{0.2} \cdot \sqrt{f_c} \cdot \phi_c \cdot \lambda_a \cdot \sqrt{f_c} \cdot c_{a1}^{1.5} \cdot R_{con}$</td> </tr> <tr> <td>$\lambda_a$</td> <td style="text-align: center;">1</td> <td></td> <td>Concrete Modification Factor (assuming normal weight concrete) (D.4.6)</td> <td></td> <td>$V_b = 3.75 \cdot \lambda_a \cdot \phi_c \cdot \sqrt{f_c} \cdot c_{a1}^{1.5} \cdot R_{con, shear}$</td> </tr> <tr> <td>$A_{vc}$</td> <td style="text-align: center;">255381</td> <td>mm²</td> <td>Projected Failure Area (Fig. D.13)</td> <td></td> <td>$A_{vc} = \pi \cdot (d_{bc} + 2 \cdot c_{p,lev}) \cdot (1.5 \cdot c_{p,lev})$</td> </tr> <tr> <td>$A_{vco}$</td> <td style="text-align: center;">11613</td> <td>mm²</td> <td>Nominal Projected Failure Area (Eq. D.34)</td> <td></td> <td>$A_{vco} = 4.5 \cdot c_{a1}^2$</td> </tr> <tr> <td>$\Psi_{ec,V}$</td> <td style="text-align: center;">1.00</td> <td></td> <td>Load Eccentricity Modification Factor (Fig. D.16)</td> <td></td> <td></td> </tr> <tr> <td>$\Psi_{ed,V}$</td> <td style="text-align: center;">1.00</td> <td></td> <td>Edge Effects Modification Factor (Eq.'s D.40 & D.41)</td> <td></td> <td>1.0 if $Ca2, \min \geq 1.5ca1$</td> </tr> <tr> <td>$\Psi_{c,V}$</td> <td style="text-align: center;">1.00</td> <td></td> <td>Crack Modification Factor (D.7.2.7)</td> <td></td> <td>cracked conc. & no hoops</td> </tr> <tr> <td>$\Psi_{h,V}$</td> <td style="text-align: center;">1.00</td> <td></td> <td>Shear Strength Modification Factor (Eq. D.42)</td> <td></td> <td></td> </tr> <tr> <td>V_{cbgr}</td> <td style="text-align: center;">29313</td> <td>N</td> <td>Factored Concrete Breakout Strength in Shear of Anchor Group. (Eq. D.33)</td> <td></td> <td>$V_{cbgr} = (A_{vc}/A_{vco}) \cdot \Psi_{ec,V} \cdot \Psi_{ed,V} \cdot \Psi_{c,V} \cdot \Psi_{h,V} \cdot V_{br}$</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td>$A_{vc} \leq nA_{vco}$ checked in V_{cbgr} calculation</td> </tr> <tr> <td>Ratio V_{u1}</td> <td style="text-align: center;">1.46</td> <td></td> <td colspan="3">Ratios must be ≤ 1.0</td> </tr> <tr> <td>Ratio V_{u2}</td> <td style="text-align: center;">1.31</td> <td></td> <td colspan="3"></td> </tr> <tr> <td>Ratio V_{u3}</td> <td style="text-align: center;">0.94</td> <td></td> <td colspan="3"></td> </tr> <tr> <td>Ratio V_{u4}</td> <td style="text-align: center;">1.22</td> <td></td> <td colspan="3"></td> </tr> <tr> <td colspan="3" style="text-align: center; background-color: #FF0000;">Check Concrete Design (Not By WesTech)</td> <td colspan="3" style="text-align: center; background-color: #FF0000;">Anchor Bolt Selection Check</td> </tr> </table>						V_{br}	3664	N	Nominal Concrete Breakout Strength in Shear (Eq. D.35)		$V_{br} = 0.58 \cdot (l_d/d_a)^{0.2} \cdot \sqrt{f_c} \cdot \phi_c \cdot \lambda_a \cdot \sqrt{f_c} \cdot c_{a1}^{1.5} \cdot R_{con}$	λ_a	1		Concrete Modification Factor (assuming normal weight concrete) (D.4.6)		$V_b = 3.75 \cdot \lambda_a \cdot \phi_c \cdot \sqrt{f_c} \cdot c_{a1}^{1.5} \cdot R_{con, shear}$	A_{vc}	255381	mm ²	Projected Failure Area (Fig. D.13)		$A_{vc} = \pi \cdot (d_{bc} + 2 \cdot c_{p,lev}) \cdot (1.5 \cdot c_{p,lev})$	A_{vco}	11613	mm ²	Nominal Projected Failure Area (Eq. D.34)		$A_{vco} = 4.5 \cdot c_{a1}^2$	$\Psi_{ec,V}$	1.00		Load Eccentricity Modification Factor (Fig. D.16)			$\Psi_{ed,V}$	1.00		Edge Effects Modification Factor (Eq.'s D.40 & D.41)		1.0 if $Ca2, \min \geq 1.5ca1$	$\Psi_{c,V}$	1.00		Crack Modification Factor (D.7.2.7)		cracked conc. & no hoops	$\Psi_{h,V}$	1.00		Shear Strength Modification Factor (Eq. D.42)			V_{cbgr}	29313	N	Factored Concrete Breakout Strength in Shear of Anchor Group. (Eq. D.33)		$V_{cbgr} = (A_{vc}/A_{vco}) \cdot \Psi_{ec,V} \cdot \Psi_{ed,V} \cdot \Psi_{c,V} \cdot \Psi_{h,V} \cdot V_{br}$						$A_{vc} \leq nA_{vco}$ checked in V_{cbgr} calculation	Ratio V_{u1}	1.46		Ratios must be ≤ 1.0			Ratio V_{u2}	1.31					Ratio V_{u3}	0.94					Ratio V_{u4}	1.22					Check Concrete Design (Not By WesTech)			Anchor Bolt Selection Check		
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Check Concrete Design (Not By WesTech)			Anchor Bolt Selection Check																																																																																												

Customer must ensure concrete is designed and reinforced to resist forces transferred from center column.

Epoxy Anchor Bolt Calculations, per CSA A23.3:19 and Respective ESR Report (continued)				Page 5
Concrete Pryout Strength of Anchor in Shear				
D.7.3	$V_{cpgr} =$ 101785 N $k_{cp} =$ 2.0	Factored Pryout Strength in Shear of Anchor Group (Eq. D.45) Pryout Strength Coefficient	$V_{cpgr} = \text{Min}[k_{cp} * N_{agr}; k_{cp} * N_{cgr}]$ $k_{cp} = 2.0$ for $hef \geq 65$ mm	
	Ratio $V_{u1} =$ 0.11 Ratio $V_{u2} =$ 0.09 Ratio $V_{u3} =$ 0.07 Ratio $V_{u4} =$ 0.09 Ratio $V_{u5} =$ 0.21	Ratios must be ≤ 1.0		
	Selection OK Anchor Bolt Selection Check			
Interaction of Tensile and Shear Forces				
D.8	(Max P_{u1} Or P_{u-tot1}) / $\phi N_n =$ 0.00 (Max P_{u2} Or P_{u-tot2}) / $\phi N_n =$ 0.00 (Max P_{u3} Or P_{u-tot3}) / $\phi N_n =$ 0.00 (Max P_{u4} Or P_{u-tot4}) / $\phi N_n =$ 0.16	Max $V_{u1} / \phi N_n =$ 1.46 Max $V_{u2} / \phi N_n =$ 1.31 Max $V_{u3} / \phi N_n =$ 0.94 Max $V_{u4} / \phi N_n =$ 1.22	Note: If the applied shear or tension is 20% or less of the shear or tension strength, the full strength of tension or shear may be used. (See ESR-4057 4.3.2)	
	$P_{u1} / \phi N_n + V_{u1} / \phi V_n =$ 1.46 $P_{u2} / \phi N_n + V_{u2} / \phi V_n =$ 1.31 $P_{u3} / \phi N_n + V_{u3} / \phi V_n =$ 0.94 $P_{u4} / \phi N_n + V_{u4} / \phi V_n =$ 1.22	Ratio must be ≤ 1.2 (ESR-4057, EQ 4.4) Ratio must be ≤ 1.2 (ESR-4057, EQ 4.4) Ratio must be ≤ 1.2 (ESR-4057, EQ 4.4) Ratio must be ≤ 1.2 (ESR-4057, EQ 4.4)		
	Increase Size / BC / Qty Anchor Bolt Selection Check			

Walway Anchor Bolts



Anchor Designer™
Software
Version 3.1.2303.1

Company:	WesTech Engineering	Date:	8/2/2023
Engineer:	ME75	Page:	1/5
Project:	Brantford 24946A		
Address:			
Phone:			
E-mail:			

1. Project information

Customer company:
Customer contact name:
Customer e-mail:
Comment:

Checked By: HO93 [8/22/2023]

Project description: Walkway Anchors
Location:
Fastening description:

2. Input Data & Anchor Parameters

General

Design method: CSA A23.3-19
Units: SI units (metric)

Anchor Information:

Anchor type: Bonded anchor
Material: A193 Grade B8/B8M (304/316SS)
Diameter (inch): 0.750
Effective Embedment depth, h_{ef} (mm): 114
Code report: ICC-ES ESR-4057
Anchor category: -
Anchor ductility: Yes
 h_{min} (mm): 159
 c_{ac} (mm): 164
 c_{min} (mm): 44
 s_{min} (mm): 76

Base Material

Concrete: Normal-weight
Concrete thickness, h (mm): 305
State: Cracked
Compressive strength, f'_c (MPa): 20.70
 $\Psi_{c,v}$: 1.0
Reinforcement condition: B tension, B shear
Supplemental edge reinforcement: Not applicable
Reinforcement provided at corners: No
Ignore concrete breakout in tension: No
Ignore concrete breakout in shear: No
Hole condition: Dry concrete
Inspection: Continuous
Temperature range, Short/Long: 150/110°F
Reduced installation torque (for AT-3G): Not applicable
Ignore 6do requirement: Not applicable
Build-up grout pad: Yes

Base Plate

Length x Width x Thickness (mm): 203 x 114 x 6

Recommended Anchor

Anchor Name: SET-3G™ - SET-3G w/ 3/4"Ø A193 Gr. B8/B8M (304/316SS)
Code Report: ICC-ES ESR-4057





Company:	WesTech Engineering	Date:	8/2/2023
Engineer:	ME75	Page:	2/5
Project:	Brantford 24946A		
Address:			
Phone:			
E-mail:			

Load and Geometry

Load factor source: CSA A23.3

Load combination: not set

Seismic design: No

Anchors subjected to sustained tension: No

Apply entire shear load at front row: No

Anchors only resisting wind and/or seismic loads: No

Strength level loads:

N_{ua} [kN]: -15.88

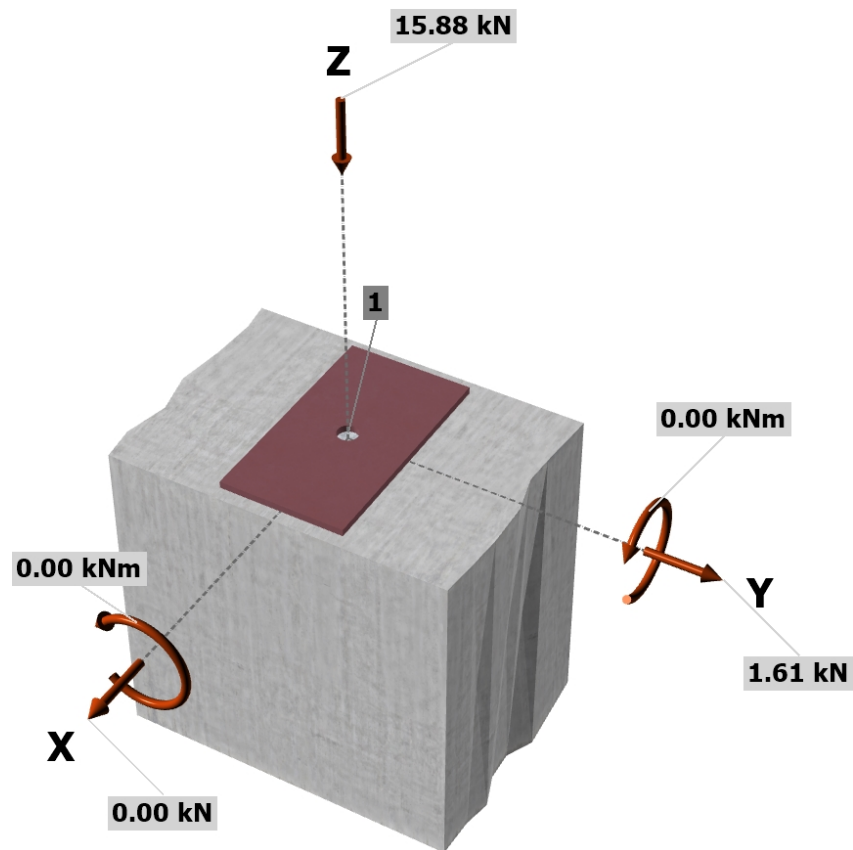
V_{uax} [kN]: 0.00

V_{uay} [kN]: 1.61

M_{ux} [kNm]: 0.00

M_{uy} [kNm]: 0.00

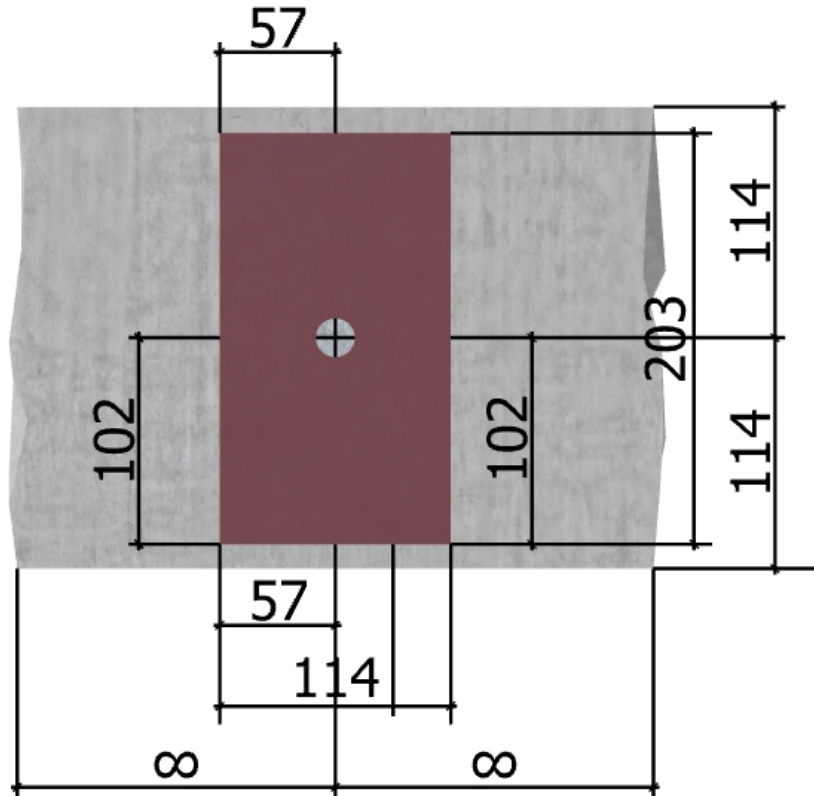
<Figure 1>





Company:	WesTech Engineering	Date:	8/2/2023
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E-mail:			

<Figure 2>





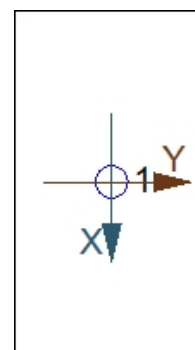
Company:	WesTech Engineering	Date:	8/2/2023
Engineer:	ME75	Page:	4/5
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Address:			
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E-mail:			

3. Resulting Anchor Forces

Anchor	Tension load, N_{fa} (kN)	Shear load x, V_{fax} (kN)	Shear load y, V_{fay} (kN)	Shear load combined, $\sqrt{(V_{fax})^2 + (V_{fay})^2}$ (kN)
1	0.0	0.0	1.6	1.6
Sum	0.0	0.0	1.6	1.6

Maximum concrete compression strain (‰): 0.00
Maximum concrete compression stress (N/mm²): 0.00
Resultant tension force (kN): 0.00
Resultant compression force (kN): 0.00
Eccentricity of resultant tension forces in x-axis, e'_{Nx} (mm): 0
Eccentricity of resultant tension forces in y-axis, e'_{Ny} (mm): 0
Eccentricity of resultant shear forces in x-axis, e'_{Vx} (mm): 0
Eccentricity of resultant shear forces in y-axis, e'_{Vy} (mm): 0
Steel resistance factor, Φ_s : 0.85 (Clause 8.4.3)
Concrete resistance factor, Φ_c : 0.65 (Clause 8.4.2)

<Figure 3>



8. Steel Resistance of Anchor in Shear (Clause D.7.1)

$$V_{sar} = \phi_{grout} V_{sa} \phi_s R \text{ (Clause D.7.1.2)}$$

V_{sa} (kN)	ϕ_{grout}	R	V_{sar} (kN)
50.82	0.8	0.75	25.92

9. Concrete Breakout Resistance of Anchor in Shear (Clause D.7.2)

Shear parallel to edge in x-direction:

$$V_{bry} = \min[0.58(l_e/d_a)^{0.2} d_a \phi_c \lambda_a \sqrt{f'_c c_{at}}^{1.5} R; 3.75 \lambda_a \phi_c \sqrt{f'_c c_{at}}^{1.5} R] \text{ (Eq. D.35 \& Eq. D.36)}$$

l_e (mm)	d_a (mm)	λ_a	f'_c (MPa)	c_{at} (mm)	R	V_{bry} (kN)
114	19	1.00	20.70	114	1.00	13.04

$$V_{cbry} = (2)(A_{Vc}/A_{Vco}) \psi_{ed,V} \psi_{c,V} \psi_{h,V} V_{bry} \text{ (Sec. D.7.2.1(c) \& Eq. D.32)}$$

A_{Vc} (mm ²)	A_{Vco} (mm ²)	$\psi_{ed,V}$	$\psi_{c,V}$	$\psi_{h,V}$	V_{bry} (kN)	V_{cbry} (kN)
58482	58482	1.000	1.000	1.000	13.04	26.08

10. Concrete Pryout Resistance of Anchor in Shear (Clause D.7.3)

$$V_{cpr} = \min[k_{cp} N_{ar}; k_{cp} N_{cb}] = \min[k_{cp}(A_{Na}/A_{Na0}) \psi_{ed,Na} \psi_{cp,Na} \lambda_a \phi_c \tau_k \pi d_a h_{ef,a} R_a; k_{cp}(A_{Nc}/A_{Nco}) \psi_{ed,N} \psi_{c,N} \psi_{cp,Na} k_c \lambda_a \phi_c \sqrt{f'_c} h_{ef,cb}^{1.5} R_{cb}] \text{ (Clause D.7.3(a))}$$

k_{cp}	A_{Na} (mm ²)	A_{Na0} (mm ²)	$\psi_{ed,Na}$	$\psi_{p,Na}$	τ_k (MPa)	d_a (mm)	$h_{ef,a}$ (mm)	R_a
2.0	118869	271810	0.831	1.000	9.03	19	114	1.00
A_{Nc} (mm ²)	A_{Nco} (mm ²)	$\psi_{ed,N}$	$\psi_{c,N}$	$\psi_{cp,N}$	k_c	λ_a	f'_c (MPa)	$h_{ef,cb}$ (mm)
78181	117580	0.899	1.000	1.000	7.0	1.00	20.70	114
R_{cb}	V_{cpr} (kN)							
1.00	30.26							

Input data and results must be checked for agreement with the existing circumstances, the standards and guidelines and must be checked for plausibility.?



Anchor Designer™
Software
Version 3.1.2303.1

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Phone:			
E-mail:			

11. Results

11. Interaction of Tensile and Shear Forces (Sec. D.8)?

Shear	Factored Load, V_{fa} (kN)	Design Resistance, V_r (kN)	Ratio	Status
Steel	1.61	25.92	0.06	Pass (Governs)
Concrete breakout x-	1.61	26.08	0.06	Pass
Pryout	1.61	30.26	0.05	Pass

SET-3G w/ 3/4"Ø A193 Gr. B8/B8M (304/316SS) with hef = 114 mm meets the selected design criteria.

12. Warnings

- Designer must exercise own judgement to determine if this design is suitable.
- Refer to manufacturer's product literature for hole cleaning and installation instructions.

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Accessory Equipment

Aluminum Grating

ALUMINUM STANDARD MESH BAR GRATING

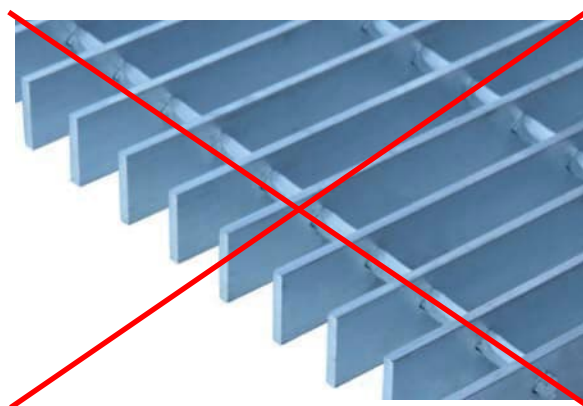
aluminum information

RECTANGULAR
AND I-BAR GRATING

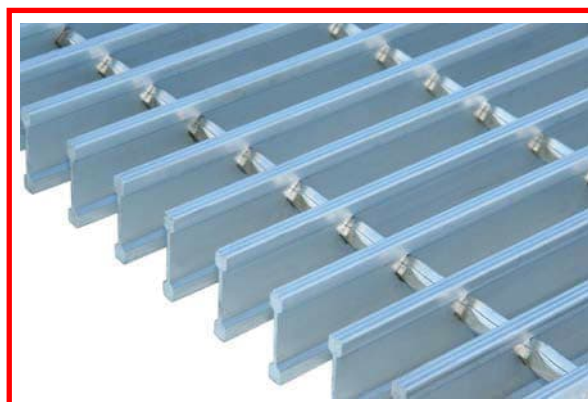
Aluminum Bar Gratings employ a unique interlocking system that joins the bearing bars and cross rods together in panels of exceptional rigidity and strength. Lightweight, corrosion-resistant, non-sparking alloys are ideal for pedestrian platforms in chemical, petroleum, and food processing plants. Fisholow gratings is recommended in most water and waste water treatment facilities and is becoming increasingly popular for use in architectural building designs.

Aluminum Bar Grating is available in two bar profiles: **Rectangular Bar** and **I-bar**. Similar to Tru-Weld Steel Bar Grating, Fisholow Rectangular Bar Grating is offered with a plain or serrated surface. Fisholow I-Bar Grating produces exceptional load ratings at a fraction of the weight of its rectangular counterpart, and is designed with a slip resistant corrugated surface on the top of each I-bar.

Both Rectangular Bar and I-Bar styles are available in special mesh options.



RECTANGULAR BAR



I-BAR

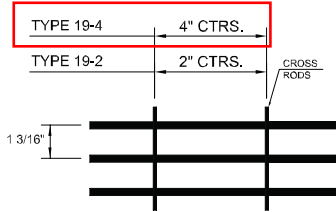


STANDARD

Bearing Bars: 1 3/16" centers, 6063T6

Cross Bars: 6063T5

Stock panels: 3' nominal width x 24' long



aluminum type 19

**IMPERIAL LEGEND**U = Safe Uniform Load (lbs./ft.²)

C = Safe Concentrated Load (lbs./foot of grating width)

D = Deflection (inches)

Loads and deflections given in this table are theoretical and are based on a maximum allowable fibre stress of 12,000 P.S.I.

For Fisholow I-bar loading, use the equivalent depth 3/16" bar size values in this load table.

BEARING BAR SIZE (inches)	APPROX. WEIGHT (lbs./ft. ²)	LOAD/ DEFLECTION	SPAN IN FEET AND INCHES														SECTION MODULUS PER FOOT OF WIDTH		
			2' 0"	2' 6"	3' 0"	3' 6"	4' 0"	4' 6"	5' 0"	5' 6"	6' 0"	6' 6"	7' 0"	7' 6"	8' 0"	8' 6"		9' 0"	
1 x 1/8	1.92	U	421	269	187	137	105	83	Spans and loads in the pink shaded area exceed a deflection of 1/4" for uniform loads of 100 lbs/sq. ft. Experience has shown that 1/4" deflection is the maximum deflection to give pedestrian comfort, but can be exceeded for other types of loads at the discretion of the engineer.									0.216	
		D	0.114	0.225	0.324	0.441	0.576	0.729											
		C	421	337	281	241	211	187											
		D	0.115	0.18	0.259	0.353	0.461	0.583											
1 x 3/16	2.72	U	632	404	281	206	158	125	For serrated surface, increase depth by one size.									0.325	
		D	0.144	0.225	0.324	0.441	0.576	0.729											
		C	632	505	421	361	316	281											
		D	0.115	0.18	0.259	0.353	0.461	0.583											
1 1/4 x 1/8	2.31	U	658	421	292	215	164	130	105	87	73								0.339
		D	0.115	0.18	0.259	0.353	0.461	0.583	0.720	0.871	1.037								
		C	658	526	439	376	329	292	263	239	219								
		D	0.092	0.144	0.207	0.282	0.369	0.467	0.576	0.697	0.829								
1 1/4 x 3/16	3.31	U	987	632	439	322	247	195	158	130	110	93	81						0.507
		D	0.115	0.18	0.259	0.353	0.461	0.583	0.720	0.871	1.037	1.217	1.411						
		C	987	789	658	564	493	439	395	359	329	304	282						
		D	0.092	0.144	0.207	0.282	0.369	0.467	0.576	0.697	0.829	0.973	1.129						
1 1/2 x 1/8	2.72	U	947	606	421	309	237	187	152	125	105	90	77	67	59	52	47	0.488	
		D	0.096	0.150	0.216	0.294	0.384	0.486	0.600	0.726	0.864	1.014	1.176	1.35	1.536	1.734	1.944		
		C	947	758	632	541	474	421	379	344	316	291	271	253	237	223	211		
		D	0.077	0.120	0.173	0.235	0.307	0.389	0.480	0.581	0.691	0.811	0.941	1.08	1.229	1.387	1.555		
1 1/2 x 3/16	3.89	U	1421	909	632	464	355	281	227	188	158	135	116	101	89	79	70	0.730	
		D	0.096	0.15	0.216	0.294	0.384	0.486	0.6	0.726	0.864	1.014	1.176	1.35	1.536	1.734	1.944		
		C	1421	1137	947	812	711	632	568	517	474	437	406	379	355	334	316		
		D	0.077	0.12	0.173	0.235	0.307	0.389	0.48	0.581	0.691	0.811	0.941	1.08	1.229	1.387	1.555		
1 3/4 x 3/16	4.48	U	1934	1238	860	632	484	382	309	256	215	183	158	138	121	107	96	0.994	
		D	0.082	0.129	0.185	0.252	0.329	0.417	0.514	0.622	0.741	0.869	1.008	1.157	1.317	1.486	1.666		
		C	1934	1547	1289	1105	967	860	774	703	645	595	553	516	484	455	430		
		D	0.066	0.103	0.148	0.202	0.263	0.333	0.411	0.498	0.592	0.695	0.806	0.926	1.053	1.189	1.333		
2 x 3/16	5.08	U	2526	1617	1123	825	632	499	404	334	281	239	206	180	158	140	125	1.299	
		D	0.072	0.113	0.162	0.221	0.288	0.365	0.45	0.545	0.648	0.761	0.882	1.013	1.152	1.301	1.458		
		C	2526	2021	1684	1444	1263	1123	1011	919	842	777	727	674	632	594	561		
		D	0.058	0.09	0.13	0.176	0.263	0.292	0.36	0.436	0.518	0.608	0.706	0.81	0.922	1.04	1.166		
2 1/4 x 3/16	5.68	U	3197	2046	1421	1044	799	632	512	423	355	303	261	227	200	177	158	1.644	
		D	0.064	0.100	0.144	0.196	0.256	0.324	0.400	0.484	0.576	0.676	0.784	0.900	1.024	1.156	1.296		
		C	3197	2558	2132	1827	1599	1421	1279	1163	1066	984	1218	1137	799	752	711		
		D	0.051	0.080	0.115	0.157	0.205	0.259	0.320	0.387	0.461	0.541	0.627	0.720	0.819	0.925	1.037		
2 1/2 x 3/16	6.28	U	3947	2526	1754	1289	987	780	632	522	439	374	322	281	247	219	195	2.029	
		D	0.058	0.090	0.130	0.176	0.230	0.292	0.360	0.436	0.518	0.608	0.706	0.81	0.922	1.04	1.166		
		C	3947	3158	2632	2256	1974	1754	1579	1435	1316	1215	1128	1053	987	929	877		
		D	0.046	0.072	0.104	0.141	0.184	0.233	0.288	0.348	0.415	0.487	0.564	0.648	0.737	0.832	0.933		

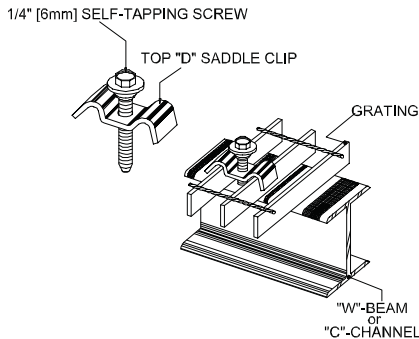
I-BAR WEIGHTS (IMPERIAL)					
BEARING BAR SIZE (inches)	WEIGHTS (lbs./ft. ²)				
	TYPE 11-4	TYPE 15-4	TYPE 19-4	TYPE 30-4	TYPE 38-4
1 x 1/4	n/a	2.35	1.85	1.22	1.02
1 1/4 x 1/4	n/a	2.86	2.29	1.51	1.26
1 1/2 x 1/4	n/a	3.30	2.63	1.76	1.47
1 3/4 x 1/4	n/a	3.73	2.97	2.02	1.75
2 x 1/4	n/a	4.15	3.30	2.24	1.88
2 1/4 x 1/4	n/a	4.67	3.89	2.61	2.18
2 1/2 x 1/4	n/a	4.77	3.99	2.67	2.23

Fisholow grating meets N.A.A.M.M. standards.

GRATING FASTENING METHODS

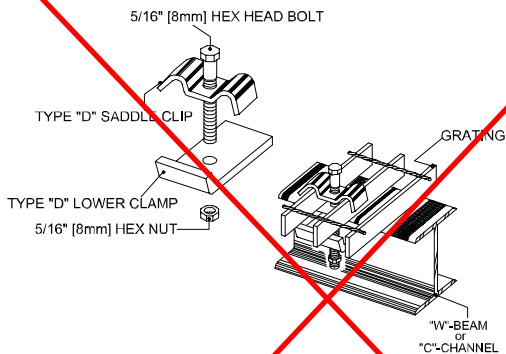
fastening methods information

BAR GRATING FASTENERS

**Type D Saddle Clip
(complete with stainless steel self tapping screw)**

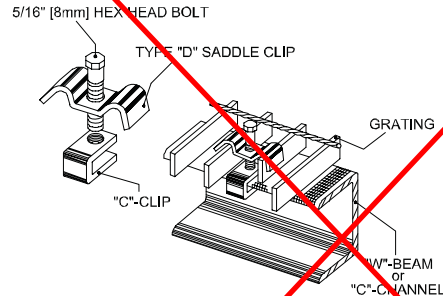
Our most common and cost-effective fastening method. Simply pre-drill a hole into the supporting member and drive in the self-tapping screw. Designed for use with Tru-Weld Type 19 and Type 15 bar grating only (in 1/8" and 3/16" bar sizes).

Available in standard galvanized or bare steel and stainless steel options.

**Type D Saddle Clip
(complete with nut, bolt, and bottom clamp)**

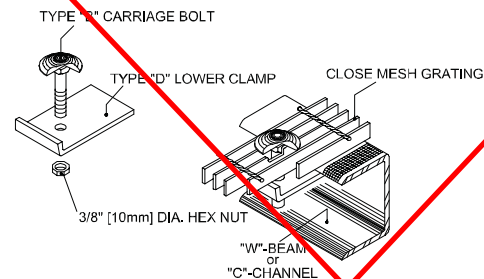
This combination allows for fastening grating without drilling into the supports. The Type D Saddle Clip holds the grating from the top as the bottom clamp is tightened under the flange of the supporting member. Designed for use with Tru-Weld Type 19 and Type 15 bar grating only (in 1/8" and 3/16" bar sizes).

Available in standard galvanized or bare steel and stainless steel options.

**Type D Saddle Clip
(complete with C-clamp and bolt)**

Eliminates the need to drill supports or have access beneath the grating during installation. The C-clamp slides between the bearing bars to clamp the flange of the supporting member and is tightened from above using a hex-driver. For use with Tru-Weld Type 19 and Type 15 bar grating only (in 1/8" and 3/16" bar sizes).

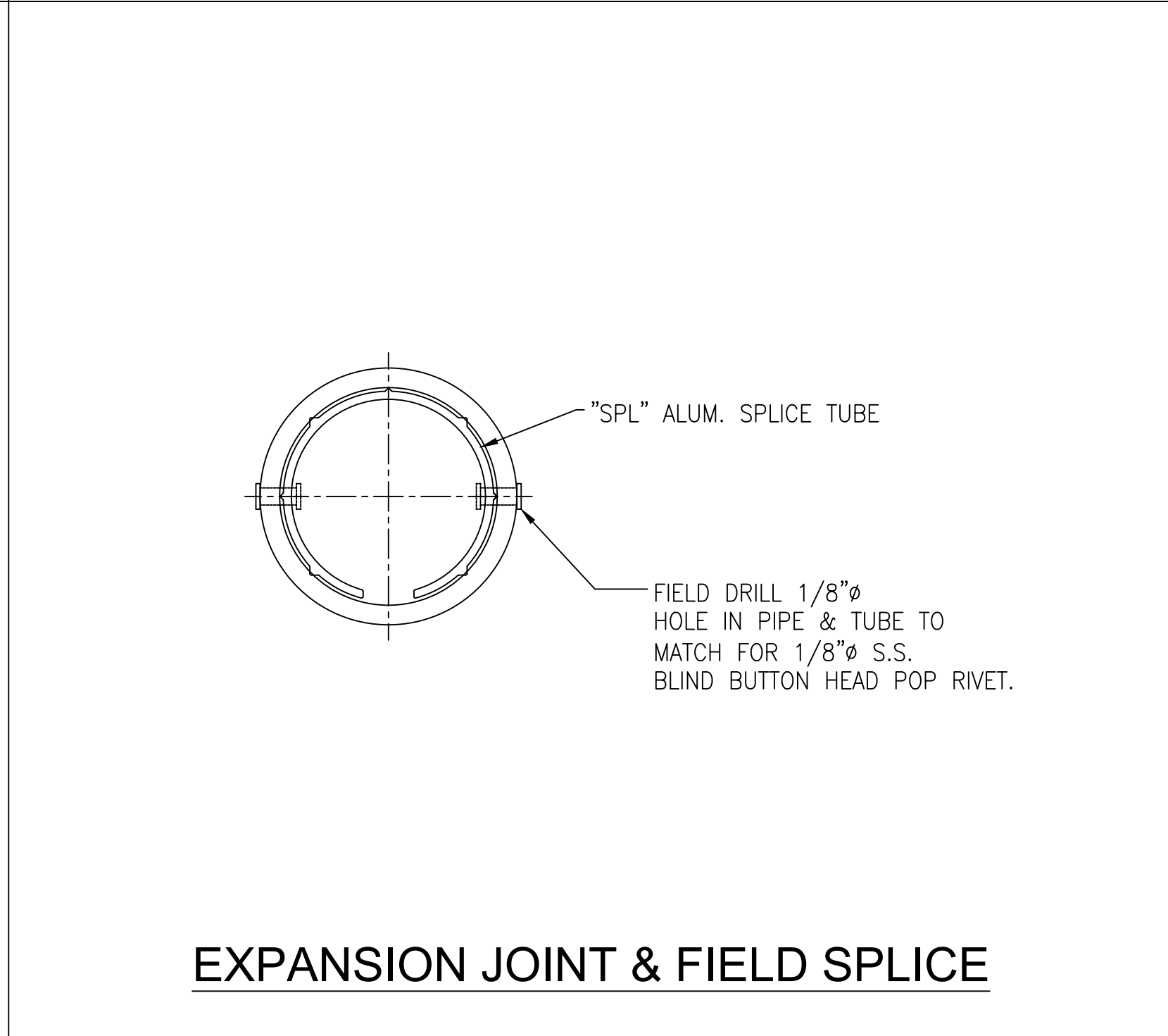
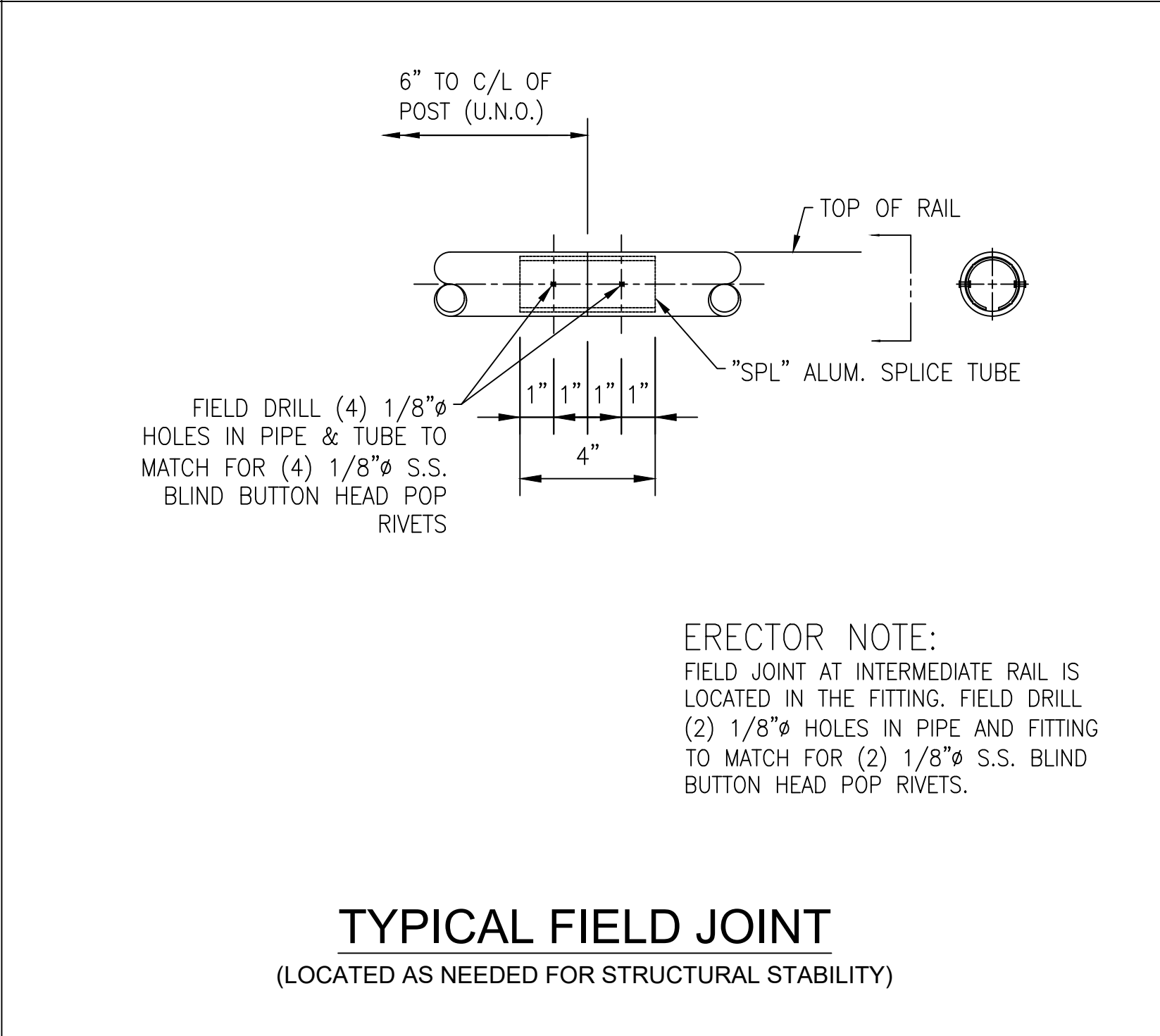
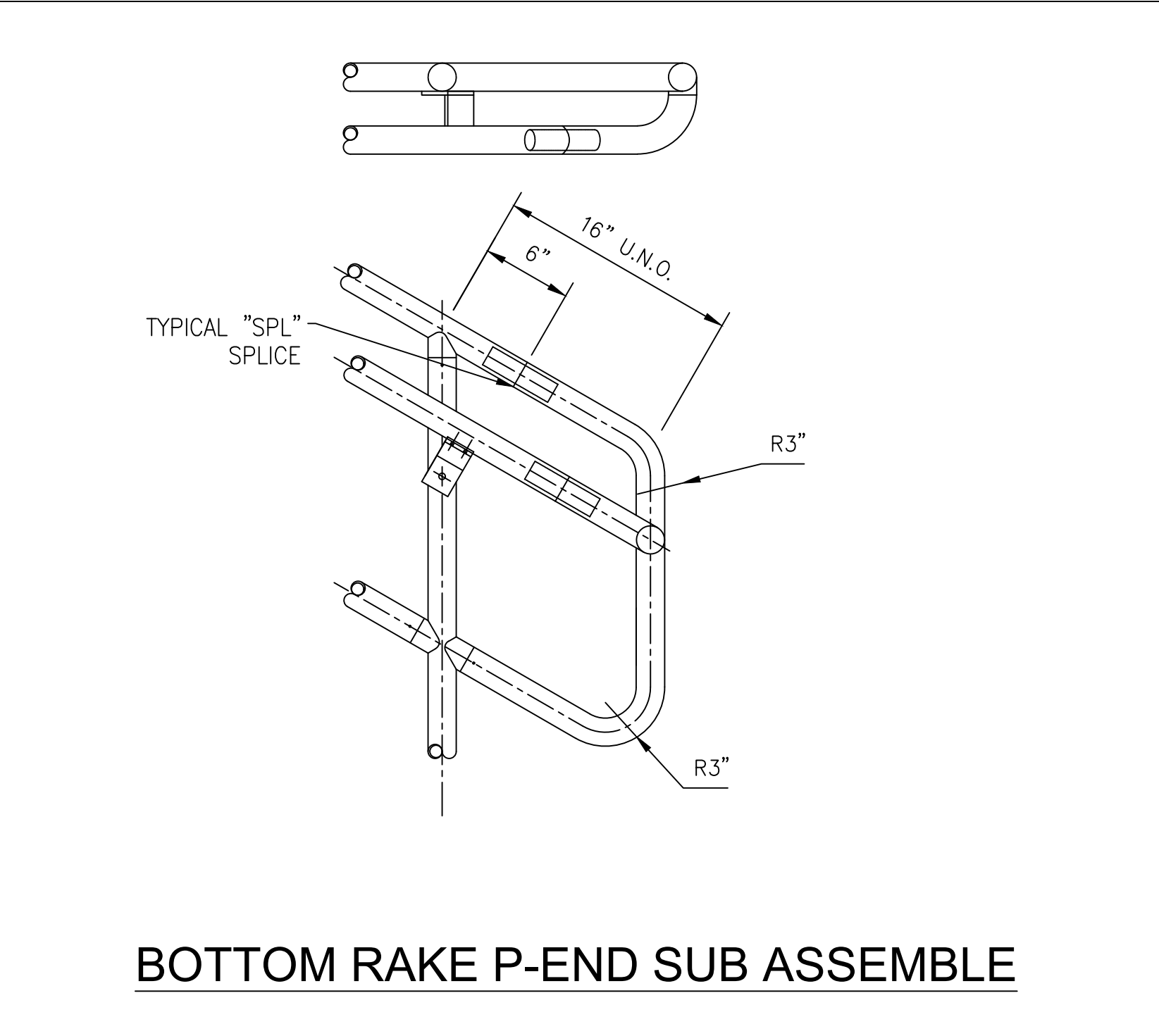
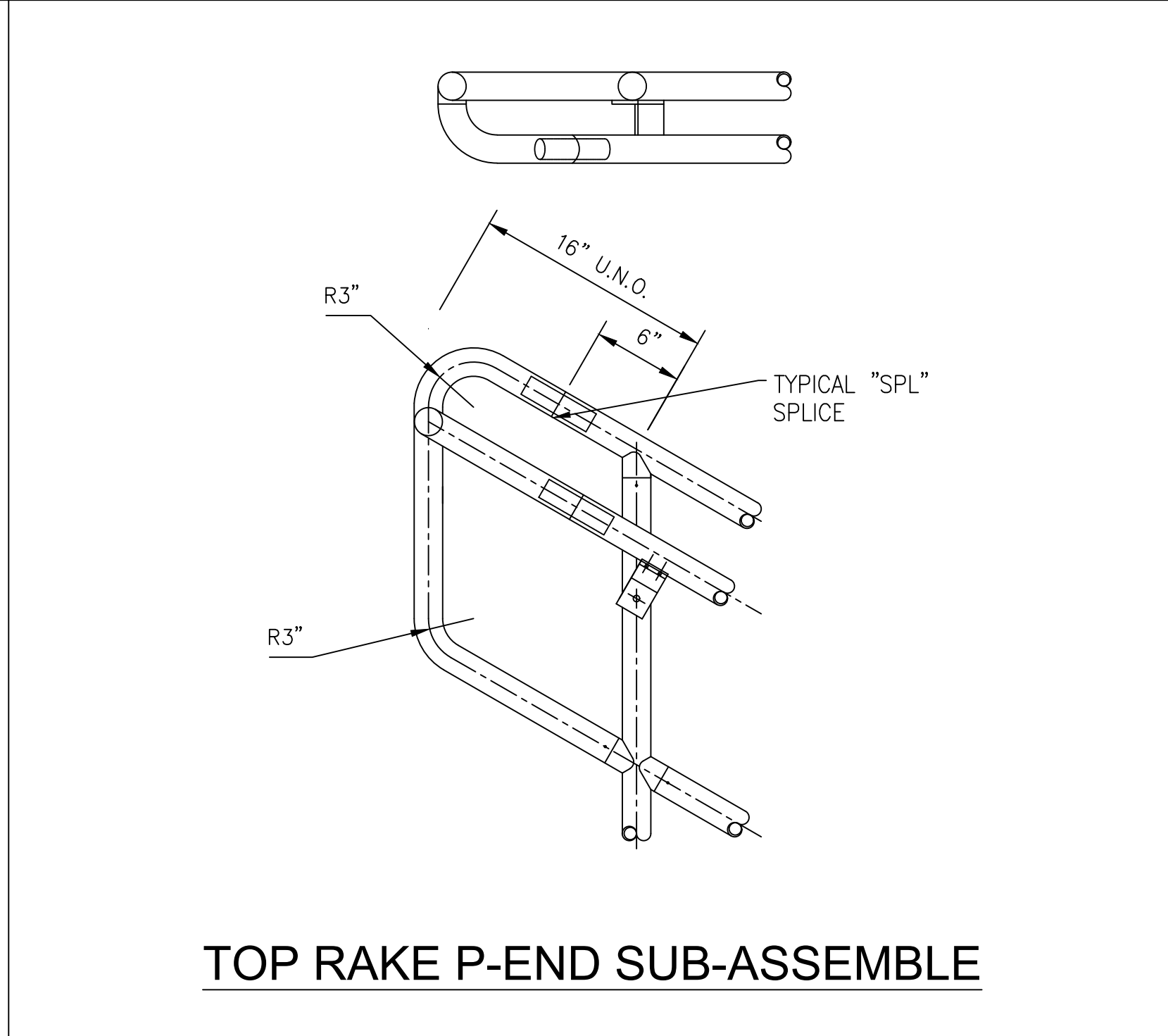
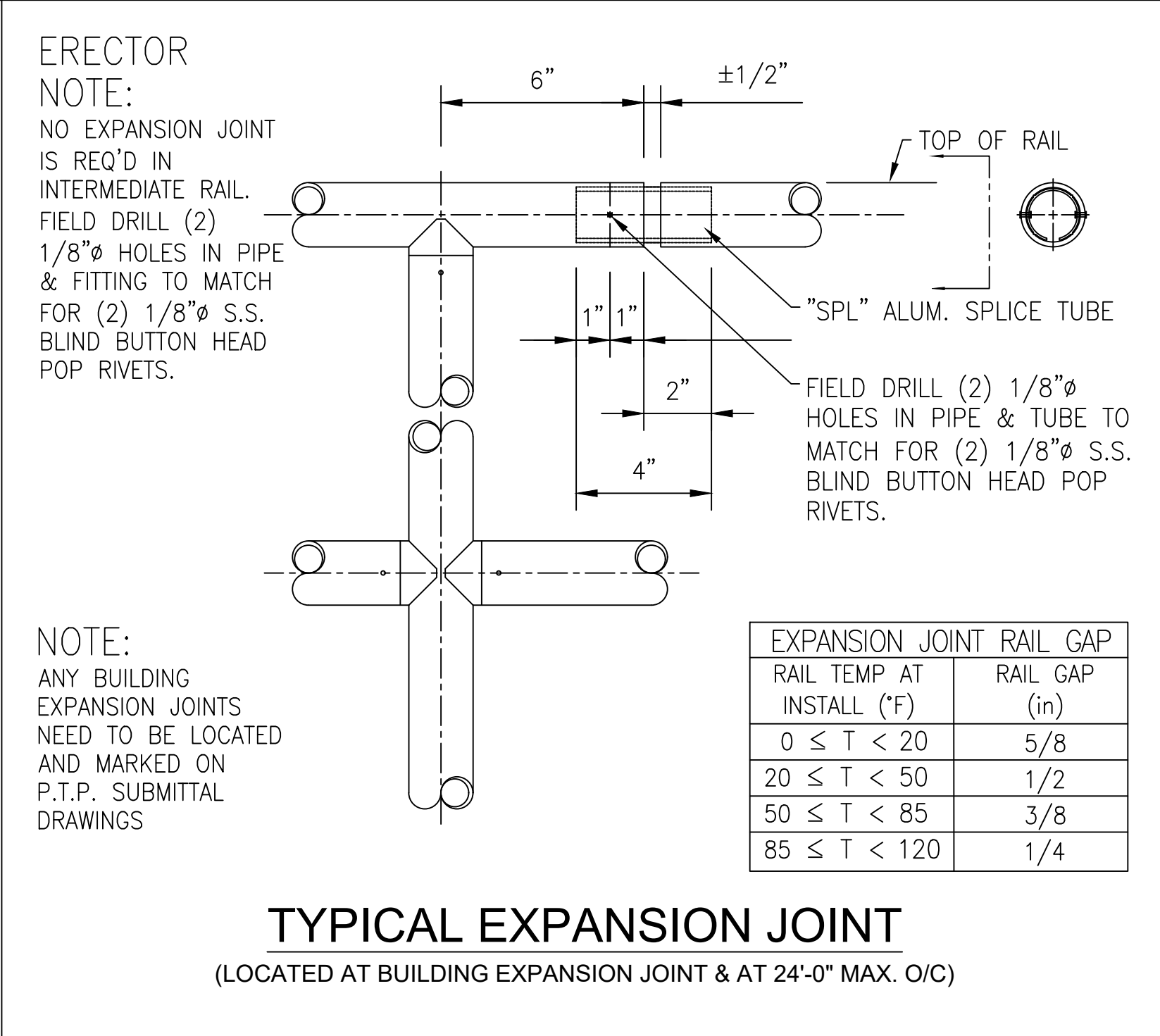
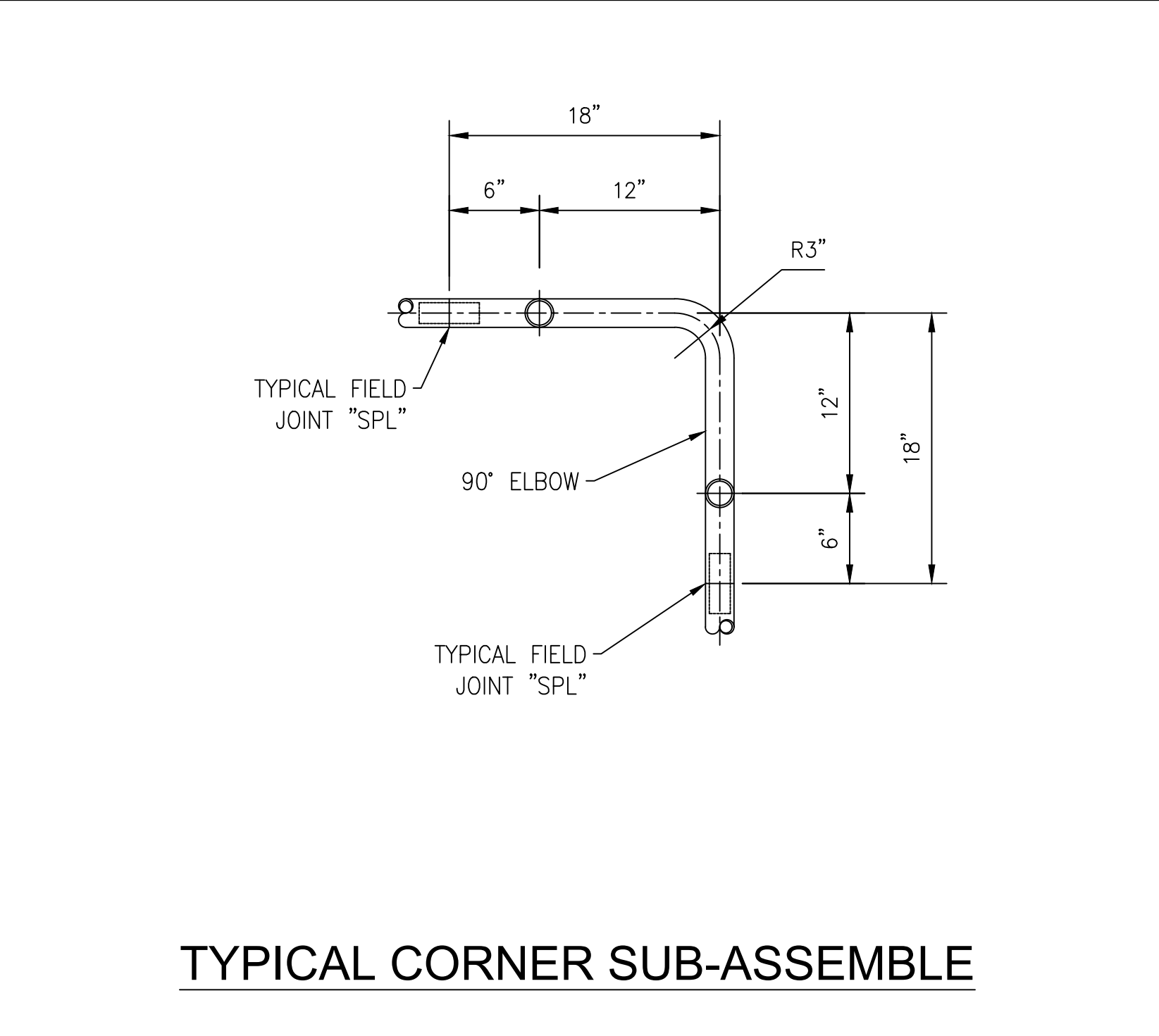
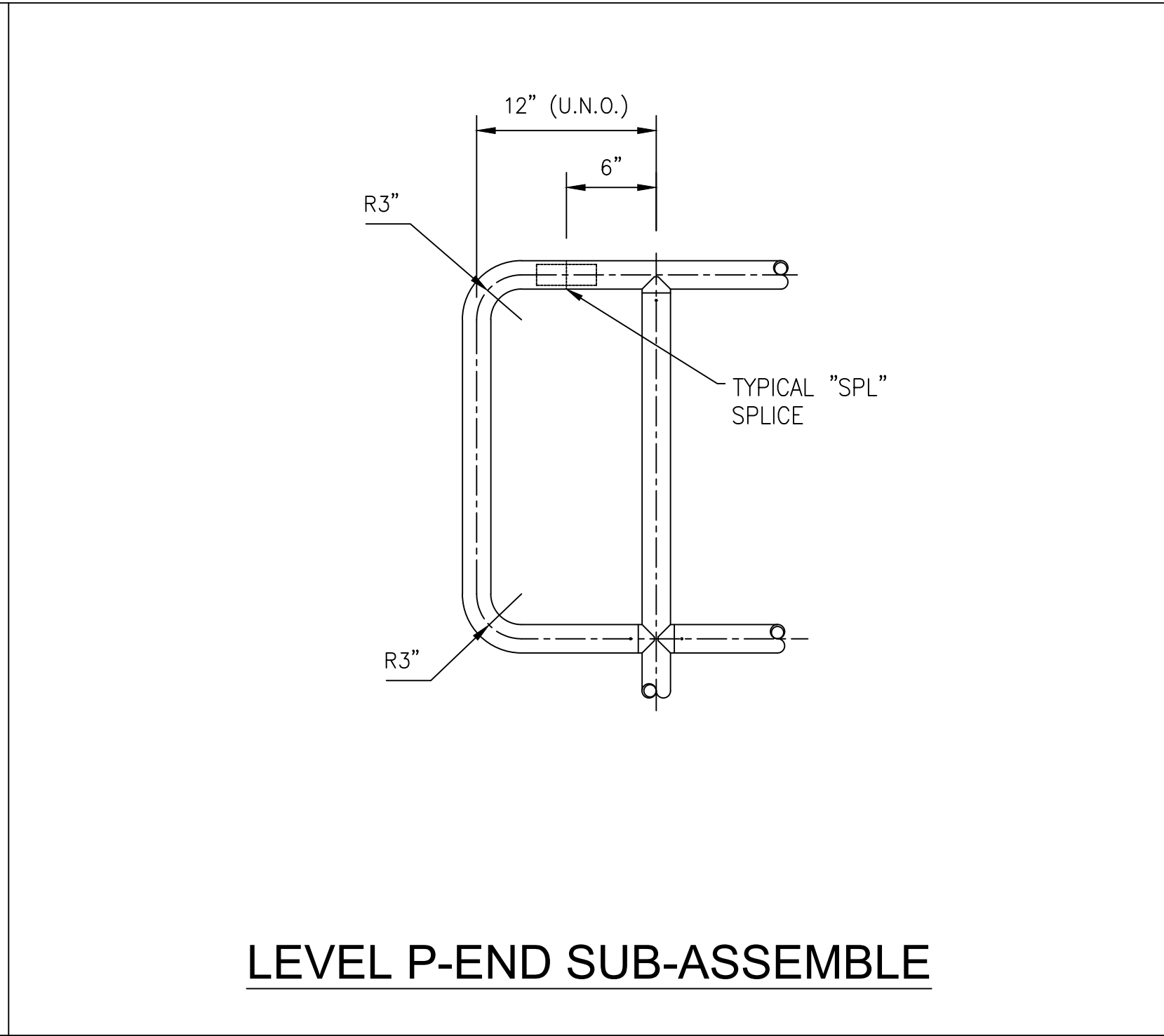
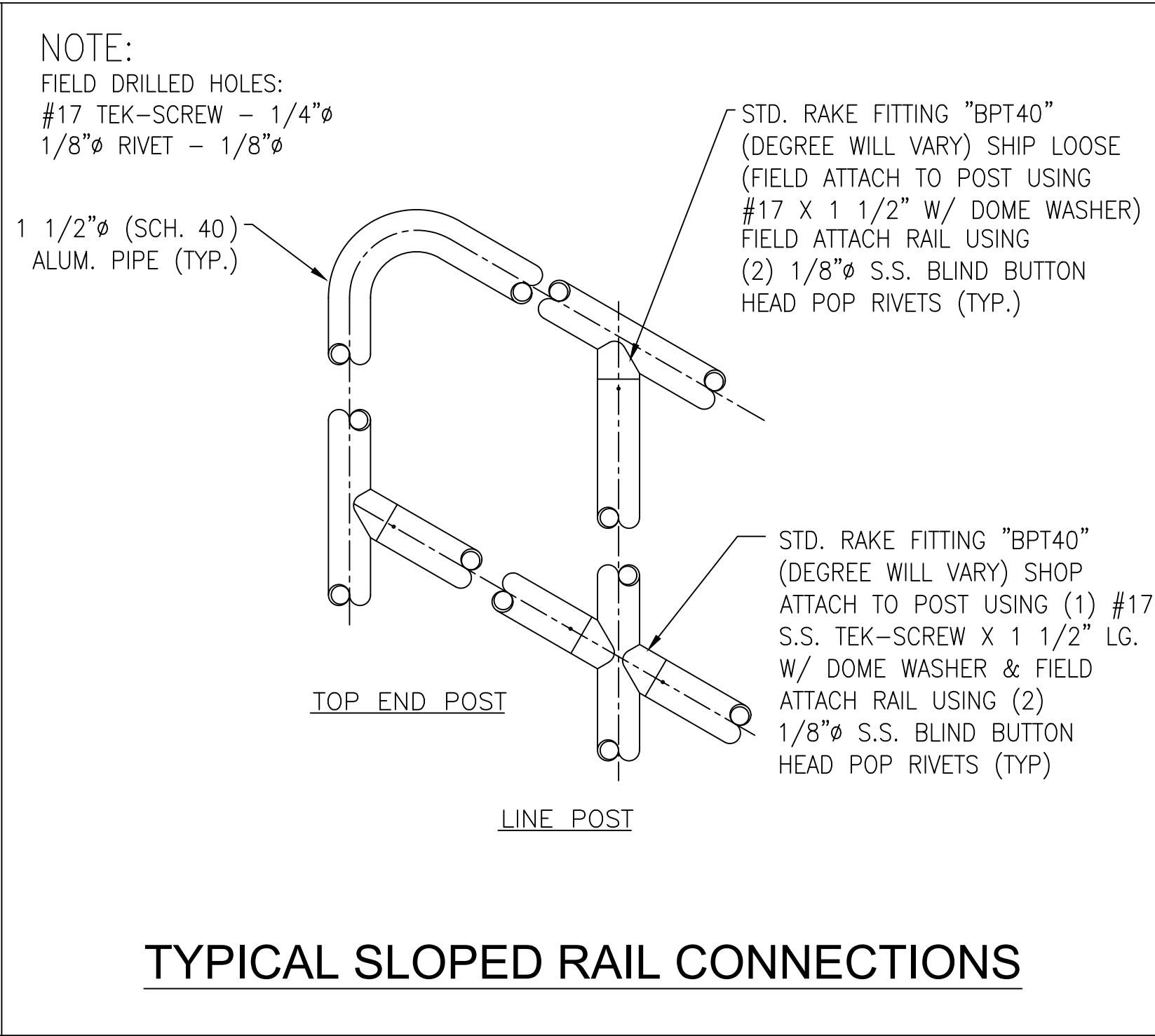
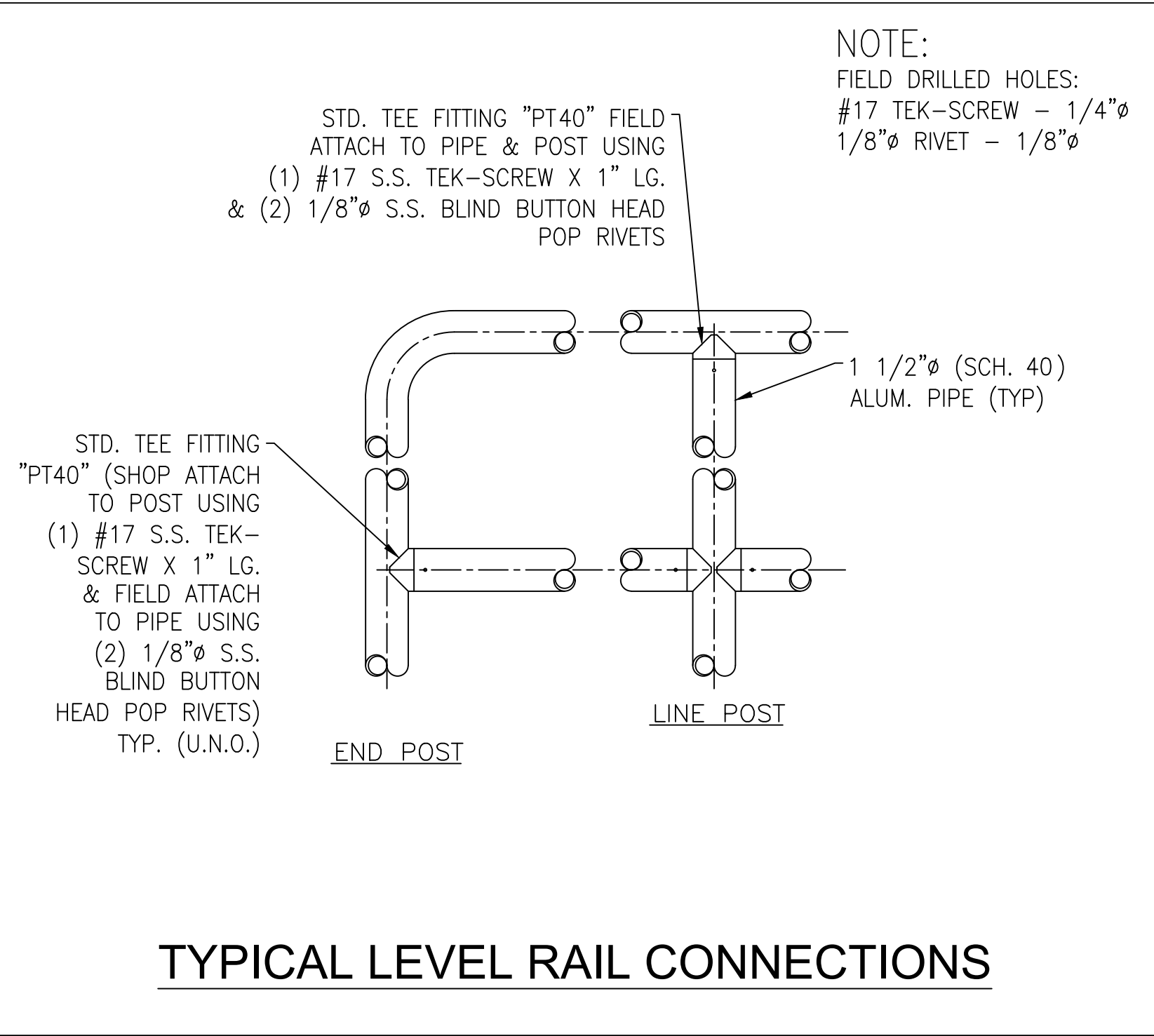
Available in standard galvanized or bare steel and stainless steel options.

Type B Clamping Bolt, Nut, and Bottom Clamp

For close mesh Type 11 and Type 9.5 grating, a square collared clamping bolt can be inserted directly between the ends of the bearing bars and fitted through a bottom clamp. The rounded bolt head rests directly on the bearing bars eliminating the need for a top saddle clip.

Available by special order in bare steel, galvanized, and stainless steel.

Aluminum Handrail




GENERAL NOTES

- ALL RAIL IS TO BE OF MECHANICAL CONSTRUCTION U.N.O.
- ALL RAILS ARE TO BE FABRICATED FROM 1 1/2"Ø (SCH. 40) ALUMINUM PIPE (6005A-T61 ALLOY) (U.N.O.)
- ALL POSTS ARE TO BE FABRICATED FROM 1 1/2"Ø (SCH. 40) ALUMINUM PIPE (6005A-T61 ALLOY) (U.N.O.)
- ALL EXTRUDED COMPONENTS ARE 6005A-T61 ALLOY, CAST COMPONENTS ARE 535 ALLOY
- ALL FASTENERS (SELF TAPPING SCREWS, MACHINE BOLTS, ADHESIVE ANCHORS, ETC.) TO BE 304 STAINLESS STEEL
- ALL RAILING SURFACES IN CONTACT WITH CONCRETE OR DISSIMILAR METALS SHALL RECEIVE ONE 1/16" THICK NEOPRENE GASKET (SHIPPED LOOSE FOR FIELD ATTACHMENT)
- ALL BOLTS, NUTS AND FLAT WASHERS USED TO MOUNT RAILINGS TO FLOORS, WALLS, STEEL, ETC. ARE BY PTP ENGINEERED RAILINGS
- ALL KICK PLATES ("FKP" OR "SKP") SHALL BE SHIPPED LOOSE IN 24'-0" LG. STOCK LENGTHS FOR FIELD CUTTING & DRILLING AS NEEDED
- ALL POSTS ARE TO BE FURNISHED CUT TO LENGTH WITH FITTINGS & MOUNTING PLATES ATTACHED OR SHIPPED LOOSE PER THEIR SPECIFIC DETAILS
- PIPE FOR STRAIGHT RAIL IS FURNISHED IN 24'-0" STOCK LENGTHS FOR CUTTING & DRILLING AS NEEDED
- PIPE FOR CURVED RAIL IS FURNISHED SUB-ASSEMBLED IN 21'-0" (MAX). ROLLED LENGTHS FOR FIELD CUTTING & DRILLING AS NEEDED
** ALL RADII MUST BE VERIFIED PRIOR TO FABRICATION **
- ALL CURVED RAIL SHALL BE FABRICATED USING CURVED TOP AND INTERMEDIATE RAILS
- PIPE FOR SINGLE LINE RAIL IS FURNISHED & SHIPPED SUB-ASSEMBLED.
- BENDS WITH A 3" C/L RADIUS ARE FURNISHED AS NEEDED & MUST BE FIELD CUT FOR FIELD CONDITIONS
- ALL RAIL WHEN PROPERLY INSTALLED SHALL MEET OR EXCEED OSHA REQUIREMENTS.
- MAX. POST SPACING TO BE 6'-0" C/C
- ALL RAIL IS TO BE FINISHED IN ACCORDANCE WITH THE ALUMINUM ASSOCIATION'S DESIGNATION M10C22A41 OR M12C22A41
- PIPE FOR CANTILEVER RAILING WILL SHIP LOOSE IN 24'-0" STOCK LENGTHS FOR FIELD CUTTING AND DRILLING AS NEEDED
- ENSURE ALL FIELD CUTS AND FIELD DRILLED HOLES ARE CLEANED UP, FREE OF SHARP EDGES AND BURRS.
- CONCRETE ANCHOR TYPE IS HILTI HIT-RE 500 V3 ADHESIVE ANCHORS. CONCRETE STRENGTH IS ASSUMED TO BE 4000 PSI, NORMAL WEIGHT CRACKED CONCRETE.
- ALL DIMENSIONS SHOWN THROUGHOUT THIS SET ARE APPROXIMATE AND SHALL BE FIELD VERIFIED BEFORE FABRICATION AND INSTALLATION

%% = SEE ERECTION DRAWINGS FOR PART NUMBER

1	SUBMITTAL	9/19/2017
REV	DESCRIPTION	DATE



3000 YOUNGFIELD ST. SUITE 275 WHEAT RIDGE, CO 80215
Ph: (720)508-3819 FAX: (720)409-3843

NOTICE TO CONTRACTOR AND ERECTOR:
BACK CHARGES FOR CORRECTIVE WORK OR REPLACEMENT MATERIALS WILL NOT BE ACCEPTED UNLESS AUTHORIZED BY PEAK TO PEAK ENGINEERED RAILINGS, INC. BEFORE SUCH COSTS ARE INCURRED

STANDARD DETAILS

CITY, ST

ALUMINUM HANDRAIL - RIVET SYSTEM - SUB-ASSEMBLED

DESIGNER	DESIGNER	CUSTOMER	CUSTOMER	DWG TITLE	STANDARD DETAILS
CUSTOMER JOB #	XXXX-XX	PRINT DATE	2/26/2020	ISSUE DATE	2/26/2020
DETAILED BY	INT	CHECKER	INT	SCALE	NTS
				CONTRACT NO	DRAWING NO.
				XXX-XXX	SD-1



3000 YOUNGFIELD ST. SUITE 275 WHEAT RIDGE, CO 80215
720.508.3819 fax 720.409.3843 www.peaktopeakrailings.com

12 December 2022

RE: Aluminum Alloy for Peak to Peak Engineered Railings System

To Whom it may concern,

Peak to Peak requests our standard 6005A-T61 aluminum alloy be accepted in lieu of 6061-T6, 6063-T6, or 6105-T5 alloys for the following reasons:

- 1) 6005A-T61 has a minimum ultimate tensile strength of 38 ksi compared to 30 ksi from 6063-T6. 6061-T6 and 6105-T5 both have the same 38 ksi ultimate tensile strength.
- 2) 6005A-T61 has a minimum yield strength of 35 ksi compared to 25 ksi from 6063-T6. 6061-T6 and 6105-T5 both have the same 35 ksi yield strength.
- 3) The standard clear anodizing of 6005A-T61 is a near perfect match in finish to the 535 alloy of all of our fittings. Compared to the finish of 6061-T6, 6105-T5, and 6063-T6 alloys, the 6005A-T61 alloy offers a more aesthetic appearance to the railing.

Additionally, corrosion resistance is typically mentioned as the main factor behind specifying 6063-T6 over a different alloy, so I wanted to follow up with some information from the Aluminum Design Manual regarding corrosion resistance. Per the following chart (Table 1 from Chapter IV of the Aluminum Design Manual 2015), 6005A-T61 has a **B** level of *General Resistance to Corrosion* and an **A** level of Resistance to *Stress-Corrosion Cracking*.

ALLOY AND TEMPER	RESISTANCE TO CORROSION		Workability (Cold) ⑤	Machinability ⑤	Brazeability ⑥	WELDABILITY ⑥		
	General ①	Stress-Corrosion Cracking ②				Gas	Arc	Resistance Spot and Seam
5657-H241 H25 H26 H28	A A A A	A A A A	A B B C	D D D D	B B B B	A A A A	A A A A	A A A A
6005-T1, T5 6005A-T1, T5 6005A-T61	B B B	A A A	.. B C	.. C C	A A A	A A A	A A A	A A A
6053-O T6, T61	.. A	.. A	E C	B B	A A	A A	B A
6061-O T4, T451, T4510, T4511 T6, T651, T652, T6510, T6511	B B B	A B A	A B C	D C C	A A A	A A A	A A A	B A A
6063-T1 T4 T5, T52 T6 T83, T831, T832	A A A A A	A A A A A	B B B C C	D D C C C	A A A A A	A A A A A	A A A A A	A A A A A

Sales Office: 720-508-3819 | Fax: 720-409-3843
3000 Youngfield Street | Wheat Ridge, CO | 80215



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The footnotes for the chart (shown below) indicate that *Alloys with A and B ratings can be used in industrial and seacoast atmospheres without protection.* Additionally, all of our railing is anodized to a thickness of 0.7 mils, so we include additional protective coating even though the Aluminum Design Manual indicates that it can be used in industrial settings without that additional protection. We also separate all faying surfaces with an isolating gasket to prevent corrosion at these locations. The stress-corrosion cracking for 6005A-T61 is rated as an A so there should be no concerns around this happening.

Footnotes for Table 1

① Ratings A through E are relative ratings in decreasing order of merit, based on exposures to sodium chloride solution by intermittent spraying or immersion. Alloys with A and B ratings can be used in industrial and seacoast atmospheres without protection. Alloys with C, D and E ratings generally should be protected at least on faying surfaces.

② Stress-corrosion cracking ratings are based on service experience and on laboratory tests of specimens exposed to the 3.5% sodium chloride alternate immersion test.

A = No known instance of failure in service or in laboratory tests.

B = No known instance of failure in service; limited failures in laboratory tests of short transverse specimens.

C = Service failures with sustained tension stress acting in short transverse direction relative to grain structure; limited failures in laboratory tests of long transverse specimens.

D = Limited service failures with sustained longitudinal or long transverse areas.

These ratings are neither product specific nor test direction specific and therefore indicate only the general level of stress-corrosion cracking resistance. For more specific information on certain alloys, see ASTM G64.

Based on all of the information listed above, we request that our anodized 6005A-T61 aluminum be accepted for use on this project.

Sincerely,

Christopher Manlove, P.E.

A handwritten signature in black ink, reading 'Christopher Manlove', written in a cursive style.

Design Engineer
Peak to Peak Engineered Railings, LLC

Sales Office: 720-508-3819 | Fax: 720-409-3843
3000 Youngfield Street | Wheat Ridge, CO | 80215

Epoxy Anchor Bolts

SET-3G™ High-Strength Epoxy Adhesive

SET-3G Adhesive Cartridge System

Model No.	Capacity (ounces)	Cartridge Type	Carton Quantity	Dispensing Tool(s)	Mixing Nozzle
SET3G10 ²	8.5	Coaxial	12	CDT10S	EMN22I
SET3G22-N ¹	22	Side-by-side	10	EDT22S, EDTA22P, EDTA22CKT	EMN22I

1. One EMN21I mixing nozzle and one extension are supplied with each cartridge.
2. Two EMN22I mixing nozzles and two nozzle extensions are supplied with each cartridge.
3. Cartridge estimation guidelines are available at strongtie.com/apps.
4. Use only Simpson Strong-Tie® mixing nozzles in accordance with Simpson Strong-Tie instructions. Modification or improper use of mixing nozzle may impair SET-3G adhesive performance.

SET-3G Cure Schedule^{1,2}

Concrete Temperature		Gel Time	Cure Time
(°F)	(°C)	(min.)	(hr.)
40	4	120	192
50	10	75	72
60	16	50	48
70	21	35	24
90	32	25	24
100	38	15	24

For SI: 1°F = (°C × 9/5) + 32.

1. For water-saturated concrete and water-filled holes, the cure times should be doubled.
2. For installation of anchors in concrete where the temperature is below 70°F (21°C), the adhesive must be conditioned to a minimum temperature of 70°F (21°C).

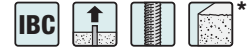
Test Criteria

Anchors installed with SET-3G adhesive have been tested in accordance with ICC-ES *Acceptance Criteria for Adhesive Anchors in Concrete Elements (AC308)*.

Property	Test Method	Result*
Consistency	ASTM C881	Passed, non-sag
Heat deflection	ASTM D648	147°F
Bond strength (moist cure)	ASTM C882	3,306 psi at 2 days
Water absorption	ASTM D570	0.13%
Compressive yield strength	ASTM D695	15,390 psi
Compressive modulus	ASTM D695	991,830 psi
Shore D durometer	ASTM D2240	84
Gel time	ASTM C881	52 minutes
Volatile Organic Compound (VOC)	—	1.9 g/L

*Material and curing conditions: 73 ± 2°F, unless otherwise noted.

SET-3G™ Design Information — Concrete

SET-3G Tension Strength Design Data for Threaded Rod in Normal-Weight Concrete^{1, 8}

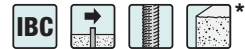
Characteristic			Symbol	Units	Nominal Rod Diameter (in.)						
					3⁄8	1⁄2	5⁄8	3⁄4	7⁄8	1	1 1⁄4
Steel Strength in Tension											
Minimum Tensile Stress Area			A_{se}	in. ²	0.078	0.142	0.226	0.334	0.462	0.606	0.969
Tension Resistance of Steel — ASTM F1554, Grade 36			N_{sa}	lb.	4,525	8,235	13,110	19,370	26,795	35,150	56,200
Tension Resistance of Steel — ASTM F1554, Grade 55					5,850	10,650	16,950	25,050	34,650	45,450	72,675
Tension Resistance of Steel — ASTM A193, Grade B7					9,750	17,750	28,250	41,750	57,750	75,750	121,125
Tension Resistance of Steel — Stainless Steel ASTM A193, Grade B8 and B8M (Types 304 and 316)					4,445	8,095	12,880	19,040	26,335	34,540	55,235
Tension Resistance of Steel — Stainless Steel ASTM F593 CW (Types 304 and 316)					7,800	14,200	22,600	28,390	39,270	51,510	82,365
Tension Resistance of Steel — Stainless Steel ASTM A193, Grade B6 (Type 410)					8,580	15,620	24,860	36,740	50,820	66,660	106,590
Strength Reduction Factor for Tension — Steel Failure			ϕ	—	0.75 ⁵						
Concrete Breakout Strength in Tension (2,500 psi ≤ f'c ≤ 8,000 psi)											
Effectiveness Factor for Cracked Concrete			$k_{C,cr}$	—	17						
Effectiveness Factor for Uncracked Concrete			$k_{C,uncr}$	—	24						
Strength Reduction Factor — Concrete Breakout Failure in Tension			ϕ	—	0.65 ⁶						
Bond Strength in Tension (2,500 psi ≤ f'c ≤ 8,000 psi) ⁷											
Minimum Embedment			$h_{ef,min}$	in.	2 3⁄8	2 3⁄4	3 1⁄8	3 1⁄2	3 3⁄4	4	5
Maximum Embedment			$h_{ef,max}$	in.	7 1⁄2	10	12 1⁄2	15	17 1⁄2	20	25
Continuous Inspection	Temperature Range A ^{2,4}	Characteristic Bond Strength in Cracked Concrete ⁹	$\tau_{k,cr}$	psi	1,448	1,402	1,356	1,310	1,265	1,219	1,128
		Characteristic Bond Strength in Uncracked Concrete ⁹	$\tau_{k,uncr}$	psi	2,357	2,260	2,162	2,064	1,967	1,868	1,672
	Temperature Range B ^{3,4}	Characteristic Bond Strength in Cracked Concrete ⁹	$\tau_{k,cr}$	psi	1,201	1,163	1,125	1,087	1,050	1,012	936
		Characteristic Bond Strength in Uncracked Concrete ⁹	$\tau_{k,uncr}$	psi	1,957	1,876	1,795	1,713	1,632	1,551	1,388
	Anchor Category		Dry Concrete	—	1						
	Strength Reduction Factor		Dry Concrete	$\phi_{dry,ci}$	0.65 ¹⁰						
	Anchor Category		Water-Saturated Concrete, or Water-Filled Hole	—	3			2			
	Strength Reduction Factor		Water-Saturated Concrete, or Water-Filled Hole	$\phi_{wet,ci}$	0.45 ¹⁰			0.55 ¹⁰			
Periodic Inspection	Temperature Range A ^{2,4}	Characteristic Bond Strength in Cracked Concrete ⁹	$\tau_{k,cr}$	psi	1,346	1,304	1,356	1,310	1,265	1,219	1,128
		Characteristic Bond Strength in Uncracked Concrete ⁹	$\tau_{k,uncr}$	psi	2,192	2,102	2,162	2,064	1,967	1,868	1,672
	Temperature Range B ^{3,4}	Characteristic Bond Strength in Cracked Concrete ⁹	$\tau_{k,cr}$	psi	1,117	1,082	1,125	1087	1,050	1,012	936
		Characteristic Bond Strength in Uncracked Concrete ⁹	$\tau_{k,uncr}$	psi	1,820	1,744	1,795	1,713	1,632	1,551	1,388
	Anchor Category		Dry Concrete	—	2			1			
	Strength Reduction Factor		Dry Concrete	$\phi_{dry,pi}$	0.55 ¹⁰			0.65 ¹⁰			
	Anchor Category		Water-Saturated Concrete, or Water-Filled Hole	—	3						
	Strength Reduction Factor		Water-Saturated Concrete, or Water-Filled Hole	$\phi_{wet,pi}$	0.45 ¹⁰						
Reduction Factor for Seismic Tension			$\alpha_{N,seis}$ ¹¹	—	1.0	0.9	1.0	1.0	1.0	1.0	1.0

- The information presented in this table is to be used in conjunction with the design criteria of ACI 318-14 and ACI 318-11.
- Temperature Range A: Maximum short-term temperature = 160°F, maximum long-term temperature = 110°F.
- Temperature Range B: Maximum short-term temperature = 176°F, maximum long-term temperature = 110°F.
- Short-term concrete temperatures are those that occur over short intervals (diurnal cycling). Long-term temperatures are roughly constant over significant periods of time.
- The tabulated value of ϕ applies when the load combinations of ACI 318-14 5.3 or ACI 318-11 9.2 are used. If the load combinations of ACI 318-11 Appendix C are used, refer to ACI 318-11 D.4.4 to determine the appropriate value of ϕ .
- The tabulated value of ϕ applies when both the load combinations of ACI 318-14 5.3, or ACI 318-11 9.2 are used and the requirements of ACI 318-14 17.3.3 (c) or ACI 318-11 D.4.3 (c), as applicable, for Condition B are met. If the load combinations of ACI 318-11 Appendix C are used, refer to ACI 318 D.4.4 (c) for Condition B to determine the appropriate value of ϕ .

- Bond strength values shown are for normal-weight concrete having a compressive strength of f'_c = 2,500 psi. For higher compressive strengths up to 8,000 psi, the tabulated characteristic bond strength may be increased by a factor of (f'_c/2,500)^{0.35} for uncracked concrete and a factor of (f'_c/2,500)^{0.24} for cracked concrete.
- For lightweight concrete, the modification factor for bond strength shall be as given in ACI 318-14 17.2.6 or ACI 318-11 D.3.6, as applicable, where applicable.
- Characteristic bond strength values are for sustained loads, including dead and live loads.
- The tabulated value of ϕ applies when both the load combinations of ACI 318-14 5.3, or ACI 318-11 9.2 are used and the requirements of ACI 318-14 17.3.3 (c) or ACI 318-11 D.4.3 (c), as applicable, for Condition B are met. If the load combinations of ACI 318-11 Appendix C are used, refer to ACI 318 D.4.4(c) for Condition B to determine the appropriate value of ϕ .
- For anchors installed in regions assigned to Seismic Design Category C, D, E or F, the bond strength values must be multiplied by $\alpha_{N,seis}$.

* See p. 13 for an explanation of the load table icons.

SET-3G™ Design Information — Concrete

SET-3G Shear Strength Design Data for Threaded Rod
in Normal-Weight Concrete¹

Characteristic	Symbol	Units	Nominal Rod Diameter (in.)						
			3/8	1/2	5/8	3/4	7/8	1	1 1/4
Steel Strength in Shear									
Minimum Shear Stress Area	A_{se}	in. ²	0.078	0.142	0.226	0.334	0.462	0.606	0.969
Shear Resistance of Steel — ASTM F1554, Grade 36	V_{sa}	lb.	2,715	4,940	7,865	11,625	16,080	21,090	33,720
Shear Resistance of Steel — ASTM F1554, Grade 55			3,510	6,390	10,170	15,030	20,790	27,270	43,605
Shear Resistance of Steel — ASTM A193, Grade B7			5,850	10,650	16,950	25,050	34,650	45,450	72,675
Reduction factor for Seismic Shear — Carbon Steel	$\alpha_{V_{seis}}^4$	—	0.75					1.0	
Shear Resistance of Steel — Stainless Steel ASTM A193, Grade B8 and B8M (Types 304 and 316)	V_{sa}	lb.	2,665	4,855	7,730	11,425	15,800	20,725	33,140
Shear Resistance of Steel — Stainless Steel ASTM F593 CW (Types 304 and 316)			4,680	8,520	13,560	17,035	23,560	30,905	49,420
Shear Resistance of Steel — Stainless Steel ASTM A193, Grade B6 (Type 410)			5,150	9,370	14,915	22,040	30,490	40,000	63,955
Reduction factor for Seismic Shear — Stainless Steel	$\alpha_{V_{seis}}^4$	—	0.80		0.75			1.0	
Strength Reduction Factor for Shear — Steel Failure	ϕ	—	0.65 ²						
Concrete Breakout Strength in Shear									
Outside Diameter of Anchor	d_a	in.	0.375	0.5	0.625	0.75	0.875	1	1.25
Load-Bearing Length of Anchor in Shear	l_e	in.	h_{ef}						
Strength Reduction Factor for Shear — Breakout Failure	ϕ	—	0.70 ³						
Concrete Pryout Strength in Shear/									
Load-Bearing Length of Anchor in Shear	k_{cp}	in.	1.0 for $h_{ef} < 2.50"$; 2.0 for $h_{ef} \geq 2.50"$						
Strength Reduction Factor for Shear — Breakout Failure	ϕ	—	0.70 ³						

1. The information presented in this table is to be used in conjunction with the design criteria of ACI 318-14 and ACI 318-11.

2. The tabulated value of ϕ applies when the load combinations of ACI 318-14 5.3 or ACI 318-11 9.2 are used. If the load combinations of ACI 318-11 Appendix C are used, refer to ACI 318-11 D.4.4 to determine the appropriate value of ϕ .

3. The tabulated value of ϕ applies when both the load combinations of ACI 318-14 5.3, or ACI 318-11 9.2 are used and the requirements

of ACI 318-14 17.3.3 (c) or ACI 318-11 D.4.3 (c), as applicable, for Condition B are met. If the load combinations of ACI 318-11 Appendix C are used, refer to ACI 318 D.4.4 (c) for Condition B to determine the appropriate value of ϕ .

4. The values of V_{sa} are applicable for both cracked concrete and uncracked concrete. For anchors installed in regions assigned to Seismic Design Category C, D, E or F, V_{sa} must be multiplied by $\alpha_{V_{seis}}$ for the corresponding anchor steel type.

* See p. 13 for an explanation of the load table icons.

SET-3G™ Design Information — Concrete

SET-3G Shear Strength Design Data for Rebar
in Normal-Weight Concrete¹

Characteristic	Symbol	Units	Nominal Rod Diameter (in.)						
			#3	#4	#5	#6	#7	#8	#10
Steel Strength in Shear									
Minimum Shear Stress Area	A_{se}	in. ²	0.110	0.200	0.310	0.440	0.600	0.790	1.270
Shear Resistance of Steel — Rebar (ASTM A615 Grade 60)	V_{sa}	lb.	5,940	10,800	16,740	23,760	32,400	42,660	68,580
Shear Resistance of Steel — Rebar (ASTM A706 Grade 60)			5,280	9,600	14,880	21,120	28,800	37,920	60,960
Reduction Factor for Seismic Shear — Rebar (ASTM A615 Grade 60)	$\alpha_{V_{seis}}^4$	—	0.60					0.8	
Reduction Factor for Seismic Shear — Rebar (ASTM A706 Grade 60)			0.60					0.8	
Strength Reduction Factor for Shear — Steel Failure	ϕ	—	0.65 ²						
Concrete Breakout Strength in Shear									
Outside Diameter of Anchor	d_a	in.	0.375	0.5	0.625	0.75	0.875	1	1.25
Load-Bearing Length of Anchor in Shear	l_e	in.	h_{ef}						
Strength Reduction Factor for Shear — Breakout Failure	ϕ	—	0.70 ³						
Concrete Pryout Strength in Shear									
Load-Bearing Length of Anchor in Shear	k_{cp}	in.	1.0 for $h_{ef} < 2.50"$; 2.0 for $h_{ef} \geq 2.50"$						
Strength Reduction Factor for Shear — Breakout Failure	ϕ	—	0.70 ³						

1. The information presented in this table is to be used in conjunction with the design criteria of ACI 318-14 and ACI 318-11.

2. The tabulated value of ϕ applies when the load combinations of ACI 318-14 5.3 or ACI 318-11 9.2 are used. If the load combinations of ACI 318-11 Appendix C are used, refer to ACI 318-11 D.4.4 to determine the appropriate value of ϕ .

3. The tabulated value of ϕ applies when both the load combinations of ACI 318-14 5.3 or ACI 318-11 9.2 are used and the requirements of

ACI 318-14 17.3.3 (c) or ACI 318-11 D.4.3 (c), as applicable, for Condition B are met. If the load combinations of ACI 318-11 Appendix C are used, refer to ACI 318 D.4.4 (c) for Condition B to determine the appropriate value of ϕ .

4. The values of V_{sa} are applicable for both cracked concrete and uncracked concrete. For anchors installed in regions assigned to Seismic Design Category C, D, E or F, V_{sa} must be multiplied by $\alpha_{V_{seis}}$ for the corresponding anchor steel type.

For additional load tables, visit strongtie.com/set3g.



Anchor Designer™ Software for ACI 318, ETAG and CSA

Simpson Strong-Tie® Anchor Designer software accurately analyzes existing design or suggests anchor solutions based on user-defined design elements in cracked and uncracked concrete conditions.

* See p. 13 for an explanation of the load table icons.

Weirs and Density Current Baffles

CHEMICAL RESISTANT SHEET
TECHNICAL DATA

PROTECTOLITE™ SERIES 210 CORR-ISO CORROSION SHEETS are manufactured under high heat and pressure in matched metal moulds. It meets or exceeds CAN/CGSB 41.22 standard. **SERIES 210 CORR-GP** sheet is an excellent premium grade isophthalic resin, with UV inhibitors, fiberglass, filled composite laminate. Suitable for use in tanks, baffles, weir plates, ducting, spacers, pipes, and other components requiring light weight, low maintenance, higher service anti-corrosive properties.

<u>PROPERTIES:</u>	<u>VALUES:</u>	<u>METHOD:</u>
TENSILE STRENGTH	14-15,000 psi	ASTM D638
FLEXURAL STRENGTH	25-27,000 psi	ASTM D790
FLEXURAL MODULUS	1.0 x 10⁶ psi	ASTM D790
COMPRESSIVE STRENGTH	30,000 psi	ASTM D790
BARCOL HARDNESS	40-45	ASTM D2583
IZOD IMPACT, notched	> 12 ft-lb./in.	ASTM D256
WATER ABSORPTION (24 Hours @ 230C)	< 0.1%	ASTM D570
SPECIFIC GRAVITY	1.85 ± 0.05	ASTM D792
STANDARD COLOUR	Light Grey (Other colours available)	
ARC RESISTANCE	130 sec	ASTM D495
DIELECTRIC STRENGTH	475 VPM	ASTM D149
DIELECTRIC CONSTANT, 60Hz	4.5	ASTM D150
AVERAGE COEFFICIENT OF THERMAL EXPANSION (Inch/ Inch/°F)	10.5 x 10⁻⁶	ASTM D696
STANDARD SIZES	36"x 72"; 48"x 96"	
STANDARD THICKNESS	1/16" through 6"	


The property values shown are based upon tests believed to be reliable. However, no liability is assumed resulting from their use. We suggest that the user perform tests to establish the material's suitability for the specific application.

March 2023

BILL OF MATERIAL

ITEM	PART NAME/DESCRIPTION	MATERIAL	QTY (2 TANKS)
1	STANDARD V-NOTCH WEIR PLATE, 9"x95-3/4"x1/4"	ISOPHTHALIC POLYESTER UV STABILIZED	58
2	WEIR KEEPER PLATE, 5" DIA X 1/4"	ISOPHTHALIC POLYESTER UV STABILIZED	232
3	WEIR SPLICE PLATE, 9"x6"x1/4"	ISOPHTHALIC POLYESTER UV STABILIZED	58
4	1/2"DIA x6" A193 B8M CLASS 1 FULL THREADED STUD	STAINLESS STEEL 316	232
5	TE1=EPOXY ADHESIVE ANCHOR NOZZLE INCLUDED 21OZ 6CT	EPOXY ADHESIVE	5
6	1/2" FLAT WASHER	STAINLESS STEEL 316	232
7	1/2" LOCK WASHER	STAINLESS STEEL 316	232
8	1/2"-13 HEX NUT	STAINLESS STEEL 316	232
9	SEALER	SEALER, 1 GAL	1

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DIMENSIONS ARE IN INCHES		DRAWN	S.H.	9/5/23	TITLE: BILL OF MATERIAL
TOLERANCES:		CHECKED	Y.L.	9/5/23	
ANGULAR: ±1°		ENG APPR.			
TWO PLACE DECIMAL ± 1/16"		MFG APPR.			
THREE PLACE DECIMAL ± 1/32"					
INTERPRET GEOMETRIC TOLERANCING PER:		Q.A.			SIZE DWG. NO. REV B P1230398 W 0
MATERIAL		COMMENTS:			
FINISH		PROJECT: BRANTFORD, ON 70' DIAMETER SECONDARY TANK WO#: 1230398 REF#: 22-104			
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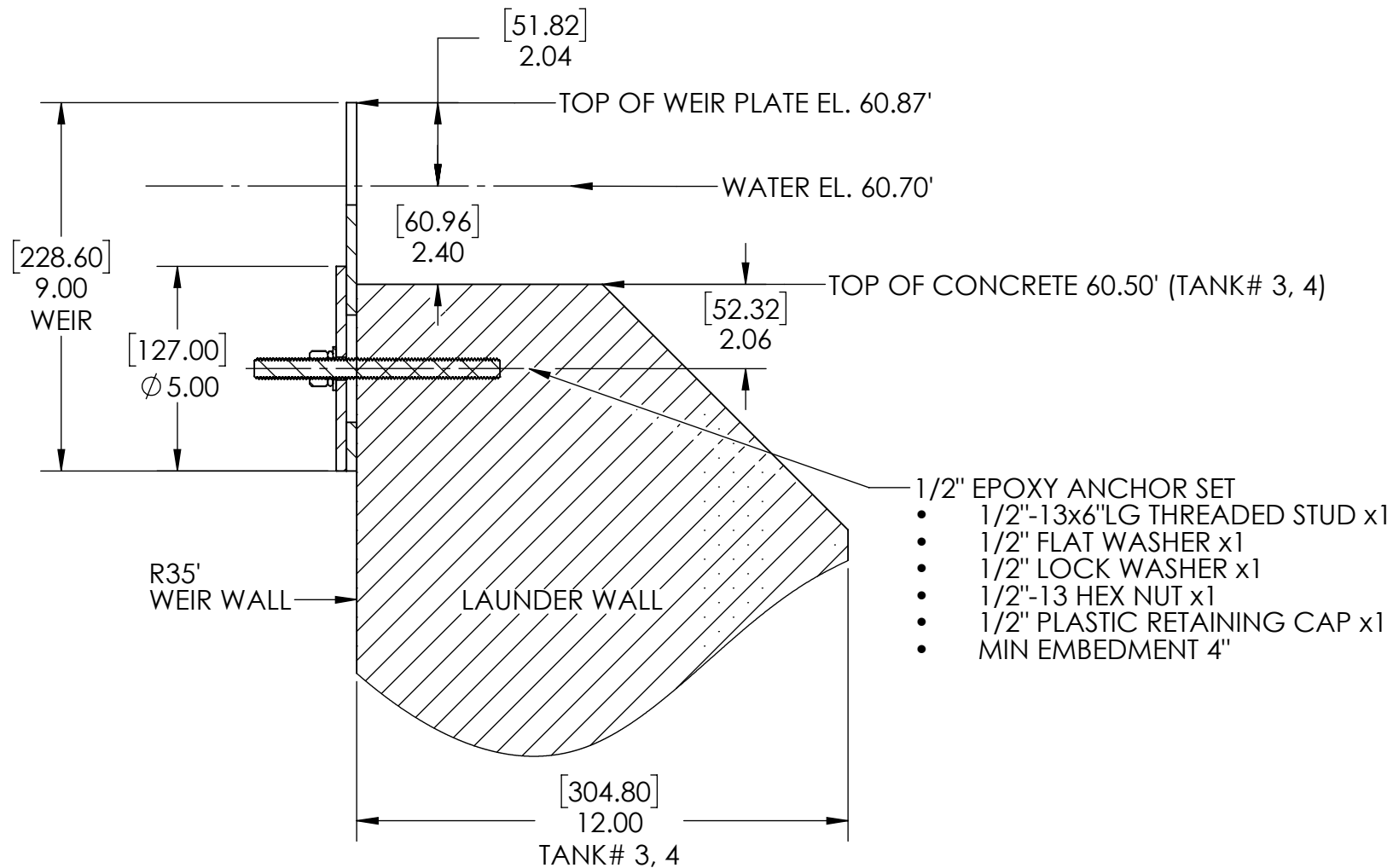
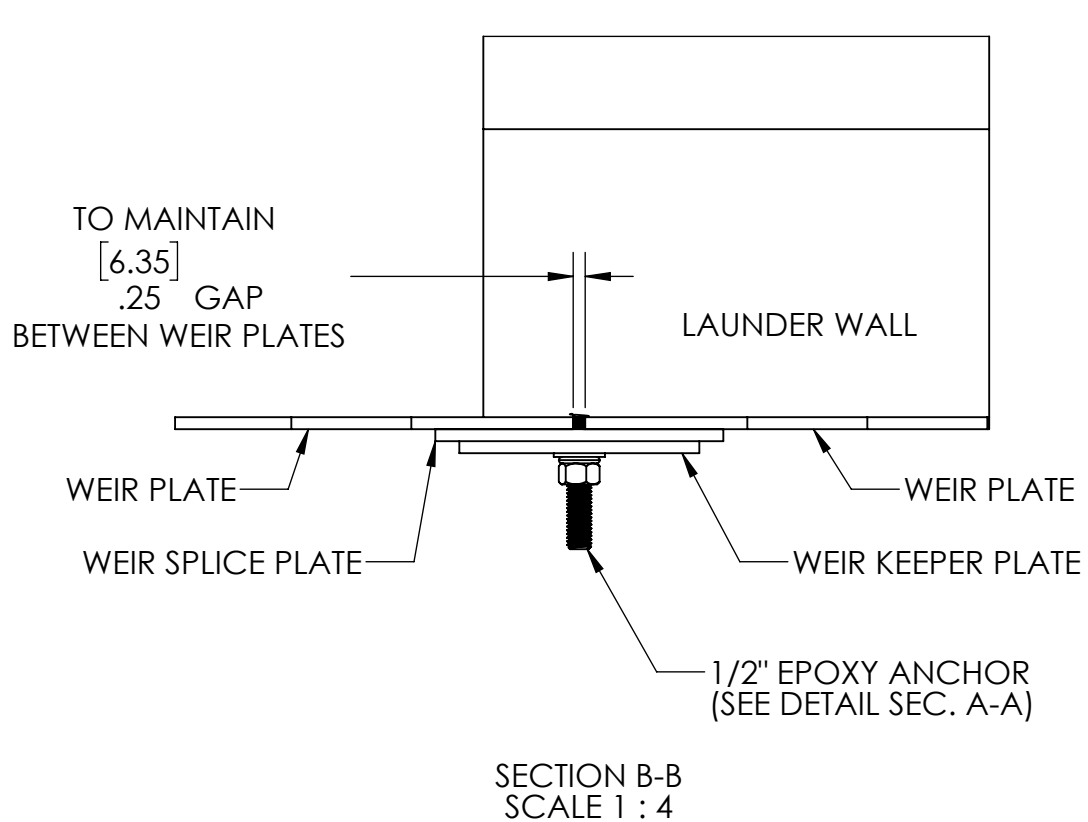
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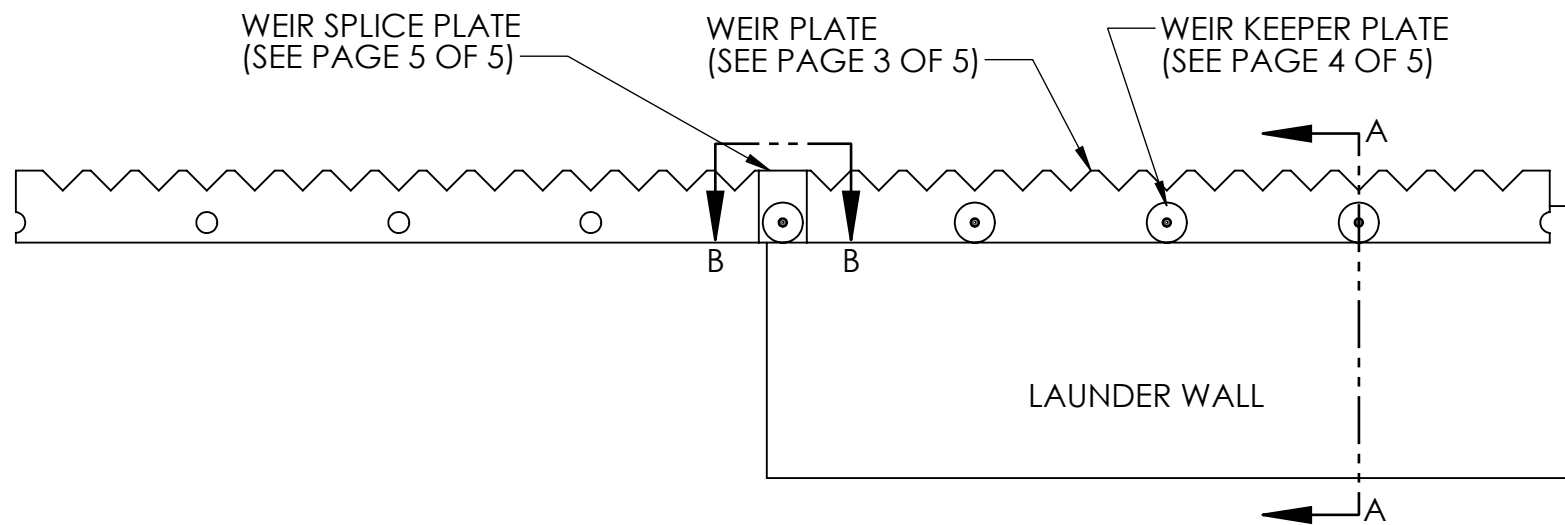
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- NOTE:
- FIELD TRIM WEIR PLATE TO FIT IN
 - MAINTAIN 1/4" GAP BETWEEN WEIR PLATES
 - SEAL ALL THE CUTTING EDGES WITH SEALER
 - NEOPRENE GASKET IS RECOMMENDED BETWEEN WEIR PLATE AND WALL

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DIMENSIONS ARE IN INCHES TOLERANCES: ANGULAR: ±1° TWO PLACE DECIMAL ± 1/16" THREE PLACE DECIMAL ± 1/32"		DRAWN	S.H.	9/5/23	TITLE: INSTALLATION LAYOUT TANK# 3, 4									
		CHECKED	Y.L.	9/5/23										
		ENG APPR.												
		MFG APPR.												
		Q.A.												
INTERPRET GEOMETRIC TOLERANCING PER:		COMMENTS:			<table><tr><td>SIZE</td><td>DWG. NO.</td><td>REV</td></tr><tr><td>B</td><td>P1230398 W</td><td>0</td></tr><tr><td>SCALE: 1:24</td><td>WEIGHT:</td><td>SHEET 2 OF 5</td></tr></table>	SIZE	DWG. NO.	REV	B	P1230398 W	0	SCALE: 1:24	WEIGHT:	SHEET 2 OF 5
SIZE	DWG. NO.	REV												
B	P1230398 W	0												
SCALE: 1:24	WEIGHT:	SHEET 2 OF 5												
MATERIAL		PROJECT: BRANTFORD, ON												
FINISH		70' DIAMETER SECONDARY TANK												
DO NOT SCALE DRAWING		WO#: 1230398												
		REF#: 22-104												

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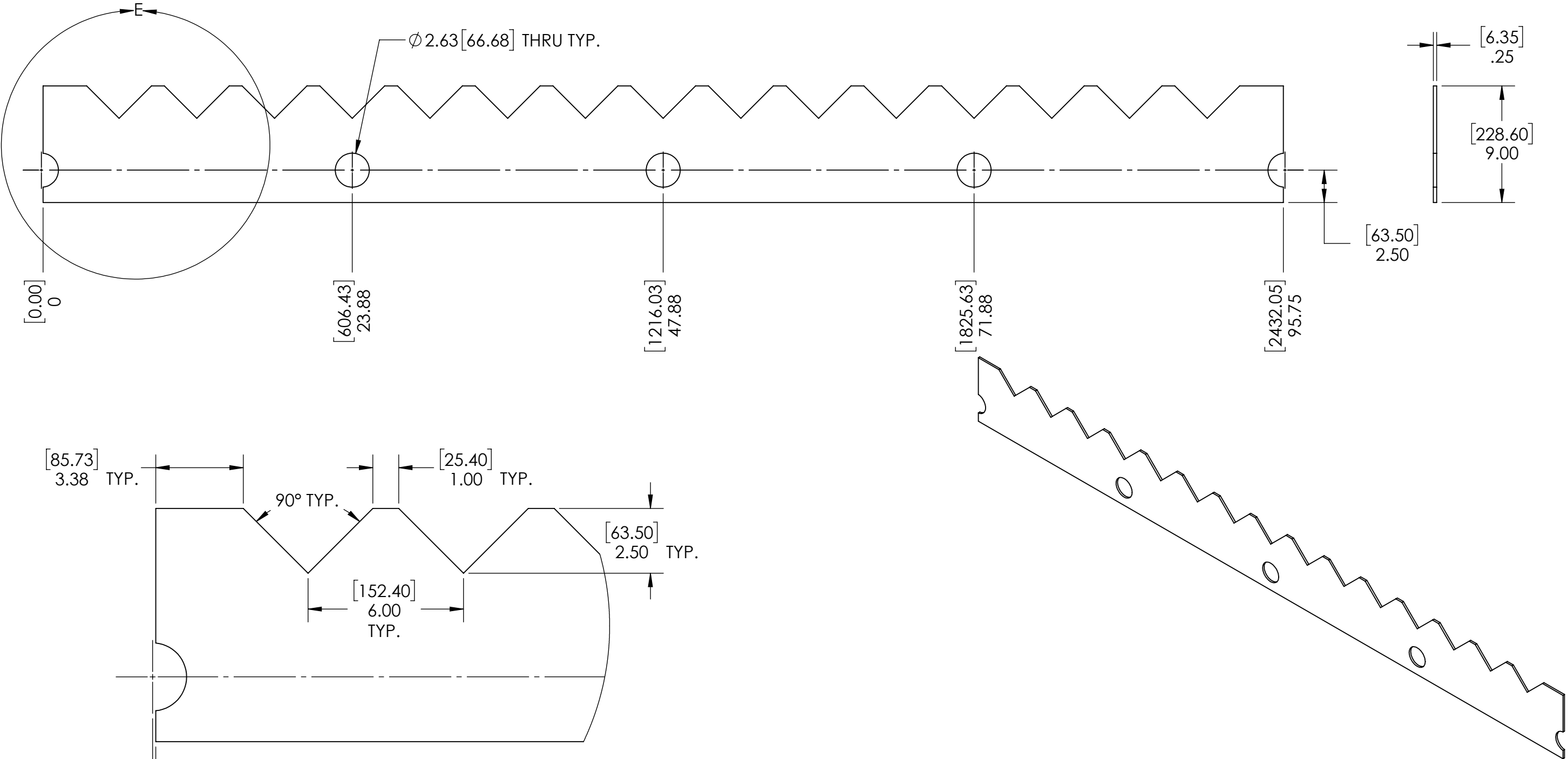
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DETAIL E
SCALE 1 : 4

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DIMENSIONS ARE IN INCHES		DRAWN	S.H.	9/5/23	TITLE: WEIR PLATE
TOLERANCES:		CHECKED	Y.L.	9/5/23	
ANGULAR: ± 1°		ENG APPR.			
TWO PLACE DECIMAL ± 1/16"		MFG APPR.			
THREE PLACE DECIMAL ± 1/32"		Q.A.			
INTERPRET GEOMETRIC TOLERANCING PER:		COMMENTS:			SIZE B
MATERIAL		PROJECT: BRANTFORD, ON 70' DIAMETER SECONDARY TANK WO#: 1230398			
FINISH		REF#: 22-104			
DO NOT SCALE DRAWING					SCALE: 1:8
					WEIGHT:
					SHEET 3 OF 5

4

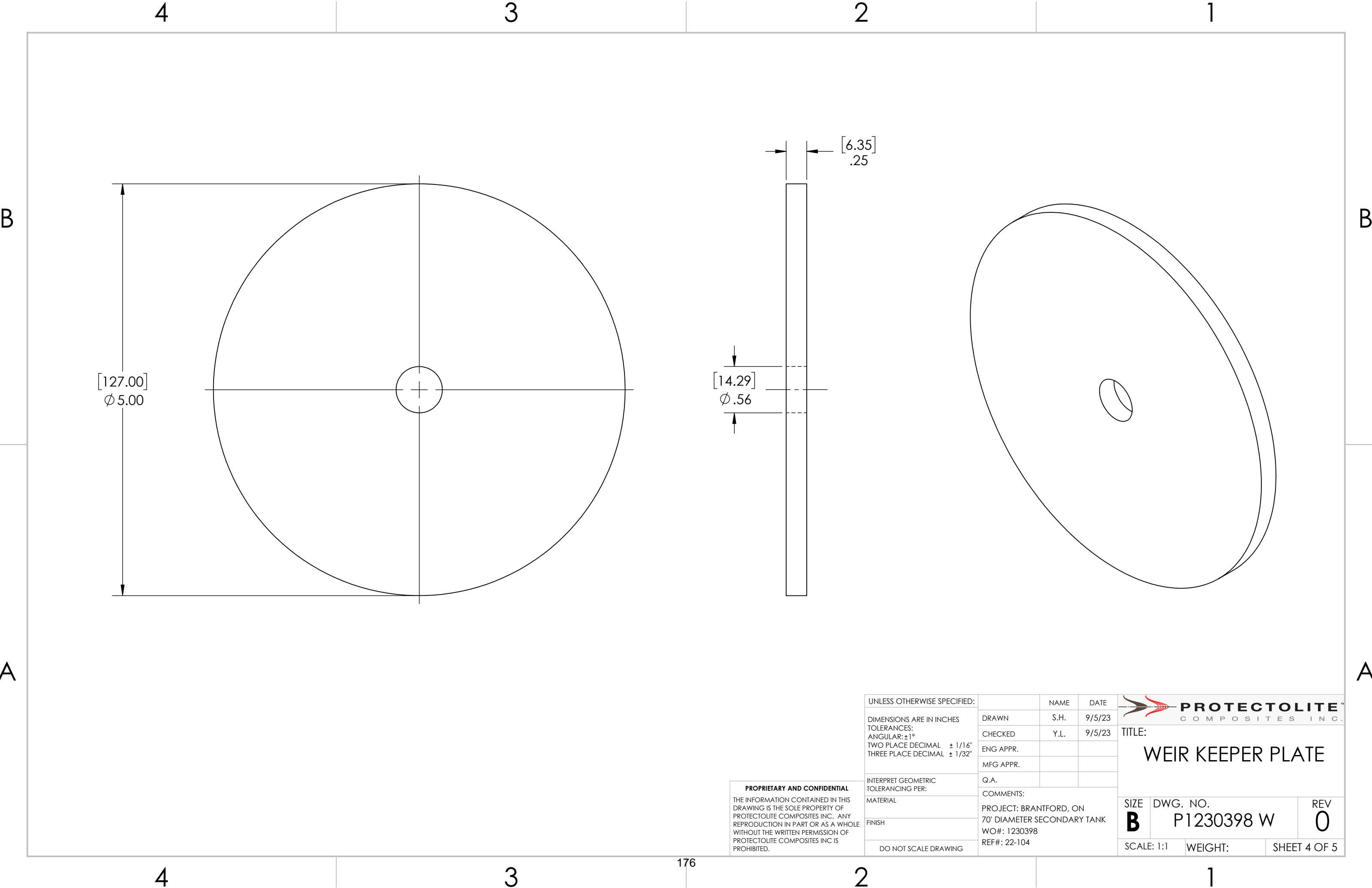
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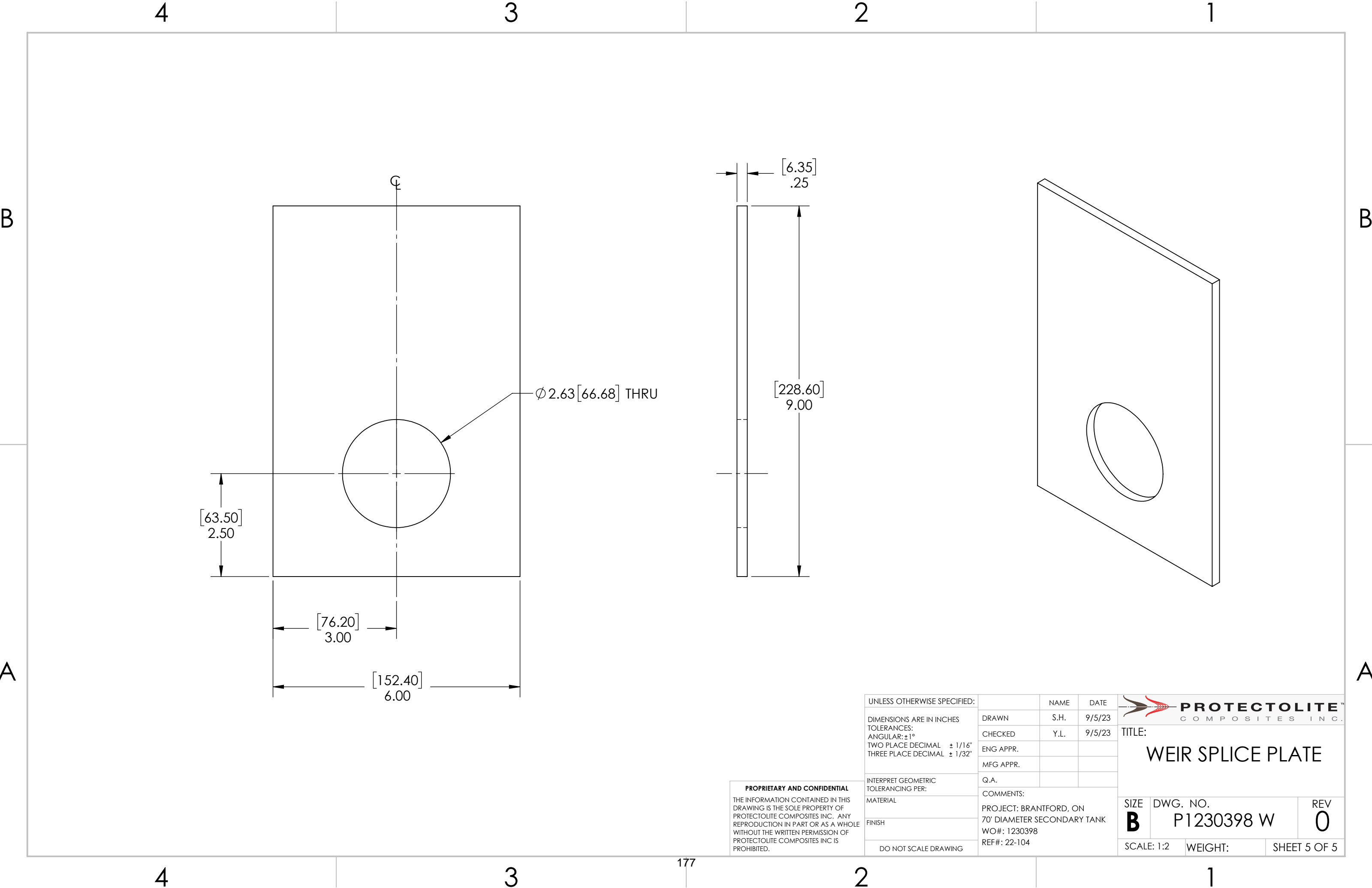
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UNLESS OTHERWISE SPECIFIED:		NAME	DATE	 PROTECTOLITE™ COMPOSITES INC.			
DIMENSIONS ARE IN INCHES		DRAWN	S.H.	9/5/23	TITLE: WEIR KEEPER PLATE		
TOLERANCES:		CHECKED	Y.L.	9/5/23			
ANGULAR: ± 1°		ENG APPR.					
TWO PLACE DECIMAL ± 1/16"		MFG APPR.					
THREE PLACE DECIMAL ± 1/32"		Q.A.					
INTERPRET GEOMETRIC TOLERANCING PER:		COMMENTS:					
MATERIAL		PROJECT: BRANTFORD, ON			SIZE	DWG. NO.	REV
FINISH		70' DIAMETER SECONDARY TANK			B	P1230398 W	0
		WO#: 1230398					
DO NOT SCALE DRAWING		REF#: 22-104			SCALE: 1:1	WEIGHT:	SHEET 4 OF 5



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BILL OF MATERIAL

ITEM #	PART NAME/DESCRIPTION	MATERIAL	QTY (4 TANKS)	COMMENTS
1	FLAT SHEET DCB PANEL36"X95-3/4", 1/4" FRP	from 1/4" 210 ISO sheet	116	
2	FLAT SHEET JOINT PLATE 36"X6", 1/4"	from 1/4" 210 ISO sheet	116	
3	DCB SUPPORT BRACKET 36"X18", 4.5" X 1/4" FRP	SHOP ASSEMBLED	232	
	FRP ANGLE, 36" LG	4.5X4.5X1/4"	232	
	FRP ANGLE, 18" LG	4.5X4.5X1/4"	232	
	FRP Gusset 12"x12, 1/4"	from 1/4" 210 ISO sheet	464	
4	1/2" PLASTIC RETAINING CAP	SIMPSON ARC50A-RP25	464	
5	1/2"DIA x6" A193 B8M CLASS 1 FULL THREADED STUD	STAINLESS STEEL 316	464	
6	TE1=EPOXY ADHESIVE ANCHOR NOZZLE INCLUDED 21OZ 6CT	EPOXY ADHESIVE	8	
7	1/2"-13X1-1/2" LENGTH, HEX HEAD BOLT	STAINLESS STEEL 316	696	
8	1/2" FLAT WASHER	STAINLESS STEEL 316	1392	
9	1/2" LOCK WASHER	STAINLESS STEEL 316	696	
10	1/2"-13 HEX NUT	STAINLESS STEEL 316	696	
11	3/8"-16X1-1/2" LENGTH, HEX HEAD BOLT	STAINLESS STEEL 316	2088	
12	3/8" FLAT WASHER	STAINLESS STEEL 316	4176	
13	3/8" LOCK WASHER	STAINLESS STEEL 316	2088	
14	3/8"-16 HEX NUT	STAINLESS STEEL 316	2088	
15	SEALER	ONE GALLON	2	

UNLESS OTHERWISE SPECIFIED:		NAME	DATE	 PROTECTOLITE COMPOSITES INC.
DIMENSIONS ARE IN INCHES TOLERANCES: ANGULAR: ±1° TWO PLACE DECIMAL ± 1/16" THREE PLACE DECIMAL ± 1/32"	DRAWN	S.H.	9/5/23	
	CHECKED	Y.L.	9/5/23	
	ENG APPR.			
	MFG APPR.			
INTERPRET GEOMETRIC TOLERANCING PER:	Q.A.			TITLE: BILL OF MATERIAL
MATERIAL	COMMENTS:			
FINISH	PROJECT: BRANTFORD, ON 70' DIAMETER SECONDARY TANK WO#: 1230398 REF#: 22-104			
DO NOT SCALE DRAWING	SIZE		DWG. NO.	REV
	B		P1230398 DCB	1
SCALE: 1:1		WEIGHT:		SHEET 1 OF 5

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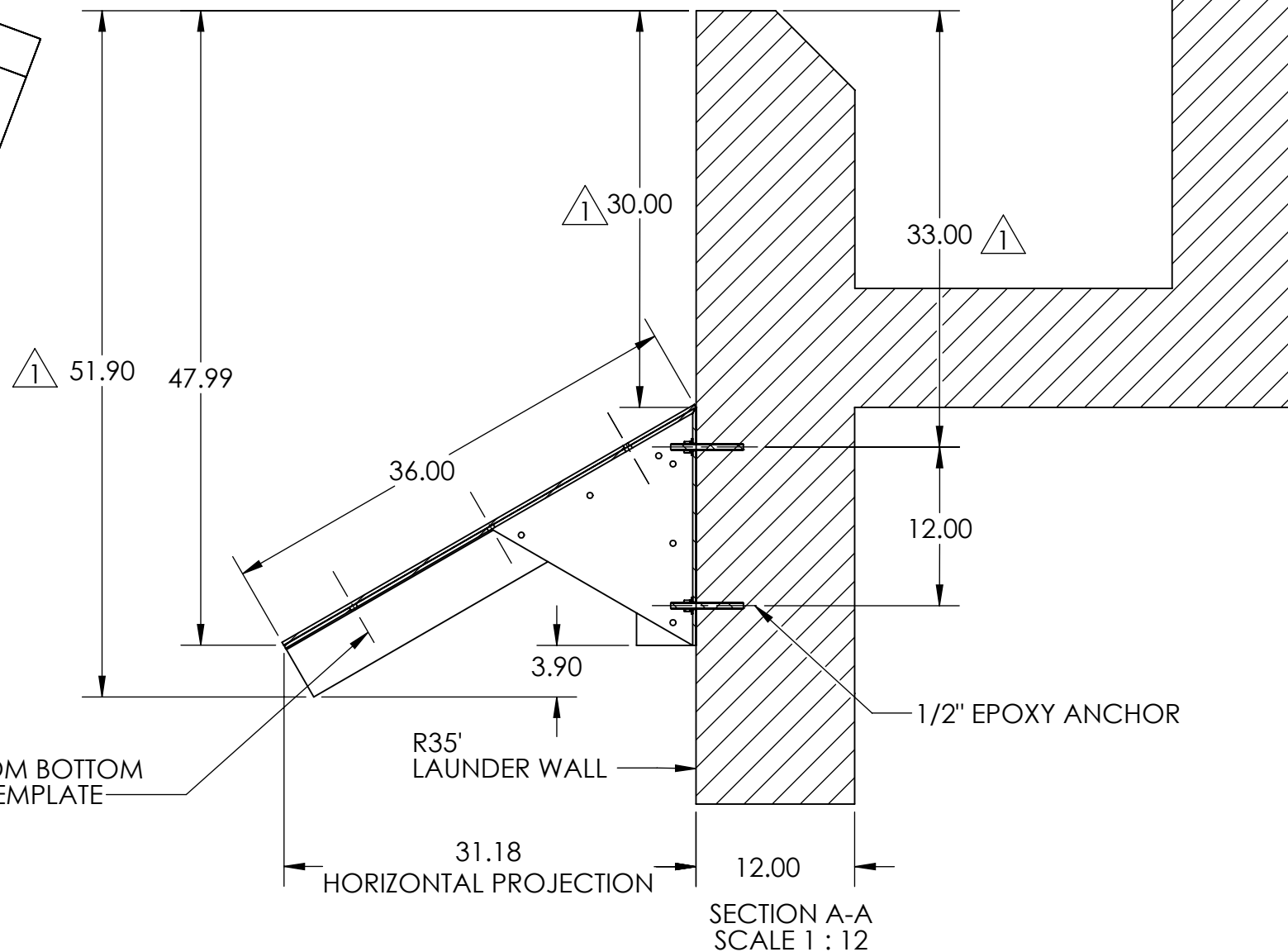
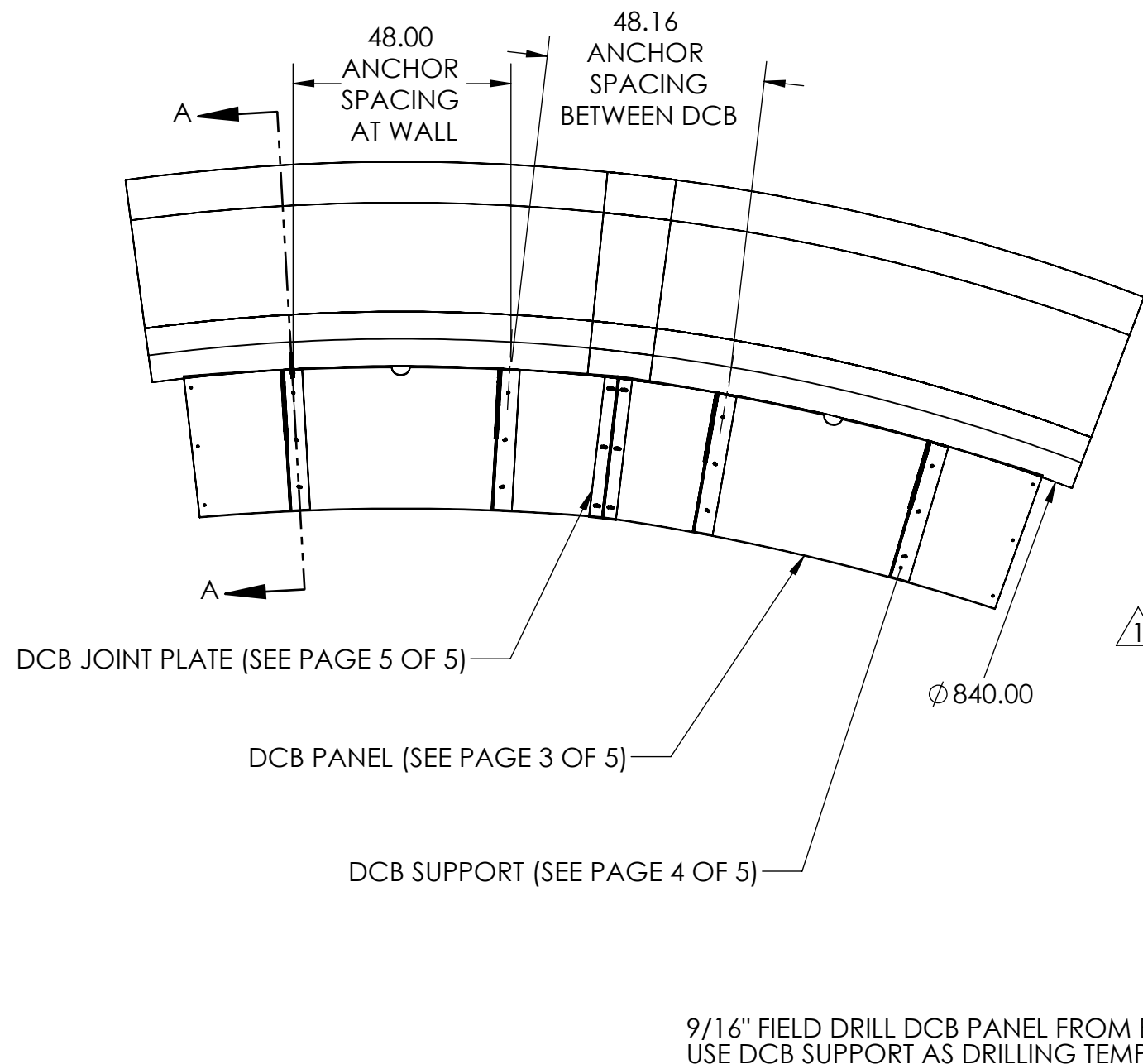
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NOTE:

1. LEAVE 1/4" GAP BETWEEN DENSITY CURRENT BAFFLE PANELS
2. USE SEALER FOR ALL CUTTING EDGES

B1, B2, B3	1	CHANGED DCB ELEVATION TO INCREASE EFFLUENT TSS BY CFD ANALYSIS	9/6/2023	Y.L.
	0	INITIAL DRAWINGS	9/5/2023	Y.L.
ZONE	REV.	DESCRIPTION	DATE	APPROVED
REVISIONS				

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DIMENSIONS ARE IN INCHES		DRAWN	S.H.	TITLE: INSTALLATION LAYOUT		
TOLERANCES:		CHECKED	Y.L.			
ANGULAR: ±1°		ENG APPR.				
TWO PLACE DECIMAL ± 1/16"		MFG APPR.				
THREE PLACE DECIMAL ± 1/32"		Q.A.				
INTERPRET GEOMETRIC TOLERANCING PER:		COMMENTS:			SIZE DWG. NO. REV B P1230398 DCB 1	
MATERIAL		PROJECT: BRANTFORD, ON				
FINISH		70" DIAMETER SECONDARY TANK				
		WO#: 1230398				
DO NOT SCALE DRAWING		REF#: 22-104				
				SCALE: 1:35	WEIGHT:	SHEET 2 OF 5

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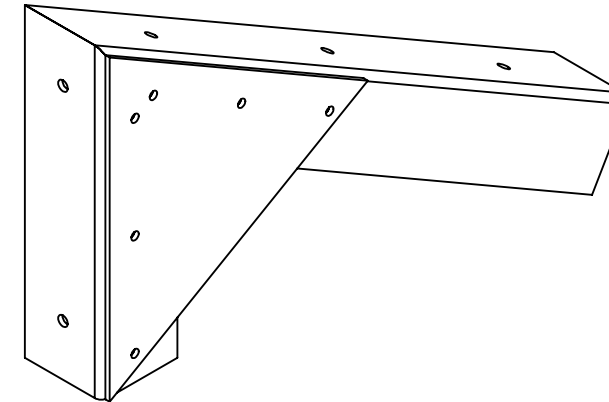
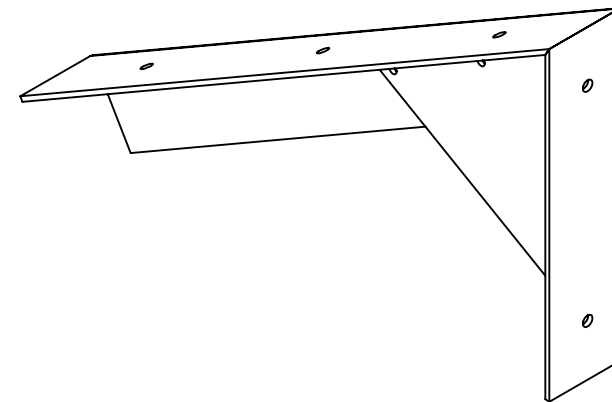
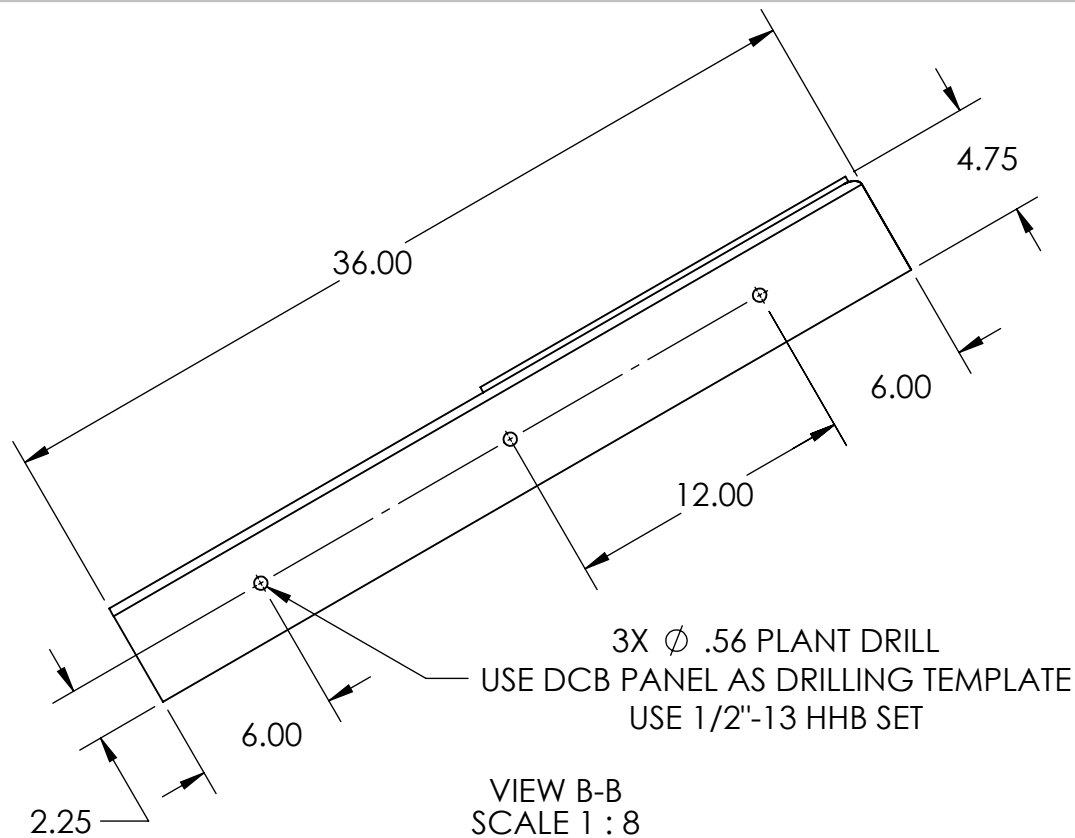
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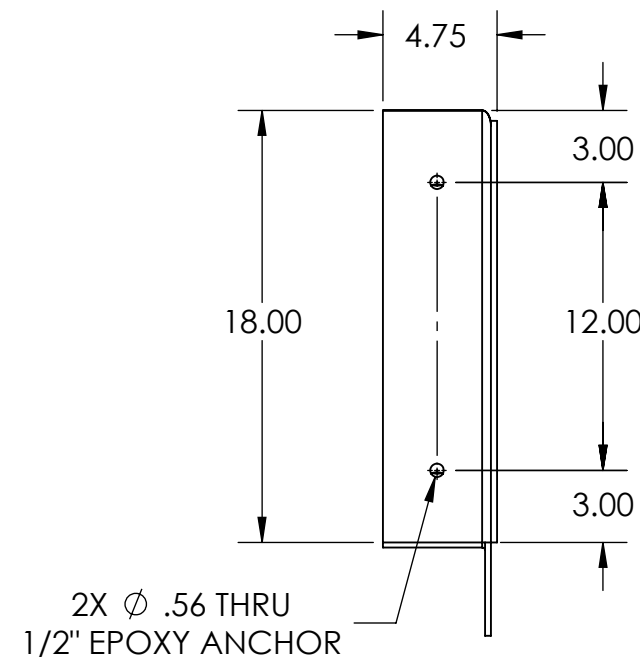
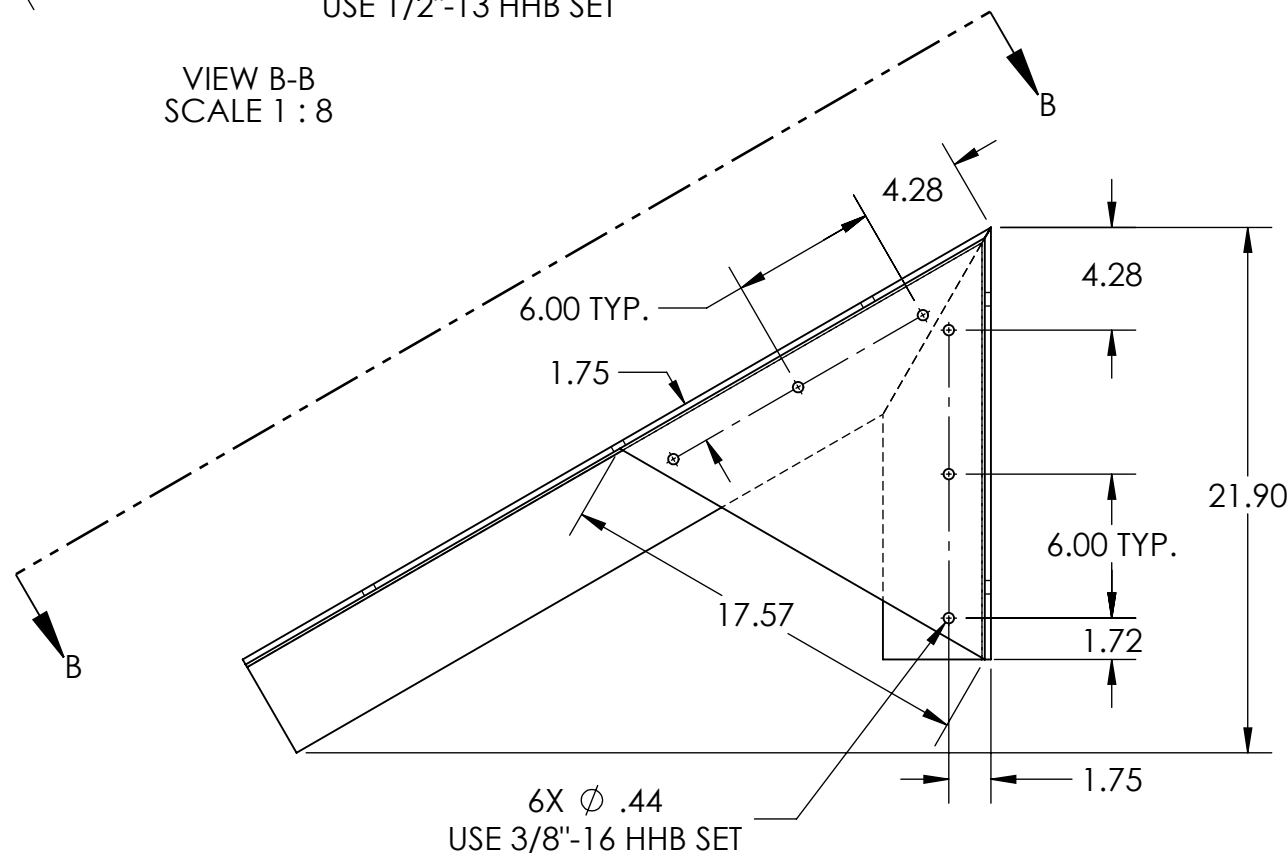
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UNLESS OTHERWISE SPECIFIED:

DIMENSIONS ARE IN INCHES
TOLERANCES:
ANGULAR: $\pm 1^\circ$
TWO PLACE DECIMAL $\pm 1/16"$
THREE PLACE DECIMAL $\pm 1/32"$

INTERPRET GEOMETRIC
TOLERANCING PER:

MATERIAL

FINISH

DO NOT SCALE DRAWING

NAME

DATE

DRAWN

S.H.

9/5/23

CHECKED

Y.L.

9/5/23

ENG APPR.

MFG APPR.

Q.A.

COMMENTS:

PROJECT: BRANTFORD, ON
70' DIAMETER SECONDARY TANK
WO#: 1230398

REF#: 22-104

**PROTECTOLITE**
COMPOSITES INC.

TITLE:

DCB SUPPORT

SIZE
BDWG. NO.
P1230398 DCBREV
1

SCALE: 1:8

WEIGHT:

SHEET 4 OF 5

4

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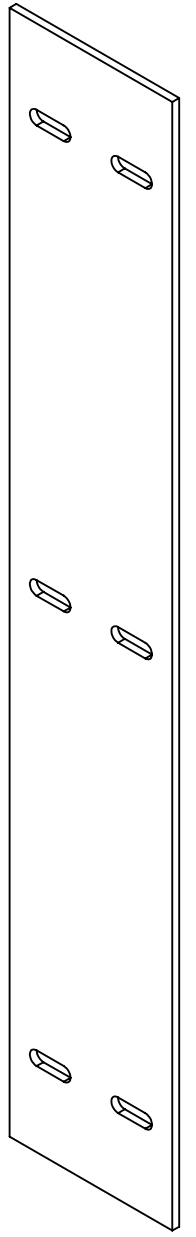
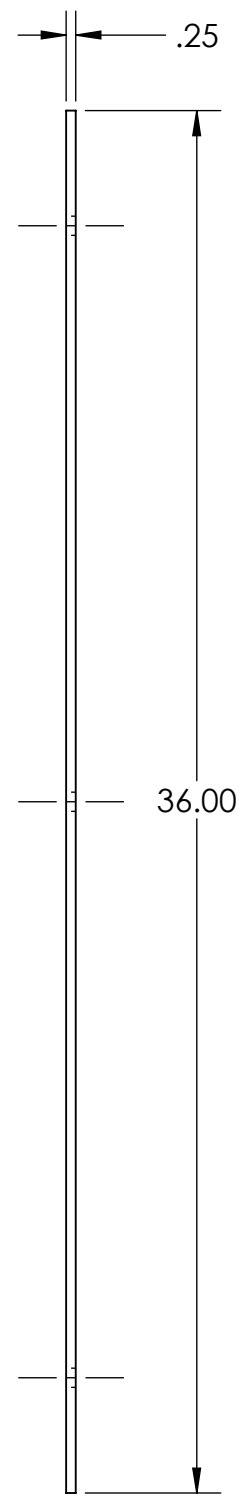
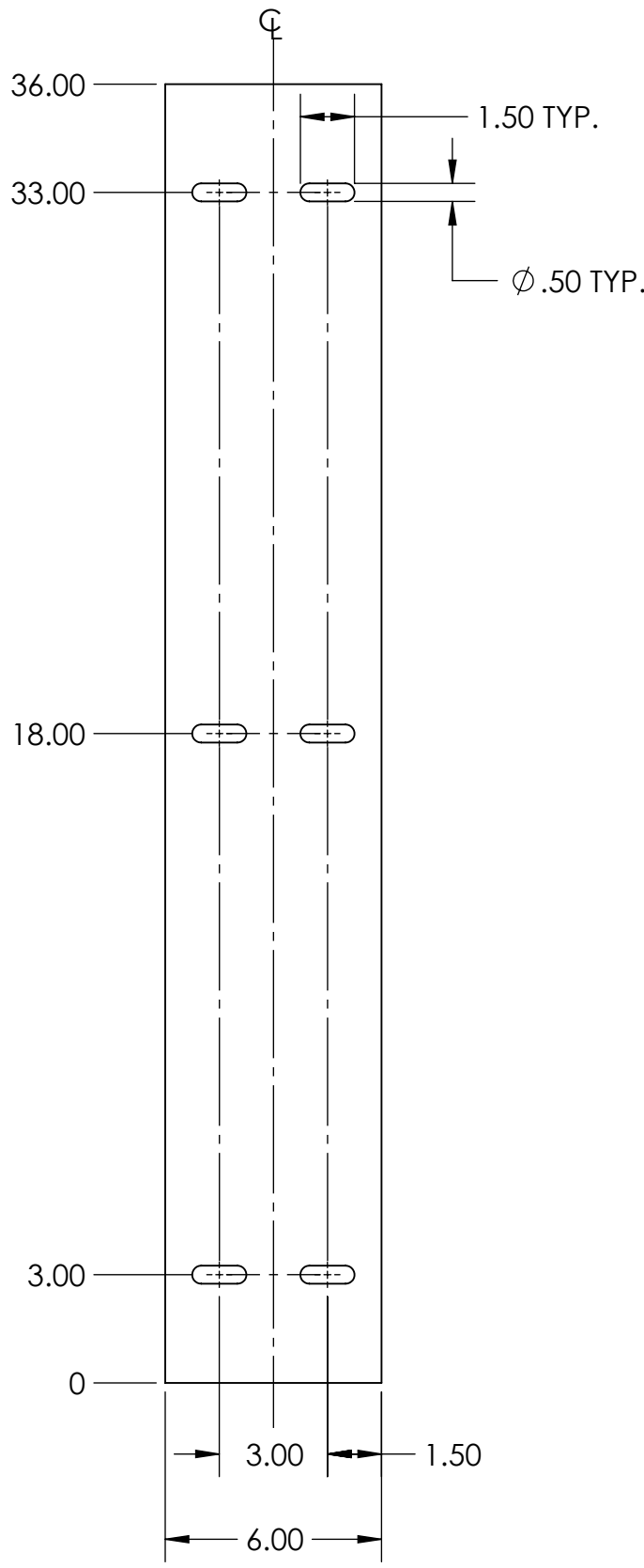
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UNLESS OTHERWISE SPECIFIED:		NAME	DATE	 PROTECTOLITE COMPOSITES INC.™	
DIMENSIONS ARE IN INCHES TOLERANCES: ANGULAR: ±1° TWO PLACE DECIMAL ± 1/16" THREE PLACE DECIMAL ± 1/32"		DRAWN	S.H.	9/5/23	TITLE: DCB JOINT PLATE
		CHECKED	Y.L.	9/5/23	
		ENG APPR.			
		MFG APPR.			
INTERPRET GEOMETRIC TOLERANCING PER:		Q.A.			
MATERIAL		COMMENTS:			SIZE B
FINISH		PROJECT: BRANTFORD, ON 70' DIAMETER SECONDARY TANK WO#: 1230398			
DO NOT SCALE DRAWING		REF#: 22-104			DWG. NO. P1230398 DCB
					REV 1
		SCALE: 1:5		WEIGHT:	SHEET 5 OF 5

4

3

182

2

1

BRANTFORD WWTP SECONDARY CLARIFIER DENSITY CURRENT BAFFLE CFD ANALYSIS

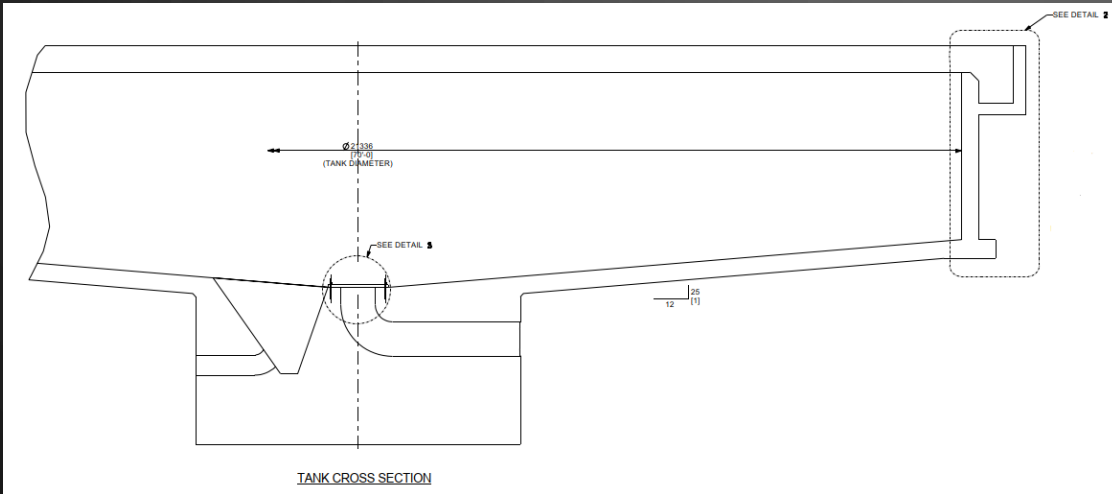
PROJECT 22-104



Sang Chun, P.Eng
September 6, 2023



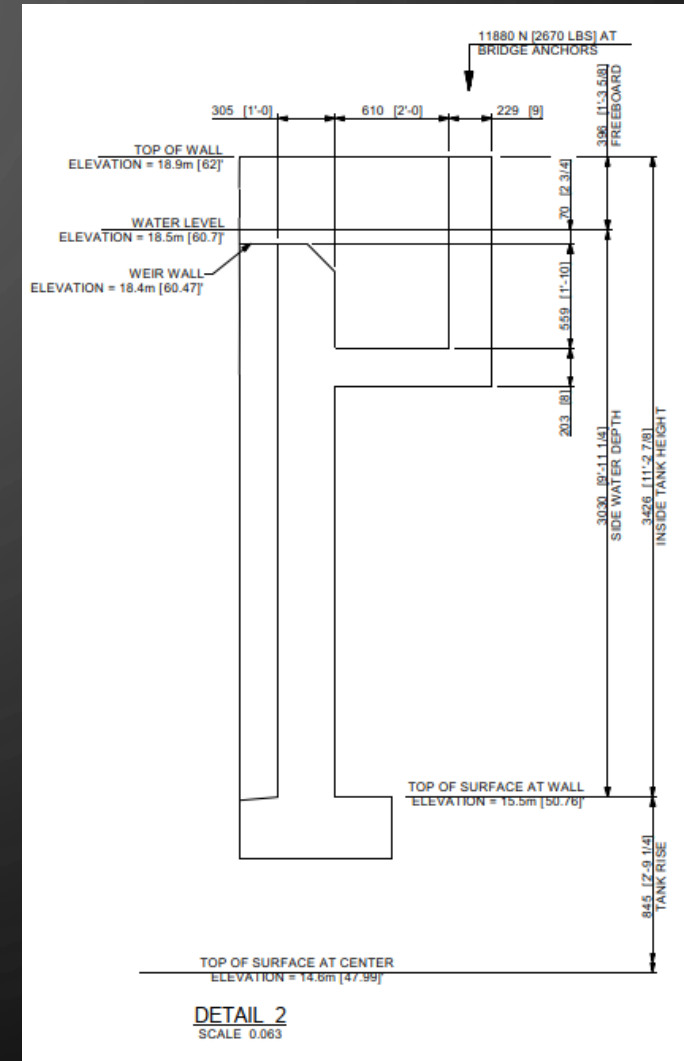
SETUP PARAMETERS



Computational fluid dynamics (CFD) was performed using the dimensions of the Secondary Clarifiers 1-4 shown above.

Setup:

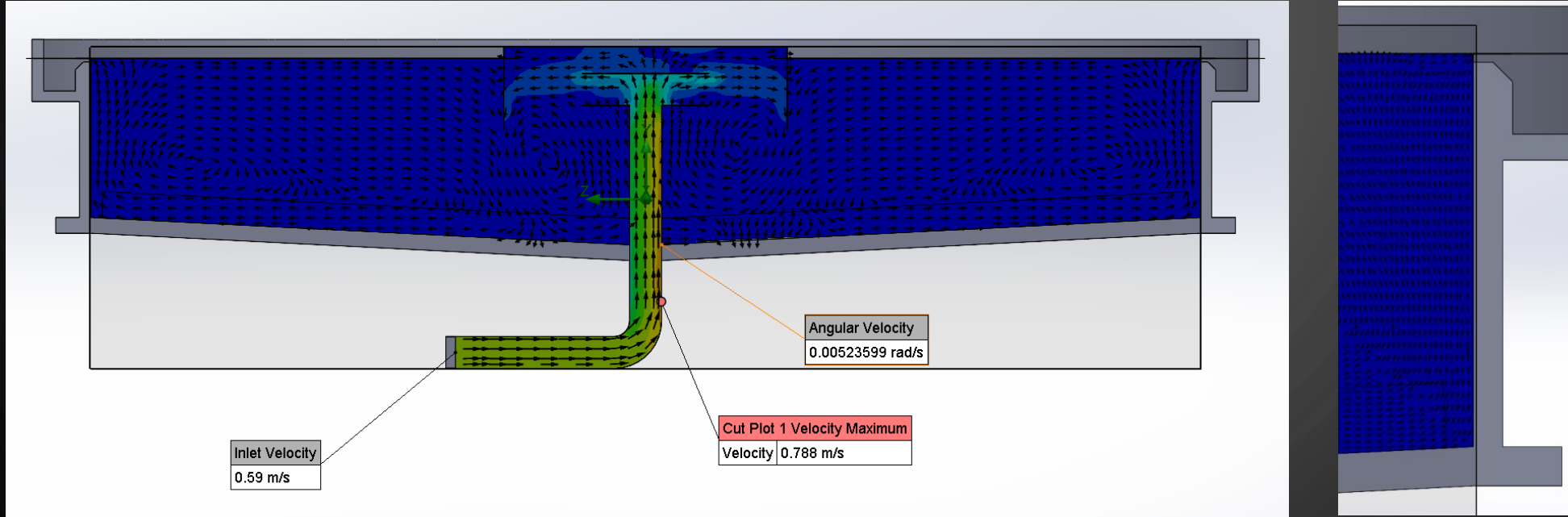
- Diameter of the Tank: 70 feet
- TOC at Weir: EL. 60.47 feet
- Water EL. 60.7 feet
- Influent velocity at port: 0.59 m/s
 - Peak: 0.76 m/s
- Angular velocity of the Rake Arm: 0.3 deg/sec
- Total Suspended Solid:
 - Micron Size: 2e-06 m
 - Density: 1682 kg/m³



COMPUTATION FLUID DYNAMICS (CFD) TARGET

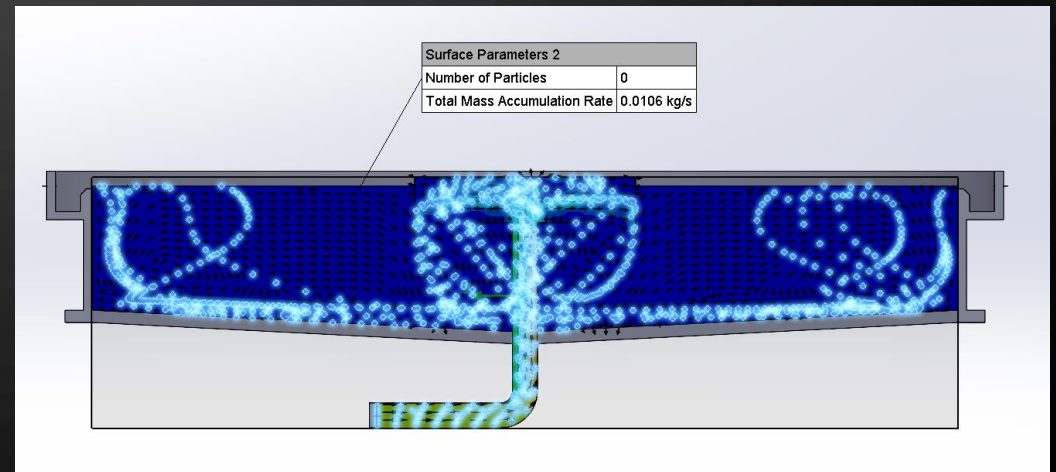
- Determine the Total Suspended Solids (TSS) reduction based on the width/depth of the Density Current Baffle (DCB) and the mounting elevation.
- Run particle study to determine the amount of TSS at the Weir

CFD RESULTS WITH NO DCB

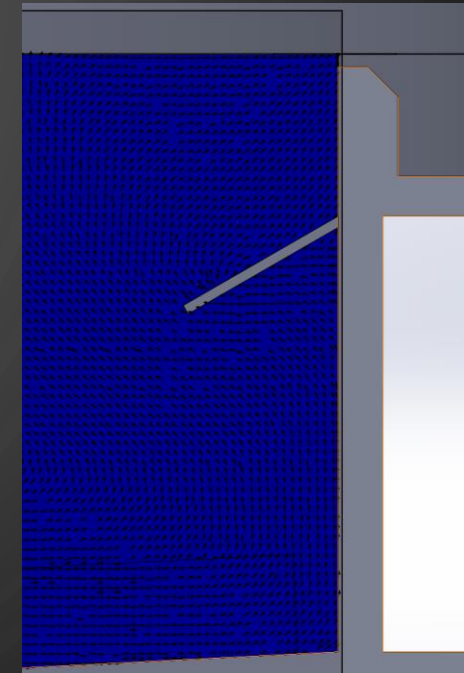
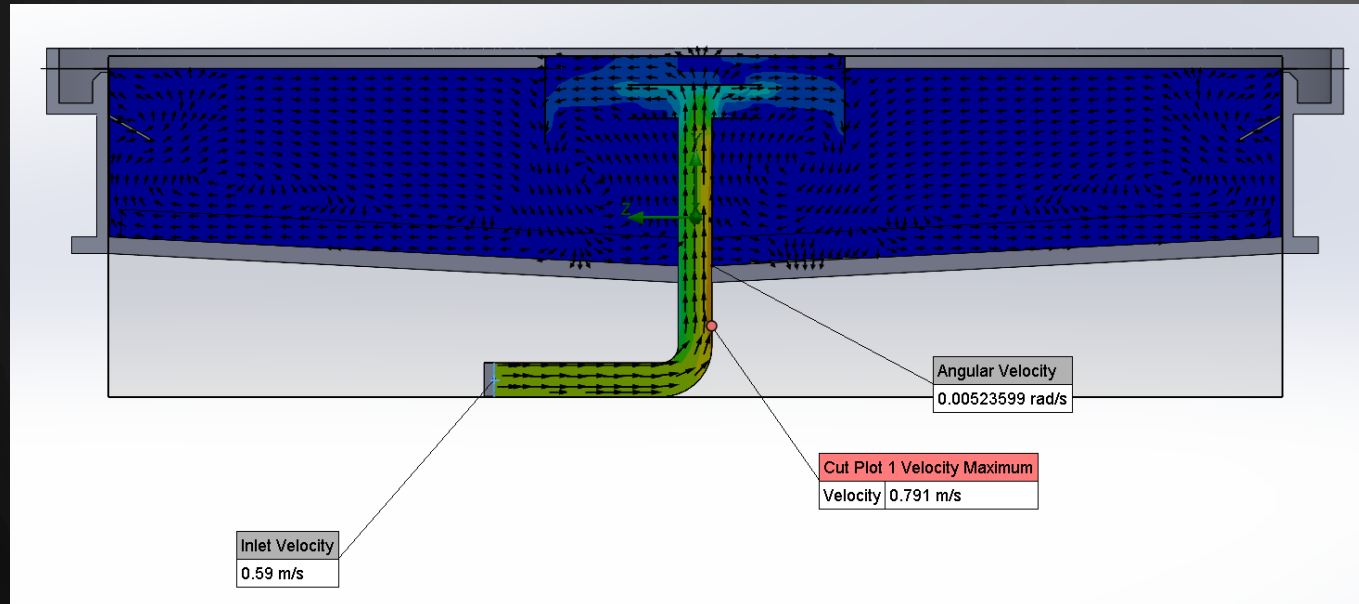


Conclusion:

- With no DCB, the total mass accumulation rate at the weir is 0.0106 kg/s.
- With no DCB, TSS is not deflected to the center and instead flows to the weir.

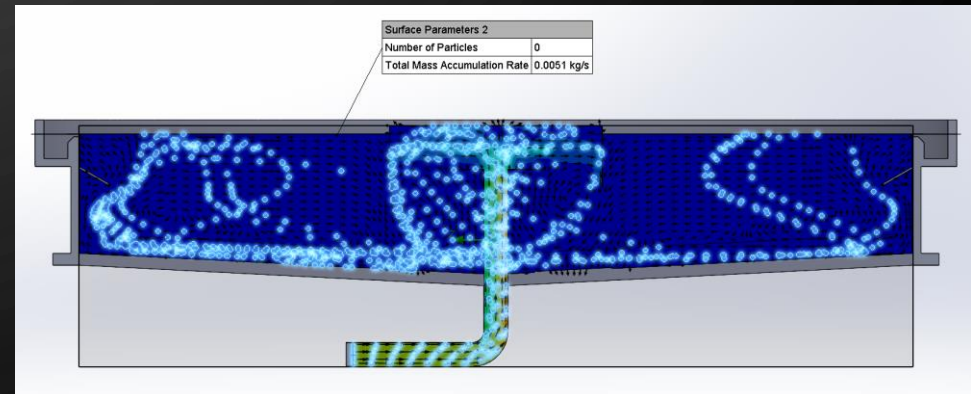


CFD RESULTS WITH DCB



Conclusion:

- With DCB at 36" width/depth at 30° and 30" from the top of concrete at the weir, the total mass accumulation rate at the weir is 0.0051 kg/s.
- TSS is reflected from the sludge tank to the center of the tank by DCB, allowing more TSS to accumulate in the sludge tank.



SUMMARY

Case Study	Height from Top of DCB to the Top of Concrete Weir	Total Mass Accumulation Rate kg/s at Weir	Effluent TSS Efficiency
Design Point 1	No Density Current Baffle	0.0106	
Design Point 2	30"	0.0051	107.84%

- The Density Current Baffle (DCB) with a 30° angle, a width/depth of 36", and 30" between the top of the DCB and the top of the concrete weir will increase the effluent TSS by 107.84%.
- The DCB will help reduce the TSS going over the weir.
- As the clarifier flow increases, the DCB will help reduce the hydraulic capacity of the clarifier.

Coatings

Coating Summary

Coating Summary

Surface preparation and paint on equipment supplied by WesTech is as follows:

Drive Unit:

Surface Preparation: SSPC-SP10

Primer Coat: One (1) Coat, Tnemec N140F-1255, Beige, Epoxy Primer (3-9 mils DFT).

Final Coat: One (1) Coat, Tnemec Series 73-B5712, WesTech Blue, Aliphatic Acrylic Polyurethane (2-5 mils DFT).

SSPC-SP10: A near white metal blast cleaned surface, when viewed without magnification, shall be free from all visible oil, grease, dirt, dust, mill scale, rust, coatings, oxides, corrosion products and other foreign materials. Random staining shall be limited to no more than 5% of each 3" x 3" [75mm x 75mm] square surface and may consist of light shadows, slight streaks, or minor discolorations caused by stains of mill scale, or stains of previously applied coating.

Submerged & Non-Submerged Mechanism Stainless Steel:

Cleaning Grade "C": A minimal amount of free iron may remain on surfaces. These locations shall be limited to small pin-point areas 1/16" (1mm) in diameter or less, scattered in a random pattern, and shall be less than 1% of the total surface area.

All surfaces shall be free from:

- Heat Tint (regardless of heat source; welding, thermal cutting, or grinding)
- Oxides and Tarnish (from thermal cutting, and tightly adherent brown or black tarnish formed along the toe of a weld)

Mechanism Stainless Steel Cleaning System

CLEANING GRADE "C"

1.

PRE-CLEAN ALL SURFACES IN ACCORDANCE WITH THE WESTECH WORKMANSHIP STANDARD (QR-00-063) SECTIONS 2.3 & 2.4, TO ENSURE THAT ALL SHARP EDGES, BURRS, WELD SPATTER, WELD SLAG ARE REMOVED.
2.

A MINIMUMAL AMOUNT OF FREE IRON MAY REMAIN ON SURFACES. THESE LOCATIONS SHALL BE LIMITED TO SMALL PIN-POINT AREAS 1/16" (1mm) IN DIAMETER OR LESS, SCATTERED IN A RANDOM PATTERN, AND SHALL BE LESS THAN 1% OF THE TOTAL SURFACE AREA.
3.

ALL SURFACES SHALL BE FREE FROM:

a.

HEAT TINT (REGARDLESS OF HEAT SOURCE; WELDING, THERMAL CUTTING, OR GRINDING).

b.

OXIDES AND TARNISH (FROM THERMAL CUTTING, AND TIGHTLY ADHERENT BROWN OR BLACK TARNISH FORMED ALONG THE TOE OF A WELD).
4.

THIS REQUIRED CLEANING APPLIES TO INTERNAL AND EXTERNAL SURFACES SUBJECT TO CORROSIVE MEDIA ATTACK; SUCH AS INTERNAL SURFACES OF PIPING.



CLEANING GRADE "C"

Drive Paint System

TYPE OF EQUIPMENT / TAG NUMBER(S): _____ DRIVE UNIT _____

ITEM NUMBERS REQUIRING THIS COATING _____

SYSTEM - ITEM NUMBERS (QUANTITY): _____ DRIVE UNIT _____

MATERIAL TO BE COATED: 9 11 CARBON STEEL AND STAINLESS STEEL (IF APPLICABLE)

DESIGN / OPERATING TEMPERATURE:	0 °F / 120 °F
HUMIDITY:	5 - 99%
SERVICE CONDITIONS:	NON-SUBMERGED
UV EXPOSED:	YES
PROCESS ENVIRONMENT:	PROCESS WATER
pH LEVEL:	NOT APPLICABLE
IF pH IS NOT NEUTRAL, WATER CHEMISTRY ANALYSIS IS REQUIRED:	NO
COATINGS SHALL MEET NSF 61 CERTIFICATION:	NOT REQUIRED

INSULATED:	_____	NO
FIREPROOFING:	_____	NO
CATHODIC PROTECTION SYSTEM:	_____	NO

NACE CERTIFIED COATINGS INSPECTOR:	<u>12</u>	NOT REQUIRED / NOT BY WESTECH
HOLIDAY TESTING (NACE SP0188):		NOT REQUIRED / NOT BY WESTECH <u>12</u>
SOLUBLE SALT TESTING:	<u>12</u>	NOT REQUIRED / NOT BY WESTECH
MILLIGRAMS /METERS² ACCEPTABLE:		NOT REQUIRED / NOT BY WESTECH <u>12</u>
ADHESION TESTING:	<u>12</u>	NOT REQUIRED / NOT BY WESTECH

NACE/SSPC SURFACE CLEANING STANDARD: SP10 (COMMERCIAL BLAST)

MINIMUM ANGULAR ANCHOR PROFILE RANGE: 2.5 mils

COATING MANUFACTURER:	TNEMEC	LPS LABORATORIES INC.
TYPE OF COATING (GENERIC):	POLYAMIDOAMINE EPOXY	RUST INHIBITOR
PRODUCT NAME/NUMBER:	N140F	LPS-3
DRY FILM THICKNESS (DFT)		
MINIMUM-MAXIMUM mils:	3-9 mils	-
COLOR NAME/ NUMBER:	BEIGE (1255)	-
TOTAL DRY FILM THICKNESS OF SYSTEM:		TOTAL DRY FILM THICKNESS

COATING MANUFACTURER:	TNEMEC	LPS LABORATORIES INC.
TYPE OF COATING (GENERIC):	POLYAMIDOAMINE EPOXY	RUST INHIBITOR
PRODUCT NAME/NUMBER:	N140F	LPS-3
DRY FILM THICKNESS (DFT)		
MINIMUM-MAXIMUM mils:	3-9 mils	-
COLOR NAME/ NUMBER:	BEIGE (1255)	-

SYSTEM:	TOTAL DRY FILM THICKNES
---------	-------------------------

COATING MANUFACTURER:	-	-
MANUFACTURER ITEM NUMBER:	-	-

1. FOLLOW THE LISTED WESTECH REFERENCE DOCUMENTS EXCEPT AS NOTED ON THIS DRAWING.
2. FIELD TOUCH-UP PAINT, LABOR AND COATINGS ARE NOT SUPPLIED BY WESTECH.
3. SURFACE PREPARATION AND COATING APPLICATION:
SHALL BE IN ACCORDANCE WITH NACE/SSPC STANDARDS, COATING MANUFACTURER'S PRODUCT DATA
SHEET AND WESTECH WORKMANSHIP STANDARD QR-00-063 (SECTION 3.1).
PRE-CLEANING - VERIFY THAT ALL SURFACES ARE FREE OF WELD SLAG, SPATTER, SHARP EDGES, AND BURRS PER QR-00-063 (SECTION 2.1).
CLEANING - PRIOR TO ABRASIVE BLAST CLEANING, SOLVENT WIPE PER SSPC SP1. REMOVE ALL VISIBLE GREASE, OIL WAX, AND ALL OTHER CONTAMINATION.
WHEN SSPC SP-6 IS SPECIFIED AND NEW STEEL IS USED, PER NACE VIS 1 SURFACE CLEANING SHALL BE SP-10.
4. COATING THICKNESS RESTRICTION LEVEL SHALL BE IN ACCORDANCE WITH SSPC PA2, TABLE 1 - RESTRICTION LEVEL 3 (80%-120%).
5. MACHINED SURFACES AND PIPE FLANGE FACES SHALL BE PROTECTED FROM ABRASIVE BLAST CLEANING AND COATING APPLICATION IN ACCORDANCE WITH THE WESTECH WORKMANSHIP STANDARD QR-00-063 (SECTIONS 2.6 AND 3.1). AFTER COATING APPLICATION IS COMPLETE, APPLY LPS-3, COSMOLINE OR, OR EQUIVALENT RUST INHIBITOR TO PROTECT THESE SURFACES.
6. STRIPE COAT ALL WELDS, EDGES AND BOLT HOLES USING A BRUSH. STRIPE COAT MAY BE COMPLETED AFTER PRIME COAT.
7. SURFACE PREPARATION AND COATING OR PROTECTION REQUIRED ON SURFACES THAT ARE INACCESSIBLE OR WILL BE INACCESSIBLE AFTER THE EQUIPMENT IS INSTALLED (I.E. UNDERSIDE OF BASE AND CAP PLATES, INTERIOR OF FANS)
 - 7.1. ALL MATING & INTERIOR SURFACES TO DRIVE EXCLUDING MACHINED SURFACES AND PREVIOUSLY PAINTED ITEMS REQUIRE COATING AND/OR PROTECTION
 - 7.2. METHOD OF COATING OR PROTECTION: APPLY COATING #2 TO MACHINED NON-MOUNTING SURFACES BEFORE ASSEMBLY
8. ALL BUYOUT ITEMS SUCH AS REDUCERS, BEARING HOUSINGS, AND MOTORS RECEIVE MANUFACTURER'S STANDARD PROTECTIVE COATINGS.
9. ALL NON-FERROUS MATERIALS, SUCH AS FIBERGLASS, ALUMINUM, STAINLESS STEEL, AND PLASTIC, ETC. SHALL NOT BE COATED, EXCEPT WHEN SPECIFICALLY STATED ON DRAWINGS OR IN THE PURCHASE ORDER.
10. COATINGS THICKNESS SHALL BE MEASURED ABOVE THE PEAKS OF THE ANCHOR PROFILE. COATING SYSTEMS OF LESS THAN (15) MILS DRY FILM THICKNESS (DFT) SHALL INCLUDE A "BASE METAL READING" ADJUSTMENT TO THE DRY FILM THICKNESS GAGE. WHEN THE ABRADED SURFACE IS INACCESSIBLE DUE TO COATING APPLICATION, AND NO REFERENCE SURFACE IS AVAILABLE, A MINIMUM OF (1) MIL DRY FILM THICKNESS SHALL BE SUBTRACTED FROM THE DRY FILM THICKNESS GAGE READINGS.


12 REFERENCE NOTES: (ONLY APPLICABLE WHEN SPECIFIC DATA IS LISTED UNDER INSPECTION REQUIREMENTS")

HOLIDAY TESTING - (IF YES) - HOLIDAY TESTING SHALL BE IN ACCORDANCE WITH THE COATING MANUFACTURER PRODUCT DATA SHEET (PREFERRED METHOD) OR PER NACE SP-0188 (LOW VOLTAGE HOLIDAY DETECTION [WET SPONGE] IS LIMITED TO COATINGS UP TO 20 MILS DFT. COATING SYSTEMS ABOVE 20 MILS DFT SHALL REQUIRE HIGH VOLTAGE HOLIDAY DETECTION [SPARK TEST]).

SOLUBLE SALT TEST - (IF YES) - TESTING SHALL BE PERFORMED IN ACCORDANCE WITH SSPC GUIDE-15. LIMITS SHALL BE DEFINED AS MILLIGRAMS/METER² (mg/m²). IF CLIENT DOES NOT SPECIFY, SEND REQUEST FOR INFORMATION.

ADHESION TEST - (IF YES) - TESTING SHALL BE IN ACCORDANCE WITH ASTM D4541, MINIMUM ADHESION SHALL BE SPECIFIED IN PSI, AND BASED ON COATING MANUFACTURERS RECOMMENDATIONS.

REV	REVISION DESCRIPTION	ECN	DESIGNER	APPROVER	DATE
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	TITLE COATING DATA SHEET DRIVE - CARBON STEEL			
DRV109				
QR-00-063 (SECTION 3.1)	DESIGNER	CHECKER	APPROVER	DATE
QR-00-063 (SECTION 2.6)	WH17	PA51	BO13	2021/02/05
QR-00-063 (SECTION 2.1)	JOB NUMBER	DOCUMENT NUMBER		SHEET
REFERENCE DOCUMENTS	-	0000952300		1 OF 1
				-



POTA-POX® PLUS SERIES N140F

PRODUCT PROFILE

GENERIC DESCRIPTION	Polyamidoamine Epoxy
COMMON USAGE	Innovative potable water coating which offers high-build edge protection and allows for application at a wide range of temperatures (down to 35°F or 2°C). For use on the interior and exterior of steel or concrete tanks, reservoirs, pipes, valves, pumps and equipment in potable water service.
COLORS	1211 Red, 1255 Beige, 00WH Tnemec White, 15BL Tank White, 39BL Delft Blue, 35GR Black. Note: Epoxies chalk with extended exposure to sunlight. Lack of ventilation, incomplete mixing, miscatalyzation or the use of heaters that emit carbon dioxide and carbon monoxide during application and initial stages of curing may cause yellowing to occur.
SPECIAL QUALIFICATIONS	<p>Certified by NSF International in accordance with ANSI/NSF Std. 61. Series N140F manufactured by Tnemec Company in Kansas City, Missouri or Baltimore, Maryland; ambient air cured (with or without 44-700 Epoxy Accelerator) is qualified for use on tanks and reservoirs of 1,000 gallons (3,785 L) capacity or greater, pipes 18 inches (46 cm) in diameter or greater, valves four (4) inches (10 cm) in diameter or greater and fittings four (4) inches (10 cm) in diameter or greater. Series N140F manufactured by Tnemec Coatings in Shanghai, China; ambient air cured (with or without 44-700 Epoxy Accelerator) is qualified for use on pipes 18 inches (46 cm) in diameter or greater, valves four (4) inches (10 cm) in diameter or greater and fittings four (4) inches (10 cm) in diameter or greater. Reference Tnemec's certified product listing at www.nsf.org for details on the maximum allowable DFT.</p> <p>Conforms to AWWA D 102 Inside Systems No. 1 and No. 2 (with or without 44-700). Conforms to AWWA C 210 (without 44-700). Contact your Tnemec representative for systems and additional information.</p>

COATING SYSTEM

SURFACER/FILLER/PATCHER	Series 215, 217, 218
PRIMERS	Self-priming, 22, 91-H ₂ O, 94-H ₂ O, L140, L140F, N140, V140, V140F, 141
TOPCOATS	<p>Interior: Series 22, FC22, L140, L140F, N140, N140F, V140, V140F, 141, 406</p> <p>Exterior: Series 22, 27, 27WB, 30, 66, L69, L69F, N69, N69F, V69, V69F, 72, 73, 118, L140, L140F, N140, N140F, V140, V140F, 141, 156, 157, 161, 180, 181, 446, 700, V700, 701, V701, 740, 750, 1026, 1028, 1029, 1074, 1074U, 1075, 1075U, 1077, 1078, 1078V, 1080, 1081, 1094, 1095, 1096, 1224. Note: When topcoating with Series 700, V700, 701, or V701, an intermediate coat of Series 73, 1075, 1075U, 1095 or 1096 is required. Note: The following recoat times apply for Series N140F: Immersion Service—Surface must be scarified by blasting with fine abrasive after 30 days. Atmospheric Service—After 30 days, scarification or an epoxy tie-coat is required. When topcoating with Series 740 or 750, recoat time for N140F is 14 days. Note: When topcoating with Series 406, recoat times will vary with temperature. Reference the Series 406 product data sheet for specific recoat times. Contact your Tnemec representative for specific recommendations.</p>

SURFACE PREPARATION

STEEL	<p>Immersion Service: SSPC-SP10/NACE 2 Near-White Blast Cleaning or ISO Sa 2 1/2 Very Thorough Blast Cleaning with a minimum angular anchor profile of 1.5 mils.</p> <p>Non-Immersion Service: SSPC-SP6/NACE 3 Commercial Blast Cleaning or ISO Sa 2 Thorough Blast Cleaning with a minimum angular anchor profile of 1.5 mils. Note: Commercial Blast Cleaning generally produces the best coating performance for this exposure. If conditions will not permit this, in moderate exposures Series N140F may be applied to SSPC-SP2 or SP3 Hand or Power Tool Cleaned surfaces (SSPC Rust Grade Condition C).</p>
CAST/DUCTILE IRON	All external surfaces of ductile iron pipe and fittings shall be delivered to the application facility without asphalt or any other protective lining on the exterior surface. All oils, small deposits of asphalt paint, grease, and soluble deposits should be removed and uniformly abrasive blasted using angular abrasive in accordance with NAF 500-03-04: External Pipe Surface condition. When viewed without magnification, the exterior surfaces shall be free of all visible dirt, dust, loose annealing oxide, rust, mold coating and other foreign matter. Any area where rust reappears before application shall be reblasted. The surface shall contain a minimum angular anchor profile of 1.5 mils (38.1 microns) (Reference NACE RP0287 or ASTM D 4417, Method C).
CONCRETE	Allow new cast-in-place concrete to cure a minimum of 28 days at 75°F (24°C). Verify concrete dryness in accordance with ASTM F 1869 "Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride" (moisture vapor transmission should not exceed three pounds per 1,000 square feet in a 24 hour period), F 2170 "Standard Test Method for Determining Relative Humidity in Concrete using in situ Probes" (relative humidity should not exceed 80%), or D 4263 "Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method" (no moisture present). Prepare concrete surfaces in accordance with NACE No. 6/SSPC-SP13 Joint Surface Preparation Standards and ICRI Technical Guidelines. Abrasive blast, shot-blast, water jet or mechanically abrade concrete surfaces to remove laitance, curing compounds, hardeners, sealers and other contaminants and to provide an ICRI-CSP 2-3 surface profile. Large cracks, voids and other surface imperfections should be filled with a recommended filler or surfacer.
PRIMED SURFACES	Immersion Service: Scarify the Series N140F prime coat surface by abrasive-blasting with fine abrasive before topcoating if the Series N140F prime coat has been in exterior exposure for 30 days or longer and Series 66, L69, L69F, N69, N69F, V69, V69F, L140, L140F, N140, N140F, V140, V140F or 161 is the specified topcoat.
ALL SURFACES	Must be clean, dry and free of oil, grease and other contaminants.

TECHNICAL DATA

VOLUME SOLIDS	68.0 ± 2.0% (mixed) †
RECOMMENDED DFT	2.0 to 10.0 mils (50 to 225 microns) per coat. Note: Dry film thickness that exceeds published recommendations but is in compliance with SSPC PA-2 and ANSI/NSF Std. 61 certifications, is acceptable. Note: The number of coats and thickness requirements will vary with substrate, application method and exposure. Contact your Tnemec representative.

POTA-POX® PLUS | SERIES N140F

CURING TIME AT 5 MILS DFT

Temperature	To Handle	To Recoat	Immersion
75°F (24°C)	4 hours	5 hours	7 days
65°F (18°C)	7-8 hours	9-11 hours	8 days
55°F (13°C)	12-14 hours	16-20 hours	9-10 days
45°F (7°C)	18-22 hours	28-32 hours	12-13 days
35°F (2°C)	28-32 hours	46-50 hours	16-18 days

Curing time varies with surface temperature, air movement, humidity and film thickness.

Note: For valve applications allow 14 days cure at 75°F (24°C) prior to immersion. For pipe applications allow 30 days cure at 75°F (24°C) prior to immersion. **Ventilation:** When used in enclosed areas, provide adequate ventilation during application and cure. **Note:** Refer to product listings on www.nsf.org for specific potable water return to service information.

VOLATILE ORGANIC COMPOUNDS

Unthinned: 2.3 lbs/gallon (273 grams/litre)
Thinned 5% (#60): 2.5 lbs/gallon (299 grams/litre)
Thinned 10% (#4): 2.7 lbs/gallon (323 grams/litre) †

HAPS

Unthinned: 2.3 lbs/gal solids
Thinned 5% (#60): 2.3 lbs/gal solids
Thinned 10% (#4): 3.1 lbs/gal solids

THEORETICAL COVERAGE

1,094 mil sq ft/gal (26.8 m²/L at 25 microns). See APPLICATION for coverage rates. †

NUMBER OF COMPONENTS

Two: Part A (amine) and Part B (epoxy) — One (Part A) to one (Part B) by volume.

PACKAGING

	Part A	Part B	Yield (mixed)
Large Kit	5 gallon pail	5 gallon pail	10 gallons (37.9 L)
Small Kit	1 gallon can	1 gallon can	2 gallons (7.6 L)

NET WEIGHT PER GALLON

12.68 ± 0.25 lbs (5.75 ± .11 kg) (mixed) †

STORAGE TEMPERATURE

Minimum 20°F (-7°C) Maximum 110°F (43°C)

For optimum application properties, material temperature should be above 60°F (16°C) prior to application.

TEMPERATURE RESISTANCE

(Dry) Continuous 250°F (121°C) Intermittent 275°F (135°C)

SHELF LIFE

Part A: 24 months; Part B: 12 months at recommended storage temperature.

FLASH POINT - SETA

Part A: 82°F (28°C) Part B: 80°F (27°C)

HEALTH & SAFETY

Paint products contain chemical ingredients which are considered hazardous. Read container label warning and Material Safety Data Sheet for important health and safety information prior to the use of this product.

Keep out of the reach of children.

APPLICATION

COVERAGE RATES

	Dry Mills (Microns)	Wet Mills (Microns)	Sq Ft/Gal (m ² /Gal)
Suggested	6.0 (150)	9.0 (230)	182 (16.9)
Minimum	2.0 (50)	3.0 (75)	545 (50.7)
Maximum	10.0 (225)	15.0 (375)	109 (10.1)

Note: Roller or brush application requires two or more coats to obtain recommended film thickness. Allow for overspray and surface irregularities. Wet film thickness is rounded to the nearest 0.5 mil or 5 microns. Application of coating below minimum or above maximum recommended dry film thicknesses may adversely affect coating performance. Reference the NSF website at www.nsf.org for details on the maximum allowable DFT. †

MIXING

Start with equal amounts of Series N140F Parts A and B. Power mix contents of each container separately, making sure no pigment remains on the bottom. Pour a measured amount of Part B into a clean container large enough to hold both components. Add an equal volume of Part A to Part B while under agitation. Continue agitation until the two components are thoroughly mixed. **Note:** Both components must be above 50°F (10°C) prior to mixing. For optimum mixing and application properties, the material should be above 60°F (16°C).

Thin by volume and thoroughly mix. Failure to thoroughly mix the Part A and Part B components prior to thinning can affect product's gloss and performance. Do not use mixed material beyond pot life limits. **Note:** For application to surfaces between 35°F to 50°F (2°C to 10°C), allow mixed material to stand 30 minutes and restir before using.

THINNING

Use No. 4 or No. 60 Thinner. For air spray, thin up to 10% or 3/4 pint (380 mL) per gallon with No. 4 Thinner or thin up to 5% or 1/4 pint (190 mL) per gallon with No. 60 Thinner. For airless spray, roller or brush, thin up to 5% or 1/4 pint (190 mL) per gallon. **Caution: Series N140F NSF certification is based on thinning with No. 4 or No. 60 Thinner for tanks and only No. 60 Thinner for pipe and valves.** Use of any other thinner voids NSF/ANSI Std. 61 certification.

POT LIFE

2 hours at 50°F (10°C) 1 hour at 75°F (24°C) 30 minutes at 100°F (38°C)

SPRAY LIFE

30 minutes at 75°F (24°C)

Note: Spray application after listed times will adversely affect ability to achieve recommended dry film thickness.

POTA-POX® PLUS | SERIES N140F

APPLICATION EQUIPMENT

Air Spray

Gun	Fluid Tip	Air Cap	Air Hose ID	Mat'l Hose ID	Atomizing Pressure	Pot Pressure
DeVilbiss JGA	E	765 or 704	5/16" or 3/8" (7.9 or 9.5 mm)	3/8" or 1/2" (9.5 or 12.7 mm)	50-80 psi (3.4-5.5 bar)	10-20 psi (0.7-1.4 bar)

Low temperatures or longer hoses require higher pot pressure.

Airless Spray

Tip Orifice	Atomizing Pressure	Mat'l Hose ID	Manifold Filter
0.015"-0.019" (380-485 microns)	3000-4800 psi (207-330 bar)	1/4" or 3/8" (6.4 or 9.5 mm)	60 mesh (250 microns)

Use appropriate tip/atomizing pressure for equipment, applicator technique and weather conditions.

Roller: Use 3/8" or 1/2" (9.5 mm to 12.7 mm) synthetic woven nap roller cover. Use longer nap to obtain penetration on rough or porous surfaces.

Brush: Recommended for small areas only. Use high quality natural or synthetic bristle brushes.

SURFACE TEMPERATURE

Minimum 35°F (2°C) Maximum 135°F (57°C)

The surface should be dry and at least 5°F (3°C) above the dew point. Coating won't cure below minimum surface temperature.

CLEANUP

Flush and clean all equipment immediately after use with the recommended thinner or MEK.

† Values may vary with color.

WARRANTY & LIMITATION OF SELLER'S LIABILITY: Tnemec Company, Inc. warrants only that its coatings represented herein meet the formulation standards of Tnemec Company, Inc. THE WARRANTY DESCRIBED IN THE ABOVE PARAGRAPH SHALL BE IN LIEU OF ANY OTHER WARRANTY, EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. THERE ARE NO WARRANTIES THAT EXTEND BEYOND THE DESCRIPTION ON THE FACE HEREOF. The buyer's sole and exclusive remedy against Tnemec Company, Inc. shall be for replacement of the product in the event a defective condition of the product should be found to exist and the exclusive remedy shall not have failed its essential purpose as long as Tnemec is willing to provide comparable replacement product to the buyer. NO OTHER REMEDY (INCLUDING, BUT NOT LIMITED TO, INCIDENTAL OR CONSEQUENTIAL DAMAGES FOR LOST PROFITS, LOST SALES, INJURY TO PERSON OR PROPERTY, ENVIRONMENTAL INJURIES OR ANY OTHER INCIDENTAL OR CONSEQUENTIAL LOSS) SHALL BE AVAILABLE TO THE BUYER. Technical and application information herein is provided for the purpose of establishing a general profile of the coating and proper coating application procedures. Test performance results were obtained in a controlled environment and Tnemec Company makes no claim that these tests or any other tests, accurately represent all environments. As application, environmental and design factors can vary significantly, due care should be exercised in the selection and use of the coating.



ENDURA-SHIELD SERIES 73

PRODUCT PROFILE

GENERIC DESCRIPTION Aliphatic Acrylic Polyurethane**COMMON USAGE**

A coating for commercial, industrial, and marine applications that is highly resistant to abrasion, wet conditions, corrosive fumes, chemical contact and has excellent resistance to exterior weathering. Direct-to-Metal capability allows for a labor-saving, high-build, single coat application.

COLORS

Refer to Tnemec Color Guide. **Note:** Certain colors may require multiple coats depending on method of application and finish coat color. When feasible, the preceding coat should be in the same color family (blue, gray, etc.), but noticeably different.

FINISH

Semi-gloss

SPECIAL QUALIFICATIONS

Series 73 meets the accelerated weathering requirements of SSPC Paint Standard 36.

This product is part of a coating system tested in accordance with ISO 12944-6 (2018). Contact your Tnemec representative for coating system test results.

COATING SYSTEM

PRIMERS

Steel: Self-priming or Series 1, 20, FC20, 27, 27WB, 37H, 66, L69, L69F, N69, N69F, V69, V69F, 90-97, H90-97, 90G-1K97, 91-H₂O, H91-H₂O, 94-H₂O, 132, 135, L140, L140F, N140, N140F, V140, V140F, 141, 161, 394, V530, 1224.

Galvanized Steel & Non-Ferrous Metal: Series 66, L69, N69, V69, 1224. **Note:** For special galvanized surface preparation instructions, consult the latest version of Tnemec Technical Bulletin 10-78.

Concrete: Series 66, L69, L69F, N69, N69F, V69, V69F, 141, 161, 1254

CMU: Series 1254

Note: Series V530 exterior exposed more than 24 hours, Series L69, N69, V69, 135, L140, N140, or V140 exterior exposed more than 60 days, Series L69F, N69F, V69F, L140F, N140F or V140F exterior exposed more than 30 days, or Series 132 or 141 exterior exposed more than 14 days must first be scarified or reprimed with themselves. Brush blasting with fine abrasive is the preferred method of scarification. Recoat windows for other primers may apply. See those data sheets for additional information.

TOPCOATS

Series 700, V700, 701, V701, 740, 750, 1070, 1070V, 1071, 1071V, 1072, 1072V, 1074, 1074U, 1075, 1075U, 1077, 1078, 1078V, 1094, 1095, 1096.

SURFACE PREPARATION

STEEL

SSPC-SP6/NACE 3 Commercial Blast Cleaning or ISO Sa 2 Thorough Blast Cleaning with a minimum angular anchor profile of 2.0 mils.

ALL SURFACES

Must be clean, dry and free of oil, grease and other contaminants.
See primer product data sheet for surface preparation recommendation.

TECHNICAL DATA

VOLUME SOLIDS

58.0 ± 2.0% (mixed) †

RECOMMENDED DFT

Topcoat Service: 2.0 to 5.0 mils (50 to 125 microns) per coat.

Direct to Metal; Over Zinc or MIO-Zinc: 3.5 to 5.0 mils (90 to 125 microns).

Note: Number of coats and thickness requirements will vary with substrate, application method and exposure. For DTM or applications over zinc or MIO-zinc, as part of a two-coat system, consult the latest version of Tnemec Technical Bulletin 13-100 or contact your Tnemec representative.

CURING TIME

Temperature	To Touch	To Handle	To Recoat
75°F (24°C)	1 hour	5-8 hours	12 hours

Curing time varies with surface temperature, air movement, humidity and film thickness. **Note:** For faster curing and low-temperature applications, add No. 44-710 Urethane Accelerator; see separate product data sheet.

VOLATILE ORGANIC COMPOUNDS

Unthinned	Thinned 10% (Max) (No. 39 Thinner)	Thinned 10% (Max) (No. 42 Thinner)	Thinned 10% (Max) (No. 48 Thinner)	Thinned 10% (Max) (No. 56 Thinner)	Thinned 10% (Max) (No. 63 Thinner)
2.61 lbs/gallon (313 grams/litre)	2.94 lbs/gallon (356 grams/litre)	3.01 lbs/gallon (361 grams/litre)	3.07 lbs/gallon (367 grams/litre)	2.67 lbs/gallon (320 grams/litre)	2.99 lbs/gallon (358 grams/litre)

HAPS

Unthinned	Thinned 10% (Max) (No. 39 Thinner)	Thinned 10% (Max) (No. 42 Thinner)	Thinned 10% (Max) (No. 48 Thinner)	Thinned 10% (Max) (No. 56 Thinner)	Thinned 10% (Max) (No. 63 Thinner)
0.44 lbs/gal solids	0.44 lbs/gal solids	0.44 lbs/gal solids	0.44 lbs/gal solids	0.44 lbs/gal solids	0.50 lbs/gal solids

THEORETICAL COVERAGE930 mil sq ft/gal (22.8 m²/L at 25 microns). †**NUMBER OF COMPONENTS**

Two: Part A and Part B

MIXING RATIO

By Volume: Four (Part A) to One (Part B)

PACKAGING

	PART A	PART B	When Mixed
5 Gallon Kit	5 gallon pail (partial fill)	1 gallon can	5 gallons (18.9L)
1 Gallon Kit	1 gallon pail (partial fill)	1 quart can (partial fill)	1 gallon (3.79L)

NET WEIGHT PER GALLON

12.13 ± 0.25 lbs (4.88 ± 0.11 kg) †

ENDURA-SHIELD | SERIES 73

STORAGE TEMPERATURE	Minimum 20°F (-7°C) Maximum 110°F (43°C)
TEMPERATURE RESISTANCE	(Dry) Continuous 250°F (121°C) Intermittent 275°F (135°C)
SHelf LIFE	Part A: 12 months at recommended storage temperature. Part B: 12 months at recommended storage temperature.
FLASH POINT - SETA	Part A: 80°F (27°C) Part B: 112°F (43°C)
HEALTH & SAFETY	Paint products contain chemical ingredients which are considered hazardous. Read container label warning and Material Safety Data Sheet for important health and safety information prior to the use of this product. Keep out of the reach of children.

APPLICATION

COVERAGE RATES

Topcoat Service

	Dry Mils (Microns)	Wet Mils (Microns)	Sq Ft/Gal (m²/Gal)
Suggested	2.5 (65)	4.5 (115)	372 (34.6)
Minimum	2.0 (50)	3.5 (90)	465 (43.2)
Maximum	5.0 (125)	8.5 (215)	186 (17.3)

Direct-to-Metal; over Zinc or MIO-Zinc

	Dry Mils (Microns)	Wet Mils (Microns)	Sq Ft/Gal (m²/Gal)
Suggested	4.0 (100)	7.0 (180)	233 (21.6)
Minimum	3.5 (90)	6.0 (150)	266 (24.7)
Maximum	5.0 (125)	8.5 (215)	186 (17.3)

Allow for overspray and surface irregularities. Wet film thickness is rounded to the nearest 0.5 mil or 5 microns. Application of coating below minimum or above maximum recommended dry film thicknesses may adversely affect coating performance. †

MIXING

Stir contents of the container marked Part A, making sure no pigment remains on the bottom. Add the contents of the can marked Part B to Part A while under agitation. Continue agitation until the two components are thoroughly mixed. When used with 44-710 Urethane Accelerator, first blend 44-710 into Part A under agitation; continue as above. Do not use mixed material beyond pot life limits. **Caution: Part B is moisture-sensitive and will react with atmospheric moisture. Keep unused material tightly closed at all times.**

THINNING

For air spray, thin up to 10% or 3/4 pint (380 mL) per gallon by volume with No. 42 Thinner if temperatures are below 80°F (27°C), use No. 48 Thinner for temperatures above 80°F (27°C). Thin up to 5% or 1/4 pint (190 mL) per gallon for airless spray. For brush or roller, thin 5% to 10% or 1/4 to 3/4 pint (190 to 380 mL) per gallon with No. 39 or No. 63 Thinner. Thinning is required for proper brush or roller application. **Note:** A maximum of 10% of No. 56 Thinner may be used to comply with VOC regulations. **Caution: Do not add thinner if more than thirty (30) minutes have elapsed after mixing.**

POT LIFE

8 hours at 40°F (4°C) 4 hours at 77°F (25°C) 2 hours at 100°F (38°C)

APPLICATION EQUIPMENT

Air Spray

Gun	Fluid Tip	Air Cap	Air Hose ID	Mat'l Hose ID	Atomizing Pressure	Pot Pressure
DeVilbiss JGA	E	765 or 704	5/16" or 3/8" (7.9 or 9.5 mm)	3/8" or 1/2" (9.5 or 12.7 mm)	75-90 psi (5.2-6.2 bar)	10-20 psi (0.7-1.4 bar)

Low temperatures or longer hoses require higher pot pressure.

Airless Spray

Tip Orifice	Atomizing Pressure	Mat'l Hose ID	Manifold Filter
0.013"-0.017" (330-430 microns)	3000-3600 psi (206-248 bar)	1/4" or 3/8" (6.4 or 9.5 mm)	60 mesh (250 microns)

Use appropriate tip/atomizing pressure for equipment, applicator technique and weather conditions.

Roller: Use 1/4" to 3/8" (6.4 mm to 9.5 mm) synthetic woven nap roller cover. Do not use long nap roller covers. **Note:** Two coats are required to obtain dry film thickness above 3.0 mils (75 microns).

Brush: Recommended for small areas only. Use high quality natural or synthetic bristle brushes. **Note:** Two or more coats may be required to obtain recommended film thicknesses.

SURFACE TEMPERATURE

Minimum 35°F (2°C) Maximum 120°F (49°C)

The surface should be dry and at least 5°F (3°C) above the dew point.

Cure time necessary to resist direct contact with moisture at surface temperature:

40°F (4°C): 24 to 40 hours 50°F (10°C): 18 to 26 hours 60°F (16°C): 12 to 16 hours
70°F (21°C): 4 to 8 hours 90°F (32°C): 2 to 4 hours 100°F (38°C): 2 to 3 hours

If the coating is exposed to moisture before the preceding cure parameters are met, dull, flat or spotty appearing areas may develop. Actual times will vary with air movement, film thickness and humidity.

CLEANUP

Flush and clean all equipment immediately after use with the recommended thinner or MEK.

† Values may vary with color.

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Field Test

Torque Test Procedure

The equipment will be tested to ensure structural and mechanical conformance with the torque requirements as outlined in the equipment specifications. The field test will also include verification of torque box settings such as the warning device and the drive cutout circuitry.

Torque will be applied to the mechanism by securing the truss arm with cables anchored to the tank floor (not by WesTech) while manually rotating the drive fan motor shaft. The load through the cable connection will be monitored with a hydraulic load cell and gauge (by WesTech).

The cables should be anchored and attached to the rake arm at a distance from the centerline of the tank, as indicated on the Torque Test Diagram, whereby calculations can be made to determine the torque values.

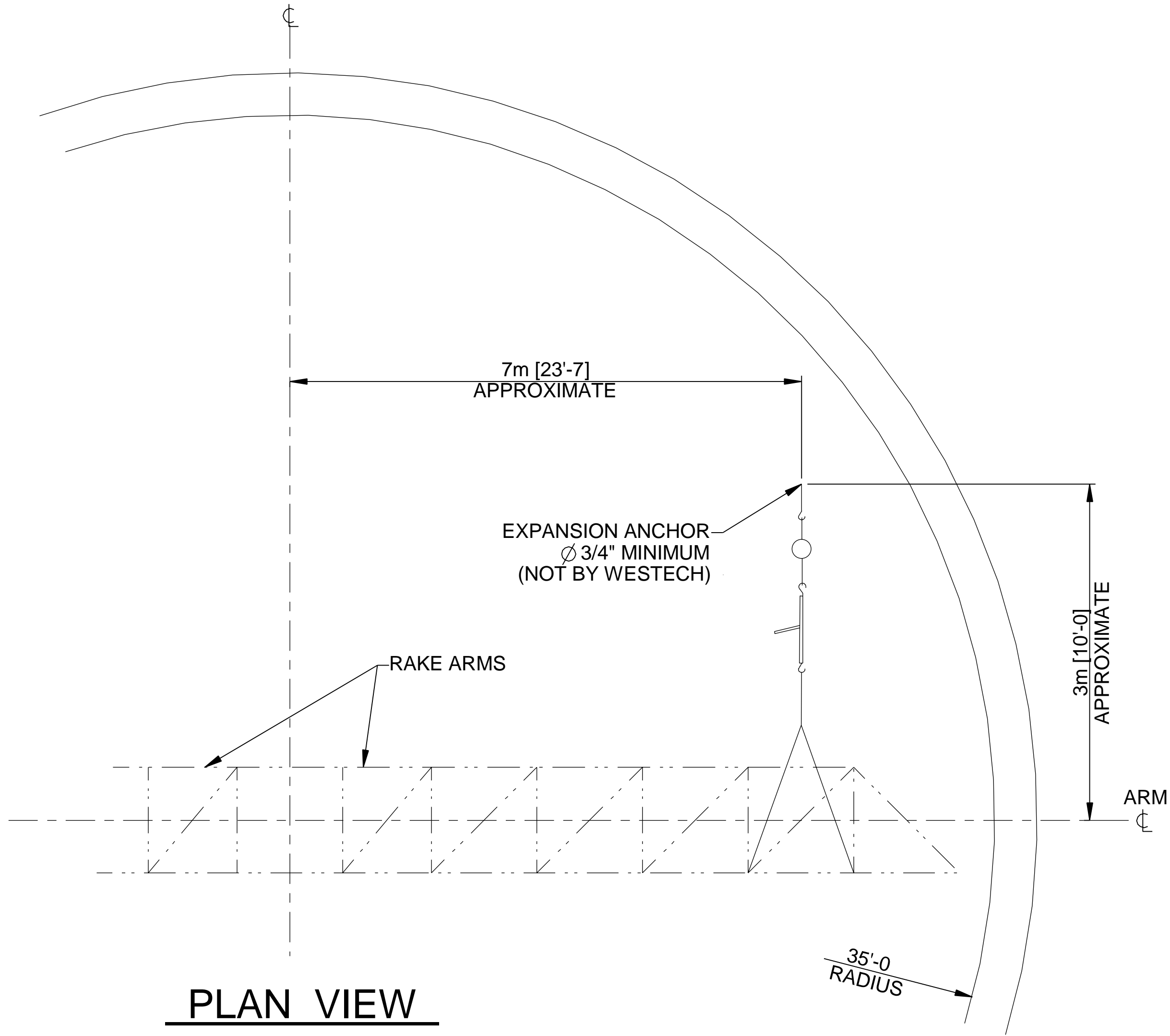
The torque, indicated as a percentage by the pointer on the drive unit torque box, should be within plus or minus 10 percent of the calculated values from the load cell readings.

Test Warnings:

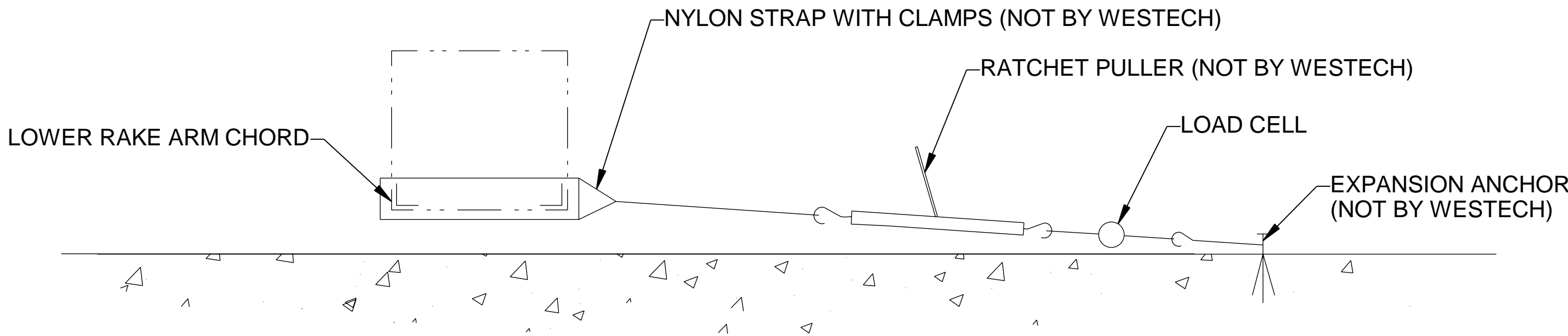
Review the Torque Test Diagram for the additional test procedures.

For the protection of personnel during the torque test, the following precautions must be taken:

1. Personnel entering the area of this equipment must be equipped with adequate safety equipment such as safety glasses, safety shoes, and a hard hat.
2. Check to ensure that the cable slings and other components to be used in the test are in good condition (not by WesTech).
3. Make sure that the anchors are properly installed and adequately sized for the loads indicated on the Torque Test Diagram (not by WesTech).
4. Limit the personnel inside the tank to that necessary to perform the test.
5. Keep a safe distance from the rake arms while the test is in progress. Do not stand in front of the leading side of the arms while they are loaded during the test.
6. Do not exceed the maximum load reading specified on the Torque Test Diagram.
7. All personnel in the area of this equipment during the torque test must be educated on these precautions before starting the test.



PLAN VIEW



ELEVATION

NOTES:

1. RAKE ARM MUST BE SECURED AS SHOWN AT TWO OR MORE PANEL POINTS WITH LOAD MEASURING ASSEMBLY.
 2. LOAD IS APPLIED BY THE RATCHET PULLER WHILE THE MOTOR OUTPUT SHAFT IS SECURED AGAINST ROTATION.
 3. DURING THE TORQUE TEST, THE LOAD INDICATOR AT THE DRIVE WILL INDICATE TORQUE VALUES.
- 4 DO NOT EXCEED THE MAXIMUM LOAD INDICATED ABOVE.
- 5 MINIMIZE LOAD APPLIED TO STRAPS AND LOAD CELL BY USING A PULLEY TO DIVIDE THE LOAD IN HALF WHEN NECESSARY, NEVER EXCEED THE CAPACITY OF THE LOAD CELL OR ANY PART OF THE RIGGING (STRAPS, RATCHET PULLER, ANCHOR, ETC.)
6. PRIOR TO TESTING, WESTECH DRIVE SHOULD RUN FOR A PERIOD OF 3-5 HOURS, OR 3-5 REVOLUTIONS.

TORQUE TEST RECORD

COMPLETED BY:				DATE :	
TEST EQUIPMENT:	ENERPAC TS5 TM5			ANALOG 8896 NEWTON DIGITAL 44483 NEWTON	
	CIRCLE ONE		S/N	5 CIRCLE ONE	

CALIBRATION EXPIRES:

REFERENCE: TORQUE (Nm) = LOAD CELL READING (N) x DISTANCE (m)

TORQUE TEST LOADS AT DESIGN ANCHOR DISTANCE				REVISED FOR	TEST RESULTS	
TORQUE BOX DIAL	DESIGN DISTANCE (m)	LOAD CELL READING (N)	TORQUE (Nm)	ACTUAL DISTANCE (m)	LOAD CELL READING (N)	TORQUE (Nm)
UNIT # 2	7					
100%		4229	29602			
120%		5075	35522			
140%		5920	41442			
4						

UNIT # 3						
100%		4229	29602			
120%		5075	35522			
140%		5920	41442			
4						

TEST VALUES WITHIN ±10% ARE ACCEPTABLE UNLESS OTHERWISE SPECIFIED

COMMENTS / ATTENDEES:

TORQUE TEST WITNESSED BY OWNERS AGENT: DATE:

PRINTED NAME: TITLE:

☐ PASS ☐ FAIL

SIGNATURE:

PREPARED FOR: BRANFORD WWTP
SECONDARY CLARIFIERS REHABILITATION
BRANTFORD, ONTARIO, CANADA

ENGINEER: CIMA+

CONTRACTOR:

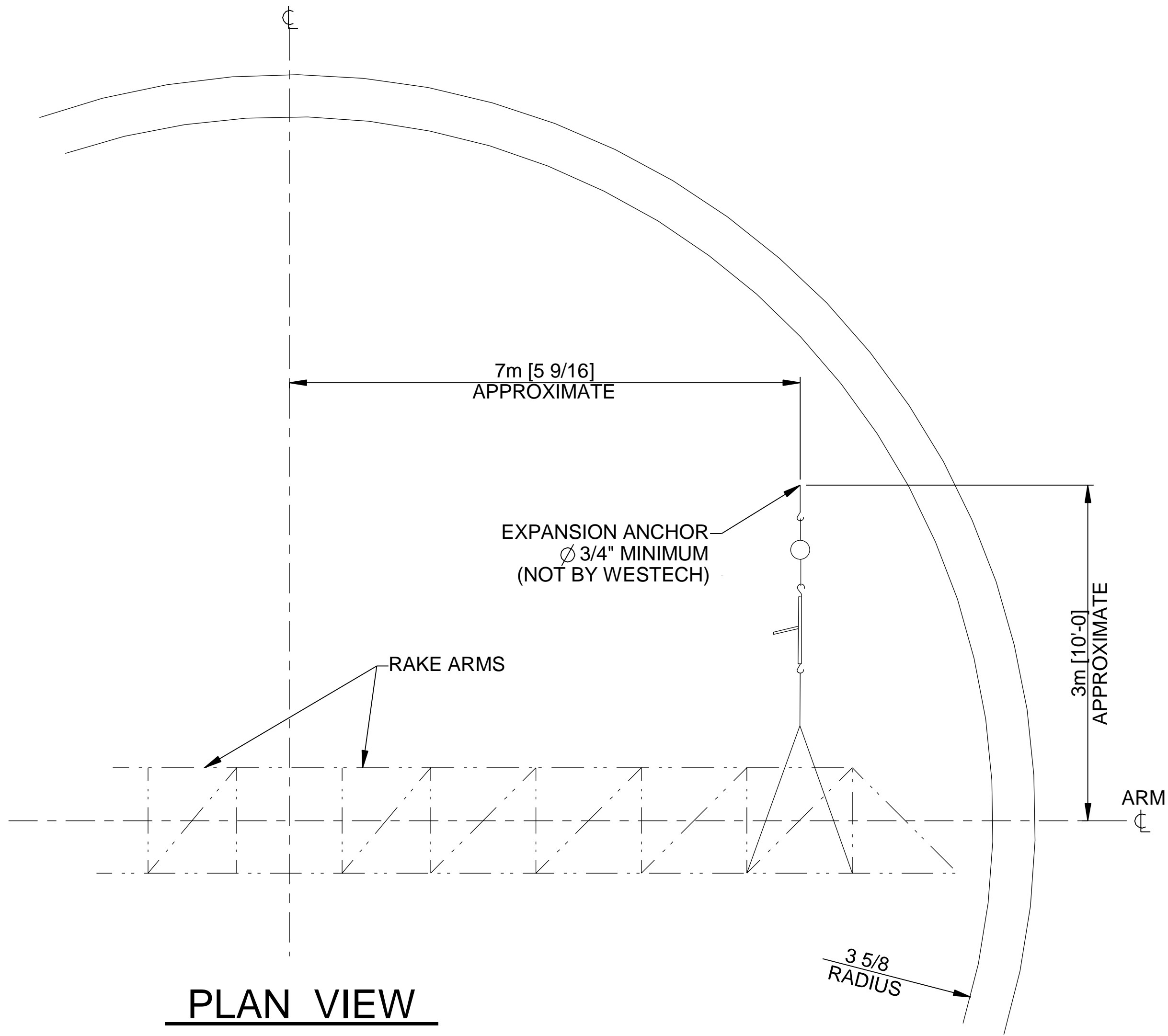
P.O./CONTRACT
NUMBER: 2022-92

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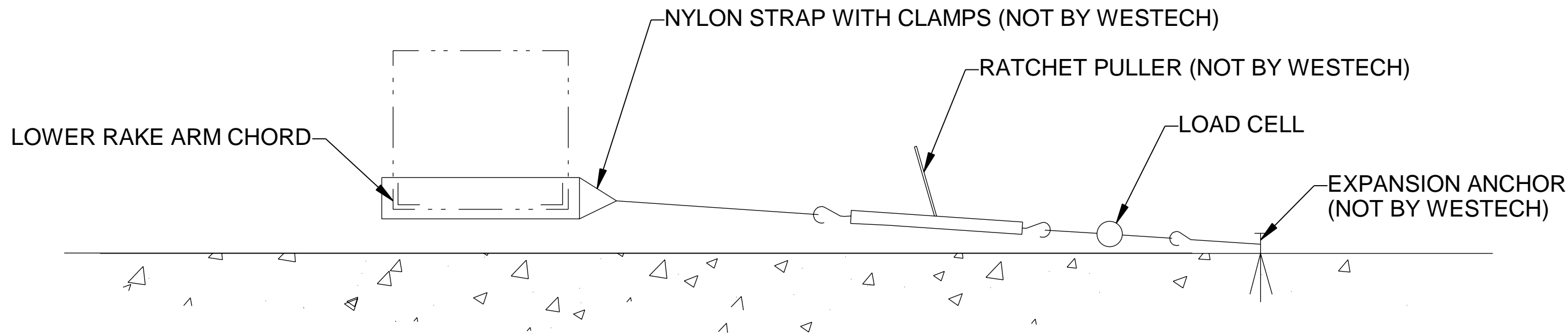
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TITLE: TORQUE TEST RECORD Ø 70'-0" SECODARY CLARIFIERS 2, 3 AND 4 COPC2G			
DESIGNER	CHECKER	APPROVER	DATE
RI62	SA103	ME75	2023-09-07
JOB NUMBER	DOCUMENT NUMBER		SHEET
24946A	0003393654		1 OF 2
			REV
			-

REV	REVISION DESCRIPTION	ECN	DESIGNER	APPROVER	DATE	REFERENCE DOCUMENTS
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PLAN VIEW



ELEVATION

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3. DURING THE TORQUE TEST, THE LOAD INDICATOR AT THE DRIVE WILL INDICATE TORQUE VALUES.
- 4 DO NOT EXCEED THE MAXIMUM LOAD INDICATED ABOVE.
- 5 MINIMIZE LOAD APPLIED TO STRAPS AND LOAD CELL BY USING A PULLEY TO DIVIDE THE LOAD IN HALF WHEN NECESSARY, NEVER EXCEED THE CAPACITY OF THE LOAD CELL OR ANY PART OF THE RIGGING (STRAPS, RATCHET PULLER, ANCHOR, ETC.)
6. PRIOR TO TESTING, WESTECH DRIVE SHOULD RUN FOR A PERIOD OF 3-5 HOURS, OR 3-5 REVOLUTIONS.

TORQUE TEST RECORD

COMPLETED BY:

DATE :

TEST EQUIPMENT:

ENERPAC TS5 TM5

ANALOG 8896 NEWTON

DIGITAL 44483 NEWTON

CIRCLE ONE

S/N

5 CIRCLE ONE

CALIBRATION EXPIRES:

REFERENCE: TORQUE (Nm) = LOAD CELL READING (N) x DISTANCE (m)

TORQUE TEST LOADS AT DESIGN ANCHOR DISTANCE				REVISED FOR	TEST RESULTS	
TORQUE BOX DIAL	DESIGN DISTANCE (m)	LOAD CELL READING (N)	TORQUE (Nm)	ACTUAL DISTANCE (m)	LOAD CELL READING (N)	TORQUE (Nm)
UNIT # 4	7					
100%		4229	29602			
120%		5075	35522			
140%		5920	41442			
4						

TEST VALUES WITHIN ±10% ARE ACCEPTABLE UNLESS OTHERWISE SPECIFIED

COMMENTS / ATTENDEES:

TORQUE TEST WITNESSED BY OWNERS AGENT: DATE:

PRINTED NAME: TITLE:

☐ PASS

☐ FAIL

SIGNATURE:

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TITLE: TORQUE TEST RECORD

Ø 70'-0 SECODARY CLARIFIERS 2, 3 AND 4

COPC2G

DESIGNER	CHECKER	APPROVER	DATE
R162	SA103	ME75	2023-09-07
JOB NUMBER	DOCUMENT NUMBER	SHEET	REV
24946A	0003393654	2 OF 2	-

Enclosures

Clouded Dimension Verification

The following drawings have clouded dimensions and assumed process data that will require verification by the contractor or owner.

These dimensions need to be verified before WesTech Engineering, LLC acknowledges the submittal as approved.


As such, contract ship dates will not be set, nor will work proceed until all requested information has been verified.

Drawings


1. A STAR DENOTES VARIANCE FROM CONTRACT DOCUMENTS AND SHOULD BE PARTICULARLY NOTED. ★
2. CONTRACTOR TO VERIFY OR SUPPLY ALL DIMENSIONS SHOWN IN CLOUDS. ☁
3. DIMENSIONS, LOADS, AND OTHER INFORMATION ARE PROVIDED FOR CONFIRMATION BY OTHERS OF POSITION AND INTERFACE BETWEEN NEW OR EXISTING CONCRETE, EQUIPMENT, PLANT STRUCTURE, OTHER SYSTEMS AND APPURTENANCES AS SHOWN ON THE GENERAL ARRANGEMENT DRAWINGS.
4. SUBMITTED DRAWINGS AND INFORMATION ARE NOT TO BE USED FOR CONSTRUCTION OR INSTALLATION PURPOSES UNTIL CUSTOMER APPROVAL HAS BEEN ISSUED. WESTECH WILL NOT PROCEED WITH FABRICATION OR DELIVERY UNTIL SUCH APPROVAL IS RECEIVED.
5. WESTECH IS NOT RESPONSIBLE FOR NEW OR EXISTING CONCRETE DESIGN, INCLUDING NECESSARY REINFORCEMENT FOR ANCHOR BOLTS, UNLESS SPECIFICALLY INDICATED OTHERWISE. THE SUITABILITY OF NEW OR EXISTING CONCRETE, EQUIPMENT, TANKAGE, OR STRUCTURES TO WITHSTAND THE DESIGN LOADS AT THE INTERFACE OF WESTECH'S EQUIPMENT IS TO BE DEFINED, CONFIRMED OR OTHERWISE PROVIDED BY OTHERS.
6. WESTECH IS NOT RESPONSIBLE FOR DAMAGE, INJURY OR LOSS RESULTING FROM IMPROPER USE OF THIS EQUIPMENT.
7. MODIFICATIONS, ADDITIONS OR CORRECTIONS TO THE APPROVED EQUIPMENT WILL NOT BE ACCEPTED BY WESTECH, UNLESS A CHANGE ORDER IS ISSUED AND APPROVED.
8. ROTATING EQUIPMENT IS DESIGNED TO OPERATE ONLY IN THE INDICATED DIRECTION. WESTECH IS NOT RESPONSIBLE FOR DAMAGE IF OPERATED IN THE OPPOSITE DIRECTION.
9. WESTECH DOES NOT FURNISH CONCRETE, GROUT, CONCRETE REINFORCING, PIPING, VALVES, PIPE SUPPORTS OR FITTINGS, WALL BRACKETS, ELECTRICAL WIRING, CONDUIT, ELECTRICAL EQUIPMENT, ERECTION, INSTALLATION, FIELD ASSEMBLY, SHIMMING MATERIALS, CAULK OR MASTIC, FIELD PAINTING OR PAINT, FIELD WELDING OR WELD ROD, WATER FOR TESTING, GREASE, ANTI-SEIZE OR LUBRICATING OIL, UNLESS SPECIFICALLY NOTED.
10. SHOP SURFACE PREPARATION AND SHOP PAINTING OF PRIME COATS ARE DESIGNED TO PROVIDE ONLY A MINIMAL PROTECTION FROM TIME OF APPLICATION PER THE COATING MANUFACTURER'S DATA SHEET. WESTECH DOES NOT GUARANTEE CONDITION OF PREPARED OR PAINTED ITEMS ONCE THE ITEMS LEAVE THE SHOP. CUSTOMER SHOP INSPECTION OF PAINTED ITEMS IS WELCOME TO VERIFY APPLICATION. ALL FIELD SURFACE PREPARATION, FIELD PAINT, TOUCH-UP, AND REPAIR TO SHOP PAINTED SURFACES ARE NOT BY WESTECH. RESPONSIBILITY FOR COMPATIBILITY OF SHOP AND FIELD APPLIED COATINGS IS BY OTHERS.
11. DOCUMENTS DEFINING WESTECH SUPPLIED SURFACE PREPARATION AND SHOP/FIELD PAINT SPECIFICATIONS ARE SUBMITTED WITH THE GENERAL ARRANGEMENT DRAWINGS AND WILL INCLUDE COATING DATA SHEET(S) AND/OR A STAINLESS-STEEL CLEANING GRADE SHEET AND FINISH LEVEL SHEET.
12. WHERE APPLICABLE, ANCHOR BOLT DETAILS ARE SHOWN ON JOB-SPECIFIC DRAWINGS AND SHALL CONFORM TO ONE OR MORE OF THE FOLLOWING SPECIFICATIONS:
 - CARBON STEEL HEADED OR ALL-THREAD ROD - ASTM F1554, GRADE 36, GRADE 55, OR GRADE 105
 - STAINLESS STEEL HEADED OR ALL-THREAD ROD - ASTM F593, ASTM A193
 - ADHESIVE ANCHORS SHALL MEET THE REQUIREMENTS OF ASTM E1512 AND SHALL HAVE A PUBLISHED ICC/ES REPORT.
 - WEDGE ANCHORS SHALL HAVE A PUBLISHED ICC/ES REPORT.
13. MATERIALS AND COATINGS OF FASTENERS ARE IDENTIFIED ON JOB-SPECIFIC GENERAL ARRANGEMENT DRAWINGS. BOLTS SHALL CONFORM TO ONE OR MORE OF THE FOLLOWING SPECIFICATIONS WITH DIMENSIONS PER ASME B18.2.1 AND B18.2.2:

14. THE FOLLOWING DEFINES THE ACCEPTABLE MATERIALS USED FOR WESTECH SUPPLIED EQUIPMENT AS SPECIFIED AND SHOWN ON THE GENERAL ARRANGEMENT DRAWINGS. ANY MATERIAL OR ITEMS NOT INCLUDED HERE SHALL BE CLEARLY SPECIFIED ON THE GENERAL ARRANGEMENT DRAWINGS.


A. CARBON STEEL SHALL MEET THE FOLLOWING SPECIFICATIONS AND REQUIREMENTS:

- STEEL SHAPES W, WT - ASTM A992/A992M
- STEEL SHAPES M, MT, S, ST, C, MC, L - ASTM A36/A36M
- STEEL PLATES AND BARS - ASTM A36/A36M; A572/A572M GRADE 50; A529/A529M
- STEEL SHAPE HP - ASTM A572/A572M GRADE 50
- STEEL PIPE - ASTM A53/A53M GRADE B, ASTM 106/A106M, API 5L
- HOLLOW STRUCTURAL SECTIONS (HSS), ROUND, SQUARE, RECTANGULAR - ASTM A500/A500M GRADE C; A1085/A1085M
- SHEETS - A1011/A1011M
- PIPE FITTINGS - ASTM A234/A234M; ASME B16.11
- ALL WELDING SHALL CONFORM TO THE LATEST AWS D1.1 CODE OR ASME BPVC SECTION IX.
- ALL SUBMERGED STRUCTURAL STEEL MEMBERS SHALL HAVE A MINIMUM 1/4" THICKNESS UNLESS NOTED OTHERWISE.
- SOME SHAPES MAY BE FORMED BY BENDING AND/OR WELDING. 

B. STAINLESS STEEL SHALL MEET THE FOLLOWING SPECIFICATIONS AND REQUIREMENTS:

- AUSTENITIC BARS, ROUND AND SQUARES, AND HOT ROLLED EXTRUDED SHAPES SUCH AS ANGLES, TEES, AND CHANNELS - ASTM A276; ASTM A484/A484M; ASTM A564/A564M
- AUSTENITIC LASER-FUSED BARS, PLATES, ANGLES, TEES, CHANNELS, AND W SHAPES - ASTM A1069/A1069M
- AUSTENITIC PLATES, SHEETS, STRIPS - ASTM A240/A240M; ASTM A480/A480M
- AUSTENITIC PIPES - ASTM A312/A312M
- AUSTENITIC HOLLOW STRUCTURAL SHAPES (HSS), ROUND, SQUARE, RECTANGULAR - ASTM A554
- PIPE FITTINGS - ASTM A182; ASME SA 182; ASME B16.11
- DUPLEX PLATES, SHEETS, STRIPS - ASTM A240/A240M; ASTM A480/A480M
- DUPLEX PIPES - ASTM A790/A790M
- DUPLEX HOLLOW STRUCTURAL SHAPES - MADE FROM PLATE 
- ALL WELDING SHALL CONFORM TO THE LATEST AWS D1.6 CODE OR ASME BPVC SECTION IX.
- SOME SHAPES MAY BE FORMED BY BENDING AND/OR WELDING.

C. ALUMINUM SHALL MEET THE FOLLOWING SPECIFICATIONS AND REQUIREMENTS:

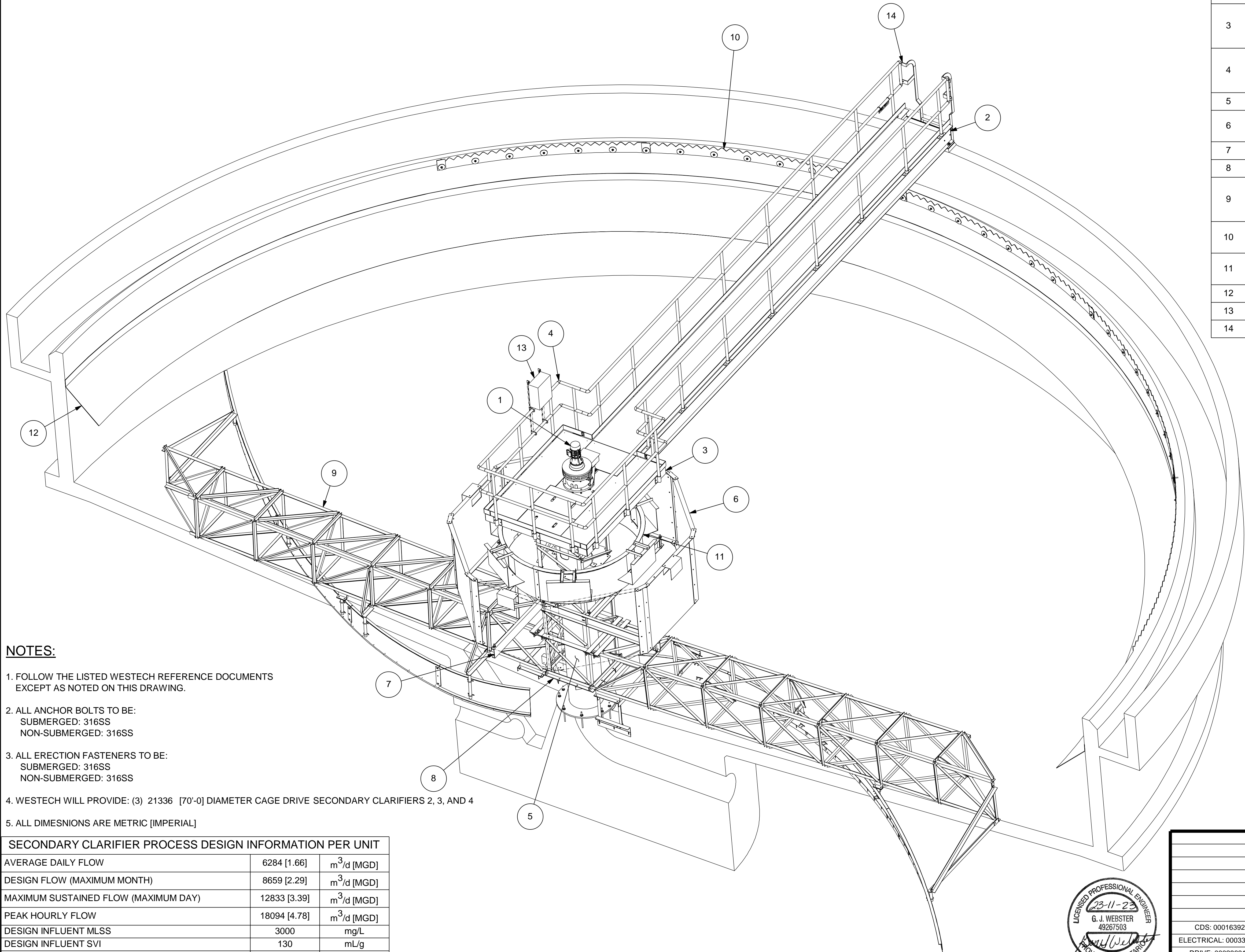
- EXTRUDED BARS, RODS, WIRE, STRUCTURAL PROFILES AND TUBES - ASTM B221/B221M
- STANDARD STRUCTURAL PROFILES - ASTM B308/B308M (FOR ALLOY 6061-T6 ONLY)
- PLATE AND SHEET - ASTM B209/B209M
- DRAWN SEAMLESS TUBE - ASTM B210/B210M; ASTM B483/B483M
- EXTRUDED SEAMLESS TUBE AND PIPE - ASTM B241/B241M; B429/B429M 
- PIPE FITTINGS - ASTM B361
- ALL WELDING SHALL CONFORM TO THE LATEST AWS D1.2 CODE.
- SOME SHAPES MAY BE FORMED BY BENDING AND/OR WELDING.

D. TANK MATERIALS SHALL CONFORM TO THE SPECIFICATIONS IN API 650 OR AWWA D100 AS NOTED ON THE GENERAL ARRANGEMENT DRAWINGS. SPECIFIED MATERIALS ARE SHOWN ON THE GENERAL ARRANGEMENT DRAWINGS. ALL WELDING SHALL CONFORM TO THE ASME BPVC - SECTION IX.

- B. ASME STAMPED PRESSURE VESSELS** SHALL CONFORM TO ASME BPVC SECTION VIII OR SECTION X (FOR FRP TANKS), THE DESIGN CALCULATIONS AND THE GENERAL ARRANGEMENT DRAWINGS.

- 15. ITEMS SHOWN, NOTED OR DESCRIBED ON THE GENERAL ARRANGEMENT DRAWINGS SUPERSEDE ANY CONFLICTING ITEMS WITHIN THESE NOTES.**

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DESIGNER	CHECKER	APPROVER	DATE																												
WH17	DESIGN/DETAIL COUNCIL	ENGINEERING COUNCIL	2020/11/11																												
JOB NUMBER		DOCUMENT NUMBER		SHEET	REV																										
-		0000647822		1 OF 1	C																										
</																															



NOTES:

1. FOLLOW THE LISTED WESTECH REFERENCE DOCUMENTS EXCEPT AS NOTED ON THIS DRAWING.
2. ALL ANCHOR BOLTS TO BE:
SUBMERGED: 316SS
NON-SUBMERGED: 316SS
3. ALL ERECTION FASTENERS TO BE:
SUBMERGED: 316SS
NON-SUBMERGED: 316SS
4. WESTECH WILL PROVIDE: (3) 21336 [70'-0] DIAMETER CAGE DRIVE SECONDARY CLARIFIERS 2, 3, AND 4
5. ALL DIMESNIONS ARE METRIC [IMPERIAL]

SECONDARY CLARIFIER PROCESS DESIGN INFORMATION PER UNIT		
AVERAGE DAILY FLOW	6284 [1.66]	m ³ /d [MGD]
DESIGN FLOW (MAXIMUM MONTH)	8659 [2.29]	m ³ /d [MGD]
MAXIMUM SUSTAINED FLOW (MAXIMUM DAY)	12833 [3.39]	m ³ /d [MGD]
PEAK HOURLY FLOW	18094 [4.78]	m ³ /d [MGD]
DESIGN INFLUENT MLSS	3000	mg/L
DESIGN INFLUENT SVI	130	mL/g
DESIGN RAS FLOW	2877 [.76]	m ³ /d [MGD]
MAXIMUM RAS FLOW	6284 [1.66]	m ³ /d [MGD]

EQUIPMENT LIST	
ITEM	DESCRIPTION/REMARKS
1	DRIVE UNIT,787 [31] WITH TORQUE CONTROL DEVICE 29602 Nm [21833 FTLBS] CONTINUOUS RUNNING TORQUE
2	WALKWAY, 914 [3'-0] WIDE (304LSS) GRATING, 32 [1 1/4] (ALUMINUM)
3	PLATFORM, 2591 [8'-6] LONG x 2134 [7'-0] WIDE (304LSS) MINIMUM 610 [2'-0] CLEARANCE AROUND DRIVE FLOORPLATE, 10 [3/8] (ALUMINUM)
4	HANDRAIL, 38 [1 1/2] NOMINAL DIAMETER x 1067 [3'-6] HIGH, 2-RAIL (ALUMINUM) RIVET, SUB-ASSEMBLED (SHIPPED LOOSE) 127 [5] x 6 [1/4] TOE BOARD (ALUMINUM)
5	CENTER COLUMN, Ø 610 [2'-0] (OUTSIDE) x 6 [1/4] THICK (304LSS) WITH PORTS
6	FEEDWELL, Ø 4000 [13'-1 1/2] (INSIDE) x 1521 [4'-11 7/8] SIDEDEPTH x 6 [1/4] THICK (304LSS) 4-BAFFLED SCUM PORTS
7	FEEDWELL SUPPORTS (304LSS)
8	DRIVE CAGE, 914 [3'-0] SQUARE (304LSS)
9	RAKE ARMS, 914 [3'-0] WIDE x 914 [3'-0] HIGH (304LSS) SPIRAL, AND SLUDGE SCRAPER BLADES ADJUSTABLE SQUEEGEES (304SS)
10	WEIR PLATE, 229 [9] DEEP x 6 [1/4] (FRP) V-NOTCHES, 90° x 64 [2 1/2]" DEEP AT 152 [6] INTERVALS
11	ENERGY DISSIPATING INLET WELL (EDI) WITH MULTIPLE INLET GATES Ø 2441 [8'-0 1/8] (INSIDE) x 762 [2'-6] SIDEDEPTH x 5 [3/16] THICK (304LSS)
12	DENSITY CURRENT BAFFLE, 6 [1/4]" (FRP)
13	NEMA 4X ELECTRICAL CONTROL PANEL (SUPPORTS NOT BY WESTECH)
14	BRIDGE ACCESS LADDER, 914 [3'-0] WIDE x 991 [3'-3] TALL (304LSS)

PREPARED FOR: BRANFORD WWTP
SECONDARY CLARIFIERS REHABILITATION
BRANTFORD, ONTARIO, CANADA

ENGINEER: CIMA+

CONTRACTOR:

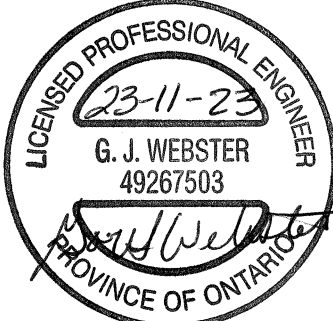
P.O./CONTRACT
NUMBER 2022-92

WestTech®

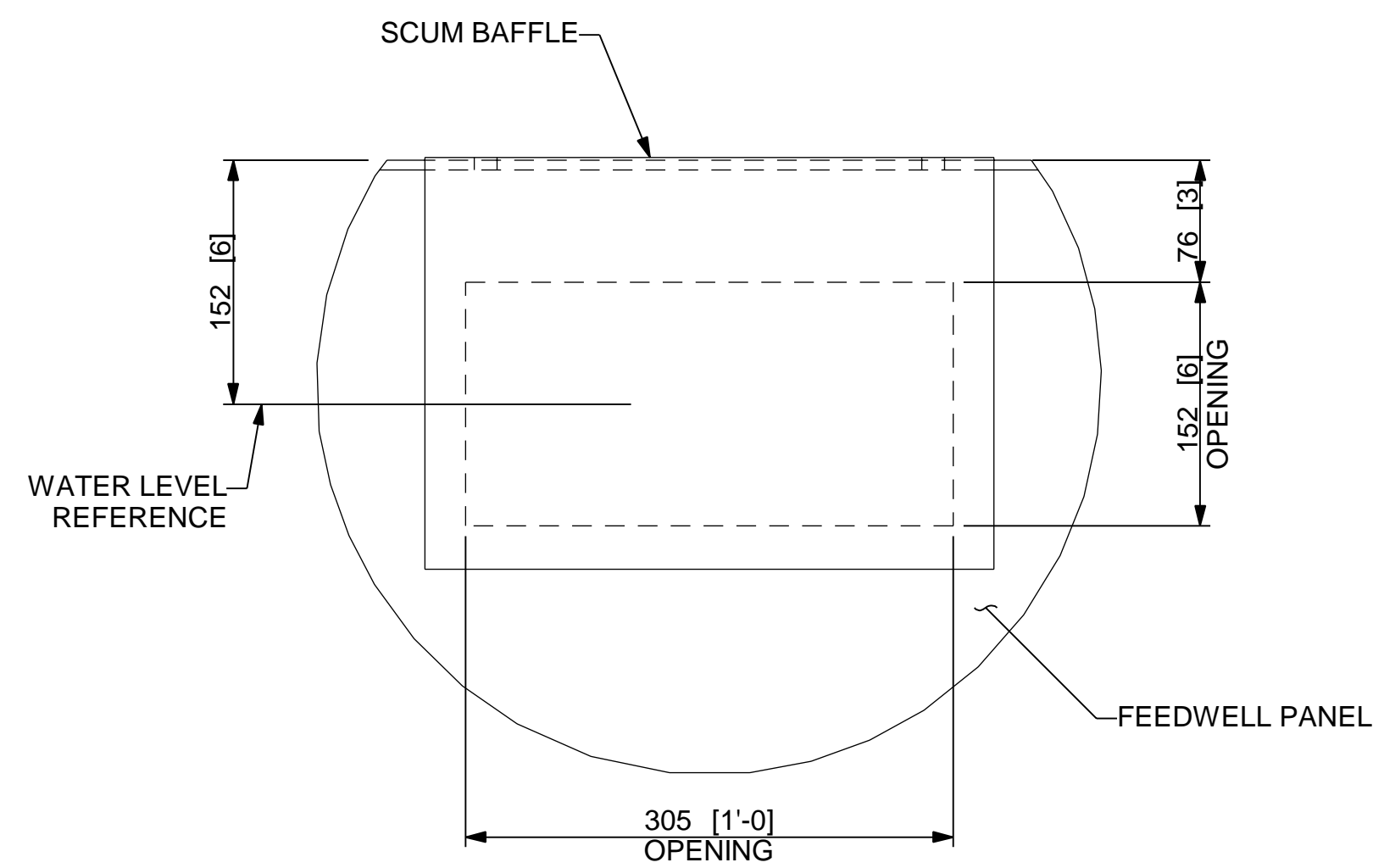
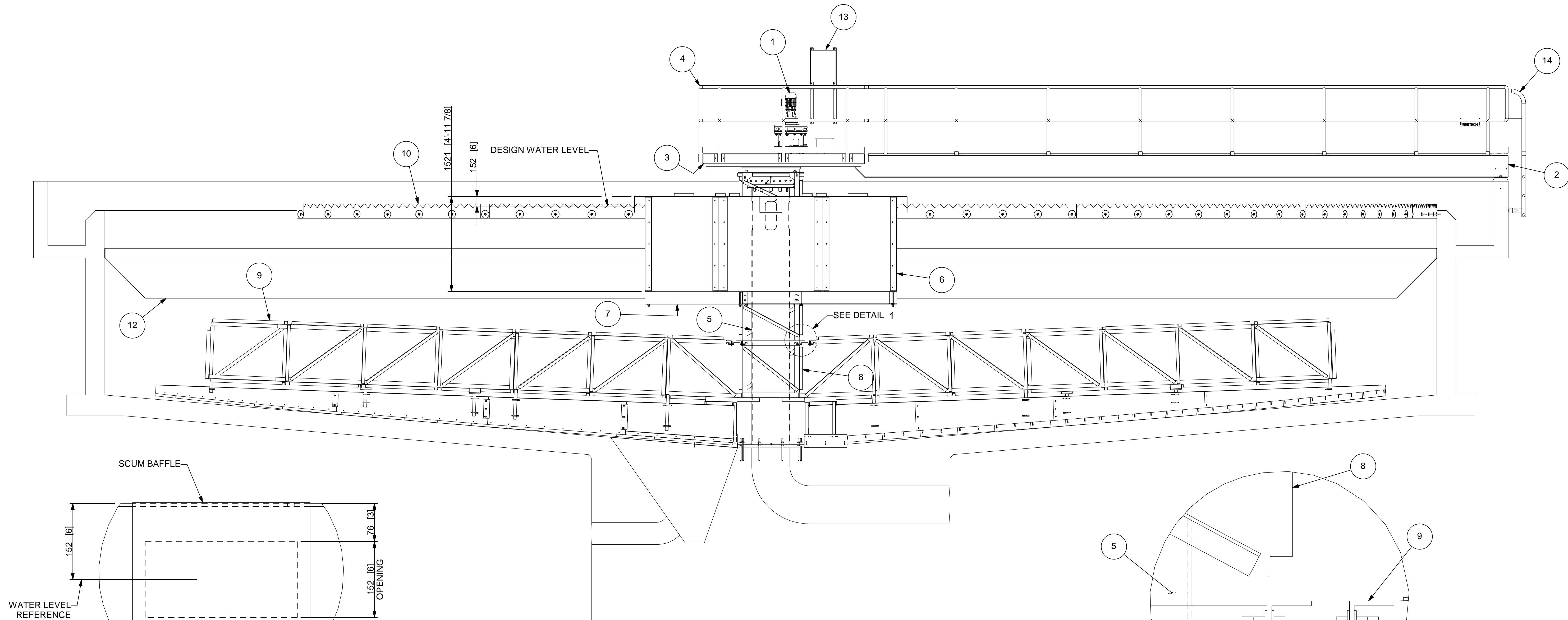
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TITLE: **GENERAL ARRANGEMENT**
Ø 21336 [70'-0] SECONDARY CLARIFIERS 2, 3, AND 4
COPC2G

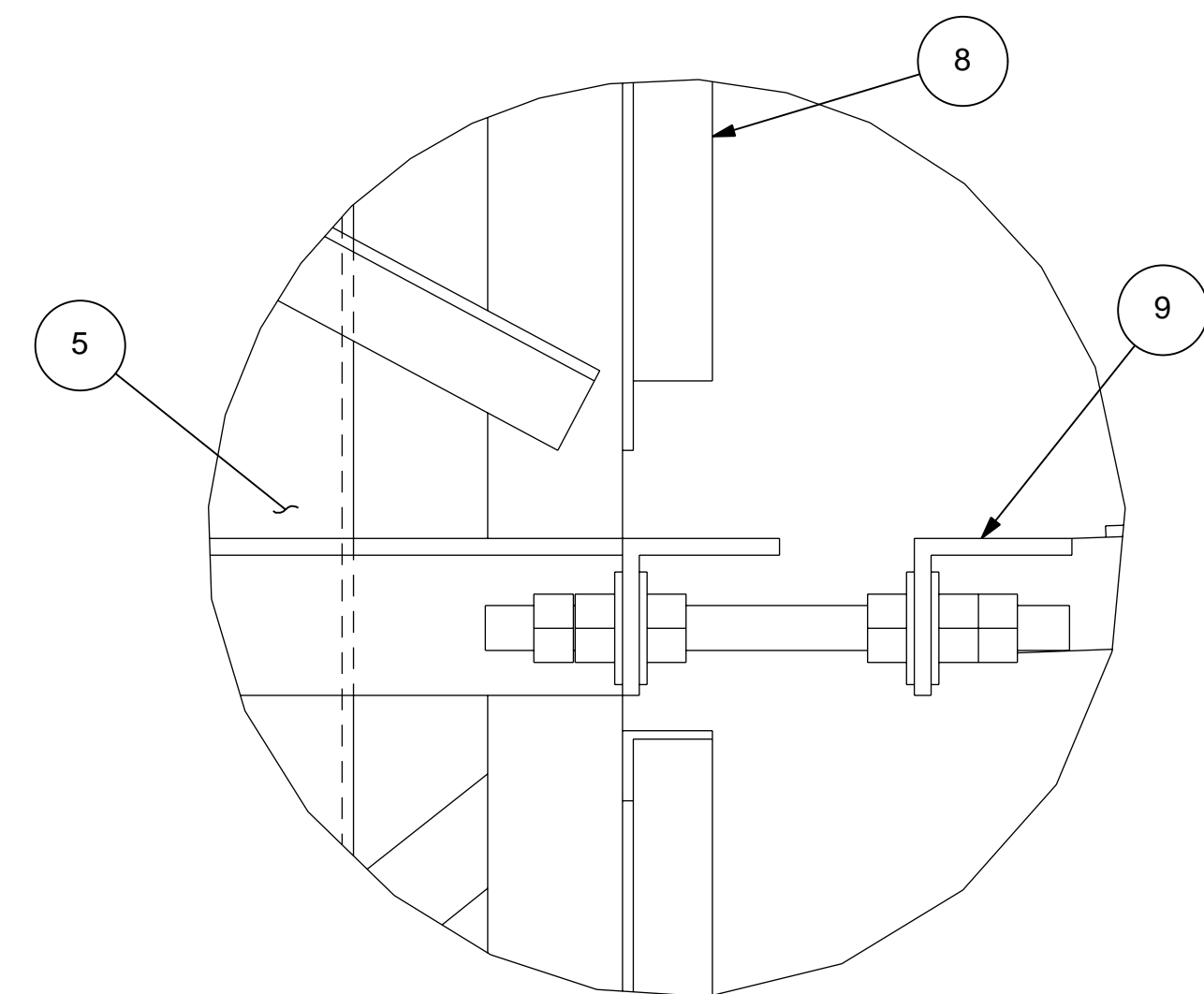
DESIGNER	CHECKER	APPROVER	DATE
ELECTRICAL: 0003380816	SA103	ME75	2023-09-07
DRIVE: 0002863150	DOCUMENT NUMBER		SHEET
GEN. NOTES: 0000647822	24946A		1 OF 5
REFERENCE DOCUMENTS	0003392085		REV
			-



REV	REVISION DESCRIPTION	ECN	DESIGNER	APPROVER	DATE
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FEEDWELL BAFFLE DETAIL
SCALE 0.250



DETAIL 1
SCALE 0.250

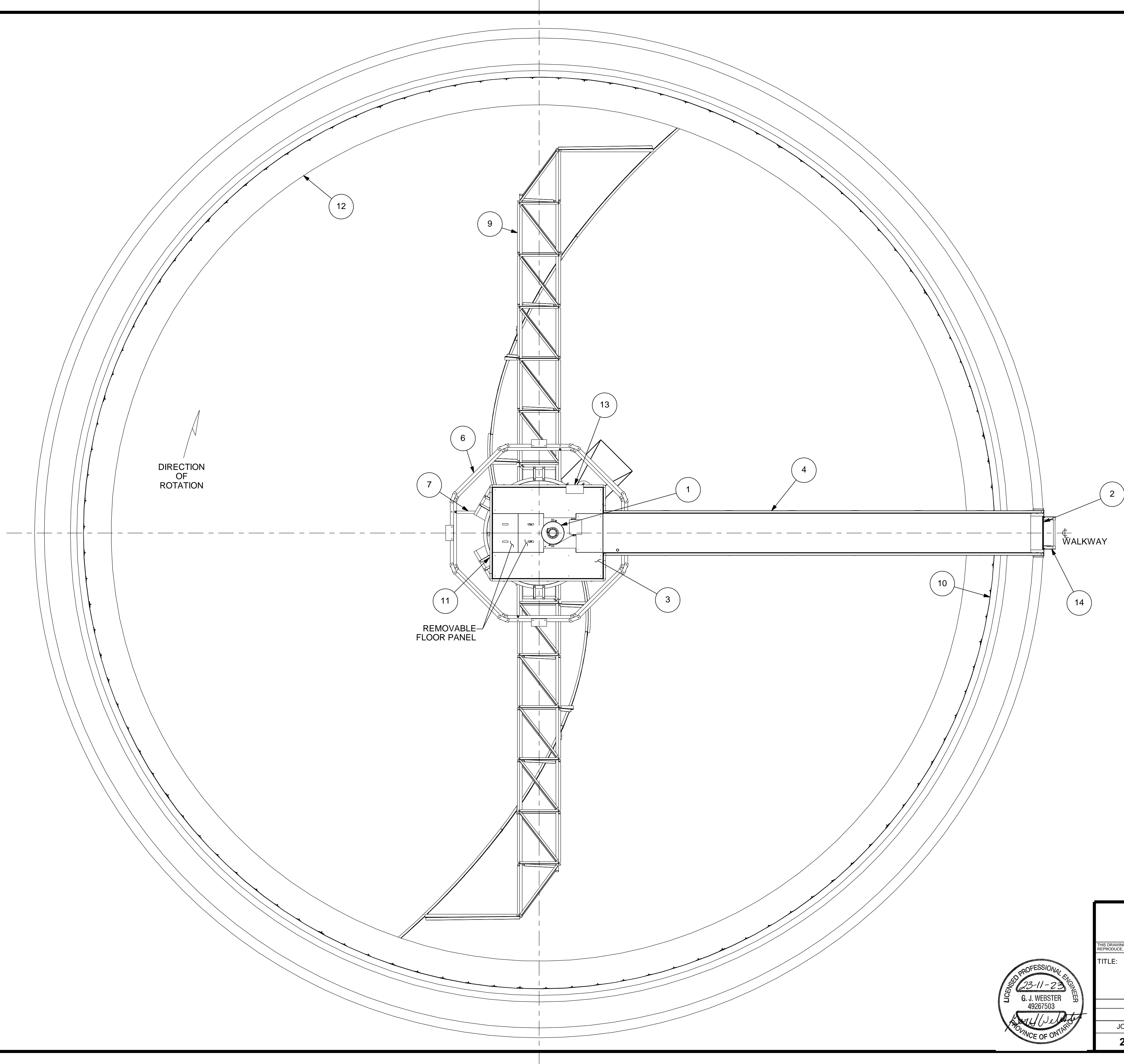


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TITLE: **GENERAL ARRANGEMENT**
Ø 21336 [70'-0] SECONDARY CLARIFIERS 2, 3, AND 4
COPC2G

DESIGNER	CHECKER	APPROVER	DATE
R162	SA103	ME75	2023-09-07
JOB NUMBER	DOCUMENT NUMBER	SHEET	REV
24946A	0003392085	2 OF 5	-

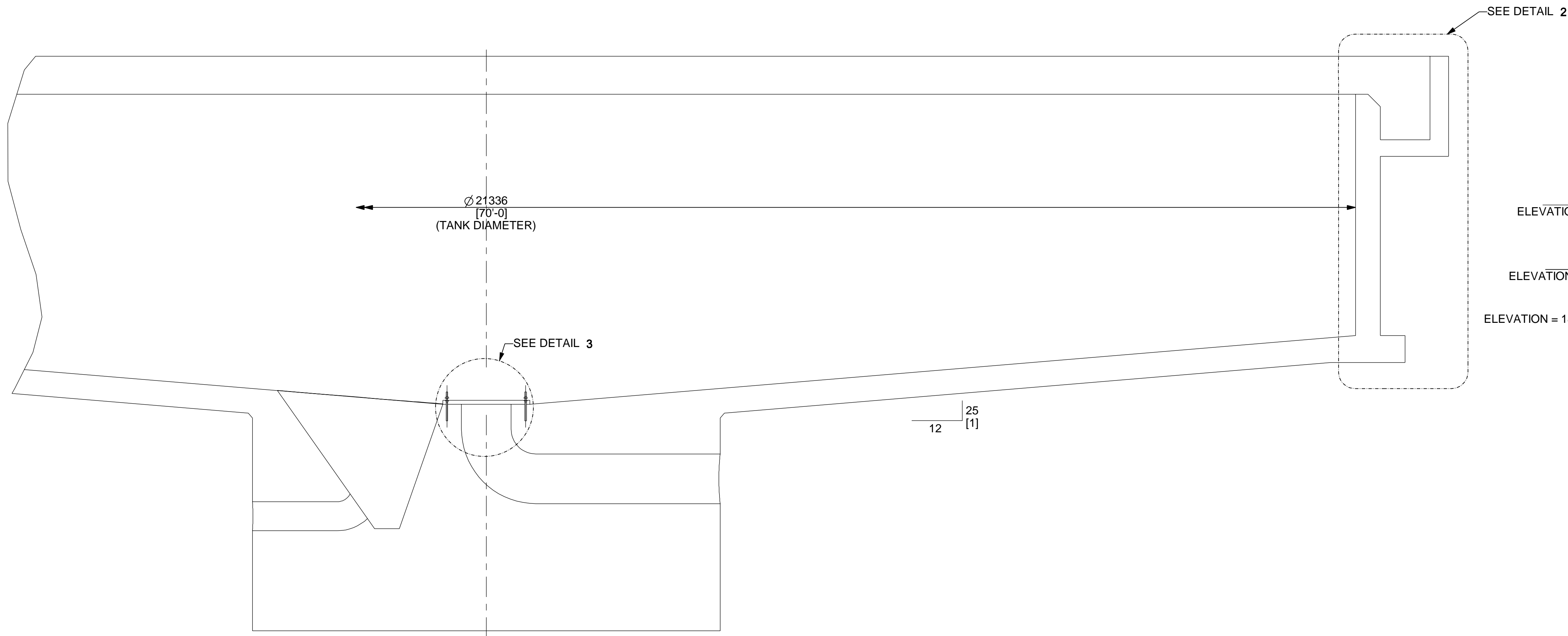


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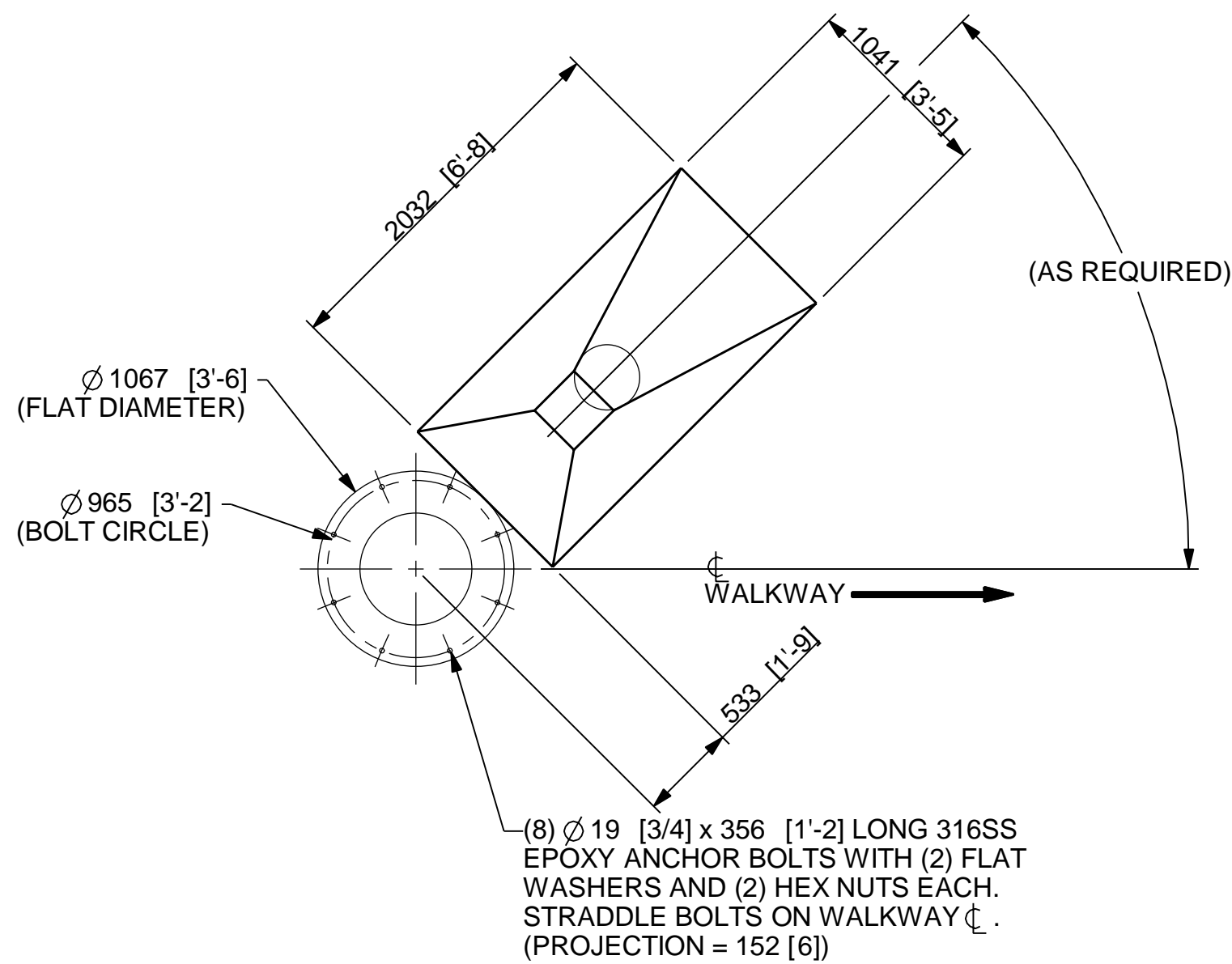
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DESIGNER	CHECKER	APPROVER	DATE	
R162	SA103	ME75	2023-09-07	
JOB NUMBER	DOCUMENT NUMBER		SHEET	REV
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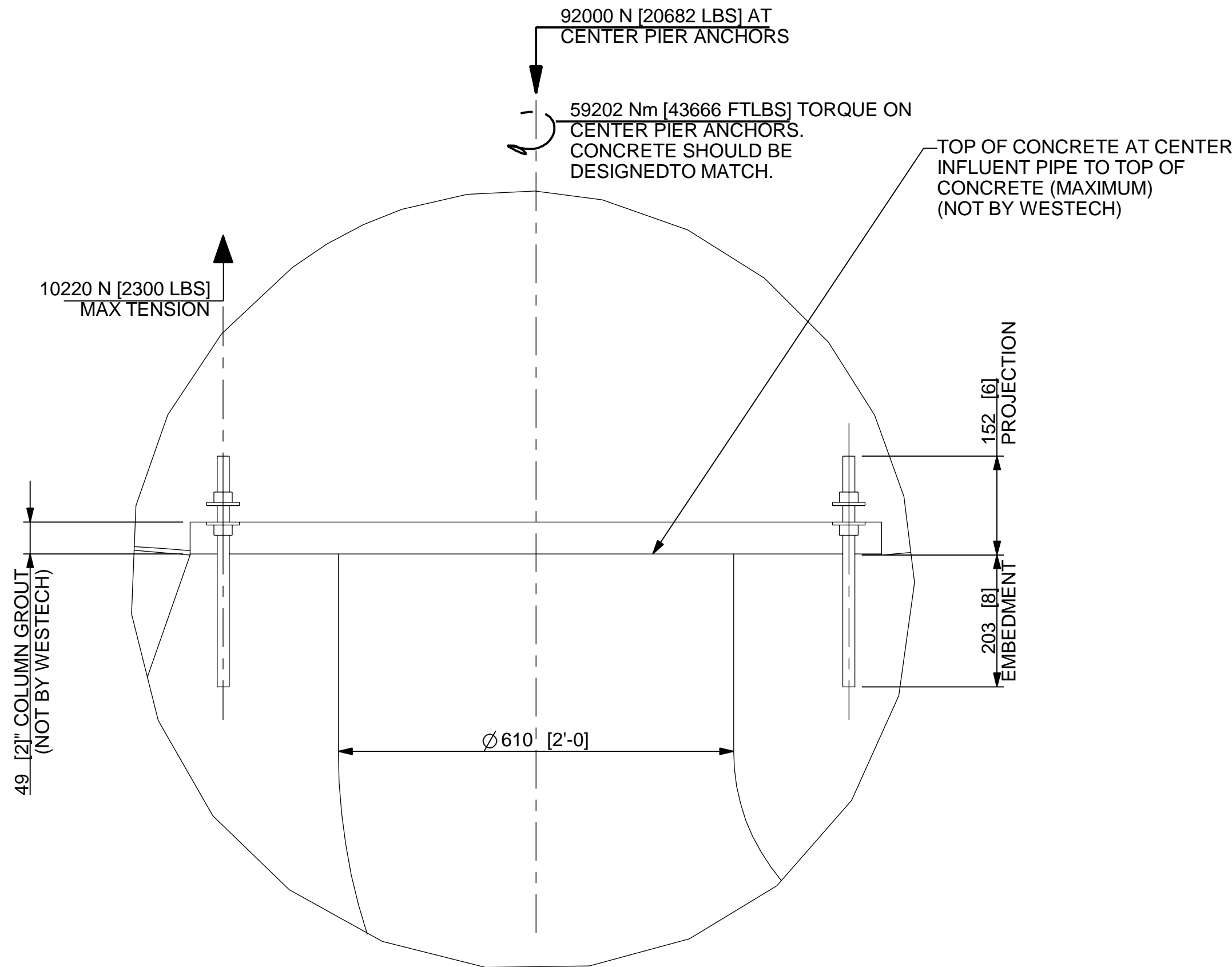
TANK CROSS SECTION



TANK CENTER PLAN VIEW
SCALE 0.030

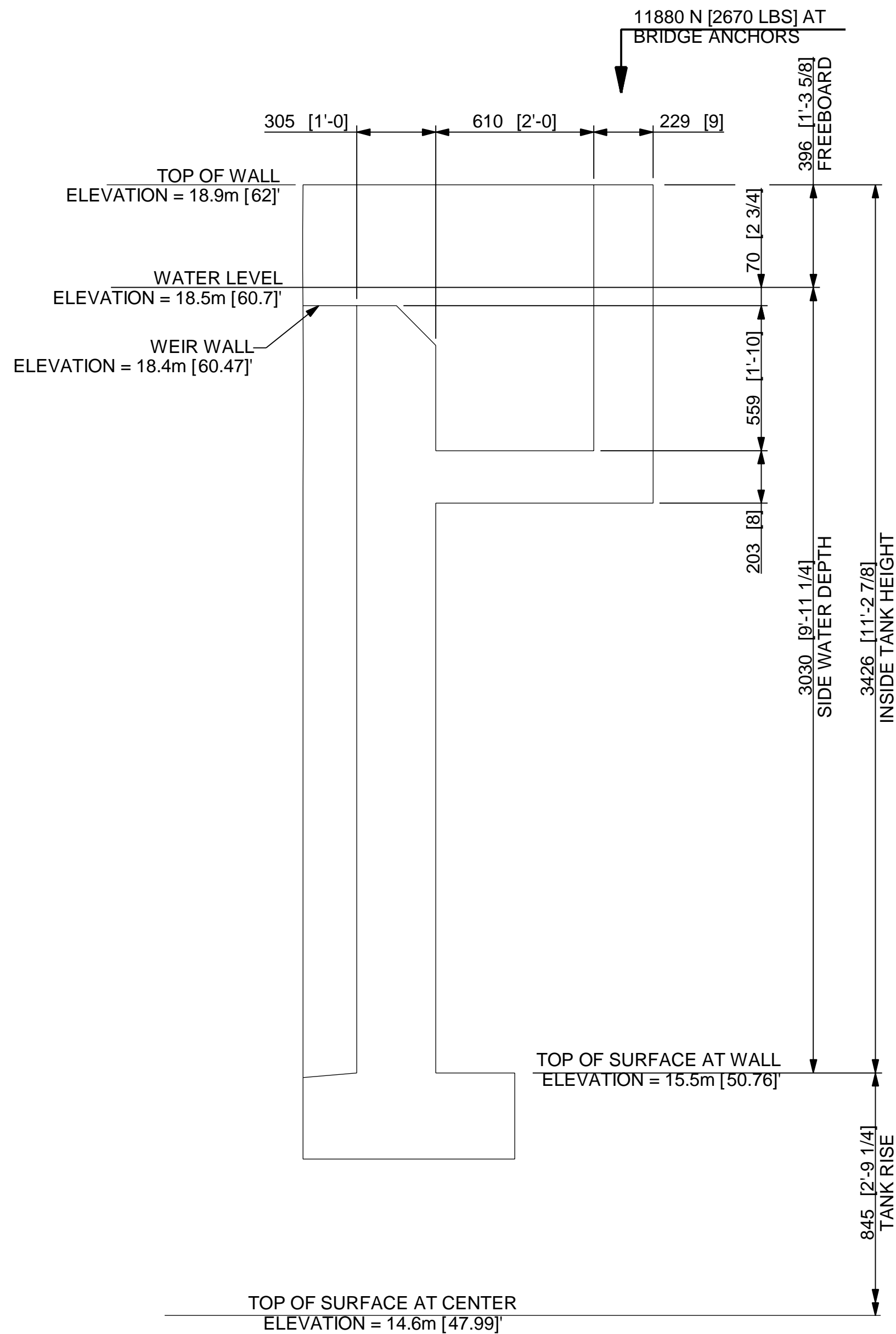
NOTES:

1. CONCRETE DESIGN IS NOT BY WESTECH. IT IS THE RESPONSIBILITY OF THE ENGINEER TO ENSURE THAT THE CONCRETE IS ADEQUATE TO SUPPORT THE LOADS SHOWN ON DRAWINGS.
2. ALL LOADS ARE NON-FACTORED UNLESS NOTED OTHERWISE.
3. INFLUENT, EFFLUENT, SLUDGE, AND SCUM PIPE LOCATION PER ENGINEERS DRAWINGS.
4. STANDARD HOLE CLEANING FOR THREADED ROD REQUIRED. REFER TO EPOXY MANUFACTURER'S RECOMMENDED CLEANING REQUIREMENTS.



DETAIL 3
SCALE 0.150

SEE DETAIL 2



DETAIL 2
SCALE 0.063

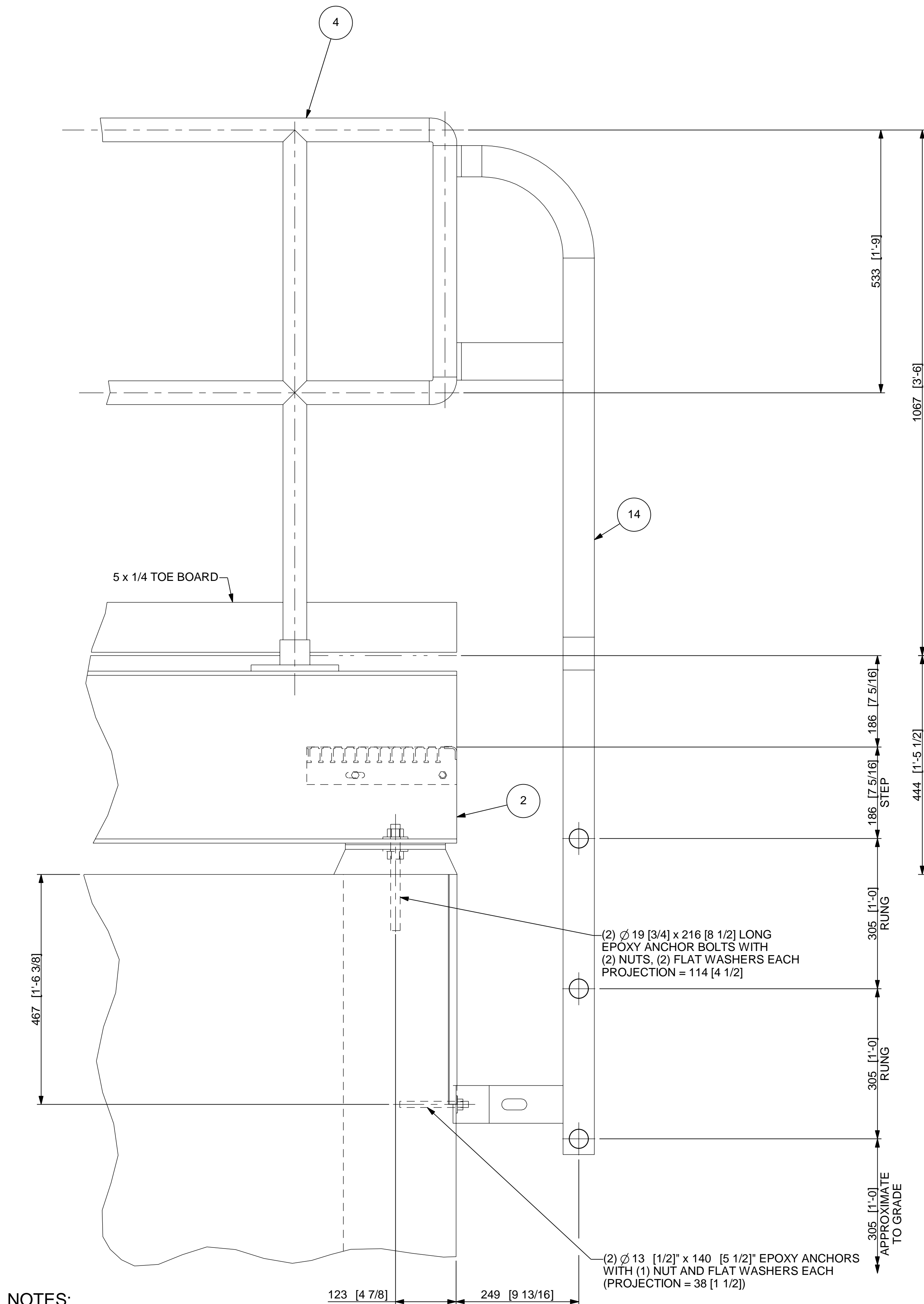


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TITLE: **GENERAL ARRANGEMENT**
Ø 21336 [70'-0"] SECONDARY CLARIFIERS 2, 3, AND 4
COPC2G

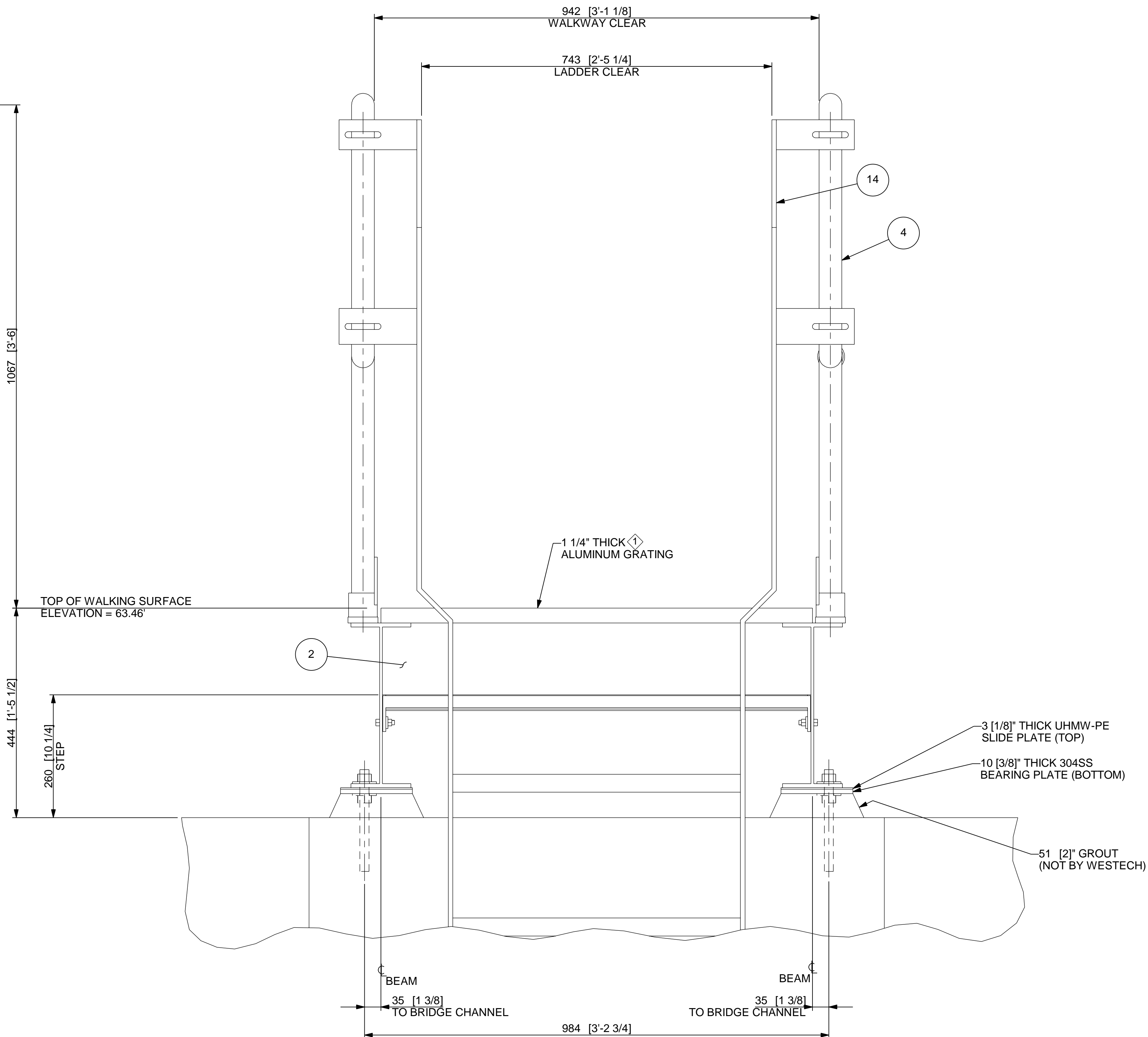
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R/62	SA103	ME75	2023-09-07
JOB NUMBER	DOCUMENT NUMBER	SHEET	REV
24946A	0003392085	4 OF 5	-



NOTES:

- ① GRATING USES SELF-TAPPING SCREWS THAT REQUIRE FIELD DRILLED PILOT HOLES.

WALKWAY TO TANK WALL

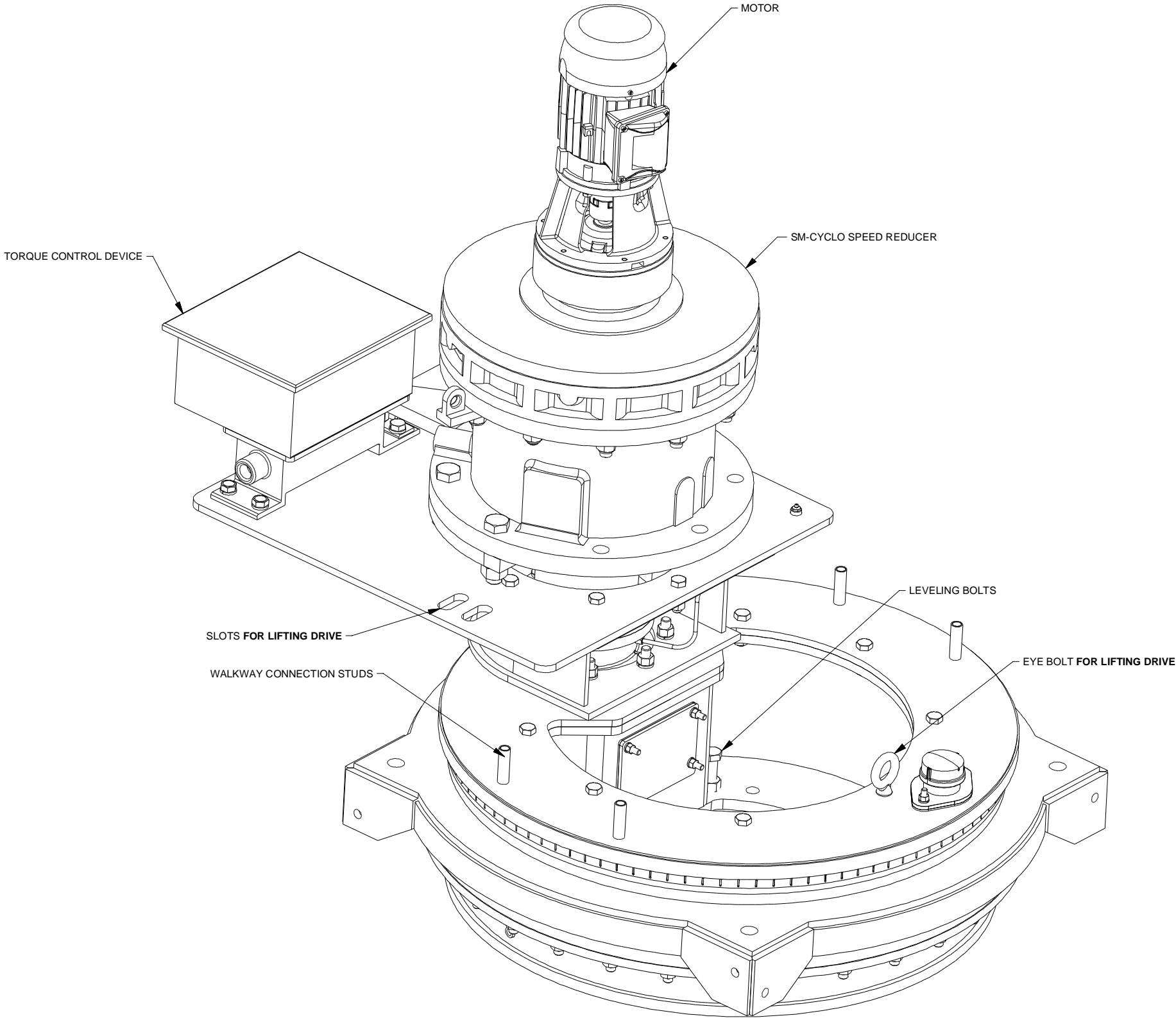


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TITLE: **GENERAL ARRANGEMENT**
 \varnothing 21336 [70'-0"] SECONDARY CLARIFIERS 2, 3, AND 4
 COPC2G

DESIGNER	CHECKER	APPROVER	DATE
RIG2	SA103	ME75	2023-09-07
JOB NUMBER	DOCUMENT NUMBER	SHEET	REV
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NOTES:

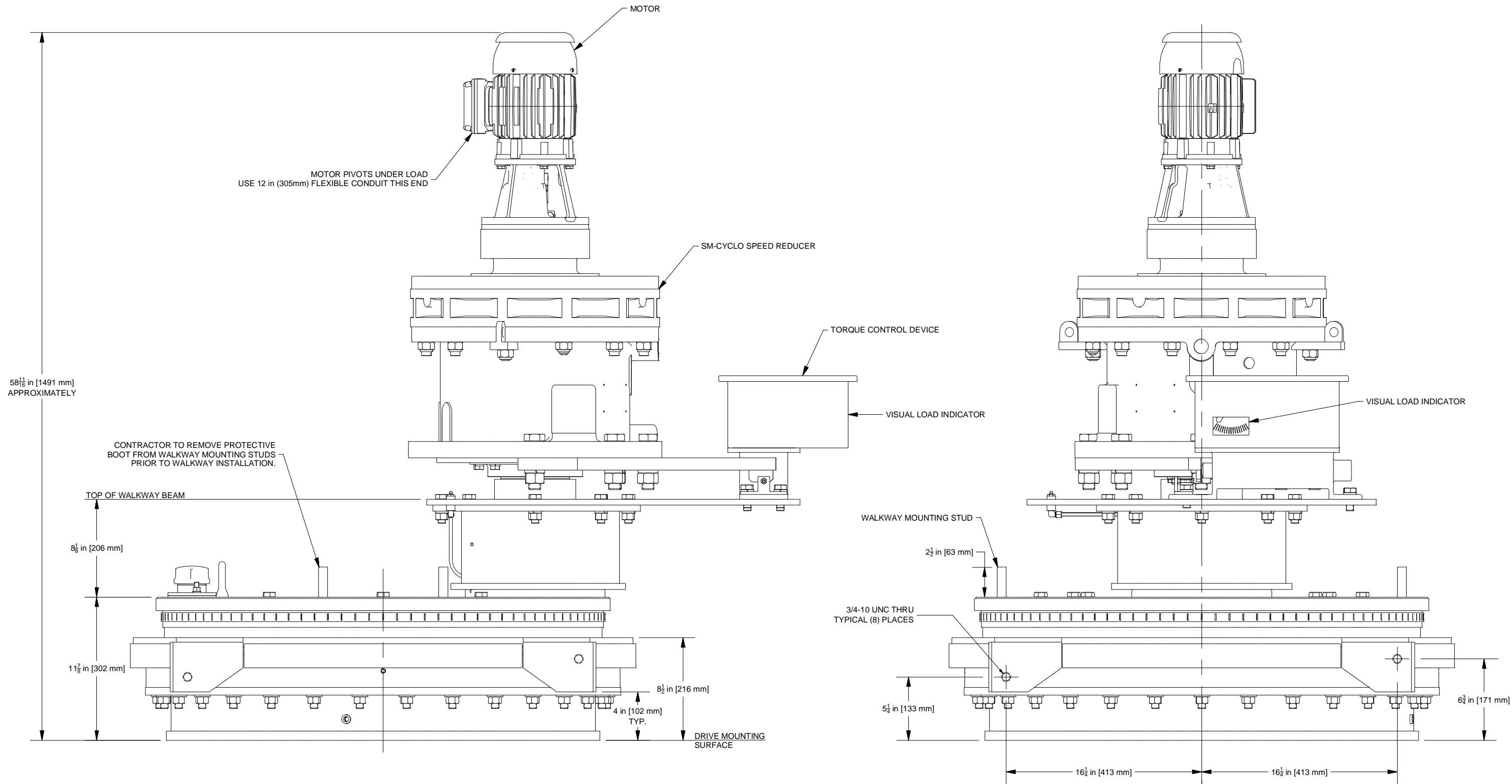
1. FOLLOW THE LISTED WESTECH REFERENCE DOCUMENTS EXCEPT AS NOTED ON THIS DRAWING.
2. LIFT DRIVE USING ONLY THE LIFT POINTS NOTED ON THE GENERAL ARRANGEMENT DRAWINGS. DO NOT LIFT THE DRIVE USING LIFTING EYES LOCATED ON REDUCER OR MOTOR.
3. CONTRACTOR TO REMOVE PROTECTIVE BOOT FROM WALKWAY MOUNTING STUDS PRIOR TO WALKWAY INSTALLATION.

APPROX. TOTAL WEIGHT (LB)
3045
APPROX. TOTAL WEIGHT (KG)
1381

APPROXIMATE DIMENSIONS: 61in [1549mm] X 42in [1067mm] X 59in [1499mm]

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	DESIGNER	CHECKER	APPROVER	DATE																		
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	-	0002863150		1 OF 3	-																	
REFERENCE DOCUMENTS																						

REV	REVISION DESCRIPTION	ECN	DESIGNER	APPROVER	DATE



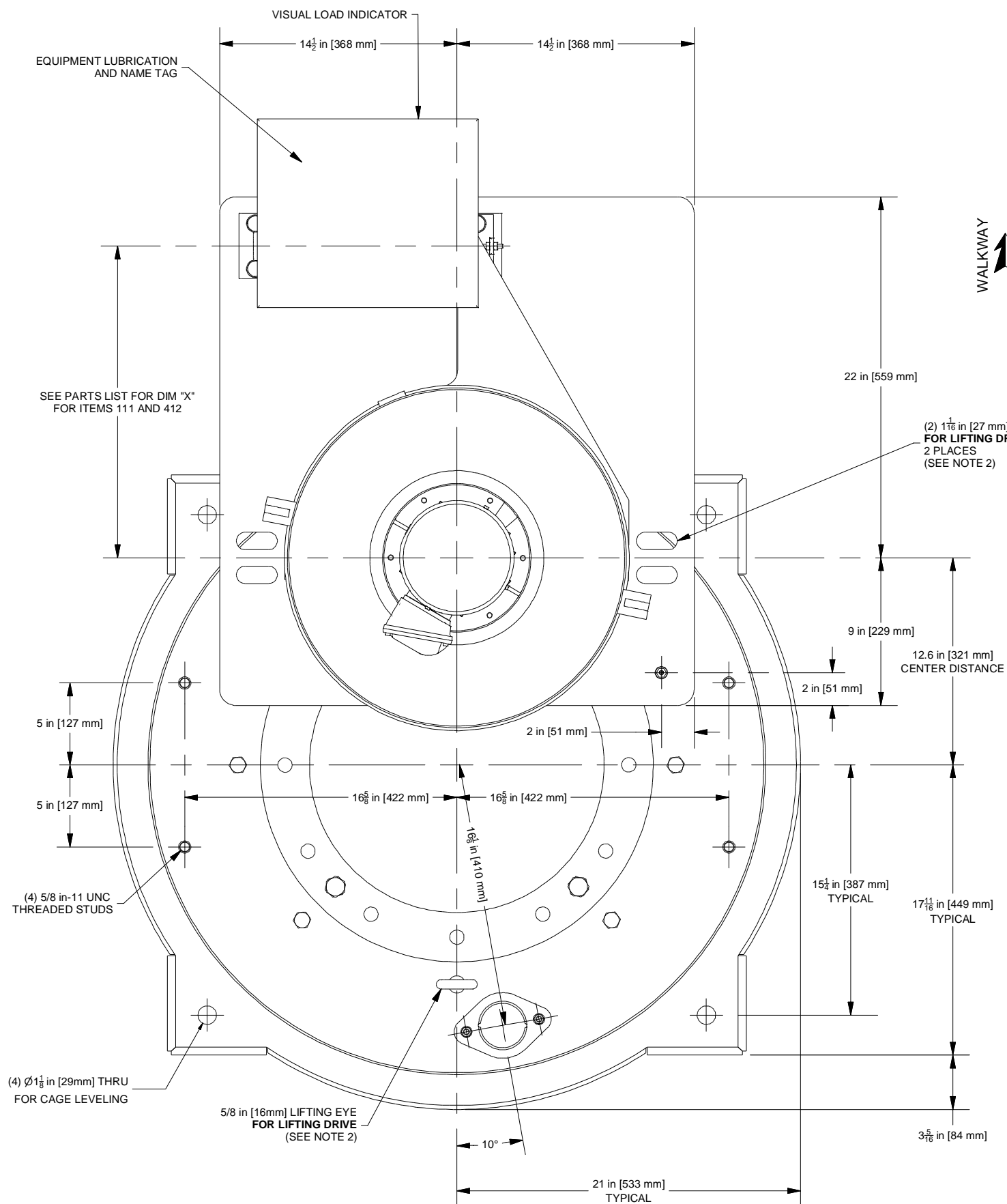
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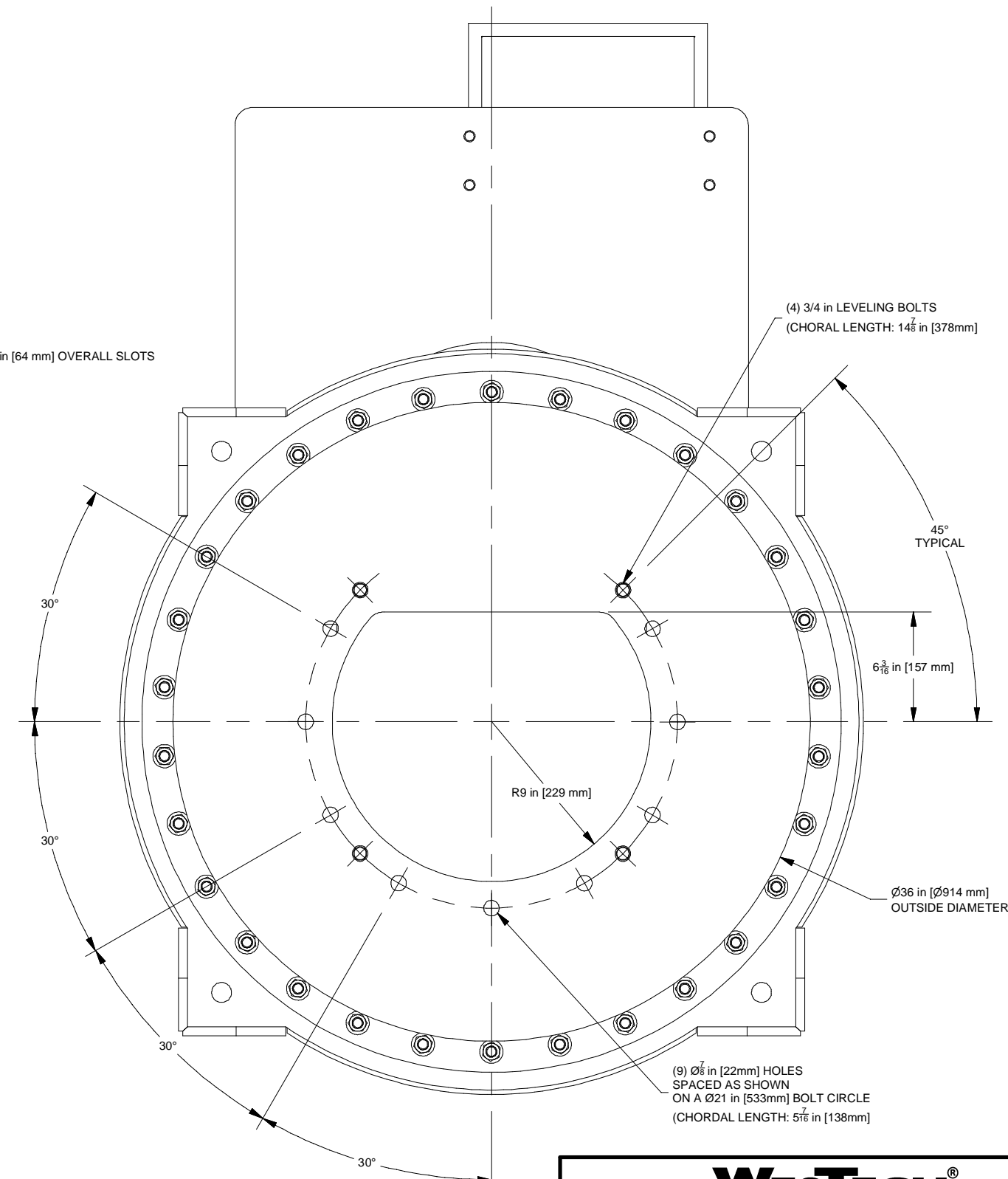
TITLE **CAGE DRIVE GENERAL ARRANGEMENT**

31" (787mm)

DESIGNER	CHECKER	APPROVER	DATE
RH00	HU72	AM73	12/6/2022
JOB NUMBER	DOCUMENT NUMBER	SHEET	REV
-	0002863150	2 OF 3	-



TOP VIEW



BOTTOM VIEW

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TITLE **CAGE DRIVE GENERAL ARRANGEMENT**

31" (787mm)

DESIGNER	CHECKER	APPROVER	DATE
RH00	HU72	AM73	12/6/2022
JOB NUMBER	DOCUMENT NUMBER	SHEET	REV
-	0002863150	3 OF 3	-



BY: HU72
DATE: 6/9/2023

CHKD: BO13
DATE: 6/13/2023

CUSTOMER INFORMATION

PROJECT NUMBER: 24946A
PREPARED FOR: BRANTFORD WWTP

DRIVE RATING INFORMATION

MOMENTARY PEAK TORQUE	43,666 FT-LBS	200 %	(59,202 NM)
FULL DIAL TORQUE	34,933 FT-LBS	160 %	(47,362 NM)
BACKUP CUTOUT SWITCH TORQUE	30,566 FT-LBS	140 %	(41,442 NM)
CUTOUT SWITCH TORQUE	26,200 FT-LBS	120 %	(35,521 NM)
ALARM SWITCH TORQUE	21,833 FT-LBS	100 %	(29,601 NM)
CONTINUOUS TORQUE	21,833 FT-LBS	100 %	(29,601 NM)

LUBRICATION

RAKE

MAIN GEAR AND PINION: OIL
MAIN BEARING: GREASE
REDUCER: GREASE

SPEED

RAKE

0.05 RPM
12 FPM (3.6 MPM)

DIRECTION OF ROTATION

RAKE

CLOCKWISE

MOTOR INFORMATION

RAKE

1 HP (0.75 KW)
575 VAC\3 PH\60 HZ
1750 RPM
CANOPY

TORQUE CONTROL DEVICE INFORMATION

3 LIMIT SWITCHES
TRANSMITTER W/4-20mA OUTPUT



LETTER OF TRANSMITTAL

WestTech®	1486 ST PAUL AVE. GURNEE, IL 60031 US	Phone: 801-265-1000 Fax: 801-265-1080	Document No. 22036
------------------	--	--	-----------------------

Requested Ship Date: 12/01/23 Required Del Date:	Group: 06 Status:	Job No.: 24946B Job Name: BRANTFORD WWTP, ONTARIO, CA Project Manager: ABDULLAH SAMAD
Re: SUBMITTAL		

from: ABDULLAH SAMAD WESTECH ENGINEERING, LLC 3665 SOUTH WEST TEMPLE SALT LAKE CITY, UT 84115	to: J. GRAHAM DEGGEWISS CIMA+ 900-101 Frederick Street Kitchener, ON N2H 6R2 CA
Ph/Fax: 847-775-2416 / 801-265-1080 Email/Cell: asamad@westech-inc.com /	Ph/Fax: 519-536-3788 / Email/Cell: Graham.Seggewiss@cima.ca /

We are sending you: ☒ Attached ☐ Under Separate Cover **Via:** ☐ Best Way ☒ Other EMAIL
the following items:

- ☐ Shop Drawings ☒ Submittal Drawings ☐ O&M Manuals ☐ Specifications
☒ Copy of Letter ☐ Change Order ☐ Other

Copies	Number	Rev	Description
1	24946B	A	SUBMITTAL - SPEC SECTION 11451
CLARIFIERS - TANK # 5 & 6			
WEIRS - TANK # 5, 6 & 8			

These are transmitted as checked below:

- ☒ For Approval ☐ Approved as Submitted ☐ For Bids Due
☐ For Your Use ☐ Approved as Noted ☐ Prints Returned After Loan to WEI
☐ As Requested ☐ Returned for Corrections ☐ Returned 0 Approved Prints
☐ For Review and Comment ☐ Returned 0 Corrected Prints ☐ Other
☒ Please Return Submittal By **12/15/23** to Avoid Delaying Project.

Remarks:

X

Signed

November 29th, 2023

Graham Seggewiss
CIMA+
500-5935 Airport Road
Mississauga, Ontario L4V 1W5

Re: Response to submittal review comments Tanks 5&6 – Spec Section 11451 – WesTech Job # 24946B

Graham,

Please find below the WesTech's response to submittal return dated November 3rd, 2023. The submittal has been updated where needed.

1. Vendor has proposed an alarm switch, cutout switch, and backup cutout switch at 100%, 120%, and 140%, respectively, of the design running torque.
Vendor to confirm these recommended setpoints do not have any impact on equipment operation (prior to cut out) or warranty.
WesTech Comment: Confirmed.
2. Warranty shall be two (2) years beyond project substantial completion.
WesTech Comment: Warranty is updated in the submittal.
3. Delete the supply of the local control panel. The local control panel shall be supplied under the installing contractor's scope of supply.
Submit a suggested electrical wiring diagram incorporating all proposed control and safety mechanisms for engineer review.
WesTech Comment: The local control station information has been removed from the submittal. Torque Control wiring information is provided on page 87 of the submittal.
4. Confirm wind on the handrail on the platform was considered.
WesTech Comment: Confirmed.

Confirm bridge model considers one end as a roller support.
WesTech Comment: Confirmed.
5. Confirm 38mm sched 40 al pipe @ 1800 c/c can hold the loads described in the OBC. for the posts and rail.
WesTech Comment: Confirmed.
6. For all structural design provide stamp from engineer licensed in Ontario.
WesTech Comment: Stamped calculations and drawings are now included in the submittal.
7. 304L SS is required in spec, not 304 SS. Please update all including bridge, structural members, feedwell, weirs and baffles.
WesTech Comment: Per email from Graham Seggewiss dated November 21st, 2023, no change to the material is required.
8. Warning about anchors is noted. Comment will be returned in separate submittal.
WesTech Comment: Per email from Graham Seggewiss dated November 9th, 2023, any modifications to the existing concrete will be outside of WesTech's submittal. No change to the submittal is required. The anchor calculations are included in the submittal.

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Submittal Package

Revision: A

For:

Brantford WWTP
Secondary Clarifiers Rehabilitation
Brantford, Ontario, Canada

Equipment:

Two (2) 105 ft [32m] Diameter COP™ Clarifier Mechanisms
Specification Section: 11451
WesTech Model Number: COPC2G

WesTech Contact:

Project Manager: Abdullah Samad
Phone: 847.775.2416
Email: asamad@westech-inc.com

WesTech Job Number 24946B
December 2023



For:

Brantford WWTP
Secondary Clarifiers Rehabilitation
Brantford, Ontario

Equipment:

Two (2) 105 ft [32m] Diameter COP™ Clarifier Mechanisms
WesTech Model Number: COPC2G

Engineer:

CIMA+
500-5935 Airport Road
Mississauga, Ontario L4V 1W5
Phone: 905.695.1005

Contractor:

TBD

WesTech Agent:

C&M Environmental Technologies
2160 Dunwin Dr

Mississauga, Ontario L5L 5M8
Contact: Rob Anderson
Phone: 705.725.9377
Email: robanderson@cmeti.com

Manufacturer:

WesTech Engineering, LLC®
3665 South West Temple
Salt Lake City, Utah 84115
Phone: 801.265.1000
Fax: 801.265.1080
24 Hour Emergency Assistance: 800.265.1000

WesTech Contact:

Project Manager: Abdullah Samad
Phone: 847.775.2416
Email: asamad@westech-inc.com

WesTech Job Number 24946B

December 2023

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WESTECH® Product Line Card

Water and Wastewater Treatment Equipment and Solutions

- *Municipal*
- *Industrial*
- *Minerals*
- *Services and Operations*



Aerators - Water

ATOMERATOR™ Pressurized Aerator
Cascade Aerator
Forced and Induced Draft Aerator



Anaerobic Digestion

Ana-Flo™ UASB – Upflow Anaerobic Sludge Blanket
Digester Cover - Radial Beam and Truss Style
DuoSphere™ Dual Membrane Gasholder
ExtremeDuty™ Mechanical Sludge Mixer
Sludge Heating System



Biological Treatment

BioDoc™ Rotary Distributor
HydroDoc™ Rotary Distributor
LANDY-7 Slow Speed Surface Aerator
OxyStream™ Oxidation Ditch
PakTOR™ Packed Bed Reactor
STM-Aerotor™ IFAS System



Clarification

Adsorption Clarifier® System
Backwash Clarifier
Conventional Clarifier
CONTRAFast® Thickening Clarifier
CONTRAFLO® Solids Contact Clarifier
COP™ Spiral Blade Clarifier
COP™ Suction Header Clarifier
Flocculating Clarifier
Metallurgical Clarifier
Pin Bed Clarifier
RapiSand™ Ballasted Flocculation
Sludge Sucker™ Sludge Removal System
Solids CONTACT CLARIFIER™
Suction Header Clarifier
Suction Pipe Clarifier
SuperSettler™ Inclined Plate Clarifier
Zickert Shark™ Sludge Removal System



Combined Sewer Overflow

WWETCO FlexFilter™



Dewatering

Filter Press
Horizontal Belt Filter
Rotary Vacuum Drum Filter
Vacuum Disc Filter



Dissolved Air Flotation (DAF)

Circular / Rectangular DAF Units
Dissolved Gas Flotation (DGF)
Dissolved Nitrogen Flotation (DNF)
R5 DAF Pre-Engineered Unit



Drives

Cage Drive
Drives with Lift
Dual Drive
Shaft Drive
Replacement, Retrofit, and Rebuild Options



Flocculation

Axial Blade Flocculators
Horizontal Paddle Flocculators
Vertical Paddle Flocculators



Filtration - Granular Media

CentROL® Gravity Filter
ESSD® Washtroughs
Gravity Filtration System
LAZERFLO™ Low-Profile Underdrain
Manganese ANTHRA/SAND™
MULTIBLOCK® Filter Underdrain
MULTICELL® Horizontal Pressure Filter
MULTICRETE™ II Filter Underdrain
MULTIWASH® Filtration Process
MULTIWASH® PRO Trough
Pressure Filters [Vertical and Horizontal]
SuperSand™ Continuous Backwash Filter



Filtration - Specialty

Ion Exchange System
Granular Activated Carbon Contactor (GAC)
SuperDisc™ Disc Filter
SuperDrum™ Drum Filter
WWETCO FlexFilter™



Headworks Grit Removal and Screening

CleanFlo™ SHEAR™ Rotary Drum Screen
Grit Collector
Shafted Grit Screw Classifier
Vortex Grit Chamber



Industrial Screening

Linear Screen
Resin / Carbon Interstage Screen
WTR Cup and Drum Screen
WTR Fish Recovery and Return Screen
WTR Stationary Screen
WTR Talon Rake™ and Bar Screen
WTR Traveling Water Screen



Membrane Filtration

AltaPac™ Ultrafiltration Membrane System
Electrodeionization (EDI)
Nanofiltration and Reverse Osmosis System
Ultrafiltration Membrane System
VersaFilter™ Open-Platform Membrane System



Oil/Water Separation

Oil/ Water Separators
Dissolved Air Flotation (DAF)



Package Treatment Systems

AERALATER® Iron and Manganese Removal System
AltaPac™ Ultrafiltration Membrane Package System
Aquarius® Package Water Treatment Plant
Multi-Tech™ Pressurized Package System
RapiSand Plus™ Package Treatment Plant
Trident® HS Package Treatment Plant
Trident® HSC Package Treatment Plant
Trident® HSR Package Treatment Plant
Trident® Package Treatment Plant
Tri-Mite® Package Treatment Plant
Water Boy™ Package Treatment System



Tankage

Anchor Channel Tanks
Bolt Together Tanks
Elevated Tanks
Field Erection
Shop-Built Tanks



Thickening

AltaFlo™ High-Rate Thickener
CONTRAFast® Thickening Clarifier
Conventional Sludge Thickener
Deep Bed™ Paste Thickener
EvenFlo® Feedwell
HiDensity™ Paste Thickener
HiFlo™ High-Rate Thickener
MudMax™ Bed-Level Instrument
Rotary Drum Thickener
TOP™ Thickener Optimization Package
Titan™ Traction Thickener



WesTech Services and Operations

Mobile and Rental Solutions
Plant Operations and Services
Systems Integration
Pilot Plants
Aftermarket Services
Laboratory Services

Many of these products are available as mobile/rental equipment or pilot plants.

Submittal Introduction

Submittal Introduction

1. This submittal is being furnished for the approval of the mechanical and electrical equipment (if applicable) as outlined under the specification section referred to in the Letter of Clarification.
2. A complete outline of materials to be supplied is listed herein. The General Arrangement drawings enclosed represent our complete scope of supply. All other materials not specifically included on the drawings, or the body of this submittal, are to be supplied by other than WesTech Engineering, LLC.
3. Document and data requirements (i.e. Operation and Maintenance Manuals) covered elsewhere in the specifications shall follow promptly and with the content to satisfy the specifications.
4. A copy of all “approved/approved as corrected” and/or “revised” General Arrangement Drawings (Shop Drawings) and Equipment Erection/Assembly Drawings will be included in the Installation, Operation & Maintenance Manuals.
5. Approval to proceed will not be recognized by WesTech until clouded dimensions (if applicable) are confirmed or supplied.
6. Re-Submittals: The enclosed information will not be duplicated in any future re-submittals, unless:
 - a. Items/sections have been commented on and need clarification or revision for the re-submittal.
 - b. Specifically requested by the Engineer or Contractor on the return Letter of Transmittal that the entire submittal must be duplicated.
7. To be environmentally aware, this submittal may utilize double-sided printing to conserve paper.

Letter of Clarification

Letter of Clarification

The purpose of this Letter of Clarification is to state any departure WesTech will take from the given specifications. This letter of clarification includes specification section 11451 updated per addendum 1,2,3 and associated contract drawings. The right side of the page is a copy of the specification section with any departures from the given specifications noted on the left side of the page. Any exceptions to the contract drawings are noted on the drawings shown as text boxes. All items with no marks or comments should be considered as “No Exceptions Taken”. This review is also used by WesTech to clarify specifications that might have multiple or vague interpretations.

The enclosed WesTech General Arrangement Drawings may contain clouded dimensions. This indicates information to be confirmed and/or corrected by the Engineer and/or the Contractor at the time this submittal is returned. Submittal will not be considered as approved until all clouded dimensions have been confirmed and/or corrected.

All items not specifically noted in the enclosed General Arrangement drawings as being supplied by WesTech are by others.

1

GENERAL

1.1

DESCRIPTION

WesTech will not be onsite to provide supervision of installation, WesTech can provide assistance during installation by means of IOM manual and remote guidance.

WesTech drive to be provided with a third cutout switch instead of shear pin.

WesTech to provide half span access bridge as per the specification drawings and proposal.

Center column will act as template for the anchor bolts since epoxy anchors are to be used.
Grout shield not by WesTech.

Labor on site by others. Material and equipment not specifically outlined in this submittal as being supplied by WesTech are by others.

Storage, assembly and erection onsite is by others, not WesTech.

.1

This section covers the Work including site verification, design, fabrication, factory testing, supply of material, delivery, supervision of the installation, on-site testing, commissioning, training and a coordinated design responsibility for the following:

.1 Two (2) spiral blade type circular clarifier mechanism for the Brantford WWTP Secondary Clarifiers 5 to 6, including:

- .1 Center drive unit, complete with reducer, motor, microswitch overload device, shear pin and torque control.
- .2 Full span access bridge and enlarged platform with handrail, grating and toe plate. Bridge shall span across secondary clarifier rings of the existing clarifier structure to the centre influent column.
- .3 Stationary center influent column, anchor bolt template, and grout shield.
- .4 Energy dissipating inlet (EDI).
- .5 Influent feedwell.
- .6 Rotating drive cage and truss arms.
- .7 V-notch effluent weir.

.2

Provide all labour, material and equipment to furnish, test and commission spiral type circular secondary clarifier mechanism together with appurtenances suitable for installation in a tank with concrete walls and concrete base slab, as indicated and specified.

.3

The intent is that the clarifier mechanism shall come with industry standard drive unit assembly and EDI components. It is recognized that specific details may vary between proponents and will be assessed as part of the technical proposal evaluations.

.4

Like items of equipment specified herein shall be the end products of one manufacturer in order to achieve standardization for operation, maintenance, spare parts and manufacturer's service.

1.2

GENERAL

.1

Equipment furnished under this section shall be fabricated, assembled, erected, and placed in proper operating condition in full conformity with drawings, specifications, engineering data, instructions and recommendations of the screens manufacturer, unless exceptions are as noted by the Engineer.

.2

Site Verification. The Vendor shall field verify all the dimensions of the existing clarifiers onsite following award and prior to submitting shop drawings for the Engineer's review. The vendor shall not rely on the existing drawings for shop drawings or fabrication.

.3

Coordination. The Clarifier Mechanism shall be installed in the existing secondary clarifiers as shown on the drawings. The Vendor shall verify that each component of the system is compatible with all other components of the system; and that all devices for a

properly functioning system have been provided. The Contractor is responsible for overall coordination of the equipment package to ensure its compatibility with other equipment. The Contractor shall decommission the existing mechanism completely and dispose of them off-site.

- .4 General Equipment Stipulations. The General Equipment Stipulations shall apply to all equipment furnished under this section.
- .5 Equipment Schedule. Manufacturer's field services, one (1) hard and electronic copy of operation and maintenance manuals, and certificates of compliance shall be provided for all items of equipment furnished under this contract.
- .6 Specific requirements for manufacturer's field services are covered in the quality control section. Specific requirements for operation and maintenance manuals and certificates of compliance are covered in the submittals section.
- .7 Power Supply. Power supply to equipment will be 575 volts, 60 Hz, 3 phase.
- .8 Complete structural calculations signed by a registered professional Engineer, licensed in Ontario (P.Eng.).

Structural calculations sealed by a Professional Engineer licensed in Ontario are included in this submittal.

1.3 APPLICABLE CODES AND STANDARDS


- .1 The following minimum applicable codes, standards and regulations must be adhered to in the design, installation and services provided by the Vendor. In the case of conflicting information among these codes, it is the Vendor's responsibility to inform and obtain written approval from the Engineer of any exceptions hereby taken.
- .2 Requirements from the following organizations shall be considered as a minimum:
 - .1 American Iron and Steel Institute (AISI), Heat Treated Steel Specifications
 - .2 American National Standards Institute (ANSI).
 - .3 American Gear Manufacturers' Association (AGMA), Gear Ratings
 - .4 American Society of Testing Materials (ASTM):
 - .1 A36 Structural Steel Specifications
 - .2 A48 Cast Iron Specifications
 - .3 A123 Hot-Dip Galvanized Coatings
 - .4 A153 Hot-Dip Galvanized Bolts
 - .5 A167 Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
 - .6 A276 Stainless Steel Bars and Shapes
 - .7 A283C Steel Plate Specifications
 - .8 A304 Bolt Specifications
 - .9 A536 Ductile Iron Specifications

- .10 A992 Structural Steel Specifications
- .5 Anti-Friction Bearing Manufacturers' Association (AFBMA), Bearing Life Specifications.
- .6 Canadian Welding Bureau (CWB):
 - .1 CAN/CSA-G40.20: General Requirements for Rolled Welded Structural Quality Steel.
 - .2 CSA/CSA-G40.21: Structural Quality Steels.
 - .3 CSA W47.1: Certification of Companies for Fusion Welding of Steel Structures.
 - .4 CSA W47.2: Certification of Companies for Fusion Welding of Aluminum.
 - .5 CSA W59: Welded Steel Construction.
 - .6 CSA W59.2: Welded Aluminum Construction.
- .7 Ontario Occupational Health and Safety (OH&S) Act and Regulations.
- .8 National Electrical Manufacturer's Association (NEMA), Motor Design Standards and Standards for Control Enclosures
- .9 National Fire Protection Association (NFPA) 820, Fire Protection in Wastewater Treatment and Collection Facilities, latest edition.
- .10 The Society for Protective Coating (SSPC) Standards and Specifications:
 - .1 SP 6: Surface Preparation No. 6 for Commercial Blast Cleaning.
 - .2 SP 10: Surface Preparation No. 10 for Near-White Blast Cleaning.
- 1.4 RELATED SECTIONS
 - .1 Division 1 - General Requirements
- 1.5 SUBMITTALS
 - .1 In accordance with Section 01330 - Submittals
 - .2 Complete assembly, installation drawings, motor and anchor bolt base plans, together with detailed specifications and data covering materials, parts, devices, and accessories forming a part of the equipment furnished, shall be submitted in accordance with the submittals section.
 - .3 Stainless steel construction protocol to avoid cross contamination with carbon steel.
 - .4 Vendor shall identify modifications required, if any, to the existing clarifier tank to accommodate the new clarifier mechanism.
 - .5 Shop Drawings shall include, but not limited to the following:

Erection drawings and installation instructions to be provided in the IOM manual before shipment.



WesTech's calculations show that the center column anchors will break out concrete due to edge distance at the sludge hopper. We recommend reviewing this and modifying the sludge hopper as necessary. Concrete calculations are not by WesTech.



Assembly and installation drawings to be provided in the IOM manual before shipment.

Overall weights and dimensions to be provided in the IOM manual before shipment.

Anchor calculation sealed by a Professional Engineer licensed in Ontario included in this submittal.

To be provided in the IOM manual before shipment.

Per submittal review comment all controls are by others, not WesTech. Local station is removed from the submittal.

- .1 Catalogue cuts or equipment data sheets showing Equipment vendor's complete descriptive information and produce literature.
- .2 Complete assembly and installation drawings, together with detailed specifications and data covering material used, and accessories forming a part of the equipment furnished.
- .3 General arrangement layout drawings based on Equipment vendor's onsite field verifications including, as a minimum, tank inside dimensions, side water depth, tank freeboard, slope of tank floor, dimensional location of the equipment, materials list, cut outs, mounting arrangements, electric drive units, and controls.
- .4 Drawings with detailed dimensions showing plan, elevation, layout, and appropriate cross sections of the complete sludge collecting systems, including location of drive units, anchor location, materials of construction, overall weights, and dimensions of largest components requiring removal for maintenance, cross referenced material list, and mechanical connections.
- .5 Drawings with detailed dimensions showing general arrangements, assembly diagrams, and cross sections for entire drive mechanism, including but not limited to motor, gear reducers, speed reducers, turntable assembly, cage drive assembly, and torque switches / sensors.
- .6 Details of sludge scraper components.
- .7 Details of electric drive units including motor data, suggested wiring diagrams, connection sizes and types, operating pressures, control devices, etc.
- .8 Catalogue cuts or equipment data sheets showing the Equipment vendor's complete descriptive information and product literature.
- .9 Equipment make and model, material of construction, weight, electrical requirements, all electrical and mechanical components, and sizes and types of all connections to interfacing components.
- .10 Submit a coordinated plan of assembly, tolerances and anchor bolts, including anchor sizing calculations sealed by a professional engineer registered in Ontario.
- .11 Installation information, including mounting requirements, access, approximate weight of each major piece of equipment sizes and types of electrical connections.
- .12 Provide the following information for each instrument and/or field device application: power supply rating, input/output signal ranges, maximum measured process range, calibrated scale, physical dimensions, electrical and environmental requirements
- .13 Provide application specific catalogue model numbers for each control panel component, field device, field equipment, and accessory options. Include a reference to the respective instrument or equipment tag name in accordance with the P&ID in this document.
- .14 Provide a list of equipment vendor's recommended list of spare parts including individual pricing with the shop drawings.

Complete equipment bill of material to be provided in the IOM manual.

- .15 Detailed structural, mechanical, and electrical drawings showing equipment fabrications and interface with other items; include dimensions, size, and locations of connections to other work, and weights of associated equipment.
- .16 Complete bill of materials of all components and equipment supplied and product data sheets and dimension drawings for all accessories.
- .17 Process, instrumentation and electrical diagrams, as required, for the component parts.
- .18 Functional description of internal and external instrumentation and controls to be supplied, including list of parameters monitored, controlled, or alarmed.

Structural calculations sealed by a Professional Engineer licensed in Ontario included in this submittal.

- .6 Catalogue data, brochures, and other information required to describe equipment. Where catalogue information is submitted, ensure information clearly indicates model number and/or option proposed for this project.
- .7 Structural calculations for design of bridge, and connections. Show design loads. Structural calculations to be signed and sealed by Professional Engineer in the Province of Ontario.

1.6

TEST PROCEDURES.

- .1 The clarifier equipment manufacturer shall furnish as a minimum the following design and description information to establish compliance with these specifications:

Certificate of design stamped by a Professional Engineer licensed in Ontario included in this submittal.

- .1 Certified general arrangement and tank dimensional drawings.
- .2 Certificate of design stamped by a Registered Professional Engineer in the Province of Ontario stating that the equipment to be provided for this project meets or exceeds all design requirements of these specifications. The certificate shall state the respective loads and design criteria.

Drive calculations stamped by a Professional Engineer licensed in Ontario included in this submittal.

- .3 Drive mechanism rating calculations, stamped by a Registered Professional Engineer in the Province of Ontario, verifying the compliance of the drive gears and bearings with the specified continuous torque rating and bearing life rating.
- .4 Motor data and catalog information. Electrical drawings as applicable to the supply of the clarifier equipment.
- .5 Microswitch overload device cutsheets and typical wiring diagram.
- .6 Suggested typical electrical schematic wiring diagrams.
- .7 Catalog cut sheets for purchased sub-components.
- .8 Descriptive information shall include the following:
 - .1 Written certification that the proposed drive meets AGMA standards. Drive mechanism calculations prepared by a registered professional engineer shall be submitted for approval along with published torque value of the proposed drive.
 - .2 General arrangement of drive unit verifying AGMA torque, overload protection system, housing and gear materials and horsepower. Provide

values used for the following AGMA design parameters per AGMA Specification 6034:

- .1 Pitch diameter of worm gear (in.)
- .2 Effective face width of gear (in.)
- .3 Lead angle of threads at mean worm diameter (deg)
- .4 Normal pressure angle of worm thread (deg)
- .5 Sliding velocity of worm at mean diameter (fpm)
- .6 Number of teeth
- .7 Service factor. Use 1.25

.3 Provide the following AGMA design parameters per AGMA 2001:

- .1 Pitch diameter of pinion and spur gear (in.)
- .2 Face width of narrowest of two mating gears (in.)
- .3 Pitch line velocity of pinion (fpm)
- .4 Allowable bending stress (Sat) of pinion and spur gear material (psi)
- .5 Allowable contact stress (Sac) of pinion and spur gear material (psi)
- .6 Geometry factor (J) for bending
- .7 Geometry factor (I) for pitting resistance
- .8 Load distribution factors Cm and Km
- .9 Dynamic factors Cv and Kv
- .10 Life factors Cl and KI at 420,000 cycles of the main gear
- .11 Number of teeth
- .12 Reliability factors, Cr and Kr equal to or greater than 1.0

.4 Complete test procedure for torque testing the clarifier mechanism for the AGMA torque specified.

.5 Complete assembly drawing of the collector components giving:

- .1 Type of material used for each component.
- .2 Connection and mounting details.
- .3 Dimension, thicknesses and weights of each component.

To be provided in the IOM manual before shipment.

.4 Factory Testing Reports

.5 Operations and maintenance data

.6 Parts list complete with a list of recommended spare parts

.2 The shop drawing shall present the required mechanism dimensions on the structural drawings including plans, sections and details. A typical dimensions or drawings shall not be acceptable.

1.7 QUALIFICATIONS

.1 Manufacturer's Experience

.1 It is the intention of this specification to cover minimum acceptable quality for a complete installation with the exception of the motor controls, electrical work and piping requirements. The electrical/mechanism from each manufacturer shall be reviewed by the Engineer if those are equal or equivalent when those are different from them specified herein.

.2 The Manufacturer shall have at least ten (10) year experience in design and fabrication of clarifier mechanism as demonstrated by a list of at least 10 successful installations of comparable size (same or larger) with references in Canada or USA. All references shall include valid contact names and phone numbers that can be verified.

.3 The Engineer may require evidence, in the form of operating records, from these plants to substantiate any claims concerning the ability of the equipment to perform as required.

1.8 PRODUCT DATA

.1 Details of storage and off-loading requirements.

.2 Recommended installation instructions.

.3 Field test reports:

.1 Submit field test reports in accordance with Sections 01330.

.2 Submit completed Manufacturer's Installation Certification Form.

.3 Submit completed Pre-Commissioning Certification Form.

.4 Installation, operation, and maintenance manuals:

.1 Include one (1) copy of both hard and electronic copy of operation and maintenance manuals.

.2 Include material under this Section in Owner's manuals in accordance with Section 01330.

.3 Submit installation manual prior to shipment of equipment.

1.9

QUALITY ASSURANCE

To be provided after unit start-up.

Will be provided one month before shipment.

- .1 Equipment specified shall be the product of one vendor.
 - .1 Equipment specified shall be the Manufacturer's standard catalogue product and modified to provide compliance with the drawings, specifications and the service conditions specified and indicated.
 - .2 Equipment Manufacturers shall show evidence of quality assurance in manufacturing and supplying equipment essential in details to the equipment herein specified. Before equipment shipment, the vendor's project engineer shall witness and sign off the product to be shipped, and the signoff sheet shall satisfy the requirement of the Owner's Engineer before equipment shipment.
 - .3 Provide shop drawings including:
 - .1 Welding: In accordance with latest applicable Canadian Welding Bureau Code.
 - .2 Services of Manufacturer's Representative as specified herein.
 - .4 Provide services of factory-trained Service Technician, specifically trained on the type of equipment specified, for on-site services.
 - .1 Service Technician must have a minimum of five (5) years of experience, all within the last seven (7) years, on the type and size of equipment.
 - .2 Supplemental Service Technician, if required, for electrical and controls equipment.

2 PRODUCTS

2.1 SYSTEM DESCRIPTION

- .1 The clarifier mechanisms shall be of the center drive type, supported on a stationary influent column, with the flow entering at the bottom of the influent column and flowing upwards into the energy dissipating inlet.
- .2 The flow shall then proceed into the feedwell through gates near the water level for further energy dissipation and settling.
- .3 The secondary clarifier mechanism shall be designed to remove settled sludge from the bottom of the tank around the periphery of the tank. The clarifier mechanism shall perform the following integrated functions:
 - .1 Dissipate energy and control localized currents.
 - .2 Separate solids from the clear liquid.
 - .3 Evenly withdraw the clear liquid.
 - .4 Transport and thicken settled sludge.
- .4 Center feed influent column, peripheral overflow type with a central driving mechanism rotating a suspended center cage with two (2) sludge removal truss arms.
- .5 The equipment shall be designed to effectively settle mixed liquor suspended solids and collect the settled solids from the basin floor to the sludge collection sump as shown on

the drawings. The clarified effluent shall be collected uniformly by the existing peripheral launder.

WesTech will provide a secondary cutout switch in lieu of a shear pin as a safety measure that will stop the drive motor in the event the load achieves 140% of the continuous operating torque and shut down the motor in the event the first cutout switch fails prematurely. This redundancy in cutout protection will sufficiently protect the drive unit against peak overloading. The two limit switches will be wired in series to stop the drive motor provided either switch is tripped.

All controls are by others, not WesTech per Submittal review comments.

Material and equipment not specifically outlined in this submittal as being supplied by WesTech are by others.

Per RFI 001 response plant flow to each clarifier can be assumed based on the clarifier surface area depending on the number of clarifiers, see General Arrangement Drawing for process information on each clarifier.

- .6 The equipment furnished for the clarifier mechanism shall include but not be limited to:
- .1 Access bridge and enlarged platform with handrail, grating and toe plate.
 - .2 Grating and toe plate
 - .3 Centre drive unit, complete with reducer, motor, microswitch overload device, shear pin and torque control.
 - .4 Lockable local disconnect and start/stop controls.
 - .5 Centre drive platform.
 - .6 Centre support column with inlet openings.
 - .7 Influent feedwell, energy dissipating inlet, and centre cage.
 - .8 Rotating drive cage and truss arms equipped with two (2) mechanism blades.
 - .9 V-notch effluent weir and assembly fasteners.
 - .10 Entire mechanism including structural members and one end of the walkway supported from a centre column.
- .7 All other appurtenances for a fully functional system.
- .8 Secondary Clarifier Mechanism shall be made by one (1) manufacturer.
- .9 Notwithstanding any dimensions, material thickness or any other design criteria relating to the construction of the specified equipment, it remains the responsibility of the manufacturer to supply equipment of suitable characteristics for the intended purpose. This does not relieve the Vendor of the requirement to adhere to this specification, subject to the sole discretion of the Engineer.

2.2 PERFORMANCE AND DESIGN REQUIREMENTS

- .1 Furnish and deliver circular spiral blade type secondary clarifier mechanism for installation in existing Secondary Clarifiers 5 - 6 (Refer to Drawings for details).
- .2 Overall Plant Design Criteria:
- .1 Plant Average Daily Flow - 81,800 m3/d
 - .2 Plant Peak Daily Flow - 166,970 m3/d
 - .3 Total Hydraulic Peak Flow - 235,212 m3/d
- .3 Secondary Clarifiers 5 -6 Design Criteria and Requirements
- .1 Internal Diameter of the Clarifier - 32 m (105 feet)
 - .2 Total Weir Length - 100.5 m

- .3 Clarifier Area - 804.3 m2 (each)
- .4 Number of Secondary Clarifiers to be replaced - 2
- .5 Side Water Depth - 4.6 m
- .6 Rotating Speed - As per the Vendor's recommendation
- .7 Motor Horsepower - Minimum 1 hp
- .8 Depth and contour as per contract drawings

- .4 The successful bidder shall field verify the dimensions onsite following Contract award and prior to submitting shop drawings for the Engineer's review.

2.3 SEISMIC DESIGN

- .1 The Equipment Manufacturer shall conform to the seismic design requirements of Ontario Building Code 4.1.8.18 for this project and for the Work of this specification Section. Shop drawings shall be stamped by licensed structural engineer in Ontario.
- .2 Provide all equipment, anchorage, supports and foundations designed in accordance with the seismic requirements indicated and specified.
- .3 Additionally, provide with the Certificate of Unit Responsibility, certification for all equipment signed by a registered structural engineer stating that computations were performed and that all components have been sized for the seismic forces specified and indicated.

2.4 COMPONENT CONSTRUCTION

.1 Materials

Clause removed per Addendum No. 1.

- ~~.1 All structural steel shall conform to AISC - Steel Construction Manual latest edition. All steel plates shall conform to ASTM A36. All structural steel shape series of M, MT, S, ST, C, MC, L shall conform to ASTM A36. Structural steel shapes W, WT, HP shall conform to ASTM A992/A572.~~

Clause lines removed per Addendum No. 1.

- ~~.2 All pipe shall be ASTM A53, Grade B. All square and rectangular tubing shall be ASTM A600, Grade B, unless otherwise noted. Steel members in contact with liquids, either continuously or intermittently, shall have a minimum thickness of 6.35 mm unless otherwise noted. All aluminum shall be type 5052, 6061, 6063, or 2014 alloy unless noted. All stainless steel shall be type 304L unless noted.~~

- .3 Comply with ASTM A276 Stainless Steel Bars and Shapes and A167 Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip to use stainless steel 304L.

.4 Fabrication

- .1 Shop fabrication and welding of structural members shall be in accordance with the latest edition of the "Structural Welding Code", AWS D1.1, (AWS D1.2-Aluminum, AWS D1.6-Stainless Steel), of the American Welding Society.

These clauses don't apply. Equipment by WesTech except Drive will be all stainless steel.

.2 All welded connections shall develop the full strength of the connected elements and all joined or lapped surfaces shall be completely seal welded with a minimum 3/16" fillet weld. Intermittent welding shall not be allowed, except on non-ferrous metals.

.5 Edge Grinding

.1 Sharp projections of cut or sheared edges of ferrous metals shall be ground to a radius by multiple passes of a power grinder as required to ensure satisfactory coating adhesion.

.6 Shop Surface Preparation/Coating

.1 All iron and steel surfaces, except the drive unit, shall be field cleaned and painted by the contractor to ensure paint compatibility and assign unit responsibility for the coating system. The drive unit shall be coated with the vendor's standard enamel paint system.

.7 Structural Design

.1 All steel design shall be in accordance with the AISC Manual of Steel Construction, latest edition and the International Building Code (IBC), latest edition.

2.5 MANUFACTURE AND FABRICATION

- .1 Corrosion Protection. All metal surfaces coming into contact with the liquid, other than stainless steel or brass shall be protected by an approved, corrosion resistant coating.
- .2 Welding. All structural butt welds shall be of full penetration. Equipment shall be free of any damages such as indentations and cracks. All welded joints shall be of similar chemistry, corrosion resistance and physical properties to the base metal being welded.
- .3 Edge Grinding. Sharp projections of cut or sheared edges of metals, which will be submerged in operation, shall be ground to a radius.
- .4 Unless otherwise specified or permitted, the materials used in the fabrication of the equipment furnished under this section shall conform to the following.

~~.5 Painting and Coating. In accordance with Section 09900 - Painting and Finishing~~

2.6 MATERIALS

- .1 Unless otherwise specified or permitted, the materials used in the fabrication of the equipment furnished under this section shall conform to the following:

Bridge	Stainless Steel 304L
Structural Members	Stainless Steel 304L or ASTM A36
Gear Housing	Gray Cast Iron, ASTM A48
Walkway	Aluminum Grating
Handrail	Sch. 40 Aluminum Pipe T6061-T6
Feedwell	Stainless Steel 304L
Effluent Weirs	Fiberglass or Stainless Steel 304L
Hardware	Stainless Steel 316

Clause removed per Addendum No. 1.

All gearing will be enclosed in a welded ASTM A36 steel drive housing with an ultimate tensile strength of 58,000 psi rather than castings. Steel has a higher modulus of elasticity and can better absorb shock loads than cast iron. Steel is stronger than cast iron, and does not have problems with blowholes, inclusions, and cracks, as are common in castings. WesTech welded steel housings do not require an interior sealer coat, which is required in cast housings to avoid oil leaks. Refer to the **WesTech Drive Unit** Section of this submittal for more information.

WesTech to provide Handrail with Aluminum Pipe 6005A-T61. Please refer to Alloy letter included in the handrail section.

Updated per Addendum No. 1.

2.7 EQUIPMENT DESIGN

.1 Drive Mechanism

- .1 The drive mechanism shall be completely factory assembled and shall consist of a primary and final gear reduction unit in accordance with AGMA Section 6034-B92 for 24-hour continuous duty and 20 year life, based on the AGMA rated torque with a minimum 1.25 service factor.
- .2 The primary reduction shall be a helical or worm gear, heavy-duty gear reducer. All bearings shall be anti-friction type and running in oil in a housing. The housing shall be effectively sealed against contamination. A readily accessible oil filling and level pipe with sight gauge shall be furnished.
- .3 Intermediate reduction unit shall be a helical or worm gear speed reduction with grease and/or oil lubricated anti-friction type bearings in cast iron housing securely bolted on the machined top face of the final reduction unit. Microswitches shall be factory set to sound an alarm when the load on the mechanism reaches 100 percent of the AGMA torque, and stop the motor when the load reaches 120 percent of the AGMA torque.
- .4 Provide internal, full depth involute tooth design, ductile iron, or heat-treated steel spur gear driven by a heat-treated steel pinion from the slow speed shaft of the intermediate reduction unit. Turntable base shall be bolted to the centre column and be designed to support the bridge, internal gear and rotating mechanisms.
- .5 The drive unit shall be equipped with a visual torque indicator and an electro-mechanical overload control device actuated by thrust from the worm shaft or an electronic torque switch that disconnects power to the drive if any overcurrent or overload condition occurs. The pointer shall provide a visual reading of the relative gear output torque on a 0 to 100 percent graduated scale. The continuous torque rating shall be a minimum of 8,000 ft-lbs. The control device shall also activate an alarm switch for warning of impending overload and a motor cutout switch for overload protection. A shear pin shall be provided as redundant back up overload protection. The switches shall be integrated with the facility's SCADA system via 4-20mA signals for alarms, warnings, and torque status for monitoring. The respective switches in the overload control device and the shear pin shall be factory calibrated and set to the following settings;
 - .6 Alarm; 40% of scale.
 - .7 Motor cutout; 85% of scale.
 - .8 Shear pin; 100% of scale.
- .9 The complete center drive assembly, including the overload protection device, shall be a regularly manufactured in-house product of the clarifier manufacturer. The center drive assembly is a key element in a successful clarifier installation, therefore drive assemblies purchased from third party vendors will not be accepted.
- .10 Major drive components, worm gears and bearings must be designed to allow for separate and individual replacement by plant personnel to facilitate quick and economical repairs.
- .11 Drive components will be located via a machined, registered fit to preserve the alignment of key drive components under all load conditions. Inspection of the

The WesTech drive unit does not use a wormgear reducer, so AGMA section 6034-B92 does not apply. The main gear of the drive unit will be designed in accordance with AGMA section 2001-C95. Using AGMA 2001-C95 and a 20 year life, the service factor of the main gear will be 1.0 with respect to durability and 2.27 with respect to yield. Refer to the **Spur Gear AGMA Calculations** Section of this submittal for more information.

Speed reduction will be accomplished by the use of a direct driven totally enclosed cycloidal type gearless grease lubricated reducer for high efficiency and reliability rather than gear reducers. The ring gear housing and cycloidal discs of cycloidal drives are made of high-carbon chromium bearing steel. The housing is fixed to the drive casing and incases the cycloidal discs. An eccentric bearing on the high speed shaft rolls cycloidal discs around the internal circumference of the stationary gear. The lobes of the cycloid disc engage successively with pins in the fixed ring gear. The movement of the cycloid discs is transmitted then by pins to the low speed shaft. Refer to the **Cycloidal Drive Advantages** Section of this submittal for more information.

Primary and intermediate reduction are combined into one speed reduction unit which will be accomplished by the use of a direct driven cycloidal type gearless grease lubricated reducer for high efficiency and reliability. Refer to the **Cycloidal Drive Advantages** Section of this submittal for more information.

The main spur gear will be forged alloy steel, which is stronger and more durable than cast iron. The pinion gear will be case hardened 8620 HR alloy steel. Refer to the **WesTech Drive Unit** Section of this submittal for more information.

The torque control system measures torque on the drive column as measured from the rotational force of the speed reducer. A visual torque indicator will be provided and oriented so that it may be read from the walkway. It will be calibrated from 0 to 160 percent of the continuous running torque. The drive will be rated for a continuous torque of 29,601 Nm (21,833 ft-lbs). WesTech will provide a secondary cutout switch in lieu of a shear pin as a safety measure that will stop the drive motor in the event the load achieves 140% of the continuous operating torque, or 41,442 Nm (30,566 ft-lbs), and shut down the motor in the event the first cutout switch fails prematurely. This redundancy in cutout protection will sufficiently protect the drive unit against peak overloading. The two limit switches will be wired in series to stop the drive motor provided either switch is tripped.

The alarm switch will be calibrated to 100% of the continuous running torque, or 29,601 Nm (21,833 ft-lbs). The scale on the torque indicator will be calibrated from 0 to 160 percent of the continuous running torque.

The cutout switch will be calibrated to 120% of the continuous running torque, or 35,522 Nm (26,200 ft-lbs). The scale on the torque indicator will be calibrated from 0 to 160 percent of the continuous running torque.

The backup cutout switch will be calibrated to 140% of the continuous running torque, or 41,442 Nm (30,566 ft-lbs). The scale on the torque indicator will be calibrated from 0 to 160 percent of the continuous running torque.

completed drive unit shall be accomplished at the clarifier manufacturer's shop, with reports of all tests and certifications of material hardness being made available for review at the Engineer's request prior to shipment to the job site.

.2 Influent Feedwell

- .1 The feedwell shall be a minimum of 4.0 m diameter x 1.5 m side depth supported by structural members attached to the center rotating center shaft.
- .2 The feedwell shall be fabricated of 6 mm stainless steel plate with upper and lower reinforcing rim angles and stiffeners as required.
- .3 A minimum of two (2) scum ports, 4 inches high x 16 inches long, shall be provided equally spaced around the feedwell periphery to allow scum to exit from the feedwell at water level.

Center column acts as influent pipe. The pipe to the center column is not by WesTech.

.3 Influent Pipe

- .1 There shall be provided a 200 mm dia. steel influent pipe, minimum 6 mm wall thickness. The pipe shall include a 125# Class ANSI steel flange for bolting to incoming influent line and shall include an elbow and energy dissipating tee at the inlet.
- .2 The pipe shall include all necessary supports and be located below the rotating feedwell to allow for the rotation of the skimmer assembly.
- .3 The Vendor may provide an alternative design which shall be reviewed by the Engineer.

The clarifier configuration does not utilize a center shaft. A center column and cage will be provided. See General Arrangement drawing included in this submittal for details.

.4 Centre Shaft and Scraper Arms

- .1 The center shaft shall be stainless steel pipe, 150 mm (6") Schedule 40. It shall be provided with connection points for the two sludge removal arms and feedwell supports. The shaft shall be bolted to the worm gear to rotate the attached arms, feedwell and skimmer assembly.
- .2 The minimum angle size used for construction of the center shaft and rake arms shall be 50 mm x 50 mm x 6.4 mm (2" x 2" x 1/4") members.
- .3 The clarifier mechanism shall include two (2) sludge removal arms with spiral plow blades of minimum 20 gauge stainless steel and adjustable neoprene squeegees.
- .4 The center shaft and rake arms shall be designed such that calculated stresses do not exceed the AISC allowable stress at twice the drive continuous torque rating.
- .5 It shall be of an all-welded construction made up of structural stainless steel 304L members.
- .6 Equipment Manufacturer shall furnish stainless steel template and grout shield to accurately locate centre pier anchors and allow for grouting beneath the pier and manifold seal plate after final plumbing.

WesTech to provide 304SS squeegees.

Center column will act as template for the anchor bolts since epoxy anchors are to be used.
Grout shield not by WesTech.

.5 Access Bridge, Handrailing and Walkway

WesTech to provide half span access bridge as per the specification drawings and proposal. The walkway will be a Pony truss bridge as allowed per Addendum No. 1.

.1 The clarifier shall be provided with a 914 mm (36") clear open width walkway extending from the tank wall to the center drive platform. The walkway shall span the tank and be supported by the tank walls. As a minimum the walkway shall be designed to safely withstand all dead loads plus a live load of 22.7 kg (50 pounds) per square foot with a maximum deflection of 1/360, over the entire span. The walkway shall consist of two (2) wide flange beams. These beams shall be sufficiently braced to resist the specified design loads. The walkway decking shall be 32 mm x 5 mm (1-1/4" x 3/16") aluminium grating.

.2 Provide a short sectional ladder, mounted and anchored on the outer clarifier tank wall and aligned with the bridge walkway. Materials should be similar of access bridge construction.

.3 A center drive operations platform shall be provided. It shall be a minimum of 2.1 m (7") square to provide clearance around the center assembly and drive control for maintenance and service. The drive platform shall be decked with 10 mm (3/8") aluminium checkered floor plate and have sufficient structural steel supports to meet the specified design load conditions.

Clause updated per Addendum No. 1.

.4 Handrails with toe plate shall be provided along both sides of the walkway and around the center drive platform. The handrailing shall be ~~38 mm (1-1/2") diameter~~ aluminium pipe, 2-rail design, with fittings factory assembled to posts. Rails are to be shipped to the job site in stock lengths for cutting and fitting. The toe plate shall be ~~125 mm x 6.4 mm plate or a 125 mm tall~~ aluminium extruded channel. ~~The handrailing shall be in conformance with the handrail specifications, found within this set of bid documents, and shall be as shown on the drawings.~~ If a pony truss bridge is used, the trusses can serve as handrails.

.6 Effluent Weirs

.1 An adjustable weir shall be provided around the periphery of the tank at the water surface for removal of clarified effluent. The weir shall be fixed once installed to match existing tank hydraulic profiles.

.2 The fiberglass or SS weir shall be provided based on the contract detailed drawings.

.3 The weir shall consist of 6 mm (1/4") thick x 230 mm (9") deep fiberglass or SS sections with 65 mm (2-1/2") deep 90 degree V notches at 150 mm (6") intervals. The weir sections shall be curved and fastened to the launder wall with special large 316L SS washers, anchor bolts, and hex nuts to allow vertical adjustment.

.7 Structural Members

Updated per Addendum No. 1.

.1 Structural steel shall be of structural stainless steel or conform to ASTM A36. Connections shall be shop welded or field bolted. Field welding will not be permitted, except for the bridge splice. All steel structural components shall be designed so that stresses developed do not exceed allowable stresses, as defined by current AISC standards when designed for the AGMA rated torque.

.2 All equipment epoxy inserted anchor bolts shall be stainless steel 316.

Per submittal review comments, all controls are by others, not WesTech. Local control station information has been removed from the submittal.

2.8

CONTROLS

.1 The Equipment Vendor is responsible for developing and updating a comprehensive City of Brantford compliant Process Control Narrative (PCN) specific for their equipment and control system. The PCN shall be submitted along with the shop drawings for the

Engineers review. The Engineer will coordinate with the Vendor to add City of Brantford SCADA tags for all equipment.

- .2 The Contractor will provide new MCC starter buckets, and NEMA 4X local start/stop push button control stations and lockable disconnect switches for the clarifiers. The Clarifier manufacturer shall provide typical and/or suggested electrical wiring diagrams to the Engineer for reference purposes and to ensure proper operation and protection of the clarifier.
- .3 Individual controls and monitoring (i.e., over-torque monitoring) devices shall be mounted on the MCC bucket.
- .4 Provide controls and SCADA monitoring as indicated on Contract Drawings.
- .5 The power cable shall be continuous and of sufficient length to suit termination in the local disconnect mounted near the respective mechanism (no splices are permitted).
- .6 Interconnected wiring between local, remote panels and MCC will be supplied and installed by the General Contractor.

2.9 ACCEPTABLE MANUFACTURERS

- .1 The below Vendor list shall not be construed as automatically acceptable, but the Owner or Engineer shall have the right, in its sole and absolute discretion, to accept or reject the shop drawing if the Vendor selected by the Contractor does not comply with the Contract Drawings and specification requirements herein. Any alternative design, dimensions or configurations shall be reviewed by the Engineer.
 - .1 Ovivo
 - .2 WesTech
 - .3 Envirodyne System INC.
 - .4 Zima Corporation

3 EXECUTION

3.1 FIELD TANK DIMENSION MEASUREMENT

- .1 Before shop drawing submittal, the Manufacturer shall provide a site visit to field review all the existing clarifier tank internal dimensions and elevations, and inspect tank bottom grouting conditions. The site visit shall be minimum of eight (8) hours of on-site time by the Manufacturer's technical support, exclusive of any required travel time. Field visit shall be completed by someone with previous experience dimensioning circular clarifier mechanisms of similar size.
- .2 Inspection report after the site visit shall be submitted to the satisfaction of the Engineer.

3.2 PRODUCT DELIVERY, STORAGE AND HANDLING

- .1 Shipment is not to be made until the Equipment vendor coordinates shipment to the jobsite with the Installation Contractors, assuring that the equipment will be properly received and stored.

Unloading and Storage on site is not by WesTech.

WesTech tech will not be onsite during unloading, WesTech can provide assistance remotely. Contractor will be responsible for unloading, storage and report any shortages.

- .2 Arrange for a representative of the Equipment vendor to be present at the job site during the unloading to inspect the delivered equipment and witness the unloading process.
- .3 Provide onsite instruction to the General Contractor for unloading of the power units, local control panels, and all other related equipment.
- .4 Notify the General Contractor of any special items necessary for unloading any of the system equipment, such as blades, etc. Supplying these special items for unloading shall be the responsibility of the General Contractor.
- .5 Provide special instruction, if any, to the General Contractor for storage and pre-installation maintenance
- .6 All equipment shall be skid mounted or crated to protect against damage during shipment. All parts shall be properly protected so that no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is completed, and the units and equipment are ready for operation.

Not all equipment will be skid mounted or crated due to the parts size.

Decommissioning, disposal and installation is not by WesTech.

3.3 INSTALLATION

- .1 Existing secondary clarifier mechanisms shall be completely decommissioned and disposed of off-site prior to installation by the General Contractor.
- .2 The Manufacturer shall review the installation of the clarifier mechanism a minimum of two (2) times, as provide for under this pre-selected equipment Contract. A minimum of eight (8) hours of on-site time by the manufacturer's technical support shall be provided for each site visit, exclusive of any required travel time.
- .3 The unit shall be leveled, plumbed, aligned, and wedged into position to fit into concrete structures. Installation procedures shall be as recommended by the manufacturer and the Hydraulic Institute Standards, and as required herein. Grouting shall be as specified in the grout section.
- .4 No stresses shall be transmitted to the scraper blades during installation or field testing.
- .5 After final alignment and bolting, the mechanism shall be adjusted to proper fit if any stress on the blades is observed.

3.4 FIELD QUALITY CONTROL

- .1 After installation by the General Contractor, to be retained by the Owner at a later date, provide field quality control services to test each component and demonstrate compliance with operating requirements as specified in Section 01751.
- .2 Installation Check. The manufacturer shall provide the services of a qualified field representative according to the quality control section to assist during installation of the equipment by the General Contractor. As a minimum, the manufacturer's field representative shall be made available as follows:
 - .1 Installation Inspection 1 trips, 2 days total
 - .2 Startup assistance 1 trip, 2 days total
- .3 Torque Test

- .1 The clarifier mechanism shall be field torque tested. The testing shall be carried out under the supervision of the equipment manufacturer's representative and as approved by the Engineer before the mechanism is accepted and placed into operation.
 - .2 The torque test shall consist of securing the rake arms by cables to anchor bolts installed by the Contractor in the tank floor at locations specified by the equipment manufacturer. A load shall be applied to the scraper arm in small increments by means of the drive mechanism. The magnitude of the applied load shall be measured by calculating the torque from the distance of the line of action of each cable to the centre line of the mechanism. A reading shall be taken at the drive design torque.
 - .3 The manufacturer's service representative shall verify that the alarm, motor cut-out, and back-up safety motor cut-out switches are properly set and are in proper operation to protect the clarifier mechanism as specified.
 - .4 Field Evaluation Tests. A performance test shall be run on the equipment after the installation is completed to ensure the equipment are operating properly as determined by the representative of the equipment manufacturer. The performance test shall be conducted by a capable representative of the manufacturer and accepted by the Engineer. The Owner's operating personnel shall assist the manufacturer's representative in the performance test. A designated representative of the Owner and/or the Engineer shall observe the performance test. As a minimum, the manufacturer's field representative shall be made available as follows:
 - .1 Performance testing 1 trip, 2 days total
 - .5 At least two (2) weeks prior to the proposed testing date, the Contractor shall notify the Engineer of the testing date and shall submit a report from the equipment manufacturer detailing the proposed performance testing procedure and analyses. Testing shall be performed between 8:00 a.m. and 5:00 p.m. and shall begin on Monday or Tuesday. If more than one (1) day of testing is required, the testing shall be done on consecutive days. The Engineer's initial observation of tests shall be at the Owner's expense. All costs of subsequent visits by the Engineer to witness or observe additional tests necessary because of failure of the initial tests or inability to conduct the initial tests will be at no extra cost to the Owner.
 - .6 Should the equipment not achieve consistent compliance during the tests, and then the manufacturer shall modify the equipment and repeat the field evaluation tests. Costs of modifying equipment, reducing or furnishing additional equipment, or subsequent retesting shall be borne by the General Contractor and Manufacturer. Should the equipment fail to meet all the design requirements after retesting, the equipment shall be rejected and shall be replaced by the Construction Contractor at the manufacturer's expense with acceptable equipment at no additional cost to the Owner.
 - .7 Performance Test and Field Evaluation Report. The manufacturer shall prepare a formal test report, including all measured data and other recorded data and observations. One (1) electronic copy of the report shall be submitted to the Engineer within 30 days after completion of the tests.
- 3.5 TRAINING
- .1 In addition to the installation and operation check required by the General Equipment Stipulations and the manufacturer's field services required by the quality control section, the manufacturer shall furnish the services of a competent and experienced operator of the equipment, who is directly employed by the manufacturer, to instruct the Owner's

operating personnel in the proper operation and maintenance of the equipment. Training shall be provided as specified in Section 01820 - Demonstration and Training.

3.6 WARRANTY

- .1 Each unit shall be new and shall carry the full Manufacturer's warranty on parts, service, and performance. Warranty shall begin at substantial completion. The warranty shall include replacement of all defective equipment and shall extend two (2) years beyond substantial completion.
- .2 Corrective Work. Any location where corrosion is evident shall be considered a failure of the material or the protection system. Before starting corrective work, the Manufacturer shall submit to the Engineer for review any analysis of the cause of the failure and details of the proposed corrective work. The Manufacturer shall make repairs acceptable to the Engineer at all points where failures are observed within the Warranty Period.
- .3 Inspection. Each unit shall be inspected at the end of the warranty period by representatives of the Owner, the Engineer, and the Manufacturer to identify any failures that may have occurred. The Manufacturer shall establish the date of each inspection and shall notify the Owner at least 30 days in advance. The scheduled inspection shall not relieve the Manufacturer from the obligation to perform corrective work whenever needed.
- .4 The Manufacturer shall prepare and deliver to the Owner an inspection report covering each inspection, indicating the number and type of failures observed, material and part where materials have failed, the percentage of the surface area where corrosion protection system failure has occurred, and the names of the persons making the inspection. Colour photographs illustrating each type of failure shall be included in the report.

END OF SECTION

Manufacturer Information

ISO Certification

ISO 9001:2015 Certification

Certificate US95/0255.00

The most responsive supplier of products and services for liquid-solid separation and the treatment of water and wastewater.

WesTech Engineering, LLC is certified to the ISO 9001:2015 standard with SGS Systems & Services Certification. SGS is an independent ISO registrar, who conducts regular audits of clients' management processes.

ISO 9001:2015 ensures the consistency of quality practices and requires continuous improvement of WesTech's entire management system. Certification therefore assures customers that:

1. WesTech's products and services will consistently meet or exceed an internationally agreed-upon level of quality, and
2. Proactive management practices will enable it to anticipate and address customers' future needs, while paying careful attention to existing installations.

Founded in 1973, WesTech has attained preferred-supplier status with an overwhelming majority of its worldwide customers. As a leading innovator in the development of equipment that lowers overall costs by improving efficiency, reliability, and performance, the firm has been approved by virtually all major consultants for their projects.

WesTech design and support personnel are committed to the success of their projects and customers. Attitudes, behaviors, and decisions are shaped by WesTech's six core values, which are:

- Exhibit honesty and integrity
- Take pride in doing the right things, and in doing them well
- Value our people and their families
- Make and keep commitments
- Achieve productivity through hard work and intelligence
- Provide superior service

The net result of WesTech's continuing ISO certification, combined with its distinctive culture, is that customers can expect to be taken care of by exceptionally responsive associates who consistently deliver superior solutions.

We invite you to learn more about our company, capabilities, and products - and then continually put us to the test. Find out for yourself why we say, "We not only guarantee our equipment, we guarantee peace of mind!"

The management system of

WesTech Engineering, LLC

3665 South West Temple
Salt Lake City, UT 84115, United States

has been assessed and certified as meeting the requirements of

ISO 9001:2015

For the following activities:

**The Design, Supply, Sales, and Service of Water and Waste Water
Treatment and Liquid-Solid Separation Equipment.**

Further clarifications regarding the scope of this certificate and the applicability of
ISO 9001:2015 requirements may be obtained by consulting the organization.

This certificate is valid from 31 March 2021 until 20 October 2023
and remains valid subject to satisfactory surveillance audits.
Recertification audit due a minimum of 60 days before the expiration date.
Issue 13. Certified since June 1995.

The audit leading to this certificate commenced on 30/03/2021.
Previous issue certificate validity date was until 20/10/2023.

This is a multi-site certification.
Additional site details are listed on subsequent pages.

Authorized by:

Dan Seal

Dan Seal

Technical Accreditation Manager, Certification &
Business Enhancement North America
SGS North America, Inc.

201 Route 17 North, Rutherford, NJ 07070, USA
t (201) 508-3000 f (201) 935-4555 www.us.sgs.com

This certificate remains the property of SGS and shall be returned upon request





WesTech Engineering, LLC

ISO 9001:2015

Issue 13



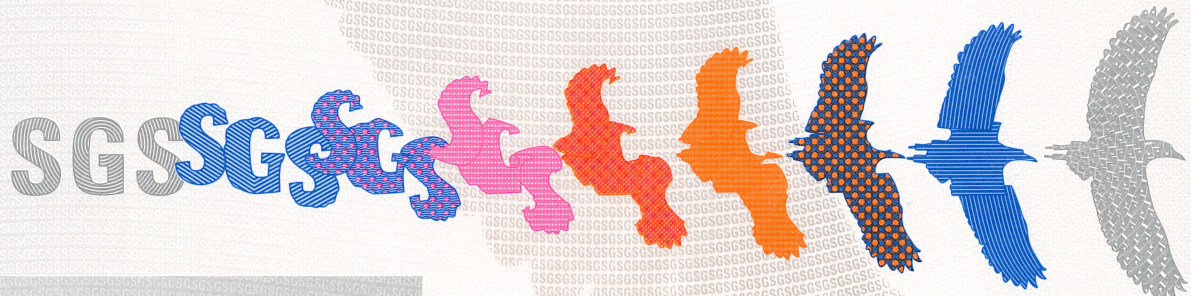
Detailed scope (applicable to all sites):

**The Design, Supply, Sales, and Service of Water and Waste Water
Treatment and Liquid-Solid Separation Equipment.**

Additional facilities:

3625 South West Temple, Salt Lake City, UT 84115, United States

600 Arrasmith Trail, Ames, IA 50010, United States



Warranty

Two Year Warranty

WesTech is meeting a global need for clean water through technology treatment solutions. We are proud that the equipment and systems we design, build, maintain, and operate are making the world a better place and creating a more sustainable environment for future generations.

Equipment manufactured or sold by WesTech Engineering, LLC, once paid for in full, is backed by the following warranty:

Subject to the terms below, WesTech warrants all new equipment manufactured or sold by WesTech Engineering, LLC to be unencumbered and free from defects in material and workmanship, and WesTech will replace or repair, F.O.B. its factories or other location it chooses, any part or parts returned to WesTech which WesTech's examination and analysis determine have failed within the warranty period because of defects in material and workmanship. The warranty period *is two (2) calendar years from substantial completion*. All repair or replacement parts qualifying under this warranty shall be free of charge. Purchaser will provide timely written notice to WesTech of any defects it believes should be repaired or replaced under this warranty. WesTech will reject as untimely any warranty defect claim that purchaser submits more than thirty (30) days after the possible warranty defect first occurred. Unless specifically stated otherwise, this warranty does not cover normal wear, consumables, or coatings. Purchasers are invited to inspect the equipment in the shop for proper surface preparation and coating application prior to shipment. This warranty is not transferable.

This warranty shall be void and shall not apply where the equipment or any part thereof

- a. has been dismantled, modified, repaired, or connected to other equipment, outside of a WesTech factory, or without WesTech's written approval, or
- b. has not been installed in complete adherence to all WesTech's or parts manufacturer's requirements, recommendations, and procedures, or
- c. has been subject to misuse, abuse, neglect, or accident, or has not at all times been operated and maintained in strict compliance with all of WesTech's requirements and recommendations therefor, including, but not limited to, the relevant WesTech Operations & Maintenance Manual and any other of WesTech's specified guidelines & procedures, or
- d. has been subject to force majeure events; use of chemicals not approved in writing by WesTech; electrical surges; overloading; significant power, water, or feed supply fluctuations; or non-compliance with agreed feedwater or chemical volumes, specifications, or procedures.

In any case where a part or component of equipment under this warranty is or may be faulty and the component or part is also covered under the warranty of a third party then the purchaser shall provide reasonable assistance to first pursue a claim under the third-party warranty before making a claim under this warranty from WesTech. WesTech Engineering, LLC gives no warranty with respect to parts, accessories, or components purchased other than through WesTech. The warranties which apply to such items are those offered by the respective manufacturers.

This warranty is expressly given by WesTech and accepted by purchaser in lieu of all other warranties whether written, oral, express, implied, statutory, or otherwise, including without limitation, warranties of merchantability and fitness for particular purpose. WesTech neither accepts nor authorizes any other person to assume for it any other liability with respect to its equipment. WesTech shall not be liable for normal wear and tear, corrosion, or any contingent, incidental, or consequential damage or expense due to partial or complete inoperability of its equipment for any reason whatsoever. The purchaser's exclusive and only remedy for breach of this warranty shall be the repair and or replacement of the defective part or parts within a reasonable time of WesTech's accepting the validity of a warranty claim made by the purchaser.

Installation List

Job No.	Year	Location	Qty	Size	Equipment/Model
19036	2003	HENDERSON, NV WRF	HENDERSON NV US 1	125' DIA	COP CLARIFIER COPC2
18741	2004	SPOKANE, WA WWTF	SPOKANE WA US 4	125' DIA	COP CLARIFIERS COPC2A
19384	2006	HENDERSON, NV WWTP	HENDERSON NV US 2	125' DIA	COP CLARIFIERS COPC2
22951	2018	RIVERSIDE PARK WRF NLT PROJECT – PHASE 1	SPOKANE WA US 1	125' Dia	Primary COP™ Clarifier COPC2G
23342	2018	WEST BANK WWTP #2 PRIMARY CLARIFIER & GEAR DRIVE	NEW ORLEANS LA US 1	120' DIA	Primary Clarifier COPC2
22779	2018	IRWIN CREEK WWTP PHASE 2 IMPROVEMENTS AND UPGRADES	CHARLOTTE NC 4	125' DIA	COP™ CLARIFIER COPC2G
23306	2019	TURLOCK RWQCF SECONDARY CLARIFIER #5	TURLOCK CA US 1	140' DIA.	COP™ Secondary Clarifier COPC2G
23745	2021	MCALPINE CREEK WWMF RELIABILITY & PROCESS IMPROV.	PINEVILLE NC US 2	105' DIA	COP™ Secondary Clarifiers COPC2
23745	2021	MCALPINE CREEK WWMF RELIABILITY & PROCESS IMPROV.	PINEVILLE NC US 2	105' DIA	COP™ Secondary Clarifiers COPC2
23745	2021	MCALPINE CREEK WWMF RELIABILITY & PROCESS IMPROV.	PINEVILLE NC US 2	125' DIA	COP™ Secondary Clarifiers COPC2
24638	2022	NAMPA WWTP GROUP F DESIGN- BUILD	NAMPA ID US 1	120' DIA	COP™ CLARIFIER COPC2G
Total Qty =			21		

Drive Unit

Professional Engineer Stamp

Professional Engineer Stamp

All drive train, AGMA, and bearing life calculations have been checked and approved by me for the C42 drive units at Brantford WWTP (WesTech Job Number 24946B).



Drive calculations are sealed by a registered professional engineer as required by the project specifications. However, providing this seal does not constitute offering engineering services nor imply licensure in the state where the project is located.

Drive Unit Information

Advantages of WesTech Drives

WesTech is submitting information on our premium drive unit: it may be slightly different from that specified. We request that you approve WesTech's design as it is superior in several ways to other designs. We've listed some of our major components and their distinct advantages below. The WesTech drive has proven itself in thousands of applications worldwide.

Precision Main Bearing/Gear

WesTech has taken advantage of the availability of large diameter precision machined bearings as the foundation of our superior drive design.

These bearings offer the following advantages:

- Fabricated from forged alloy steel, the bearing balls run in fully contoured machined races.
- The raceway is locked; the bearing races cannot separate. This distributes applied loads to all the balls rather than just a few. This feature makes it ideal for heavy duty industrial applications.
- The bearing life is often in excess of 100 years. When properly maintained the main bearing will never need replacement during the life of the equipment.
- The main spur gear is integral with the bearing assembly. This ensures a precision mounting for the gear, eliminating improper wear and increasing gear life.

Drive Housing

WesTech drives use welded steel for the main parts of the drive housing:

- Steel is stronger than cast iron.
- Steel is uniform. Unlike cast iron, there are no problems with blowholes, inclusions, and/or cracks that can compromise the structural integrity of the drive unit.
- Welded steel housings do not require an interior sealer coat, which is required in cast housings to avoid oil leaks.

Speed Reduction

WesTech incorporates direct-driven cycloidal reducers to achieve speed reduction.

- Cycloidal reducers are extremely efficient and save energy.
- Smooth rolling operation virtually eliminates wear and maintenance.
- Reducers are guaranteed to withstand a 500% shock load without failure.
- Direct coupling throughout makes the unit safer and easier to maintain than conventional chain and sprocket type systems.
- Maintenance is accomplished via a single grease fitting. In instances where oil lubrication is required for the cycloidal speed reducer, an oil fill pipe is provided together with an expansion tank/sight gauge.

Torque Control Device

- WesTech's torque control is an electro-mechanical device that measures rotational force directly from the main pinion shaft. NEMA 4x switches (or NEMA 7 for explosion proof applications) are housed in a stainless steel enclosure. A visual indicator is included to show the torque as a percentage of Full Dial Torque.

Advantages of Oil/Grease Lubricated Drives

Advantages of Oil/Grease Lubricated Drives

Maintenance

Oil/Grease lubrication is easily accessible

- All gearing is total enclosed and running in an oil bath
- Level of the oil bath for the main gear/pinion gear and lower support bearing is highly visible. Oil is discharged at the lowest point of the drive with ease.
- The main bearing is grease lubricated via two grease fittings, located 180 degrees from each other. It is sealed from the gear cavity which is a source of wear particles and water. Proper greasing of the main bearing flushes old grease out of bearing critical surfaces (equivalent to periodically changing oil).
- The upper bearing assembly and lift components (where used) are grease lubricated.
- The cycloidal speed reducer is grease lubricated, unless oil lubrication is specified. Grease lubricated cycloidal speed reducers require less maintenance.
- There is no need to replace a slip ring on the lift housing (where used).
- There are no chains or belts to replace or maintain.
- Spare parts are usually in stock if they are needed. Standard industrial type bearings and seals are used to reduce maintenance costs and increase parts availability.
- The moving parts of the drive are self-contained, limiting corrosion.

Drive Train Summary

**WESTECH DRIVE TRAIN SUMMARY
OF UNIT TO BE SUPPLIED**

JOB NO.: 24946B

PAGE 1 OF 1

BY: HU72

CHKD: BO13

DATE: 6/12/2023

DATE: 6/13/2023

STAGE 1 - MAIN GEAR INFORMATIONREQUIRED CONTINUOUS OUTPUT TORQUE OF MAIN GEAR: 35,750 FT-LBS
(AS SPECIFIED)

OUTPUT RPM OF MAIN GEAR: 0.041 RPM

PINION/GEAR RATIO: 5.6 :1

MAIN GEAR EFFICIENCY: 0.96

GEAR TORQUE RATING : 45,772 FT-LBS
(SEE AGMA CALCULATIONS)SERVICE FACTOR = $\frac{45,772}{35,750} = 1.28 \geq 1.00$ **OK**
(WITH RESPECT TO TORQUE)**STAGE 2 - SPEED REDUCER**REQUIRED OUTPUT TORQUE OF SPEED REDUCER: $\frac{35,750}{5.6 * 0.96} = 6650$ FT-LBS

= 79799 IN-LBS

OUTPUT RPM OF SPEED REDUCER: 0.231 RPM

SPEED REDUCER RATIO: 7569 : 1

SPEED REDUCER EFFICIENCY: 0.90

SPEED REDUCER TORQUE RATING: 102,600 IN-LBS
(SEE CATALOG CUTS)SERVICE FACTOR = $\frac{102,600}{79,799} = 1.29 \geq 1.25$ **OK**
(WITH RESPECT TO TORQUE)**STAGE 3 - MOTOR**REQUIRED HP OF MOTOR: $\frac{35,750}{5252} * \frac{0.041}{0.96 * 0.90} = 0.33$ HP

OUTPUT RPM OF MOTOR: 1750

MOTOR HP RATING: 1.00

NAMEPLATE SERVICE FACTOR: 1.15

CALCULATED SERVICE FACTOR: $\frac{1.00}{0.33} = 3.07 \geq 1.0$ **OK**

Spur Gear AGMA Calculations

AGMA CALCULATIONS INPUT SHEET

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WesTech Program no. CWP-030
Responsible Person: J. Bonner
Last Updated: 05/31/18

JOB_NO := "24946B"

PAGE NO. 1 OF 7

RUN_BY := "HU72"

DATE_RUN := "06/12/2023"

CHK_BY := "BO13"

DATE_CHK := "06/13/2023"

INPUTS FOR 42" CAGE RAKE DRIVE (C 42)

INPUTS

DRIVE OUTPUT SPEED, RPM

$$n_g := 0.041 \cdot \frac{1}{\text{min}}$$

EXPECTED LIFE IN YEARS

$$X_L := 20 \text{ LIFE IN HOURS}$$

$$L_i := X_L \cdot 365 \cdot 24 \cdot \text{hr}$$

$$L_i = 1.752 \times 10^5 \cdot \text{hr}$$

CONTINUOUS DESIGN TORQUE.

$$T_{\text{design}} := 35750 \cdot \text{ft} \cdot \text{lbf}$$

DUTY CYCLE

$$= 24 \text{ HOURS/DAY}$$

SERVICE FACTOR

$$= 1.00$$

DRIVE GEAR DATA

	PINION	GEAR
NO. OF TEETH	$N_1 := 15$	$N_2 := 84$
DIAMETRAL PITCH	$P_d := 2 \cdot \frac{1}{\text{in}}$	
PRESSURE ANGLE	$\phi := 20 \cdot \text{deg}$	
FACE WIDTH	$F_1 := 4 \cdot \text{in}$	$F_2 := 3.75 \cdot \text{in}$
	$F := F_2$	
TOOTH FORM	SMI-RECESS ACTION, FULL DEPTH	
SPUR GEAR	$\psi := 0 \cdot \text{deg}$	$\cos(\psi) = 1$
ADDENDUM MODIFICATION COEFFICIENT	$x_1 := 0.5$	$x_2 := -0.5$
BENDING STRENGTH GEOMETRY FACTOR	$J_p := 0.41026$	$J_g := 0.39191$
CORE HARDNESS	300-350 BHN	285-321 BHN
SURF. HARDNESS	55-60 Rc	285-321 BHN
DRIVE WITH ONE PINION	$q_g := 1$	

(NOTE: For Drive with two Pinions $q_g=2$, For Drive with four Pinions $q_g=4$)

BASIC GEAR GEOMETRY:

(Ref: PARAGRAPH 3 AGMA 908-B89)

GEAR RATIO	$m_G := \frac{N_2}{N_1}$	$m_G = 5.6$		
PITCH RADIUS	$R_1 := \frac{N_1}{2 \cdot \cos(\psi)}$	$R_2 := R_1 \cdot m_G$	$R_1 = 7.5$	$R_2 = 42$
OPERATING C.D.	$C_r := R_2 - R_1$		$C_r = 34.5$	
BASE RADIUS	$R_{b1} := R_1 \cdot \cos(\phi)$	$R_{b2} := R_2 \cdot \cos(\phi)$	$R_{b1} = 7.048$	$R_{b2} = 39.467$
OPR. PRES ANGLE	$\phi_r := \arccos\left(\frac{R_{b2} - R_{b1}}{C_r}\right)$	$\phi_r = 20 \cdot \text{deg}$		
ADD. RAD.	$R_{o1} := \frac{1}{2} \cdot \left(\frac{N_1}{\cos(\psi)}\right) + (1 + x_1)$	$R_{o2} := (0.50) \cdot \left(\frac{N_2}{\cos(\psi)}\right) - (1 + x_2)$	$R_{o1} = 9$	$R_{o2} = 41.5$
PITCH DIAMETER	$d := \frac{2 \cdot C_r}{m_G - 1}$	$d = 15$	$D := d \cdot m_G$	$D = 84$
BASE PITCH	$p_b := \frac{2 \cdot \pi \cdot R_{b1}}{N_1}$	$p_b = 2.952$		

THE ABOVE VARIABLES MADE DIMENSIONLESS BY MULTIPLYING WITH DIAMETRAL PITCH

$C_6 := C_r \cdot \sin(\phi_r)$	$C_6 = 11.8$
$C_1 := \left[C_6 - \left[(R_{o2})^2 - (R_{b2})^2 \right]^{0.5} \right]$	$C_1 = 1.03$
$C_3 := \frac{C_6}{m_G - 1}$	$C_3 = 2.565$
$C_4 := C_1 + p_b$	$C_4 = 3.982$
$C_5 := \left[(R_{o1})^2 - (R_{b1})^2 \right]^{0.5}$	$C_5 = 5.597$
$C_2 := C_5 - p_b$	$C_2 = 2.645$
$Z := C_5 - C_1$	$Z = 4.567$
$m_p := \frac{Z}{p_b}$	$m_p = 1.547$

FOR SPUR GEARS

$\rho_1 := C_2$	$\rho_1 = 2.645$	$C_\psi := 1$	$m_N := 1$
$\rho_2 := C_6 + \rho_1$	$\rho_2 = 14.445$		
$L_{\min} := F$	$L_{\min} = 3.75 \cdot \text{in}$		

PITTING RESISTANCE GEOMETRY FACTOR, I

(Ref : PARAGRAPH 4 AGMA 908-B89)

GEOMETRY FACTOR	$I := \frac{\cos(\phi_r) \cdot (C_\psi)^2}{\left(\frac{1}{\rho_1} - \frac{1}{\rho_2} \right) \cdot d \cdot m_N}$	$I = 0.203$
-----------------	---	-------------

SURFACE DURABILITY RATING CALCULATIONS

$$S_{ac} := \begin{cases} 225000 \cdot \text{psi} \\ 133765 \cdot \text{psi} \\ 146329 \cdot \text{psi} \end{cases} \quad \begin{array}{l} \mathbf{Q=0} \text{ WHEN } 225,000 \text{ PSI} = 55\text{-}60 \text{ RC}(350\text{BHN}) \\ \mathbf{Q=1} \text{ WHEN } 133,765 \text{ PSI} = 285 \text{ BHN} \\ \mathbf{Q=2} \text{ WHEN } 146,329 \text{ PSI} = 321 \text{ BHN} \end{array} \quad \begin{array}{l} (\text{Ref: Table 3, Paragraph 16 AGMA 2001-C95}) \\ (\text{Fig 8, GR 2; } S_{ac}=349\text{HB}+34300) \\ (\text{Fig 8, GR 2; } S_{ac}=349\text{HB}+34300) \end{array}$$

$$d := \frac{N_1}{P_d} \quad d = 7.5 \cdot \text{in}$$

$$n_p := n_g \cdot m_G \quad n_p = 0.23 \cdot \frac{1}{\text{min}}$$

$$v_t := \pi \cdot n_p \cdot d \quad v_t = 0.451 \cdot \frac{\text{ft}}{\text{min}}$$

DERATING FACTORS:

$$K_o := 1 \text{ FOR UNIFORM LOAD TRANSMISSION}$$

$$Q_v := 6$$

$$B := 0.25 \cdot (12 - Q_v)^{0.667} \quad B = 0.826$$

$$A := 50 + 56 \cdot (1.0 - B) \quad A = 59.745$$

$$K_v := \left[\frac{\left(A + \sqrt{v_t \cdot \frac{\text{min}}{\text{ft}}} \right)}{A} \right]^B \quad K_v = 1.009$$

$$K_s := 1$$

$$C_{mc} := 1.0 \quad C_{pf} := \left(\frac{F}{10 \cdot d} \right) - 0.0375 + 0.0125 \cdot \frac{1}{\text{in}} \cdot F \quad C_{pf} = 0.059 \quad (\text{Ref. EQ 39: Paragraph 15.3 AGMA 2001-C95})$$

FROM LAYOUT

$$S_1 := 1.01 \quad S := 8.14 \quad \frac{S_1}{S} = 0.124 \quad C_{pm} := 1.0 \quad (\text{Since } S_1/S < 0.175)$$

$$A_1 := 1.27 \cdot 10^{-1} \quad B_1 := 0.158 \cdot 10^{-1} \cdot \frac{1}{\text{in}} \quad C := -1.093 \cdot 10^{-4} \cdot \frac{1}{\text{in}^2} \quad (\text{Ref. EQ 41: Paragraph 15.3 AGMA 2001-C95})$$

$$C_{ma} := A_1 + B_1 \cdot F + C \cdot (F)^2 \quad C_{ma} = 0.185 \quad (\text{Ref: Table 2, Paragraph 15.3 AGMA 2001-C95})$$

$$C_e := 1.0$$

$$C_{mf} := 1.0 + C_{mc} \cdot (C_{pf} \cdot C_{pm} + C_{ma} \cdot C_e) \quad C_{mf} = 1.244 \quad (\text{Ref: EQ 37 Paragraph 15.3 AGMA 2001-C95})$$

$$K_m := C_{mf} \quad K_m = 1.244 \quad (\text{Ref: EQ 36 Paragraph 15.1 AGMA 2001-C95})$$

$$C_f := 1 \quad (\text{Ref: Paragraph 13 AGMA 2001-C95})$$

$$C_H := 1 \quad \text{SURFACE FINISH OF PINION} \quad f_p > 64 R_a \quad (\text{Ref: Fig 3, Paragraph 14.2 AGMA 2001-C95})$$

$$K_R := 1.0 \quad \text{FEWER THAN ONE FAILURE IN 100} \quad (\text{Ref: Table 11, Paragraph 18 AGMA 2001-C95})$$

$$K_T := 1.0 \quad \text{FOR GEARS OPERATING AT LESS THAN 250 DEG. F}$$

$$S_H := 1.0$$

$$C_P := 2300 \cdot \left(\frac{\text{lbf}}{\text{in}^2} \right)^{0.5} \quad \text{FOR STEEL GEARS}$$

$$q_p := 1 \quad q_g = 1 \quad (\text{FOR TWO PINION DRIVE } q_g=2, \text{ FOR 4 PINION DRIVE } q_g=4)$$

$$N_{\text{pinion}} := 60 \cdot \frac{\text{min}}{\text{hr}} \cdot L_i \cdot n_p \cdot q_p \quad N_{\text{pinion}} = 2413555$$

$$N_{\text{gear}} := \frac{60 \cdot \frac{\text{min}}{\text{hr}} \cdot L_1 \cdot n_p \cdot q_p \cdot q_g}{m_G} \quad N_{\text{gear}} = 430992$$

$$Z_{\text{NP}} := 2.466 \cdot N_{\text{pinion}}^{-0.056} \quad Z_{\text{NP}} = 1.083$$

$$Z_{\text{NG}} := 2.466 \cdot N_{\text{gear}}^{-0.056} \quad Z_{\text{NG}} = 1.193$$

THE PITTING RESISTANCE POWER RATING (REF PARAGRAPH 5 AGMA 2001-C95)

Q := 0 (FOR PINION SURFACE HARDNESS = 55-60 RC)

$$P_{\text{acp}} := \frac{n_p \cdot F}{126000 \cdot \frac{\text{in} \cdot \text{lbf}}{\text{min} \cdot \text{hp}}} \cdot \frac{I}{K_o \cdot K_v \cdot K_s \cdot K_m \cdot C_f} \cdot \left(\frac{S_{\text{ac}Q,0} \cdot Z_{\text{NP}} \cdot C_H \cdot d}{S_H \cdot K_T \cdot K_R \cdot C_P} \right)^2 \quad P_{\text{acp}} = 0.697 \cdot \text{hp}$$

$$T_{\text{pdur}} := \frac{63000 \cdot \frac{\text{in} \cdot \text{lbf}}{\text{min} \cdot \text{hp}} \cdot P_{\text{acp}}}{n_p} \quad T_{\text{pdur}} = 191204 \cdot \text{in} \cdot \text{lbf} \quad T_{\text{pdur}} = 15934 \cdot \text{ft} \cdot \text{lbf}$$

$$T_{\text{dpoutput}} := m_G \cdot T_{\text{pdur}} \cdot q_g \quad T_{\text{dpoutput}} = 89228 \cdot \text{ft} \cdot \text{lbf}$$

Q := 1 (FOR GEAR HARDNESS = 285 BHN)

$$P_{\text{acgmin}} := \frac{n_p \cdot F \cdot q_g}{126000 \cdot \frac{\text{in} \cdot \text{lbf}}{\text{min} \cdot \text{hp}}} \cdot \frac{I}{K_o \cdot K_v \cdot K_s \cdot K_m \cdot C_f} \cdot \left(\frac{S_{\text{ac}Q,0} \cdot Z_{\text{NG}} \cdot C_H \cdot d}{S_H \cdot K_T \cdot K_R \cdot C_P} \right)^2 \quad P_{\text{acgmin}} = 0.299 \cdot \text{hp}$$

$$T_{\text{dgoutputmin}} := \frac{63000 \cdot \frac{\text{in} \cdot \text{lbf}}{\text{min} \cdot \text{hp}} \cdot P_{\text{acgmin}}}{n_g} \quad T_{\text{dgoutputmin}} = 458988 \cdot \text{in} \cdot \text{lbf} \quad T_{\text{dgoutputmin}} = 38249 \cdot \text{ft} \cdot \text{lbf}$$

Q := 2 (FOR GEAR HARDNESS = 321 BHN)

$$P_{\text{acgmax}} := \frac{n_p \cdot F \cdot q_g}{126000 \cdot \frac{\text{in} \cdot \text{lbf}}{\text{min} \cdot \text{hp}}} \cdot \frac{I}{K_o \cdot K_v \cdot K_s \cdot K_m \cdot C_f} \cdot \left(\frac{S_{\text{ac}Q,0} \cdot Z_{\text{NG}} \cdot C_H \cdot d}{S_H \cdot K_T \cdot K_R \cdot C_P} \right)^2 \quad P_{\text{acgmax}} = 0.357 \cdot \text{hp}$$

$$T_{\text{dgoutputmax}} := \frac{63000 \cdot \frac{\text{in} \cdot \text{lbf}}{\text{min} \cdot \text{hp}} \cdot P_{\text{acgmax}}}{n_g} \quad T_{\text{dgoutputmax}} = 549259 \cdot \text{in} \cdot \text{lbf} \quad T_{\text{dgoutputmax}} = 45772 \cdot \text{ft} \cdot \text{lbf}$$

$$S_{at} := \begin{cases} 65000 \cdot \text{psi} \\ 70000 \cdot \text{psi} \\ 45470 \cdot \text{psi} \\ 49142 \cdot \text{psi} \end{cases} \begin{array}{l} \mathbf{U=0} \text{ WHEN } 65,000 \text{ PSI} = 55\text{-}60 \text{ RC (300 BHN)} \\ \mathbf{U=1} \text{ WHEN } 70,000 \text{ PSI} = 55\text{-}60 \text{ RC (350 BHN)} \\ \mathbf{U=2} \text{ WHEN } 45,470 \text{ PSI} = 285 \text{ BHN} \\ \mathbf{U=3} \text{ WHEN } 49,142 \text{ PSI} = 321 \text{ BHN} \end{array} \begin{array}{l} (\text{Ref: Table 4, Paragraph 16 AGMA 2001-C95}) \\ (\text{Ref: Table 4, Paragraph 16 AGMA 2001-C95}) \\ (\text{Fig 9, GR 2; Sat=102HB+16400}) \\ (\text{Fig 9, GR 2; Sat=102HB+16400}) \end{array}$$

$$S_F := 1 \quad \text{SAFETY FACTOR}$$

$$Y_{N_{pinion}} := 6.1514 \cdot N_{pinion}^{-0.1192} \quad Y_{N_{pinion}} = 1.067$$

$$Y_{N_{gear}} := 6.1514 \cdot N_{gear}^{-0.1192} \quad Y_{N_{gear}} = 1.31$$

THE BENDING STRENGTH POWER RATING (Ref PARAGRAPH 5 AGMA 2001-C95)

U := 0 (FOR PINION WITH CORE HARDNESS = 300 BHN/SURF. HARD = 55-60 RC)

$$K_B := 1$$

$$P_{atpmin} := \frac{n_p \cdot d}{126000 \cdot \frac{\text{in} \cdot \text{lbf}}{\text{min} \cdot \text{hp}} K_O \cdot K_v} \cdot \frac{F}{P_d} \cdot \frac{J_p}{K_s \cdot K_m \cdot K_B} \cdot \frac{S_{at_{U,0}} \cdot Y_{N_{pinion}}}{S_F \cdot K_T \cdot K_R} \quad P_{atpmin} = 0.581 \cdot \text{hp}$$

$$T_{psmin} := \frac{63000 \cdot \frac{\text{in} \cdot \text{lbf}}{\text{min} \cdot \text{hp}} \cdot P_{atpmin}}{n_p} \quad T_{psmin} = 159333 \cdot \text{in} \cdot \text{lbf} \quad T_{psmin} = 13278 \cdot \text{ft} \cdot \text{lbf}$$

$$T_{spoutputmin} := m_G \cdot T_{psmin} \cdot q_g \quad T_{spoutputmin} = 74356 \cdot \text{ft} \cdot \text{lbf}$$

U := 1 (FOR PINION WITH CORE HARDNESS = 350 BHN/SURF. HARD = 55-60 RC)

$$P_{atpmax} := \frac{n_p \cdot d}{126000 \cdot \frac{\text{in} \cdot \text{lbf}}{\text{min} \cdot \text{hp}} K_O \cdot K_v} \cdot \frac{F}{P_d} \cdot \frac{J_p}{K_s \cdot K_m \cdot K_B} \cdot \frac{S_{at_{U,0}} \cdot Y_{N_{pinion}}}{S_F \cdot K_T \cdot K_R} \quad P_{atpmax} = 0.625 \cdot \text{hp}$$

$$T_{spoutputmax} := \frac{63000 \cdot \frac{\text{in} \cdot \text{lbf}}{\text{min} \cdot \text{hp}} \cdot P_{atpmax} \cdot q_g}{n_g} \quad T_{spoutputmax} = 960902 \cdot \text{in} \cdot \text{lbf} \quad T_{spoutputmax} = 80075 \cdot \text{ft} \cdot \text{lbf}$$

U := 2 (FOR GEAR HARDNESS = 285 BHN)

$$P_{atgmin} := \frac{n_p \cdot d \cdot q_g}{126000 \cdot \frac{\text{in} \cdot \text{lbf}}{\text{min} \cdot \text{hp}} K_O \cdot K_v} \cdot \frac{F}{P_d} \cdot \frac{J_g}{K_s \cdot K_m \cdot K_B} \cdot \frac{S_{at_{U,0}} \cdot Y_{N_{gear}}}{S_F \cdot K_T \cdot K_R} \quad P_{atgmin} = 0.476 \cdot \text{hp}$$

$$T_{sgoutputmin} := \frac{63000 \cdot \frac{\text{in} \cdot \text{lbf}}{\text{min} \cdot \text{hp}} \cdot P_{atgmin}}{n_g} \quad T_{sgoutputmin} = 732179 \cdot \text{in} \cdot \text{lbf} \quad T_{sgoutputmin} = 61015 \cdot \text{ft} \cdot \text{lbf}$$

U := 3 (FOR GEAR HARDNESS = 321 BHN)

$$P_{atgmax} := \frac{n_p \cdot d \cdot q_g}{126000 \cdot \frac{\text{in} \cdot \text{lbf}}{\text{min} \cdot \text{hp}} K_O \cdot K_v} \cdot \frac{F}{P_d} \cdot \frac{J_g}{K_s \cdot K_m \cdot K_B} \cdot \frac{S_{at_{U,0}} \cdot Y_{N_{gear}}}{S_F \cdot K_T \cdot K_R} \quad P_{atgmax} = 0.515 \cdot \text{hp}$$

$$T_{sgoutputmax} := \frac{63000 \cdot \frac{\text{in} \cdot \text{lbf}}{\text{min} \cdot \text{hp}} \cdot P_{atgmax}}{n_g} \quad T_{sgoutputmax} = 791307 \cdot \text{in} \cdot \text{lbf} \quad T_{sgoutputmax} = 65942 \cdot \text{ft} \cdot \text{lbf}$$

(Ref: Fig 16, Paragraph 16.4 AGMA 2001-C95)

$$S_{ay} := \begin{cases} 111800 \cdot \text{psi} \\ 135900 \cdot \text{psi} \\ 104570 \cdot \text{psi} \\ 121922 \cdot \text{psi} \end{cases} \quad \begin{array}{l} \mathbf{Y=0} \text{ WHEN } 111,800 \text{ PSI} = 55\text{-}60 \text{ RC (300 BHN)} \\ \mathbf{Y=1} \text{ WHEN } 135,900 \text{ PSI} = 55\text{-}60 \text{ RC (350 BHN)} \\ \mathbf{Y=2} \text{ WHEN } 104,570 \text{ PSI} = 285 \text{ BHN} \\ \mathbf{Y=3} \text{ WHEN } 121,922 \text{ PSI} = 321 \text{ BHN} \end{array} \quad \begin{array}{l} \text{(Ref: Fig 16, Say=482xHB - 32800)} \\ \text{(Ref: Fig 16, Say=482xHB - 32800)} \end{array}$$

$$K_v := 0.75 \quad \text{FOR INDUSTRIAL PRACTICE}$$

$$K_{my} := 0.0144 \cdot \frac{1}{\text{in}} \cdot F + 1.07 \quad K_{my} = 1.124$$

$$K_f := 1 \quad \text{(Ref Paragraph 16.3 AGMA 2001-C95)}$$

$$Y := 0 \quad \text{(FOR PINION TEETH CORE HARD. 300 BHN AND SURF. HARD. 55-60 RC)}$$

(Ref: EQ (45) AGMA2001-C95)

$$T_{pyieldmin} := \left[\frac{F \cdot d}{2 \cdot P_d} \cdot \frac{J_p \cdot K_f}{K_{my} \cdot K_B} \cdot (S_{ayY,0} \cdot K_y) \right] \quad T_{pyieldmin} = 215193 \cdot \text{in} \cdot \text{lbf} \quad T_{pyieldmin} = 17933 \cdot \text{ft} \cdot \text{lbf}$$

$$T_{ypoutmin} := m_G \cdot T_{pyieldmin} \cdot q_g \quad T_{ypoutmin} = 100423 \cdot \text{ft} \cdot \text{lbf}$$

$$Y := 1 \quad \text{(FOR PINION TEETH CORE HARD. 350 BHN AND SURF. HARD. 55-60 RC)}$$

$$T_{pyieldmax} := \left[\frac{F \cdot d}{2 \cdot P_d} \cdot \frac{J_p \cdot K_f}{K_{my} \cdot K_B} \cdot (S_{ayY,0} \cdot K_y) \right] \quad T_{pyieldmax} = 261581 \cdot \text{in} \cdot \text{lbf} \quad T_{pyieldmax} = 21798 \cdot \text{ft} \cdot \text{lbf}$$

$$T_{ypoutmax} := m_G \cdot T_{pyieldmax} \cdot q_g \quad T_{ypoutmax} = 122071 \cdot \text{ft} \cdot \text{lbf}$$

$$Y := 2 \quad \text{(FOR GEAR TEETH CORE HARD. 285 BHN)}$$

$$T_{gyieldmin} := \left[\frac{F \cdot \left(\frac{N_2}{P_d} \right)}{2 \cdot P_d} \cdot \frac{J_g \cdot K_f \cdot q_g}{K_{my} \cdot K_B} \cdot (S_{ayY,0} \cdot K_y) \right] \quad T_{gyieldmin} = 89728 \cdot \text{ft} \cdot \text{lbf}$$

$$Y := 3 \quad \text{(FOR GEAR TEETH CORE HARD. 321 BHN)}$$

$$T_{gyieldmax} := \left[\frac{F \cdot \left(\frac{N_2}{P_d} \right)}{2 \cdot P_d} \cdot \frac{J_g \cdot K_f \cdot q_g}{K_{my} \cdot K_B} \cdot (S_{ayY,0} \cdot K_y) \right] \quad T_{gyieldmax} = 104617 \cdot \text{ft} \cdot \text{lbf}$$

	<u>DURABILITY</u>	<u>STRENGTH</u>	<u>YIELD STRENGTH</u>
MAIN GEAR (MAX)	$T_{dgoutputmax} = 45772 \cdot \text{ft} \cdot \text{lbf}$	$T_{sgoutputmax} = 65942 \cdot \text{ft} \cdot \text{lbf}$	$T_{gyieldmax} = 104617 \cdot \text{ft} \cdot \text{lbf}$
(MIN)	$T_{dgoutputmin} = 38249 \cdot \text{ft} \cdot \text{lbf}$	$T_{sgoutputmin} = 61015 \cdot \text{ft} \cdot \text{lbf}$	$T_{gyieldmin} = 89728 \cdot \text{ft} \cdot \text{lbf}$
PINION (MAX)	$T_{dpoutput} = 89228 \cdot \text{ft} \cdot \text{lbf}$	$T_{spoutputmax} = 80075 \cdot \text{ft} \cdot \text{lbf}$	$T_{ypoutputmax} = 122071 \cdot \text{ft} \cdot \text{lbf}$
(MIN)	* $T_{dpoutput} = 89228 \cdot \text{ft} \cdot \text{lbf}$	$T_{spoutputmin} = 74356 \cdot \text{ft} \cdot \text{lbf}$	$T_{ypoutputmin} = 100423 \cdot \text{ft} \cdot \text{lbf}$

* SAME AS PINION (MAX) SINCE AGMA GIVES ONE VALUE OF 'Sac' FOR HARDNESS RANGE.

AGMA GEAR RATING IS BASED UPON MAXIMUM VALUE OF DURABILITY FOR THE MAIN GEAR:

SURFACE DURABILITY RATING $T_{dgoutputmax} = 45772 \cdot \text{ft} \cdot \text{lbf}$ $SF := \frac{T_{dgoutputmax}}{T_{design}}$ **SF = 1.28** OK

AGMA MOMENTARY GEAR RATING IS BASED UPON MAXIMUM VALUE OF THE MAIN GEAR YIELD

MOMENTARY YIELD RATING $T_{gyieldmax} = 104617 \cdot \text{ft} \cdot \text{lbf}$ $SF := \frac{T_{gyieldmax}}{T_{design}}$ **SF = 2.93** OK

Bearing Life Calculations

THE ATTACHED BEARING LIFE CALCULATIONS UTILIZE A RELATIONSHIP BETWEEN THE BASIC RATING LIFE, THE BASIC DYNAMIC LOAD RATING, AND THE BEARING LOAD AS EXPRESSED BY THE EQUATION:

$$L_{10} = (C/P)^K$$

WHERE:

L_{10} = BASIC RATING LIFE IN MILLIONS OF REVOLUTIONS

*NOTE -

L_{10} AND B_{10} ARE EQUIVALENT RATINGS. L_{10} HAS REPLACED B_{10} TO MAKE A WORLDWIDE RATING STANDARD.

B_{10} RATING IS NOT USED ANYMORE.

C = BASIC DYNAMIC LOAD RATING, LB

NOTE THE BASIC DYNAMIC LOAD RATINGS HAVE BEEN DETERMINED IN ACCORDANCE WITH THE METHODS PRESCRIBED BY ISO, AFBMA, AND ANSI.

P = EQUIVALENT DYNAMIC BEARING LOAD, LB

$$P = XR + YT$$

WHERE:

R = RADIAL LOAD, (LB)

T = THRUST (AXIAL) LOAD, (LB)

X = 0.56 FOR BALL BEARINGS

= 1.0 FOR CYLINDRICAL ROLLER BEARINGS

Y = 1.40 FOR BALL BEARINGS

= 0.0 FOR CYLINDRICAL ROLLER BEARINGS

K = EXPONENT FOR THE LIFE EQUATION

K = 3 FOR BALL BEARINGS

K = 3.333 FOR ROLLER BEARINGS

BASED ON BOTH LABORATORY TESTS AND PRACTICAL EXPERIENCE, SEEMINGLY IDENTICAL BEARINGS OPERATING UNDER SEEMINGLY IDENTICAL CONDITIONS HAVE DIFFERENT LIVES.

ALL INFORMATION PRESENTED ON DYNAMIC LOAD RATINGS IS BASED ON THE LIFE THAT 90% OF A SUFFICIENTLY LARGE GROUP OF BEARINGS CAN BE EXPECTED TO ATTAIN OR EXCEED.

WesTech Program no. CWP-049
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BEARING LIFE CALCULATIONS L-10

DESIGN TORQUE	=	35,750	FT-LB
GEAR PITCH DIAMETER	=	42	INCHES
BEARING BALL RACE DIAMETER	=	47	INCHES
REQUIRED LIFE	=	20	YEARS
F_{tan} = TANGENTIAL LOAD	=	20,428.57	LB
F_{total} = TOTAL LOAD	=	21,739.63	LB

MAIN BEARING

BEARING TYPE : BALL

C	=	57,855	LB	P	=	35,274	LB
X	=	0.56		K	=	3	
Y	=	1.4		L-10	=	4,412,162	REVOLUTIONS
F_{total}	=	21,739.63	LB				
T	=	16,500	LB				
RPM	=	0.041					
LIFE IN HOURS	=	1,781,102	HOURS				
LIFE IN YEARS	=	203	YEARS				

IN CONCLUSION:

REQUIRED LIFE	20	YEARS	
SERVICE FACTOR	10.17	> 1.0	OK

LOWER PINION BEARING

BEARING TYPE : ROLLER

C	=	46,100	LB	P	=	14,493.09	LB
X	=	1		K	=	3.333	
R	=	14,493.09	LB	L-10	=	47,311,420	REVOLUTIONS
RPM	=	0.231					

LIFE IN HOURS = 3,410,478 HOURS

LIFE IN YEARS = 389 YEARS

IN CONCLUSION:

REQUIRED LIFE: 20 YEARS

SERVICE FACTOR: 19.47 > 1.0 **OK**

UPPER PINION BEARING

BEARING TYPE : BALL

C	=	27,200	LB	P	=	5,458.06	LB
X	=	0.56		K	=	3	
Y	=	1.4		L-10	=	123,762,994	REVOLUTIONS
R	=	7,246.54	LB				
T	=	1,000	LB				
RPM	=	0.231					

LIFE IN HOURS = 8,921,544 HOURS

LIFE IN YEARS = 1,018 YEARS

IN CONCLUSION:

REQUIRED LIFE: 20 YEARS

SERVICE FACTOR: 50.92 > 1.0 **OK**

Precision Main Bearing

Precision Main Bearing

WesTech premium drive units for clarifier and thickener mechanisms employ a precision and integral main gear and bearing unit. The summary below explains the reasons why WesTech chooses to use this bearing arrangement.

Forged Alloy Steel

Forged Alloy Steel is stronger and will last longer.

Both the inner and outer races of the bearing are made of 4140 HR Alloy steel. To create a forged ring, a billet of the material is heated up red hot. It is then formed using high pressure rollers to produce the required dimensions. The forging process makes the material grain flow throughout the part. This makes the part several times stronger than a cast part where the liquid metal cools into a grain-like crystal structure, with no particular orientation.

Locked Raceway

Locked Raceway prevents failure and lasts longer.

Since the inner and outer races are locked these bearings are utilized for high load and speed applications, such as: Construction Equipment, Cranes, Wind Power Generators, and Amusement Park Rides. Similar to our equipment, these are applications where failure is not an option. These bearings are manufactured by recognized bearing companies such as Rotek, Kaydon, Gear Products, PSL, Titanus, and Galperti Tech.

Long Life and Load Capacities

Exceptional Long Life and Load Capacities for less maintenance and fewer replacements.

Instead of loading the balls on four points in the vertical and horizontal planes, as with strip liner bearings, the precision bearing utilizes one piece, contoured, ground raceways. Since the inner and outer raceways are locked together the load is evenly transferred in a diagonal direction between the inner and outer raceways.

Calculated bearing life is in the range of five times that for strip liners of the same ball size and diameter. This is often over 100 years. The need for splitting gears and housings is eliminated because of superior service life.

Superior Gear Quality

Superior Gear Quality provides smoother operation and fewer failures.

The majority of all spur-gear driving capacity comes from the stability of mounting and precision tolerance of its bearings. The use of an integral gear with bearing housing makes this precision inherent in the design. Stripliner gears often need to oversize one component to compensate for the lack of strength of another. AGMA 6 or better manufacturing tolerances are held for all gearing, which is ideal for slow speeds.

Fabricated Steel Drive Housing

Fabricated Steel Drive Housing

WesTech's premium drive units for clarifier and thickener mechanisms provide a welded fabricated steel housing to enclose moving parts and serve as a rugged structural frame for gear reduction and overturning loads. The advantages for doing this are listed below.

Strength of Material

Strength of Material gives more robust design.

Steel is a stronger material than cast iron. The modulus of elasticity for A36 steel is typically 150 percent greater than Class 40 cast iron. Steel also has higher yield and ultimate strengths which enhance fatigue resistance and ductility.

Material Characteristics

Material Characteristics yield more consistent quality.

Rolled steel is a very uniform material. The procedures for pouring cast iron produce a varying density of material due to blow holes, sand particles, voids, and cracks. Defects in cast iron cannot always be controlled or even identified by x-ray examination. Seal coating of interior raceway surfaces in cast iron is required to prevent oil leaks.

Structural Design

Structural Design is simplified and more consistent.

The defects of cast iron mentioned above make its structural performance far less consistent and predictable. The safety factors required in design must also be increased to account for material defects of cast iron. In order to provide the equivalent structural performance as steel, cast iron components must be more massive.

Flexibility of Design

Flexibility of Design saves you money.

WesTech encourages the use of our 'Standard' equipment. However, fabrication with structural steel permits a wide variety in the dimensioning of premium component parts to meet specific customer needs. The variety of dimensions economically available in cast iron molds is restricted.

Ease of Repairs

Ease of Repairs for reduced maintenance costs.

While it is rare, repairs to fabricated steel components are much simpler and can usually be made on site. Defective or damaged cast iron housings often require complete replacement or removal from the mechanism and repair at an off-site source.

Motor Information

MAX-E1® FAMILY



AEHH8N, NEMA PREMIUM (1 HP - 500 HP) [EP]

AEHE, HIGH EFFICIENCY [E]

AEHH8NCF, NEMA PREMIUM, FOOTED C-FACE (1 HP - 300 HP) [EP_C]

AEUH8NDC, NEMA PREMIUM, ROUND BODY C-FACE (1 HP - 100 HP) [EPV_C]



Effective 07-08-18
Supercedes 03-24-17

APPLICATIONS:

- Fans & Blowers
- Pumps
- Crushers

- Compressors
- Mixers
- Conveyors

- Any Severe Duty/ Petro-Chem/
Pulp & Paper Application

FEATURES:

- Output Range: 3/4 - 800 HP
- Speed: 3600, 1800, 1200 & 900 RPM
- Enclosure: Totally Enclosed Fan Cooled (IP54 for 280 Frames and below, IP55 for 280TS Frames and above)
- Voltage: 230/460V (Usable on 208V); 150HP and Larger is 460V Only^(1,2)
- Three Phase, 60 Hz, 1.15 Service Factor (Continuous); 50 Hz, 1.0 Service Factor (Continuous)
- CSA Certified for Class I, Div. 2, Groups B, C, D - Temp Code T3 Minimum^(7,8)
- CSA Certified for Class II, Div. 2, Groups F & G - Temp Code T3 Minimum^(7,8,12) (444T and Above)
- Class F Insulation
- Class B Temperature Rise
- NEMA Design B Torques as a Minimum; Various Ratings also Meet Design C
- Cast Iron Frame, End Brackets & Fan Cover and Main Conduit Box⁽⁹⁾
- Grounding Terminal Inside Main Conduit Box
- Oversized Main Conduit Box Rotatable in 90 Degree Increments - F1 Mounted
- Designed for 40°C Ambient Temperature⁽³⁾
- Designed for 3300 ft. Elevation⁽⁴⁾
- Bi-Directional Rotation; Except 2 Pole "Hybrid" and F# 5000 and Larger Ratings are Counter-Clockwise facing the DE
- 1045 Carbon Steel Shaft
- Aluminum Die Cast Squirrel Cage Rotor Construction for F# 140T - 449T
- Copper/Copper Alloy Rotor Construction for F# 5000 and Larger⁽¹⁰⁾
- Paint System: Phenolic Rust Proof Base Plus Polyurethane Top Coat
- Paint Color: Light Gray - Munsell N5.0
- Double Shielded Bearings Pre-Packed with MULTEMP SRL for F# 140T - 280T (Non-regreasable)
- High Quality Ball (or Roller) Bearings Regreasable with Mobil Polyrex™ EM for F# 280TS and Larger
- Automatic Grease Discharge Fittings on Regreasable Models
- Labyrinth Type Metal Flinger on Both Ends for F# 280TS and Larger
- Cast Iron Inner and Outer Bearing Caps for F#280TS and Larger
- Stainless Steel Nameplate
- New Dual Column Design Nameplate as Standard (60/50 Hz)
- Suitable for Inverter Use per NEMA MG-1 Part 31.4.4.2^(5,6,11)
- Inverter Duty Speed Range: 20:1 Variable Torque, 10:1 Constant Torque (350 HP and Larger are 3:1 Constant Torque)⁽¹¹⁾
- 9 Leads for 5 HP and Smaller;
- 12 Leads for 7.5 HP to 125 HP;
- 6 Leads for 150 HP and Larger
- Motors are U.L. Recognized, CSA Approved, CE Marked. ABS Design Assessment from 250 HP-800 HP⁽¹¹⁾
- Dual Drilled Feet Available on Most Ratings - Longer Frames (i.e. 145T Drilled also for 143T)
- 2-Pole Motors 600 HP and Larger are Form Wound and Insulated Non-Drive End Bearing
- Rubber Dust Flinger on Drive-End for F# 140T - 280T
- Catalog Numbers Ending in "R" Come Standard with Roller Bearings for Belted Applications.

EXTRAS/ OPTIONS:

Please refer to pages 147 - 154 for common modifications that can be performed.

Notes:

- (1) TWMC carries minimal MAX-E1® 575V stock; please check availability to ensure required motors are available. Ratings may be available from our Canadian warehouses at a higher price or from our factory with a longer lead time. Pricing and lead time may vary.
- (2) Motors 7.5 HP & up are Suitable for Wye/Delta Starting.
- (3) Consult a Stock Product Application Specialist for suitability in higher ambient environments.
- (4) Consult a Stock Product Application Specialist for suitability at higher elevations.
- (5) Motor service factor is 1.0 when operated on a VFD.
- (6) Precautions should be taken to eliminate or reduce shaft currents that may be imposed on the motor by the VFD as stated per NEMA MG-1. Part 31.
- (7) Catalog# EP3502, EP3504, EP4002T & EP4004T are "Hybrid" ratings; Not CSA Certified (Self-Certify Only) for hazardous locations, and not dual drilled.
- (8) Catalog# EP3006 also not CSA Certified for Hazardous Locations (Self-Certify Only).
- (9) F# 5000 and with Larger with Pressed Steel Plate Main Conduit Box.
- (10) F# 5007 - 5011 8 Pole Ratings are Aluminum Die Cast Squirrel Cage Rotor Construction.
- (11) EP4002T & EP4004T are hybrid frames and not VFD suitable.
- (12) Various temp codes apply to ratings. Consult a product specialist for accurate code.

DATE
JUNE 21, 2005
CATALOG NO.
EP00145

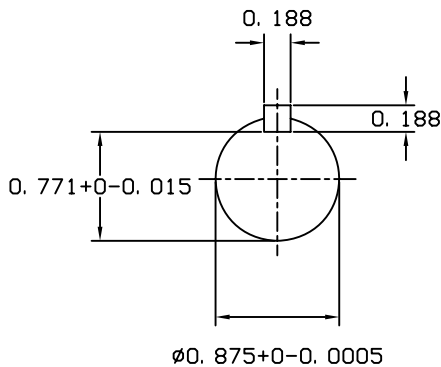
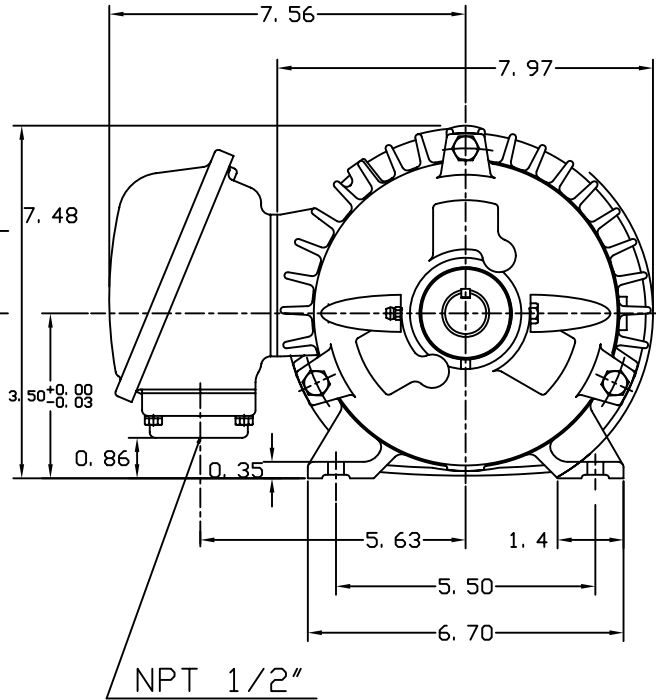
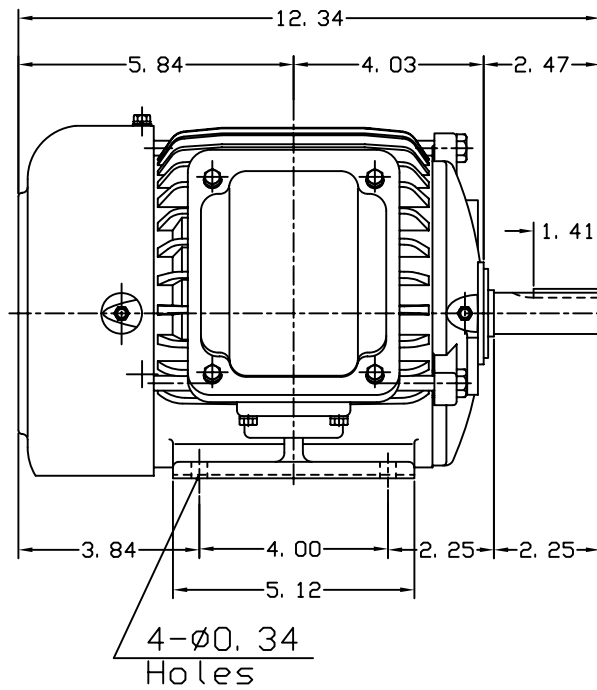
OUTLINE DIMENSIONS 3-PHASE INDUCTION MOTOR

MOTOR TYPE:
AEHH8N
FRAME NO. 143T

Pole	HP	KW	Hz	VOLT	Syn. Speed RPM
4	1	.75	60	575	1800

Ins	Rating	Dimension in	Approx Weight	Bearings
F	CONT.	inch	55 lbs.	DE: 6205ZZ NDE: 6205ZZ

Totally Enclosed Fan-Cooled Type. Squirrel-Cage Rotor.



DWN. J. H. LIANG 11-30-98
CHKD. C. S. LO 12-29-98
APPD. Y. B. HUANG 12-29-98

TECO Westinghouse

DWG NO.
31057H351000

TECO Westinghouse

ISSUED June 28, 2005	PERFORMANCE DATA 3-PHASE INDUCTION MOTOR	ENCLOSURE TEFC
TYPE AEHH8N		CATALOG# EP00145

NAMEPLATE INFORMATION

OUTPUT		POLE	FRAME SIZE	VOLTAGE	HZ	RATED AMBIENT	INS. CLASS	NEMA DESIGN	TIME RATING	SERVICE FACTOR
HP	KW									
1	0.7	4	143T	575	60	40°C	F	C	CONT.	1.15

TYPICAL PERFORMANCE

FULL LOAD RPM	EFFICIENCY				POWER FACTOR			MAXIMUM POWER FACTOR CORRECTION
	FULL LOAD		3/4 LOAD	1/2 LOAD	F. L.	3/4 LOAD	1/2 LOAD	
	MIN. %	NOM. %						
1745	82.5	85.5	84	81.5	73	64.5	51.5	1 KVAR

CURRENTS

NO LOAD			FULL LOAD			LOCKED ROTOR			NEMA KVA CODE LETTER
AT	AT	AT	AT	AT	AT	AT	AT	AT	
VOLT	575 VOLT	VOLT	VOLT	575 VOLT	VOLT	VOLT	575 VOLT	VOLT	
	0.64			1.20			12.00		

TORQUE

INERTIA

ACCEL TIME

FULL LOAD lb-ft	LOCKED ROTOR %FLT	PULL UP %FLT	BREAK DOWN %FLT	ROTOR WR ² lb-ft ²	NEMA LOAD WK ² lb-ft ²	MAX ALLOWABLE WK ² lb-ft ²	NEMA LOAD WK ² Sec	MAX ALLOWABLE WK ² Sec
3.009	310	280	410	0.086	5.8	46	3.41	26.70

SAFE STALL TIME IN SECONDS

ALLOWABLE STARTS PER HOUR

SOUND PRESSURE LEVEL @ 3 FT dB(A)

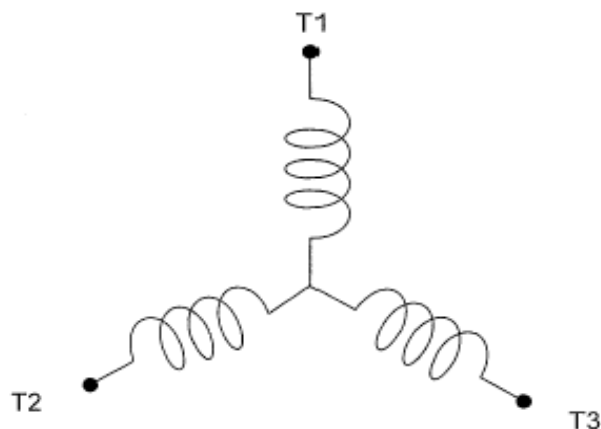
COLD	HOT	COLD	HOT	49
71	50	2	1	

APPROVED:	M. PRATER	DRAWING NO.	31057EP00145	REVISION 0
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DATE:
July 7, 2005

CONNECTION DIAGRAM

CATALOG NO.:
EP00145



SCHEMATIC - Y CONNECTION

ACROSS THE LINE CONNECTION



575 VOLT CONNECTION

Cycloidal Speed Reducer Information

Cycloidal Speed Reducer Features

WesTech premium drive units for clarifier and thickener mechanisms employ a cycloidal type gearless reducer for high efficiency and reliability. The summary below explains the reasons why WesTech chooses to use cycloidal drives rather than old-fashioned worm and other conventional gearing wherever possible.

Efficiency

Great efficiency even at high ratios means less power input for the same output.

At 87:1 reduction the cycloidal reducer can achieve 95 percent efficiency. This reduction ratio is achieved in one stage using the cycloidal drive reducer. In comparison, an average worm gear reducer with an 87:1 ratio would have a maximum efficiency of 60 percent and would require more than one stage.

Long Life

Long life for less frequent replacements and lowered maintenance budgets.

The long life of the cycloidal drive is due to its unique rolling action where high carbon chromium bearing steel is utilized on the wearing parts. This reducer does not use the sliding engagement that is translated into heat and wear that is used in most other types of gear reducers.

500 Percent Overload Capacity

500% Overload Capacity means unmatched strength.

At least two thirds of the cycloidal drive's teeth (lobes) are engaged at one time. Compare that to a conventional reducer: one or two teeth absorb the shock. Conventional reducer teeth also have a shear point. In the cycloidal drive there is no shear point.

Compactness

Compactness gives you more space to work.

The cycloidal drive is considerably smaller than conventional reducers.

A wide range of ratios available:

- Single stage reduction, ratios from 11: 1 to 87: 1.
- Double stage reduction, ratios up to 7,569: 1.
- Triple stage reduction, ratios up to 658,503: 1.
- Input horsepower ranges from 1/4 HP to 150 HP.
- Both horizontal and vertical mountings are available.

Cycloidal Speed Reducer Operating Principles

The cyclo is a speed reducer without gears that operates differently than the helical or worm gearing that most customers are familiar with. Its main components are the eccentric cam, the cycloidal disc, and the ring gear housing.

The unique, rolling-action operation of these components allows Sumitomo to offer a 500 percent momentary shock capacity. These components have a standard two year warranty. No other manufacturer offers these benefits. Sumitomo has manufactured over 5 million of these reducers since 1939.

The eccentric cam, mounted on the input shaft, rotates inside the bore of the cyclo disc forcing the cycloidal disc to roll inside the ring gear housing. Each complete revolution of the input shaft advances the cyclo discs one tooth in the opposite direction achieving reduction ratios up to:

- 87:1 in a single stage reducer
- 7,569:1 in just two stages

All of the rolling components are manufactured with 52,100 high carbon chromium bearing quality steel. The number of lobes (rather than teeth) on the cyclo disc and the number of rollers in the ring gear housing determine the ratio, i.e., 29:1 reduction will have a cyclo disc with 29 lobes and a ring gear housing with 30 rollers.

Other ratios such as 6, 8, 11, 17, 21, 35, 43, 59, 71, and 87 all have the same characteristics of having one more roller in the ring gear housing than there are lobes on the cyclo disc. The double-eccentric, two-disc cyclo design allows two-thirds of the cyclo lobes to be in contact to transmit torque at any one time.

This relates to a greater load sharing and higher shock capacity than in helical type reducers which have only one or two teeth in contact. It is virtually impossible to break a lobe on a cyclo disc. Applied correctly, negligible wear occurs even after years of operation.

The flanged output shaft is designed with pins and rollers that fit into larger holes machined in the cyclo disc. As the cyclo disc rolls inside the ring gear housing, the output shaft pins are driven in the opposite direction of the input shaft at the reduced output speed.

The features and benefits of this design provide for torque ratings from hundreds of inch-pounds to over 500,000 inch-pounds. Many models can be built with grease lubrication for virtually maintenance-free operation. Optional mounting configurations and compact size make the cyclo adaptable to most applications.

Municipal Clarifiers and Thickeners^[1]

1750 RPM

Output RPM	2.08	1.74	1.4	1.18	0.946	0.847	0.69	0.575	0.503	0.394	0.341	0.283	0.231	Frame Size
Ratio	841	1003	1247	1479	1849	2065	2537	3045	3481	4437	5133	6177	7569	
Minimum Input HP	-	-	-	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	-	-	6145DA
Overhung Load (lbf)	3590	3590	3530	3590	3530	3590	3590	3590	3590	3590	3590	-	-	
Application Specific Torque (lbf in)	20000	22200	22200	20000	22200	22200	22200	20000	22200	20000	20000	-	-	
Minimum Input HP	-	-	-	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	6145DB
Overhung Load (lbf)	3550	3590	3530	3590	3530	3590	3590	3590	3590	3590	3590	3590	3590	
Application Specific Torque (lbf in)	22200	22200	22200	20000	22200	22200	22200	20000	22200	20000	20000	20000	20000	
Minimum Input HP	-	-	-	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	6145DC
Overhung Load (lbf)	3550	3590	3530	3590	3530	3590	3590	3590	3590	3590	3590	3590	3590	
Application Specific Torque (lbf in)	22200	22200	22200	20000	22200	22200	22200	20000	22200	20000	20000	20000	20000	
Minimum Input HP	-	0.54	0.54	0.54	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	6160DC
Overhung Load (lbf)	4960	4960	4960	4960	4960	4960	4960	4960	4960	4960	4960	4960	4960	
Application Specific Torque (lbf in)	28200	28200	28000	28200	28000	28200	28200	28200	28200	28200	28200	28200	28000	
Minimum Input HP	-	-	0.54	0.54	0.54	-	0.27	0.27	0.27	0.27	0.27	0.27	0.27	6165DC
Overhung Load (lbf)	4960	4960	4960	4890	4960	4960	4960	4890	4960	4890	4890	4890	4890	
Application Specific Torque (lbf in)	33800	33800	33800	32900	33800	33800	33800	32900	33800	32900	32900	32900	32000	
Minimum Input HP	-	-	-	0.54	0.54	0.54	-	0.27	0.27	0.27	0.27	0.27	0.27	6170DC
Overhung Load (lbf)	6640	6640	6640	6640	6640	6640	6640	6640	6640	6640	6640	6640	6640	
Application Specific Torque (lbf in)	35600	35600	35600	35600	35600	35600	35600	35600	35600	35600	35600	35600	35000	
Minimum Input HP	-	-	-	-	0.54	0.54	0.54	-	0.27	0.27	0.27	0.27	0.27	6175DC
Overhung Load (lbf)	6640	6640	6640	6640	6640	6640	6640	6640	6640	6640	6640	6640	6640	
Application Specific Torque (lbf in)	44300	44300	44300	44300	44300	44300	44300	44300	44300	44300	44300	44300	44000	
Minimum Input HP	-	-	1.01	1.01	-	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	6180DB
Overhung Load (lbf)	9370	9370	9370	9370	9370	9370	9370	9370	9370	9370	9370	9370	9370	
Application Specific Torque (lbf in)	49700	49700	49900	49900	49900	49700	49700	49900	49700	49900	49900	49900	49000	
Minimum Input HP	-	-	-	1.01	1.01	1.01	-	0.54	0.54	0.54	0.54	0.54	0.54	6185DB
Overhung Load (lbf)	9370	9350	9370	9370	9370	9350	9350	9370	9350	9370	9370	9370	9370	
Application Specific Torque (lbf in)	61500	61500	61500	61500	61500	61500	61500	61500	61500	61500	61500	61500	61000	
Minimum Input HP	-	-	-	-	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	6190DA
Overhung Load (lbf)	13200	13200	13200	13200	13200	13200	13200	13200	13200	13200	13200	13200	13200	
Application Specific Torque (lbf in)	102600	102600	102600	102600	102600	102600	102600	102600	102600	102600	102600	102600	102600	
Minimum Input HP	-	-	-	-	-	-	-	-	-	-	-	-	-	6190DB
Overhung Load (lbf)	-	-	-	-	-	-	-	-	-	-	-	-	-	
Application Specific Torque (lbf in)	-	-	-	-	-	-	-	-	-	-	-	-	-	

Table Notes^[1]:

Please provide Special Specification Code (SSC) YAE8 when placing an order.

Metric Shafts are required.

Minimum Input HP = values are to overcome breakaway torque requirements in cold temperatures or high inertia applications. Minimum HP motor assuming a torque limiting device is being used.

* = units are susceptible to grease de-rate.

The application criteria is:

- Load profile based on the experience of WesTech Engineering in municipal water treatment applications.
- Reducer is operated in conjunction with a torque limiting device.
- Starts/stops less than 10 times per year.
- Continuous duty.
- Proper maintenance.

Speed Reducers

Selection Tables

A Unique Concept . . .

The word CYCLO . . .

. . . derives from *Kyklos* the Greek word for *circle* and refers to the CYCLO disc, whose outer profile describes a cycloidal curve.

Features & Benefits of the CYCLO concept

• Outstanding Reliability – 2 Year Warranty

CYCLO speed reducers are noted for outstanding reliability and extended operating lifetime – 20 years of problem-free performance is not unusual. This reliability is due in part to the high material specifications, component quality controls and careful assembly procedures. It also results from the *total absence of sliding friction*. Correctly sized and selected CYCLO speed reducers and gearmotors are covered by a two year warranty.

• High Overload Capacity – 500% plus

CYCLO speed reducers have the strength to withstand over-loads that can break the teeth of other reducers.

Here's why:

At least 30% of the CYCLO's unique disc profiles share shock

of overload and the components are in *compression* – so they cannot be sheared off.

Compare that to conventional helical gear reducers, where one or two teeth must absorb the entire shock and are more prone to catastrophic failure.

• Overall Economy

Competitive initial cost, high reliability, long life and minimal maintenance give CYCLO speed reducers superior overall economy when compared to conventional gear boxes.

• Ideal for Highly Dynamic Applications

Since inertia is very low, the CYCLO speed reducer is ideally suitable for frequent start-stop-reversing duties and the combination with a frequency inverter.

• High Efficiency – Even at High Ratios

Torque transmitting parts have rolling action with minimal friction, so the overall efficiency is as high as 95% in single reduction units.

• Compact Size

Reduction ratios from 6:1 to 119:1 are available for the single stage. Triple reduction stages offer ratios up to nearly 1,000,000:1.

Additional Value

Sumitomo, THE ORIGINAL CYCLO, offers these additional benefits:

• Total Quality

Precision manufacturing and unmatched Quality Assurance insure consistent product performance.

• 70 Years of Product Development

The unique CYCLO operating principle was invented by the German engineer Lorenz Braren in 1931 and his ingenious design has continued its progressive development until the present day.



• Over 7,000,000 Units Sold

CYCLO speed reducers are in daily use in industries throughout the world replacing the more conventional helical, worm and spur gear units.

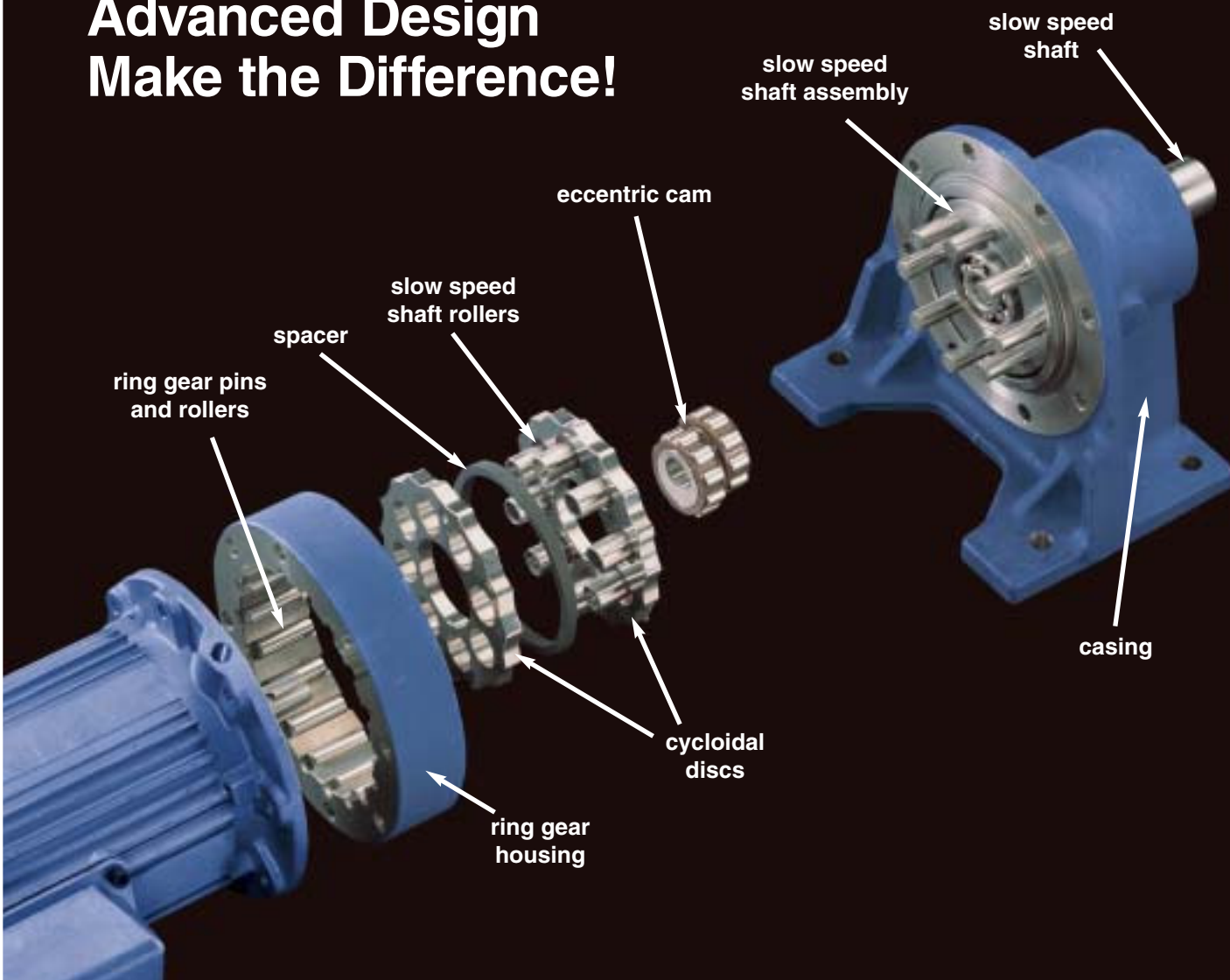
• Many Options . . .

. . . in mechanical and electrical power transmission and control are offered in the complete CYCLO product range. Right Angle, Offset, Hollow Shaft, and Bushing Mounted variations are readily available.

• Worldwide Product Support

Fast, competent technical assistance with selection, installation and after-sales service is available from production and distribution centers throughout the world.

...Fewer Parts & Advanced Design Make the Difference!



Quiet, Dependable, Consistently Long Life

- **Quieter Operation**

Super finishing of rotating components provides smoother rolling action

- **Higher Ratings**

Optimized design imparts more uniform internal load distribution

- **Longer Life**

Improved internal gearometry extends already long life

- **Reduced Backlash**

Decreased internal clearances for high performance requirements

- **Total Dependability**

Torque transmitting parts are made from fully hardened, vacuum degassed bearing grade steel

- **Absolute Consistency**

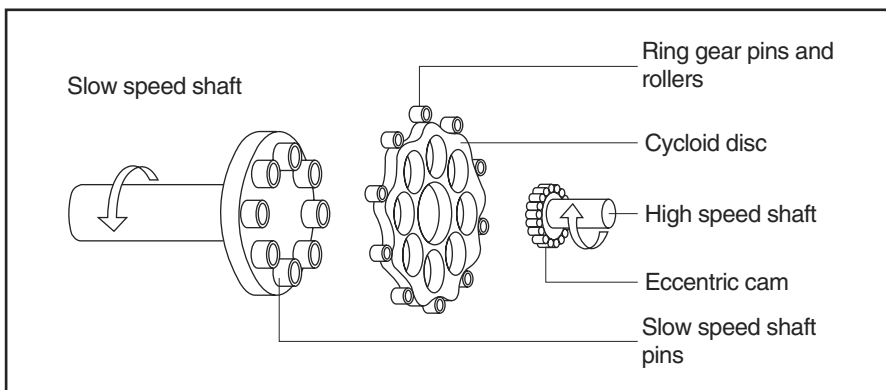
Stringent manufacturing process and assembly controls assure reliability

HOW IT WORKS

The unique SM-CYCLO® speed reducing system is based on an ingeniously simple principle that offers many benefits to the designer and user of power

transmission drives. Basically, the speed reducer has only three major moving parts:

1. **High speed input shaft with integrally mounted eccentric cam and roller bearing assembly**
2. **Cycloid discs**
3. **Slow speed shaft assembly**



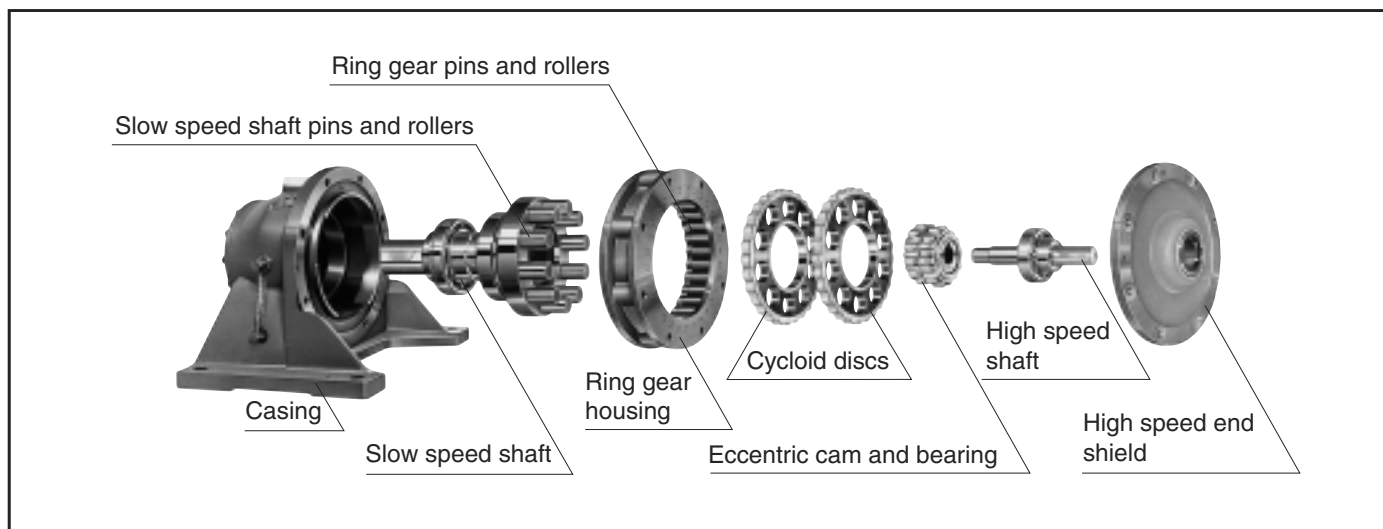
As the eccentric cam rotates, it rolls the cycloid discs around the internal circumference of the stationary ring gear.

The resulting action is similar to that of a wheel rolling around the inside of a ring. As the wheel (cycloid disc) travels in a clockwise path around the ring (ring gear housing), the wheel itself turns slowly on its own axis in a counter-clockwise direction. In the SM-CYCLO® system the cycloidal profile around the outer edge of the disc engages progressively with the rollers of the fixed ring gear housing to produce a reverse rotation at reduced speed. For each complete revolution of the high speed shaft, the cycloid disc turns one cycloidal tooth in the opposite direction. In general, there is one

less cycloidal tooth around the disc than there are pins in the fixed ring gear housing, which results in reduction ratios equal to the number of cycloidal teeth on the disc. (Note: For some ratios, there are two less teeth per cycloid disc than there are pins in the ring gear housing.)

The reduced rotation of the cycloid discs is transmitted to the slow speed shaft by means of drive pins and rollers that engage with holes located around the middle of each disc.

Typically, a two disc system is used with a double eccentric cam which increases the torque capacity and offers an exceptionally smooth, vibration-free drive.

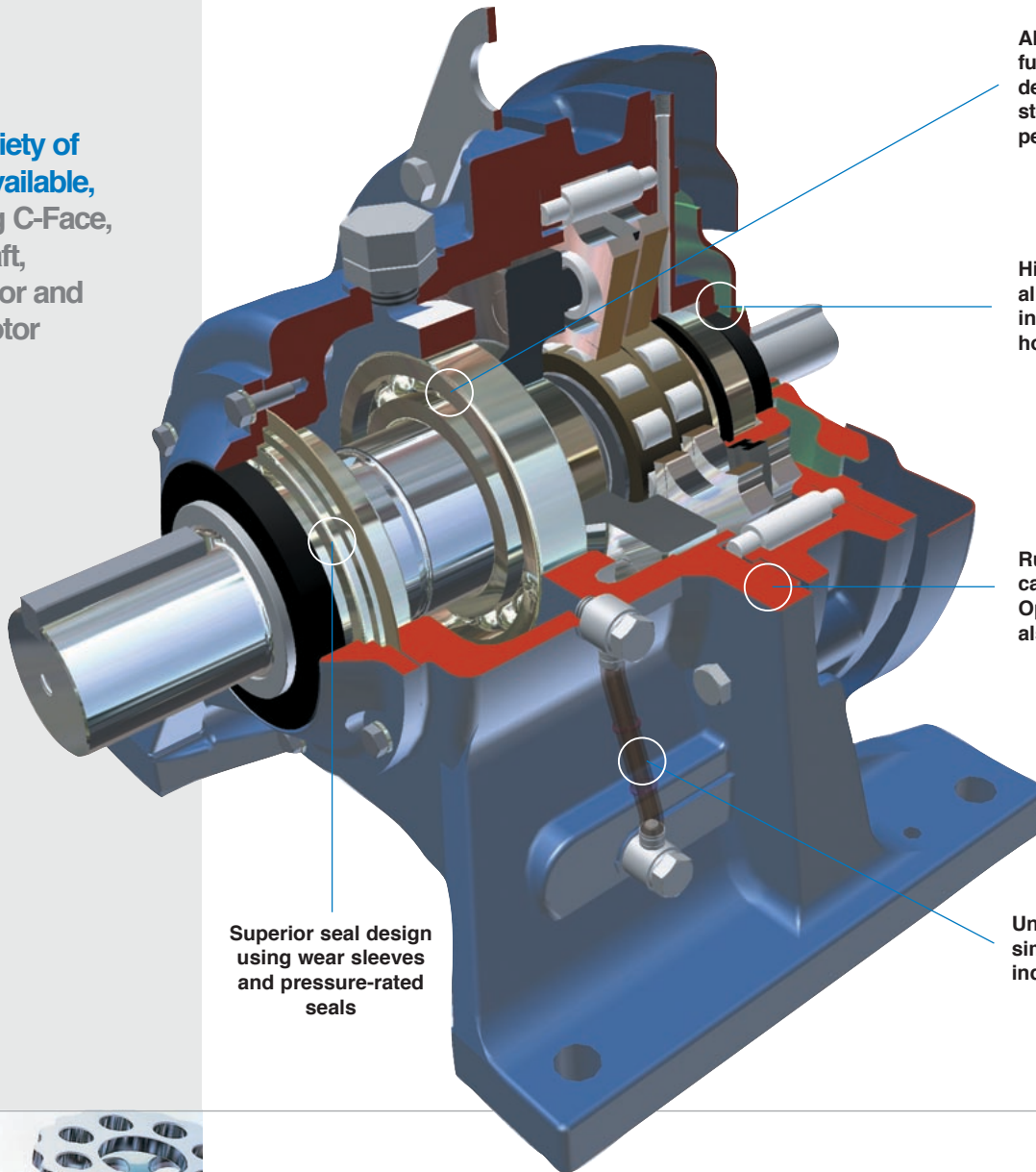




Cyclo® 6000

High Torque Density, High Reliability Cycloidal Speed Reducers and Gearmotors

- ▶ **Wide variety of inputs available, including C-Face, Free-Shaft, Gearmotor and Brakemotor**



All rotating components are fully hardened, vacuum degassed bearing grade steel, for consistent, reliable performance

High power density, all reduction contained in compact ring gear housing

Rugged, shock-resistant cast iron housing. Optional ductile iron also available

Superior seal design using wear sleeves and pressure-rated seals

Unique oil sight gauge for simple, visible lubrication indication

Unmatched Reliability, Exceptional Performance

- ▶ Cyclo® speed reducers and gearmotors are **designed to withstand shock loads exceeding 500%** of their ratings



Product Description

The Sumitomo Cyclo® drive is **unsurpassed by any other inline drive** available in the market today. **Cyclo®'s unique cycloidal design** has advantages superior to speed reducers using common involute tooth gears. Cyclo® components operate in compression, not in shear. Unlike gear teeth with limited contact points, a Cyclo® has two thirds of its reduction components in contact at all times. Cyclo® speed reducers and gearmotors are **designed to withstand shock loads exceeding 500%** of their ratings, and provide exceptional performance, reliability and long life in the most severe applications.

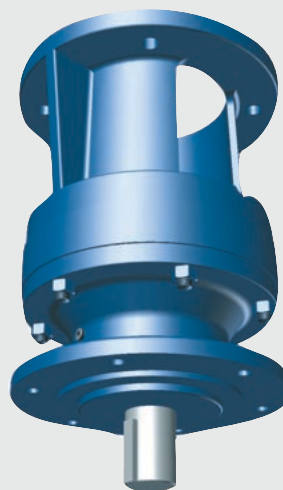
Features & Benefits

- **Highest overload capacity**, exceeding 500%
- **Exceptional life** with a 24 month warranty
- **High efficiency**, even at high reduction ratios
- Versatile, available as inline speed reducer or gearmotor
- Ideal for **severe, high shock** applications
- Optional grease lubrication for **no maintenance**

Specifications

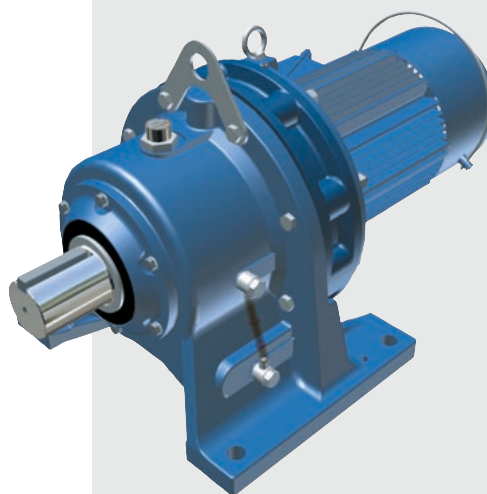
Sizes:	23 models (5lbs to 5000lbs)
Torque Rating:	210 to 603,000 lb in
HP Rating:	.10 to 232 HP
Ratio Range:	3 to 119 (single), 121 to 7569 (double), 8041 to 658,503 (triple)
Mounting:	Foot, Flange, Face Mount
Motor Standards:	NEMA, IEC, JIS, UL, CSA, CE

- **Sumitomo's Cyclo® 6000 has extremely high torque density** and is available as an inline speed reducer or gearmotor



Reducer

- Simple, Compact Design
- Rugged Forged Output Shaft
- Many Mounting Styles
- C-Face, Shovel Base & Top Mount Options



Gearmotor

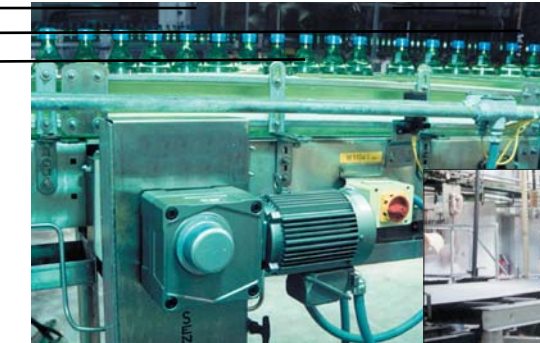
- Connection free design
- Rugged forged output shaft
- Direct acting brake option
- Unmatched durability



► Applications

- Conveyors
- Food Machinery
- Mixers
- Automotive Plants
- Recycling Machines
- Poultry Plants
- Sawmills and Wood Mills
- Wastewater Treatment
- Steel Mills
- Construction Equipment
- Paper Mills
- Processing Plants

Bottling/Baking



Steel hypoid gear technology, maintenance-free grease lubrication and a compact modular housing makes the Hyponic® an efficient performer in the food industry.



A 15-hp Beier mechanical variable speed drive with electric remote control provides an adjustable, steady speed range for this 350-ft. oven band conveyor.

Water Treatment



Each of these Sumitomo Paramax® speed reducers helps pump up to 13 million gallons a day at this state-of-the-art wastewater treatment facility in the City of Clearwater, Florida.



Cyclo® mixer drives are a key component of this award-winning water treatment facility in Hillsborough County, Florida.

Material Handling



Sumitomo Paramax® reducers provide quiet, reliable operation for both the hoist and trolley drive systems in this 35-ton capacity DC Trolley Hoist used for heavy-duty coil handling service.



Custom Designs



In less than 20 minutes, 96 Sumitomo Cyclo® Bevel Buddybox gearmotors help retract the 13,000-ton roof on Seattle's Safeco Field.

The Sumitomo gearmotors, on eight travel truck assemblies, turn 128 36" wheels.

Wood Products

Sumitomo Cyclo® drives are an integral part of this manufacturing plant which produces 150,000 board feet of unfinished strip and plank hardwood flooring each week.

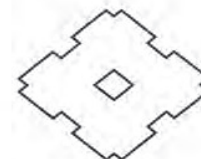


Once flooring is side-matched, it is inspected for defects. This conveyor, driven by Sumitomo Cyclo® drives, carries defective material to the hammer mill.

Steel



After molten steel is formed in the five-strand continuous caster at this steel mill, it is conveyed by Sumitomo Cyclo® drives on the auto-torch conveyors where the steel is cut into billets.



Lubricants

Grease Lubricated Models

Those models listed in Tables A-3 ~ A-6 as grease lubricated are filled with grease before shipment to the customer and are ready for use.

Table A-7. Standard Greases^[1]

Ambient Temperature ^[2]		Cyclo [®] Disc-Type	Cyclo [®] Planetary-Type
°F	°C		
14 to 122	-10 to 50	Exxon Unirex N2 Grease	Shell Gadus S2 V220 0 Grease

Table A-8. Grease Replenishment and Change Interval

Model	Condition		Interval ^[3]
Maintenance Free Type: Single (6060 to 6125) Double Reduction (6065DA to 6125DB)	Replenishment		NOT REQUIRED
	Overhaul ^[4]		Every 20,000 Hours or Every 4 ~ 5 Years
Non- Maintenance Free Type	Replenishment	Less Than 10 Hours Per Day Operation	Every 3 ~ 6 Months
		10 ~ 24 Hours Per Day Operation	Every 500 ~ 1000
	Change	Speed Reducer Mechanism, High Speed Shaft Bearings (Speed Reducer Type)	Every 2 ~ 3 Years
		Slow Speed Shaft Bearings	Every 3 ~ 5 Years

Replenishment and Change Guidelines

Those units designated as maintenance free in Tables A-3 ~ A-6 do not require replenishment when supplied with standard greases. Certain optional greases do require replenishment. Those units will have a Zerk fitting either on the high speed endshield or near the input shaft bearing housing.

Replenish grease to the reduction mechanism with 1/3 to 1/2 of the quantity listed in Table A-9 or A-10 at the interval recommended in Table A-8. Remove the drain plug from gearbox output section. Replenish grease through the Zerk fitting. After inserting the recommended amount of grease run the unit for five or 10 minutes to circulate the grease and purge any excess. Replace the drain plug and return to service.

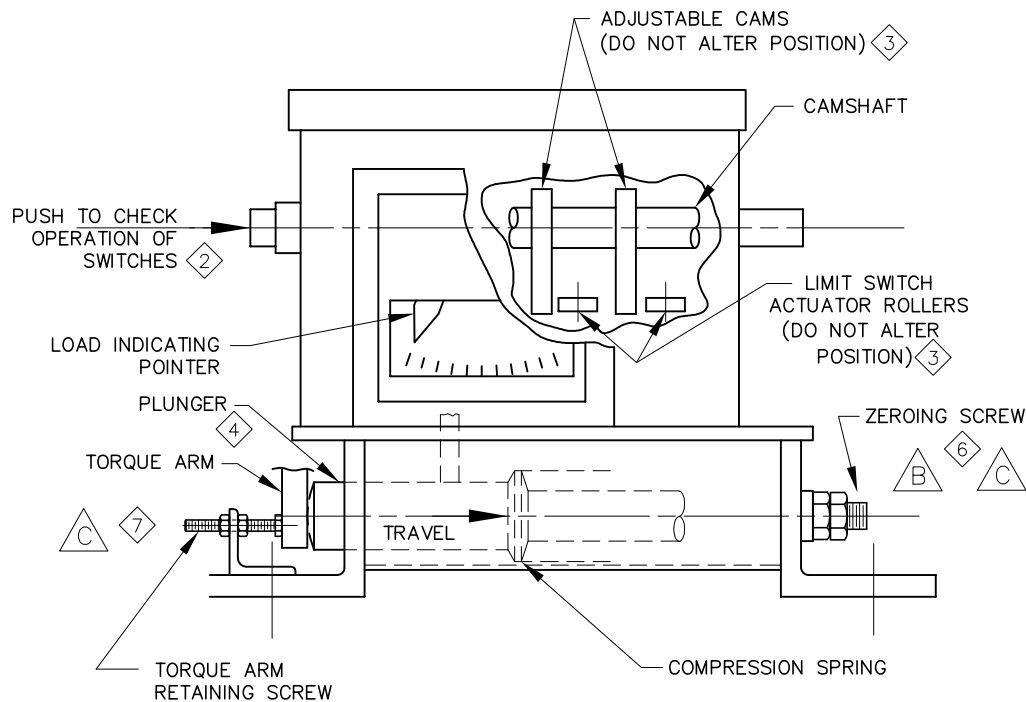
When the unit is disassembled for overhauling, refill with the grease quantities indicated in Table A-9 or A-10. Or alternatively, 80% of the space around the reduction mechanism and slow speed shaft

bearings of single reduction units, and 50% around the reduction mechanism of both the first and second stage of double reduction units.

Apply grease liberally to the central part (i.e., around the eccentric bearings) of the mechanism. Apply grease to both the slow speed and high speed shaft bearings as you would to ordinary bearings at the time or re-assembly.

If excessive grease is added, agitation heating of the grease will raise the operating temperature of the unit. Avoid excessive greasing, but do not supply an insufficient amount of grease. When the grease is insufficient, it will raise the unit's operating temperature due to breakdown of the lubrication films on the eccentric bearing. In this case, if the operating temperature rises, supply grease immediately.

Torque Control Information



- (5) TORQUE TRANSMITTER (OPTIONAL) SHALL BE CALIBRATED TO SHOW 4ma AT ZERO TORQUE AND 20ma AT FULL DIAL TORQUE.
- (6) NUTS ON ZEROING SCREW CAN BE ADJUSTED TO BRING LOAD INDICATING POINTER UP TO ZERO. TORQUE ARM RETAINING SCREW SHOULD NOT BE USED TO ADJUST THE POINTER.
- (7) RETAINING SCREW IS INTENDED TO KEEP THE TORQUE ARM IN PLACE AND TOUCHING THE PLUNGER AT THE ZERO POSITION ON THE SCALE. THE RETAINING SCREW/BRAKET IS INTENDED TO BEND OR BREAK IF THE DRIVE IS RUN IN REVERSE. THIS PROTECTS THE MECHANISM FROM MORE COSTLY DAMAGE.

- (1) THE TORQUE CONTROL IS AN ELECTRO - MECHANICAL DEVICE DESIGNED TO PROTECT THE DRIVE AND MECHANISM FROM OVERLOAD CAUSED BY EXTREME TORQUE BUILD - UP DUE TO A VARIETY OF UNUSUAL OPERATING CONDITIONS.

THE DEVICE IS ACTUATED BY THE TORQUE ARM OF THE ADAPTER PLATE UPON WHICH THE SPEED REDUCER IS MOUNTED, SUPPORTED BY A PIVOT BEARING, WHICH IS FREE TO ROTATE IN REACTION TO THE TORQUE LOAD BEING IMPOSED UPON THE SPEED REDUCER. THE TORQUE ARM EXERTS A FORCE AGAINST A CALIBRATED COMPRESSION SPRING. AS TORQUE ON THE SCRAPER MECHANISM INCREASES THE SPRING DEFLECTION MOVEMENT IS TRANSMITTED BY A VERTICAL ROD TO THE SHAFT UPON WHICH THE CAMS ARE MOUNTED. THE POSITION OF THE CAMS TO THE ROLLERS OF THE LIMIT SWITCHES HAS BEEN SET IN WESTECH'S SHOP FOR ALARM AND CUTOFF. THE PERCENTAGE OF TORQUE LOAD IS INDICATED BY A POINTER AND A SCALE VISIBLE FROM THE FRONT OF THE UNIT. UNDER NORMAL CONDITIONS TORQUE WILL NOT BE SUFFICIENT TO ACTUATE THE ALARM CONTROLS.

AS THE TORQUE INCREASES AND THE POINTER MOVES TOWARDS THE UPPER PORTION OF THE PERCENTAGE SCALE AN ALARM IS ACTUATED ALERTING THE OPERATOR OF AN IMPENDING OVERLOAD. IF THE OVERLOAD CONDITION IS NOT CORRECTED AND CONTINUES TO BUILD UP UNTIL THE SECOND SWITCH IS ACTUATED, THE DRIVE MOTOR WILL CUT - OUT AND THE MECHANISM WILL AUTOMATICALLY STOP. WITH THE SCRAPER ARMS STOPPED THERE IS NO OVERLOAD FOR THE TORQUE CONTROL TO READ, SO WHILE THE OVERLOAD CONDITION IS BEING CORRECTED, MEANS MUST BE PROVIDED IN THE ELECTRICAL CONTROLS TO PREVENT THE MOTOR FROM COMING ON PREMATURELY.

- (2) TO CHECK THE OPERATION OF SWITCHES, THE CONDITIONS OF AN OVERLOAD MAY BE SIMULATED BY PUSHING THE BRASS ROD COVERED WITH A RUBBER CAP LOCATED ON THE LEFT SIDE OF THE UNIT. THIS IS TO BE DONE AT THE TIME OF START - UP AND WEEKLY AFTER THE MACHINE IS PUT INTO OPERATION.
- (3) DO NOT ALTER THE FACTORY SET POSITION OF LIMIT SWITCH ACTUATORS AS DAMAGE TO THE DRIVE AND MECHANISM CAN OCCUR. THIS ALSO VOIDS ANY WARRANTY.
- (4) SPRAY OIL (WD-40 OR EQUAL) WEEKLY TO LUBRICATE THE PLUNGER FOR FREE MOVEMENT.

TORQUE CONTROL DEVICE

DESCRIPTION

TYPE

SIZE

				NONE	11-03	MPW	NK	JJ
DATE	STD. BY	STD.CHKD.	STD.APPVD	SCALE	DATE	PROJ. BY	PROJ.CHKD.	PROJ.APPVD

ALL COMPONENTS MUST BE FABRICATED AND MACHINED ACCORDING TO WESTECH STANDARD SPECIFICATION (DRAWING P24Z-024A), UNLESS SPECIFICALLY NOTED ON THIS DRAWING.

This drawing is property of WESTECH ENGINEERING, INC. and is transmitted in confidence. Neither receipt nor possession confers or transfers any rights to reproduce, use, or disclose, in whole or in part, data contained herein for any purpose, without the written permission of WESTECH ENGINEERING, INC., Salt Lake City, Utah

ADDED SECOND NUT TO RETAINING SCREW, ADDED NOTES 6 AND 7	TAP	JJ	11-07	
ADDED SECOND NUT TO ZEROING SCREW	RHS	JAJ	03/06	
NOTE 5 ADDED, OR EQUAL ADDED	DK	JJ	5-04	
REVISION	BY	CHKD	DATE	LTR

Westech	DRAWING NUMBER	PROJECT NUMBER	REV.
	7 - 8222 B1		








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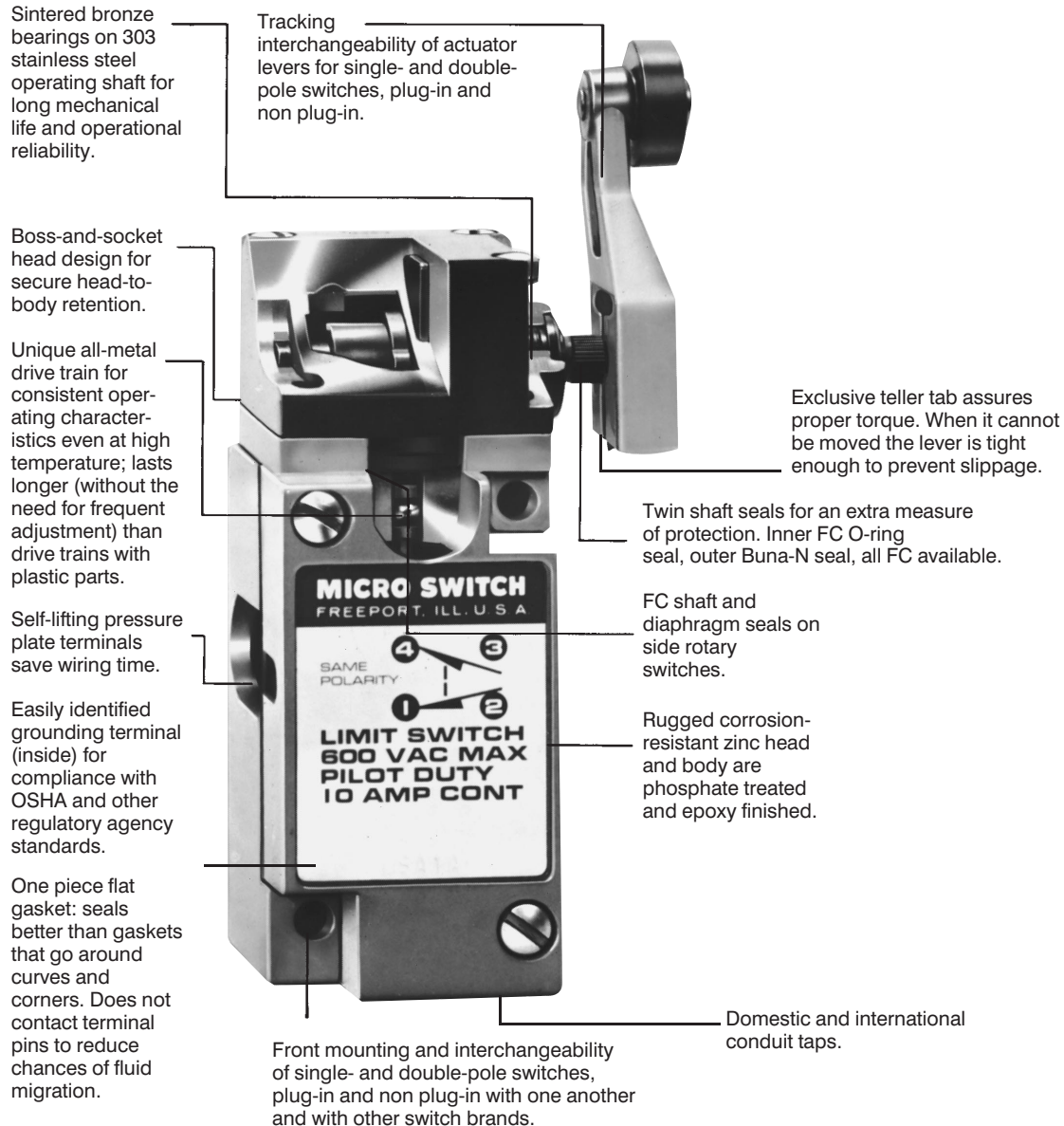
87

Heavy Duty Limit Switches

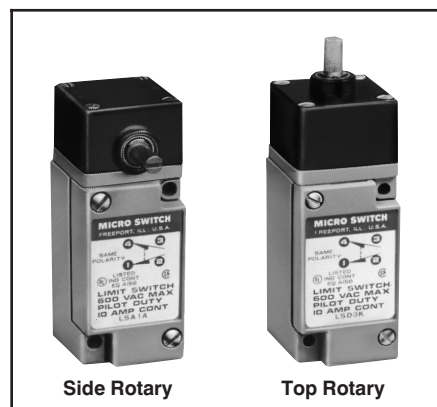
ADDITIONAL FEATURES AND OPTIONS

- Wide variety of operating heads
- Field adjustable operating modes, for reduced inventory
- Convenience of on-the-spot adjustment instructions
- Complete choice of circuitry and electrical rating options, including solid state switching
- Plug-in and non plug-in versions have identical operating characteristics and are dimensionally interchangeable
- Manifold (rear-wire) version
- NEMA 1, 3, 4, 4X, 6, 6P, and 13*
- UL Listed, file #E37138
- CSA Certified, file #LR57326
- Explosion-proof version page A113
- Low temperature versions to -40°F (-40°C) page A42
- Captive head and body screws
- Designed to withstand seismic shock
- Stainless steel (NEMA 4X) version page A47
- Preleaded cable or prewired connector types page A42
- Epoxy filled wash down (NEMA 6P) types page A44
- Completely fluorocarbon (FC) sealed versions page A42

* Depending on operating head, prewired connector or cable, enclosure ratings may vary. For enclosure rating information on specific catalog listings, contact the 800 number.



Rotary Actuated Switches



Side Rotary

Top Rotary

Order guides below and on page A35 provide specification and pricing information for side and top rotary switches.

Plug-in body style catalog listings consist of the complete plug-in base receptacle.

Levers are ordered separately. See pages A37-A39 for lever selection.

For rapid response – off the shelf service, all **bold face** listings are normally stocked items.

For low temperature, high temperature or preleading see page A42.

ASSEMBLED CONDITIONS

Catalog listings in order guide below are factory assembled with:

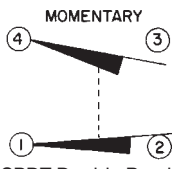
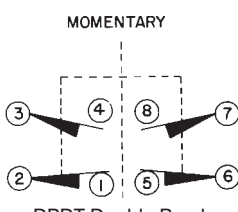

- Shaft of side rotary heads facing front of switch (label side).
- Head adjusted for both clockwise and counterclockwise operation.
- Light on indicator versions wired to N.O. circuit.

Refer to facing page to specify modifications to these assembled conditions.

PRELEADED OR CONNECTORIZED VERSIONS

Refer to page A42.

ORDER GUIDE (Momentary action. UL listed, CSA certified, CE approved. Levers not included. Order separately pages A37-A39.)

Circuitry	Electrical Rating	Body** Style	Catalog Listings					
			Standard	Low Differential	5° Pretravel	Low Torque	Low Differential Low Torque	Top Rotary High Overtravel
Silver contacts	A	Plug-in 1/2" Conduit	LSA1A	LSP1A	LSU1A	LSR1A	LSH1A	LSB1A
Gold cross point contacts	C	Plug-in 1/2" Conduit	LSA1J		LSU1J	—	—	LSB1J
Gold plated contacts	C		LSA1E	LSP1E	—	LSR1E	LSH1E	—
Silver contacts	A*	120 V Ind. lite Plug-In* 1/2" Conduit	LSA5A	LSP5A	LSU5A	LSR5A	LSH5A	LSB5A
	A*	240 V Ind. lite Plug-In 1/2" Conduit	LSA8A	LSP8A	LSU8A	LSR8A	LSH8A	LSB8A
	A*	24 V LED lite 1.5mA max. Auto polarity Plug-in 1/2" Conduit	LSA9A	LSP9A	LSU9A	LSR9A	LSH9A	LSB9A
 SPDT Double Break	A	Non plug-in 1/2" Conduit	LSA3K	LSP3K	LSU3K	LSR3K	LSH3K	LSB3K
Silver contacts	B	Plug-in 3/4" Conduit	LSA2B	LSP2B	LSU2B	LSR2B	LSH2B	LSB2B
 DPDT Double Break	B	Plug-in 1/2" Conduit	LSA6B	LSP6B	LSU6B	LSR6B	LSH6B	LSB6B
	B	120 V Ind. lite Plug-in 3/4" Conduit	LSA2R	LSP2R	LSU2R	LSR2R	LSH2R	LSB2R
	B	Non plug-in 3/4" Conduit	LSA4L	LSP4L	LSU4L	LSR4L	LSH4L	LSB4L
	B	Non plug-in 1/2" Conduit	LSA7L	LSP7L	LSU7L	LSR7L	LSH7L	LSB7L
 SPNC Direct Acting	D	Non plug-in 1/2" Conduit	LSA3N			LSR3N		LSB3N

*Use at voltage indicated for light. Wired to N.O. circuit.

Upper temperature limit for lighted units is 200°F (93°C).

**Plug-in listings include base receptacle.

OPERATING CHARACTERISTICS

Pretravel (degrees max.)		15	9	5	15	9	25
Differential Travel (degrees max.)	SPDT	5	3	3	5	3	10
	DPDT	7	4	4	7	4	12
Overtravel (degrees min.)		60	66	70	60	66	110
Operating Torque (max.)	NM = Newton meters	0,45 Nm 4 in. lbs.	0,45 Nm 4 in. lbs.	0,45 Nm 4 in. lbs.	0,19 Nm 1.7 in. lbs.	0,19 Nm 1.7 in. lbs.	0,28 Nm 2.5 in. lbs.
Operating Temperature Range***		10°F to 250°F -12° to 121°C			30°F to 250°F -1° to 121°C		

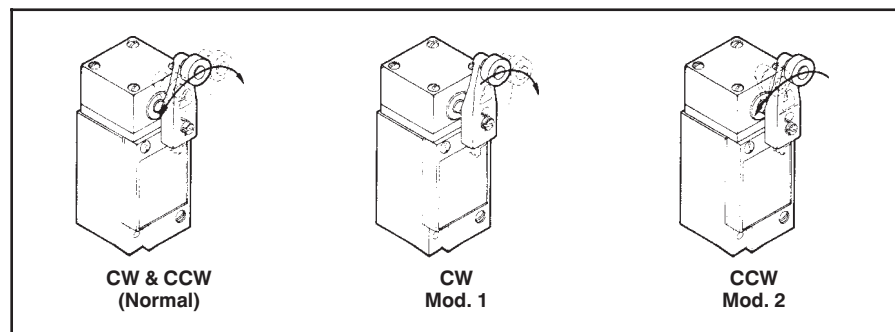
***Completely fluorocarbon-sealed switches are preferred for use in temperatures above 200°F (93°C). Refer to page A42.

Limit/Enclosed

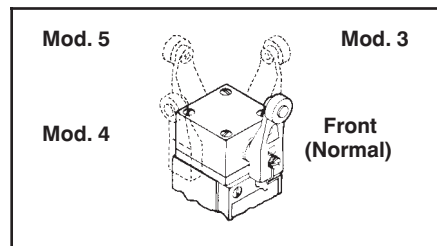
Rotary Actuated Switches

ACTUATION DIRECTION

(Drawings apply to listings on facing page only).



HEAD ORIENTATION



ASSEMBLY MODIFICATIONS

How to order

Momentary action rotary switches can be furnished in other than the normal assembled conditions described on the facing page. To specify modifications, add the number(s) shown below to the catalog listings. Prices are the same as their counterparts shown in the order guide.

Modification number suffixes are:

- 1 Clockwise operation only
- 2 Counterclockwise operation only
- 3 Shaft to right of switch front
- 4 Shaft to left of switch front
- 5 Shaft to back of switch
- 7 Indicator light wired to N.C. circuit

Examples:

Catalog Listing LSA1A23 is an LSA1A switch adjusted for counterclockwise operation only. The operating shaft is to the right side of the switch when viewing it from the front (label side). No lever.

Catalog Listing LSA8A7 is an LSA8A switch with the 240 volt indicator light wired to the N.C. circuit. No lever.

Switches with assembly modifications are not normally stocked and may extend delivery leadtimes.

LEVERS

Levers for rotary actuated switches are normally ordered as separate catalog listings. They also may be ordered by including a suffix to the switch catalog listing and adding the lever price. See pages A34-A39.

SWITCHES FOR SPECIAL APPLICATIONS

HDLS limit switches for special application needs are described on pages A42 and A43. They include: manifold mount, low temperature, complete fluorocarbon-sealed, gravity return, extra low torque and 20 Amp switches.

Adapter plates for interchanging HDLS with LS/200LS limit switches are described on page A49.

ELECTRICAL RATINGS

10 amps continuous carry (except for electrical rating "C"). Circuits on any one pole must be the same polarity.

AC Volts

Pilot duty: 600 VAC, 720VA

Electrical Rating	Circuitry	VAC	Amps at 0.35 Power Factor	
			Make	Break
A*	Single-Pole Double-Throw	120	60	6
		240	30	3
		480	15	1.5
		600	12	1.2
B	Double-Pole Double-Throw	120	30	3
		240	15	1.5
		480	7.5	0.75
		600	6	0.60
D	Single-Pole Single-Throw Normally Closed	120	60	6
		240	30	3
		480	15	1.5
		600	12	1.2
C**	Single-Pole Double-Throw	250 VAC or 60 VDC, .050 amp max.		

DC Volts

Pilot duty: 240 VDC, 30 watts

Electrical Rating	Circuitry	VDC	Make and Break Amps	
			Inductive	Resistive
A*	Single-Pole Double-Throw	120	0.25	0.8
		240	0.15	0.4
B	Double-Pole Double-Throw	120	0.25	0.8
		240	0.15	0.4
D	Single-Pole Single-Throw Normally Closed	30	4.3	4.3
		120	1.1	1.1
C**	Single-Pole Double-Throw	250 VAC or 60 VDC, .050 amp max.		

*For switches with indicator light, use only at voltage stated for indicator light.

**These switches have either gold plated or gold cross point contacts. Cross point contacts improve high reliability of contact make when particle contamination is a problem or low energy loads must be carried.

Universal transmitter

4114



- Input for RTD, TC, Ohm, potentiometer, mA and V
- 2-wire supply > 16 V
- FM-approved for installation in Div. 2
- Output for current and voltage
- Universal AC or DC supply



Advanced features

- Programmable by way of detachable display front (4501), process calibration, signal simulation, password protection, error diagnostics and help text available in several languages.

Application

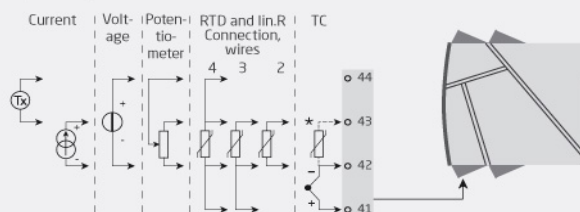
- Linearized, electronic temperature measurement with RTD or TC sensor.
- Conversion of linear resistance variation to a standard analog current / voltage signal, i.e. from solenoids and butterfly valves or linear movements with attached potentiometer.
- Power supply and signal isolator for 2-wire transmitters.
- Process control with standard analog output.
- Galvanic separation of analog signals and measurement of floating signals.
- The 4114 is designed according to strict safety requirements and is therefore suitable for application in SIL 2 installations.

Technical characteristics

- When 4114 is used with the 4501 display / programming front, all operational parameters can be modified to suit any application. As the 4114 is designed with electronic hardware switches, it is not necessary to open the device for setting of DIP-switches.
- A green / red front LED indicates normal operation and malfunction.
- Continuous check of vital stored data for safety reasons.
- 3-port 2.3 kVAC galvanic isolation.

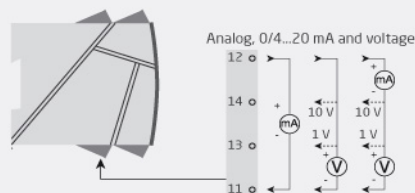
Applications

Input signals:

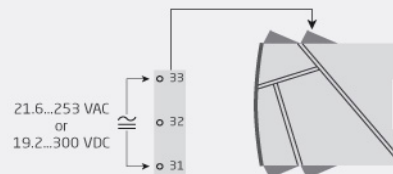


*Order separately: CJC connector 5910.

Output signals:



Supply:



Order:

Type
4114

Environmental Conditions

Operating temperature.....	-20°C to +60°C
Storage temperature.....	-20°C to +85°C
Calibration temperature.....	20...28°C
Relative humidity.....	< 95% RH (non-cond.)
Protection degree.....	IP20

Mechanical specifications

Dimensions (HxWxD).....	109 x 23.5 x 104 mm
Dimensions (HxWxD) w/ 4501/451x.....	109 x 23.5 x 116 / 131 mm
Weight approx.....	155 g
Weight incl. 4501 / 451x (approx.).....	170 g / 185 g
Wire size.....	1 x 2.5 mm ² stranded wire
Screw terminal torque.....	0.5 Nm
Vibration.....	IEC 60068-2-6
2...13.2 Hz.....	±1 mm
13.2...100 Hz.....	±0.7 g

Common specifications

Supply	
Supply voltage, universal.....	21.6...253 VAC, 50...60 Hz or 19.2...300 VDC
Fuse.....	400 mA SB / 250 VAC
Max. required power.....	≤ 2.0 W

Isolation voltage

Isolation voltage, test / working.....	2.3 kVAC / 250 VAC
---	--------------------

Response time

Temperature input (0...90%, 100...10%).....	≤ 1 s
mA / V input (0...90%, 100...10%).....	≤ 400 ms

Auxiliary supplies

2-w. supply (term. 44...43).....	25...16 VDC / 0...20 mA
Programming.....	PR 45xx
Signal / noise ratio.....	Min. 60 dB (0...100 kHz)
Accuracy.....	Better than 0.1% of sel. range
EMC immunity influence.....	< ±0.5% of span
Extended EMC immunity: NAMUR NE21, A criterion, burst.....	< ±1% of span

Input specifications

RTD input

RTD type.....	Pt10/20/50/100/200/250; Pt300/400/500/1000; Ni50/100/120/1000; Cu10/20/50/100
Cable resistance per wire.....	50 Ω (max.)
Sensor current.....	Nom. 0.2 mA
Effect of sensor cable resistance (3-/4-wire).....	< 0.002 Ω / Ω
Sensor error detection.....	Yes
Short circuit detection.....	< 15 Ω

Linear resistance input

Linear resistance min....max.....	0 Ω...10000 Ω
-----------------------------------	---------------

Potentiometer input

Potentiometer min....max.....	10 Ω...100 kΩ
-------------------------------	---------------

TC input

Thermocouple type.....	B, E, J, K, L, N, R, S, T, U, W3, W5, LR
------------------------	---

Cold junction compensation
(CJC) via ext. sensor in

5910.....	20...28°C ≤ ±1°C, -20...20°C / 28...70°C ≤ 2°C
-----------	---

CJC via int. mounted sensor..... ±(2.0°C + 0.4°C * Δt)

Δt = Internal temp.-ambient temp.

Sensor error detection..... Yes

Sensor error current: When

detecting / else..... Nom. 2 μA / 0 μA

Current input

Measurement range.....	0...20 mA
Programmable measurement ranges.....	0...20 and 4...20 mA
Input resistance.....	Nom. 20 Ω + PTC 50 Ω
Sensor error detection: Loop break 4...20 mA.....	Yes

Voltage input

Measurement range.....	0...12 VDC
Programmable measurement ranges.....	0/0.2...1, 0/1...5, 0/2...10 VDC
Input resistance.....	Nom. 10 MΩ

Output specifications

Current output

Signal range.....	0...20 mA
Programmable signal ranges.....	0...20/4...20/20...0/20...4 mA
Load (@ current output).....	≤ 800 Ω
Load stability.....	≤ 0.01% of span / 100 Ω
Sensor error indication.....	0 / 3.5 / 23 mA / none
NAMUR NE43 Upscale/Downscale.....	23 mA / 3.5 mA
Output limitation, on 4...20 and 20...4 mA signals.....	3.8...20.5 mA
Output limitation, on 0...20 and 20...0 mA signals.....	0...20.5 mA
Current limit.....	≤ 28 mA

Voltage output

Signal range.....	0...10 VDC
Programmable signal ranges.....	0/0.2...1; 0/1...5; 0/2...10; 1...0.2/0; 5...1/0; 10...2/0 V
Load (@ voltage output).....	≥ 500 kΩ
of span.....	= of the currently selected measurement range

Observed authority requirements

EMC.....	2014/30/EU
LVD.....	2014/35/EU
EAC.....	TR-CU 020/2011

Approvals

FM.....	3025177
UL.....	UL 508 / C22.2 no. 14
DNV-GL Marine.....	Stand. f. Certific. No. 2.4
EU RO Mutual Recognition Type Approval.....	MRA000000Z
SIL.....	Hardware assessed for use in SIL applications



Display / programming front

4501

- Modification of operational parameters in system 4000 and 9000 devices
- Fixed display for visualisation of process data and status
- Password protection
- Scrolling help text in 7 languages
- Clicks on to the front of the device mounted in the process

ERC

Application

- Communications interface for modification of operational parameters in system 4000 and 9000 devices.
- Can be moved from one device to another of the same type and download the configuration of the first device to subsequent devices.
- Fixed display for visualization of process data and status.

Technical characteristics

- LCD display with 4 lines featuring scrolling help text in 7 languages which guides the user effortlessly through all the configuration steps.
- Programming access can be blocked by assigning a password. The password is saved in the device in order to ensure a high degree of protection against unauthorized modifications to the configuration.

Mounting / installation

- Click 4501 onto the front of the device mounted in the process.
- The display module 4501 is approved and certified as an add-on component to the 4000 and 9000 series of devices. For more information on the 4501 refer to the manual of the specific device in the 4000 or 9000 series where the 4501 is attached.

Structural Calculations

Certificate of Design

Certificate of Design

Project Name: Brantford WWTP

Project Number: 24946B/C

Specification Section: 11451/11452 Secondary Clarifier Mechanism

The following standards have been utilized in the design of the mechanism:

NBCC 2020

Specification section 11451/11452 with exceptions and clarifications as listed in the Letter of Clarification

The type and strength of materials to be used in the:

304 Stainless Steel

$F_y = 30,000$ psi

$F_u = 75,000$ psi

The loading conditions used in the design of the clarifier:

Horizontal Seismic Load: $0.11 \times \text{Dead Load}$

Platform & Walkway (See Structural calculations):

Walkway Flooring: 5 psf

Platform Flooring: 6 psf

Handrail: 5 plf

Live Load: 50 psf

Snow Load: 37.6 psf

Wind Load: 12.73 psf

Maximum deflection: $L/360$

Rake Arms & Cage (See Structural Calculations):

Continuous Torque: 35,750 ft-lbs

Design Torque: 71,500 ft-lbs (200% Continuous)

Torque Test: 53,625 ft-lbs (150% Continuous)

EDI Load: 2,000 lbs steel; 8,266 lbs water

Feedwell Load: 3,520 lbs

Spiral Blade Load (Total): 2,228 lbs

Column & Walkway Anchors:

See calculations for loadings and design

The mechanism is designed to withstand the design loads as specified.



Rake and Cage

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	Part Rakes & Cage				
Job Title Brantford			Ref		
Client			By ME75	Date 8/3/2023	Chd
			File STAAD-rc_24946B.std	Date/Time 16-Aug-2023 11:48	

Job Information

	Engineer	Checked	Approved
Name:	ME75	HO93	
Date:	8/3/2023	8/16/2023	

Project ID	
Project Name	

Comments

Designed to NBCC 2020
 304 STAINLESS STEEL
 Mechanism Design Torque: 71500 ft-lbs
 Max Continuous Torque: 35750 ft-lbs
 Torque Test: 53625 ft-lbs
 Feedwell Diameter: 14 ft
 Feedwell Weight: 3520 lbs
 EDI Diameter: 8.5 ft
 EDI Steel Weight: 2000 lbs
 EDI Water Weight: 8266 lbs
 Spiral Blade Weight: 2228 lbs
 Horizontal Seismic: $EH = 0.11 * Wp$
 These structural calculations represent the minimum member size necessary to satisfy the requirement of the specification. WesTech reserves the option of increasing the member size to facilitate design or fabrication requirements.

Structure Type	SPACE FRAME
----------------	-------------

Number of Nodes	140	Highest Node	323
Number of Elements	390	Highest Beam	1122

Number of Basic Load Cases	16
Number of Combination Load Cases	0

Included in this printout are data for:

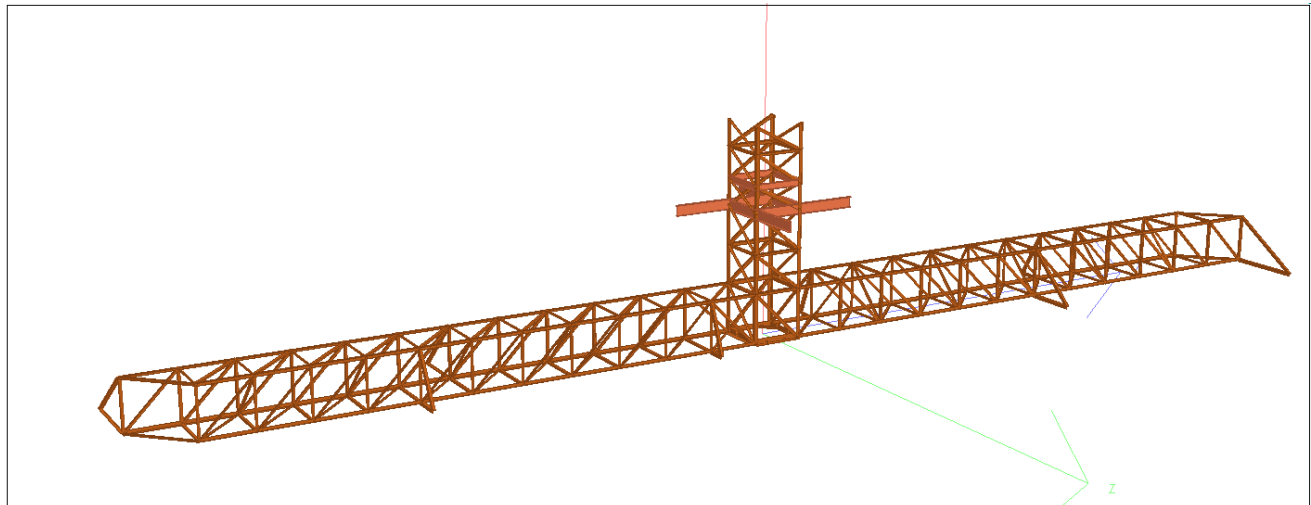
All	The Whole Structure
-----	---------------------



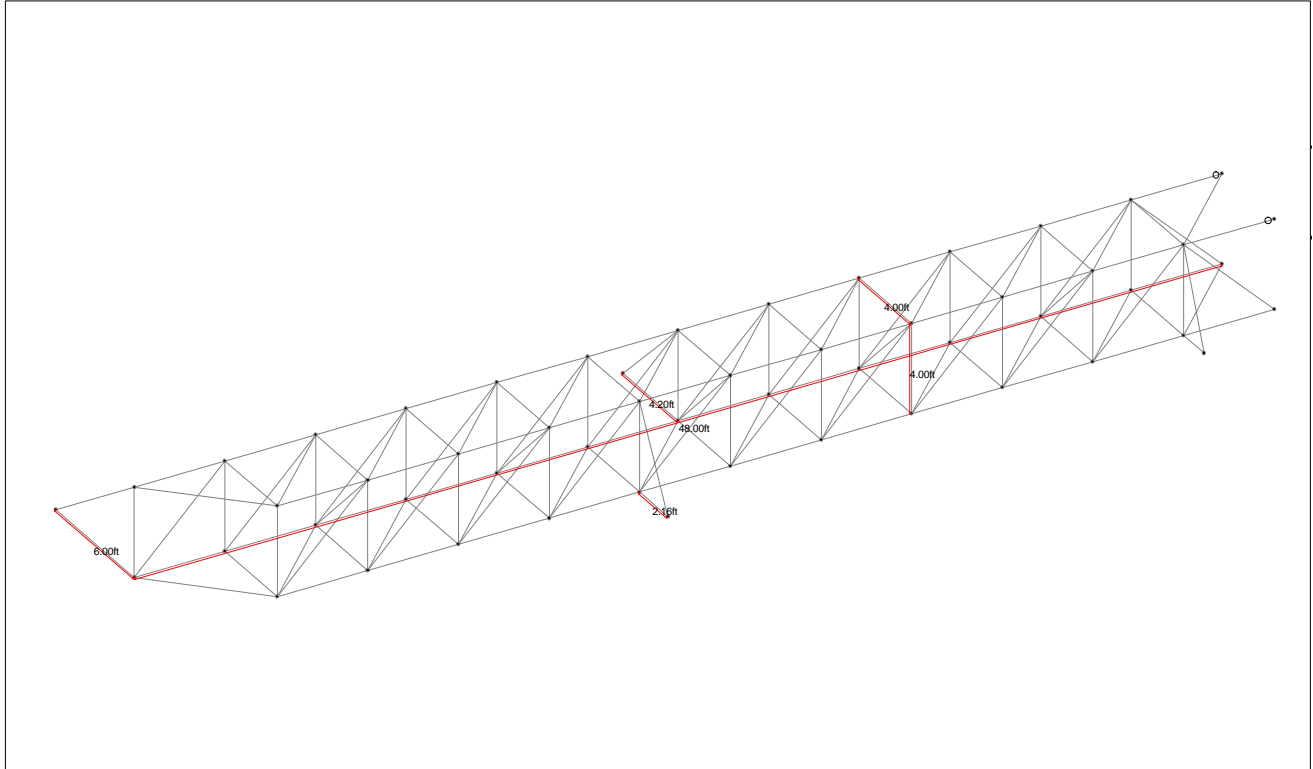
Job Information Cont...

Included in this printout are results for load cases:

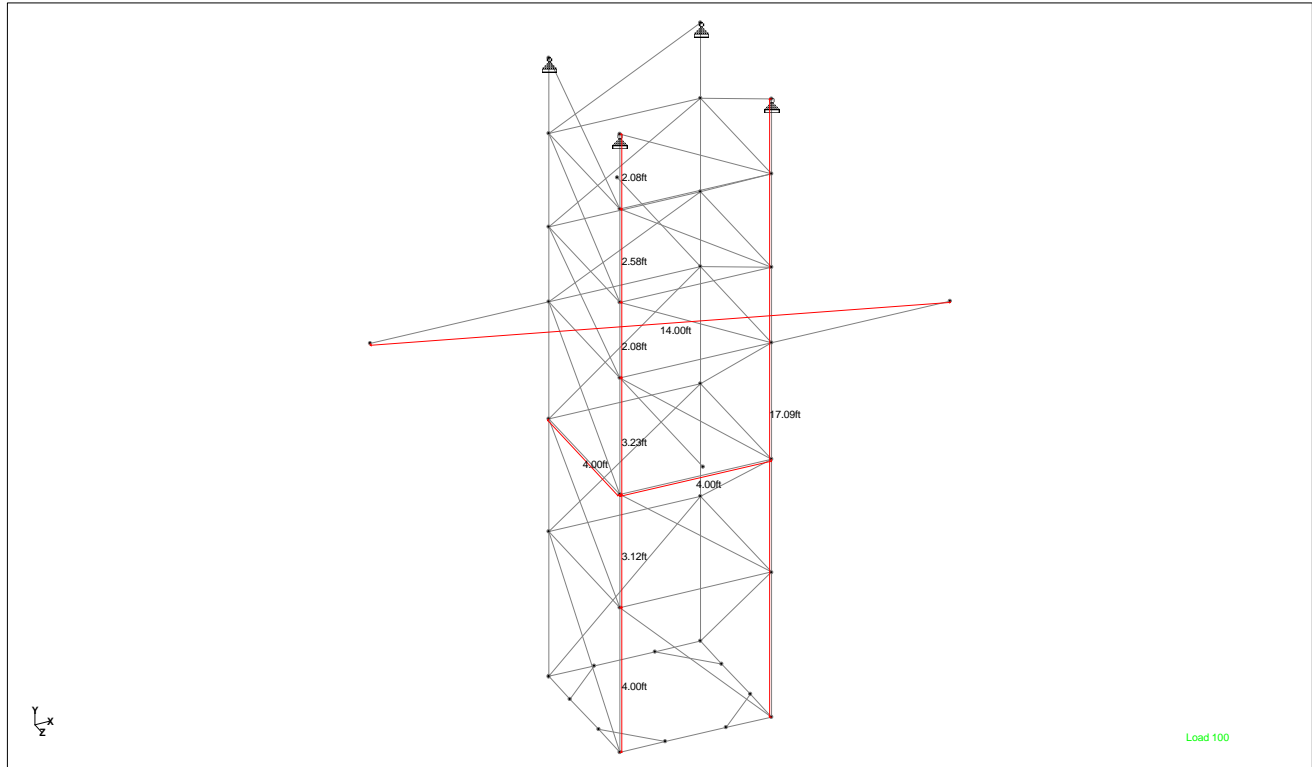
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Primary	1	GRAVITY
Primary	2	CONTINUOUS TORQUE
Primary	3	TORQUE TEST
Primary	4	EDI WELL STEEL LOAD
Primary	5	EDI WELL WATER LOAD
Primary	6	FEEDWELL LOAD
Primary	7	SPIRAL BLADE LOAD
Primary	8	EH(Z) SEISMIC LOADS
Primary	9	EH(X) SEISMIC LOADS
Primary	100	1.4D
Primary	101	1.25D + OPERATING
Primary	102	1.25D + CUT-OUT TORQUE
Primary	103	1.0D + EH(X)
Primary	104	1.0D + EH(Z)
Primary	200	D
Primary	201	D + OPERATING



Rake Arm and Cage



Rake Arm Dimensions



Cage Dimensions

Section Properties

Prop	Section	Area (in ²)	I _{yy} (in ⁴)	I _{zz} (in ⁴)	J (in ⁴)	Material
1	L30306	2.110	2.793	0.727	0.102	STAINLESSST
2	L30306	2.110	2.793	0.727	0.102	STAINLESSST
3	L35356	2.500	4.542	1.188	0.120	STAINLESSST
4	L50506	3.650	13.877	3.614	0.172	STAINLESSST
5	L25254	1.190	1.118	0.288	0.025	STAINLESSST
6	L25254	1.190	1.118	0.288	0.025	STAINLESSST
7	C10X15	4.480	2.270	67.300	0.209	STAINLESSST
8	C6X10	3.070	0.860	15.100	0.128	STAINLESSST
9	L20204	0.944	0.550	0.146	0.020	STAINLESSST
10	L20204	0.944	0.550	0.146	0.020	STAINLESSST
11	L30304	1.440	1.982	0.506	0.030599	STAINLESSST
12	L25254	1.190	1.118	0.288	0.025	STAINLESSST
13	L20204	0.944	0.550	0.146	0.020	STAINLESSST
14	L20204	0.944	0.550	0.146	0.020	STAINLESSST
15	L25254	1.190	1.118	0.288	0.025	STAINLESSST
16	L30304	1.440	1.982	0.506	0.030599	STAINLESSST



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Job Title **Brantford**

Part **Rakes & Cage**

Ref

By **ME75**

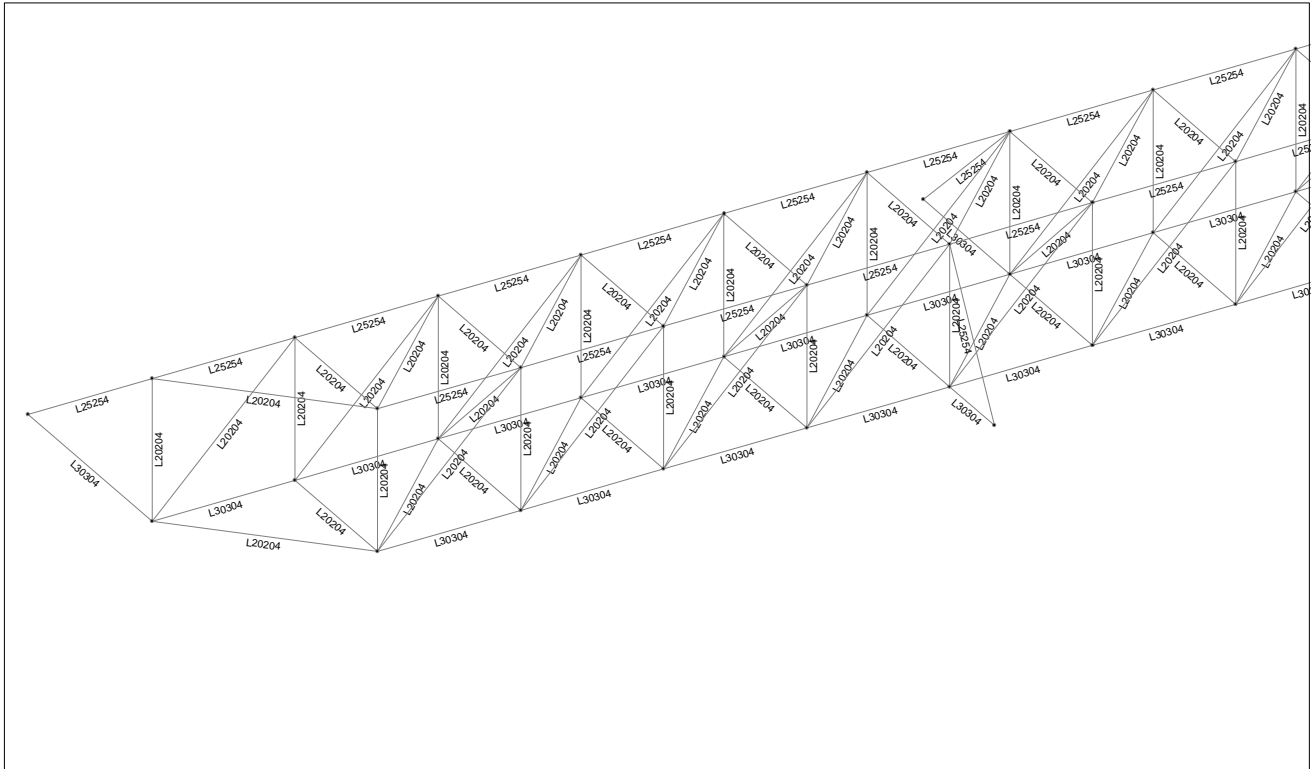
Date **8/3/2023**

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Rake Arm Member Sizes



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Part Rakes & Cage

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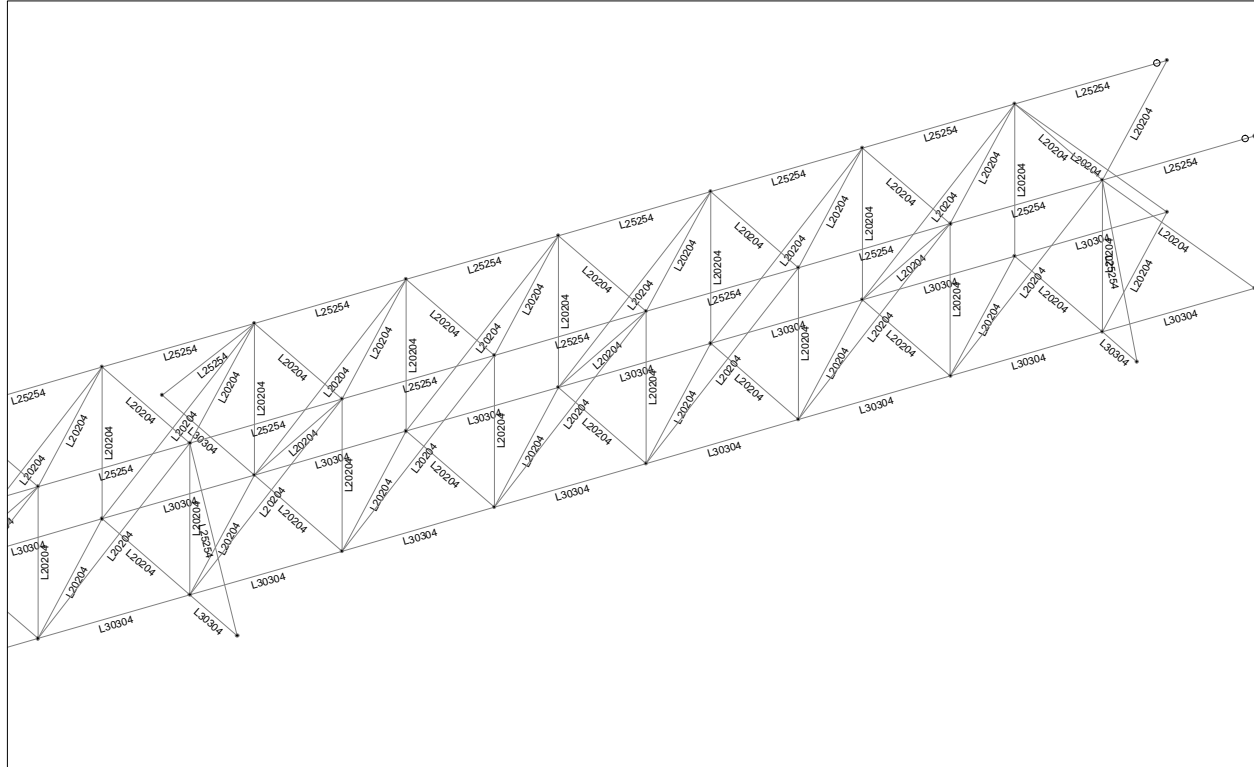
By ME75

Date 8/3/2023

Chd

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Rake Arm Member Sizes



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Part **Rakes & Cage**

Job Title **Brantford**

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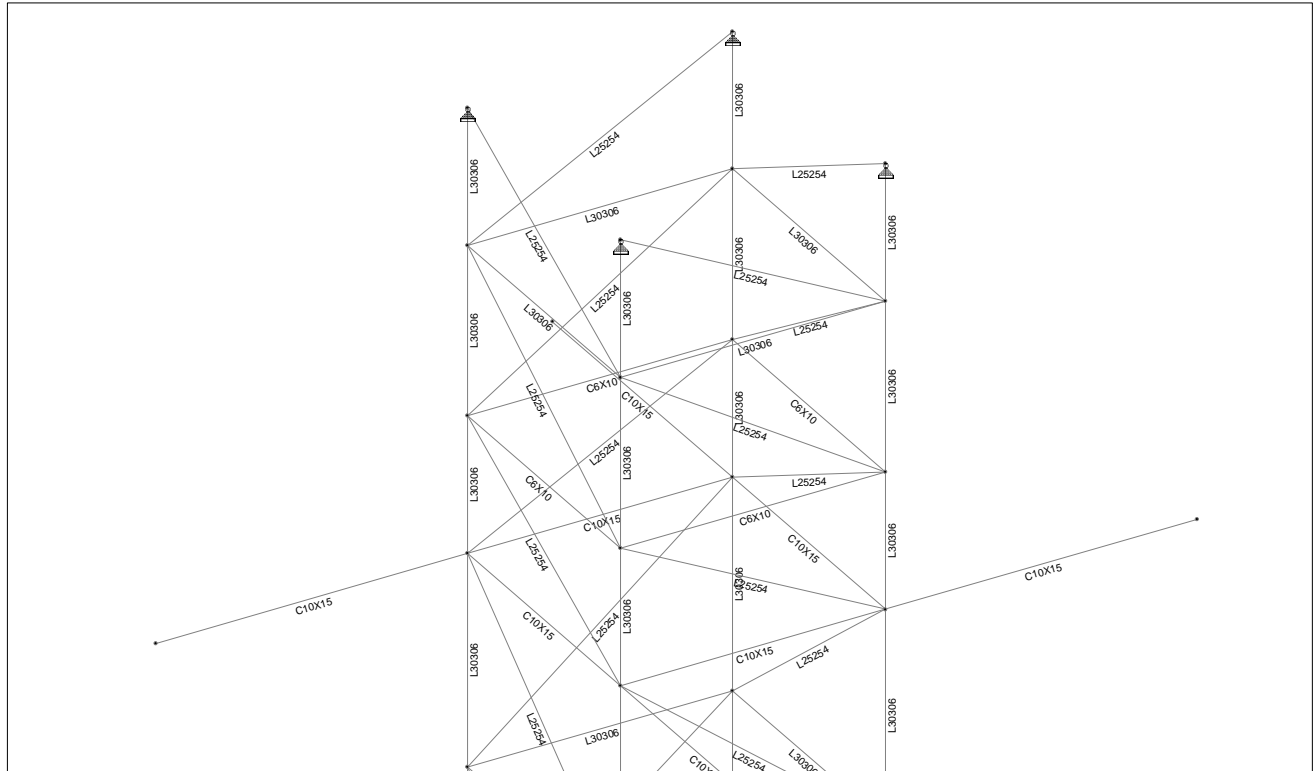
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Chd

Client

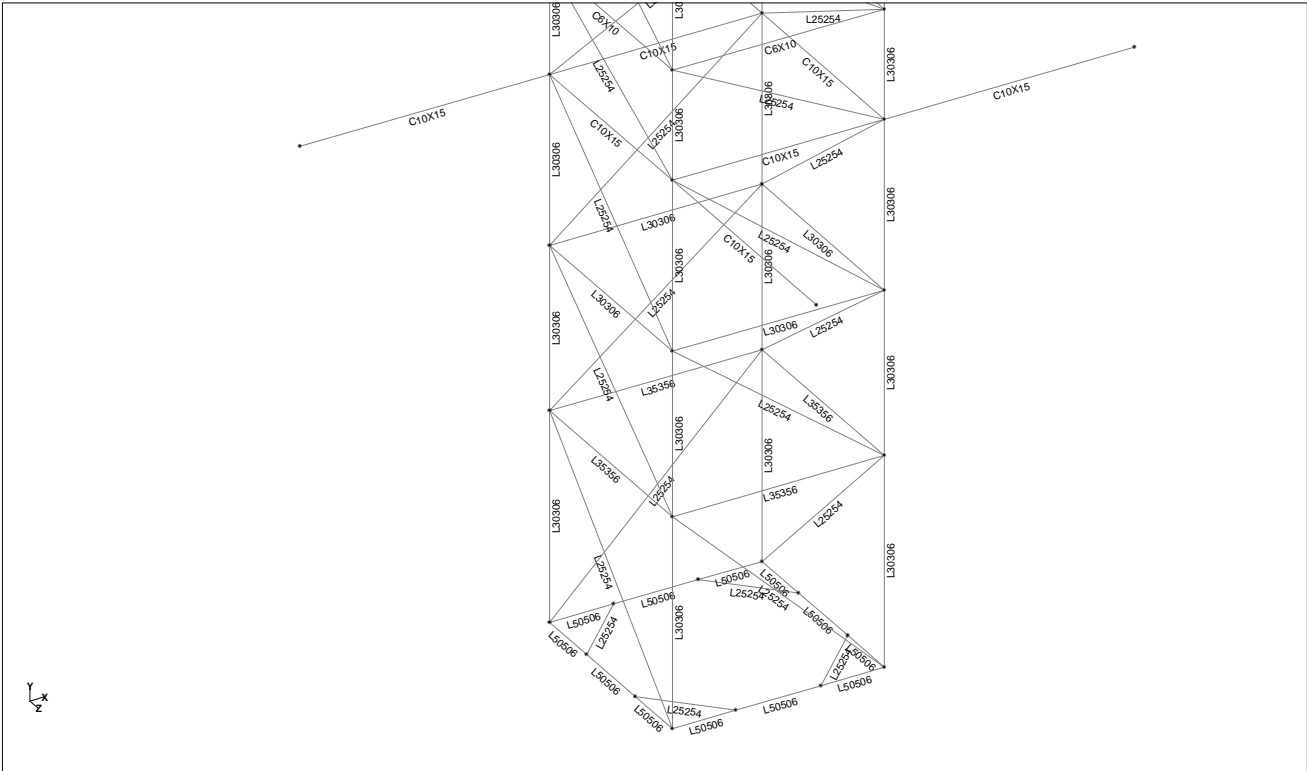
File **STAAD-rc_24946B.std**

Date/Time **16-Aug-2023 11:48**



Cage Member Sizes

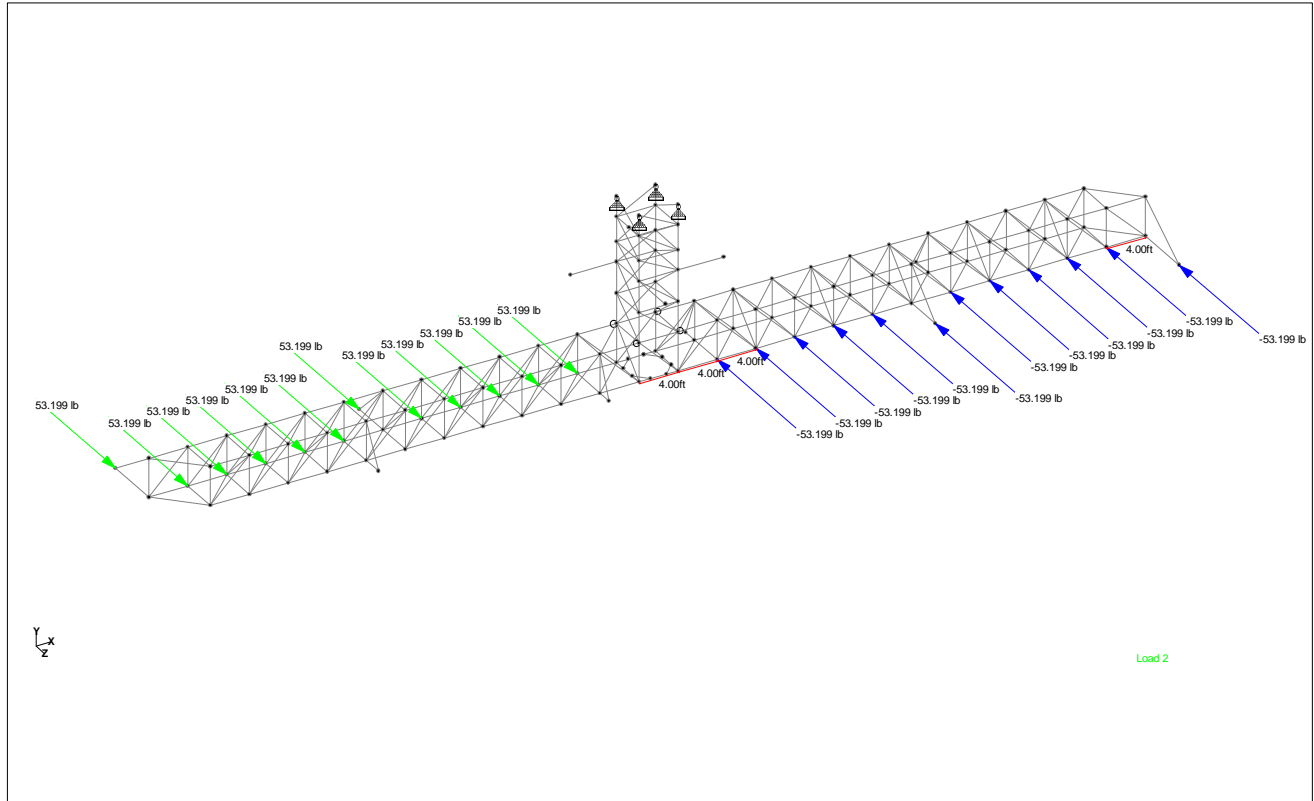
Bentley Software licensed to Westech Engineering Inc CONNECTED User: Jennifer MEIKLE	WESTECH		Job No 24946B	Sheet No 8	Rev 0
	Part Rakes & Cage		Ref		
Job Title Brantford			By ME75		Date 8/3/2023
Client			File STAAD-rc_24946B.std		Date/Time 16-Aug-2023 11:48



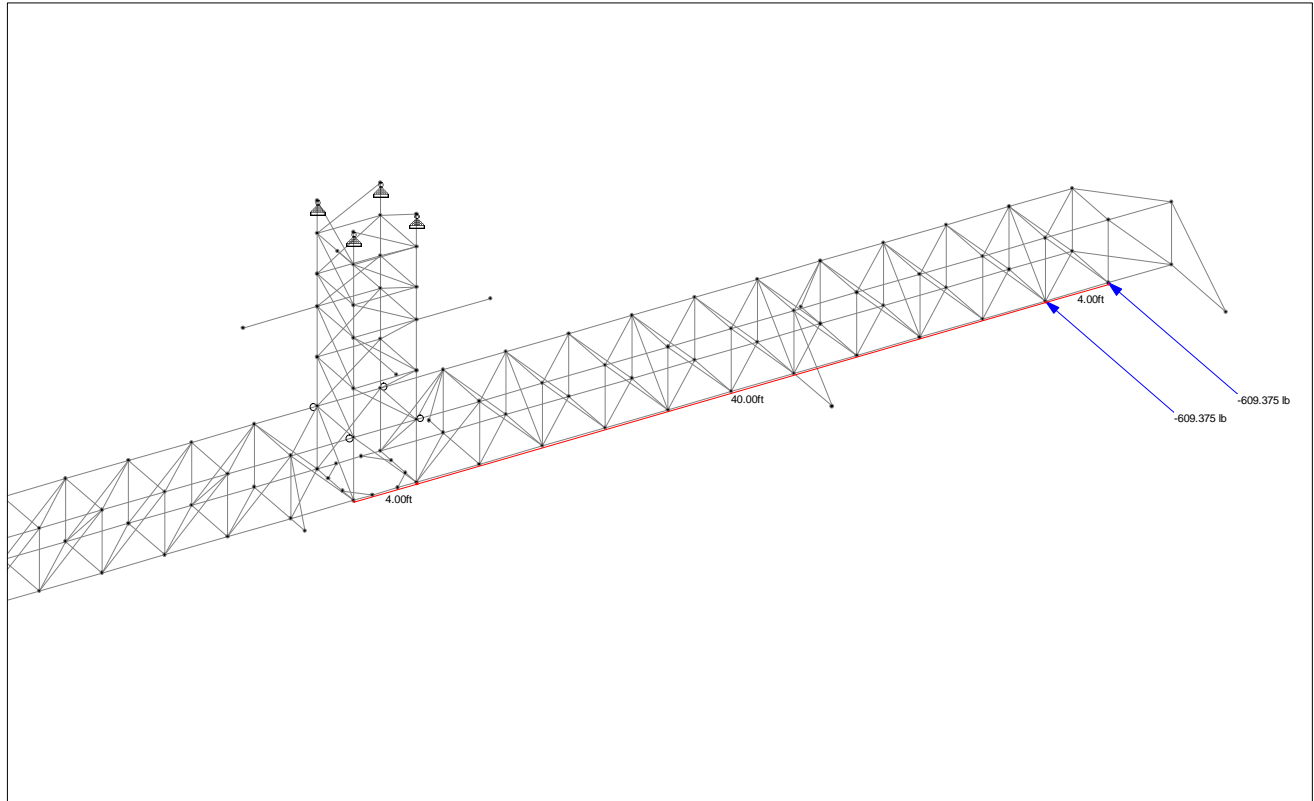
Cage Member Sizes

Primary Load Cases

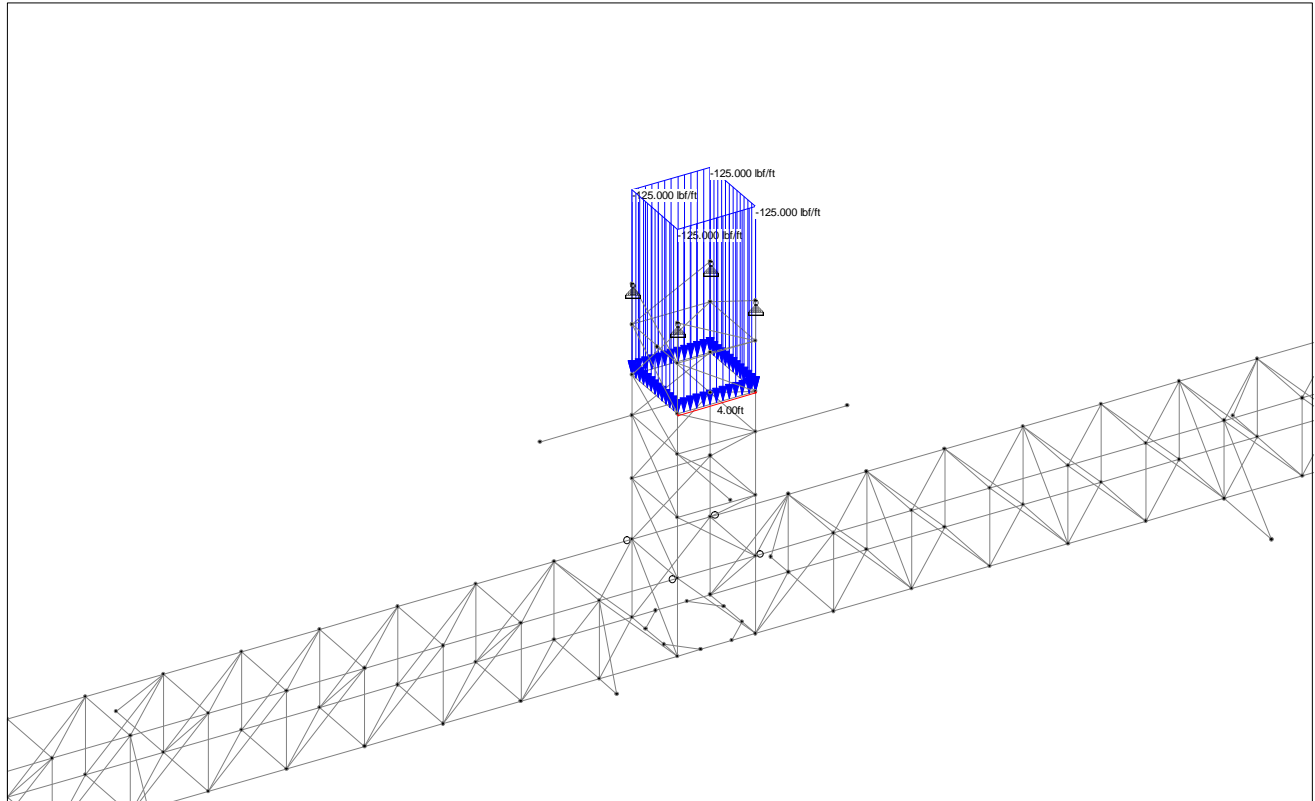
Number	Name	Type
1	GRAVITY	None
2	CONTINUOUS TORQUE	None
3	TORQUE TEST	None
4	EDI WELL STEEL LOAD	None
5	EDI WELL WATER LOAD	None
6	FEEDWELL LOAD	None
7	SPIRAL BLADE LOAD	None
8	EH(Z) SEISMIC LOADS	None
9	EH(X) SEISMIC LOADS	None
100	1.4D	None
101	1.25D + OPERATING	None
102	1.25D + CUT-OUT TORQUE	None
103	1.0D + EH(X)	None
104	1.0D + EH(Z)	None
200	D	None
201	D + OPERATING	None



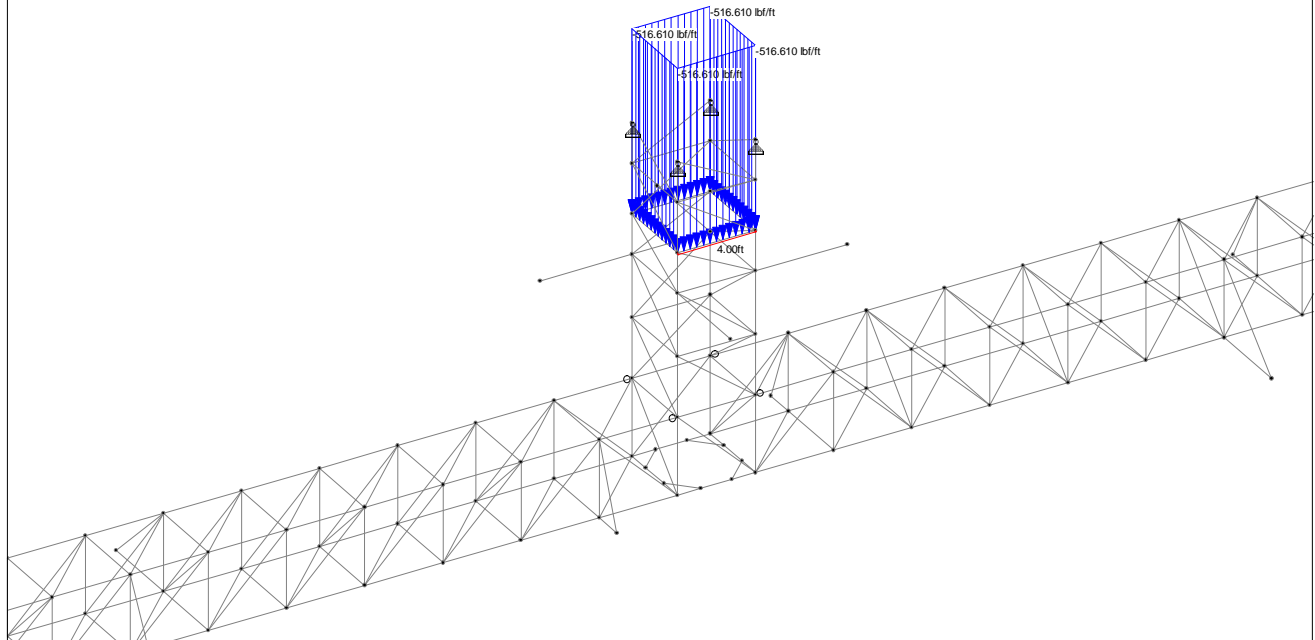
Continuous Torque (35,750 ft-lbs)



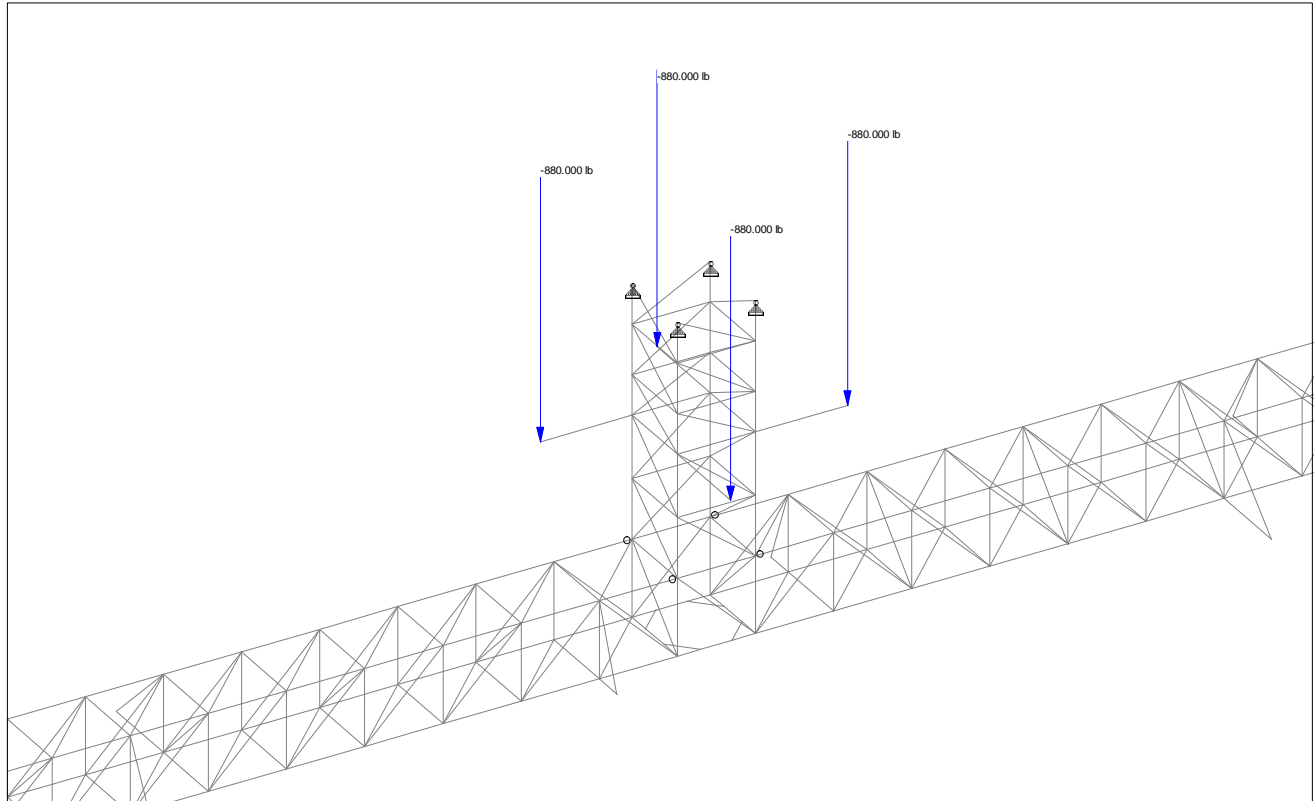
Torque Test (53,625 ft-lbs)



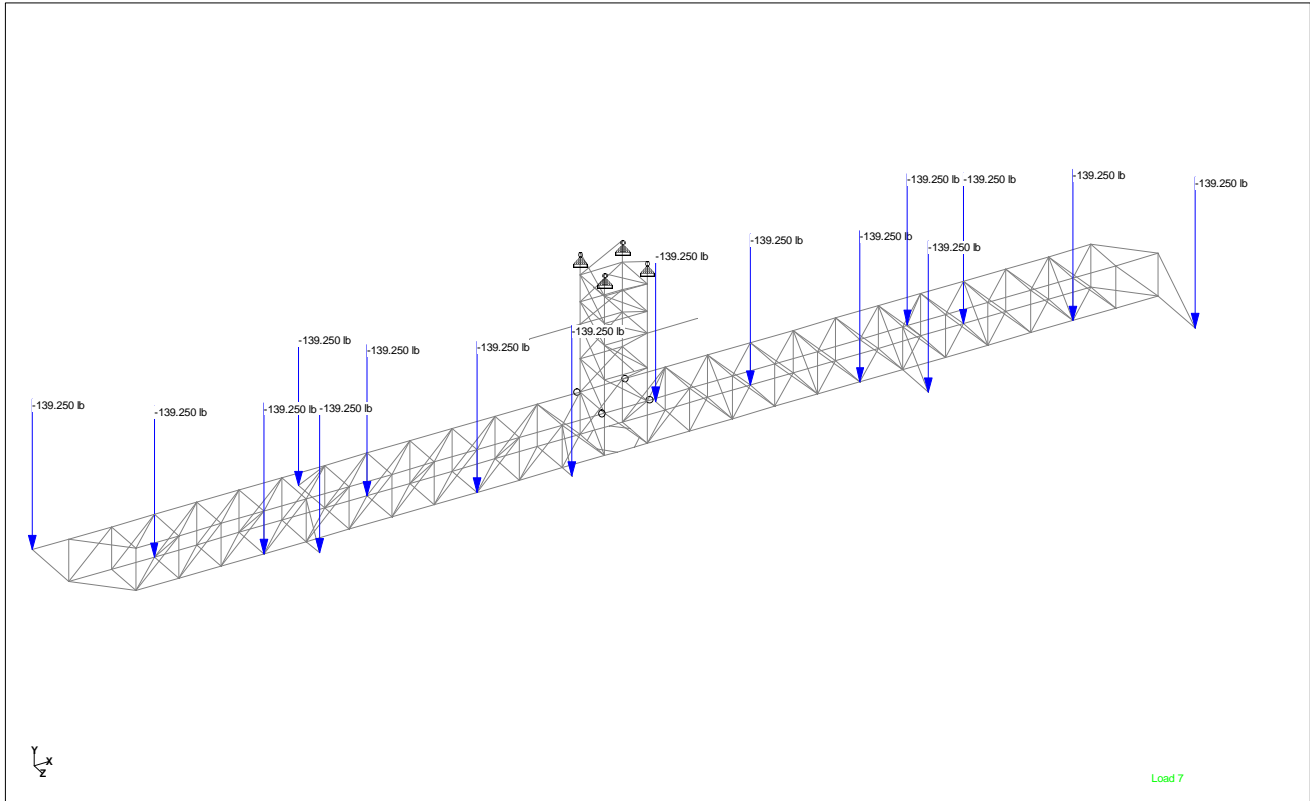
EDI Steel Load (2000 lbs)



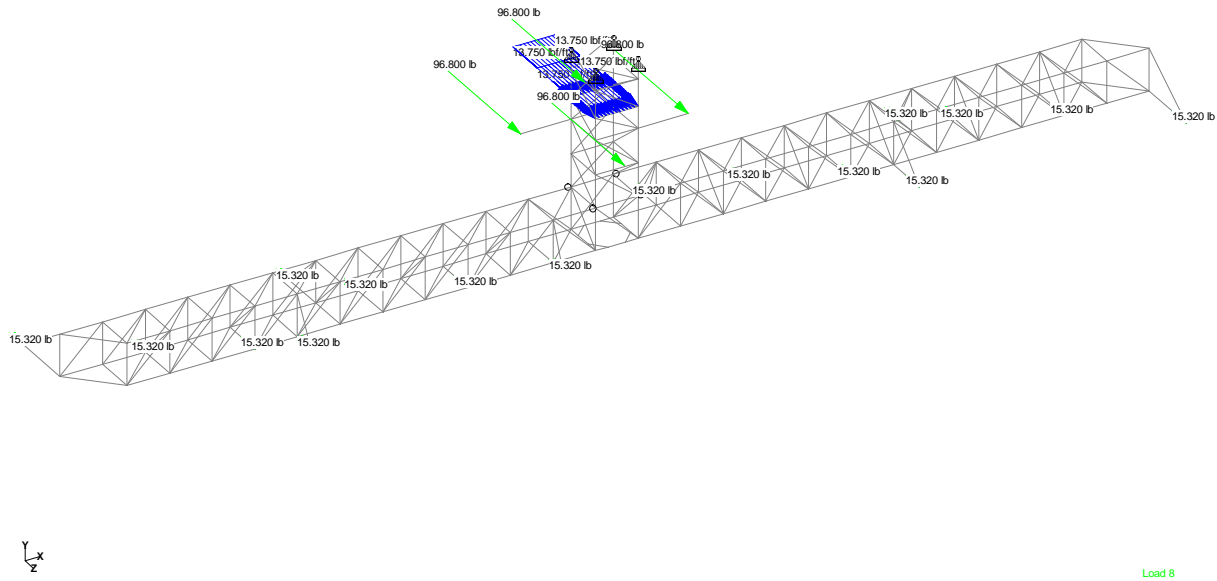
EDI Water Load (8266 lbs)



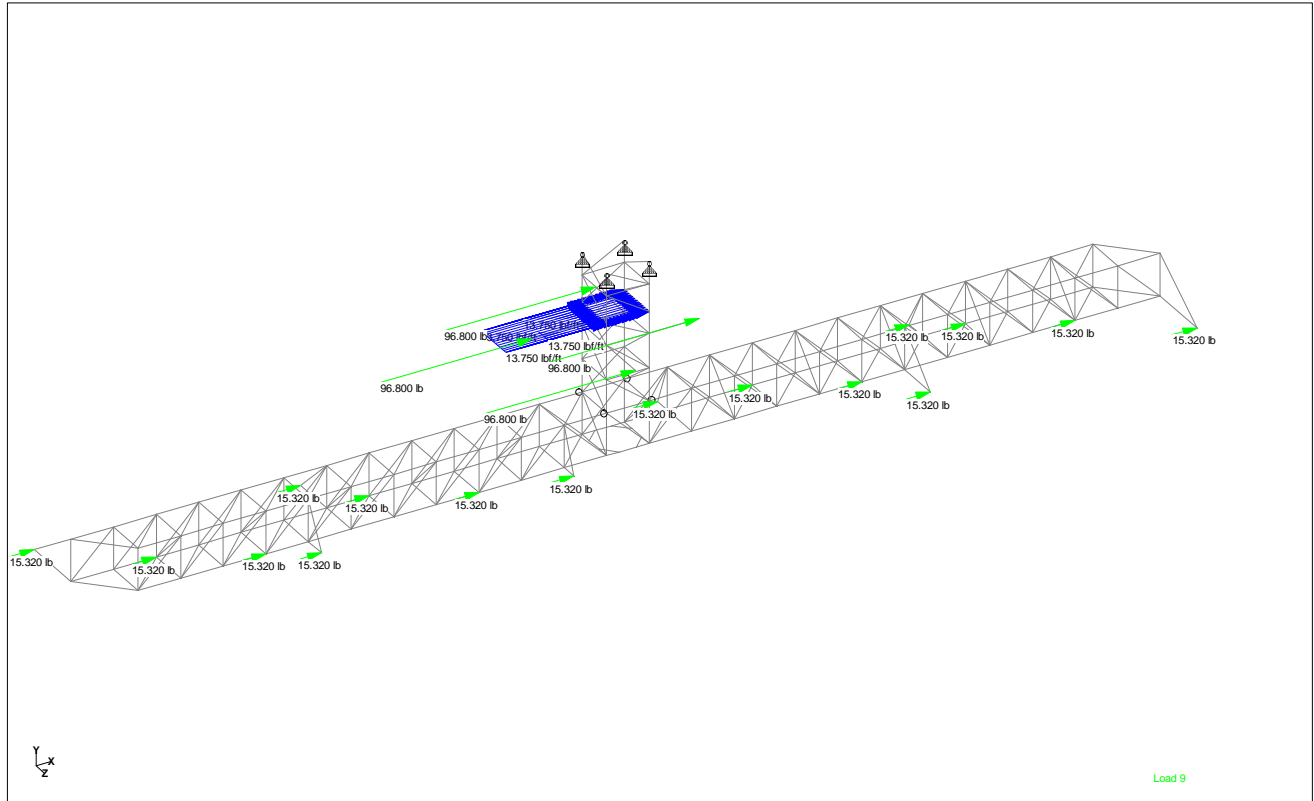
Feedwell Load (3520 lbs)



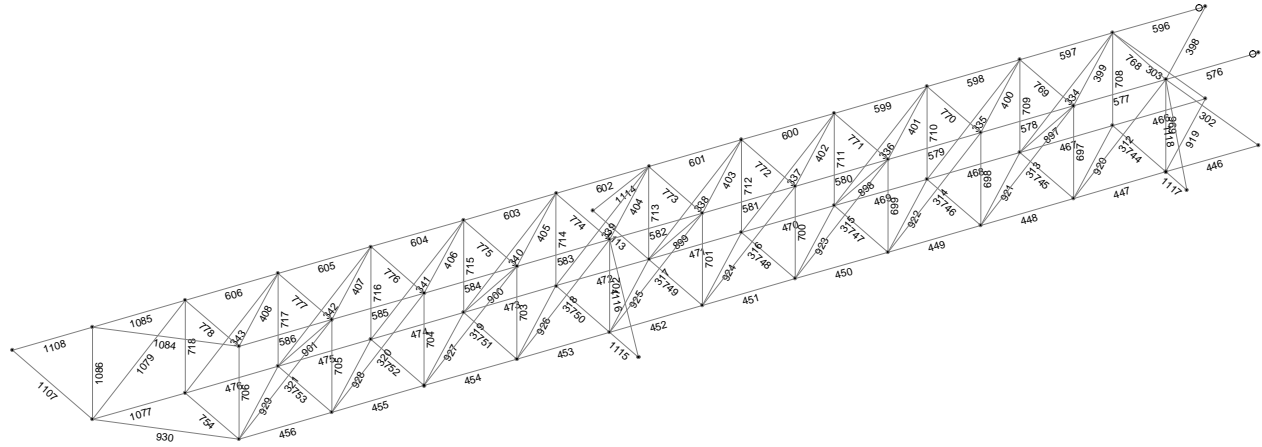
Spiral Blade Load (2228 lbs)



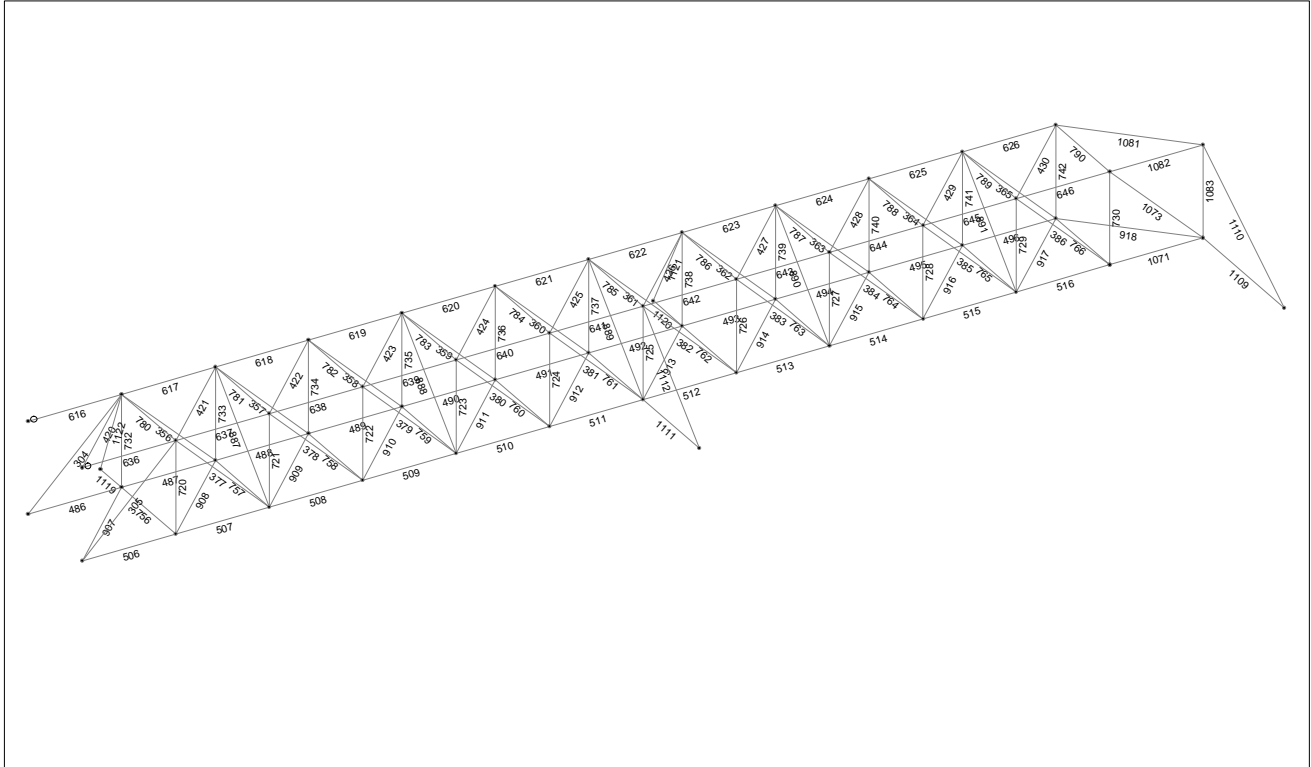
*Seismic-Z (0.11*Dead Load)*



*Seismic-X (0.11*Dead Load)*

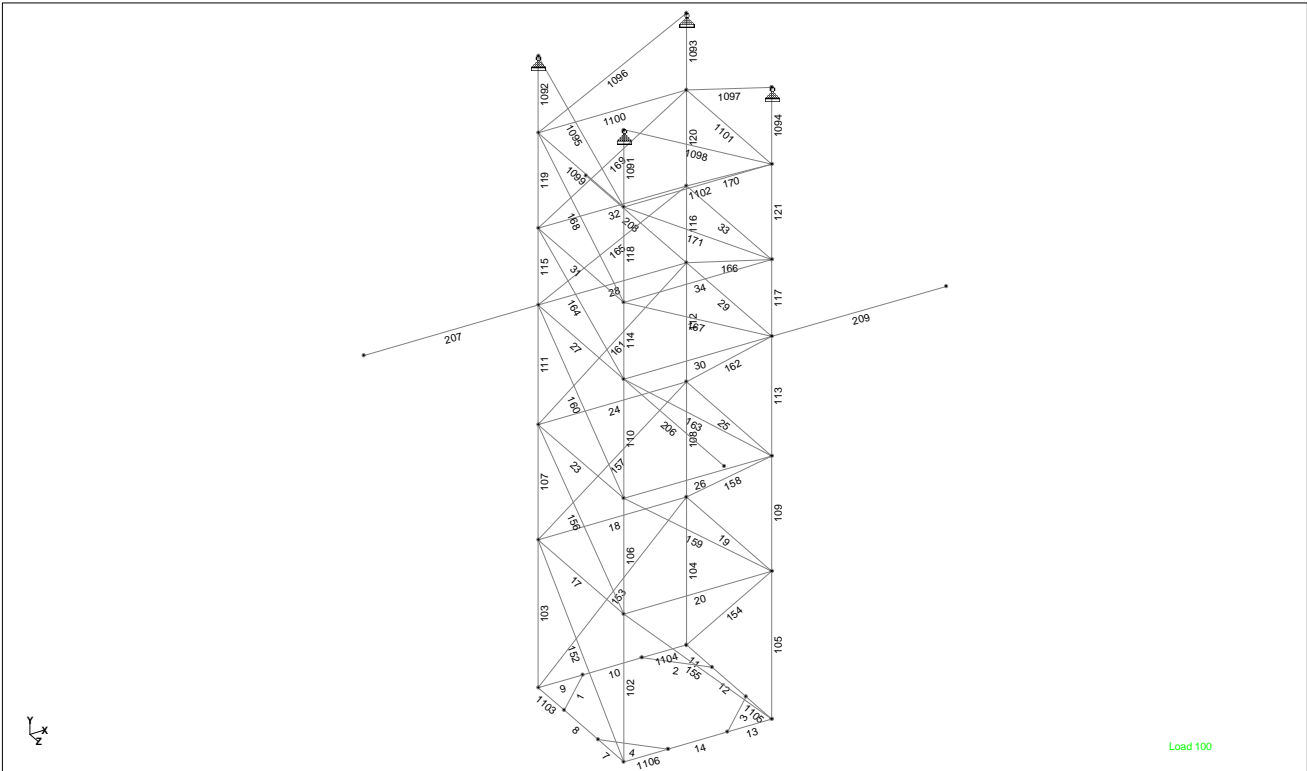


Beam Numbers



Beam Numbers



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Client			By ME75	Date 8/3/2023	Chd
			File STAAD-rc_24946B.std	Date/Time 16-Aug-2023 11:48	



Beam Numbers



Utilization Ratio

Beam	Analysis Property	Design Property	Actual Ratio	Allowable Ratio	Ratio (Act./Allow.)	Clause	L/C	Ax (in ²)	Iz (in ⁴)	Iy (in ⁴)	Ix (in ⁴)
1	L25254	L25254	0.458	1.000	0.458	Cl. 13.8.4	101	1.190	0.276	1.130	0.025
2	L25254	L25254	0.403	1.000	0.403	Cl. 13.9.1	101	1.190	0.276	1.130	0.025
3	L25254	L25254	0.458	1.000	0.458	Cl. 13.8.4	101	1.190	0.276	1.130	0.025
4	L25254	L25254	0.403	1.000	0.403	Cl. 13.9.1	101	1.190	0.276	1.130	0.025
7	L50506	L50506	0.587	1.000	0.587	Cl. 13.8.4	101	3.650	3.549	13.943	0.171
8	L50506	L50506	0.605	1.000	0.605	Cl. 13.8.4	101	3.650	3.549	13.943	0.171
9	L50506	L50506	0.662	1.000	0.662	Cl. 13.8.4	101	3.650	3.549	13.943	0.171
10	L50506	L50506	0.760	1.000	0.760	Cl. 13.8.4	101	3.650	3.549	13.943	0.171
11	L50506	L50506	0.587	1.000	0.587	Cl. 13.8.4	101	3.650	3.549	13.943	0.171
12	L50506	L50506	0.605	1.000	0.605	Cl. 13.8.4	101	3.650	3.549	13.943	0.171
13	L50506	L50506	0.662	1.000	0.662	Cl. 13.8.4	101	3.650	3.549	13.943	0.171
14	L50506	L50506	0.760	1.000	0.760	Cl. 13.8.4	101	3.650	3.549	13.943	0.171
17	L35356	L35356	0.609	1.000	0.609	Cl. 13.8.4	101	2.500	1.166	4.564	0.117
18	L35356	L35356	0.663	1.000	0.663	Cl. 13.9.1	101	2.500	1.166	4.564	0.117
19	L35356	L35356	0.609	1.000	0.609	Cl. 13.8.4	101	2.500	1.166	4.564	0.117
20	L35356	L35356	0.663	1.000	0.663	Cl. 13.9.1	101	2.500	1.166	4.564	0.117
23	L30306	L30306	0.492	1.000	0.492	Cl. 13.8.4	101	2.110	0.712	2.807	0.099
24	L30306	L30306	0.801	1.000	0.801	Cl. 13.8.4	101	2.110	0.712	2.807	0.099
25	L30306	L30306	0.492	1.000	0.492	Cl. 13.8.4	101	2.110	0.712	2.807	0.099

 	Job No 24946B	Sheet No 20	Rev 0
	Part Rakes & Cage		
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Job Title Brantford	By ME75	Date 8/3/2023	Chd
Client	File STAAD-rc_24946B.std	Date/Time 16-Aug-2023 11:48	



Utilization Ratio Cont...

Beam	Analysis Property	Design Property	Actual Ratio	Allowable Ratio	Ratio (Act./Allow.)	Clause	L/C	Ax (in ²)	Iz (in ⁴)	Iy (in ⁴)	Ix (in ⁴)
26	L30306	L30306	0.801	1.000	0.801	Cl. 13.8.4	101	2.110	0.712	2.807	0.099
27	C10X15	C10X15	0.401	1.000	0.401	Cl. 13.8.4	101	4.480	67.300	2.270	0.195
28	C10X15	C10X15	0.410	1.000	0.410	Cl. 13.8.4	101	4.480	67.300	2.270	0.195
29	C10X15	C10X15	0.401	1.000	0.401	Cl. 13.8.4	101	4.480	67.300	2.270	0.195
30	C10X15	C10X15	0.410	1.000	0.410	Cl. 13.8.4	101	4.480	67.300	2.270	0.195
31	C6X10	C6X10	0.363	1.000	0.363	Cl. 13.8.4	101	3.070	15.100	0.860	0.115
32	C6X10	C6X10	0.468	1.000	0.468	Cl. 13.8.4	101	3.070	15.100	0.860	0.115
33	C6X10	C6X10	0.363	1.000	0.363	Cl. 13.8.4	101	3.070	15.100	0.860	0.115
34	C6X10	C6X10	0.468	1.000	0.468	Cl. 13.8.4	101	3.070	15.100	0.860	0.115
102	L30306	L30306	0.250	1.000	0.250	Cl. 13.8.4	101	2.110	0.712	2.807	0.099
103	L30306	L30306	0.212	1.000	0.212	Cl. 13.9.1	101	2.110	0.712	2.807	0.099
104	L30306	L30306	0.250	1.000	0.250	Cl. 13.8.4	101	2.110	0.712	2.807	0.099
105	L30306	L30306	0.212	1.000	0.212	Cl. 13.9.1	101	2.110	0.712	2.807	0.099
106	L30306	L30306	0.472	1.000	0.472	Cl. 13.8.4	101	2.110	0.712	2.807	0.099
107	L30306	L30306	0.357	1.000	0.357	Cl. 13.8.4	101	2.110	0.712	2.807	0.099
108	L30306	L30306	0.472	1.000	0.472	Cl. 13.8.4	101	2.110	0.712	2.807	0.099
109	L30306	L30306	0.357	1.000	0.357	Cl. 13.8.4	101	2.110	0.712	2.807	0.099
110	L30306	L30306	0.544	1.000	0.544	Cl. 13.8.4	101	2.110	0.712	2.807	0.099
111	L30306	L30306	0.473	1.000	0.473	Cl. 13.8.4	101	2.110	0.712	2.807	0.099
112	L30306	L30306	0.544	1.000	0.544	Cl. 13.8.4	101	2.110	0.712	2.807	0.099
113	L30306	L30306	0.473	1.000	0.473	Cl. 13.8.4	101	2.110	0.712	2.807	0.099
114	L30306	L30306	0.588	1.000	0.588	Cl. 13.9.1	101	2.110	0.712	2.807	0.099
115	L30306	L30306	0.694	1.000	0.694	Cl. 13.8.4	101	2.110	0.712	2.807	0.099
116	L30306	L30306	0.588	1.000	0.588	Cl. 13.9.1	101	2.110	0.712	2.807	0.099
117	L30306	L30306	0.694	1.000	0.694	Cl. 13.8.4	101	2.110	0.712	2.807	0.099
118	L30306	L30306	0.442	1.000	0.442	Cl. 13.9.1	101	2.110	0.712	2.807	0.099
119	L30306	L30306	0.406	1.000	0.406	Cl. 13.8.4	101	2.110	0.712	2.807	0.099
120	L30306	L30306	0.442	1.000	0.442	Cl. 13.9.1	101	2.110	0.712	2.807	0.099
121	L30306	L30306	0.406	1.000	0.406	Cl. 13.8.4	101	2.110	0.712	2.807	0.099
152	L25254	L25254	0.530	1.000	0.530	Cl. 13.9.1	101	1.190	0.276	1.130	0.025
153	L25254	L25254	0.258	1.000	0.258	Cl. 13.9.1	101	1.190	0.276	1.130	0.025
154	L25254	L25254	0.530	1.000	0.530	Cl. 13.9.1	101	1.190	0.276	1.130	0.025
155	L25254	L25254	0.258	1.000	0.258	Cl. 13.9.1	101	1.190	0.276	1.130	0.025
156	L25254	L25254	0.575	1.000	0.575	Cl. 13.9.1	101	1.190	0.276	1.130	0.025
157	L25254	L25254	0.778	1.000	0.778	Cl. 13.9.1	101	1.190	0.276	1.130	0.025
158	L25254	L25254	0.575	1.000	0.575	Cl. 13.9.1	101	1.190	0.276	1.130	0.025
159	L25254	L25254	0.778	1.000	0.778	Cl. 13.9.1	101	1.190	0.276	1.130	0.025
160	L25254	L25254	0.445	1.000	0.445	Cl. 13.9.1	101	1.190	0.276	1.130	0.025
161	L25254	L25254	0.767	1.000	0.767	Cl. 13.9.1	101	1.190	0.276	1.130	0.025
162	L25254	L25254	0.445	1.000	0.445	Cl. 13.9.1	101	1.190	0.276	1.130	0.025
163	L25254	L25254	0.767	1.000	0.767	Cl. 13.9.1	101	1.190	0.276	1.130	0.025
164	L25254	L25254	0.415	1.000	0.415	Cl. 13.9.1	101	1.190	0.276	1.130	0.025
165	L25254	L25254	0.539	1.000	0.539	Cl. 13.9.1	101	1.190	0.276	1.130	0.025
166	L25254	L25254	0.415	1.000	0.415	Cl. 13.9.1	101	1.190	0.276	1.130	0.025
167	L25254	L25254	0.539	1.000	0.539	Cl. 13.9.1	101	1.190	0.276	1.130	0.025

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Utilization Ratio Cont...

Beam	Analysis Property	Design Property	Actual Ratio	Allowable Ratio	Ratio (Act./Allow.)	Clause	L/C	Ax (in ²)	Iz (in ⁴)	Iy (in ⁴)	Ix (in ⁴)
168	L25254	L25254	0.526	1.000	0.526	Cl. 13.9.1	101	1.190	0.276	1.130	0.025
169	L25254	L25254	0.610	1.000	0.610	Cl. 13.9.1	101	1.190	0.276	1.130	0.025
170	L25254	L25254	0.526	1.000	0.526	Cl. 13.9.1	101	1.190	0.276	1.130	0.025
171	L25254	L25254	0.610	1.000	0.610	Cl. 13.9.1	101	1.190	0.276	1.130	0.025
206	C10X15	C10X15	0.318	1.000	0.318	Cl. 13.8.4	103	4.480	67.300	2.270	0.195
207	C10X15	C10X15	0.318	1.000	0.318	Cl. 13.8.4	104	4.480	67.300	2.270	0.195
208	C10X15	C10X15	0.318	1.000	0.318	Cl. 13.8.4	103	4.480	67.300	2.270	0.195
209	C10X15	C10X15	0.318	1.000	0.318	Cl. 13.8.4	104	4.480	67.300	2.270	0.195
302	L20204	L20204	0.509	1.000	0.509	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
303	L20204	L20204	0.776	1.000	0.776	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
304	L20204	L20204	0.509	1.000	0.509	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
305	L20204	L20204	0.776	1.000	0.776	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
312	L20204	L20204	0.147	1.000	0.147	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
313	L20204	L20204	0.142	1.000	0.142	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
314	L20204	L20204	0.120	1.000	0.120	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
315	L20204	L20204	0.109	1.000	0.109	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
316	L20204	L20204	0.100	1.000	0.100	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
317	L20204	L20204	0.089	1.000	0.089	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
318	L20204	L20204	0.066	1.000	0.066	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
319	L20204	L20204	0.048	1.000	0.048	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
320	L20204	L20204	0.038	1.000	0.038	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
321	L20204	L20204	0.033748	1.000	0.033748	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
334	L20204	L20204	0.230	1.000	0.230	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
335	L20204	L20204	0.193	1.000	0.193	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
336	L20204	L20204	0.175	1.000	0.175	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
337	L20204	L20204	0.157	1.000	0.157	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
338	L20204	L20204	0.135	1.000	0.135	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
339	L20204	L20204	0.108	1.000	0.108	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
340	L20204	L20204	0.097	1.000	0.097	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
341	L20204	L20204	0.086	1.000	0.086	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
342	L20204	L20204	0.073	1.000	0.073	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
343	L20204	L20204	0.051	1.000	0.051	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
356	L20204	L20204	0.147	1.000	0.147	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
357	L20204	L20204	0.142	1.000	0.142	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
358	L20204	L20204	0.120	1.000	0.120	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
359	L20204	L20204	0.109	1.000	0.109	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
360	L20204	L20204	0.100	1.000	0.100	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
361	L20204	L20204	0.089	1.000	0.089	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
362	L20204	L20204	0.066	1.000	0.066	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
363	L20204	L20204	0.048	1.000	0.048	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
364	L20204	L20204	0.053155	1.000	0.053155	Cl. 13.8.4	102	0.944	0.141	0.554	0.020
365	L20204	L20204	0.033748	1.000	0.033748	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
377	L20204	L20204	0.230	1.000	0.230	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
378	L20204	L20204	0.203	1.000	0.203	Cl. 13.9.1	102	0.944	0.141	0.554	0.020
379	L20204	L20204	0.185	1.000	0.185	Cl. 13.9.1	102	0.944	0.141	0.554	0.020

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Utilization Ratio Cont...

Beam	Analysis Property	Design Property	Actual Ratio	Allowable Ratio	Ratio (Act./Allow.)	Clause	L/C	Ax (in ²)	Iz (in ⁴)	Iy (in ⁴)	Ix (in ⁴)
380	L20204	L20204	0.168	1.000	0.168	Cl. 13.9.1	102	0.944	0.141	0.554	0.020
381	L20204	L20204	0.147	1.000	0.147	Cl. 13.9.1	102	0.944	0.141	0.554	0.020
382	L20204	L20204	0.122	1.000	0.122	Cl. 13.9.1	102	0.944	0.141	0.554	0.020
383	L20204	L20204	0.111	1.000	0.111	Cl. 13.9.1	102	0.944	0.141	0.554	0.020
384	L20204	L20204	0.102	1.000	0.102	Cl. 13.9.1	102	0.944	0.141	0.554	0.020
385	L20204	L20204	0.089	1.000	0.089	Cl. 13.9.1	102	0.944	0.141	0.554	0.020
386	L20204	L20204	0.051	1.000	0.051	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
398	L20204	L20204	0.201	1.000	0.201	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
399	L20204	L20204	0.083	1.000	0.083	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
400	L20204	L20204	0.093	1.000	0.093	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
401	L20204	L20204	0.089	1.000	0.089	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
402	L20204	L20204	0.099	1.000	0.099	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
403	L20204	L20204	0.095	1.000	0.095	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
404	L20204	L20204	0.061134	1.000	0.061134	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
405	L20204	L20204	0.078482	1.000	0.078482	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
406	L20204	L20204	0.084	1.000	0.084	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
407	L20204	L20204	0.081	1.000	0.081	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
408	L20204	L20204	0.087	1.000	0.087	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
420	L20204	L20204	0.201	1.000	0.201	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
421	L20204	L20204	0.083	1.000	0.083	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
422	L20204	L20204	0.093	1.000	0.093	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
423	L20204	L20204	0.089	1.000	0.089	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
424	L20204	L20204	0.099	1.000	0.099	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
425	L20204	L20204	0.095	1.000	0.095	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
426	L20204	L20204	0.061134	1.000	0.061134	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
427	L20204	L20204	0.078482	1.000	0.078482	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
428	L20204	L20204	0.084	1.000	0.084	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
429	L20204	L20204	0.081	1.000	0.081	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
430	L20204	L20204	0.087	1.000	0.087	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
446	L30304	L30304	0.827	1.000	0.827	Cl. 13.8.4	101	1.440	0.493	1.996	0.03
447	L30304	L30304	0.662	1.000	0.662	Cl. 13.8.4	101	1.440	0.493	1.996	0.03
448	L30304	L30304	0.612	1.000	0.612	Cl. 13.8.4	101	1.440	0.493	1.996	0.03
449	L30304	L30304	0.499	1.000	0.499	Cl. 13.8.4	101	1.440	0.493	1.996	0.03
450	L30304	L30304	0.411	1.000	0.411	Cl. 13.8.4	101	1.440	0.493	1.996	0.03
451	L30304	L30304	0.319	1.000	0.319	Cl. 13.8.4	101	1.440	0.493	1.996	0.03
452	L30304	L30304	0.242	1.000	0.242	Cl. 13.8.4	101	1.440	0.493	1.996	0.03
453	L30304	L30304	0.172	1.000	0.172	Cl. 13.8.4	101	1.440	0.493	1.996	0.03
454	L30304	L30304	0.117	1.000	0.117	Cl. 13.8.4	101	1.440	0.493	1.996	0.03
455	L30304	L30304	0.082	1.000	0.082	Cl. 13.8.4	101	1.440	0.493	1.996	0.03
456	L30304	L30304	0.060	1.000	0.060	Cl. 13.8.4	101	1.440	0.493	1.996	0.03
466	L30304	L30304	0.658	1.000	0.658	Cl. 13.8.4	100	1.440	0.493	1.996	0.03
467	L30304	L30304	0.556	1.000	0.556	Cl. 13.8.4	100	1.440	0.493	1.996	0.03
468	L30304	L30304	0.488	1.000	0.488	Cl. 13.8.4	100	1.440	0.493	1.996	0.03
469	L30304	L30304	0.387	1.000	0.387	Cl. 13.8.4	100	1.440	0.493	1.996	0.03
470	L30304	L30304	0.311	1.000	0.311	Cl. 13.8.4	100	1.440	0.493	1.996	0.03

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Utilization Ratio Cont...

Beam	Analysis Property	Design Property	Actual Ratio	Allowable Ratio	Ratio (Act./Allow.)	Clause	L/C	Ax (in ²)	Iz (in ⁴)	Iy (in ⁴)	Ix (in ⁴)
471	L30304	L30304	0.234	1.000	0.234	Cl. 13.8.4	100	1.440	0.493	1.996	0.03
472	L30304	L30304	0.169	1.000	0.169	Cl. 13.8.4	100	1.440	0.493	1.996	0.03
473	L30304	L30304	0.123	1.000	0.123	Cl. 13.8.4	100	1.440	0.493	1.996	0.03
474	L30304	L30304	0.085	1.000	0.085	Cl. 13.8.4	100	1.440	0.493	1.996	0.03
475	L30304	L30304	0.054	1.000	0.054	Cl. 13.8.4	100	1.440	0.493	1.996	0.03
476	L30304	L30304	0.025	1.000	0.025	Cl. 13.8.4	100	1.440	0.493	1.996	0.03
486	L30304	L30304	0.948	1.000	0.948	Cl. 13.8.4	102	1.440	0.493	1.996	0.03
487	L30304	L30304	0.805	1.000	0.805	Cl. 13.8.4	102	1.440	0.493	1.996	0.03
488	L30304	L30304	0.720	1.000	0.720	Cl. 13.8.4	102	1.440	0.493	1.996	0.03
489	L30304	L30304	0.611	1.000	0.611	Cl. 13.8.4	102	1.440	0.493	1.996	0.03
490	L30304	L30304	0.519	1.000	0.519	Cl. 13.8.4	102	1.440	0.493	1.996	0.03
491	L30304	L30304	0.422	1.000	0.422	Cl. 13.8.4	102	1.440	0.493	1.996	0.03
492	L30304	L30304	0.332	1.000	0.332	Cl. 13.8.4	102	1.440	0.493	1.996	0.03
493	L30304	L30304	0.248	1.000	0.248	Cl. 13.8.4	102	1.440	0.493	1.996	0.03
494	L30304	L30304	0.179	1.000	0.179	Cl. 13.8.4	102	1.440	0.493	1.996	0.03
495	L30304	L30304	0.122	1.000	0.122	Cl. 13.8.4	102	1.440	0.493	1.996	0.03
496	L30304	L30304	0.079	1.000	0.079	Cl. 13.8.4	102	1.440	0.493	1.996	0.03
506	L30304	L30304	0.658	1.000	0.658	Cl. 13.8.4	100	1.440	0.493	1.996	0.03
507	L30304	L30304	0.556	1.000	0.556	Cl. 13.8.4	100	1.440	0.493	1.996	0.03
508	L30304	L30304	0.488	1.000	0.488	Cl. 13.8.4	100	1.440	0.493	1.996	0.03
509	L30304	L30304	0.387	1.000	0.387	Cl. 13.8.4	100	1.440	0.493	1.996	0.03
510	L30304	L30304	0.311	1.000	0.311	Cl. 13.8.4	100	1.440	0.493	1.996	0.03
511	L30304	L30304	0.234	1.000	0.234	Cl. 13.8.4	100	1.440	0.493	1.996	0.03
512	L30304	L30304	0.169	1.000	0.169	Cl. 13.8.4	100	1.440	0.493	1.996	0.03
513	L30304	L30304	0.123	1.000	0.123	Cl. 13.8.4	100	1.440	0.493	1.996	0.03
514	L30304	L30304	0.085	1.000	0.085	Cl. 13.8.4	100	1.440	0.493	1.996	0.03
515	L30304	L30304	0.054	1.000	0.054	Cl. 13.8.4	100	1.440	0.493	1.996	0.03
516	L30304	L30304	0.034	1.000	0.034	Cl. 13.8.4	102	1.440	0.493	1.996	0.03
576	L25254	L25254	0.548	1.000	0.548	Cl. 13.9.1	100	1.190	0.276	1.130	0.025
577	L25254	L25254	0.423	1.000	0.423	Cl. 13.9.1	100	1.190	0.276	1.130	0.025
578	L25254	L25254	0.339	1.000	0.339	Cl. 13.9.1	100	1.190	0.276	1.130	0.025
579	L25254	L25254	0.277	1.000	0.277	Cl. 13.9.1	100	1.190	0.276	1.130	0.025
580	L25254	L25254	0.220	1.000	0.220	Cl. 13.9.1	100	1.190	0.276	1.130	0.025
581	L25254	L25254	0.166	1.000	0.166	Cl. 13.9.1	100	1.190	0.276	1.130	0.025
582	L25254	L25254	0.121	1.000	0.121	Cl. 13.9.1	100	1.190	0.276	1.130	0.025
583	L25254	L25254	0.086	1.000	0.086	Cl. 13.9.1	100	1.190	0.276	1.130	0.025
584	L25254	L25254	0.062	1.000	0.062	Cl. 13.9.1	100	1.190	0.276	1.130	0.025
585	L25254	L25254	0.047	1.000	0.047	Cl. 13.9.1	100	1.190	0.276	1.130	0.025
586	L25254	L25254	0.031	1.000	0.031	Cl. 13.9.1	100	1.190	0.276	1.130	0.025
596	L25254	L25254	0.699	1.000	0.699	Cl. 13.9.1	101	1.190	0.276	1.130	0.025
597	L25254	L25254	0.448	1.000	0.448	Cl. 13.9.1	101	1.190	0.276	1.130	0.025
598	L25254	L25254	0.345	1.000	0.345	Cl. 13.9.1	101	1.190	0.276	1.130	0.025
599	L25254	L25254	0.268	1.000	0.268	Cl. 13.9.1	101	1.190	0.276	1.130	0.025
600	L25254	L25254	0.202	1.000	0.202	Cl. 13.9.1	101	1.190	0.276	1.130	0.025
601	L25254	L25254	0.150	1.000	0.150	Cl. 13.9.1	101	1.190	0.276	1.130	0.025

 	Job No 24946B	Sheet No 24	Rev 0
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Utilization Ratio Cont...

Beam	Analysis Property	Design Property	Actual Ratio	Allowable Ratio	Ratio (Act./Allow.)	Clause	L/C	Ax (in ²)	Iz (in ⁴)	Iy (in ⁴)	Ix (in ⁴)
602	L25254	L25254	0.106	1.000	0.106	Cl. 13.9.1	101	1.190	0.276	1.130	0.025
603	L25254	L25254	0.070	1.000	0.070	Cl. 13.9.1	101	1.190	0.276	1.130	0.025
604	L25254	L25254	0.043	1.000	0.043	Cl. 13.9.1	101	1.190	0.276	1.130	0.025
605	L25254	L25254	0.022	1.000	0.022	Cl. 13.9.1	100	1.190	0.276	1.130	0.025
606	L25254	L25254	0.026	1.000	0.026	Cl. 13.8.4	100	1.190	0.276	1.130	0.025
616	L25254	L25254	0.548	1.000	0.548	Cl. 13.9.1	100	1.190	0.276	1.130	0.025
617	L25254	L25254	0.423	1.000	0.423	Cl. 13.9.1	100	1.190	0.276	1.130	0.025
618	L25254	L25254	0.339	1.000	0.339	Cl. 13.9.1	100	1.190	0.276	1.130	0.025
619	L25254	L25254	0.277	1.000	0.277	Cl. 13.9.1	100	1.190	0.276	1.130	0.025
620	L25254	L25254	0.220	1.000	0.220	Cl. 13.9.1	100	1.190	0.276	1.130	0.025
621	L25254	L25254	0.166	1.000	0.166	Cl. 13.9.1	100	1.190	0.276	1.130	0.025
622	L25254	L25254	0.121	1.000	0.121	Cl. 13.9.1	100	1.190	0.276	1.130	0.025
623	L25254	L25254	0.086	1.000	0.086	Cl. 13.9.1	100	1.190	0.276	1.130	0.025
624	L25254	L25254	0.062	1.000	0.062	Cl. 13.9.1	100	1.190	0.276	1.130	0.025
625	L25254	L25254	0.047	1.000	0.047	Cl. 13.9.1	100	1.190	0.276	1.130	0.025
626	L25254	L25254	0.031	1.000	0.031	Cl. 13.9.1	100	1.190	0.276	1.130	0.025
636	L25254	L25254	0.769	1.000	0.769	Cl. 13.9.1	102	1.190	0.276	1.130	0.025
637	L25254	L25254	0.528	1.000	0.528	Cl. 13.9.1	102	1.190	0.276	1.130	0.025
638	L25254	L25254	0.426	1.000	0.426	Cl. 13.9.1	102	1.190	0.276	1.130	0.025
639	L25254	L25254	0.337	1.000	0.337	Cl. 13.9.1	102	1.190	0.276	1.130	0.025
640	L25254	L25254	0.266	1.000	0.266	Cl. 13.9.1	102	1.190	0.276	1.130	0.025
641	L25254	L25254	0.204	1.000	0.204	Cl. 13.9.1	102	1.190	0.276	1.130	0.025
642	L25254	L25254	0.149	1.000	0.149	Cl. 13.9.1	102	1.190	0.276	1.130	0.025
643	L25254	L25254	0.100	1.000	0.100	Cl. 13.9.1	102	1.190	0.276	1.130	0.025
644	L25254	L25254	0.056	1.000	0.056	Cl. 13.9.1	102	1.190	0.276	1.130	0.025
645	L25254	L25254	0.022	1.000	0.022	Cl. 13.9.1	100	1.190	0.276	1.130	0.025
646	L25254	L25254	0.027	1.000	0.027	Cl. 13.8.4	102	1.190	0.276	1.130	0.025
696	L20204	L20204	0.029	1.000	0.029	Cl. 13.9.1	102	0.944	0.141	0.554	0.020
697	L20204	L20204	0.174	1.000	0.174	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
698	L20204	L20204	0.166	1.000	0.166	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
699	L20204	L20204	0.154	1.000	0.154	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
700	L20204	L20204	0.138	1.000	0.138	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
701	L20204	L20204	0.130	1.000	0.130	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
702	L20204	L20204	0.104	1.000	0.104	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
703	L20204	L20204	0.068	1.000	0.068	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
704	L20204	L20204	0.048635	1.000	0.048635	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
705	L20204	L20204	0.040	1.000	0.040	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
706	L20204	L20204	0.020	1.000	0.020	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
708	L20204	L20204	0.068	1.000	0.068	Cl. 13.9.1	102	0.944	0.141	0.554	0.020
709	L20204	L20204	0.267	1.000	0.267	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
710	L20204	L20204	0.254	1.000	0.254	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
711	L20204	L20204	0.229	1.000	0.229	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
712	L20204	L20204	0.195	1.000	0.195	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
713	L20204	L20204	0.167	1.000	0.167	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
714	L20204	L20204	0.136	1.000	0.136	Cl. 13.8.4	101	0.944	0.141	0.554	0.020

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Utilization Ratio Cont...

Beam	Analysis Property	Design Property	Actual Ratio	Allowable Ratio	Ratio (Act./Allow.)	Clause	L/C	Ax (in ²)	Iz (in ⁴)	Iy (in ⁴)	Ix (in ⁴)
715	L20204	L20204	0.122	1.000	0.122	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
716	L20204	L20204	0.103	1.000	0.103	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
717	L20204	L20204	0.074	1.000	0.074	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
718	L20204	L20204	0.055	1.000	0.055	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
720	L20204	L20204	0.068	1.000	0.068	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
721	L20204	L20204	0.277	1.000	0.277	Cl. 13.8.4	102	0.944	0.141	0.554	0.020
722	L20204	L20204	0.264	1.000	0.264	Cl. 13.8.4	102	0.944	0.141	0.554	0.020
723	L20204	L20204	0.236	1.000	0.236	Cl. 13.8.4	102	0.944	0.141	0.554	0.020
724	L20204	L20204	0.201	1.000	0.201	Cl. 13.8.4	102	0.944	0.141	0.554	0.020
725	L20204	L20204	0.179	1.000	0.179	Cl. 13.8.4	102	0.944	0.141	0.554	0.020
726	L20204	L20204	0.152	1.000	0.152	Cl. 13.8.4	102	0.944	0.141	0.554	0.020
727	L20204	L20204	0.145	1.000	0.145	Cl. 13.8.4	102	0.944	0.141	0.554	0.020
728	L20204	L20204	0.128	1.000	0.128	Cl. 13.8.4	102	0.944	0.141	0.554	0.020
729	L20204	L20204	0.075	1.000	0.075	Cl. 13.8.4	102	0.944	0.141	0.554	0.020
730	L20204	L20204	0.065	1.000	0.065	Cl. 13.8.4	102	0.944	0.141	0.554	0.020
732	L20204	L20204	0.025	1.000	0.025	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
733	L20204	L20204	0.174	1.000	0.174	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
734	L20204	L20204	0.166	1.000	0.166	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
735	L20204	L20204	0.154	1.000	0.154	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
736	L20204	L20204	0.138	1.000	0.138	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
737	L20204	L20204	0.130	1.000	0.130	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
738	L20204	L20204	0.104	1.000	0.104	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
739	L20204	L20204	0.068	1.000	0.068	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
740	L20204	L20204	0.048635	1.000	0.048635	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
741	L20204	L20204	0.040	1.000	0.040	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
742	L20204	L20204	0.020	1.000	0.020	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
744	L20204	L20204	0.172	1.000	0.172	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
745	L20204	L20204	0.117	1.000	0.117	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
746	L20204	L20204	0.176	1.000	0.176	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
747	L20204	L20204	0.157	1.000	0.157	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
748	L20204	L20204	0.149	1.000	0.149	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
749	L20204	L20204	0.128	1.000	0.128	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
750	L20204	L20204	0.107	1.000	0.107	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
751	L20204	L20204	0.091	1.000	0.091	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
752	L20204	L20204	0.078	1.000	0.078	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
753	L20204	L20204	0.064	1.000	0.064	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
754	L20204	L20204	0.038	1.000	0.038	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
756	L20204	L20204	0.177	1.000	0.177	Cl. 13.8.4	102	0.944	0.141	0.554	0.020
757	L20204	L20204	0.140	1.000	0.140	Cl. 13.8.4	102	0.944	0.141	0.554	0.020
758	L20204	L20204	0.185	1.000	0.185	Cl. 13.8.4	102	0.944	0.141	0.554	0.020
759	L20204	L20204	0.180	1.000	0.180	Cl. 13.8.4	102	0.944	0.141	0.554	0.020
760	L20204	L20204	0.185	1.000	0.185	Cl. 13.8.4	102	0.944	0.141	0.554	0.020
761	L20204	L20204	0.177	1.000	0.177	Cl. 13.8.4	102	0.944	0.141	0.554	0.020
762	L20204	L20204	0.167	1.000	0.167	Cl. 13.8.4	102	0.944	0.141	0.554	0.020
763	L20204	L20204	0.165	1.000	0.165	Cl. 13.8.4	102	0.944	0.141	0.554	0.020

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Utilization Ratio Cont...

Beam	Analysis Property	Design Property	Actual Ratio	Allowable Ratio	Ratio (Act./Allow.)	Clause	L/C	Ax (in ²)	Iz (in ⁴)	Iy (in ⁴)	Ix (in ⁴)
764	L20204	L20204	0.162	1.000	0.162	Cl. 13.8.4	102	0.944	0.141	0.554	0.020
765	L20204	L20204	0.158	1.000	0.158	Cl. 13.8.4	102	0.944	0.141	0.554	0.020
766	L20204	L20204	0.105	1.000	0.105	Cl. 13.8.4	102	0.944	0.141	0.554	0.020
768	L20204	L20204	0.104	1.000	0.104	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
769	L20204	L20204	0.064	1.000	0.064	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
770	L20204	L20204	0.060	1.000	0.060	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
771	L20204	L20204	0.051	1.000	0.051	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
772	L20204	L20204	0.047	1.000	0.047	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
773	L20204	L20204	0.036	1.000	0.036	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
774	L20204	L20204	0.030	1.000	0.030	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
775	L20204	L20204	0.028	1.000	0.028	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
776	L20204	L20204	0.027	1.000	0.027	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
777	L20204	L20204	0.028514	1.000	0.028514	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
778	L20204	L20204	0.027	1.000	0.027	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
780	L20204	L20204	0.104	1.000	0.104	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
781	L20204	L20204	0.064	1.000	0.064	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
782	L20204	L20204	0.060	1.000	0.060	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
783	L20204	L20204	0.051	1.000	0.051	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
784	L20204	L20204	0.047	1.000	0.047	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
785	L20204	L20204	0.036	1.000	0.036	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
786	L20204	L20204	0.032	1.000	0.032	Cl. 13.8.4	102	0.944	0.141	0.554	0.020
787	L20204	L20204	0.029	1.000	0.029	Cl. 13.8.4	102	0.944	0.141	0.554	0.020
788	L20204	L20204	0.027	1.000	0.027	Cl. 13.8.4	102	0.944	0.141	0.554	0.020
789	L20204	L20204	0.028514	1.000	0.028514	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
790	L20204	L20204	0.038	1.000	0.038	Cl. 13.8.4	102	0.944	0.141	0.554	0.020
887	L20204	L20204	0.186	1.000	0.186	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
888	L20204	L20204	0.053	1.000	0.053	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
889	L20204	L20204	0.046	1.000	0.046	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
890	L20204	L20204	0.03134	1.000	0.03134	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
891	L20204	L20204	0.103	1.000	0.103	Cl. 13.8.4	102	0.944	0.141	0.554	0.020
897	L20204	L20204	0.186	1.000	0.186	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
898	L20204	L20204	0.053	1.000	0.053	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
899	L20204	L20204	0.046	1.000	0.046	Cl. 13.8.4	103	0.944	0.141	0.554	0.020
900	L20204	L20204	0.03134	1.000	0.03134	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
901	L20204	L20204	0.053	1.000	0.053	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
907	L20204	L20204	0.137	1.000	0.137	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
908	L20204	L20204	0.088	1.000	0.088	Cl. 13.9.1	102	0.944	0.141	0.554	0.020
909	L20204	L20204	0.096	1.000	0.096	Cl. 13.9.1	102	0.944	0.141	0.554	0.020
910	L20204	L20204	0.101	1.000	0.101	Cl. 13.9.1	102	0.944	0.141	0.554	0.020
911	L20204	L20204	0.109	1.000	0.109	Cl. 13.9.1	102	0.944	0.141	0.554	0.020
912	L20204	L20204	0.110	1.000	0.110	Cl. 13.9.1	102	0.944	0.141	0.554	0.020
913	L20204	L20204	0.098	1.000	0.098	Cl. 13.9.1	102	0.944	0.141	0.554	0.020
914	L20204	L20204	0.103	1.000	0.103	Cl. 13.9.1	102	0.944	0.141	0.554	0.020
915	L20204	L20204	0.105	1.000	0.105	Cl. 13.9.1	102	0.944	0.141	0.554	0.020
916	L20204	L20204	0.104	1.000	0.104	Cl. 13.9.1	102	0.944	0.141	0.554	0.020

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Utilization Ratio Cont...

Beam	Analysis Property	Design Property	Actual Ratio	Allowable Ratio	Ratio (Act./Allow.)	Clause	L/C	Ax (in ²)	Iz (in ⁴)	Iy (in ⁴)	Ix (in ⁴)
917	L20204	L20204	0.078	1.000	0.078	Cl. 13.9.1	102	0.944	0.141	0.554	0.020
918	L20204	L20204	0.125	1.000	0.125	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
919	L20204	L20204	0.204	1.000	0.204	Cl. 13.8.4	102	0.944	0.141	0.554	0.020
920	L20204	L20204	0.103	1.000	0.103	Cl. 13.8.4	102	0.944	0.141	0.554	0.020
921	L20204	L20204	0.092	1.000	0.092	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
922	L20204	L20204	0.088	1.000	0.088	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
923	L20204	L20204	0.090	1.000	0.090	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
924	L20204	L20204	0.084	1.000	0.084	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
925	L20204	L20204	0.070	1.000	0.070	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
926	L20204	L20204	0.065	1.000	0.065	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
927	L20204	L20204	0.062	1.000	0.062	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
928	L20204	L20204	0.055	1.000	0.055	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
929	L20204	L20204	0.053	1.000	0.053	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
930	L20204	L20204	0.125	1.000	0.125	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
1071	L30304	L30304	0.046	1.000	0.046	Cl. 13.9.1	103	1.440	0.493	1.996	0.03
1073	L20204	L20204	0.037	1.000	0.037	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
1077	L30304	L30304	0.044	1.000	0.044	Cl. 13.9.1	103	1.440	0.493	1.996	0.03
1079	L20204	L20204	0.037	1.000	0.037	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
1081	L20204	L20204	0.058	1.000	0.058	Cl. 13.9.1	102	0.944	0.141	0.554	0.020
1082	L25254	L25254	0.040	1.000	0.040	Cl. 13.8.4	103	1.190	0.276	1.130	0.025
1083	L20204	L20204	0.056	1.000	0.056	Cl. 13.8.4	103	0.944	0.141	0.554	0.020
1084	L20204	L20204	0.053057	1.000	0.053057	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
1085	L25254	L25254	0.033	1.000	0.033	Cl. 13.8.4	103	1.190	0.276	1.130	0.025
1086	L20204	L20204	0.041	1.000	0.041	Cl. 13.8.4	103	0.944	0.141	0.554	0.020
1091	L30306	L30306	0.217	1.000	0.217	Cl. 13.9.1	102	2.110	0.712	2.807	0.099
1092	L30306	L30306	0.200	1.000	0.200	Cl. 13.8.4	102	2.110	0.712	2.807	0.099
1093	L30306	L30306	0.210	1.000	0.210	Cl. 13.9.1	101	2.110	0.712	2.807	0.099
1094	L30306	L30306	0.161	1.000	0.161	Cl. 13.8.4	101	2.110	0.712	2.807	0.099
1095	L25254	L25254	0.491	1.000	0.491	Cl. 13.9.1	101	1.190	0.276	1.130	0.025
1096	L25254	L25254	0.616	1.000	0.616	Cl. 13.9.1	101	1.190	0.276	1.130	0.025
1097	L25254	L25254	0.491	1.000	0.491	Cl. 13.9.1	101	1.190	0.276	1.130	0.025
1098	L25254	L25254	0.616	1.000	0.616	Cl. 13.9.1	101	1.190	0.276	1.130	0.025
1099	L30306	L30306	0.476	1.000	0.476	Cl. 13.8.4	101	2.110	0.712	2.807	0.099
1100	L30306	L30306	0.595	1.000	0.595	Cl. 13.8.4	101	2.110	0.712	2.807	0.099
1101	L30306	L30306	0.476	1.000	0.476	Cl. 13.8.4	101	2.110	0.712	2.807	0.099
1102	L30306	L30306	0.595	1.000	0.595	Cl. 13.8.4	101	2.110	0.712	2.807	0.099
1103	L50506	L50506	0.550	1.000	0.550	Cl. 13.9.1	101	3.650	3.549	13.943	0.171
1104	L50506	L50506	0.746	1.000	0.746	Cl. 13.8.4	101	3.650	3.549	13.943	0.171
1105	L50506	L50506	0.550	1.000	0.550	Cl. 13.9.1	101	3.650	3.549	13.943	0.171
1106	L50506	L50506	0.746	1.000	0.746	Cl. 13.8.4	101	3.650	3.549	13.943	0.171
1107	L30304	L30304	0.077	1.000	0.077	Cl. 13.8.4	103	1.440	0.493	1.996	0.03
1108	L25254	L25254	0.043	1.000	0.043	Cl. 13.9.1	103	1.190	0.276	1.130	0.025
1109	L30304	L30304	0.075	1.000	0.075	Cl. 13.8.4	103	1.440	0.493	1.996	0.03
1110	L25254	L25254	0.055	1.000	0.055	Cl. 13.9.1	103	1.190	0.276	1.130	0.025
1111	L30304	L30304	0.056	1.000	0.056	Cl. 13.8.4	103	1.440	0.493	1.996	0.03

 	Job No 24946B	Sheet No 28	Rev 0
	Part Rakes & Cage		
Software licensed to Westech Engineering Inc CONNECTED User: Jennifer MEIKLE	Ref		
Job Title Brantford	By ME75	Date 8/3/2023	Chd
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Utilization Ratio Cont...

Beam	Analysis Property	Design Property	Actual Ratio	Allowable Ratio	Ratio (Act./Allow.)	Clause	L/C	Ax (in ²)	Iz (in ⁴)	Iy (in ⁴)	Ix (in ⁴)
1112	L25254	L25254	0.045	1.000	0.045	Cl. 13.9.1	103	1.190	0.276	1.130	0.025
1113	L30304	L30304	0.054	1.000	0.054	Cl. 13.8.4	103	1.440	0.493	1.996	0.03
1114	L25254	L25254	0.027	1.000	0.027	Cl. 13.9.1	100	1.190	0.276	1.130	0.025
1115	L30304	L30304	0.038	1.000	0.038	Cl. 13.8.4	103	1.440	0.493	1.996	0.03
1116	L25254	L25254	0.016	1.000	0.016	Cl. 13.9.1	101	1.190	0.276	1.130	0.025
1117	L30304	L30304	0.023	1.000	0.023	Cl. 13.8.4	103	1.440	0.493	1.996	0.03
1118	L25254	L25254	0.023	1.000	0.023	Cl. 13.9.1	102	1.190	0.276	1.130	0.025
1119	L30304	L30304	0.026	1.000	0.026	Cl. 13.8.4	103	1.440	0.493	1.996	0.03
1120	L30304	L30304	0.024	1.000	0.024	Cl. 13.8.4	100	1.440	0.493	1.996	0.03
1121	L25254	L25254	0.020	1.000	0.020	Cl. 13.9.1	102	1.190	0.276	1.130	0.025
1122	L25254	L25254	0.019	1.000	0.019	Cl. 13.9.1	101	1.190	0.276	1.130	0.025

Walkway

Bentley Software licensed to Westech Engineering Inc CONNECTED User: Jennifer MEIKLE	WESTECH		Job No 24946B	Sheet No 1	Rev A
	Part Bridge and Platform				
Job Title Brantford			Ref		
			By ME75	Date 8/3/2023	Chd GR00 11/13/2023
Client			File STAAD-ww_24946B.std	Date/Time 10-Nov-2023 10:57	

Job Information

	Engineer	Checked	Approved
Name:	ME75		
Date:	8/3/2023		

Project ID	
Project Name	

Comments

REV A: Changed Wind and Snow loads (11/9/2023)
 Designed to NBCC 2020
 Stainless Steel Design
 Maximum allowable deflection = $l/360$
 DIMENSIONS:
 Radius to end of Bridge: 57 ft.
 Walkway Width: 3 ft.
 Platform Width: 7.0 ft.
 Platform Length: 8.5 ft.
 LOADINGS:
 Walkway Flooring: 5 lbs./sq.ft.
 Platform Flooring: 6 lbs./sq.ft.
 Handrail: 5 lbs./lin.ft.
 Walkway Live Load: 50 lbs./sq.ft.
 Horizontal Wind Load: 12.73 lbs./sq.ft. (Rev A)
 Snow Load: 37.594 lbs./sq.ft. (Rev A)
 Seismic Load: 0.11*Weight (Horizontal)
 These structural calculations represent the minimum member size necessary to satisfy the requirement of the specification. WesTech reserves the option of increasing the member size to facilitate design or fabrication requirements.

Structure Type	SPACE FRAME
----------------	-------------



Number of Nodes	76	Highest Node	110
Number of Elements	159	Highest Beam	379

Number of Basic Load Cases	32
Number of Combination Load Cases	0

Included in this printout are data for:

All	The Whole Structure
-----	---------------------

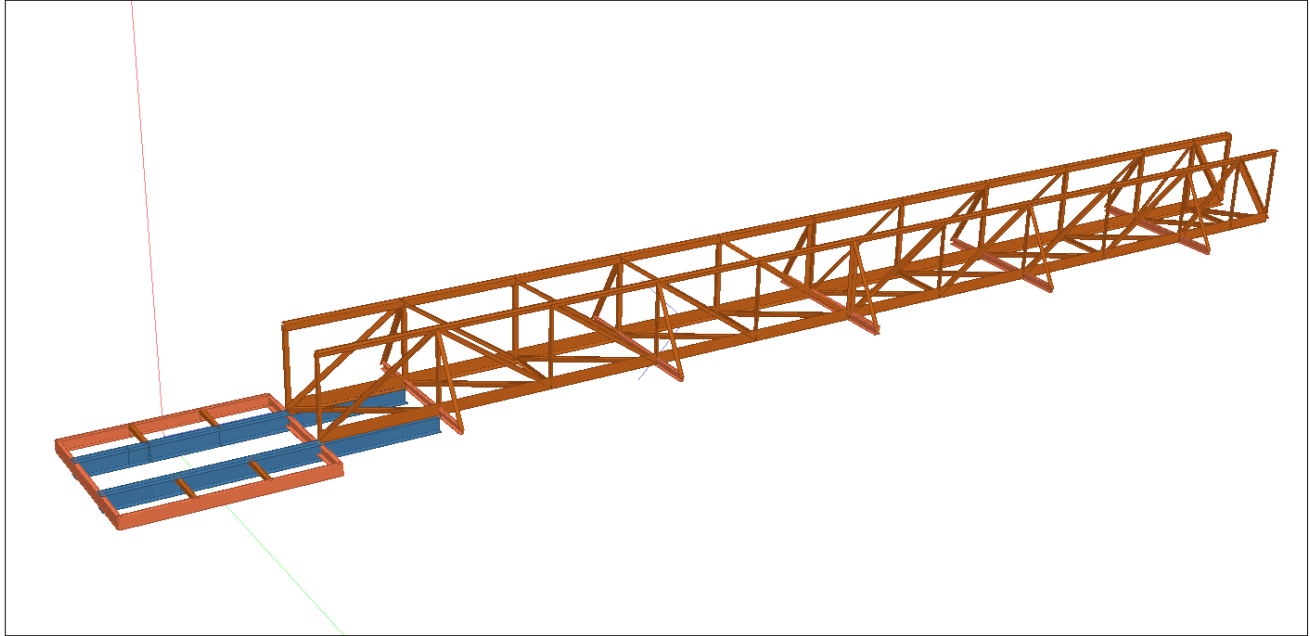


 	Job No 24946B	Sheet No 2	Rev A
	Part Bridge and Platform		
Job Title Brantford	Ref		
	By ME75	Date 8/3/2023	Chd
Client	File STAAD-ww_24946B.std	Date/Time 10-Nov-2023 10:57	

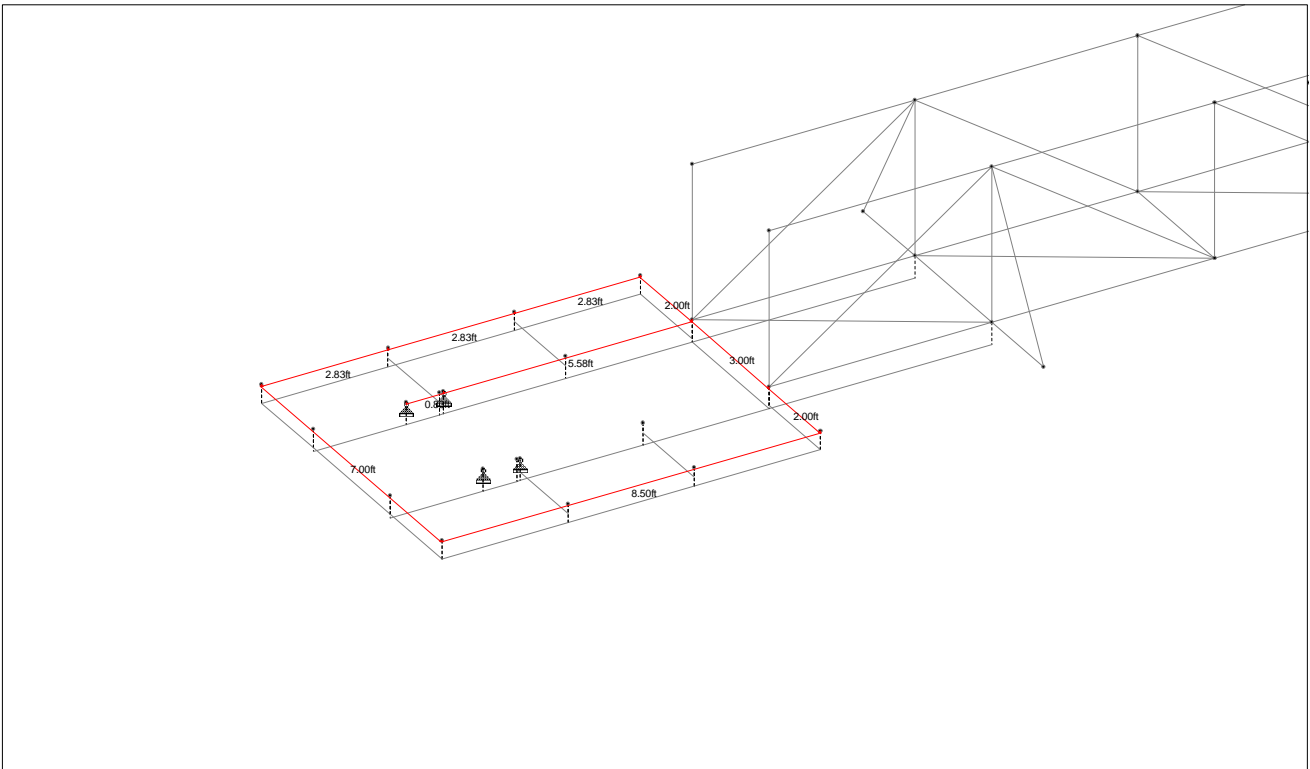
Job Information Cont...

Included in this printout are results for load cases:

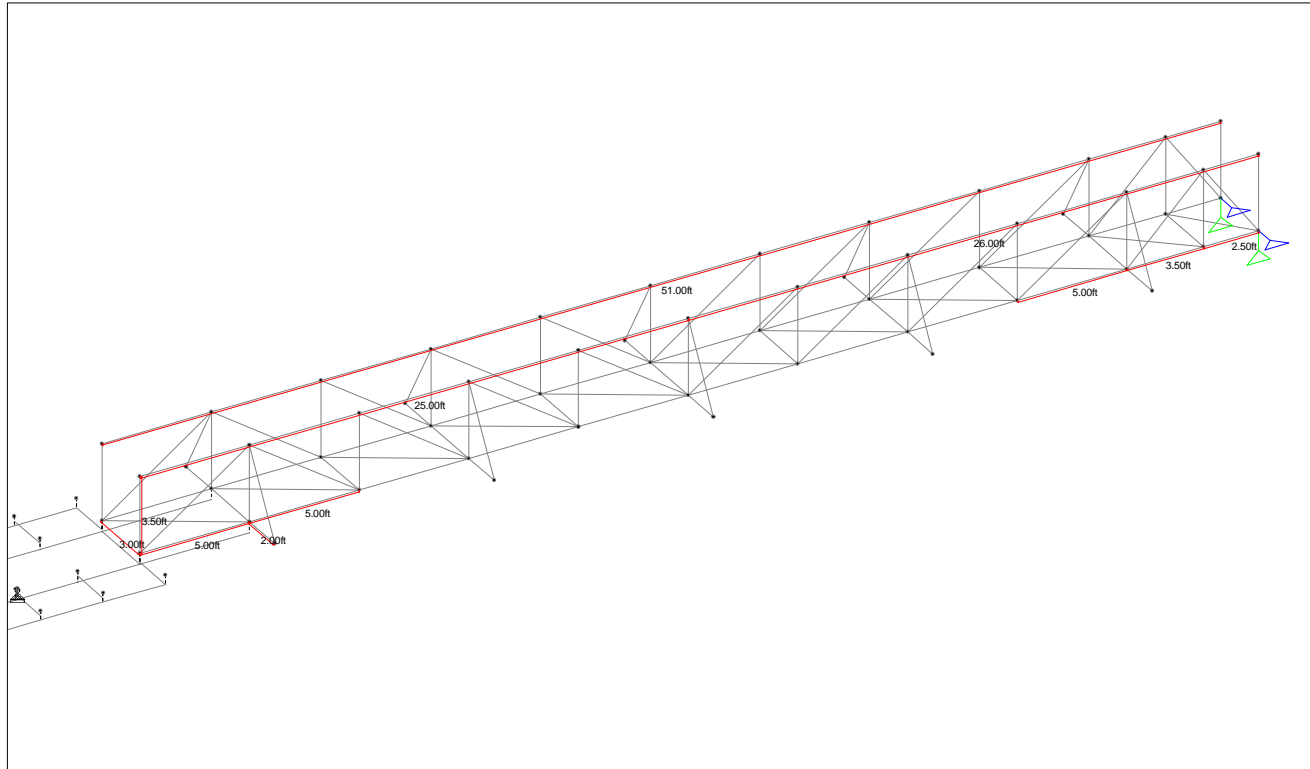
Type	L/C	Name
Primary	1	GRAVITY
Primary	2	FLOORING
Primary	3	HANDRAIL
Primary	4	LIVE
Primary	5	WIND(Z)
Primary	6	WIND(X)
Primary	7	SNOW
Primary	8	EH(Z)
Primary	9	EH(X)
Primary	100	1.4D
Primary	101	1.25D + 1.5L + 1.0S
Primary	102	1.25D + 1.5L + 0.4W (Z)
Primary	103	1.25D + 1.5L + 0.4W (X)
Primary	104	1.25D + 1.5S + 1.0L
Primary	105	1.25D + 1.5S + 0.4W (Z)
Primary	106	1.25D + 1.5S + 0.4W (X)
Primary	107	1.25D + 1.4W (Z) + 0.5L
Primary	108	1.25D + 1.4W (X) + 0.5L
Primary	109	1.25D + 1.4W (Z) + 0.5S
Primary	110	1.25D + 1.4W (X) + 0.5S
Primary	111	1.0D + 1.0E (Z) + 0.5L
Primary	112	1.0D + 1.0E (Z) + 0.25S
Primary	113	1.0D + 1.0E (X) + 0.5L
Primary	114	1.0D + 1.0E (X) + 0.25S
Primary	200	DEAD
Primary	201	1.0D + 1.0L + 0.3(Z)W
Primary	202	1.0D + 1.0L + 0.35S
Primary	203	1.0D + 1.0(Z)W + 0.35L
Primary	204	1.0D + 1.0(Z)W + 0.35S
Primary	205	1.0D + 1.0S + 0.3(Z)W
Primary	206	1.0D + 1.0S + 0.35L
Primary	300	CAMBER



Walkway & Platform



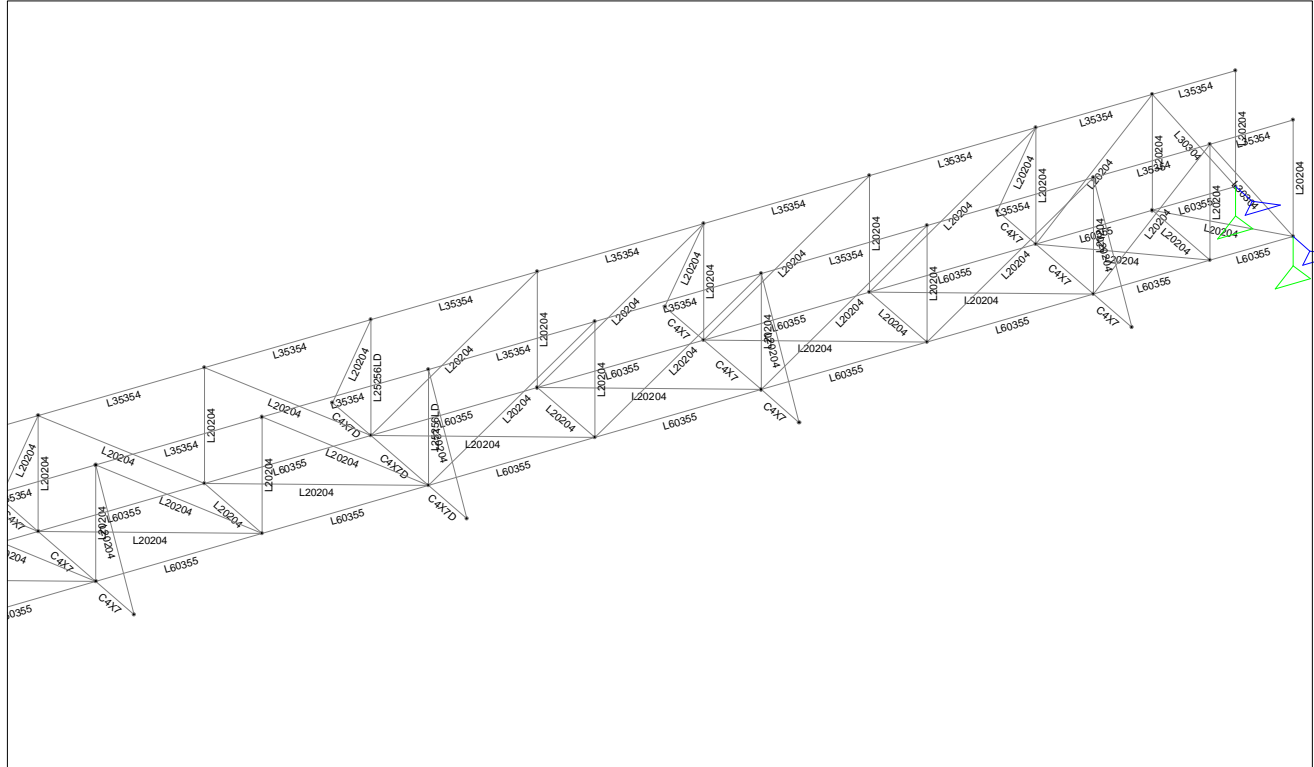
Platform Dimensions



Walkway Dimensions

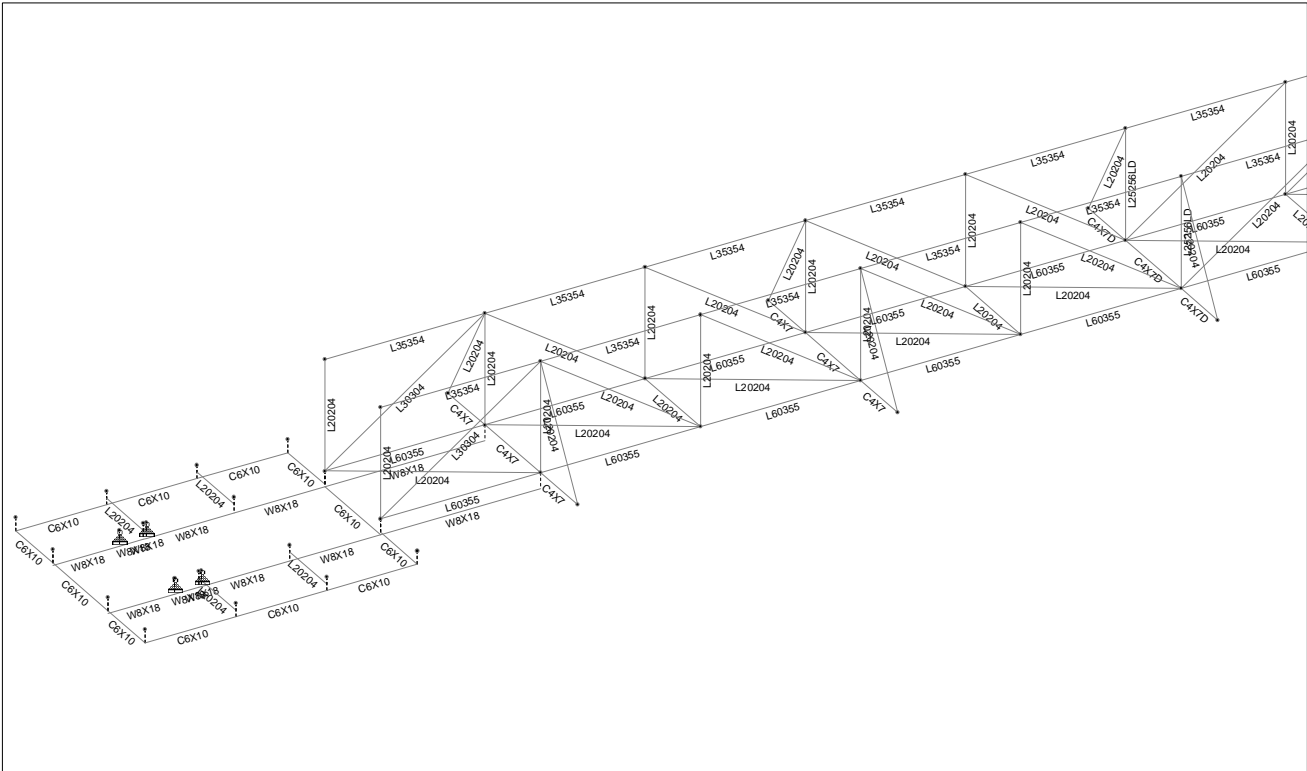
Section Properties

Prop	Section	Area (in ²)	I _{yy} (in ⁴)	I _{zz} (in ⁴)	J (in ⁴)	Material
1	L60355	2.890	12.039	1.726	0.096	STAINLESSST
2	L20204	0.944	0.550	0.146	0.020	STAINLESSST
3	L20204	0.944	0.550	0.146	0.020	STAINLESSST
4	L35354	1.700	3.196	0.824	0.036	STAINLESSST
5	L20204	0.944	0.550	0.146	0.020	STAINLESSST
6	L30304	1.440	1.982	0.506	0.030599	STAINLESSST
7	L20204	0.944	0.550	0.146	0.020	STAINLESSST
8	C4X7	2.130	0.425	4.580	0.0817	STAINLESSST
9	L20204	0.944	0.550	0.146	0.020	STAINLESSST
10	W8X18	5.260	7.970	61.900	0.172	STAINLESSST
11	C6X10	3.070	0.860	15.100	0.128	STAINLESSST
12	L20204	0.944	0.550	0.146	0.020	STAINLESSST
13	W8X18	5.260	7.970	61.900	0.172	STAINLESSST
14	L25256	3.460	3.976	1.968	0.163	STAINLESSST
15	C4X7	4.260	1.905	9.160	0.141	STAINLESSST



Member Sizes

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	Part Bridge and Platform				
Job Title Brantford			Ref		
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Member Sizes

Primary Load Cases

Number	Name	Type
1	GRAVITY	Dead
2	FLOORING	Dead
3	HANDRAIL	Dead
4	LIVE	Live
5	WIND(Z)	Wind
6	WIND(X)	Wind
7	SNOW	Snow
8	EH(Z)	Seismic-H
9	EH(X)	Seismic-H
100	1.4D	None
101	1.25D + 1.5L + 1.0S	None
102	1.25D + 1.5L + 0.4W (Z)	None
103	1.25D + 1.5L + 0.4W (X)	None
104	1.25D + 1.5S + 1.0L	None
105	1.25D + 1.5S + 0.4W (Z)	None
106	1.25D + 1.5S + 0.4W (X)	None
107	1.25D + 1.4W (Z) + 0.5L	None
108	1.25D + 1.4W (X) + 0.5L	None
109	1.25D + 1.4W (Z) + 0.5S	None

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Job Title	Brantford
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Part Bridge and Platform

Ref

By ME75

Date 8/3/2023

Chd

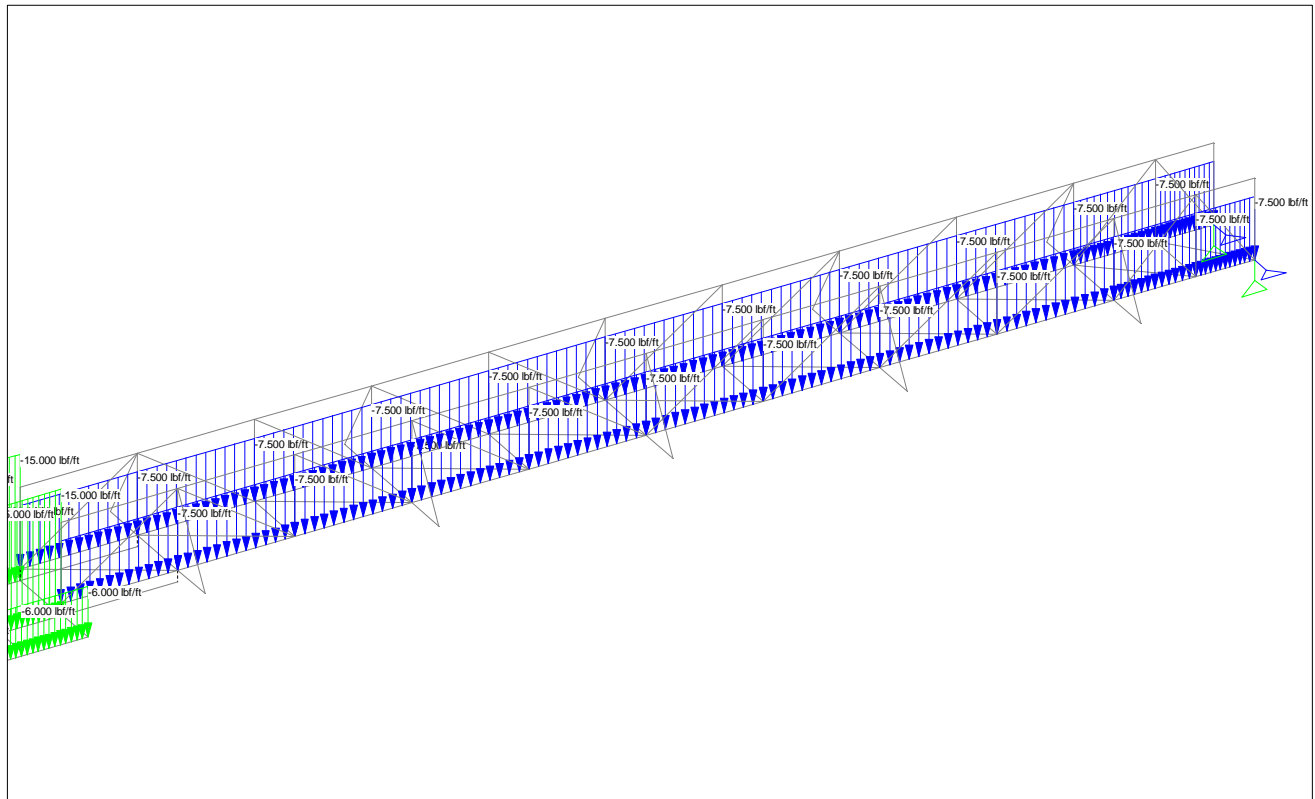
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File STAAD-ww_24946B.std

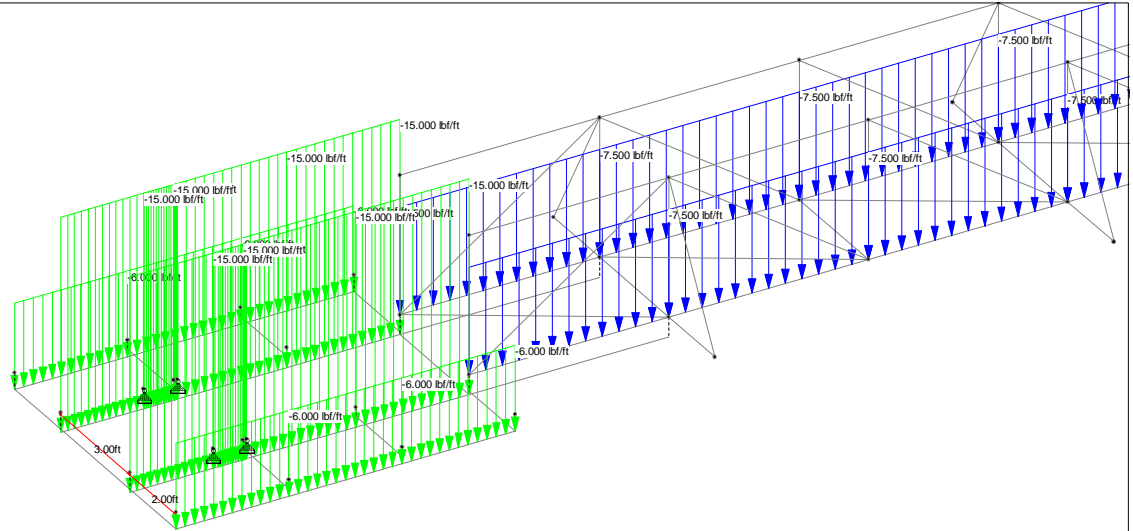
Date/Time 10-Nov-2023 10:57

Primary Load Cases Cont...

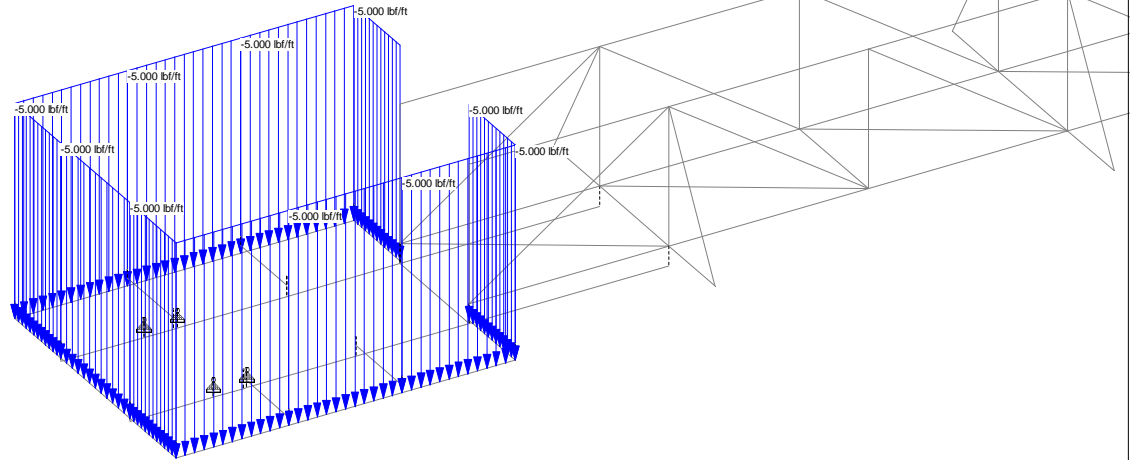
Number	Name	Type
110	$1.25D + 1.4W(X) + 0.5S$	None
111	$1.0D + 1.0E(Z) + 0.5L$	None
112	$1.0D + 1.0E(Z) + 0.25S$	None
113	$1.0D + 1.0E(X) + 0.5L$	None
114	$1.0D + 1.0E(X) + 0.25S$	None
200	DEAD	None
201	$1.0D + 1.0L + 0.3(Z)W$	None
202	$1.0D + 1.0L + 0.35S$	None
203	$1.0D + 1.0(Z)W + 0.35L$	None
204	$1.0D + 1.0(Z)W + 0.35S$	None
205	$1.0D + 1.0S + 0.3(Z)W$	None
206	$1.0D + 1.0S + 0.35L$	None
300	CAMBER	None



Walkway Flooring (5 psf)

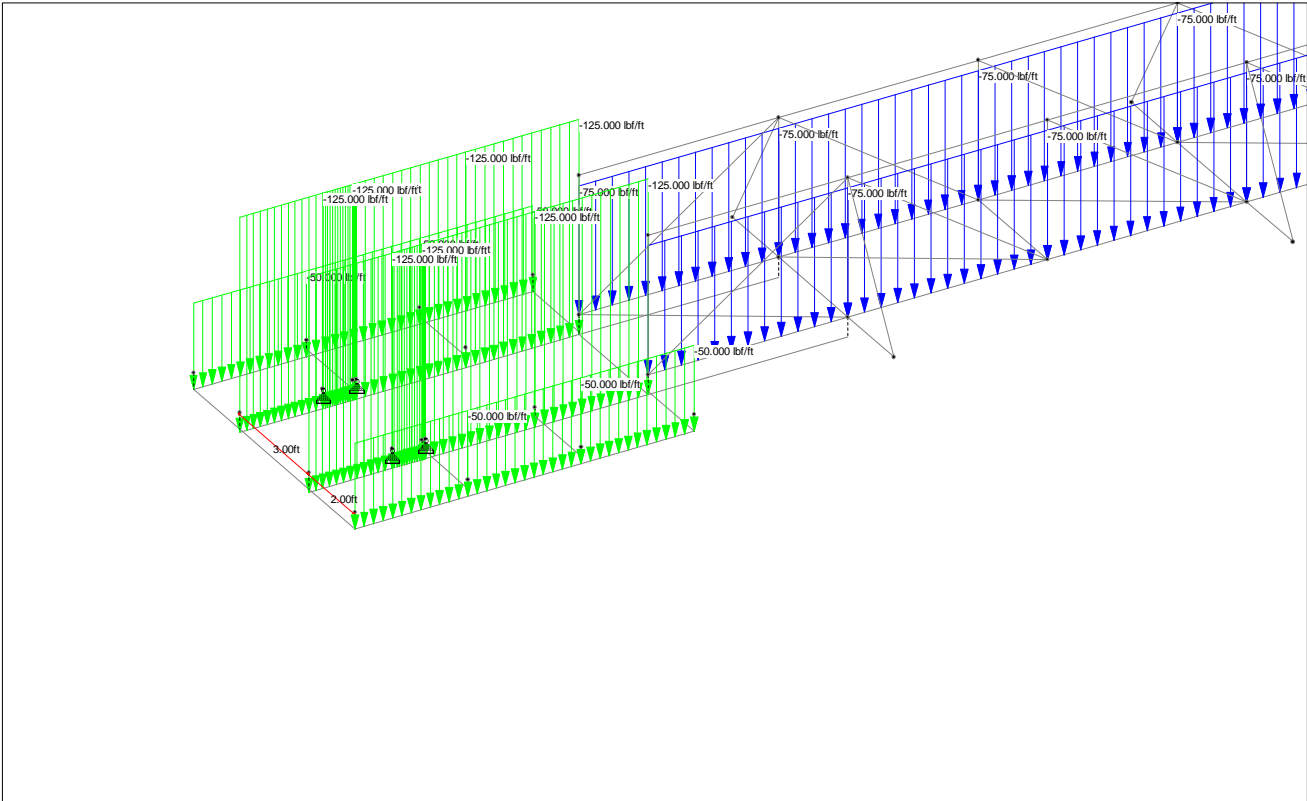


Platform Flooring (6 psf)

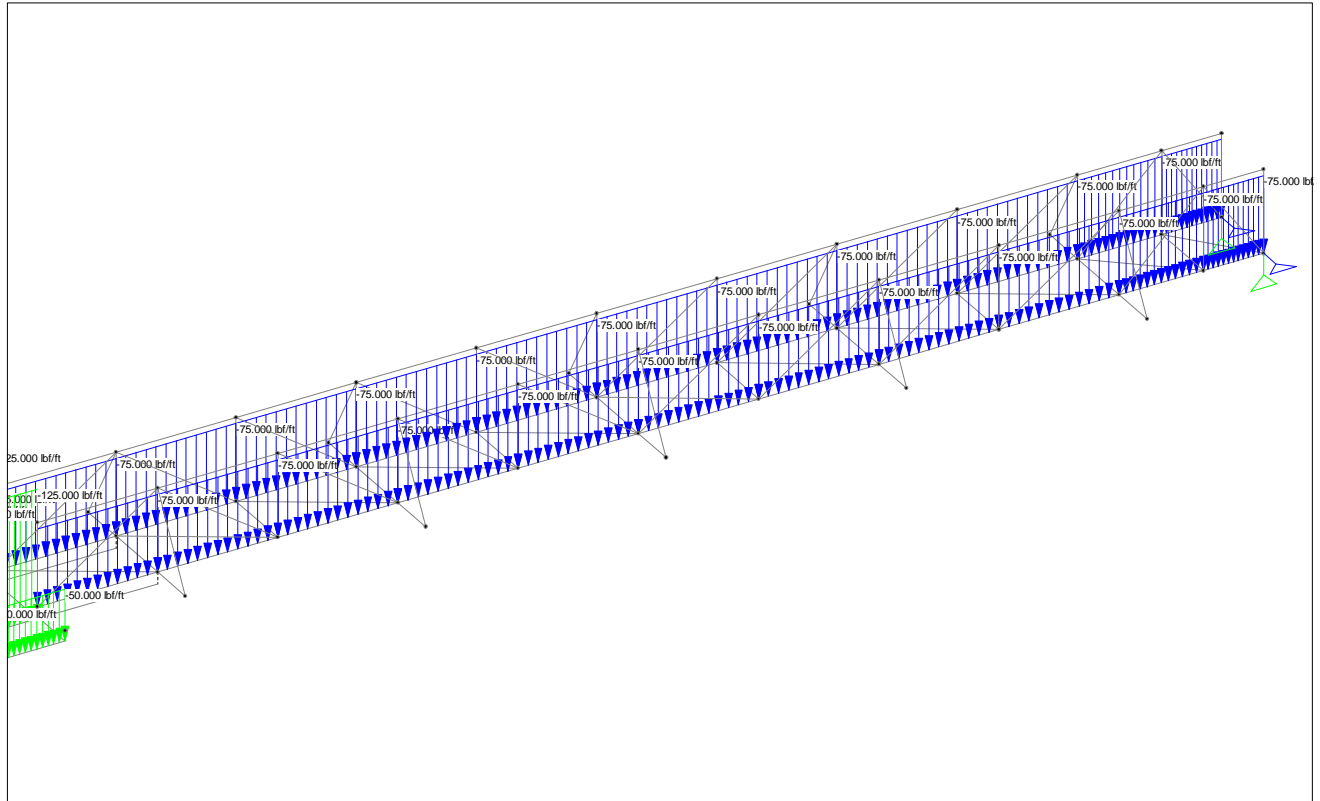


Handrail (5 plf)

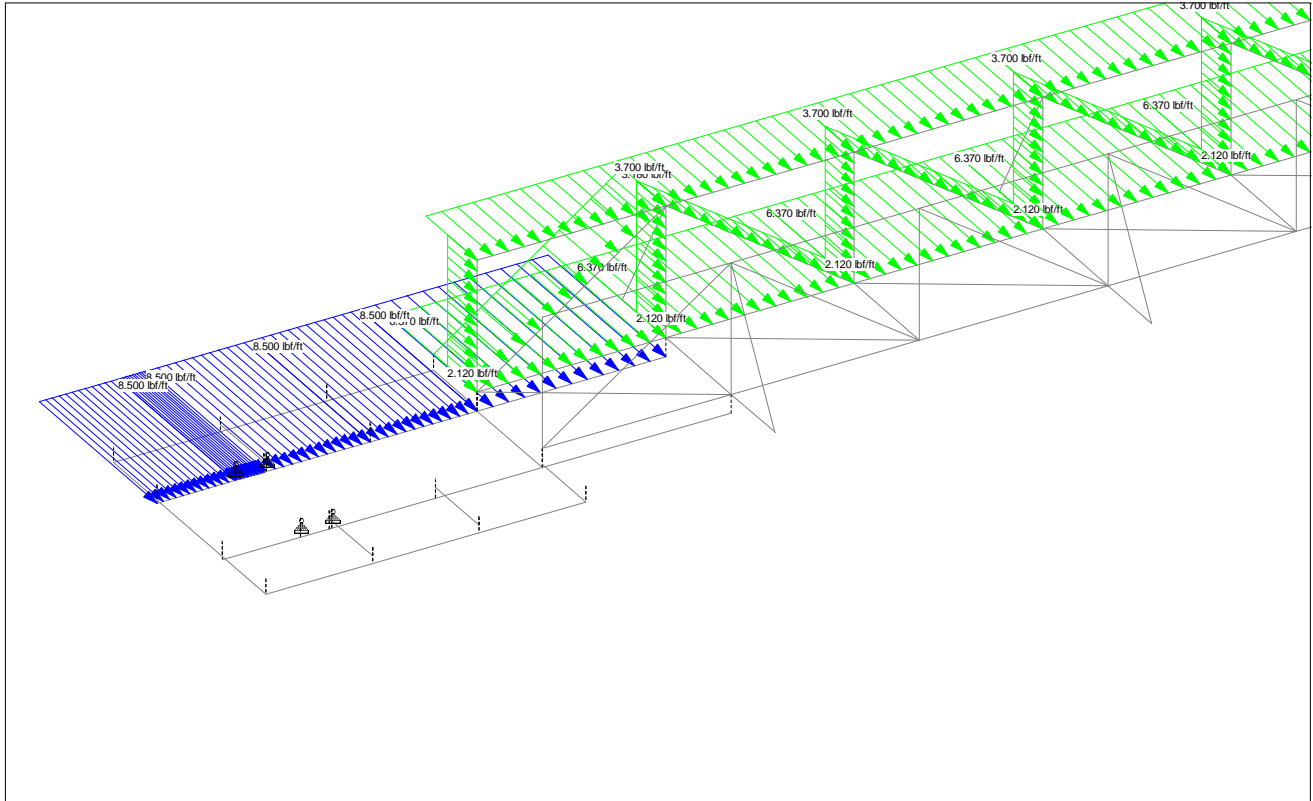
<div><div><div>Bentley®</div></div><div>Software licensed to Westech Engineering Inc CONNECTED User: Jennifer MEIKLE</div></div>	<div><div>WESTECH</div></div>	Job No 24946B	Sheet No 10	Rev A
		PartBridge and Platform		
Job Title Brantford	Ref			
	By ME75Date8/3/2023Chd			
Client	FileSTAAD-ww_24946B.std		Date/Time10-Nov-2023 10:57	



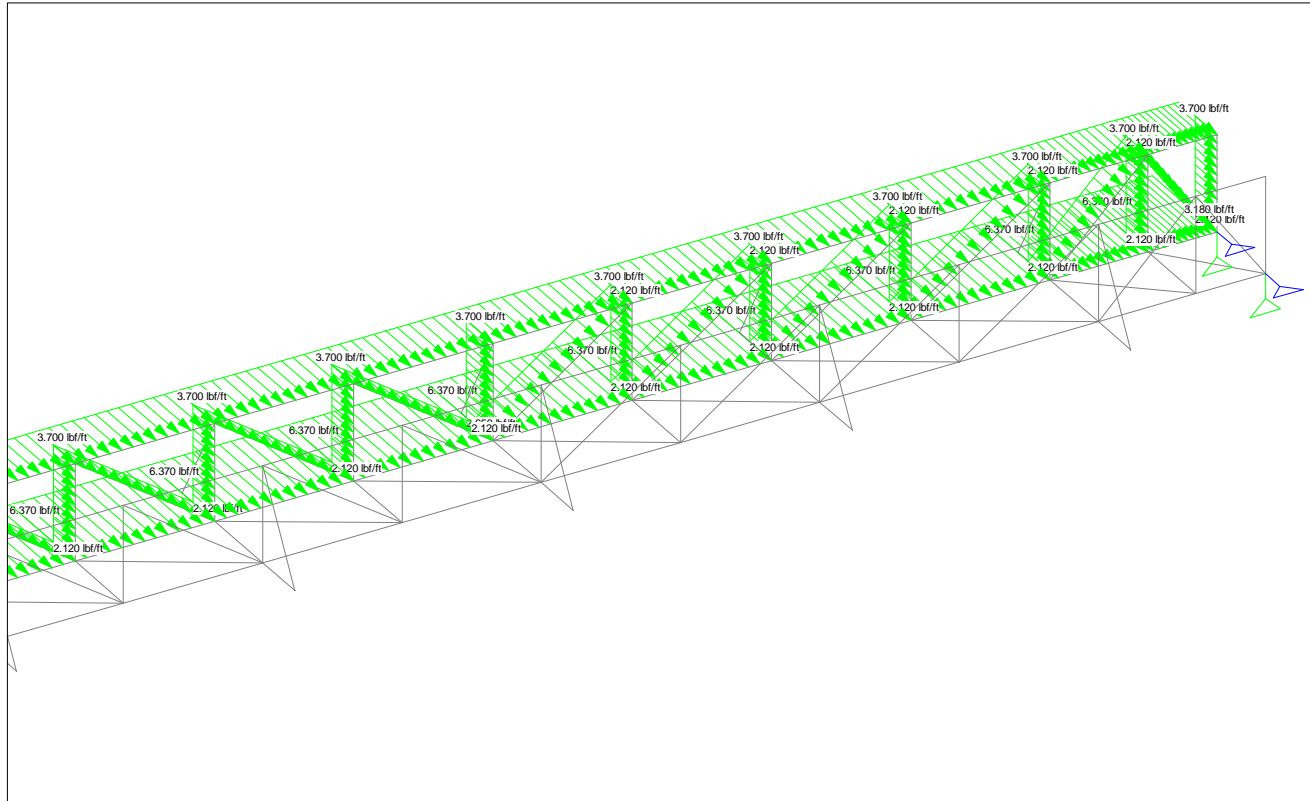
Live Load (50 psf)



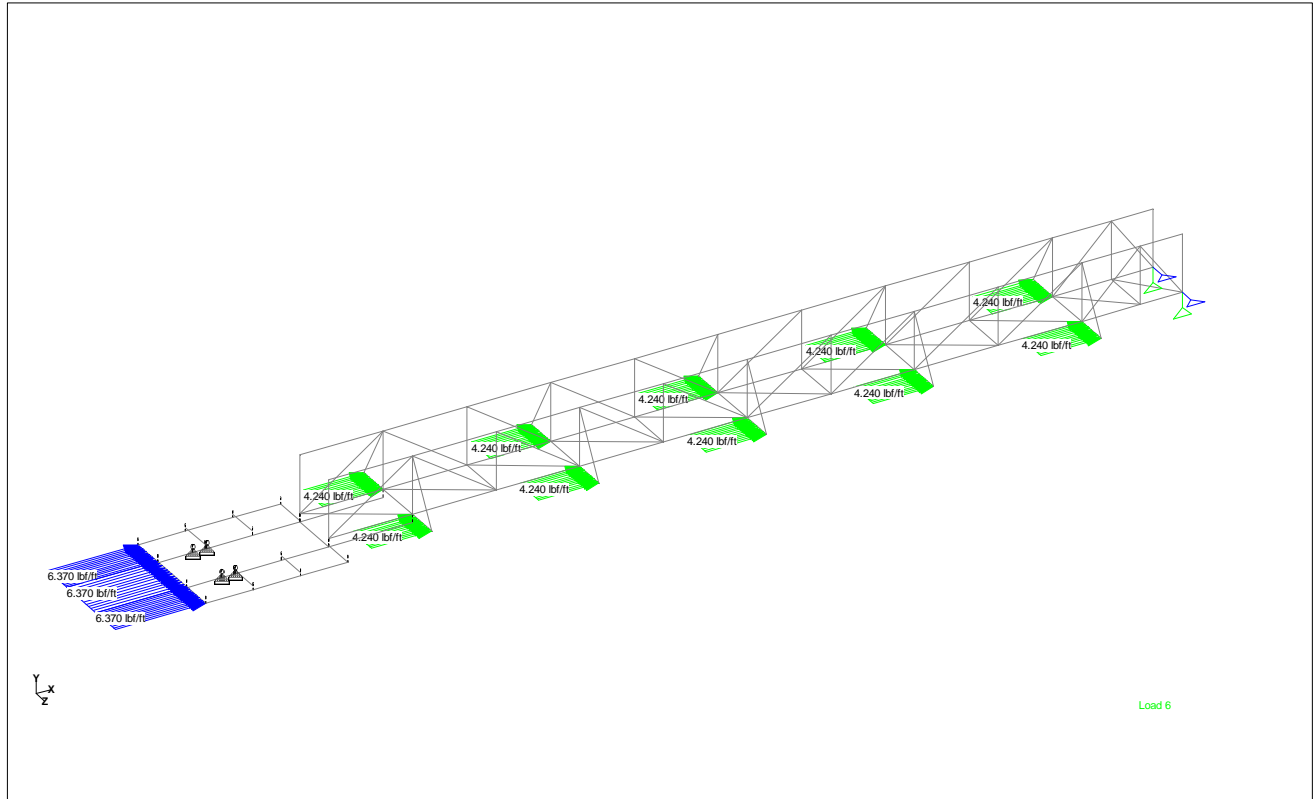
Live Load (50 psf)



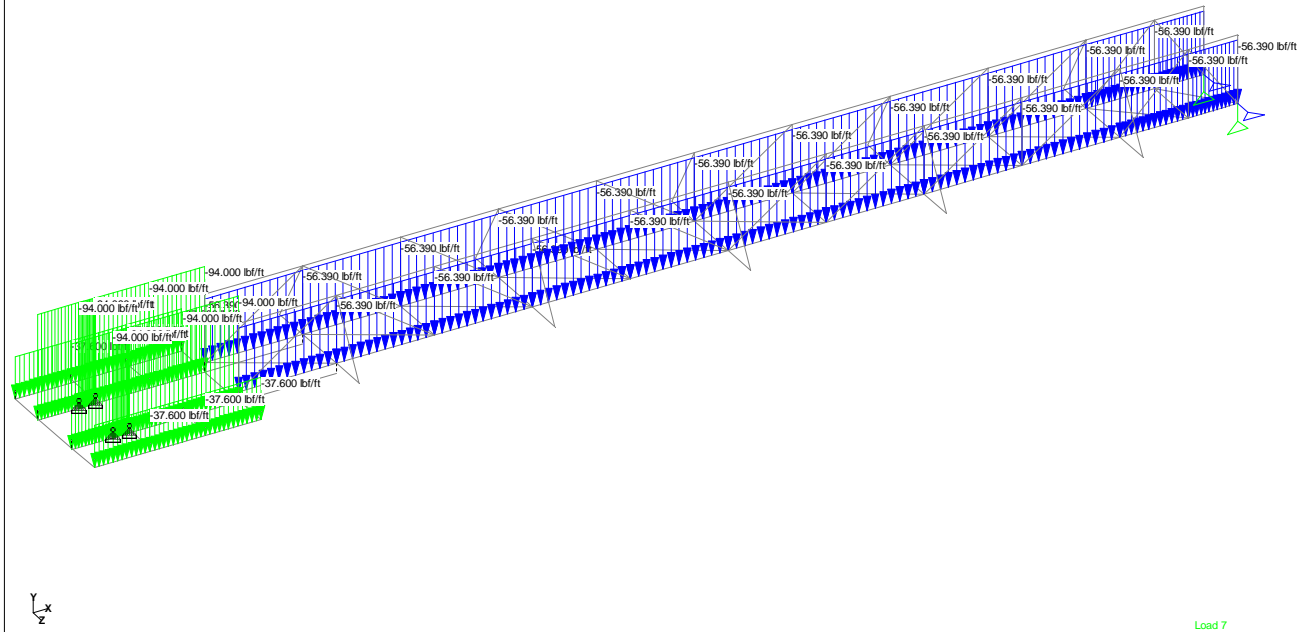
Wind Load-Z (12.73 psf) (Rev A)



Wind Load-Z (12.73 psf) (Rev A)

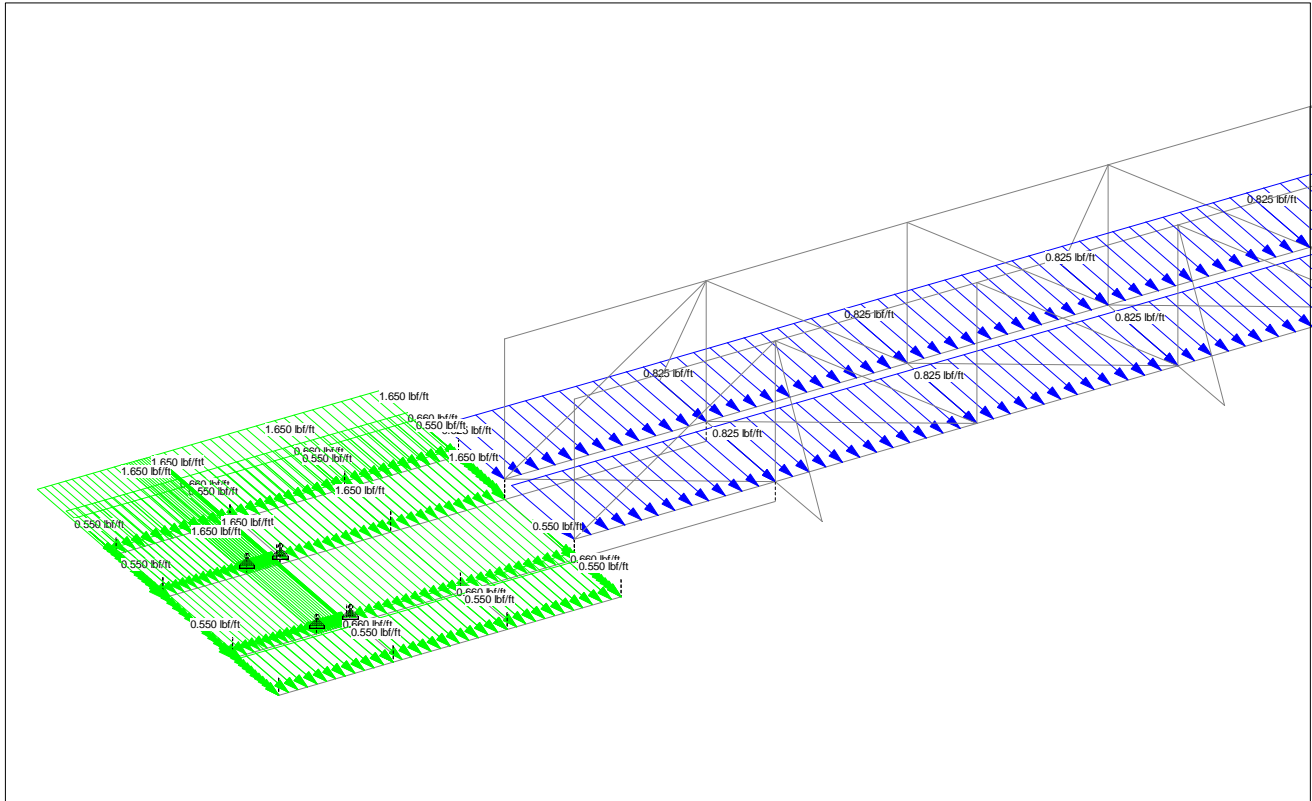


Wind Load-X (12.73 psf) (Rev A)



Snow Load (37.594 psf) (Rev A)

Load 7



*Seismic-Z (0.11*Dead Load)*

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Part Bridge and Platform

Ref

By ME75

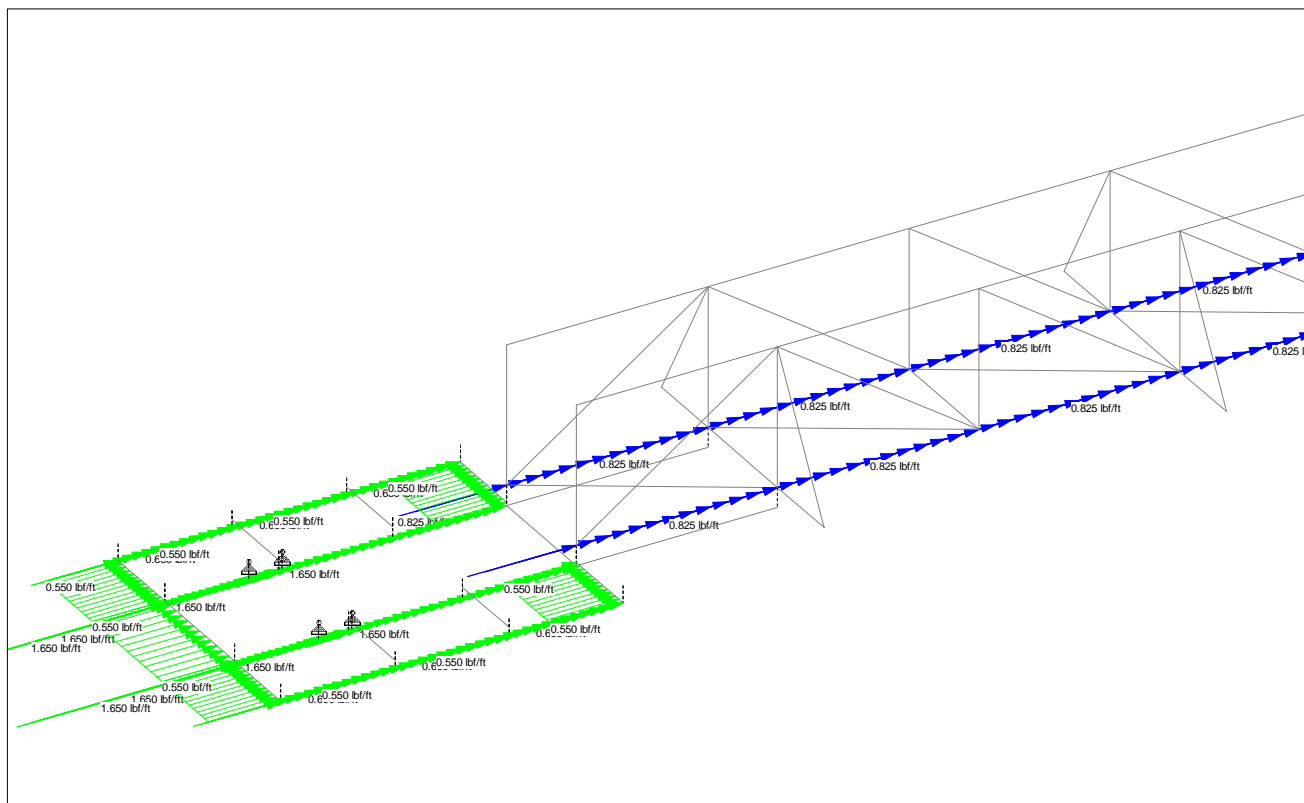
Date 8/3/2023

Chd

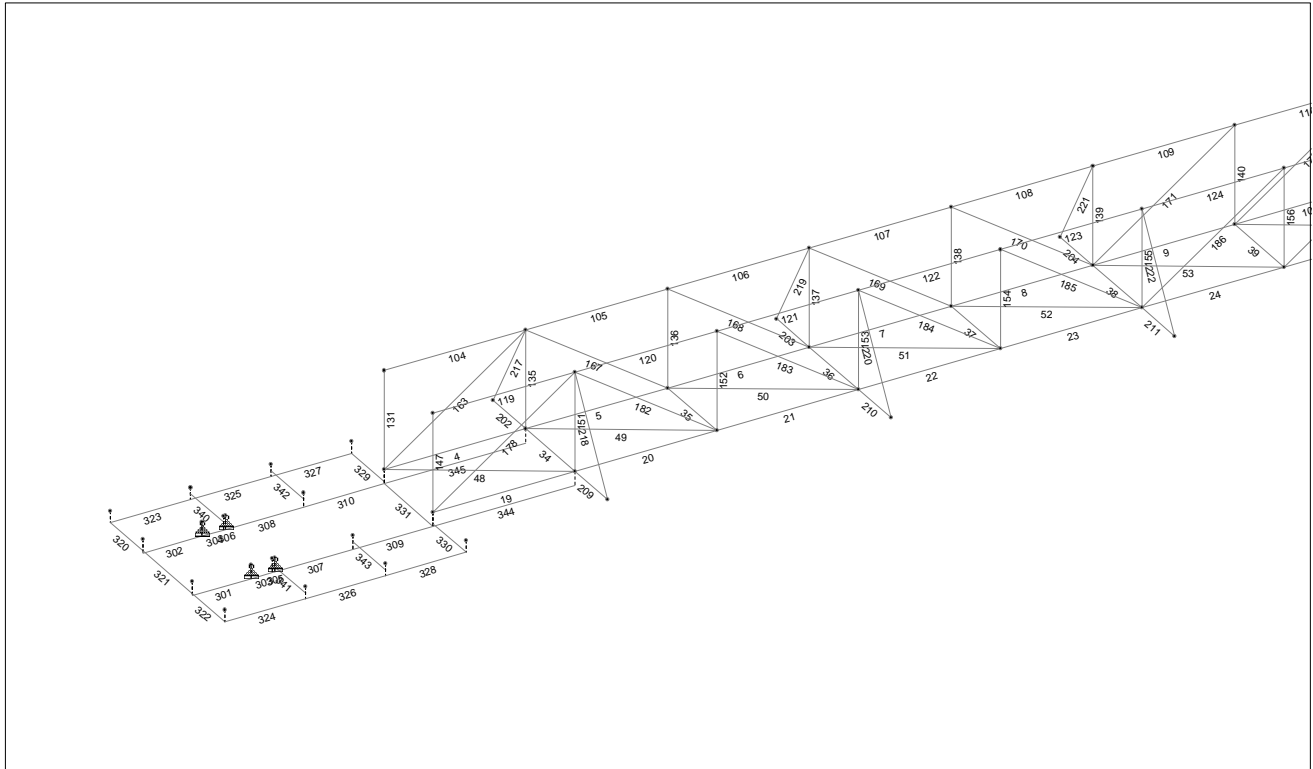
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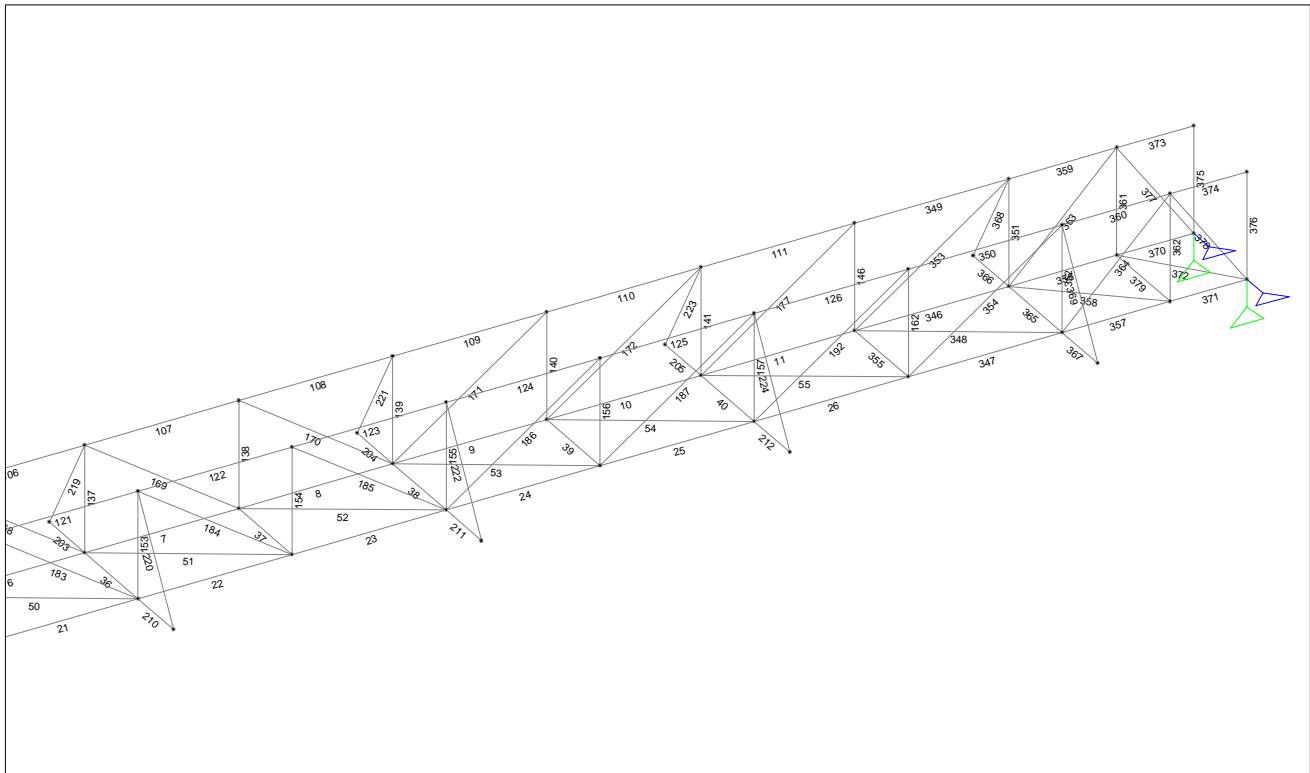


Seismic-X (0.11*Dead Load)



Beam Numbers



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	Part Bridge and Platform				
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Beam Numbers



Utilization Ratio

Beam	Analysis Property	Design Property	Actual Ratio	Allowable Ratio	Ratio (Act./Allow.)	Clause	L/C	Ax (in ²)	Iz (in ⁴)	Iy (in ⁴)	Ix (in ⁴)
4	L60355	L60355	0.288	1.000	0.288	Cl. 13.9.1	101	2.890	1.700	12.065	0.094
5	L60355	L60355	0.301	1.000	0.301	Cl. 13.9.1	101	2.890	1.700	12.065	0.094
6	L60355	L60355	0.342	1.000	0.342	Cl. 13.9.1	101	2.890	1.700	12.065	0.094
7	L60355	L60355	0.408	1.000	0.408	Cl. 13.9.1	101	2.890	1.700	12.065	0.094
8	L60355	L60355	0.456	1.000	0.456	Cl. 13.9.1	101	2.890	1.700	12.065	0.094
9	L60355	L60355	0.441	1.000	0.441	Cl. 13.9.1	101	2.890	1.700	12.065	0.094
10	L60355	L60355	0.390	1.000	0.390	Cl. 13.9.1	101	2.890	1.700	12.065	0.094
11	L60355	L60355	0.325	1.000	0.325	Cl. 13.9.1	101	2.890	1.700	12.065	0.094
19	L60355	L60355	0.272	1.000	0.272	Cl. 13.8.4	101	2.890	1.700	12.065	0.094
20	L60355	L60355	0.257	1.000	0.257	Cl. 13.9.1	101	2.890	1.700	12.065	0.094
21	L60355	L60355	0.312	1.000	0.312	Cl. 13.9.1	101	2.890	1.700	12.065	0.094
22	L60355	L60355	0.385	1.000	0.385	Cl. 13.9.1	101	2.890	1.700	12.065	0.094
23	L60355	L60355	0.427	1.000	0.427	Cl. 13.9.1	101	2.890	1.700	12.065	0.094
24	L60355	L60355	0.435	1.000	0.435	Cl. 13.9.1	101	2.890	1.700	12.065	0.094
25	L60355	L60355	0.374	1.000	0.374	Cl. 13.9.1	101	2.890	1.700	12.065	0.094
26	L60355	L60355	0.316	1.000	0.316	Cl. 13.9.1	101	2.890	1.700	12.065	0.094
34	C4X7	C4X7	0.099	1.000	0.099	Cl. 13.8.4	107	2.130	4.580	0.425	0.071
35	L20204	L20204	0.069	1.000	0.069	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
36	C4X7	C4X7	0.073	1.000	0.073	Cl. 13.8.4	101	2.130	4.580	0.425	0.071

 	Job No 24946B	Sheet No 20	Rev A
	Part Bridge and Platform		
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Utilization Ratio Cont...

Beam	Analysis Property	Design Property	Actual Ratio	Allowable Ratio	Ratio (Act./Allow.)	Clause	L/C	Ax (in ²)	Iz (in ⁴)	Iy (in ⁴)	Ix (in ⁴)
37	L20204	L20204	0.107	1.000	0.107	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
38	C4X7	C4X7 D S	0.038	1.000	0.038	Cl. 13.8	101	4.260	9.160	1.748	0.141
39	L20204	L20204	0.107	1.000	0.107	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
40	C4X7	C4X7	0.069	1.000	0.069	Cl. 13.8.4	101	2.130	4.580	0.425	0.071
48	L20204	L20204	0.146	1.000	0.146	Cl. 13.9.1	107	0.944	0.141	0.554	0.020
49	L20204	L20204	0.065	1.000	0.065	Cl. 13.9.1	107	0.944	0.141	0.554	0.020
50	L20204	L20204	0.060	1.000	0.060	Cl. 13.9.1	109	0.944	0.141	0.554	0.020
51	L20204	L20204	0.043	1.000	0.043	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
52	L20204	L20204	0.051	1.000	0.051	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
53	L20204	L20204	0.051	1.000	0.051	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
54	L20204	L20204	0.056	1.000	0.056	Cl. 13.8.4	109	0.944	0.141	0.554	0.020
55	L20204	L20204	0.097	1.000	0.097	Cl. 13.8.4	109	0.944	0.141	0.554	0.020
104	L35354	L35354	0.053568	1.000	0.053568	Cl. 13.8.4	101	1.700	0.805	3.215	0.035
105	L35354	L35354	0.643	1.000	0.643	Cl. 13.8.4	101	1.700	0.805	3.215	0.035
106	L35354	L35354	0.770	1.000	0.770	Cl. 13.8.4	101	1.700	0.805	3.215	0.035
107	L35354	L35354	0.846	1.000	0.846	Cl. 13.8.4	101	1.700	0.805	3.215	0.035
108	L35354	L35354	0.875	1.000	0.875	Cl. 13.8.4	101	1.700	0.805	3.215	0.035
109	L35354	L35354	0.879	1.000	0.879	Cl. 13.8.4	101	1.700	0.805	3.215	0.035
110	L35354	L35354	0.830	1.000	0.830	Cl. 13.8.4	101	1.700	0.805	3.215	0.035
111	L35354	L35354	0.739	1.000	0.739	Cl. 13.8.4	101	1.700	0.805	3.215	0.035
119	L35354	L35354	0.051	1.000	0.051	Cl. 13.8.4	101	1.700	0.805	3.215	0.035
120	L35354	L35354	0.627	1.000	0.627	Cl. 13.8.4	101	1.700	0.805	3.215	0.035
121	L35354	L35354	0.761	1.000	0.761	Cl. 13.8.4	101	1.700	0.805	3.215	0.035
122	L35354	L35354	0.840	1.000	0.840	Cl. 13.8.4	101	1.700	0.805	3.215	0.035
123	L35354	L35354	0.874	1.000	0.874	Cl. 13.8.4	101	1.700	0.805	3.215	0.035
124	L35354	L35354	0.875	1.000	0.875	Cl. 13.8.4	101	1.700	0.805	3.215	0.035
125	L35354	L35354	0.827	1.000	0.827	Cl. 13.8.4	101	1.700	0.805	3.215	0.035
126	L35354	L35354	0.740	1.000	0.740	Cl. 13.8.4	101	1.700	0.805	3.215	0.035
131	L20204	L20204	0.248	1.000	0.248	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
135	L20204	L20204	0.305	1.000	0.305	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
136	L20204	L20204	0.307	1.000	0.307	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
137	L20204	L20204	0.210	1.000	0.210	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
138	L20204	L20204	0.101	1.000	0.101	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
139	L25256	L25256 LI	0.022	1.000	0.022	Cl. 13.8.4	107	3.460	1.968	3.986	0.162
140	L20204	L20204	0.122	1.000	0.122	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
141	L20204	L20204	0.245	1.000	0.245	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
146	L20204	L20204	0.351	1.000	0.351	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
147	L20204	L20204	0.239	1.000	0.239	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
151	L20204	L20204	0.292	1.000	0.292	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
152	L20204	L20204	0.310	1.000	0.310	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
153	L20204	L20204	0.219	1.000	0.219	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
154	L20204	L20204	0.098	1.000	0.098	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
155	L25256	L25256 LI	0.009	1.000	0.009	Cl. 13.8.4	101	3.460	1.968	3.986	0.162
156	L20204	L20204	0.129	1.000	0.129	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
157	L20204	L20204	0.238	1.000	0.238	Cl. 13.8.4	101	0.944	0.141	0.554	0.020

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Utilization Ratio Cont...

Beam	Analysis Property	Design Property	Actual Ratio	Allowable Ratio	Ratio (Act./Allow.)	Clause	L/C	Ax (in ²)	Iz (in ⁴)	Iy (in ⁴)	Ix (in ⁴)
162	L20204	L20204	0.353	1.000	0.353	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
163	L30304	L30304	0.887	1.000	0.887	Cl. 13.8.4	101	1.440	0.493	1.996	0.03
167	L20204	L20204	0.293	1.000	0.293	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
168	L20204	L20204	0.209	1.000	0.209	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
169	L20204	L20204	0.138	1.000	0.138	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
170	L20204	L20204	0.073	1.000	0.073	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
171	L20204	L20204	0.089	1.000	0.089	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
172	L20204	L20204	0.159	1.000	0.159	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
177	L20204	L20204	0.233	1.000	0.233	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
178	L30304	L30304	0.852	1.000	0.852	Cl. 13.8.4	101	1.440	0.493	1.996	0.03
182	L20204	L20204	0.284	1.000	0.284	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
183	L20204	L20204	0.208	1.000	0.208	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
184	L20204	L20204	0.139	1.000	0.139	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
185	L20204	L20204	0.069	1.000	0.069	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
186	L20204	L20204	0.091	1.000	0.091	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
187	L20204	L20204	0.156	1.000	0.156	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
192	L20204	L20204	0.230	1.000	0.230	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
202	C4X7	C4X7	0.056	1.000	0.056	Cl. 13.8.4	107	2.130	4.580	0.425	0.071
203	C4X7	C4X7	0.037	1.000	0.037	Cl. 13.8.4	109	2.130	4.580	0.425	0.071
204	C4X7	C4X7 D S	0.013	1.000	0.013	Cl. 13.8	107	4.260	9.160	1.748	0.141
205	C4X7	C4X7	0.033	1.000	0.033	Cl. 13.8.4	109	2.130	4.580	0.425	0.071
209	C4X7	C4X7	0.015867	1.000	0.015867	Cl. 13.8.4	110	2.130	4.580	0.425	0.071
210	C4X7	C4X7	0.020	1.000	0.020	Cl. 13.8.4	110	2.130	4.580	0.425	0.071
211	C4X7	C4X7 D S	0.007	1.000	0.007	Cl. 13.8	108	4.260	9.160	1.748	0.141
212	C4X7	C4X7	0.027	1.000	0.027	Cl. 13.9.1	108	2.130	4.580	0.425	0.071
217	L20204	L20204	0.030	1.000	0.030	Cl. 13.9.1	109	0.944	0.141	0.554	0.020
218	L20204	L20204	0.024	1.000	0.024	Cl. 13.9.1	107	0.944	0.141	0.554	0.020
219	L20204	L20204	0.032	1.000	0.032	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
220	L20204	L20204	0.032	1.000	0.032	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
221	L20204	L20204	0.018	1.000	0.018	Cl. 13.9.1	107	0.944	0.141	0.554	0.020
222	L20204	L20204	0.010522	1.000	0.010522	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
223	L20204	L20204	0.025947	1.000	0.025947	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
224	L20204	L20204	0.028	1.000	0.028	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
301	W8X18	W8X18	0.085	1.000	0.085	Cl. 13.8	101	5.260	61.900	7.970	0.172
302	W8X18	W8X18	0.078207	1.000	0.078207	Cl. 13.8	101	5.260	61.900	7.970	0.172
303	W8X18	W8X18	0.903	1.000	0.903	Cl. 13.4.1.1	101	5.260	61.900	7.970	0.172
304	W8X18	W8X18	0.869	1.000	0.869	Cl. 13.4.1.1	101	5.260	61.900	7.970	0.172
305	W8X18	W8X18	0.907	1.000	0.907	Cl. 13.4.1.1	101	5.260	61.900	7.970	0.172
306	W8X18	W8X18	0.873	1.000	0.873	Cl. 13.4.1.1	101	5.260	61.900	7.970	0.172
307	W8X18	W8X18	0.731	1.000	0.731	Cl. 13.8	101	5.260	61.900	7.970	0.172
308	W8X18	W8X18	0.734	1.000	0.734	Cl. 13.8	101	5.260	61.900	7.970	0.172
309	W8X18	W8X18	0.367	1.000	0.367	Cl. 13.8	101	5.260	61.900	7.970	0.172
310	W8X18	W8X18	0.332	1.000	0.332	Cl. 13.8	101	5.260	61.900	7.970	0.172
320	C6X10	C6X10	0.168	1.000	0.168	Cl. 13.8.4	101	3.070	15.100	0.860	0.115
321	C6X10	C6X10	0.443	1.000	0.443	Cl. 13.8.4	107	3.070	15.100	0.860	0.115

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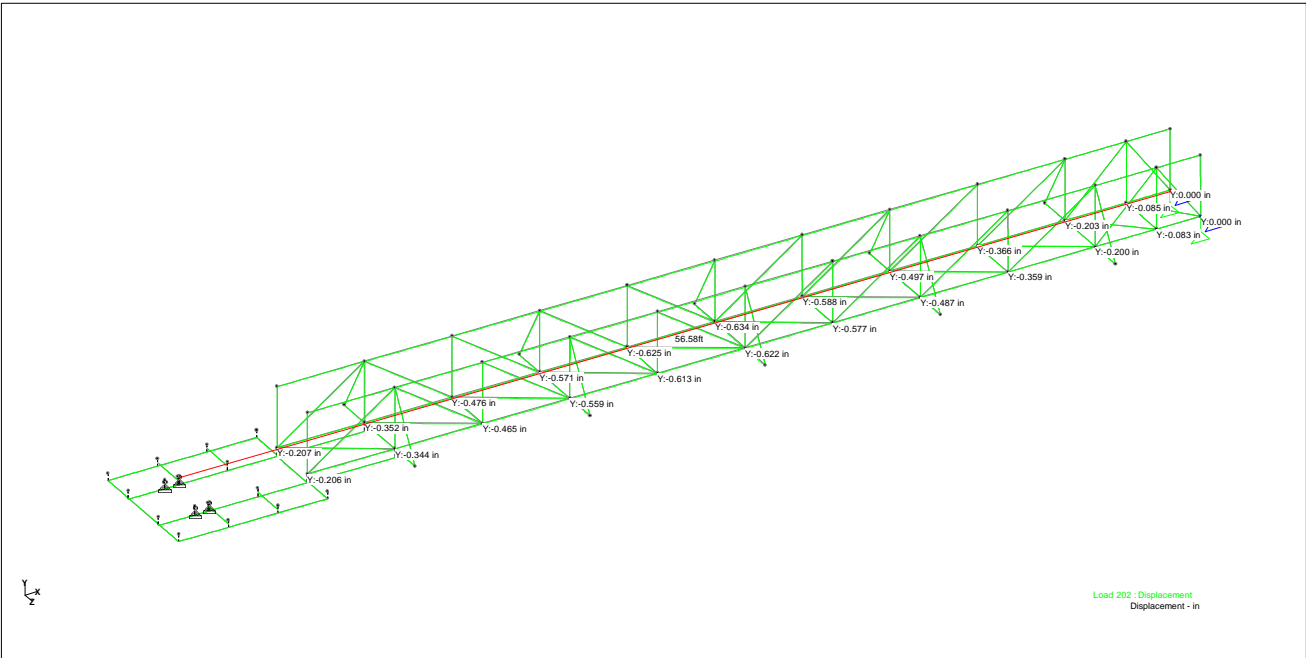
Utilization Ratio Cont...

Beam	Analysis Property	Design Property	Actual Ratio	Allowable Ratio	Ratio (Act./Allow.)	Clause	L/C	Ax (in ²)	Iz (in ⁴)	Iy (in ⁴)	Ix (in ⁴)
322	C6X10	C6X10	0.183	1.000	0.183	Cl. 13.8.4	101	3.070	15.100	0.860	0.115
323	C6X10	C6X10	0.140	1.000	0.140	Cl. 13.8.4	101	3.070	15.100	0.860	0.115
324	C6X10	C6X10	0.154	1.000	0.154	Cl. 13.8.4	101	3.070	15.100	0.860	0.115
325	C6X10	C6X10	0.152	1.000	0.152	Cl. 13.8.4	101	3.070	15.100	0.860	0.115
326	C6X10	C6X10	0.171	1.000	0.171	Cl. 13.8.4	101	3.070	15.100	0.860	0.115
327	C6X10	C6X10	0.092	1.000	0.092	Cl. 13.8.4	101	3.070	15.100	0.860	0.115
328	C6X10	C6X10	0.088	1.000	0.088	Cl. 13.8.4	101	3.070	15.100	0.860	0.115
329	C6X10	C6X10	0.200	1.000	0.200	Cl. 13.8.4	101	3.070	15.100	0.860	0.115
330	C6X10	C6X10	0.189	1.000	0.189	Cl. 13.8.4	101	3.070	15.100	0.860	0.115
331	C6X10	C6X10	0.286	1.000	0.286	Cl. 13.8.4	107	3.070	15.100	0.860	0.115
340	L20204	L20204	0.408	1.000	0.408	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
341	L20204	L20204	0.528	1.000	0.528	Cl. 13.9.1	107	0.944	0.141	0.554	0.020
342	L20204	L20204	0.193	1.000	0.193	Cl. 13.9.1	109	0.944	0.141	0.554	0.020
343	L20204	L20204	0.256	1.000	0.256	Cl. 13.8.4	107	0.944	0.141	0.554	0.020
344	W8X18	W8X18	0.232	1.000	0.232	Cl. 13.9.2	101	5.260	61.900	7.970	0.172
345	W8X18	W8X18	0.231	1.000	0.231	Cl. 13.9.2	101	5.260	61.900	7.970	0.172
346	L60355	L60355	0.228	1.000	0.228	Cl. 13.9.1	101	2.890	1.700	12.065	0.094
347	L60355	L60355	0.222	1.000	0.222	Cl. 13.9.1	101	2.890	1.700	12.065	0.094
348	L20204	L20204	0.118	1.000	0.118	Cl. 13.8.4	109	0.944	0.141	0.554	0.020
349	L35354	L35354	0.579	1.000	0.579	Cl. 13.8.4	101	1.700	0.805	3.215	0.035
350	L35354	L35354	0.578	1.000	0.578	Cl. 13.8.4	101	1.700	0.805	3.215	0.035
351	L20204	L20204	0.454	1.000	0.454	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
352	L20204	L20204	0.454	1.000	0.454	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
353	L20204	L20204	0.311	1.000	0.311	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
354	L20204	L20204	0.305	1.000	0.305	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
355	L20204	L20204	0.058	1.000	0.058	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
356	L60355	L60355	0.127	1.000	0.127	Cl. 13.9.1	101	2.890	1.700	12.065	0.094
357	L60355	L60355	0.128	1.000	0.128	Cl. 13.9.1	101	2.890	1.700	12.065	0.094
358	L20204	L20204	0.108	1.000	0.108	Cl. 13.8.4	109	0.944	0.141	0.554	0.020
359	L35354	L35354	0.347	1.000	0.347	Cl. 13.8.4	101	1.700	0.805	3.215	0.035
360	L35354	L35354	0.350	1.000	0.350	Cl. 13.8.4	101	1.700	0.805	3.215	0.035
361	L20204	L20204	0.131	1.000	0.131	Cl. 13.9.1	107	0.944	0.141	0.554	0.020
362	L20204	L20204	0.115	1.000	0.115	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
363	L20204	L20204	0.322	1.000	0.322	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
364	L20204	L20204	0.320	1.000	0.320	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
365	C4X7	C4X7	0.074	1.000	0.074	Cl. 13.9.1	107	2.130	4.580	0.425	0.071
366	C4X7	C4X7	0.050	1.000	0.050	Cl. 13.8.4	109	2.130	4.580	0.425	0.071
367	C4X7	C4X7	0.029	1.000	0.029	Cl. 13.9.1	108	2.130	4.580	0.425	0.071
368	L20204	L20204	0.047158	1.000	0.047158	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
369	L20204	L20204	0.047	1.000	0.047	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
370	L60355	L60355	0.091	1.000	0.091	Cl. 13.9.1	101	2.890	1.700	12.065	0.094
371	L60355	L60355	0.085689	1.000	0.085689	Cl. 13.9.1	101	2.890	1.700	12.065	0.094
372	L20204	L20204	0.136	1.000	0.136	Cl. 13.8.4	107	0.944	0.141	0.554	0.020
373	L35354	L35354	0.020	1.000	0.020	Cl. 13.8.4	101	1.700	0.805	3.215	0.035
374	L35354	L35354	0.020	1.000	0.020	Cl. 13.8.4	101	1.700	0.805	3.215	0.035

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	Part Bridge and Platform				
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Utilization Ratio Cont...

Beam	Analysis Property	Design Property	Actual Ratio	Allowable Ratio	Ratio (Act./Allow.)	Clause	L/C	Ax (in ²)	Iz (in ⁴)	Iy (in ⁴)	Ix (in ⁴)
375	L20204	L20204	0.073	1.000	0.073	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
376	L20204	L20204	0.084	1.000	0.084	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
377	L30304	L30304	0.350	1.000	0.350	Cl. 13.8.4	101	1.440	0.493	1.996	0.03
378	L30304	L30304	0.353	1.000	0.353	Cl. 13.8.4	101	1.440	0.493	1.996	0.03
379	L20204	L20204	0.097	1.000	0.097	Cl. 13.9.1	107	0.944	0.141	0.554	0.020



Walkway Displacement: Load Case 202, D+L+0.35S (1.87" max) (Rev A)



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Job Title Brantford

Client

Job No
24946B

Sheet No
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Rev
A

Part Bridge and Platform

Ref

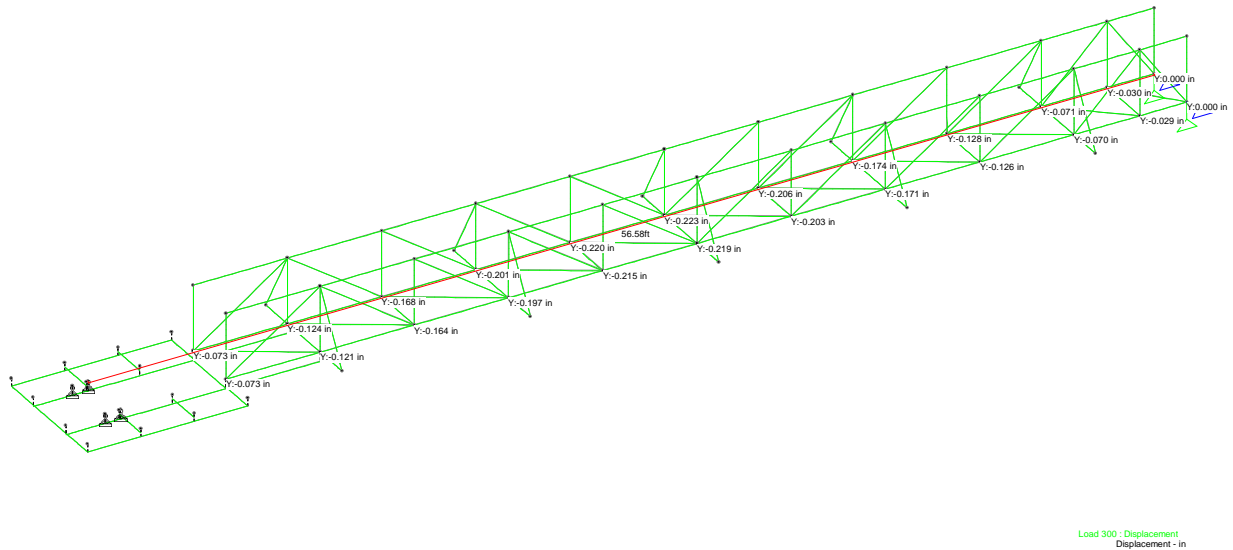
By ME75

Date 8/3/2023

Chd

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Camber

Center Column Anchor Bolts

Center Column Epoxy Anchor Bolt Calculations

Page 1

Job Name: Brantford	By: ME75	Last Saved Date: 08/02/23
Job Number: 24946B	Chk'd: PO07	Date: 8/3/2023

Note: Concrete Breakout Strength of Anchor in Shear is not passing

CENTER COLUMN INPUT

Column Diameter (D_c) = 914 mm

ANCHOR BOLT INPUT

Anchor Bolt Type =	Epoxy
Epoxy Type =	Simpson SET-3G
Anchor Bolt Material =	316SS ASTM A193B8
Bolt Tensile Strength (f_{tsa}) =	517 MPa
Bolt Yield Strength (f_{ys}) =	207 MPa
Elastic Modulus (E_s) =	1331 MPa
Number of Anchor Bolts (n) =	8
Bolt Diameter (d_b) =	25.40 mm
Thread Root Diameter (d_{root}) =	21.971 mm
Bolt Circle Diameter (d_{bc}) =	1473.2 mm
Anchor Bolt Embedment Depth, SELECTED (h_{ef}) =	254 mm
Anchor Bolt Minimum Embedment Depth ($h_{ef,min}$) =	101.6 mm
Anchor Bolt Maximum Embedment Depth ($h_{ef,max}$) =	508.0 mm
Distance to Loaded Edge (Edge) =	50.8 mm
Steel Strength Reduction Factor (Tension), ($\phi_{tension}$) =	0.75
Steel Strength Reduction Factor (Shear), (ϕ_{shear}) =	0.65
Temperature Range =	A

Table 5 of ESR-4057

Table 5 of ESR-4057

Table 3 of ESR-4057

Table 3 of ESR-4057

Max Short Term 160°F, Max Long Term 110°F

Short term temperatures are those that occur over short intervals, such as a day.
Long term temperatures are constant over a significant time period.

DRIVE TORQUE LOADING

Drive Design Torque (Torque) =	48,471 N-m
Drive Momentary Peak Torque (TorqueP) =	96,941 N-m

NBCC 2020

Earthquake Importance Factor, (I_e) =	1.5	NBCC 2020, Table 4.1.8.5.A, Post Disaster
Site Class =	D	Assume D
Mapped Spectral Response Accel, ($S_a(0.2)$) =	0.205	
Component Amplification Factor (A_r) =	1.00	
Component Response Modification Factor (R_p) =	2.50	
Seismic Coefficient (V_p) =	0.11	

CONCRETE INPUT

Concrete Compressive Strength (f'_c) =	17.2 MPa	Assumed.
Concrete Elastic Modulus (E_c) =	236649 MPa	
Concrete Strength Reduction Factor ($R_{conc_tension}$) =	1.00	CSA A23.3:19 D.5.3.c (condition B)
Concrete Strength Reduction Factor (R_{conc_shear}) =	1.00	CSA A23.3:19 D.5.3.c (condition B)
Concrete Density Modification Factor (λ) =	1	CSA A23.3:19 8.6.5 (Assumed Normal Density)

LOADS & MOMENTS

Load Description	Vert. Center of Gravity*	Weight**		Bending Moment (COG*Wt*C _g)	
Rake Arms	1.076 m	28402 N		3409 N-m	
Cage	2.832 m	6034 N		1906 N-m	
Center Column	2.972 m	10955 N		3631 N-m	
Drive	6.246 m	9786 N		6816 N-m	
Feedwell	4.863 m	14962 N		8114 N-m	
Feedwell supports	6.082 m	3833 N		2600 N-m	
Walkway	6.211 m	18484 N		12802 N-m	
Energy Dissipating Inlet	5.168 m	9603 N		5534 N-m	
Total =		102059 N		44811 N-m	

* With Respect To Anchor Bolt Elevation

** Component Weights Must Be Verified With Final Design

Maximum tension and compression force on anchor bolts due to overturning loads

P_{max} (TENS & COMP) =	15209 N	$P_{max} = (4 \cdot M / d_{bc}) / n$
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Anchor Bolt Forces, per NBCC 2020				Page 2
Tension Forces (Per Anchor Bolt)				
D =	-12757	N	-W/n	
TQ =	0	N	Torque from Drive (Treated as Dead Load due to well defined limit)	
L =	-3506	N	Tension Due to Live Load	
E _{o1} =	15209	N	P _{max} (Tension Due to Over-Turning Moment)	
E _v =	0	N	Vertical Seismic	
R _d *R _o =	1.3		SFRS Overstrength Factor (CSA A23.3:19 D.4.3.5.3.d.i)	
Combined Tension Forces (Per Anchor Bolt)		Total Tension Force of Anchors (For Use in Concrete Breakout Capacity Checks)		
P _{u1} =	-17860	N	P _{u-tot1} =	-142883 N 1.4(D+TQ) NBCC 2020 Table 4.1.3.2-A
P _{u2} =	-21206	N	P _{u-tot2} =	-169649 N 1.25(D+TQ)+1.5L NBCC 2020 Table 4.1.3.2-A
P _{u3} =	-16741	N	P _{u-tot3} =	-50223 N 0.9(D+TQ)+1.5L NBCC 2020 Table 4.1.3.2-A
P _{u4} =	5261	N	P _{u-tot4} =	4201 N 1.0(D+TQ) + 1.0(E _v + E _{o1} *R _d *R _o) + 0.5L NBCC 2020 Table 4.1.3.2-A
Shear Forces (Per Anchor Bolt)				
D =	0	N	No Shear Due to Dead Load	
TQ =	8225	N	Torque from Drive (Treated as Dead Load due to well defined limit) (Cont. Torque/(dbc/2)/n)	
L =	0	N	No Shear Due to Live Load	
E _h =	1423	N	((W*Ca)/n)	
R _d *R _o =	1.3		SFRS Overstrength Factor (CSA A23.3:19 D.4.3.5.3.c.i)	
Combined Shear Forces (Per Anchor Bolt)		Total Shear Force of Anchor Group (For Use in Concrete Breakout Capacity Checks)		
V _{u1} =	11516	N	V _{u-tot1} =	92124 N 1.4(D+TQ) NBCC 2020 Table 4.1.3.2-A
V _{u2} =	10282	N	V _{u-tot2} =	82254 N 1.25(D+TQ) + 1.5L NBCC 2020 Table 4.1.3.2-A
V _{u3} =	7403	N	V _{u-tot3} =	59223 N 0.9(D+TQ)+1.5L NBCC 2020 Table 4.1.3.2-A
V _{u4} =	10075	N	V _{u-tot4} =	80599 N 1.0(D+TQ) + 1.0(E _h *R _d *R _o) + 0.5L NBCC 2020 Table 4.1.3.2-A
V _{u5} =	23031	N	1.4(Peak Torque/Cont. Torque)*TQ	Momentary-Peak Torque or Duty-Rated Torque

Epoxy Anchor Bolt Calculations, per CSA A23.3:19 and Respective ESR Report

Page 3

$N_{UB} =$	198351	N	Load Combination Critical Column Vertical Total Load
$V_{UB} =$	17440	N	Load Combination Critical Column Horizontal Total Load
$s =$	563.77	mm	Anchor Bolt Chordal Spacing
$C_{IP} =$	127	mm	Center of Anchor to Edge of Concrete at Influent Opening
$C_{Pier} =$	50.8	mm	Center of Anchor to Edge of Concrete at Pier, Edge of Sludge Outlet/Hopper ($\leq 1.5h_{ef}$)
$C_{a1} =$	50.8	mm	Minimum Center of Anchor to Edge of Concrete in Direction of Shear
$C_{a2} =$	278.24	mm	Center of Anchor to Edge of Concrete Orthogonal to Direction of Shear

Required Edge Distance and Spacing

$C_{min} =$	44.45	mm	Table 2 of ESR-4057
$C_{max} =$	278.24	mm	Largest Edge Distance
$C_{a,min} =$	50.80	mm	Smallest Edge Distance
$S_{min} =$	76.20	mm	Table 2 of ESR-4057
$h_{min} =$	311.15	mm	Minimum concrete thickness based on embedment and Table 2 of ESR-4057
$h_a =$	311.15	mm	Concrete thickness. If unknown, assumes h_{min} .

Grouted Joint? =	YES	Grout Under Column Flange? (If YES, 0.8 factor applied to shear design) (17.5.1.3)
Grout Thickness =	50.80	mm

Anchor Bolt Physical Properties:

Anchor Diameter =	25.40	mm
Area _{root} =	379.13	mm ²
$I_x = I_y =$	11438.5	mm ⁴
$Z =$	1041.236	mm ³
$r =$	5.493	mm
$K =$	1	
$KL/r =$	9.25	Slenderness Ratio (< 200)
No. of Anchors in Group =	3	For Group Action in Tension
No. of Anchors in Group =	8	For Group Action in Shear

Anchor Compressive Stress

Stress _C =	6	MPa	Stress _C = $(P_{max} + Wt/N) / A_{root}$
	Selection OK	Compressive Stress Check	80% yield strength

Design requirements for tensile loading

Steel Strength of Anchor in Tension (Single Anchor)

$N_{sa} =$	153642	N	Nominal Axial Strength (Per Anchor), Table 3 of ESR-4057
$\phi_{tension} N_{sa} =$	115231	N	
Ratio $P_{u1} =$	0.00		Ratios must be ≤ 1.0
Ratio $P_{u2} =$	0.00		
Ratio $P_{u3} =$	0.00		
Ratio $P_{u4} =$	0.05		
	Selection OK	Anchor Bolt Selection Check	

Concrete Breakout Strength of Anchor Group in Tension

D.6.2	$N_{br} =$	76470	N	Nominal Concrete Breakout Strength in tension of single anchor (Eq.D.6)	$N_{br} = k_c \phi_c \lambda (f_c)^{0.5} h_{ef}^{1.5} R_{conc, tension}$
	$h_{ef} =$	254	mm	Effective Embedment of Anchor	
	$\lambda =$	1.0		Concrete Modification Factor (adhesive anchor concrete failure) (D.4.6)	
	$K_{c,cr} =$	7		$K_c = 7$ for post-installed anchors (D.6.2.2)	
	$A_{Nc} =$	889697	mm ²	Projected Concrete Failure Area (D.6.2.1) $A_{Nc} \leq n A_{Nco}$	
	$A_{Nco} =$	580644	mm ²	Maximum Possible Concrete Failure Area (Eq. D.5)	$A_{Nco} = 9 h_{ef}^2$
	$\psi_{ec,N} =$	0.96		Modification Factor for Eccentricity (Eq D.8)	$\psi_{ec,N} = 1 / (1 + (2 e_N / 3 h_{ef})) \leq 1$
	$\psi_{ed,N} =$	0.74		Modification Factor for Edge Effects (Eq D.10)	$0.7 + 0.3 (C_{a1, min} / 1.5 h_{ef})$
	$\psi_{c,N} =$	1.00		Modification Factor for Cracked Concrete (D6.2.6)	Assume Cracked Concrete
	$\psi_{cp,N} =$	1.00		Modification Factor for Post-Installed Anchor (D.6.2.7)	Assume Cracked Concrete
	$N_{cbgr} =$	82910	N	Factored Concrete Breakout Strength in tension for anchor group (Eq. D.4)	$N_{cbgr} = (A_{Nc} / A_{Nco}) \psi_{ec,N} \psi_{ed,N} \psi_{c,N} \psi_{cp,N} N_{br}$
	$\phi_c =$	0.65		Concrete resistance factor, $\phi_c = 0.65$ (per 8.4.2)	
	$0.75 N_{cbgr} =$	62182	N	0.75 Factor for SFRS (D.4.3.5.4)	
	Ratio $P_{u-tot1} =$	0.00		Ratios must be ≤ 1.0	
	Ratio $P_{u-tot2} =$	0.00			
	Ratio $P_{u-tot3} =$	0.00			
	Ratio $P_{u-tot4} =$	0.07			
		Selection OK	Anchor Bolt Selection Check		

Epoxy Anchor Bolt Calculations, per CSA A23.3:19 and Respective ESR Report (Continued)				Page 4																																																																					
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$\Psi_{cp,Na}$	1.00																																																																								
C_{ac}	78.9	mm																																																																							
N_{bar}	110727	N																																																																							
λ	1																																																																								
τ_{cr}	8.40	MPa																																																																							
$\alpha_{N,seis}$	1																																																																								
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Customer must ensure concrete is designed and reinforced to resist forces transferred from center column.

Epoxy Anchor Bolt Calculations, per CSA A23.3:19 and Respective ESR Report (continued)				Page 5
Concrete Pryout Strength of Anchor in Shear				
D.7.3	$V_{cprg} =$ 55917 N $k_{cp} =$ 2.0	Factored Pryout Strength in Shear of Anchor Group (Eq. D.45) Pryout Strength Coefficient	$V_{cprg} = \text{Min}[k_{cp} * N_{agr}; k_{cp} * N_{cgr}]$ $k_{cp} = 2.0$ for hef ≥ 65 mm	
	Ratio $V_{u1} =$ 0.21 Ratio $V_{u2} =$ 0.18 Ratio $V_{u3} =$ 0.13 Ratio $V_{u4} =$ 0.18 Ratio $V_{u5} =$ 0.41	Ratios must be ≤ 1.0		
	Selection OK Anchor Bolt Selection Check			
Interaction of Tensile and Shear Forces				
D.8	(Max P_{u1} Or P_{u-tot1}) / $\phi N_n =$ 0.00 (Max P_{u2} Or P_{u-tot2}) / $\phi N_n =$ 0.00 (Max P_{u3} Or P_{u-tot3}) / $\phi N_n =$ 0.00 (Max P_{u4} Or P_{u-tot4}) / $\phi N_n =$ 0.25	Max $V_{u1} / \phi N_n =$ 1.57 Max $V_{u2} / \phi N_n =$ 1.40 Max $V_{u3} / \phi N_n =$ 1.01 Max $V_{u4} / \phi N_n =$ 1.37	Note: If the applied shear or tension is 20% or less of the shear or tension strength, the full strength of tension or shear may be used. (See ESR-4057 4.3.2)	
	$P_{u1} / \phi N_n + V_{u1} / \phi V_n =$ 1.57 $P_{u2} / \phi N_n + V_{u2} / \phi V_n =$ 1.40 $P_{u3} / \phi N_n + V_{u3} / \phi V_n =$ 1.01 $P_{u4} / \phi N_n + V_{u4} / \phi V_n =$ 1.63	Ratio must be ≤ 1.2 (ESR-4057, EQ 4.4) Ratio must be ≤ 1.2 (ESR-4057, EQ 4.4) Ratio must be ≤ 1.2 (ESR-4057, EQ 4.4) Ratio must be ≤ 1.2 (ESR-4057, EQ 4.4)		
	Increase Size / BC / Qty Anchor Bolt Selection Check			

Walway Anchor Bolts

Company:	WesTech Engineering	Date:	8/2/2023
Engineer:	ME75	Page:	1/5
Project:	Brantford 24946B		
Address:			
Phone:			
E-mail:			

1. Project information

Customer company:
 Customer contact name:
 Customer e-mail:
 Comment:

Checked By: HO93 [8/16/2023]

Project description: Walkway Anchors
 Location:
 Fastening description:

2. Input Data & Anchor Parameters

General

Design method: CSA A23.3-19
 Units: SI units (metric)

Anchor Information:

Anchor type: Bonded anchor
 Material: A193 Grade B8/B8M (304/316SS)
 Diameter (inch): 0.750
 Effective Embedment depth, h_{ef} (mm): 114
 Code report: ICC-ES ESR-4057
 Anchor category: -
 Anchor ductility: Yes
 h_{min} (mm): 159
 c_{ac} (mm): 164
 c_{min} (mm): 44
 s_{min} (mm): 76

Base Material

Concrete: Normal-weight
 Concrete thickness, h (mm): 305
 State: Cracked
 Compressive strength, f'_c (MPa): 20.70
 $\Psi_{c,v}$: 1.0
 Reinforcement condition: B tension, B shear
 Supplemental edge reinforcement: Not applicable
 Reinforcement provided at corners: No
 Ignore concrete breakout in tension: No
 Ignore concrete breakout in shear: No
 Hole condition: Dry concrete
 Inspection: Continuous
 Temperature range, Short/Long: 150/110°F
 Reduced installation torque (for AT-3G): Not applicable
 Ignore 6do requirement: Not applicable
 Build-up grout pad: Yes

Base Plate

Length x Width x Thickness (mm): 203 x 114 x 6

Recommended Anchor

Anchor Name: SET-3G™ - SET-3G w/ 3/4"Ø A193 Gr. B8/B8M (304/316SS)
 Code Report: ICC-ES ESR-4057





Company:	WesTech Engineering	Date:	8/2/2023
Engineer:	ME75	Page:	2/5
Project:	Brantford 24946B		
Address:			
Phone:			
E-mail:			

Load and Geometry

Load factor source: CSA A23.3

Load combination: not set

Seismic design: No

Anchors subjected to sustained tension: No

Apply entire shear load at front row: No

Anchors only resisting wind and/or seismic loads: No

Strength level loads:

N_{ua} [kN]: -24.60

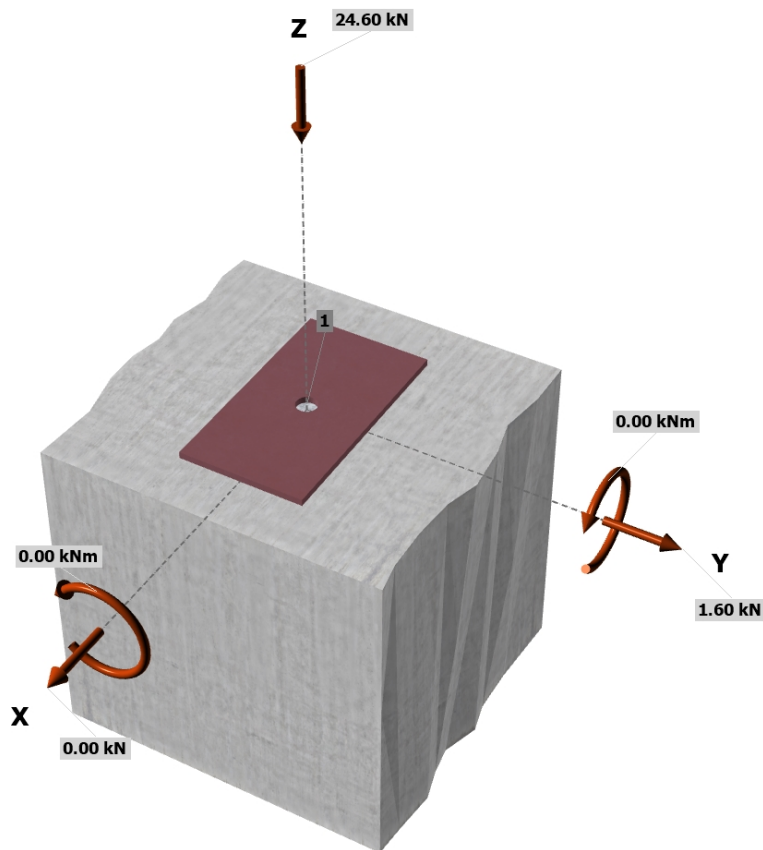
V_{uax} [kN]: 0.00

V_{uay} [kN]: 1.60

M_{ux} [kNm]: 0.00

M_{uy} [kNm]: 0.00

<Figure 1>



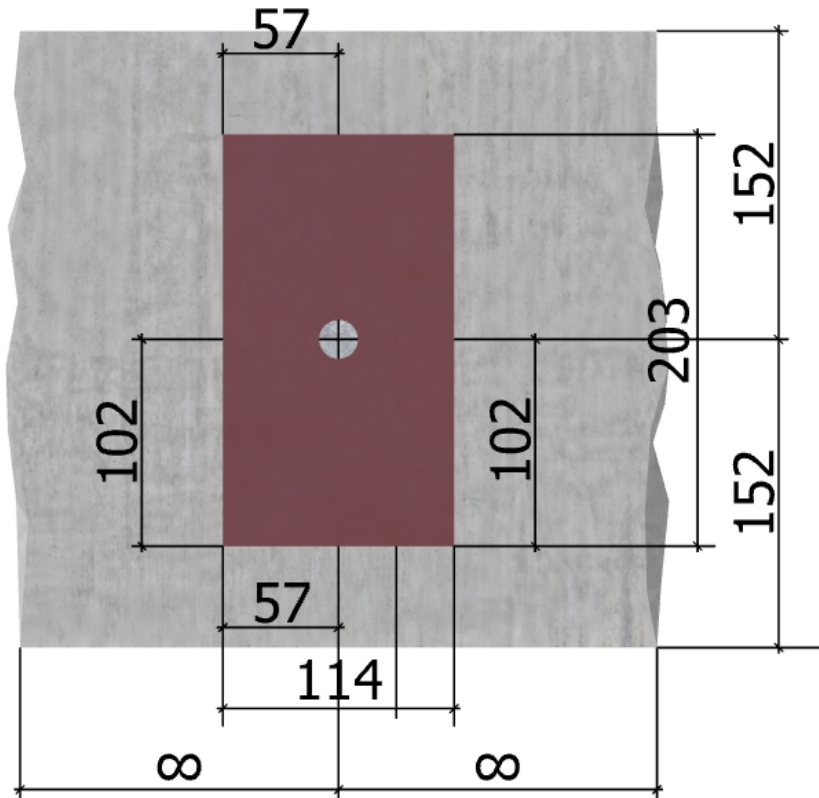
Input data and results must be checked for agreement with the existing circumstances, the standards and guidelines and must be checked for plausibility.?

Simpson Strong-Tie Company Inc. 5956 W. Las Positas Boulevard Pleasanton, CA 94588 Phone: 925.560.9000 Fax: 925.847.3871 www.strongtie.com



Company:	WesTech Engineering	Date:	8/2/2023
Engineer:	ME75	Page:	3/5
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<Figure 2>





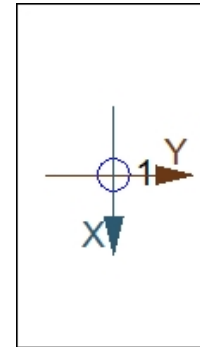
Company:	WesTech Engineering	Date:	8/2/2023
Engineer:	ME75	Page:	4/5
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Address:			
Phone:			
E-mail:			

3. Resulting Anchor Forces

Anchor	Tension load, N_{fa} (kN)	Shear load x, V_{fax} (kN)	Shear load y, V_{fay} (kN)	Shear load combined, $\sqrt{(V_{fax})^2 + (V_{fay})^2}$ (kN)
1	0.0	0.0	1.6	1.6
Sum	0.0	0.0	1.6	1.6

Maximum concrete compression strain (‰): 0.00
Maximum concrete compression stress (N/mm²): 0.00
Resultant tension force (kN): 0.00
Resultant compression force (kN): 0.00
Eccentricity of resultant tension forces in x-axis, e'_{Nx} (mm): 0
Eccentricity of resultant tension forces in y-axis, e'_{Ny} (mm): 0
Eccentricity of resultant shear forces in x-axis, e'_{Vx} (mm): 0
Eccentricity of resultant shear forces in y-axis, e'_{Vy} (mm): 0
Steel resistance factor, Φ_s : 0.85 (Clause 8.4.3)
Concrete resistance factor, Φ_c : 0.65 (Clause 8.4.2)

<Figure 3>



8. Steel Resistance of Anchor in Shear (Clause D.7.1)

$$V_{sar} = \phi_{grout} V_{sa} \phi_s R \text{ (Clause D.7.1.2)}$$

V_{sa} (kN)	ϕ_{grout}	R	V_{sar} (kN)
50.82	0.8	0.75	25.92

9. Concrete Breakout Resistance of Anchor in Shear (Clause D.7.2)

Shear parallel to edge in x-direction:

$$V_{bry} = \min[0.58(l_e/d_a)^{0.2} d_a \phi_c \lambda_a \sqrt{f'_c c_{at}}^{1.5} R; 3.75 \lambda_a \phi_c \sqrt{f'_c c_{at}}^{1.5} R] \text{ (Eq. D.35 \& Eq. D.36)}$$

l_e (mm)	d_a (mm)	λ_a	f'_c (MPa)	c_{at} (mm)	R	V_{bry} (kN)
114	19	1.00	20.70	152	1.00	20.08

$$V_{cbry} = (2)(A_{Vc}/A_{Vco}) \psi_{ed,V} \psi_{c,V} \psi_{h,V} V_{bry} \text{ (Sec. D.7.2.1(c) \& Eq. D.32)}$$

A_{Vc} (mm²)	A_{Vco} (mm²)	$\psi_{ed,V}$	$\psi_{c,V}$	$\psi_{h,V}$	V_{bry} (kN)	V_{cbry} (kN)
103968	103968	1.000	1.000	1.000	20.08	40.15

10. Concrete Pryout Resistance of Anchor in Shear (Clause D.7.3)

$$V_{cpr} = \min[k_{cp} N_{ar}; k_{cp} N_{cb}] = \min[k_{cp}(A_{Na}/A_{Na0}) \psi_{ed,Na} \psi_{cp,Na} \lambda_a \phi_c \tau_k \pi d_a h_{ef,a} R_a; k_{cp}(A_{Nc}/A_{Nco}) \psi_{ed,N} \psi_{c,N} \psi_{cp,Na} k_c \lambda_a \phi_c \sqrt{f'_c} h_{ef,cb}^{1.5} R_{cb}] \text{ (Clause D.7.3(a))}$$

k_{cp}	A_{Na} (mm²)	A_{Na0} (mm²)	$\psi_{ed,Na}$	$\psi_{cp,Na}$	τ_k (MPa)	d_a (mm)	$h_{ef,a}$ (mm)	R_a
2.0	158492	271810	0.875	1.000	9.03	19	114	1.00
A_{Nc} (mm²)	A_{Nco} (mm²)	$\psi_{ed,N}$	$\psi_{c,N}$	$\psi_{cp,N}$	k_c	λ_a	f'_c (MPa)	$h_{ef,cb}$ (mm)
104242	117580	0.966	1.000	1.000	7.0	1.00	20.70	114
R_{cb}	V_{cpr} (kN)							
1.00	42.81							

Input data and results must be checked for agreement with the existing circumstances, the standards and guidelines and must be checked for plausibility.?



Anchor Designer™
Software
Version 3.1.2303.1

Company:	WesTech Engineering	Date:	8/2/2023
Engineer:	ME75	Page:	5/5
Project:	Brantford 24946B		
Address:			
Phone:			
E-mail:			

11. Results

11. Interaction of Tensile and Shear Forces (Sec. D.8)?

Shear	Factored Load, V_{fa} (kN)	Design Resistance, V_r (kN)	Ratio	Status
Steel	1.60	25.92	0.06	Pass (Governs)
Concrete breakout x-	1.60	40.15	0.04	Pass
Pryout	1.60	42.81	0.04	Pass

SET-3G w/ 3/4"Ø A193 Gr. B8/B8M (304/316SS) with hef = 114 mm meets the selected design criteria.

12. Warnings

- Designer must exercise own judgement to determine if this design is suitable.
- Refer to manufacturer's product literature for hole cleaning and installation instructions.

Accessory Equipment

Aluminum Grating

ALUMINUM STANDARD MESH BAR GRATING

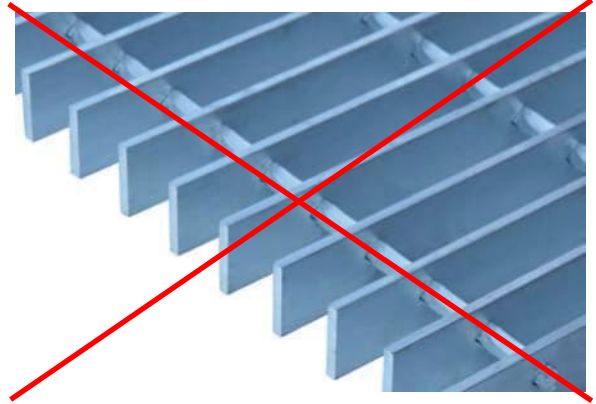
aluminum information

**RECTANGULAR
AND I-BAR GRATING**

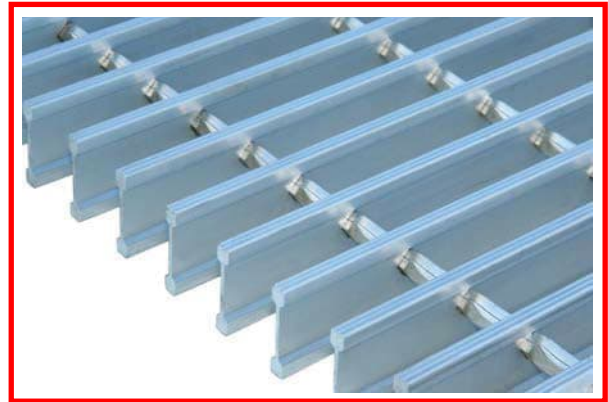
Aluminum Bar Gratings employ a unique interlocking system that joins the bearing bars and cross rods together in panels of exceptional rigidity and strength. Lightweight, corrosion-resistant, non-sparking alloys are ideal for pedestrian platforms in chemical, petroleum, and food processing plants. Fisholow gratings is recommended in most water and waste water treatment facilities and is becoming increasingly popular for use in architectural building designs.

Aluminum Bar Grating is available in two bar profiles: **Rectangular Bar** and **I-bar**. Similar to Tru-Weld Steel Bar Grating, Fisholow Rectangular Bar Grating is offered with a plain or serrated surface. Fisholow I-Bar Grating produces exceptional load ratings at a fraction of the weight of its rectangular counterpart, and is designed with a slip resistant corrugated surface on the top of each I-bar.

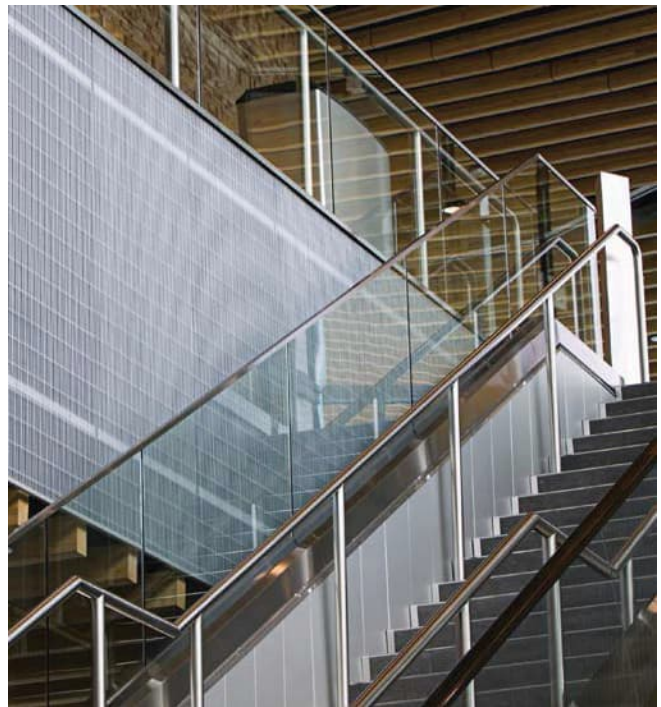
Both Rectangular Bar and I-Bar styles are available in special mesh options.



RECTANGULAR BAR



I-BAR

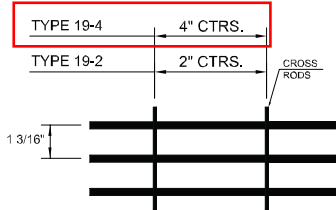


STANDARD

Bearing Bars: 1 3/16" centers, 6063T6

Cross Bars: 6063T5

Stock panels: 3' nominal width x 24' long



aluminum type 19

**IMPERIAL LEGEND**U = Safe Uniform Load (lbs./ft.²)

C = Safe Concentrated Load (lbs./foot of grating width)

D = Deflection (inches)

Loads and deflections given in this table are theoretical and are based on a maximum allowable fibre stress of 12,000 P.S.I.

For Fisholow I-bar loading, use the equivalent depth 3/16" bar size values in this load table.

BEARING BAR SIZE (inches)	APPROX. WEIGHT (lbs./ft. ²)	LOAD/ DEFLECTION	SPAN IN FEET AND INCHES																SECTION MODULUS PER FOOT OF WIDTH
			2' 0"	2' 6"	3' 0"	3' 6"	4' 0"	4' 6"	5' 0"	5' 6"	6' 0"	6' 6"	7' 0"	7' 6"	8' 0"	8' 6"	9' 0"		
1 x 1/8	1.92	U	421	269	187	137	105	83	Spans and loads in the pink shaded area exceed a deflection of 1/4" for uniform loads of 100 lbs/sq. ft. Experience has shown that 1/4" deflection is the maximum deflection to give pedestrian comfort, but can be exceeded for other types of loads at the discretion of the engineer.										0.216
		D	0.114	0.225	0.324	0.441	0.576	0.729											
		C	421	337	281	241	211	187											
		D	0.115	0.18	0.259	0.353	0.461	0.583											
1 x 3/16	2.72	U	632	404	281	206	158	125	For serrated surface, increase depth by one size.										0.325
		D	0.144	0.225	0.324	0.441	0.576	0.729											
		C	632	505	421	361	316	281											
		D	0.115	0.18	0.259	0.353	0.461	0.583											
1 1/4 x 1/8	2.31	U	658	421	292	215	164	130	105	87	73								0.339
		D	0.115	0.18	0.259	0.353	0.461	0.583	0.720	0.871	1.037								
		C	658	526	439	376	329	292	263	239	219								
		D	0.092	0.144	0.207	0.282	0.369	0.467	0.576	0.697	0.829								
1 1/4 x 3/16	3.31	U	987	632	439	322	247	195	158	130	110	93	81						0.507
		D	0.115	0.18	0.259	0.353	0.461	0.583	0.720	0.871	1.037	1.217	1.411						
		C	987	789	658	564	493	439	395	359	329	304	282						
		D	0.092	0.144	0.207	0.282	0.369	0.467	0.576	0.697	0.829	0.973	1.129						
1 1/2 x 1/8	2.72	U	947	606	421	309	237	187	152	125	105	90	77	67	59	52	47	0.488	
		D	0.096	0.150	0.216	0.294	0.384	0.486	0.600	0.726	0.864	1.014	1.176	1.35	1.536	1.734	1.944		
		C	947	758	632	541	474	421	379	344	316	291	271	253	237	223	211		
		D	0.077	0.120	0.173	0.235	0.307	0.389	0.480	0.581	0.691	0.811	0.941	1.08	1.229	1.387	1.555		
1 1/2 x 3/16	3.89	U	1421	909	632	464	355	281	227	188	158	135	116	101	89	79	70	0.730	
		D	0.096	0.15	0.216	0.294	0.384	0.486	0.6	0.726	0.864	1.014	1.176	1.35	1.536	1.734	1.944		
		C	1421	1137	947	812	711	632	568	517	474	437	406	379	355	334	316		
		D	0.077	0.12	0.173	0.235	0.307	0.389	0.48	0.581	0.691	0.811	0.941	1.08	1.229	1.387	1.555		
1 3/4 x 3/16	4.48	U	1934	1238	860	632	484	382	309	256	215	183	158	138	121	107	96	0.994	
		D	0.082	0.129	0.185	0.252	0.329	0.417	0.514	0.622	0.741	0.869	1.008	1.157	1.317	1.486	1.666		
		C	1934	1547	1289	1105	967	860	774	703	645	595	553	516	484	455	430		
		D	0.066	0.103	0.148	0.202	0.263	0.333	0.411	0.498	0.592	0.695	0.806	0.926	1.053	1.189	1.333		
2 x 3/16	5.08	U	2526	1617	1123	825	632	499	404	334	281	239	206	180	158	140	125	1.299	
		D	0.072	0.113	0.162	0.221	0.288	0.365	0.45	0.545	0.648	0.761	0.882	1.013	1.152	1.301	1.458		
		C	2526	2021	1684	1444	1263	1123	1011	919	842	777	727	674	632	594	561		
		D	0.058	0.09	0.13	0.176	0.263	0.292	0.36	0.436	0.518	0.608	0.706	0.81	0.922	1.04	1.166		
2 1/4 x 3/16	5.68	U	3197	2046	1421	1044	799	632	512	423	355	303	261	227	200	177	158	1.644	
		D	0.064	0.100	0.144	0.196	0.256	0.324	0.400	0.484	0.576	0.676	0.784	0.900	1.024	1.156	1.296		
		C	3197	2558	2132	1827	1599	1421	1279	1163	1066	984	1218	1137	799	752	711		
		D	0.051	0.080	0.115	0.157	0.205	0.259	0.320	0.387	0.461	0.541	0.627	0.720	0.819	0.925	1.037		
2 1/2 x 3/16	6.28	U	3947	2526	1754	1289	987	780	632	522	439	374	322	281	247	219	195	2.029	
		D	0.058	0.090	0.130	0.176	0.230	0.292	0.360	0.436	0.518	0.608	0.706	0.81	0.922	1.04	1.166		
		C	3947	3158	2632	2256	1974	1754	1579	1435	1316	1215	1128	1053	987	929	877		
		D	0.046	0.072	0.104	0.141	0.184	0.233	0.288	0.348	0.415	0.487	0.564	0.648	0.737	0.832	0.933		

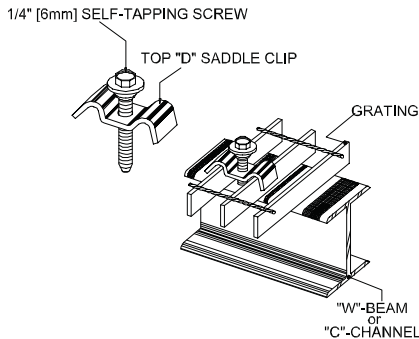
I-BAR WEIGHTS (IMPERIAL)					
BEARING BAR SIZE (inches)	WEIGHTS (lbs./ft. ²)				
	TYPE 11-4	TYPE 15-4	TYPE 19-4	TYPE 30-4	TYPE 38-4
1 x 1/4	n/a	2.35	1.85	1.22	1.02
1 1/4 x 1/4	n/a	2.86	2.29	1.51	1.26
1 1/2 x 1/4	n/a	3.30	2.63	1.76	1.47
1 3/4 x 1/4	n/a	3.73	2.97	2.02	1.75
2 x 1/4	n/a	4.15	3.30	2.24	1.88
2 1/4 x 1/4	n/a	4.67	3.89	2.61	2.18
2 1/2 x 1/4	n/a	4.77	3.99	2.67	2.23

Fisholow grating meets N.A.A.M.M. standards.

GRATING FASTENING METHODS

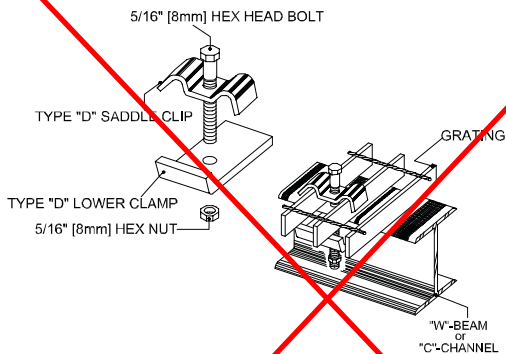
fastening methods information

BAR GRATING FASTENERS

**Type D Saddle Clip
(complete with stainless steel self tapping screw)**

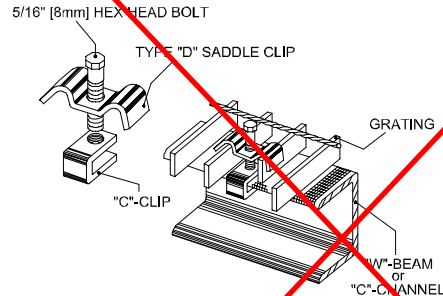
Our most common and cost-effective fastening method. Simply pre-drill a hole into the supporting member and drive in the self-tapping screw. Designed for use with Tru-Weld Type 19 and Type 15 bar grating only (in 1/8" and 3/16" bar sizes).

Available in standard galvanized or bare steel and stainless steel options.

**Type D Saddle Clip
(complete with nut, bolt, and bottom clamp)**

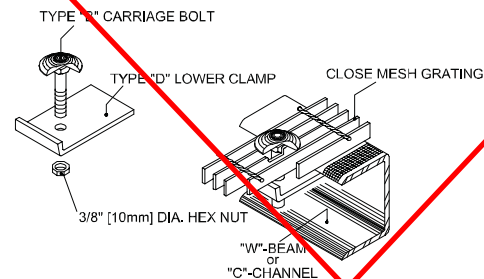
This combination allows for fastening grating without drilling into the supports. The Type D Saddle Clip holds the grating from the top as the bottom clamp is tightened under the flange of the supporting member. Designed for use with Tru-Weld Type 19 and Type 15 bar grating only (in 1/8" and 3/16" bar sizes).

Available in standard galvanized or bare steel and stainless steel options.

**Type D Saddle Clip
(complete with C-clamp and bolt)**

Eliminates the need to drill supports or have access beneath the grating during installation. The C-clamp slides between the bearing bars to clamp the flange of the supporting member and is tightened from above using a hex-driver. For use with Tru-Weld Type 19 and Type 15 bar grating only (in 1/8" and 3/16" bar sizes).

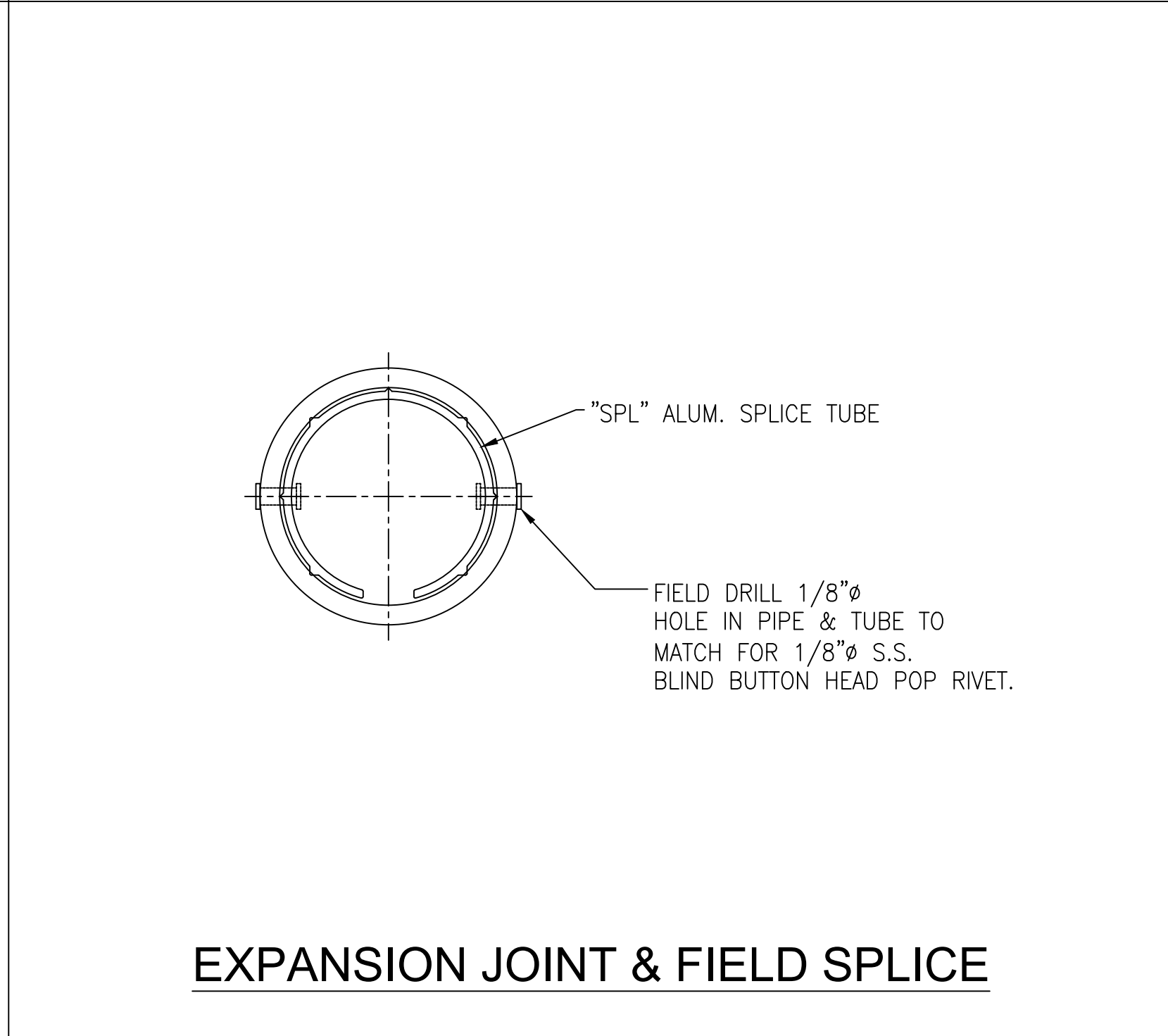
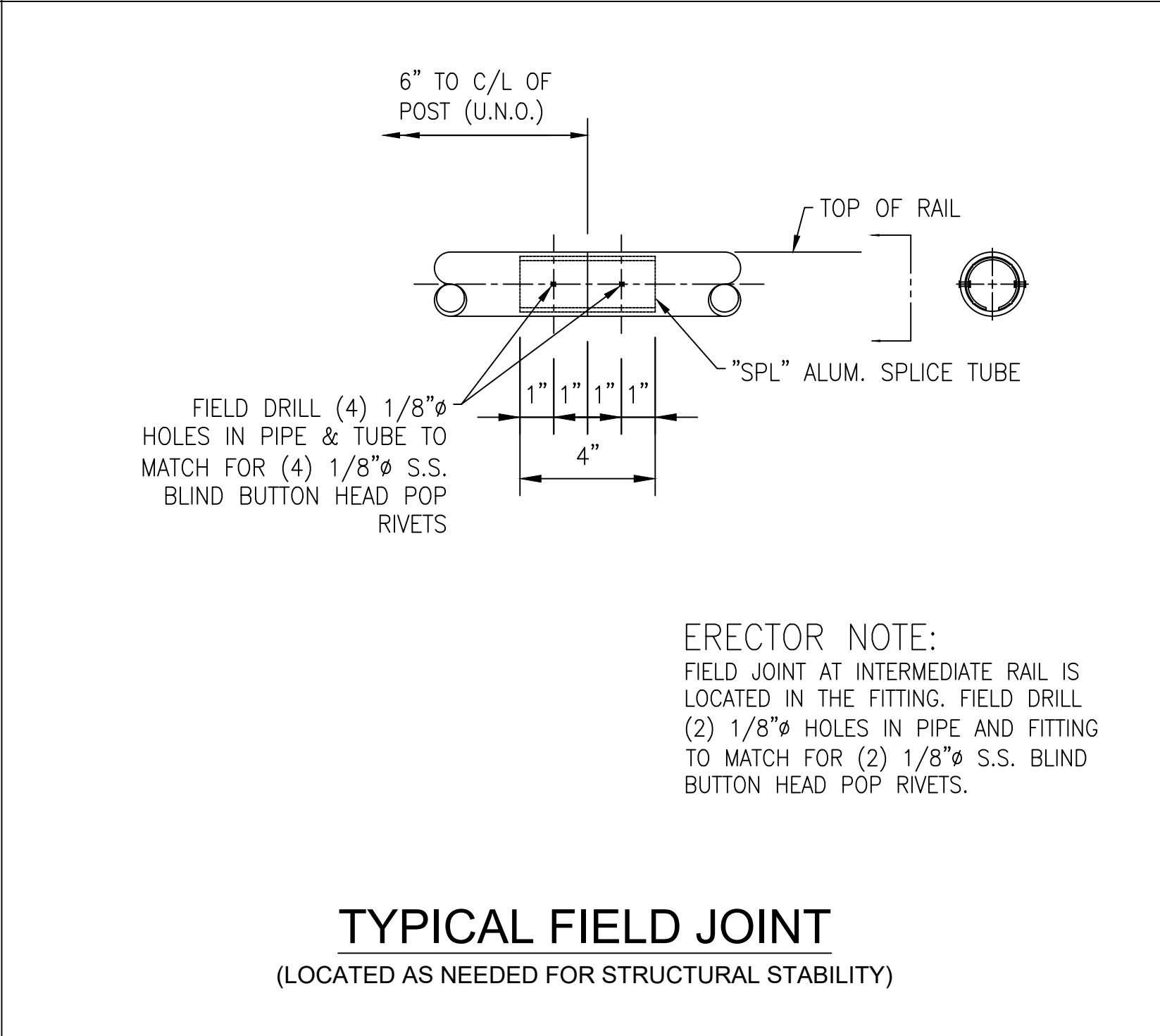
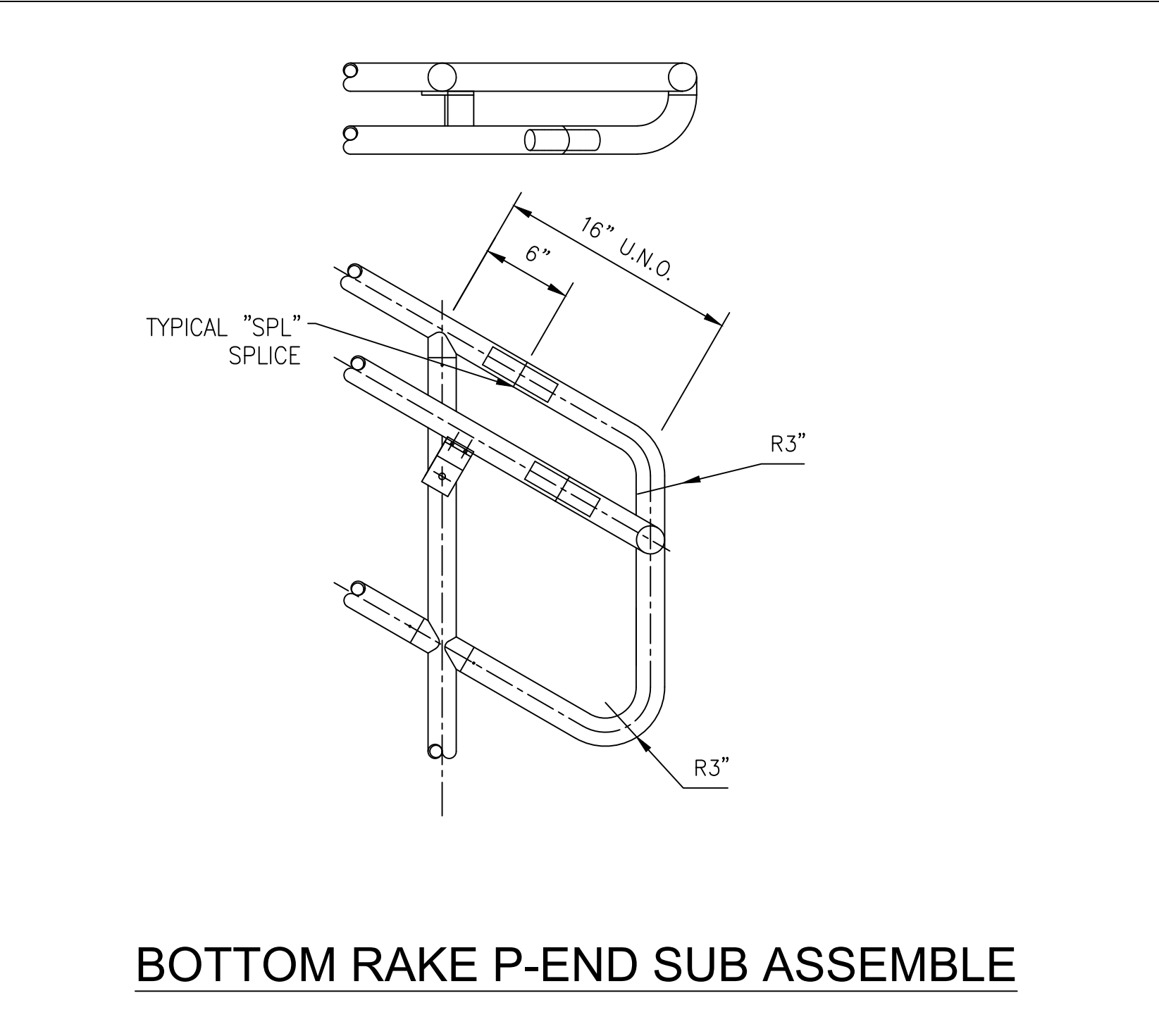
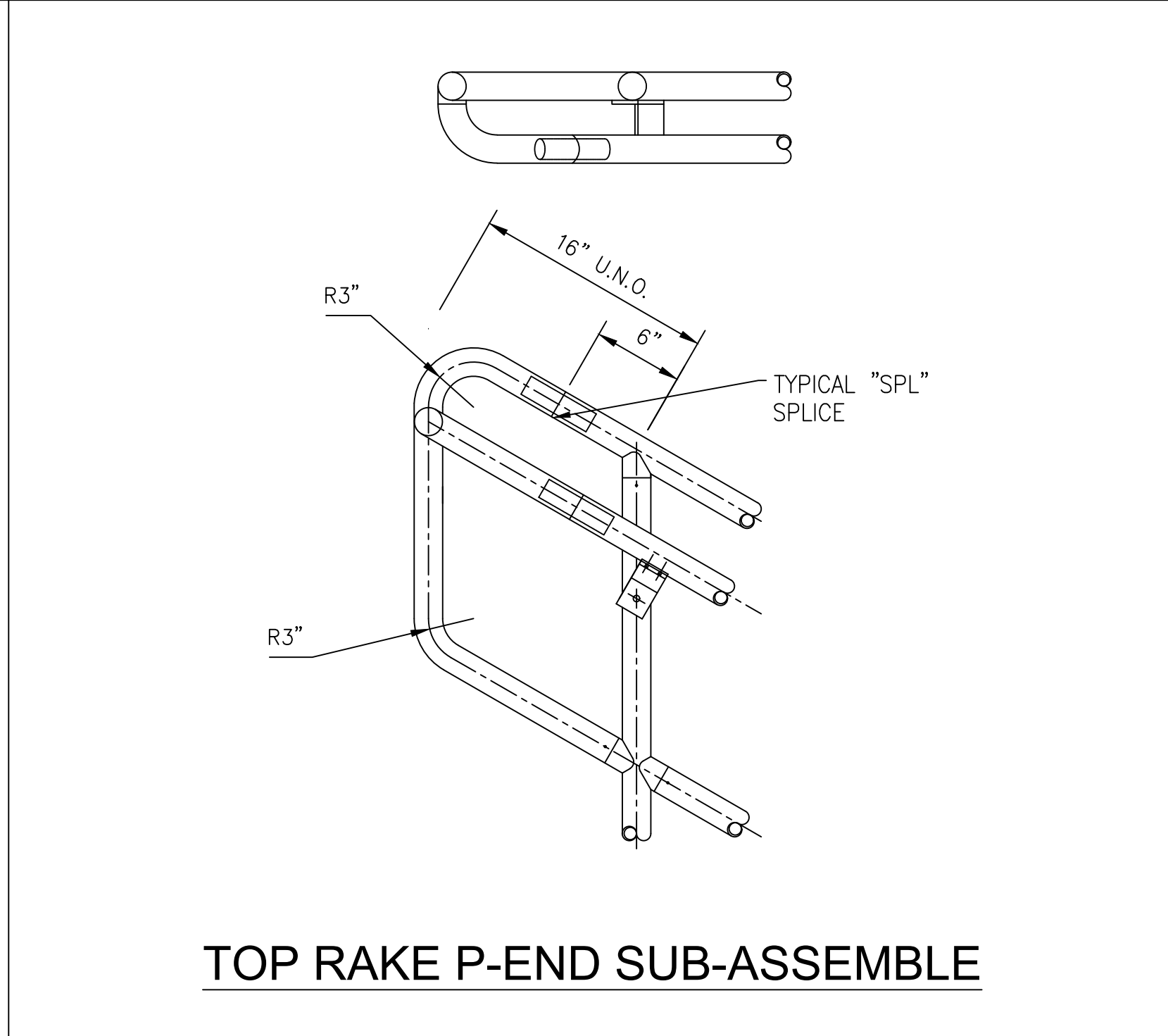
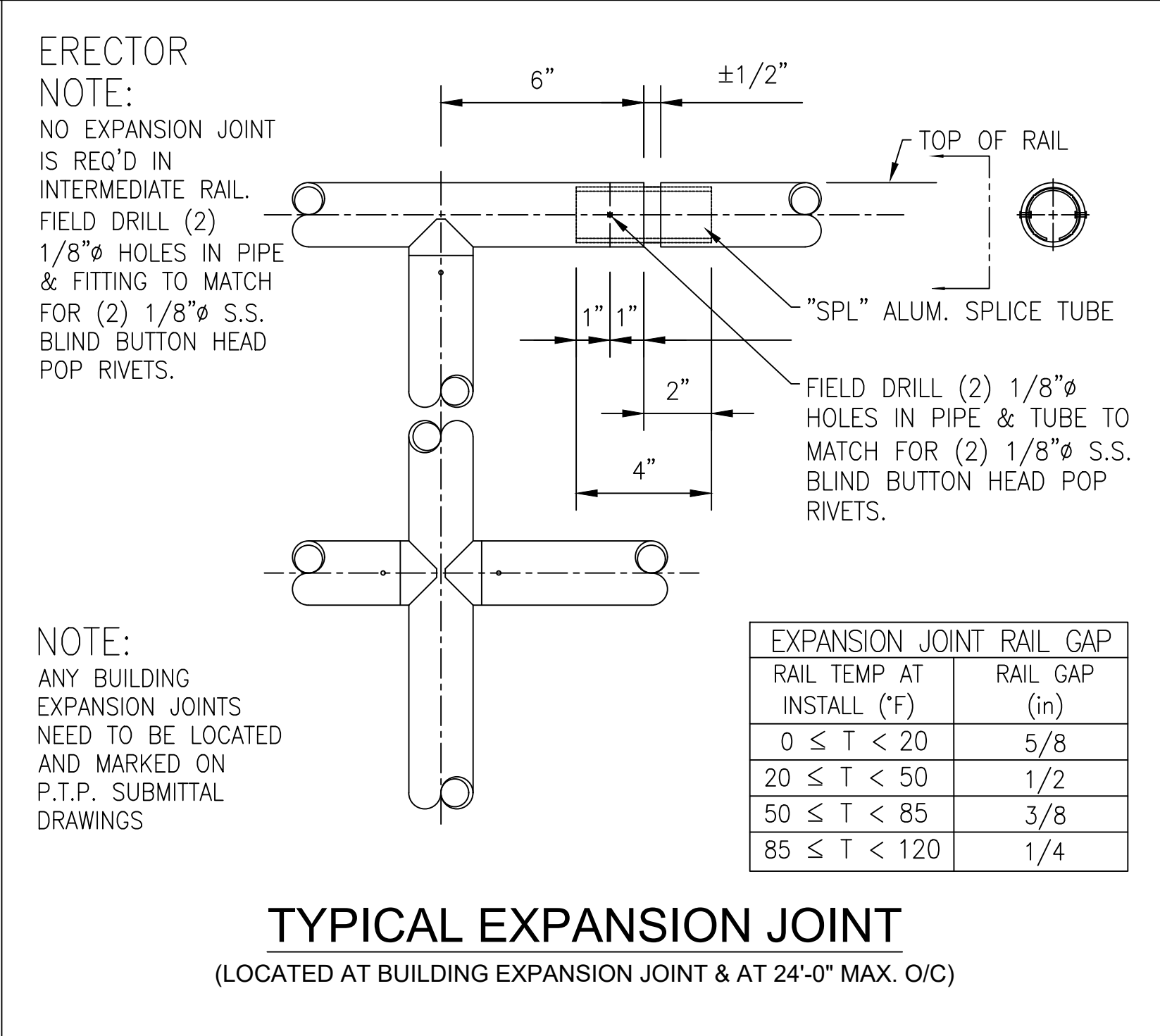
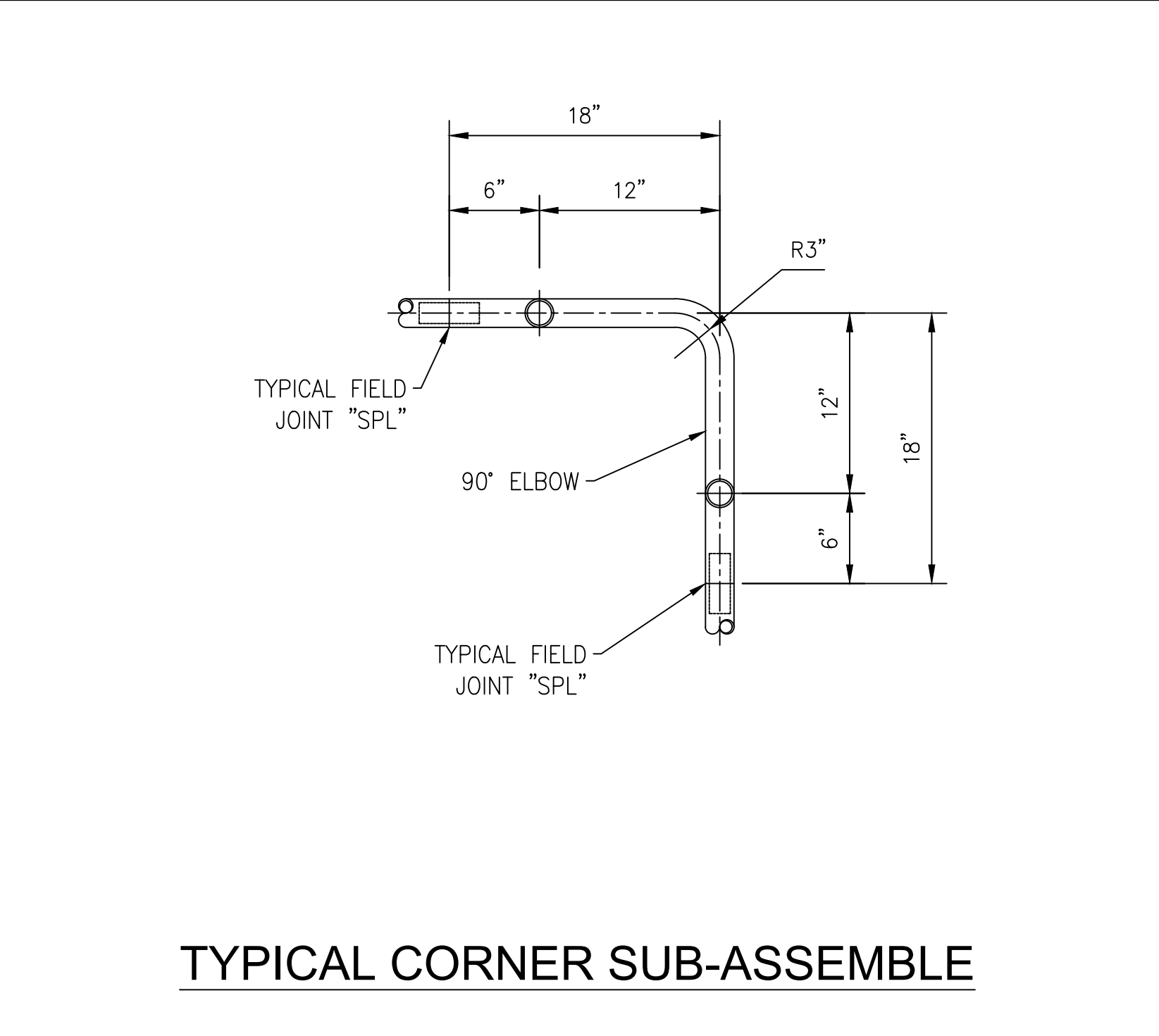
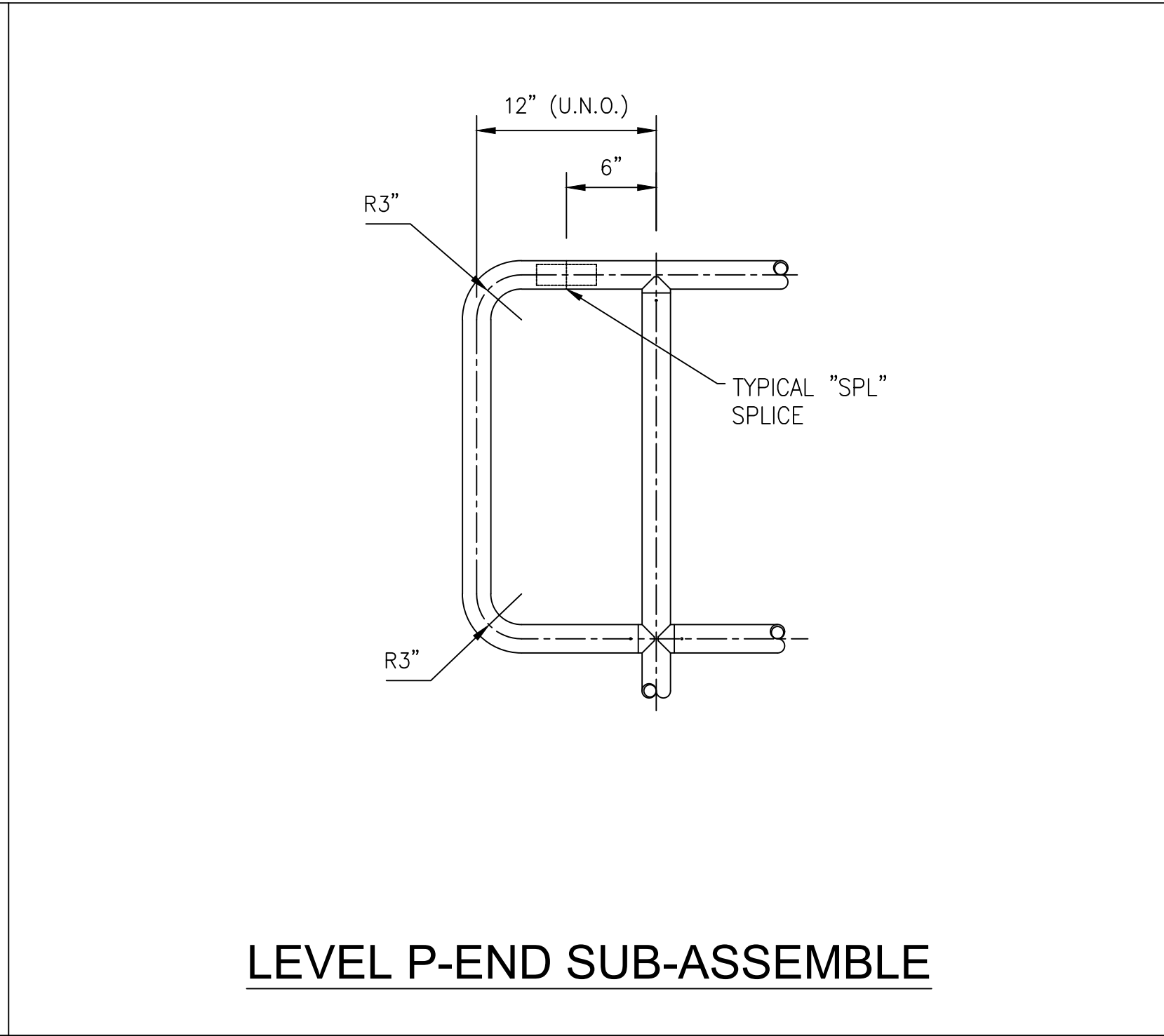
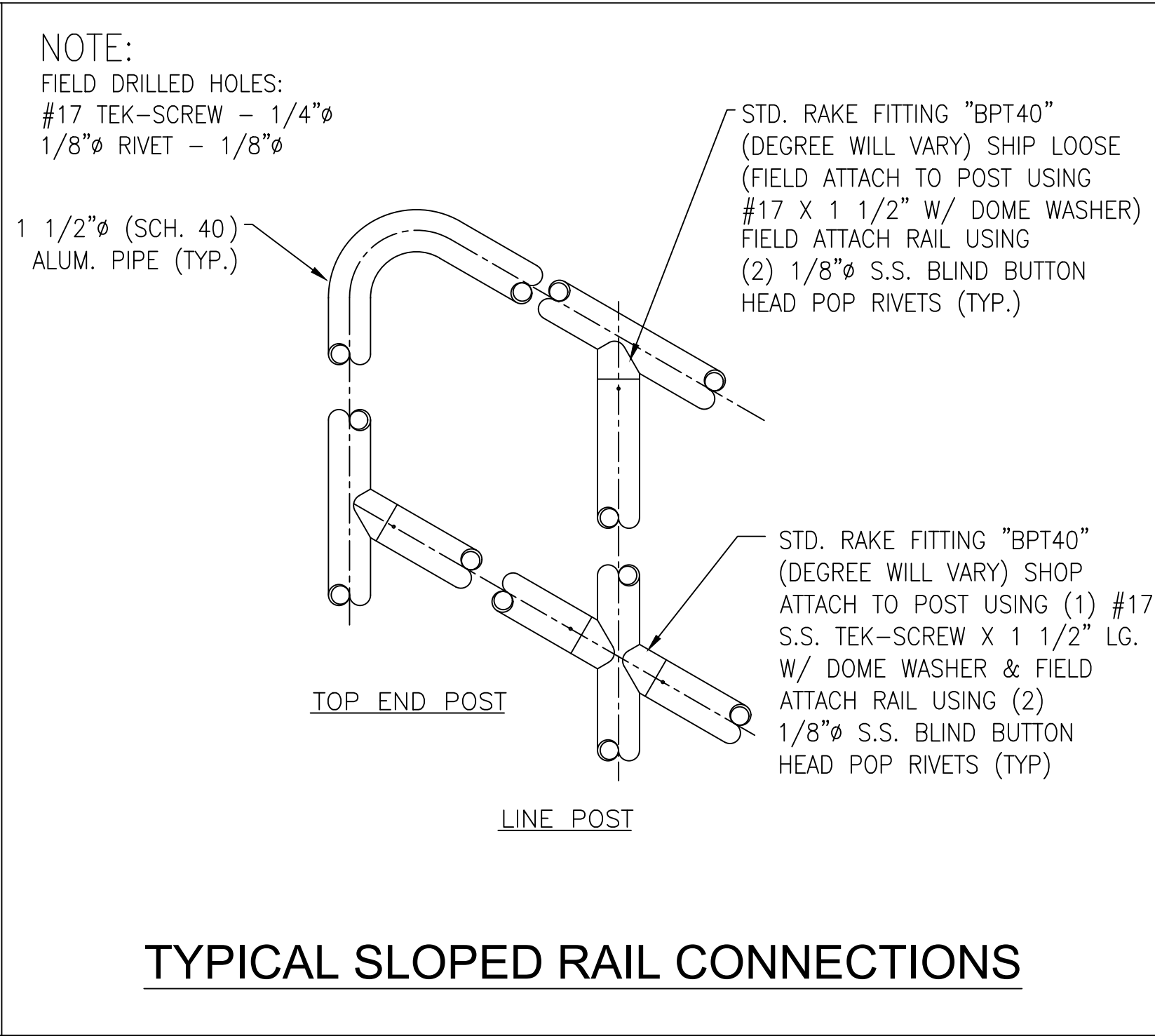
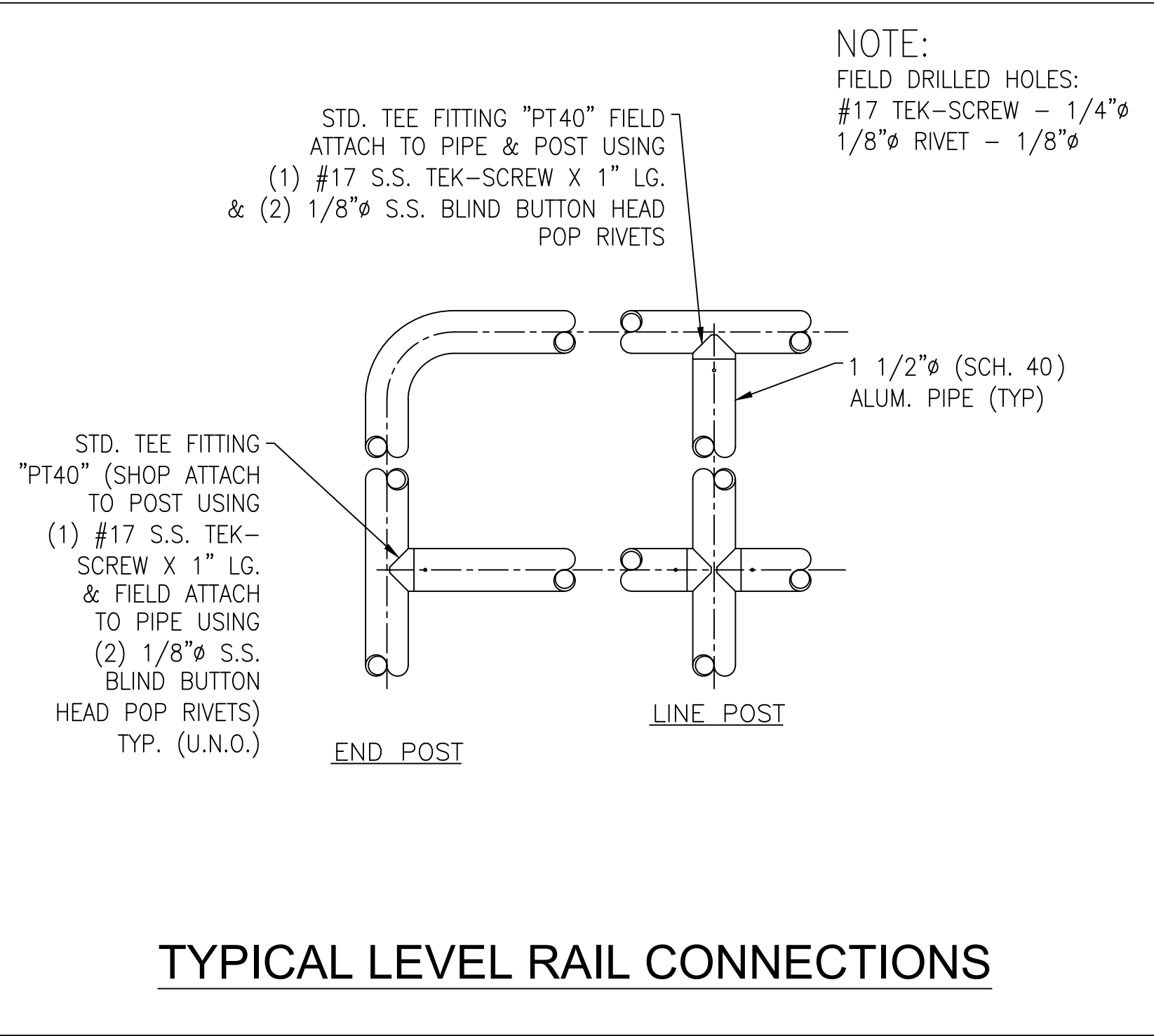
Available in standard galvanized or bare steel and stainless steel options.

Type B Clamping Bolt, Nut, and Bottom Clamp

For close mesh Type 11 and Type 9.5 grating, a square collared clamping bolt can be inserted directly between the ends of the bearing bars and fitted through a bottom clamp. The rounded bolt head rests directly on the bearing bars eliminating the need for a top saddle clip.

Available by special order in bare steel, galvanized, and stainless steel.

Aluminum Handrail




GENERAL NOTES

- ALL RAIL IS TO BE OF MECHANICAL CONSTRUCTION U.N.O.
- ALL RAILS ARE TO BE FABRICATED FROM 1 1/2"Ø (SCH. 40) ALUMINUM PIPE (6005A-T61 ALLOY) (U.N.O.)
- ALL POSTS ARE TO BE FABRICATED FROM 1 1/2"Ø (SCH. 40) ALUMINUM PIPE (6005A-T61 ALLOY) (U.N.O.)
- ALL EXTRUDED COMPONENTS ARE 6005A-T61 ALLOY, CAST COMPONENTS ARE 535 ALLOY
- ALL FASTENERS (SELF TAPPING SCREWS, MACHINE BOLTS, ADHESIVE ANCHORS, ETC.) TO BE 304 STAINLESS STEEL
- ALL RAILING SURFACES IN CONTACT WITH CONCRETE OR DISSIMILAR METALS SHALL RECEIVE ONE 1/16" THICK NEOPRENE GASKET (SHIPPED LOOSE FOR FIELD ATTACHMENT)
- ALL BOLTS, NUTS AND FLAT WASHERS USED TO MOUNT RAILINGS TO FLOORS, WALLS, STEEL, ETC. ARE BY PTP ENGINEERED RAILINGS
- ALL KICK PLATES ("FKP" OR "SKP") SHALL BE SHIPPED LOOSE IN 24'-0" LG. STOCK LENGTHS FOR FIELD CUTTING & DRILLING AS NEEDED
- ALL POSTS ARE TO BE FURNISHED CUT TO LENGTH WITH FITTINGS & MOUNTING PLATES ATTACHED OR SHIPPED LOOSE PER THEIR SPECIFIC DETAILS
- PIPE FOR STRAIGHT RAIL IS FURNISHED IN 24'-0" STOCK LENGTHS FOR CUTTING & DRILLING AS NEEDED
- PIPE FOR CURVED RAIL IS FURNISHED SUB-ASSEMBLED IN 21'-0" (MAX). ROLLED LENGTHS FOR FIELD CUTTING & DRILLING AS NEEDED
** ALL RADII MUST BE VERIFIED PRIOR TO FABRICATION **
- ALL CURVED RAIL SHALL BE FABRICATED USING CURVED TOP AND INTERMEDIATE RAILS
- PIPE FOR SINGLE LINE RAIL IS FURNISHED & SHIPPED SUB-ASSEMBLED.
- BENDS WITH A 3" C/L RADIUS ARE FURNISHED AS NEEDED & MUST BE FIELD CUT FOR FIELD CONDITIONS
- ALL RAIL WHEN PROPERLY INSTALLED SHALL MEET OR EXCEED OSHA REQUIREMENTS.
- MAX. POST SPACING TO BE 6'-0" C/C
- ALL RAIL IS TO BE FINISHED IN ACCORDANCE WITH THE ALUMINUM ASSOCIATION'S DESIGNATION M10C22A41 OR M12C22A41
- PIPE FOR CANTILEVER RAILING WILL SHIP LOOSE IN 24'-0" STOCK LENGTHS FOR FIELD CUTTING AND DRILLING AS NEEDED
- ENSURE ALL FIELD CUTS AND FIELD DRILLED HOLES ARE CLEANED UP, FREE OF SHARP EDGES AND BURRS.
- CONCRETE ANCHOR TYPE IS HILTI HIT-RE 500 V3 ADHESIVE ANCHORS. CONCRETE STRENGTH IS ASSUMED TO BE 4000 PSI, NORMAL WEIGHT CRACKED CONCRETE.
- ALL DIMENSIONS SHOWN THROUGHOUT THIS SET ARE APPROXIMATE AND SHALL BE FIELD VERIFIED BEFORE FABRICATION AND INSTALLATION

%% = SEE ERECTION DRAWINGS FOR PART NUMBER

1	SUBMITTAL	9/19/2017
REV	DESCRIPTION	DATE



3000 YOUNGFIELD ST. SUITE 275 WHEAT RIDGE, CO 80215
Ph: (720)608-3819 FAX: (720)409-3843

NOTICE TO CONTRACTOR AND ERECTOR:
BACK CHARGES FOR CORRECTIVE WORK OR REPLACEMENT MATERIALS WILL NOT BE ACCEPTED UNLESS AUTHORIZED BY PEAK TO PEAK ENGINEERED RAILINGS, INC. BEFORE SUCH COSTS ARE INCURRED

STANDARD DETAILS

CITY, ST

ALUMINUM HANDRAIL - RIVET SYSTEM - SUB-ASSEMBLED

DESIGNER	DESIGNER	CUSTOMER	CUSTOMER	DWG TITLE	STANDARD DETAILS
CUSTOMER JOB #	XXXX-XX	PRINT DATE	2/26/2020	ISSUE DATE	2/26/2020
DETAILED BY	INT	CHECKER	INT	SCALE	NTS
				CONTRACT NO	XXX-XXX
				DRAWING NO.	SD-1



3000 YOUNGFIELD ST. SUITE 275 WHEAT RIDGE, CO 80215
720.508.3819 fax 720.409.3843 www.peaktopeakrailings.com

12 December 2022

RE: Aluminum Alloy for Peak to Peak Engineered Railings System

To Whom it may concern,

Peak to Peak requests our standard 6005A-T61 aluminum alloy be accepted in lieu of 6061-T6, 6063-T6, or 6105-T5 alloys for the following reasons:

- 1) 6005A-T61 has a minimum ultimate tensile strength of 38 ksi compared to 30 ksi from 6063-T6. 6061-T6 and 6105-T5 both have the same 38 ksi ultimate tensile strength.
- 2) 6005A-T61 has a minimum yield strength of 35 ksi compared to 25 ksi from 6063-T6. 6061-T6 and 6105-T5 both have the same 35 ksi yield strength.
- 3) The standard clear anodizing of 6005A-T61 is a near perfect match in finish to the 535 alloy of all of our fittings. Compared to the finish of 6061-T6, 6105-T5, and 6063-T6 alloys, the 6005A-T61 alloy offers a more aesthetic appearance to the railing.

Additionally, corrosion resistance is typically mentioned as the main factor behind specifying 6063-T6 over a different alloy, so I wanted to follow up with some information from the Aluminum Design Manual regarding corrosion resistance. Per the following chart (Table 1 from Chapter IV of the Aluminum Design Manual 2015), 6005A-T61 has a **B** level of *General Resistance to Corrosion* and an **A** level of Resistance to *Stress-Corrosion Cracking*.

ALLOY AND TEMPER	RESISTANCE TO CORROSION		Workability (Cold) ⑤	Machinability ⑤	Brazeability ⑥	WELDABILITY ⑥		
	General ①	Stress-Corrosion Cracking ②				Gas	Arc	Resistance Spot and Seam
5657-H241 H25 H26 H28	A A A A	A A A A	A B B C	D D D D	B B B B	A A A A	A A A A	A A A A
6005-T1, T5 6005A-T1, T5 6005A-T61	B B B	A A A	.. B C	.. C C	A A A	A A A	A A A	A A A
6053-O T6, T61	.. A	.. A	E C	B B	A A	A A	B A
6061-O T4, T451, T4510, T4511 T6, T651, T652, T6510, T6511	B B B	A B A	A B C	D C C	A A A	A A A	A A A	B A A
6063-T1 T4 T5, T52 T6 T83, T831, T832	A A A A A	A A A A A	B B B C C	D D C C C	A A A A A	A A A A A	A A A A A	A A A A A

Sales Office: 720-508-3819 | Fax: 720-409-3843
3000 Youngfield Street | Wheat Ridge, CO | 80215



3000 YOUNGFIELD ST. SUITE 275 WHEAT RIDGE, CO 80215
720.508.3819 fax 720.409.3843 www.peaktopeakrailings.com

The footnotes for the chart (shown below) indicate that *Alloys with A and B ratings can be used in industrial and seacoast atmospheres without protection.* Additionally, all of our railing is anodized to a thickness of 0.7 mils, so we include additional protective coating even though the Aluminum Design Manual indicates that it can be used in industrial settings without that additional protection. We also separate all faying surfaces with an isolating gasket to prevent corrosion at these locations. The stress-corrosion cracking for 6005A-T61 is rated as an A so there should be no concerns around this happening.

Footnotes for Table 1

① Ratings A through E are relative ratings in decreasing order of merit, based on exposures to sodium chloride solution by intermittent spraying or immersion. Alloys with A and B ratings can be used in industrial and seacoast atmospheres without protection. Alloys with C, D and E ratings generally should be protected at least on faying surfaces.

② Stress-corrosion cracking ratings are based on service experience and on laboratory tests of specimens exposed to the 3.5% sodium chloride alternate immersion test.

A = No known instance of failure in service or in laboratory tests.

B = No known instance of failure in service; limited failures in laboratory tests of short transverse specimens.

C = Service failures with sustained tension stress acting in short transverse direction relative to grain structure; limited failures in laboratory tests of long transverse specimens.

D = Limited service failures with sustained longitudinal or long transverse areas.

These ratings are neither product specific nor test direction specific and therefore indicate only the general level of stress-corrosion cracking resistance. For more specific information on certain alloys, see ASTM G64.

Based on all of the information listed above, we request that our anodized 6005A-T61 aluminum be accepted for use on this project.

Sincerely,

Christopher Manlove, P.E.

A handwritten signature in black ink, reading 'Christopher Manlove', written in a cursive style.

Design Engineer
Peak to Peak Engineered Railings, LLC

Sales Office: 720-508-3819 | Fax: 720-409-3843
3000 Youngfield Street | Wheat Ridge, CO | 80215

Epoxy Anchor Bolts

SET-3G™ High-Strength Epoxy Adhesive

SET-3G Adhesive Cartridge System

Model No.	Capacity (ounces)	Cartridge Type	Carton Quantity	Dispensing Tool(s)	Mixing Nozzle
SET3G10 ²	8.5	Coaxial	12	CDT10S	EMN22I
SET3G22-N ¹	22	Side-by-side	10	EDT22S, EDTA22P, EDTA22CKT	EMN22I

1. One EMN21I mixing nozzle and one extension are supplied with each cartridge.
2. Two EMN22I mixing nozzles and two nozzle extensions are supplied with each cartridge.
3. Cartridge estimation guidelines are available at strongtie.com/apps.
4. Use only Simpson Strong-Tie® mixing nozzles in accordance with Simpson Strong-Tie instructions. Modification or improper use of mixing nozzle may impair SET-3G adhesive performance.

SET-3G Cure Schedule^{1,2}

Concrete Temperature		Gel Time	Cure Time
(°F)	(°C)	(min.)	(hr.)
40	4	120	192
50	10	75	72
60	16	50	48
70	21	35	24
90	32	25	24
100	38	15	24

For SI: 1°F = (°C × 9/5) + 32.

1. For water-saturated concrete and water-filled holes, the cure times should be doubled.
2. For installation of anchors in concrete where the temperature is below 70°F (21°C), the adhesive must be conditioned to a minimum temperature of 70°F (21°C).

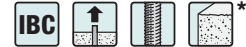
Test Criteria

Anchors installed with SET-3G adhesive have been tested in accordance with ICC-ES *Acceptance Criteria for Adhesive Anchors in Concrete Elements (AC308)*.

Property	Test Method	Result*
Consistency	ASTM C881	Passed, non-sag
Heat deflection	ASTM D648	147°F
Bond strength (moist cure)	ASTM C882	3,306 psi at 2 days
Water absorption	ASTM D570	0.13%
Compressive yield strength	ASTM D695	15,390 psi
Compressive modulus	ASTM D695	991,830 psi
Shore D durometer	ASTM D2240	84
Gel time	ASTM C881	52 minutes
Volatile Organic Compound (VOC)	—	1.9 g/L

*Material and curing conditions: 73 ± 2°F, unless otherwise noted.

SET-3G™ Design Information — Concrete

SET-3G Tension Strength Design Data for Threaded Rod in Normal-Weight Concrete^{1, 8}

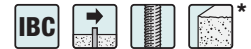
Characteristic			Symbol	Units	Nominal Rod Diameter (in.)						
					⅜	½	⅝	¾	⅞	1	1¼
Steel Strength in Tension											
Minimum Tensile Stress Area			A_{se}	in. ²	0.078	0.142	0.226	0.334	0.462	0.606	0.969
Tension Resistance of Steel — ASTM F1554, Grade 36			N_{sa}	lb.	4,525	8,235	13,110	19,370	26,795	35,150	56,200
Tension Resistance of Steel — ASTM F1554, Grade 55					5,850	10,650	16,950	25,050	34,650	45,450	72,675
Tension Resistance of Steel — ASTM A193, Grade B7					9,750	17,750	28,250	41,750	57,750	75,750	121,125
Tension Resistance of Steel — Stainless Steel ASTM A193, Grade B8 and B8M (Types 304 and 316)					4,445	8,095	12,880	19,040	26,335	34,540	55,235
Tension Resistance of Steel — Stainless Steel ASTM F593 CW (Types 304 and 316)					7,800	14,200	22,600	28,390	39,270	51,510	82,365
Tension Resistance of Steel — Stainless Steel ASTM A193, Grade B6 (Type 410)					8,580	15,620	24,860	36,740	50,820	66,660	106,590
Strength Reduction Factor for Tension — Steel Failure			ϕ	—	0.75 ⁵						
Concrete Breakout Strength in Tension (2,500 psi ≤ f'c ≤ 8,000 psi)											
Effectiveness Factor for Cracked Concrete			$k_{c,cr}$	—	17						
Effectiveness Factor for Uncracked Concrete			$k_{c,uncr}$	—	24						
Strength Reduction Factor — Concrete Breakout Failure in Tension			ϕ	—	0.65 ⁶						
Bond Strength in Tension (2,500 psi ≤ f'c ≤ 8,000 psi) ⁷											
Minimum Embedment			$h_{ef,min}$	in.	2⅜	2¾	3⅛	3½	3¾	4	5
Maximum Embedment			$h_{ef,max}$	in.	7½	10	12½	15	17½	20	25
Continuous Inspection	Temperature Range A ^{2,4}	Characteristic Bond Strength in Cracked Concrete ⁹	$\tau_{k,cr}$	psi	1,448	1,402	1,356	1,310	1,265	1,219	1,128
		Characteristic Bond Strength in Uncracked Concrete ⁹	$\tau_{k,uncr}$	psi	2,357	2,260	2,162	2,064	1,967	1,868	1,672
	Temperature Range B ^{3,4}	Characteristic Bond Strength in Cracked Concrete ⁹	$\tau_{k,cr}$	psi	1,201	1,163	1,125	1,087	1,050	1,012	936
		Characteristic Bond Strength in Uncracked Concrete ⁹	$\tau_{k,uncr}$	psi	1,957	1,876	1,795	1,713	1,632	1,551	1,388
	Anchor Category		Dry Concrete	—	1						
	Strength Reduction Factor		Dry Concrete	$\phi_{dry,ci}$	0.65 ¹⁰						
	Anchor Category		Water-Saturated Concrete, or Water-Filled Hole	—	3			2			
	Strength Reduction Factor		Water-Saturated Concrete, or Water-Filled Hole	$\phi_{wet,ci}$	0.45 ¹⁰			0.55 ¹⁰			
Periodic Inspection	Temperature Range A ^{2,4}	Characteristic Bond Strength in Cracked Concrete ⁹	$\tau_{k,cr}$	psi	1,346	1,304	1,356	1,310	1,265	1,219	1,128
		Characteristic Bond Strength in Uncracked Concrete ⁹	$\tau_{k,uncr}$	psi	2,192	2,102	2,162	2,064	1,967	1,868	1,672
	Temperature Range B ^{3,4}	Characteristic Bond Strength in Cracked Concrete ⁹	$\tau_{k,cr}$	psi	1,117	1,082	1,125	1087	1,050	1,012	936
		Characteristic Bond Strength in Uncracked Concrete ⁹	$\tau_{k,uncr}$	psi	1,820	1,744	1,795	1,713	1,632	1,551	1,388
	Anchor Category		Dry Concrete	—	2			1			
	Strength Reduction Factor		Dry Concrete	$\phi_{dry,pi}$	0.55 ¹⁰			0.65 ¹⁰			
	Anchor Category		Water-Saturated Concrete, or Water-Filled Hole	—	3						
	Strength Reduction Factor		Water-Saturated Concrete, or Water-Filled Hole	$\phi_{wet,pi}$	0.45 ¹⁰						
Reduction Factor for Seismic Tension			$\alpha_{N,seis}$ ¹¹	—	1.0	0.9	1.0	1.0	1.0	1.0	1.0

- The information presented in this table is to be used in conjunction with the design criteria of ACI 318-14 and ACI 318-11.
- Temperature Range A: Maximum short-term temperature = 160°F, maximum long-term temperature = 110°F.
- Temperature Range B: Maximum short-term temperature = 176°F, maximum long-term temperature = 110°F.
- Short-term concrete temperatures are those that occur over short intervals (diurnal cycling). Long-term temperatures are roughly constant over significant periods of time.
- The tabulated value of ϕ applies when the load combinations of ACI 318-14 5.3 or ACI 318-11 9.2 are used. If the load combinations of ACI 318-11 Appendix C are used, refer to ACI 318-11 D.4.4 to determine the appropriate value of ϕ .
- The tabulated value of ϕ applies when both the load combinations of ACI 318-14 5.3, or ACI 318-11 9.2 are used and the requirements of ACI 318-14 17.3.3 (c) or ACI 318-11 D.4.3 (c), as applicable, for Condition B are met. If the load combinations of ACI 318-11 Appendix C are used, refer to ACI 318 D.4.4 (c) for Condition B to determine the appropriate value of ϕ .

- Bond strength values shown are for normal-weight concrete having a compressive strength of f'_c = 2,500 psi. For higher compressive strengths up to 8,000 psi, the tabulated characteristic bond strength may be increased by a factor of (f'_c/2,500)^{0.35} for uncracked concrete and a factor of (f'_c/2,500)^{0.24} for cracked concrete.
- For lightweight concrete, the modification factor for bond strength shall be as given in ACI 318-14 17.2.6 or ACI 318-11 D.3.6, as applicable, where applicable.
- Characteristic bond strength values are for sustained loads, including dead and live loads.
- The tabulated value of ϕ applies when both the load combinations of ACI 318-14 5.3, or ACI 318-11 9.2 are used and the requirements of ACI 318-14 17.3.3 (c) or ACI 318-11 D.4.3 (c), as applicable, for Condition B are met. If the load combinations of ACI 318-11 Appendix C are used, refer to ACI 318 D.4.4(c) for Condition B to determine the appropriate value of ϕ .
- For anchors installed in regions assigned to Seismic Design Category C, D, E or F, the bond strength values must be multiplied by $\alpha_{N,seis}$.

* See p. 13 for an explanation of the load table icons.

SET-3G™ Design Information — Concrete

SET-3G Shear Strength Design Data for Threaded Rod
in Normal-Weight Concrete¹

Characteristic	Symbol	Units	Nominal Rod Diameter (in.)						
			3⁄8	1⁄2	5⁄8	3⁄4	7⁄8	1	1 1⁄4
Steel Strength in Shear									
Minimum Shear Stress Area	A _{se}	in. ²	0.078	0.142	0.226	0.334	0.462	0.606	0.969
Shear Resistance of Steel — ASTM F1554, Grade 36	V _{sa}	lb.	2,715	4,940	7,865	11,625	16,080	21,090	33,720
Shear Resistance of Steel — ASTM F1554, Grade 55			3,510	6,390	10,170	15,030	20,790	27,270	43,605
Shear Resistance of Steel — ASTM A193, Grade B7			5,850	10,650	16,950	25,050	34,650	45,450	72,675
Reduction factor for Seismic Shear — Carbon Steel	α _{V,seis} ⁴	—	0.75					1.0	
Shear Resistance of Steel — Stainless Steel ASTM A193, Grade B8 and B8M (Types 304 and 316)	V _{sa}	lb.	2,665	4,855	7,730	11,425	15,800	20,725	33,140
Shear Resistance of Steel — Stainless Steel ASTM F593 CW (Types 304 and 316)			4,680	8,520	13,560	17,035	23,560	30,905	49,420
Shear Resistance of Steel — Stainless Steel ASTM A193, Grade B6 (Type 410)			5,150	9,370	14,915	22,040	30,490	40,000	63,955
Reduction factor for Seismic Shear — Stainless Steel	α _{V,seis} ⁴	—	0.80		0.75			1.0	
Strength Reduction Factor for Shear — Steel Failure	φ	—	0.65 ²						
Concrete Breakout Strength in Shear									
Outside Diameter of Anchor	d _a	in.	0.375	0.5	0.625	0.75	0.875	1	1.25
Load-Bearing Length of Anchor in Shear	l _e	in.	h _{ef}						
Strength Reduction Factor for Shear — Breakout Failure	φ	—	0.70 ³						
Concrete Pryout Strength in Shear/									
Load-Bearing Length of Anchor in Shear	k _{cp}	in.	1.0 for h _{ef} < 2.50"; 2.0 for h _{ef} ≥ 2.50"						
Strength Reduction Factor for Shear — Breakout Failure	φ	—	0.70 ³						

1. The information presented in this table is to be used in conjunction with the design criteria of ACI 318-14 and ACI 318-11.

2. The tabulated value of ϕ applies when the load combinations of ACI 318-14 5.3 or ACI 318-11 9.2 are used. If the load combinations of ACI 318-11 Appendix C are used, refer to ACI 318-11 D.4.4 to determine the appropriate value of ϕ .

3. The tabulated value of ϕ applies when both the load combinations of ACI 318-14 5.3, or ACI 318-11 9.2 are used and the requirements

of ACI 318-14 17.3.3 (c) or ACI 318-11 D.4.3 (c), as applicable, for Condition B are met. If the load combinations of ACI 318-11 Appendix C are used, refer to ACI 318 D.4.4 (c) for Condition B to determine the appropriate value of ϕ .

4. The values of V_{sa} are applicable for both cracked concrete and uncracked concrete. For anchors installed in regions assigned to Seismic Design Category C, D, E or F, V_{sa} must be multiplied by $\alpha_{V_{seis}}$ for the corresponding anchor steel type.

* See p. 13 for an explanation of the load table icons.

SET-3G™ Design Information — Concrete

SET-3G Shear Strength Design Data for Rebar in Normal-Weight Concrete¹

Characteristic	Symbol	Units	Nominal Rod Diameter (in.)						
			#3	#4	#5	#6	#7	#8	#10
Steel Strength in Shear									
Minimum Shear Stress Area	A_{se}	in. ²	0.110	0.200	0.310	0.440	0.600	0.790	1.270
Shear Resistance of Steel — Rebar (ASTM A615 Grade 60)	V_{sa}	lb.	5,940	10,800	16,740	23,760	32,400	42,660	68,580
Shear Resistance of Steel — Rebar (ASTM A706 Grade 60)			5,280	9,600	14,880	21,120	28,800	37,920	60,960
Reduction Factor for Seismic Shear — Rebar (ASTM A615 Grade 60)	$\alpha_{V_{seis}}^4$	—	0.60					0.8	
Reduction Factor for Seismic Shear — Rebar (ASTM A706 Grade 60)			0.60					0.8	
Strength Reduction Factor for Shear — Steel Failure	ϕ	—	0.65 ²						
Concrete Breakout Strength in Shear									
Outside Diameter of Anchor	d_a	in.	0.375	0.5	0.625	0.75	0.875	1	1.25
Load-Bearing Length of Anchor in Shear	l_e	in.	h_{ef}						
Strength Reduction Factor for Shear — Breakout Failure	ϕ	—	0.70 ³						
Concrete Pryout Strength in Shear									
Load-Bearing Length of Anchor in Shear	k_{cp}	in.	1.0 for $h_{ef} < 2.50"$; 2.0 for $h_{ef} \geq 2.50"$						
Strength Reduction Factor for Shear — Breakout Failure	ϕ	—	0.70 ³						

1. The information presented in this table is to be used in conjunction with the design criteria of ACI 318-14 and ACI 318-11.

2. The tabulated value of ϕ applies when the load combinations of ACI 318-14 5.3 or ACI 318-11 9.2 are used. If the load combinations of ACI 318-11 Appendix C are used, refer to ACI 318-11 D.4.4 to determine the appropriate value of ϕ .

3. The tabulated value of ϕ applies when both the load combinations of ACI 318-14 5.3 or ACI 318-11 9.2 are used and the requirements of

ACI 318-14 17.3.3 (c) or ACI 318-11 D.4.3 (c), as applicable, for Condition B are met. If the load combinations of ACI 318-11 Appendix C are used, refer to ACI 318 D.4.4 (c) for Condition B to determine the appropriate value of ϕ .

4. The values of V_{sa} are applicable for both cracked concrete and uncracked concrete. For anchors installed in regions assigned to Seismic Design Category C, D, E or F, V_{sa} must be multiplied by $\alpha_{V_{seis}}$ for the corresponding anchor steel type.

For additional load tables, visit strongtie.com/set3g.



Anchor Designer™ Software for ACI 318, ETAG and CSA

Simpson Strong-Tie® Anchor Designer software accurately analyzes existing design or suggests anchor solutions based on user-defined design elements in cracked and uncracked concrete conditions.

* See p. 13 for an explanation of the load table icons.

Weirs

CHEMICAL RESISTANT SHEET
TECHNICAL DATA

PROTECTOLITE™ SERIES 210 CORR-ISO CORROSION SHEETS are manufactured under high heat and pressure in matched metal moulds. It meets or exceeds CAN/CGSB 41.22 standard. **SERIES 210 CORR-GP** sheet is an excellent premium grade isophthalic resin, with UV inhibitors, fiberglass, filled composite laminate. Suitable for use in tanks, baffles, weir plates, ducting, spacers, pipes, and other components requiring light weight, low maintenance, higher service anti-corrosive properties.

<u>PROPERTIES:</u>	<u>VALUES:</u>	<u>METHOD:</u>
TENSILE STRENGTH	14-15,000 psi	ASTM D638
FLEXURAL STRENGTH	25-27,000 psi	ASTM D790
FLEXURAL MODULUS	1.0 x 10⁶ psi	ASTM D790
COMPRESSIVE STRENGTH	30,000 psi	ASTM D790
BARCOL HARDNESS	40-45	ASTM D2583
IZOD IMPACT, notched	> 12 ft-lb./in.	ASTM D256
WATER ABSORPTION (24 Hours @ 230C)	< 0.1%	ASTM D570
SPECIFIC GRAVITY	1.85 ± 0.05	ASTM D792
STANDARD COLOUR	Light Grey (Other colours available)	
ARC RESISTANCE	130 sec	ASTM D495
DIELECTRIC STRENGTH	475 VPM	ASTM D149
DIELECTRIC CONSTANT, 60Hz	4.5	ASTM D150
AVERAGE COEFFICIENT OF THERMAL EXPANSION (Inch/ Inch/°F)	10.5 x 10⁻⁶	ASTM D696
STANDARD SIZES	36"x 72"; 48"x 96"	
STANDARD THICKNESS	1/16" through 6"	


The property values shown are based upon tests believed to be reliable. However, no liability is assumed resulting from their use. We suggest that the user perform tests to establish the material's suitability for the specific application.

March 2023

BILL OF MATERIAL			
ITEM	PART NAME/DESCRIPTION	MATERIAL	QTY (3 TANKS)
1	STANDARD V-NOTCH WEIR PLATE, 9"x95-3/4"x1/4"	ISOPHTHALIC POLYESTER UV STABILIZED	129
2	WEIR KEEPER PLATE, 5" DIA X 1/4"	ISOPHTHALIC POLYESTER UV STABILIZED	516
3	WEIR SPLICE PLATE, 9"x6"x1/4"	ISOPHTHALIC POLYESTER UV STABILIZED	129
4	1/2"DIA x6" A193 B8M CLASS 1 FULL THREADED STUD	STAINLESS STEEL 316	516
5	1/2" PLASTIC RETAINING CAP	SIMPSON ARC50A-RP25	516
6	TE1=EPOXY ADHESIVE ANCHOR NOZZLE INCLUDED 21OZ 6CT	EPOXY ADHESIVE	8
7	1/2" FLAT WASHER	STAINLESS STEEL 316	516
8	1/2" LOCK WASHER	STAINLESS STEEL 316	516
9	1/2-13 HEX NUT	STAINLESS STEEL 316	516
10	SEALER	SEALER, 1 GAL	1

	1	ADDED PAGE 3 FOR TANK# 8, UPDATED DIMENSIONS ACCORDING TO THE CHANGE IN LAUNDER WALL ELEVATION	8/21/2023	Y.L.
	0	INITIAL DRAWINGS	8/18/2023	Y.L.
ZONE	REV.	DESCRIPTION	DATE	APPROVED
REVISIONS				

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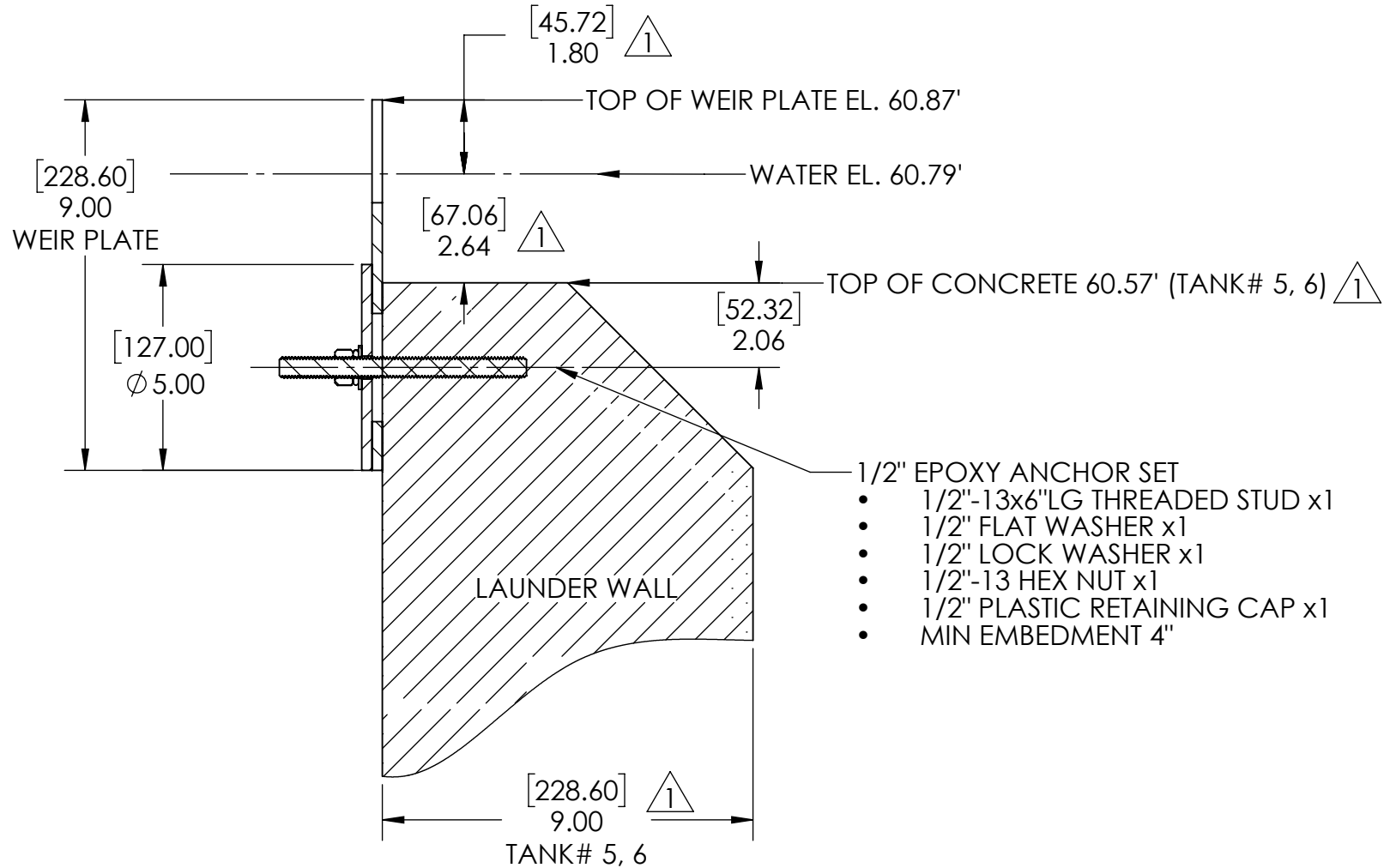
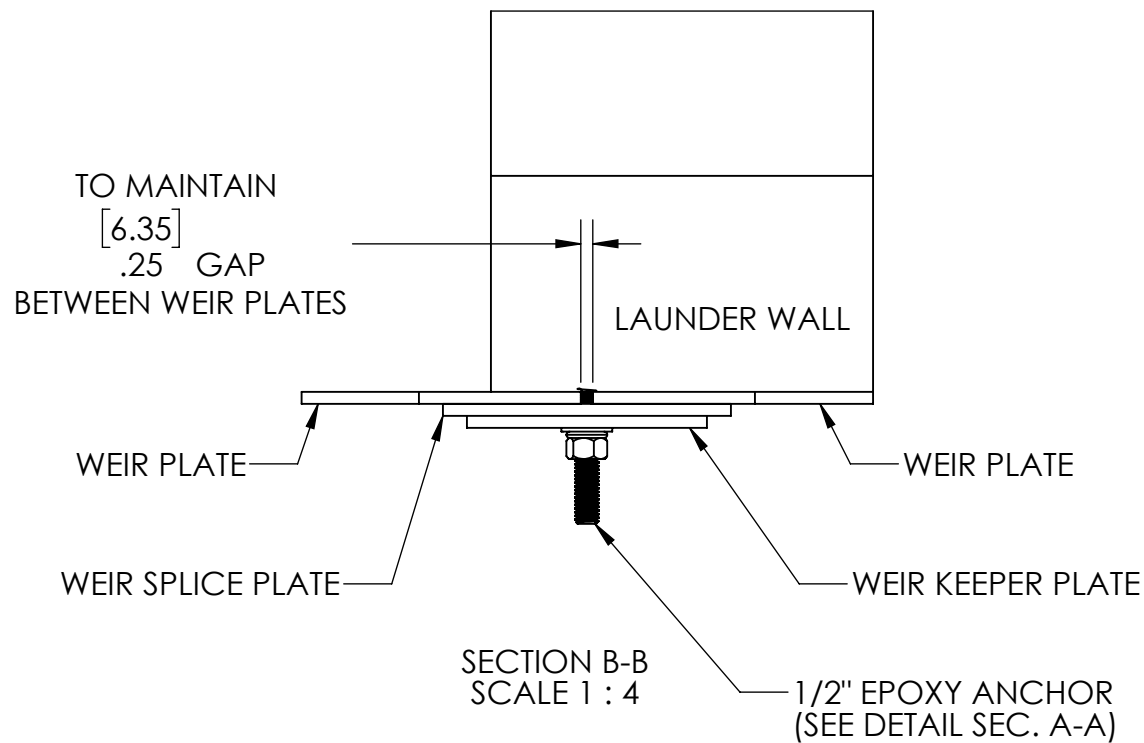
UNLESS OTHERWISE SPECIFIED:		NAME	DATE	 PROTECTOLITE COMPOSITES INC.	
DIMENSIONS ARE IN INCHES TOLERANCES: ANGULAR: ± 1° TWO PLACE DECIMAL ± 1/16" THREE PLACE DECIMAL ± 1/32"	DRAWN	S.H.	8/18/23	TITLE: BILL OF MATERIAL	
	CHECKED	C.X.	8/18/23		
	ENG APPR.				
	MFG APPR.				
INTERPRET GEOMETRIC TOLERANCING PER:	Q.A.			COMMENTS: PROJECT: BRANTFORD, ON 105' DIAMETER SECONDARY TANK WO#: 1230395 REF#: 22-104	
MATERIAL					
FINISH					
DO NOT SCALE DRAWING					
		SIZE	DWG. NO.	REV	
		B	P1230395W	1	
		SCALE: 1:1	WEIGHT:	SHEET 1 OF 6	

4

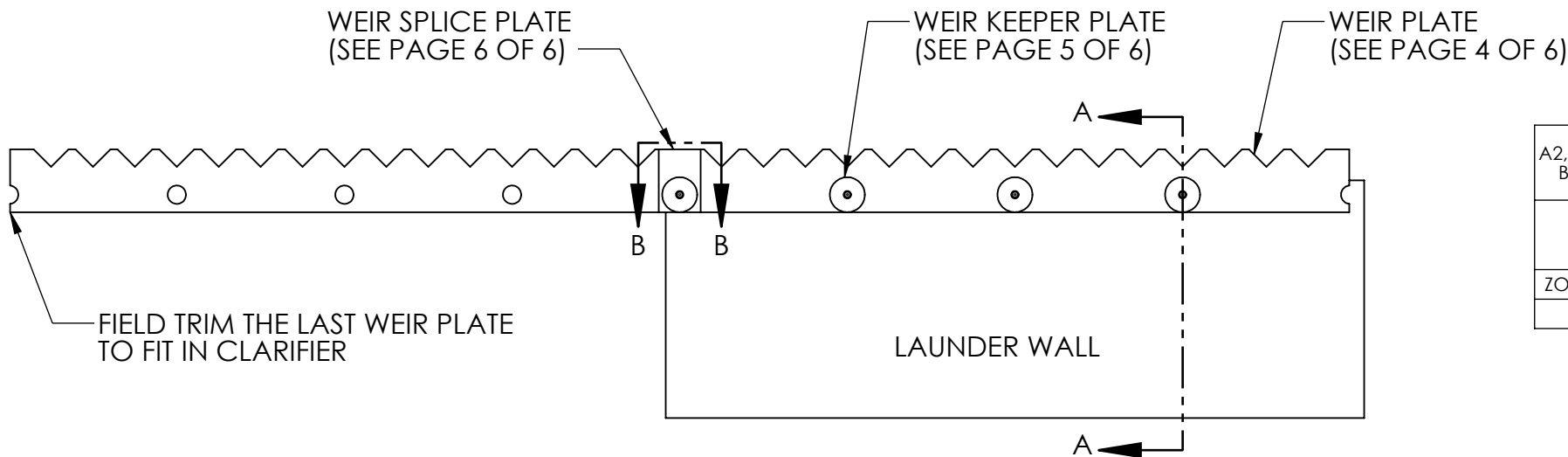
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SECTION A-A
SCALE 1 : 4



A2, B1, B2	1	CHANGED ELEVATION OF TOP OF CONCRETE AND LAUNDER WALL THICKNESS	8/21/2023	Y.L.
	0	INITIAL DRAWINGS	8/18/2023	Y.L.
ZONE	REV.	DESCRIPTION	DATE	APPROVED

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DIMENSIONS ARE IN INCHES TOLERANCES: ANGULAR: ±1° TWO PLACE DECIMAL ± 1/16" THREE PLACE DECIMAL ± 1/32"	DRAWN	S.H.	8/18/23
	CHECKED	C.X.	8/18/23
	ENG APPR.		
	MFG APPR.		
INTERPRET GEOMETRIC TOLERANCING PER:		Q.A.	
MATERIAL		COMMENTS:	
FINISH		PROJECT: BRANTFORD, ON 105' DIAMETER SECONDARY TANK WO#: 1230395 REF#: 22-104	
DO NOT SCALE DRAWING			

PROTECTOLITE
COMPOSITES INC.

TITLE:
**INSTALLATION LAYOUT
TANK# 5, 6**

SIZE B	DWG. NO. P1230395W	REV 1
SCALE: 1:24	WEIGHT:	SHEET 2 OF 6

4

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2

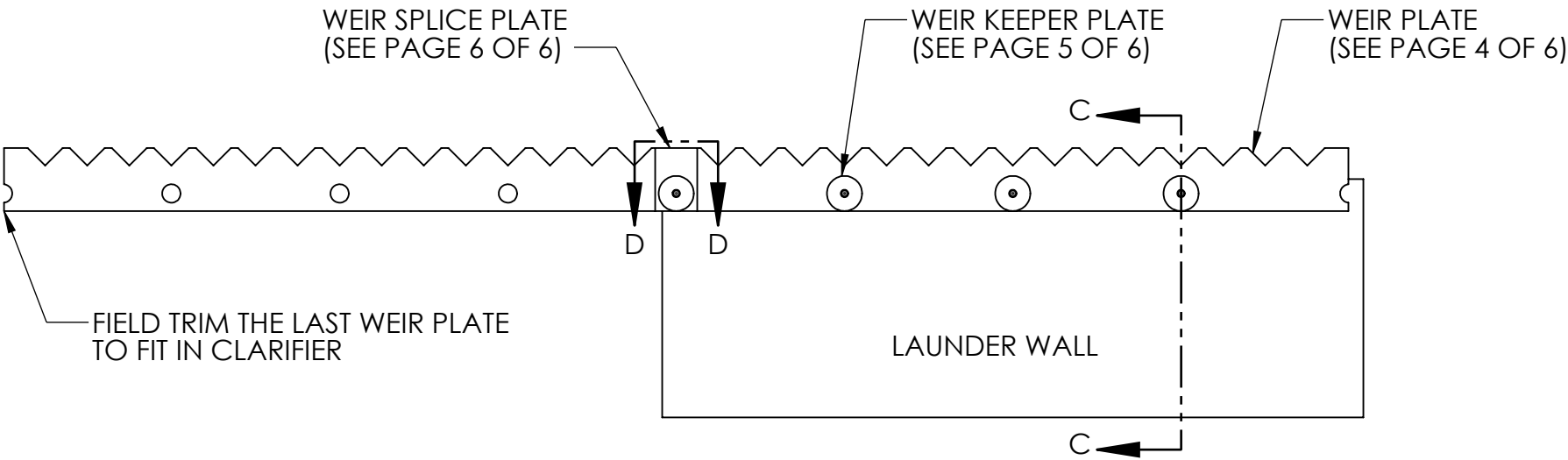
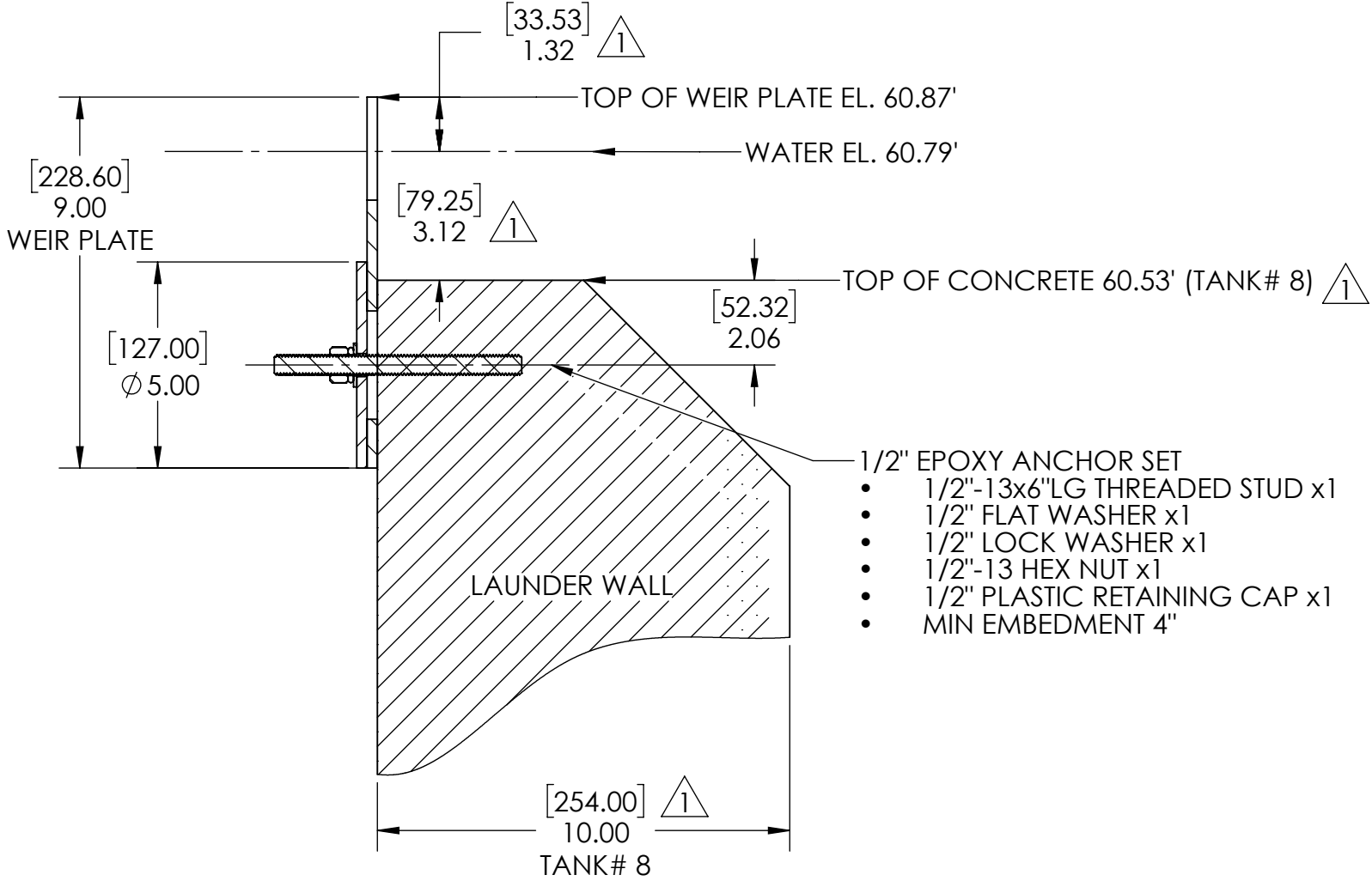
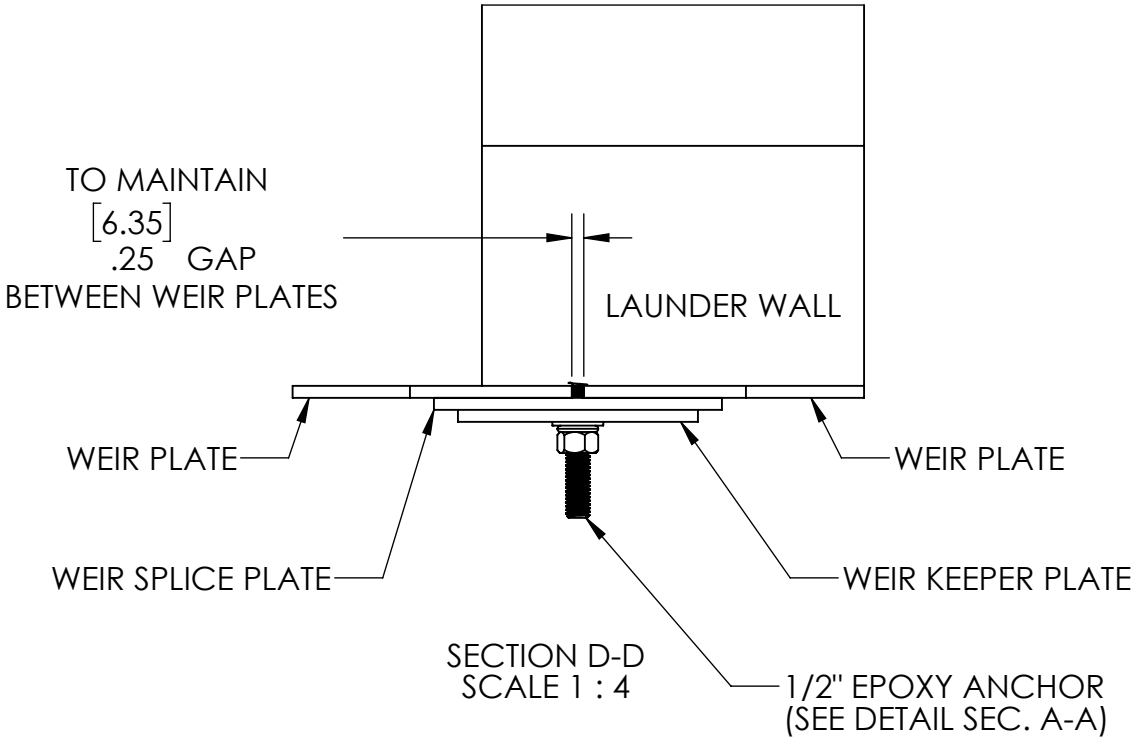
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	1	ADDED INSTALLATION LAYOUT FOR TANK# 8	8/21/2023	Y.L.
	0	INITIAL DRAWINGS	8/18/2023	Y.L.
ZONE	REV.	DESCRIPTION	DATE	APPROVED
REVISIONS				

UNLESS OTHERWISE SPECIFIED:		NAME	DATE
DIMENSIONS ARE IN INCHES TOLERANCES: ANGULAR: ±1° TWO PLACE DECIMAL ± 1/16" THREE PLACE DECIMAL ± 1/32"	DRAWN	S.H.	8/18/23
	CHECKED	C.X.	8/18/23
	ENG APPR.		
	MFG APPR.		
INTERPRET GEOMETRIC TOLERANCING PER:		Q.A.	
MATERIAL		COMMENTS:	
FINISH		PROJECT: BRANTFORD, ON 105' DIAMETER SECONDARY TANK WO#: 1230395 REF#: 22-104	
DO NOT SCALE DRAWING			

		TITLE: INSTALLATION LAYOUT TANK# 8		
SIZE B	DWG. NO. P1230395W	REV 1		
SCALE: 1:24		WEIGHT:	SHEET 3 OF 6	

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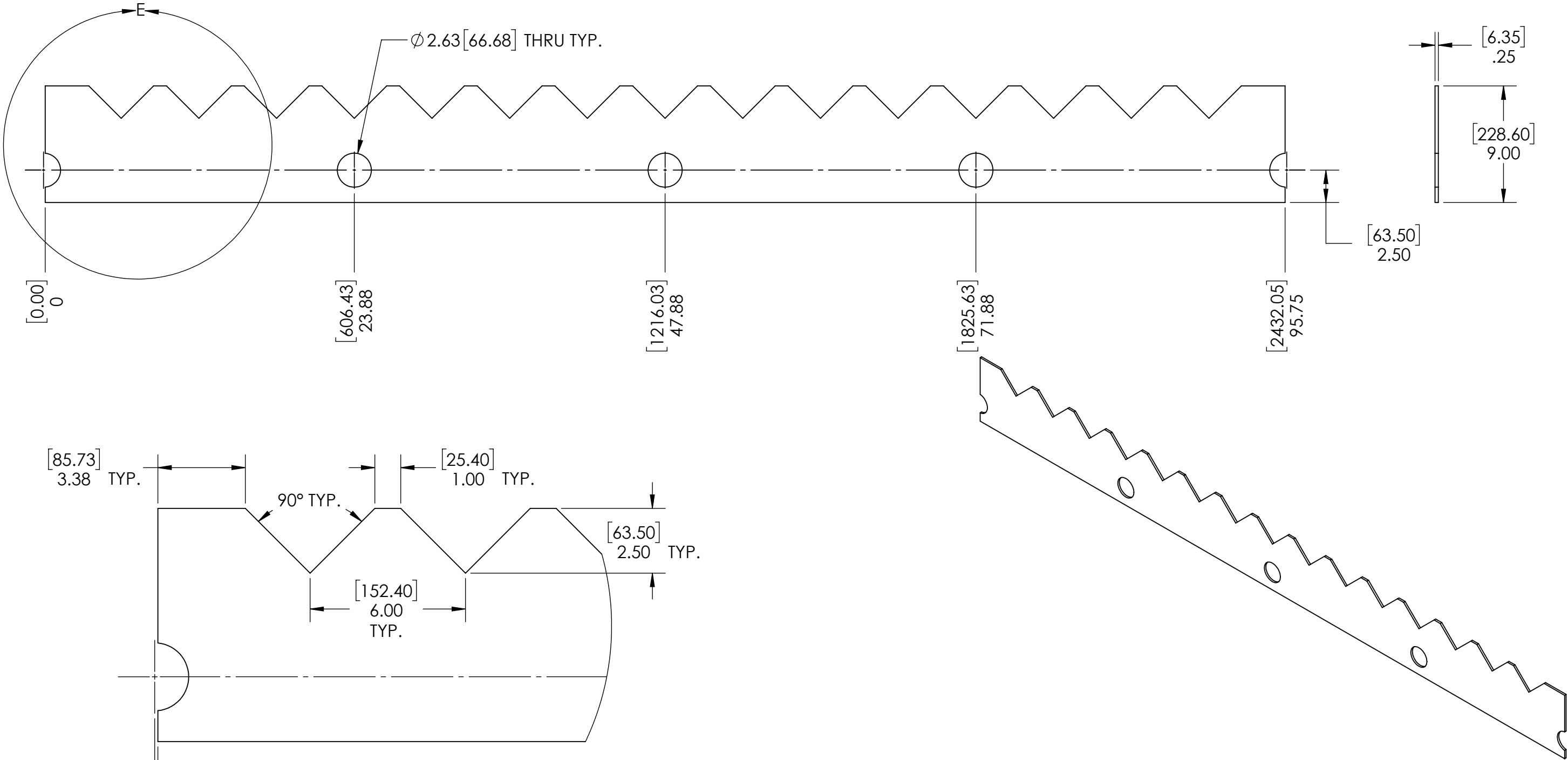
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B

B


A

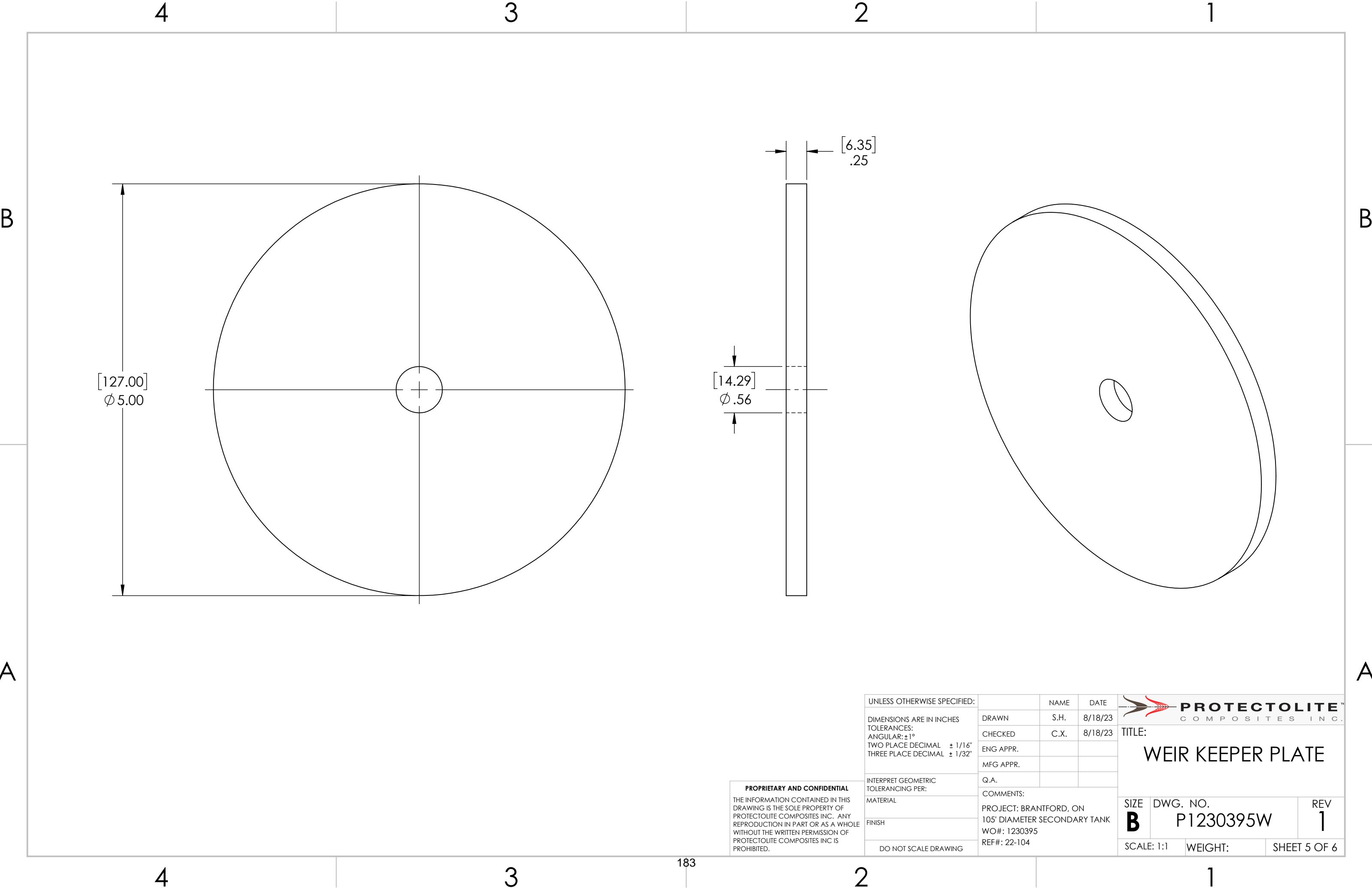
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DETAIL E
SCALE 1 : 4

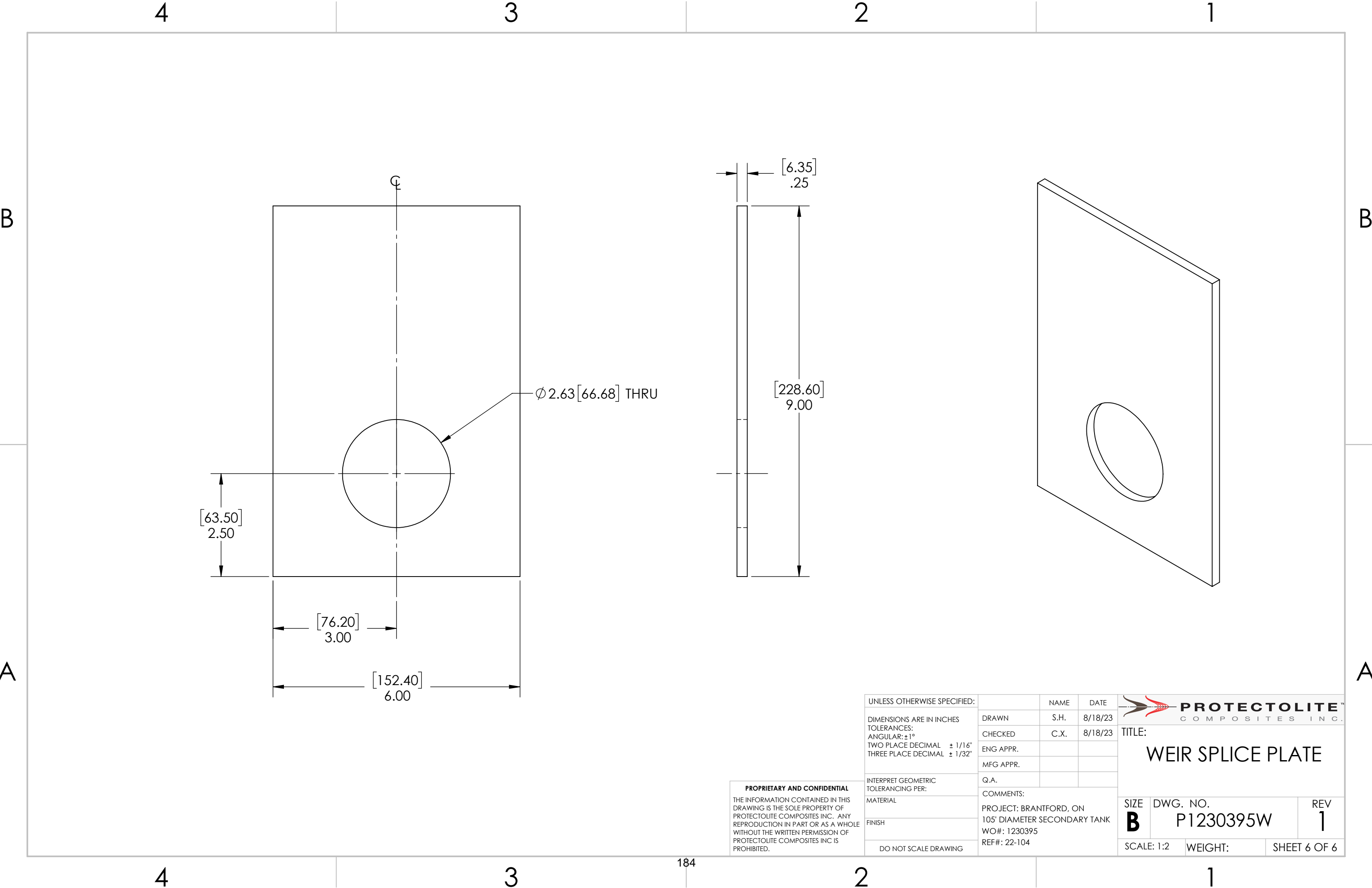
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DIMENSIONS ARE IN INCHES TOLERANCES: ANGULAR: ± 1° TWO PLACE DECIMAL ± 1/16" THREE PLACE DECIMAL ± 1/32"	DRAWN	S.H.	8/18/23	TITLE: WEIR PLATE	
	CHECKED	C.X.	8/18/23		
	ENG APPR.				
	MFG APPR.				
INTERPRET GEOMETRIC TOLERANCING PER:	Q.A.			SIZE DWG. NO. REV B P1230395W 1	
MATERIAL	COMMENTS:				
FINISH	PROJECT: BRANTFORD, ON 105' DIAMETER SECONDARY TANK WO#: 1230395				
DO NOT SCALE DRAWING	REF #: 22-104	SCALE: 1:8 WEIGHT: SHEET 4 OF 6			



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DIMENSIONS ARE IN INCHES		DRAWN	S.H.				8/18/23
TOLERANCES:		CHECKED	C.X.				8/18/23
ANGULAR: ± 1°		ENG APPR.					
TWO PLACE DECIMAL ± 1/16"		MFG APPR.					
THREE PLACE DECIMAL ± 1/32"					TITLE: WEIR KEEPER PLATE		
INTERPRET GEOMETRIC TOLERANCING PER:		Q.A.					
MATERIAL		COMMENTS:					
FINISH		PROJECT: BRANTFORD, ON 105' DIAMETER SECONDARY TANK WO#: 1230395					
DO NOT SCALE DRAWING		REF#: 22-104					
		SIZE		DWG. NO.		REV	
		B		P1230395W		1	
		SCALE: 1:1		WEIGHT:		SHEET 5 OF 6	



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Coatings

Coating Summary

Coating Summary

Surface preparation and paint on equipment supplied by WesTech is as follows:

Drive Unit:

Surface Preparation: SSPC-SP10

Primer Coat: One (1) Coat, Tnemec N140F-1255, Beige, Epoxy Primer (3-9 mils DFT).

Final Coat: One (1) Coat, Tnemec Series 73-B5712, WesTech Blue, Aliphatic Acrylic Polyurethane (2-5 mils DFT).

SSPC-SP10: A near white metal blast cleaned surface, when viewed without magnification, shall be free from all visible oil, grease, dirt, dust, mill scale, rust, coatings, oxides, corrosion products and other foreign materials. Random staining shall be limited to no more than 5% of each 3" x 3" [75mm x 75mm] square surface and may consist of light shadows, slight streaks, or minor discolorations caused by stains of mill scale, or stains of previously applied coating.

Submerged & Non-Submerged Mechanism Stainless Steel:


Cleaning Grade "C": A minimal amount of free iron may remain on surfaces. These locations shall be limited to small pin-point areas 1/16" (1mm) in diameter or less, scattered in a random pattern, and shall be less than 1% of the total surface area.

All surfaces shall be free from:

- Heat Tint (regardless of heat source; welding, thermal cutting, or grinding)
- Oxides and Tarnish (from thermal cutting, and tightly adherent brown or black tarnish formed along the toe of a weld)

Mechanism Stainless Steel Cleaning System

CLEANING GRADE "C"

1. PRE-CLEAN ALL SURFACES IN ACCORDANCE WITH THE WESTECH WORKMANSHIP STANDARD (QR-00-063) SECTIONS 2.3 & 2.4, TO ENSURE THAT ALL SHARP EDGES, BURRS, WELD SPATTER, WELD SLAG ARE REMOVED. 
2. A MINIMAL AMOUNT OF FREE IRON MAY REMAIN ON SURFACES. THESE LOCATIONS SHALL BE LIMITED TO SMALL PIN-POINT AREAS 1/16" (1mm) IN DIAMETER OR LESS, SCATTERED IN A RANDOM PATTERN, AND SHALL BE LESS THAN 1% OF THE TOTAL SURFACE AREA.
3. ALL SURFACES SHALL BE FREE FROM:
 - a. HEAT TINT (REGARDLESS OF HEAT SOURCE; WELDING, THERMAL CUTTING, OR GRINDING).
 - b. OXIDES AND TARNISH (FROM THERMAL CUTTING, AND TIGHTLY ADHERENT BROWN OR BLACK TARNISH FORMED ALONG THE TOE OF A WELD).
4. THIS REQUIRED CLEANING APPLIES TO INTERNAL AND EXTERNAL SURFACES SUBJECT TO CORROSIVE MEDIA ATTACK; SUCH AS INTERNAL SURFACES OF PIPING.



CLEANING GRADE "C"

A	SECTIONS 2.3 & 2.4 WAS SECTION 12 & 13, LLC WAS INC	-	WH17	TO02	2023-03-13	QR-00-063	DOCUMENT NUMBER	SHEET	REV
REV	REVISION DESCRIPTION	ECN	DESIGNER	APPROVER	DATE	REFERENCE DOCUMENTS	0000163925	1 OF 1	A

Drive Paint System

EQUIPMENT DESCRIPTION:

TYPE OF EQUIPMENT / TAG NUMBER(S): _____ DRIVE UNIT _____

ITEM NUMBERS REQUIRING THIS COATING _____

SYSTEM - ITEM NUMBERS (QUANTITY): _____ DRIVE UNIT _____

MATERIAL TO BE COATED: 9x11 CARBON STEEL AND STAINLESS STEEL (IF APPLICABLE)

PROCESS APPLICATION

DESIGN / OPERATING TEMPERATURE:	0 °F / 120 °F
HUMIDITY:	5 - 99%
SERVICE CONDITIONS:	NON-SUBMERGED
UV EXPOSED:	YES
PROCESS ENVIRONMENT:	PROCESS WATER
pH LEVEL:	NOT APPLICABLE
IF pH IS NOT NEUTRAL, WATER CHEMISTRY ANALYSIS IS REQUIRED:	NO
COATINGS SHALL MEET NSF 61 CERTIFICATION:	NOT REQUIRED

FINISHING

INSULATED:	NO
FIREPROOFING:	NO
CATHODIC PROTECTION SYSTEM:	NO

12 INSPECTION REQUIREMENTS

NACE CERTIFIED COATINGS INSPECTOR:	<input checked="" type="checkbox"/> NOT REQUIRED / NOT BY WESTECH
HOLIDAY TESTING (NACE SP0188):	<input checked="" type="checkbox"/> NOT REQUIRED / NOT BY WESTECH
SOLUBLE SALT TESTING:	<input checked="" type="checkbox"/> NOT REQUIRED / NOT BY WESTECH
MILLIGRAMS /METERS² ACCEPTABLE:	<input checked="" type="checkbox"/> NOT REQUIRED / NOT BY WESTECH
ADHESION TESTING:	<input checked="" type="checkbox"/> NOT REQUIRED / NOT BY WESTECH

SURFACE PREPARATION

NACE/SSPC SURFACE CLEANING STANDARD:	SP10 (COMMERCIAL BLAST)
MINIMUM ANGULAR ANCHOR PROFILE RANGE:	2.5 mils

COATING SYSTEM SPECIFICATION

PRIMER COAT #1

NON-MOUNTING SURFACES

COAT #2

COATING MANUFACTURER:	TNEMEC	LPS LABORATORIES INC.
TYPE OF COATING (GENERIC):	POLYAMIDOAMINE EPOXY	RUST INHIBITOR
PRODUCT NAME/NUMBER:	N140F	LPS-3
DRY FILM THICKNESS (DFT)		
MINIMUM-MAXIMUM mils:	3-9 mils	-
COLOR NAME/ NUMBER:	BEIGE (1255)	-

TOTAL DRY FILM THICKNESS OF		TOTAL DRY FILM THICKNESS	
SYSTEM:		OF SYSTEM:	
1	2	3	4
5	6	7	8
9	10	11	12
13	14	15	16
17	18	19	20
21	22	23	24
25	26	27	28
29	30	31	32
33	34	35	36
37	38	39	40
41	42	43	44
45	46	47	48
49	50	51	52
53	54	55	56
57	58	59	60
61	62	63	64
65	66	67	68
69	70	71	72
73	74	75	76
77	78	79	80
81	82	83	84
85	86	87	88
89	90	91	92
93	94	95	96
97	98	99	100

TOTAL DRY FILM THICKNESS:

5-14 mils

11 STAINLESS PARTS

COATING MANUFACTURER:	-	-
MANUFACTURER ITEM NUMBER:	-	-

FINAL TOP COAT #3

TNEMEC

ALIPHATIC ACRYLIC POLYURETHANE

ENDURA-SHIELD 73

2-5 mils

WESTECH BLUE (B5712)

5-14 mils

WALTER-STAINLESS SHINE™

SURFACE CLEANER/PROTECTOR

53-G 402

NOTES:

1. FOLLOW THE LISTED WESTECH REFERENCE DOCUMENTS EXCEPT AS NOTED ON THIS DRAWING.
2. FIELD TOUCH-UP PAINT, LABOR AND COATINGS ARE NOT SUPPLIED BY WESTECH.
3. SURFACE PREPARATION AND COATING APPLICATION:
SHALL BE IN ACCORDANCE WITH NACE/SSPC STANDARDS, COATING MANUFACTURER'S PRODUCT DATA
SHEET AND WESTECH WORKMANSHIP STANDARD QR-00-063 (SECTION 3.1).
PRE-CLEANING - VERIFY THAT ALL SURFACES ARE FREE OF WELD SLAG, SPATTER, SHARP EDGES, AND BURRS PER QR-00-063 (SECTION 2.1).
CLEANING - PRIOR TO ABRASIVE BLAST CLEANING, SOLVENT WIPE PER SSPC SP1. REMOVE ALL VISIBLE GREASE, OIL WAX, AND ALL OTHER CONTAMINATION.
WHEN SSPC SP-6 IS SPECIFIED AND NEW STEEL IS USED, PER NACE VIS 1 SURFACE CLEANING SHALL BE SP-10.
4. COATING THICKNESS RESTRICTION LEVEL SHALL BE IN ACCORDANCE WITH SSPC PA2, TABLE 1 - RESTRICTION LEVEL 3 (80%-120%).
5. MACHINED SURFACES AND PIPE FLANGE FACES SHALL BE PROTECTED FROM ABRASIVE BLAST CLEANING AND COATING APPLICATION IN ACCORDANCE WITH THE WESTECH WORKMANSHIP STANDARD QR-00-063 (SECTIONS 2.6 AND 3.1). AFTER COATING APPLICATION IS COMPLETE, APPLY LPS-3, COSMOLINE OR, OR EQUIVALENT RUST INHIBITOR TO PROTECT THESE SURFACES.
6. STRIPE COAT ALL WELDS, EDGES AND BOLT HOLES USING A BRUSH. STRIPE COAT MAY BE COMPLETED AFTER PRIME COAT.
7. SURFACE PREPARATION AND COATING OR PROTECTION REQUIRED ON SURFACES THAT ARE INACCESSIBLE OR WILL BE INACCESSIBLE AFTER THE EQUIPMENT IS INSTALLED (I.E. UNDERSIDE OF BASE AND CAP PLATES, INTERIOR OF FANS)
 - 7.1. ALL MATING & INTERIOR SURFACES TO DRIVE EXCLUDING MACHINED SURFACES AND PREVIOUSLY PAINTED ITEMS REQUIRE COATING AND/OR PROTECTION
 - 7.2. METHOD OF COATING OR PROTECTION: APPLY COATING #2 TO MACHINED NON-MOUNTING SURFACES BEFORE ASSEMBLY
8. ALL BUYOUT ITEMS SUCH AS REDUCERS, BEARING HOUSINGS, AND MOTORS RECEIVE MANUFACTURER'S STANDARD PROTECTIVE COATINGS.
9. ALL NON-FERROUS MATERIALS, SUCH AS FIBERGLASS, ALUMINUM, STAINLESS STEEL, AND PLASTIC, ETC. SHALL NOT BE COATED, EXCEPT WHEN SPECIFICALLY STATED ON DRAWINGS OR IN THE PURCHASE ORDER.
10. COATINGS THICKNESS SHALL BE MEASURED ABOVE THE PEAKS OF THE ANCHOR PROFILE. COATING SYSTEMS OF LESS THAN (15) mils DRY FILM THICKNESS (DFT) SHALL INCLUDE A "BASE METAL READING" ADJUSTMENT TO THE DRY FILM THICKNESS GAGE. WHEN THE ABRADED SURFACE IS INACCESSIBLE DUE TO COATING APPLICATION, AND NO REFERENCE SURFACE IS AVAILABLE, A MINIMUM OF (1) mil DRY FILM THICKNESS SHALL BE SUBTRACTED FROM THE DRY FILM THICKNESS GAGE READINGS.
11. PROTECT STAINLESS PARTS OF DRIVE DURING PAINTING OF CARBON STEEL PARTS AND PROTECT PAINTED SURFACES DURING COATING OF STAINLESS PARTS.
12. REFERENCE NOTES: (ONLY APPLICABLE WHEN SPECIFIC DATA IS LISTED UNDER INSPECTION REQUIREMENTS)


NACE CERTIFIED COATING INSPECTION - (IF YES) - COATING SHALL BE INSPECTED BY A NACE CERTIFIED INSPECTOR, LEVEL 1 OR HIGHER, SPECIFY LEVEL ON THE NEXT LINE.

HOLIDAY TESTING - (IF YES) - HOLIDAY TESTING SHALL BE IN ACCORDANCE WITH THE COATING MANUFACTURER PRODUCT DATA SHEET (PREFERRED METHOD) OR PER NACE SP-0188 (LOW VOLTAGE HOLIDAY DETECTION [WET SPONGE] IS LIMITED TO COATINGS UP TO 20 MILS DFT. COATING SYSTEMS ABOVE 20 MILS DFT SHALL REQUIRE HIGH VOLTAGE HOLIDAY DETECTION [SPARK TEST]).

SOLUBLE SALT TEST - (IF YES) - TESTING SHALL BE PERFORMED IN ACCORDANCE WITH SSPC GUIDE-15. LIMITS SHALL BE DEFINED AS MILLIGRAMS/METER² (mg/m²). IF CLIENT DOES NOT SPECIFY, SEND REQUEST FOR INFORMATION.

ADHESION TEST - (IF YES) - TESTING SHALL BE IN ACCORDANCE WITH ASTM D4541, MINIMUM ADHESION SHALL BE SPECIFIED IN PSI, AND BASED ON COATING MANUFACTURERS RECOMMENDATIONS.

REV	REVISION DESCRIPTION	ECN	DESIGNER	APPROVER	DATE
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	TITLE COATING DATA SHEET DRIVE - CARBON STEEL			
DRV109				
QR-00-063 (SECTION 3.1)	DESIGNER	CHECKER	APPROVER	DATE
QR-00-063 (SECTION 2.6)	WH17	PA51	B013	2021/02/05
QR-00-063 (SECTION 2.1)	JOB NUMBER	DOCUMENT NUMBER		SHEET
REFERENCE DOCUMENTS	-	0000952300		1 OF 1
				-



POTA-POX® PLUS SERIES N140F

PRODUCT PROFILE

GENERIC DESCRIPTION	Polyamidoamine Epoxy
COMMON USAGE	Innovative potable water coating which offers high-build edge protection and allows for application at a wide range of temperatures (down to 35°F or 2°C). For use on the interior and exterior of steel or concrete tanks, reservoirs, pipes, valves, pumps and equipment in potable water service.
COLORS	1211 Red, 1255 Beige, 00WH Tnemec White, 15BL Tank White, 39BL Delft Blue, 35GR Black. Note: Epoxies chalk with extended exposure to sunlight. Lack of ventilation, incomplete mixing, miscatalyzation or the use of heaters that emit carbon dioxide and carbon monoxide during application and initial stages of curing may cause yellowing to occur.
SPECIAL QUALIFICATIONS	<p>Certified by NSF International in accordance with ANSI/NSF Std. 61. Series N140F manufactured by Tnemec Company in Kansas City, Missouri or Baltimore, Maryland; ambient air cured (with or without 44-700 Epoxy Accelerator) is qualified for use on tanks and reservoirs of 1,000 gallons (3,785 L) capacity or greater, pipes 18 inches (46 cm) in diameter or greater, valves four (4) inches (10 cm) in diameter or greater and fittings four (4) inches (10 cm) in diameter or greater. Series N140F manufactured by Tnemec Coatings in Shanghai, China; ambient air cured (with or without 44-700 Epoxy Accelerator) is qualified for use on pipes 18 inches (46 cm) in diameter or greater, valves four (4) inches (10 cm) in diameter or greater and fittings four (4) inches (10 cm) in diameter or greater. Reference Tnemec's certified product listing at www.nsf.org for details on the maximum allowable DFT.</p> <p>Conforms to AWWA D 102 Inside Systems No. 1 and No. 2 (with or without 44-700). Conforms to AWWA C 210 (without 44-700). Contact your Tnemec representative for systems and additional information.</p>

COATING SYSTEM

SURFACER/FILLER/PATCHER	Series 215, 217, 218
PRIMERS	Self-priming, 22, 91-H ₂ O, 94-H ₂ O, L140, L140F, N140, V140, V140F, 141
TOPCOATS	<p>Interior: Series 22, FC22, L140, L140F, N140, N140F, V140, V140F, 141, 406</p> <p>Exterior: Series 22, 27, 27WB, 30, 66, L69, L69F, N69, N69F, V69, V69F, 72, 73, 118, L140, L140F, N140, N140F, V140, V140F, 141, 156, 157, 161, 180, 181, 446, 700, V700, 701, V701, 740, 750, 1026, 1028, 1029, 1074, 1074U, 1075, 1075U, 1077, 1078, 1078V, 1080, 1081, 1094, 1095, 1096, 1224. Note: When topcoating with Series 700, V700, 701, or V701, an intermediate coat of Series 73, 1075, 1075U, 1095 or 1096 is required. Note: The following recoat times apply for Series N140F: Immersion Service—Surface must be scarified by blasting with fine abrasive after 30 days. Atmospheric Service—After 30 days, scarification or an epoxy tie-coat is required. When topcoating with Series 740 or 750, recoat time for N140F is 14 days. Note: When topcoating with Series 406, recoat times will vary with temperature. Reference the Series 406 product data sheet for specific recoat times. Contact your Tnemec representative for specific recommendations.</p>

SURFACE PREPARATION

STEEL	<p>Immersion Service: SSPC-SP10/NACE 2 Near-White Blast Cleaning or ISO Sa 2 1/2 Very Thorough Blast Cleaning with a minimum angular anchor profile of 1.5 mils.</p> <p>Non-Immersion Service: SSPC-SP6/NACE 3 Commercial Blast Cleaning or ISO Sa 2 Thorough Blast Cleaning with a minimum angular anchor profile of 1.5 mils. Note: Commercial Blast Cleaning generally produces the best coating performance for this exposure. If conditions will not permit this, in moderate exposures Series N140F may be applied to SSPC-SP2 or SP3 Hand or Power Tool Cleaned surfaces (SSPC Rust Grade Condition C).</p>
CAST/DUCTILE IRON	All external surfaces of ductile iron pipe and fittings shall be delivered to the application facility without asphalt or any other protective lining on the exterior surface. All oils, small deposits of asphalt paint, grease, and soluble deposits should be removed and uniformly abrasive blasted using angular abrasive in accordance with NAF 500-03-04: External Pipe Surface condition. When viewed without magnification, the exterior surfaces shall be free of all visible dirt, dust, loose annealing oxide, rust, mold coating and other foreign matter. Any area where rust reappears before application shall be reblasted. The surface shall contain a minimum angular anchor profile of 1.5 mils (38.1 microns) (Reference NACE RP0287 or ASTM D 4417, Method C).
CONCRETE	Allow new cast-in-place concrete to cure a minimum of 28 days at 75°F (24°C). Verify concrete dryness in accordance with ASTM F 1869 "Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride" (moisture vapor transmission should not exceed three pounds per 1,000 square feet in a 24 hour period), F 2170 "Standard Test Method for Determining Relative Humidity in Concrete using in situ Probes" (relative humidity should not exceed 80%), or D 4263 "Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method" (no moisture present). Prepare concrete surfaces in accordance with NACE No. 6/SSPC-SP13 Joint Surface Preparation Standards and ICRI Technical Guidelines. Abrasive blast, shot-blast, water jet or mechanically abrade concrete surfaces to remove laitance, curing compounds, hardeners, sealers and other contaminants and to provide an ICRI-CSP 2-3 surface profile. Large cracks, voids and other surface imperfections should be filled with a recommended filler or surfacer.
PRIMED SURFACES	Immersion Service: Scarify the Series N140F prime coat surface by abrasive-blasting with fine abrasive before topcoating if the Series N140F prime coat has been in exterior exposure for 30 days or longer and Series 66, L69, L69F, N69, N69F, V69, V69F, L140, L140F, N140, N140F, V140, V140F or 161 is the specified topcoat.
ALL SURFACES	Must be clean, dry and free of oil, grease and other contaminants.

TECHNICAL DATA

VOLUME SOLIDS	68.0 ± 2.0% (mixed) †
RECOMMENDED DFT	2.0 to 10.0 mils (50 to 225 microns) per coat. Note: Dry film thickness that exceeds published recommendations but is in compliance with SSPC PA-2 and ANSI/NSF Std. 61 certifications, is acceptable. Note: The number of coats and thickness requirements will vary with substrate, application method and exposure. Contact your Tnemec representative.

POTA-POX® PLUS | SERIES N140F

CURING TIME AT 5 MILS DFT

Temperature	To Handle	To Recoat	Immersion
75°F (24°C)	4 hours	5 hours	7 days
65°F (18°C)	7-8 hours	9-11 hours	8 days
55°F (13°C)	12-14 hours	16-20 hours	9-10 days
45°F (7°C)	18-22 hours	28-32 hours	12-13 days
35°F (2°C)	28-32 hours	46-50 hours	16-18 days

Curing time varies with surface temperature, air movement, humidity and film thickness.

Note: For valve applications allow 14 days cure at 75°F (24°C) prior to immersion. For pipe applications allow 30 days cure at 75°F (24°C) prior to immersion. **Ventilation:** When used in enclosed areas, provide adequate ventilation during application and cure. **Note:** Refer to product listings on www.nsf.org for specific potable water return to service information.

VOLATILE ORGANIC COMPOUNDS

Unthinned: 2.3 lbs/gallon (273 grams/litre)
Thinned 5% (#60): 2.5 lbs/gallon (299 grams/litre)
Thinned 10% (#4): 2.7 lbs/gallon (323 grams/litre) †

HAPS

Unthinned: 2.3 lbs/gal solids
Thinned 5% (#60): 2.3 lbs/gal solids
Thinned 10% (#4): 3.1 lbs/gal solids

THEORETICAL COVERAGE

1,094 mil sq ft/gal (26.8 m²/L at 25 microns). See APPLICATION for coverage rates. †

NUMBER OF COMPONENTS

Two: Part A (amine) and Part B (epoxy) — One (Part A) to one (Part B) by volume.

PACKAGING

	Part A	Part B	Yield (mixed)
Large Kit	5 gallon pail	5 gallon pail	10 gallons (37.9 L)
Small Kit	1 gallon can	1 gallon can	2 gallons (7.6 L)

NET WEIGHT PER GALLON

12.68 ± 0.25 lbs (5.75 ± .11 kg) (mixed) †

STORAGE TEMPERATURE

Minimum 20°F (-7°C) Maximum 110°F (43°C)

For optimum application properties, material temperature should be above 60°F (16°C) prior to application.

TEMPERATURE RESISTANCE

(Dry) Continuous 250°F (121°C) Intermittent 275°F (135°C)

SHELF LIFE

Part A: 24 months; Part B: 12 months at recommended storage temperature.

FLASH POINT - SETA

Part A: 82°F (28°C) Part B: 80°F (27°C)

HEALTH & SAFETY

Paint products contain chemical ingredients which are considered hazardous. Read container label warning and Material Safety Data Sheet for important health and safety information prior to the use of this product.

Keep out of the reach of children.

APPLICATION

COVERAGE RATES

	Dry Mills (Microns)	Wet Mills (Microns)	Sq Ft/Gal (m ² /Gal)
Suggested	6.0 (150)	9.0 (230)	182 (16.9)
Minimum	2.0 (50)	3.0 (75)	545 (50.7)
Maximum	10.0 (225)	15.0 (375)	109 (10.1)

Note: Roller or brush application requires two or more coats to obtain recommended film thickness. Allow for overspray and surface irregularities. Wet film thickness is rounded to the nearest 0.5 mil or 5 microns. Application of coating below minimum or above maximum recommended dry film thicknesses may adversely affect coating performance. Reference the NSF website at www.nsf.org for details on the maximum allowable DFT. †

MIXING

Start with equal amounts of Series N140F Parts A and B. Power mix contents of each container separately, making sure no pigment remains on the bottom. Pour a measured amount of Part B into a clean container large enough to hold both components. Add an equal volume of Part A to Part B while under agitation. Continue agitation until the two components are thoroughly mixed. **Note:** Both components must be above 50°F (10°C) prior to mixing. For optimum mixing and application properties, the material should be above 60°F (16°C).

Thin by volume and thoroughly mix. Failure to thoroughly mix the Part A and Part B components prior to thinning can affect product's gloss and performance. Do not use mixed material beyond pot life limits. **Note:** For application to surfaces between 35°F to 50°F (2°C to 10°C), allow mixed material to stand 30 minutes and restir before using.

THINNING

Use No. 4 or No. 60 Thinner. For air spray, thin up to 10% or 3/4 pint (380 mL) per gallon with No. 4 Thinner or thin up to 5% or 1/4 pint (190 mL) per gallon with No. 60 Thinner. For airless spray, roller or brush, thin up to 5% or 1/4 pint (190 mL) per gallon. **Caution: Series N140F NSF certification is based on thinning with No. 4 or No. 60 Thinner for tanks and only No. 60 Thinner for pipe and valves.** Use of any other thinner voids NSF/ANSI Std. 61 certification.

POT LIFE

2 hours at 50°F (10°C) 1 hour at 75°F (24°C) 30 minutes at 100°F (38°C)

SPRAY LIFE

30 minutes at 75°F (24°C)

Note: Spray application after listed times will adversely affect ability to achieve recommended dry film thickness.

POTA-POX[®] PLUS | SERIES N140F

APPLICATION EQUIPMENT

Air Spray

Gun	Fluid Tip	Air Cap	Air Hose ID	Mat'l Hose ID	Atomizing Pressure	Pot Pressure
DeVilbiss JGA	E	765 or 704	5/16" or 3/8" (7.9 or 9.5 mm)	3/8" or 1/2" (9.5 or 12.7 mm)	50-80 psi (3.4-5.5 bar)	10-20 psi (0.7-1.4 bar)

Low temperatures or longer hoses require higher pot pressure.

Airless Spray

Tip Orifice	Atomizing Pressure	Mat'l Hose ID	Manifold Filter
0.015"-0.019" (380-485 microns)	3000-4800 psi (207-330 bar)	1/4" or 3/8" (6.4 or 9.5 mm)	60 mesh (250 microns)

Use appropriate tip/atomizing pressure for equipment, applicator technique and weather conditions.

Roller: Use 3/8" or 1/2" (9.5 mm to 12.7 mm) synthetic woven nap roller cover. Use longer nap to obtain penetration on rough or porous surfaces.

Brush: Recommended for small areas only. Use high quality natural or synthetic bristle brushes.

SURFACE TEMPERATURE

Minimum 35°F (2°C) Maximum 135°F (57°C)

The surface should be dry and at least 5°F (3°C) above the dew point. Coating won't cure below minimum surface temperature.

CLEANUP

Flush and clean all equipment immediately after use with the recommended thinner or MEK.

† Values may vary with color.

WARRANTY & LIMITATION OF SELLER'S LIABILITY: Tnemec Company, Inc. warrants only that its coatings represented herein meet the formulation standards of Tnemec Company, Inc. THE WARRANTY DESCRIBED IN THE ABOVE PARAGRAPH SHALL BE IN LIEU OF ANY OTHER WARRANTY, EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. THERE ARE NO WARRANTIES THAT EXTEND BEYOND THE DESCRIPTION ON THE FACE HEREOF. The buyer's sole and exclusive remedy against Tnemec Company, Inc. shall be for replacement of the product in the event a defective condition of the product should be found to exist and the exclusive remedy shall not have failed its essential purpose as long as Tnemec is willing to provide comparable replacement product to the buyer. NO OTHER REMEDY (INCLUDING, BUT NOT LIMITED TO, INCIDENTAL OR CONSEQUENTIAL DAMAGES FOR LOST PROFITS, LOST SALES, INJURY TO PERSON OR PROPERTY, ENVIRONMENTAL INJURIES OR ANY OTHER INCIDENTAL OR CONSEQUENTIAL LOSS) SHALL BE AVAILABLE TO THE BUYER. Technical and application information herein is provided for the purpose of establishing a general profile of the coating and proper coating application procedures. Test performance results were obtained in a controlled environment and Tnemec Company makes no claim that these tests or any other tests, accurately represent all environments. As application, environmental and design factors can vary significantly, due care should be exercised in the selection and use of the coating.



ENDURA-SHIELD SERIES 73

PRODUCT PROFILE

GENERIC DESCRIPTION Aliphatic Acrylic Polyurethane**COMMON USAGE**

A coating for commercial, industrial, and marine applications that is highly resistant to abrasion, wet conditions, corrosive fumes, chemical contact and has excellent resistance to exterior weathering. Direct-to-Metal capability allows for a labor-saving, high-build, single coat application.

COLORS

Refer to Tnemec Color Guide. **Note:** Certain colors may require multiple coats depending on method of application and finish coat color. When feasible, the preceding coat should be in the same color family (blue, gray, etc.), but noticeably different.

FINISH

Semi-gloss

SPECIAL QUALIFICATIONS

Series 73 meets the accelerated weathering requirements of SSPC Paint Standard 36.

This product is part of a coating system tested in accordance with ISO 12944-6 (2018). Contact your Tnemec representative for coating system test results.

COATING SYSTEM

PRIMERS

Steel: Self-priming or Series 1, 20, FC20, 27, 27WB, 37H, 66, L69, L69F, N69, N69F, V69, V69F, 90-97, H90-97, 90G-1K97, 91-H₂O, H91-H₂O, 94-H₂O, 132, 135, L140, L140F, N140, N140F, V140, V140F, 141, 161, 394, V530, 1224.

Galvanized Steel & Non-Ferrous Metal: Series 66, L69, N69, V69, 1224. **Note:** For special galvanized surface preparation instructions, consult the latest version of Tnemec Technical Bulletin 10-78.

Concrete: Series 66, L69, L69F, N69, N69F, V69, V69F, 141, 161, 1254

CMU: Series 1254

Note: Series V530 exterior exposed more than 24 hours, Series L69, N69, V69, 135, L140, N140, or V140 exterior exposed more than 60 days, Series L69F, N69F, V69F, L140F, N140F or V140F exterior exposed more than 30 days, or Series 132 or 141 exterior exposed more than 14 days must first be scarified or reprimed with themselves. Brush blasting with fine abrasive is the preferred method of scarification. Recoat windows for other primers may apply. See those data sheets for additional information.

TOPCOATS

Series 700, V700, 701, V701, 740, 750, 1070, 1070V, 1071, 1071V, 1072, 1072V, 1074, 1074U, 1075, 1075U, 1077, 1078, 1078V, 1094, 1095, 1096.

SURFACE PREPARATION

STEEL

SSPC-SP6/NACE 3 Commercial Blast Cleaning or ISO Sa 2 Thorough Blast Cleaning with a minimum angular anchor profile of 2.0 mils.

ALL SURFACES

Must be clean, dry and free of oil, grease and other contaminants.
See primer product data sheet for surface preparation recommendation.

TECHNICAL DATA

VOLUME SOLIDS

58.0 ± 2.0% (mixed) †

RECOMMENDED DFT

Topcoat Service: 2.0 to 5.0 mils (50 to 125 microns) per coat.

Direct to Metal; Over Zinc or MIO-Zinc: 3.5 to 5.0 mils (90 to 125 microns).

Note: Number of coats and thickness requirements will vary with substrate, application method and exposure. For DTM or applications over zinc or MIO-zinc, as part of a two-coat system, consult the latest version of Tnemec Technical Bulletin 13-100 or contact your Tnemec representative.

CURING TIME

Temperature	To Touch	To Handle	To Recoat
75°F (24°C)	1 hour	5-8 hours	12 hours

Curing time varies with surface temperature, air movement, humidity and film thickness. **Note:** For faster curing and low-temperature applications, add No. 44-710 Urethane Accelerator; see separate product data sheet.

VOLATILE ORGANIC COMPOUNDS

Unthinned	Thinned 10% (Max) (No. 39 Thinner)	Thinned 10% (Max) (No. 42 Thinner)	Thinned 10% (Max) (No. 48 Thinner)	Thinned 10% (Max) (No. 56 Thinner)	Thinned 10% (Max) (No. 63 Thinner)
2.61 lbs/gallon (313 grams/litre)	2.94 lbs/gallon (356 grams/litre)	3.01 lbs/gallon (361 grams/litre)	3.07 lbs/gallon (367 grams/litre)	2.67 lbs/gallon (320 grams/litre)	2.99 lbs/gallon (358 grams/litre)

HAPS

Unthinned	Thinned 10% (Max) (No. 39 Thinner)	Thinned 10% (Max) (No. 42 Thinner)	Thinned 10% (Max) (No. 48 Thinner)	Thinned 10% (Max) (No. 56 Thinner)	Thinned 10% (Max) (No. 63 Thinner)
0.44 lbs/gal solids	0.44 lbs/gal solids	0.44 lbs/gal solids	0.44 lbs/gal solids	0.44 lbs/gal solids	0.50 lbs/gal solids

THEORETICAL COVERAGE930 mil sq ft/gal (22.8 m²/L at 25 microns). †**NUMBER OF COMPONENTS**

Two: Part A and Part B

MIXING RATIO

By Volume: Four (Part A) to One (Part B)

PACKAGING

	PART A	PART B	When Mixed
5 Gallon Kit	5 gallon pail (partial fill)	1 gallon can	5 gallons (18.9L)
1 Gallon Kit	1 gallon pail (partial fill)	1 quart can (partial fill)	1 gallon (3.79L)

NET WEIGHT PER GALLON

12.13 ± 0.25 lbs (4.88 ± 0.11 kg) †

ENDURA-SHIELD | SERIES 73

STORAGE TEMPERATURE	Minimum 20°F (-7°C) Maximum 110°F (43°C)
TEMPERATURE RESISTANCE	(Dry) Continuous 250°F (121°C) Intermittent 275°F (135°C)
SHelf LIFE	Part A: 12 months at recommended storage temperature. Part B: 12 months at recommended storage temperature.
FLASH POINT - SETA	Part A: 80°F (27°C) Part B: 112°F (43°C)
HEALTH & SAFETY	Paint products contain chemical ingredients which are considered hazardous. Read container label warning and Material Safety Data Sheet for important health and safety information prior to the use of this product. Keep out of the reach of children.

APPLICATION

COVERAGE RATES

Topcoat Service

	Dry Mils (Microns)	Wet Mils (Microns)	Sq Ft/Gal (m²/Gal)
Suggested	2.5 (65)	4.5 (115)	372 (34.6)
Minimum	2.0 (50)	3.5 (90)	465 (43.2)
Maximum	5.0 (125)	8.5 (215)	186 (17.3)

Direct-to-Metal; over Zinc or MIO-Zinc

	Dry Mils (Microns)	Wet Mils (Microns)	Sq Ft/Gal (m²/Gal)
Suggested	4.0 (100)	7.0 (180)	233 (21.6)
Minimum	3.5 (90)	6.0 (150)	266 (24.7)
Maximum	5.0 (125)	8.5 (215)	186 (17.3)

Allow for overspray and surface irregularities. Wet film thickness is rounded to the nearest 0.5 mil or 5 microns. Application of coating below minimum or above maximum recommended dry film thicknesses may adversely affect coating performance. †

MIXING

Stir contents of the container marked Part A, making sure no pigment remains on the bottom. Add the contents of the can marked Part B to Part A while under agitation. Continue agitation until the two components are thoroughly mixed. When used with 44-710 Urethane Accelerator, first blend 44-710 into Part A under agitation; continue as above. Do not use mixed material beyond pot life limits. **Caution: Part B is moisture-sensitive and will react with atmospheric moisture. Keep unused material tightly closed at all times.**

THINNING

For air spray, thin up to 10% or 3/4 pint (380 mL) per gallon by volume with No. 42 Thinner if temperatures are below 80°F (27°C), use No. 48 Thinner for temperatures above 80°F (27°C). Thin up to 5% or 1/4 pint (190 mL) per gallon for airless spray. For brush or roller, thin 5% to 10% or 1/4 to 3/4 pint (190 to 380 mL) per gallon with No. 39 or No. 63 Thinner. Thinning is required for proper brush or roller application. **Note:** A maximum of 10% of No. 56 Thinner may be used to comply with VOC regulations. **Caution: Do not add thinner if more than thirty (30) minutes have elapsed after mixing.**

POT LIFE

8 hours at 40°F (4°C) 4 hours at 77°F (25°C) 2 hours at 100°F (38°C)

APPLICATION EQUIPMENT

Air Spray

Gun	Fluid Tip	Air Cap	Air Hose ID	Mat'l Hose ID	Atomizing Pressure	Pot Pressure
DeVilbiss JGA	E	765 or 704	5/16" or 3/8" (7.9 or 9.5 mm)	3/8" or 1/2" (9.5 or 12.7 mm)	75-90 psi (5.2-6.2 bar)	10-20 psi (0.7-1.4 bar)

Low temperatures or longer hoses require higher pot pressure.

Airless Spray

Tip Orifice	Atomizing Pressure	Mat'l Hose ID	Manifold Filter
0.013"-0.017" (330-430 microns)	3000-3600 psi (206-248 bar)	1/4" or 3/8" (6.4 or 9.5 mm)	60 mesh (250 microns)

Use appropriate tip/atomizing pressure for equipment, applicator technique and weather conditions.

Roller: Use 1/4" to 3/8" (6.4 mm to 9.5 mm) synthetic woven nap roller cover. Do not use long nap roller covers. **Note:** Two coats are required to obtain dry film thickness above 3.0 mils (75 microns).

Brush: Recommended for small areas only. Use high quality natural or synthetic bristle brushes. **Note:** Two or more coats may be required to obtain recommended film thicknesses.

SURFACE TEMPERATURE

Minimum 35°F (2°C) Maximum 120°F (49°C)

The surface should be dry and at least 5°F (3°C) above the dew point.

Cure time necessary to resist direct contact with moisture at surface temperature:

40°F (4°C): 24 to 40 hours 50°F (10°C): 18 to 26 hours 60°F (16°C): 12 to 16 hours

70°F (21°C): 4 to 8 hours 90°F (32°C): 2 to 4 hours 100°F (38°C): 2 to 3 hours

If the coating is exposed to moisture before the preceding cure parameters are met, dull, flat or spotty appearing areas may develop. Actual times will vary with air movement, film thickness and humidity.

CLEANUP

Flush and clean all equipment immediately after use with the recommended thinner or MEK.

† Values may vary with color.

WARRANTY & LIMITATION OF SELLER'S LIABILITY: Tnemec Company, Inc. warrants only that its coatings represented herein meet the formulation standards of Tnemec Company, Inc. THE WARRANTY DESCRIBED IN THE ABOVE PARAGRAPH SHALL BE IN LIEU OF ANY OTHER WARRANTY, EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. THERE ARE NO WARRANTIES THAT EXTEND BEYOND THE DESCRIPTION ON THE FACE HEREOF. The buyer's sole and exclusive remedy against Tnemec Company, Inc. shall be for replacement of the product in the event a defective condition of the product should be found to exist and the exclusive remedy shall not have failed its essential purpose as long as Tnemec is willing to provide comparable replacement product to the buyer. NO OTHER REMEDY (INCLUDING, BUT NOT LIMITED TO, INCIDENTAL OR CONSEQUENTIAL DAMAGES FOR LOST PROFITS, LOST SALES, INJURY TO PERSON OR PROPERTY, ENVIRONMENTAL INJURIES OR ANY OTHER INCIDENTAL OR CONSEQUENTIAL LOSS) SHALL BE AVAILABLE TO THE BUYER. Technical and application information herein is provided for the purpose of establishing a general profile of the coating and proper coating application procedures. Test performance results were obtained in a controlled environment and Tnemec Company makes no claim that these tests or any other tests, accurately represent all environments. As application, environmental and design factors can vary significantly, due care should be exercised in the selection and use of the coating.

Field Test

Torque Test Procedure

The equipment will be tested to ensure structural and mechanical conformance with the torque requirements as outlined in the equipment specifications. The field test will also include verification of torque box settings such as the warning device and the drive cutout circuitry.

Torque will be applied to the mechanism by securing the truss arm with cables anchored to the tank floor (not by WesTech) while manually rotating the drive fan motor shaft. The load through the cable connection will be monitored with a hydraulic load cell and gauge (by WesTech).

The cables should be anchored and attached to the rake arm at a distance from the centerline of the tank, as indicated on the Torque Test Diagram, whereby calculations can be made to determine the torque values.

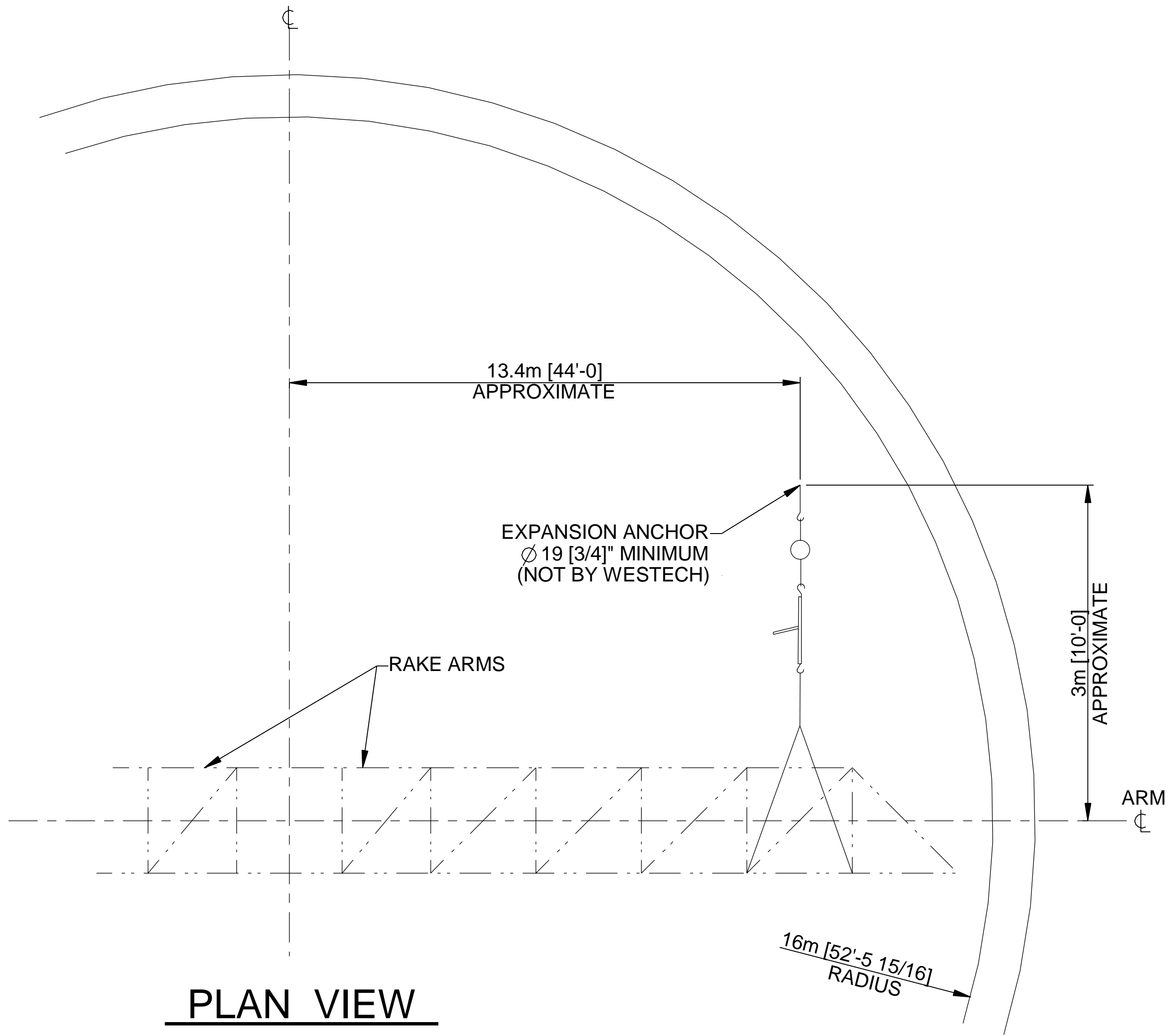
The torque, indicated as a percentage by the pointer on the drive unit torque box, should be within plus or minus 10 percent of the calculated values from the load cell readings.

Test Warnings:

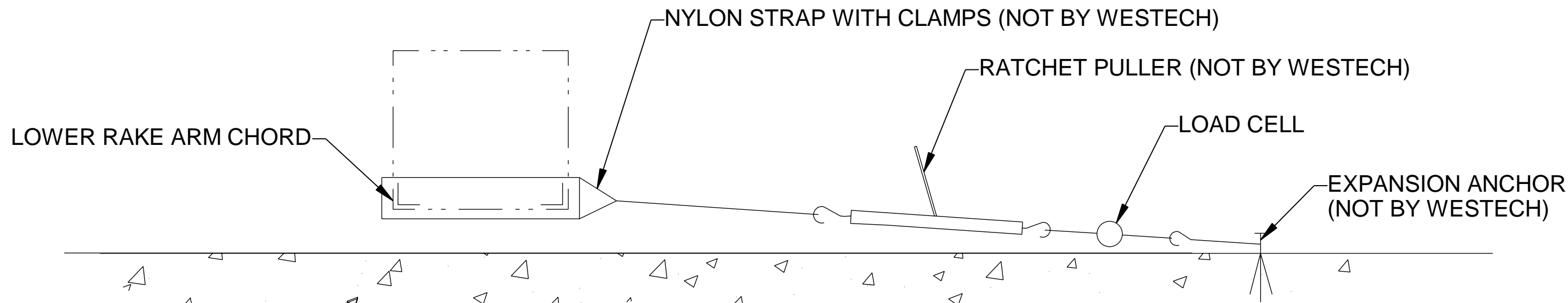
Review the Torque Test Diagram for the additional test procedures.

For the protection of personnel during the torque test, the following precautions must be taken:

1. Personnel entering the area of this equipment must be equipped with adequate safety equipment such as safety glasses, safety shoes, and a hard hat.
2. Check to ensure that the cable slings and other components to be used in the test are in good condition (not by WesTech).
3. Make sure that the anchors are properly installed and adequately sized for the loads indicated on the Torque Test Diagram (not by WesTech).
4. Limit the personnel inside the tank to that necessary to perform the test.
5. Keep a safe distance from the rake arms while the test is in progress. Do not stand in front of the leading side of the arms while they are loaded during the test.
6. Do not exceed the maximum load reading specified on the Torque Test Diagram.
7. All personnel in the area of this equipment during the torque test must be educated on these precautions before starting the test.



PLAN VIEW



ELEVATION

NOTES:

1. RAKE ARM MUST BE SECURED AS SHOWN AT TWO OR MORE PANEL POINTS WITH LOAD MEASURING ASSEMBLY.
 2. LOAD IS APPLIED BY THE RATCHET PULLER WHILE THE MOTOR OUTPUT SHAFT IS SECURED AGAINST ROTATION.
 3. DURING THE TORQUE TEST, THE LOAD INDICATOR AT THE DRIVE WILL INDICATE TORQUE VALUES.
- 4 DO NOT EXCEED THE MAXIMUM LOAD INDICATED ABOVE.
- 5 MINIMIZE LOAD APPLIED TO STRAPS AND LOAD CELL BY USING A PULLEY TO DIVIDE THE LOAD IN HALF WHEN NECESSARY, NEVER EXCEED THE CAPACITY OF THE LOAD CELL OR ANY PART OF THE RIGGING (STRAPS, RATCHET PULLER, ANCHOR, ETC.)
6. PRIOR TO TESTING, WESTECH DRIVE SHOULD RUN FOR A PERIOD OF 3-5 HOURS, OR 3-5 REVOLUTIONS.

TORQUE TEST RECORD

COMPLETED BY:				DATE :	
TEST EQUIPMENT:	ENERPAC TS5 TM5			ANALOG 8896 NEWTON DIGITAL 44483 NEWTON	
	CIRCLE ONE		S/N	5 CIRCLE ONE	

CALIBRATION EXPIRES:

REFERENCE: TORQUE (Nm) = LOAD CELL READING (N) x DISTANCE (m)

TORQUE TEST LOADS AT DESIGN ANCHOR DISTANCE				REVISED FOR	TEST RESULTS	
TORQUE BOX DIAL	DESIGN DISTANCE (m)	LOAD CELL READING (N)	TORQUE (Nm)	ACTUAL DISTANCE (m)	LOAD CELL READING (N)	TORQUE (Nm)
UNIT # 5	13.4					
100%		3617	48471			
120%		4341	58165			
140%		5064	67859			
4						
UNIT # 6	13.4					
100%		3617	48471			
120%		4341	58165			
140%		5064	67859			
4						

TEST VALUES WITHIN ±10% ARE ACCEPTABLE UNLESS OTHERWISE SPECIFIED

COMMENTS / ATTENDEES:

TORQUE TEST WITNESSED BY OWNERS AGENT: DATE:

PRINTED NAME: TITLE:

PASS FAIL

SIGNATURE:

PREPARED FOR: BRANFORD WWTP
SECONDARY CLARIFIERS REHABILITATION
BRANTFORD, ONTARIO, CANADA

ENGINEER: CIMA+

CONTRACTOR:

P.O./CONTRACT NUMBER: 2022-92

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TITLE: TORQUE TEST RECORD
Ø 104'-11 7/8 SECONDARY CLARIFIERS 5 AND 6
COPC2G

DESIGNER	CHECKER	APPROVER	DATE
RI62	SA103	ME75	2023-08-25
JOB NUMBER	DOCUMENT NUMBER	SHEET	REV
24946B	0003404432	1 OF 1	-

REV	REVISION DESCRIPTION	ECN	DESIGNER	APPROVER	DATE	REFERENCE DOCUMENTS
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Enclosures

Clouded Dimension Verification

The following drawings have clouded dimensions and assumed process data that will require verification by the contractor or owner.

These dimensions need to be verified before WesTech Engineering, LLC acknowledges the submittal as approved.


As such, contract ship dates will not be set, nor will work proceed until all requested information has been verified.

Drawings


1. A STAR DENOTES VARIANCE FROM CONTRACT DOCUMENTS AND SHOULD BE PARTICULARLY NOTED. ★
2. CONTRACTOR TO VERIFY OR SUPPLY ALL DIMENSIONS SHOWN IN CLOUDS. ☁
3. DIMENSIONS, LOADS, AND OTHER INFORMATION ARE PROVIDED FOR CONFIRMATION BY OTHERS OF POSITION AND INTERFACE BETWEEN NEW OR EXISTING CONCRETE, EQUIPMENT, PLANT STRUCTURE, OTHER SYSTEMS AND APPURTENANCES AS SHOWN ON THE GENERAL ARRANGEMENT DRAWINGS.
4. SUBMITTED DRAWINGS AND INFORMATION ARE NOT TO BE USED FOR CONSTRUCTION OR INSTALLATION PURPOSES UNTIL CUSTOMER APPROVAL HAS BEEN ISSUED. WESTECH WILL NOT PROCEED WITH FABRICATION OR DELIVERY UNTIL SUCH APPROVAL IS RECEIVED.
5. WESTECH IS NOT RESPONSIBLE FOR NEW OR EXISTING CONCRETE DESIGN, INCLUDING NECESSARY REINFORCEMENT FOR ANCHOR BOLTS, UNLESS SPECIFICALLY INDICATED OTHERWISE. THE SUITABILITY OF NEW OR EXISTING CONCRETE, EQUIPMENT, TANKAGE, OR STRUCTURES TO WITHSTAND THE DESIGN LOADS AT THE INTERFACE OF WESTECH'S EQUIPMENT IS TO BE DEFINED, CONFIRMED OR OTHERWISE PROVIDED BY OTHERS.
6. WESTECH IS NOT RESPONSIBLE FOR DAMAGE, INJURY OR LOSS RESULTING FROM IMPROPER USE OF THIS EQUIPMENT.
7. MODIFICATIONS, ADDITIONS OR CORRECTIONS TO THE APPROVED EQUIPMENT WILL NOT BE ACCEPTED BY WESTECH, UNLESS A CHANGE ORDER IS ISSUED AND APPROVED.
8. ROTATING EQUIPMENT IS DESIGNED TO OPERATE ONLY IN THE INDICATED DIRECTION. WESTECH IS NOT RESPONSIBLE FOR DAMAGE IF OPERATED IN THE OPPOSITE DIRECTION.
9. WESTECH DOES NOT FURNISH CONCRETE, GROUT, CONCRETE REINFORCING, PIPING, VALVES, PIPE SUPPORTS OR FITTINGS, WALL BRACKETS, ELECTRICAL WIRING, CONDUIT, ELECTRICAL EQUIPMENT, ERECTION, INSTALLATION, FIELD ASSEMBLY, SHIMMING MATERIALS, CAULK OR MASTIC, FIELD PAINTING OR PAINT, FIELD WELDING OR WELD ROD, WATER FOR TESTING, GREASE, ANTI-SEIZE OR LUBRICATING OIL, UNLESS SPECIFICALLY NOTED.
10. SHOP SURFACE PREPARATION AND SHOP PAINTING OF PRIME COATS ARE DESIGNED TO PROVIDE ONLY A MINIMAL PROTECTION FROM TIME OF APPLICATION PER THE COATING MANUFACTURER'S DATA SHEET. WESTECH DOES NOT GUARANTEE CONDITION OF PREPARED OR PAINTED ITEMS ONCE THE ITEMS LEAVE THE SHOP. CUSTOMER SHOP INSPECTION OF PAINTED ITEMS IS WELCOME TO VERIFY APPLICATION. ALL FIELD SURFACE PREPARATION, FIELD PAINT, TOUCH-UP, AND REPAIR TO SHOP PAINTED SURFACES ARE NOT BY WESTECH. RESPONSIBILITY FOR COMPATIBILITY OF SHOP AND FIELD APPLIED COATINGS IS BY OTHERS.
11. DOCUMENTS DEFINING WESTECH SUPPLIED SURFACE PREPARATION AND SHOP/FIELD PAINT SPECIFICATIONS ARE SUBMITTED WITH THE GENERAL ARRANGEMENT DRAWINGS AND WILL INCLUDE COATING DATA SHEET(S) AND/OR A STAINLESS-STEEL CLEANING GRADE SHEET AND FINISH LEVEL SHEET.
12. WHERE APPLICABLE, ANCHOR BOLT DETAILS ARE SHOWN ON JOB-SPECIFIC DRAWINGS AND SHALL CONFORM TO ONE OR MORE OF THE FOLLOWING SPECIFICATIONS:
 - CARBON STEEL HEADED OR ALL-THREAD ROD - ASTM F1554, GRADE 36, GRADE 55, OR GRADE 105
 - STAINLESS STEEL HEADED OR ALL-THREAD ROD - ASTM F593, ASTM A193
 - ADHESIVE ANCHORS SHALL MEET THE REQUIREMENTS OF ASTM E1512 AND SHALL HAVE A PUBLISHED ICC/ES REPORT.
 - WEDGE ANCHORS SHALL HAVE A PUBLISHED ICC/ES REPORT.
13. MATERIALS AND COATINGS OF FASTENERS ARE IDENTIFIED ON JOB-SPECIFIC GENERAL ARRANGEMENT DRAWINGS. BOLTS SHALL CONFORM TO ONE OR MORE OF THE FOLLOWING SPECIFICATIONS WITH DIMENSIONS PER ASME B18.2.1 AND B18.2.2:

14. THE FOLLOWING DEFINES THE ACCEPTABLE MATERIALS USED FOR WESTECH SUPPLIED EQUIPMENT AS SPECIFIED AND SHOWN ON THE GENERAL ARRANGEMENT DRAWINGS. ANY MATERIAL OR ITEMS NOT INCLUDED HERE SHALL BE CLEARLY SPECIFIED ON THE GENERAL ARRANGEMENT DRAWINGS.


A. CARBON STEEL SHALL MEET THE FOLLOWING SPECIFICATIONS AND REQUIREMENTS:

- STEEL SHAPES W, WT - ASTM A992/A992M
- STEEL SHAPES M, MT, S, ST, C, MC, L - ASTM A36/A36M
- STEEL PLATES AND BARS - ASTM A36/A36M; A572/A572M GRADE 50; A529/A529M
- STEEL SHAPE HP - ASTM A572/A572M GRADE 50
- STEEL PIPE - ASTM A53/A53M GRADE B, ASTM 106/A106M, API 5L
- HOLLOW STRUCTURAL SECTIONS (HSS), ROUND, SQUARE, RECTANGULAR - ASTM A500/A500M GRADE C; A1085/A1085M
- SHEETS - A1011/A1011M
- PIPE FITTINGS - ASTM A234/A234M; ASME B16.11
- ALL WELDING SHALL CONFORM TO THE LATEST AWS D1.1 CODE OR ASME BPVC SECTION IX.
- ALL SUBMERGED STRUCTURAL STEEL MEMBERS SHALL HAVE A MINIMUM 1/4" THICKNESS UNLESS NOTED OTHERWISE.
- SOME SHAPES MAY BE FORMED BY BENDING AND/OR WELDING. 

B. STAINLESS STEEL SHALL MEET THE FOLLOWING SPECIFICATIONS AND REQUIREMENTS:

- AUSTENITIC BARS, ROUND AND SQUARES, AND HOT ROLLED EXTRUDED SHAPES SUCH AS ANGLES, TEES, AND CHANNELS - ASTM A276; ASTM A484/A484M; ASTM A564/A564M
- AUSTENITIC LASER-FUSED BARS, PLATES, ANGLES, TEES, CHANNELS, AND W SHAPES - ASTM A1069/A1069M
- AUSTENITIC PLATES, SHEETS, STRIPS - ASTM A240/A240M; ASTM A480/A480M
- AUSTENITIC PIPES - ASTM A312/A312M
- AUSTENITIC HOLLOW STRUCTURAL SHAPES (HSS), ROUND, SQUARE, RECTANGULAR - ASTM A554
- PIPE FITTINGS - ASTM A182; ASME SA 182; ASME B16.11
- DUPLEX PLATES, SHEETS, STRIPS - ASTM A240/A240M; ASTM A480/A480M
- DUPLEX PIPES - ASTM A790/A790M
- DUPLEX HOLLOW STRUCTURAL SHAPES - MADE FROM PLATE 
- ALL WELDING SHALL CONFORM TO THE LATEST AWS D1.6 CODE OR ASME BPVC SECTION IX.
- SOME SHAPES MAY BE FORMED BY BENDING AND/OR WELDING.

C. ALUMINUM SHALL MEET THE FOLLOWING SPECIFICATIONS AND REQUIREMENTS:

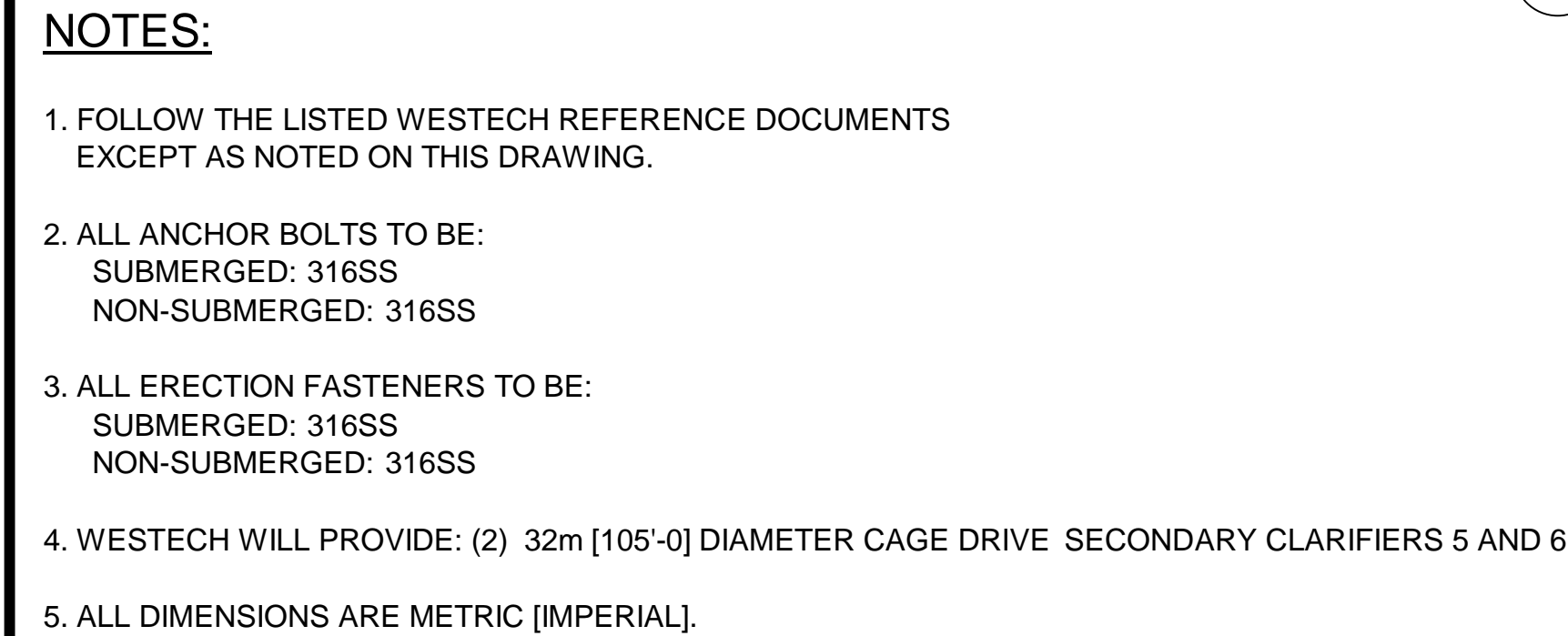
- EXTRUDED BARS, RODS, WIRE, STRUCTURAL PROFILES AND TUBES - ASTM B221/B221M
- STANDARD STRUCTURAL PROFILES - ASTM B308/B308M (FOR ALLOY 6061-T6 ONLY)
- PLATE AND SHEET - ASTM B209/B209M
- DRAWN SEAMLESS TUBE - ASTM B210/B210M; ASTM B483/B483M
- EXTRUDED SEAMLESS TUBE AND PIPE - ASTM B241/B241M; B429/B429M 
- PIPE FITTINGS - ASTM B361
- ALL WELDING SHALL CONFORM TO THE LATEST AWS D1.2 CODE.
- SOME SHAPES MAY BE FORMED BY BENDING AND/OR WELDING.

D. TANK MATERIALS SHALL CONFORM TO THE SPECIFICATIONS IN API 650 OR AWWA D100 AS NOTED ON THE GENERAL ARRANGEMENT DRAWINGS. SPECIFIED MATERIALS ARE SHOWN ON THE GENERAL ARRANGEMENT DRAWINGS. ALL WELDING SHALL CONFORM TO THE ASME BPVC - SECTION IX.

- B. ASME STAMPED PRESSURE VESSELS SHALL CONFORM TO ASME BPVC SECTION VIII OR SECTION X (FOR FRP TANKS), THE DESIGN CALCULATIONS AND THE GENERAL ARRANGEMENT DRAWINGS.**

- 15. ITEMS SHOWN, NOTED OR DESCRIBED ON THE GENERAL ARRANGEMENT DRAWINGS SUPERSEDE ANY CONFLICTING ITEMS WITHIN THESE NOTES.**

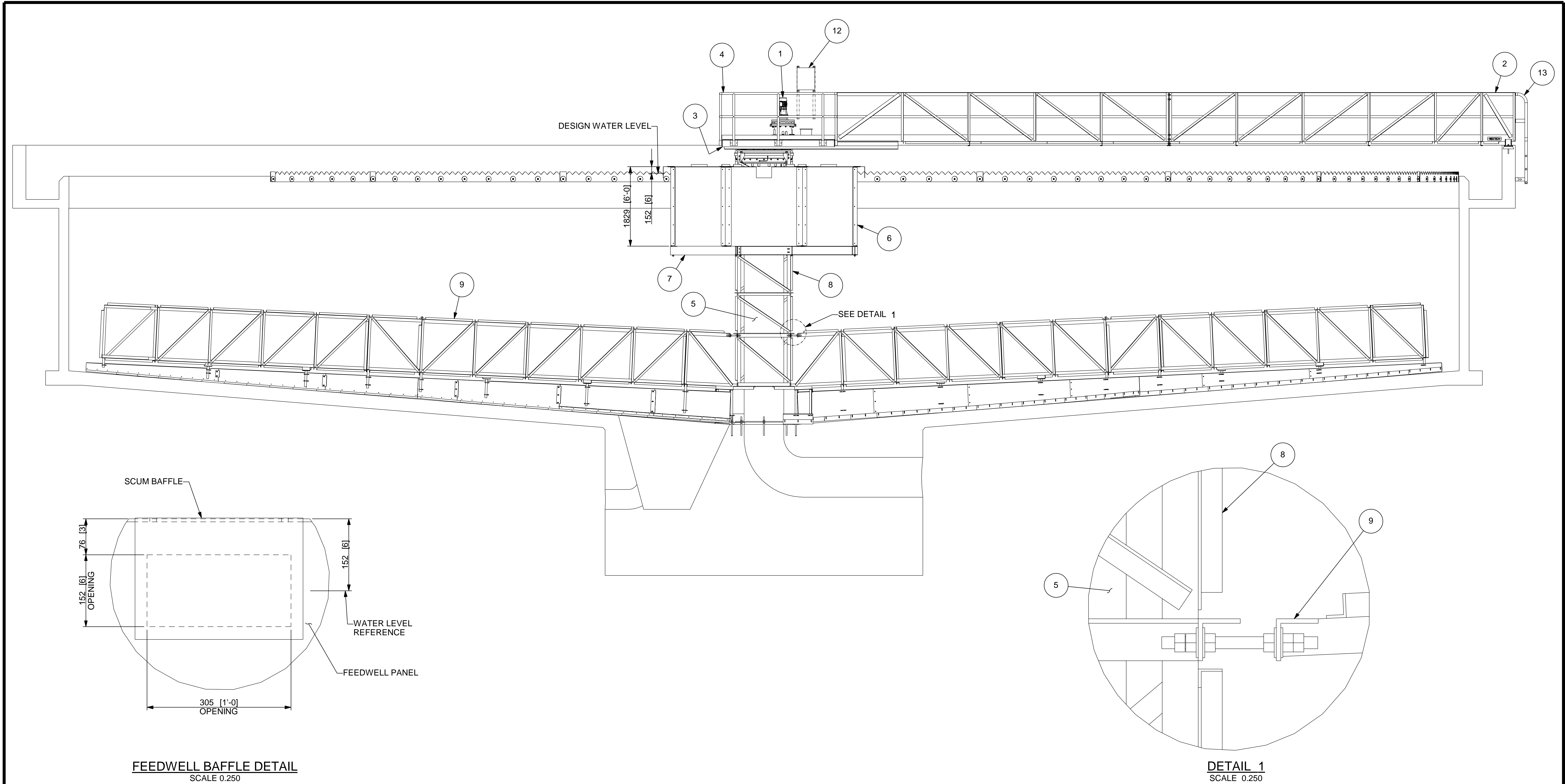
						<div>WESTECH®</div> <div>THIS DRAWING IS PROPERTY OF WESTECH® ENGINEERING, LLC. AND IS TRANSMITTED IN CONFIDENCE. NEITHER RECEIPT NOR POSSESSION CONFERS OR TRANSFERS ANY RIGHTS TO REPRODUCE, USE, OR DISCLOSE, IN WHOLE OR IN PART, DATA CONTAINED HEREIN FOR ANY PURPOSE, WITHOUT THE WRITTEN PERMISSION OF WESTECH ENGINEERING, LLC.</div> <div>GENERAL NOTES</div> <table><tr><td>DESIGNER</td><td>CHECKER</td><td>APPROVER</td><td colspan="2">DATE</td></tr><tr><td>WH17</td><td>DESIGN/DETAIL COUNCIL</td><td>ENGINEERING COUNCIL</td><td colspan="2">2020/11/11</td></tr><tr><td colspan="2">JOB NUMBER</td><td colspan="2">DOCUMENT NUMBER</td><td>SHEET</td><td>REV</td></tr><tr><td colspan="2">-</td><td colspan="2">0000647822</td><td>1 OF 1</td><td>C</td></tr></table>				DESIGNER	CHECKER	APPROVER	DATE		WH17	DESIGN/DETAIL COUNCIL	ENGINEERING COUNCIL	2020/11/11		JOB NUMBER		DOCUMENT NUMBER		SHEET	REV	-		0000647822		1 OF 1	C
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-		0000647822		1 OF 1	C																										



REV	REVISION DESCRIPTION	ECN	DESIGNER	APPROVER	DATE
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PREPARED FOR:	BRANFORD WWTP SECONDARY CLARIFIERS REHABILITATION BRANTFORD, ONTARIO, CANADA
ENGINEER:	CIMA+
CONTRACTOR:	
P.O./CONTRACT NUMBER	2022-92

A circular professional seal for a Licensed Professional Engineer in the Province of Ontario. The seal contains the following text: "LICENSED PROFESSIONAL ENGINEER" around the top arc, "23-11-23" in the center, "G. J. WEBSTER" below the license number, "49267503" below the name, and "PROVINCE OF ONTARIO" around the bottom arc. A signature, "G. J. Webster", is written across the bottom half of the seal.

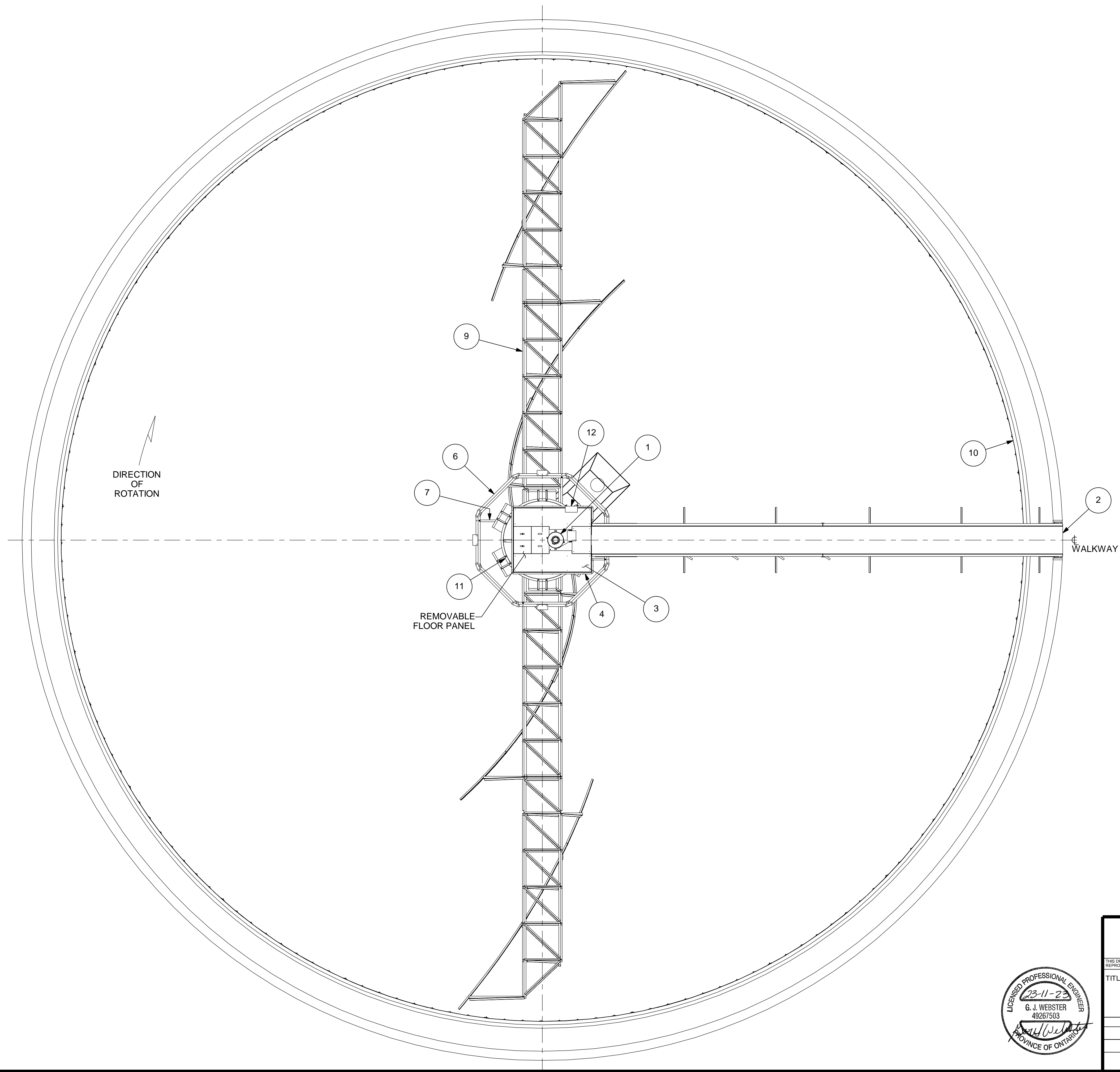


FEEDWELL BAFFLE DETAIL
SCALE 0.250

DETAIL 1
SCALE 0.250



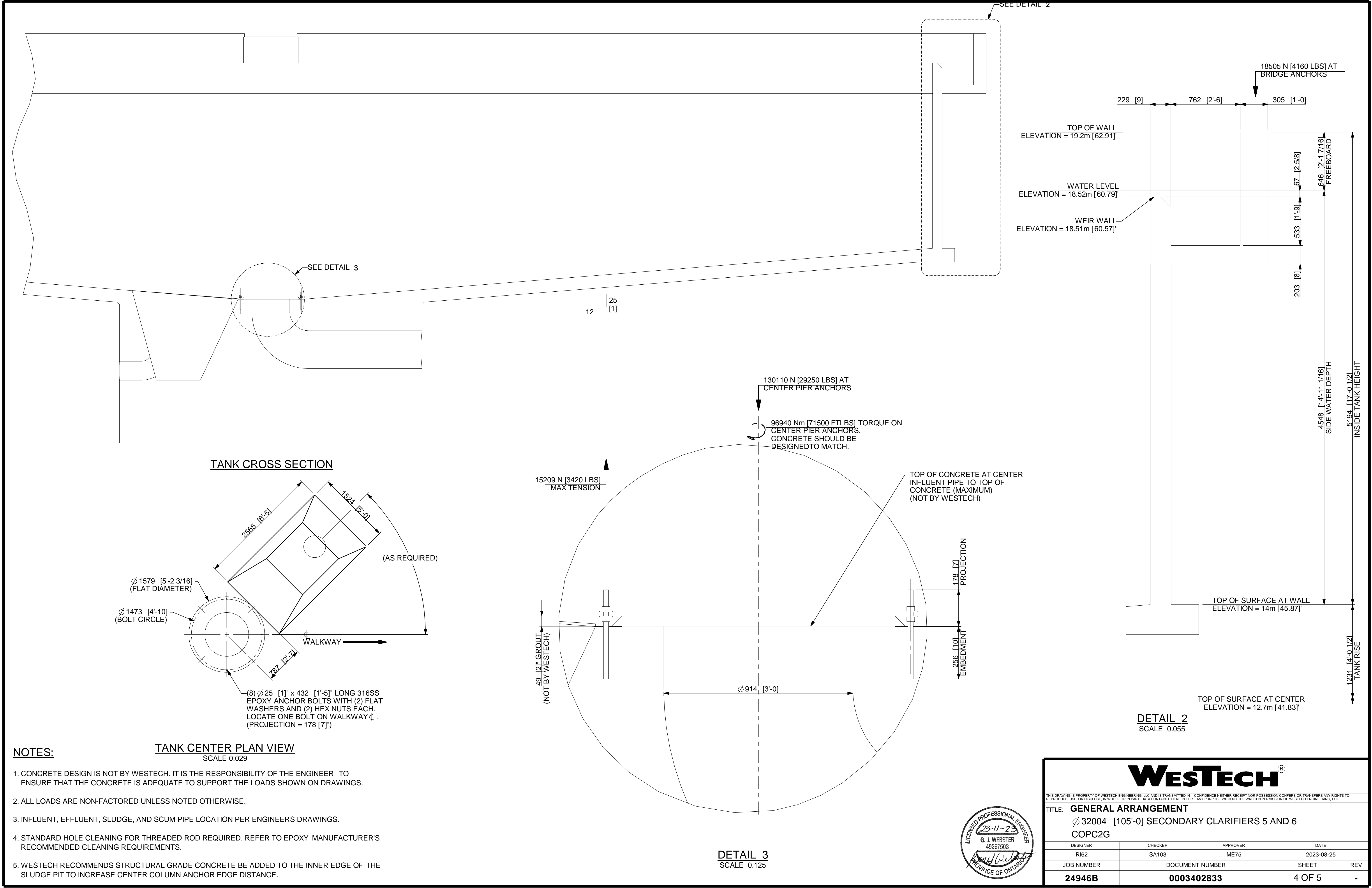
WestTech®				
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TITLE: GENERAL ARRANGEMENT				
Ø 32004 [105'-0"] SECONDARY CLARIFIERS 5 AND 6				
COPC2G				
DESIGNER	CHECKER	APPROVER	DATE	
R162	SA103	ME75	2023-08-25	
JOB NUMBER	DOCUMENT NUMBER		SHEET	REV
24946B	0003402833		2 OF 5	-



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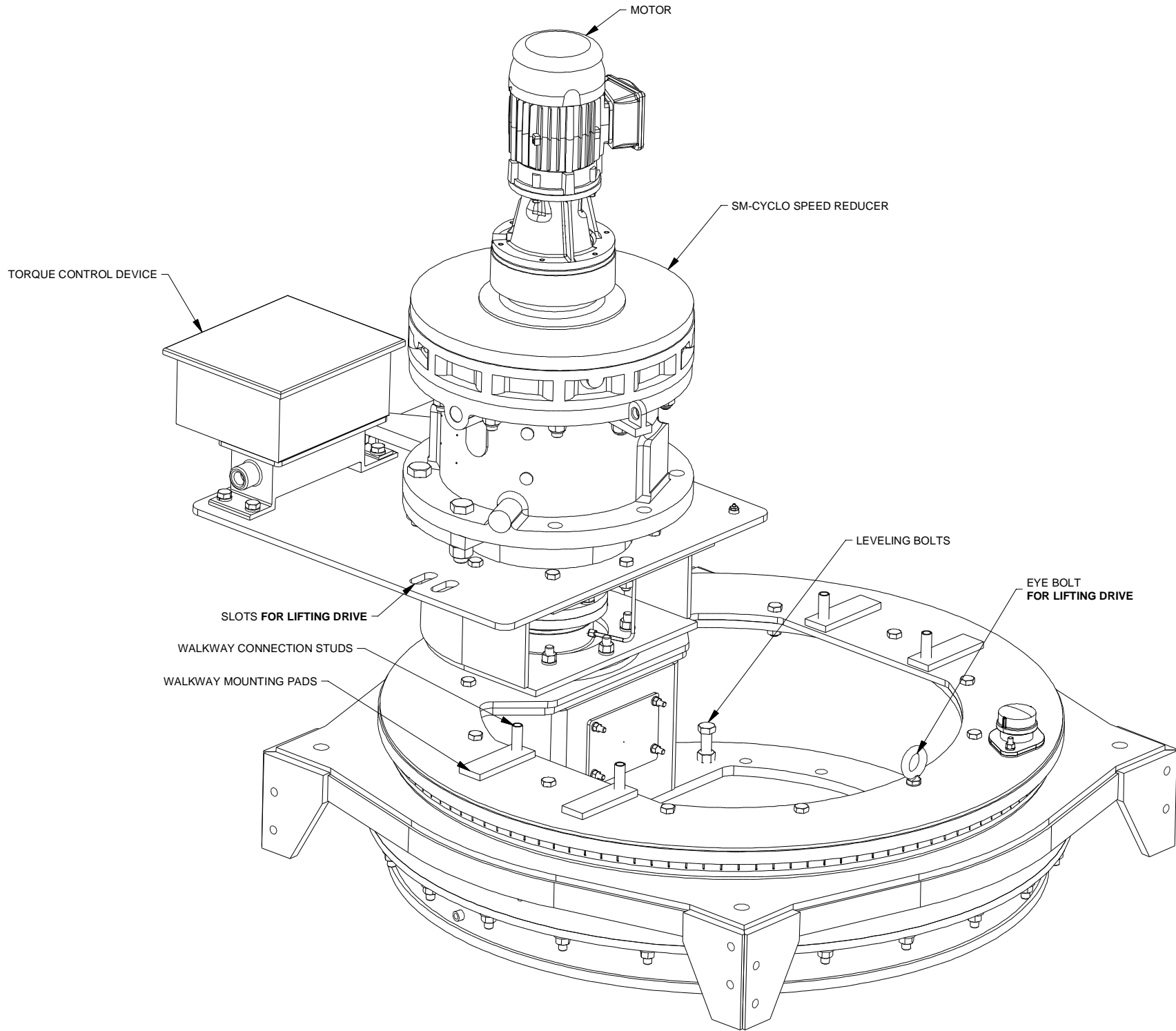
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Ø 32004 [105'-0"] SECONDARY CLARIFIERS 5 AND 6			
COPC2G			
DESIGNER	CHECKER	APPROVER	DATE
R162	SA103	ME75	2023-08-25
JOB NUMBER	DOCUMENT NUMBER		SHEET
24946B	0003402833		3 OF 5
			REV
			-



- NOTES:**
1. CONCRETE DESIGN IS NOT BY WESTECH. IT IS THE RESPONSIBILITY OF THE ENGINEER TO ENSURE THAT THE CONCRETE IS ADEQUATE TO SUPPORT THE LOADS SHOWN ON DRAWINGS.
 2. ALL LOADS ARE NON-FACTORED UNLESS NOTED OTHERWISE.
 3. INFLUENT, EFFLUENT, SLUDGE, AND SCUM PIPE LOCATION PER ENGINEERS DRAWINGS.
 4. STANDARD HOLE CLEANING FOR THREADED ROD REQUIRED. REFER TO EPOXY MANUFACTURER'S RECOMMENDED CLEANING REQUIREMENTS.
 5. WESTECH RECOMMENDS STRUCTURAL GRADE CONCRETE BE ADDED TO THE INNER EDGE OF THE SLUDGE PIT TO INCREASE CENTER COLUMN ANCHOR EDGE DISTANCE.



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TITLE: GENERAL ARRANGEMENT			
Ø 32004 [105'-0"] SECONDARY CLARIFIERS 5 AND 6			
COPC2G			
DESIGNER	CHECKER	APPROVER	DATE
RI62	SA103	ME75	2023-08-25
JOB NUMBER	DOCUMENT NUMBER		SHEET
24946B	0003402833		4 OF 5
			REV
			-



NOTES:

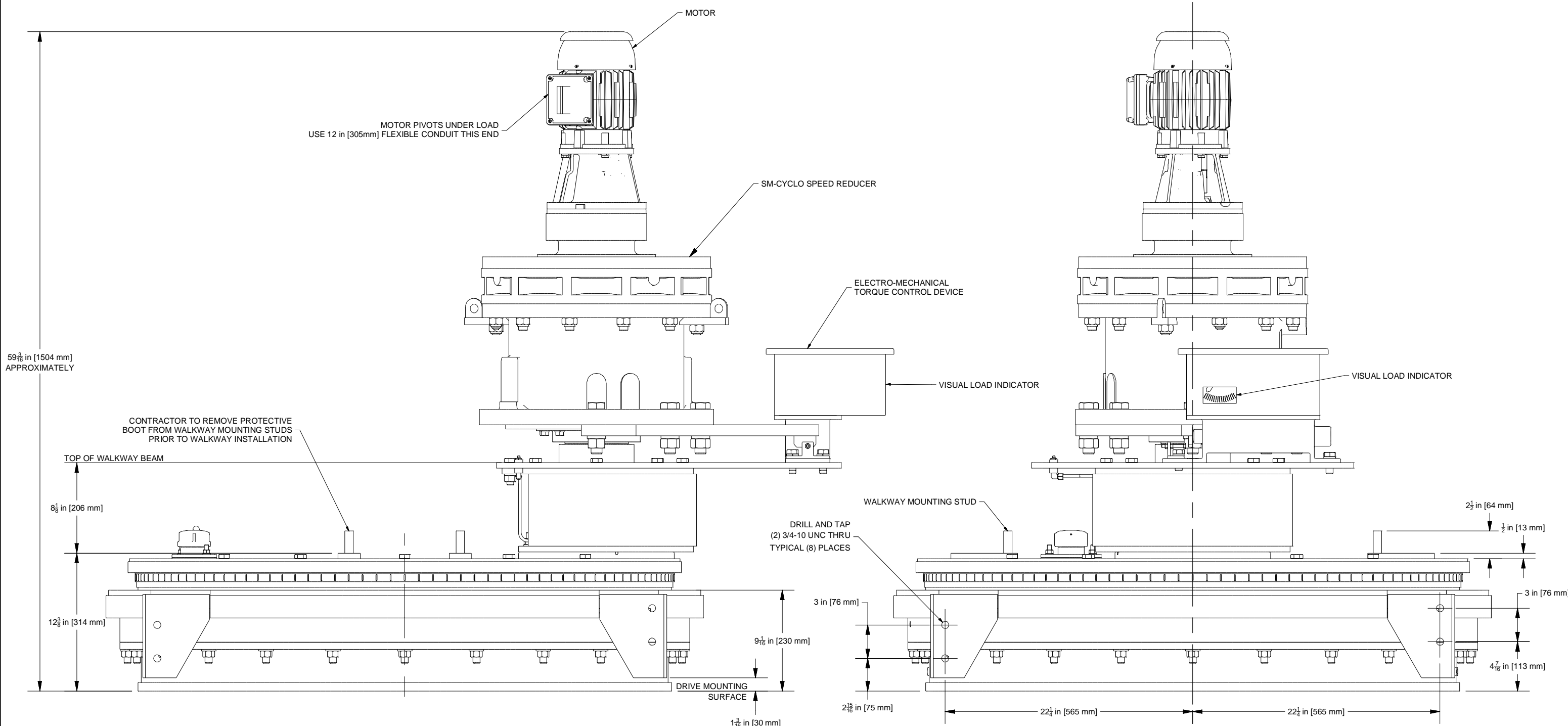
1. FOLLOW THE LISTED WESTECH REFERENCE DOCUMENTS EXCEPT AS NOTED ON THIS DRAWING.
2. LIFT DRIVE USING ONLY THE LIFT POINTS NOTED ON THE GENERAL ARRANGEMENT DRAWINGS. DO NOT LIFT THE DRIVE USING LIFTING EYES LOCATED ON REDUCER OR MOTOR.
3. CONTRACTOR TO REMOVE PROTECTIVE BOOT FROM WALKWAY MOUTING STUDS PRIOR TO WALKWAY INSTALLATION.

APPROX. TOTAL WEIGHT (LB)
3946
APPROX. TOTAL WEIGHT (KG)
1790

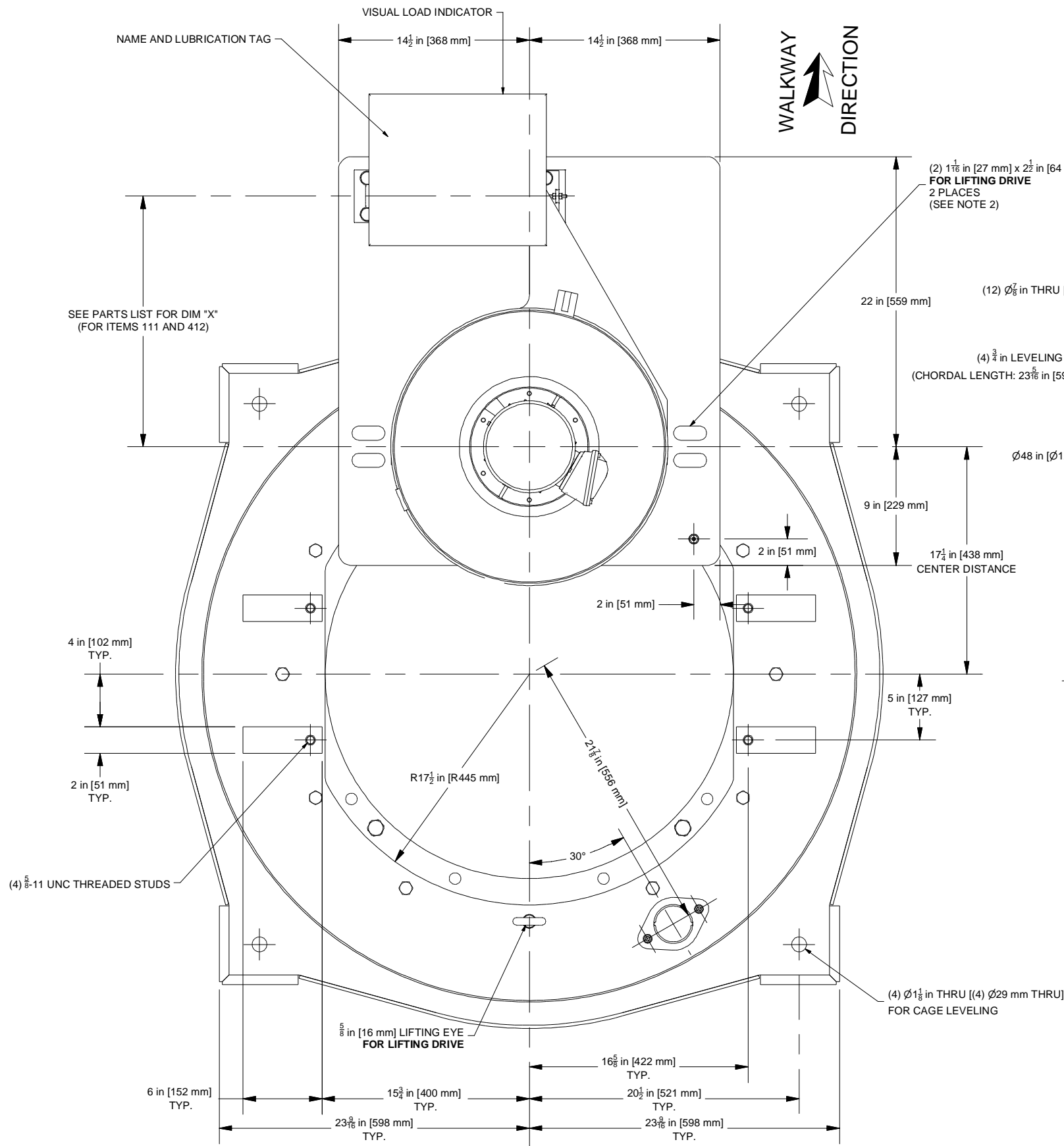
APPROXIMATE DIMENSIONS: 54in [1372mm] X 74in [1880mm] X 60in [1524mm]

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TITLE CAGE DRIVE GENERAL ARRANGEMENT				
42" (1067mm)				
DESIGNER	CHECKER	APPROVER	DATE	
RH00	HU72	AM73	12/6/2022	
JOB NUMBER	DOCUMENT NUMBER		SHEET	REV
-	0002875869		1 OF 3	-
REFERENCE DOCUMENTS				

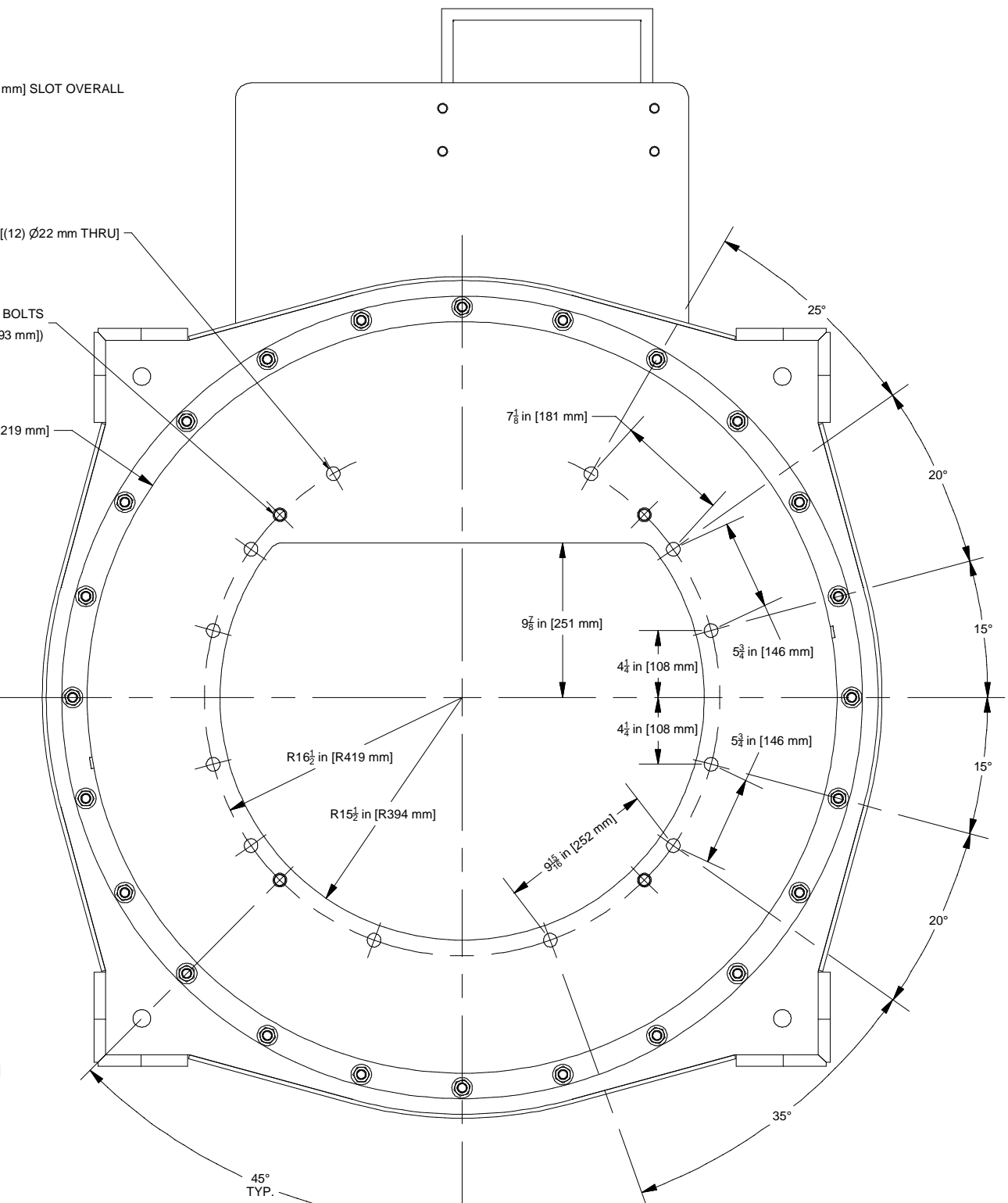
REV	REVISION DESCRIPTION	ECN	DESIGNER	APPROVER	DATE



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TITLE CAGE DRIVE GENERAL ARRANGEMENT				
42" (1067mm)				
DESIGNER	CHECKER	APPROVER	DATE	
RH00	HU72	AM73	12/6/2022	
JOB NUMBER	DOCUMENT NUMBER		SHEET	REV
-	0002875869		2 OF 3	-



TOP VIEW



BOTTOM VIEW

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JOB NUMBER	DOCUMENT NUMBER		SHEET	REV
-	0002875869		3 OF 3	-



BY: HU72
DATE: 6/12/2023

CHKD: BO13
DATE: 6/13/2023

CUSTOMER INFORMATION

PROJECT NUMBER: 24946B
PREPARED FOR: BRANTFORD WWTP

DRIVE RATING INFORMATION

MOMENTARY PEAK TORQUE	71,500 FT-LBS	200 %	(96,940 NM)
FULL DIAL TORQUE	57,200 FT-LBS	160 %	(77,552 NM)
BACKUP CUTOUT SWITCH TORQUE	50,050 FT-LBS	140 %	(67,858 NM)
CUTOUT SWITCH TORQUE	42,900 FT-LBS	120 %	(58,164 NM)
ALARM SWITCH TORQUE	35,750 FT-LBS	100 %	(48,470 NM)
CONTINUOUS TORQUE	35,750 FT-LBS	100 %	(48,470 NM)

LUBRICATION

RAKE

MAIN GEAR AND PINION: OIL
MAIN BEARING: GREASE
REDUCER: GREASE

SPEED

RAKE

0.04 RPM
13 FPM (4.1 MPM)

DIRECTION OF ROTATION

RAKE

CLOCKWISE

MOTOR INFORMATION

RAKE

1 HP (0.75 KW)
575 VAC\3 PH\60 HZ
1750 RPM
CANOPY

TORQUE CONTROL DEVICE INFORMATION

3 LIMIT SWITCHES
TRANSMITTER W/4-20mA OUTPUT



LETTER OF TRANSMITTAL

WESTECH®	1486 ST PAUL AVE. GURNEE, IL 60031 US	Phone: 801-265-1000 Fax: 801-265-1080	Document No. 22037
-----------------	--	--	-----------------------

Requested Ship Date: 12/01/23 Required Del Date:	Group: 06 Status:	Job No.: 24946C Job Name: BRANTFORD WWTP, ONTARIO, CA Project Manager: ABDULLAH SAMAD
Re: SUBMITTAL		

from: ABDULLAH SAMAD WESTECH ENGINEERING, LLC 3665 SOUTH WEST TEMPLE SALT LAKE CITY, UT 84115	to: J. GRAHAM DEGGEWISS CIMA+ 900-101 Frederick Street Kitchener, ON N2H 6R2 CA
Ph/Fax: 847-775-2416 / 801-265-1080 Email/Cell: asamad@westech-inc.com /	Ph/Fax: 519-536-3788 / Email/Cell: Graham.Seggewiss@cima.ca /

We are sending you: ☒ Attached ☐ Under Separate Cover **Via:** ☐ Best Way ☒ Other EMAIL
the following items:

- ☐ Shop Drawings ☒ Submittal Drawings ☐ O&M Manuals ☐ Specifications
☒ Copy of Letter ☐ Change Order ☐ Other

Copies	Number	Rev	Description
1	24946C	A	SUBMITTAL - SPEC SECTION 11452

CLARIFIER - TANK # 8

These are transmitted as checked below:

- ☒ For Approval ☐ Approved as Submitted ☐ For Bids Due
☐ For Your Use ☐ Approved as Noted ☐ Prints Returned After Loan to WEI
☐ As Requested ☐ Returned for Corrections ☐ Returned 0 Approved Prints
☐ For Review and Comment ☐ Returned 0 Corrected Prints ☐ Other

☒ Please Return Submittal By **12/15/23** to Avoid Delaying Project.

Remarks:

X

Signed

November 29th, 2023

Graham Seggewiss
CIMA+
500-5935 Airport Road
Mississauga, Ontario L4V 1W5

Re: Response to submittal review comments Tank 8 – Spec Section 11452 – WesTech Job # 24946C

Graham,

Please find below the WesTech's response to submittal return dated November 3rd, 2023. The submittal has been updated where needed.

1. Vendor has proposed an alarm switch, cutout switch, and backup cutout switch at 100%, 120%, and 140%, respectively, of the design running torque.
Vendor to confirm these recommended setpoints do not have any impact on equipment operation (prior to cut out) or warranty.
WesTech Comment: Confirmed.
2. Warranty shall be two (2) years beyond project substantial completion.
WesTech Comment: Warranty is updated in the submittal.
3. Provide details of RAS Pipe Adapter.
WesTech Comment: Per email from Graham Seggewiss dated November 9th, 2023, additional details of the RAS pipe adapter are not required. The RAS pipe details are already shown on the GA drawing in the submittal.
4. Delete the supply of the local control panel. The local control panel shall be supplied under the installing contractor's scope of supply.
Submit a suggested electrical wiring diagram incorporating all proposed control and safety mechanisms for engineer review.
WesTech Comment: The local control station information has been removed from the submittal. Torque Control wiring information is provided on page 87 of the submittal.
5. Confirm wind on the handrail on the platform was considered.
WesTech Comment: Confirmed.
Confirm bridge model considers one end as a roller support.
WesTech Comment: Confirmed.
6. Confirm 38mm sched 40 al pipe @ 1800 c/c can hold the loads described in the OBC. for the posts and rail.
WesTech Comment: Confirmed.
7. For all structural design provide stamp from engineer licensed in Ontario.
WesTech Comment: Stamped calculations and drawings are now included in the submittal.
8. 304L SS is required in spec, not 304 SS. Please update all including bridge, structural members, feedwell, weirs and baffles.
WesTech Comment: Per email from Graham Seggewiss dated November 21st, 2023, no change to the material is required.
9. Warning about anchors is noted. Comment will be returned in separate submittal.
WesTech Comment: Per email from Graham Seggewiss dated November 9th, 2023, any modifications to the existing concrete will be outside of WesTech's submittal. No change to the submittal is required. The anchor calculations are included in the submittal.

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Submittal Package

Revision: A

For:

Brantford WWTP
Secondary Clarifiers Rehabilitation
Brantford, Ontario, Canada

Equipment:

One (1) 105 ft [32m] Diameter COP™ Clarifier Mechanism
Specification Section: 11452
WesTech Model Number: COPC1G

WesTech Contact:

Project Manager: Abdullah Samad
Phone: 847.775.2416
Email: asamad@westech-inc.com

WesTech Job Number 24946C
December 2023



For:

Brantford WWTP
Secondary Clarifiers Rehabilitation
Brantford, Ontario

Equipment:

One (1) 105 ft [32m] Diameter COP™ Clarifier Mechanism
WesTech Model Number: COPC1G

Engineer:

CIMA+
500-5935 Airport Road
Mississauga, Ontario L4V 1W5
Phone: 905.695.1005

Contractor:

TBD

WesTech Agent:

C&M Environmental Technologies
2160 Dunwin Dr
Mississauga, Ontario L5L 5M8
Contact: Rob Anderson
Phone: 705.725.9377
Email: robanderson@cmeti.com

Manufacturer:

WesTech Engineering, LLC®
3665 South West Temple
Salt Lake City, Utah 84115
Phone: 801.265.1000
Fax: 801.265.1080
24 Hour Emergency Assistance: 800.265.1000

WesTech Contact:

Project Manager: Abdullah Samad
Phone: 847.775.2416
Email: asamad@westech-inc.com

WesTech Job Number 24946C

December 2023

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WESTECH® Product Line Card

Water and Wastewater Treatment Equipment and Solutions

- Municipal
- Industrial
- Minerals
- Services and Operations



Aerators - Water

ATOMERATOR™ Pressurized Aerator
Cascade Aerator
Forced and Induced Draft Aerator



Anaerobic Digestion

Ana-Flo™ UASB – Upflow Anaerobic Sludge Blanket
Digester Cover - Radial Beam and Truss Style
DuoSphere™ Dual Membrane Gasholder
ExtremeDuty™ Mechanical Sludge Mixer
Sludge Heating System



Biological Treatment

BioDoc™ Rotary Distributor
HydroDoc™ Rotary Distributor
LANDY-7 Slow Speed Surface Aerator
OxyStream™ Oxidation Ditch
PakTOR™ Packed Bed Reactor
STM-Aerotor™ IFAS System



Clarification

Adsorption Clarifier® System
Backwash Clarifier
Conventional Clarifier
CONTRAFast® Thickening Clarifier
CONTRAFLO® Solids Contact Clarifier
COP™ Spiral Blade Clarifier
COP™ Suction Header Clarifier
Flocculating Clarifier
Metallurgical Clarifier
Pin Bed Clarifier
RapiSand™ Ballasted Flocculation
Sludge Sucker™ Sludge Removal System
Solids CONTACT CLARIFIER™
Suction Header Clarifier
Suction Pipe Clarifier
SuperSettler™ Inclined Plate Clarifier
Zickert Shark™ Sludge Removal System



Combined Sewer Overflow

WWETCO FlexFilter™



Dewatering

Filter Press
Horizontal Belt Filter
Rotary Vacuum Drum Filter
Vacuum Disc Filter



Dissolved Air Flotation (DAF)

Circular / Rectangular DAF Units
Dissolved Gas Flotation (DGF)
Dissolved Nitrogen Flotation (DNF)
R5 DAF Pre-Engineered Unit



Drives

Cage Drive
Drives with Lift
Dual Drive
Shaft Drive
Replacement, Retrofit, and Rebuild Options



Flocculation

Axial Blade Flocculators
Horizontal Paddle Flocculators
Vertical Paddle Flocculators



Filtration - Granular Media

CentROL® Gravity Filter
ESSD® Washtroughs
Gravity Filtration System
LAZERFLO™ Low-Profile Underdrain
Manganese ANTHRA/SAND™
MULTIBLOCK® Filter Underdrain
MULTICELL® Horizontal Pressure Filter
MULTICRETE™ II Filter Underdrain
MULTIWASH® Filtration Process
MULTIWASH® PRO Trough
Pressure Filters [Vertical and Horizontal]
SuperSand™ Continuous Backwash Filter



Filtration - Specialty

Ion Exchange System
Granular Activated Carbon Contactor (GAC)
SuperDisc™ Disc Filter
SuperDrum™ Drum Filter
WWETCO FlexFilter™



Headworks Grit Removal and Screening

CleanFlo™ SHEAR™ Rotary Drum Screen
Grit Collector
Shafted Grit Screw Classifier
Vortex Grit Chamber



Industrial Screening

Linear Screen
Resin / Carbon Interstage Screen
WTR Cup and Drum Screen
WTR Fish Recovery and Return Screen
WTR Stationary Screen
WTR Talon Rake™ and Bar Screen
WTR Traveling Water Screen



Membrane Filtration

AltaPac™ Ultrafiltration Membrane System
Electrodeionization (EDI)
Nanofiltration and Reverse Osmosis System
Ultrafiltration Membrane System
VersaFilter™ Open-Platform Membrane System



Oil/Water Separation

Oil/ Water Separators
Dissolved Air Flotation (DAF)



Package Treatment Systems

AERALATER® Iron and Manganese Removal System
AltaPac™ Ultrafiltration Membrane Package System
Aquarius® Package Water Treatment Plant
Multi-Tech™ Pressurized Package System
RapiSand Plus™ Package Treatment Plant
Trident® HS Package Treatment Plant
Trident® HSC Package Treatment Plant
Trident® HSR Package Treatment Plant
Trident® Package Treatment Plant
Tri-Mite® Package Treatment Plant
Water Boy™ Package Treatment System



Tankage

Anchor Channel Tanks
Bolt Together Tanks
Elevated Tanks
Field Erection
Shop-Built Tanks



Thickening

AltaFlo™ High-Rate Thickener
CONTRAFast® Thickening Clarifier
Conventional Sludge Thickener
Deep Bed™ Paste Thickener
EvenFlo® Feedwell
HiDensity™ Paste Thickener
HiFlo™ High-Rate Thickener
MudMax™ Bed-Level Instrument
Rotary Drum Thickener
TOP™ Thickener Optimization Package
Titan™ Traction Thickener



WesTech Services and Operations

Mobile and Rental Solutions
Plant Operations and Services
Systems Integration
Pilot Plants
Aftermarket Services
Laboratory Services

Many of these products are available as mobile/rental equipment or pilot plants.

Submittal Introduction

Submittal Introduction

1. This submittal is being furnished for the approval of the mechanical and electrical equipment (if applicable) as outlined under the specification section referred to in the Letter of Clarification.
2. A complete outline of materials to be supplied is listed herein. The General Arrangement drawings enclosed represent our complete scope of supply. All other materials not specifically included on the drawings, or the body of this submittal, are to be supplied by other than WesTech Engineering, LLC.
3. Document and data requirements (i.e. Operation and Maintenance Manuals) covered elsewhere in the specifications shall follow promptly and with the content to satisfy the specifications.
4. A copy of all “approved/approved as corrected” and/or “revised” General Arrangement Drawings (Shop Drawings) and Equipment Erection/Assembly Drawings will be included in the Installation, Operation & Maintenance Manuals.
5. Approval to proceed will not be recognized by WesTech until clouded dimensions (if applicable) are confirmed or supplied.
6. Re-Submittals: The enclosed information will not be duplicated in any future re-submittals, unless:
 - a. Items/sections have been commented on and need clarification or revision for the re-submittal.
 - b. Specifically requested by the Engineer or Contractor on the return Letter of Transmittal that the entire submittal must be duplicated.
7. To be environmentally aware, this submittal may utilize double-sided printing to conserve paper.

Letter of Clarification

Letter of Clarification

The purpose of this Letter of Clarification is to state any departure WesTech will take from the given specifications. This letter of clarification includes specification section 11452 updated per addendum 1,2,3 and associated contract drawings. The right side of the page is a copy of the specification section with any departures from the given specifications noted on the left side of the page. Any exceptions to the contract drawings are noted on the drawings shown as text boxes. All items with no marks or comments should be considered as “No Exceptions Taken”. This review is also used by WesTech to clarify specifications that might have multiple or vague interpretations.

The enclosed WesTech General Arrangement Drawings may contain clouded dimensions. This indicates information to be confirmed and/or corrected by the Engineer and/or the Contractor at the time this submittal is returned. Submittal will not be considered as approved until all clouded dimensions have been confirmed and/or corrected.

All items not specifically noted in the enclosed General Arrangement drawings as being supplied by WesTech are by others.

1

GENERAL

1.1

DESCRIPTION

WesTech will not be onsite to provide supervision of installation, WesTech can provide assistance during installation by means of IOM manual and remote guidance.

WesTech drive to be provided with a third cutout switch instead of shear pin.

WesTech to provide half span access bridge as per the specification drawings and proposal.

Center column will act as template for the anchor bolts since epoxy anchors are to be used.
Grout shield not by WesTech.

.1

This section covers the Work including site verification, design, fabrication, factory testing, supply of material, delivery, supervision of the installation, on-site testing, commissioning, training and a coordinated design responsibility for the following:

.1 One (1) spiral blade type circular clarifier mechanism for the Brantford WWTP Secondary Clarifier 8, including:

.1 Center drive unit, complete with reducer, motor, microswitch overload device, shear pin or backup overload switch and torque control.

.2 Full span access bridge and enlarged platform with handrail, grating and toe plate. Bridge shall span across secondary clarifier rings of the existing clarifier structure to the centre influent column.

.3 Stationary center influent column with RAS pipe adapter / sludge manifold and collection header, anchor bolt template, and grout shield.

.4 Energy dissipating inlet (EDI).

.5 Influent feedwell.

.6 Rotating drive cage and truss arms.

.7 V-notch effluent weir.

.2

Provide all labour, material and equipment to furnish, test and commission spiral type circular secondary clarifier mechanism together with appurtenances suitable for installation in a tank with concrete walls and concrete base slab, as indicated and specified.

.3

The intent is that the clarifier mechanism shall come with industry standard drive unit assembly and EDI components. It is recognized that specific details may vary between proponents and will be assessed as part of the technical proposal evaluations.

.4

Like items of equipment specified herein shall be the end products of one manufacturer in order to achieve standardization for operation, maintenance, spare parts and manufacturer's service.

1.2

GENERAL

Storage, assembly and erection onsite is by others, not WesTech.

.1

Equipment furnished under this section shall be fabricated, assembled, erected, and placed in proper operating condition in full conformity with drawings, specifications, engineering data, instructions and recommendations of the screens manufacturer, unless exceptions are as noted by the Engineer.

.2

Site Verification. The Clarifier supplier shall field verify all the dimensions of the existing clarifier onsite following award and prior to submitting shop drawings for the Engineer's review. The vendor shall not rely on the existing drawings for shop drawings or fabrication.

- .3 Coordination. The Clarifier Mechanism shall be installed in the existing secondary clarifiers as shown on the drawings. The Clarifier supplier shall verify that each component of the system is compatible with all other components of the system; and that all devices for a properly functioning system have been provided. The Contractor is responsible for overall coordination of the equipment package to ensure its compatibility with other equipment. The Contractor shall decommission the existing mechanism completely and dispose of materials off-site.
- .4 General Equipment Stipulations. The General Equipment Stipulations shall apply to all equipment furnished under this section.
- .5 Equipment Schedule. Manufacturer's field services, one (1) hard and electronic copy of operation and maintenance manuals, and certificates of compliance shall be provided for all items of equipment furnished under this contract.
- .6 Specific requirements for manufacturer's field services are covered in the quality control section. Specific requirements for operation and maintenance manuals and certificates of compliance are covered in the submittals section.
- .7 Power Supply. Power supply to equipment will be 575 volts, 60 Hz, 3 phase.
- .8 Complete structural calculations signed by a registered professional Engineer, licensed in Ontario (P.Eng.).

Structural calculations sealed by a Professional Engineer licensed in Ontario are included in this submittal.



1.3 APPLICABLE CODES AND STANDARDS

- .1 The following minimum applicable codes, standards and regulations must be adhered to in the design, installation and services provided by the Vendor. In the case of conflicting information among these codes, it is the Vendor's responsibility to inform and obtain written approval from the Engineer of any exceptions hereby taken.
- .2 Requirements from the following organizations shall be considered as a minimum:
 - .1 American Iron and Steel Institute (AISI), Heat Treated Steel Specifications
 - .2 American National Standards Institute (ANSI).
 - .3 American Gear Manufacturers' Association (AGMA), Gear Ratings
 - .4 American Society of Testing Materials (ASTM):
 - .1 A36 Structural Steel Specifications
 - .2 A48 Cast Iron Specifications
 - .3 A123 Hot-Dip Galvanized Coatings
 - .4 A153 Hot-Dip Galvanized Bolts
 - .5 A167 Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
 - .6 A276 Stainless Steel Bars and Shapes
 - .7 A283C Steel Plate Specifications

- .8 A304 Bolt Specifications
- .9 A536 Ductile Iron Specifications
- .10 A992 Structural Steel Specifications
- .5 Anti-Friction Bearing Manufacturers' Association (AFBMA), Bearing Life Specifications.
- .6 Canadian Welding Bureau (CWB):
 - .1 CAN/CSA-G40.20: General Requirements for Rolled Welded Structural Quality Steel.
 - .2 CSA/CSA-G40.21: Structural Quality Steels.
 - .3 CSA W47.1: Certification of Companies for Fusion Welding of Steel Structures.
 - .4 CSA W47.2: Certification of Companies for Fusion Welding of Aluminum.
 - .5 CSA W59: Welded Steel Construction.
 - .6 CSA W59.2: Welded Aluminum Construction.
- .7 Ontario Occupational Health and Safety (OH&S) Act and Regulations.
- .8 National Electrical Manufacturer's Association (NEMA), Motor Design Standards and Standards for Control Enclosures
- .9 National Fire Protection Association (NFPA) 820, Fire Protection in Wastewater Treatment and Collection Facilities, latest edition.
- .10 The Society for Protective Coating (SSPC) Standards and Specifications:
 - .1 SP 6: Surface Preparation No. 6 for Commercial Blast Cleaning.
 - .2 SP 10: Surface Preparation No. 10 for Near-White Blast Cleaning.

1.4 RELATED SECTIONS

- .1 Division 1 - General Requirements

1.5 SUBMITTALS

- .1 In accordance with Section 01330 - Submittals
- .2 Complete assembly, installation drawings, motor and anchor bolt base plans, together with detailed specifications and data covering materials, parts, devices, and accessories forming a part of the equipment furnished, shall be submitted in accordance with the submittals section.
- .3 Stainless steel construction protocol to avoid cross contamination with carbon steel.
- .4 Vendor shall identify modifications required, if any, to the existing clarifier tank to accommodate the new clarifier mechanism.

Erection drawings and installation instructions to be provided in the IOM manual before shipment.

WesTech's calculations show that the center column anchors will break out concrete due to edge distance at the sludge hopper. We recommend reviewing this and modifying the sludge hopper as necessary. Concrete calculations are not by WesTech.

.5 Shop Drawings:

Assembly and installation drawings to be provided in the IOM manual before shipment.

Overall weights and dimensions to be provided in the IOM manual before shipment.

Anchor calculation sealed by a Professional Engineer licensed in Ontario included in this submittal.

To be provided in the IOM manual before shipment.

Per submittal review comment all controls are by others, not WesTech. Local station is removed from the submittal.

- .1 Catalogue cuts or equipment data sheets showing Equipment vendor's complete descriptive information and produce literature.
- .2 Complete assembly and installation drawings, together with detailed specifications and data covering material used, and accessories forming a part of the equipment furnished.
- .3 General arrangement layout drawings based on vendor's onsite field verifications including, as a minimum, tank inside dimensions, side water depth, tank freeboard, slope of tank floor, dimensional location of the equipment, materials list, cut outs, mounting arrangements, electric drive units, and controls.
- .4 Drawings with detailed dimensions showing plan, elevation, layout, and appropriate cross sections of the complete sludge collecting systems, including location of drive units, anchor location, materials of construction, overall weights, and dimensions of largest components requiring removal for maintenance, cross referenced material list, and mechanical connections.
- .5 Drawings with detailed dimensions showing general arrangements, assembly diagrams, and cross sections for entire drive mechanism, including but not limited to motor, gear reducers, speed reducers, turntable assembly, cage drive assembly, and torque switches / sensors.
- .6 Details of sludge scraper and RAS Adapter / Sludge Manifold components.
- .7 Details of electric drive units including motor data, suggested wiring diagrams, connection sizes and types, operating pressures, control devices, etc.
- .8 Catalogue cuts or equipment data sheets showing the Equipment vendor's complete descriptive information and product literature.
- .9 Equipment make and model, material of construction, weight, electrical requirements, all electrical and mechanical components, and sizes and types of all connections to interfacing components.
- .10 Submit a coordinated plan of assembly, tolerances and anchor bolts, including anchor sizing calculations sealed by a professional engineer registered in Ontario.
- .11 Installation information, including mounting requirements, access, approximate weight of each major piece of equipment sizes and types of electrical connections.
- .12 Provide the following information for each instrument and/or field device application: power supply rating, input/output signal ranges, maximum measured process range, calibrated scale, physical dimensions, electrical and environmental requirements
- .13 Provide application specific catalogue model numbers for each control panel component, field device, field equipment, and accessory options. Include a reference to the respective instrument or equipment tag name in accordance with the P&ID in this document.

Complete equipment bill of material to be provided in the IOM manual.

- .14 Provide a list of equipment vendor's recommended list of spare parts including individual pricing with the shop drawings.
- .15 Detailed structural, mechanical, and electrical drawings showing equipment fabrications and interface with other items; include dimensions, size, and locations of connections to other work, and weights of associated equipment.
- .16 Complete bill of materials of all components and equipment supplied and product data sheets and dimension drawings for all accessories.
- .17 Process, instrumentation and electrical diagrams, as required, for the component parts.
- .18 Functional description of internal and external instrumentation and controls to be supplied, including list of parameters monitored, controlled, or alarmed.

Structural calculations sealed by a Professional Engineer licensed in Ontario included in this submittal.

- .6 Catalogue data, brochures, and other information required to describe equipment. Where catalogue information is submitted, ensure information clearly indicates model number and/or option proposed for this project.
- .7 Structural calculations for design of bridge, and connections. Show design loads. Structural calculations to be signed and sealed by Professional Engineer in the Province of Ontario.

1.6 TEST PROCEDURES.

- .1 The clarifier equipment manufacturer shall furnish as a minimum the following design and description information to establish compliance with these specifications:

Certificate of design stamped by a Professional Engineer licensed in Ontario included in this submittal.

- .1 Certified general arrangement and tank dimensional drawings.
- .2 Certificate of design stamped by a Registered Professional Engineer in the Province of Ontario stating that the equipment to be provided for this project meets or exceeds all design requirements of these specifications. The certificate shall state the respective loads and design criteria.

Drive calculations stamped by a Professional Engineer licensed in Ontario included in this submittal.

- .3 Drive mechanism rating calculations, stamped by a Registered Professional Engineer in the Province of Ontario, verifying the compliance of the drive gears and bearings with the specified continuous torque rating and bearing life rating.
- .4 Motor data and catalog information. Electrical drawings as applicable to the supply of the clarifier equipment.
- .5 Microswitch overload device cutsheets and typical wiring diagram.
- .6 Suggested typical electrical schematic wiring diagrams.
- .7 Catalog cut sheets for purchased sub-components.
- .8 Descriptive information shall include the following:
 - .1 Written certification that the proposed drive meets AGMA standards. Drive mechanism calculations prepared by a registered professional engineer shall be submitted for approval along with published torque value of the proposed drive.

- .2 General arrangement of drive unit verifying AGMA torque, overload protection system, housing and gear materials and horsepower. Provide values used for the following AGMA design parameters per AGMA Specification 6034:
 - .1 Pitch diameter of worm gear (in.)
 - .2 Effective face width of gear (in.)
 - .3 Lead angle of threads at mean worm diameter (deg)
 - .4 Normal pressure angle of worm thread (deg)
 - .5 Sliding velocity of worm at mean diameter (fpm)
 - .6 Number of teeth
 - .7 Service factor. Use 1.25
- .3 Provide the following AGMA design parameters per AGMA 2001:
 - .1 Pitch diameter of pinion and spur gear (in.)
 - .2 Face width of narrowest of two mating gears (in.)
 - .3 Pitch line velocity of pinion (fpm)
 - .4 Allowable bending stress (Sat) of pinion and spur gear material (psi)
 - .5 Allowable contact stress (Sac) of pinion and spur gear material (psi)
 - .6 Geometry factor (J) for bending
 - .7 Geometry factor (I) for pitting resistance
 - .8 Load distribution factors Cm and Km
 - .9 Dynamic factors Cv and Kv
 - .10 Life factors Cl and KI at 420,000 cycles of the main gear
 - .11 Number of teeth
 - .12 Reliability factors, Cr and Kr equal to or greater than 1.0
- .4 Complete test procedure for torque testing the clarifier mechanism for the AGMA torque specified.
- .5 Complete assembly drawing of the collector components giving:
 - .1 Type of material used for each component.
 - .2 Connection and mounting details.

To be provided in the IOM manual before shipment.

.3 Dimension, thicknesses and weights of each component.

.6 Factory Testing Reports

.7 Operations and maintenance data

.8 Parts list complete with a list of recommended spare parts

.2 The shop drawing shall present the required mechanism dimensions on the structural drawings including plans, sections and details. A typical dimensions or drawings shall not be acceptable.

1.7 QUALIFICATIONS

.1 Manufacturer's Experience

.1 It is the intention of this specification to cover minimum acceptable quality for a complete installation with the exception of the motor controls, electrical work and piping requirements. The electrical/mechanism from each manufacturer shall be reviewed by the Engineer if those are equal or equivalent when those are different from them specified herein.

.2 The Manufacturer shall have at least ten (10) year experience in design and fabrication of clarifier mechanism as demonstrated by a list of at least 10 successful installations of comparable size (same or larger) with references in Canada or USA. All references shall include valid contact names and phone numbers that can be verified.

.3 The Engineer may require evidence, in the form of operating records, from these plants to substantiate any claims concerning the ability of the equipment to perform as required.

1.8 PRODUCT DATA

.1 Details of storage and off-loading requirements.

.2 Recommended installation instructions.

To be provided after unit start-up.

.3 Field test reports:

.1 Submit field test reports in accordance with Sections 01330.

.2 Submit completed Manufacturer's Installation Certification Form.

.3 Submit completed Pre-Commissioning Certification Form.

Will be provided one month before shipment.

.4 Installation, operation, and maintenance manuals:

.1 Include one (1) copy of both hard and electronic copy of operation and maintenance manuals.

.2 Include material under this Section in Owner's manuals in accordance with Section 01330.

.3 Submit installation manual prior to shipment of equipment.

1.9 QUALITY ASSURANCE

- .1 Equipment specified shall be the product of one vendor.
- .1 Equipment specified shall be the Manufacturer's standard catalogue product and modified to provide compliance with the drawings, specifications and the service conditions specified and indicated.
- .2 Equipment Manufacturers shall show evidence of quality assurance in manufacturing and supplying equipment essential in details to the equipment herein specified. Before equipment shipment, the vendor's project engineer shall witness and sign off the product to be shipped, and the signoff sheet shall satisfy the requirement of the Owner's Engineer before equipment shipment.
- .3 Provide shop drawings including:
 - .1 Welding: In accordance with latest applicable Canadian Welding Bureau Code.
 - .2 Services of Manufacturer's Representative as specified herein.
- .4 Provide services of factory-trained Service Technician, specifically trained on the type of equipment specified, for on-site services.
 - .1 Service Technician must have a minimum of five (5) years of experience, all within the last seven (7) years, on the type and size of equipment.
 - .2 Supplemental Service Technician, if required, for electrical and controls equipment.

2 PRODUCTS

2.1 SYSTEM DESCRIPTION

- .1 The clarifier mechanism shall be of the center drive type, supported on a stationary influent column, with the flow entering at the bottom of the influent column and flowing upwards into the energy dissipating inlet.
- .2 The flow shall then proceed into the feedwell through gates near the water level for further energy dissipation and settling.
- .3 The secondary clarifier mechanism shall be designed to remove settled sludge from the bottom of the tank from around the periphery of the tank. The clarifier mechanism shall perform the following integrated functions:
 - .1 Dissipate energy and control localized currents.
 - .2 Separate solids from the clear liquid.
 - .3 Evenly withdraw the clear liquid.
 - .4 Transport and thicken settled sludge.
- .4 Center feed influent column, peripheral overflow type with a central driving mechanism rotating a suspended center cage with two (2) spiral blade sludge removal truss arms.

WesTech will provide a secondary cutout switch in lieu of a shear pin as a safety measure that will stop the drive motor in the event the load achieves 140% of the continuous operating torque and shut down the motor in the event the first cutout switch fails prematurely. This redundancy in cutout protection will sufficiently protect the drive unit against peak overloading. The two limit switches will be wired in series to stop the drive motor provided either switch is tripped.

All controls are by others, not WesTech per Submittal review comments.

Material and equipment not specifically outlined in this submittal as being supplied by WesTech are by others.

Per RFI 001 response plant flow to each clarifier can be assumed based on the clarifier surface area depending on the number of clarifiers, see General Arrangement Drawing for process information on each clarifier.

.5 The equipment shall be designed to effectively settle mixed liquor suspended solids and collect the settled solids from the basin floor to the sludge collection sump as shown on the drawings. The clarified effluent shall be collected uniformly by the existing peripheral launder.

.6 The equipment furnished for the clarifier mechanism shall include but not be limited to:

.1 Access bridge and enlarged platform with handrail, grating and toe plate.

.2 Centre drive unit, complete with reducer, motor, microswitch overload device, shear pin and torque control.

.3 Lockable local disconnect and start/stop controls.

.4 Centre drive platform.

.5 Centre support column with inlet openings.

.6 Influent feedwell, energy dissipating inlet, and centre cage.

.7 Rotating drive cage and truss arms equipped with two (2) mechanism blades.

.8 RAS Adapter / Sludge Manifold and supporting equipment.

.9 V-notch effluent weir, and assembly fasteners.

.10 Entire mechanism including structural members and one end of the walkway supported from a centre column.

.7 All other appurtenances for a fully functional system.

.8 Secondary Clarifier Mechanism shall be made by one (1) manufacturer.

.9 Notwithstanding any dimensions, material thickness or any other design criteria relating to the construction of the specified equipment, it remains the responsibility of the manufacturer to supply equipment of suitable characteristics for the intended purpose. This does not relieve the Supplier of the requirement to adhere to this specification, subject to the sole discretion of the Engineer.

2.2 PERFORMANCE AND DESIGN REQUIREMENTS

.1 Furnish and deliver circular type secondary clarifier mechanism for installation in existing Secondary Clarifiers 8 (Refer to Drawings for details).

.2 Overall Plant Design Criteria:

.1 Plant Average Daily Flow - 81,800 m3/d

.2 Total Peak Process Capacity - 166,970 m3/d

.3 Total Hydraulic Peak Flow - 235,212 m3/d

.3 Secondary Clarifiers 8 Design Criteria and Requirements

.1 Internal Diameter of the Clarifier - 32 m (105 feet)

- .2 Total Weir Length - 100.5 m
- .3 Clarifier Area - 804.3 m2 (each)
- .4 Number of Secondary Clarifiers to be replaced - 1
- .5 Side Water Depth - 4.6 m
- .6 Rotating Speed - As per the Supplier's recommendation
- .7 Motor Horsepower - Minimum 1 hp
- .8 Depth and contour as per contract drawings

- .4 The successful bidder shall field verify the dimensions onsite following Contract award and prior to submitting shop drawings for the Engineer's review.

2.3 SEISMIC DESIGN

- .1 The Equipment Manufacturer shall conform to the seismic design requirements of Ontario Building Code 4.1.8.18 for this project and for the Work of this specification Section. Shop drawings shall be stamped by licensed structural engineer in Ontario.
- .2 Provide all equipment, anchorage, supports and foundations designed in accordance with the seismic requirements indicated and specified.
- .3 Additionally, provide with the Certificate of Unit Responsibility, certification for all equipment signed by a registered structural engineer stating that computations were performed and that all components have been sized for the seismic forces specified and indicated.

2.4 COMPONENT CONSTRUCTION

.1 Materials

Clause removed per Addendum No. 1.

- ~~.1 All structural steel shall conform to AISC - Steel Construction Manual latest edition. All steel plates shall conform to ASTM A36. All structural steel shape series of M, MT, S, ST, C, MC, L shall conform to ASTM A36. Structural steel shapes W, WT, HP shall conform to ASTM A992/A572.~~

Clause lines removed per Addendum No. 1.

- ~~.2 All pipe shall be ASTM A53, Grade B. All square and rectangular tubing shall be ASTM A500, Grade B, unless otherwise noted. Steel members in contact with liquids, either continuously or intermittently, shall have a minimum thickness of 6.35 mm unless otherwise noted. All aluminum shall be type 5052, 6061, 6063, or 2014 alloy unless noted. All stainless steel shall be type 304L unless noted.~~

- .3 Comply with ASTM A276 Stainless Steel Bars and Shapes and A167 Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip to use stainless steel 304L.

.4 Fabrication

- .1 Shop fabrication and welding of structural members shall be in accordance with the latest edition of the "Structural Welding Code", AWS D1.1, (AWS D1.2-Aluminum, AWS D1.6-Stainless Steel), of the American Welding Society.

These clauses don't apply. Equipment by WesTech except Drive will be all stainless steel.

.2 All welded connections shall develop the full strength of the connected elements and all joined or lapped surfaces shall be completely seal welded with a minimum 3/16" fillet weld. Intermittent welding shall not be allowed, except on non-ferrous metals.

.5 Edge Grinding

.1 Sharp projections of cut or sheared edges of ferrous metals shall be ground to a radius by multiple passes of a power grinder as required to ensure satisfactory coating adhesion.

.6 Shop Surface Preparation/Coating

.1 All iron and steel surfaces, except the drive unit, shall be field cleaned and painted by the contractor to ensure paint compatibility and assign unit responsibility for the coating system. The drive unit shall be coated with the supplier's standard enamel paint system.

.7 Structural Design

.1 All steel design shall be in accordance with the AISC Manual of Steel Construction, latest edition and the International Building Code (IBC), latest edition.

2.5 MANUFACTURE AND FABRICATION

- .1 Corrosion Protection. All metal surfaces coming into contact with the liquid, other than stainless steel or brass shall be protected by an approved, corrosion resistant coating.
- .2 Welding. All structural butt welds shall be of full penetration. Equipment shall be free of any damages such as indentations and cracks. All welded joints shall be of similar chemistry, corrosion resistance and physical properties to the base metal being welded.
- .3 Edge Grinding. Sharp projections of cut or sheared edges of metals, which will be submerged in operation, shall be ground to a radius.
- .4 Unless otherwise specified or permitted, the materials used in the fabrication of the equipment furnished under this section shall conform to the following.

~~.5 Painting and Coating. In accordance with Section 09900 - Painting and Finishing~~

2.6 MATERIALS

- .1 Unless otherwise specified or permitted, the materials used in the fabrication of the equipment furnished under this section shall conform to the following

Bridge	Stainless Steel 304L
Structural Members	Stainless Steel 304L or ASTM A36
Gear Housing	Gray Cast Iron, ASTM A48 or Fabricated Steel
Walkway	Aluminum Grating
Handrail	Sch. 40 Aluminum Pipe T6061-T6
Feedwell	Stainless Steel 304L
RAS Adapter / Sludge Manifold	Stainless Steel 304L or ASTM A36
Effluent Weirs	Fiberglass or Stainless Steel 304L

Clause removed per Addendum No. 1.

All gearing will be enclosed in a welded ASTM A36 steel drive housing with an ultimate tensile strength of 58,000 psi rather than castings. Steel has a higher modulus of elasticity and can better absorb shock loads than cast iron. Steel is stronger than cast iron, and does not have problems with blowholes, inclusions, and cracks, as are common in castings. WesTech welded steel housings do not require an interior sealer coat, which is required in cast housings to avoid oil leaks. Refer to the **WesTech Drive Unit** Section of this submittal for more information.

WesTech to provide Handrail with Aluminum Pipe 6005A-T61. Please refer to Alloy letter included in the handrail section.

Updated per Addendum No. 1.

The WesTech drive unit does not use a wormgear reducer, so AGMA section 6034-B92 does not apply. The main gear of the drive unit will be designed in accordance with AGMA section 2001-C95. Using AGMA 2001-C95 and a 20 year life, the service factor of the main gear will be 1.0 with respect to durability and 2.27 with respect to yield. Refer to the **Spur Gear AGMA Calculations** Section of this submittal for more information.

Speed reduction will be accomplished by the use of a direct driven totally enclosed cycloidal type gearless grease lubricated reducer for high efficiency and reliability rather than gear reducers. The ring gear housing and cycloidal discs of cycloidal drives are made of high-carbon chromium bearing steel. The housing is fixed to the drive casing and incases the cycloidal discs. An eccentric bearing on the high speed shaft rolls cycloidal discs around the internal circumference of the stationary gear. The lobes of the cycloid disc engage successively with pins in the fixed ring gear. The movement of the cycloid discs is transmitted then by pins to the low speed shaft. Refer to the **Cycloidal Drive Advantages** Section of this submittal for more information.

Primary and intermediate reduction are combined into one speed reduction unit which will be accomplished by the use of a direct driven cycloidal type gearless grease lubricated reducer for high efficiency and reliability. Refer to the **Cycloidal Drive Advantages** Section of this submittal for more information.

The main spur gear will be forged alloy steel, which is stronger and more durable than cast iron. The pinion gear will be case hardened 8620 HR alloy steel. Refer to the **WesTech Drive Unit** Section of this submittal for more information.

The torque control system measures torque on the drive column as measured from the rotational force of the speed reducer. A visual torque indicator will be provided and oriented so that it may be read from the walkway. It will be calibrated from 0 to 160 percent of the continuous running torque. The drive will be rated for a continuous torque of 29,601 Nm (21,833 ft-lbs). WesTech will provide a secondary cutout switch in lieu of a shear pin as a safety measure that will stop the drive motor in the event the load achieves 140% of the continuous operating torque, or 41,442 Nm (30,566 ft-lbs), and shut down the motor in the event the first cutout switch fails prematurely. This redundancy in cutout protection will sufficiently protect the drive unit against peak overloading. The two limit switches will be wired in series to stop the drive motor provided either switch is tripped.

The alarm switch will be calibrated to 100% of the continuous running torque, or 29,601 Nm (21,833 ft-lbs). The scale on the torque indicator will be calibrated from 0 to 160 percent of the continuous running torque.

The cutout switch will be calibrated to 120% of the continuous running torque, or 35,522 Nm (26,200 ft-lbs). The scale on the torque indicator will be calibrated from 0 to 160 percent of the continuous running torque.

The backup cutout switch will be calibrated to 140% of the continuous running torque, or 41,442 Nm (30,566 ft-lbs). The scale on the torque indicator will be calibrated from 0 to 160 percent of the continuous running torque.

Hardware	Stainless Steel 316
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2.7	EQUIPMENT DESIGN
.1	Drive Mechanism
.1	The drive mechanism shall be completely factory assembled and shall consist of a primary and final gear reduction unit in accordance with AGMA Section 6034-B92 for 24-hour continuous duty and 20 year life, based on the AGMA rated torque with a minimum 1.25 service factor.
.2	The primary reduction shall be a helical or worm gear, heavy-duty gear reducer. All bearings shall be anti-friction type and running in oil in a housing. The housing shall be effectively sealed against contamination. A readily accessible oil filling and level pipe with sight gauge shall be furnished.
.3	Intermediate reduction unit shall be a helical or worm gear speed reduction with grease and/or oil lubricated anti-friction type bearings in cast iron housing securely bolted on the machined top face of the final reduction unit. Microswitches shall be factory set to sound an alarm when the load on the mechanism reaches 100 percent of the AGMA torque, and stop the motor when the load reaches 120 percent of the AGMA torque.
.4	Provide internal, full depth involute tooth design, ductile iron, or heat-treated steel spur gear driven by a heat-treated steel pinion from the slow speed shaft of the intermediate reduction unit. Turntable base shall be bolted to the centre column and be designed to support the bridge, internal gear and rotating mechanisms.
.5	The drive unit shall be equipped with a visual torque indicator and an electro-mechanical overload control device actuated by thrust from the worm shaft or an electronic torque switch that disconnects power to the drive if any overcurrent or overload condition occurs. The pointer shall provide a visual reading of the relative gear output torque on a 0 to 100 percent graduated scale. The continuous torque rating shall be a minimum of 8,000 ft-lbs. The control device shall also activate an alarm switch for warning of impending overload and a motor cutout switch for overload protection. A shear pin shall be provided as redundant back up overload protection. The switches shall be integrated with the facility's SCADA system via 4-20mA signals for alarms, warnings, and torque status for monitoring. The respective switches in the overload control device and the shear pin shall be factory calibrated and set to the following settings:
.6	Alarm; 40% of scale.
.7	Motor cutout; 85% of scale.
.8	Shear pin; 100% of scale.
.9	The complete center drive assembly, including the overload protection device, shall be a regularly manufactured in-house product of the clarifier manufacturer. The center drive assembly is a key element in a successful clarifier installation, therefore drive assemblies purchased from third party vendors will not be accepted.
.10	Major drive components, worm gears and bearings must be designed to allow for separate and individual replacement by plant personnel to facilitate quick and economical repairs.

- .11 Drive components will be located via a machined, registered fit to preserve the alignment of key drive components under all load conditions. Inspection of the completed drive unit shall be accomplished at the clarifier manufacturer's shop, with reports of all tests and certifications of material hardness being made available for review at the Engineer's request prior to shipment to the job site.
- .12 Influent Feedwell
- .13 The feedwell shall be a minimum of 4.0 m diameter x 1.5 m side depth supported by structural members attached to the center rotating center shaft.
- .14 The feedwell shall be fabricated of 6 mm stainless steel plate with upper and lower reinforcing rim angles and stiffeners as required.
- .15 A minimum of two (2) scum ports, 4 inches high x 16 inches long, shall be provided equally spaced around the feedwell periphery to allow scum to exit from the feedwell at water level.

Center column acts as influent pipe. The pipe to the center column is not by WesTech.

→ .2

Influent Pipe

- .1 There shall be provided a 200 mm dia. steel influent pipe, minimum 6 mm wall thickness. The pipe shall include a 125# Class ANSI steel flange for bolting to incoming influent line and shall include an elbow and energy dissipating tee at the inlet.
- .2 The pipe shall include all necessary supports and be located below the rotating feedwell to allow for the rotation of the skimmer assembly.
- .3 The Supplier may provide an alternative design which shall be reviewed by the Engineer.

The clarifier configuration does not utilize a center shaft. A center column and cage will be provided. See General Arrangement drawing included in this submittal for details.

→ .3

Centre Shaft and Scraper Arms

- .1 The center shaft shall be stainless steel pipe, 150 mm (6") Schedule 40. It shall be provided with connection points for the two sludge removal arms and feedwell supports. The shaft shall be bolted to the worm gear to rotate the attached arms, feedwell and skimmer assembly.
- .2 The minimum angle size used for construction of the center shaft and rake arms shall be 50 mm x 50 mm x 6.4 mm (2" x 2" x 1/4") members.
- .3 The clarifier mechanism shall include two (2) sludge removal arms with spiral plow blades of minimum 20 gauge stainless steel and adjustable neoprene squeegees.
- .4 The center shaft and rake arms shall be designed such that calculated stresses do not exceed the AISC allowable stress at twice the drive continuous torque rating.
- .5 It shall be of an all-welded construction made up of structural stainless steel 304L members.

WesTech to provide 304SS squeegees.

→ .3

Center column will act as template for the anchor bolts since epoxy anchors are to be used.
Grout shield not by WesTech.

→ .6

- .6 Clarifier manufacturer shall furnish stainless steel template and grout shield to accurately locate centre pier anchors and allow for grouting beneath the pier and manifold seal plate after final plumbing.

.4 Sludge Manifold / RAS Adapter

- .1 An influent/sludge return adapter device shall be furnished and supplied which shall serve as both a support base for the centre influent column and an inlet manifold for the existing sludge return pipe. The sludge return adapter device shall be sized to prevent short-circuiting of the influent underflow and plugging. Sludge shall enter the collection ports of the rotating or stationary drum and then return branches which joins to the existing central RAS pipe as per clarifier manufacturer drawings. The sludge adapter device shall include appropriate anchorage to the tank floor. The cross section of the sludge return adapter device shall be tapered along its length to assure a constant sludge velocity.
- .2 The spiral blades shall rake the settled sludge to the sludge manifold and the adapter device at a constant rate.
- .3 The manifold and adapter unit shall be constructed of 304L stainless steel ~~or ASTM A36 grade steel~~ with bolted connections to structural members.
- .4 The manifold and adapter unit shall be designed by the same clarifier manufacturer which shall be reviewed by the Engineer.

Clause updated per Addendum No. 1.

.5 Access Bridge, Handrailing and Walkway

- .1 The clarifier shall be provided with a 914 mm (36") clear open width walkway extending from the tank wall to the center drive platform. The walkway shall span the tank and be supported by the tank walls. As a minimum the walkway shall be designed to safely withstand all dead loads plus a live load of 22.7 kg (50 pounds) per square foot with a maximum deflection of 1/360, over the entire span. The walkway shall consist of two (2) wide flange beams. These beams shall be sufficiently braced to resist the specified design loads. The walkway decking shall be 32 mm x 5 mm (1-1/4" x 3/16") aluminium grating.
- .2 Provide a short sectional ladder, mounted and anchored on the outer clarifier tank wall and aligned with the bridge walkway. Materials should be similar of access bridge construction.
- .3 A center drive operations platform shall be provided. It shall be a minimum of 2.1 m (7') square to provide clearance around the center assembly and drive control for maintenance and service. The drive platform shall be decked with 10 mm (3/8") aluminium checkered floor plate and have sufficient structural steel supports to meet the specified design load conditions.
- .4 Handrails with toe plate shall be provided along both sides of the walkway and around the center drive platform. The handrailing shall be ~~38 mm (1 1/2") diameter~~ aluminium pipe, 2-rail design, with fittings factory assembled to posts. Rails are to be shipped to the job site in stock lengths for cutting and fitting. The toe plate shall be ~~a 125 mm x 6.4 mm plate or a 125 mm tall~~ aluminium extruded channel. ~~The handrailing shall be in conformance with the handrail specifications found within this set of bid documents, and shall be as shown on the drawings.~~ If a pony truss bridge is used, the trusses can serve as handrails.

WesTech to provide half span access bridge as per the specification drawings and proposal. The walkway will be a Pony truss bridge as allowed per Addendum No. 1.

Clause updated per Addendum No. 1.

.6 Effluent Weirs

- .1 An adjustable weir shall be provided around the periphery of the tank at the water surface for removal of clarified effluent. The weir shall be fixed once installed to match existing tank hydraulic profiles.

- .2 The fiberglass or SS weir shall be provided based on the contract detailed drawings.
- .3 The weir shall consist of 6 mm (1/4") thick x 230 mm (9") deep fiberglass or SS sections with 65 mm (2-1/2") deep 90 degree V notches at 150 mm (6") intervals. The weir sections shall be curved and fastened to the launder wall with special large 316L SS washers, anchor bolts, and hex nuts to allow vertical adjustment.

.7 Structural Members

- .1 Structural steel shall be of structural stainless steel or ~~conform to ASTM A36~~. Connections shall be shop welded or field bolted. Field welding will not be permitted, except for the bridge splice. All steel structural components shall be designed so that stresses developed do not exceed allowable stresses, as defined by current AISC standards when designed for the AGMA rated torque.
- .2 All equipment epoxy inserted anchor bolts shall be stainless steel 316.

Updated per Addendum No. 1.

Per submittal review comments, all controls are by others, not WesTech. Local control station information has been removed from the submittal.

2.8

CONTROLS

- .1 The Equipment Vendor is responsible for developing and updating a comprehensive City of Brantford compliant Process Control Narrative (PCN) specific for their equipment and control system. The PCN shall be submitted along with the shop drawings for the Engineers review. The Engineer will coordinate with the Vendor to add City of Brantford SCADA tags for all equipment.
- .2 The Contractor will provide new MCC starter buckets, and NEMA 4X rated local start/stop push button control stations for the clarifiers. The Clarifier manufacturer shall provide typical and/or suggested electrical wiring diagrams to the Engineer for reference purposes and to ensure proper operation and protection of the clarifier.
- .3 Individual controls and monitoring (i.e., over-torque monitoring) devices shall be mounted on the MCC bucket.
- .4 Provide controls and SCADA monitoring as indicated on Contract Drawings.
- .5 The power cable shall be continuous and of sufficient length to suit termination in the local disconnect mounted near the respective mechanism (no splices are permitted).
- .6 Interconnected wiring between local, remote panels and MCC will be supplied and installed by the General Contractor.

2.9

ACCEPTABLE MANUFACTURERS

- .1 The below Supplier list shall not be construed as automatically acceptable, but the Owner or Engineer shall have the right, in its sole and absolute discretion, to accept or reject the shop drawing if the Supplier selected by the Contractor does not comply with the Contract Drawings and specification requirements herein. Any alternative design, dimensions or configurations shall be reviewed by the Engineer.
 - .1 Ovivo
 - .2 WesTech
 - .3 Envirodyne System INC.

.4 Zima Corporation

3 EXECUTION

3.1 FIELD TANK DIMENSION MEASUREMENT

- .1 Before shop drawing submittal, the Manufacturer shall provide a site visit to field review all the existing clarifier tank internal dimensions and elevations and inspect tank bottom grouting conditions. The site visit shall be minimum of eight (8) hours of on-site time by the Manufacturer's technical support, exclusive of any required travel time. Field visit shall be completed by someone with previous experience dimensioning circular clarifier mechanisms of similar size.
- .2 Inspection report after the site visit shall be submitted to the satisfaction of the Engineer.

Unloading and Storage on site is not by WesTech.

3.2

PRODUCT DELIVERY, STORAGE AND HANDLING

- .1 Shipment is not to be made until the Equipment vendor coordinates shipment to the jobsite with the Installation Contractors, assuring that the equipment will be properly received and stored.
- .2 Arrange for a representative of the Equipment vendor to be present at the job site during the unloading to inspect the delivered equipment and witness the unloading process.
- .3 Provide onsite instruction to the General Contractor for unloading of the power units, local control panels, and all other related equipment.
- .4 Notify the General Contractor of any special items necessary for unloading any of the system equipment, such as blades, etc. Supplying these special items for unloading shall be the responsibility of the General Contractor.
- .5 Provide special instruction, if any, to the General Contractor for storage and pre-installation maintenance
- .6 All equipment shall be skid mounted or crated to protect against damage during shipment. All parts shall be properly protected so that no damage or deterioration will occur during a prolonged delay from the time of shipment until installation is completed, and the units and equipment are ready for operation.

Not all equipment will be skid mounted or crated due to the parts size.

Decommissioning, disposal and installation is not by WesTech.

3.3

INSTALLATION

- .1 Existing secondary clarifier mechanisms shall be completely decommissioned and disposed of off-site prior to installation by the General Contractor.
- .2 The Manufacturer shall review the installation of the clarifier mechanism a minimum of two (2) times, as provide for under this pre-selected equipment Contract. A minimum of eight (8) hours of on-site time by the manufacturer's technical support shall be provided for each site visit, exclusive of any required travel time.
- .3 The unit shall be leveled, plumbed, aligned, and wedged into position to fit into concrete structures. Installation procedures shall be as recommended by the manufacturer and the Hydraulic Institute Standards, and as required herein. Grouting shall be as specified in the grout section.
- .4 No stresses shall be transmitted to the scraper blades during installation or field testing.

- .5 After final alignment and bolting, the mechanism shall be adjusted to proper fit if any stress on the blades is observed.
- 3.4 FIELD QUALITY CONTROL
 - .1 After installation by the General Contractor, to be retained by the Owner at a later date, provide field quality control services to test each component and demonstrate compliance with operating requirements as specified in Section 01751.
 - .2 Installation Check. The manufacturer shall provide the services of a qualified field representative according to the quality control section to assist during installation of the equipment by the General Contractor. As a minimum, the manufacturer's field representative shall be made available as follows:
 - .1 Installation Inspection 1 trip, 2 days total
 - .2 Startup assistance 1 trip, 2 days total
 - .3 Torque Test
 - .1 The clarifier mechanism shall be field torque tested. The testing shall be carried out under the supervision of the equipment manufacturer's representative and as approved by the Engineer before the mechanism is accepted and placed into operation.
 - .2 The torque test shall consist of securing the rake arms by cables to anchor bolts installed by the Contractor in the tank floor at locations specified by the equipment manufacturer. A load shall be applied to the scraper arm in small increments by means of a ratchet lever and cylinder connected to the cable assembly. The magnitude of the applied load shall be measured by calculating the torque from the distance of the line of action of each cable to the centre line of the mechanism. A reading shall be taken at the drive design torque.
 - .3 The manufacturer's service representative shall verify that the alarm, motor cut-out, and back-up safety motor cut-out switches are properly set and are in proper operation to protect the clarifier mechanism as specified.
 - .4 Field Evaluation Tests. A performance test shall be run on the equipment after the installation is completed to ensure the equipment are operating properly as determined by the representative of the equipment manufacturer. The performance test shall be conducted by a capable representative of the manufacturer and accepted by the Engineer. The Owner's operating personnel shall assist the manufacturer's representative in the performance test. A designated representative of the Owner and/or the Engineer shall observe the performance test. As a minimum, the manufacturer's field representative shall be made available as follows:
 - .1 Performance testing 1 trip, 2 days total
 - .5 At least two (2) weeks prior to the proposed testing date, the Contractor shall notify the Engineer of the testing date and shall submit a report from the equipment manufacturer detailing the proposed performance testing procedure and analyses. Testing shall be performed between 8:00 a.m. and 5:00 p.m. and shall begin on Monday or Tuesday. If more than one (1) day of testing is required, the testing shall be done on consecutive days. The Engineer's initial observation of tests shall be at the Owner's expense. All costs of subsequent visits by the Engineer to witness or observe additional tests necessary because of failure of the initial tests or inability to conduct the initial tests will be at no extra cost to the Owner.

- .6 Should the equipment not achieve consistent compliance during the tests, and then the manufacturer shall modify the equipment and repeat the field evaluation tests. Costs of modifying equipment, reducing or furnishing additional equipment, or subsequent retesting shall be borne by the General Contractor and Manufacturer. Should the equipment fail to meet all the design requirements after retesting, the equipment shall be rejected and shall be replaced by the Construction Contractor at the manufacturer's expense with acceptable equipment at no additional cost to the Owner.

- .7 Performance Test and Field Evaluation Report. The manufacturer shall prepare a formal test report, including all measured data and other recorded data and observations. One (1) electronic copy of the report shall be submitted to the Engineer within 30 days after completion of the tests.

3.5 TRAINING

- .1 In addition to the installation and operation check required by the General Equipment Stipulations and the manufacturer's field services required by the quality control section, the manufacturer shall furnish the services of a competent and experienced operator of the equipment, who is directly employed by the manufacturer, to instruct the Owner's operating personnel in the proper operation and maintenance of the equipment. Training shall be provided as specified in Section 01820 - Demonstration and Training.

3.6 WARRANTY

- .1 Each unit shall be new and shall carry the full Manufacturer's warranty on parts, service, and performance. Warranty shall begin at substantial completion. The warranty shall include replacement of all defective equipment and shall extend two (2) years beyond substantial completion.
- .2 Corrective Work. Any location where corrosion is evident shall be considered a failure of the material or the protection system. Before starting corrective work, the Manufacturer shall submit to the Engineer for review any analysis of the cause of the failure and details of the proposed corrective work. The Manufacturer shall make repairs acceptable to the Engineer at all points where failures are observed within the Warranty Period.
- .3 Inspection. Each unit shall be inspected at the end of the warranty period by representatives of the Owner, the Engineer, and the Manufacturer to identify any failures that may have occurred. The Manufacturer shall establish the date of each inspection and shall notify the Owner at least 30 days in advance. The scheduled inspection shall not relieve the Manufacturer from the obligation to perform corrective work whenever needed.
- .4 The Manufacturer shall prepare and deliver to the Owner an inspection report covering each inspection, indicating the number and type of failures observed, material and part where materials have failed, the percentage of the surface area where corrosion protection system failure has occurred, and the names of the persons making the inspection. Colour photographs illustrating each type of failure shall be included in the report.

END OF SECTION

Manufacturer Information

ISO Certification

ISO 9001:2015 Certification

Certificate US95/0255.00

The most responsive supplier of products and services for liquid-solid separation and the treatment of water and wastewater.

WesTech Engineering, LLC is certified to the ISO 9001:2015 standard with SGS Systems & Services Certification. SGS is an independent ISO registrar, who conducts regular audits of clients' management processes.

ISO 9001:2015 ensures the consistency of quality practices and requires continuous improvement of WesTech's entire management system. Certification therefore assures customers that:

1. WesTech's products and services will consistently meet or exceed an internationally agreed-upon level of quality, and
2. Proactive management practices will enable it to anticipate and address customers' future needs, while paying careful attention to existing installations.

Founded in 1973, WesTech has attained preferred-supplier status with an overwhelming majority of its worldwide customers. As a leading innovator in the development of equipment that lowers overall costs by improving efficiency, reliability, and performance, the firm has been approved by virtually all major consultants for their projects.

WesTech design and support personnel are committed to the success of their projects and customers. Attitudes, behaviors, and decisions are shaped by WesTech's six core values, which are:

- Exhibit honesty and integrity
- Take pride in doing the right things, and in doing them well
- Value our people and their families
- Make and keep commitments
- Achieve productivity through hard work and intelligence
- Provide superior service

The net result of WesTech's continuing ISO certification, combined with its distinctive culture, is that customers can expect to be taken care of by exceptionally responsive associates who consistently deliver superior solutions.

We invite you to learn more about our company, capabilities, and products - and then continually put us to the test. Find out for yourself why we say, "We not only guarantee our equipment, we guarantee peace of mind!"

The management system of

WesTech Engineering, LLC

3665 South West Temple
Salt Lake City, UT 84115, United States

has been assessed and certified as meeting the requirements of

ISO 9001:2015

For the following activities:

**The Design, Supply, Sales, and Service of Water and Waste Water
Treatment and Liquid-Solid Separation Equipment.**

Further clarifications regarding the scope of this certificate and the applicability of
ISO 9001:2015 requirements may be obtained by consulting the organization.

This certificate is valid from 31 March 2021 until 20 October 2023
and remains valid subject to satisfactory surveillance audits.
Recertification audit due a minimum of 60 days before the expiration date.
Issue 13. Certified since June 1995.

The audit leading to this certificate commenced on 30/03/2021.
Previous issue certificate validity date was until 20/10/2023.

This is a multi-site certification.
Additional site details are listed on subsequent pages.

Authorized by:

Dan Seal

Dan Seal

Technical Accreditation Manager, Certification &
Business Enhancement North America
SGS North America, Inc.

201 Route 17 North, Rutherford, NJ 07070, USA
t (201) 508-3000 f (201) 935-4555 www.us.sgs.com

This certificate remains the property of SGS and shall be returned upon request





WesTech Engineering, LLC

ISO 9001:2015

Issue 13



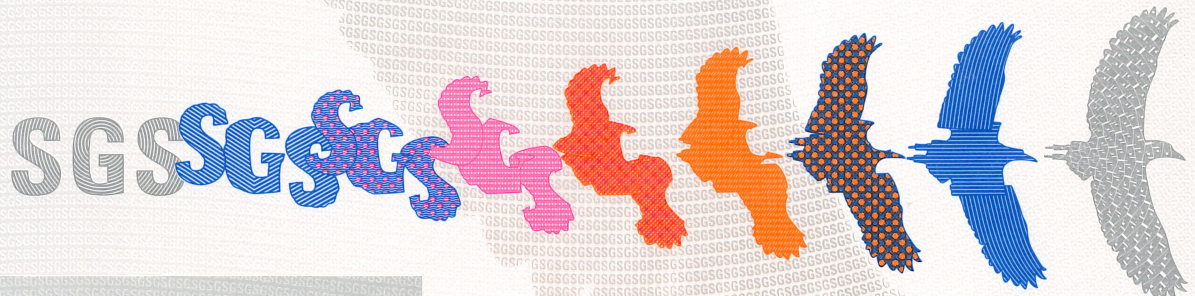
Detailed scope (applicable to all sites):

**The Design, Supply, Sales, and Service of Water and Waste Water
Treatment and Liquid-Solid Separation Equipment.**

Additional facilities:

3625 South West Temple, Salt Lake City, UT 84115, United States

600 Arrasmith Trail, Ames, IA 50010, United States



Warranty

Two Year Warranty

WesTech is meeting a global need for clean water through technology treatment solutions. We are proud that the equipment and systems we design, build, maintain, and operate are making the world a better place and creating a more sustainable environment for future generations.

Equipment manufactured or sold by WesTech Engineering, LLC, once paid for in full, is backed by the following warranty:

Subject to the terms below, WesTech warrants all new equipment manufactured or sold by WesTech Engineering, LLC to be unencumbered and free from defects in material and workmanship, and WesTech will replace or repair, F.O.B. its factories or other location it chooses, any part or parts returned to WesTech which WesTech's examination and analysis determine have failed within the warranty period because of defects in material and workmanship. The warranty period *is two (2) calendar years from substantial completion*. All repair or replacement parts qualifying under this warranty shall be free of charge. Purchaser will provide timely written notice to WesTech of any defects it believes should be repaired or replaced under this warranty. WesTech will reject as untimely any warranty defect claim that purchaser submits more than thirty (30) days after the possible warranty defect first occurred. Unless specifically stated otherwise, this warranty does not cover normal wear, consumables, or coatings. Purchasers are invited to inspect the equipment in the shop for proper surface preparation and coating application prior to shipment. This warranty is not transferable.

This warranty shall be void and shall not apply where the equipment or any part thereof

- a. has been dismantled, modified, repaired, or connected to other equipment, outside of a WesTech factory, or without WesTech's written approval, or
- b. has not been installed in complete adherence to all WesTech's or parts manufacturer's requirements, recommendations, and procedures, or
- c. has been subject to misuse, abuse, neglect, or accident, or has not at all times been operated and maintained in strict compliance with all of WesTech's requirements and recommendations therefor, including, but not limited to, the relevant WesTech Operations & Maintenance Manual and any other of WesTech's specified guidelines & procedures, or
- d. has been subject to force majeure events; use of chemicals not approved in writing by WesTech; electrical surges; overloading; significant power, water, or feed supply fluctuations; or non-compliance with agreed feedwater or chemical volumes, specifications, or procedures.

In any case where a part or component of equipment under this warranty is or may be faulty and the component or part is also covered under the warranty of a third party then the purchaser shall provide reasonable assistance to first pursue a claim under the third-party warranty before making a claim under this warranty from WesTech. WesTech Engineering, LLC gives no warranty with respect to parts, accessories, or components purchased other than through WesTech. The warranties which apply to such items are those offered by the respective manufacturers.

This warranty is expressly given by WesTech and accepted by purchaser in lieu of all other warranties whether written, oral, express, implied, statutory, or otherwise, including without limitation, warranties of merchantability and fitness for particular purpose. WesTech neither accepts nor authorizes any other person to assume for it any other liability with respect to its equipment. WesTech shall not be liable for normal wear and tear, corrosion, or any contingent, incidental, or consequential damage or expense due to partial or complete inoperability of its equipment for any reason whatsoever. The purchaser's exclusive and only remedy for breach of this warranty shall be the repair and or replacement of the defective part or parts within a reasonable time of WesTech's accepting the validity of a warranty claim made by the purchaser.

Installation List

Job No.	Year	Location	Qty	Size	Equipment/Model
5167	1998	KOKOMO, IN WWTP/REYNOLDS INC.	KOKOMO IN US 1	140' DIA	COP CLARIFIERS FLAT FLOOR COPC1D
5164	1998	PUYALLUP, WA WWTF/ROBISON CONSTR.	PUYALLUP WA US 2	110' DIA	COP CLARIFIERS COPC1
5167	1998	KOKOMO, IN WWTP/REYNOLDS INC.	KOKOMO IN US 2	140' DIA	COP CLARIFIERS FLAT FLOOR COPC1D
19167	2003	SOUTH CENTRAL WWTP PETERSBURG, VA	PETERSBURG VA US 2	110' DIA	COP CLARIFIERS COPC1
19112	2003	POCATELLO, ID WWTP	POCATELLO ID US 1	120' DIA	COP CLARIFIER COPC1C
22612	2016	ORANGE COUNTY, FL EASTERN WRF	ORLANDO FL US 1	125' DIA	COP™ Secondary Clarifier COPC1G
22921	2018	NORTHWEST REGIONAL WRF EXPANSION	TAMPA FL US 4	110' DIA	COP™ Final Clarifiers COPC1G
23324	2019	PIQUA WWTP UPGRADE AND EXPANSION PROJECT 13-15	PIQUA OH US 3	120' DIA.	COP™ Secondary Clarifiers COPC1G
24061	2020	WOODLAND WPCP	Woodland CA US 1	130' DIA	304SS Secondary COP™ Clarifier COPC1G
23969	2021	NORTHERN DISTRICT WWTP, GUAM	MANGILAO OR GU 3	110'	COP™ CLARIFIER COPC1G
23777	2021	HONOULIULI WWTP SECONDARY TREATMENT PHASE 1B	EWA BEACH, OAHU HI US 6	140' DIA	COP™ CLARIFIER COPC1C
24327	2021	SHELL SET SECONDARY CLARIFIER UPGRADE	DEER PARK TX US 1	130' x 14'	COP™ CLARIFIER COPC1G
Total Qty =			27		

Drive Unit

Professional Engineer Stamp

Professional Engineer Stamp

All drive train, AGMA, and bearing life calculations have been checked and approved by me for the C42 drive unit at Brantford WWTP (WesTech Job Number 24946C).



Drive calculations are sealed by a registered professional engineer as required by the project specifications. However, providing this seal does not constitute offering engineering services nor imply licensure in the state where the project is located.

Drive Unit Information

Advantages of WesTech Drives

WesTech is submitting information on our premium drive unit: it may be slightly different from that specified. We request that you approve WesTech's design as it is superior in several ways to other designs. We've listed some of our major components and their distinct advantages below. The WesTech drive has proven itself in thousands of applications worldwide.

Precision Main Bearing/Gear

WesTech has taken advantage of the availability of large diameter precision machined bearings as the foundation of our superior drive design.

These bearings offer the following advantages:

- Fabricated from forged alloy steel, the bearing balls run in fully contoured machined races.
- The raceway is locked; the bearing races cannot separate. This distributes applied loads to all the balls rather than just a few. This feature makes it ideal for heavy duty industrial applications.
- The bearing life is often in excess of 100 years. When properly maintained the main bearing will never need replacement during the life of the equipment.
- The main spur gear is integral with the bearing assembly. This ensures a precision mounting for the gear, eliminating improper wear and increasing gear life.

Drive Housing

WesTech drives use welded steel for the main parts of the drive housing:

- Steel is stronger than cast iron.
- Steel is uniform. Unlike cast iron, there are no problems with blowholes, inclusions, and/or cracks that can compromise the structural integrity of the drive unit.
- Welded steel housings do not require an interior sealer coat, which is required in cast housings to avoid oil leaks.

Speed Reduction

WesTech incorporates direct-driven cycloidal reducers to achieve speed reduction.

- Cycloidal reducers are extremely efficient and save energy.
- Smooth rolling operation virtually eliminates wear and maintenance.
- Reducers are guaranteed to withstand a 500% shock load without failure.
- Direct coupling throughout makes the unit safer and easier to maintain than conventional chain and sprocket type systems.
- Maintenance is accomplished via a single grease fitting. In instances where oil lubrication is required for the cycloidal speed reducer, an oil fill pipe is provided together with an expansion tank/sight gauge.

Torque Control Device

- WesTech's torque control is an electro-mechanical device that measures rotational force directly from the main pinion shaft. NEMA 4x switches (or NEMA 7 for explosion proof applications) are housed in a stainless steel enclosure. A visual indicator is included to show the torque as a percentage of Full Dial Torque.

Advantages of Oil/Grease Lubricated Drives

Advantages of Oil/Grease Lubricated Drives

Maintenance

Oil/Grease lubrication is easily accessible

- All gearing is total enclosed and running in an oil bath
- Level of the oil bath for the main gear/pinion gear and lower support bearing is highly visible. Oil is discharged at the lowest point of the drive with ease.
- The main bearing is grease lubricated via two grease fittings, located 180 degrees from each other. It is sealed from the gear cavity which is a source of wear particles and water. Proper greasing of the main bearing flushes old grease out of bearing critical surfaces (equivalent to periodically changing oil).
- The upper bearing assembly and lift components (where used) are grease lubricated.
- The cycloidal speed reducer is grease lubricated, unless oil lubrication is specified. Grease lubricated cycloidal speed reducers require less maintenance.
- There is no need to replace a slip ring on the lift housing (where used).
- There are no chains or belts to replace or maintain.
- Spare parts are usually in stock if they are needed. Standard industrial type bearings and seals are used to reduce maintenance costs and increase parts availability.
- The moving parts of the drive are self-contained, limiting corrosion.

Drive Train Summary

**WESTECH DRIVE TRAIN SUMMARY
OF UNIT TO BE SUPPLIED**

JOB NO.: 24946C

PAGE 1 OF 1

BY: HU72

CHKD: BO13

DATE: 6/12/2023

DATE: 6/13/2023

STAGE 1 - MAIN GEAR INFORMATIONREQUIRED CONTINUOUS OUTPUT TORQUE OF MAIN GEAR: 35,750 FT-LBS
(AS SPECIFIED)

OUTPUT RPM OF MAIN GEAR: 0.041 RPM

PINION/GEAR RATIO: 5.6 :1

MAIN GEAR EFFICIENCY: 0.96

GEAR TORQUE RATING : 45,772 FT-LBS
(SEE AGMA CALCULATIONS)SERVICE FACTOR = $\frac{45,772}{35,750} = 1.28 \geq 1.00$ **OK**
(WITH RESPECT TO TORQUE)**STAGE 2 - SPEED REDUCER**REQUIRED OUTPUT TORQUE OF SPEED REDUCER: $\frac{35,750}{5.6 * 0.96} = 6650$ FT-LBS

= 79799 IN-LBS

OUTPUT RPM OF SPEED REDUCER: 0.231 RPM

SPEED REDUCER RATIO: 7569 : 1

SPEED REDUCER EFFICIENCY: 0.90

SPEED REDUCER TORQUE RATING: 102,600 IN-LBS
(SEE CATALOG CUTS)SERVICE FACTOR = $\frac{102,600}{79,799} = 1.29 \geq 1.25$ **OK**
(WITH RESPECT TO TORQUE)**STAGE 3 - MOTOR**REQUIRED HP OF MOTOR: $\frac{35,750}{5252} * \frac{0.041}{0.96 * 0.90} = 0.33$ HP

OUTPUT RPM OF MOTOR: 1750

MOTOR HP RATING: 1.00

NAMEPLATE SERVICE FACTOR: 1.15

CALCULATED SERVICE FACTOR: $\frac{1.00}{0.33} = 3.07 \geq 1.0$ **OK**

Spur Gear AGMA Calculations

AGMA CALCULATIONS INPUT SHEET

Copyright (c) 2004 WesTech Engineering, Inc.
 WesTech Program no. CWP-030
 Responsible Person: J. Bonner
 Last Updated: 05/31/18

JOB_NO := "24946C"

PAGE NO. 1 OF 7

RUN_BY := "HU72"

DATE_RUN := "06/12/2023"

CHK_BY := "BO13"

DATE_CHK := "06/13/2023"

INPUTS FOR 42" CAGE RAKE DRIVE (C 42)

INPUTS

DRIVE OUTPUT SPEED, RPM

$$n_g := 0.041 \cdot \frac{1}{\text{min}}$$

EXPECTED LIFE IN YEARS

$$X_L := 20 \text{ LIFE IN HOURS}$$

$$L_i := X_L \cdot 365 \cdot 24 \cdot \text{hr}$$

$$L_i = 1.752 \times 10^5 \cdot \text{hr}$$

CONTINUOUS DESIGN TORQUE.

$$T_{\text{design}} := 35750 \cdot \text{ft} \cdot \text{lbf}$$

DUTY CYCLE

$$= 24 \text{ HOURS/DAY}$$

SERVICE FACTOR

$$= 1.00$$

DRIVE GEAR DATA

	PINION	GEAR
NO. OF TEETH	$N_1 := 15$	$N_2 := 84$
DIAMETRAL PITCH	$P_d := 2 \cdot \frac{1}{\text{in}}$	
PRESSURE ANGLE	$\phi := 20 \cdot \text{deg}$	
FACE WIDTH	$F_1 := 4 \cdot \text{in}$	$F_2 := 3.75 \cdot \text{in}$
	$F := F_2$	
TOOTH FORM	SMI-RECESS ACTION, FULL DEPTH	
SPUR GEAR	$\psi := 0 \cdot \text{deg}$	$\cos(\psi) = 1$
ADDENDUM MODIFICATION COEFFICIENT	$x_1 := 0.5$	$x_2 := -0.5$
BENDING STRENGTH GEOMETRY FACTOR	$J_p := 0.41026$	$J_g := 0.39191$
CORE HARDNESS	300-350 BHN	285-321 BHN
SURF. HARDNESS	55-60 Rc	285-321 BHN
DRIVE WITH ONE PINION	$q_g := 1$	

(NOTE: For Drive with two Pinions $q_g=2$, For Drive with four Pinions $q_g=4$)

BASIC GEAR GEOMETRY:

(Ref: PARAGRAPH 3 AGMA 908-B89)

GEAR RATIO	$m_G := \frac{N_2}{N_1}$	$m_G = 5.6$		
PITCH RADIUS	$R_1 := \frac{N_1}{2 \cdot \cos(\psi)}$	$R_2 := R_1 \cdot m_G$	$R_1 = 7.5$	$R_2 = 42$
OPERATING C.D.	$C_r := R_2 - R_1$		$C_r = 34.5$	
BASE RADIUS	$R_{b1} := R_1 \cdot \cos(\phi)$	$R_{b2} := R_2 \cdot \cos(\phi)$	$R_{b1} = 7.048$	$R_{b2} = 39.467$
OPR. PRES ANGLE	$\phi_r := \arccos\left(\frac{R_{b2} - R_{b1}}{C_r}\right)$	$\phi_r = 20 \cdot \text{deg}$		
ADD. RAD.	$R_{o1} := \frac{1}{2} \cdot \left(\frac{N_1}{\cos(\psi)}\right) + (1 + x_1)$	$R_{o2} := (0.50) \cdot \left(\frac{N_2}{\cos(\psi)}\right) - (1 + x_2)$	$R_{o1} = 9$	$R_{o2} = 41.5$
PITCH DIAMETER	$d := \frac{2 \cdot C_r}{m_G - 1}$	$d = 15$	$D := d \cdot m_G$	$D = 84$
BASE PITCH	$p_b := \frac{2 \cdot \pi \cdot R_{b1}}{N_1}$	$p_b = 2.952$		

THE ABOVE VARIABLES MADE DIMENSIONLESS BY MULTIPLYING WITH DIAMETRAL PITCH

$C_6 := C_r \cdot \sin(\phi_r)$	$C_6 = 11.8$
$C_1 := \left[C_6 - \left[(R_{o2})^2 - (R_{b2})^2 \right]^{0.5} \right]$	$C_1 = 1.03$
$C_3 := \frac{C_6}{m_G - 1}$	$C_3 = 2.565$
$C_4 := C_1 + p_b$	$C_4 = 3.982$
$C_5 := \left[(R_{o1})^2 - (R_{b1})^2 \right]^{0.5}$	$C_5 = 5.597$
$C_2 := C_5 - p_b$	$C_2 = 2.645$
$Z := C_5 - C_1$	$Z = 4.567$
$m_p := \frac{Z}{p_b}$	$m_p = 1.547$

FOR SPUR GEARS

$\rho_1 := C_2$	$\rho_1 = 2.645$	$C_\psi := 1$	$m_N := 1$
$\rho_2 := C_6 + \rho_1$	$\rho_2 = 14.445$		
$L_{\min} := F$	$L_{\min} = 3.75 \cdot \text{in}$		

PITTING RESISTANCE GEOMETRY FACTOR, I

(Ref : PARAGRAPH 4 AGMA 908-B89)

GEOMETRY FACTOR	$I := \frac{\cos(\phi_r) \cdot (C_\psi)^2}{\left(\frac{1}{\rho_1} - \frac{1}{\rho_2} \right) \cdot d \cdot m_N}$	$I = 0.203$
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SURFACE DURABILITY RATING CALCULATIONS

$$S_{ac} := \begin{cases} 225000 \cdot \text{psi} \\ 133765 \cdot \text{psi} \\ 146329 \cdot \text{psi} \end{cases} \quad \begin{array}{l} \mathbf{Q=0} \text{ WHEN } 225,000 \text{ PSI} = 55\text{-}60 \text{ RC}(350\text{BHN}) \\ \mathbf{Q=1} \text{ WHEN } 133,765 \text{ PSI} = 285 \text{ BHN} \\ \mathbf{Q=2} \text{ WHEN } 146,329 \text{ PSI} = 321 \text{ BHN} \end{array} \quad \begin{array}{l} (\text{Ref: Table 3, Paragraph 16 AGMA 2001-C95}) \\ (\text{Fig 8, GR 2; } S_{ac}=349\text{HB}+34300) \\ (\text{Fig 8, GR 2; } S_{ac}=349\text{HB}+34300) \end{array}$$

$$d := \frac{N_1}{P_d} \quad d = 7.5 \cdot \text{in}$$

$$n_p := n_g \cdot m_G \quad n_p = 0.23 \cdot \frac{1}{\text{min}}$$

$$v_t := \pi \cdot n_p \cdot d \quad v_t = 0.451 \cdot \frac{\text{ft}}{\text{min}}$$

DERATING FACTORS:

$$K_o := 1 \text{ FOR UNIFORM LOAD TRANSMISSION}$$

$$Q_v := 6$$

$$B := 0.25 \cdot (12 - Q_v)^{0.667} \quad B = 0.826$$

$$A := 50 + 56 \cdot (1.0 - B) \quad A = 59.745$$

$$K_v := \left[\frac{\left(A + \sqrt{v_t \cdot \frac{\text{min}}{\text{ft}}} \right)}{A} \right]^B \quad K_v = 1.009$$

$$K_s := 1$$

$$C_{mc} := 1.0 \quad C_{pf} := \left(\frac{F}{10 \cdot d} \right) - 0.0375 + 0.0125 \cdot \frac{1}{\text{in}} \cdot F \quad C_{pf} = 0.059 \quad (\text{Ref. EQ 39: Paragraph 15.3 AGMA 2001-C95})$$

FROM LAYOUT

$$S_1 := 1.01 \quad S := 8.14 \quad \frac{S_1}{S} = 0.124 \quad C_{pm} := 1.0 \quad (\text{Since } S_1/S < 0.175)$$

$$A_1 := 1.27 \cdot 10^{-1} \quad B_1 := 0.158 \cdot 10^{-1} \cdot \frac{1}{\text{in}} \quad C := -1.093 \cdot 10^{-4} \cdot \frac{1}{\text{in}^2} \quad (\text{Ref. EQ 41: Paragraph 15.3 AGMA 2001-C95})$$

$$C_{ma} := A_1 + B_1 \cdot F + C \cdot (F)^2 \quad C_{ma} = 0.185 \quad (\text{Ref: Table 2, Paragraph 15.3 AGMA 2001-C95})$$

$$C_e := 1.0$$

$$C_{mf} := 1.0 + C_{mc} \cdot (C_{pf} \cdot C_{pm} + C_{ma} \cdot C_e) \quad C_{mf} = 1.244 \quad (\text{Ref: EQ 37 Paragraph 15.3 AGMA 2001-C95})$$

$$K_m := C_{mf} \quad K_m = 1.244 \quad (\text{Ref: EQ 36 Paragraph 15.1 AGMA 2001-C95})$$

$$C_f := 1 \quad (\text{Ref: Paragraph 13 AGMA 2001-C95})$$

$$C_H := 1 \quad \text{SURFACE FINISH OF PINION} \quad f_p > 64 R_a \quad (\text{Ref: Fig 3, Paragraph 14.2 AGMA 2001-C95})$$

$$K_R := 1.0 \quad \text{FEWER THAN ONE FAILURE IN 100} \quad (\text{Ref: Table 11, Paragraph 18 AGMA 2001-C95})$$

$$K_T := 1.0 \quad \text{FOR GEARS OPERATING AT LESS THAN 250 DEG. F}$$

$$S_H := 1.0$$

$$C_p := 2300 \cdot \left(\frac{\text{lbf}}{\text{in}^2} \right)^{0.5} \quad \text{FOR STEEL GEARS}$$

$$q_p := 1 \quad q_g = 1 \quad (\text{FOR TWO PINION DRIVE } q_g=2, \text{ FOR 4 PINION DRIVE } q_g=4)$$

$$N_{\text{pinion}} := 60 \cdot \frac{\text{min}}{\text{hr}} \cdot L_i \cdot n_p \cdot q_p \quad N_{\text{pinion}} = 2413555$$

$$N_{\text{gear}} := \frac{60 \cdot \frac{\text{min}}{\text{hr}} \cdot L_1 \cdot n_p \cdot q_p \cdot q_g}{m_G} \quad N_{\text{gear}} = 430992$$

$$Z_{\text{NP}} := 2.466 \cdot N_{\text{pinion}}^{-0.056} \quad Z_{\text{NP}} = 1.083$$

$$Z_{\text{NG}} := 2.466 \cdot N_{\text{gear}}^{-0.056} \quad Z_{\text{NG}} = 1.193$$

THE PITTING RESISTANCE POWER RATING (REF PARAGRAPH 5 AGMA 2001-C95)

Q := 0 (FOR PINION SURFACE HARDNESS = 55-60 RC)

$$P_{\text{acp}} := \frac{n_p \cdot F}{126000 \cdot \frac{\text{in} \cdot \text{lbf}}{\text{min} \cdot \text{hp}}} \cdot \frac{I}{K_o \cdot K_v \cdot K_s \cdot K_m \cdot C_f} \cdot \left(\frac{S_{\text{ac},0} \cdot Z_{\text{NP}} \cdot C_H \cdot d}{S_H \cdot K_T \cdot K_R \cdot C_P} \right)^2 \quad P_{\text{acp}} = 0.697 \cdot \text{hp}$$

$$T_{\text{pdur}} := \frac{63000 \cdot \frac{\text{in} \cdot \text{lbf}}{\text{min} \cdot \text{hp}} \cdot P_{\text{acp}}}{n_p} \quad T_{\text{pdur}} = 191204 \cdot \text{in} \cdot \text{lbf} \quad T_{\text{pdur}} = 15934 \cdot \text{ft} \cdot \text{lbf}$$

$$T_{\text{dpoutput}} := m_G \cdot T_{\text{pdur}} \cdot q_g \quad T_{\text{dpoutput}} = 89228 \cdot \text{ft} \cdot \text{lbf}$$

Q := 1 (FOR GEAR HARDNESS = 285 BHN)

$$P_{\text{acgmin}} := \frac{n_p \cdot F \cdot q_g}{126000 \cdot \frac{\text{in} \cdot \text{lbf}}{\text{min} \cdot \text{hp}}} \cdot \frac{I}{K_o \cdot K_v \cdot K_s \cdot K_m \cdot C_f} \cdot \left(\frac{S_{\text{ac},0} \cdot Z_{\text{NG}} \cdot C_H \cdot d}{S_H \cdot K_T \cdot K_R \cdot C_P} \right)^2 \quad P_{\text{acgmin}} = 0.299 \cdot \text{hp}$$

$$T_{\text{dgoutputmin}} := \frac{63000 \cdot \frac{\text{in} \cdot \text{lbf}}{\text{min} \cdot \text{hp}} \cdot P_{\text{acgmin}}}{n_g} \quad T_{\text{dgoutputmin}} = 458988 \cdot \text{in} \cdot \text{lbf} \quad T_{\text{dgoutputmin}} = 38249 \cdot \text{ft} \cdot \text{lbf}$$

Q := 2 (FOR GEAR HARDNESS = 321 BHN)

$$P_{\text{acgmax}} := \frac{n_p \cdot F \cdot q_g}{126000 \cdot \frac{\text{in} \cdot \text{lbf}}{\text{min} \cdot \text{hp}}} \cdot \frac{I}{K_o \cdot K_v \cdot K_s \cdot K_m \cdot C_f} \cdot \left(\frac{S_{\text{ac},0} \cdot Z_{\text{NG}} \cdot C_H \cdot d}{S_H \cdot K_T \cdot K_R \cdot C_P} \right)^2 \quad P_{\text{acgmax}} = 0.357 \cdot \text{hp}$$

$$T_{\text{dgoutputmax}} := \frac{63000 \cdot \frac{\text{in} \cdot \text{lbf}}{\text{min} \cdot \text{hp}} \cdot P_{\text{acgmax}}}{n_g} \quad T_{\text{dgoutputmax}} = 549259 \cdot \text{in} \cdot \text{lbf} \quad T_{\text{dgoutputmax}} = 45772 \cdot \text{ft} \cdot \text{lbf}$$

$$S_{at} := \begin{cases} 65000 \cdot \text{psi} \\ 70000 \cdot \text{psi} \\ 45470 \cdot \text{psi} \\ 49142 \cdot \text{psi} \end{cases} \begin{matrix} \mathbf{U=0} \text{ WHEN } 65,000 \text{ PSI} = 55\text{-}60 \text{ RC (300 BHN)} \\ \mathbf{U=1} \text{ WHEN } 70,000 \text{ PSI} = 55\text{-}60 \text{ RC (350 BHN)} \\ \mathbf{U=2} \text{ WHEN } 45,470 \text{ PSI} = 285 \text{ BHN} \\ \mathbf{U=3} \text{ WHEN } 49,142 \text{ PSI} = 321 \text{ BHN} \end{matrix} \begin{matrix} (\text{Ref: Table 4, Paragraph 16 AGMA 2001-C95}) \\ (\text{Ref: Table 4, Paragraph 16 AGMA 2001-C95}) \\ (\text{Fig 9, GR 2; Sat=102HB+16400}) \\ (\text{Fig 9, GR 2; Sat=102HB+16400}) \end{matrix}$$

$$S_F := 1 \quad \text{SAFETY FACTOR}$$

$$Y_{N_{pinion}} := 6.1514 \cdot N_{pinion}^{-0.1192} \quad Y_{N_{pinion}} = 1.067$$

$$Y_{N_{gear}} := 6.1514 \cdot N_{gear}^{-0.1192} \quad Y_{N_{gear}} = 1.31$$

THE BENDING STRENGTH POWER RATING (Ref PARAGRAPH 5 AGMA 2001-C95)

U := 0 (FOR PINION WITH CORE HARDNESS = 300 BHN/SURF. HARD = 55-60 RC)

$$K_B := 1$$

$$P_{atpmin} := \frac{n_p \cdot d}{126000 \cdot \frac{\text{in} \cdot \text{lbf}}{\text{min} \cdot \text{hp}} K_O \cdot K_v} \cdot \frac{F}{P_d} \cdot \frac{J_p}{K_s \cdot K_m \cdot K_B} \cdot \frac{S_{at_{U,0}} \cdot Y_{N_{pinion}}}{S_F \cdot K_T \cdot K_R} \quad P_{atpmin} = 0.581 \cdot \text{hp}$$

$$T_{psmin} := \frac{63000 \cdot \frac{\text{in} \cdot \text{lbf}}{\text{min} \cdot \text{hp}} \cdot P_{atpmin}}{n_p} \quad T_{psmin} = 159333 \cdot \text{in} \cdot \text{lbf} \quad T_{psmin} = 13278 \cdot \text{ft} \cdot \text{lbf}$$

$$T_{spoutputmin} := m_G \cdot T_{psmin} \cdot q_g \quad T_{spoutputmin} = 74356 \cdot \text{ft} \cdot \text{lbf}$$

U := 1 (FOR PINION WITH CORE HARDNESS = 350 BHN/SURF. HARD = 55-60 RC)

$$P_{atpmax} := \frac{n_p \cdot d}{126000 \cdot \frac{\text{in} \cdot \text{lbf}}{\text{min} \cdot \text{hp}} K_O \cdot K_v} \cdot \frac{F}{P_d} \cdot \frac{J_p}{K_s \cdot K_m \cdot K_B} \cdot \frac{S_{at_{U,0}} \cdot Y_{N_{pinion}}}{S_F \cdot K_T \cdot K_R} \quad P_{atpmax} = 0.625 \cdot \text{hp}$$

$$T_{spoutputmax} := \frac{63000 \cdot \frac{\text{in} \cdot \text{lbf}}{\text{min} \cdot \text{hp}} \cdot P_{atpmax} \cdot q_g}{n_g} \quad T_{spoutputmax} = 960902 \cdot \text{in} \cdot \text{lbf} \quad T_{spoutputmax} = 80075 \cdot \text{ft} \cdot \text{lbf}$$

U := 2 (FOR GEAR HARDNESS = 285 BHN)

$$P_{atgmin} := \frac{n_p \cdot d \cdot q_g}{126000 \cdot \frac{\text{in} \cdot \text{lbf}}{\text{min} \cdot \text{hp}} K_O \cdot K_v} \cdot \frac{F}{P_d} \cdot \frac{J_g}{K_s \cdot K_m \cdot K_B} \cdot \frac{S_{at_{U,0}} \cdot Y_{N_{gear}}}{S_F \cdot K_T \cdot K_R} \quad P_{atgmin} = 0.476 \cdot \text{hp}$$

$$T_{sgoutputmin} := \frac{63000 \cdot \frac{\text{in} \cdot \text{lbf}}{\text{min} \cdot \text{hp}} \cdot P_{atgmin}}{n_g} \quad T_{sgoutputmin} = 732179 \cdot \text{in} \cdot \text{lbf} \quad T_{sgoutputmin} = 61015 \cdot \text{ft} \cdot \text{lbf}$$

U := 3 (FOR GEAR HARDNESS = 321 BHN)

$$P_{atgmax} := \frac{n_p \cdot d \cdot q_g}{126000 \cdot \frac{\text{in} \cdot \text{lbf}}{\text{min} \cdot \text{hp}} K_O \cdot K_v} \cdot \frac{F}{P_d} \cdot \frac{J_g}{K_s \cdot K_m \cdot K_B} \cdot \frac{S_{at_{U,0}} \cdot Y_{N_{gear}}}{S_F \cdot K_T \cdot K_R} \quad P_{atgmax} = 0.515 \cdot \text{hp}$$

$$T_{sgoutputmax} := \frac{63000 \cdot \frac{\text{in} \cdot \text{lbf}}{\text{min} \cdot \text{hp}} \cdot P_{atgmax}}{n_g} \quad T_{sgoutputmax} = 791307 \cdot \text{in} \cdot \text{lbf} \quad T_{sgoutputmax} = 65942 \cdot \text{ft} \cdot \text{lbf}$$

(Ref: Fig 16, Paragraph 16.4 AGMA 2001-C95)

$$S_{ay} := \begin{cases} 111800 \cdot \text{psi} \\ 135900 \cdot \text{psi} \\ 104570 \cdot \text{psi} \\ 121922 \cdot \text{psi} \end{cases} \quad \begin{array}{l} \mathbf{Y=0} \text{ WHEN } 111,800 \text{ PSI} = 55\text{-}60 \text{ RC (300 BHN)} \\ \mathbf{Y=1} \text{ WHEN } 135,900 \text{ PSI} = 55\text{-}60 \text{ RC (350 BHN)} \\ \mathbf{Y=2} \text{ WHEN } 104,570 \text{ PSI} = 285 \text{ BHN} \\ \mathbf{Y=3} \text{ WHEN } 121,922 \text{ PSI} = 321 \text{ BHN} \end{array} \quad \begin{array}{l} \text{(Ref: Fig 16, Say=482xHB - 32800)} \\ \text{(Ref: Fig 16, Say=482xHB - 32800)} \end{array}$$

$$K_v := 0.75 \quad \text{FOR INDUSTRIAL PRACTICE}$$

$$K_{my} := 0.0144 \cdot \frac{1}{\text{in}} \cdot F + 1.07 \quad K_{my} = 1.124$$

$$K_f := 1 \quad \text{(Ref Paragraph 16.3 AGMA 2001-C95)}$$

$$Y := 0 \quad \text{(FOR PINION TEETH CORE HARD. 300 BHN AND SURF. HARD. 55-60 RC)}$$

(Ref: EQ (45) AGMA2001-C95)

$$T_{pyieldmin} := \left[\frac{F \cdot d}{2 \cdot P_d} \cdot \frac{J_p \cdot K_f}{K_{my} \cdot K_B} \cdot (S_{ayY,0} \cdot K_y) \right] \quad T_{pyieldmin} = 215193 \cdot \text{in} \cdot \text{lbf} \quad T_{pyieldmin} = 17933 \cdot \text{ft} \cdot \text{lbf}$$

$$T_{ypoutmin} := m_G \cdot T_{pyieldmin} \cdot q_g \quad T_{ypoutmin} = 100423 \cdot \text{ft} \cdot \text{lbf}$$

$$Y := 1 \quad \text{(FOR PINION TEETH CORE HARD. 350 BHN AND SURF. HARD. 55-60 RC)}$$

$$T_{pyieldmax} := \left[\frac{F \cdot d}{2 \cdot P_d} \cdot \frac{J_p \cdot K_f}{K_{my} \cdot K_B} \cdot (S_{ayY,0} \cdot K_y) \right] \quad T_{pyieldmax} = 261581 \cdot \text{in} \cdot \text{lbf} \quad T_{pyieldmax} = 21798 \cdot \text{ft} \cdot \text{lbf}$$

$$T_{ypoutmax} := m_G \cdot T_{pyieldmax} \cdot q_g \quad T_{ypoutmax} = 122071 \cdot \text{ft} \cdot \text{lbf}$$

$$Y := 2 \quad \text{(FOR GEAR TEETH CORE HARD. 285 BHN)}$$

$$T_{gyieldmin} := \left[\frac{F \cdot \left(\frac{N_2}{P_d} \right)}{2 \cdot P_d} \cdot \frac{J_g \cdot K_f \cdot q_g}{K_{my} \cdot K_B} \cdot (S_{ayY,0} \cdot K_y) \right] \quad T_{gyieldmin} = 89728 \cdot \text{ft} \cdot \text{lbf}$$

$$Y := 3 \quad \text{(FOR GEAR TEETH CORE HARD. 321 BHN)}$$

$$T_{gyieldmax} := \left[\frac{F \cdot \left(\frac{N_2}{P_d} \right)}{2 \cdot P_d} \cdot \frac{J_g \cdot K_f \cdot q_g}{K_{my} \cdot K_B} \cdot (S_{ayY,0} \cdot K_y) \right] \quad T_{gyieldmax} = 104617 \cdot \text{ft} \cdot \text{lbf}$$

	<u>DURABILITY</u>	<u>STRENGTH</u>	<u>YIELD STRENGTH</u>
MAIN GEAR (MAX)	$T_{dgoutputmax} = 45772 \cdot \text{ft} \cdot \text{lbf}$	$T_{sgoutputmax} = 65942 \cdot \text{ft} \cdot \text{lbf}$	$T_{gyieldmax} = 104617 \cdot \text{ft} \cdot \text{lbf}$
(MIN)	$T_{dgoutputmin} = 38249 \cdot \text{ft} \cdot \text{lbf}$	$T_{sgoutputmin} = 61015 \cdot \text{ft} \cdot \text{lbf}$	$T_{gyieldmin} = 89728 \cdot \text{ft} \cdot \text{lbf}$
PINION (MAX)	$T_{dpoutput} = 89228 \cdot \text{ft} \cdot \text{lbf}$	$T_{spoutputmax} = 80075 \cdot \text{ft} \cdot \text{lbf}$	$T_{ypoutputmax} = 122071 \cdot \text{ft} \cdot \text{lbf}$
(MIN)	* $T_{dpoutput} = 89228 \cdot \text{ft} \cdot \text{lbf}$	$T_{spoutputmin} = 74356 \cdot \text{ft} \cdot \text{lbf}$	$T_{ypoutputmin} = 100423 \cdot \text{ft} \cdot \text{lbf}$

* SAME AS PINION (MAX) SINCE AGMA GIVES ONE VALUE OF 'Sac' FOR HARDNESS RANGE.

AGMA GEAR RATING IS BASED UPON MAXIMUM VALUE OF DURABILITY FOR THE MAIN GEAR:

SURFACE DURABILITY RATING $T_{dgoutputmax} = 45772 \cdot \text{ft} \cdot \text{lbf}$ $SF := \frac{T_{dgoutputmax}}{T_{design}}$ **SF = 1.28** OK

AGMA MOMENTARY GEAR RATING IS BASED UPON MAXIMUM VALUE OF THE MAIN GEAR YIELD

MOMENTARY YIELD RATING $T_{gyieldmax} = 104617 \cdot \text{ft} \cdot \text{lbf}$ $SF := \frac{T_{gyieldmax}}{T_{design}}$ **SF = 2.93** OK

Bearing Life Calculations

THE ATTACHED BEARING LIFE CALCULATIONS UTILIZE A RELATIONSHIP BETWEEN THE BASIC RATING LIFE, THE BASIC DYNAMIC LOAD RATING, AND THE BEARING LOAD AS EXPRESSED BY THE EQUATION:

$$L_{-10} = (C/P)^K$$

WHERE:

L-10 = BASIC RATING LIFE IN MILLIONS OF REVOLUTIONS

*NOTE -

L-10 AND B-10 ARE EQUIVALENT RATINGS. L-10 HAS REPLACED B-10 TO MAKE A WORLDWIDE RATING STANDARD.

B-10 RATING IS NOT USED ANYMORE.

C = BASIC DYNAMIC LOAD RATING, LB

NOTE THE BASIC DYNAMIC LOAD RATINGS HAVE BEEN DETERMINED IN ACCORDANCE WITH THE METHODS PRESCRIBED BY ISO, AFBMA, AND ANSI.

P = EQUIVALENT DYNAMIC BEARING LOAD, LB

$$P = XR + YT$$

WHERE:

R = RADIAL LOAD, (LB)

T = THRUST (AXIAL) LOAD, (LB)

X = 0.56 FOR BALL BEARINGS

= 1.0 FOR CYLINDRICAL ROLLER BEARINGS

Y = 1.40 FOR BALL BEARINGS

= 0.0 FOR CYLINDRICAL ROLLER BEARINGS

K = EXPONENT FOR THE LIFE EQUATION

K = 3 FOR BALL BEARINGS

K = 3.333 FOR ROLLER BEARINGS

BASED ON BOTH LABORATORY TESTS AND PRACTICAL EXPERIENCE, SEEMINGLY IDENTICAL BEARINGS OPERATING UNDER SEEMINGLY IDENTICAL CONDITIONS HAVE DIFFERENT LIVES.

ALL INFORMATION PRESENTED ON DYNAMIC LOAD RATINGS IS BASED ON THE LIFE THAT 90% OF A SUFFICIENTLY LARGE GROUP OF BEARINGS CAN BE EXPECTED TO ATTAIN OR EXCEED.

WesTech Program no. CWP-049
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BEARING LIFE CALCULATIONS L-10

DESIGN TORQUE	=	35,750	FT-LB
GEAR PITCH DIAMETER	=	42	INCHES
BEARING BALL RACE DIAMETER	=	47	INCHES
REQUIRED LIFE	=	20	YEARS
F_{tan} = TANGENTIAL LOAD	=	20,428.57	LB
F_{total} = TOTAL LOAD	=	21,739.63	LB

MAIN BEARING

BEARING TYPE : BALL

C	=	57,855	LB	P	=	35,274	LB
X	=	0.56		K	=	3	
Y	=	1.4		L-10	=	4,412,162	REVOLUTIONS
F_{total}	=	21,739.63	LB				
T	=	16,500	LB				
RPM	=	0.041					
LIFE IN HOURS	=	1,781,102	HOURS				
LIFE IN YEARS	=	203	YEARS				

IN CONCLUSION:

REQUIRED LIFE	20	YEARS	
SERVICE FACTOR	10.17	> 1.0	OK

LOWER PINION BEARING

BEARING TYPE : ROLLER

C	=	46,100	LB	P	=	14,493.09	LB
X	=	1		K	=	3.333	
R	=	14,493.09	LB	L-10	=	47,311,420	REVOLUTIONS
RPM	=	0.231					

LIFE IN HOURS = 3,410,478 HOURS

LIFE IN YEARS = 389 YEARS

IN CONCLUSION:

REQUIRED LIFE: 20 YEARS

SERVICE FACTOR: 19.47 > 1.0 **OK**

UPPER PINION BEARING

BEARING TYPE : BALL

C	=	27,200	LB	P	=	5,458.06	LB
X	=	0.56		K	=	3	
Y	=	1.4		L-10	=	123,762,994	REVOLUTIONS
R	=	7,246.54	LB				
T	=	1,000	LB				
RPM	=	0.231					

LIFE IN HOURS = 8,921,544 HOURS

LIFE IN YEARS = 1,018 YEARS

IN CONCLUSION:

REQUIRED LIFE: 20 YEARS

SERVICE FACTOR: 50.92 > 1.0 **OK**

Precision Main Bearing

Precision Main Bearing

WesTech premium drive units for clarifier and thickener mechanisms employ a precision and integral main gear and bearing unit. The summary below explains the reasons why WesTech chooses to use this bearing arrangement.

Forged Alloy Steel

Forged Alloy Steel is stronger and will last longer.

Both the inner and outer races of the bearing are made of 4140 HR Alloy steel. To create a forged ring, a billet of the material is heated up red hot. It is then formed using high pressure rollers to produce the required dimensions. The forging process makes the material grain flow throughout the part. This makes the part several times stronger than a cast part where the liquid metal cools into a grain-like crystal structure, with no particular orientation.

Locked Raceway

Locked Raceway prevents failure and lasts longer.

Since the inner and outer races are locked these bearings are utilized for high load and speed applications, such as: Construction Equipment, Cranes, Wind Power Generators, and Amusement Park Rides. Similar to our equipment, these are applications where failure is not an option. These bearings are manufactured by recognized bearing companies such as Rotek, Kaydon, Gear Products, PSL, Titanus, and Galperti Tech.

Long Life and Load Capacities

Exceptional Long Life and Load Capacities for less maintenance and fewer replacements.

Instead of loading the balls on four points in the vertical and horizontal planes, as with strip liner bearings, the precision bearing utilizes one piece, contoured, ground raceways. Since the inner and outer raceways are locked together the load is evenly transferred in a diagonal direction between the inner and outer raceways.

Calculated bearing life is in the range of five times that for strip liners of the same ball size and diameter. This is often over 100 years. The need for splitting gears and housings is eliminated because of superior service life.

Superior Gear Quality

Superior Gear Quality provides smoother operation and fewer failures.

The majority of all spur-gear driving capacity comes from the stability of mounting and precision tolerance of its bearings. The use of an integral gear with bearing housing makes this precision inherent in the design. Stripliner gears often need to oversize one component to compensate for the lack of strength of another. AGMA 6 or better manufacturing tolerances are held for all gearing, which is ideal for slow speeds.

Fabricated Steel Drive Housing

Fabricated Steel Drive Housing

WesTech's premium drive units for clarifier and thickener mechanisms provide a welded fabricated steel housing to enclose moving parts and serve as a rugged structural frame for gear reduction and overturning loads. The advantages for doing this are listed below.

Strength of Material

Strength of Material gives more robust design.

Steel is a stronger material than cast iron. The modulus of elasticity for A36 steel is typically 150 percent greater than Class 40 cast iron. Steel also has higher yield and ultimate strengths which enhance fatigue resistance and ductility.

Material Characteristics

Material Characteristics yield more consistent quality.

Rolled steel is a very uniform material. The procedures for pouring cast iron produce a varying density of material due to blow holes, sand particles, voids, and cracks. Defects in cast iron cannot always be controlled or even identified by x-ray examination. Seal coating of interior raceway surfaces in cast iron is required to prevent oil leaks.

Structural Design

Structural Design is simplified and more consistent.

The defects of cast iron mentioned above make its structural performance far less consistent and predictable. The safety factors required in design must also be increased to account for material defects of cast iron. In order to provide the equivalent structural performance as steel, cast iron components must be more massive.

Flexibility of Design

Flexibility of Design saves you money.

WesTech encourages the use of our 'Standard' equipment. However, fabrication with structural steel permits a wide variety in the dimensioning of premium component parts to meet specific customer needs. The variety of dimensions economically available in cast iron molds is restricted.

Ease of Repairs

Ease of Repairs for reduced maintenance costs.

While it is rare, repairs to fabricated steel components are much simpler and can usually be made on site. Defective or damaged cast iron housings often require complete replacement or removal from the mechanism and repair at an off-site source.

Motor Information

MAX-E1® FAMILY



AEHH8N, NEMA PREMIUM (1 HP - 500 HP) [EP]

AEHE, HIGH EFFICIENCY [E]

AEHH8NCF, NEMA PREMIUM, FOOTED C-FACE (1 HP - 300 HP) [EP_C]

AEUH8NDC, NEMA PREMIUM, ROUND BODY C-FACE (1 HP - 100 HP) [EPV_C]



Effective 07-08-18
Supercedes 03-24-17

APPLICATIONS:

- | | | |
|------------------|---------------|--------------------------------|
| ■ Fans & Blowers | ■ Compressors | ■ Any Severe Duty/ Petro-Chem/ |
| ■ Pumps | ■ Mixers | Pulp & Paper Application |
| ■ Crushers | ■ Conveyors | |

FEATURES:

- Output Range: 3/4 - 800 HP
- Speed: 3600, 1800, 1200 & 900 RPM
- Enclosure: Totally Enclosed Fan Cooled (IP54 for 280 Frames and below, IP55 for 280TS Frames and above)
- Voltage: 230/460V (Usable on 208V); 150HP and Larger is 460V Only^(1,2)
- Three Phase, 60 Hz, 1.15 Service Factor (Continuous); 50 Hz, 1.0 Service Factor (Continuous)
- CSA Certified for Class I, Div. 2, Groups B, C, D - Temp Code T3 Minimum^(7,8)
- CSA Certified for Class II, Div. 2, Groups F & G - Temp Code T3 Minimum^(7,8,12) (444T and Above)
- Class F Insulation
- Class B Temperature Rise
- NEMA Design B Torques as a Minimum; Various Ratings also Meet Design C
- Cast Iron Frame, End Brackets & Fan Cover and Main Conduit Box⁽⁹⁾
- Grounding Terminal Inside Main Conduit Box
- Oversized Main Conduit Box Rotatable in 90 Degree Increments - F1 Mounted
- Designed for 40°C Ambient Temperature⁽³⁾
- Designed for 3300 ft. Elevation⁽⁴⁾
- Bi-Directional Rotation; Except 2 Pole "Hybrid" and F# 5000 and Larger Ratings are Counter-Clockwise facing the DE
- 1045 Carbon Steel Shaft
- Aluminum Die Cast Squirrel Cage Rotor Construction for F# 140T - 449T
- Copper/Copper Alloy Rotor Construction for F# 5000 and Larger⁽¹⁰⁾
- Paint System: Phenolic Rust Proof Base Plus Polyurethane Top Coat
- Paint Color: Light Gray - Munsell N5.0
- Double Shielded Bearings Pre-Packed with MULTEMP SRL for F# 140T - 280T (Non-regreasable)
- High Quality Ball (or Roller) Bearings Regreasable with Mobil Polyrex™ EM for F# 280TS and Larger
- Automatic Grease Discharge Fittings on Regreasable Models
- Labyrinth Type Metal Flinger on Both Ends for F# 280TS and Larger
- Cast Iron Inner and Outer Bearing Caps for F#280TS and Larger
- Stainless Steel Nameplate
- New Dual Column Design Nameplate as Standard (60/50 Hz)
- Suitable for Inverter Use per NEMA MG-1 Part 31.4.4.2^(5,6,11)
- Inverter Duty Speed Range: 20:1 Variable Torque, 10:1 Constant Torque (350 HP and Larger are 3:1 Constant Torque)⁽¹¹⁾
- 9 Leads for 5 HP and Smaller;
- 12 Leads for 7.5 HP to 125 HP;
- 6 Leads for 150 HP and Larger
- Motors are U.L. Recognized, CSA Approved, CE Marked. ABS Design Assessment from 250 HP-800 HP⁽¹¹⁾
- Dual Drilled Feet Available on Most Ratings - Longer Frames (i.e. 145T Drilled also for 143T)
- 2-Pole Motors 600 HP and Larger are Form Wound and Insulated Non-Drive End Bearing
- Rubber Dust Flinger on Drive-End for F# 140T - 280T
- Catalog Numbers Ending in "R" Come Standard with Roller Bearings for Belted Applications.

EXTRAS/ OPTIONS:

Please refer to pages 147 - 154 for common modifications that can be performed.

Notes:

- (1) TWMC carries minimal MAX-E1® 575V stock; please check availability to ensure required motors are available. Ratings may be available from our Canadian warehouses at a higher price or from our factory with a longer lead time. Pricing and lead time may vary.
- (2) Motors 7.5 HP & up are Suitable for Wye/Delta Starting.
- (3) Consult a Stock Product Application Specialist for suitability in higher ambient environments.
- (4) Consult a Stock Product Application Specialist for suitability at higher elevations.
- (5) Motor service factor is 1.0 when operated on a VFD.
- (6) Precautions should be taken to eliminate or reduce shaft currents that may be imposed on the motor by the VFD as stated per NEMA MG-1. Part 31.
- (7) Catalog# EP3502, EP3504, EP4002T & EP4004T are "Hybrid" ratings; Not CSA Certified (Self-Certify Only) for hazardous locations, and not dual drilled.
- (8) Catalog# EP3006 also not CSA Certified for Hazardous Locations (Self-Certify Only).
- (9) F# 5000 and with Larger with Pressed Steel Plate Main Conduit Box.
- (10) F# 5007 - 5011 8 Pole Ratings are Aluminum Die Cast Squirrel Cage Rotor Construction.
- (11) EP4002T & EP4004T are hybrid frames and not VFD suitable.
- (12) Various temp codes apply to ratings. Consult a product specialist for accurate code.

DATE
JUNE 21, 2005
CATALOG NO.
EP00145

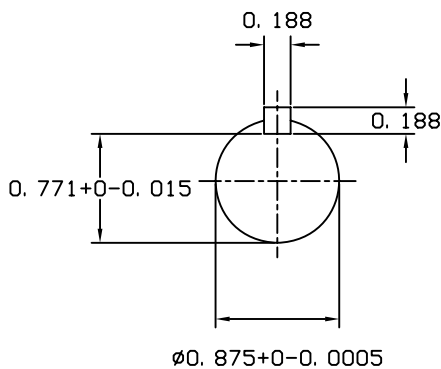
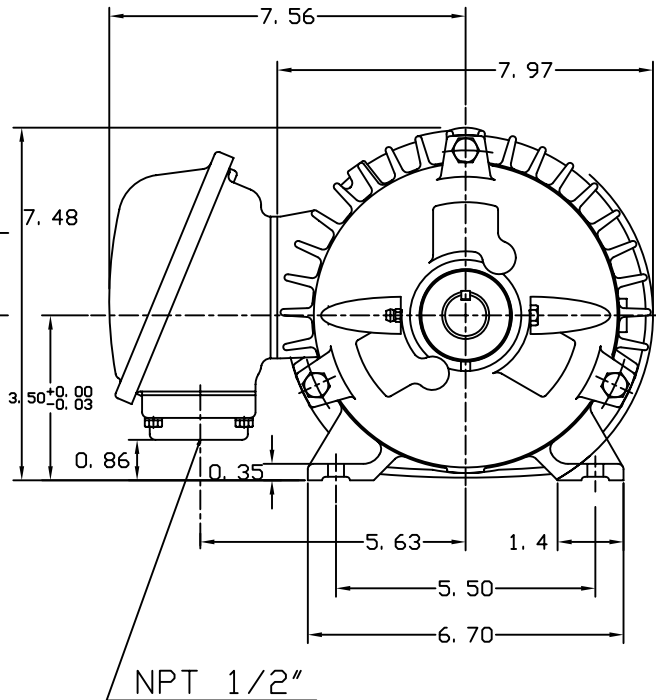
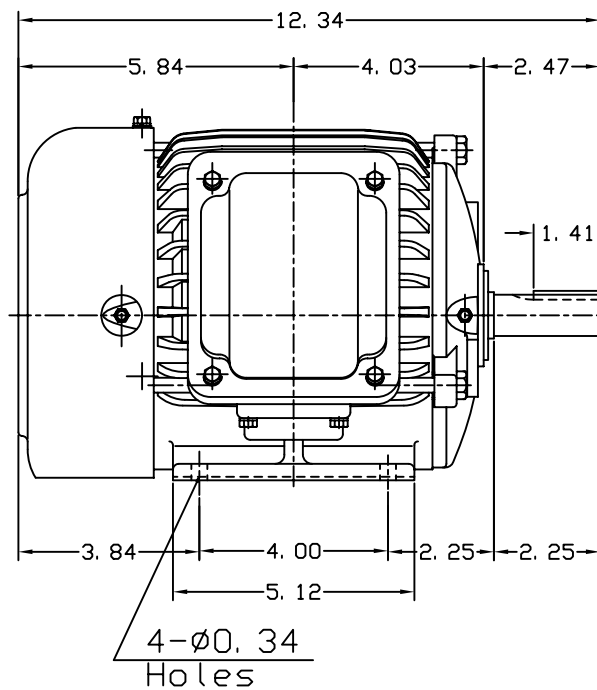
OUTLINE DIMENSIONS 3-PHASE INDUCTION MOTOR

MOTOR TYPE:
AEHH8N
FRAME NO. 143T

Pole	HP	KW	Hz	VOLT	Syn. Speed RPM
4	1	.75	60	575	1800

Ins	Rating	Dimension in	Approx Weight	Bearings
F	CONT.	inch	55 lbs.	DE: 6205ZZ NDE: 6205ZZ

Totally Enclosed Fan-Cooled Type. Squirrel-Cage Rotor.



DWN. J. H. LIANG 11-30-98
CHKD. C. S. LO 12-29-98
APPD. Y. B. HUANG 12-29-98

TECO Westinghouse

DWG NO.
31057H351000

TECO Westinghouse

ISSUED June 28, 2005	PERFORMANCE DATA 3-PHASE INDUCTION MOTOR	ENCLOSURE TEFC
TYPE AEHH8N		CATALOG# EP00145

NAMEPLATE INFORMATION

OUTPUT		POLE	FRAME SIZE	VOLTAGE	HZ	RATED AMBIENT	INS. CLASS	NEMA DESIGN	TIME RATING	SERVICE FACTOR
HP	KW									
1	0.7	4	143T	575	60	40°C	F	C	CONT.	1.15

TYPICAL PERFORMANCE

FULL LOAD RPM	EFFICIENCY				POWER FACTOR			MAXIMUM POWER FACTOR CORRECTION
	FULL LOAD		3/4 LOAD	1/2 LOAD	F. L.	3/4 LOAD	1/2 LOAD	
	MIN. %	NOM. %						
1745	82.5	85.5	84	81.5	73	64.5	51.5	1 KVAR

CURRENTS

NO LOAD			FULL LOAD			LOCKED ROTOR			NEMA KVA CODE LETTER
AT	AT	AT	AT	AT	AT	AT	AT	AT	
VOLT	575 VOLT	VOLT	VOLT	575 VOLT	VOLT	VOLT	575 VOLT	VOLT	
	0.64			1.20			12.00		N

TORQUE

INERTIA

ACCEL TIME

FULL LOAD lb-ft	LOCKED ROTOR %FLT	PULL UP %FLT	BREAK DOWN %FLT	ROTOR WR ² lb-ft ²	NEMA LOAD WK ² lb-ft ²	MAX ALLOWABLE WK ² lb-ft ²	NEMA LOAD WK ² Sec	MAX ALLOWABLE WK ² Sec
3.009	310	280	410	0.086	5.8	46	3.41	26.70

SAFE STALL TIME IN SECONDS

ALLOWABLE STARTS PER HOUR

SOUND PRESSURE LEVEL @ 3 FT dB(A)

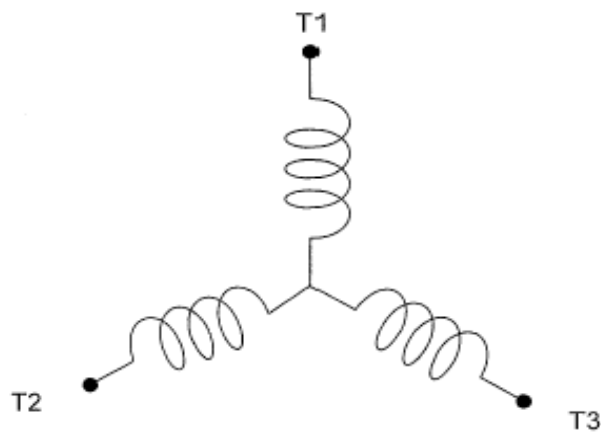
COLD	HOT	COLD	HOT	49
71	50	2	1	

APPROVED:	M. PRATER	DRAWING NO.	31057EP00145	REVISION 0
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DATE:
July 7, 2005

CONNECTION DIAGRAM

CATALOG NO.:
EP00145



SCHEMATIC - Y CONNECTION

ACROSS THE LINE CONNECTION



575 VOLT CONNECTION

Cycloidal Speed Reducer Information

Cycloidal Speed Reducer Features

WesTech premium drive units for clarifier and thickener mechanisms employ a cycloidal type gearless reducer for high efficiency and reliability. The summary below explains the reasons why WesTech chooses to use cycloidal drives rather than old-fashioned worm and other conventional gearing wherever possible.

Efficiency

Great efficiency even at high ratios means less power input for the same output.

At 87:1 reduction the cycloidal reducer can achieve 95 percent efficiency. This reduction ratio is achieved in one stage using the cycloidal drive reducer. In comparison, an average worm gear reducer with an 87:1 ratio would have a maximum efficiency of 60 percent and would require more than one stage.

Long Life

Long life for less frequent replacements and lowered maintenance budgets.

The long life of the cycloidal drive is due to its unique rolling action where high carbon chromium bearing steel is utilized on the wearing parts. This reducer does not use the sliding engagement that is translated into heat and wear that is used in most other types of gear reducers.

500 Percent Overload Capacity

500% Overload Capacity means unmatched strength.

At least two thirds of the cycloidal drive's teeth (lobes) are engaged at one time. Compare that to a conventional reducer: one or two teeth absorb the shock. Conventional reducer teeth also have a shear point. In the cycloidal drive there is no shear point.

Compactness

Compactness gives you more space to work.

The cycloidal drive is considerably smaller than conventional reducers.

A wide range of ratios available:

- Single stage reduction, ratios from 11: 1 to 87: 1.
- Double stage reduction, ratios up to 7,569: 1.
- Triple stage reduction, ratios up to 658,503: 1.
- Input horsepower ranges from 1/4 HP to 150 HP.
- Both horizontal and vertical mountings are available.

Cycloidal Speed Reducer Operating Principles

The cyclo is a speed reducer without gears that operates differently than the helical or worm gearing that most customers are familiar with. Its main components are the eccentric cam, the cycloidal disc, and the ring gear housing.

The unique, rolling-action operation of these components allows Sumitomo to offer a 500 percent momentary shock capacity. These components have a standard two year warranty. No other manufacturer offers these benefits. Sumitomo has manufactured over 5 million of these reducers since 1939.

The eccentric cam, mounted on the input shaft, rotates inside the bore of the cyclo disc forcing the cycloidal disc to roll inside the ring gear housing. Each complete revolution of the input shaft advances the cyclo discs one tooth in the opposite direction achieving reduction ratios up to:

- 87:1 in a single stage reducer
- 7,569:1 in just two stages

All of the rolling components are manufactured with 52,100 high carbon chromium bearing quality steel. The number of lobes (rather than teeth) on the cyclo disc and the number of rollers in the ring gear housing determine the ratio, i.e., 29:1 reduction will have a cyclo disc with 29 lobes and a ring gear housing with 30 rollers.

Other ratios such as 6, 8, 11, 17, 21, 35, 43, 59, 71, and 87 all have the same characteristics of having one more roller in the ring gear housing than there are lobes on the cyclo disc. The double-eccentric, two-disc cyclo design allows two-thirds of the cyclo lobes to be in contact to transmit torque at any one time.

This relates to a greater load sharing and higher shock capacity than in helical type reducers which have only one or two teeth in contact. It is virtually impossible to break a lobe on a cyclo disc. Applied correctly, negligible wear occurs even after years of operation.

The flanged output shaft is designed with pins and rollers that fit into larger holes machined in the cyclo disc. As the cyclo disc rolls inside the ring gear housing, the output shaft pins are driven in the opposite direction of the input shaft at the reduced output speed.

The features and benefits of this design provide for torque ratings from hundreds of inch-pounds to over 500,000 inch-pounds. Many models can be built with grease lubrication for virtually maintenance-free operation. Optional mounting configurations and compact size make the cyclo adaptable to most applications.

Municipal Clarifiers and Thickeners^[1]

1750 RPM

Output RPM	2.08	1.74	1.4	1.18	0.946	0.847	0.69	0.575	0.503	0.394	0.341	0.283	0.231	Frame Size
Ratio	841	1003	1247	1479	1849	2065	2537	3045	3481	4437	5133	6177	7569	
Minimum Input HP	-	-	-	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	-	-	6145DA
Overhung Load (lbf)	3590	3590	3530	3590	3530	3590	3590	3590	3590	3590	3590	-	-	
Application Specific Torque (lbf in)	20000	22200	22200	20000	22200	22200	22200	20000	22200	20000	20000	-	-	
Minimum Input HP	-	-	-	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	6145DB
Overhung Load (lbf)	3550	3590	3530	3590	3530	3590	3590	3590	3590	3590	3590	3590	3590	
Application Specific Torque (lbf in)	22200	22200	22200	20000	22200	22200	22200	20000	22200	20000	20000	20000	20000	
Minimum Input HP	-	-	-	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	6145DC
Overhung Load (lbf)	3550	3590	3530	3590	3530	3590	3590	3590	3590	3590	3590	3590	3590	
Application Specific Torque (lbf in)	22200	22200	22200	20000	22200	22200	22200	20000	22200	20000	20000	20000	20000	
Minimum Input HP	-	0.54	0.54	0.54	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	6160DC
Overhung Load (lbf)	4960	4960	4960	4960	4960	4960	4960	4960	4960	4960	4960	4960	4960	
Application Specific Torque (lbf in)	28200	28200	28000	28200	28000	28200	28200	28200	28200	28200	28200	28200	28000	
Minimum Input HP	-	-	0.54	0.54	0.54	-	0.27	0.27	0.27	0.27	0.27	0.27	0.27	6165DC
Overhung Load (lbf)	4960	4960	4960	4890	4960	4960	4960	4890	4960	4890	4890	4890	4890	
Application Specific Torque (lbf in)	33800	33800	33800	32900	33800	33800	33800	32900	33800	32900	32900	32900	32000	
Minimum Input HP	-	-	-	0.54	0.54	0.54	-	0.27	0.27	0.27	0.27	0.27	0.27	6170DC
Overhung Load (lbf)	6640	6640	6640	6640	6640	6640	6640	6640	6640	6640	6640	6640	6640	
Application Specific Torque (lbf in)	35600	35600	35600	35600	35600	35600	35600	35600	35600	35600	35600	35600	35000	
Minimum Input HP	-	-	-	-	0.54	0.54	0.54	-	0.27	0.27	0.27	0.27	0.27	6175DC
Overhung Load (lbf)	6640	6640	6640	6640	6640	6640	6640	6640	6640	6640	6640	6640	6640	
Application Specific Torque (lbf in)	44300	44300	44300	44300	44300	44300	44300	44300	44300	44300	44300	44300	44000	
Minimum Input HP	-	-	1.01	1.01	-	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	6180DB
Overhung Load (lbf)	9370	9370	9370	9370	9370	9370	9370	9370	9370	9370	9370	9370	9370	
Application Specific Torque (lbf in)	49700	49700	49900	49900	49900	49700	49700	49900	49700	49900	49900	49900	49000	
Minimum Input HP	-	-	-	1.01	1.01	1.01	-	0.54	0.54	0.54	0.54	0.54	0.54	6185DB
Overhung Load (lbf)	9370	9350	9370	9370	9370	9350	9350	9370	9350	9370	9370	9370	9370	
Application Specific Torque (lbf in)	61500	61500	61500	61500	61500	61500	61500	61500	61500	61500	61500	61500	61000	
Minimum Input HP	-	-	-	-	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	6190DA
Overhung Load (lbf)	13200	13200	13200	13200	13200	13200	13200	13200	13200	13200	13200	13200	13200	
Application Specific Torque (lbf in)	102600	102600	102600	102600	102600	102600	102600	102600	102600	102600	102600	102600	102600	
Minimum Input HP	-	-	-	-	-	-	-	-	-	-	-	-	-	6190DB
Overhung Load (lbf)	-	-	-	-	-	-	-	-	-	-	-	-	-	
Application Specific Torque (lbf in)	-	-	-	-	-	-	-	-	-	-	-	-	-	

Table Notes^[1]:

Please provide Special Specification Code (SSC) YAE8 when placing an order.

Metric Shafts are required.

Minimum Input HP = values are to overcome breakaway torque requirements in cold temperatures or high inertia applications. Minimum HP motor assuming a torque limiting device is being used.

* = units are susceptible to grease de-rate.

The application criteria is:

- Load profile based on the experience of WesTech Engineering in municipal water treatment applications.
- Reducer is operated in conjunction with a torque limiting device.
- Starts/stops less than 10 times per year.
- Continuous duty.
- Proper maintenance.

Speed Reducers

Selection Tables

A Unique Concept . . .

The word CYCLO . . .

. . . derives from *Kyklos* the Greek word for *circle* and refers to the CYCLO disc, whose outer profile describes a cycloidal curve.

Features & Benefits of the CYCLO concept

• Outstanding Reliability – 2 Year Warranty

CYCLO speed reducers are noted for outstanding reliability and extended operating lifetime – 20 years of problem-free performance is not unusual. This reliability is due in part to the high material specifications, component quality controls and careful assembly procedures. It also results from the *total absence of sliding friction*. Correctly sized and selected CYCLO speed reducers and gearmotors are covered by a two year warranty.

• High Overload Capacity – 500% plus

CYCLO speed reducers have the strength to withstand over-loads that can break the teeth of other reducers.

Here's why:

At least 30% of the CYCLO's unique disc profiles share shock

of overload and the components are in *compression* – so they cannot be sheared off.

Compare that to conventional helical gear reducers, where one or two teeth must absorb the entire shock and are more prone to catastrophic failure.

• Overall Economy

Competitive initial cost, high reliability, long life and minimal maintenance give CYCLO speed reducers superior overall economy when compared to conventional gear boxes.

• Ideal for Highly Dynamic Applications

Since inertia is very low, the CYCLO speed reducer is ideally suitable for frequent start-stop-reversing duties and the combination with a frequency inverter.

• High Efficiency – Even at High Ratios

Torque transmitting parts have rolling action with minimal friction, so the overall efficiency is as high as 95% in single reduction units.

• Compact Size

Reduction ratios from 6:1 to 119:1 are available for the single stage. Triple reduction stages offer ratios up to nearly 1,000,000:1.

Additional Value

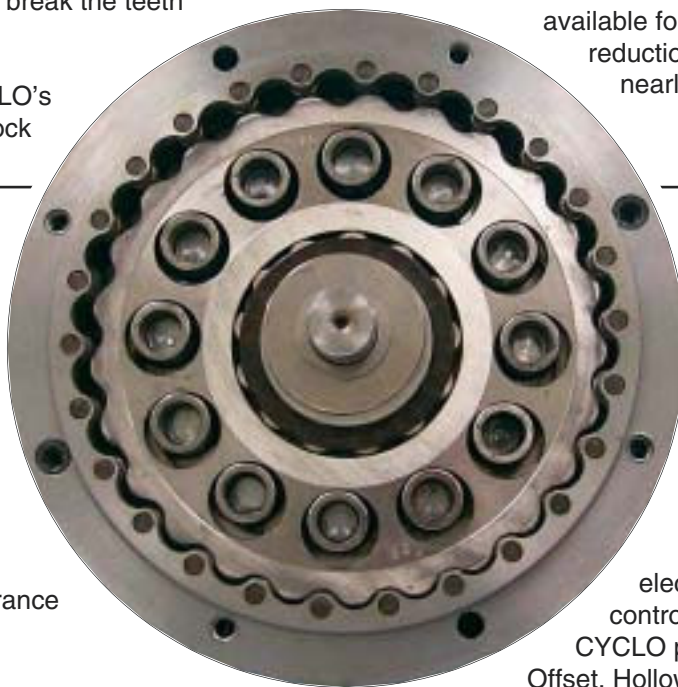
Sumitomo, THE ORIGINAL CYCLO, offers these additional benefits:

• Total Quality

Precision manufacturing and unmatched Quality Assurance insure consistent product performance.

• 70 Years of Product Development

The unique CYCLO operating principle was invented by the German engineer Lorenz Braren in 1931 and his ingenious design has continued its progressive development until the present day.



• Over 7,000,000 Units Sold

CYCLO speed reducers are in daily use in industries throughout the world replacing the more conventional helical, worm and spur gear units.

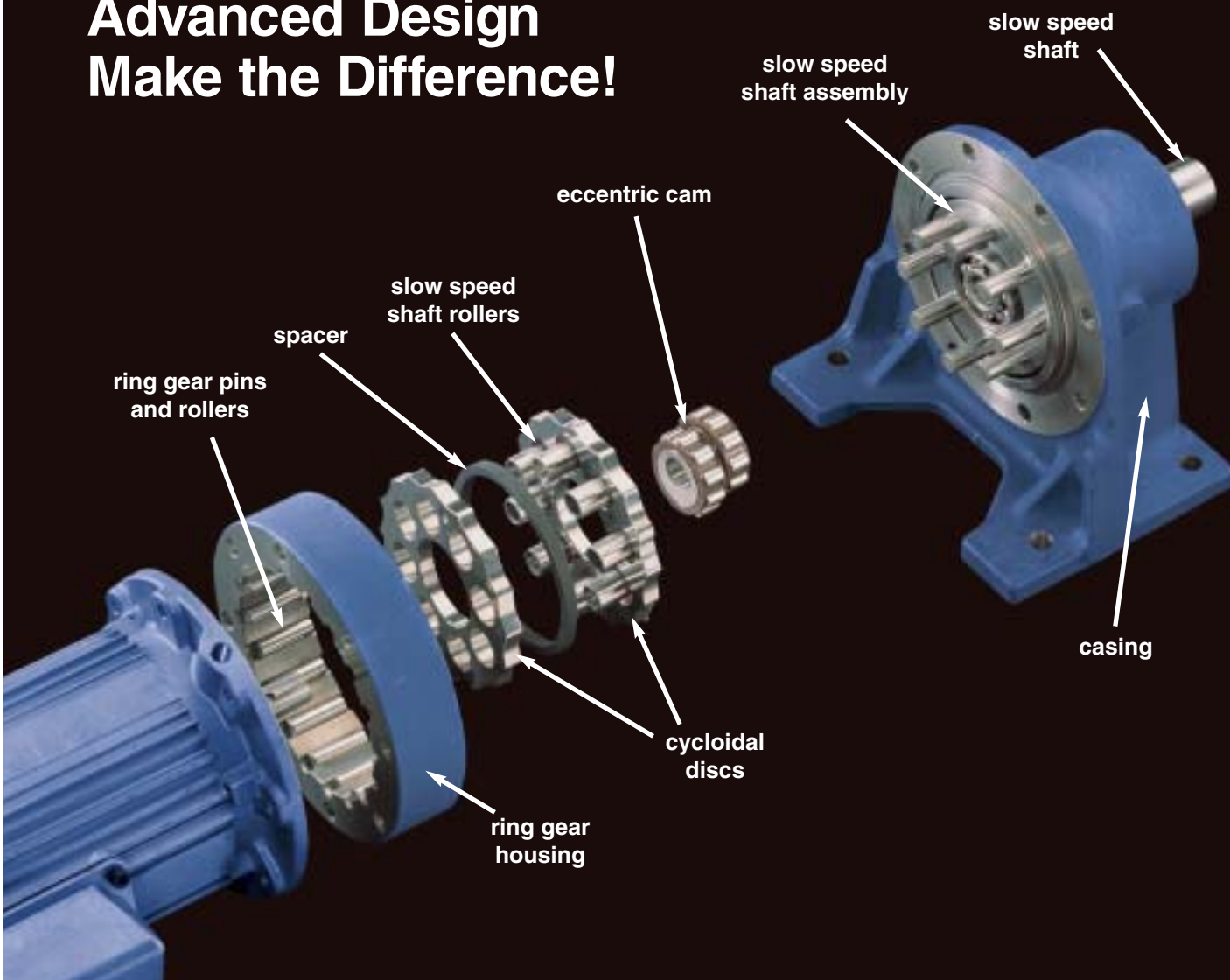
• Many Options . . .

. . . in mechanical and electrical power transmission and control are offered in the complete CYCLO product range. Right Angle, Offset, Hollow Shaft, and Bushing Mounted variations are readily available.

• Worldwide Product Support

Fast, competent technical assistance with selection, installation and after-sales service is available from production and distribution centers throughout the world.

...Fewer Parts & Advanced Design Make the Difference!



Quiet, Dependable, Consistently Long Life

- **Quieter Operation**

Super finishing of rotating components provides smoother rolling action

- **Higher Ratings**

Optimized design imparts more uniform internal load distribution

- **Longer Life**

Improved internal gearometry extends already long life

- **Reduced Backlash**

Decreased internal clearances for high performance requirements

- **Total Dependability**

Torque transmitting parts are made from fully hardened, vacuum degassed bearing grade steel

- **Absolute Consistency**

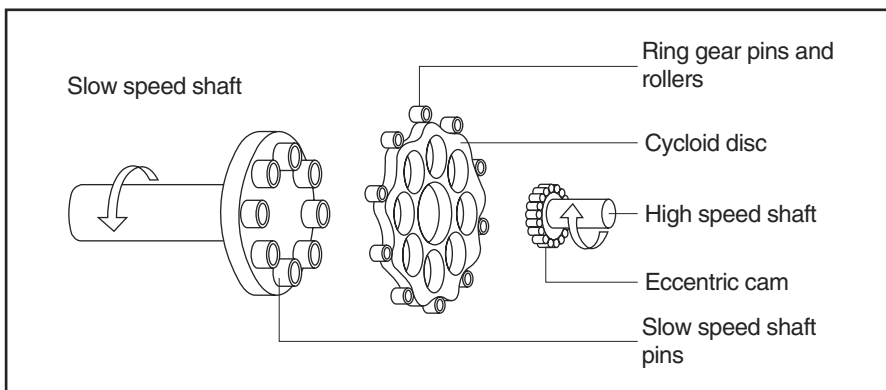
Stringent manufacturing process and assembly controls assure reliability

HOW IT WORKS

The unique SM-CYCLO® speed reducing system is based on an ingeniously simple principle that offers many benefits to the designer and user of power

transmission drives. Basically, the speed reducer has only three major moving parts:

1. **High speed input shaft with integrally mounted eccentric cam and roller bearing assembly**
2. **Cycloid discs**
3. **Slow speed shaft assembly**



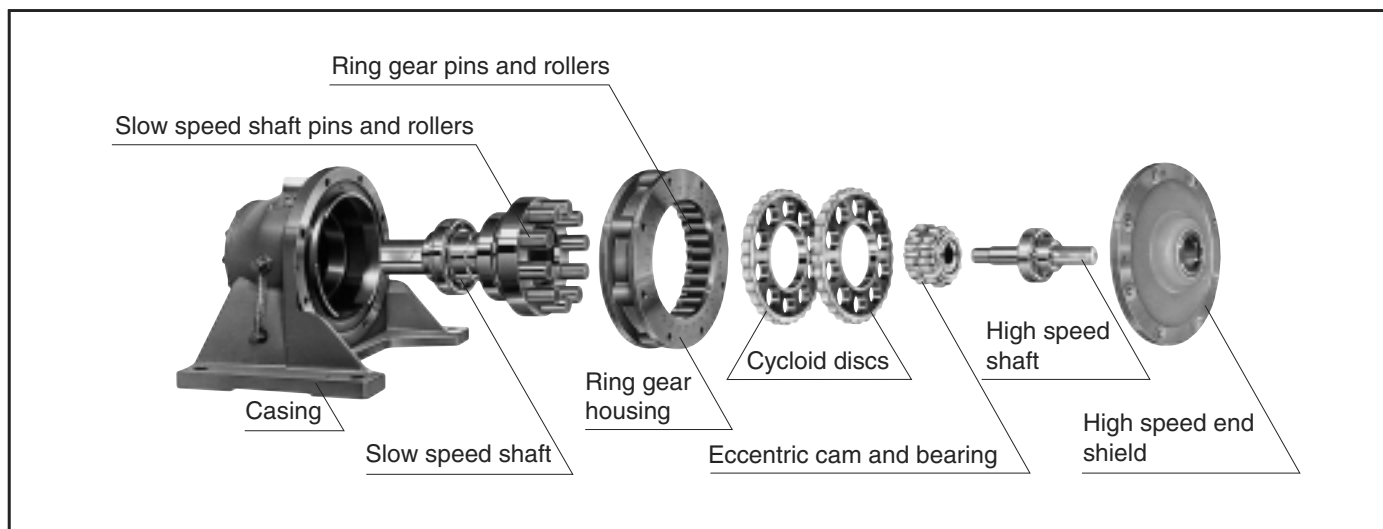
As the eccentric cam rotates, it rolls the cycloid discs around the internal circumference of the stationary ring gear.

The resulting action is similar to that of a wheel rolling around the inside of a ring. As the wheel (cycloid disc) travels in a clockwise path around the ring (ring gear housing), the wheel itself turns slowly on its own axis in a counter-clockwise direction. In the SM-CYCLO® system the cycloidal profile around the outer edge of the disc engages progressively with the rollers of the fixed ring gear housing to produce a reverse rotation at reduced speed. For each complete revolution of the high speed shaft, the cycloid disc turns one cycloidal tooth in the opposite direction. In general, there is one

less cycloidal tooth around the disc than there are pins in the fixed ring gear housing, which results in reduction ratios equal to the number of cycloidal teeth on the disc. (Note: For some ratios, there are two less teeth per cycloid disc than there are pins in the ring gear housing.)

The reduced rotation of the cycloid discs is transmitted to the slow speed shaft by means of drive pins and rollers that engage with holes located around the middle of each disc.

Typically, a two disc system is used with a double eccentric cam which increases the torque capacity and offers an exceptionally smooth, vibration-free drive.

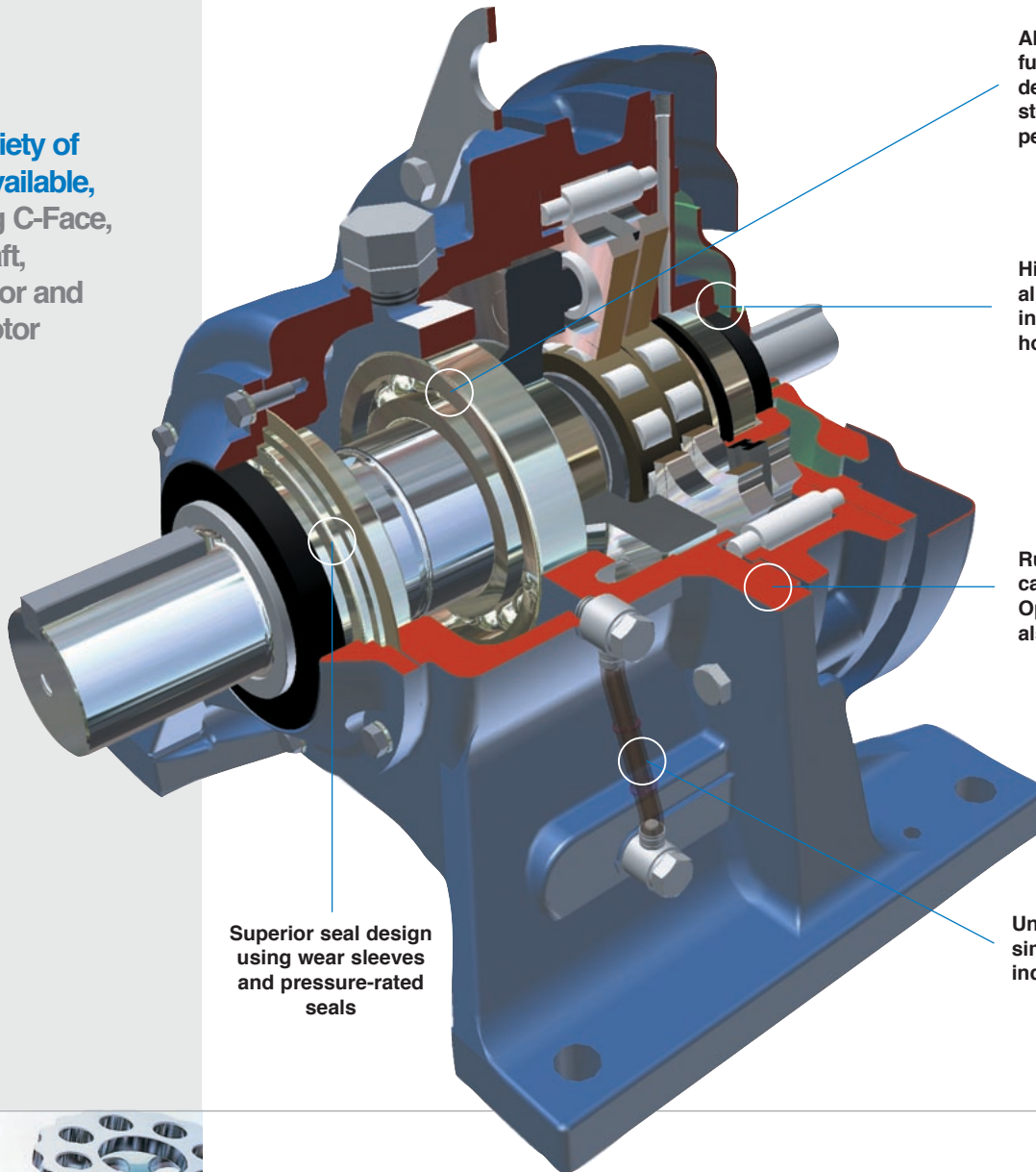




Cyclo® 6000

High Torque Density, High Reliability Cycloidal Speed Reducers and Gearmotors

- ▶ **Wide variety of inputs available, including C-Face, Free-Shaft, Gearmotor and Brakemotor**



All rotating components are fully hardened, vacuum degassed bearing grade steel, for consistent, reliable performance

High power density, all reduction contained in compact ring gear housing

Rugged, shock-resistant cast iron housing. Optional ductile iron also available

Superior seal design using wear sleeves and pressure-rated seals

Unique oil sight gauge for simple, visible lubrication indication

Unmatched Reliability, Exceptional Performance

- ▶ Cyclo® speed reducers and gearmotors are **designed to withstand shock loads exceeding 500%** of their ratings



Product Description

The Sumitomo Cyclo® drive is **unsurpassed by any other inline drive** available in the market today. **Cyclo®'s unique cycloidal design** has advantages superior to speed reducers using common involute tooth gears. Cyclo® components operate in compression, not in shear. Unlike gear teeth with limited contact points, a Cyclo® has two thirds of its reduction components in contact at all times. Cyclo® speed reducers and gearmotors are **designed to withstand shock loads exceeding 500%** of their ratings, and provide exceptional performance, reliability and long life in the most severe applications.

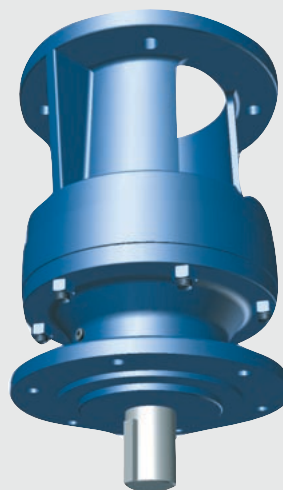
Features & Benefits

- **Highest overload capacity**, exceeding 500%
- **Exceptional life** with a 24 month warranty
- **High efficiency**, even at high reduction ratios
- Versatile, available as inline speed reducer or gearmotor
- Ideal for **severe, high shock** applications
- Optional grease lubrication for **no maintenance**

Specifications

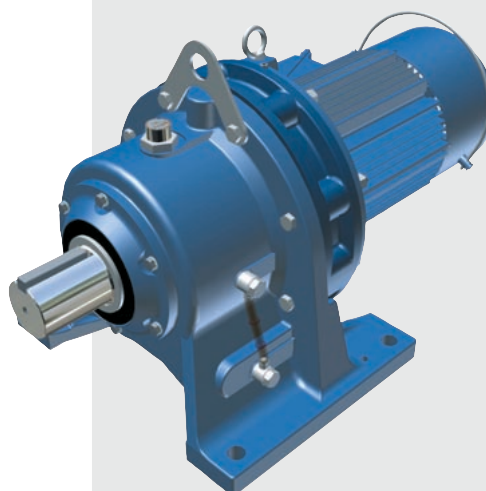
Sizes:	23 models (5lbs to 5000lbs)
Torque Rating:	210 to 603,000 lb in
HP Rating:	.10 to 232 HP
Ratio Range:	3 to 119 (single), 121 to 7569 (double), 8041 to 658,503 (triple)
Mounting:	Foot, Flange, Face Mount
Motor Standards:	NEMA, IEC, JIS, UL, CSA, CE

- **Sumitomo's Cyclo® 6000 has extremely high torque density** and is available as an inline speed reducer or gearmotor



Reducer

- Simple, Compact Design
- Rugged Forged Output Shaft
- Many Mounting Styles
- C-Face, Shovel Base & Top Mount Options



Gearmotor

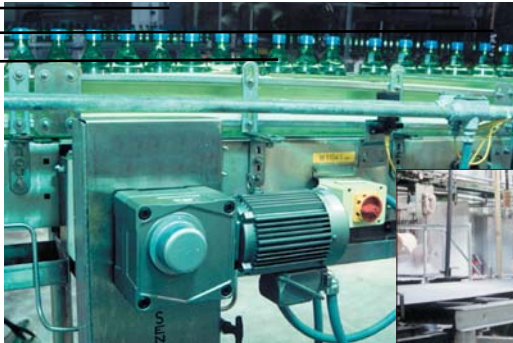
- Connection free design
- Rugged forged output shaft
- Direct acting brake option
- Unmatched durability



► Applications

- Conveyors
- Food Machinery
- Mixers
- Automotive Plants
- Recycling Machines
- Poultry Plants
- Sawmills and Wood Mills
- Wastewater Treatment
- Steel Mills
- Construction Equipment
- Paper Mills
- Processing Plants

Bottling/Baking



Steel hypoid gear technology, maintenance-free grease lubrication and a compact modular housing makes the Hyponic® an efficient performer in the food industry.



A 15-hp Beier mechanical variable speed drive with electric remote control provides an adjustable, steady speed range for this 350-ft. oven band conveyor.

Water Treatment

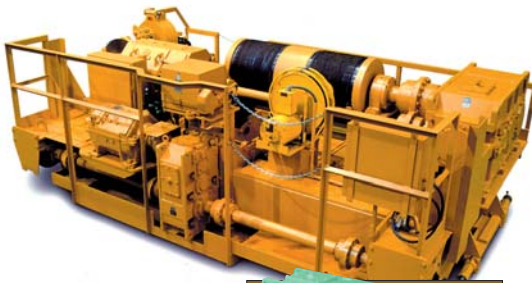


Each of these Sumitomo Paramax® speed reducers helps pump up to 13 million gallons a day at this state-of-the-art wastewater treatment facility in the City of Clearwater, Florida.



Cyclo® mixer drives are a key component of this award-winning water treatment facility in Hillsborough County, Florida.

Material Handling



Sumitomo Paramax® reducers provide quiet, reliable operation for both the hoist and trolley drive systems in this 35-ton capacity DC Trolley Hoist used for heavy-duty coil handling service.



Custom Designs



In less than 20 minutes, 96 Sumitomo Cyclo® Bevel Buddybox gearmotors help retract the 13,000-ton roof on Seattle's Safeco Field.



The Sumitomo gearmotors, on eight travel truck assemblies, turn 128 36" wheels.

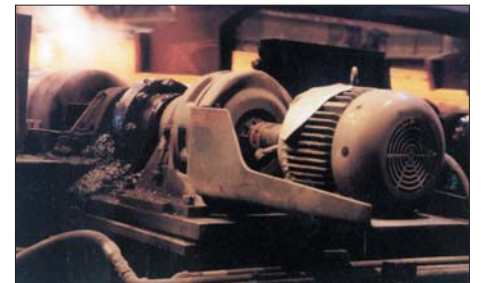
Wood Products

Sumitomo Cyclo® drives are an integral part of this manufacturing plant which produces 150,000 board feet of unfinished strip and plank hardwood flooring each week.

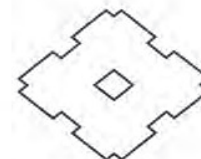


Once flooring is side-matched, it is inspected for defects. This conveyor, driven by Sumitomo Cyclo® drives, carries defective material to the hammer mill.

Steel



After molten steel is formed in the five-strand continuous caster at this steel mill, it is conveyed by Sumitomo Cyclo® drives on the auto-torch conveyors where the steel is cut into billets.



Lubricants

Grease Lubricated Models

Those models listed in Tables A-3 ~ A-6 as grease lubricated are filled with grease before shipment to the customer and are ready for use.

Table A-7. Standard Greases^[1]

Ambient Temperature ^[2]		Cyclo [®] Disc-Type	Cyclo [®] Planetary-Type
°F	°C		
14 to 122	-10 to 50	Exxon Unirex N2 Grease	Shell Gadus S2 V220 0 Grease

Table A-8. Grease Replenishment and Change Interval

Model	Condition		Interval ^[3]
Maintenance Free Type: Single (6060 to 6125) Double Reduction (6065DA to 6125DB)	Replenishment		NOT REQUIRED
	Overhaul ^[4]		Every 20,000 Hours or Every 4 ~ 5 Years
Non- Maintenance Free Type	Replenishment	Less Than 10 Hours Per Day Operation	Every 3 ~ 6 Months
		10 ~ 24 Hours Per Day Operation	Every 500 ~ 1000
	Change	Speed Reducer Mechanism, High Speed Shaft Bearings (Speed Reducer Type)	Every 2 ~ 3 Years
		Slow Speed Shaft Bearings	Every 3 ~ 5 Years

Replenishment and Change Guidelines

Those units designated as maintenance free in Tables A-3 ~ A-6 do not require replenishment when supplied with standard greases. Certain optional greases do require replenishment. Those units will have a Zerk fitting either on the high speed endshield or near the input shaft bearing housing.

Replenish grease to the reduction mechanism with 1/3 to 1/2 of the quantity listed in Table A-9 or A-10 at the interval recommended in Table A-8. Remove the drain plug from gearbox output section. Replenish grease through the Zerk fitting. After inserting the recommended amount of grease run the unit for five or 10 minutes to circulate the grease and purge any excess. Replace the drain plug and return to service.

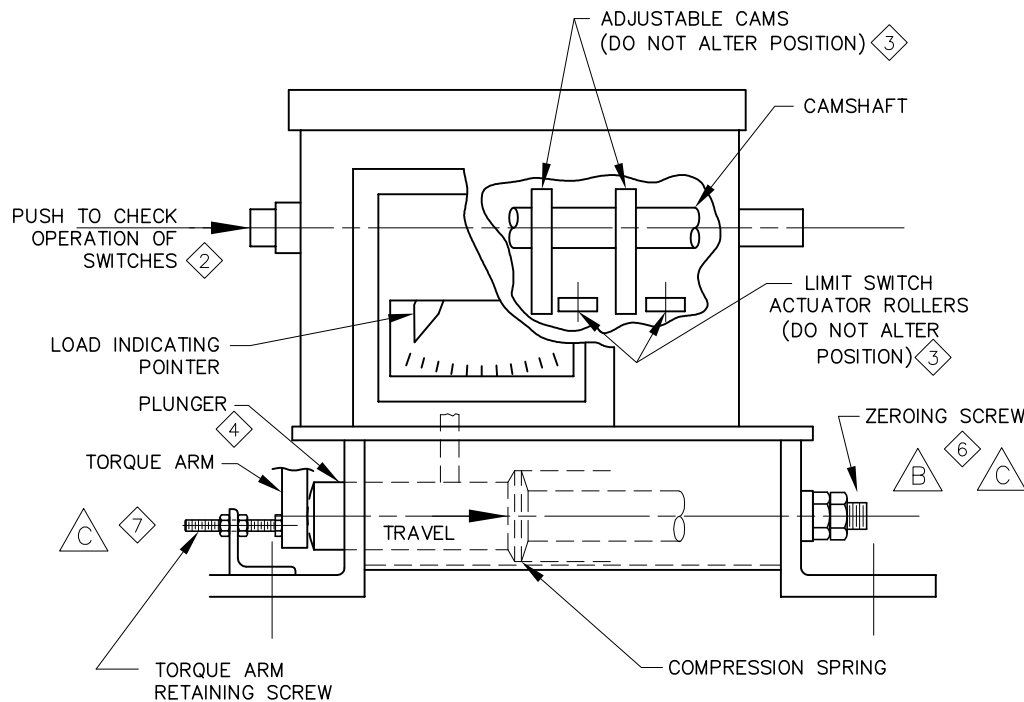
When the unit is disassembled for overhauling, refill with the grease quantities indicated in Table A-9 or A-10. Or alternatively, 80% of the space around the reduction mechanism and slow speed shaft

bearings of single reduction units, and 50% around the reduction mechanism of both the first and second stage of double reduction units.

Apply grease liberally to the central part (i.e., around the eccentric bearings) of the mechanism. Apply grease to both the slow speed and high speed shaft bearings as you would to ordinary bearings at the time or re-assembly.

If excessive grease is added, agitation heating of the grease will raise the operating temperature of the unit. Avoid excessive greasing, but do not supply an insufficient amount of grease. When the grease is insufficient, it will raise the unit's operating temperature due to breakdown of the lubrication films on the eccentric bearing. In this case, if the operating temperature rises, supply grease immediately.

Torque Control Information



(5) TORQUE TRANSMITTER (OPTIONAL) SHALL BE CALIBRATED TO SHOW 4ma AT ZERO TORQUE AND 20ma AT FULL DIAL TORQUE.

(6) NUTS ON ZEROING SCREW CAN BE ADJUSTED TO BRING LOAD INDICATING POINTER UP TO ZERO. TORQUE ARM RETAINING SCREW SHOULD NOT BE USED TO ADJUST THE POINTER.

(7) RETAINING SCREW IS INTENDED TO KEEP THE TORQUE ARM IN PLACE AND TOUCHING THE PLUNGER AT THE ZERO POSITION ON THE SCALE. THE RETAINING SCREW/BRAKET IS INTENDED TO BEND OR BREAK IF THE DRIVE IS RUN IN REVERSE. THIS PROTECTS THE MECHANISM FROM MORE COSTLY DAMAGE.

(1) THE TORQUE CONTROL IS AN ELECTRO - MECHANICAL DEVICE DESIGNED TO PROTECT THE DRIVE AND MECHANISM FROM OVERLOAD CAUSED BY EXTREME TORQUE BUILD - UP DUE TO A VARIETY OF UNUSUAL OPERATING CONDITIONS.

THE DEVICE IS ACTUATED BY THE TORQUE ARM OF THE ADAPTER PLATE UPON WHICH THE SPEED REDUCER IS MOUNTED, SUPPORTED BY A PIVOT BEARING, WHICH IS FREE TO ROTATE IN REACTION TO THE TORQUE LOAD BEING IMPOSED UPON THE SPEED REDUCER. THE TORQUE ARM EXERTS A FORCE AGAINST A CALIBRATED COMPRESSION SPRING. AS TORQUE ON THE SCRAPER MECHANISM INCREASES THE SPRING DEFLECTION MOVEMENT IS TRANSMITTED BY A VERTICAL ROD TO THE SHAFT UPON WHICH THE CAMS ARE MOUNTED. THE POSITION OF THE CAMS TO THE ROLLERS OF THE LIMIT SWITCHES HAS BEEN SET IN WESTECH'S SHOP FOR ALARM AND CUTOFF. THE PERCENTAGE OF TORQUE LOAD IS INDICATED BY A POINTER AND A SCALE VISIBLE FROM THE FRONT OF THE UNIT. UNDER NORMAL CONDITIONS TORQUE WILL NOT BE SUFFICIENT TO ACTUATE THE ALARM CONTROLS.

AS THE TORQUE INCREASES AND THE POINTER MOVES TOWARDS THE UPPER PORTION OF THE PERCENTAGE SCALE AN ALARM IS ACTUATED ALERTING THE OPERATOR OF AN IMPENDING OVERLOAD. IF THE OVERLOAD CONDITION IS NOT CORRECTED AND CONTINUES TO BUILD UP UNTIL THE SECOND SWITCH IS ACTUATED, THE DRIVE MOTOR WILL CUT - OUT AND THE MECHANISM WILL AUTOMATICALLY STOP. WITH THE SCRAPER ARMS STOPPED THERE IS NO OVERLOAD FOR THE TORQUE CONTROL TO READ, SO WHILE THE OVERLOAD CONDITION IS BEING CORRECTED, MEANS MUST BE PROVIDED IN THE ELECTRICAL CONTROLS TO PREVENT THE MOTOR FROM COMING ON PREMATURELY.

(2) TO CHECK THE OPERATION OF SWITCHES, THE CONDITIONS OF AN OVERLOAD MAY BE SIMULATED BY PUSHING THE BRASS ROD COVERED WITH A RUBBER CAP LOCATED ON THE LEFT SIDE OF THE UNIT. THIS IS TO BE DONE AT THE TIME OF START - UP AND WEEKLY AFTER THE MACHINE IS PUT INTO OPERATION.

(3) DO NOT ALTER THE FACTORY SET POSITION OF LIMIT SWITCH ACTUATORS AS DAMAGE TO THE DRIVE AND MECHANISM CAN OCCUR. THIS ALSO VOIDS ANY WARRANTY.

(4) SPRAY OIL (WD-40 OR EQUAL) WEEKLY TO LUBRICATE THE PLUNGER FOR FREE MOVEMENT.

TORQUE CONTROL DEVICE

DESCRIPTION

TYPE

SIZE

				NONE	11-03	MPW	NK	JJ
DATE	STD. BY	STD.CHKD.	STD.APPVD	SCALE	DATE	PROJ. BY	PROJ.CHKD.	PROJ.APPVD

ALL COMPONENTS MUST BE FABRICATED AND MACHINED ACCORDING TO WESTECH STANDARD SPECIFICATION (DRAWING P24Z-024A), UNLESS SPECIFICALLY NOTED ON THIS DRAWING.

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ADDED SECOND NUT TO RETAINING SCREW, ADDED NOTES 6 AND 7	TAP	JJ	11-07	
ADDED SECOND NUT TO ZEROING SCREW	RHS	JAJ	03/06	
NOTE 5 ADDED, OR EQUAL ADDED	DK	JJ	5-04	
REVISION	BY	CHKD	DATE	LTR

Westech

DRAWING NUMBER

7 - 8222 B1

PROJECT NUMBER

REV.

C

REVISION

BY

CHKD

DATE

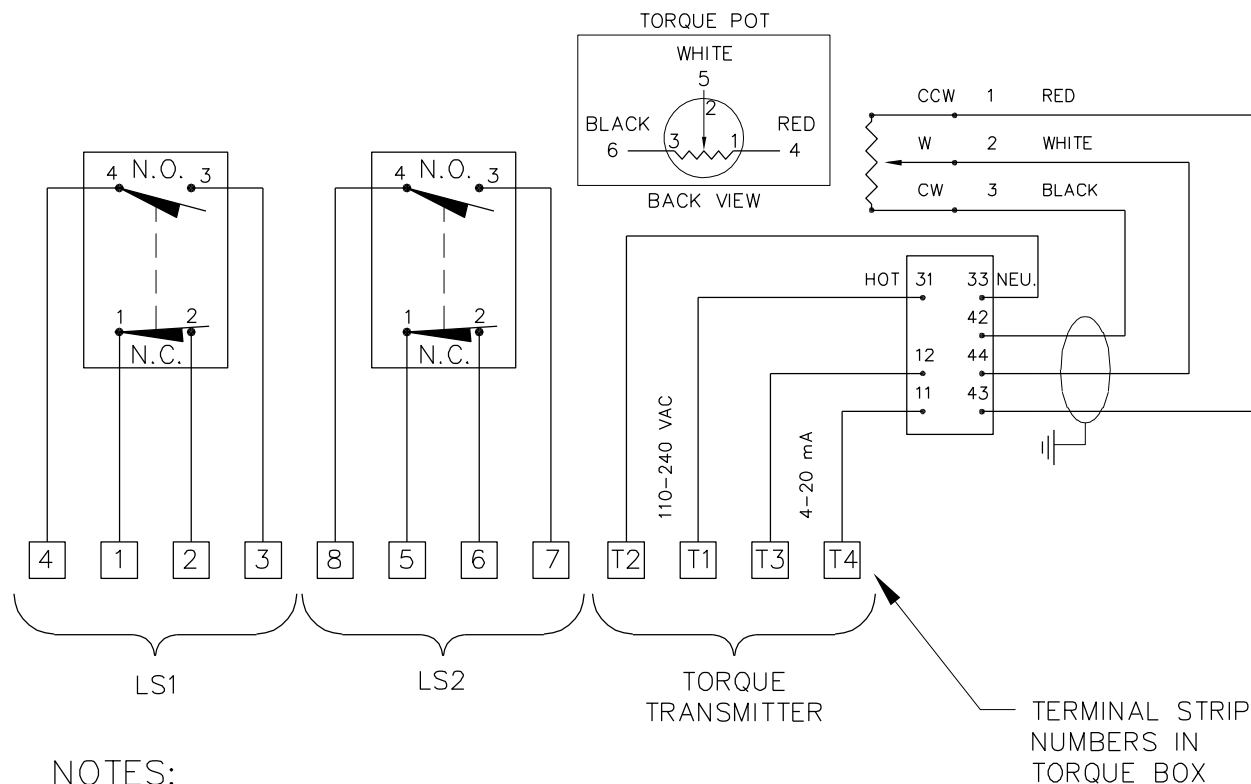
LTR

A

B

C

D



NOTES:

1. FIELD CONNECTIONS MAY BE WIRED TO N.O. OR N.C. CONTACTS DEPENDING ON FIELD REQUIREMENTS.
2. SWITCH FUNCTIONS SHALL CORRESPOND WITH THE SUGGESTED ELECTRICAL SCHEMATIC
3. LIMIT SWITCH TERMINAL ARRANGEMENT IS SEQUENTIALLY TYPICAL FOR 3 OR 4 SWITCH TORQUE BOXES
4. SWITCHES ARE RATED 600 VOLT MAX.
5. MEETS NEMA 1, 3, 4, 4X, 6P, 12 & 13

TORQUE BOX WITH TRANSMITTER

DESCRIPTION

RIGHT HAND

MODEL

SIZE

1, X 1

10/22/19

RU08

PA53

KE32

NONE

DATE

STD. BY

STD.CHKD.

STD.APPVD

SCALE

DATE

PROJ. BY

PROJ.CHKD.

PROJ.APPVD

WestTech

DRAWING NUMBER

TB-076A

PROJECT NUMBER

REV.

0

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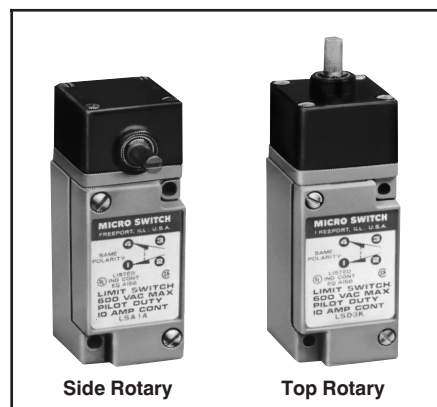
Heavy Duty Limit Switches

HDLS Series

- * Depending on operating head, prewired connector or cable, enclosure ratings may vary. For enclosure rating information on specific catalog listings, contact the 800 number.



Rotary Actuated Switches



Order guides below and on page A35 provide specification and pricing information for side and top rotary switches.

Plug-in body style catalog listings consist of the complete plug-in base receptacle.

Levers are ordered separately. See pages A37-A39 for lever selection.

For rapid response – off the shelf service, all **bold face** listings are normally stocked items.

For low temperature, high temperature or preleading see page A42.

ASSEMBLED CONDITIONS

Catalog listings in order guide below are factory assembled with:

- Shaft of side rotary heads facing front of switch (label side).
- Head adjusted for both clockwise and counterclockwise operation.
- Light on indicator versions wired to N.O. circuit.

Refer to facing page to specify modifications to these assembled conditions.

PRELEADED OR CONNECTORIZED VERSIONS

Refer to page A42.

ORDER GUIDE (Momentary action. UL listed, CSA certified, CE approved. Levers not included. Order separately pages A37-A39.)

Circuitry	Electrical Rating	Body** Style	Catalog Listings					
			Standard	Low Differential	5° Pretravel	Low Torque	Low Differential Low Torque	Top Rotary High Overtravel
Silver contacts	A	Plug-in 1/2" Conduit	LSA1A	LSP1A	LSU1A	LSR1A	LSH1A	LSB1A
Gold cross point contacts	C	Plug-in 1/2" Conduit	LSA1J		LSU1J	—	—	LSB1J
Gold plated contacts	C		LSA1E	LSP1E	—	LSR1E	LSH1E	—
Silver contacts	A*	120 V Ind. lite Plug-In* 1/2" Conduit	LSA5A	LSP5A	LSU5A	LSR5A	LSH5A	LSB5A
	A*	240 V Ind. lite Plug-In 1/2" Conduit	LSA8A	LSP8A	LSU8A	LSR8A	LSH8A	LSB8A
	A*	24 V LED lite 1.5mA max. Auto polarity Plug-in 1/2" Conduit	LSA9A	LSP9A	LSU9A	LSR9A	LSH9A	LSB9A
SPDT Double Break	A	Non plug-in 1/2" Conduit	LSA3K	LSP3K	LSU3K	LSR3K	LSH3K	LSB3K
Silver contacts	B	Plug-in 3/4" Conduit	LSA2B	LSP2B	LSU2B	LSR2B	LSH2B	LSB2B
DPDT Double Break	B	Plug-in 1/2" Conduit	LSA6B	LSP6B	LSU6B	LSR6B	LSH6B	LSB6B
	B	120 V Ind. lite Plug-in 3/4" Conduit	LSA2R	LSP2R	LSU2R	LSR2R	LSH2R	LSB2R
	B	Non plug-in 3/4" Conduit	LSA4L	LSP4L	LSU4L	LSR4L	LSH4L	LSB4L
	B	Non plug-in 1/2" Conduit	LSA7L	LSP7L	LSU7L	LSR7L	LSH7L	LSB7L
SPNC Direct Acting	D	Non plug-in 1/2" Conduit	LSA3N			LSR3N		LSB3N

*Use at voltage indicated for light. Wired to N.O. circuit.

Upper temperature limit for lighted units is 200°F (93°C).

**Plug-in listings include base receptacle.

OPERATING CHARACTERISTICS

Pretravel (degrees max.)		15	9	5	15	9	25
Differential Travel (degrees max.)	SPDT	5	3	3	5	3	10
	DPDT	7	4	4	7	4	12
Overtravel (degrees min.)		60	66	70	60	66	110
Operating Torque (max.)	NM = Newton meters	0,45 Nm 4 in. lbs.	0,45 Nm 4 in. lbs.	0,45 Nm 4 in. lbs.	0,19 Nm 1.7 in. lbs.	0,19 Nm 1.7 in. lbs.	0,28 Nm 2.5 in. lbs.
Operating Temperature Range***		10°F to 250°F -12° to 121°C			30°F to 250°F -1° to 121°C		

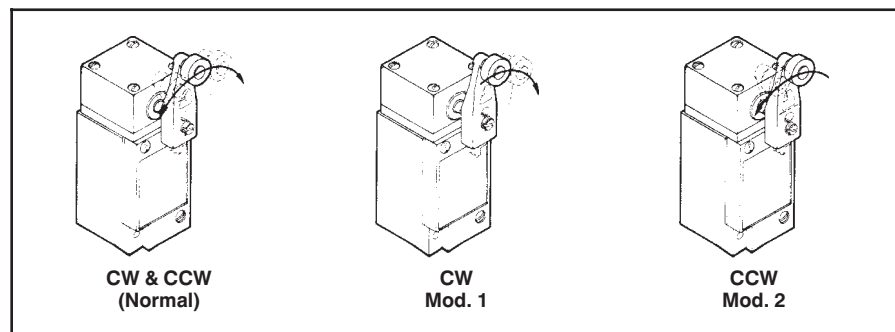
***Completely fluorocarbon-sealed switches are preferred for use in temperatures above 200°F (93°C). Refer to page A42.

Limit/Enclosed

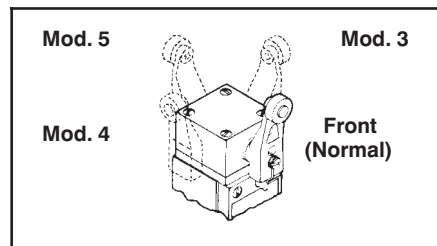
Rotary Actuated Switches

ACTUATION DIRECTION

(Drawings apply to listings on facing page only).



HEAD ORIENTATION



ASSEMBLY MODIFICATIONS

How to order

Momentary action rotary switches can be furnished in other than the normal assembled conditions described on the facing page. To specify modifications, add the number(s) shown below to the catalog listings. Prices are the same as their counterparts shown in the order guide.

Modification number suffixes are:

- 1 Clockwise operation only
- 2 Counterclockwise operation only
- 3 Shaft to right of switch front
- 4 Shaft to left of switch front
- 5 Shaft to back of switch
- 7 Indicator light wired to N.C. circuit

Examples:

Catalog Listing LSA1A23 is an LSA1A switch adjusted for counterclockwise operation only. The operating shaft is to the right side of the switch when viewing it from the front (label side). No lever.

Catalog Listing LSA8A7 is an LSA8A switch with the 240 volt indicator light wired to the N.C. circuit. No lever.

Switches with assembly modifications are not normally stocked and may extend delivery leadtimes.

LEVERS

Levers for rotary actuated switches are normally ordered as separate catalog listings. They also may be ordered by including a suffix to the switch catalog listing and adding the lever price. See pages A34-A39.

SWITCHES FOR SPECIAL APPLICATIONS

HDLS limit switches for special application needs are described on pages A42 and A43. They include: manifold mount, low temperature, complete fluorocarbon-sealed, gravity return, extra low torque and 20 Amp switches.

Adapter plates for interchanging HDLS with LS/200LS limit switches are described on page A49.

ELECTRICAL RATINGS

10 amps continuous carry (except for electrical rating "C"). Circuits on any one pole must be the same polarity.

AC Volts

Pilot duty: 600 VAC, 720VA

Electrical Rating	Circuitry	VAC	Amps at 0.35 Power Factor	
			Make	Break
A*	Single-Pole Double-Throw	120	60	6
		240	30	3
		480	15	1.5
		600	12	1.2
B	Double-Pole Double-Throw	120	30	3
		240	15	1.5
		480	7.5	0.75
		600	6	0.60
D	Single-Pole Single-Throw Normally Closed	120	60	6
		240	30	3
		480	15	1.5
		600	12	1.2
C**	Single-Pole Double-Throw	250 VAC or 60 VDC, .050 amp max.		

DC Volts

Pilot duty: 240 VDC, 30 watts

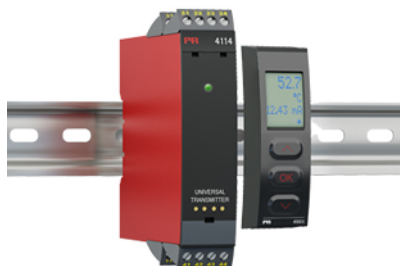
Electrical Rating	Circuitry	VDC	Make and Break Amps	
			Inductive	Resistive
A*	Single-Pole Double-Throw	120	0.25	0.8
		240	0.15	0.4
B	Double-Pole Double-Throw	120	0.25	0.8
		240	0.15	0.4
D	Single-Pole Single-Throw Normally Closed	30	4.3	4.3
		120	1.1	1.1
C**	Single-Pole Double-Throw	250 VAC or 60 VDC, .050 amp max.		

*For switches with indicator light, use only at voltage stated for indicator light.

**These switches have either gold plated or gold cross point contacts. Cross point contacts improve high reliability of contact make when particle contamination is a problem or low energy loads must be carried.

Universal transmitter

4114



- Input for RTD, TC, Ohm, potentiometer, mA and V
- 2-wire supply > 16 V
- FM-approved for installation in Div. 2
- Output for current and voltage
- Universal AC or DC supply



Advanced features

- Programmable by way of detachable display front (4501), process calibration, signal simulation, password protection, error diagnostics and help text available in several languages.

Application

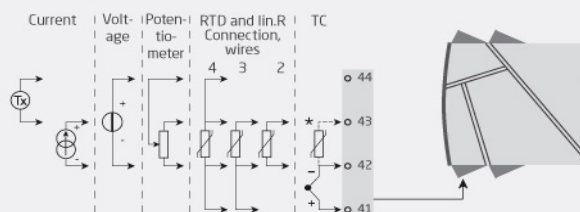
- Linearized, electronic temperature measurement with RTD or TC sensor.
- Conversion of linear resistance variation to a standard analog current / voltage signal, i.e. from solenoids and butterfly valves or linear movements with attached potentiometer.
- Power supply and signal isolator for 2-wire transmitters.
- Process control with standard analog output.
- Galvanic separation of analog signals and measurement of floating signals.
- The 4114 is designed according to strict safety requirements and is therefore suitable for application in SIL 2 installations.

Technical characteristics

- When 4114 is used with the 4501 display / programming front, all operational parameters can be modified to suit any application. As the 4114 is designed with electronic hardware switches, it is not necessary to open the device for setting of DIP-switches.
- A green / red front LED indicates normal operation and malfunction.
- Continuous check of vital stored data for safety reasons.
- 3-port 2.3 kVAC galvanic isolation.

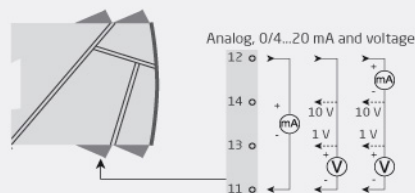
Applications

Input signals:

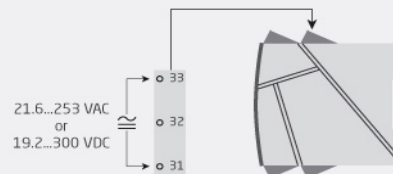


*Order separately: CJC connector 5910.

Output signals:



Supply:



Order:

Type
4114

Environmental Conditions

Operating temperature.....	-20°C to +60°C
Storage temperature.....	-20°C to +85°C
Calibration temperature.....	20...28°C
Relative humidity.....	< 95% RH (non-cond.)
Protection degree.....	IP20

Mechanical specifications

Dimensions (HxWxD).....	109 x 23.5 x 104 mm
Dimensions (HxWxD) w/ 4501/451x.....	109 x 23.5 x 116 / 131 mm
Weight approx.....	155 g
Weight incl. 4501 / 451x (approx.).....	170 g / 185 g
Wire size.....	1 x 2.5 mm ² stranded wire
Screw terminal torque.....	0.5 Nm
Vibration.....	IEC 60068-2-6
2...13.2 Hz.....	±1 mm
13.2...100 Hz.....	±0.7 g

Common specifications

Supply	
Supply voltage, universal.....	21.6...253 VAC, 50...60 Hz or 19.2...300 VDC
Fuse.....	400 mA SB / 250 VAC
Max. required power.....	≤ 2.0 W

Isolation voltage

Isolation voltage, test / working.....	2.3 kVAC / 250 VAC
--	--------------------

Response time

Temperature input (0...90%, 100...10%).....	≤ 1 s
mA / V input (0...90%, 100...10%).....	≤ 400 ms

Auxiliary supplies

2-w. supply (term. 44...43).....	25...16 VDC / 0...20 mA
Programming.....	PR 45xx
Signal / noise ratio.....	Min. 60 dB (0...100 kHz)
Accuracy.....	Better than 0.1% of sel. range
EMC immunity influence.....	< ±0.5% of span
Extended EMC immunity: NAMUR NE21, A criterion, burst.....	< ±1% of span

Input specifications

RTD input

RTD type.....	Pt10/20/50/100/200/250; Pt300/400/500/1000; Ni50/100/120/1000; Cu10/20/50/100
Cable resistance per wire.....	50 Ω (max.)
Sensor current.....	Nom. 0.2 mA
Effect of sensor cable resistance (3-/4-wire).....	< 0.002 Ω / Ω
Sensor error detection.....	Yes
Short circuit detection.....	< 15 Ω

Linear resistance input

Linear resistance min...max.....	0 Ω...10000 Ω
----------------------------------	---------------

Potentiometer input

Potentiometer min...max.....	10 Ω...100 kΩ
------------------------------	---------------

TC input

Thermocouple type.....	B, E, J, K, L, N, R, S, T, U, W3, W5, LR
------------------------	--

Cold junction compensation (CJC) via ext. sensor in

5910.....	20...28°C ≤ ±1°C, -20...20°C / 28...70°C ≤ 2°C
-----------	--

CJC via int. mounted sensor..... ±(2.0°C + 0.4°C * Δt)

Δt = Internal temp.-ambient temp.

Sensor error detection..... Yes

Sensor error current: When

detecting / else..... Nom. 2 μA / 0 μA

Current input

Measurement range.....	0...20 mA
Programmable measurement ranges.....	0...20 and 4...20 mA
Input resistance.....	Nom. 20 Ω + PTC 50 Ω
Sensor error detection: Loop break 4...20 mA.....	Yes

Voltage input

Measurement range.....	0...12 VDC
Programmable measurement ranges.....	0/0.2...1, 0/1...5, 0/2...10 VDC
Input resistance.....	Nom. 10 MΩ

Output specifications

Current output

Signal range.....	0...20 mA
Programmable signal ranges.....	0...20/4...20/20...0/20...4 mA
Load (@ current output).....	≤ 800 Ω
Load stability.....	≤ 0.01% of span / 100 Ω
Sensor error indication.....	0 / 3.5 / 23 mA / none
NAMUR NE43 Upscale/Downscale.....	23 mA / 3.5 mA
Output limitation, on 4...20 and 20...4 mA signals.....	3.8...20.5 mA
Output limitation, on 0...20 and 20...0 mA signals.....	0...20.5 mA
Current limit.....	≤ 28 mA

Voltage output

Signal range.....	0...10 VDC
Programmable signal ranges.....	0/0.2...1; 0/1...5; 0/2...10; 1...0.2/0; 5...1/0; 10...2/0 V
Load (@ voltage output).....	≥ 500 kΩ
of span.....	= of the currently selected measurement range

Observed authority requirements

EMC.....	2014/30/EU
LVD.....	2014/35/EU
EAC.....	TR-CU 020/2011

Approvals

FM.....	3025177
UL.....	UL 508 / C22.2 no. 14
DNV-GL Marine.....	Stand. f. Certific. No. 2.4
EU RO Mutual Recognition Type Approval.....	MRA000000Z
SIL.....	Hardware assessed for use in SIL applications



Display / programming front

4501

- Modification of operational parameters in system 4000 and 9000 devices
- Fixed display for visualisation of process data and status
- Password protection
- Scrolling help text in 7 languages
- Clicks on to the front of the device mounted in the process

EN

Application

- Communications interface for modification of operational parameters in system 4000 and 9000 devices.
- Can be moved from one device to another of the same type and download the configuration of the first device to subsequent devices.
- Fixed display for visualization of process data and status.

Technical characteristics

- LCD display with 4 lines featuring scrolling help text in 7 languages which guides the user effortlessly through all the configuration steps.
- Programming access can be blocked by assigning a password. The password is saved in the device in order to ensure a high degree of protection against unauthorized modifications to the configuration.

Mounting / installation

- Click 4501 onto the front of the device mounted in the process.
- The display module 4501 is approved and certified as an add-on component to the 4000 and 9000 series of devices. For more information on the 4501 refer to the manual of the specific device in the 4000 or 9000 series where the 4501 is attached.

Structural Calculations

Certificate of Design

Certificate of Design

Project Name: Brantford WWTP

Project Number: 24946B/C

Specification Section: 11451/11452 Secondary Clarifier Mechanism

The following standards have been utilized in the design of the mechanism:

NBCC 2020

Specification section 11451/11452 with exceptions and clarifications as listed in the Letter of Clarification

The type and strength of materials to be used in the:

304 Stainless Steel

$F_y = 30,000$ psi

$F_u = 75,000$ psi

The loading conditions used in the design of the clarifier:

Horizontal Seismic Load: $0.11 \times \text{Dead Load}$

Platform & Walkway (See Structural calculations):

Walkway Flooring: 5 psf

Platform Flooring: 6 psf

Handrail: 5 plf

Live Load: 50 psf

Snow Load: 37.6 psf

Wind Load: 12.73 psf

Maximum deflection: $L/360$

Rake Arms & Cage (See Structural Calculations):

Continuous Torque: 35,750 ft-lbs

Design Torque: 71,500 ft-lbs (200% Continuous)

Torque Test: 53,625 ft-lbs (150% Continuous)

EDI Load: 2,000 lbs steel; 8,266 lbs water

Feedwell Load: 3,520 lbs

Spiral Blade Load (Total): 2,228 lbs

Column & Walkway Anchors:

See calculations for loadings and design

The mechanism is designed to withstand the design loads as specified.



Rake and Cage

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	Part Rakes & Cage				
Job Title Brantford			Ref		
Client			By ME75	Date 8/3/2023	Chd
Client			File STAAD-rc_24946B.std	Date/Time 16-Aug-2023 11:48	

Job Information

	Engineer	Checked	Approved
Name:	ME75	HO93	
Date:	8/3/2023	8/16/2023	

Project ID	
Project Name	

Comments

Designed to NBCC 2020
 304 STAINLESS STEEL
 Mechanism Design Torque: 71500 ft-lbs
 Max Continuous Torque: 35750 ft-lbs
 Torque Test: 53625 ft-lbs
 Feedwell Diameter: 14 ft
 Feedwell Weight: 3520 lbs
 EDI Diameter: 8.5 ft
 EDI Steel Weight: 2000 lbs
 EDI Water Weight: 8266 lbs
 Spiral Blade Weight: 2228 lbs
 Horizontal Seismic: $EH = 0.11 * Wp$
 These structural calculations represent the minimum member size necessary to satisfy the requirement of the specification. WesTech reserves the option of increasing the member size to facilitate design or fabrication requirements.

Structure Type SPACE FRAME

Number of Nodes	140	Highest Node	323
Number of Elements	390	Highest Beam	1122

Number of Basic Load Cases	16
Number of Combination Load Cases	0

Included in this printout are data for:

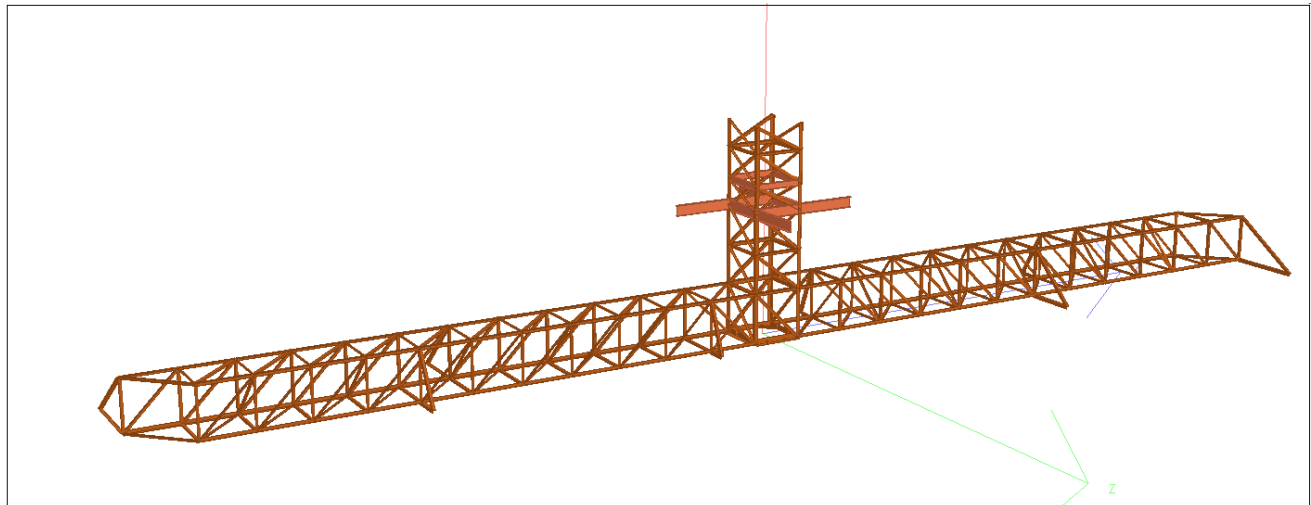
All	The Whole Structure
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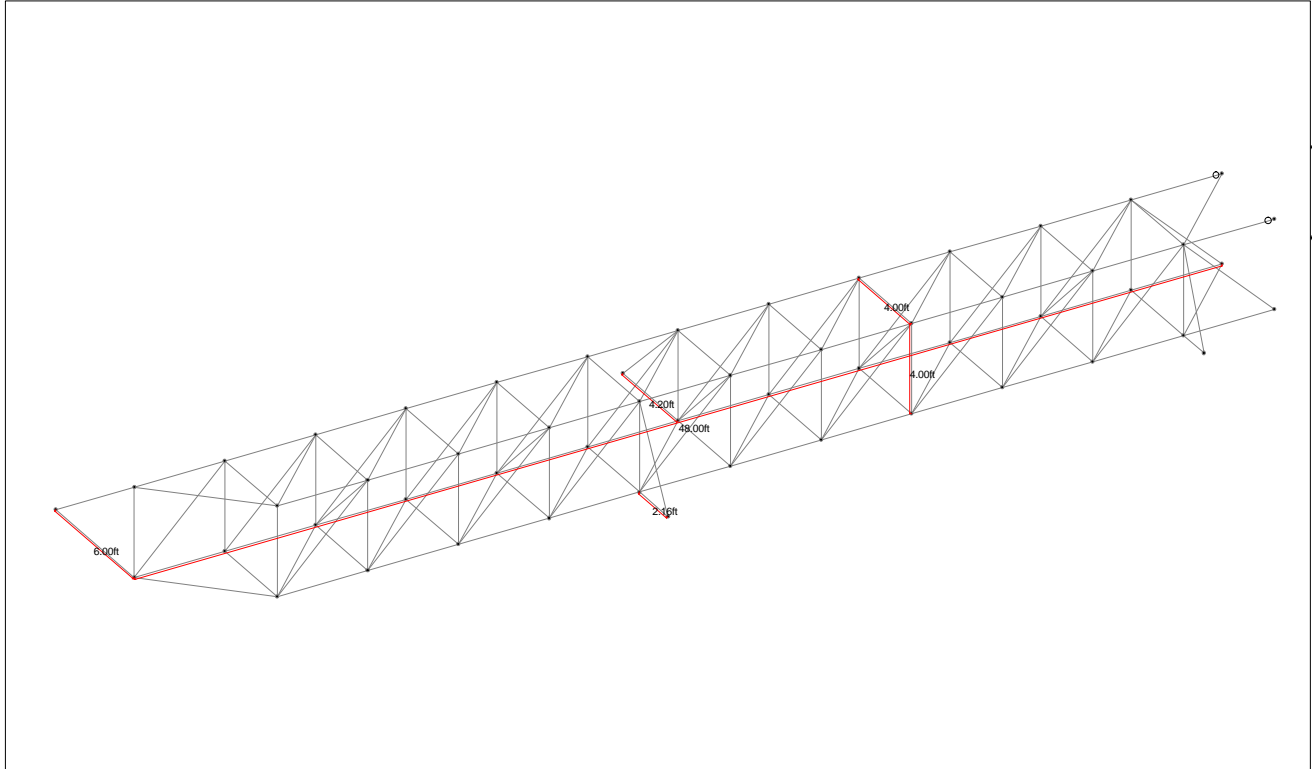
Job Information Cont...

Included in this printout are results for load cases:

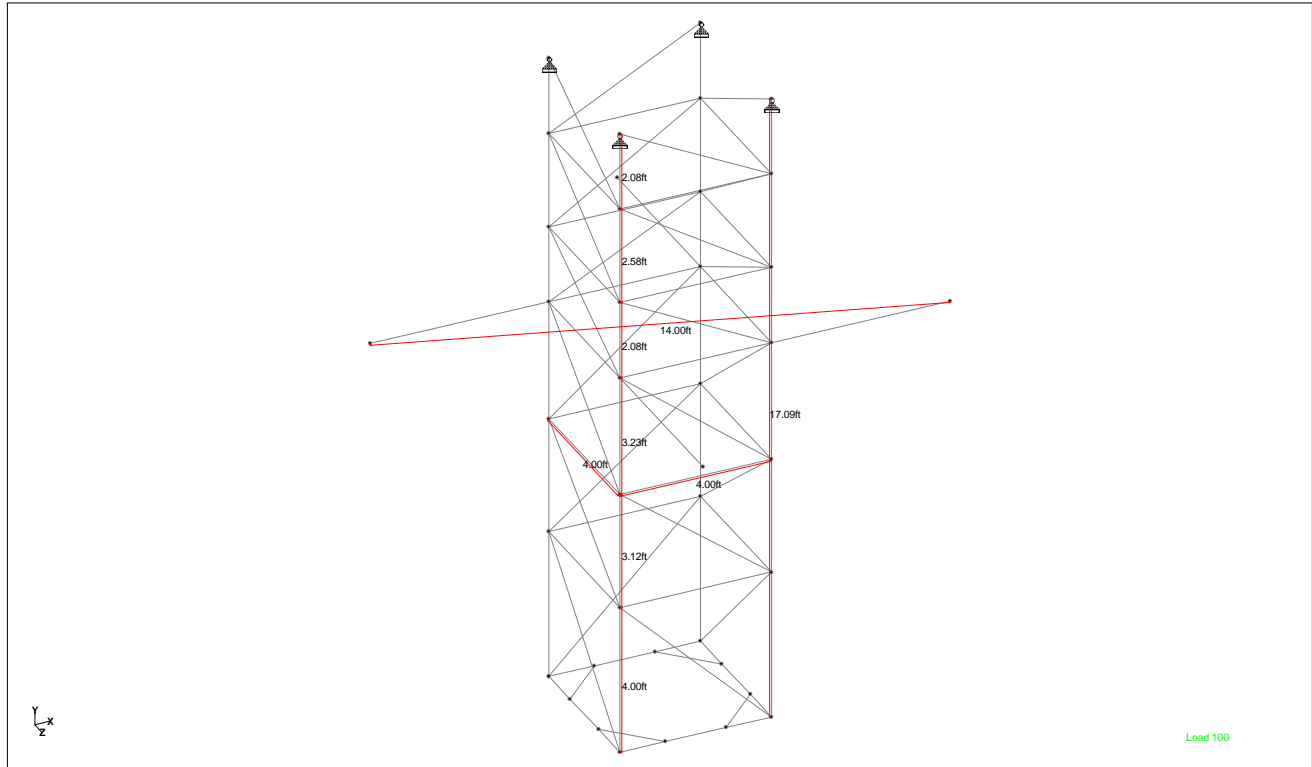
Type	L/C	Name
Primary	1	GRAVITY
Primary	2	CONTINUOUS TORQUE
Primary	3	TORQUE TEST
Primary	4	EDI WELL STEEL LOAD
Primary	5	EDI WELL WATER LOAD
Primary	6	FEEDWELL LOAD
Primary	7	SPIRAL BLADE LOAD
Primary	8	EH(Z) SEISMIC LOADS
Primary	9	EH(X) SEISMIC LOADS
Primary	100	1.4D
Primary	101	1.25D + OPERATING
Primary	102	1.25D + CUT-OUT TORQUE
Primary	103	1.0D + EH(X)
Primary	104	1.0D + EH(Z)
Primary	200	D
Primary	201	D + OPERATING



Rake Arm and Cage



Rake Arm Dimensions



Cage Dimensions

Section Properties

Prop	Section	Area (in ²)	I _{yy} (in ⁴)	I _{zz} (in ⁴)	J (in ⁴)	Material
1	L30306	2.110	2.793	0.727	0.102	STAINLESSST
2	L30306	2.110	2.793	0.727	0.102	STAINLESSST
3	L35356	2.500	4.542	1.188	0.120	STAINLESSST
4	L50506	3.650	13.877	3.614	0.172	STAINLESSST
5	L25254	1.190	1.118	0.288	0.025	STAINLESSST
6	L25254	1.190	1.118	0.288	0.025	STAINLESSST
7	C10X15	4.480	2.270	67.300	0.209	STAINLESSST
8	C6X10	3.070	0.860	15.100	0.128	STAINLESSST
9	L20204	0.944	0.550	0.146	0.020	STAINLESSST
10	L20204	0.944	0.550	0.146	0.020	STAINLESSST
11	L30304	1.440	1.982	0.506	0.030599	STAINLESSST
12	L25254	1.190	1.118	0.288	0.025	STAINLESSST
13	L20204	0.944	0.550	0.146	0.020	STAINLESSST
14	L20204	0.944	0.550	0.146	0.020	STAINLESSST
15	L25254	1.190	1.118	0.288	0.025	STAINLESSST
16	L30304	1.440	1.982	0.506	0.030599	STAINLESSST



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Sheet No
5

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Job Title **Brantford**

Part **Rakes & Cage**

Ref

By **ME75**

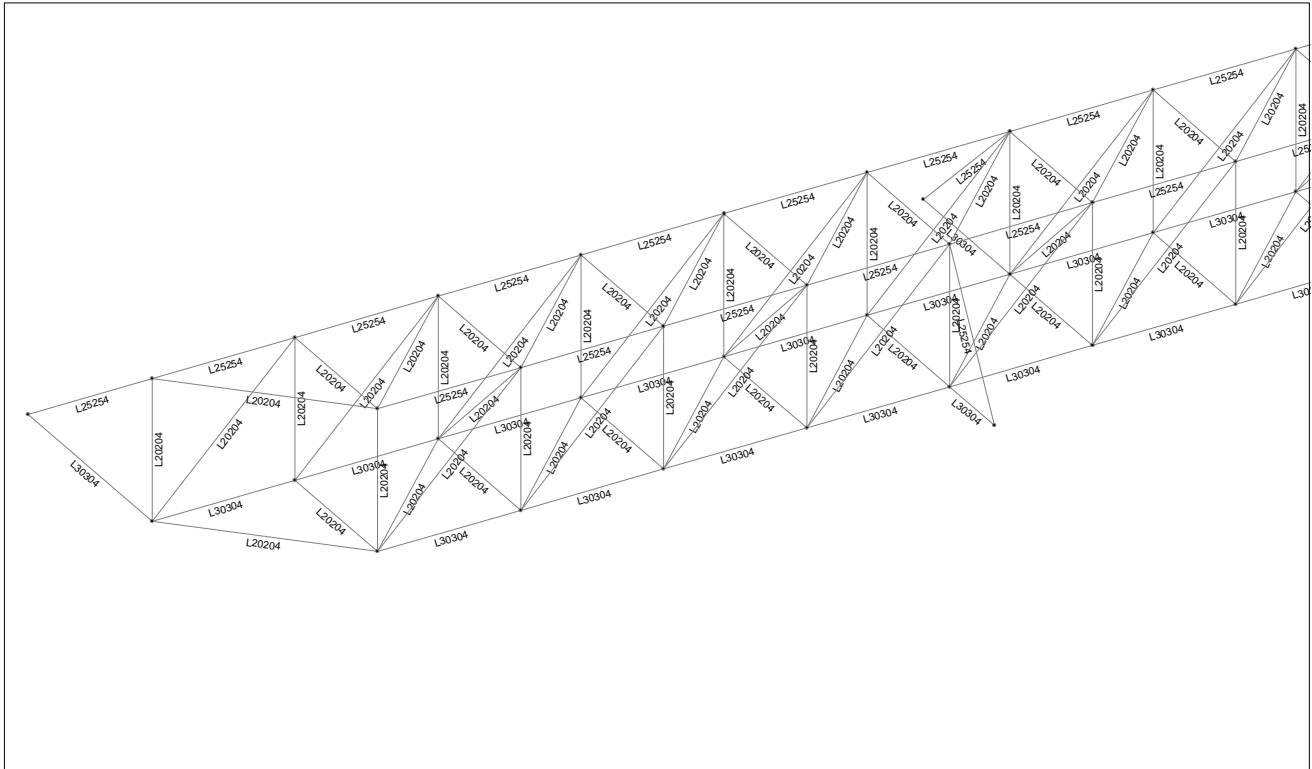
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Rake Arm Member Sizes



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Client

Job No
24946B

Sheet No
6

Rev
0

Part Rakes & Cage

Ref

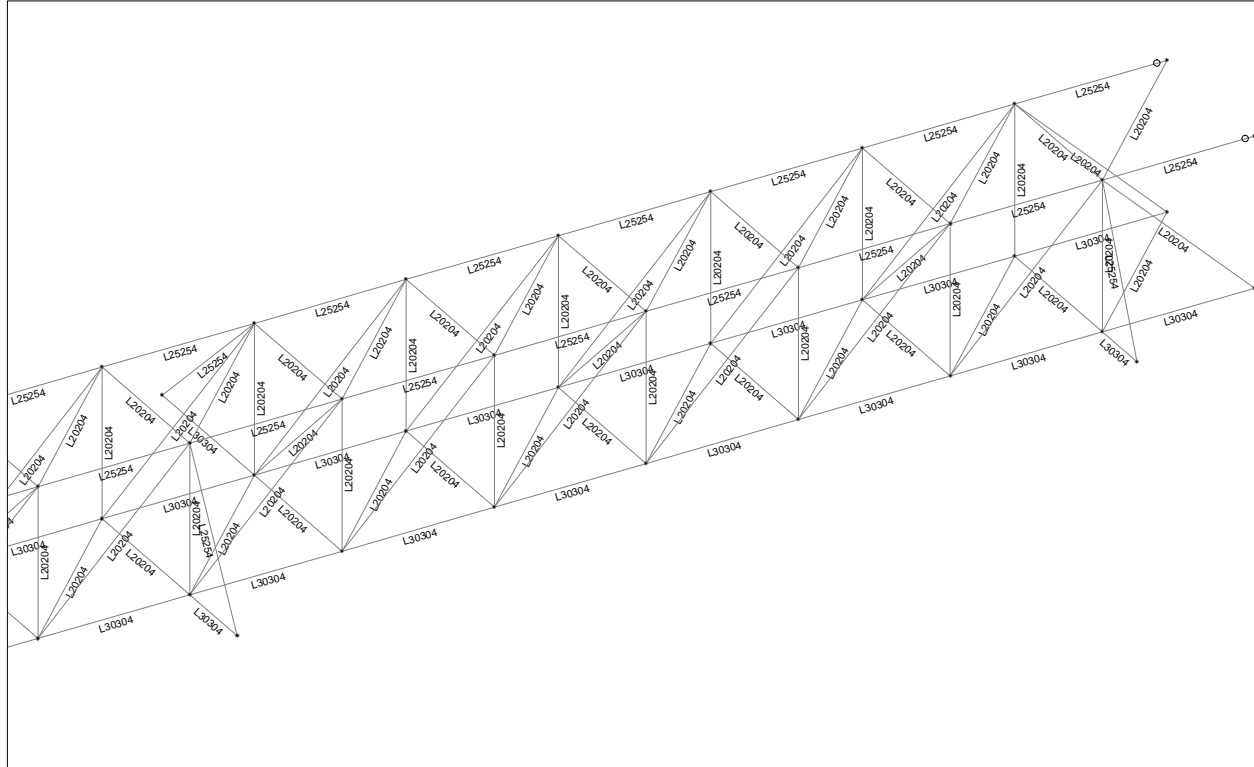
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Rake Arm Member Sizes



Job No
24946B

Sheet No
7

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Part **Rakes & Cage**

Job Title **Brantford**

Ref

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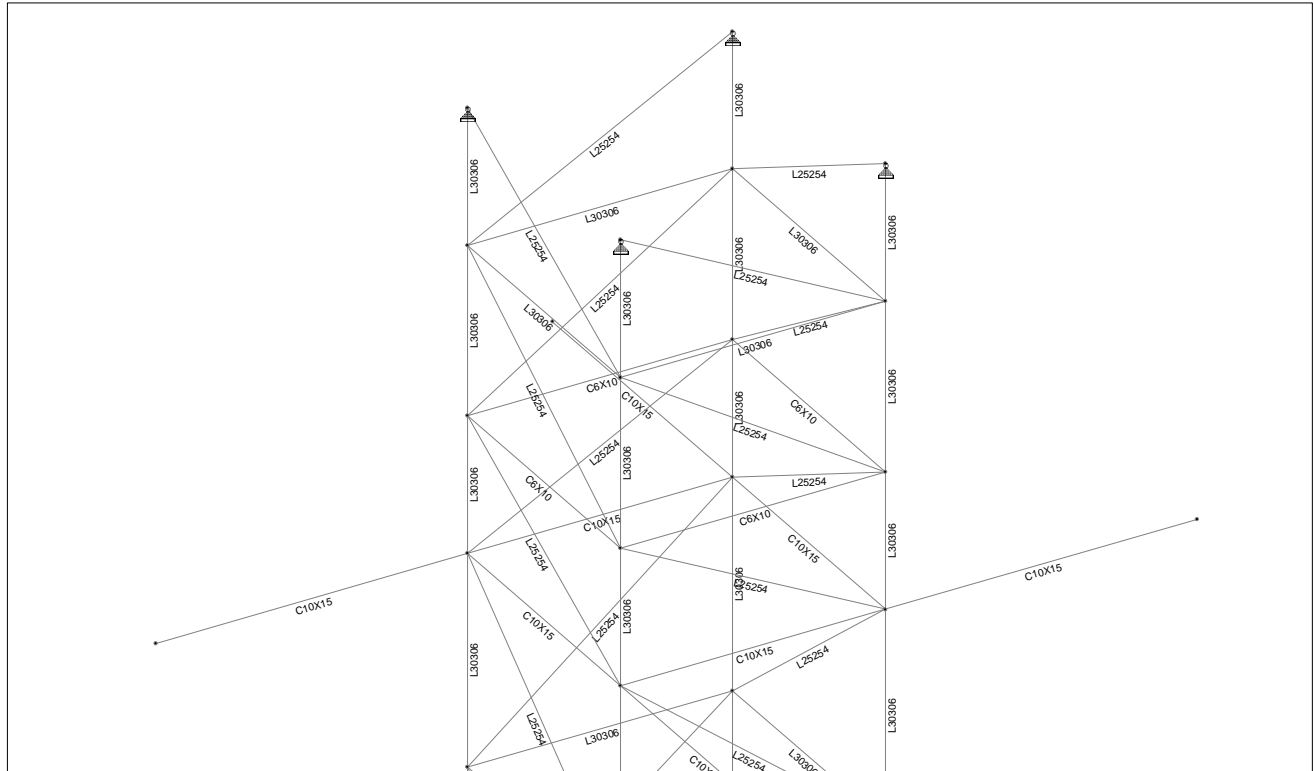
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Chd

Client

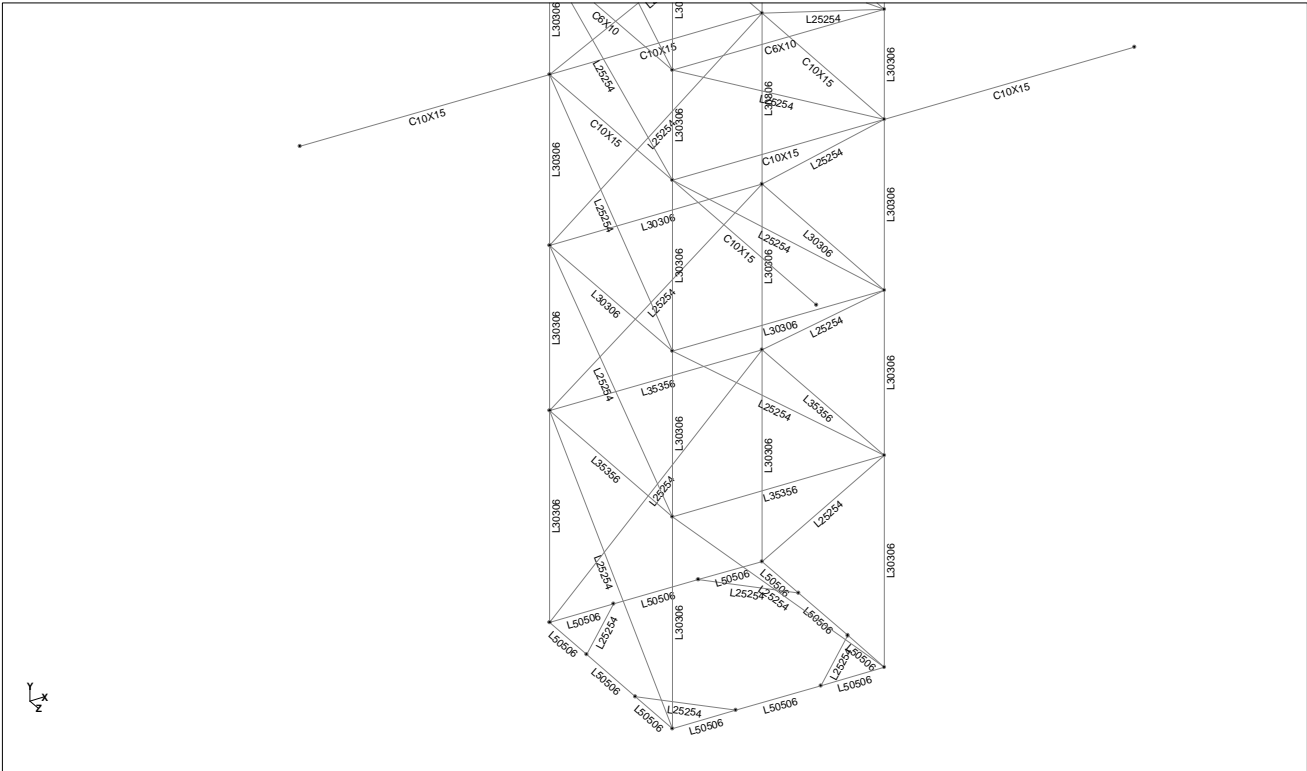
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Cage Member Sizes

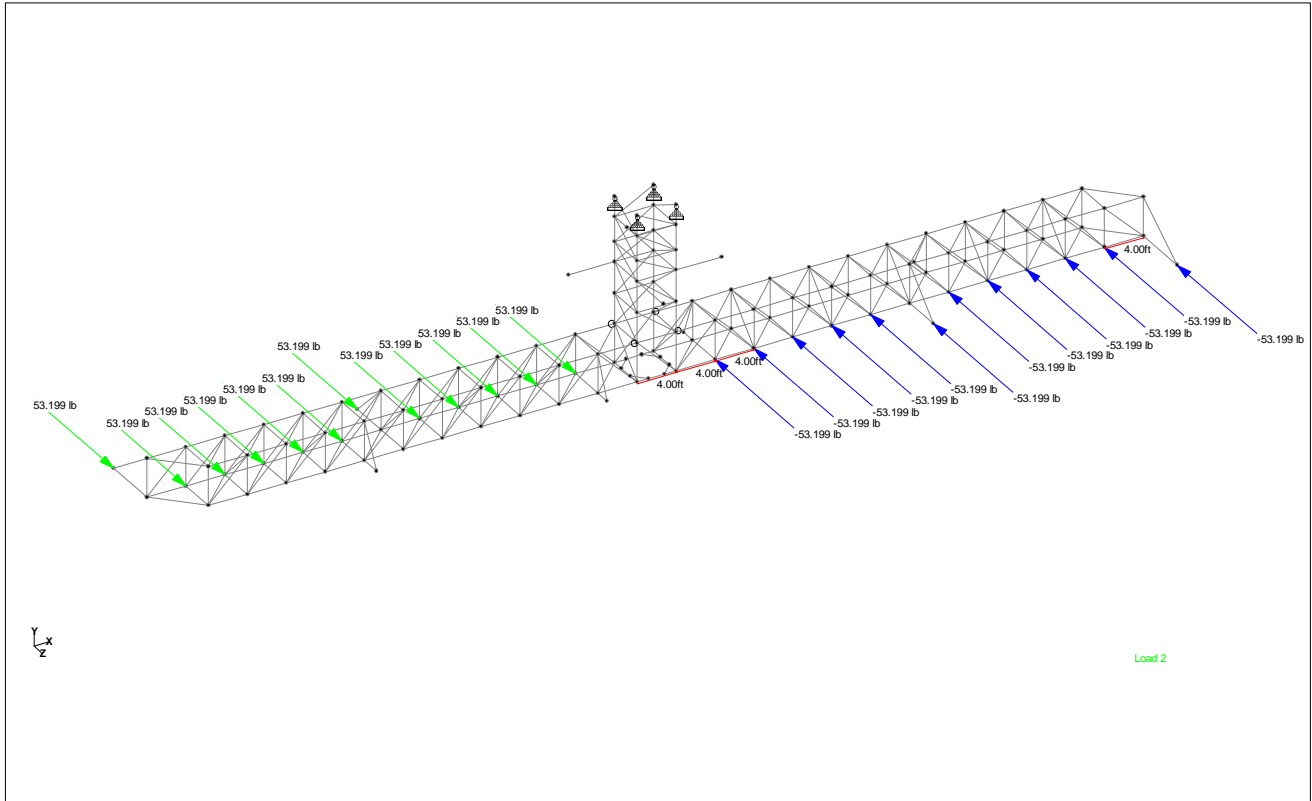
Bentley Software licensed to Westech Engineering Inc CONNECTED User: Jennifer MEIKLE	WESTECH		Job No 24946B	Sheet No 8	Rev 0
	Part Rakes & Cage				
Job Title Brantford			Ref		
Client			By ME75	Date 8/3/2023	Chd
			File STAAD-rc_24946B.std	Date/Time 16-Aug-2023 11:48	



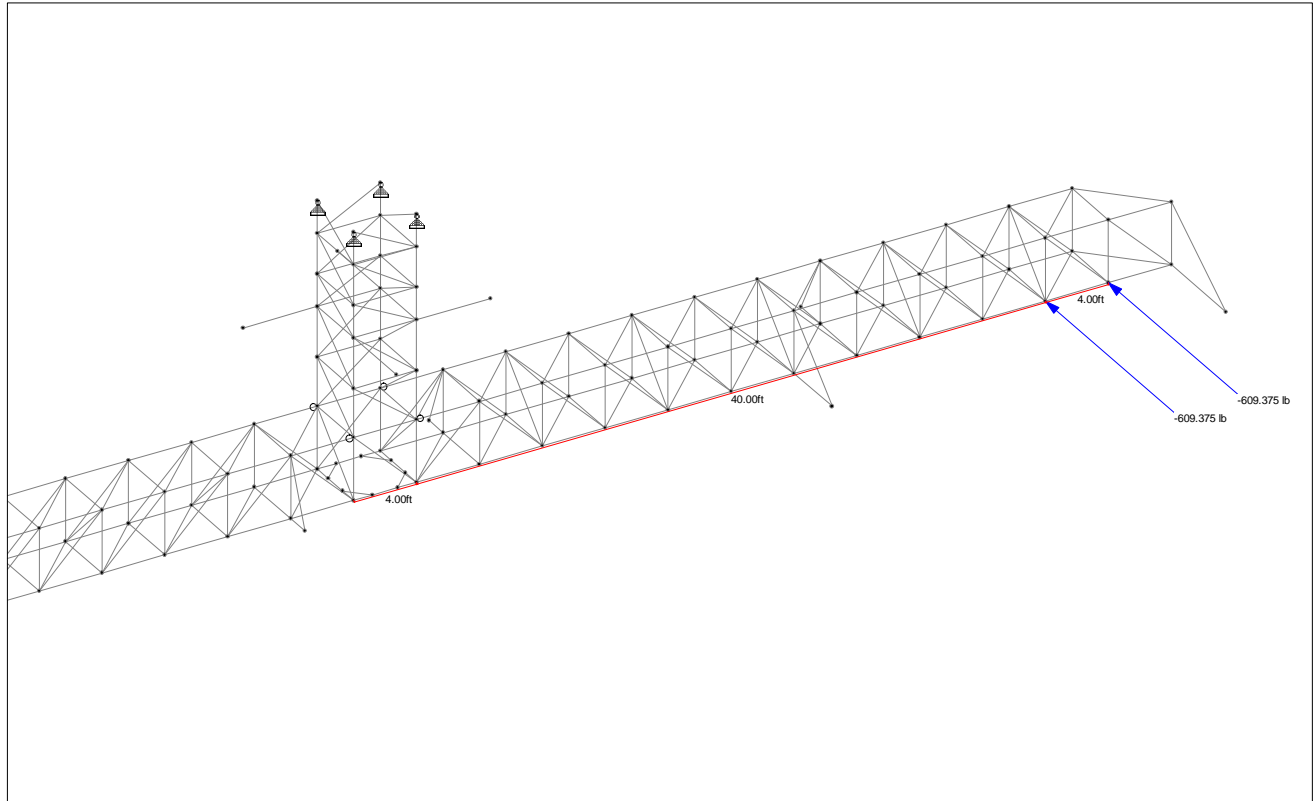
Cage Member Sizes

Primary Load Cases

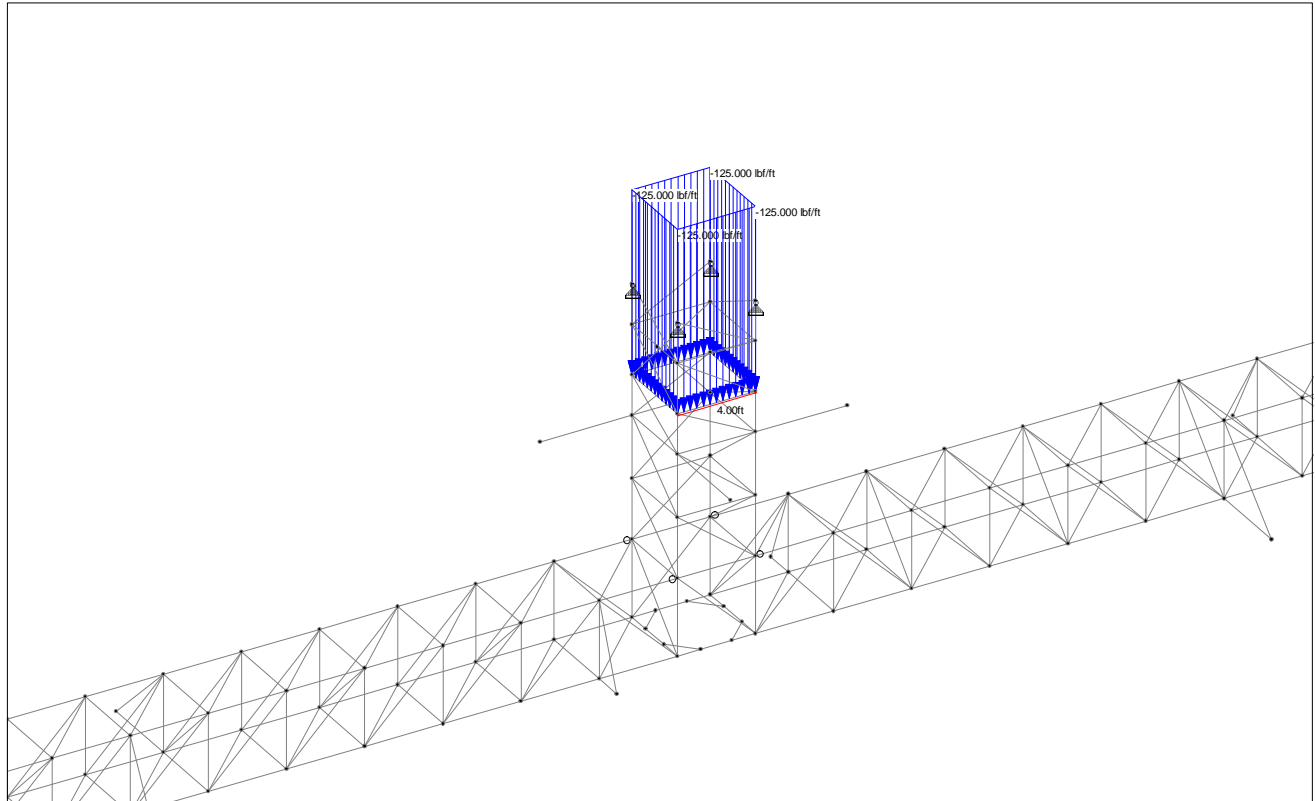
Number	Name	Type
1	GRAVITY	None
2	CONTINUOUS TORQUE	None
3	TORQUE TEST	None
4	EDI WELL STEEL LOAD	None
5	EDI WELL WATER LOAD	None
6	FEEDWELL LOAD	None
7	SPIRAL BLADE LOAD	None
8	EH(Z) SEISMIC LOADS	None
9	EH(X) SEISMIC LOADS	None
100	1.4D	None
101	1.25D + OPERATING	None
102	1.25D + CUT-OUT TORQUE	None
103	1.0D + EH(X)	None
104	1.0D + EH(Z)	None
200	D	None
201	D + OPERATING	None



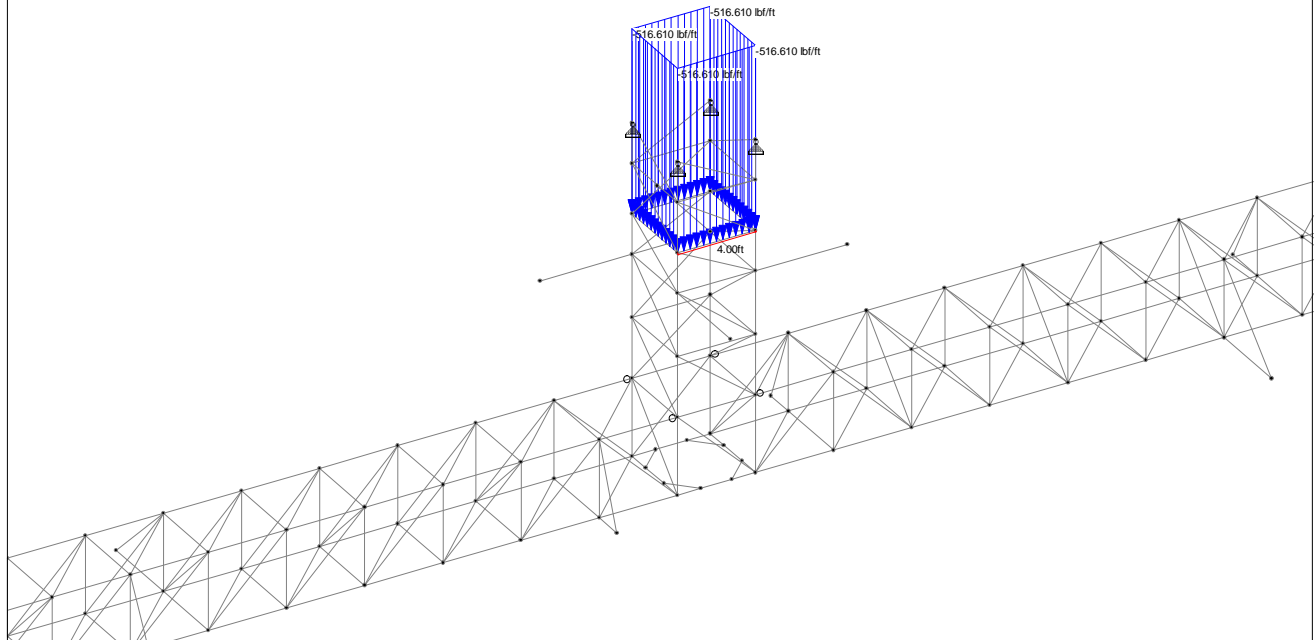
Continuous Torque (35,750 ft-lbs)



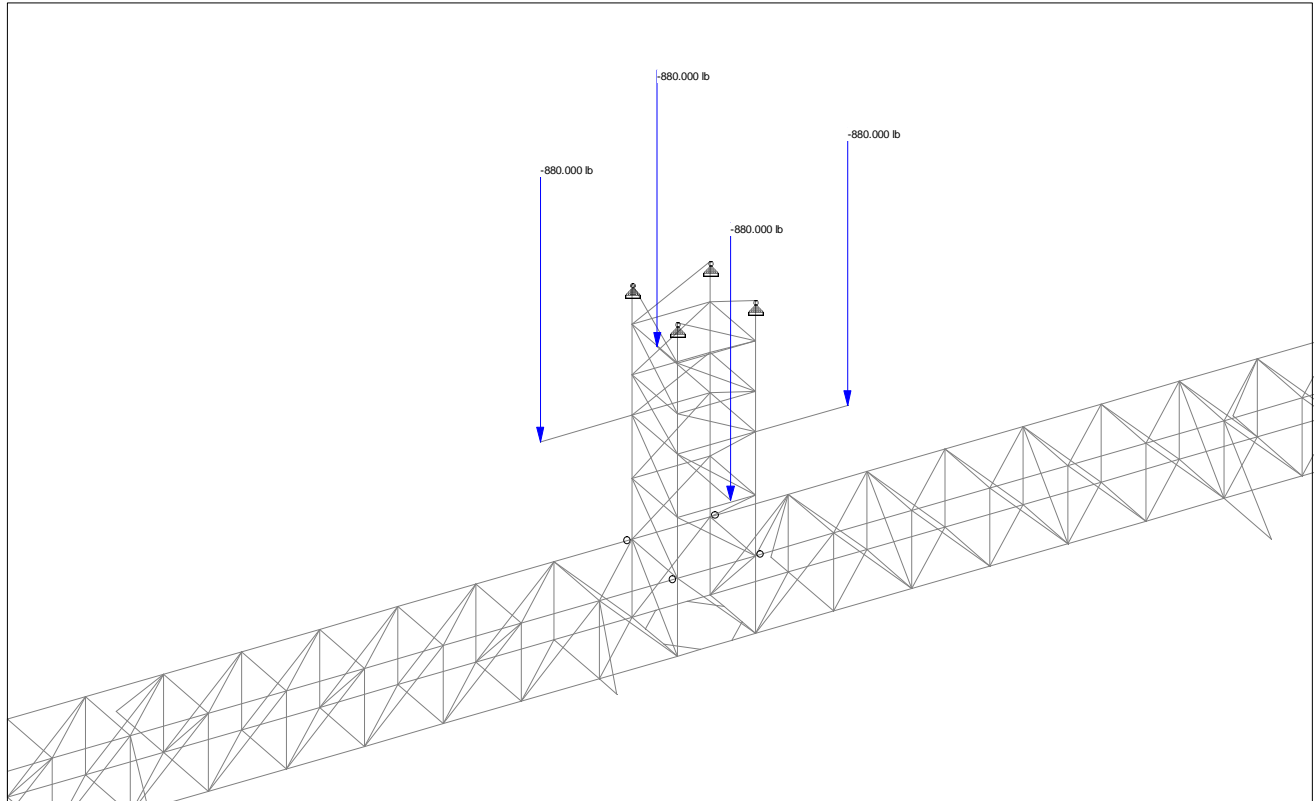
Torque Test (53,625 ft-lbs)



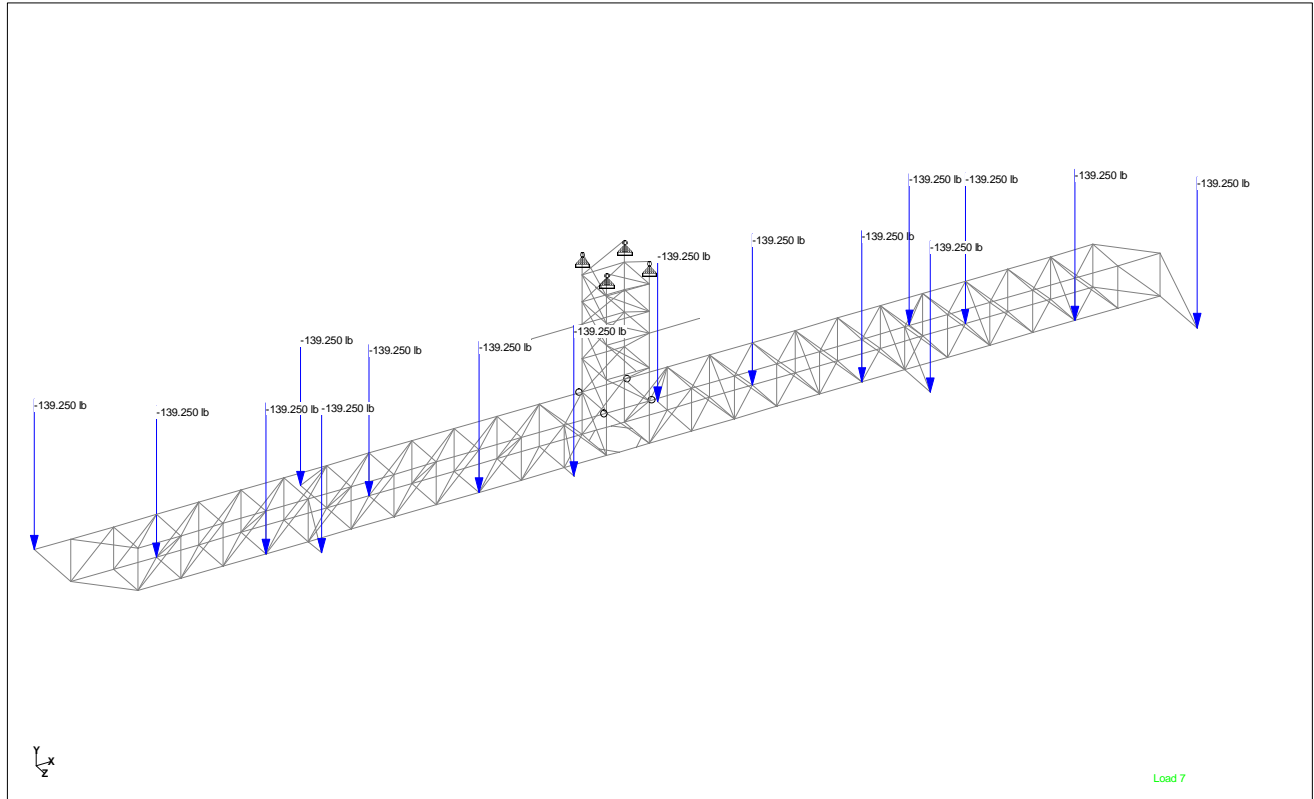
EDI Steel Load (2000 lbs)



EDI Water Load (8266 lbs)



Feedwell Load (3520 lbs)



Spiral Blade Load (2228 lbs)

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Job Title	Brantford
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Part Rakes & Cage

Ref

By ME75

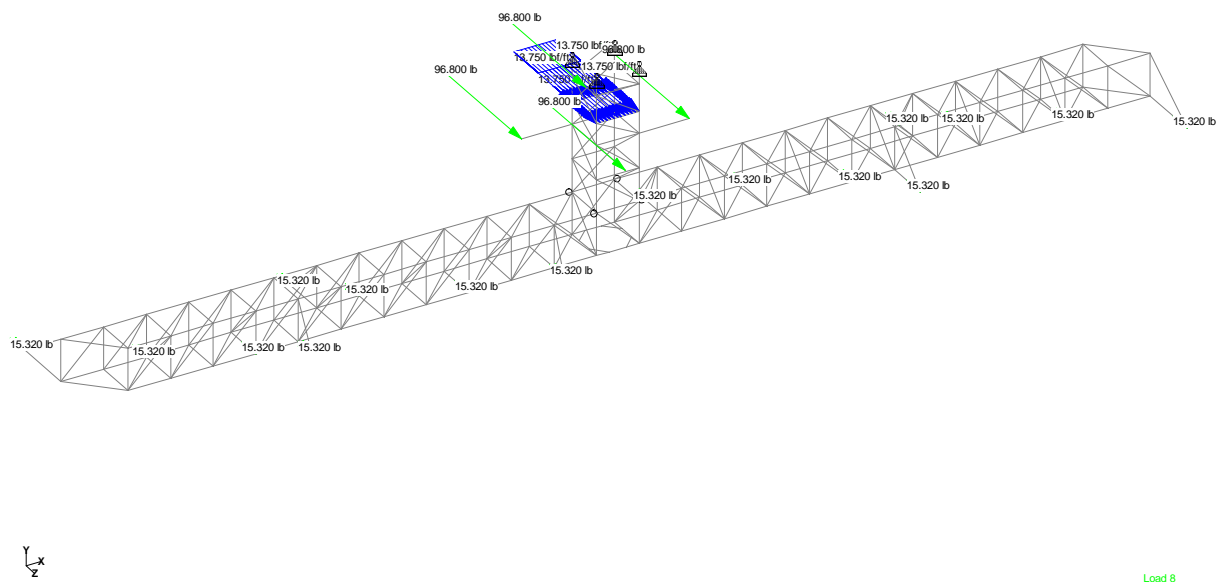
Date 8/3/2023

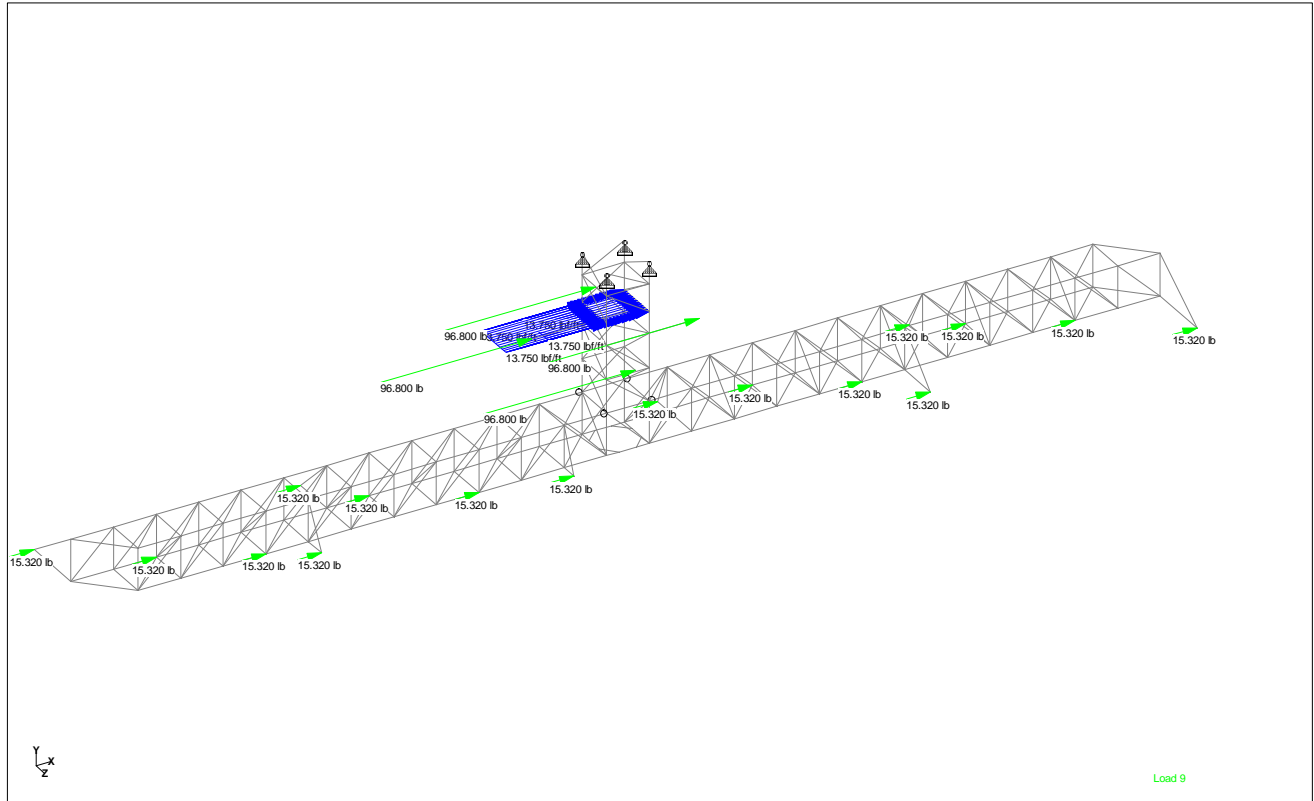
Chd

Client	
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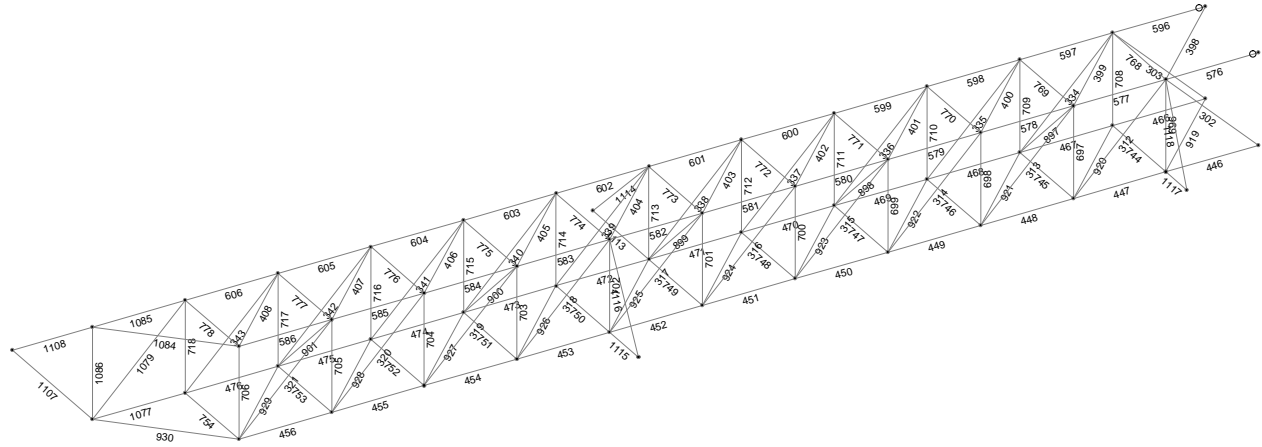
File STAAD-rc_24946B.std

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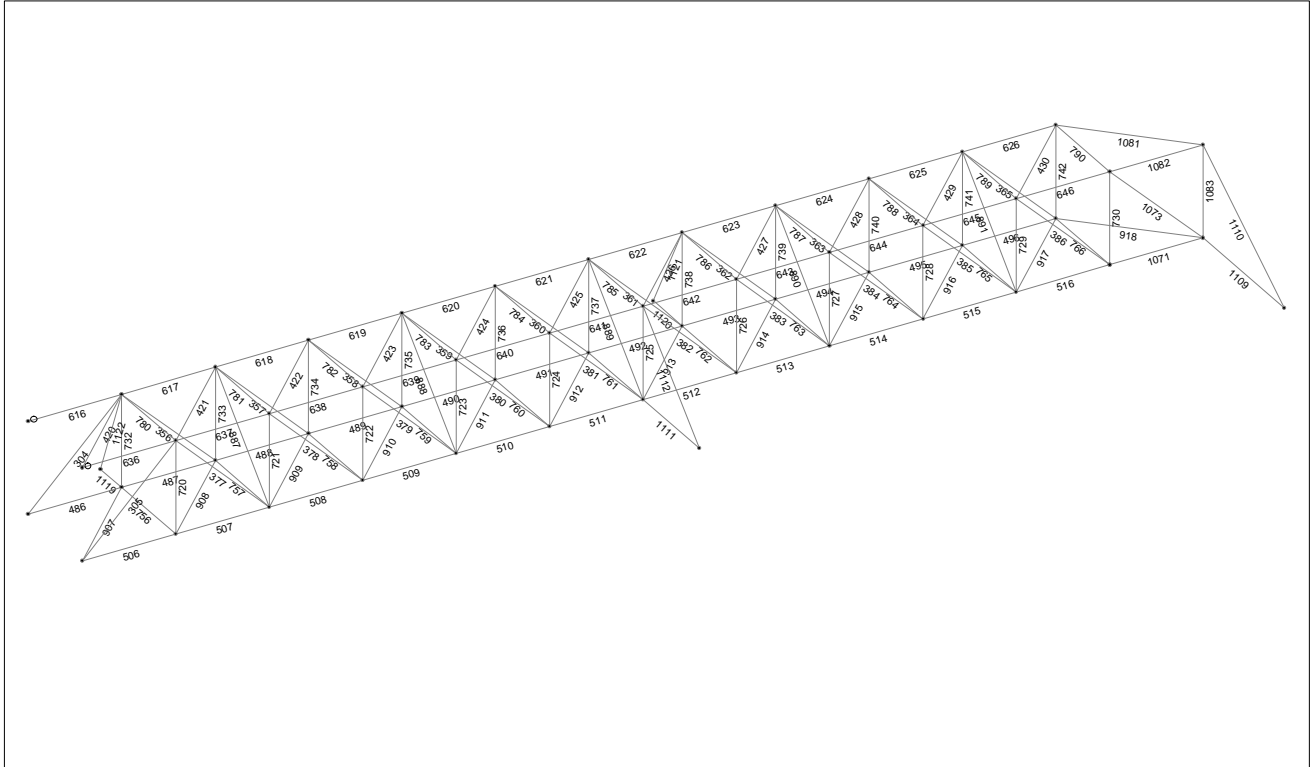
Seismic-Z ($0.11 \cdot \text{Dead Load}$)



*Seismic-X (0.11*Dead Load)*

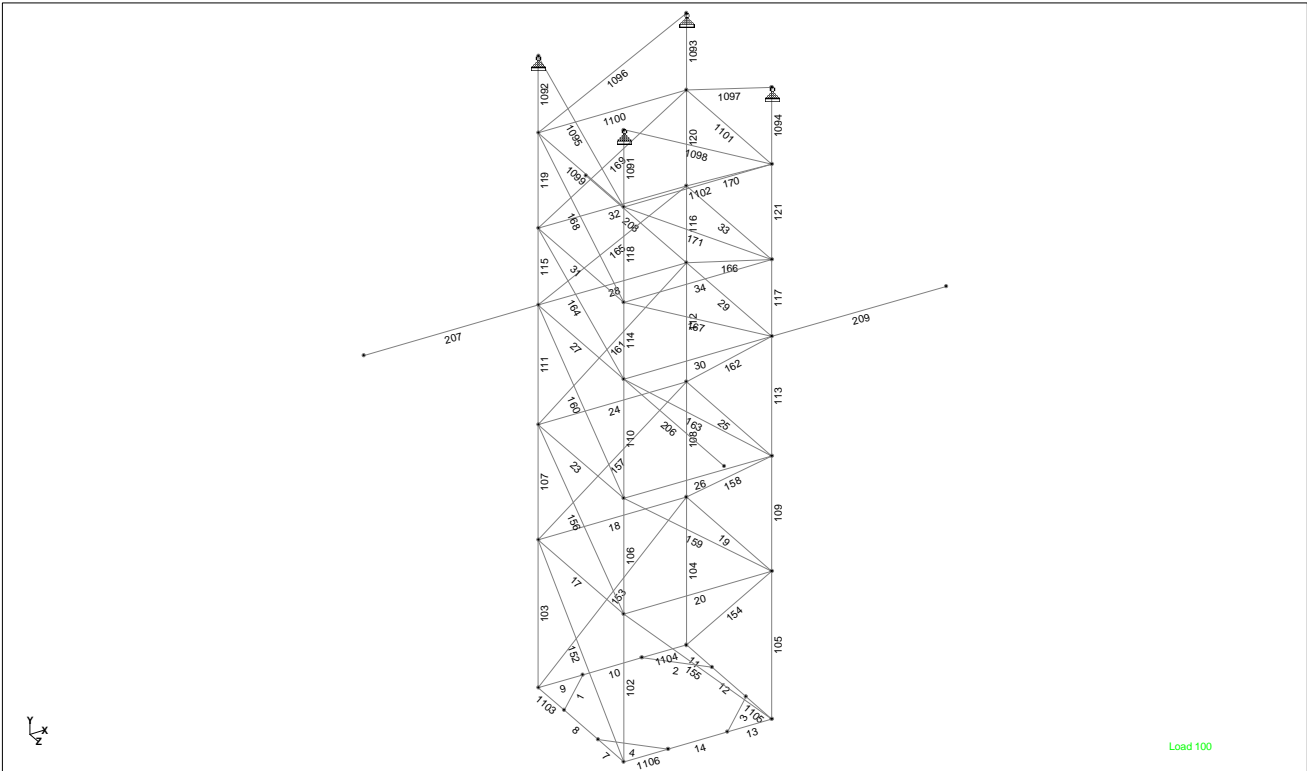


Beam Numbers



Beam Numbers



Bentley Software licensed to Westech Engineering Inc CONNECTED User: Jennifer MEIKLE	WESTECH		Job No 24946B	Sheet No 19	Rev 0
	Part Rakes & Cage				
Job Title Brantford			Ref		
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Beam Numbers



Utilization Ratio

Beam	Analysis Property	Design Property	Actual Ratio	Allowable Ratio	Ratio (Act./Allow.)	Clause	L/C	Ax (in ²)	Iz (in ⁴)	Iy (in ⁴)	Ix (in ⁴)
1	L25254	L25254	0.458	1.000	0.458	Cl. 13.8.4	101	1.190	0.276	1.130	0.025
2	L25254	L25254	0.403	1.000	0.403	Cl. 13.9.1	101	1.190	0.276	1.130	0.025
3	L25254	L25254	0.458	1.000	0.458	Cl. 13.8.4	101	1.190	0.276	1.130	0.025
4	L25254	L25254	0.403	1.000	0.403	Cl. 13.9.1	101	1.190	0.276	1.130	0.025
7	L50506	L50506	0.587	1.000	0.587	Cl. 13.8.4	101	3.650	3.549	13.943	0.171
8	L50506	L50506	0.605	1.000	0.605	Cl. 13.8.4	101	3.650	3.549	13.943	0.171
9	L50506	L50506	0.662	1.000	0.662	Cl. 13.8.4	101	3.650	3.549	13.943	0.171
10	L50506	L50506	0.760	1.000	0.760	Cl. 13.8.4	101	3.650	3.549	13.943	0.171
11	L50506	L50506	0.587	1.000	0.587	Cl. 13.8.4	101	3.650	3.549	13.943	0.171
12	L50506	L50506	0.605	1.000	0.605	Cl. 13.8.4	101	3.650	3.549	13.943	0.171
13	L50506	L50506	0.662	1.000	0.662	Cl. 13.8.4	101	3.650	3.549	13.943	0.171
14	L50506	L50506	0.760	1.000	0.760	Cl. 13.8.4	101	3.650	3.549	13.943	0.171
17	L35356	L35356	0.609	1.000	0.609	Cl. 13.8.4	101	2.500	1.166	4.564	0.117
18	L35356	L35356	0.663	1.000	0.663	Cl. 13.9.1	101	2.500	1.166	4.564	0.117
19	L35356	L35356	0.609	1.000	0.609	Cl. 13.8.4	101	2.500	1.166	4.564	0.117
20	L35356	L35356	0.663	1.000	0.663	Cl. 13.9.1	101	2.500	1.166	4.564	0.117
23	L30306	L30306	0.492	1.000	0.492	Cl. 13.8.4	101	2.110	0.712	2.807	0.099
24	L30306	L30306	0.801	1.000	0.801	Cl. 13.8.4	101	2.110	0.712	2.807	0.099
25	L30306	L30306	0.492	1.000	0.492	Cl. 13.8.4	101	2.110	0.712	2.807	0.099

 	Job No 24946B	Sheet No 20	Rev 0
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Utilization Ratio Cont...

Beam	Analysis Property	Design Property	Actual Ratio	Allowable Ratio	Ratio (Act./Allow.)	Clause	L/C	Ax (in ²)	Iz (in ⁴)	Iy (in ⁴)	Ix (in ⁴)
26	L30306	L30306	0.801	1.000	0.801	Cl. 13.8.4	101	2.110	0.712	2.807	0.099
27	C10X15	C10X15	0.401	1.000	0.401	Cl. 13.8.4	101	4.480	67.300	2.270	0.195
28	C10X15	C10X15	0.410	1.000	0.410	Cl. 13.8.4	101	4.480	67.300	2.270	0.195
29	C10X15	C10X15	0.401	1.000	0.401	Cl. 13.8.4	101	4.480	67.300	2.270	0.195
30	C10X15	C10X15	0.410	1.000	0.410	Cl. 13.8.4	101	4.480	67.300	2.270	0.195
31	C6X10	C6X10	0.363	1.000	0.363	Cl. 13.8.4	101	3.070	15.100	0.860	0.115
32	C6X10	C6X10	0.468	1.000	0.468	Cl. 13.8.4	101	3.070	15.100	0.860	0.115
33	C6X10	C6X10	0.363	1.000	0.363	Cl. 13.8.4	101	3.070	15.100	0.860	0.115
34	C6X10	C6X10	0.468	1.000	0.468	Cl. 13.8.4	101	3.070	15.100	0.860	0.115
102	L30306	L30306	0.250	1.000	0.250	Cl. 13.8.4	101	2.110	0.712	2.807	0.099
103	L30306	L30306	0.212	1.000	0.212	Cl. 13.9.1	101	2.110	0.712	2.807	0.099
104	L30306	L30306	0.250	1.000	0.250	Cl. 13.8.4	101	2.110	0.712	2.807	0.099
105	L30306	L30306	0.212	1.000	0.212	Cl. 13.9.1	101	2.110	0.712	2.807	0.099
106	L30306	L30306	0.472	1.000	0.472	Cl. 13.8.4	101	2.110	0.712	2.807	0.099
107	L30306	L30306	0.357	1.000	0.357	Cl. 13.8.4	101	2.110	0.712	2.807	0.099
108	L30306	L30306	0.472	1.000	0.472	Cl. 13.8.4	101	2.110	0.712	2.807	0.099
109	L30306	L30306	0.357	1.000	0.357	Cl. 13.8.4	101	2.110	0.712	2.807	0.099
110	L30306	L30306	0.544	1.000	0.544	Cl. 13.8.4	101	2.110	0.712	2.807	0.099
111	L30306	L30306	0.473	1.000	0.473	Cl. 13.8.4	101	2.110	0.712	2.807	0.099
112	L30306	L30306	0.544	1.000	0.544	Cl. 13.8.4	101	2.110	0.712	2.807	0.099
113	L30306	L30306	0.473	1.000	0.473	Cl. 13.8.4	101	2.110	0.712	2.807	0.099
114	L30306	L30306	0.588	1.000	0.588	Cl. 13.9.1	101	2.110	0.712	2.807	0.099
115	L30306	L30306	0.694	1.000	0.694	Cl. 13.8.4	101	2.110	0.712	2.807	0.099
116	L30306	L30306	0.588	1.000	0.588	Cl. 13.9.1	101	2.110	0.712	2.807	0.099
117	L30306	L30306	0.694	1.000	0.694	Cl. 13.8.4	101	2.110	0.712	2.807	0.099
118	L30306	L30306	0.442	1.000	0.442	Cl. 13.9.1	101	2.110	0.712	2.807	0.099
119	L30306	L30306	0.406	1.000	0.406	Cl. 13.8.4	101	2.110	0.712	2.807	0.099
120	L30306	L30306	0.442	1.000	0.442	Cl. 13.9.1	101	2.110	0.712	2.807	0.099
121	L30306	L30306	0.406	1.000	0.406	Cl. 13.8.4	101	2.110	0.712	2.807	0.099
152	L25254	L25254	0.530	1.000	0.530	Cl. 13.9.1	101	1.190	0.276	1.130	0.025
153	L25254	L25254	0.258	1.000	0.258	Cl. 13.9.1	101	1.190	0.276	1.130	0.025
154	L25254	L25254	0.530	1.000	0.530	Cl. 13.9.1	101	1.190	0.276	1.130	0.025
155	L25254	L25254	0.258	1.000	0.258	Cl. 13.9.1	101	1.190	0.276	1.130	0.025
156	L25254	L25254	0.575	1.000	0.575	Cl. 13.9.1	101	1.190	0.276	1.130	0.025
157	L25254	L25254	0.778	1.000	0.778	Cl. 13.9.1	101	1.190	0.276	1.130	0.025
158	L25254	L25254	0.575	1.000	0.575	Cl. 13.9.1	101	1.190	0.276	1.130	0.025
159	L25254	L25254	0.778	1.000	0.778	Cl. 13.9.1	101	1.190	0.276	1.130	0.025
160	L25254	L25254	0.445	1.000	0.445	Cl. 13.9.1	101	1.190	0.276	1.130	0.025
161	L25254	L25254	0.767	1.000	0.767	Cl. 13.9.1	101	1.190	0.276	1.130	0.025
162	L25254	L25254	0.445	1.000	0.445	Cl. 13.9.1	101	1.190	0.276	1.130	0.025
163	L25254	L25254	0.767	1.000	0.767	Cl. 13.9.1	101	1.190	0.276	1.130	0.025
164	L25254	L25254	0.415	1.000	0.415	Cl. 13.9.1	101	1.190	0.276	1.130	0.025
165	L25254	L25254	0.539	1.000	0.539	Cl. 13.9.1	101	1.190	0.276	1.130	0.025
166	L25254	L25254	0.415	1.000	0.415	Cl. 13.9.1	101	1.190	0.276	1.130	0.025
167	L25254	L25254	0.539	1.000	0.539	Cl. 13.9.1	101	1.190	0.276	1.130	0.025

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Utilization Ratio Cont...

Beam	Analysis Property	Design Property	Actual Ratio	Allowable Ratio	Ratio (Act./Allow.)	Clause	L/C	Ax (in ²)	Iz (in ⁴)	Iy (in ⁴)	Ix (in ⁴)
168	L25254	L25254	0.526	1.000	0.526	Cl. 13.9.1	101	1.190	0.276	1.130	0.025
169	L25254	L25254	0.610	1.000	0.610	Cl. 13.9.1	101	1.190	0.276	1.130	0.025
170	L25254	L25254	0.526	1.000	0.526	Cl. 13.9.1	101	1.190	0.276	1.130	0.025
171	L25254	L25254	0.610	1.000	0.610	Cl. 13.9.1	101	1.190	0.276	1.130	0.025
206	C10X15	C10X15	0.318	1.000	0.318	Cl. 13.8.4	103	4.480	67.300	2.270	0.195
207	C10X15	C10X15	0.318	1.000	0.318	Cl. 13.8.4	104	4.480	67.300	2.270	0.195
208	C10X15	C10X15	0.318	1.000	0.318	Cl. 13.8.4	103	4.480	67.300	2.270	0.195
209	C10X15	C10X15	0.318	1.000	0.318	Cl. 13.8.4	104	4.480	67.300	2.270	0.195
302	L20204	L20204	0.509	1.000	0.509	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
303	L20204	L20204	0.776	1.000	0.776	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
304	L20204	L20204	0.509	1.000	0.509	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
305	L20204	L20204	0.776	1.000	0.776	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
312	L20204	L20204	0.147	1.000	0.147	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
313	L20204	L20204	0.142	1.000	0.142	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
314	L20204	L20204	0.120	1.000	0.120	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
315	L20204	L20204	0.109	1.000	0.109	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
316	L20204	L20204	0.100	1.000	0.100	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
317	L20204	L20204	0.089	1.000	0.089	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
318	L20204	L20204	0.066	1.000	0.066	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
319	L20204	L20204	0.048	1.000	0.048	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
320	L20204	L20204	0.038	1.000	0.038	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
321	L20204	L20204	0.033748	1.000	0.033748	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
334	L20204	L20204	0.230	1.000	0.230	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
335	L20204	L20204	0.193	1.000	0.193	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
336	L20204	L20204	0.175	1.000	0.175	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
337	L20204	L20204	0.157	1.000	0.157	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
338	L20204	L20204	0.135	1.000	0.135	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
339	L20204	L20204	0.108	1.000	0.108	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
340	L20204	L20204	0.097	1.000	0.097	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
341	L20204	L20204	0.086	1.000	0.086	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
342	L20204	L20204	0.073	1.000	0.073	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
343	L20204	L20204	0.051	1.000	0.051	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
356	L20204	L20204	0.147	1.000	0.147	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
357	L20204	L20204	0.142	1.000	0.142	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
358	L20204	L20204	0.120	1.000	0.120	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
359	L20204	L20204	0.109	1.000	0.109	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
360	L20204	L20204	0.100	1.000	0.100	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
361	L20204	L20204	0.089	1.000	0.089	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
362	L20204	L20204	0.066	1.000	0.066	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
363	L20204	L20204	0.048	1.000	0.048	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
364	L20204	L20204	0.053155	1.000	0.053155	Cl. 13.8.4	102	0.944	0.141	0.554	0.020
365	L20204	L20204	0.033748	1.000	0.033748	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
377	L20204	L20204	0.230	1.000	0.230	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
378	L20204	L20204	0.203	1.000	0.203	Cl. 13.9.1	102	0.944	0.141	0.554	0.020
379	L20204	L20204	0.185	1.000	0.185	Cl. 13.9.1	102	0.944	0.141	0.554	0.020

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Utilization Ratio Cont...

Beam	Analysis Property	Design Property	Actual Ratio	Allowable Ratio	Ratio (Act./Allow.)	Clause	L/C	Ax (in ²)	Iz (in ⁴)	Iy (in ⁴)	Ix (in ⁴)
380	L20204	L20204	0.168	1.000	0.168	Cl. 13.9.1	102	0.944	0.141	0.554	0.020
381	L20204	L20204	0.147	1.000	0.147	Cl. 13.9.1	102	0.944	0.141	0.554	0.020
382	L20204	L20204	0.122	1.000	0.122	Cl. 13.9.1	102	0.944	0.141	0.554	0.020
383	L20204	L20204	0.111	1.000	0.111	Cl. 13.9.1	102	0.944	0.141	0.554	0.020
384	L20204	L20204	0.102	1.000	0.102	Cl. 13.9.1	102	0.944	0.141	0.554	0.020
385	L20204	L20204	0.089	1.000	0.089	Cl. 13.9.1	102	0.944	0.141	0.554	0.020
386	L20204	L20204	0.051	1.000	0.051	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
398	L20204	L20204	0.201	1.000	0.201	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
399	L20204	L20204	0.083	1.000	0.083	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
400	L20204	L20204	0.093	1.000	0.093	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
401	L20204	L20204	0.089	1.000	0.089	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
402	L20204	L20204	0.099	1.000	0.099	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
403	L20204	L20204	0.095	1.000	0.095	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
404	L20204	L20204	0.061134	1.000	0.061134	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
405	L20204	L20204	0.078482	1.000	0.078482	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
406	L20204	L20204	0.084	1.000	0.084	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
407	L20204	L20204	0.081	1.000	0.081	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
408	L20204	L20204	0.087	1.000	0.087	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
420	L20204	L20204	0.201	1.000	0.201	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
421	L20204	L20204	0.083	1.000	0.083	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
422	L20204	L20204	0.093	1.000	0.093	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
423	L20204	L20204	0.089	1.000	0.089	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
424	L20204	L20204	0.099	1.000	0.099	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
425	L20204	L20204	0.095	1.000	0.095	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
426	L20204	L20204	0.061134	1.000	0.061134	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
427	L20204	L20204	0.078482	1.000	0.078482	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
428	L20204	L20204	0.084	1.000	0.084	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
429	L20204	L20204	0.081	1.000	0.081	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
430	L20204	L20204	0.087	1.000	0.087	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
446	L30304	L30304	0.827	1.000	0.827	Cl. 13.8.4	101	1.440	0.493	1.996	0.03
447	L30304	L30304	0.662	1.000	0.662	Cl. 13.8.4	101	1.440	0.493	1.996	0.03
448	L30304	L30304	0.612	1.000	0.612	Cl. 13.8.4	101	1.440	0.493	1.996	0.03
449	L30304	L30304	0.499	1.000	0.499	Cl. 13.8.4	101	1.440	0.493	1.996	0.03
450	L30304	L30304	0.411	1.000	0.411	Cl. 13.8.4	101	1.440	0.493	1.996	0.03
451	L30304	L30304	0.319	1.000	0.319	Cl. 13.8.4	101	1.440	0.493	1.996	0.03
452	L30304	L30304	0.242	1.000	0.242	Cl. 13.8.4	101	1.440	0.493	1.996	0.03
453	L30304	L30304	0.172	1.000	0.172	Cl. 13.8.4	101	1.440	0.493	1.996	0.03
454	L30304	L30304	0.117	1.000	0.117	Cl. 13.8.4	101	1.440	0.493	1.996	0.03
455	L30304	L30304	0.082	1.000	0.082	Cl. 13.8.4	101	1.440	0.493	1.996	0.03
456	L30304	L30304	0.060	1.000	0.060	Cl. 13.8.4	101	1.440	0.493	1.996	0.03
466	L30304	L30304	0.658	1.000	0.658	Cl. 13.8.4	100	1.440	0.493	1.996	0.03
467	L30304	L30304	0.556	1.000	0.556	Cl. 13.8.4	100	1.440	0.493	1.996	0.03
468	L30304	L30304	0.488	1.000	0.488	Cl. 13.8.4	100	1.440	0.493	1.996	0.03
469	L30304	L30304	0.387	1.000	0.387	Cl. 13.8.4	100	1.440	0.493	1.996	0.03
470	L30304	L30304	0.311	1.000	0.311	Cl. 13.8.4	100	1.440	0.493	1.996	0.03

 	Job No 24946B	Sheet No 23	Rev 0
	Part Rakes & Cage		
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Client	File STAAD-rc_24946B.std	Date/Time 16-Aug-2023 11:48	



Utilization Ratio Cont...

Beam	Analysis Property	Design Property	Actual Ratio	Allowable Ratio	Ratio (Act./Allow.)	Clause	L/C	Ax (in ²)	Iz (in ⁴)	Iy (in ⁴)	Ix (in ⁴)
471	L30304	L30304	0.234	1.000	0.234	Cl. 13.8.4	100	1.440	0.493	1.996	0.03
472	L30304	L30304	0.169	1.000	0.169	Cl. 13.8.4	100	1.440	0.493	1.996	0.03
473	L30304	L30304	0.123	1.000	0.123	Cl. 13.8.4	100	1.440	0.493	1.996	0.03
474	L30304	L30304	0.085	1.000	0.085	Cl. 13.8.4	100	1.440	0.493	1.996	0.03
475	L30304	L30304	0.054	1.000	0.054	Cl. 13.8.4	100	1.440	0.493	1.996	0.03
476	L30304	L30304	0.025	1.000	0.025	Cl. 13.8.4	100	1.440	0.493	1.996	0.03
486	L30304	L30304	0.948	1.000	0.948	Cl. 13.8.4	102	1.440	0.493	1.996	0.03
487	L30304	L30304	0.805	1.000	0.805	Cl. 13.8.4	102	1.440	0.493	1.996	0.03
488	L30304	L30304	0.720	1.000	0.720	Cl. 13.8.4	102	1.440	0.493	1.996	0.03
489	L30304	L30304	0.611	1.000	0.611	Cl. 13.8.4	102	1.440	0.493	1.996	0.03
490	L30304	L30304	0.519	1.000	0.519	Cl. 13.8.4	102	1.440	0.493	1.996	0.03
491	L30304	L30304	0.422	1.000	0.422	Cl. 13.8.4	102	1.440	0.493	1.996	0.03
492	L30304	L30304	0.332	1.000	0.332	Cl. 13.8.4	102	1.440	0.493	1.996	0.03
493	L30304	L30304	0.248	1.000	0.248	Cl. 13.8.4	102	1.440	0.493	1.996	0.03
494	L30304	L30304	0.179	1.000	0.179	Cl. 13.8.4	102	1.440	0.493	1.996	0.03
495	L30304	L30304	0.122	1.000	0.122	Cl. 13.8.4	102	1.440	0.493	1.996	0.03
496	L30304	L30304	0.079	1.000	0.079	Cl. 13.8.4	102	1.440	0.493	1.996	0.03
506	L30304	L30304	0.658	1.000	0.658	Cl. 13.8.4	100	1.440	0.493	1.996	0.03
507	L30304	L30304	0.556	1.000	0.556	Cl. 13.8.4	100	1.440	0.493	1.996	0.03
508	L30304	L30304	0.488	1.000	0.488	Cl. 13.8.4	100	1.440	0.493	1.996	0.03
509	L30304	L30304	0.387	1.000	0.387	Cl. 13.8.4	100	1.440	0.493	1.996	0.03
510	L30304	L30304	0.311	1.000	0.311	Cl. 13.8.4	100	1.440	0.493	1.996	0.03
511	L30304	L30304	0.234	1.000	0.234	Cl. 13.8.4	100	1.440	0.493	1.996	0.03
512	L30304	L30304	0.169	1.000	0.169	Cl. 13.8.4	100	1.440	0.493	1.996	0.03
513	L30304	L30304	0.123	1.000	0.123	Cl. 13.8.4	100	1.440	0.493	1.996	0.03
514	L30304	L30304	0.085	1.000	0.085	Cl. 13.8.4	100	1.440	0.493	1.996	0.03
515	L30304	L30304	0.054	1.000	0.054	Cl. 13.8.4	100	1.440	0.493	1.996	0.03
516	L30304	L30304	0.034	1.000	0.034	Cl. 13.8.4	102	1.440	0.493	1.996	0.03
576	L25254	L25254	0.548	1.000	0.548	Cl. 13.9.1	100	1.190	0.276	1.130	0.025
577	L25254	L25254	0.423	1.000	0.423	Cl. 13.9.1	100	1.190	0.276	1.130	0.025
578	L25254	L25254	0.339	1.000	0.339	Cl. 13.9.1	100	1.190	0.276	1.130	0.025
579	L25254	L25254	0.277	1.000	0.277	Cl. 13.9.1	100	1.190	0.276	1.130	0.025
580	L25254	L25254	0.220	1.000	0.220	Cl. 13.9.1	100	1.190	0.276	1.130	0.025
581	L25254	L25254	0.166	1.000	0.166	Cl. 13.9.1	100	1.190	0.276	1.130	0.025
582	L25254	L25254	0.121	1.000	0.121	Cl. 13.9.1	100	1.190	0.276	1.130	0.025
583	L25254	L25254	0.086	1.000	0.086	Cl. 13.9.1	100	1.190	0.276	1.130	0.025
584	L25254	L25254	0.062	1.000	0.062	Cl. 13.9.1	100	1.190	0.276	1.130	0.025
585	L25254	L25254	0.047	1.000	0.047	Cl. 13.9.1	100	1.190	0.276	1.130	0.025
586	L25254	L25254	0.031	1.000	0.031	Cl. 13.9.1	100	1.190	0.276	1.130	0.025
596	L25254	L25254	0.699	1.000	0.699	Cl. 13.9.1	101	1.190	0.276	1.130	0.025
597	L25254	L25254	0.448	1.000	0.448	Cl. 13.9.1	101	1.190	0.276	1.130	0.025
598	L25254	L25254	0.345	1.000	0.345	Cl. 13.9.1	101	1.190	0.276	1.130	0.025
599	L25254	L25254	0.268	1.000	0.268	Cl. 13.9.1	101	1.190	0.276	1.130	0.025
600	L25254	L25254	0.202	1.000	0.202	Cl. 13.9.1	101	1.190	0.276	1.130	0.025
601	L25254	L25254	0.150	1.000	0.150	Cl. 13.9.1	101	1.190	0.276	1.130	0.025

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	Part Rakes & Cage		
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Client	File STAAD-rc_24946B.std	Date/Time 16-Aug-2023 11:48	



Utilization Ratio Cont...

Beam	Analysis Property	Design Property	Actual Ratio	Allowable Ratio	Ratio (Act./Allow.)	Clause	L/C	Ax (in ²)	Iz (in ⁴)	Iy (in ⁴)	Ix (in ⁴)
602	L25254	L25254	0.106	1.000	0.106	Cl. 13.9.1	101	1.190	0.276	1.130	0.025
603	L25254	L25254	0.070	1.000	0.070	Cl. 13.9.1	101	1.190	0.276	1.130	0.025
604	L25254	L25254	0.043	1.000	0.043	Cl. 13.9.1	101	1.190	0.276	1.130	0.025
605	L25254	L25254	0.022	1.000	0.022	Cl. 13.9.1	100	1.190	0.276	1.130	0.025
606	L25254	L25254	0.026	1.000	0.026	Cl. 13.8.4	100	1.190	0.276	1.130	0.025
616	L25254	L25254	0.548	1.000	0.548	Cl. 13.9.1	100	1.190	0.276	1.130	0.025
617	L25254	L25254	0.423	1.000	0.423	Cl. 13.9.1	100	1.190	0.276	1.130	0.025
618	L25254	L25254	0.339	1.000	0.339	Cl. 13.9.1	100	1.190	0.276	1.130	0.025
619	L25254	L25254	0.277	1.000	0.277	Cl. 13.9.1	100	1.190	0.276	1.130	0.025
620	L25254	L25254	0.220	1.000	0.220	Cl. 13.9.1	100	1.190	0.276	1.130	0.025
621	L25254	L25254	0.166	1.000	0.166	Cl. 13.9.1	100	1.190	0.276	1.130	0.025
622	L25254	L25254	0.121	1.000	0.121	Cl. 13.9.1	100	1.190	0.276	1.130	0.025
623	L25254	L25254	0.086	1.000	0.086	Cl. 13.9.1	100	1.190	0.276	1.130	0.025
624	L25254	L25254	0.062	1.000	0.062	Cl. 13.9.1	100	1.190	0.276	1.130	0.025
625	L25254	L25254	0.047	1.000	0.047	Cl. 13.9.1	100	1.190	0.276	1.130	0.025
626	L25254	L25254	0.031	1.000	0.031	Cl. 13.9.1	100	1.190	0.276	1.130	0.025
636	L25254	L25254	0.769	1.000	0.769	Cl. 13.9.1	102	1.190	0.276	1.130	0.025
637	L25254	L25254	0.528	1.000	0.528	Cl. 13.9.1	102	1.190	0.276	1.130	0.025
638	L25254	L25254	0.426	1.000	0.426	Cl. 13.9.1	102	1.190	0.276	1.130	0.025
639	L25254	L25254	0.337	1.000	0.337	Cl. 13.9.1	102	1.190	0.276	1.130	0.025
640	L25254	L25254	0.266	1.000	0.266	Cl. 13.9.1	102	1.190	0.276	1.130	0.025
641	L25254	L25254	0.204	1.000	0.204	Cl. 13.9.1	102	1.190	0.276	1.130	0.025
642	L25254	L25254	0.149	1.000	0.149	Cl. 13.9.1	102	1.190	0.276	1.130	0.025
643	L25254	L25254	0.100	1.000	0.100	Cl. 13.9.1	102	1.190	0.276	1.130	0.025
644	L25254	L25254	0.056	1.000	0.056	Cl. 13.9.1	102	1.190	0.276	1.130	0.025
645	L25254	L25254	0.022	1.000	0.022	Cl. 13.9.1	100	1.190	0.276	1.130	0.025
646	L25254	L25254	0.027	1.000	0.027	Cl. 13.8.4	102	1.190	0.276	1.130	0.025
696	L20204	L20204	0.029	1.000	0.029	Cl. 13.9.1	102	0.944	0.141	0.554	0.020
697	L20204	L20204	0.174	1.000	0.174	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
698	L20204	L20204	0.166	1.000	0.166	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
699	L20204	L20204	0.154	1.000	0.154	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
700	L20204	L20204	0.138	1.000	0.138	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
701	L20204	L20204	0.130	1.000	0.130	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
702	L20204	L20204	0.104	1.000	0.104	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
703	L20204	L20204	0.068	1.000	0.068	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
704	L20204	L20204	0.048635	1.000	0.048635	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
705	L20204	L20204	0.040	1.000	0.040	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
706	L20204	L20204	0.020	1.000	0.020	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
708	L20204	L20204	0.068	1.000	0.068	Cl. 13.9.1	102	0.944	0.141	0.554	0.020
709	L20204	L20204	0.267	1.000	0.267	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
710	L20204	L20204	0.254	1.000	0.254	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
711	L20204	L20204	0.229	1.000	0.229	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
712	L20204	L20204	0.195	1.000	0.195	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
713	L20204	L20204	0.167	1.000	0.167	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
714	L20204	L20204	0.136	1.000	0.136	Cl. 13.8.4	101	0.944	0.141	0.554	0.020

 	Job No 24946B	Sheet No 25	Rev 0
	Part Rakes & Cage		
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Client	File STAAD-rc_24946B.std	Date/Time 16-Aug-2023 11:48	



Utilization Ratio Cont...

Beam	Analysis Property	Design Property	Actual Ratio	Allowable Ratio	Ratio (Act./Allow.)	Clause	L/C	Ax (in ²)	Iz (in ⁴)	Iy (in ⁴)	Ix (in ⁴)
715	L20204	L20204	0.122	1.000	0.122	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
716	L20204	L20204	0.103	1.000	0.103	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
717	L20204	L20204	0.074	1.000	0.074	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
718	L20204	L20204	0.055	1.000	0.055	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
720	L20204	L20204	0.068	1.000	0.068	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
721	L20204	L20204	0.277	1.000	0.277	Cl. 13.8.4	102	0.944	0.141	0.554	0.020
722	L20204	L20204	0.264	1.000	0.264	Cl. 13.8.4	102	0.944	0.141	0.554	0.020
723	L20204	L20204	0.236	1.000	0.236	Cl. 13.8.4	102	0.944	0.141	0.554	0.020
724	L20204	L20204	0.201	1.000	0.201	Cl. 13.8.4	102	0.944	0.141	0.554	0.020
725	L20204	L20204	0.179	1.000	0.179	Cl. 13.8.4	102	0.944	0.141	0.554	0.020
726	L20204	L20204	0.152	1.000	0.152	Cl. 13.8.4	102	0.944	0.141	0.554	0.020
727	L20204	L20204	0.145	1.000	0.145	Cl. 13.8.4	102	0.944	0.141	0.554	0.020
728	L20204	L20204	0.128	1.000	0.128	Cl. 13.8.4	102	0.944	0.141	0.554	0.020
729	L20204	L20204	0.075	1.000	0.075	Cl. 13.8.4	102	0.944	0.141	0.554	0.020
730	L20204	L20204	0.065	1.000	0.065	Cl. 13.8.4	102	0.944	0.141	0.554	0.020
732	L20204	L20204	0.025	1.000	0.025	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
733	L20204	L20204	0.174	1.000	0.174	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
734	L20204	L20204	0.166	1.000	0.166	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
735	L20204	L20204	0.154	1.000	0.154	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
736	L20204	L20204	0.138	1.000	0.138	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
737	L20204	L20204	0.130	1.000	0.130	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
738	L20204	L20204	0.104	1.000	0.104	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
739	L20204	L20204	0.068	1.000	0.068	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
740	L20204	L20204	0.048635	1.000	0.048635	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
741	L20204	L20204	0.040	1.000	0.040	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
742	L20204	L20204	0.020	1.000	0.020	Cl. 13.8.4	100	0.944	0.141	0.554	0.020
744	L20204	L20204	0.172	1.000	0.172	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
745	L20204	L20204	0.117	1.000	0.117	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
746	L20204	L20204	0.176	1.000	0.176	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
747	L20204	L20204	0.157	1.000	0.157	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
748	L20204	L20204	0.149	1.000	0.149	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
749	L20204	L20204	0.128	1.000	0.128	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
750	L20204	L20204	0.107	1.000	0.107	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
751	L20204	L20204	0.091	1.000	0.091	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
752	L20204	L20204	0.078	1.000	0.078	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
753	L20204	L20204	0.064	1.000	0.064	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
754	L20204	L20204	0.038	1.000	0.038	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
756	L20204	L20204	0.177	1.000	0.177	Cl. 13.8.4	102	0.944	0.141	0.554	0.020
757	L20204	L20204	0.140	1.000	0.140	Cl. 13.8.4	102	0.944	0.141	0.554	0.020
758	L20204	L20204	0.185	1.000	0.185	Cl. 13.8.4	102	0.944	0.141	0.554	0.020
759	L20204	L20204	0.180	1.000	0.180	Cl. 13.8.4	102	0.944	0.141	0.554	0.020
760	L20204	L20204	0.185	1.000	0.185	Cl. 13.8.4	102	0.944	0.141	0.554	0.020
761	L20204	L20204	0.177	1.000	0.177	Cl. 13.8.4	102	0.944	0.141	0.554	0.020
762	L20204	L20204	0.167	1.000	0.167	Cl. 13.8.4	102	0.944	0.141	0.554	0.020
763	L20204	L20204	0.165	1.000	0.165	Cl. 13.8.4	102	0.944	0.141	0.554	0.020

 	Job No 24946B	Sheet No 26	Rev 0
	Part Rakes & Cage		
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Job Title Brantford	By ME75	Date 8/3/2023	Chd
Client	File STAAD-rc_24946B.std	Date/Time 16-Aug-2023 11:48	

Utilization Ratio Cont...

Beam	Analysis Property	Design Property	Actual Ratio	Allowable Ratio	Ratio (Act./Allow.)	Clause	L/C	Ax (in ²)	Iz (in ⁴)	Iy (in ⁴)	Ix (in ⁴)
764	L20204	L20204	0.162	1.000	0.162	Cl. 13.8.4	102	0.944	0.141	0.554	0.020
765	L20204	L20204	0.158	1.000	0.158	Cl. 13.8.4	102	0.944	0.141	0.554	0.020
766	L20204	L20204	0.105	1.000	0.105	Cl. 13.8.4	102	0.944	0.141	0.554	0.020
768	L20204	L20204	0.104	1.000	0.104	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
769	L20204	L20204	0.064	1.000	0.064	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
770	L20204	L20204	0.060	1.000	0.060	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
771	L20204	L20204	0.051	1.000	0.051	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
772	L20204	L20204	0.047	1.000	0.047	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
773	L20204	L20204	0.036	1.000	0.036	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
774	L20204	L20204	0.030	1.000	0.030	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
775	L20204	L20204	0.028	1.000	0.028	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
776	L20204	L20204	0.027	1.000	0.027	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
777	L20204	L20204	0.028514	1.000	0.028514	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
778	L20204	L20204	0.027	1.000	0.027	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
780	L20204	L20204	0.104	1.000	0.104	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
781	L20204	L20204	0.064	1.000	0.064	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
782	L20204	L20204	0.060	1.000	0.060	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
783	L20204	L20204	0.051	1.000	0.051	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
784	L20204	L20204	0.047	1.000	0.047	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
785	L20204	L20204	0.036	1.000	0.036	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
786	L20204	L20204	0.032	1.000	0.032	Cl. 13.8.4	102	0.944	0.141	0.554	0.020
787	L20204	L20204	0.029	1.000	0.029	Cl. 13.8.4	102	0.944	0.141	0.554	0.020
788	L20204	L20204	0.027	1.000	0.027	Cl. 13.8.4	102	0.944	0.141	0.554	0.020
789	L20204	L20204	0.028514	1.000	0.028514	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
790	L20204	L20204	0.038	1.000	0.038	Cl. 13.8.4	102	0.944	0.141	0.554	0.020
887	L20204	L20204	0.186	1.000	0.186	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
888	L20204	L20204	0.053	1.000	0.053	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
889	L20204	L20204	0.046	1.000	0.046	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
890	L20204	L20204	0.03134	1.000	0.03134	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
891	L20204	L20204	0.103	1.000	0.103	Cl. 13.8.4	102	0.944	0.141	0.554	0.020
897	L20204	L20204	0.186	1.000	0.186	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
898	L20204	L20204	0.053	1.000	0.053	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
899	L20204	L20204	0.046	1.000	0.046	Cl. 13.8.4	103	0.944	0.141	0.554	0.020
900	L20204	L20204	0.03134	1.000	0.03134	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
901	L20204	L20204	0.053	1.000	0.053	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
907	L20204	L20204	0.137	1.000	0.137	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
908	L20204	L20204	0.088	1.000	0.088	Cl. 13.9.1	102	0.944	0.141	0.554	0.020
909	L20204	L20204	0.096	1.000	0.096	Cl. 13.9.1	102	0.944	0.141	0.554	0.020
910	L20204	L20204	0.101	1.000	0.101	Cl. 13.9.1	102	0.944	0.141	0.554	0.020
911	L20204	L20204	0.109	1.000	0.109	Cl. 13.9.1	102	0.944	0.141	0.554	0.020
912	L20204	L20204	0.110	1.000	0.110	Cl. 13.9.1	102	0.944	0.141	0.554	0.020
913	L20204	L20204	0.098	1.000	0.098	Cl. 13.9.1	102	0.944	0.141	0.554	0.020
914	L20204	L20204	0.103	1.000	0.103	Cl. 13.9.1	102	0.944	0.141	0.554	0.020
915	L20204	L20204	0.105	1.000	0.105	Cl. 13.9.1	102	0.944	0.141	0.554	0.020
916	L20204	L20204	0.104	1.000	0.104	Cl. 13.9.1	102	0.944	0.141	0.554	0.020

 	Job No 24946B	Sheet No 27	Rev 0
	Part Rakes & Cage		
Software licensed to Westech Engineering Inc CONNECTED User: Jennifer MEIKLE	Ref		
Job Title Brantford	By ME75	Date 8/3/2023	Chd
Client	File STAAD-rc_24946B.std	Date/Time 16-Aug-2023 11:48	

Utilization Ratio Cont...

Beam	Analysis Property	Design Property	Actual Ratio	Allowable Ratio	Ratio (Act./Allow.)	Clause	L/C	Ax (in ²)	Iz (in ⁴)	Iy (in ⁴)	Ix (in ⁴)
917	L20204	L20204	0.078	1.000	0.078	Cl. 13.9.1	102	0.944	0.141	0.554	0.020
918	L20204	L20204	0.125	1.000	0.125	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
919	L20204	L20204	0.204	1.000	0.204	Cl. 13.8.4	102	0.944	0.141	0.554	0.020
920	L20204	L20204	0.103	1.000	0.103	Cl. 13.8.4	102	0.944	0.141	0.554	0.020
921	L20204	L20204	0.092	1.000	0.092	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
922	L20204	L20204	0.088	1.000	0.088	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
923	L20204	L20204	0.090	1.000	0.090	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
924	L20204	L20204	0.084	1.000	0.084	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
925	L20204	L20204	0.070	1.000	0.070	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
926	L20204	L20204	0.065	1.000	0.065	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
927	L20204	L20204	0.062	1.000	0.062	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
928	L20204	L20204	0.055	1.000	0.055	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
929	L20204	L20204	0.053	1.000	0.053	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
930	L20204	L20204	0.125	1.000	0.125	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
1071	L30304	L30304	0.046	1.000	0.046	Cl. 13.9.1	103	1.440	0.493	1.996	0.03
1073	L20204	L20204	0.037	1.000	0.037	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
1077	L30304	L30304	0.044	1.000	0.044	Cl. 13.9.1	103	1.440	0.493	1.996	0.03
1079	L20204	L20204	0.037	1.000	0.037	Cl. 13.9.1	100	0.944	0.141	0.554	0.020
1081	L20204	L20204	0.058	1.000	0.058	Cl. 13.9.1	102	0.944	0.141	0.554	0.020
1082	L25254	L25254	0.040	1.000	0.040	Cl. 13.8.4	103	1.190	0.276	1.130	0.025
1083	L20204	L20204	0.056	1.000	0.056	Cl. 13.8.4	103	0.944	0.141	0.554	0.020
1084	L20204	L20204	0.053057	1.000	0.053057	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
1085	L25254	L25254	0.033	1.000	0.033	Cl. 13.8.4	103	1.190	0.276	1.130	0.025
1086	L20204	L20204	0.041	1.000	0.041	Cl. 13.8.4	103	0.944	0.141	0.554	0.020
1091	L30306	L30306	0.217	1.000	0.217	Cl. 13.9.1	102	2.110	0.712	2.807	0.099
1092	L30306	L30306	0.200	1.000	0.200	Cl. 13.8.4	102	2.110	0.712	2.807	0.099
1093	L30306	L30306	0.210	1.000	0.210	Cl. 13.9.1	101	2.110	0.712	2.807	0.099
1094	L30306	L30306	0.161	1.000	0.161	Cl. 13.8.4	101	2.110	0.712	2.807	0.099
1095	L25254	L25254	0.491	1.000	0.491	Cl. 13.9.1	101	1.190	0.276	1.130	0.025
1096	L25254	L25254	0.616	1.000	0.616	Cl. 13.9.1	101	1.190	0.276	1.130	0.025
1097	L25254	L25254	0.491	1.000	0.491	Cl. 13.9.1	101	1.190	0.276	1.130	0.025
1098	L25254	L25254	0.616	1.000	0.616	Cl. 13.9.1	101	1.190	0.276	1.130	0.025
1099	L30306	L30306	0.476	1.000	0.476	Cl. 13.8.4	101	2.110	0.712	2.807	0.099
1100	L30306	L30306	0.595	1.000	0.595	Cl. 13.8.4	101	2.110	0.712	2.807	0.099
1101	L30306	L30306	0.476	1.000	0.476	Cl. 13.8.4	101	2.110	0.712	2.807	0.099
1102	L30306	L30306	0.595	1.000	0.595	Cl. 13.8.4	101	2.110	0.712	2.807	0.099
1103	L50506	L50506	0.550	1.000	0.550	Cl. 13.9.1	101	3.650	3.549	13.943	0.171
1104	L50506	L50506	0.746	1.000	0.746	Cl. 13.8.4	101	3.650	3.549	13.943	0.171
1105	L50506	L50506	0.550	1.000	0.550	Cl. 13.9.1	101	3.650	3.549	13.943	0.171
1106	L50506	L50506	0.746	1.000	0.746	Cl. 13.8.4	101	3.650	3.549	13.943	0.171
1107	L30304	L30304	0.077	1.000	0.077	Cl. 13.8.4	103	1.440	0.493	1.996	0.03
1108	L25254	L25254	0.043	1.000	0.043	Cl. 13.9.1	103	1.190	0.276	1.130	0.025
1109	L30304	L30304	0.075	1.000	0.075	Cl. 13.8.4	103	1.440	0.493	1.996	0.03
1110	L25254	L25254	0.055	1.000	0.055	Cl. 13.9.1	103	1.190	0.276	1.130	0.025
1111	L30304	L30304	0.056	1.000	0.056	Cl. 13.8.4	103	1.440	0.493	1.996	0.03

Bentley Software licensed to Westech Engineering Inc CONNECTED User: Jennifer MEIKLE	WESTECH		Job No 24946B	Sheet No 28	Rev 0
	Part Rakes & Cage				
Job Title Brantford			Ref		
Client			By ME75	Date 8/3/2023	Chd
Client			File STAAD-rc_24946B.std	Date/Time 16-Aug-2023 11:48	

Utilization Ratio Cont...

Beam	Analysis Property	Design Property	Actual Ratio	Allowable Ratio	Ratio (Act./Allow.)	Clause	L/C	Ax (in ²)	Iz (in ⁴)	Iy (in ⁴)	Ix (in ⁴)
1112	L25254	L25254	0.045	1.000	0.045	Cl. 13.9.1	103	1.190	0.276	1.130	0.025
1113	L30304	L30304	0.054	1.000	0.054	Cl. 13.8.4	103	1.440	0.493	1.996	0.03
1114	L25254	L25254	0.027	1.000	0.027	Cl. 13.9.1	100	1.190	0.276	1.130	0.025
1115	L30304	L30304	0.038	1.000	0.038	Cl. 13.8.4	103	1.440	0.493	1.996	0.03
1116	L25254	L25254	0.016	1.000	0.016	Cl. 13.9.1	101	1.190	0.276	1.130	0.025
1117	L30304	L30304	0.023	1.000	0.023	Cl. 13.8.4	103	1.440	0.493	1.996	0.03
1118	L25254	L25254	0.023	1.000	0.023	Cl. 13.9.1	102	1.190	0.276	1.130	0.025
1119	L30304	L30304	0.026	1.000	0.026	Cl. 13.8.4	103	1.440	0.493	1.996	0.03
1120	L30304	L30304	0.024	1.000	0.024	Cl. 13.8.4	100	1.440	0.493	1.996	0.03
1121	L25254	L25254	0.020	1.000	0.020	Cl. 13.9.1	102	1.190	0.276	1.130	0.025
1122	L25254	L25254	0.019	1.000	0.019	Cl. 13.9.1	101	1.190	0.276	1.130	0.025

Walkway

Bentley Software licensed to Westech Engineering Inc CONNECTED User: Jennifer MEIKLE	WESTECH		Job No 24946B	Sheet No 1	Rev A
	Part Bridge and Platform				
Job Title Brantford			Ref		
			By ME75	Date 8/3/2023	Chd GR00 11/13/2023
Client			File STAAD-ww_24946B.std	Date/Time 10-Nov-2023 10:57	

Job Information

	Engineer	Checked	Approved
Name:	ME75		
Date:	8/3/2023		

Project ID	
Project Name	

Comments

REV A: Changed Wind and Snow loads (11/9/2023)
 Designed to NBCC 2020
 Stainless Steel Design
 Maximum allowable deflection = $l/360$
 DIMENSIONS:
 Radius to end of Bridge: 57 ft.
 Walkway Width: 3 ft.
 Platform Width: 7.0 ft.
 Platform Length: 8.5 ft.
 LOADINGS:
 Walkway Flooring: 5 lbs./sq.ft.
 Platform Flooring: 6 lbs./sq.ft.
 Handrail: 5 lbs./lin.ft.
 Walkway Live Load: 50 lbs./sq.ft.
 Horizontal Wind Load: 12.73 lbs./sq.ft. (Rev A)
 Snow Load: 37.594 lbs./sq.ft. (Rev A)
 Seismic Load: 0.11*Weight (Horizontal)
 These structural calculations represent the minimum member size necessary to satisfy the requirement of the specification. WesTech reserves the option of increasing the member size to facilitate design or fabrication requirements.

Structure Type	SPACE FRAME
----------------	-------------



Number of Nodes	76	Highest Node	110
Number of Elements	159	Highest Beam	379

Number of Basic Load Cases	32
Number of Combination Load Cases	0

Included in this printout are data for:

All	The Whole Structure
-----	---------------------

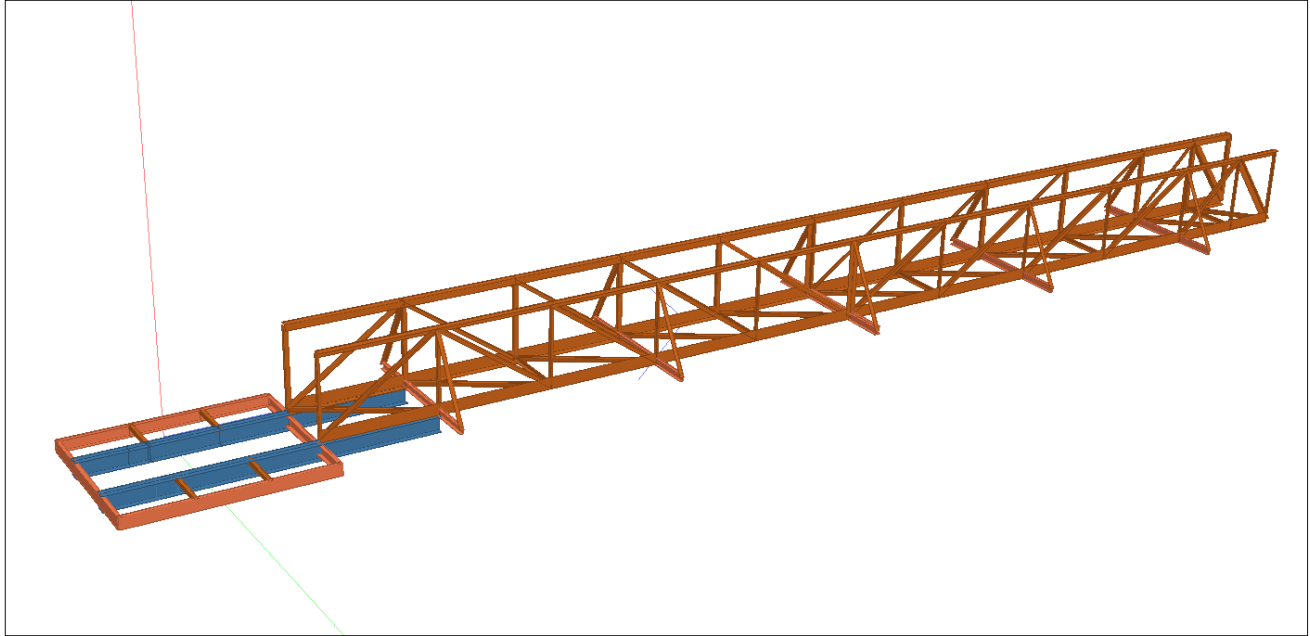


 	Job No 24946B	Sheet No 2	Rev A
	Part Bridge and Platform		
Job Title Brantford	Ref		
	By ME75	Date 8/3/2023	Chd
Client	File STAAD-ww_24946B.std	Date/Time 10-Nov-2023 10:57	

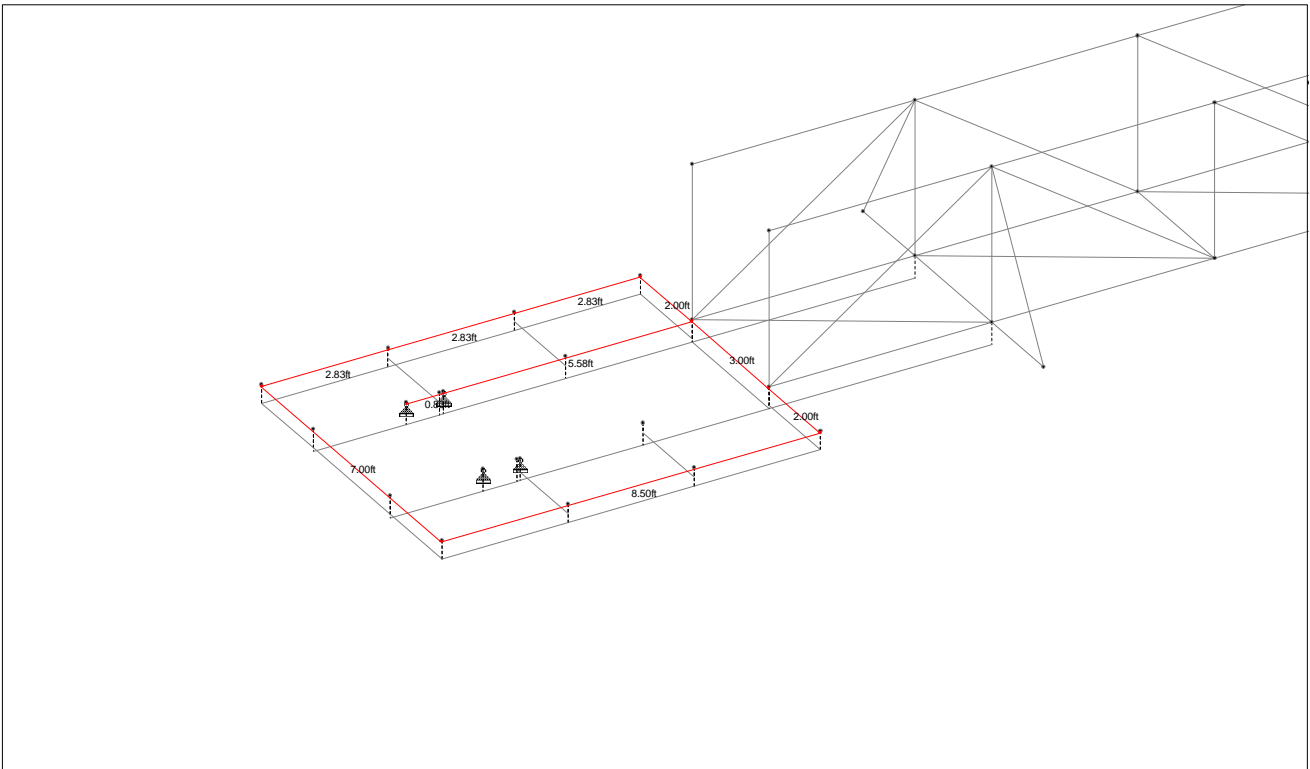
Job Information Cont...

Included in this printout are results for load cases:

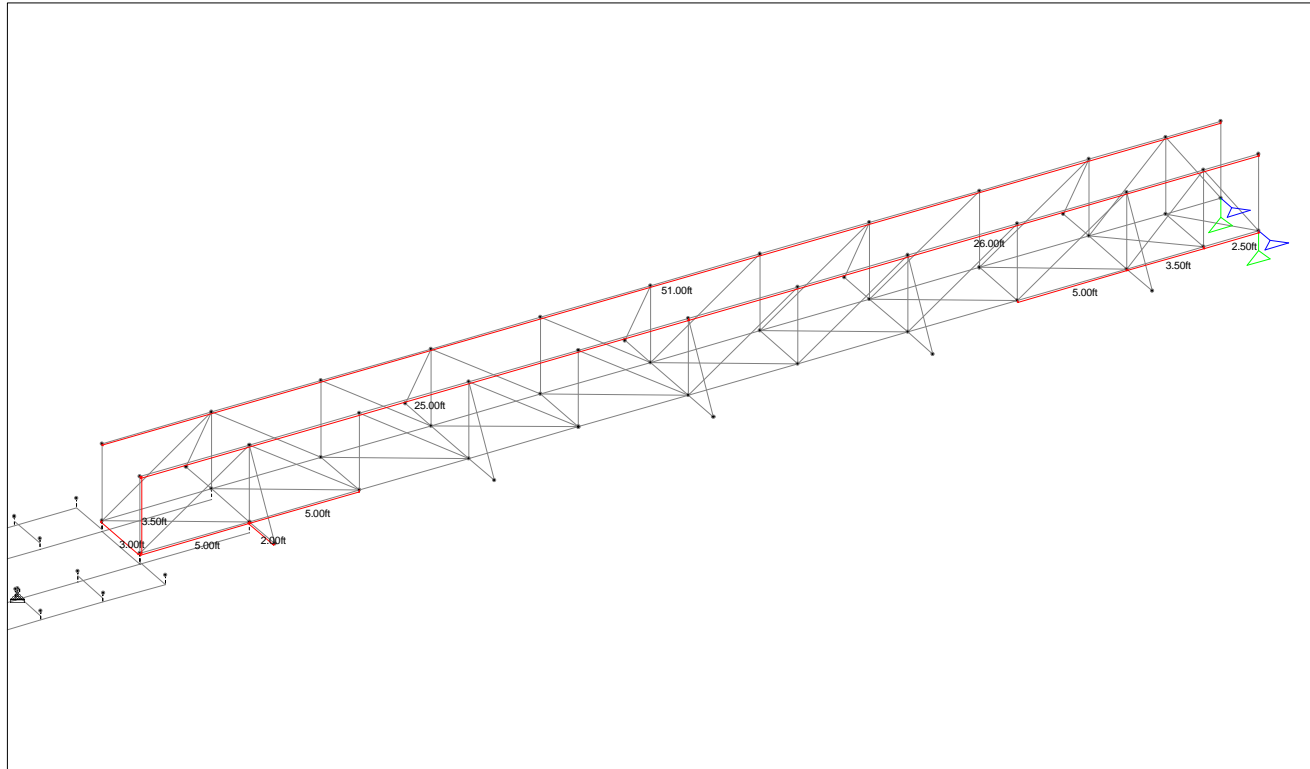
Type	L/C	Name
Primary	1	GRAVITY
Primary	2	FLOORING
Primary	3	HANDRAIL
Primary	4	LIVE
Primary	5	WIND(Z)
Primary	6	WIND(X)
Primary	7	SNOW
Primary	8	EH(Z)
Primary	9	EH(X)
Primary	100	1.4D
Primary	101	1.25D + 1.5L + 1.0S
Primary	102	1.25D + 1.5L + 0.4W (Z)
Primary	103	1.25D + 1.5L + 0.4W (X)
Primary	104	1.25D + 1.5S + 1.0L
Primary	105	1.25D + 1.5S + 0.4W (Z)
Primary	106	1.25D + 1.5S + 0.4W (X)
Primary	107	1.25D + 1.4W (Z) + 0.5L
Primary	108	1.25D + 1.4W (X) + 0.5L
Primary	109	1.25D + 1.4W (Z) + 0.5S
Primary	110	1.25D + 1.4W (X) + 0.5S
Primary	111	1.0D + 1.0E (Z) + 0.5L
Primary	112	1.0D + 1.0E (Z) + 0.25S
Primary	113	1.0D + 1.0E (X) + 0.5L
Primary	114	1.0D + 1.0E (X) + 0.25S
Primary	200	DEAD
Primary	201	1.0D + 1.0L + 0.3(Z)W
Primary	202	1.0D + 1.0L + 0.35S
Primary	203	1.0D + 1.0(Z)W + 0.35L
Primary	204	1.0D + 1.0(Z)W + 0.35S
Primary	205	1.0D + 1.0S + 0.3(Z)W
Primary	206	1.0D + 1.0S + 0.35L
Primary	300	CAMBER



Walkway & Platform



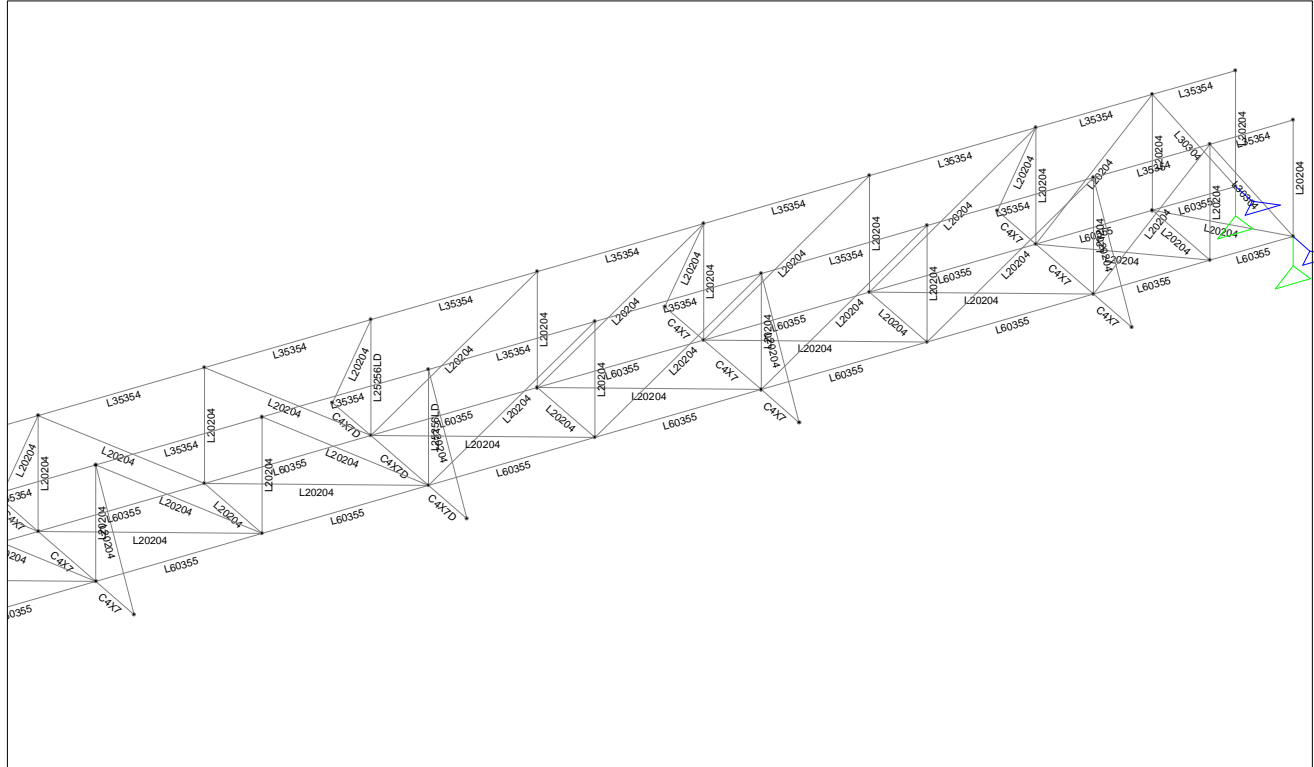
Platform Dimensions



Walkway Dimensions

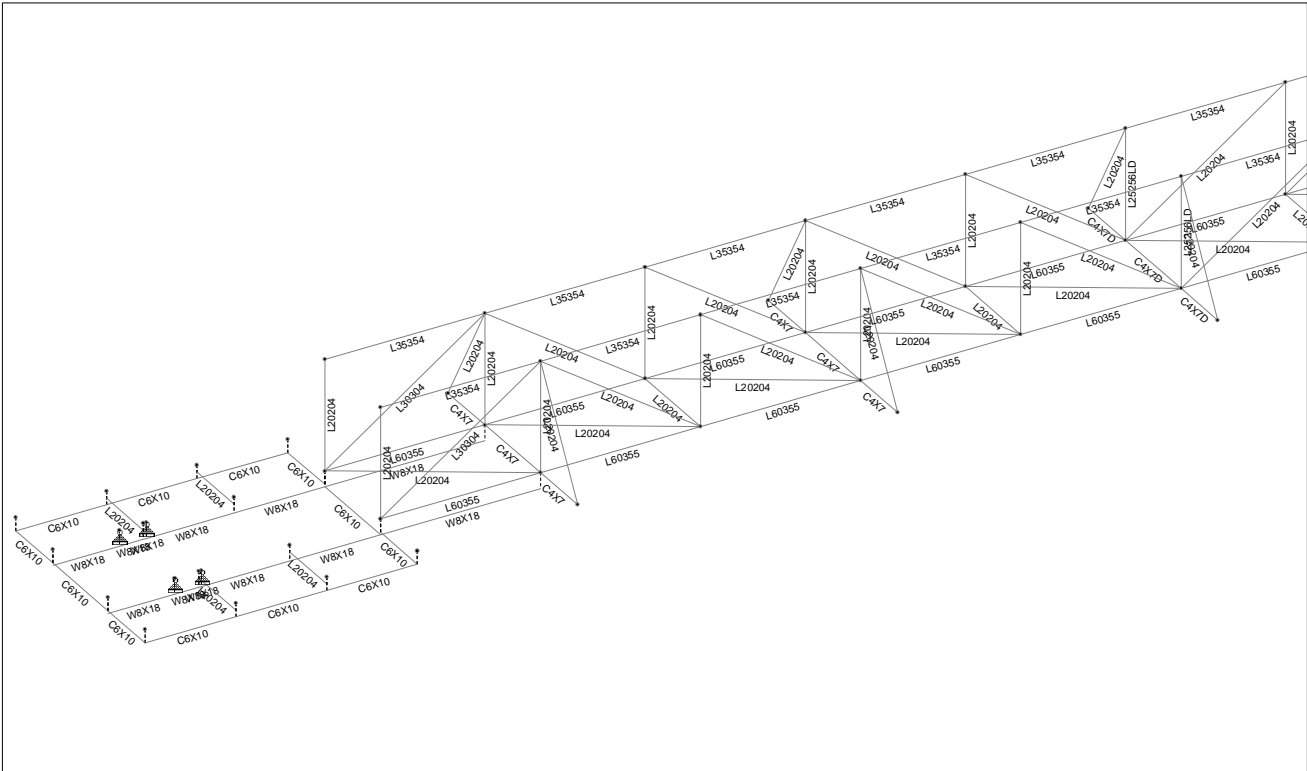
Section Properties

Prop	Section	Area (in ²)	I _{yy} (in ⁴)	I _{zz} (in ⁴)	J (in ⁴)	Material
1	L60355	2.890	12.039	1.726	0.096	STAINLESSST
2	L20204	0.944	0.550	0.146	0.020	STAINLESSST
3	L20204	0.944	0.550	0.146	0.020	STAINLESSST
4	L35354	1.700	3.196	0.824	0.036	STAINLESSST
5	L20204	0.944	0.550	0.146	0.020	STAINLESSST
6	L30304	1.440	1.982	0.506	0.030599	STAINLESSST
7	L20204	0.944	0.550	0.146	0.020	STAINLESSST
8	C4X7	2.130	0.425	4.580	0.0817	STAINLESSST
9	L20204	0.944	0.550	0.146	0.020	STAINLESSST
10	W8X18	5.260	7.970	61.900	0.172	STAINLESSST
11	C6X10	3.070	0.860	15.100	0.128	STAINLESSST
12	L20204	0.944	0.550	0.146	0.020	STAINLESSST
13	W8X18	5.260	7.970	61.900	0.172	STAINLESSST
14	L25256	3.460	3.976	1.968	0.163	STAINLESSST
15	C4X7	4.260	1.905	9.160	0.141	STAINLESSST



Member Sizes

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	Part Bridge and Platform				
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Member Sizes

Primary Load Cases

Number	Name	Type
1	GRAVITY	Dead
2	FLOORING	Dead
3	HANDRAIL	Dead
4	LIVE	Live
5	WIND(Z)	Wind
6	WIND(X)	Wind
7	SNOW	Snow
8	EH(Z)	Seismic-H
9	EH(X)	Seismic-H
100	1.4D	None
101	1.25D + 1.5L + 1.0S	None
102	1.25D + 1.5L + 0.4W (Z)	None
103	1.25D + 1.5L + 0.4W (X)	None
104	1.25D + 1.5S + 1.0L	None
105	1.25D + 1.5S + 0.4W (Z)	None
106	1.25D + 1.5S + 0.4W (X)	None
107	1.25D + 1.4W (Z) + 0.5L	None
108	1.25D + 1.4W (X) + 0.5L	None
109	1.25D + 1.4W (Z) + 0.5S	None

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Job Title	Brantford
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Part Bridge and Platform

Ref

By ME75

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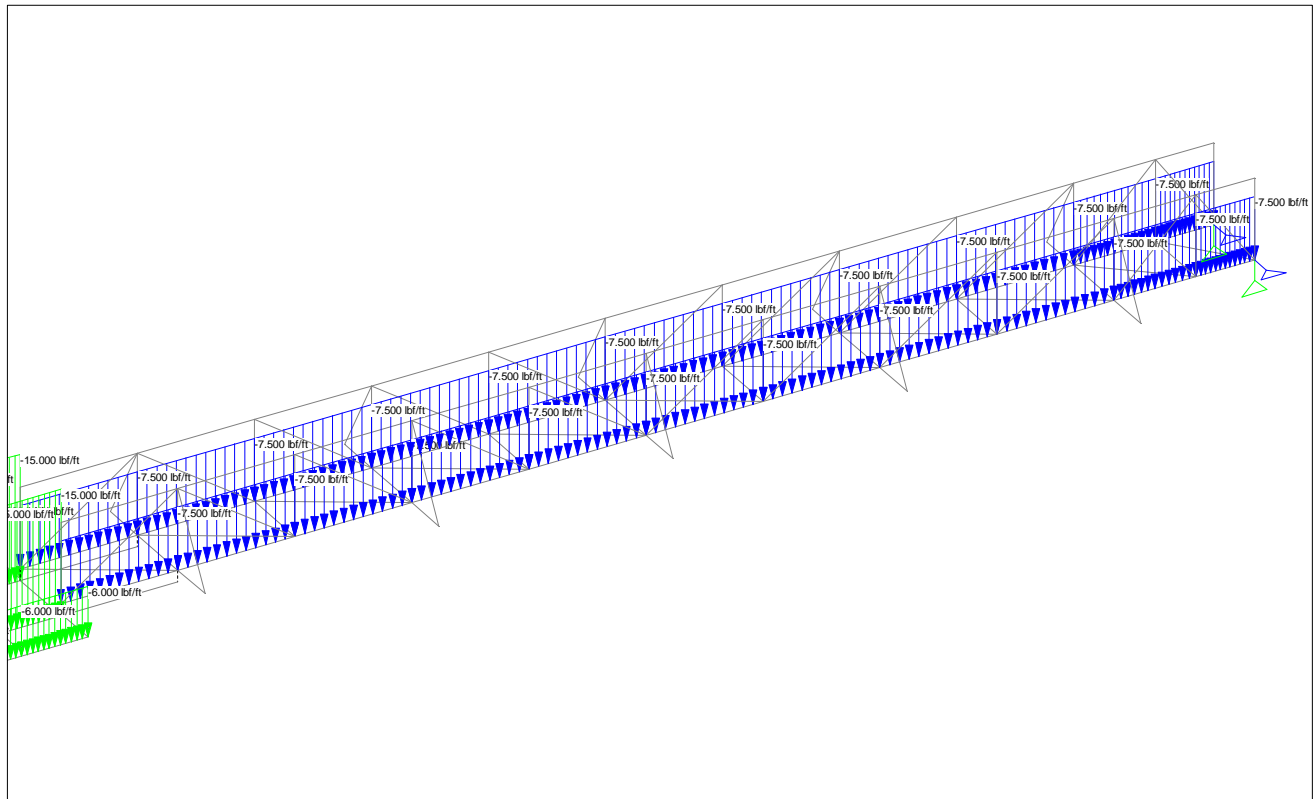
Client

File STAAD-ww_24946B.std

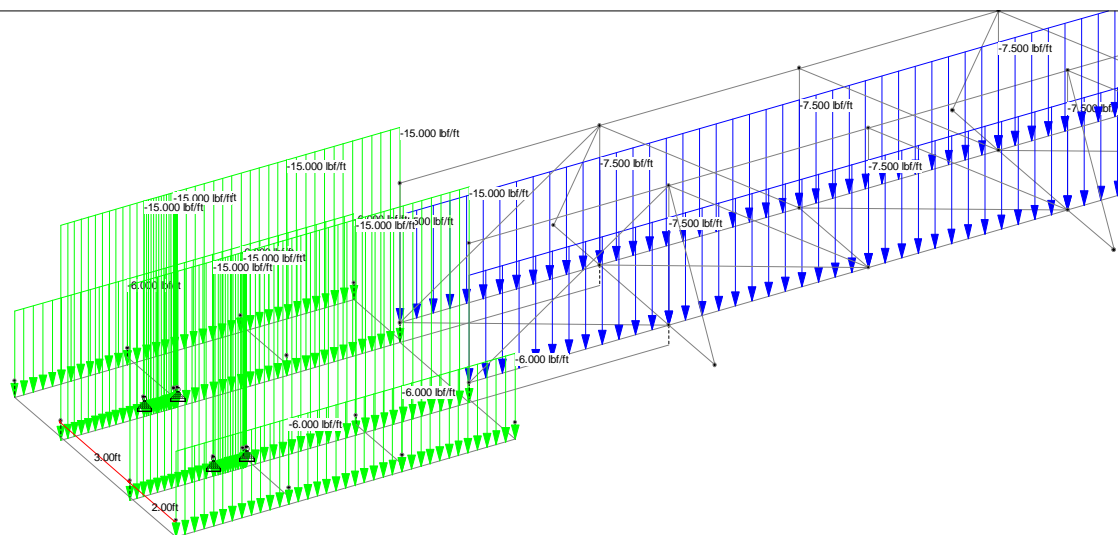
Date/Time 10-Nov-2023 10:57

Primary Load Cases Cont...

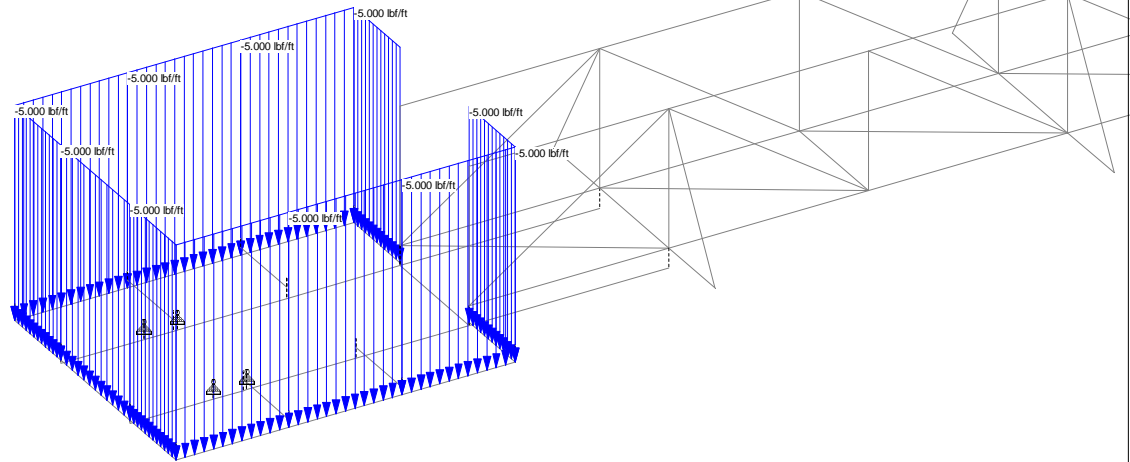
Number	Name	Type
110	$1.25D + 1.4W(X) + 0.5S$	None
111	$1.0D + 1.0E(Z) + 0.5L$	None
112	$1.0D + 1.0E(Z) + 0.25S$	None
113	$1.0D + 1.0E(X) + 0.5L$	None
114	$1.0D + 1.0E(X) + 0.25S$	None
200	DEAD	None
201	$1.0D + 1.0L + 0.3(Z)W$	None
202	$1.0D + 1.0L + 0.35S$	None
203	$1.0D + 1.0(Z)W + 0.35L$	None
204	$1.0D + 1.0(Z)W + 0.35S$	None
205	$1.0D + 1.0S + 0.3(Z)W$	None
206	$1.0D + 1.0S + 0.35L$	None
300	CAMBER	None



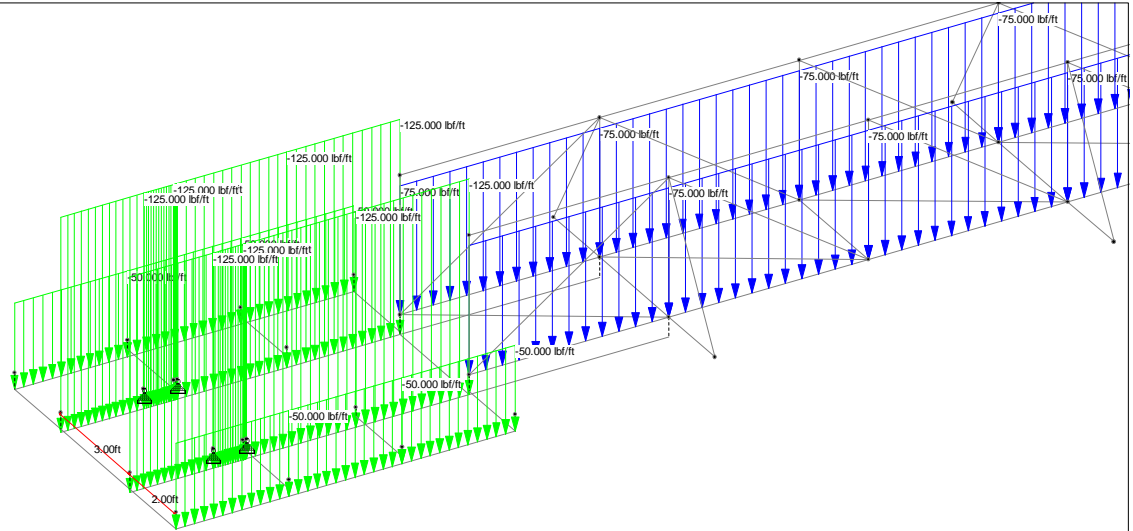
Walkway Flooring (5 psf)



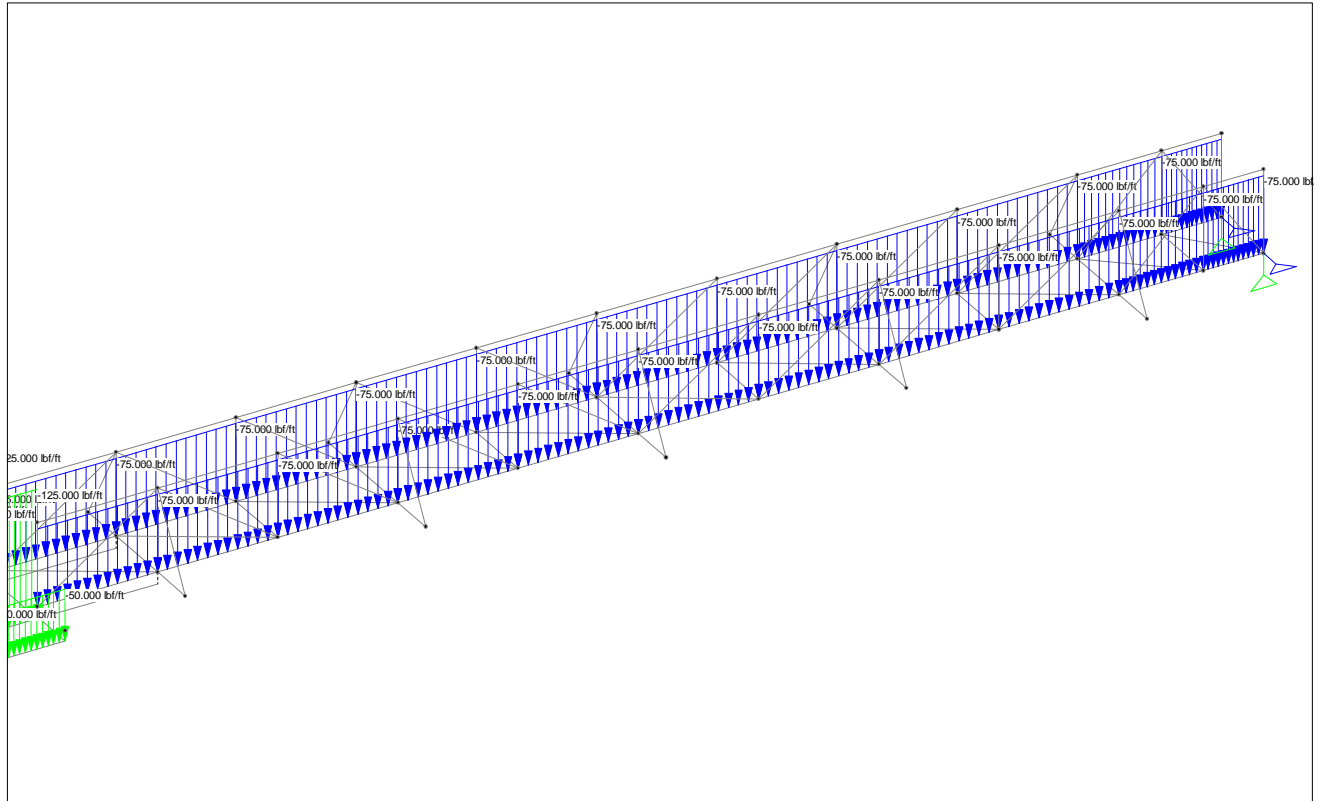
Platform Flooring (6 psf)



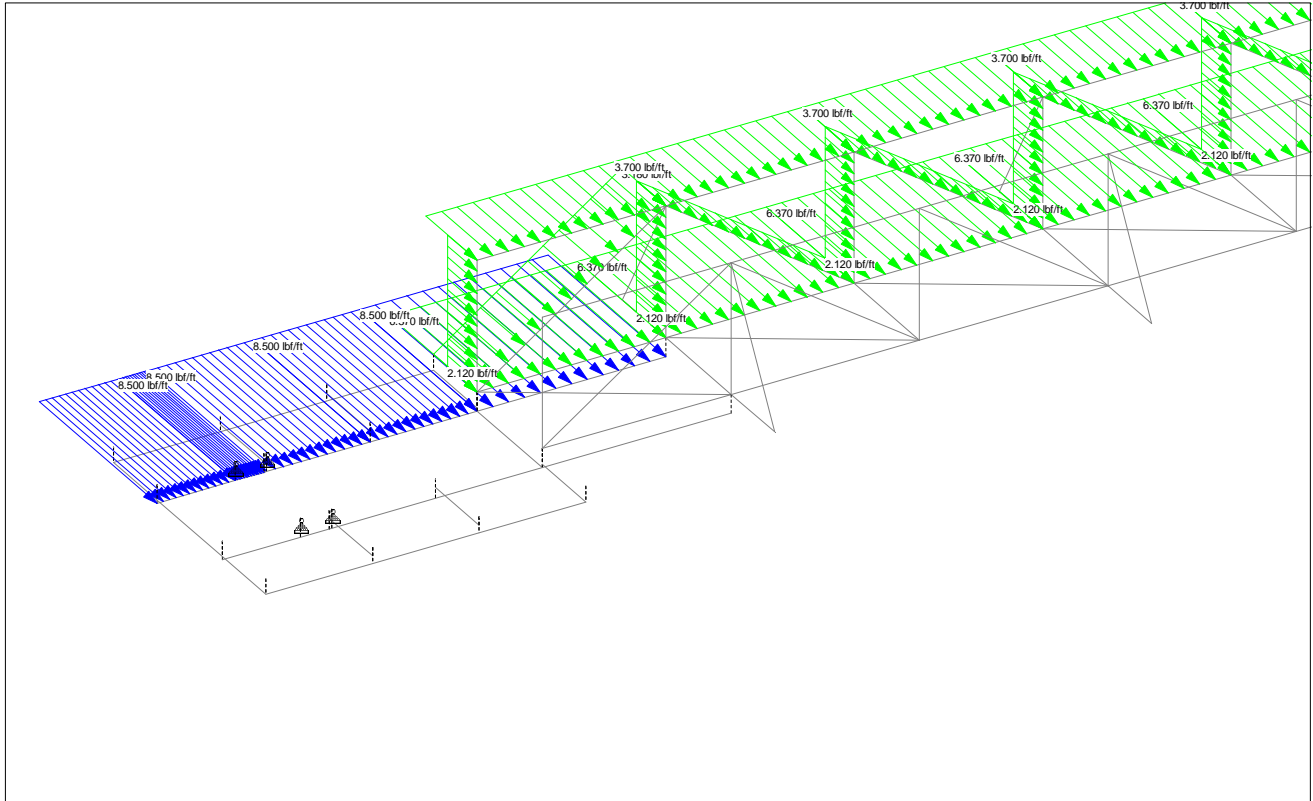
Handrail (5 plf)



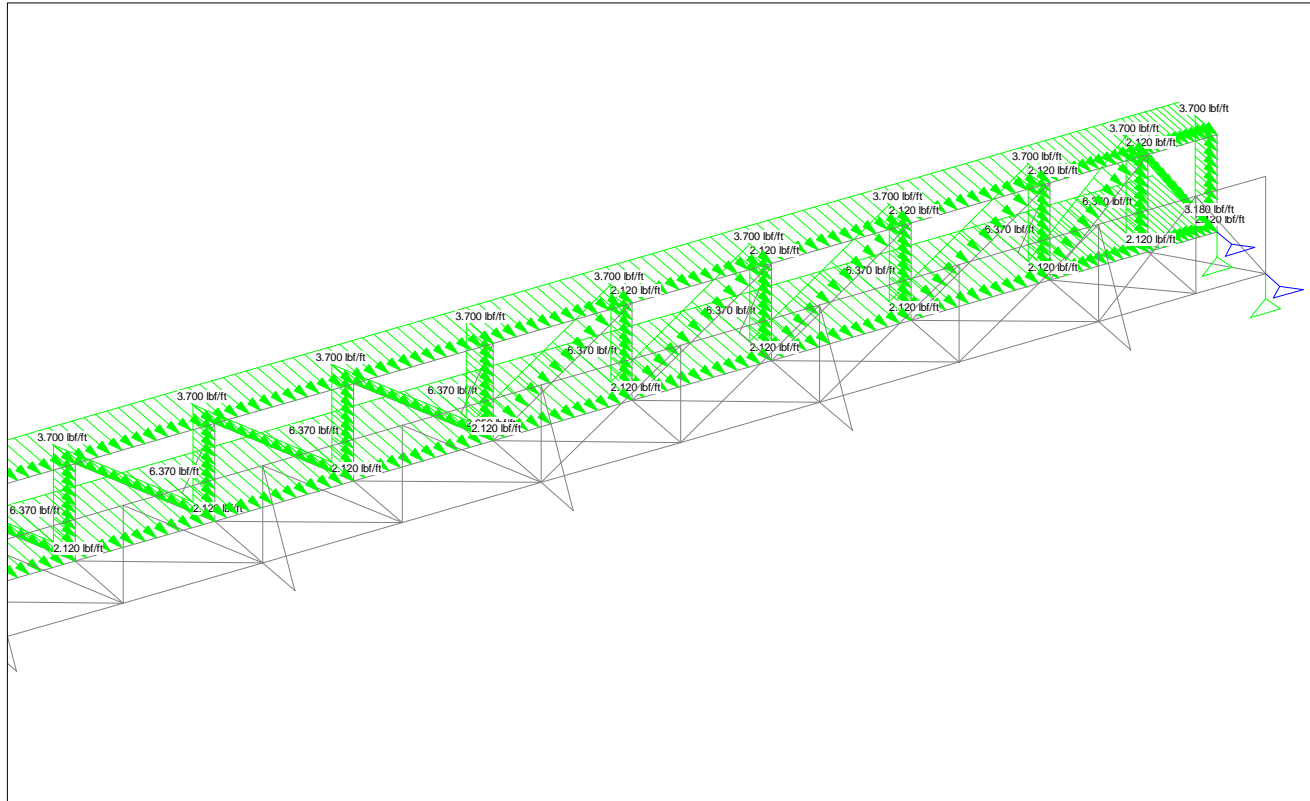
Live Load (50 psf)



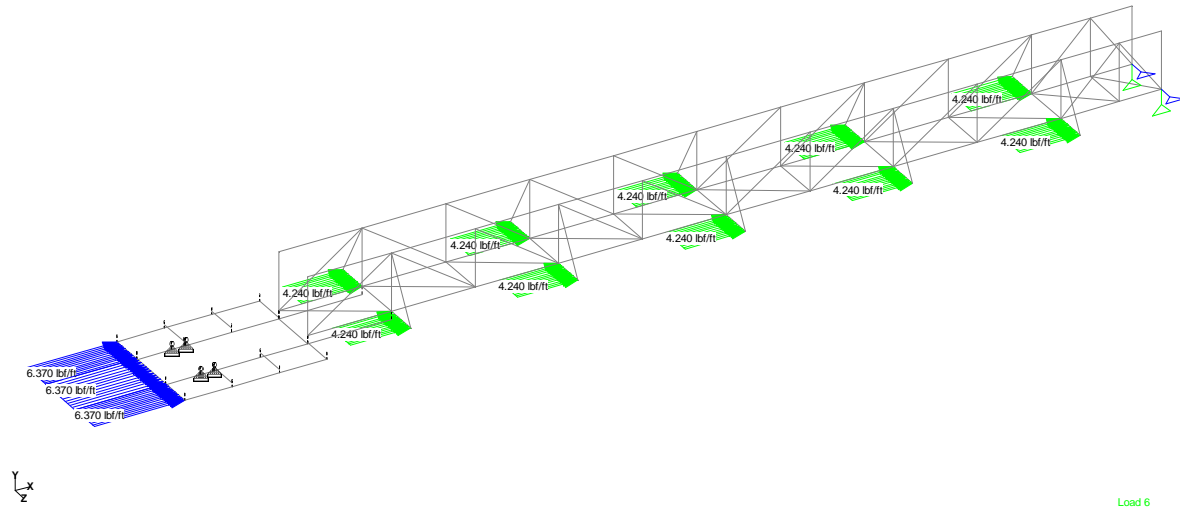
Live Load (50 psf)



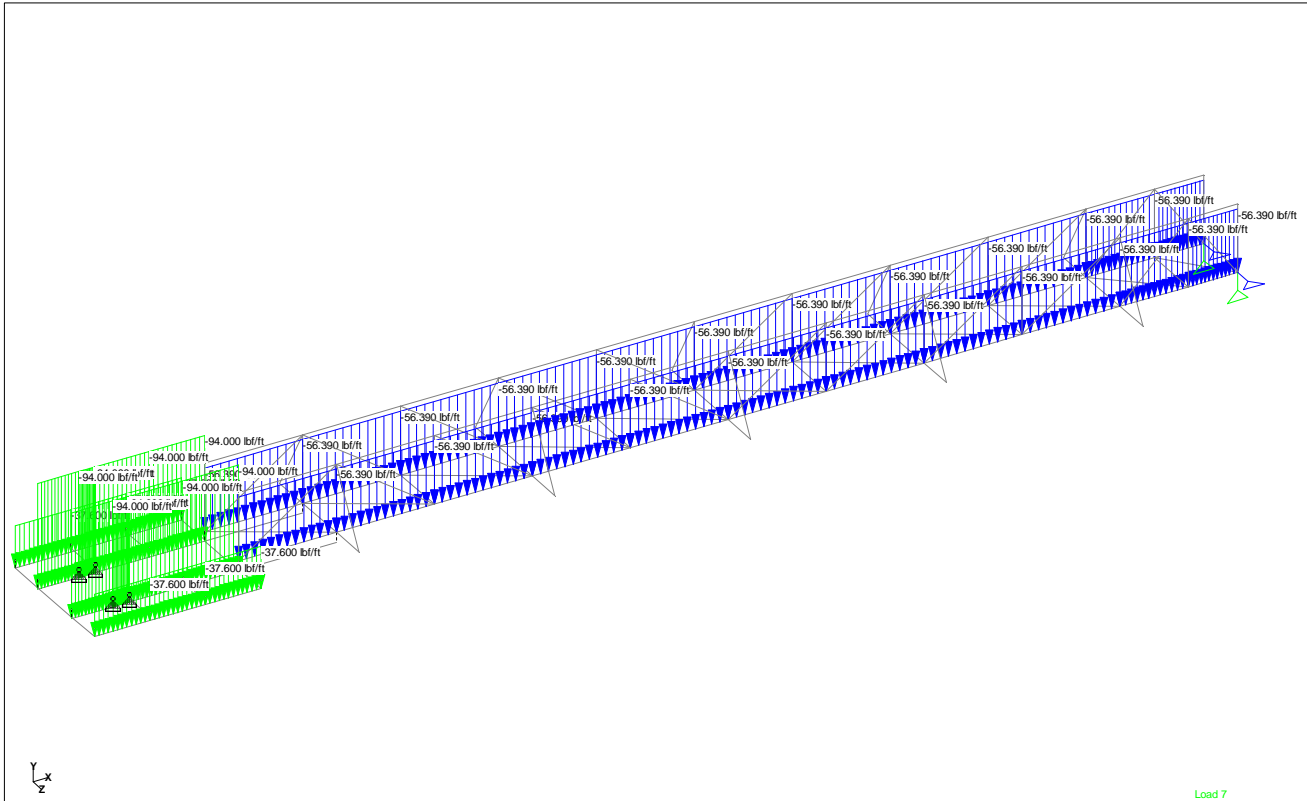
Wind Load-Z (12.73 psf) (Rev A)



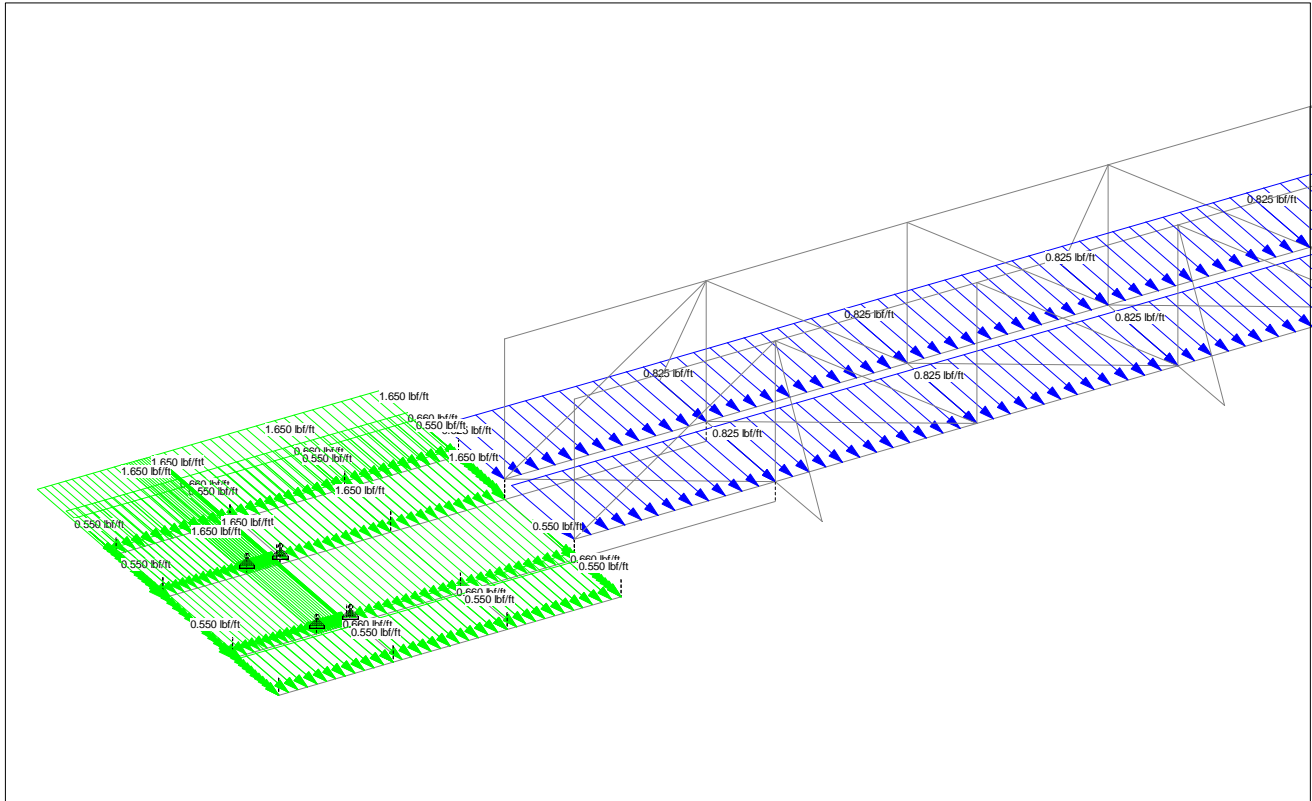
Wind Load-Z (12.73 psf) (Rev A)



Wind Load-X (12.73 psf) (Rev A)



Snow Load (37.594 psf) (Rev A)



*Seismic-Z (0.11*Dead Load)*

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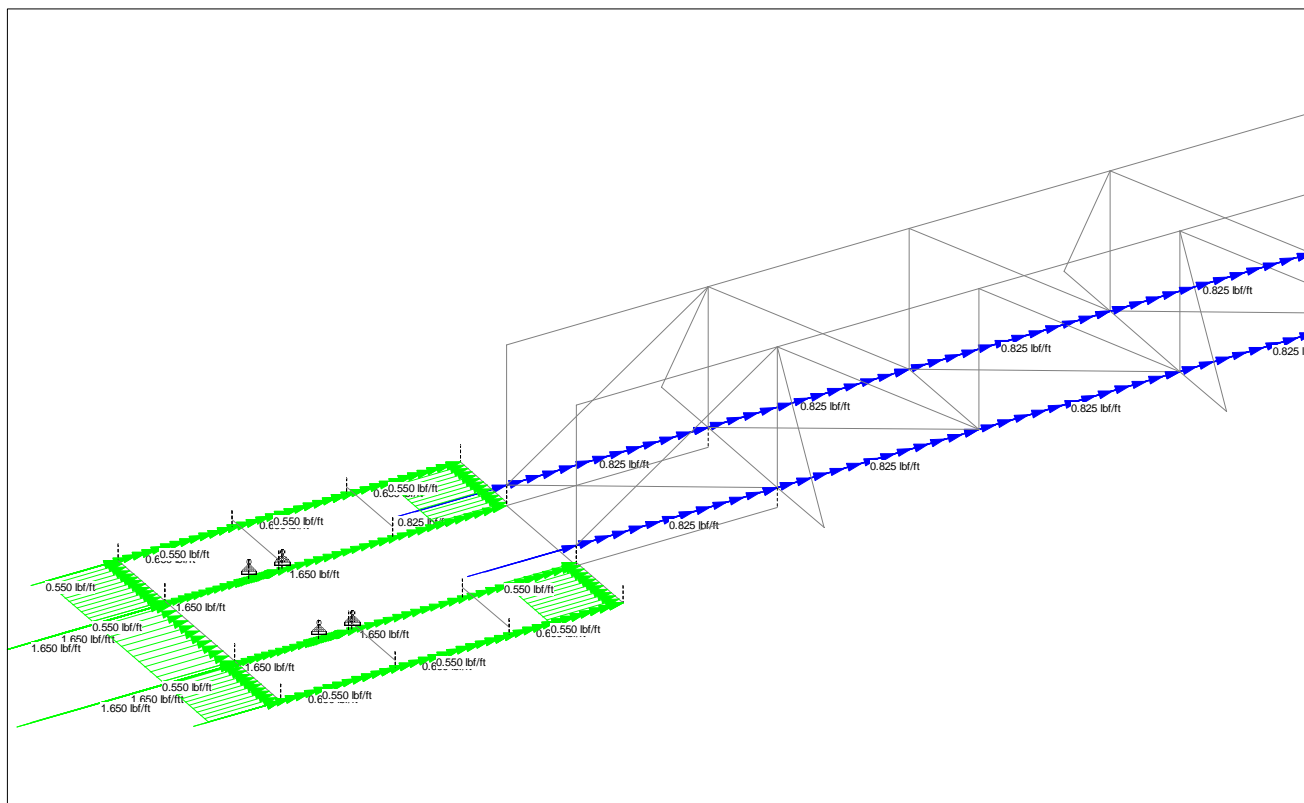
Date 8/3/2023

Chd

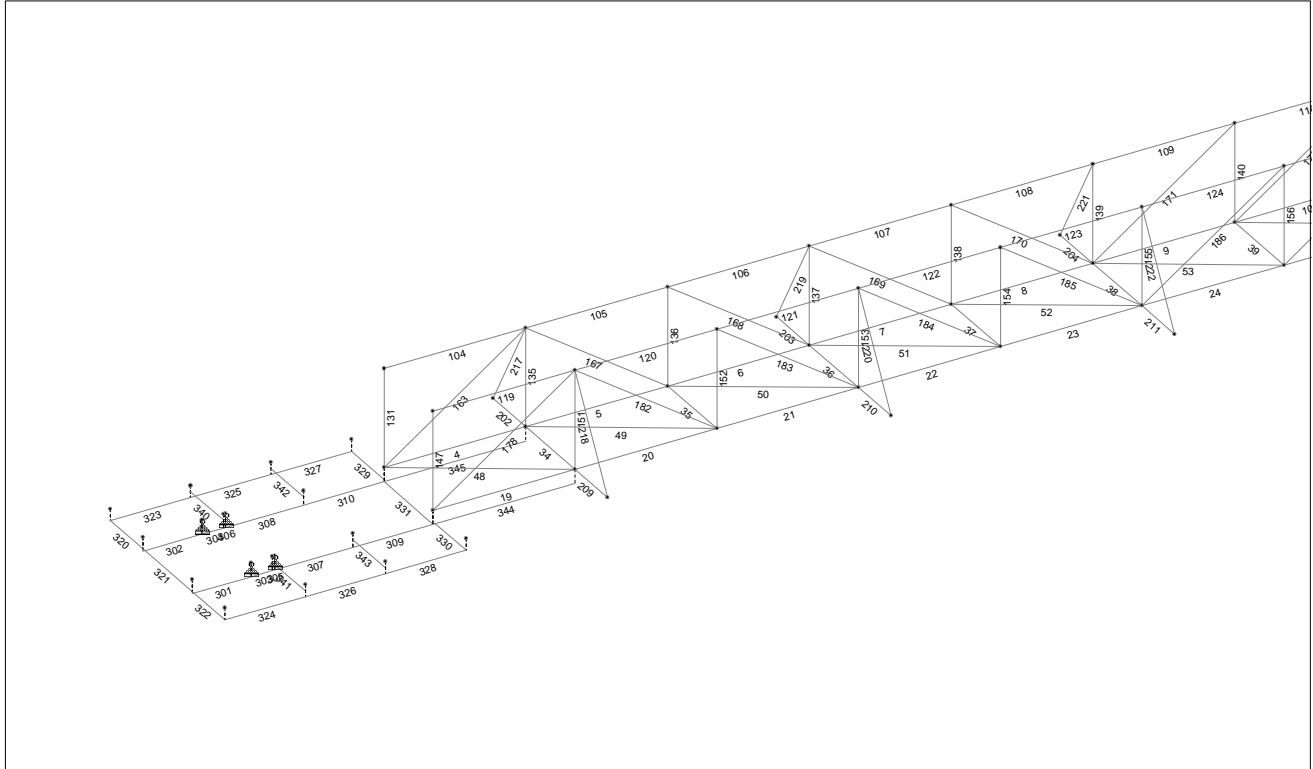
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Seismic-X (0.11*Dead Load)



Beam Numbers

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Part Bridge and Platform

Job Title	Brantford
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Ref

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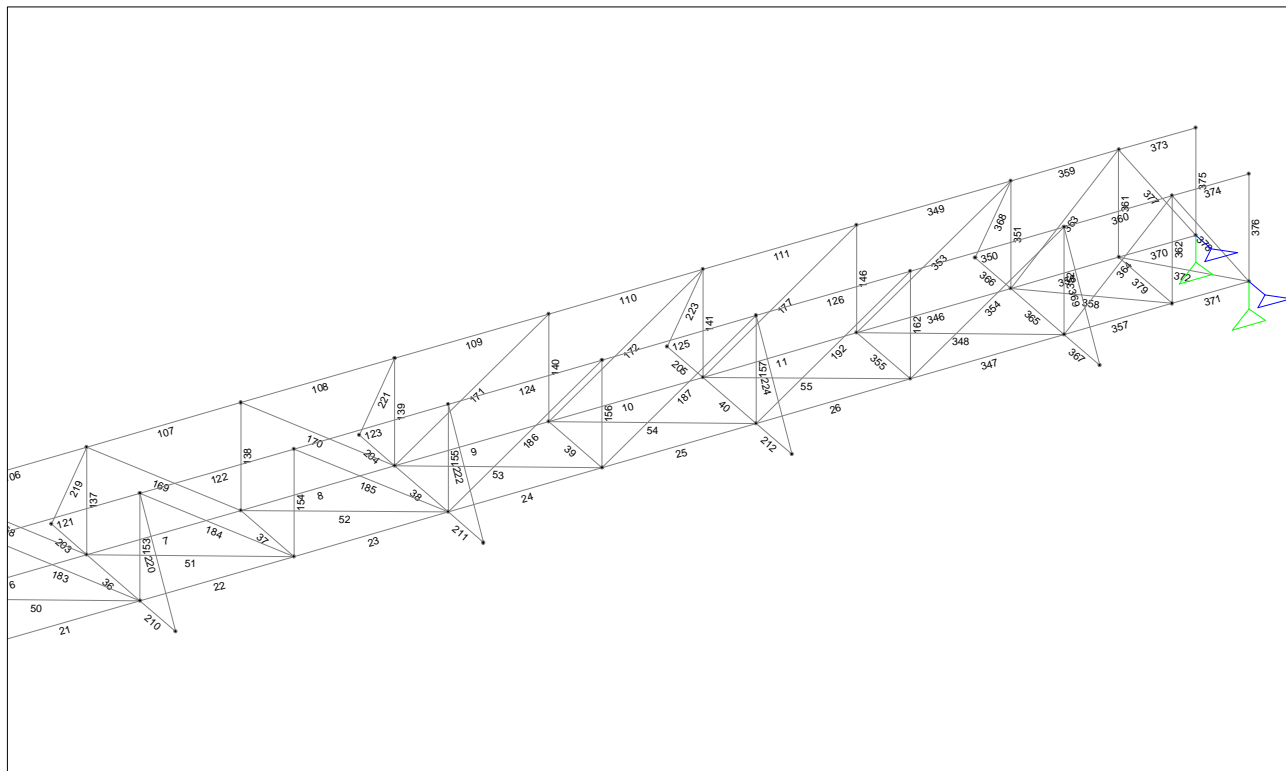
Date 8/3/2023

Chd

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Beam Numbers



Utilization Ratio

Beam	Analysis Property	Design Property	Actual Ratio	Allowable Ratio	Ratio (Act./Allow.)	Clause	L/C	Ax (in ²)	Iz (in ⁴)	Iy (in ⁴)	Ix (in ⁴)
4	L60355	L60355	0.288	1.000	0.288	Cl. 13.9.1	101	2.890	1.700	12.065	0.094
5	L60355	L60355	0.301	1.000	0.301	Cl. 13.9.1	101	2.890	1.700	12.065	0.094
6	L60355	L60355	0.342	1.000	0.342	Cl. 13.9.1	101	2.890	1.700	12.065	0.094
7	L60355	L60355	0.408	1.000	0.408	Cl. 13.9.1	101	2.890	1.700	12.065	0.094
8	L60355	L60355	0.456	1.000	0.456	Cl. 13.9.1	101	2.890	1.700	12.065	0.094
9	L60355	L60355	0.441	1.000	0.441	Cl. 13.9.1	101	2.890	1.700	12.065	0.094
10	L60355	L60355	0.390	1.000	0.390	Cl. 13.9.1	101	2.890	1.700	12.065	0.094
11	L60355	L60355	0.325	1.000	0.325	Cl. 13.9.1	101	2.890	1.700	12.065	0.094
19	L60355	L60355	0.272	1.000	0.272	Cl. 13.8.4	101	2.890	1.700	12.065	0.094
20	L60355	L60355	0.257	1.000	0.257	Cl. 13.9.1	101	2.890	1.700	12.065	0.094
21	L60355	L60355	0.312	1.000	0.312	Cl. 13.9.1	101	2.890	1.700	12.065	0.094
22	L60355	L60355	0.385	1.000	0.385	Cl. 13.9.1	101	2.890	1.700	12.065	0.094
23	L60355	L60355	0.427	1.000	0.427	Cl. 13.9.1	101	2.890	1.700	12.065	0.094
24	L60355	L60355	0.435	1.000	0.435	Cl. 13.9.1	101	2.890	1.700	12.065	0.094
25	L60355	L60355	0.374	1.000	0.374	Cl. 13.9.1	101	2.890	1.700	12.065	0.094
26	L60355	L60355	0.316	1.000	0.316	Cl. 13.9.1	101	2.890	1.700	12.065	0.094
34	C4X7	C4X7	0.099	1.000	0.099	Cl. 13.8.4	107	2.130	4.580	0.425	0.071
35	L20204	L20204	0.069	1.000	0.069	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
36	C4X7	C4X7	0.073	1.000	0.073	Cl. 13.8.4	101	2.130	4.580	0.425	0.071

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Utilization Ratio Cont...

Beam	Analysis Property	Design Property	Actual Ratio	Allowable Ratio	Ratio (Act./Allow.)	Clause	L/C	Ax (in ²)	Iz (in ⁴)	Iy (in ⁴)	Ix (in ⁴)
37	L20204	L20204	0.107	1.000	0.107	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
38	C4X7	C4X7 D S	0.038	1.000	0.038	Cl. 13.8	101	4.260	9.160	1.748	0.141
39	L20204	L20204	0.107	1.000	0.107	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
40	C4X7	C4X7	0.069	1.000	0.069	Cl. 13.8.4	101	2.130	4.580	0.425	0.071
48	L20204	L20204	0.146	1.000	0.146	Cl. 13.9.1	107	0.944	0.141	0.554	0.020
49	L20204	L20204	0.065	1.000	0.065	Cl. 13.9.1	107	0.944	0.141	0.554	0.020
50	L20204	L20204	0.060	1.000	0.060	Cl. 13.9.1	109	0.944	0.141	0.554	0.020
51	L20204	L20204	0.043	1.000	0.043	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
52	L20204	L20204	0.051	1.000	0.051	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
53	L20204	L20204	0.051	1.000	0.051	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
54	L20204	L20204	0.056	1.000	0.056	Cl. 13.8.4	109	0.944	0.141	0.554	0.020
55	L20204	L20204	0.097	1.000	0.097	Cl. 13.8.4	109	0.944	0.141	0.554	0.020
104	L35354	L35354	0.053568	1.000	0.053568	Cl. 13.8.4	101	1.700	0.805	3.215	0.035
105	L35354	L35354	0.643	1.000	0.643	Cl. 13.8.4	101	1.700	0.805	3.215	0.035
106	L35354	L35354	0.770	1.000	0.770	Cl. 13.8.4	101	1.700	0.805	3.215	0.035
107	L35354	L35354	0.846	1.000	0.846	Cl. 13.8.4	101	1.700	0.805	3.215	0.035
108	L35354	L35354	0.875	1.000	0.875	Cl. 13.8.4	101	1.700	0.805	3.215	0.035
109	L35354	L35354	0.879	1.000	0.879	Cl. 13.8.4	101	1.700	0.805	3.215	0.035
110	L35354	L35354	0.830	1.000	0.830	Cl. 13.8.4	101	1.700	0.805	3.215	0.035
111	L35354	L35354	0.739	1.000	0.739	Cl. 13.8.4	101	1.700	0.805	3.215	0.035
119	L35354	L35354	0.051	1.000	0.051	Cl. 13.8.4	101	1.700	0.805	3.215	0.035
120	L35354	L35354	0.627	1.000	0.627	Cl. 13.8.4	101	1.700	0.805	3.215	0.035
121	L35354	L35354	0.761	1.000	0.761	Cl. 13.8.4	101	1.700	0.805	3.215	0.035
122	L35354	L35354	0.840	1.000	0.840	Cl. 13.8.4	101	1.700	0.805	3.215	0.035
123	L35354	L35354	0.874	1.000	0.874	Cl. 13.8.4	101	1.700	0.805	3.215	0.035
124	L35354	L35354	0.875	1.000	0.875	Cl. 13.8.4	101	1.700	0.805	3.215	0.035
125	L35354	L35354	0.827	1.000	0.827	Cl. 13.8.4	101	1.700	0.805	3.215	0.035
126	L35354	L35354	0.740	1.000	0.740	Cl. 13.8.4	101	1.700	0.805	3.215	0.035
131	L20204	L20204	0.248	1.000	0.248	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
135	L20204	L20204	0.305	1.000	0.305	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
136	L20204	L20204	0.307	1.000	0.307	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
137	L20204	L20204	0.210	1.000	0.210	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
138	L20204	L20204	0.101	1.000	0.101	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
139	L25256	L25256 LI	0.022	1.000	0.022	Cl. 13.8.4	107	3.460	1.968	3.986	0.162
140	L20204	L20204	0.122	1.000	0.122	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
141	L20204	L20204	0.245	1.000	0.245	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
146	L20204	L20204	0.351	1.000	0.351	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
147	L20204	L20204	0.239	1.000	0.239	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
151	L20204	L20204	0.292	1.000	0.292	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
152	L20204	L20204	0.310	1.000	0.310	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
153	L20204	L20204	0.219	1.000	0.219	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
154	L20204	L20204	0.098	1.000	0.098	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
155	L25256	L25256 LI	0.009	1.000	0.009	Cl. 13.8.4	101	3.460	1.968	3.986	0.162
156	L20204	L20204	0.129	1.000	0.129	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
157	L20204	L20204	0.238	1.000	0.238	Cl. 13.8.4	101	0.944	0.141	0.554	0.020

 	Job No 24946B	Sheet No 21	Rev A
	Part Bridge and Platform		
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Client	File STAAD-ww_24946B.std	Date/Time 10-Nov-2023 10:57	

Utilization Ratio Cont...

Beam	Analysis Property	Design Property	Actual Ratio	Allowable Ratio	Ratio (Act./Allow.)	Clause	L/C	Ax (in ²)	Iz (in ⁴)	Iy (in ⁴)	Ix (in ⁴)
162	L20204	L20204	0.353	1.000	0.353	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
163	L30304	L30304	0.887	1.000	0.887	Cl. 13.8.4	101	1.440	0.493	1.996	0.03
167	L20204	L20204	0.293	1.000	0.293	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
168	L20204	L20204	0.209	1.000	0.209	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
169	L20204	L20204	0.138	1.000	0.138	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
170	L20204	L20204	0.073	1.000	0.073	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
171	L20204	L20204	0.089	1.000	0.089	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
172	L20204	L20204	0.159	1.000	0.159	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
177	L20204	L20204	0.233	1.000	0.233	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
178	L30304	L30304	0.852	1.000	0.852	Cl. 13.8.4	101	1.440	0.493	1.996	0.03
182	L20204	L20204	0.284	1.000	0.284	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
183	L20204	L20204	0.208	1.000	0.208	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
184	L20204	L20204	0.139	1.000	0.139	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
185	L20204	L20204	0.069	1.000	0.069	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
186	L20204	L20204	0.091	1.000	0.091	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
187	L20204	L20204	0.156	1.000	0.156	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
192	L20204	L20204	0.230	1.000	0.230	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
202	C4X7	C4X7	0.056	1.000	0.056	Cl. 13.8.4	107	2.130	4.580	0.425	0.071
203	C4X7	C4X7	0.037	1.000	0.037	Cl. 13.8.4	109	2.130	4.580	0.425	0.071
204	C4X7	C4X7 D S	0.013	1.000	0.013	Cl. 13.8	107	4.260	9.160	1.748	0.141
205	C4X7	C4X7	0.033	1.000	0.033	Cl. 13.8.4	109	2.130	4.580	0.425	0.071
209	C4X7	C4X7	0.015867	1.000	0.015867	Cl. 13.8.4	110	2.130	4.580	0.425	0.071
210	C4X7	C4X7	0.020	1.000	0.020	Cl. 13.8.4	110	2.130	4.580	0.425	0.071
211	C4X7	C4X7 D S	0.007	1.000	0.007	Cl. 13.8	108	4.260	9.160	1.748	0.141
212	C4X7	C4X7	0.027	1.000	0.027	Cl. 13.9.1	108	2.130	4.580	0.425	0.071
217	L20204	L20204	0.030	1.000	0.030	Cl. 13.9.1	109	0.944	0.141	0.554	0.020
218	L20204	L20204	0.024	1.000	0.024	Cl. 13.9.1	107	0.944	0.141	0.554	0.020
219	L20204	L20204	0.032	1.000	0.032	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
220	L20204	L20204	0.032	1.000	0.032	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
221	L20204	L20204	0.018	1.000	0.018	Cl. 13.9.1	107	0.944	0.141	0.554	0.020
222	L20204	L20204	0.010522	1.000	0.010522	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
223	L20204	L20204	0.025947	1.000	0.025947	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
224	L20204	L20204	0.028	1.000	0.028	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
301	W8X18	W8X18	0.085	1.000	0.085	Cl. 13.8	101	5.260	61.900	7.970	0.172
302	W8X18	W8X18	0.078207	1.000	0.078207	Cl. 13.8	101	5.260	61.900	7.970	0.172
303	W8X18	W8X18	0.903	1.000	0.903	Cl. 13.4.1.1	101	5.260	61.900	7.970	0.172
304	W8X18	W8X18	0.869	1.000	0.869	Cl. 13.4.1.1	101	5.260	61.900	7.970	0.172
305	W8X18	W8X18	0.907	1.000	0.907	Cl. 13.4.1.1	101	5.260	61.900	7.970	0.172
306	W8X18	W8X18	0.873	1.000	0.873	Cl. 13.4.1.1	101	5.260	61.900	7.970	0.172
307	W8X18	W8X18	0.731	1.000	0.731	Cl. 13.8	101	5.260	61.900	7.970	0.172
308	W8X18	W8X18	0.734	1.000	0.734	Cl. 13.8	101	5.260	61.900	7.970	0.172
309	W8X18	W8X18	0.367	1.000	0.367	Cl. 13.8	101	5.260	61.900	7.970	0.172
310	W8X18	W8X18	0.332	1.000	0.332	Cl. 13.8	101	5.260	61.900	7.970	0.172
320	C6X10	C6X10	0.168	1.000	0.168	Cl. 13.8.4	101	3.070	15.100	0.860	0.115
321	C6X10	C6X10	0.443	1.000	0.443	Cl. 13.8.4	107	3.070	15.100	0.860	0.115

 	Job No 24946B	Sheet No 22	Rev A
	Part Bridge and Platform		
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Job Title Brantford	By ME75	Date 8/3/2023	Chd
Client	File STAAD-ww_24946B.std	Date/Time 10-Nov-2023 10:57	

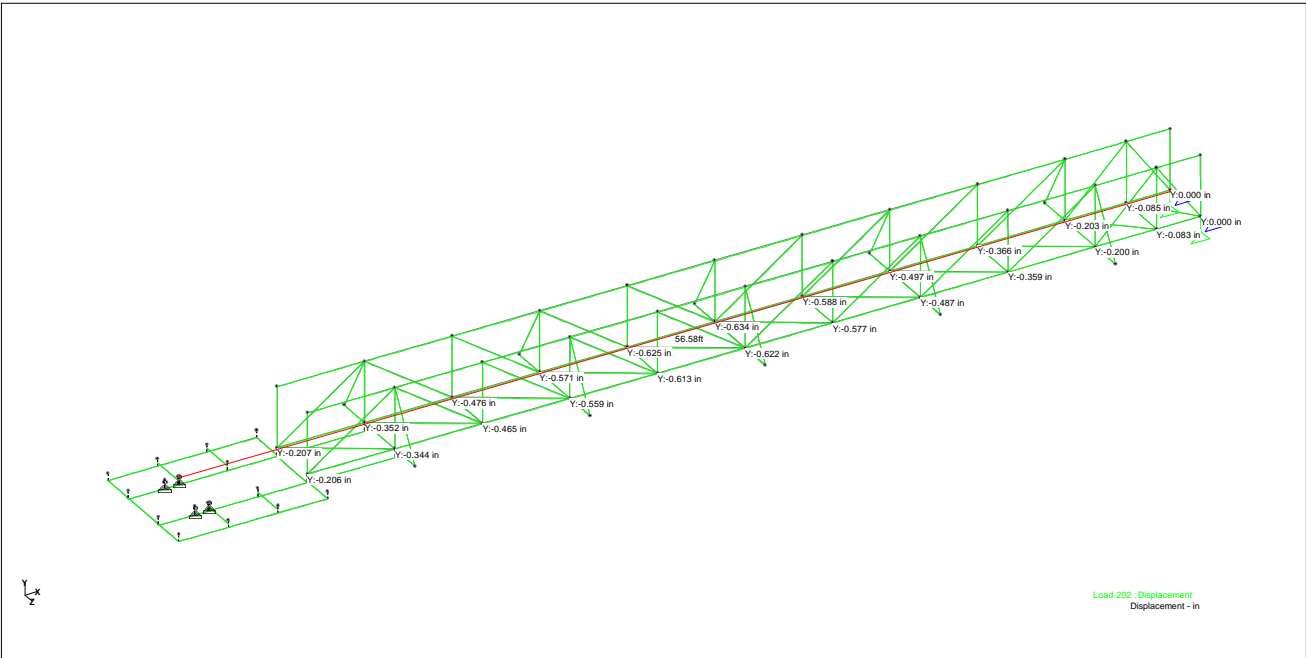
Utilization Ratio Cont...

Beam	Analysis Property	Design Property	Actual Ratio	Allowable Ratio	Ratio (Act./Allow.)	Clause	L/C	Ax (in ²)	Iz (in ⁴)	Iy (in ⁴)	Ix (in ⁴)
322	C6X10	C6X10	0.183	1.000	0.183	Cl. 13.8.4	101	3.070	15.100	0.860	0.115
323	C6X10	C6X10	0.140	1.000	0.140	Cl. 13.8.4	101	3.070	15.100	0.860	0.115
324	C6X10	C6X10	0.154	1.000	0.154	Cl. 13.8.4	101	3.070	15.100	0.860	0.115
325	C6X10	C6X10	0.152	1.000	0.152	Cl. 13.8.4	101	3.070	15.100	0.860	0.115
326	C6X10	C6X10	0.171	1.000	0.171	Cl. 13.8.4	101	3.070	15.100	0.860	0.115
327	C6X10	C6X10	0.092	1.000	0.092	Cl. 13.8.4	101	3.070	15.100	0.860	0.115
328	C6X10	C6X10	0.088	1.000	0.088	Cl. 13.8.4	101	3.070	15.100	0.860	0.115
329	C6X10	C6X10	0.200	1.000	0.200	Cl. 13.8.4	101	3.070	15.100	0.860	0.115
330	C6X10	C6X10	0.189	1.000	0.189	Cl. 13.8.4	101	3.070	15.100	0.860	0.115
331	C6X10	C6X10	0.286	1.000	0.286	Cl. 13.8.4	107	3.070	15.100	0.860	0.115
340	L20204	L20204	0.408	1.000	0.408	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
341	L20204	L20204	0.528	1.000	0.528	Cl. 13.9.1	107	0.944	0.141	0.554	0.020
342	L20204	L20204	0.193	1.000	0.193	Cl. 13.9.1	109	0.944	0.141	0.554	0.020
343	L20204	L20204	0.256	1.000	0.256	Cl. 13.8.4	107	0.944	0.141	0.554	0.020
344	W8X18	W8X18	0.232	1.000	0.232	Cl. 13.9.2	101	5.260	61.900	7.970	0.172
345	W8X18	W8X18	0.231	1.000	0.231	Cl. 13.9.2	101	5.260	61.900	7.970	0.172
346	L60355	L60355	0.228	1.000	0.228	Cl. 13.9.1	101	2.890	1.700	12.065	0.094
347	L60355	L60355	0.222	1.000	0.222	Cl. 13.9.1	101	2.890	1.700	12.065	0.094
348	L20204	L20204	0.118	1.000	0.118	Cl. 13.8.4	109	0.944	0.141	0.554	0.020
349	L35354	L35354	0.579	1.000	0.579	Cl. 13.8.4	101	1.700	0.805	3.215	0.035
350	L35354	L35354	0.578	1.000	0.578	Cl. 13.8.4	101	1.700	0.805	3.215	0.035
351	L20204	L20204	0.454	1.000	0.454	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
352	L20204	L20204	0.454	1.000	0.454	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
353	L20204	L20204	0.311	1.000	0.311	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
354	L20204	L20204	0.305	1.000	0.305	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
355	L20204	L20204	0.058	1.000	0.058	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
356	L60355	L60355	0.127	1.000	0.127	Cl. 13.9.1	101	2.890	1.700	12.065	0.094
357	L60355	L60355	0.128	1.000	0.128	Cl. 13.9.1	101	2.890	1.700	12.065	0.094
358	L20204	L20204	0.108	1.000	0.108	Cl. 13.8.4	109	0.944	0.141	0.554	0.020
359	L35354	L35354	0.347	1.000	0.347	Cl. 13.8.4	101	1.700	0.805	3.215	0.035
360	L35354	L35354	0.350	1.000	0.350	Cl. 13.8.4	101	1.700	0.805	3.215	0.035
361	L20204	L20204	0.131	1.000	0.131	Cl. 13.9.1	107	0.944	0.141	0.554	0.020
362	L20204	L20204	0.115	1.000	0.115	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
363	L20204	L20204	0.322	1.000	0.322	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
364	L20204	L20204	0.320	1.000	0.320	Cl. 13.9.1	101	0.944	0.141	0.554	0.020
365	C4X7	C4X7	0.074	1.000	0.074	Cl. 13.9.1	107	2.130	4.580	0.425	0.071
366	C4X7	C4X7	0.050	1.000	0.050	Cl. 13.8.4	109	2.130	4.580	0.425	0.071
367	C4X7	C4X7	0.029	1.000	0.029	Cl. 13.9.1	108	2.130	4.580	0.425	0.071
368	L20204	L20204	0.047158	1.000	0.047158	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
369	L20204	L20204	0.047	1.000	0.047	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
370	L60355	L60355	0.091	1.000	0.091	Cl. 13.9.1	101	2.890	1.700	12.065	0.094
371	L60355	L60355	0.085689	1.000	0.085689	Cl. 13.9.1	101	2.890	1.700	12.065	0.094
372	L20204	L20204	0.136	1.000	0.136	Cl. 13.8.4	107	0.944	0.141	0.554	0.020
373	L35354	L35354	0.020	1.000	0.020	Cl. 13.8.4	101	1.700	0.805	3.215	0.035
374	L35354	L35354	0.020	1.000	0.020	Cl. 13.8.4	101	1.700	0.805	3.215	0.035

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Utilization Ratio Cont...

Beam	Analysis Property	Design Property	Actual Ratio	Allowable Ratio	Ratio (Act./Allow.)	Clause	L/C	Ax (in ²)	Iz (in ⁴)	Iy (in ⁴)	Ix (in ⁴)
375	L20204	L20204	0.073	1.000	0.073	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
376	L20204	L20204	0.084	1.000	0.084	Cl. 13.8.4	101	0.944	0.141	0.554	0.020
377	L30304	L30304	0.350	1.000	0.350	Cl. 13.8.4	101	1.440	0.493	1.996	0.03
378	L30304	L30304	0.353	1.000	0.353	Cl. 13.8.4	101	1.440	0.493	1.996	0.03
379	L20204	L20204	0.097	1.000	0.097	Cl. 13.9.1	107	0.944	0.141	0.554	0.020



Walkway Displacement: Load Case 202, D+L+0.35S (1.87" max) (Rev A)



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24946B

Sheet No
24

Rev
A

Part Bridge and Platform

Job Title Brantford

Ref

By ME75

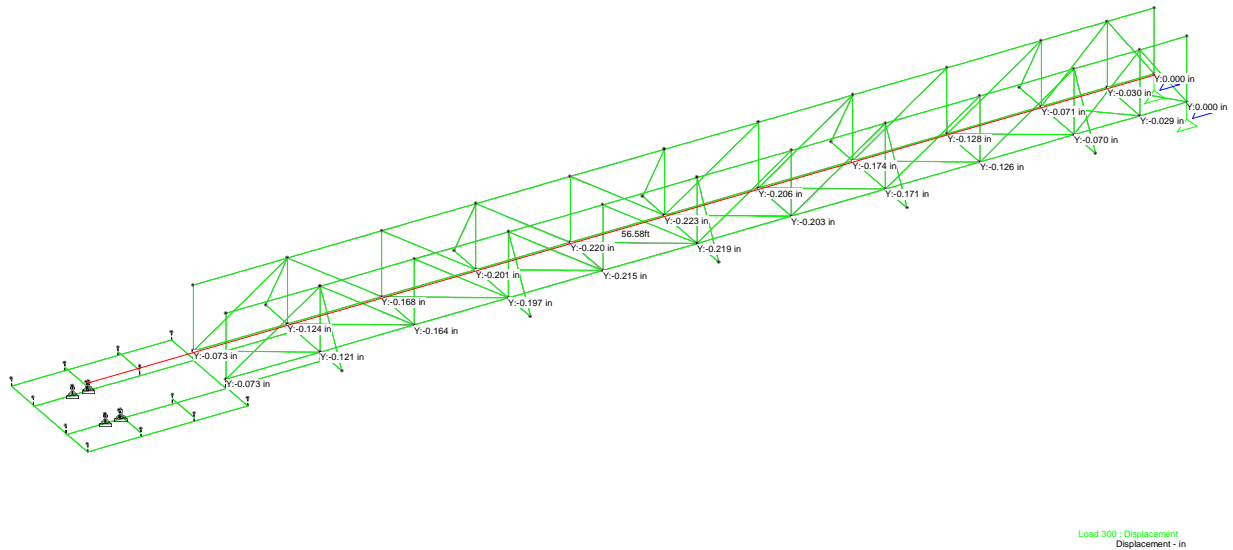
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Camber

Center Column Anchor Bolts

Center Column Epoxy Anchor Bolt Calculations

Page 1

Job Name: Brantford	By: ME75	Last Saved Date: 08/02/23
Job Number: 24946B	Chk'd: PO07	Date: 8/3/2023

Note: Concrete Breakout Strength of Anchor in Shear is not passing

CENTER COLUMN INPUT

Column Diameter (D _c) =	914	mm
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ANCHOR BOLT INPUT

Anchor Bolt Type =	Epoxy	
Epoxy Type =	Simpson SET-3G	
Anchor Bolt Material =	316SS	ASTM A193B8
Bolt Tensile Strength (f_{tsa}) =	517	MPa
Bolt Yield Strength (f_{ys}) =	207	MPa
Elastic Modulus (E_s) =	1331	MPa
Number of Anchor Bolts (n) =	8	
Bolt Diameter (d_b) =	25.40	mm
Thread Root Diameter (d_{root}) =	21.971	mm
Bolt Circle Diameter (d_{bc}) =	1473.2	mm
Anchor Bolt Embedment Depth, SELECTED (h_{ef}) =	254	mm
Anchor Bolt Minimum Embedment Depth ($h_{ef,min}$) =	101.6	mm
Anchor Bolt Maximum Embedment Depth ($h_{ef,max}$) =	508.0	mm
Distance to Loaded Edge (Edge) =	50.8	mm
Steel Strength Reduction Factor (Tension), ($\Phi_{tension}$) =	0.75	
Steel Strength Reduction Factor (Shear), (Φ_{shear}) =	0.65	
Temperature Range =	A	

Table 5 of ESR-4057

Table 5 of ESR-4057

Table 3 of ESR-4057

Table 3 of ESR-4057

Max Short Term 160°F, Max Long Term 110°F

Short term temperatures are those that occur over short intervals, such as a day.
Long term temperatures are constant over a significant time period.

DRIVE TORQUE LOADING

Drive Design Torque (Torque) =	48,471	N-m
Drive Momentary Peak Torque (TorqueP) =	96,941	N-m

NBCC 2020

Earthquake Importance Factor, (I _e) =	1.5	NBCC 2020, Table 4.1.8.5.A, Post Disaster
Site Class =	D	
Mapped Spectral Response Accel, (S _a (0.2)) =	0.205	
Component Amplification Factor (A _r) =	1.00	
Component Response Modification Factor (R _p) =	2.50	
Seismic Coefficient (V _p) =	0.11	
		Assume D

CONCRETE INPUT

Concrete Compressive Strength (f' _c) =	17.2	MPa	Assumed.
Concrete Elastic Modulus (E _c) =	236649	MPa	
Concrete Strength Reduction Factor (R _{conc,tension}) =	1.00		CSA A23.3:19 D.5.3.c (condition B)
Concrete Strength Reduction Factor (R _{conc,shear}) =	1.00		CSA A23.3:19 D.5.3.c (condition B)
Concrete Density Modification Factor (λ) =	1		CSA A23.3:19 8.6.5 (Assumed Normal Density)

LOADS & MOMENTS

Load Description	Vert. Center of Gravity*	Weight**	Bending Moment (COG*Wt*C _g)
Rake Arms	1.076 m	28402 N	3409 N-m
Cage	2.832 m	6034 N	1906 N-m
Center Column	2.972 m	10955 N	3631 N-m
Drive	6.246 m	9786 N	6816 N-m
Feedwell	4.863 m	14962 N	8114 N-m
Feedwell supports	6.082 m	3833 N	2600 N-m
Walkway	6.211 m	18484 N	12802 N-m
Energy Dissipating Inlet	5.168 m	9603 N	5534 N-m
Total =		102059 N	44811 N-m

* With Respect To Anchor Bolt Elevation

** Component Weights Must Be Verified With Final Design

Maximum tension and compression force on anchor bolts due to overturning loads

P _{max} (TENS & COMP) =	15209	N	P _{max} = (4*M/d _{bc})/n
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Anchor Bolt Forces, per NBCC 2020			Page 2
Tension Forces (Per Anchor Bolt)			
D =	-12757	N	-W/n
TQ =	0	N	Torque from Drive (Treated as Dead Load due to well defined limit)
L =	-3506	N	Tension Due to Live Load
E _{o1} =	15209	N	P _{max} (Tension Due to Over-Turning Moment)
E _v =	0	N	Vertical Seismic
R _d *R _o =	1.3		SFRS Overstrength Factor (CSA A23.3:19 D.4.3.5.3.d.i)
Combined Tension Forces (Per Anchor Bolt)		Total Tension Force of Anchors (For Use in Concrete Breakout Capacity Checks)	
P _{u1} =	-17860	N	P _{u-tot1} = -142883 N 1.4(D+TQ) NBCC 2020 Table 4.1.3.2-A
P _{u2} =	-21206	N	P _{u-tot2} = -169649 N 1.25(D+TQ)+1.5L NBCC 2020 Table 4.1.3.2-A
P _{u3} =	-16741	N	P _{u-tot3} = -50223 N 0.9(D+TQ)+1.5L NBCC 2020 Table 4.1.3.2-A
P _{u4} =	5261	N	P _{u-tot4} = 4201 N 1.0(D+TQ) + 1.0(E _v + E _{o1} *R _d *R _o) + 0.5L NBCC 2020 Table 4.1.3.2-A
Shear Forces (Per Anchor Bolt)			
D =	0	N	No Shear Due to Dead Load
TQ =	8225	N	Torque from Drive (Treated as Dead Load due to well defined limit) (Cont. Torque/(dbc/2)/n)
L =	0	N	No Shear Due to Live Load
E _h =	1423	N	((W*Ca)/n)
R _d *R _o =	1.3		SFRS Overstrength Factor (CSA A23.3:19 D.4.3.5.3.c.i)
Combined Shear Forces (Per Anchor Bolt)		Total Shear Force of Anchor Group (For Use in Concrete Breakout Capacity Checks)	
V _{u1} =	11516	N	V _{u-tot1} = 92124 N 1.4(D+TQ) NBCC 2020 Table 4.1.3.2-A
V _{u2} =	10282	N	V _{u-tot2} = 82254 N 1.25(D+TQ) + 1.5L NBCC 2020 Table 4.1.3.2-A
V _{u3} =	7403	N	V _{u-tot3} = 59223 N 0.9(D+TQ)+1.5L NBCC 2020 Table 4.1.3.2-A
V _{u4} =	10075	N	V _{u-tot4} = 80599 N 1.0(D+TQ) + 1.0(E _h *R _d *R _o) + 0.5L NBCC 2020 Table 4.1.3.2-A
V _{u5} =	23031	N	1.4(Peak Torque/Cont. Torque)*TQ Momentary-Peak Torque or Duty-Rated Torque

Epoxy Anchor Bolt Calculations, per CSA A23.3:19 and Respective ESR Report			Page 3
$N_{UB} = 198351 \text{ N}$ $V_{UB} = 17440 \text{ N}$ $s = 563.77 \text{ mm}$ $C_{IP} = 127 \text{ mm}$ $C_{Pier} = 50.8 \text{ mm}$ $C_{a1} = 50.8 \text{ mm}$ $C_{a2} = 278.24 \text{ mm}$	Load Combination Critical Column Vertical Total Load Load Combination Critical Column Horizontal Total Load Anchor Bolt Chordal Spacing Center of Anchor to Edge of Concrete at Influent Opening Center of Anchor to Edge of Concrete at Pier, Edge of Sludge Outlet/Hopper ($\leq 1.5h_d$) Minimum Center of Anchor to Edge of Concrete in Direction of Shear Center of Anchor to Edge of Concrete Orthogonal to Direction of Shear		
Required Edge Distance and Spacing			
$C_{min} = 44.45 \text{ mm}$ $C_{max} = 278.24 \text{ mm}$ $C_{a,min} = 50.80 \text{ mm}$ $S_{min} = 76.20 \text{ mm}$ $h_{min} = 311.15 \text{ mm}$ $h_a = 311.15 \text{ mm}$	Table 2 of ESR-4057 Largest Edge Distance Smallest Edge Distance Selection OK Table 2 of ESR-4057 Selection OK Minimum concrete thickness based on embedment and Table 2 of ESR-4057 Concrete thickness. If unknown, assumes h_{min} .	Edge Distance Check Anchor Spacing Check	
Grouted Joint? = YES Grout Thickness = 50.80 mm Grout Under Column Flange? (If YES, 0.8 factor applied to shear design) (17.5.1.3)			
Anchor Bolt Physical Properties:			
Anchor Diameter = 25.40 mm Area _{root} = 379.13 mm² $I_x = I_y = 11438.5 \text{ mm}^4$ $Z = 1041.236 \text{ mm}^3$ $r = 5.493 \text{ mm}$ $K = 1$ $KL/r = 9.25$ No. of Anchors in Group = 3 No. of Anchors in Group = 8	Slenderness Ratio (< 200) For Group Action in Tension For Group Action in Shear		
Anchor Compressive Stress			
Stress _C = 6 MPa Selection OK	Stress _C = $(P_{max} + Wt/N) / A_{root}$ Compressive Stress Check 80% yield strength		
Design requirements for tensile loading			
Steel Strength of Anchor in Tension (Single Anchor)			
$N_{sa} = 153642 \text{ N}$ $\phi_{tension} N_{sa} = 115231 \text{ N}$ Ratio $P_{u1} = 0.00$ Ratio $P_{u2} = 0.00$ Ratio $P_{u3} = 0.00$ Ratio $P_{u4} = 0.05$	Nominal Axial Strength (Per Anchor), Table 3 of ESR-4057 Ratios must be ≤ 1.0 Selection OK		
Anchor Bolt Selection Check			
Concrete Breakout Strength of Anchor Group in Tension			
D.6.2 $N_{br} = 76470 \text{ N}$ $h_{ef} = 254 \text{ mm}$ $\lambda = 1.0$ $K_{c,cr} = 7$ $A_{Nco} = 889697 \text{ mm}^2$ $A_{Nco} = 580644 \text{ mm}^2$ $\psi_{ec,N} = 0.96$ $\psi_{ed,N} = 0.74$ $\psi_{c,N} = 1.00$ $\psi_{cp,N} = 1.00$ $N_{cbgr} = 82910 \text{ N}$ $\phi_c = 0.65$ $0.75N_{cbgr} = 62182 \text{ N}$ Ratio $P_{u-tot1} = 0.00$ Ratio $P_{u-tot2} = 0.00$ Ratio $P_{u-tot3} = 0.00$ Ratio $P_{u-tot4} = 0.07$	Nominal Concrete Breakout Strength in tension of single anchor (Eq.D.6) $N_{br} = k_c \phi_c \lambda (f_c)^{0.5} h_{ef}^{1.5} R_{conc_tension}$ Effective Embedment of Anchor Concrete Modification Factor (adhesive anchor concrete failure) (D.4.6) $K_c = 7$ for post-installed anchors (D.6.2.2) Projected Concrete Failure Area (D.6.2.1) $A_{nc} \leq n A_{Nco}$ Maximum Possible Concrete Failure Area (Eq. D.5) $A_{Nco} = 9 h_{ef}^2$ Modification Factor for Eccentricity (Eq D.8) $\psi_{ec,N} = 1 / (1 + (2 e_N / 3 h_{ef})) \leq 1$ Modification Factor for Edge Effects (Eq D.10) $0.7 + 0.3 (C_{a1} / \min(1.5 h_{ef}))$ Modification Factor for Cracked Concrete (D6.2.6) Assume Cracked Concrete Modification Factor for Post-Installed Anchor (D.6.2.7) Assume Cracked Concrete Factored Concrete Breakout Strength in tension for anchor group (Eq. D.4) $N_{cbgr} = (A_{Nco} / A_{Nco}) \psi_{ec,N} \psi_{ed,N} \psi_{c,N} \psi_{cp,N} N_{br}$ Concrete resistance factor, $\phi_c = 0.65$ (per 8.4.2) 0.75 Factor for SFRS (D.4.3.5.4) Ratios must be ≤ 1.0		
Selection OK			
Anchor Bolt Selection Check			

Epoxy Anchor Bolt Calculations, per CSA A23.3:19 and Respective ESR Report (Continued)				Page 4																																																																																																																														
<p>Pullout Strength of Cast-in, post-installed expansion and undercut anchors in Tension</p> <p style="text-align: center;">Pullout Strength of Cast-in, post-installed expansion and undercut anchors in Tension is Not Applicable to Epoxy Anchors</p>																																																																																																																																		
<p>Concrete Side-Face Blowout in Tension</p> <p style="text-align: center;">Concrete Side-Face Blowout in Tension is Not Applicable to Epoxy Anchors</p>																																																																																																																																		
<p>Bond Strength of Adhesive Anchor (Single) in Tension</p> <p>D.6.5</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 20%;">C_{Na}</td> <td style="width: 10%; text-align: center;">266.58</td> <td style="width: 10%;">mm</td> <td style="width: 30%;">Projected Influence Line</td> <td style="width: 30%;">(Eq. D.23)</td> <td style="width: 10%;">$C_{Na} = 10d_a(\tau_{uncr}/7.60)^{0.5}$</td> </tr> <tr> <td>$\phi_d$</td> <td style="text-align: center;">0.65</td> <td></td> <td>Hole Installation Condition Factor</td> <td>Table 5 of ESR-4057</td> <td></td> </tr> <tr> <td>τ_{uncr}</td> <td style="text-align: center;">13</td> <td>MPa</td> <td>Bond Strength, Uncracked Concrete</td> <td>Table 5 of ESR-4057</td> <td></td> </tr> <tr> <td>A_{Na0}</td> <td style="text-align: center;">284265</td> <td>mm²</td> <td>Nominal Projected Area of Single Anchor</td> <td>(Eq. D.22)</td> <td>$A_{Na0} = (2C_{Na})^2$</td> </tr> <tr> <td>A_{Na}</td> <td style="text-align: center;">94797</td> <td>mm²</td> <td>Projected Influence Area of Anchor Group</td> <td>(D.6.5.1)</td> <td></td> </tr> <tr> <td>$\Psi_{ec,Na}$</td> <td style="text-align: center;">1.00</td> <td></td> <td>Load Eccentricity Modification Factor</td> <td>(Eq. D.25)</td> <td>$\Psi_{ec,Na} = 1/(1+(e'_N/C_{Na})) \leq 1.0$</td> </tr> <tr> <td>$e'_N$</td> <td style="text-align: center;">NA</td> <td>mm</td> <td>Tension Load Eccentricity N/A for Single Anchor</td> <td></td> <td></td> </tr> <tr> <td>$\Psi_{ed,Na}$</td> <td style="text-align: center;">0.76</td> <td></td> <td>Edge Effects Modification Factor</td> <td>(Eq. D.27)</td> <td>$0.7+0.3(Ca1, \min/cNa) \leq 1.0$</td> </tr> <tr> <td>$\Psi_{cp,Na}$</td> <td style="text-align: center;">1.00</td> <td></td> <td>Splitting Modification Factor</td> <td>(Eq. D.29)</td> <td>1.0 for cracked concrete</td> </tr> <tr> <td>C_{ac}</td> <td style="text-align: center;">78.9</td> <td>mm</td> <td>Critical Edge Distance</td> <td>Table 2 of ESR-4057</td> <td></td> </tr> <tr> <td>N_{bar}</td> <td style="text-align: center;">110727</td> <td>N</td> <td>Nominal Bond Strength of Single Anchor</td> <td>(Eq. 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D.23)	$C_{Na} = 10d_a(\tau_{uncr}/7.60)^{0.5}$	ϕ_d	0.65		Hole Installation Condition Factor	Table 5 of ESR-4057		τ_{uncr}	13	MPa	Bond Strength, Uncracked Concrete	Table 5 of ESR-4057		A_{Na0}	284265	mm ²	Nominal Projected Area of Single Anchor	(Eq. D.22)	$A_{Na0} = (2C_{Na})^2$	A_{Na}	94797	mm ²	Projected Influence Area of Anchor Group	(D.6.5.1)		$\Psi_{ec,Na}$	1.00		Load Eccentricity Modification Factor	(Eq. D.25)	$\Psi_{ec,Na} = 1/(1+(e'_N/C_{Na})) \leq 1.0$	e'_N	NA	mm	Tension Load Eccentricity N/A for Single Anchor			$\Psi_{ed,Na}$	0.76		Edge Effects Modification Factor	(Eq. D.27)	$0.7+0.3(Ca1, \min/cNa) \leq 1.0$	$\Psi_{cp,Na}$	1.00		Splitting Modification Factor	(Eq. D.29)	1.0 for cracked concrete	C_{ac}	78.9	mm	Critical Edge Distance	Table 2 of ESR-4057		N_{bar}	110727	N	Nominal Bond Strength of Single Anchor	(Eq. 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Customer must ensure concrete is designed and reinforced to resist forces transferred from center column.

Epoxy Anchor Bolt Calculations, per CSA A23.3:19 and Respective ESR Report (continued)				Page 5
Concrete Pryout Strength of Anchor in Shear				
D.7.3	$V_{cprg} =$ 55917 N $k_{cp} =$ 2.0	Factored Pryout Strength in Shear of Anchor Group (Eq. D.45) Pryout Strength Coefficient	$V_{cprg} = \text{Min}[k_{cp} * N_{agr}; k_{cp} * N_{cgr}]$ $k_{cp} = 2.0$ for $hef \geq 65$ mm	
	Ratio $V_{u1} =$ 0.21 Ratio $V_{u2} =$ 0.18 Ratio $V_{u3} =$ 0.13 Ratio $V_{u4} =$ 0.18 Ratio $V_{u5} =$ 0.41	Ratios must be ≤ 1.0		
	Selection OK Anchor Bolt Selection Check			
Interaction of Tensile and Shear Forces				
D.8	$(\text{Max } P_{u1} \text{ Or } P_{u-tot1}) / \phi N_n =$ 0.00 $(\text{Max } P_{u2} \text{ Or } P_{u-tot2}) / \phi N_n =$ 0.00 $(\text{Max } P_{u3} \text{ Or } P_{u-tot3}) / \phi N_n =$ 0.00 $(\text{Max } P_{u4} \text{ Or } P_{u-tot4}) / \phi N_n =$ 0.25	$\text{Max } V_{u1} / \phi N_n =$ 1.57 $\text{Max } V_{u2} / \phi N_n =$ 1.40 $\text{Max } V_{u3} / \phi N_n =$ 1.01 $\text{Max } V_{u4} / \phi N_n =$ 1.37	Ratio must be ≤ 1.2 (ESR-4057, EQ 4.4) Ratio must be ≤ 1.2 (ESR-4057, EQ 4.4) Ratio must be ≤ 1.2 (ESR-4057, EQ 4.4) Ratio must be ≤ 1.2 (ESR-4057, EQ 4.4)	
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	Increase Size / BC / Qty Anchor Bolt Selection Check			

Walway Anchor Bolts

Company:	WesTech Engineering	Date:	8/2/2023
Engineer:	ME75	Page:	1/5
Project:	Brantford 24946B		
Address:			
Phone:			
E-mail:			

1. Project information

Customer company:
 Customer contact name:
 Customer e-mail:
 Comment:

Checked By: H093 [8/16/2023]

Project description: Walkway Anchors
 Location:
 Fastening description:

2. Input Data & Anchor Parameters

General

Design method: CSA A23.3-19
 Units: SI units (metric)

Anchor Information:

Anchor type: Bonded anchor
 Material: A193 Grade B8/B8M (304/316SS)
 Diameter (inch): 0.750
 Effective Embedment depth, h_{ef} (mm): 114
 Code report: ICC-ES ESR-4057
 Anchor category: -
 Anchor ductility: Yes
 h_{min} (mm): 159
 c_{ac} (mm): 164
 c_{min} (mm): 44
 s_{min} (mm): 76

Base Material

Concrete: Normal-weight
 Concrete thickness, h (mm): 305
 State: Cracked
 Compressive strength, f'_c (MPa): 20.70
 $\Psi_{c,v}$: 1.0
 Reinforcement condition: B tension, B shear
 Supplemental edge reinforcement: Not applicable
 Reinforcement provided at corners: No
 Ignore concrete breakout in tension: No
 Ignore concrete breakout in shear: No
 Hole condition: Dry concrete
 Inspection: Continuous
 Temperature range, Short/Long: 150/110°F
 Reduced installation torque (for AT-3G): Not applicable
 Ignore 6do requirement: Not applicable
 Build-up grout pad: Yes

Base Plate

Length x Width x Thickness (mm): 203 x 114 x 6

Recommended Anchor

Anchor Name: SET-3G™ - SET-3G w/ 3/4"Ø A193 Gr. B8/B8M (304/316SS)
 Code Report: ICC-ES ESR-4057



Input data and results must be checked for agreement with the existing circumstances, the standards and guidelines and must be checked for plausibility.?

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Load and Geometry

Load factor source: CSA A23.3

Load combination: not set

Seismic design: No

Anchors subjected to sustained tension: No

Apply entire shear load at front row: No

Anchors only resisting wind and/or seismic loads: No

Strength level loads:

N_{ua} [kN]: -24.60

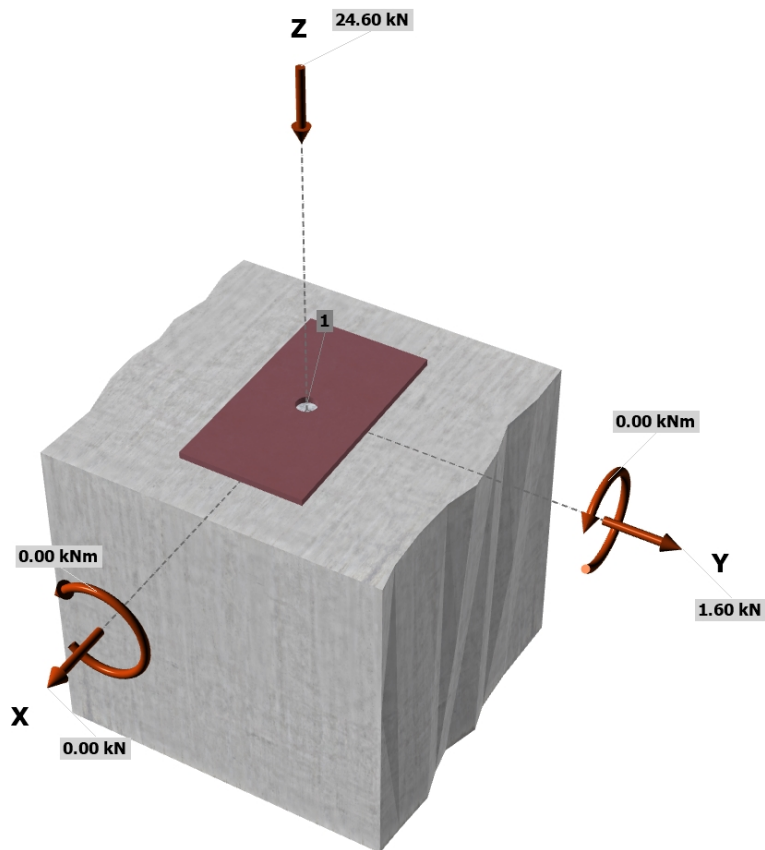
V_{uax} [kN]: 0.00

V_{uay} [kN]: 1.60

M_{ux} [kNm]: 0.00

M_{uy} [kNm]: 0.00

<Figure 1>



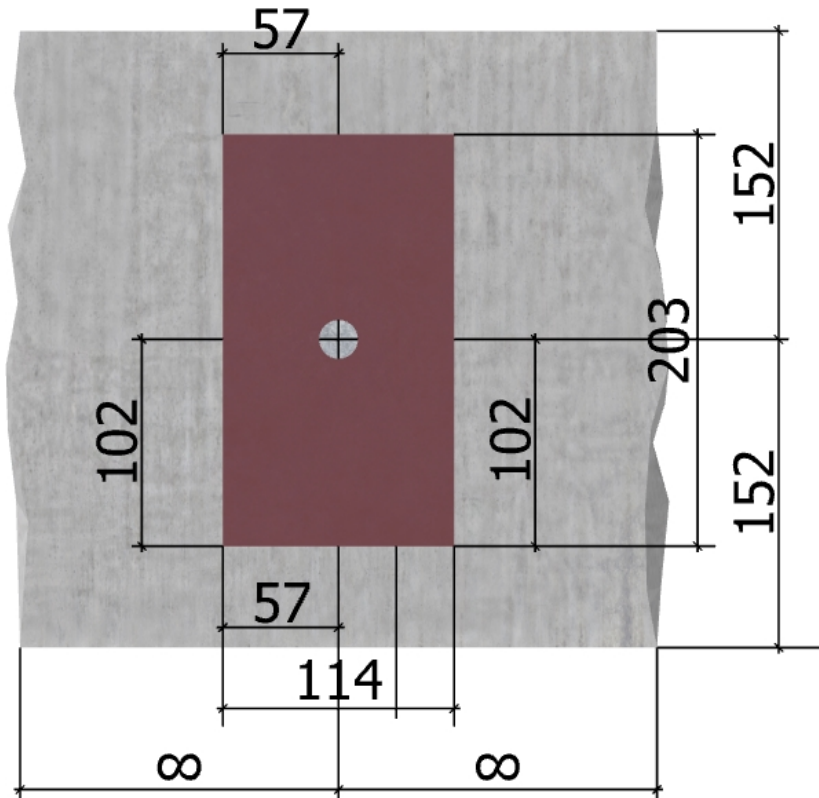
Input data and results must be checked for agreement with the existing circumstances, the standards and guidelines and must be checked for plausibility.?

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<Figure 2>





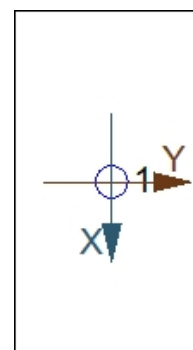
Company:	WesTech Engineering	Date:	8/2/2023
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Address:			
Phone:			
E-mail:			

3. Resulting Anchor Forces

Anchor	Tension load, N_{fa} (kN)	Shear load x, V_{fax} (kN)	Shear load y, V_{fay} (kN)	Shear load combined, $\sqrt{(V_{fax})^2 + (V_{fay})^2}$ (kN)
1	0.0	0.0	1.6	1.6
Sum	0.0	0.0	1.6	1.6

Maximum concrete compression strain (‰): 0.00
Maximum concrete compression stress (N/mm²): 0.00
Resultant tension force (kN): 0.00
Resultant compression force (kN): 0.00
Eccentricity of resultant tension forces in x-axis, e'_{Nx} (mm): 0
Eccentricity of resultant tension forces in y-axis, e'_{Ny} (mm): 0
Eccentricity of resultant shear forces in x-axis, e'_{Vx} (mm): 0
Eccentricity of resultant shear forces in y-axis, e'_{Vy} (mm): 0
Steel resistance factor, Φ_s : 0.85 (Clause 8.4.3)
Concrete resistance factor, Φ_c : 0.65 (Clause 8.4.2)

<Figure 3>



8. Steel Resistance of Anchor in Shear (Clause D.7.1)

$$V_{sar} = \phi_{grout} V_{sa} \phi_s R \text{ (Clause D.7.1.2)}$$

V_{sa} (kN)	ϕ_{grout}	R	V_{sar} (kN)
50.82	0.8	0.75	25.92

9. Concrete Breakout Resistance of Anchor in Shear (Clause D.7.2)

Shear parallel to edge in x-direction:

$$V_{bry} = \min[0.58(l_e/d_a)^{0.2} \sqrt{d_a} \phi_c \lambda_a \sqrt{f'_c} c_{at}^{1.5} R; 3.75 \lambda_a \phi_c \sqrt{f'_c} c_{at}^{1.5} R] \text{ (Eq. D.35 \& Eq. D.36)}$$

l_e (mm)	d_a (mm)	λ_a	f'_c (MPa)	c_{at} (mm)	R	V_{bry} (kN)
114	19	1.00	20.70	152	1.00	20.08

$$V_{cbry} = (2)(A_{Vc}/A_{Vco}) \psi_{ed,V} \psi_{c,V} \psi_{h,V} V_{bry} \text{ (Sec. D.7.2.1(c) \& Eq. D.32)}$$

A_{Vc} (mm ²)	A_{Vco} (mm ²)	$\psi_{ed,V}$	$\psi_{c,V}$	$\psi_{h,V}$	V_{bry} (kN)	V_{cbry} (kN)
103968	103968	1.000	1.000	1.000	20.08	40.15

10. Concrete Pryout Resistance of Anchor in Shear (Clause D.7.3)

$$V_{cpr} = \min[k_{cp} N_{ar}; k_{cp} N_{cb}] = \min[k_{cp}(A_{Na}/A_{Na0}) \psi_{ed,Na} \psi_{cp,Na} \lambda_a \phi_c \tau_k \pi d_a h_{ef,a} R_a; k_{cp}(A_{Nc}/A_{Nco}) \psi_{ed,N} \psi_{c,N} \psi_{cp,N} k_c \lambda_a \phi_c \sqrt{f'_c} h_{ef,cb}^{1.5} R_{cb}] \text{ (Clause D.7.3(a))}$$

k_{cp}	A_{Na} (mm ²)	A_{Na0} (mm ²)	$\psi_{ed,Na}$	$\psi_{cp,Na}$	τ_k (MPa)	d_a (mm)	$h_{ef,a}$ (mm)	R_a
2.0	158492	271810	0.875	1.000	9.03	19	114	1.00
A_{Nc} (mm ²)	A_{Nco} (mm ²)	$\psi_{ed,N}$	$\psi_{c,N}$	$\psi_{cp,N}$	k_c	λ_a	f'_c (MPa)	$h_{ef,cb}$ (mm)
104242	117580	0.966	1.000	1.000	7.0	1.00	20.70	114
R_{cb}	V_{cpr} (kN)							
1.00	42.81							

Input data and results must be checked for agreement with the existing circumstances, the standards and guidelines and must be checked for plausibility.?

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Anchor Designer™
Software
Version 3.1.2303.1

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11. Results

11. Interaction of Tensile and Shear Forces (Sec. D.8)?

Shear	Factored Load, V_{fa} (kN)	Design Resistance, V_r (kN)	Ratio	Status
Steel	1.60	25.92	0.06	Pass (Governs)
Concrete breakout x-	1.60	40.15	0.04	Pass
Pryout	1.60	42.81	0.04	Pass

SET-3G w/ 3/4"Ø A193 Gr. B8/B8M (304/316SS) with hef = 114 mm meets the selected design criteria.

12. Warnings

- Designer must exercise own judgement to determine if this design is suitable.
- Refer to manufacturer's product literature for hole cleaning and installation instructions.

Accessory Equipment

Aluminum Grating

ALUMINUM STANDARD MESH BAR GRATING

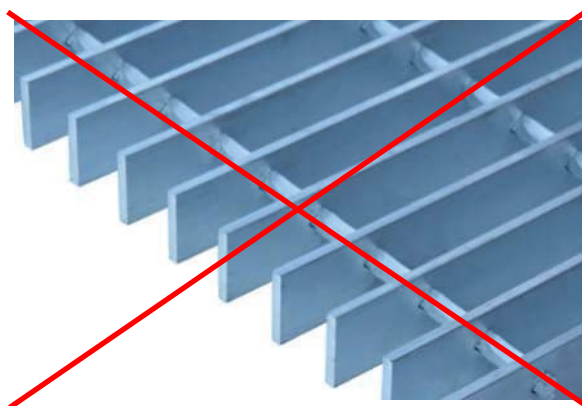
aluminum information

RECTANGULAR
AND I-BAR GRATING

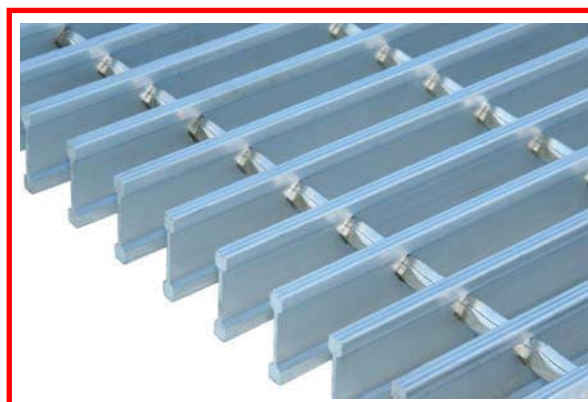
Aluminum Bar Gratings employ a unique interlocking system that joins the bearing bars and cross rods together in panels of exceptional rigidity and strength. Lightweight, corrosion-resistant, non-sparking alloys are ideal for pedestrian platforms in chemical, petroleum, and food processing plants. Fisholow gratings is recommended in most water and waste water treatment facilities and is becoming increasingly popular for use in architectural building designs.

Aluminum Bar Grating is available in two bar profiles: **Rectangular Bar** and **I-bar**. Similar to Tru-Weld Steel Bar Grating, Fisholow Rectangular Bar Grating is offered with a plain or serrated surface. Fisholow I-Bar Grating produces exceptional load ratings at a fraction of the weight of its rectangular counterpart, and is designed with a slip resistant corrugated surface on the top of each I-bar.

Both Rectangular Bar and I-Bar styles are available in special mesh options.



RECTANGULAR BAR



I-BAR

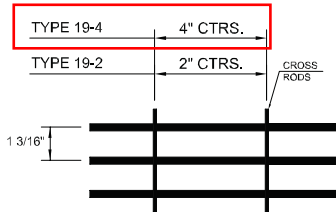


STANDARD

Bearing Bars: 1 3/16" centers, 6063T6

Cross Bars: 6063T5

Stock panels: 3' nominal width x 24' long



aluminum type 19

**IMPERIAL LEGEND**U = Safe Uniform Load (lbs./ft.²)

C = Safe Concentrated Load (lbs./foot of grating width)

D = Deflection (inches)

Loads and deflections given in this table are theoretical and are based on a maximum allowable fibre stress of 12,000 P.S.I.

For Fisholow I-bar loading, use the equivalent depth 3/16" bar size values in this load table.

BEARING BAR SIZE (inches)	APPROX. WEIGHT (lbs./ft. ²)	LOAD/ DEFLECTION	SPAN IN FEET AND INCHES																SECTION MODULUS PER FOOT OF WIDTH					
			2' 0"	2' 6"	3' 0"	3' 6"	4' 0"	4' 6"	5' 0"	5' 6"	6' 0"	6' 6"	7' 0"	7' 6"	8' 0"	8' 6"	9' 0"							
1 x 1/8	1.92	U	421	269	187	137	105	83	Spans and loads in the pink shaded area exceed a deflection of 1/4" for uniform loads of 100 lbs/sq. ft. Experience has shown that 1/4" deflection is the maximum deflection to give pedestrian comfort, but can be exceeded for other types of loads at the discretion of the engineer.										0.216					
		D	0.114	0.225	0.324	0.441	0.576	0.729																
		C	421	337	281	241	211	187																
		D	0.115	0.18	0.259	0.353	0.461	0.583																
1 x 3/16	2.72	U	632	404	281	206	158	125	For serrated surface, increase depth by one size.										0.325					
		D	0.144	0.225	0.324	0.441	0.576	0.729																
		C	632	505	421	361	316	281																
		D	0.115	0.18	0.259	0.353	0.461	0.583																
1 1/4 x 1/8	2.31	U	658	421	292	215	164	130	105	87	73											0.339		
		D	0.115	0.18	0.259	0.353	0.461	0.583	0.720	0.871	1.037													
		C	658	526	439	376	329	292	263	239	219													
		D	0.092	0.144	0.207	0.282	0.369	0.467	0.576	0.697	0.829													
1 1/4 x 3/16	3.31	U	987	632	439	322	247	195	158	130	110	93	81											0.507
		D	0.115	0.18	0.259	0.353	0.461	0.583	0.720	0.871	1.037	1.217	1.411											
		C	987	789	658	564	493	439	395	359	329	304	282											
		D	0.092	0.144	0.207	0.282	0.369	0.467	0.576	0.697	0.829	0.973	1.129											
1 1/2 x 1/8	2.72	U	947	606	421	309	237	187	152	125	105	90	77	67	59	52	47	0.488						
		D	0.096	0.150	0.216	0.294	0.384	0.486	0.600	0.726	0.864	1.014	1.176	1.35	1.536	1.734	1.944							
		C	947	758	632	541	474	421	379	344	316	291	271	253	237	223	211							
		D	0.077	0.120	0.173	0.235	0.307	0.389	0.480	0.581	0.691	0.811	0.941	1.08	1.229	1.387	1.555							
1 1/2 x 3/16	3.89	U	1421	909	632	464	355	281	227	188	158	135	116	101	89	79	70	0.730						
		D	0.096	0.15	0.216	0.294	0.384	0.486	0.6	0.726	0.864	1.014	1.176	1.35	1.536	1.734	1.944							
		C	1421	1137	947	812	711	632	568	517	474	437	406	379	355	334	316							
		D	0.077	0.12	0.173	0.235	0.307	0.389	0.48	0.581	0.691	0.811	0.941	1.08	1.229	1.387	1.555							
1 3/4 x 3/16	4.48	U	1934	1238	860	632	484	382	309	256	215	183	158	138	121	107	96	0.994						
		D	0.082	0.129	0.185	0.252	0.329	0.417	0.514	0.622	0.741	0.869	1.008	1.157	1.317	1.486	1.666							
		C	1934	1547	1289	1105	967	860	774	703	645	595	553	516	484	455	430							
		D	0.066	0.103	0.148	0.202	0.263	0.333	0.411	0.498	0.592	0.695	0.806	0.926	1.053	1.189	1.333							
2 x 3/16	5.08	U	2526	1617	1123	825	632	499	404	334	281	239	206	180	158	140	125	1.299						
		D	0.072	0.113	0.162	0.221	0.288	0.365	0.45	0.545	0.648	0.761	0.882	1.013	1.152	1.301	1.458							
		C	2526	2021	1684	1444	1263	1123	1011	919	842	777	727	674	632	594	561							
		D	0.058	0.09	0.13	0.176	0.263	0.292	0.36	0.436	0.518	0.608	0.706	0.81	0.922	1.04	1.166							
2 1/4 x 3/16	5.68	U	3197	2046	1421	1044	799	632	512	423	355	303	261	227	200	177	158	1.644						
		D	0.064	0.100	0.144	0.196	0.256	0.324	0.400	0.484	0.576	0.676	0.784	0.900	1.024	1.156	1.296							
		C	3197	2558	2132	1827	1599	1421	1279	1163	1066	984	1218	1137	799	752	711							
		D	0.051	0.080	0.115	0.157	0.205	0.259	0.320	0.387	0.461	0.541	0.627	0.720	0.819	0.925	1.037							
2 1/2 x 3/16	6.28	U	3947	2526	1754	1289	987	780	632	522	439	374	322	281	247	219	195	2.029						
		D	0.058	0.090	0.130	0.176	0.230	0.292	0.360	0.436	0.518	0.608	0.706	0.81	0.922	1.04	1.166							
		C	3947	3158	2632	2256	1974	1754	1579	1435	1316	1215	1128	1053	987	929	877							
		D	0.046	0.072	0.104	0.141	0.184	0.233	0.288	0.348	0.415	0.487	0.564	0.648	0.737	0.832	0.933							

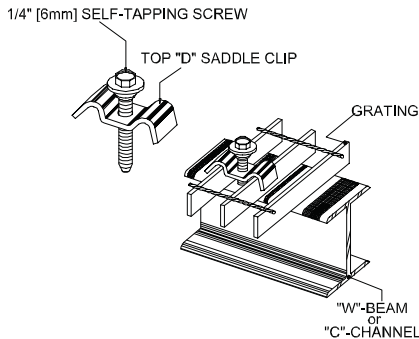
I-BAR WEIGHTS (IMPERIAL)					
BEARING BAR SIZE (inches)	WEIGHTS (lbs./ft ²)				
	TYPE 11-4	TYPE 15-4	TYPE 19-4	TYPE 30-4	TYPE 38-4
1 x 1/4	n/a	2.35	1.85	1.22	1.02
1 1/4 x 1/4	n/a	2.86	2.29	1.51	1.26
1 1/2 x 1/4	n/a	3.30	2.63	1.76	1.47
1 3/4 x 1/4	n/a	3.73	2.97	2.02	1.75
2 x 1/4	n/a	4.15	3.30	2.24	1.88
2 1/4 x 1/4	n/a	4.67	3.89	2.61	2.18
2 1/2 x 1/4	n/a	4.77	3.99	2.67	2.23

Fisholow grating meets N.A.A.M.M. standards.

GRATING FASTENING METHODS

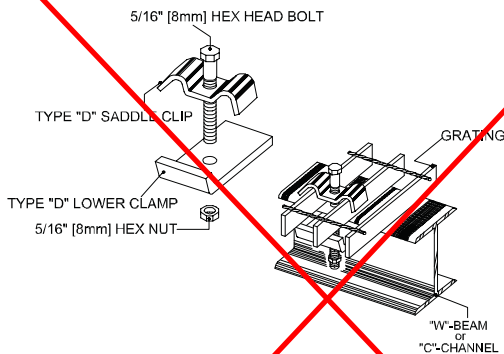
fastening methods information

BAR GRATING FASTENERS

**Type D Saddle Clip
(complete with stainless steel self tapping screw)**

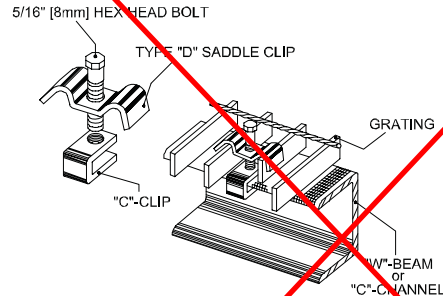
Our most common and cost-effective fastening method. Simply pre-drill a hole into the supporting member and drive in the self-tapping screw. Designed for use with Tru-Weld Type 19 and Type 15 bar grating only (in 1/8" and 3/16" bar sizes).

Available in standard galvanized or bare steel and stainless steel options.

**Type D Saddle Clip
(complete with nut, bolt, and bottom clamp)**

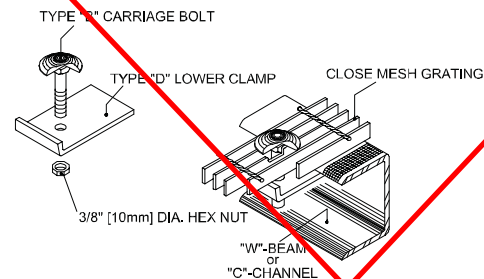
This combination allows for fastening grating without drilling into the supports. The Type D Saddle Clip holds the grating from the top as the bottom clamp is tightened under the flange of the supporting member. Designed for use with Tru-Weld Type 19 and Type 15 bar grating only (in 1/8" and 3/16" bar sizes).

Available in standard galvanized or bare steel and stainless steel options.

**Type D Saddle Clip
(complete with C-clamp and bolt)**

Eliminates the need to drill supports or have access beneath the grating during installation. The C-clamp slides between the bearing bars to clamp the flange of the supporting member and is tightened from above using a hex-driver. For use with Tru-Weld Type 19 and Type 15 bar grating only (in 1/8" and 3/16" bar sizes).

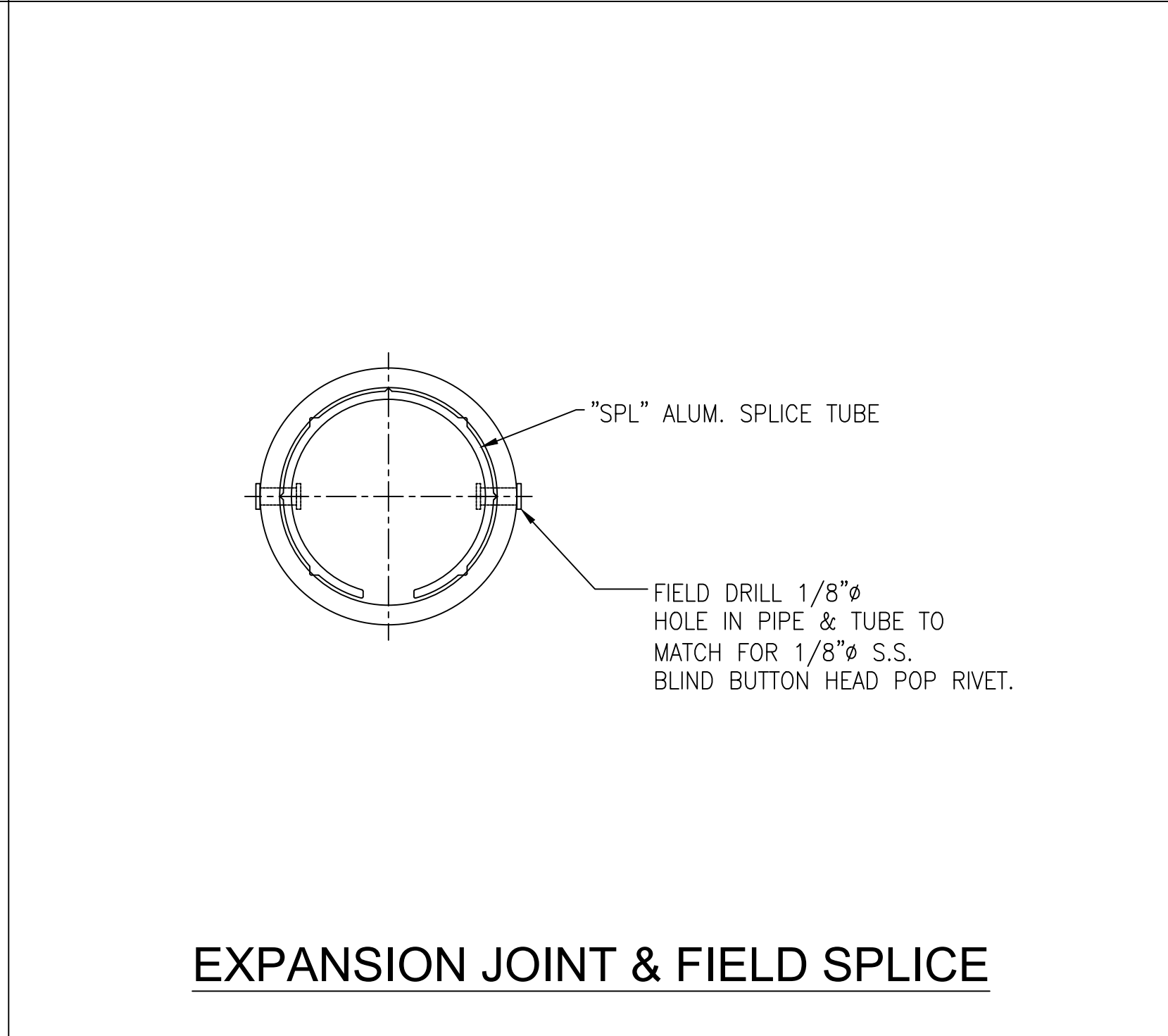
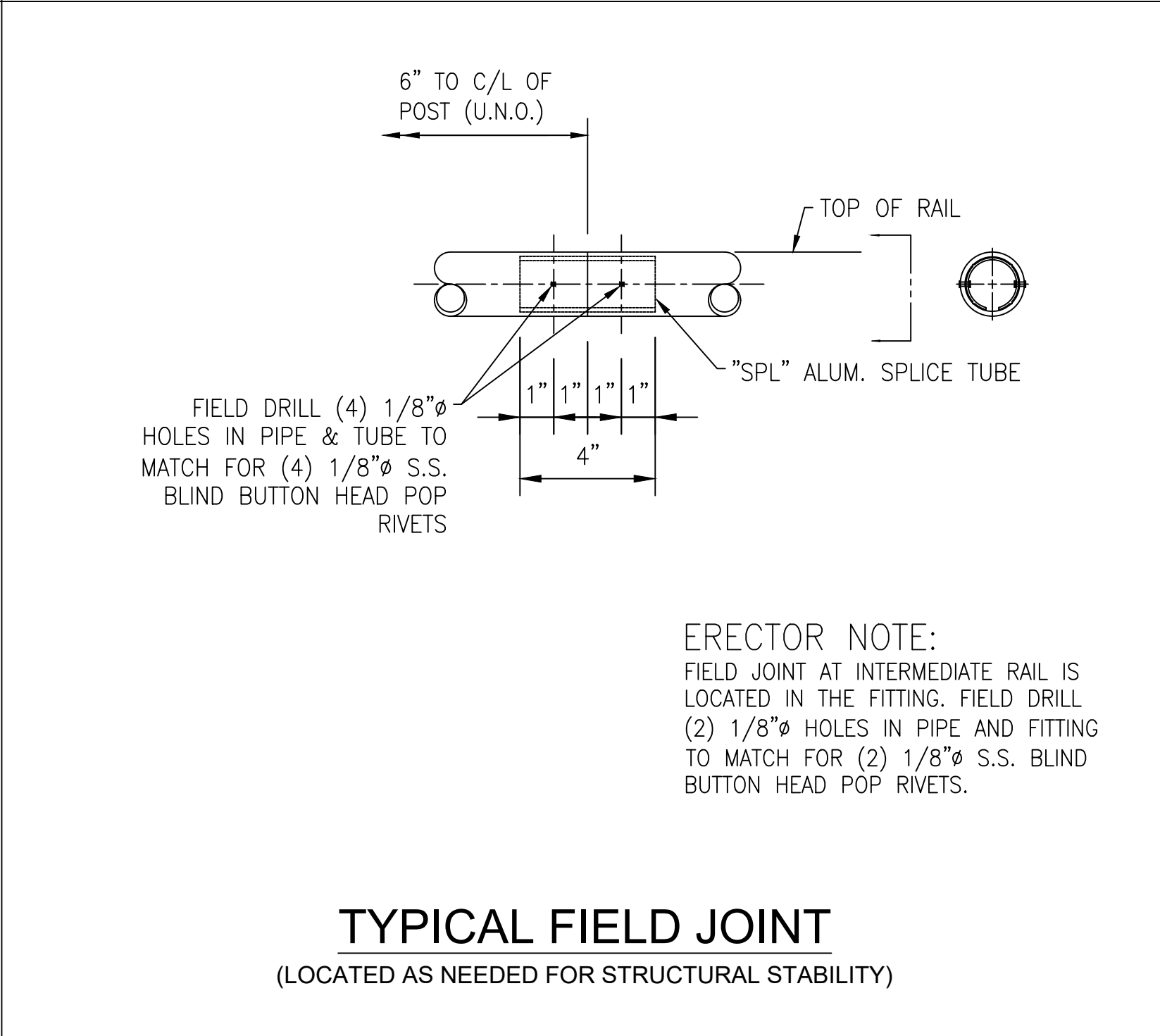
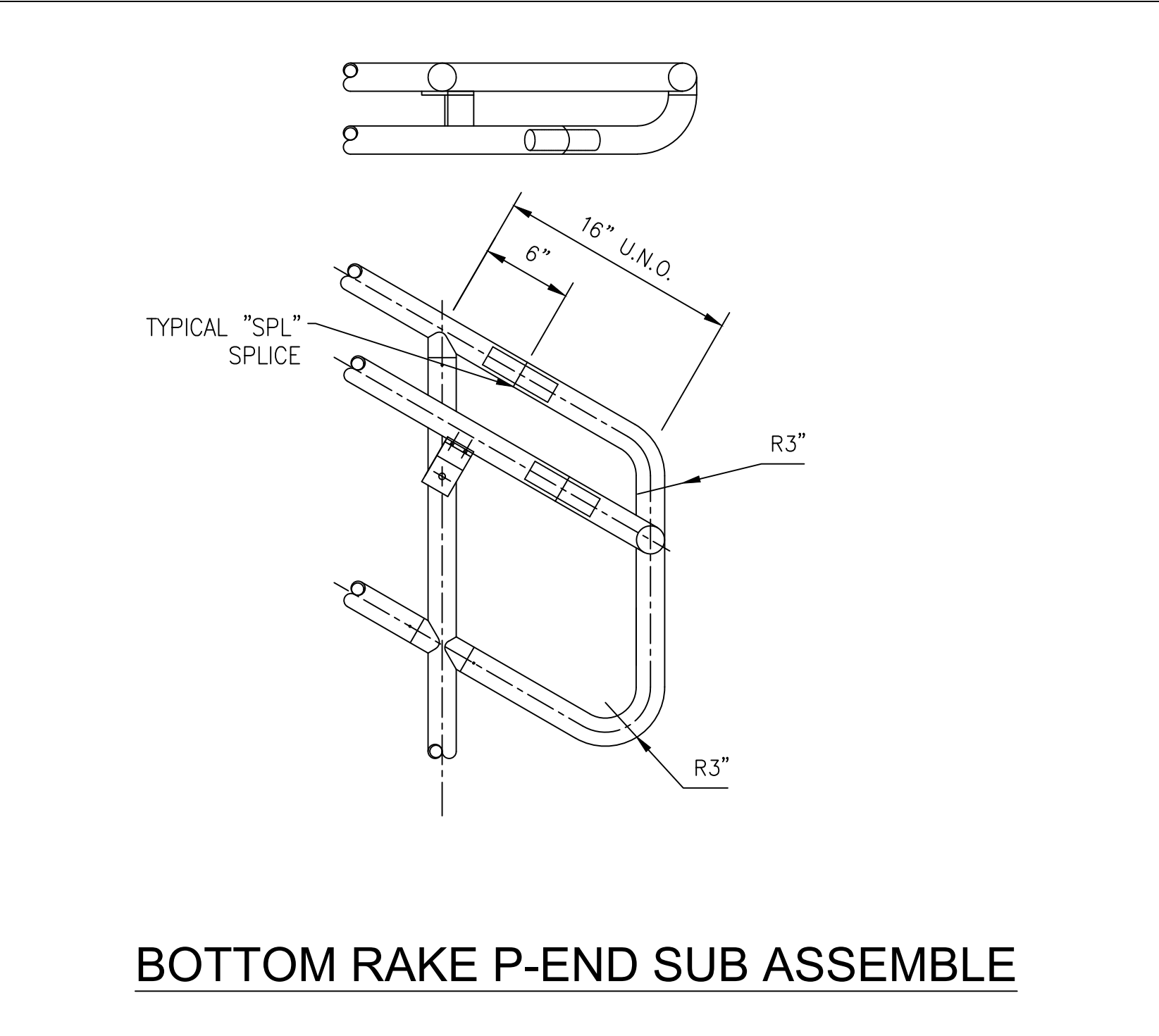
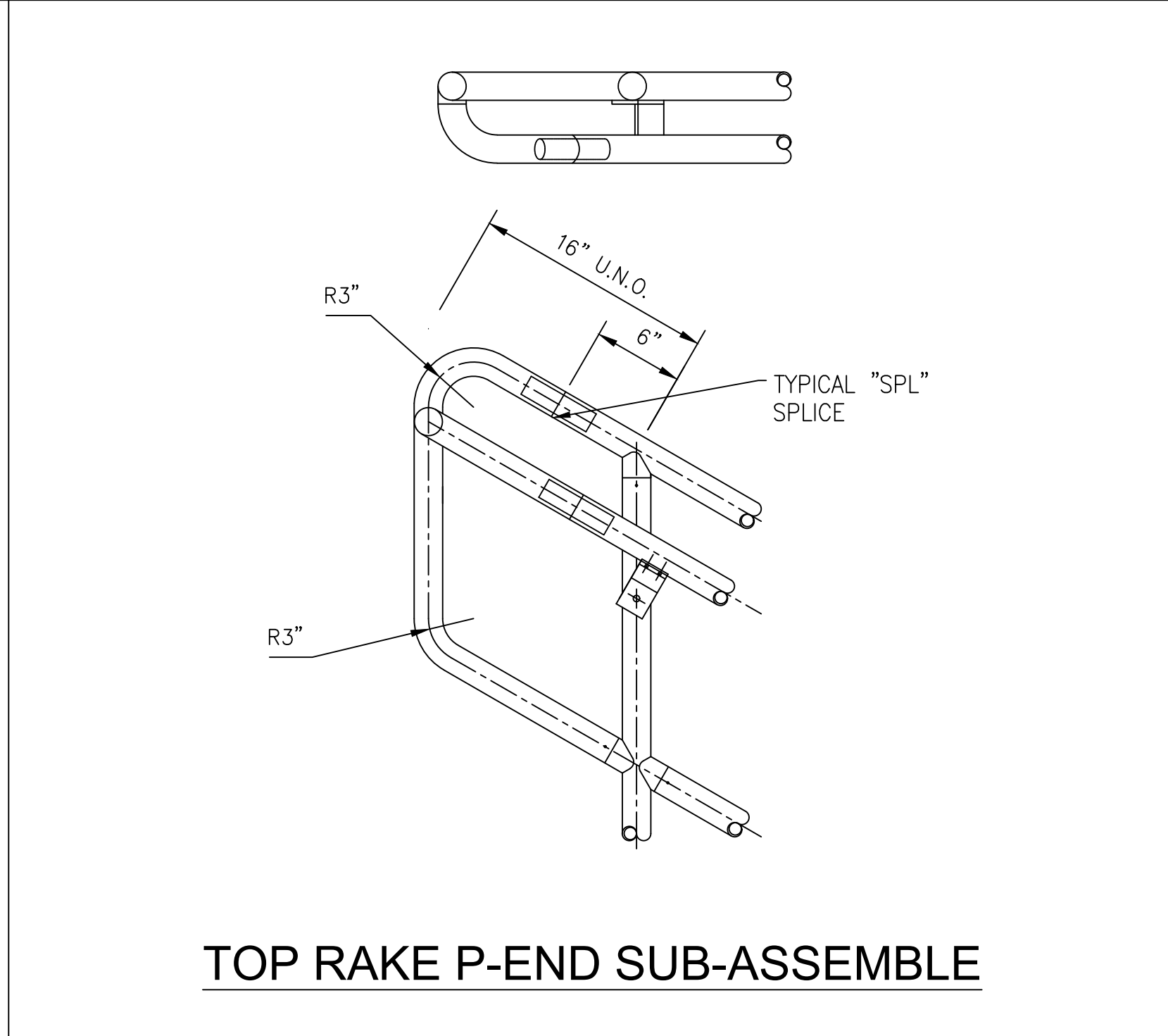
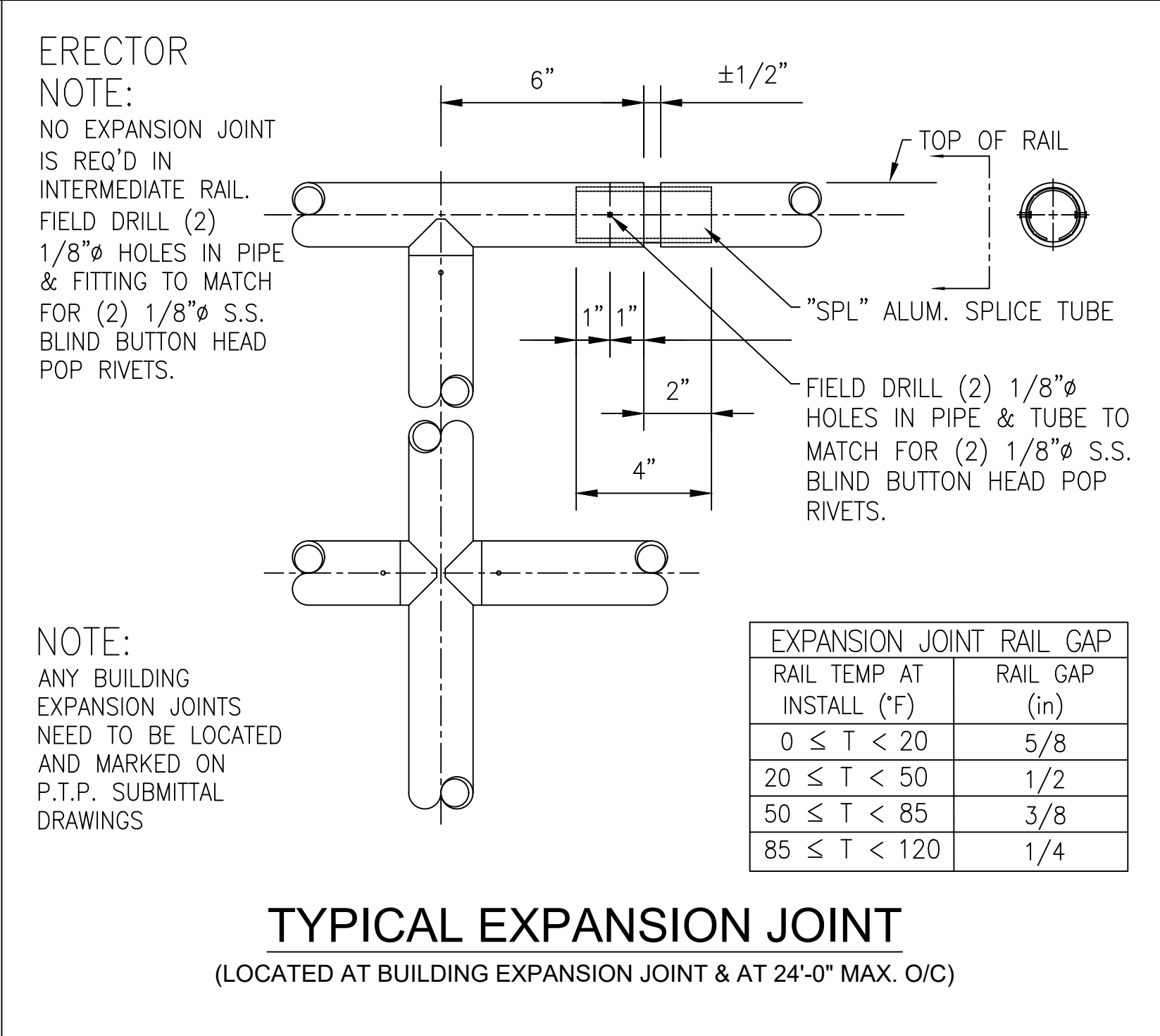
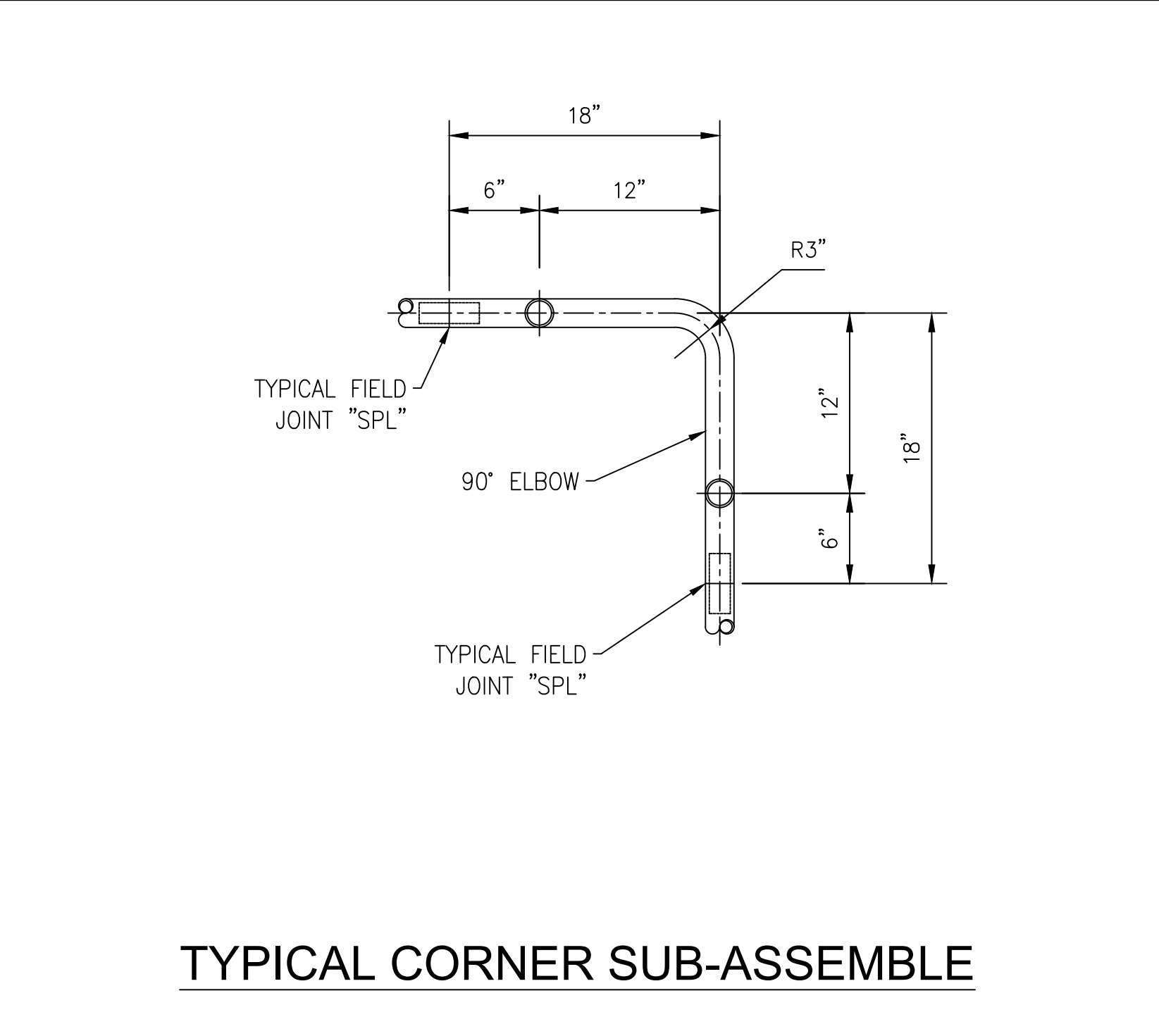
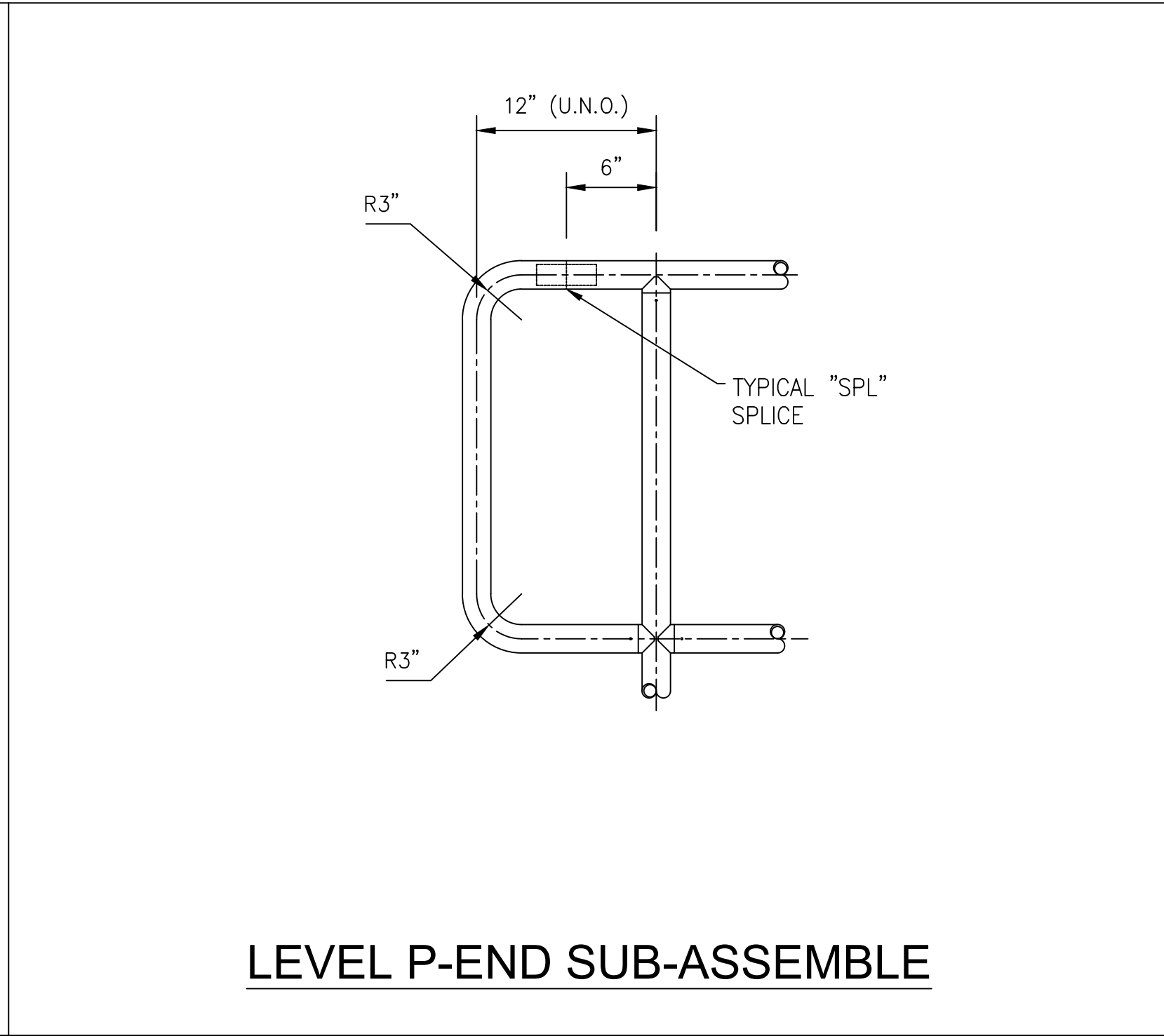
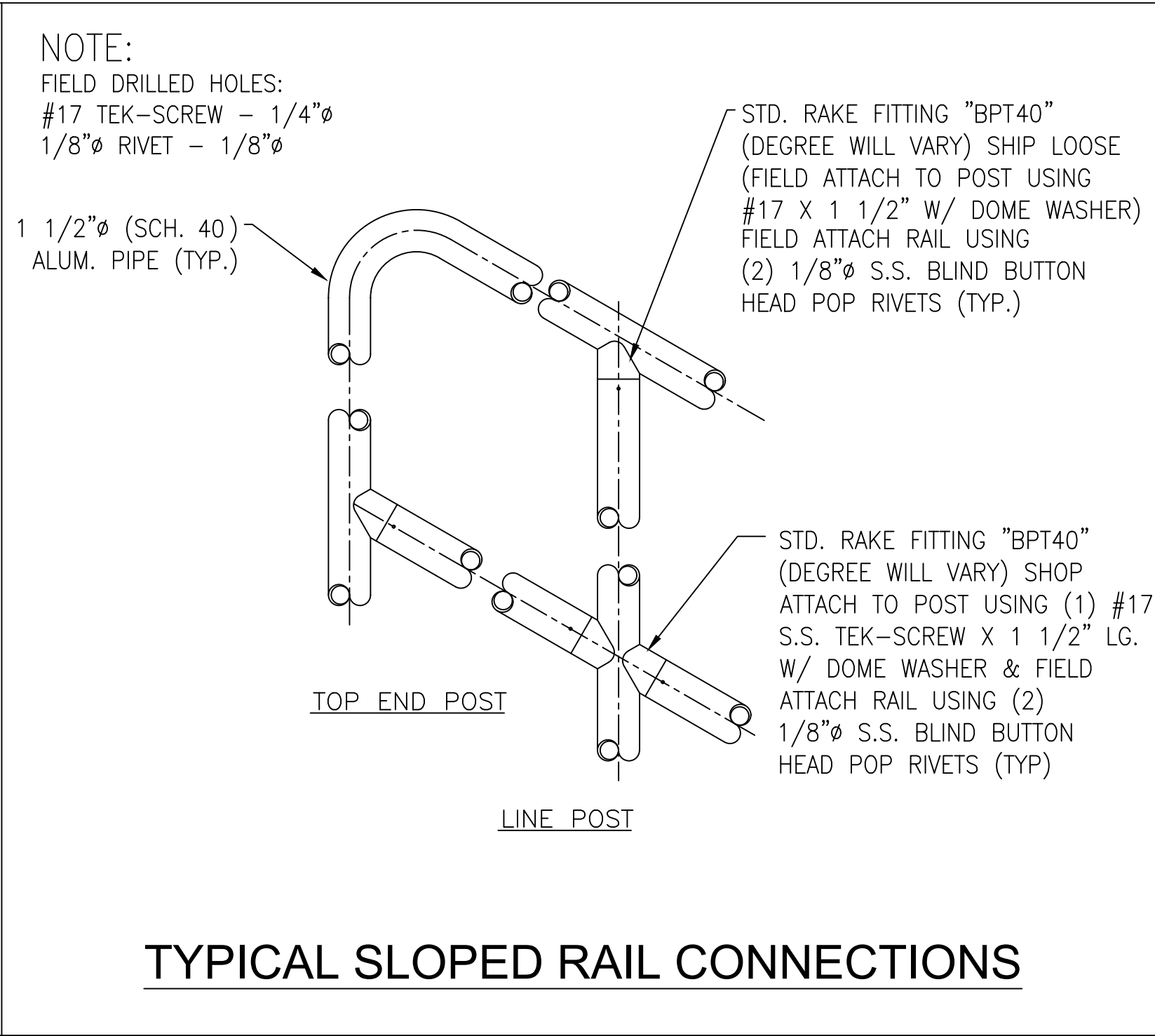
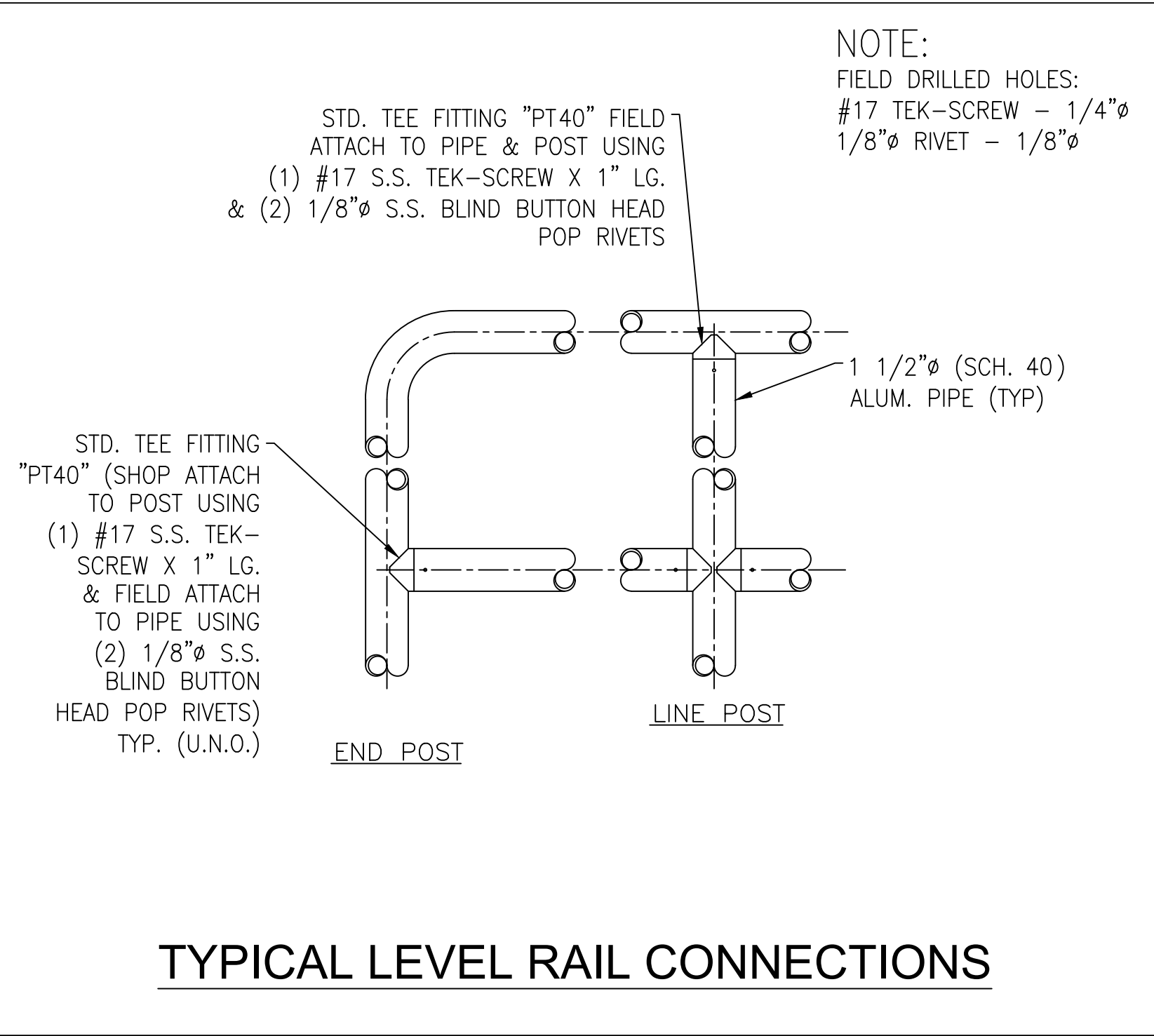
Available in standard galvanized or bare steel and stainless steel options.

Type B Clamping Bolt, Nut, and Bottom Clamp

For close mesh Type 11 and Type 9.5 grating, a square collared clamping bolt can be inserted directly between the ends of the bearing bars and fitted through a bottom clamp. The rounded bolt head rests directly on the bearing bars eliminating the need for a top saddle clip.

Available by special order in bare steel, galvanized, and stainless steel.

Aluminum Handrail



GENERAL NOTES

- ALL RAIL IS TO BE OF MECHANICAL CONSTRUCTION U.N.O.
- ALL RAILS ARE TO BE FABRICATED FROM 1 1/2"Ø (SCH. 40) ALUMINUM PIPE (6005A-T61 ALLOY) (U.N.O.)
- ALL POSTS ARE TO BE FABRICATED FROM 1 1/2"Ø (SCH. 40) ALUMINUM PIPE (6005A-T61 ALLOY) (U.N.O.)
- ALL EXTRUDED COMPONENTS ARE 6005A-T61 ALLOY, CAST COMPONENTS ARE 535 ALLOY
- ALL FASTENERS (SELF TAPPING SCREWS, MACHINE BOLTS, ADHESIVE ANCHORS, ETC.) TO BE 304 STAINLESS STEEL
- ALL RAILING SURFACES IN CONTACT WITH CONCRETE OR DISSIMILAR METALS SHALL RECEIVE ONE 1/16" THICK NEOPRENE GASKET (SHIPPED LOOSE FOR FIELD ATTACHMENT)
- ALL BOLTS, NUTS AND FLAT WASHERS USED TO MOUNT RAILINGS TO FLOORS, WALLS, STEEL, ETC. ARE BY PTP ENGINEERED RAILINGS
- ALL KICK PLATES ("FKP" OR "SKP") SHALL BE SHIPPED LOOSE IN 24'-0" LG. STOCK LENGTHS FOR FIELD CUTTING & DRILLING AS NEEDED
- ALL POSTS ARE TO BE FURNISHED CUT TO LENGTH WITH FITTINGS & MOUNTING PLATES ATTACHED OR SHIPPED LOOSE PER THEIR SPECIFIC DETAILS
- PIPE FOR STRAIGHT RAIL IS FURNISHED IN 24'-0" STOCK LENGTHS FOR CUTTING & DRILLING AS NEEDED
- PIPE FOR CURVED RAIL IS FURNISHED SUB-ASSEMBLED IN 21'-0" (MAX). ROLLED LENGTHS FOR FIELD CUTTING & DRILLING AS NEEDED
** ALL RADII MUST BE VERIFIED PRIOR TO FABRICATION **
- ALL CURVED RAIL SHALL BE FABRICATED USING CURVED TOP AND INTERMEDIATE RAILS
- PIPE FOR SINGLE LINE RAIL IS FURNISHED & SHIPPED SUB-ASSEMBLED.
- BENDS WITH A 3" C/L RADIUS ARE FURNISHED AS NEEDED & MUST BE FIELD CUT FOR FIELD CONDITIONS
- ALL RAIL WHEN PROPERLY INSTALLED SHALL MEET OR EXCEED OSHA REQUIREMENTS.
- MAX. POST SPACING TO BE 6'-0" C/C
- ALL RAIL IS TO BE FINISHED IN ACCORDANCE WITH THE ALUMINUM ASSOCIATION'S DESIGNATION M10C22A41 OR M12C22A41
- PIPE FOR CANTILEVER RAILING WILL SHIP LOOSE IN 24'-0" STOCK LENGTHS FOR FIELD CUTTING AND DRILLING AS NEEDED
- ENSURE ALL FIELD CUTS AND FIELD DRILLED HOLES ARE CLEANED UP, FREE OF SHARP EDGES AND BURRS.
- CONCRETE ANCHOR TYPE IS HILTI HIT-RE 500 V3 ADHESIVE ANCHORS. CONCRETE STRENGTH IS ASSUMED TO BE 4000 PSI, NORMAL WEIGHT CRACKED CONCRETE.
- ALL DIMENSIONS SHOWN THROUGHOUT THIS SET ARE APPROXIMATE AND SHALL BE FIELD VERIFIED BEFORE FABRICATION AND INSTALLATION

%% = SEE ERECTION DRAWINGS FOR PART NUMBER

1	SUBMITTAL	9/19/2017
REV	DESCRIPTION	DATE

3000 YOUNGFIELD ST. SUITE 275 WHEAT RIDGE, CO 80215
Ph: (720)508-3819 FAX: (720)409-3843

NOTICE TO CONTRACTOR AND ERECTOR:
BACK CHARGES FOR CORRECTIVE WORK OR REPLACEMENT MATERIALS WILL NOT BE ACCEPTED UNLESS AUTHORIZED BY PEAK TO PEAK ENGINEERED RAILINGS, INC. BEFORE SUCH COSTS ARE INCURRED

STANDARD DETAILS
CITY, ST
ALUMINUM HANDRAIL - RIVET SYSTEM - SUB-ASSEMBLED

DESIGNER	DESIGNER	CUSTOMER	CUSTOMER	DWG TITLE	STANDARD DETAILS
CUSTOMER JOB #	XXXX-XX	PRINT DATE	2/26/2020	ISSUE DATE	2/26/2020
DETAILED BY	INT	CHECKER	INT	SCALE	NTS
				CONTRACT NO	DRAWING NO.
				XXX-XXX	SD-1



3000 YOUNGFIELD ST. SUITE 275 WHEAT RIDGE, CO 80215
720.508.3819 fax 720.409.3843 www.peaktopeakrailings.com

12 December 2022

RE: Aluminum Alloy for Peak to Peak Engineered Railings System

To Whom it may concern,

Peak to Peak requests our standard 6005A-T61 aluminum alloy be accepted in lieu of 6061-T6, 6063-T6, or 6105-T5 alloys for the following reasons:

- 1) 6005A-T61 has a minimum ultimate tensile strength of 38 ksi compared to 30 ksi from 6063-T6. 6061-T6 and 6105-T5 both have the same 38 ksi ultimate tensile strength.
- 2) 6005A-T61 has a minimum yield strength of 35 ksi compared to 25 ksi from 6063-T6. 6061-T6 and 6105-T5 both have the same 35 ksi yield strength.
- 3) The standard clear anodizing of 6005A-T61 is a near perfect match in finish to the 535 alloy of all of our fittings. Compared to the finish of 6061-T6, 6105-T5, and 6063-T6 alloys, the 6005A-T61 alloy offers a more aesthetic appearance to the railing.

Additionally, corrosion resistance is typically mentioned as the main factor behind specifying 6063-T6 over a different alloy, so I wanted to follow up with some information from the Aluminum Design Manual regarding corrosion resistance. Per the following chart (Table 1 from Chapter IV of the Aluminum Design Manual 2015), 6005A-T61 has a **B** level of *General Resistance to Corrosion* and an **A** level of Resistance to *Stress-Corrosion Cracking*.

ALLOY AND TEMPER	RESISTANCE TO CORROSION		Workability (Cold) ⑤	Machinability ⑤	Brazeability ⑥	WELDABILITY ⑥		
	General ①	Stress-Corrosion Cracking ②				Gas	Arc	Resistance Spot and Seam
5657-H241 H25 H26 H28	A A A A	A A A A	A B B C	D D D D	B B B B	A A A A	A A A A	A A A A
6005-T1, T5 6005A-T1, T5 6005A-T61	B B B	A A A	.. B C	.. C C	A A A	A A A	A A A	A A A
6053-O T6, T61	.. A	.. A	E C	B B	A A	A A	B A
6061-O T4, T451, T4510, T4511 T6, T651, T652, T6510, T6511	B B B	A B A	A B C	D C C	A A A	A A A	A A A	B A A
6063-T1 T4 T5, T52 T6 T83, T831, T832	A A A A A	A A A A A	B B B C C	D D C C C	A A A A A	A A A A A	A A A A A	A A A A A

Sales Office: 720-508-3819 | Fax: 720-409-3843
3000 Youngfield Street | Wheat Ridge, CO | 80215



3000 YOUNGFIELD ST. SUITE 275 WHEAT RIDGE, CO 80215
720.508.3819 fax 720.409.3843 www.peaktopeakrailings.com

The footnotes for the chart (shown below) indicate that *Alloys with A and B ratings can be used in industrial and seacoast atmospheres without protection.* Additionally, all of our railing is anodized to a thickness of 0.7 mils, so we include additional protective coating even though the Aluminum Design Manual indicates that it can be used in industrial settings without that additional protection. We also separate all faying surfaces with an isolating gasket to prevent corrosion at these locations. The stress-corrosion cracking for 6005A-T61 is rated as an A so there should be no concerns around this happening.

Footnotes for Table 1

① Ratings A through E are relative ratings in decreasing order of merit, based on exposures to sodium chloride solution by intermittent spraying or immersion. Alloys with A and B ratings can be used in industrial and seacoast atmospheres without protection. Alloys with C, D and E ratings generally should be protected at least on faying surfaces.

② Stress-corrosion cracking ratings are based on service experience and on laboratory tests of specimens exposed to the 3.5% sodium chloride alternate immersion test.

A = No known instance of failure in service or in laboratory tests.

B = No known instance of failure in service; limited failures in laboratory tests of short transverse specimens.

C = Service failures with sustained tension stress acting in short transverse direction relative to grain structure; limited failures in laboratory tests of long transverse specimens.

D = Limited service failures with sustained longitudinal or long transverse areas.

These ratings are neither product specific nor test direction specific and therefore indicate only the general level of stress-corrosion cracking resistance. For more specific information on certain alloys, see ASTM G64.

Based on all of the information listed above, we request that our anodized 6005A-T61 aluminum be accepted for use on this project.

Sincerely,

Christopher Manlove, P.E.

A handwritten signature in black ink, reading 'Christopher Manlove', written in a cursive style.

Design Engineer
Peak to Peak Engineered Railings, LLC

Sales Office: 720-508-3819 | Fax: 720-409-3843
3000 Youngfield Street | Wheat Ridge, CO | 80215

Epoxy Anchor Bolts

SET-3G™ High-Strength Epoxy Adhesive

SET-3G Adhesive Cartridge System

Model No.	Capacity (ounces)	Cartridge Type	Carton Quantity	Dispensing Tool(s)	Mixing Nozzle
SET3G10 ²	8.5	Coaxial	12	CDT10S	EMN22I
SET3G22-N ¹	22	Side-by-side	10	EDT22S, EDTA22P, EDTA22CKT	EMN22I

1. One EMN21I mixing nozzle and one extension are supplied with each cartridge.
2. Two EMN22I mixing nozzles and two nozzle extensions are supplied with each cartridge.
3. Cartridge estimation guidelines are available at strongtie.com/apps.
4. Use only Simpson Strong-Tie® mixing nozzles in accordance with Simpson Strong-Tie instructions. Modification or improper use of mixing nozzle may impair SET-3G adhesive performance.

SET-3G Cure Schedule^{1,2}

Concrete Temperature		Gel Time	Cure Time
(°F)	(°C)	(min.)	(hr.)
40	4	120	192
50	10	75	72
60	16	50	48
70	21	35	24
90	32	25	24
100	38	15	24

For SI: 1°F = (°C × 9/5) + 32.

1. For water-saturated concrete and water-filled holes, the cure times should be doubled.
2. For installation of anchors in concrete where the temperature is below 70°F (21°C), the adhesive must be conditioned to a minimum temperature of 70°F (21°C).

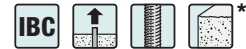
Test Criteria

Anchors installed with SET-3G adhesive have been tested in accordance with ICC-ES *Acceptance Criteria for Adhesive Anchors in Concrete Elements (AC308)*.

Property	Test Method	Result*
Consistency	ASTM C881	Passed, non-sag
Heat deflection	ASTM D648	147°F
Bond strength (moist cure)	ASTM C882	3,306 psi at 2 days
Water absorption	ASTM D570	0.13%
Compressive yield strength	ASTM D695	15,390 psi
Compressive modulus	ASTM D695	991,830 psi
Shore D durometer	ASTM D2240	84
Gel time	ASTM C881	52 minutes
Volatile Organic Compound (VOC)	—	1.9 g/L

*Material and curing conditions: 73 ± 2°F, unless otherwise noted.

SET-3G™ Design Information — Concrete

SET-3G Tension Strength Design Data for Threaded Rod in Normal-Weight Concrete^{1, 8}

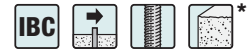
Characteristic			Symbol	Units	Nominal Rod Diameter (in.)							
					⅜	½	⅝	¾	⅞	1	1¼	
Steel Strength in Tension												
Minimum Tensile Stress Area			A_{se}	in. ²	0.078	0.142	0.226	0.334	0.462	0.606	0.969	
Tension Resistance of Steel — ASTM F1554, Grade 36			N_{sa}	lb.	4,525	8,235	13,110	19,370	26,795	35,150	56,200	
Tension Resistance of Steel — ASTM F1554, Grade 55					5,850	10,650	16,950	25,050	34,650	45,450	72,675	
Tension Resistance of Steel — ASTM A193, Grade B7					9,750	17,750	28,250	41,750	57,750	75,750	121,125	
Tension Resistance of Steel — Stainless Steel ASTM A193, Grade B8 and B8M (Types 304 and 316)					4,445	8,095	12,880	19,040	26,335	34,540	55,235	
Tension Resistance of Steel — Stainless Steel ASTM F593 CW (Types 304 and 316)					7,800	14,200	22,600	28,390	39,270	51,510	82,365	
Tension Resistance of Steel — Stainless Steel ASTM A193, Grade B6 (Type 410)					8,580	15,620	24,860	36,740	50,820	66,660	106,590	
Strength Reduction Factor for Tension — Steel Failure			ϕ	—	0.75 ⁵							
Concrete Breakout Strength in Tension (2,500 psi ≤ f'c ≤ 8,000 psi)												
Effectiveness Factor for Cracked Concrete			$k_{c,cr}$	—	17							
Effectiveness Factor for Uncracked Concrete			$k_{c,uncr}$	—	24							
Strength Reduction Factor — Concrete Breakout Failure in Tension			ϕ	—	0.65 ⁶							
Bond Strength in Tension (2,500 psi ≤ f'c ≤ 8,000 psi) ⁷												
Minimum Embedment			$h_{ef,min}$	in.	2⅜	2¾	3⅛	3½	3¾	4	5	
Maximum Embedment			$h_{ef,max}$	in.	7½	10	12½	15	17½	20	25	
Continuous Inspection	Temperature Range A ^{2,4}	Characteristic Bond Strength in Cracked Concrete ⁹	$\tau_{k,cr}$	psi	1,448	1,402	1,356	1,310	1,265	1,219	1,128	
		Characteristic Bond Strength in Uncracked Concrete ⁹	$\tau_{k,uncr}$	psi	2,357	2,260	2,162	2,064	1,967	1,868	1,672	
	Temperature Range B ^{3,4}	Characteristic Bond Strength in Cracked Concrete ⁹	$\tau_{k,cr}$	psi	1,201	1,163	1,125	1,087	1,050	1,012	936	
		Characteristic Bond Strength in Uncracked Concrete ⁹	$\tau_{k,uncr}$	psi	1,957	1,876	1,795	1,713	1,632	1,551	1,388	
	Anchor Category		Dry Concrete	—	1							
	Strength Reduction Factor		Dry Concrete	$\phi_{dry,ci}$	0.65 ¹⁰							
	Anchor Category		Water-Saturated Concrete, or Water-Filled Hole	—	3			2				
	Strength Reduction Factor		Water-Saturated Concrete, or Water-Filled Hole	$\phi_{wet,ci}$	0.45 ¹⁰			0.55 ¹⁰				
Periodic Inspection	Temperature Range A ^{2,4}	Characteristic Bond Strength in Cracked Concrete ⁹	$\tau_{k,cr}$	psi	1,346	1,304	1,356	1,310	1,265	1,219	1,128	
		Characteristic Bond Strength in Uncracked Concrete ⁹	$\tau_{k,uncr}$	psi	2,192	2,102	2,162	2,064	1,967	1,868	1,672	
	Temperature Range B ^{3,4}	Characteristic Bond Strength in Cracked Concrete ⁹	$\tau_{k,cr}$	psi	1,117	1,082	1,125	1087	1,050	1,012	936	
		Characteristic Bond Strength in Uncracked Concrete ⁹	$\tau_{k,uncr}$	psi	1,820	1,744	1,795	1,713	1,632	1,551	1,388	
	Anchor Category		Dry Concrete	—	2			1				
	Strength Reduction Factor		Dry Concrete	$\phi_{dry,pi}$	0.55 ¹⁰			0.65 ¹⁰				
	Anchor Category		Water-Saturated Concrete, or Water-Filled Hole	—	3							
	Strength Reduction Factor		Water-Saturated Concrete, or Water-Filled Hole	$\phi_{wet,pi}$	0.45 ¹⁰							
Reduction Factor for Seismic Tension			$\alpha_{N,seis}^{11}$	—	1.0	0.9	1.0	1.0	1.0	1.0	1.0	

- The information presented in this table is to be used in conjunction with the design criteria of ACI 318-14 and ACI 318-11.
- Temperature Range A: Maximum short-term temperature = 160°F, maximum long-term temperature = 110°F.
- Temperature Range B: Maximum short-term temperature = 176°F, maximum long-term temperature = 110°F.
- Short-term concrete temperatures are those that occur over short intervals (diurnal cycling). Long-term temperatures are roughly constant over significant periods of time.
- The tabulated value of ϕ applies when the load combinations of ACI 318-14 5.3 or ACI 318-11 9.2 are used. If the load combinations of ACI 318-11 Appendix C are used, refer to ACI 318-11 D.4.4 to determine the appropriate value of ϕ .
- The tabulated value of ϕ applies when both the load combinations of ACI 318-14 5.3, or ACI 318-11 9.2 are used and the requirements of ACI 318-14 17.3.3 (c) or ACI 318-11 D.4.3 (c), as applicable, for Condition B are met. If the load combinations of ACI 318-11 Appendix C are used, refer to ACI 318 D.4.4 (c) for Condition B to determine the appropriate value of ϕ .

- Bond strength values shown are for normal-weight concrete having a compressive strength of $f'_c = 2,500$ psi. For higher compressive strengths up to 8,000 psi, the tabulated characteristic bond strength may be increased by a factor of $(f'_c/2,500)^{0.35}$ for uncracked concrete and a factor of $(f'_c/2,500)^{0.24}$ for cracked concrete.
- For lightweight concrete, the modification factor for bond strength shall be as given in ACI 318-14 17.2.6 or ACI 318-11 D.3.6, as applicable, where applicable.
- Characteristic bond strength values are for sustained loads, including dead and live loads.
- The tabulated value of ϕ applies when both the load combinations of ACI 318-14 5.3, or ACI 318-11 9.2 are used and the requirements of ACI 318-14 17.3.3 (c) or ACI 318-11 D.4.3 (c), as applicable, for Condition B are met. If the load combinations of ACI 318-11 Appendix C are used, refer to ACI 318 D.4.4 (c) for Condition B to determine the appropriate value of ϕ .
- For anchors installed in regions assigned to Seismic Design Category C, D, E or F, the bond strength values must be multiplied by $\alpha_{N,seis}$.

* See p. 13 for an explanation of the load table icons.

SET-3G™ Design Information — Concrete

SET-3G Shear Strength Design Data for Threaded Rod
in Normal-Weight Concrete¹

Characteristic	Symbol	Units	Nominal Rod Diameter (in.)						
			3/8	1/2	5/8	3/4	7/8	1	1 1/4
Steel Strength in Shear									
Minimum Shear Stress Area	A_{se}	in. ²	0.078	0.142	0.226	0.334	0.462	0.606	0.969
Shear Resistance of Steel — ASTM F1554, Grade 36	V_{sa}	lb.	2,715	4,940	7,865	11,625	16,080	21,090	33,720
Shear Resistance of Steel — ASTM F1554, Grade 55			3,510	6,390	10,170	15,030	20,790	27,270	43,605
Shear Resistance of Steel — ASTM A193, Grade B7			5,850	10,650	16,950	25,050	34,650	45,450	72,675
Reduction factor for Seismic Shear — Carbon Steel	$\alpha_{V,seis}^4$	—	0.75					1.0	
Shear Resistance of Steel — Stainless Steel ASTM A193, Grade B8 and B8M (Types 304 and 316)	V_{sa}	lb.	2,665	4,855	7,730	11,425	15,800	20,725	33,140
Shear Resistance of Steel — Stainless Steel ASTM F593 CW (Types 304 and 316)			4,680	8,520	13,560	17,035	23,560	30,905	49,420
Shear Resistance of Steel — Stainless Steel ASTM A193, Grade B6 (Type 410)			5,150	9,370	14,915	22,040	30,490	40,000	63,955
Reduction factor for Seismic Shear — Stainless Steel	$\alpha_{V,seis}^4$	—	0.80		0.75			1.0	
Strength Reduction Factor for Shear — Steel Failure	ϕ	—	0.65 ²						
Concrete Breakout Strength in Shear									
Outside Diameter of Anchor	d_a	in.	0.375	0.5	0.625	0.75	0.875	1	1.25
Load-Bearing Length of Anchor in Shear	l_e	in.	h_{ef}						
Strength Reduction Factor for Shear — Breakout Failure	ϕ	—	0.70 ³						
Concrete Pryout Strength in Shear/									
Load-Bearing Length of Anchor in Shear	k_{cp}	in.	1.0 for $h_{ef} < 2.50''$; 2.0 for $h_{ef} \geq 2.50''$						
Strength Reduction Factor for Shear — Breakout Failure	ϕ	—	0.70 ³						

1. The information presented in this table is to be used in conjunction with the design criteria of ACI 318-14 and ACI 318-11.

2. The tabulated value of ϕ applies when the load combinations of ACI 318-14 5.3 or ACI 318-11 9.2 are used. If the load combinations of ACI 318-11 Appendix C are used, refer to ACI 318-11 D.4.4 to determine the appropriate value of ϕ .

3. The tabulated value of ϕ applies when both the load combinations of ACI 318-14 5.3, or ACI 318-11 9.2 are used and the requirements

of ACI 318-14 17.3.3 (c) or ACI 318-11 D.4.3 (c), as applicable, for Condition B are met. If the load combinations of ACI 318-11 Appendix C are used, refer to ACI 318 D.4.4 (c) for Condition B to determine the appropriate value of ϕ .

4. The values of V_{sa} are applicable for both cracked concrete and uncracked concrete. For anchors installed in regions assigned to Seismic Design Category C, D, E or F, V_{sa} must be multiplied by $\alpha_{V_{seis}}$ for the corresponding anchor steel type.

* See p. 13 for an explanation of the load table icons.

SET-3G™ Design Information — Concrete

SET-3G Shear Strength Design Data for Rebar in Normal-Weight Concrete¹

Characteristic	Symbol	Units	Nominal Rod Diameter (in.)						
			#3	#4	#5	#6	#7	#8	#10
Steel Strength in Shear									
Minimum Shear Stress Area	A_{se}	in. ²	0.110	0.200	0.310	0.440	0.600	0.790	1.270
Shear Resistance of Steel — Rebar (ASTM A615 Grade 60)	V_{sa}	lb.	5,940	10,800	16,740	23,760	32,400	42,660	68,580
Shear Resistance of Steel — Rebar (ASTM A706 Grade 60)			5,280	9,600	14,880	21,120	28,800	37,920	60,960
Reduction Factor for Seismic Shear — Rebar (ASTM A615 Grade 60)	$\alpha_{V_{seis}}^4$	—	0.60					0.8	
Reduction Factor for Seismic Shear — Rebar (ASTM A706 Grade 60)			0.60					0.8	
Strength Reduction Factor for Shear — Steel Failure	ϕ	—	0.65 ²						
Concrete Breakout Strength in Shear									
Outside Diameter of Anchor	d_a	in.	0.375	0.5	0.625	0.75	0.875	1	1.25
Load-Bearing Length of Anchor in Shear	l_e	in.	h_{ef}						
Strength Reduction Factor for Shear — Breakout Failure	ϕ	—	0.70 ³						
Concrete Pryout Strength in Shear									
Load-Bearing Length of Anchor in Shear	k_{cp}	in.	1.0 for $h_{ef} < 2.50"$; 2.0 for $h_{ef} \geq 2.50"$						
Strength Reduction Factor for Shear — Breakout Failure	ϕ	—	0.70 ³						

1. The information presented in this table is to be used in conjunction with the design criteria of ACI 318-14 and ACI 318-11.

2. The tabulated value of ϕ applies when the load combinations of ACI 318-14 5.3 or ACI 318-11 9.2 are used. If the load combinations of ACI 318-11 Appendix C are used, refer to ACI 318-11 D.4.4 to determine the appropriate value of ϕ .

3. The tabulated value of ϕ applies when both the load combinations of ACI 318-14 5.3 or ACI 318-11 9.2 are used and the requirements of

ACI 318-14 17.3.3 (c) or ACI 318-11 D.4.3 (c), as applicable, for Condition B are met. If the load combinations of ACI 318-11 Appendix C are used, refer to ACI 318 D.4.4 (c) for Condition B to determine the appropriate value of ϕ .

4. The values of V_{sa} are applicable for both cracked concrete and uncracked concrete. For anchors installed in regions assigned to Seismic Design Category C, D, E or F, V_{sa} must be multiplied by $\alpha_{V_{seis}}$ for the corresponding anchor steel type.

For additional load tables, visit strongtie.com/set3g.



Anchor Designer™ Software for ACI 318, ETAG and CSA

Simpson Strong-Tie® Anchor Designer software accurately analyzes existing design or suggests anchor solutions based on user-defined design elements in cracked and uncracked concrete conditions.

* See p. 13 for an explanation of the load table icons.

Coatings

Coating Summary

Coating Summary

Surface preparation and paint on equipment supplied by WesTech is as follows:

Drive Unit:

Surface Preparation: SSPC-SP10

Primer Coat: One (1) Coat, Tnemec N140F-1255, Beige, Epoxy Primer (3-9 mils DFT).

Final Coat: One (1) Coat, Tnemec Series 73-B5712, WesTech Blue, Aliphatic Acrylic Polyurethane (2-5 mils DFT).

SSPC-SP10: A near white metal blast cleaned surface, when viewed without magnification, shall be free from all visible oil, grease, dirt, dust, mill scale, rust, coatings, oxides, corrosion products and other foreign materials. Random staining shall be limited to no more than 5% of each 3" x 3" [75mm x 75mm] square surface and may consist of light shadows, slight streaks, or minor discolorations caused by stains of mill scale, or stains of previously applied coating.

Submerged & Non-Submerged Mechanism Stainless Steel:

Cleaning Grade "C": A minimal amount of free iron may remain on surfaces. These locations shall be limited to small pin-point areas 1/16" (1mm) in diameter or less, scattered in a random pattern, and shall be less than 1% of the total surface area.

All surfaces shall be free from:

- Heat Tint (regardless of heat source; welding, thermal cutting, or grinding)
- Oxides and Tarnish (from thermal cutting, and tightly adherent brown or black tarnish formed along the toe of a weld)

Mechanism Stainless Steel Cleaning System

CLEANING GRADE "C"

1. PRE-CLEAN ALL SURFACES IN ACCORDANCE WITH THE WESTECH WORKMANSHIP STANDARD (QR-00-063) SECTIONS 2.3 & 2.4, TO ENSURE THAT ALL SHARP EDGES, BURRS, WELD SPATTER, WELD SLAG ARE REMOVED.

A
2. A MINIMUMAL AMOUNT OF FREE IRON MAY REMAIN ON SURFACES. THESE LOCATIONS SHALL BE LIMITED TO SMALL PIN-POINT AREAS 1/16" (1mm) IN DIAMETER OR LESS, SCATTERED IN A RANDOM PATTERN, AND SHALL BE LESS THAN 1% OF THE TOTAL SURFACE AREA.
3. ALL SURFACES SHALL BE FREE FROM:

a. HEAT TINT (REGARDLESS OF HEAT SOURCE; WELDING, THERMAL CUTTING, OR GRINDING).

b. OXIDES AND TARNISH (FROM THERMAL CUTTING, AND TIGHTLY ADHERENT BROWN OR BLACK TARNISH FORMED ALONG THE TOE OF A WELD).
4. THIS REQUIRED CLEANING APPLIES TO INTERNAL AND EXTERNAL SURFACES SUBJECT TO CORROSIVE MEDIA ATTACK; SUCH AS INTERNAL SURFACES OF PIPING.



CLEANING GRADE "C"

Drive Paint System

TYPE OF EQUIPMENT / TAG NUMBER(S): _____ DRIVE UNIT _____

ITEM NUMBERS REQUIRING THIS COATING _____

SYSTEM - ITEM NUMBERS (QUANTITY): _____ DRIVE UNIT _____

MATERIAL TO BE COATED: 9 x 11 CARBON STEEL AND STAINLESS STEEL (IF APPLICABLE)

DESIGN / OPERATING TEMPERATURE:	0 °F / 120 °F
HUMIDITY:	5 - 99%
SERVICE CONDITIONS:	NON-SUBMERGED
UV EXPOSED:	YES
PROCESS ENVIRONMENT:	PROCESS WATER
pH LEVEL:	NOT APPLICABLE
IF pH IS NOT NEUTRAL, WATER CHEMISTRY ANALYSIS IS REQUIRED:	NO
COATINGS SHALL MEET NSF 61 CERTIFICATION:	NOT REQUIRED

INSULATED:	NO
FIREPROOFING:	NO
CATHODIC PROTECTION SYSTEM:	NO

NACE CERTIFIED COATINGS INSPECTOR:	<div>12</div> NOT REQUIRED / NOT BY WESTECH
HOLIDAY TESTING (NACE SP0188):	NOT REQUIRED / NOT BY WESTECH <div>12</div>
SOLUBLE SALT TESTING:	<div>12</div> NOT REQUIRED / NOT BY WESTECH
MILLIGRAMS /METERS² ACCEPTABLE:	NOT REQUIRED / NOT BY WESTECH <div>12</div>
ADHESION TESTING:	<div>12</div> NOT REQUIRED / NOT BY WESTECH

NACE/SSPC SURFACE CLEANING STANDARD: SP10 (COMMERCIAL BLAST)

MINIMUM ANGULAR ANCHOR PROFILE RANGE: 2.5 mils

COATING MANUFACTURER:	TNEMEC	LPS LABORATORIES INC.
TYPE OF COATING (GENERIC):	POLYAMIDOAMINE EPOXY	RUST INHIBITOR
PRODUCT NAME/NUMBER:	N140F	LPS-3
DRY FILM THICKNESS (DFT)		
MINIMUM-MAXIMUM mils:	3-9 mils	-
COLOR NAME/ NUMBER:	BEIGE (1255)	-
TOTAL DRY FILM THICKNESS OF SYSTEM:		TOTAL DRY FILM THICKNESS

COATING MANUFACTURER:	-	-
MANUFACTURER ITEM NUMBER:	-	-

1. FOLLOW THE LISTED WESTECH REFERENCE DOCUMENTS EXCEPT AS NOTED ON THIS DRAWING.
2. FIELD TOUCH-UP PAINT, LABOR AND COATINGS ARE NOT SUPPLIED BY WESTECH.
3. SURFACE PREPARATION AND COATING APPLICATION:
SHALL BE IN ACCORDANCE WITH NACE/SSPC STANDARDS, COATING MANUFACTURER'S PRODUCT DATA
SHEET AND WESTECH WORKMANSHIP STANDARD QR-00-063 (SECTION 3.1).
PRE-CLEANING - VERIFY THAT ALL SURFACES ARE FREE OF WELD SLAG, SPATTER, SHARP EDGES, AND BURRS PER QR-00-063 (SECTION 2.1).
CLEANING - PRIOR TO ABRASIVE BLAST CLEANING, SOLVENT WIPE PER SSPC SP1. REMOVE ALL VISIBLE GREASE, OIL WAX, AND ALL OTHER CONTAMINATION.
WHEN SSPC SP-6 IS SPECIFIED AND NEW STEEL IS USED, PER NACE VIS 1 SURFACE CLEANING SHALL BE SP-10.
4. COATING THICKNESS RESTRICTION LEVEL SHALL BE IN ACCORDANCE WITH SSPC PA2, TABLE 1 - RESTRICTION LEVEL 3 (80%-120%).
5. MACHINED SURFACES AND PIPE FLANGE FACES SHALL BE PROTECTED FROM ABRASIVE BLAST CLEANING AND COATING APPLICATION IN ACCORDANCE WITH THE WESTECH WORKMANSHIP STANDARD QR-00-063 (SECTIONS 2.6 AND 3.1). AFTER COATING APPLICATION IS COMPLETE, APPLY LPS-3, COSMOLINE OR, OR EQUIVALENT RUST INHIBITOR TO PROTECT THESE SURFACES.
6. STRIPE COAT ALL WELDS, EDGES AND BOLT HOLES USING A BRUSH. STRIPE COAT MAY BE COMPLETED AFTER PRIME COAT.
7. SURFACE PREPARATION AND COATING OR PROTECTION REQUIRED ON SURFACES THAT ARE INACCESSIBLE OR WILL BE INACCESSIBLE AFTER THE EQUIPMENT IS INSTALLED (I.E. UNDERSIDE OF BASE AND CAP PLATES, INTERIOR OF FANS)
 - 7.1. ALL MATING & INTERIOR SURFACES TO DRIVE EXCLUDING MACHINED SURFACES AND PREVIOUSLY PAINTED ITEMS REQUIRE COATING AND/OR PROTECTION
 - 7.2. METHOD OF COATING OR PROTECTION: APPLY COATING #2 TO MACHINED NON-MOUNTING SURFACES BEFORE ASSEMBLY
8. ALL BUYOUT ITEMS SUCH AS REDUCERS, BEARING HOUSINGS, AND MOTORS RECEIVE MANUFACTURER'S STANDARD PROTECTIVE COATINGS.
9. ALL NON-FERROUS MATERIALS, SUCH AS FIBERGLASS, ALUMINUM, STAINLESS STEEL, AND PLASTIC, ETC. SHALL NOT BE COATED, EXCEPT WHEN SPECIFICALLY STATED ON DRAWINGS OR IN THE PURCHASE ORDER.
10. COATINGS THICKNESS SHALL BE MEASURED ABOVE THE PEAKS OF THE ANCHOR PROFILE. COATING SYSTEMS OF LESS THAN (15) mils DRY FILM THICKNESS (DFT) SHALL INCLUDE A "BASE METAL READING" ADJUSTMENT TO THE DRY FILM THICKNESS GAGE. WHEN THE ABRADED SURFACE IS INACCESSIBLE DUE TO COATING APPLICATION, AND NO REFERENCE SURFACE IS AVAILABLE, A MINIMUM OF (1) mil DRY FILM THICKNESS SHALL BE SUBTRACTED FROM THE DRY FILM THICKNESS GAGE READINGS.
11. PROTECT STAINLESS PARTS OF DRIVE DURING PAINTING OF CARBON STEEL PARTS AND PROTECT PAINTED SURFACES DURING COATING OF STAINLESS PARTS.
12. REFERENCE NOTES: (ONLY APPLICABLE WHEN SPECIFIC DATA IS LISTED UNDER INSPECTION REQUIREMENTS")

ADHESION TEST - (IF YES) - TESTING SHALL BE IN ACCORDANCE WITH ASTM D4541, MINIMUM ADHESION SHALL BE SPECIFIED IN PSI, AND BASED ON COATING MANUFACTURERS RECOMMENDATIONS.

COATING MANUFACTURER:	TNEMEC	LPS LABORATORIES INC.
TYPE OF COATING (GENERIC):	POLYAMIDOAMINE EPOXY	RUST INHIBITOR
PRODUCT NAME/NUMBER:	N140F	LPS-3
DRY FILM THICKNESS (DFT)		
MINIMUM-MAXIMUM mils:	3-9 mils	-
COLOR NAME/ NUMBER:	BEIGE (1255)	-
TOTAL DRY FILM THICKNESS OF SYSTEM:		TOTAL DRY FILM THICKNESS

COATING MANUFACTURER:	-	-
MANUFACTURER ITEM NUMBER:	-	-

FINAL TOP COAT #3

TNEMEC

ALIPHATIC ACRYLIC POLYURETHANE

ENDURA-SHIELD 73

2-5 mils

WESTECH BLUE (B5712)


5-14 mils

WALTER-STAINLESS SHINE™

SURFACE CLEANER/PROTECTOR

53-G 402

REV	REVISION DESCRIPTION	ECN	DESIGNER	APPROVER	DATE
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	TITLE COATING DATA SHEET DRIVE - CARBON STEEL			
DRV109				
QR-00-063 (SECTION 3.1)	DESIGNER	CHECKER	APPROVER	DATE
QR-00-063 (SECTION 2.6)	WH17	PA51	BO13	2021/02/05
QR-00-063 (SECTION 2.1)	JOB NUMBER	DOCUMENT NUMBER		SHEET
REFERENCE DOCUMENTS	-	0000952300		1 OF 1
				-



POTA-POX® PLUS SERIES N140F

PRODUCT PROFILE

GENERIC DESCRIPTION	Polyamidoamine Epoxy
COMMON USAGE	Innovative potable water coating which offers high-build edge protection and allows for application at a wide range of temperatures (down to 35°F or 2°C). For use on the interior and exterior of steel or concrete tanks, reservoirs, pipes, valves, pumps and equipment in potable water service.
COLORS	1211 Red, 1255 Beige, 00WH Tnemec White, 15BL Tank White, 39BL Delft Blue, 35GR Black. Note: Epoxies chalk with extended exposure to sunlight. Lack of ventilation, incomplete mixing, miscatalyzation or the use of heaters that emit carbon dioxide and carbon monoxide during application and initial stages of curing may cause yellowing to occur.
SPECIAL QUALIFICATIONS	<p>Certified by NSF International in accordance with ANSI/NSF Std. 61. Series N140F manufactured by Tnemec Company in Kansas City, Missouri or Baltimore, Maryland; ambient air cured (with or without 44-700 Epoxy Accelerator) is qualified for use on tanks and reservoirs of 1,000 gallons (3,785 L) capacity or greater, pipes 18 inches (46 cm) in diameter or greater, valves four (4) inches (10 cm) in diameter or greater and fittings four (4) inches (10 cm) in diameter or greater. Series N140F manufactured by Tnemec Coatings in Shanghai, China; ambient air cured (with or without 44-700 Epoxy Accelerator) is qualified for use on pipes 18 inches (46 cm) in diameter or greater, valves four (4) inches (10 cm) in diameter or greater and fittings four (4) inches (10 cm) in diameter or greater. Reference Tnemec's certified product listing at www.nsf.org for details on the maximum allowable DFT.</p> <p>Conforms to AWWA D 102 Inside Systems No. 1 and No. 2 (with or without 44-700). Conforms to AWWA C 210 (without 44-700). Contact your Tnemec representative for systems and additional information.</p>

COATING SYSTEM

SURFACER/FILLER/PATCHER	Series 215, 217, 218
PRIMERS	Self-priming, 22, 91-H ₂ O, 94-H ₂ O, L140, L140F, N140, V140, V140F, 141
TOPCOATS	<p>Interior: Series 22, FC22, L140, L140F, N140, N140F, V140, V140F, 141, 406</p> <p>Exterior: Series 22, 27, 27WB, 30, 66, L69, L69F, N69, N69F, V69, V69F, 72, 73, 118, L140, L140F, N140, N140F, V140, V140F, 141, 156, 157, 161, 180, 181, 446, 700, V700, 701, V701, 740, 750, 1026, 1028, 1029, 1074, 1074U, 1075, 1075U, 1077, 1078, 1078V, 1080, 1081, 1094, 1095, 1096, 1224. Note: When topcoating with Series 700, V700, 701, or V701, an intermediate coat of Series 73, 1075, 1075U, 1095 or 1096 is required. Note: The following recoat times apply for Series N140F: Immersion Service—Surface must be scarified by blasting with fine abrasive after 30 days. Atmospheric Service—After 30 days, scarification or an epoxy tie-coat is required. When topcoating with Series 740 or 750, recoat time for N140F is 14 days. Note: When topcoating with Series 406, recoat times will vary with temperature. Reference the Series 406 product data sheet for specific recoat times. Contact your Tnemec representative for specific recommendations.</p>

SURFACE PREPARATION

STEEL	<p>Immersion Service: SSPC-SP10/NACE 2 Near-White Blast Cleaning or ISO Sa 2 1/2 Very Thorough Blast Cleaning with a minimum angular anchor profile of 1.5 mils.</p> <p>Non-Immersion Service: SSPC-SP6/NACE 3 Commercial Blast Cleaning or ISO Sa 2 Thorough Blast Cleaning with a minimum angular anchor profile of 1.5 mils. Note: Commercial Blast Cleaning generally produces the best coating performance for this exposure. If conditions will not permit this, in moderate exposures Series N140F may be applied to SSPC-SP2 or SP3 Hand or Power Tool Cleaned surfaces (SSPC Rust Grade Condition C).</p>
CAST/DUCTILE IRON	All external surfaces of ductile iron pipe and fittings shall be delivered to the application facility without asphalt or any other protective lining on the exterior surface. All oils, small deposits of asphalt paint, grease, and soluble deposits should be removed and uniformly abrasive blasted using angular abrasive in accordance with NAF 500-03-04: External Pipe Surface condition. When viewed without magnification, the exterior surfaces shall be free of all visible dirt, dust, loose annealing oxide, rust, mold coating and other foreign matter. Any area where rust reappears before application shall be reblasted. The surface shall contain a minimum angular anchor profile of 1.5 mils (38.1 microns) (Reference NACE RP0287 or ASTM D 4417, Method C).
CONCRETE	Allow new cast-in-place concrete to cure a minimum of 28 days at 75°F (24°C). Verify concrete dryness in accordance with ASTM F 1869 "Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride" (moisture vapor transmission should not exceed three pounds per 1,000 square feet in a 24 hour period), F 2170 "Standard Test Method for Determining Relative Humidity in Concrete using in situ Probes" (relative humidity should not exceed 80%), or D 4263 "Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method" (no moisture present). Prepare concrete surfaces in accordance with NACE No. 6/SSPC-SP13 Joint Surface Preparation Standards and ICRI Technical Guidelines. Abrasive blast, shot-blast, water jet or mechanically abrade concrete surfaces to remove laitance, curing compounds, hardeners, sealers and other contaminants and to provide an ICRI-CSP 2-3 surface profile. Large cracks, voids and other surface imperfections should be filled with a recommended filler or surfacer.
PRIMED SURFACES	Immersion Service: Scarify the Series N140F prime coat surface by abrasive-blasting with fine abrasive before topcoating if the Series N140F prime coat has been in exterior exposure for 30 days or longer and Series 66, L69, L69F, N69, N69F, V69, V69F, L140, L140F, N140, N140F, V140, V140F or 161 is the specified topcoat.
ALL SURFACES	Must be clean, dry and free of oil, grease and other contaminants.

TECHNICAL DATA

VOLUME SOLIDS	68.0 ± 2.0% (mixed) †
RECOMMENDED DFT	2.0 to 10.0 mils (50 to 225 microns) per coat. Note: Dry film thickness that exceeds published recommendations but is in compliance with SSPC PA-2 and ANSI/NSF Std. 61 certifications, is acceptable. Note: The number of coats and thickness requirements will vary with substrate, application method and exposure. Contact your Tnemec representative.

POTA-POX® PLUS | SERIES N140F

CURING TIME AT 5 MILS DFT

Temperature	To Handle	To Recoat	Immersion
75°F (24°C)	4 hours	5 hours	7 days
65°F (18°C)	7-8 hours	9-11 hours	8 days
55°F (13°C)	12-14 hours	16-20 hours	9-10 days
45°F (7°C)	18-22 hours	28-32 hours	12-13 days
35°F (2°C)	28-32 hours	46-50 hours	16-18 days

Curing time varies with surface temperature, air movement, humidity and film thickness.

Note: For valve applications allow 14 days cure at 75°F (24°C) prior to immersion. For pipe applications allow 30 days cure at 75°F (24°C) prior to immersion. **Ventilation:** When used in enclosed areas, provide adequate ventilation during application and cure. **Note:** Refer to product listings on www.nsf.org for specific potable water return to service information.

VOLATILE ORGANIC COMPOUNDS

Unthinned: 2.3 lbs/gallon (273 grams/litre)
Thinned 5% (#60): 2.5 lbs/gallon (299 grams/litre)
Thinned 10% (#4): 2.7 lbs/gallon (323 grams/litre) †

HAPS

Unthinned: 2.3 lbs/gal solids
Thinned 5% (#60): 2.3 lbs/gal solids
Thinned 10% (#4): 3.1 lbs/gal solids

THEORETICAL COVERAGE

1,094 mil sq ft/gal (26.8 m²/L at 25 microns). See APPLICATION for coverage rates. †

NUMBER OF COMPONENTS

Two: Part A (amine) and Part B (epoxy) — One (Part A) to one (Part B) by volume.

PACKAGING

	Part A	Part B	Yield (mixed)
Large Kit	5 gallon pail	5 gallon pail	10 gallons (37.9 L)
Small Kit	1 gallon can	1 gallon can	2 gallons (7.6 L)

NET WEIGHT PER GALLON

12.68 ± 0.25 lbs (5.75 ± .11 kg) (mixed) †

STORAGE TEMPERATURE

Minimum 20°F (-7°C) Maximum 110°F (43°C)

For optimum application properties, material temperature should be above 60°F (16°C) prior to application.

TEMPERATURE RESISTANCE

(Dry) Continuous 250°F (121°C) Intermittent 275°F (135°C)

SHELF LIFE

Part A: 24 months; Part B: 12 months at recommended storage temperature.

FLASH POINT - SETA

Part A: 82°F (28°C) Part B: 80°F (27°C)

HEALTH & SAFETY

Paint products contain chemical ingredients which are considered hazardous. Read container label warning and Material Safety Data Sheet for important health and safety information prior to the use of this product.

Keep out of the reach of children.

APPLICATION

COVERAGE RATES

	Dry Mills (Microns)	Wet Mills (Microns)	Sq Ft/Gal (m ² /Gal)
Suggested	6.0 (150)	9.0 (230)	182 (16.9)
Minimum	2.0 (50)	3.0 (75)	545 (50.7)
Maximum	10.0 (225)	15.0 (375)	109 (10.1)

Note: Roller or brush application requires two or more coats to obtain recommended film thickness. Allow for overspray and surface irregularities. Wet film thickness is rounded to the nearest 0.5 mil or 5 microns. Application of coating below minimum or above maximum recommended dry film thicknesses may adversely affect coating performance. Reference the NSF website at www.nsf.org for details on the maximum allowable DFT. †

MIXING

Start with equal amounts of Series N140F Parts A and B. Power mix contents of each container separately, making sure no pigment remains on the bottom. Pour a measured amount of Part B into a clean container large enough to hold both components. Add an equal volume of Part A to Part B while under agitation. Continue agitation until the two components are thoroughly mixed. **Note:** Both components must be above 50°F (10°C) prior to mixing. For optimum mixing and application properties, the material should be above 60°F (16°C).

Thin by volume and thoroughly mix. Failure to thoroughly mix the Part A and Part B components prior to thinning can affect product's gloss and performance. Do not use mixed material beyond pot life limits. **Note:** For application to surfaces between 35°F to 50°F (2°C to 10°C), allow mixed material to stand 30 minutes and restir before using.

THINNING

Use No. 4 or No. 60 Thinner. For air spray, thin up to 10% or 3/4 pint (380 mL) per gallon with No. 4 Thinner or thin up to 5% or 1/4 pint (190 mL) per gallon with No. 60 Thinner. For airless spray, roller or brush, thin up to 5% or 1/4 pint (190 mL) per gallon. **Caution: Series N140F NSF certification is based on thinning with No. 4 or No. 60 Thinner for tanks and only No. 60 Thinner for pipe and valves.** Use of any other thinner voids NSF/ANSI Std. 61 certification.

POT LIFE

2 hours at 50°F (10°C) 1 hour at 75°F (24°C) 30 minutes at 100°F (38°C)

SPRAY LIFE

30 minutes at 75°F (24°C)

Note: Spray application after listed times will adversely affect ability to achieve recommended dry film thickness.

POTA-POX® PLUS | SERIES N140F

APPLICATION EQUIPMENT

Air Spray

Gun	Fluid Tip	Air Cap	Air Hose ID	Mat'l Hose ID	Atomizing Pressure	Pot Pressure
DeVilbiss JGA	E	765 or 704	5/16" or 3/8" (7.9 or 9.5 mm)	3/8" or 1/2" (9.5 or 12.7 mm)	50-80 psi (3.4-5.5 bar)	10-20 psi (0.7-1.4 bar)

Low temperatures or longer hoses require higher pot pressure.

Airless Spray

Tip Orifice	Atomizing Pressure	Mat'l Hose ID	Manifold Filter
0.015"-0.019" (380-485 microns)	3000-4800 psi (207-330 bar)	1/4" or 3/8" (6.4 or 9.5 mm)	60 mesh (250 microns)

Use appropriate tip/atomizing pressure for equipment, applicator technique and weather conditions.

Roller: Use 3/8" or 1/2" (9.5 mm to 12.7 mm) synthetic woven nap roller cover. Use longer nap to obtain penetration on rough or porous surfaces.

Brush: Recommended for small areas only. Use high quality natural or synthetic bristle brushes.

SURFACE TEMPERATURE

Minimum 35°F (2°C) Maximum 135°F (57°C)

The surface should be dry and at least 5°F (3°C) above the dew point. Coating won't cure below minimum surface temperature.

CLEANUP

Flush and clean all equipment immediately after use with the recommended thinner or MEK.

† Values may vary with color.

WARRANTY & LIMITATION OF SELLER'S LIABILITY: Tnemec Company, Inc. warrants only that its coatings represented herein meet the formulation standards of Tnemec Company, Inc. THE WARRANTY DESCRIBED IN THE ABOVE PARAGRAPH SHALL BE IN LIEU OF ANY OTHER WARRANTY, EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. THERE ARE NO WARRANTIES THAT EXTEND BEYOND THE DESCRIPTION ON THE FACE HEREOF. The buyer's sole and exclusive remedy against Tnemec Company, Inc. shall be for replacement of the product in the event a defective condition of the product should be found to exist and the exclusive remedy shall not have failed its essential purpose as long as Tnemec is willing to provide comparable replacement product to the buyer. NO OTHER REMEDY (INCLUDING, BUT NOT LIMITED TO, INCIDENTAL OR CONSEQUENTIAL DAMAGES FOR LOST PROFITS, LOST SALES, INJURY TO PERSON OR PROPERTY, ENVIRONMENTAL INJURIES OR ANY OTHER INCIDENTAL OR CONSEQUENTIAL LOSS) SHALL BE AVAILABLE TO THE BUYER. Technical and application information herein is provided for the purpose of establishing a general profile of the coating and proper coating application procedures. Test performance results were obtained in a controlled environment and Tnemec Company makes no claim that these tests or any other tests, accurately represent all environments. As application, environmental and design factors can vary significantly, due care should be exercised in the selection and use of the coating.

ENDURA-SHIELD

SERIES 73

PRODUCT PROFILE

GENERIC DESCRIPTION Aliphatic Acrylic Polyurethane

COMMON USAGE

A coating for commercial, industrial, and marine applications that is highly resistant to abrasion, wet conditions, corrosive fumes, chemical contact and has excellent resistance to exterior weathering. Direct-to-Metal capability allows for a labor-saving, high-build, single coat application.

COLORS

Refer to Tnemec Color Guide. **Note:** Certain colors may require multiple coats depending on method of application and finish coat color. When feasible, the preceding coat should be in the same color family (blue, gray, etc.), but noticeably different.

FINISH

Semi-gloss

SPECIAL QUALIFICATIONS

Series 73 meets the accelerated weathering requirements of SSPC Paint Standard 36.

This product is part of a coating system tested in accordance with ISO 12944-6 (2018). Contact your Tnemec representative for coating system test results.

COATING SYSTEM

PRIMERS

Steel: Self-priming or Series 1, 20, FC20, 27, 27WB, 37H, 66, L69, L69F, N69, N69F, V69, V69F, 90-97, H90-97, 90G-1K97, 91-H₂O, H91-H₂O, 94-H₂O, 132, 135, L140, L140F, N140, N140F, V140, V140F, 141, 161, 394, V530, 1224.

Galvanized Steel & Non-Ferrous Metal: Series 66, L69, N69, V69, 1224. **Note:** For special galvanized surface preparation instructions, consult the latest version of Tnemec Technical Bulletin 10-78.

Concrete: Series 66, L69, L69F, N69, N69F, V69, V69F, 141, 161, 1254

CMU: Series 1254

Note: Series V530 exterior exposed more than 24 hours, Series L69, N69, V69, 135, L140, N140, or V140 exterior exposed more than 60 days, Series L69F, N69F, V69F, L140F, N140F or V140F exterior exposed more than 30 days, or Series 132 or 141 exterior exposed more than 14 days must first be scarified or reprimed with themselves. Brush blasting with fine abrasive is the preferred method of scarification. Recoat windows for other primers may apply. See those data sheets for additional information.

TOPCOATS

Series 700, V700, 701, V701, 740, 750, 1070, 1070V, 1071, 1071V, 1072, 1072V, 1074, 1074U, 1075, 1075U, 1077, 1078, 1078V, 1094, 1095, 1096.

SURFACE PREPARATION

STEEL

SSPC-SP6/NACE 3 Commercial Blast Cleaning or ISO Sa 2 Thorough Blast Cleaning with a minimum angular anchor profile of 2.0 mils.

ALL SURFACES

Must be clean, dry and free of oil, grease and other contaminants. See primer product data sheet for surface preparation recommendation.

TECHNICAL DATA

VOLUME SOLIDS

58.0 ± 2.0% (mixed) †

RECOMMENDED DFT

Topcoat Service: 2.0 to 5.0 mils (50 to 125 microns) per coat.

Direct to Metal; Over Zinc or MIO-Zinc: 3.5 to 5.0 mils (90 to 125 microns).

Note: Number of coats and thickness requirements will vary with substrate, application method and exposure. For DTM or applications over zinc or MIO-zinc, as part of a two-coat system, consult the latest version of Tnemec Technical Bulletin 13-100 or contact your Tnemec representative.

CURING TIME

Temperature	To Touch	To Handle	To Recoat
75°F (24°C)	1 hour	5-8 hours	12 hours

Curing time varies with surface temperature, air movement, humidity and film thickness. **Note:** For faster curing and low-temperature applications, add No. 44-710 Urethane Accelerator; see separate product data sheet.

VOLATILE ORGANIC COMPOUNDS

Unthinned	Thinned 10% (Max) (No. 39 Thinner)	Thinned 10% (Max) (No. 42 Thinner)	Thinned 10% (Max) (No. 48 Thinner)	Thinned 10% (Max) (No. 56 Thinner)	Thinned 10% (Max) (No. 63 Thinner)
2.61 lbs/gallon (313 grams/litre)	2.94 lbs/gallon (356 grams/litre)	3.01 lbs/gallon (361 grams/litre)	3.07 lbs/gallon (367 grams/litre)	2.67 lbs/gallon (320 grams/litre)	2.99 lbs/gallon (358 grams/litre)

HAPS

Unthinned	Thinned 10% (Max) (No. 39 Thinner)	Thinned 10% (Max) (No. 42 Thinner)	Thinned 10% (Max) (No. 48 Thinner)	Thinned 10% (Max) (No. 56 Thinner)	Thinned 10% (Max) (No. 63 Thinner)
0.44 lbs/gal solids	0.44 lbs/gal solids	0.44 lbs/gal solids	0.44 lbs/gal solids	0.44 lbs/gal solids	0.50 lbs/gal solids

THEORETICAL COVERAGE

930 mil sq ft/gal (22.8 m²/L at 25 microns). †

NUMBER OF COMPONENTS

Two: Part A and Part B

MIXING RATIO

By Volume: Four (Part A) to One (Part B)

PACKAGING

	PART A	PART B	When Mixed
5 Gallon Kit	5 gallon pail (partial fill)	1 gallon can	5 gallons (18.9L)
1 Gallon Kit	1 gallon pail (partial fill)	1 quart can (partial fill)	1 gallon (3.79L)

NET WEIGHT PER GALLON

12.13 ± 0.25 lbs (4.88 ± 0.11 kg) †

ENDURA-SHIELD | SERIES 73

STORAGE TEMPERATURE	Minimum 20°F (-7°C) Maximum 110°F (43°C)
TEMPERATURE RESISTANCE	(Dry) Continuous 250°F (121°C) Intermittent 275°F (135°C)
SHelf LIFE	Part A: 12 months at recommended storage temperature. Part B: 12 months at recommended storage temperature.
FLASH POINT - SETA	Part A: 80°F (27°C) Part B: 112°F (43°C)
HEALTH & SAFETY	Paint products contain chemical ingredients which are considered hazardous. Read container label warning and Material Safety Data Sheet for important health and safety information prior to the use of this product. Keep out of the reach of children.

APPLICATION

COVERAGE RATES

Topcoat Service

	Dry Mils (Microns)	Wet Mils (Microns)	Sq Ft/Gal (m²/Gal)
Suggested	2.5 (65)	4.5 (115)	372 (34.6)
Minimum	2.0 (50)	3.5 (90)	465 (43.2)
Maximum	5.0 (125)	8.5 (215)	186 (17.3)

Direct-to-Metal; over Zinc or MIO-Zinc

	Dry Mils (Microns)	Wet Mils (Microns)	Sq Ft/Gal (m²/Gal)
Suggested	4.0 (100)	7.0 (180)	233 (21.6)
Minimum	3.5 (90)	6.0 (150)	266 (24.7)
Maximum	5.0 (125)	8.5 (215)	186 (17.3)

Allow for overspray and surface irregularities. Wet film thickness is rounded to the nearest 0.5 mil or 5 microns. Application of coating below minimum or above maximum recommended dry film thicknesses may adversely affect coating performance. †

MIXING

Stir contents of the container marked Part A, making sure no pigment remains on the bottom. Add the contents of the can marked Part B to Part A while under agitation. Continue agitation until the two components are thoroughly mixed. When used with 44-710 Urethane Accelerator, first blend 44-710 into Part A under agitation; continue as above. Do not use mixed material beyond pot life limits. **Caution: Part B is moisture-sensitive and will react with atmospheric moisture. Keep unused material tightly closed at all times.**

THINNING

For air spray, thin up to 10% or 3/4 pint (380 mL) per gallon by volume with No. 42 Thinner if temperatures are below 80°F (27°C), use No. 48 Thinner for temperatures above 80°F (27°C). Thin up to 5% or 1/4 pint (190 mL) per gallon for airless spray. For brush or roller, thin 5% to 10% or 1/4 to 3/4 pint (190 to 380 mL) per gallon with No. 39 or No. 63 Thinner. Thinning is required for proper brush or roller application. **Note:** A maximum of 10% of No. 56 Thinner may be used to comply with VOC regulations. **Caution: Do not add thinner if more than thirty (30) minutes have elapsed after mixing.**

POT LIFE

8 hours at 40°F (4°C) 4 hours at 77°F (25°C) 2 hours at 100°F (38°C)

APPLICATION EQUIPMENT

Air Spray

Gun	Fluid Tip	Air Cap	Air Hose ID	Mat'l Hose ID	Atomizing Pressure	Pot Pressure
DeVilbiss JGA	E	765 or 704	5/16" or 3/8" (7.9 or 9.5 mm)	3/8" or 1/2" (9.5 or 12.7 mm)	75-90 psi (5.2-6.2 bar)	10-20 psi (0.7-1.4 bar)

Low temperatures or longer hoses require higher pot pressure.

Airless Spray

Tip Orifice	Atomizing Pressure	Mat'l Hose ID	Manifold Filter
0.013"-0.017" (330-430 microns)	3000-3600 psi (206-248 bar)	1/4" or 3/8" (6.4 or 9.5 mm)	60 mesh (250 microns)

Use appropriate tip/atomizing pressure for equipment, applicator technique and weather conditions.

Roller: Use 1/4" to 3/8" (6.4 mm to 9.5 mm) synthetic woven nap roller cover. Do not use long nap roller covers. **Note:** Two coats are required to obtain dry film thickness above 3.0 mils (75 microns).

Brush: Recommended for small areas only. Use high quality natural or synthetic bristle brushes. **Note:** Two or more coats may be required to obtain recommended film thicknesses.

SURFACE TEMPERATURE

Minimum 35°F (2°C) Maximum 120°F (49°C)

The surface should be dry and at least 5°F (3°C) above the dew point.

Cure time necessary to resist direct contact with moisture at surface temperature:

40°F (4°C): 24 to 40 hours 50°F (10°C): 18 to 26 hours 60°F (16°C): 12 to 16 hours
70°F (21°C): 4 to 8 hours 90°F (32°C): 2 to 4 hours 100°F (38°C): 2 to 3 hours

If the coating is exposed to moisture before the preceding cure parameters are met, dull, flat or spotty appearing areas may develop. Actual times will vary with air movement, film thickness and humidity.

CLEANUP

Flush and clean all equipment immediately after use with the recommended thinner or MEK.

† Values may vary with color.

WARRANTY & LIMITATION OF SELLER'S LIABILITY: Tnemec Company, Inc. warrants only that its coatings represented herein meet the formulation standards of Tnemec Company, Inc. THE WARRANTY DESCRIBED IN THE ABOVE PARAGRAPH SHALL BE IN LIEU OF ANY OTHER WARRANTY, EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. THERE ARE NO WARRANTIES THAT EXTEND BEYOND THE DESCRIPTION ON THE FACE HEREOF. The buyer's sole and exclusive remedy against Tnemec Company, Inc. shall be for replacement of the product in the event a defective condition of the product should be found to exist and the exclusive remedy shall not have failed its essential purpose as long as Tnemec is willing to provide comparable replacement product to the buyer. NO OTHER REMEDY (INCLUDING, BUT NOT LIMITED TO, INCIDENTAL OR CONSEQUENTIAL DAMAGES FOR LOST PROFITS, LOST SALES, INJURY TO PERSON OR PROPERTY, ENVIRONMENTAL INJURIES OR ANY OTHER INCIDENTAL OR CONSEQUENTIAL LOSS) SHALL BE AVAILABLE TO THE BUYER. Technical and application information herein is provided for the purpose of establishing a general profile of the coating and proper coating application procedures. Test performance results were obtained in a controlled environment and Tnemec Company makes no claim that these tests or any other tests, accurately represent all environments. As application, environmental and design factors can vary significantly, due care should be exercised in the selection and use of the coating.

Field Test

Torque Test Procedure

The equipment will be tested to ensure structural and mechanical conformance with the torque requirements as outlined in the equipment specifications. The field test will also include verification of torque box settings such as the warning device and the drive cutout circuitry.

Torque will be applied to the mechanism by securing the truss arm with cables anchored to the tank floor (not by WesTech) while manually rotating the drive fan motor shaft. The load through the cable connection will be monitored with a hydraulic load cell and gauge (by WesTech).

The cables should be anchored and attached to the rake arm at a distance from the centerline of the tank, as indicated on the Torque Test Diagram, whereby calculations can be made to determine the torque values.

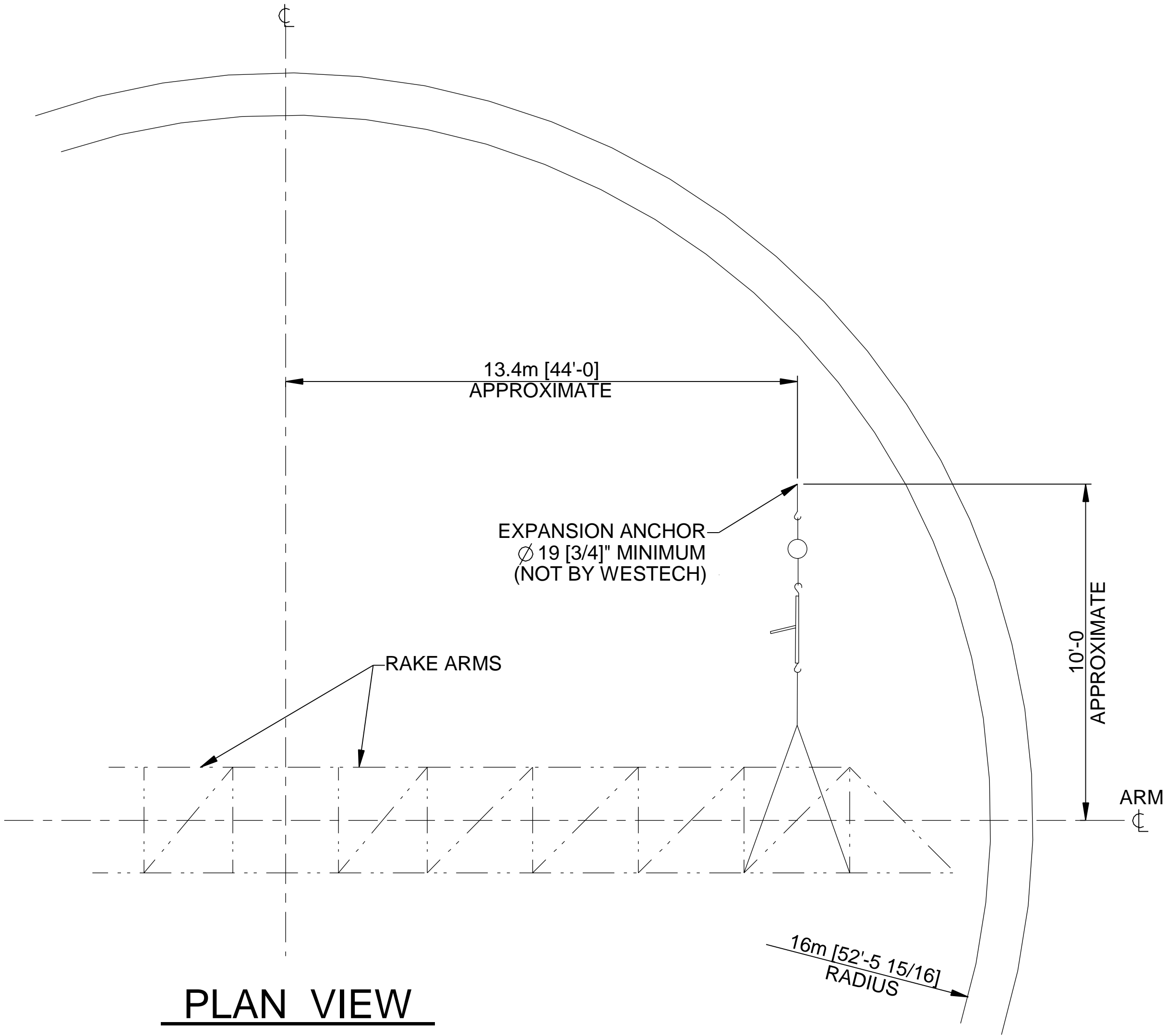
The torque, indicated as a percentage by the pointer on the drive unit torque box, should be within plus or minus 10 percent of the calculated values from the load cell readings.

Test Warnings:

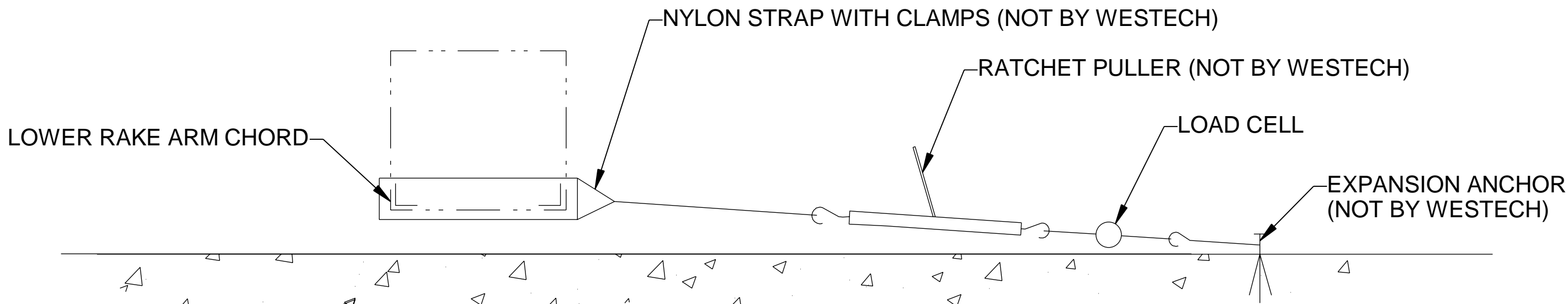
Review the Torque Test Diagram for the additional test procedures.

For the protection of personnel during the torque test, the following precautions must be taken:

1. Personnel entering the area of this equipment must be equipped with adequate safety equipment such as safety glasses, safety shoes, and a hard hat.
2. Check to ensure that the cable slings and other components to be used in the test are in good condition (not by WesTech).
3. Make sure that the anchors are properly installed and adequately sized for the loads indicated on the Torque Test Diagram (not by WesTech).
4. Limit the personnel inside the tank to that necessary to perform the test.
5. Keep a safe distance from the rake arms while the test is in progress. Do not stand in front of the leading side of the arms while they are loaded during the test.
6. Do not exceed the maximum load reading specified on the Torque Test Diagram.
7. All personnel in the area of this equipment during the torque test must be educated on these precautions before starting the test.



PLAN VIEW



ELEVATION

NOTES:

1. RAKE ARM MUST BE SECURED AS SHOWN AT TWO OR MORE PANEL POINTS WITH LOAD MEASURING ASSEMBLY.
2. LOAD IS APPLIED BY THE RATCHET PULLER WHILE THE MOTOR OUTPUT SHAFT IS SECURED AGAINST ROTATION.
3. DURING THE TORQUE TEST, THE LOAD INDICATOR AT THE DRIVE WILL INDICATE TORQUE VALUES.
- 4 DO NOT EXCEED THE MAXIMUM LOAD INDICATED ABOVE.
- 5 MINIMIZE LOAD APPLIED TO STRAPS AND LOAD CELL BY USING A PULLEY TO DIVIDE THE LOAD IN HALF WHEN NECESSARY, NEVER EXCEED THE CAPACITY OF THE LOAD CELL OR ANY PART OF THE RIGGING (STRAPS, RATCHET PULLER, ANCHOR, ETC.)
6. PRIOR TO TESTING, WESTECH DRIVE SHOULD RUN FOR A PERIOD OF 3-5 HOURS, OR 3-5 REVOLUTIONS.

TORQUE TEST RECORD

COMPLETED BY:				DATE :	
TEST EQUIPMENT:	ENERPAC TS5 TM5			ANALOG 8896 NEWTON DIGITAL 44483 NEWTON	
	CIRCLE ONE		S/N	5 CIRCLE ONE	

CALIBRATION EXPIRES:

REFERENCE: TORQUE (Nm) = LOAD CELL READING (N) x DISTANCE (m)

TORQUE TEST LOADS AT DESIGN ANCHOR DISTANCE				REVISED FOR	TEST RESULTS	
TORQUE BOX DIAL	DESIGN DISTANCE (m)	LOAD CELL READING (N)	TORQUE (Nm)	ACTUAL DISTANCE (m)	LOAD CELL READING (N)	TORQUE (Nm)
UNIT # 8	13.4m					
100%		3616	48454			
120%		4337	58116			
140%		5064	67859			
4						
UNIT # N/A						
100%						
120%						
4						

TEST VALUES WITHIN ±10% ARE ACCEPTABLE UNLESS OTHERWISE SPECIFIED

COMMENTS / ATTENDEES:

TORQUE TEST WITNESSED BY OWNERS AGENT: DATE:

PRINTED NAME: TITLE:

PASS FAIL

SIGNATURE:

PREPARED FOR: BRANTFORD WWTP
SECONDARY CLARIFIERS REHABILITATION
BRANTFORD, ONTARIO, CANADA

ENGINEER: CIMA+

CONTRACTOR:

P.O./CONTRACT NUMBER: 2022-92

WestTech®

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TITLE: TORQUE TEST RECORD
Ø 32004 [105'-0] SECONDARY CLARIFIER 8
COPC1G

DESIGNER	CHECKER	APPROVER	DATE
RI62	SA103	ME75	2023-08-28
JOB NUMBER	DOCUMENT NUMBER	SHEET	REV
24946C	0003410410	1 OF 1	-

REV	REVISION DESCRIPTION	ECN	DESIGNER	APPROVER	DATE	REFERENCE DOCUMENTS
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Enclosures

Clouded Dimension Verification

The following drawings have clouded dimensions and assumed process data that will require verification by the contractor or owner.

These dimensions need to be verified before WesTech Engineering, LLC acknowledges the submittal as approved.


As such, contract ship dates will not be set, nor will work proceed until all requested information has been verified.

Drawings


1. A STAR DENOTES VARIANCE FROM CONTRACT DOCUMENTS AND SHOULD BE PARTICULARLY NOTED. ★
2. CONTRACTOR TO VERIFY OR SUPPLY ALL DIMENSIONS SHOWN IN CLOUDS. ☁
3. DIMENSIONS, LOADS, AND OTHER INFORMATION ARE PROVIDED FOR CONFIRMATION BY OTHERS OF POSITION AND INTERFACE BETWEEN NEW OR EXISTING CONCRETE, EQUIPMENT, PLANT STRUCTURE, OTHER SYSTEMS AND APPURTENANCES AS SHOWN ON THE GENERAL ARRANGEMENT DRAWINGS.
4. SUBMITTED DRAWINGS AND INFORMATION ARE NOT TO BE USED FOR CONSTRUCTION OR INSTALLATION PURPOSES UNTIL CUSTOMER APPROVAL HAS BEEN ISSUED. WESTECH WILL NOT PROCEED WITH FABRICATION OR DELIVERY UNTIL SUCH APPROVAL IS RECEIVED.
5. WESTECH IS NOT RESPONSIBLE FOR NEW OR EXISTING CONCRETE DESIGN, INCLUDING NECESSARY REINFORCEMENT FOR ANCHOR BOLTS, UNLESS SPECIFICALLY INDICATED OTHERWISE. THE SUITABILITY OF NEW OR EXISTING CONCRETE, EQUIPMENT, TANKAGE, OR STRUCTURES TO WITHSTAND THE DESIGN LOADS AT THE INTERFACE OF WESTECH'S EQUIPMENT IS TO BE DEFINED, CONFIRMED OR OTHERWISE PROVIDED BY OTHERS.
6. WESTECH IS NOT RESPONSIBLE FOR DAMAGE, INJURY OR LOSS RESULTING FROM IMPROPER USE OF THIS EQUIPMENT.
7. MODIFICATIONS, ADDITIONS OR CORRECTIONS TO THE APPROVED EQUIPMENT WILL NOT BE ACCEPTED BY WESTECH, UNLESS A CHANGE ORDER IS ISSUED AND APPROVED.
8. ROTATING EQUIPMENT IS DESIGNED TO OPERATE ONLY IN THE INDICATED DIRECTION. WESTECH IS NOT RESPONSIBLE FOR DAMAGE IF OPERATED IN THE OPPOSITE DIRECTION.
9. WESTECH DOES NOT FURNISH CONCRETE, GROUT, CONCRETE REINFORCING, PIPING, VALVES, PIPE SUPPORTS OR FITTINGS, WALL BRACKETS, ELECTRICAL WIRING, CONDUIT, ELECTRICAL EQUIPMENT, ERECTION, INSTALLATION, FIELD ASSEMBLY, SHIMMING MATERIALS, CAULK OR MASTIC, FIELD PAINTING OR PAINT, FIELD WELDING OR WELD ROD, WATER FOR TESTING, GREASE, ANTI-SEIZE OR LUBRICATING OIL, UNLESS SPECIFICALLY NOTED.
10. SHOP SURFACE PREPARATION AND SHOP PAINTING OF PRIME COATS ARE DESIGNED TO PROVIDE ONLY A MINIMAL PROTECTION FROM TIME OF APPLICATION PER THE COATING MANUFACTURER'S DATA SHEET. WESTECH DOES NOT GUARANTEE CONDITION OF PREPARED OR PAINTED ITEMS ONCE THE ITEMS LEAVE THE SHOP. CUSTOMER SHOP INSPECTION OF PAINTED ITEMS IS WELCOME TO VERIFY APPLICATION. ALL FIELD SURFACE PREPARATION, FIELD PAINT, TOUCH-UP, AND REPAIR TO SHOP PAINTED SURFACES ARE NOT BY WESTECH. RESPONSIBILITY FOR COMPATIBILITY OF SHOP AND FIELD APPLIED COATINGS IS BY OTHERS.
11. DOCUMENTS DEFINING WESTECH SUPPLIED SURFACE PREPARATION AND SHOP/FIELD PAINT SPECIFICATIONS ARE SUBMITTED WITH THE GENERAL ARRANGEMENT DRAWINGS AND WILL INCLUDE COATING DATA SHEET(S) AND/OR A STAINLESS-STEEL CLEANING GRADE SHEET AND FINISH LEVEL SHEET.
12. WHERE APPLICABLE, ANCHOR BOLT DETAILS ARE SHOWN ON JOB-SPECIFIC DRAWINGS AND SHALL CONFORM TO ONE OR MORE OF THE FOLLOWING SPECIFICATIONS:
 - CARBON STEEL HEADED OR ALL-THREAD ROD - ASTM F1554, GRADE 36, GRADE 55, OR GRADE 105
 - STAINLESS STEEL HEADED OR ALL-THREAD ROD - ASTM F593, ASTM A193
 - ADHESIVE ANCHORS SHALL MEET THE REQUIREMENTS OF ASTM E1512 AND SHALL HAVE A PUBLISHED ICC/ES REPORT.
 - WEDGE ANCHORS SHALL HAVE A PUBLISHED ICC/ES REPORT.
13. MATERIALS AND COATINGS OF FASTENERS ARE IDENTIFIED ON JOB-SPECIFIC GENERAL ARRANGEMENT DRAWINGS. BOLTS SHALL CONFORM TO ONE OR MORE OF THE FOLLOWING SPECIFICATIONS WITH DIMENSIONS PER ASME B18.2.1 AND B18.2.2:

14. THE FOLLOWING DEFINES THE ACCEPTABLE MATERIALS USED FOR WESTECH SUPPLIED EQUIPMENT AS SPECIFIED AND SHOWN ON THE GENERAL ARRANGEMENT DRAWINGS. ANY MATERIAL OR ITEMS NOT INCLUDED HERE SHALL BE CLEARLY SPECIFIED ON THE GENERAL ARRANGEMENT DRAWINGS.


A. CARBON STEEL SHALL MEET THE FOLLOWING SPECIFICATIONS AND REQUIREMENTS:

- STEEL SHAPES W, WT - ASTM A992/A992M
- STEEL SHAPES M, MT, S, ST, C, MC, L - ASTM A36/A36M
- STEEL PLATES AND BARS - ASTM A36/A36M; A572/A572M GRADE 50; A529/A529M
- STEEL SHAPE HP - ASTM A572/A572M GRADE 50
- STEEL PIPE - ASTM A53/A53M GRADE B, ASTM 106/A106M, API 5L
- HOLLOW STRUCTURAL SECTIONS (HSS), ROUND, SQUARE, RECTANGULAR - ASTM A500/A500M GRADE C; A1085/A1085M
- SHEETS - A1011/A1011M
- PIPE FITTINGS - ASTM A234/A234M; ASME B16.11
- ALL WELDING SHALL CONFORM TO THE LATEST AWS D1.1 CODE OR ASME BPVC SECTION IX.
- ALL SUBMERGED STRUCTURAL STEEL MEMBERS SHALL HAVE A MINIMUM 1/4" THICKNESS UNLESS NOTED OTHERWISE.
- SOME SHAPES MAY BE FORMED BY BENDING AND/OR WELDING. 

B. STAINLESS STEEL SHALL MEET THE FOLLOWING SPECIFICATIONS AND REQUIREMENTS:

- AUSTENITIC BARS, ROUND AND SQUARES, AND HOT ROLLED EXTRUDED SHAPES SUCH AS ANGLES, TEES, AND CHANNELS - ASTM A276; ASTM A484/A484M; ASTM A564/A564M
- AUSTENITIC LASER-FUSED BARS, PLATES, ANGLES, TEES, CHANNELS, AND W SHAPES - ASTM A1069/A1069M
- AUSTENITIC PLATES, SHEETS, STRIPS - ASTM A240/A240M; ASTM A480/A480M
- AUSTENITIC PIPES - ASTM A312/A312M
- AUSTENITIC HOLLOW STRUCTURAL SHAPES (HSS), ROUND, SQUARE, RECTANGULAR - ASTM A554
- PIPE FITTINGS - ASTM A182; ASME SA 182; ASME B16.11
- DUPLEX PLATES, SHEETS, STRIPS - ASTM A240/A240M; ASTM A480/A480M
- DUPLEX PIPES - ASTM A790/A790M
- DUPLEX HOLLOW STRUCTURAL SHAPES - MADE FROM PLATE 
- ALL WELDING SHALL CONFORM TO THE LATEST AWS D1.6 CODE OR ASME BPVC SECTION IX.
- SOME SHAPES MAY BE FORMED BY BENDING AND/OR WELDING.

C. ALUMINUM SHALL MEET THE FOLLOWING SPECIFICATIONS AND REQUIREMENTS:


- EXTRUDED BARS, RODS, WIRE, STRUCTURAL PROFILES AND TUBES - ASTM B221/B221M
- STANDARD STRUCTURAL PROFILES - ASTM B308/B308M (FOR ALLOY 6061-T6 ONLY)
- PLATE AND SHEET - ASTM B209/B209M
- DRAWN SEAMLESS TUBE - ASTM B210/B210M; ASTM B483/B483M
- EXTRUDED SEAMLESS TUBE AND PIPE - ASTM B241/B241M; B429/B429M 
- PIPE FITTINGS - ASTM B361
- ALL WELDING SHALL CONFORM TO THE LATEST AWS D1.2 CODE.
- SOME SHAPES MAY BE FORMED BY BENDING AND/OR WELDING.

D. TANK MATERIALS SHALL CONFORM TO THE SPECIFICATIONS IN API 650 OR AWWA D100 AS NOTED ON THE GENERAL ARRANGEMENT DRAWINGS. SPECIFIED MATERIALS ARE SHOWN ON THE GENERAL ARRANGEMENT DRAWINGS. ALL WELDING SHALL CONFORM TO THE ASME BPVC - SECTION IX.

- B.E. ASME STAMPED PRESSURE VESSELS SHALL CONFORM TO ASME BPVC SECTION VIII OR SECTION X (FOR FRP TANKS), THE DESIGN CALCULATIONS AND THE GENERAL ARRANGEMENT DRAWINGS.**

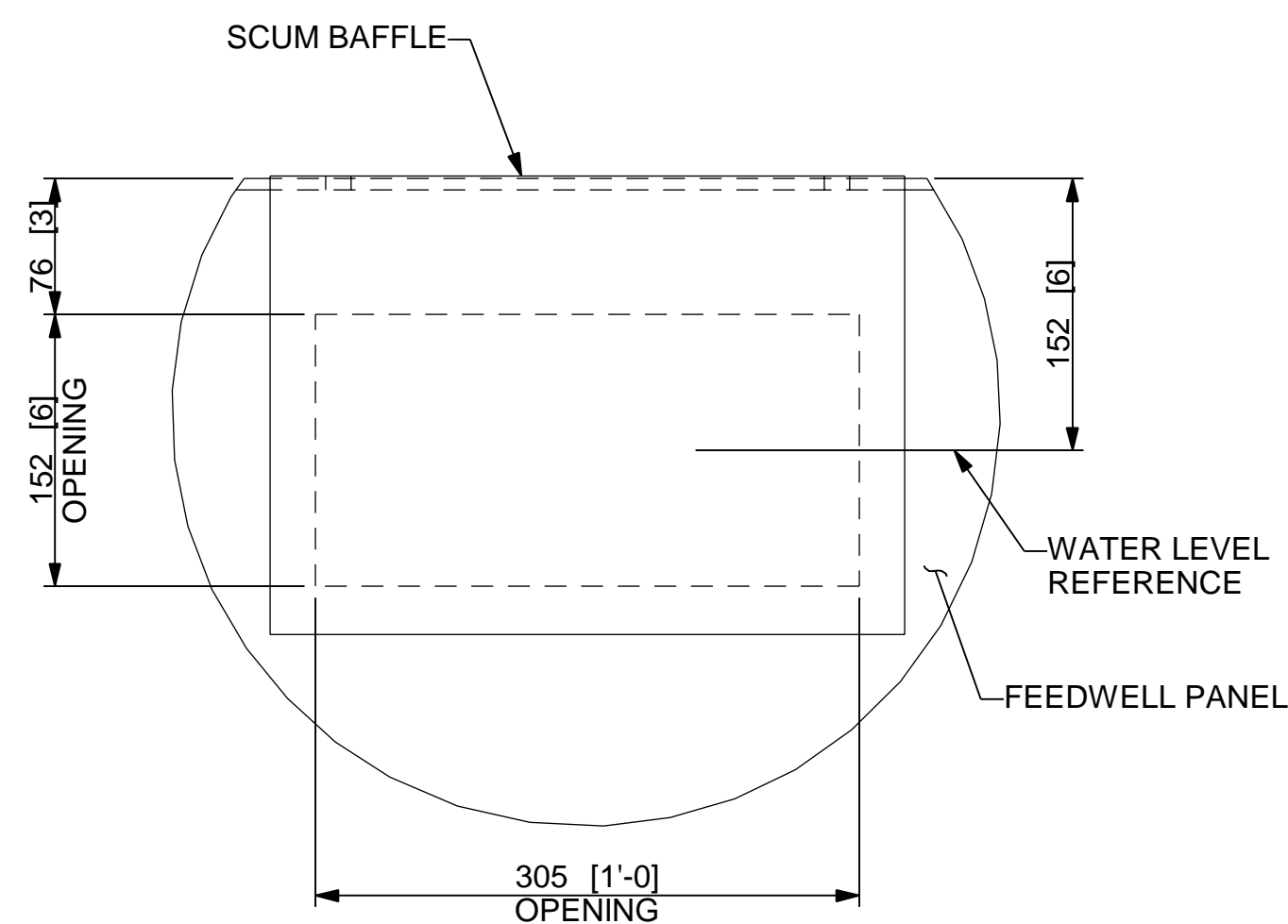
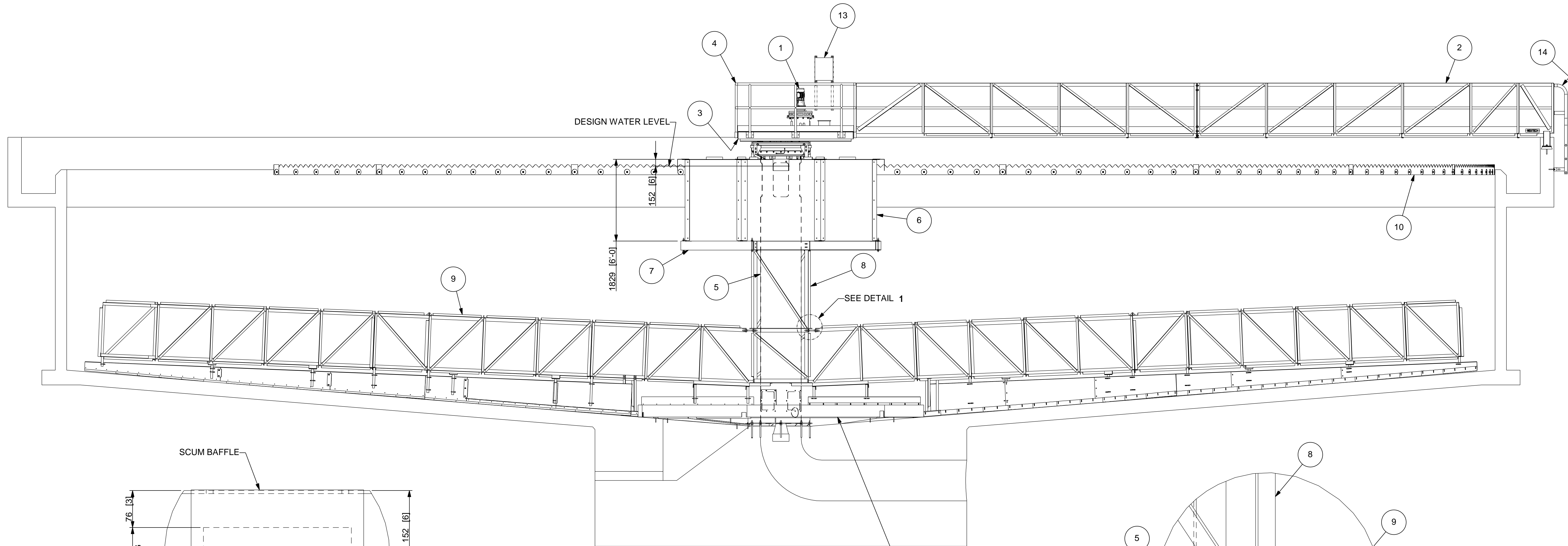
- 15. ITEMS SHOWN, NOTED OR DESCRIBED ON THE GENERAL ARRANGEMENT DRAWINGS SUPERSEDE ANY CONFLICTING ITEMS WITHIN THESE NOTES.**

HIGH TEMPERATURE)																																																																																																																																																																																																																																																																																																																																																																																																																																										
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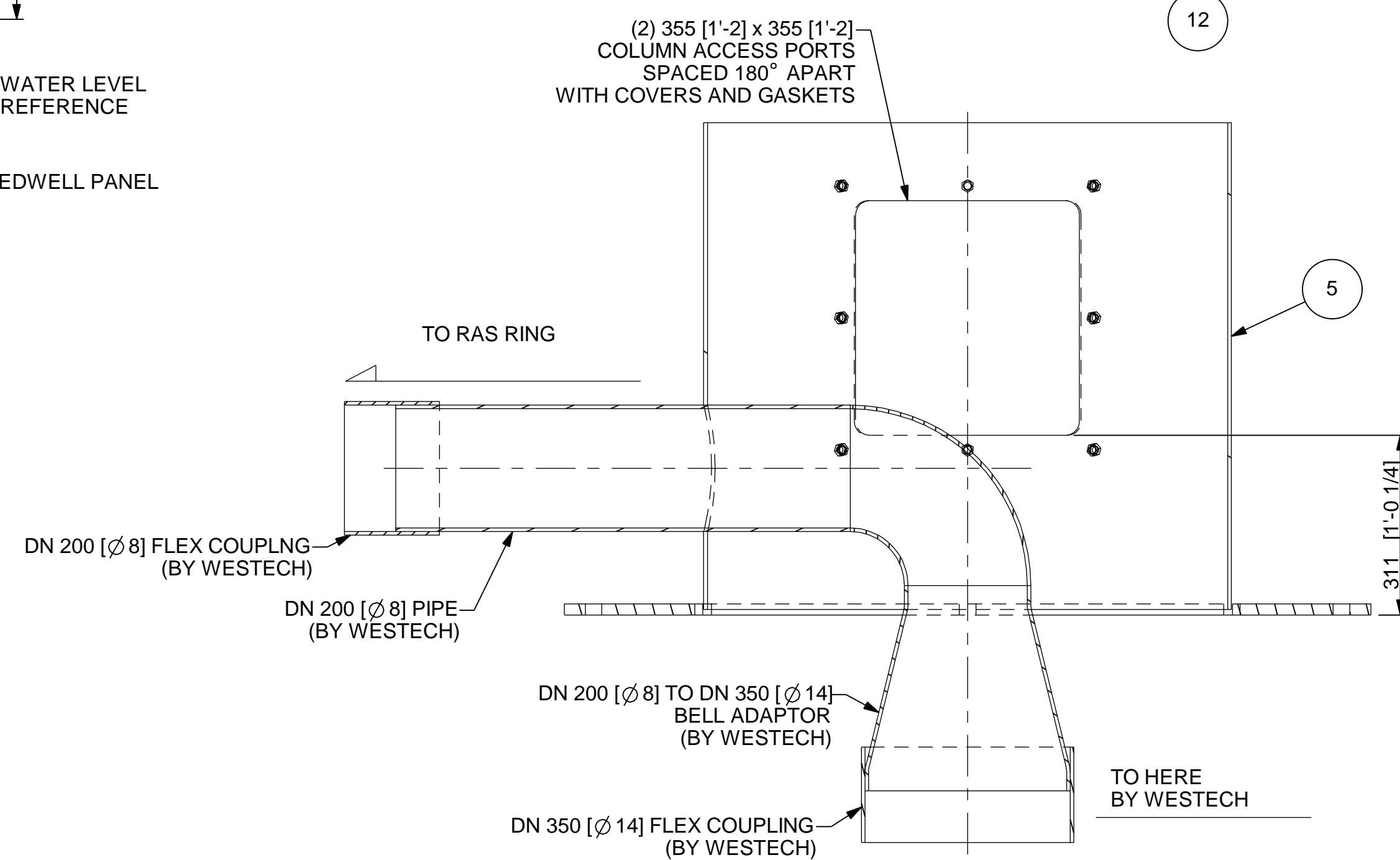


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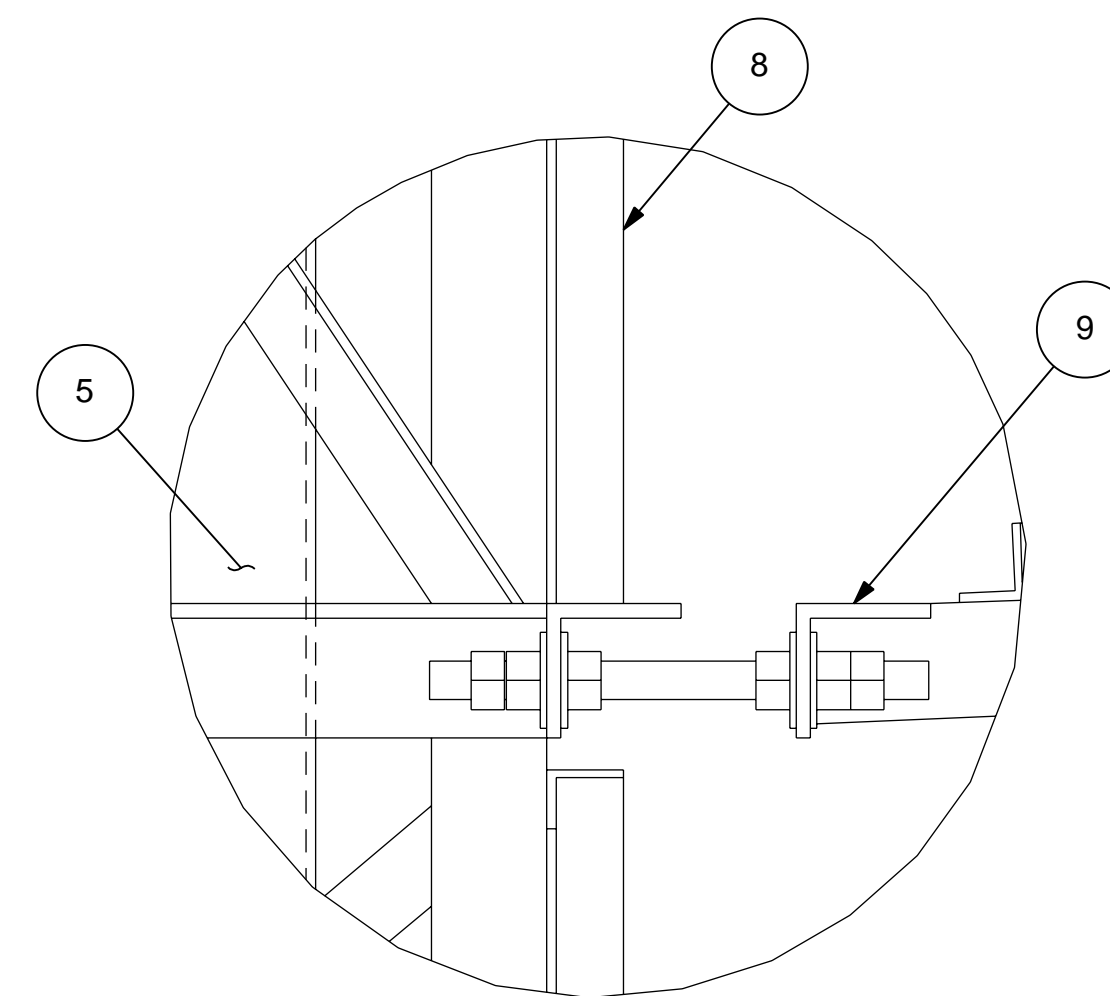
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DESIGNER	CHECKER	APPROVER	DATE
R162	SA103	ME75	2023-08-28
JOB NUMBER	DOCUMENT NUMBER		SHEET
24946C	0003408851		1 OF 5
			REV
			-



FEEDWELL BAFFLE DETAIL
SCALE 0.250



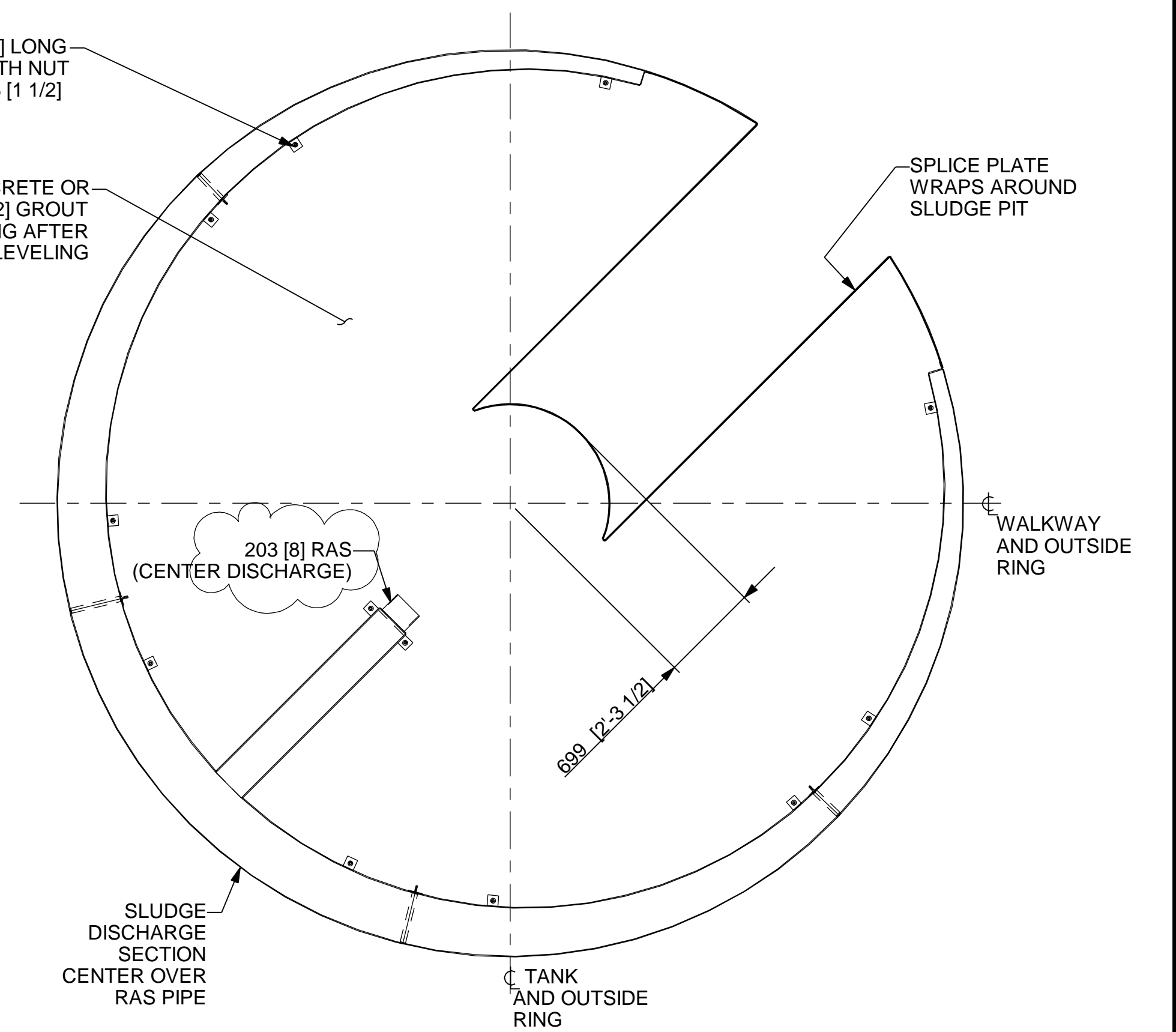
RAS CONNECTION DETAIL
SCALE 0.125



DETAIL 1
SCALE 0.200



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R162	SA103	ME75	2023-08-28
JOB NUMBER	DOCUMENT NUMBER	SHEET	REV
24946C	0003408851	2 OF 5	-



SCALE 0.031
OUTSIDE OF SLUDGE RING IS CENTERED IN TANK.
RING MOUNTS DIRECTLY ON CONCRETE FLOOR WITH
ANCHOR BOLTS BEFORE FLOOR GROUT IS POURED.
SEE OTHER VIEW FOR ORIENTATION.



WESTECH[®]

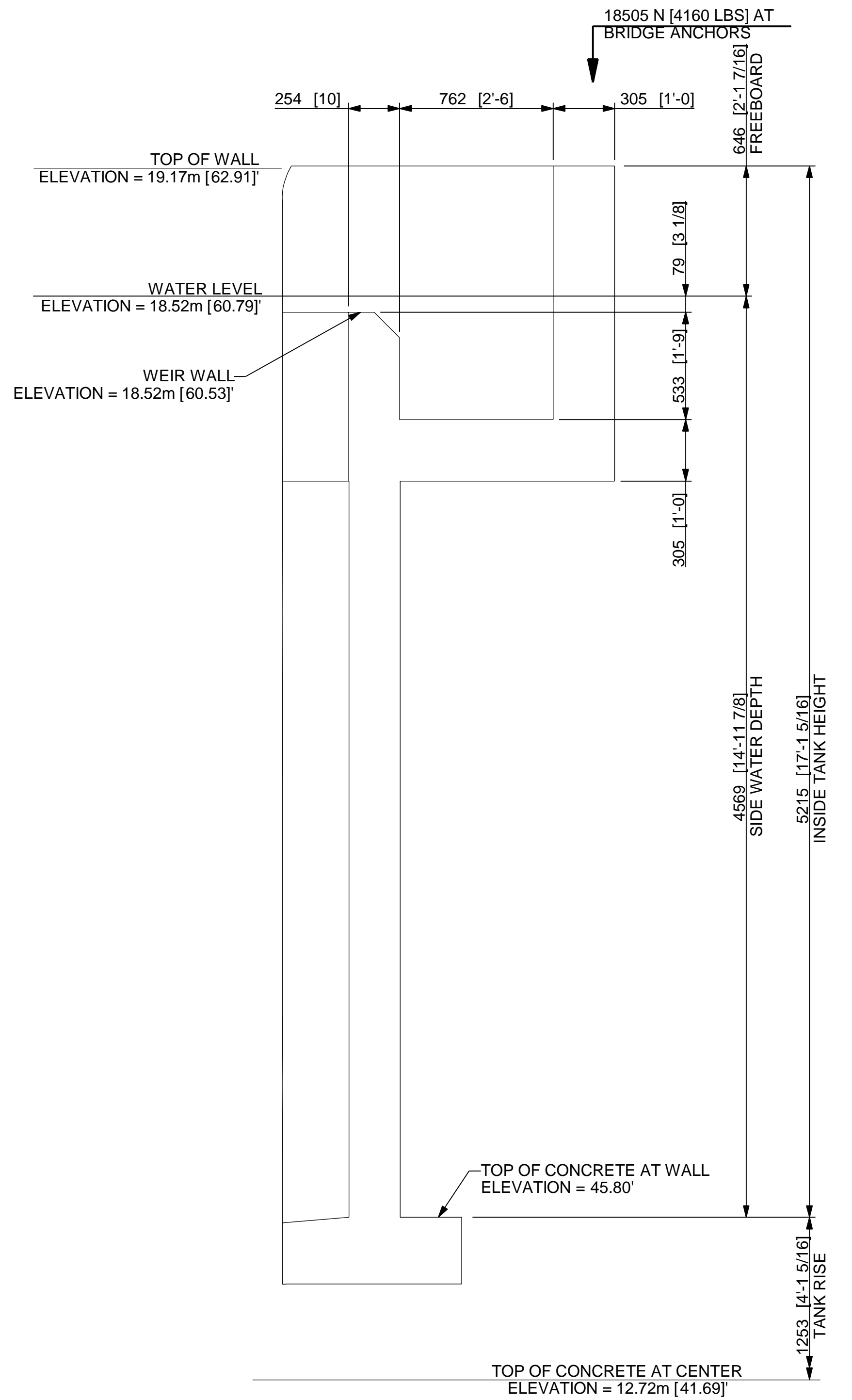
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TITLE: GENERAL ARRANGEMENT

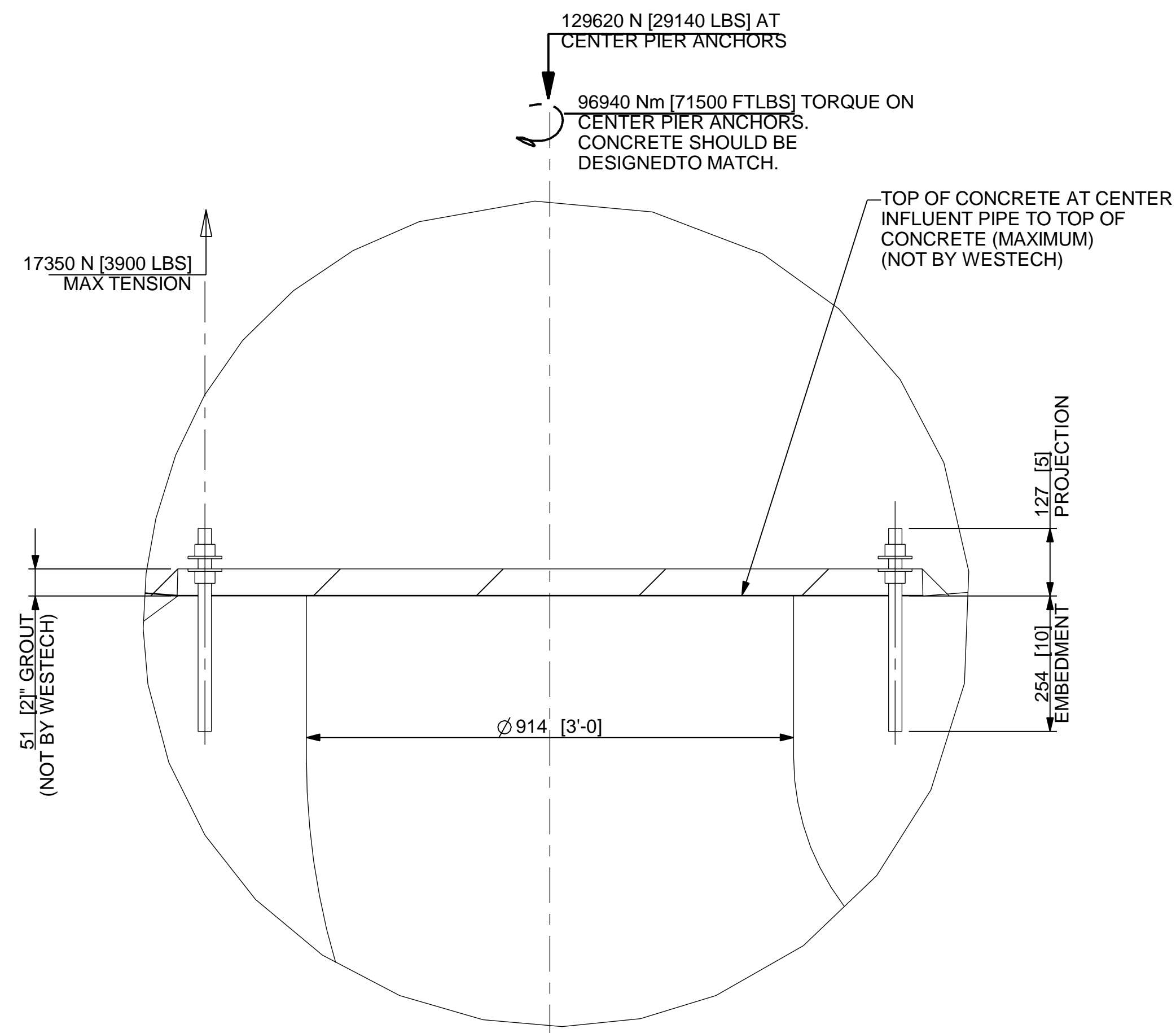
Ø 32004 [105'-0"] SECONDARY CLARIFIER 8

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DESIGNER	CHECKER	APPROVER	DATE
RI62	SA103	ME75	2023-08-28
JOB NUMBER	DOCUMENT NUMBER		REV
24946C	0003408851		3 OF 5



DETAIL 2
SCALE 0.055



DETAIL 3
SCALE 0.125

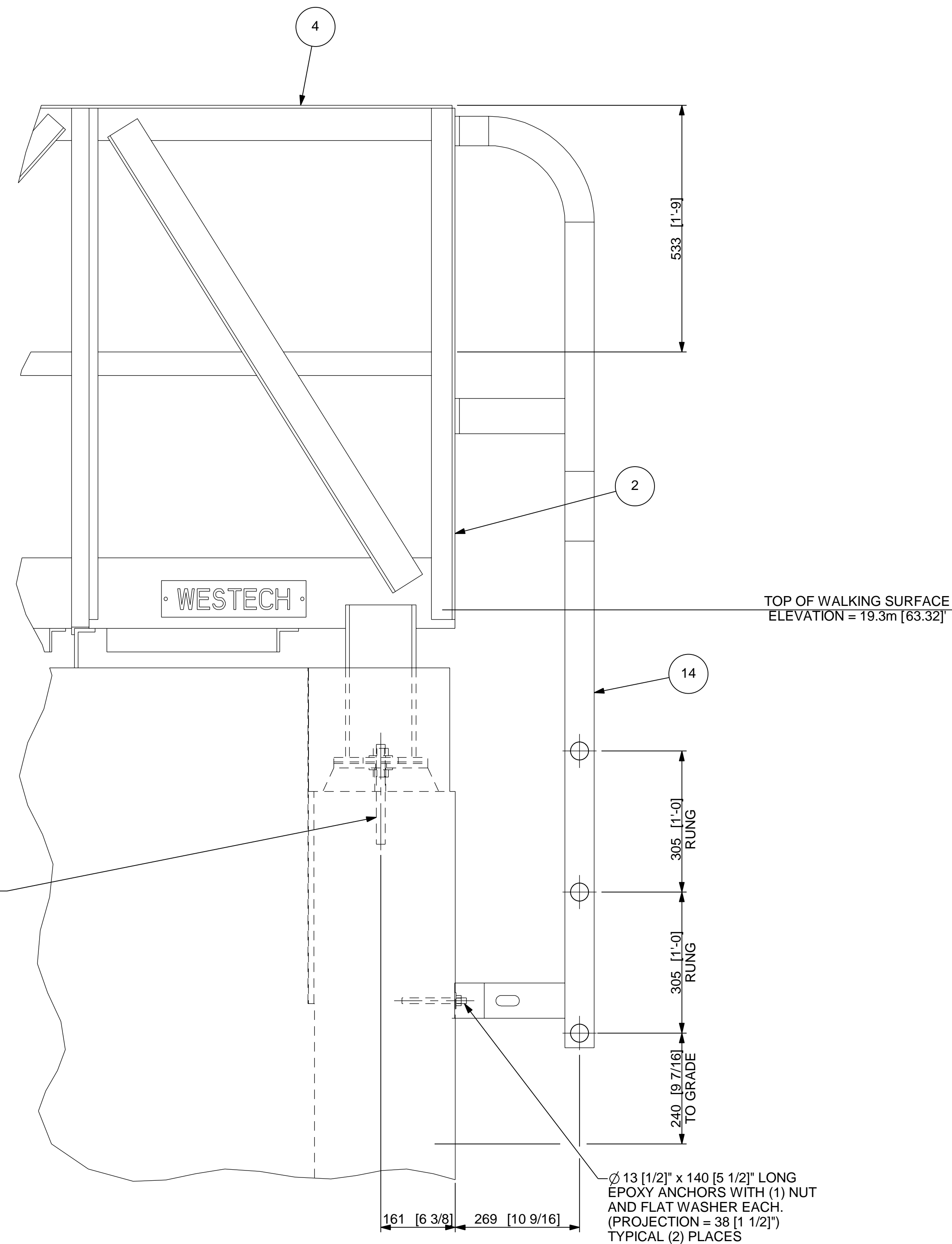
1. CONCRETE DESIGN IS NOT BY WESTECH. IT IS THE RESPONSIBILITY OF THE ENGINEER TO ENSURE THAT THE CONCRETE IS ADEQUATE TO SUPPORT THE LOADS SHOWN ON DRAWINGS.
2. ALL LOADS ARE NON-FACTORED UNLESS NOTED OTHERWISE.
3. INFLUENT, EFFLUENT, SLUDGE, AND SCUM PIPE LOCATION PER ENGINEERS DRAWINGS.
4. STANDARD HOLE CLEANING FOR THREADED ROD REQUIRED. REFER TO EPOXY MANUFACTURER'S RECOMMENDED CLEANING REQUIREMENTS.
5. WESTECH RECOMMENDS STRUCTURAL GRADE CONCRETE BE ADDED TO THE INNER EDGE OF THE SLUDGE PIT TO INCREASE CENTER COLUMN ROD ANCHOR EDGE DISTANCE.

**WESTECH®**

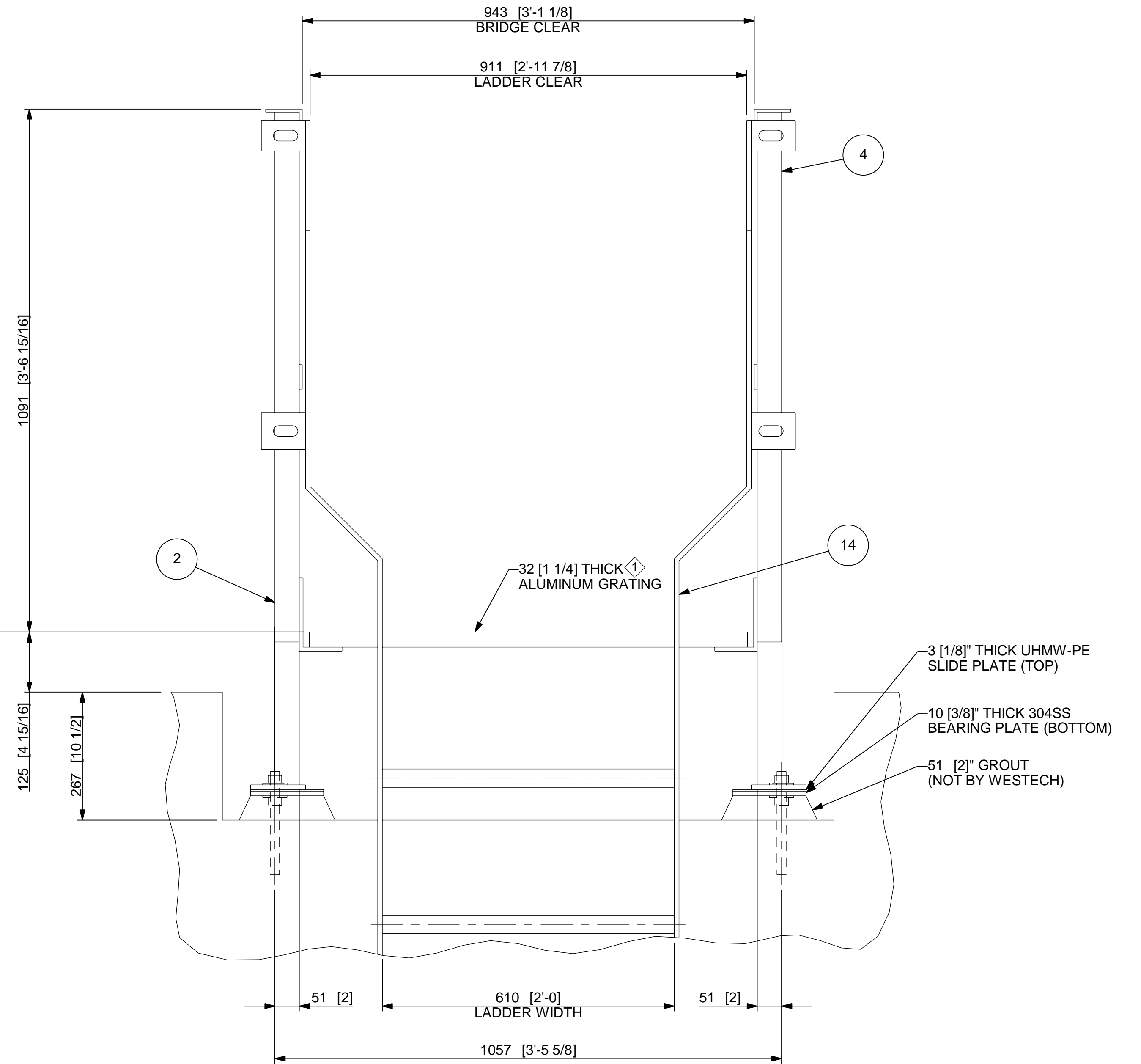
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TITLE: **GENERAL ARRANGEMENT**
Ø 32004 [105'-0] SECONDARY CLARIFIER 8
COPC1G

DESIGNER	CHECKER	APPROVER	DATE	
RI62	SA103	ME75	2023-08-28	
JOB NUMBER	DOCUMENT NUMBER		SHEET	REV
24946C	0003408851		4 OF 5	-



WALKWAY TO TANK WALL

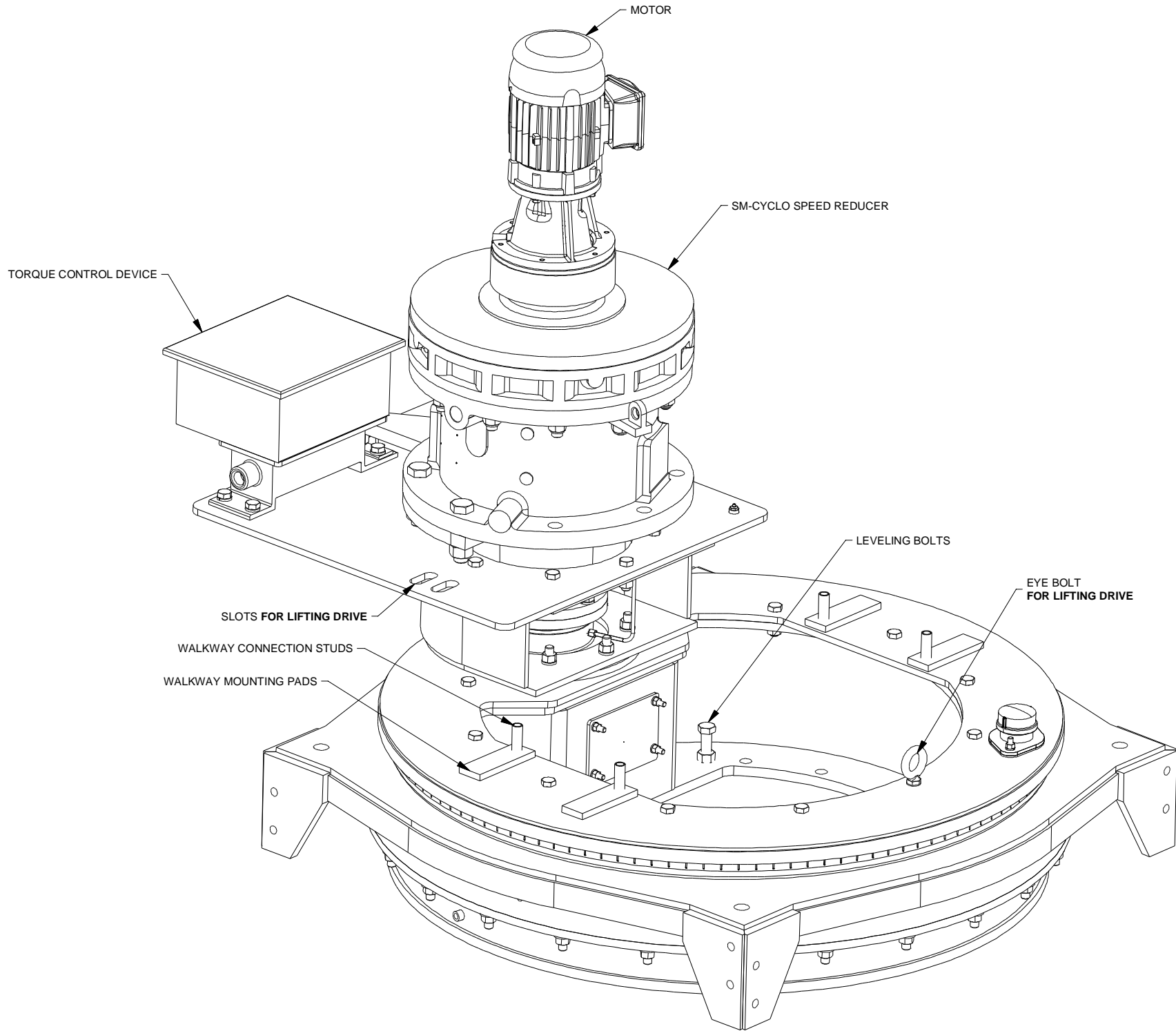


NOTES:

- 1 GRATING USES SELF-TAPPING SCREWS THAT REQUIRE FIELD DRILLED PILOT HOLES.



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24946C	0003408851		5 OF 5
			REV
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NOTES:

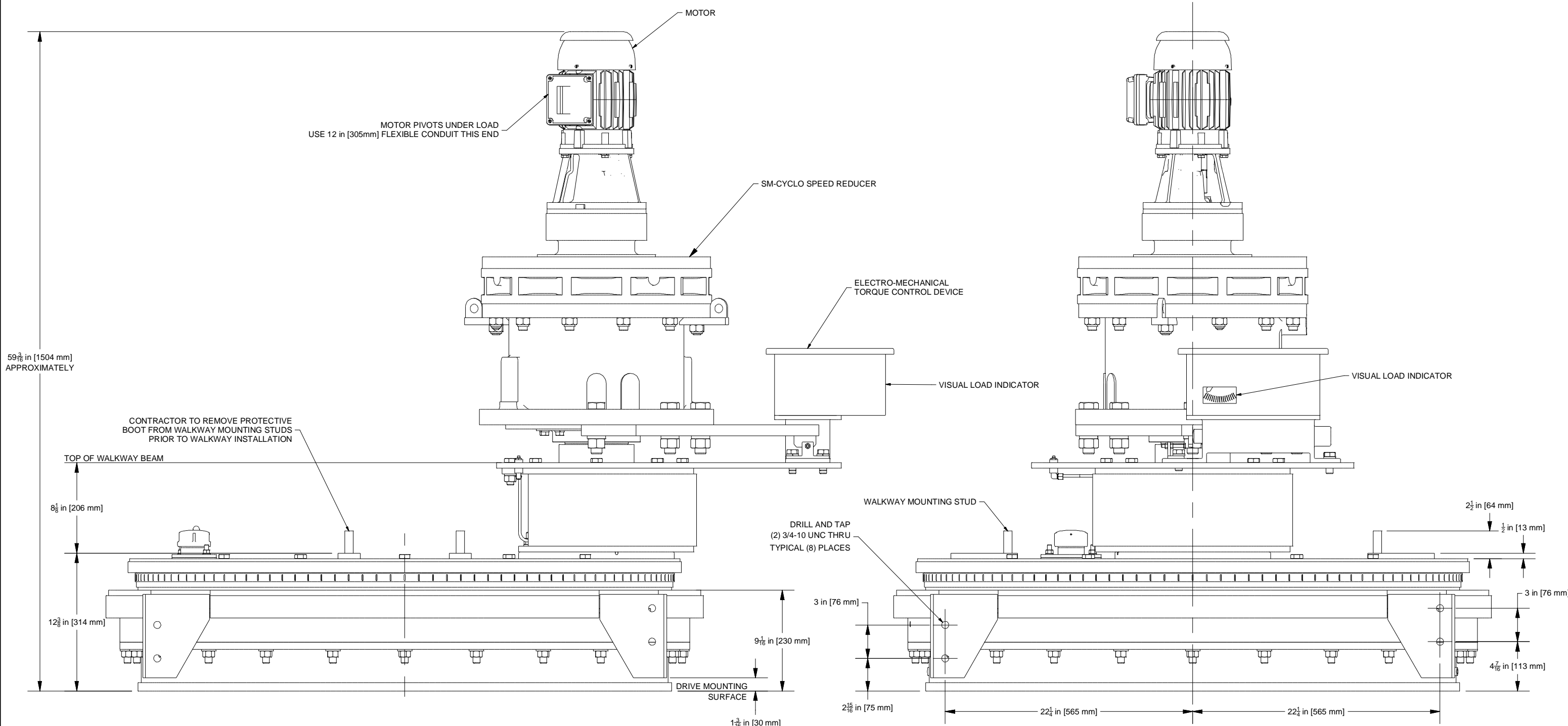
1. FOLLOW THE LISTED WESTECH REFERENCE DOCUMENTS EXCEPT AS NOTED ON THIS DRAWING.
2. LIFT DRIVE USING ONLY THE LIFT POINTS NOTED ON THE GENERAL ARRANGEMENT DRAWINGS. DO NOT LIFT THE DRIVE USING LIFTING EYES LOCATED ON REDUCER OR MOTOR.
3. CONTRACTOR TO REMOVE PROTECTIVE BOOT FROM WALKWAY MOUTING STUDS PRIOR TO WALKWAY INSTALLATION.

APPROX. TOTAL WEIGHT (LB)
3946
APPROX. TOTAL WEIGHT (KG)
1790

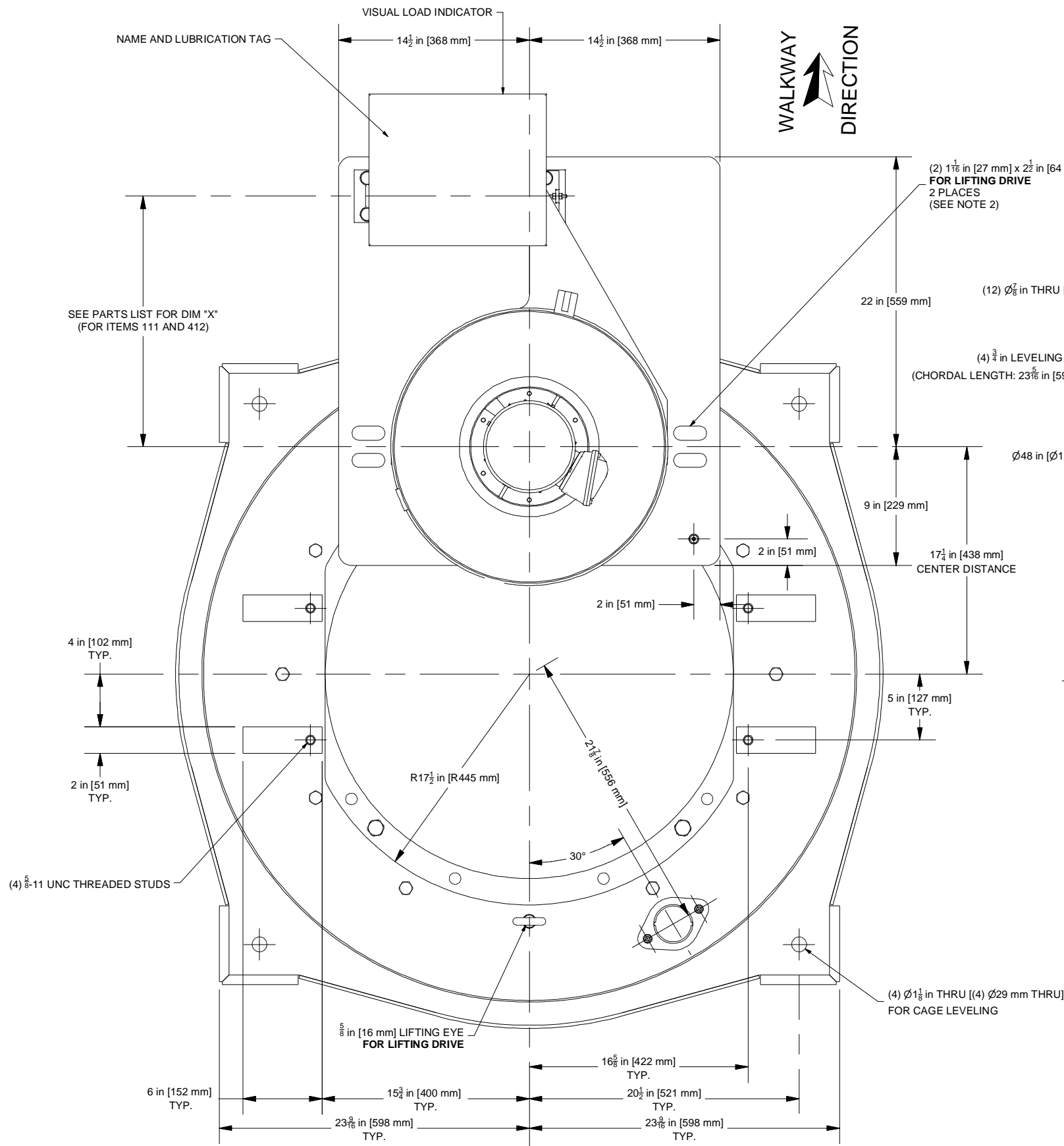
APPROXIMATE DIMENSIONS: 54in [1372mm] X 74in [1880mm] X 60in [1524mm]

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TITLE CAGE DRIVE GENERAL ARRANGEMENT				
42" (1067mm)				
DESIGNER	CHECKER	APPROVER	DATE	
RH00	HU72	AM73	12/6/2022	
JOB NUMBER	DOCUMENT NUMBER		SHEET	REV
-	0002875869		1 OF 3	-
REFERENCE DOCUMENTS				

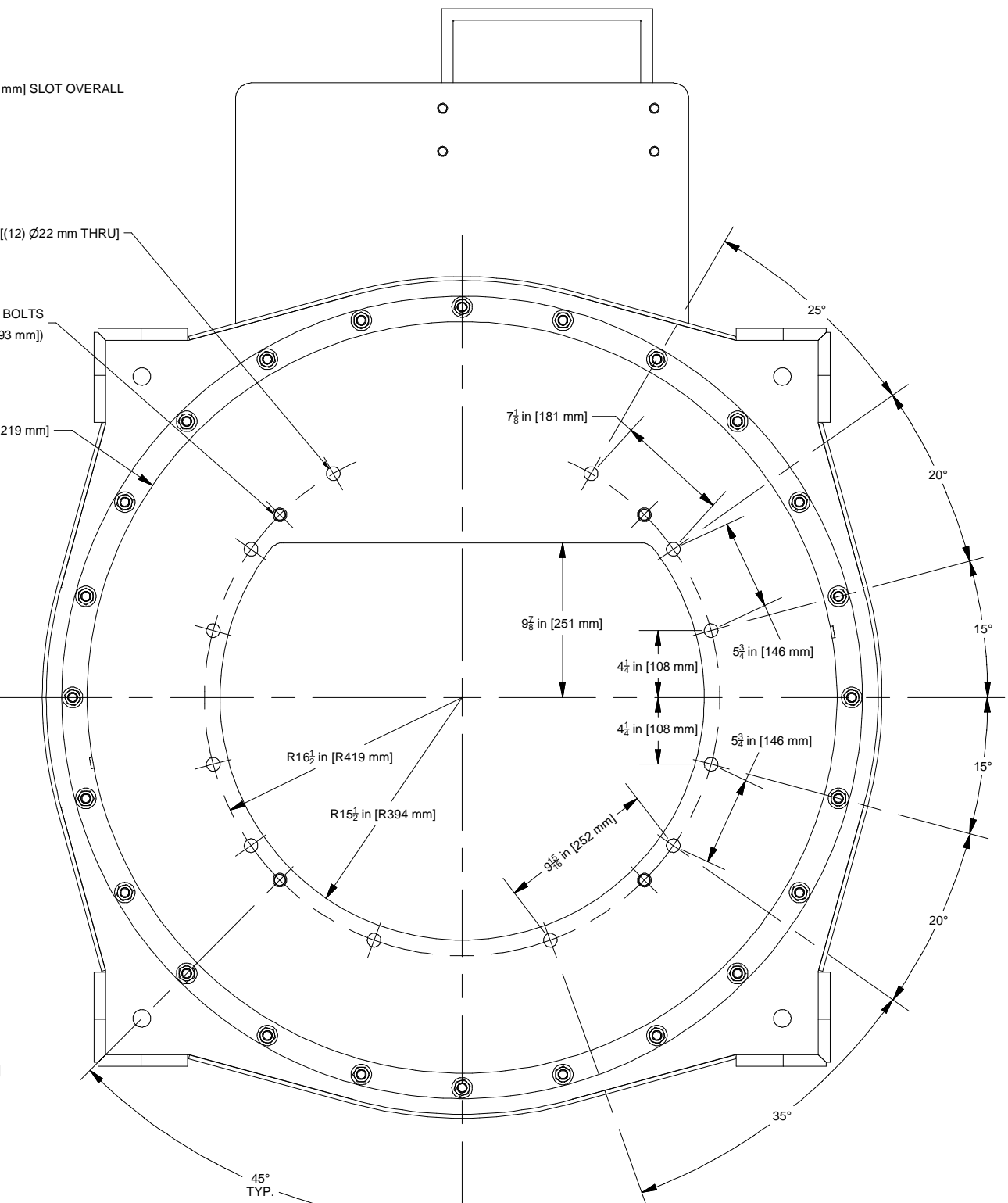
REV	REVISION DESCRIPTION	ECN	DESIGNER	APPROVER	DATE
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JOB NUMBER	DOCUMENT NUMBER		SHEET	REV
-	0002875869		2 OF 3	-



TOP VIEW



BOTTOM VIEW

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JOB NUMBER	DOCUMENT NUMBER		SHEET	REV
-	0002875869		3 OF 3	-



BY: HU72
DATE: 6/12/2023

CHKD: BO13
DATE: 6/13/2023

CUSTOMER INFORMATION

PROJECT NUMBER: 24946C
PREPARED FOR: BRANTFORD WWTP

DRIVE RATING INFORMATION

MOMENTARY PEAK TORQUE	71,500 FT-LBS	200 %	(96,940 NM)
FULL DIAL TORQUE	57,200 FT-LBS	160 %	(77,552 NM)
BACKUP CUTOUT SWITCH TORQUE	50,050 FT-LBS	140 %	(67,858 NM)
CUTOUT SWITCH TORQUE	42,900 FT-LBS	120 %	(58,164 NM)
ALARM SWITCH TORQUE	35,750 FT-LBS	100 %	(48,470 NM)
CONTINUOUS TORQUE	35,750 FT-LBS	100 %	(48,470 NM)

LUBRICATION

RAKE

MAIN GEAR AND PINION: OIL
MAIN BEARING: GREASE
REDUCER: GREASE

SPEED

RAKE

0.04 RPM
13 FPM (4.1 MPM)

DIRECTION OF ROTATION

RAKE

CLOCKWISE

MOTOR INFORMATION

RAKE

1 HP (0.75 KW)
575 VAC\3 PH\60 HZ
1750 RPM
CANOPY

TORQUE CONTROL DEVICE INFORMATION

3 LIMIT SWITCHES
TRANSMITTER W/4-20mA OUTPUT