Structural Work Plan

Revision: 5

October 7, 2024

LOWER DUWAMISH WATERWAY

Upper Reach Remedial Action

Contract KC001065

Prepared By:

Pacific Pile&Marine

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1.0 Introduction

This submittal plan outlines the methodologies, equipment, and quality control measures for the installation of Steel Pipe Piling, Bulkhead Wall Systems, and Outfall Energy Dissipation Structures, as specified in Specification Sections 31 62 10, 32 32 10, and 33 05 25 of the project specifications. The plan ensures compliance with project requirements and environmental regulations.

2.0 Steel Pipe Piling

2.1 Scope of Work & Schedule

The scope of work involves the installation of 2 new steel pipe piles. The pilings would be installed after the completion of material placement activities in SMA 6 & 7 and take approximately 1 day to install.

2.2 Equipment and Materials

Materials

- **Steel Pipe Piling**:
  - **Materials**: Conforming to ASTM A252 Grade 3, seamless or welded and API 5Lx42 or API 5Lx52 standards. Supplied in a single length
  - **Coating:** Will be applied per Specification Section 31 62 10, Articles 2.01.B.1 and 09 90 62

Equipment

- **Vibratory Hammer**: The hammer utilized for pile installation will be an APE 200. The Ape 200 Vibratory hammer has a drive force of 201 US tons, and a total weight of 8,330 lbs.
- **Crane**: For bulkhead installation PPM will utilize an American 9310 derrick crane. The 9310 was built in 1979 and is a crawler crane rated to lift 225 tons. It will be outfitted with 150’ of boom and is powered by a Cummins 855 diesel engine.
- **Construction Barge**: For bulkhead wall installation and pipe pile installation PPM will utilize the PamTay. Pamtay is a 200’ x 50’ x 12. The barge is outfitted with two heavy duty spuds for anchoring and stability once it is in the desired location. The spuds on the PamTay are 90 feet long allowing it to anchor itself in 60+ feet of water

2.3 Methods and Procedures

Construction Preparations

- **Reference Section:** The following specification sections will be utilized in the construction preparations:
  - 01 78 39
  - 09 90 62
  - 31 62 10, Articles 1.07.B & 3.04
  - 32 32 10, Articles 1.05.A and H

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- Submittals: The following will be submitted during construction prior to actual work activity being performed:
  - Steel Piling Shop Drawings
  - Steel Piling Material Certifications
  - Pile Coating Product Data & SDS sheets
    - Epoxy-Polyamide
    - Primer
    - Thinner
    - Blasting Media
  - Pile Coating Inspector Certification
  - Pile Coating Sample Inspection Report Form
  - Pile Coating Samples per Specification Section 09 90 62, Article 3.05,A.3
  - Pile Coating Completed Inspection Report Form
  - Welding certifications for personnel that will perform welding (Attachment A)
- **Pre-Installation Conference**: PPM shall host, and any subcontractors shall attend, a conference at the Work Site prior to Steel Pipe Piling installation.
- **Delivery and Handling**: Deliver Steel Pipe Piling in quantities and at times to ensure continuity of installation. Handle and store Steel Pipe Piling to prevent physical damage.
- **Surveying**: A Registered Professional Land Surveyor shall establish Steel Pipe Piling locations.

Construction

- **Removal & Demolition of Existing Piles**:
  - Please refer to the Demolition Plan and the Transload & Disposal plan for details regarding the removal and disposal of the existing timber piling.
- **Installation Procedures**:
  - Prior to driving, Steel Pipe Piling shall be marked at 1-foot intervals for the full pile length, beginning at the bottom. Pile lengths shall be marked on the pile at 5-foot intervals.
  - Measure the vertical distance from the driving platform to the waterway bed.
  - Lift and set up pile with its tip touching the waterway bed.
  - Drop the pile under its own weight; measure the penetration depth after the downward movement stops.
  - Install the pile to the estimated embedment depth as determined in Drawing S140If rapid penetration to specified tip depth occurs, return after 24 hours and continue driving piles using a vibratory hammer to evaluate pile setup or freeze-back as requested by the Project Representative to confirm that pile capacity is satisfactory.
- **Monitoring and Documentation**:
  - Mark piles at 1-foot intervals and record penetration depths during driving.
  - Use a vibratory hammer to achieve required embedment without distortion.
  - Maintain axial alignment of piles during installation.
  - Monitor and document daily and weekly installation activities.
  - **Environmental Procedures**: Please refer to the Water Quality Control Plan for methodologies to prevent discharge of sediment into the water.

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- **Tolerance**: PPM shall install piling with a maximum variation of 3 inches off-center from the location shown in the accepted submittal package. Steel Pipe Piling shall not be out of plumb more than 0.5%.

Post-Construction

- **Field Surveys**: PPM will conduct field surveys to verify pile locations and plumbness after installation. PPM's Professional Land Surveyor subcontractor, Marker Offshore, shall make a field survey of completed Steel Pipe Piling work. Please refer to the Survey and Positioning Control Plan for additional details.
- **As-Built Drawings**: PPM will submit As-Built Drawings
- **Cutoffs:** Any pile cutoffs generated during installation will be recycled as scrap steel.

2.4 Quality Control

Inspections and Testing:

- **Weld Procedures, Certifications and Inspections**: Weld procedures, certifications of welders, and visual inspections and testing of welds as per AWS D1.1 standards.
- **Project Representative**: Regular monitoring by Project Representative to ensure compliance with specifications. PPM shall notify the Project Representative in writing at least 3 days before commencing Steel Pipe Piling installation.
- **Coordination**: Coordinate with the Project Representative throughout the installation process. Adjustments to the embedment length of the Steel Pipe Piling will be required based on actual soil conditions encountered.
- **Suspension of Work**: The Project Representative will suspend piling pulling or installation if field observations indicate performance issues, including material, subsurface conditions, or other issues that will cause unsatisfactory pile performance.

3.0 Bulkhead Wall Systems

3.1 Scope of Work

Construction of bulkhead walls using steel sheet piles, corner piles, cement grout, reinforcement bars, and necessary structural components as per project Drawings S121, S125, and S131.

3.2 Equipment and Materials

Equipment

- **Vibratory Hammer**: The hammer utilized for pile installation will be an APE 200. The Ape 200 Vibratory hammer has a drive force of 201 US tons, and a total weight of 8,330 lbs.
- **Crane**: For bulkhead installation PPM will utilize an American 9310 derrick crane. The 9310 was built in 1979 and is a crawler crane rated to lift 225 tons. It will be outfitted with 150' of boom and is powered by a Cummins 855 diesel engine.
- **Construction Barge**: For bulkhead wall installation and pipe pile installation PPM will utilize the PamTay. Pamtay is a 200' x 50' x 12. The barge is outfitted with two heavy duty spuds for anchoring and stability once it is in the desired location. The spuds on the PamTay are 90 feet long allowing it to anchor itself in 60+ feet of water

- **Cement Delivery System**: Cement will be delivered via cement truck and placed via a concrete pump truck (Attachment D).

Materials

- **Steel Sheet Piles**: Conforming to ASTM A572 Grade 50.
- **Corner Piles**: Conforming to ASTM A328, Grade 50 with a minimum web thickness of 1/2 inch.
- **Cement Grout**: Conforming to ASTM C1107 and CRD-C-621 standards. Cement grout shall be non-shrink and washout resistant.
- **Reinforcement**:
  - **Bars:** ASTM A615, grade 60
  - **Bending:** ACI 318
  - Fabricate reinforcement to the required shapes and dimensions, within fabrication tolerances stated in the Concrete Reinforcing Steel Institute Handbook (2008).

3.3 Methods and Procedures

Construction Preparations:

- **Submittals**:
  - Shop drawings for steel sheet piles, corner piles, tip protection, and other structural steel components, indicating all welding with American Welding Society (AWS) symbols (Attachment C) Interlock tension strength test report conforming to steel sheet piling manufacturer's standard test (Attachment B)
  - Reinforcing bar shop and placement drawings
  - Cut sheets of reinforcing bar mat side form spacer
  - Cement cut sheets (Attachment D)
  - Comprehensive work plan for cement production and placement per 32 32 10, 1.04, B.1.h
  - Installer qualifications showing a minimum of 5 years' experience in constructing similar bulkhead wall systems (Attachment B)
- **Pre-Installation Conference**: PPM shall host, and any subcontractors shall attend, a conference at the Work Site prior to shoring system installation.
- **Site Preparation**: Locate and protect structures, utilities, and other construction from damage caused by bulkhead installation.
- **Alignment Considerations**: The alignment of the sheet pile walls bisects mounds of Identified Debris that directly rest against the existing bulkhead. PPM will need to remove all debris located in the alignment of the new bulkhead wall. PPM will have the Hitachi EX1200-6 remove the debris several days prior to the sheet pile installation. Please refer to Appendix J of the RAWP for details regarding the removal of debris.

  PPM will protect Outfall 2075 during debris removal by loading its location into the 1200-6 machine control software and set a minimum 5' offset so the operator does not place the bucket near it. During sheet pile installation the location of the outfall and a minimum 5' offset will be staked with high-visibility indicators for the crane operator and piledrivers to avoid.

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Construction:

- **Sheet Wall Installation Procedures**:
  - Mark sheet piles at 1-foot intervals for the full pile length, beginning at the bottom. Pile lengths shall be marked at 5-foot intervals.
  - The sheet pile will be fed from the stockpile located on the barge. The pile will be picked from the top end, lying horizontal, utilizing the picking hole and a quick release clamp. The pile will be lofted and stabbed into the template utilizing the crane. All sheets will be picked with a single line. Interlocks shall be inspected prior to lofting to ensure they are undamaged and free-sliding.
  - Work shall begin at one end of the wall and proceed to the termination point at the other end of the wall.
  - Remove debris prior to lifting and setting sheet pile.
  - Lift and set the sheet pile with its tip touching the waterway bed making sure it is plumb and weld off to the template. The pile template for the steel sheet piles will consist of (3) 14" H-piles. Piles will be driven on the offshore side of the existing bulkhead wall at approximately 10-20' spacing using a vibratory hammer. A 24" H-beam, spanning the length of two of the three piles, will be surveyed into position, and set for the piles to be driven against. Saddles welded onto the H-pile will allow for the beam to be set in plan location if the piles are not on exact location. Piling and beams will be relocated from north to south throughout the sheet pile installation to facilitate the work.
  - Hand-threaded the next sheet utilizing a snipe of the interlock.
  - Continue to set and weld a few more sheets to the template, making sure the sheets are always plumb in each direction. Temporary welding on interlocks shall not be performed without Engineer approval. Temporary welds shall be removed by grinding and shall be flush with the original surface. Temporary welds shall not be driven through.
  - Remove the temporary weld on a sheet that has a pile welded on either side by grinding smooth with the original surface; drive down 5-feet to help secure the wall and weld back up after driving. Sheets shall be driven in increments to the required tip elevation. The tip of any sheet pile shall not be more than 5-feet below that of any adjacent sheet pile.
  - If obstructions restrict driving a pile to the specified tip elevation, the obstructions shall be removed.
  - Continue setting sheets and welding off, working from one end of the wall towards the other end, driving sheets as necessary to maintain stability.
  - Drive all piles to form a relatively straight line between the termini points and within 6 inches of the face indicated on the Drawings.
  - Drive each individual sheet pile plumb and within a 2% verticality.
  - Monitor existing bulkheads for movement during construction.
  - A ¾" closure plate will be driven to a minimum tip elevation of 0.0 MLLW at each end of the bulkhead wall. The plate will be driven to connect the existing bulkhead wall sheet pile to the new wall sheet pile, with field welding of the exposed edges to create a seal to contain grout during the tremie pours.
- **Means & Methods**

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- PPM will install the bulkhead wall from the PamTay utilizing the 9310 American crane.
- All sheet pile shall be installed using templates to establish and maintain correct location and alignment and to provide sheet pile support during installation. Templates shall be constructed of structural steel and will be supported by driving an HPx89') or a 24" x .500 pile on each end of the template with an H-beam welded horizontally at an approximate elevation.

Cement Placement:

Cement will be placed at the bulkhead using an extendable pump truck positioned on CenterPoint properties. This approach will provide the highest level of protection for water quality and worker safety. Equipment specifications for the pump truck can be found in Attachment D.

Scope of Work

This plan covers the delivery, pumping, and placement of concrete the bulkhead wall utilizing a pump truck to efficiently deliver the concrete to the required locations. The plan also includes pre-placement preparation, equipment setup, placement procedures, and post-placement activities.

Responsibilities:

- **Project Manager:** Overall responsibility for coordinating the concrete placement, ensuring all team members understand their roles, and managing communication between the concrete supplier, pump truck operator, and placement crew.
- **Superintendent:** On-site management of the placement process, including ensuring safety protocols are followed, monitoring the quality of concrete, and managing the crew.
- **Pump Truck Operator:** Responsible for the setup, operation, and cleaning of the pump truck, as well as the safe delivery of concrete to the placement site.
- **Concrete Crew:** Responsible for placing, leveling, and finishing the concrete as it is delivered.

Pre-Placement Preparation:

- **Site Preparation:**
  - Ensure the site is clear of obstacles and debris that could interfere with the pump truck or concrete placement.
  - Confirm that all formwork and reinforcement are correctly positioned and securely fixed according to the design specifications.
  - Clean reinforcing steel of mill rust scale or other coatings that will reduce bond.

    - Reinforcing shall be braced/supported such that it is properly situated and aligned between the sheet piles, with clearances indicated on the Drawings, and maintained during cement placement.
        - Do not release vertical support of the reinforcing bars until cement has cured for 2 days.
- **Concrete Mix Verification:**
    - Confirm the concrete mix design meets the project specifications, including the required strength, slump, and any additives.
    - Coordinate with the concrete supplier to ensure the delivery schedule aligns with the placement plan.
- **Pump Truck Setup:**
    - Position the pump truck on a stable, level surface, ensuring it is within reach of the placement area while maintaining safe distances from the formwork and any overhead obstructions.
    - Extend the outriggers of the pump truck to provide stability during operation.
    - Attach the needed length and type of hoses for the specific placement requirements, ensuring they are securely connected and free of blockages.
    - Conduct a pre-operation check of the pump truck to ensure it is in proper working condition, including checking hydraulic systems, hose connections, and controls.

Concrete Placement Procedure:

1. **Initial Placement:**
    - Start by pumping a small amount of concrete to check for proper flow and consistency. Adjust the mix or pump settings as needed based on feedback from the crew.
    - The pump truck will extend the boom (198’) with its integrated 5.5” line out to the south bulkhead first.
    - Placement will start at the farthest southern portion of the southern bulkhead point and work back toward the truck to minimize the need for boom and hose movement.
2. **Continuous Monitoring:**
    - Continuously monitor the concrete flow, adjusting the pump speed to match the rate at which the crew can place and finish the concrete.
    - Ensure that the concrete is placed as close to its final position as possible to minimize rehandling.
3. **Placing Concrete:**
    - Maintain a consistent flow of concrete to avoid segregation and ensure uniform compaction. Avoid over-pumping or excessive pressure, which can cause formwork damage or blowouts.
    - Keep communication open between the pump operator and the crew to manage the pace and direction of placement.
4. **Handling Delays:**

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- If there is a delay in placement, keep the concrete in the hoses moving by cycling the pump at low speed or by periodically discharging a small amount of concrete.

5. **Laitance Avoidance and Removal:**
   - Mix Design: Use a mix design that minimizes the water-to-cement ratio and includes proper aggregate gradation and admixtures to reduce the risk for laitance.
   - Surface Management: Monitor the surface of the placed concrete and remove any excess water or fine particles (laitance) using a screed or float as needed.
6. **Equipment and Procedure for Water and Grout Displacement:**
   - Overtopping Prevention: Monitor the volume of displaced water or grout during the placement to prevent overtopping. Use water-tight forms and containment barriers around the placement area to capture and manage displaced water.
   - Full Capture and Management: A collection system of a pump and storage tank will be employed to capture displaced water or cement, preventing its release into adjacent surface water. The captured water will be treated or disposed of in accordance with environmental regulations.
7. **Contingency Plan:**

   - Accidental Discharge: In the event of an accidental discharge of cement or displaced water into the waterway, immediately stop the placement operation and deploy containment booms or absorbent materials to prevent the spread of contamination.
   - Blockage of Pipe: If a blockage occurs, the crew will immediately cease pumping, flush the pipe with water or air, and attempt to clear the blockage using required tools. If the blockage cannot be cleared, the pipe will be relocated or replaced as necessary.
   - Have backup equipment on standby, such as an additional pump or extra hoses, to quickly address any equipment failures.
   - Prepare for adverse weather conditions by having protective coverings and materials ready to shield the concrete and equipment.

8. **Post-Placement Activities:**
   - After placement, the concrete will be leveled and finished according to project specifications.
   - Pay special attention to edges and corners to ensure they are properly filled and finished.
   - Conduct a final inspection of the placed concrete to ensure it meets the required quality standards and project specifications.
   - Document any issues or deviations from the plan and take corrective action if necessary.
9. **Communication and Documentation:**
   - Maintain clear communication between all team members throughout the placement process.

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- Record all relevant data, including concrete mix details, pump settings, placement start and finish times, weather conditions, and any issues encountered.

Post-Construction:

- **As-Built Drawings**: Submit As-Built Drawings showing bulkhead wall locations and extent within 10 days of completing work.

3.4 Quality Control

- **Monitoring and Documentation**:
  - Continuous monitoring and documentation of installation activities.
  - Regular field inspections to ensure compliance with project specifications.
  - Submit a summary of daily bulkhead installation activities as part of the Daily Construction Report.
  - Submit a summary of the week's bulkhead installation activities and anticipated installation activities to be completed in the following week as part of the Weekly Construction Report.
- **Project Representative**: The bulkhead wall system shall not be installed except in the presence of the Project Representative. Notify the Project Representative in writing at least 3 days before commencing bulkhead wall system installation.
- **Welding Standards**: Qualify welding procedures and personnel according to AWS D1.1. The County's inspector will provide inspection for all field welds.

3.5 Disposal

- **Material Disposal**: PPM shall remove cutoff sections of the sheet piles from the Work Site and recycle them as scrap steel.

4.0 Outfall Energy Dissipation Structures

4.1 Scope of Work

Installation of outfall energy dissipation structures to manage and dissipate energy from discharged water as indicated in Drawings S200-203.

4.2 Equipment and Materials

Equipment

The outfall energy dissipations structures will be installed with the same equipment used to dredge. For outfall 2093 it will be installed with the FlexiFloat barge and 470 excavator. For outfall 2073 it will be installed with the Lash barge and 1200-6 excavator.

Materials

- **Gabions and Gabion Mattresses**:

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- Gabions shall be rectangular wire mesh containers uniformly partitioned into internal cells by diaphragms positioned approximately 3 feet on centers, interconnected with other similar units, and filled with stone at the Work Site to form a flexible and permeable structure.
- Gabion Mattresses are similar but have smaller height and mesh openings.
- Welded wire fabric meeting the requirements of ASTM International (ASTM) A974, Style 2, fabricated using uncoated steel wire conforming to ASTM A853, with the fabric subsequently zinc-coated by the hot dip process, and overcoated with polyvinyl chloride (PVC)
- b. Double-twisted hexagonal wire mesh meeting the requirements of ASTM A975, Style 1 or Style 3, fabricated using soft-temper galvanized steel wire, Class 3 coating, in accordance with ASTM A641, and overcoated with High Abrasion Resistant polymer
- For Gabions, the mesh opening shall not exceed 4-1/2 inches, and its area shall not exceed 10 square inches.
- For Gabion Mattresses, the maximum linear dimension of mesh opening shall not exceed 3-1/4 inches.
- Wire for Gabions, Gabion Mattresses, and lacing shall have a minimum tensile strength of 60,000 pounds per square inch.

- **Geotextile Filter Fabric**:
  - Meeting the minimum physical requirements listed in Table 33 05 25-1.
- **Stone Fill**:
  - Rocks shall be hard, angular to round, durable, and of such quality that they shall not disintegrate on exposure to water or weathering during the life of the structure. Fill shall conform to the requirements of ASTM D6711.
  - Gradation:
    - Gabion basket, 4 to 8 inches
    - Gabion Mattress basket, 3 to 5 inches

The range in sizes shall allow for a variation of 5% oversize and/or 5% undersize rock by weight. In all cases, the sizes of any oversize rock shall allow for the placement of three or more layers of rock within each compartment. In all cases, undersize rock shall be placed within the interior of the compartment and shall not be placed on the exposed surface of the structure.

4.3 Methods and Procedures

Construction Preparations:

- **Submittals**:
  - Filter fabric product data
  - Gabion and Gabion Mattresses product data and drawings
  - Stone fill gradation and chemical testing
- **Site Preparation**:
  - The area will be smoothed by relocating surface projections (debris, riprap, etc.), as necessary for proper placement of the Gabions or Gabion Mattresses, as indicated on the Drawings or as directed by the Project Representative. Surface preparation or placement of selected or special bedding material in preparing the surface shall be as indicated on the Drawings or as directed by the Project Representative. Where Amended Cover is used, Amended Cover shall be

placed and smoothed as the Gabion bedding material as depicted on the Drawings. Place geotextile fabric under and behind the baskets as indicated on the Drawings or directed by the Project Representative.

Construction:

- **Gabion and Gabion Mattress Assembly and Placement**:
  - Assemble gabion baskets at the Work Site into specified sizes. They shall be of single-unit construction.
  - Place the baskets in their proper positions for slope and alignment as shown on the Drawings or as directed by the Project Representative. Slope faces of gabions 1 (horizontal) to 6 (vertical) unless otherwise shown.
  - Connect adjacent baskets at vertical corner edges and diaphragms. Stacked gabions are also to be connected at horizontal edges, front and back, using lacing or steel ring fasteners.
  - Fill each basket with specified stone fill, ensuring maximum density without bulges and compact, dense exposed face.
  - Gabions 3 feet high shall be filled in three lifts, 1 foot at a time, with each lift oriented as necessary.
  - For exposed cells, install connecting wires between each lift to maintain alignment.
- **Final Placement**:
  - Fasten the lids in place at edges and diaphragms as specified above. If using steel ring fasteners, spacing shall not exceed nominal 5 inches (±1.0 inch).

Post-Construction:

- **Submittals**:
  - Submit As-Built Drawings showing the location and extent of the installed outfall energy dissipation structures within 10 days of completing work.

4.4 Quality Control

Monitoring and Documentation:

- Conduct daily inspections and document construction activities daily to ensure compliance with specifications.
- Continuous monitoring of the installation process to ensure alignment, density, and structural integrity.
- Include daily and weekly summaries of installation activities as part of the Daily and Weekly Construction Reports.

Compliance:

Ensure all work is conducted in accordance with the environmental provisions of relevant local, state, and federal regulations, as listed in Specification Section 01 41 00 (Environmental Regulatory Requirements).

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Attachment A - Welder Certifications

Washington Association of Building Officials
PO Box 7310, Olympia, WA 98507
360-628-8669 ◆ www.wabo.org

CERTIFIED WELDER

MARC E CAREY

[redacted]

WELDER ID: W13997

EXPIRES: JAN 1, 2025

Renew on or before expiration date

The welder named on this card is certified for the following:

Structural Steel: SMAW, Plate, All Positions, Up, E7018, F-4 & lower, 1/8" & over, w/backing
Structural Steel: FCAW, Plate, All Positions, Up, E71T-8, 1/8" & over, w/backing
Sheet Steel: FCAW, All Positions, Down, E71T-GS, 1/16"-1/8", w/o backing
Reinforcing Steel: FCAW, Bar to Plate, All Positions, Up, E71T-8, No. 4 & Above

WABO welder certified process qualifications are outlined in WABO Standard 27-13 & in accordance with ANSI/AWS D1.1. D1.3. D1.4

THIS CARD IS THE PROPERTY OF WABO

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Attachment B - Installer Qualifications

ID	Project Name	Customer	Location	Contract	Performance Dates	Description
08-001	Dakota Creek Industries Shipyard Redevelopment Phase 1 and 2	Dakota Creek Industries	Anacortes, WA	$14.1M	MAY-2008 - JAN-2010	450-ft OPEN CELL Bulkhead with up to 49-ft of vertical face.
09-005	Small Boat Harbor Entrance Surge Control Project	Municipality of Skagway	Skagway, AK	$3.5M	AUG-2009 - JAN-2010	Partially penetrating vertical wave barrier with public promenade.
09-015	Terminal 115 Berth 1 Modifications	Port of Seattle	Seattle, WA	$3.5M	SEP-2009 - FEB-2010	Barge loading and unloading facility including sheet pile installation, upland and in-water pile driving.
12-013	Don Morse Park Phase I Improvements	KRCI, LLC	Chelan, WA	$0.6M	AUG-2012 - APR-2013	Remove existing and install steel breakwater piling and install steel breakwater frame and paneling.
12-032	Terminal Bulkhead and Pier Repair, Port of Bellingham	Port of Bellingham	Bellingham, WA	$3.4M	SEP-2012 - DEC-2014	Remove existing structures and install combi-wall utilizing W26x104 King Pile and AZ26 paired sheet pile, dewatering, erosion/water pollution control.
14-003	Jorgensen Forge Shoring	Jorgensen Forge Corporation	Seattle, WA	$0.3M	JAN-2014 - MAY-2014	Sheet pile shoring.
14-009	Pier 3 Replacement	City of Kodiak	Kodiak, AK	$29.6M	APR-2014 - SEP-2016	Complete dock structure with crane rail with 400-ft revetment consisting of 45,000 CY of stone. 300-ft OCSP bulkhead wall using PS31 20-ft sheets.
16-009	Chignik Public Dock	AKDOT&PF	Chignik, AK	$12M	JAN-2016 - OCT-2017	Installation of 54,000 SF OCSP bulkhead comprised of (935) sheets backfilled with 73,600 CY material.
16-019	Portage Cove Harbor Expansion	Haines Borough	Haines, AK	$13.3M	NOV-2016 - AUG-2018	Installation of breakwater and steel sheet pile and pipe pile-supported wave barrier.
17-023	Terminal 7 Wharf Rehabilitation	Centerpoint Properties	Seattle, WA	$3.4M	NOV-2017 - MAR-2019	Sheet pile shoring.
18-013	Muckleshoot 1st Avenue Tribal Fishing Facility Improvements	Muckleshoot Indian Tribe	Seattle, WA	$4.5M	NOV-2018 - MAR-2020	Expanding existing fishing port. Replaced the bulkhead with a steel sheet pile bulkhead wall.
20-017	Palmer Station	National Science Foundation via Leidos	Anvers Island, Antarctica	$34.3M	JAN-2021 - JUN-2023	Replacement of existing dock with pile supported dock including fender systems and bulkhead.
24-001	Conway Cofferdams	Hanging H Companies, LLC	Conway, WA	$1.2M	JAN-2024 - APR-2024	Installation of cofferdam shoring system.

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Attachment C- Shop Drawings for Steel Sheet Piles, Corner piles & Protector

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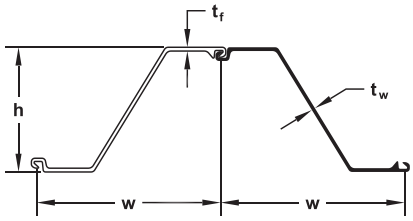
Attachment C- Shop Drawings for Steel Sheet Piles, Corner piles & Protector

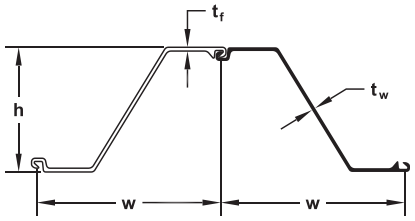
AZ HOT ROLLED STEEL SHEET PILE SERIES



JD FIELDS & COMPANY, INC. A FIELDS COMPANY			THICKNESS			WEIGHT		SECTION MODULUS			COATING AREA	
	Width (w)	Height (h)	Flange (t_f)	Web (t_W)	Cross Sec Area (A)	Single Pile	Wall Area	Elastic	Plastic	Moment of Inertia	Both Sides	Wall Surface
	in	in	in	in	in^2/ft	lb/ft	lb/ft^2	in^3/ft	in^3/ft	in^4/ ft	ft^2/ft of single	ft^2/ft^2
SECTION	mm	mm	mm	mm	cm^2/m	kg/m	kg/m^2	cm^3/m	cm^3/m	cm^4/m	m^2/m	m^2/m^2
AZ 12-770	30.31 770	13.52 344	0.335 8.5	0.335 8.5	5.67 120.1	48.78 72.6	19.31 94.3	23.2 1245	27.5 1480	156.9 21430	6.07 1.85	1.20 1.20
AZ 13-770	30.31 770	13.54 344	0.354 9.0	0.354 9.0	5.94 125.8	51.14 76.1	20.24 98.8	24.2 1300	28.8 1546	163.7 22360	6.07 1.85	1.20 1.20
AZ 14-770	30.31 770	13.56 345	0.375 9.5	0.375 9.5	6.21 131.5	53.42 79.5	21.14 103.2	25.2 1355	30.0 1611	170.6 23300	6.07 1.85	1.20 1.20
AZ 17-700	27.56 700	16.52 420	0.335 8.5	0.335 8.5	6.28 133.0	49.12 73.1	21.38 104.4	32.2 1730	37.7 2027	265.3 36230	6.10 1.86	1.33 1.33
AZ 18-700	27.56 700	16.54 420	0.354 9.0	0.354 9.0	6.58 139.2	51.41 76.5	22.39 109.3	33.5 1800	39.4 2116	276.8 37800	6.10 1.86	1.33 1.33
AZ 19-700	27.56 700	16.56 421	0.375 9.5	0.375 9.5	6.88 145.6	53.76 80.0	23.35 114.3	34.8 1870	41.0 2206	288.4 39380	6.10 1.86	1.33 1.33
AZ 20-700	27.56 700	16.57 421	0.394 10.0	0.394 10.0	7.18 152.0	56.11 83.5	24.43 119.3	36.2 1945	42.7 2296	300.0 40960	6.10 1.86	1.33 1.33
AZ 18-800	31.5 800	17.68 449	0.335 8.5	0.335 8.5	6.07 128.6	54.26 80.7	20.67 100.9	34.2 1840	39.7 2135	302.6 41320	6.82 2.08	1.30 1.30
AZ 20-800	31.5 800	17.72 450	0.375 9.5	0.375 9.5	6.66 141.0	59.50 88.6	22.67 110.7	37.2 2000	43.3 2330	329.9 45050	6.82 2.08	1.30 1.30
AZ 22-800	31.5 800	17.76 451	0.413 10.5	0.413 10.5	7.25 153.5	64.77 96.4	24.68 120.5	40.3 2165	47.0 2525	357.3 48790	6.82 2.08	1.30 1.30
AZ 23-800	31.50 800	18.66 474	0.453 11.5	0.354 9.0	7.12 150.6	63.56 94.6	24.22 118.2	43.3 2330	49.9 2680	404.6 55260	6.94 2.11	1.32 1.32
AZ 25-800	31.50 800	18.70 475	0.492 12.5	0.394 10.0	7.71 163.3	68.91 102.6	26.26 128.2	46.5 2500	53.8 2890	435.1 59410	6.94 2.11	1.32 1.32
AZ 27-800	31.50 800	18.74 476	0.531 13.5	0.433 11.0	8.31 176.0	74.26 110.5	28.29 138.1	49.7 2670	57.6 3100	465.5 63570	6.94 2.11	1.32 1.32
AZ 24-700	27.56 700	18.07 459	0.441 11.2	0.441 11.2	8.23 174.1	64.30 95.7	28.00 136.7	45.2 2430	53.5 2867	408.8 55820	6.33 1.93	1.38 1.38
AZ 26-700	27.56 700	18.11 460	0.480 12.2	0.480 12.2	8.84 187.2	69.12 102.9	30.10 146.9	48.4 2600	57.1 3070	437.3 59720	6.33 1.93	1.38 1.38
AZ 28-700	27.56 700	18.15 461	0.520 13.2	0.520 13.2	9.46 200.2	73.93 110.0	32.19 157.2	51.3 2760	60.9 3273	465.9 63620	6.33 1.93	1.38 1.38
AZ 28-750	29.53 750.0	20.04 509.0	0.472 12.00	0.394 10.00	8.09 171.2	67.73 100.80	27.53 134.40	52.3 2810	60.3 3245	523.9 71540	6.93 2.11	1.41 1.41
AZ 30-750	29.53 750.0	20.08 510.0	0.512 13.00	0.433 11.00	8.73 184.7	73.08 108.80	29.70 145.00	55.9 3005	64.8 3485	561.5 76670	6.93 2.11	1.41 1.41
AZ 32-750	29.53 750.0	20.12 511.0	0.551 14.00	0.472 12.00	9.37 198.3	78.44 116.70	31.88 155.60	59.5 3200	69.2 3720	599.0 81800	6.93 2.11	1.41 1.41
AZ 36-700N	27.56 700	19.65 499	0.591 15.0	0.441 11.2	10.20 215.9	79.72 118.6	34.71 169.5	66.8 3590	76.4 4110	656.2 89610	6.73 2.05	1.47 1.47
AZ 38-700N	27.56 700	19.69 500	0.630 16.0	0.480 12.2	10.87 230.0	84.94 126.4	36.98 180.6	70.6 3795	81.1 4360	694.5 94840	6.73 2.05	1.47 1.47
AZ 40-700N	27.56 700	19.72 501	0.669 17.0	0.520 13.2	11.54 244.2	90.16 134.2	39.26 191.7	74.3 3995	85.7 4605	732.9 100080	6.73 2.05	1.47 1.47
AZ 42-700N	27.56 700	19.65 499	0.709 18.0	0.551 14.0	12.22 258.7	95.51 142.1	41.59 203.1	78.2 4205	90.3 4855	768.4 104930	6.75 2.06	1.47 1.47
AZ 44-700N	27.56 700	19.69 500	0.748 19.0	0.591 15.0	12.89 272.8	100.74 149.9	43.87 214.2	81.9 4405	95.0 5105	806.6 110150	6.75 2.06	1.47 1.47
AZ 46-700N	27.56 700	19.72 501	0.787 20.0	0.630 16.0	13.56 287.0	105.97 157.7	46.14 225.3	85.7 4605	99.5 5350	844.9 115370	6.75 2.06	1.47 1.47
AZ 48-700	27.56 700.0	19.80 503.0	0.866 22.00	0.591 15.00	13.63 288.4	106.49 158.50	46.37 226.40	88.4 4755	102.1 5490	876.2 119650	6.70 2.04	1.46 1.46
AZ 50-700	27.56 700.0	19.84 504.0	0.906 23.00	0.630 16.00	14.30 302.6	111.73 166.30	48.65 237.50	92.2 4955	106.7 5735	914.6 124890	6.70 2.04	1.46 1.46
AZ 52-700	27.56 700.0	19.88 505.0	0.945 24.00	0.669 17.00	14.97 317.0	116.97 174.10	50.93 248.70	95.9 5155	111.3 5985	953.0 130140	6.70 2.04	1.46 1.46

*Indicates standard stocking sections. Please check with your local sales representative for material availability.

AZ HOT ROLLED STEEL SHEET PILE SERIES

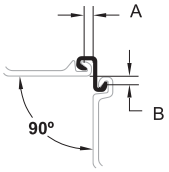


Available Steel Grades

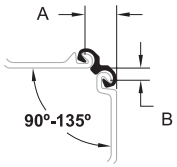
AMERICAN			CANADIAN			EUROPEAN			AMLoCor®**		
ASTM	Yield Strength		ASTM	Yield Strength		ASTM	Yield Strength		ASTM	Yield Strength	
	ksi	MPa		ksi	MPa		ksi	MPa		ksi	MPa
A328	39	270	**Grade 260 W**	38	260	**S240 GP**	35	240	**Blue 320**	46	320
A572 Gr . 42	42	290	**Grade 300 W**	43	300	**S270 GP**	39	270	**Blue 355**	51	355
A572 Gr . 50	50	345	**Grade 350 W**	51	355	**S320 GP**	46	320	**Blue 390**	57	390
A572 Gr . 55	55	380	**Grade 400 W**	58	400	**S355 GP**	51	355			
A572 Gr . 60	60	415				**S390 GP**	57	390			
A572 Gr . 65	65	450				**S430 GP**	62	430			
A690	50	345				**S460 AP**	67	460			
A690*	57	390									

Highlighted fields represent the most commonly used and readily available steel grades. *Not available for AZ 48/50/52-700. ** Corrosion resistant steel; check for availability.

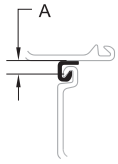
Corner Piles



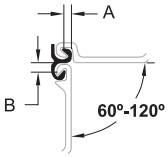
E 20
Gr: S355 GP
Wt: 9.68 lb/ft
14.4 kg/m
A: ~0.95”
24.9 mm
B: ~0.73”
18.5 mm



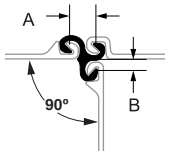
Omega 18
Gr: S355 GP / Gr. 60
Wt: 12.10 lb/ft
18.0 kg/m
A: ~2.76”
~70 mm
B: ~1.18”
~30 mm



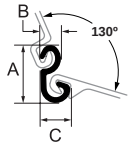
E 22
Gr: S355 GP / Gr. 60
Wt: 6.87 lb/ft
10.2 kg/m
A: ~1.28”
~32.5 mm



Delta 13
Gr: S355 GP / Gr. 60
Wt: 8.8 lb/ft
13.1 kg/m
A: ~0.59”
~15 mm
B: ~0.79”
~20 mm



LTn
Gr: A572 Gr. 60
Wt: 14.02 lb/ft
20.9 kg/m
A: 2.075”
5.27 mm
B: 0.914”
23.2 mm

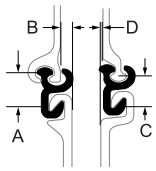


LV20n
Gr: S355 GP / Gr. 60
Wt: 8.50 lb/ft
12.6 kg/m
A: 4.09”
103.9 mm
B: 1.10”
27.9 mm
C 2.05”
52.1 mm

Delivery Conditions & Tolerances

	ASTM A6	EN 10248
Mass	± 2.5%	± 5%
Length	+ 5 in. – 0 in.	± 200 mm
Height	± 7 mm	
Thickness	≤ 8.5 mm	± 0.5 mm
	> 8.5 mm	± 6%
Single Pile Width		± 2%
Double Pile Width		± 3%
Straightness		0.2% of the length
Ends out of Square		2% of the width

Transitional Piles



PL1Z
Gr: A572 Gr. 60
Wt 8.95 lb/f 13.3 kg/m
A: 1.97” 50.0 mm
B: 0.69” 17.5 mm
C: 1.61” 40.9 mm
D: 0.02” 0.5 mm

Maximum Rolled Lengths†

AZ	101.7 ft.	31.0 m
E 22	59.1 ft.	18.0 m
E 20	59.1 ft.	18.0 m
Delta 13	55.8 ft.	17.0 m
Omega 18	52.0 ft.	16.0 m

† Longer lengths may be possible upon request.

Delivery Forms

Single Pile
Position A

Double Pile
Form I Standard

Single Pile
Position B

Double Pile
Form II on Request

Basic series

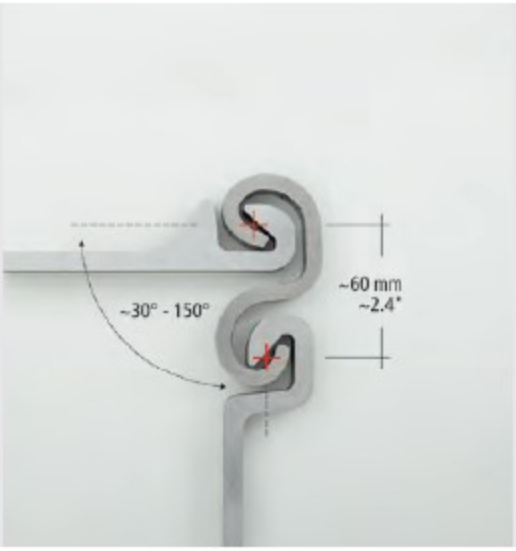
Suitable sheet piles

LV20n

Application Corner connection

Properties

Steel grade:	S355
Length:	11.8 m, 18 m | 38.7 ft, 59 ft
Steel thickness:	8 mm | 0.32"
Weight:	14.067 kg/m | 9.45 lbs/ft
Angular flexibility:	~30 - 150° *
Max. tensile strength:	~600 kN/m | ~3.43 kips/in
Suitable for single drive:	no



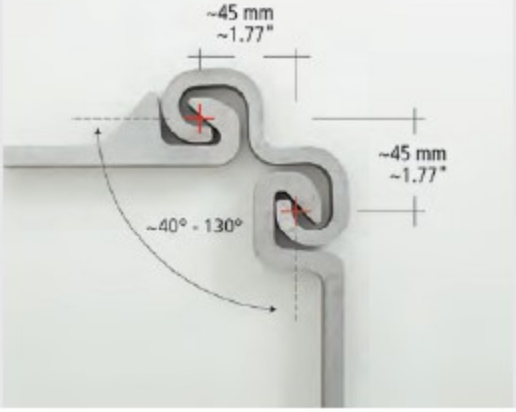
Suitable for all sheet piles with a Larssen interlock.
Usage example with sheet pile AZ18.

LVO

Application Omega connection

Properties

Steel grade:	S355
Length:	11.8 m, 18 m | 38.7 ft, 59 ft
Steel thickness:	8 mm | 0.32"
Weight:	13.847 kg/m | 9.3 lbs/ft
Angular flexibility:	~40 - 130° *
Max. tensile strength:	~600 kN/m | ~3.43 kips/in
Suitable for single drive:	no



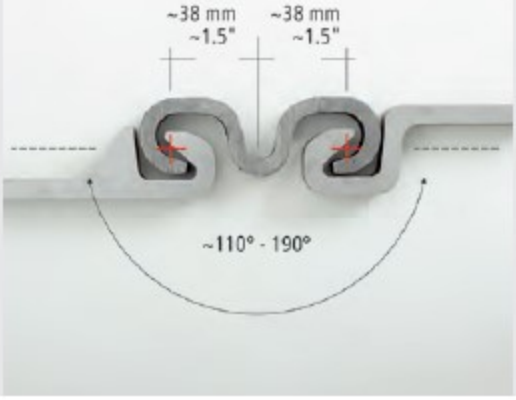
Suitable for all sheet piles with a Larssen interlock.
Usage example with sheet pile AZ18.

LV-Omega

Application Omega connection

Properties

Steel grade:	S355
Length:	11.8 m, 18 m | 38.7 ft, 59 ft
Steel thickness:	8 mm | 0.32"
Weight:	14.036 kg/m | 9.43 lbs/ft
Angular flexibility:	~110 - 190° *
Max. tensile strength:	~600 kN/m | ~3.43 kips/in
Suitable for single drive:	no



Suitable for all sheet piles with a Larssen interlock.
Usage example with sheet pile AZ18.

SHEET PILE PROTECTOR

X-09828

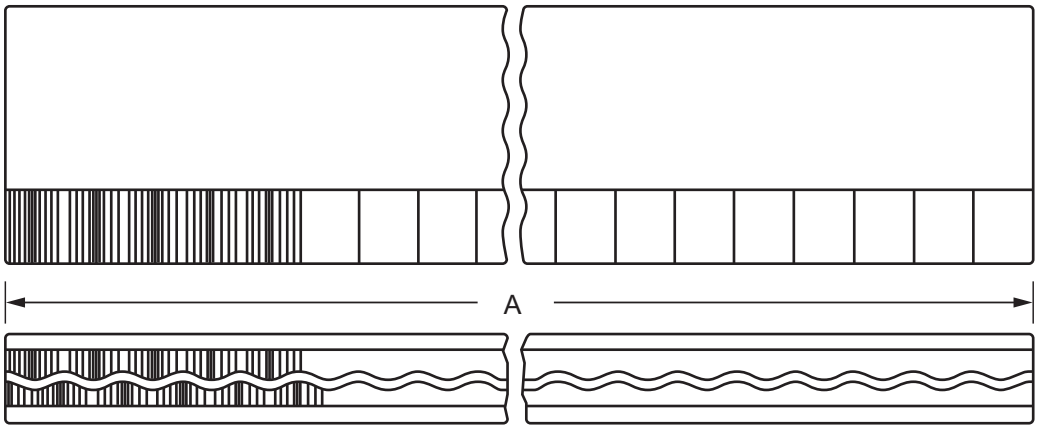
Attached to Web only AZ48-700

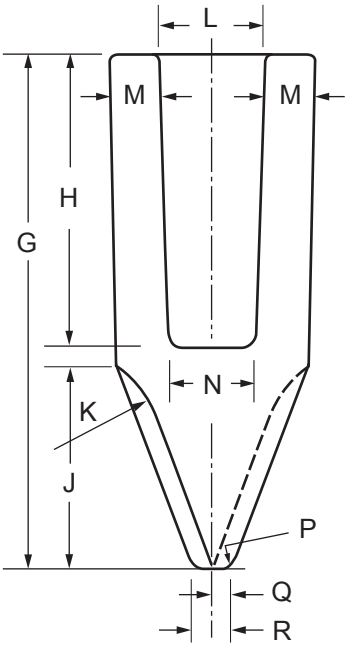
28" STRAIGHT BAR

MATERIAL: CAST STEEL

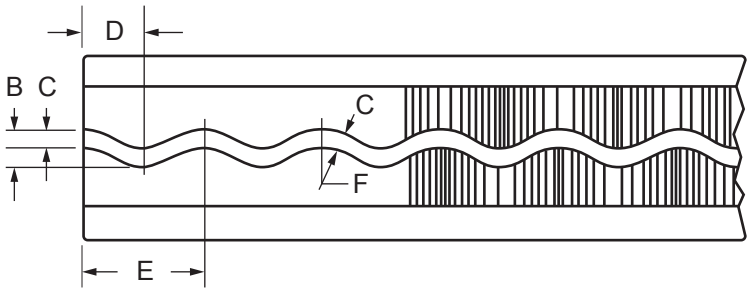
ASTM A148 90/60

NORMAL FOUNDRY TOLERENCES APPLY





END VIEW



A	28.00”
B	0.25”
C	0.125”
D	0.375”
E	0.75”
F	0.25” R
G	3.5"
H	2.0"

J	1.375"
K	0.75" R
L	0.875"
M	11/32"
N	13/16"
P	1/16" R
Q	0.125"
R	0.25"

Attachment Procedure

1. Torch-cut appropriate length of protector and hold in close contact with web and/or flanges of the sheet pile.
2. Place a 1-1/2" long groove weld, 5/16", at each corner of the protector for flange sections.
3. Place a 3" long groove weld, 5/16", at each corner of the protector for web section.

Note: An E-7018 welding rod or E71T-l Flux Core is recommended.

ASSOCIATED PILE & FITTING

45 Samworth Road, Clifton, NJ 07014
Tel: 973-773-8400
Fax: 973-773-8442
email: apf@associatedpile.com
www.associatedpile.com
Call Toll Free: 800-526-9047

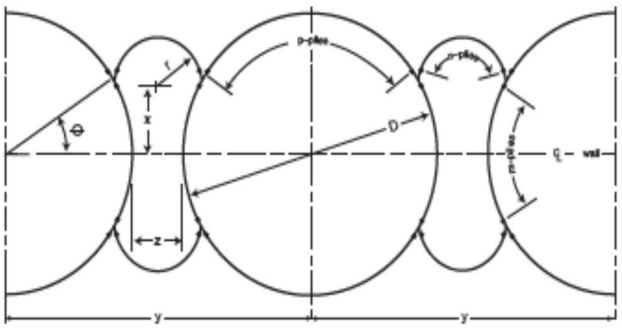
(11/18)

JD FIELDS & COMPANY, INC.
A FIELDS COMPANY

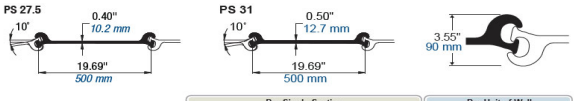
August 19th, 2021

Re: Interlock Strength of Z-Shaped Sections

Interlock Strength or Interlock Tensile Strength relates to Straight Web Sheets also known as Flat Sheets. Flat Sheets are designed to resist Hoop Stress and are specially designed to resist Heavy Tensile Loads in the joints in structures like the circular cells below. Therefore, Flat Sheets have published Minimum Interlock Strengths. See PS Flat Sheet examples below.



PS (FLAT SHEET) PILING PROPERTIES



Section	Nominal Width in. (mm)	Depth (Height) in. (mm)	Wall Depth (Height) in. (mm)	Web Thickness in. (mm)	Per Single Section: Area in.²/ft (cm²/m)	Weight lbs/ft (kg/m)	Moment of Inertia in.⁴/ft (cm⁴/m)	Section Modulus in.³/ft (cm³/m)	Total Surface Area ft²/ft (m²/m)	Nominal Coating Area* ft²/ft (m²/m)	Per Unit of Wall: Area in.²/ft² (cm²/m²)	Weight lbs/ft² (kg/m²)	Moment of Inertia in.⁴/ft² (cm⁴/m²)	Section Modulus in.³/ft² (cm³/m²)
PS 27.5	19.69	2.83	3.55	0.40	13.26	45.1	5.0	3.2	4.50	3.64	8.08	27.5	3.0	1.9
	500	72	90	10.2	85.5	67.1	207	52	1.37	1.11	171.0	134.2	414	103
PS 31	19.69	2.83	3.55	0.50	14.96	50.9	5.0	3.2	4.50	3.64	9.11	31.0	3.0	1.9
	500	72	90	12.7	96.5	75.7	207	52	1.37	1.11	192.9	151.4	414	103

*Both sides of sheet; excludes interior of interlock.

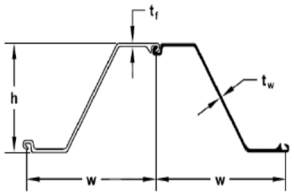
All listed dimensions are nominal. Due to rolling practices, variations in web thickness is common. Permitted variations for such dimensions are not addressed.

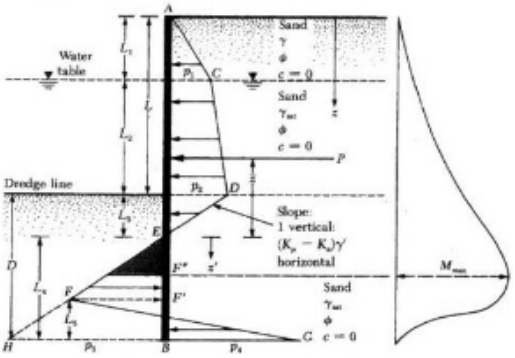
Grade	Minimum Interlock Strength(1)	Minimum Swing(2)
A328	16 kips/in. (2,800 kN/m)	10 degrees
A572-50	20 kips/in. (3,500 kN/m)	10 degrees
A572-60	24 kips/in. (4,200 kN/m)	10 degrees

Higher interlock strengths are available; obtainable swing may be reduced in interlock strengths above 24 kips/in (4,200 kN/m).

(1) These minimum ultimate interlock strengths assume proper interlocking of sheets. To verify the strength of PS Sheet Piling, consider both yielding of the web and failure of the interlock.
(2) Swing reduces 1.5 degrees for each 10 feet (3 meters) in length over 70 feet (21 meters).

The Z-Shaped sheets (see sketch below) are not designed to resist hoop stress but are designed to resist bending loads like the example below.





Z-shaped sheet piles have published values for Section Modulus and Moment of Inertia along with minimum Yield Strengths so the Minimum Bending Moment Capacity of the sections can be calculated. Since the Z-shaped sheets are designed for bending rather than to resist hoop stress, the Z-shaped sheets do not have published values for interlock strength.

Sincerely,
Alwyn McDowall

Engineer/Business Development
JD Fields and Company, Inc

Global Research and Development
Esch-sur-Alzette

ArcelorMittal

JD Fields & Company Inc
2727 Allen Parkway, Suite 2000
Houston, Texas 77019

30.11.2023

Subject: Tensile resistance of AZ® interlocks

Manufacturer of AZ® steel sheet piles

According to the tender documents for the project, tension tests have to be performed by the manufacturer to determine the interlocked joint strength of the Z piles. The specification requires a specific minimum ultimate interlock Strength in Tension for Z piles.
This kind of specification of interlock strength is common for straight web steel sheet piles used in cellular cofferdams. Such cofferdam structures resist through tension in the straight web sheet piles and therefore the interlocks of these piles are designed for high interlock strength. For Z-shaped steel sheet piles, interlock strength is much less relevant because these piles resist through bending. Under normal load conditions, no interlock tension forces will occur. Due to their cross-sectional flexibility (plate bending) Z-shaped sheet piles cope with deformations occurring during installation (state of the art) without generating major interlock forces. This is why interlock resistance for Z-sheet piles is not specified in the manufacturer's catalogues. This difference in behaviour is clearly stated in section 2.4B-(1) of the "Design of steel sheet pile walls", by ASCE. Furthermore, ASTM A572 specifies that interlock strength may be specified for straight web sheet piles.
AZ® steel sheet piles have Larssen interlocks. To ensure load-bearing capacity as well as the integrity of the sheet pile wall, the EN 10248-1: 2023, section 9.2.6 requires the following tests to be performed at the time of determination of the product type:

- Interference criterion according to EN 10248-2;
- Declutching criterion according to Annex E, section E.2.1;
- Tensile interlock resistance according to Annex E, section E.2.2;
- Interlock stiffness according to Annex E, section E.3

These criteria have been developed by the WG1 of TC 459/SC 3 responsible for the development of product standards for sheet piles. Various sheet pile manufacturers are members of this working group. The AZ® sheet piles manufactured by ArcelorMittal have been tested accordingly and fulfil these criteria. The interference criterion according to EN 101248-2 is part of our quality assurance plan.
Considering the information above, we consider that our AZ® sheet piles are fit for purpose for sheet pile applications in which they are used in bending and installed according to the state of the art.

If you have any questions or require additional information regarding this topic, please do not hesitate to contact ArcelorMittal technical team. We are committed to providing you with all the necessary assistance to address any of your concerns.

Sincerely,

Nicolas CAILLET
Porteur de signature spéciale

Pierre HUBSCH
Porteur de signature spéciale

ArcelorMittal Belval & Differdange S.A.
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RCS Bobigny 380 347 591 Code APE 7219 Z
N° d'identification TVA : FR 66 380 347 591

Pacific Pile & Marine, LP
700 South Riverside Drive
Seattle, WA 98108

T 206 331-3873
F 206 774-5958
License # PACIFPM922J3

Attachment D- Grout Placement Submittals

CWD WIRE DOBIES

Individual Cementitious Support

TECHNICAL DATA SHEET

DESCRIPTION

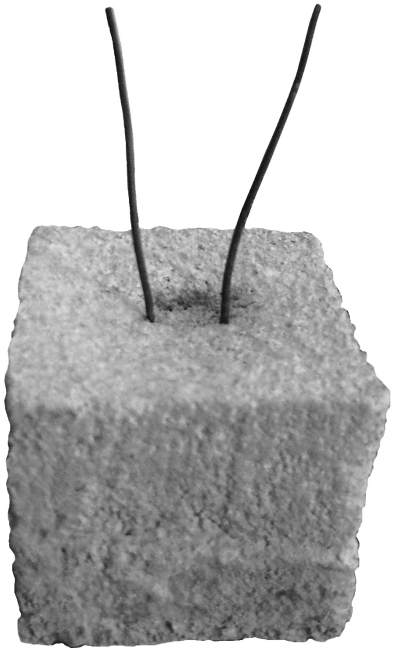
Dayton Superior Combination Dobie, Series: CWD is used for supporting wire mesh or rebar to ensure proper placement during construction. It has a standard strength of 4,000 PSI. The CWD comes in mutlple heights within a single unit. CRSI Class 1, D.O.T Approved.

APPLICATION

Supports rebar mats and wire mesh to provide proper concrete cover of rebar that is used primarily in horizontal rebar applications.

PRODUCT SPECIFICATION

- Manufactured using standard 4000 psi



FEATURES

- Available in cover heights from 3/4" to 5"
- Suited for On-Grade, Below-Grade, Metal Decks, Side-Form Spacers, and Pools

APPROVALS / COMPLIANCE

- Meets all requirements and qualifies as a CRSI Class 1 Bar Support.
- On-Grade or Below Grade, D.O.T. Approved (in most states).

RELATED PRODUCTS

- CCD Combination Dobies
- CDD Dowel Dobies
- CPD Plain Dobies

HOW TO ORDER

- Additional sizes available through made to order. Please call for lead time, pricing and availability.

ORDERING INFORMATION

WIRE DOBIES - STANDARD

Product Code	Description	Weight
123701	2" X 2" X 1"	0.326 LB
123702	2" X 2" X 1-1/2"	0.536 LB
123704	2" X 2" X 2"	0.734 LB
123707	3" X 3" X 3"	2.193 LB

MANUFACTURER

Dayton Superior Corporation
1125 Byers Road
Miamisburg, OH 45342
Customer Service: 888-977-9600
Technical Services: 877-266-7732
Website: www.daytonsuperior.com

WARRANTY (ACCESSORIES)

Limited Warranty. Dayton warrants, for a period of 60 days from the date of shipment (three years from the date of shipment in the case of formwork, excluding any consumable Products included with such formwork), that Products and any associated application drawings and engineering services provided by Dayton (“Ancillary Services”) will be free from defects in material and workmanship and, in the case of custom designed formwork, that the formwork will meet the specifications set forth in the design drawings approved by Dayton and Customer. Any claim under this warranty must be made in writing within such warranty period. If any Product and/or Ancillary Service covered by a timely claim are found to be defective, Dayton will, within a reasonable time, make any necessary repairs or corrections or, at Dayton’s option, replace the Product. Unless pre-authorized by Dayton in writing, Dayton will not accept any charges for correcting defects or accept the return of any Product. This warranty will not apply to any Products that have been subjected to misuse, neglect, storage damage, misapplication, accident or any other damage caused by any person other than Dayton, or that have not been maintained in accordance with Dayton’s specifications. THIS LIMITED WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES AS TO THE PRODUCTS AND ANCILLARY SERVICES. DAYTON MAKES NO OTHER WARRANTIES OR GUARANTEES, EXPRESS OR IMPLIED, INCLUDING ANY WARRANTY OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR OTHERWISE. THE REMEDIES SET FORTH IN THIS SECTION ARE CUSTOMER’S EXCLUSIVE REMEDY FOR BREACH OF WARRANTY.

File Date: 7/11/2024

2 MOE Cyls @ 56 days

LEHIGH HEIDELBERGCEMENT Group
Lehigh Northwest Technical Services
5225 E.Marginal Way South
Seattle, WA 98134
Phone: (206) 763-2525

Report Number : C-17080
Date Cast : 12/03/19
Customer: Cadman
F'c: 10K @ 56 Days
Mix ID: PPECC10K1

Ingredient	1 Cu. Yd. SSD Wts.	Specific Gravity	Absolute Volume	Aggregate Moistures	Batch Size 0.045		Aggregate Moistures
Cement (Lehigh Delta PLC)	730	3.15	3.71	1.000	33.05	lbs.	3/4" x #4
ID:# (08-28-19)		2.20	0.00	1.010	33.05	lbs.	3/8" x #8
Fly Ash (Centralia Class F)	250	2.56	1.57	1.035	44.30	lbs.	B.S. Mst.
ID: (Lab Supply / 10-16-19)		2.71	0.00	0.00	44.30	lbs.	
3/4" x #4 (Manke / X125)		2.77	0.00	0.00	0.00	lbs.	
3/8 x #8 (Manke / X125)	1380	2.76	8.01	1393.80	66.12	lbs.	3.4
Fine Agg.		2.67	0.00	0.00	0.00	lbs.	
Fine Agg. (Sechelt / CA7)	1440	2.65	8.71	1490.40	70.47	lbs.	3.4
Fine Agg.		2.60	0.00	0.00	0.00	lbs.	
Water	275	1.00	4.41	212.64	9.57	lbs.	
Mbae- 90		oz./yd.	0.68	0.00	0.0	cc.	
VMA 358		oz./yd.		0.00	0.0	cc.	
Polyheed 997		oz./yd.		0.00	0.0	cc.	
Glenium 7500	84.1	oz./yd.		3.78	111.9	cc.	
Total	4075	lbs.	27.09		120.7	lbs.	

Calculated Unit Wt. / Density	150.92	Measured Spread	30.00	Air Temp.	68.0
W/C Ratio	0.28	J-Ring Spread	29.00	Unit Wt.	150.42
S/A Ratio (by weight)	51.1	Air Content	2.4	Yield	27.09
S/A Ratio (by volume)	52.1	VSI	0	Conc. Temp.	70
Design Air Content	2.5% ± 1.5%	T-20 Time:	x	HVSI	x
Target Spread	29.00" ± 2.00"	Column Segregation	x	MOE (56 day)	6.10 x 10^6
		Rapid Segregation	x		

Area : 12.79

Cylinder Number	Date Cast	Test Date	Age	Size	Pounds	Psi	Avg. Psi
C-17080	12/03/19	12/04/19	1	4 x 8	54490	4260	
		""	1		53860	4210	**4240**
		12/06/19	3		107500	8410	
		""	3		108590	8490	**8450**
		12/10/19	7		134130	10490	
		""	7		133570	10440	**10470**
		12/31/19	28		164130	12830	
		""	28		165750	12960	**12900**
		""	28		165160	12910	
		01/28/20	56		174940	13680	
		""	56		174180	13620	**13620**
		""	56		173340	13550	
		03/02/20	90		177260	13860	
		""	90		177710	13890	**13850**
		""	90		176440	13800	

Remarks: Bon / Pete. Excellent W/F/P.

Heidelberg Materials

Concrete Mix Evaluation Report

ACI 318 Required Average Strength

Mix ID	PPECC8K	**Number Of Tests**	46
Mix Name	PERFORMX 8000 PSI	**Average Strength**	10567 psi
Design Strength (f'c)	8000 psi @ 56 Days	**St Dev**	935 psi
Required Strength (f'cr)	9380 psi @ 56 Days	**St Dev (Modified)**	935 psi

Test Date	Mix	Lab	Temp (Concrete) (°F)	Slump (in)	Air Content (%)	Unit Weight (lb/ft3)	Comp Strength (7-Day) (psi)	Acceptance Strength (56-Day) (psi)	Moving Average (psi)
12/02/2022	PPECC8K	Heidelberg Materials Technician	70	8			7700	10590	
12/19/2022	PPECC8K	MTC Lab	68	8.5			5700	9940	
08/18/2023	PPECC8K		76		2.4		7130	11480	10670
08/25/2023	PPECC8K		76		2.2	147.95	7020	10300	10573
09/05/2023	PPECC8K						8200	11800	11193
09/13/2023	PPECC8K						5750	9320	10473
09/21/2023	PPECC8K		75		1.8	145.34	7180	11960	11027
09/22/2023	PPECC8K		72		2.7	147.04	7610	11660	10980
10/06/2023	PPECC8K		76		2.2	148.71	7590	11080	11567
10/09/2023	PPECC8K		81				7390	11200	11313
10/25/2023	PPECC8K		71			146.15	7060	10620	10967
10/31/2023	PPECC8K		88		1.2	152.8	7260	11660	11160
11/02/2023	PPECC8K		71		2	151.6	6590	10640	10973
11/03/2023	PPECC8K		76		2.2	149.88	5880	9600	10633
11/08/2023	PPECC8K		69		2.3	147.42	6600	10400	10213
11/10/2023	PPECC8K		71		1.8	150.2	6430	9780	9927
11/17/2023	PPECC8K		67		2.4	148.2	6160	9680	9953
11/17/2023	PPECC8K		78			149.88	5840	9340	9600
11/29/2023	PPECC8K	HM	63				5070	8910	9310
11/30/2023	PPECC8K		62		3	145.48	5740	9520	9257
12/05/2023	PPECC8K	HM	69		2	148.6	5680	8700	9043
12/25/2023	PPECC8K	HM	66		2.3		6000	10240	9487
01/24/2024	PPECC8K	HM	66		2.8	149.08	6560	10470	9803
01/29/2024	PPECC8K	HM	64		1.7	148.23	5680	8820	9843
01/31/2024	PPECC8K	HM	66		2.4		6630	10720	10003
02/12/2024	PPECC8K	HM	65		3.2	149.08		10460	10000
03/06/2024	PPECC8K	HM	65		3.4	149.48	6980	11460	10880
03/07/2024	PPECC8K	HM	62		1.8	1490.1	6440	10900	10940
03/26/2024	PPECC8K	HM	64		2.2	0	6460	10660	11007
03/27/2024	PPECC8K		58				7490	12320	11293
03/27/2024	PPECC8K		70		2.5	196.9	7090	11180	11387
04/09/2024	PPECC8K	HM	65		2	0	6700	11080	11527
04/10/2024	PPECC8K	HM	60		2	148.58	6000	10600	10953
04/30/2024	PPECC8K	HM	62		3.8	149.08	5840	9690	10457
05/01/2024	PPECC8K	HM	65		1.6	151	7020	11650	10647
05/14/2024	PPECC8K	HM	66		1.4	148.19	6640	10400	10580
05/27/2024	PPECC8K	HM	60		2.6	149	6980	11290	11113

Heidelberg Materials

Concrete Mix Evaluation Report

ACI 318 Required Average Strength

Mix ID	PPECC8K	**Number Of Tests**	46
Mix Name	PERFORMX 8000 PSI	**Average Strength**	10567 psi
Design Strength (f'c)	8000 psi @ 56 Days	**St Dev**	935 psi
Required Strength (f'cr)	9380 psi @ 56 Days	**St Dev (Modified)**	935 psi

Test Date	Mix	Lab	Temp (Concrete) (°F)	Slump (in)	Air Content (%)	Unit Weight (lb/ft3)	Comp Strength (7-Day) (psi)	Acceptance Strength (56-Day) (psi)	Moving Average (psi)
05/28/2024	PPECC8K	HM	69		2.4	146.2	6530	10510	10733
06/06/2024	PPECC8K	HM	65		2.6	144.5	6240	10400	10733
06/07/2024	PPECC8K	HM	65		1.8	146.2	6990	11220	10710
06/19/2024	PPECC8K		66			150.1	7580	12500	11373
07/02/2024	PPECC8K	HM	65		1.6	146.2	5960	10440	11387
07/03/2024	PPECC8K		66		3.6	149.4	6750	10420	11120
07/16/2024	PPECC8K	HM	64		3.4	149.4		9720	10193
07/23/2024	PPECC8K	HM	62		1.6	148.18	5560	9060	9733
07/29/2024	PPECC8K	HM	63		2	147.77	7560	11680	10153

Heidelberg Materials

Concrete Mix Evaluation Report

ACI 318 Required Average Strength

Mix ID	PPECC8K	**Number Of Tests**	50
Mix Name	PERFORMX 8000 PSI	**Average Strength**	9410 psi
Design Strength (f'c)	8000 psi @ 28 Days	**St Dev**	896 psi
Required Strength (f'cr)	9290 psi @ 28 Days	**St Dev (Modified)**	896 psi

Test Date	Mix	Lab	Temp (Concrete) (°F)	Slump (in)	Air Content (%)	Unit Weight (lb/ft3)	Comp Strength (3-Day) (psi)	Comp Strength (7-Day) (psi)	Acceptance Strength (28-Day) (psi)	Moving Average (psi)
11/04/2022	PPECC8K	Heidelberg Materials Technician	70	8				7700	8470	
11/21/2022	PPECC8K	MTC Lab	68	8.5				5700	8200	
02/03/2023	PPECC8K	Krazan	60	6				6230	10220	8963
05/01/2023	PPECC8K	MTC Lab	53	30				7590	11190	9870
07/21/2023	PPECC8K		76		2.4			7130	10100	10503
07/28/2023	PPECC8K		76		2.2	147.95		7020	9110	10133
08/08/2023	PPECC8K							8200	11060	10090
08/16/2023	PPECC8K							5750	8440	9537
08/24/2023	PPECC8K		75		1.8	145.34		7180	10410	9970
08/25/2023	PPECC8K		72		2.7	147.04		7610	10630	9827
09/08/2023	PPECC8K		76		2.2	148.71		7590	9890	10310
09/11/2023	PPECC8K		81					7390	9970	10163
09/27/2023	PPECC8K		71			146.15		7060	9540	9800
10/03/2023	PPECC8K		88		1.2	152.8		7260	10260	9923
10/05/2023	PPECC8K		71		2	151.6		6590	9380	9727
10/06/2023	PPECC8K		76		2.2	149.88		5880	8380	9340
10/11/2023	PPECC8K		69		2.3	147.42		6600	9150	8970
10/13/2023	PPECC8K		71		1.8	150.2		6430	8790	8773
10/20/2023	PPECC8K		67		2.4	148.2		6160	8840	8927
10/20/2023	PPECC8K		78			149.88		5840	8560	8730
11/01/2023	PPECC8K	HM	63					5070	8070	8490
11/02/2023	PPECC8K		62		3	145.48		5740	8720	8450
11/07/2023	PPECC8K	HM	69		2	148.6		5680	7940	8243
11/27/2023	PPECC8K	HM	66		2.3			6000	8740	8467
12/27/2023	PPECC8K	HM	66		2.8	149.08		6560	8800	8493
01/01/2024	PPECC8K	HM	64		1.7	148.23		5680	8170	8570
01/03/2024	PPECC8K	HM	66		2.4			6630	9540	8837
01/15/2024	PPECC8K	HM	65		3.2	149.08			8600	8770
02/07/2024	PPECC8K	HM	65		3.4	149.48		6980	10120	9420
02/08/2024	PPECC8K	HM	62		1.8	1490.1		6440	9040	9253
02/27/2024	PPECC8K	HM	64		2.2	0		6460	9230	9463
02/28/2024	PPECC8K		58					7490	11510	9927
02/28/2024	PPECC8K		70		2.5	196.9		7090	10180	10307
03/12/2024	PPECC8K	HM	65		2	0		6700	9480	10390
03/13/2024	PPECC8K	HM	60		2	148.58		6000	9250	9637
04/02/2024	PPECC8K	HM	62		3.8	149.08		5840	8120	8950
04/03/2024	PPECC8K	HM	65		1.6	151		7020	10080	9150

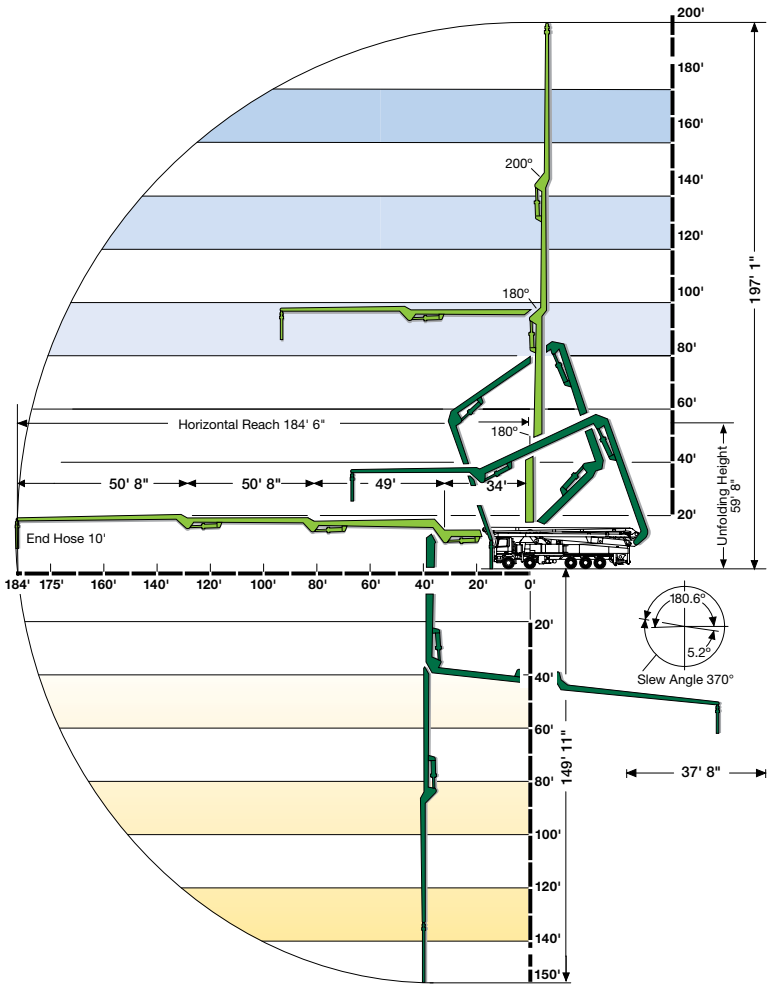
Heidelberg Materials

Concrete Mix Evaluation Report

ACI 318 Required Average Strength

Mix ID	PPECC8K	**Number Of Tests**	50
Mix Name	PERFORMX 8000 PSI	**Average Strength**	9410 psi
Design Strength (f'c)	8000 psi @ 28 Days	**St Dev**	896 psi
Required Strength (f'cr)	9290 psi @ 28 Days	**St Dev (Modified)**	896 psi

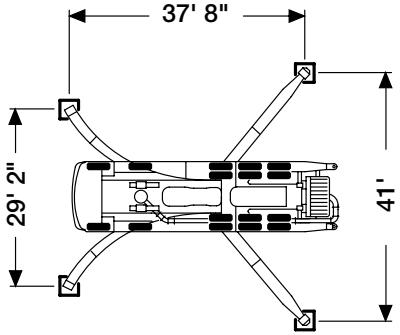
Test Date	Mix	Lab	Temp (Concrete) (°F)	Slump (in)	Air Content (%)	Unit Weight (lb/ft3)	Comp Strength (3-Day) (psi)	Comp Strength (7-Day) (psi)	Acceptance Strength (28-Day) (psi)	Moving Average (psi)
04/15/2024	PPECC8K	HM	63		1.4	148.2	4750	6260	8580	8927
04/16/2024	PPECC8K	HM	66		1.4	148.19		6640	9220	9293
04/29/2024	PPECC8K	HM	60		2.6	149		6980	10080	9293
04/30/2024	PPECC8K	HM	69		2.4	146.2		6530	9160	9487
05/09/2024	PPECC8K	HM	65		2.6	144.5		6240	8960	9400
05/10/2024	PPECC8K	HM	65		1.8	146.2		6990	9680	9267
05/22/2024	PPECC8K		66			150.1		7580	10490	9710
06/04/2024	PPECC8K	HM	65		1.6	146.2		5960	10340	10170
06/05/2024	PPECC8K		66		3.6	149.4		6750	9420	10083
06/18/2024	PPECC8K		49					7510	10770	10177
06/18/2024	PPECC8K	HM	64		3.4	149.4			9240	9810
06/25/2024	PPECC8K	HM	62		1.6	148.18		5560	8240	9417
07/01/2024	PPECC8K	HM	63		2	147.77		7560	10120	9200



OUTRIGGER SPREADS & LOADS

FRONT Outrigger Spread	29 ft 2 in
REAR Outrigger Spread	41 ft
FRONT TO REAR Outrigger Length	37 ft 8 in
MAX FRONT Outrigger Load	83,179 lbf
MAX REAR Outrigger Load	80,931 lbf

All dimensions and weights are approximate.



Booms over 47-Meters have high ground soil pressures that often require additional dunnage. We have the **expertise to set big booms up properly**, providing a safe work zone for everyone on the job site. Steel plates, crane pads or similar may need to be provided by the customer.

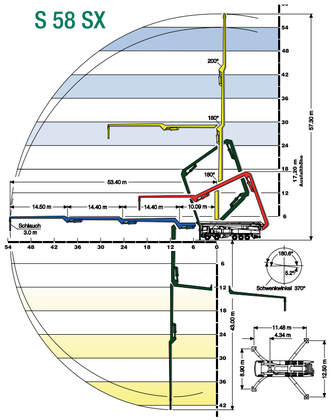
TECHNICAL DATA

Pump battery		**P 2525**
Max. theor. output	m³/h	164
Max. number of strokes	min.	22
Max. concrete pressure	bar	85

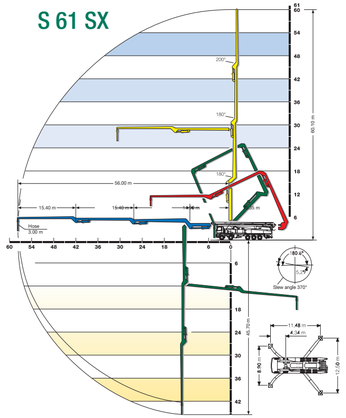
Placing boom		**58 R**	**61 R**
Delivery line diameter		DN 125	DN 112
Length of end hose	m	3,0	3,0
Vertical reach	m	57,3	60,1
Horizontal reach	m	53,4	56,3
Number of articulations		4	4
Height of articulations	m	13,9 / 28,4 / 42,8	14,2 / 29,1 / 44,6
Slewing range		370°	370°
Outrigger load, front	kN	370	370
Outrigger load, rear	kN	360	360

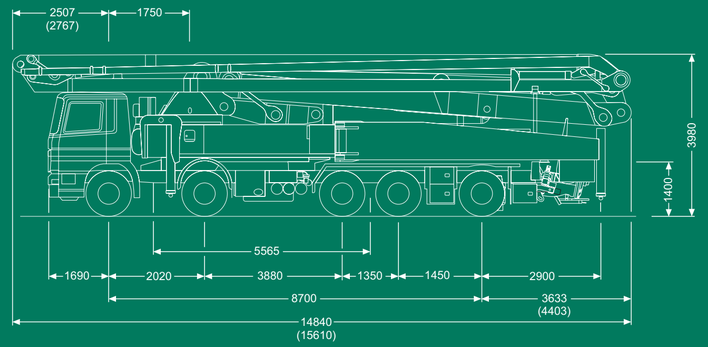
WORKING RANGE

S 58 SX



S 61 SX





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SCHWING-STETTER MOVES CONCRETE. WORLDWIDE.

Wherever concrete is produced and moved is where you will find Schwing-Stetter machinery.

With plants in Germany, Austria, USA, Brazil, Russia, China and India as well as with more than 100 sales and service facilities, the group of companies is always close to the customer.

Our wide range of products with something for every application is what makes Schwing-Stetter the No. 1 system supplier for concrete machinery worldwide.

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TRUCK-MOUNTED CONCRETE PUMPS
S 58 SX / S 61 SX

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LONG REACH BOOMS WITH HIGH END TECHNOLOGY

SCHWING's S 58 SX and S 61 SX truck-mounted concrete pumps are the top-of-the-line, high-end machines in the ultra-long boom class.

Customers can choose between a 58 m boom with a 125 pump line or a 61 m placing boom with a 112 line from the turret outlet.

The Super X-outrigger system is both the key design feature and the prerequisite for revolutionary space and weight breakthroughs in the ultra-long boom class. Thanks to the curved outrigger configuration, this machine has a front outrigger spread of just 8.90 m – a huge advantage for urban jobs and tight construction sites.

All outrigger arms are constructed as one-piece components, ensuring a secure and stable stand compared to the heavy telescoping systems with their high tolerances.

In addition, the front outriggers extend rapidly and directly into the stabilizing position and thus require a smaller footprint than ordinary outrigger systems.

Only SX outriggers free up enough space in the machine's substructure to accommodate a pump kit with a stroke length of 2.5 m. These long-stroke pump kits, proven in many years of operation, are an ideal match of diameter and stroke.

Unlike truck-mounted concrete pumps with short-stroke pump cylinders with 280 mm diameter, the S 58 SX is able to run at just 22 strokes per minute. This translates to 16% fewer strokes, less wear and smoother running.

Additionally, the long-stroke pump kit cuts energy consumption and friction resistance thanks to the use of a smaller reduction between the material cylinder and the valve system. This way the concrete does not have to be forced through a narrow throat. Together with the Rock Valve system and the open hydraulic circuit, this means better energy efficiency and greater economy of SCHWING concrete pumps.

The breathtaking dimensions of the placing boom are a further highlight of this machine. This machine's exceptional versatility is largely due to the sophisticated overhead Roll and Fold design with the efficient 186° travel of stage 1. This folding method allows the boom to be moved into its working position directly, without having to be slewed. This makes for time savings, greater stability of short rigged pumps and excellent flexibility for setting up in spaces with lateral or overhead restrictions.

Due to its 200° joint on the final section the placing boom provides for optimum slip and threading properties, which lets the operator thread it into narrow structural openings even in buildings with low ceiling clearances.

The system can cover the full working range between the vehicle and the maximum possible reach and height. Because the boom is folded overhead, the vehicle length of the S 58 SX is less than 15 m overall.

The relatively low weight of this ultra-long boom pump – just 48 t – makes for stress-free, flexible and rapid machine handling. The five-axle pump is characterized by high maneuverability on the road and on the construction site.
Further advantages include the low fuel consumption, low wear and maintenance costs, the Super 3000 pipeline, the large water tank in the rear of the pump, generous stowage capacity, a wide range of options and accessories, and highest resale value in its class.

Only 48 ton gross vehicle weight make this long reach boom more versatile, faster, and it has a carrying reserve for equipment. on its 5 axles this pump is very agile on the road and on the site.

The Command centre on the ground integrates the rear panel control, chamber valve control block, the mailbox for the dockets, and a lockable equipment box.

The 600 litre water tank is mounted close to the hopper and can be optionally equipped with a high pressure cleaner or a water tank heating system.

Operator friendly - the swivel pads are mounted on the front and rear outriggers

The SX outriggers leave enough space to mount a pump kit with a 2,5m stroke. The result is less wear and smooth pumping.