Request for Bids – OHPA

Install Trelleborg Fender System

Addendum

Question 1

Section II - Submission of Proposal
Please provide the date the last question is allowed to be submitted at 3:00 PM EST

Answer
February 14, 2025, no later than 3:00 PM EST.

Question 2

Section V – 3 Vs 2 – Instructions
Please confirm which cost breakdown is required.
1. Civil, Mechanical and Install of Fenders
2. Administration Overhead, Equipment Design, Equipment Fab, and Installation Support

Answer
Both

QUESTION 3

4 - Primary Scope
Please confirm if the contractor is furnishing and delivering the three Trelleborg Fender Systems

ANSWER

- Furnish and deliver three (3) Trelleborg Fender Systems to the Port of Fernandina. Please note all freight cost associated with procurement and delivery are the contractor's responsibility.

QUESTION 4

ANSWER

Attached: *Trelleborg Fender Drawings*

QUESTION 5

ANSWER

All anchors shall be replaced in accordance to attached Trelleborg Fender Drawings. *Attached*

Question 6

4 - Primary Scope
Will a crane be allowed on the wharf to perform the work or does the work have to be completed by barge? Please provide the loading capacity of the current dock and what size crane is allowed on the wharf.

ANSWER

Mobile crane is allowed on the wharf.

QUESTION 7

4 - Primary Scope
Please confirm if there is working space on the dock designated for the installation of the fender system and laydown area. If so, please provide the SF area of the designated space.

ANSWER

The wharf is in full operation, but required working space will be allotted for each fender as it is being replaced. Onsite laydown area will be supplied, may not be on the wharf.

QUESTION 8

4 - Primary Scope
Please confirm who is responsible for the anchor design for the fenders.

ANSWER

- Assemble and install new Trelleborg Fender Systems according to OEM manual.

QUESTION 9

General
Please provide any technical specifications that are required for the project.

ANSWER

Attached: *Trelleborg Technical Design Package*

QUESTION 10

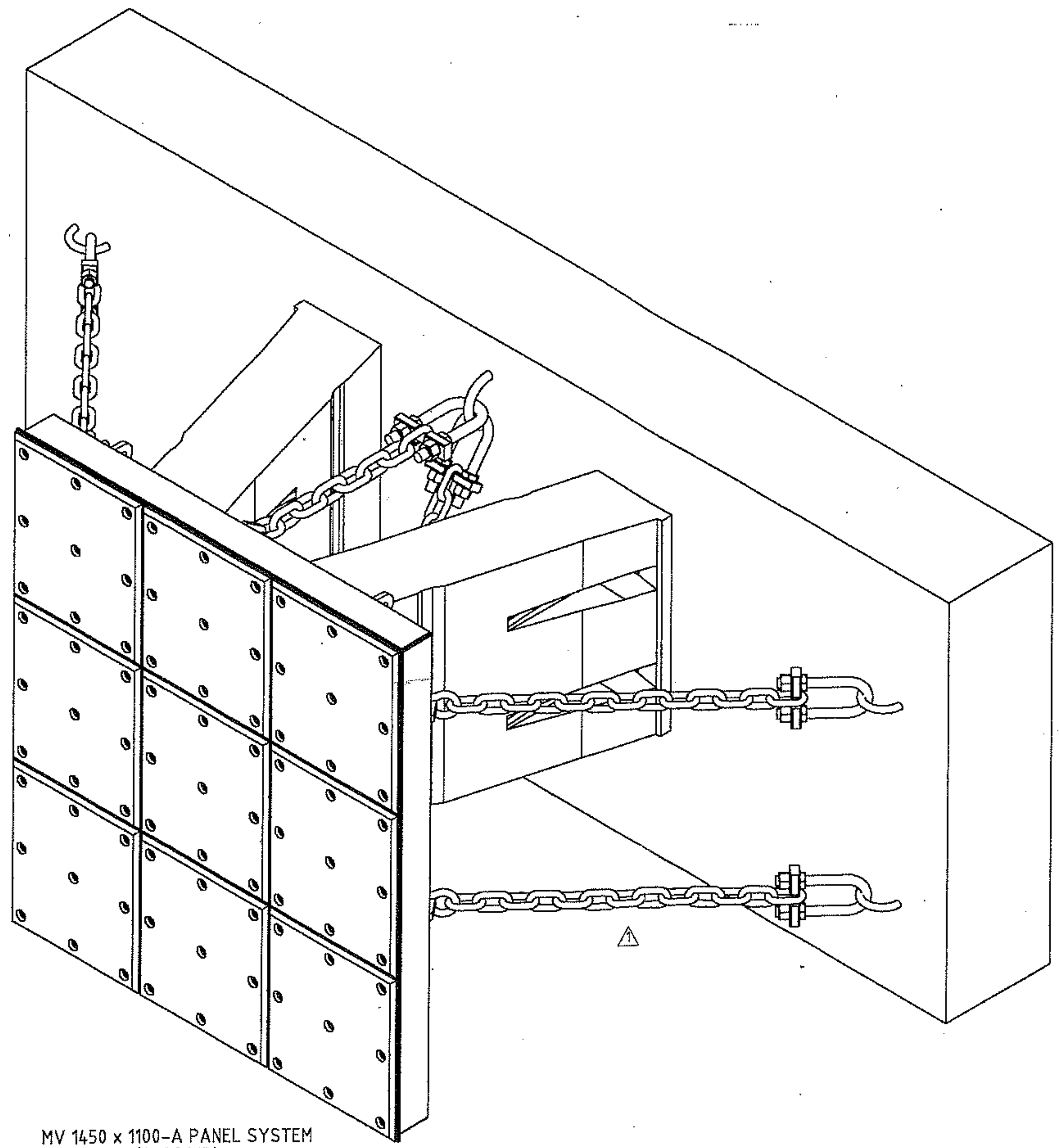
General
Please confirm if the project has any Buy America or Buy American requirements.

ANSWER

NA

PORT OF FERNANDINA DOCK FENDER

PROJECT NUMBER: 61537
INITIAL RELEASE: 3/28/2017



MV 1450 x 1100-A PANEL SYSTEM
(17 REQ'D)

GENERAL NOTES:

1. ALL HOT DIP GALVANIZED (HDG) ITEMS TO BE AS PER A153 OR A123 AS REQUIRED (IF APPLICABLE).
2. ALL STAINLESS STEEL ITEMS TO BE 316 STAINLESS STEEL, U.N.O. (IF APPLICABLE).
3. MODIFICATION OF DOCK SIDE ATTACHMENT LOCATIONS NOT ALLOWED UNLESS AUTHORIZED BY TRELLEBORG.
4. ALL DIMENSIONS ARE IN FEET AND INCHES [MM].
5. PRIOR TO PAINTING OR GALVANIZING, ALL EXTERIOR EDGES TO BE GROUND TO 1/8" [3] MINIMUM RADIUS TO AVOID SHARP EDGES.
6. LOC-TITE 242 (MED. STRENGTH) TO BE APPLIED TO ALL HARDWARE.

FENDER SYSTEM PERFORMANCE:

REACTION = 375 kips [1169 kN]
ENERGY = 822 ft-kips [1113 kN-m]
DEFLECTION = 57.5%
TOLERANCE = 10%
HULL PRESSURE = 6.12 ksf

UHMW NOTES:

1. UHMW TO BE 1 1/4 [32] THICK.
2. UHMW COLOR TO BE GREEN.
3. UHMW TO BE VIRGIN MAT.
4. UHMW MATERIAL PROPERTIES AS PER TRELLEBORG STANDARDS.

CHAIN NOTES:

1. ALL CHAIN ASSEMBLIES TO BE HOT DIP GALVANIZED (HDG) AS PER ASTM A123 AS REQUIRED.
2. ALL WEIGHT CHAINS MUST BE TAUT AFTER PANEL INSTALLATION.
3. ALL CHAINS TO PRE-ASSEMBLED AT FACTORY PRIOR TO SHIPMENT.

STEEL NOTES:

1. ALL EXTERIOR STEEL TO BE MINIMUM Q345B (50 KSI)
2. ALL INTERIOR STEEL TO BE MINIMUM Q345B (50 KSI)
3. ALL CHAIN PADEYES AND LIFTING EYES TO BE MINIMUM 50 KSI.
4. ALL HOLES IN CHAIN PADEYES AND LIFTING EYES MUST BE DRILLED. THESE HOLES MUST NOT BE FLAME CUT.

FENDER SYSTEM WEIGHTS (lbs.)

STEEL FRAME = 3188
RUBBER = 4233
UHMW = 354
TOTAL = 7775

WELDING NOTES:

1. ALL WELDING TO BE AS PER AWS D1.1. ALL EXTERIOR WELDS TO BE WATER TIGHT. USE 70 KSI WELD METAL.
2. ALL WELDS TO BE 1/4" [6] FILLET ALL AROUND UNLESS NOTED OTHERWISE.
3. PANEL TO BE AIR TIGHT PRESSURE TESTED AS FOLLWS:
   a. ALL VERTICAL AND HORIZONTAL WEB CAVITIES TO HAVE A 1/4" [6] VENT HOLE.
   b. INSTALL 1/2" [12] PIPE NIPPLE ON BACK SIDE OF PANEL (BACK PLATE).
   c. PRESSURE TEST INSIDE OF PANEL WITH 2-4 PSI OF AIR & SPRAY ALL EXTERIOR WELDS WITH SOAP AND WATER SOLUTION.
   d. PRESSURE TO BE HELD FOR 10 MINUTES.
   e. REPAIR ALL LEAKS.

TOLERANCES:

1. TOLERANCE ON CHAIN LINKS TO BE +5%/-2.5%.
2. TOLERANCE ON DRILLED HOLE LOCATIONS TO BE ±1/8" [3].
3. TOLERANCE ON UHMW DIMENSIONS TO BE ±1/8" [3].
4. TOLERANCE FOR LOCATION OF DOCK SIDE HARDWARE TO BE ±1/16" [2].
5. TOLERANCE ON GENERAL STEEL FABRICATION TO BE ±1/4" [6].
6. PANEL SHOULD NOT BE OUT OF FLATNESS BY MORE THAN 1/4" [6] ON VERTICAL, 1/4" [6] ON HORIZONTAL AND 3/8" [10] ON DIAGONAL.

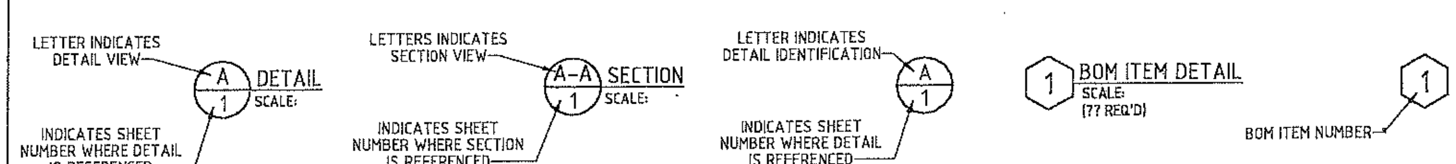
PAINT NOTES:

1. PANEL TO BE PAINTED AS PER THE FOLLOWING SPECIFICATIONS:
   a. BLAST SURFACES TO SSPC-SP10 NEAR WHITE BLAST.
   b. PRIMER COAT: 7.0-8.0 MILS OF CARBOGUARD 890.
   c. INTERMEDIATE COAT: 7.0-8.0 MILS OF CARBOGUARD 890.
   d. TOP COAT: 2.0-4.0 MILS OF CARBOTHANE 134.
   e. TOTAL D.F.T. TO BE 16.0-20.0 MILS.
   f. COLOR TO BE BLACK.
   g. STRIPE COAT ALL EDGES & WELDS.
2. NO SINGLE SPOT MEASUREMENT CAN BE LESS THAN 80% OF THE SPECIFIED MINIMUM THICKNESS AND NO MORE THAN 120% OF THE SPECIFIED MAXIMUM THICKNESS.

FIT-UP NOTE:

1. TO ENSURE PROPER FIT-UP AND PREVENT DAMAGE TO THE FENDER PANEL SYSTEM COMPONENTS, REVIEW TRELLEBORG'S INSTALLATION PROCEDURES PRIOR TO INSTALLING THE SYSTEM IN THE FIELD.

SYMBOL LEGEND



REV.	BY	DESCRIPTION	DATE
1	KLG	ADDED SHEAR CHAINS & U-ANCHORS	10/30/2017

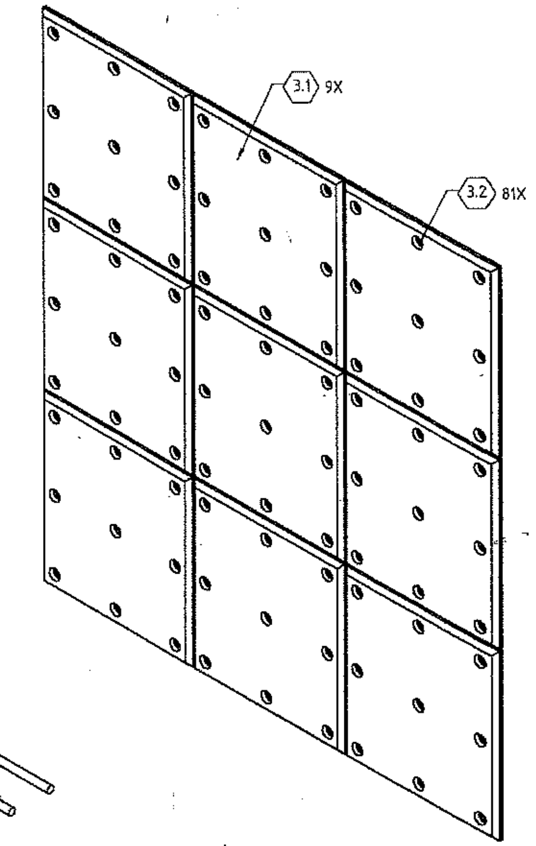
REVISIONS

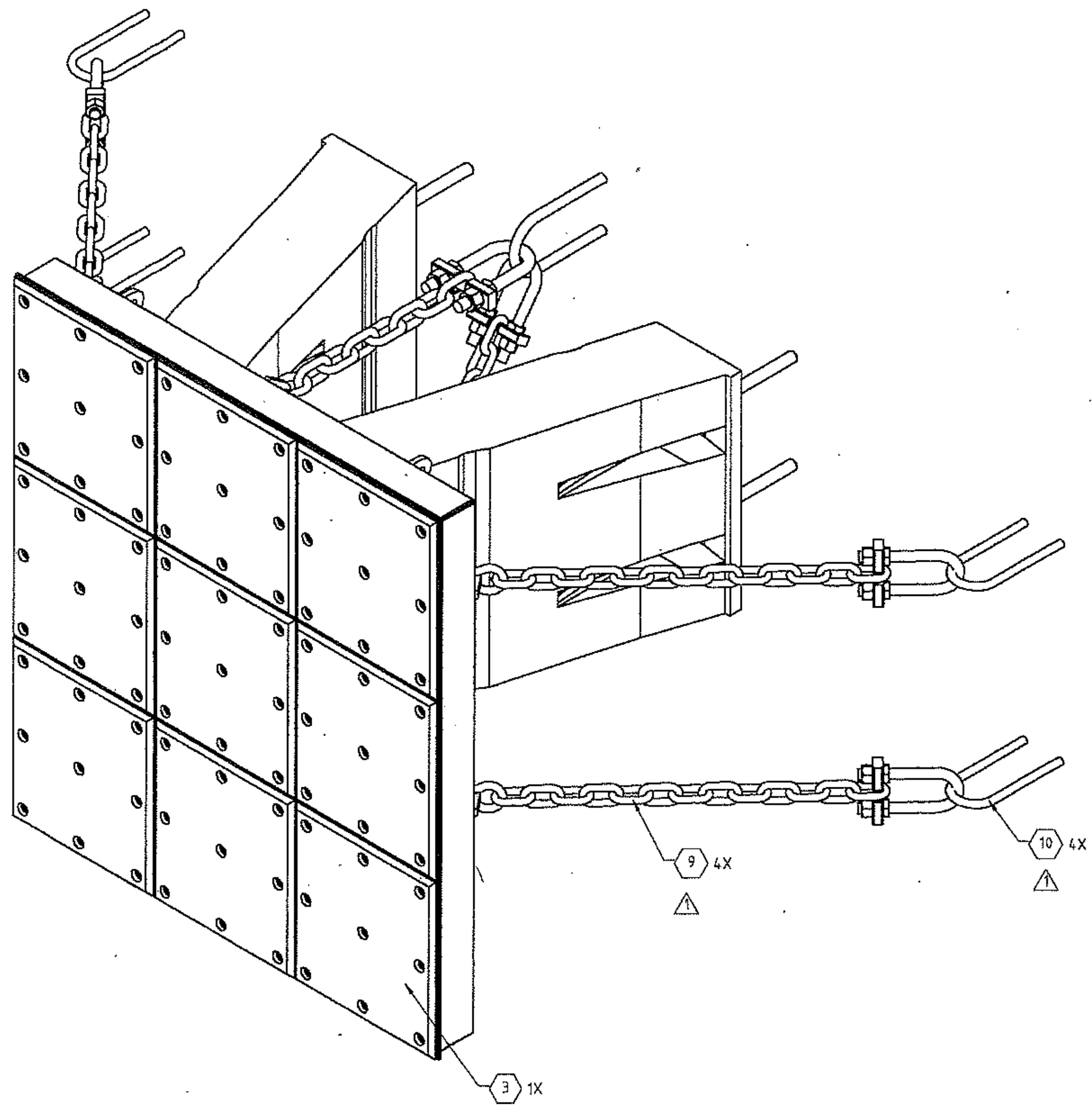
TRELLEBORG

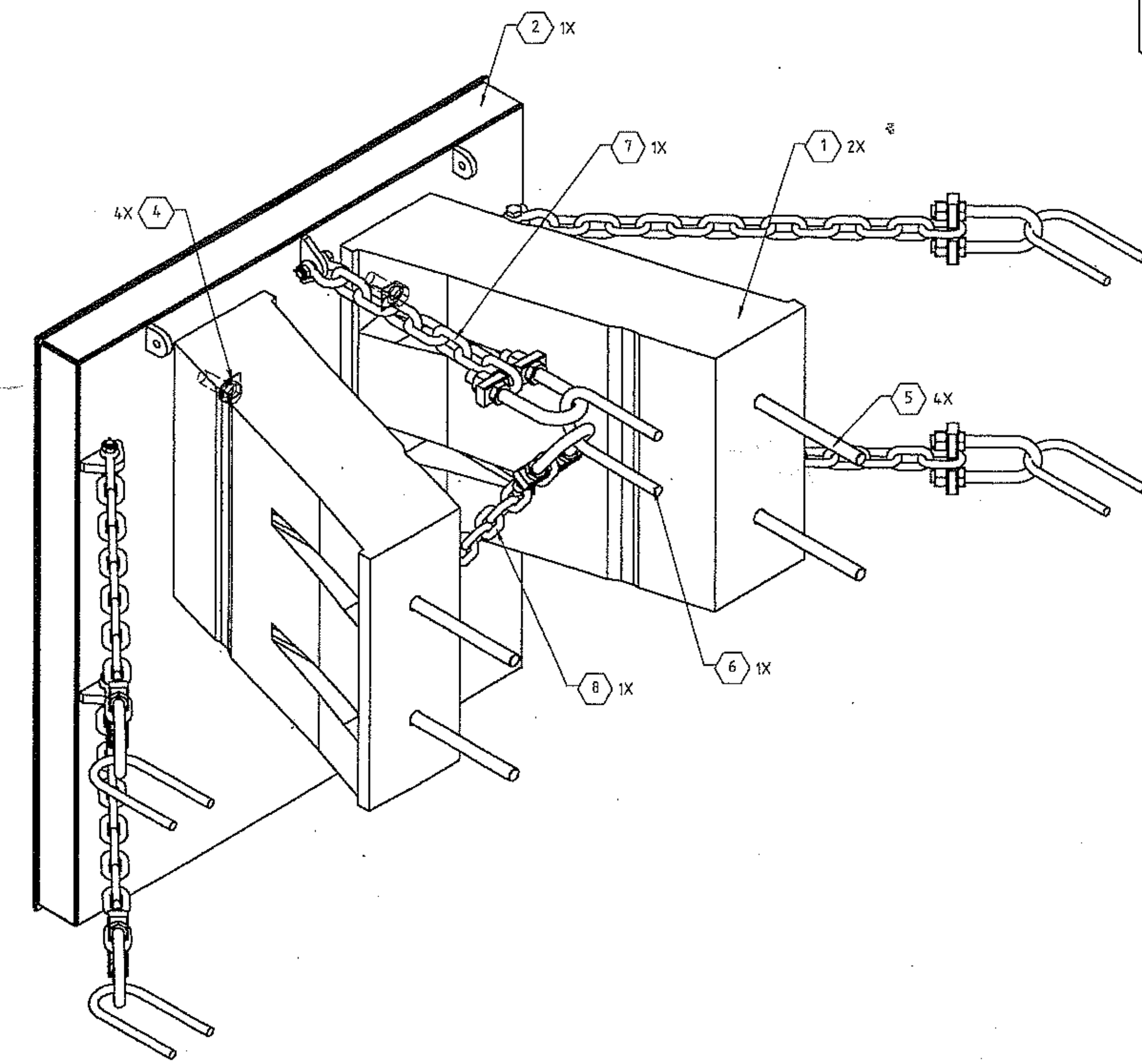
PROJECT TITLE: PORT OF FERNANDINA DOCK FENDER			
DRAWING TITLE: TITLE SHEET			
SCALE: N.T.S.	DRAWN BY: KLG	CHECKED BY: KPT	APPROVED BY: KPT
SHEET: D	PROJECT NUMBER: 61537	DRAWING NUMBER: 61537 -01	REV: 1

ITEM NO.	SHEET	DESCRIPTION	QTY.	JOB QTY.
1	6	MV 1450 x 1000 LEG FENDER-A	2	34
2	8	CLOSED BACK STEEL FRONTAL FRAME	1	17
3	3	UHMW LAYOUT	1	17
4	6	FENDER TO PANEL HARDWARE ASSEMBLY	4	68
5	6	FENDER ANCHOR HARDWARE ASSEMBLY	4	68
6	6	M40 U-ANCHOR	1	17
7	4	TENSION CHAIN ASSEMBLY	1	17
8	4	WEIGHT CHAIN ASSEMBLY	1	17
9	4	SHEAR CHAIN ASSEMBLY ⚠1	4	68
10	6	M32 U-ANCHOR ⚠1	4	68

ITEM NO.	SHEET	DESCRIPTION	QTY.	JOB QTY.
3.1	7	1 1/4" [32] THICK GREEN UHMW	9	153
3.2	7	5/8" LOW PROFILE UHMW NUT	81	1377







REV.	BY	DESCRIPTION	DATE
1	KLG	ADDED SHEAR CHAINS & U-ANCHORS	10/30/2017

REVISIONS

TRELLEBORG

PROJECT TITLE
PORT OF FERNANDINA DOCK FENDER

DRAWING TITLE
BILL OF MATERIALS

SCALE:	DRAWN BY:	CHECKED BY:	APPROVED BY:
N.T.S.	KLG	KPT	KPT

SHEET	PROJECT NUMBER:	DRAWING NUMBER:	REV
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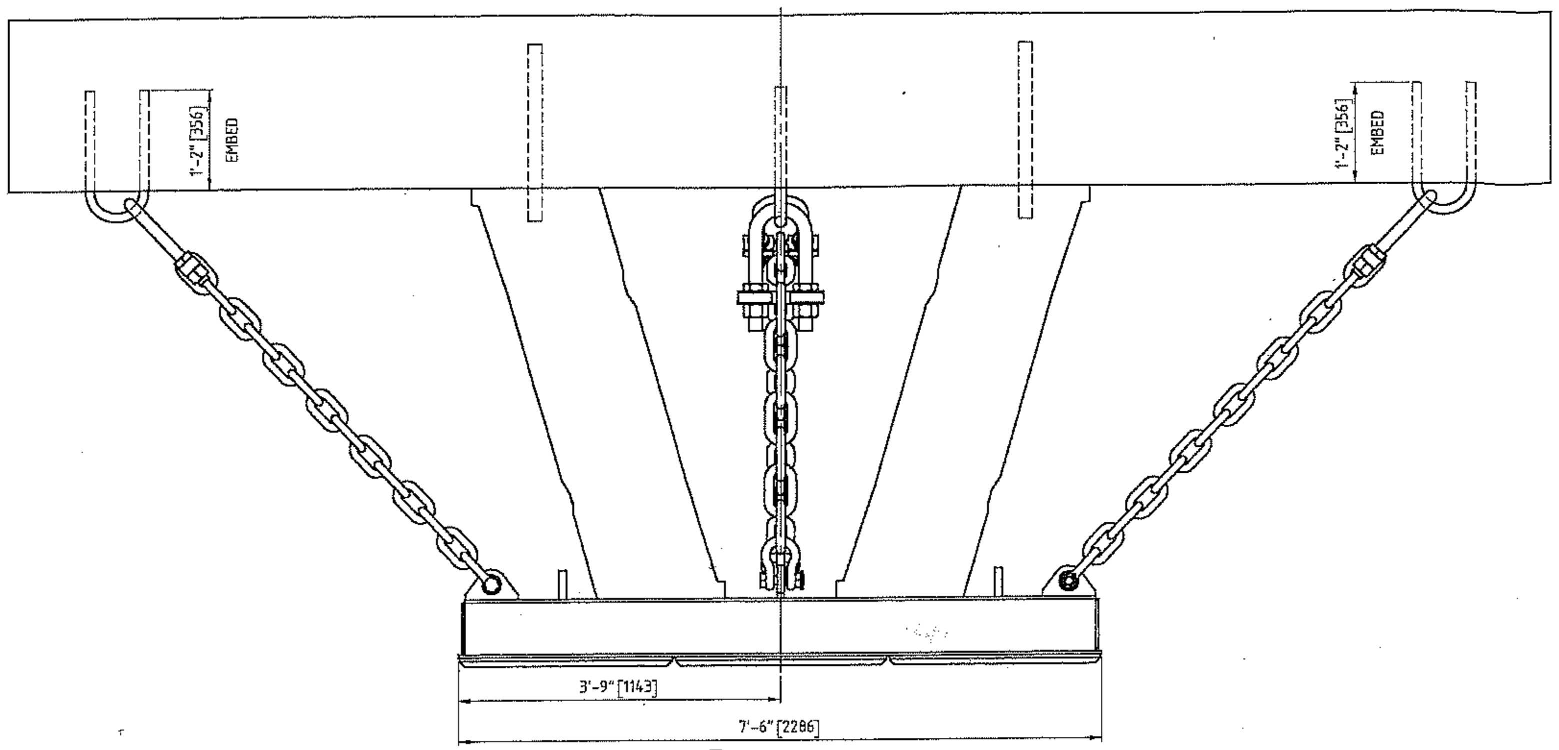
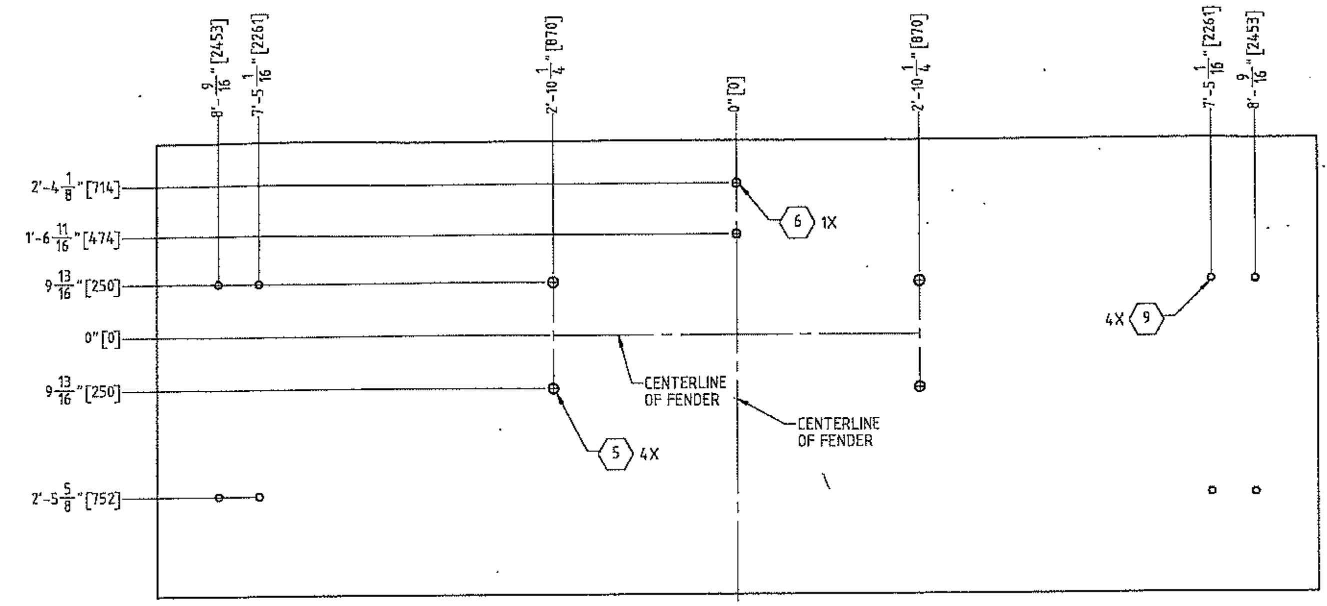
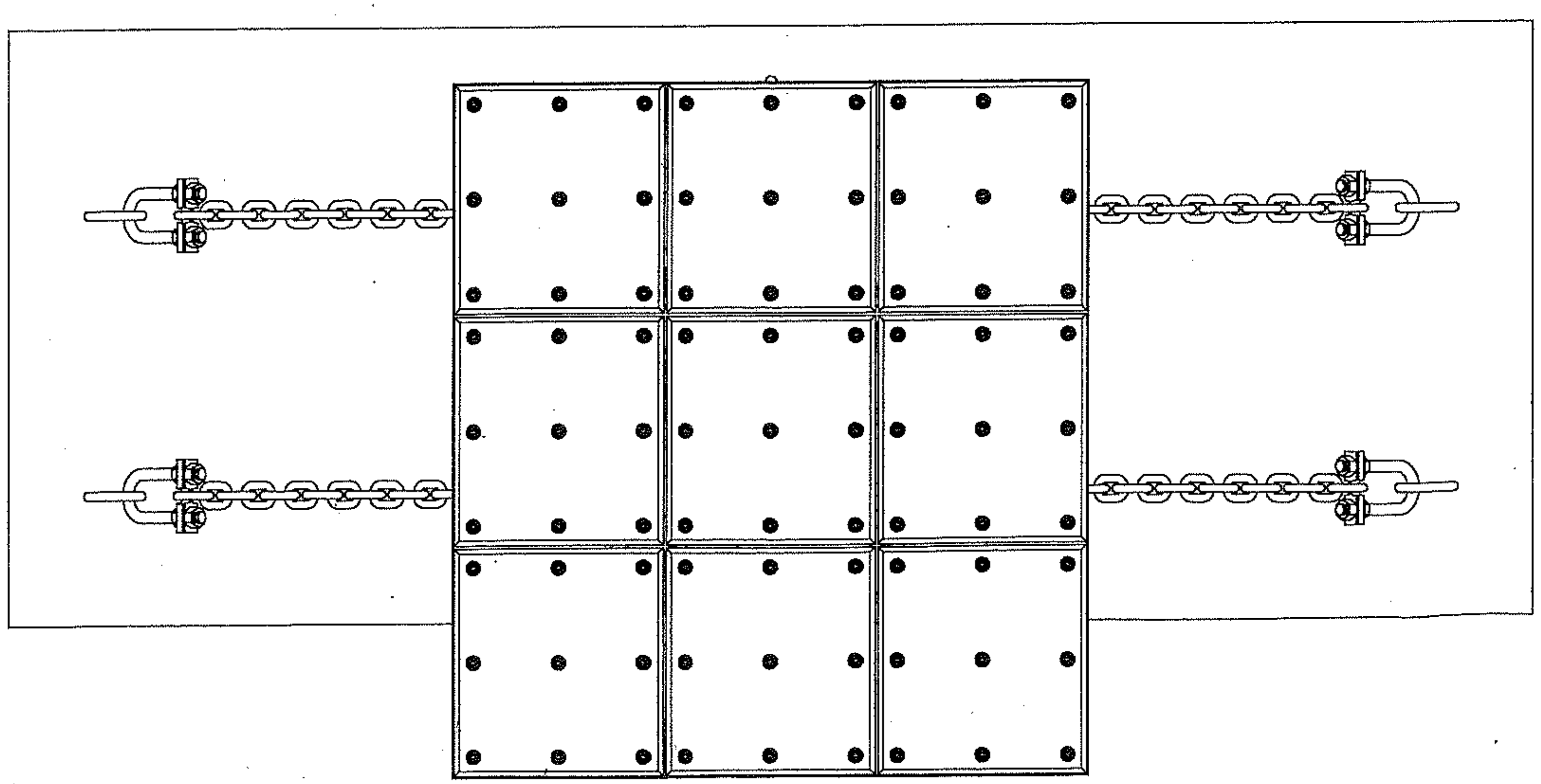


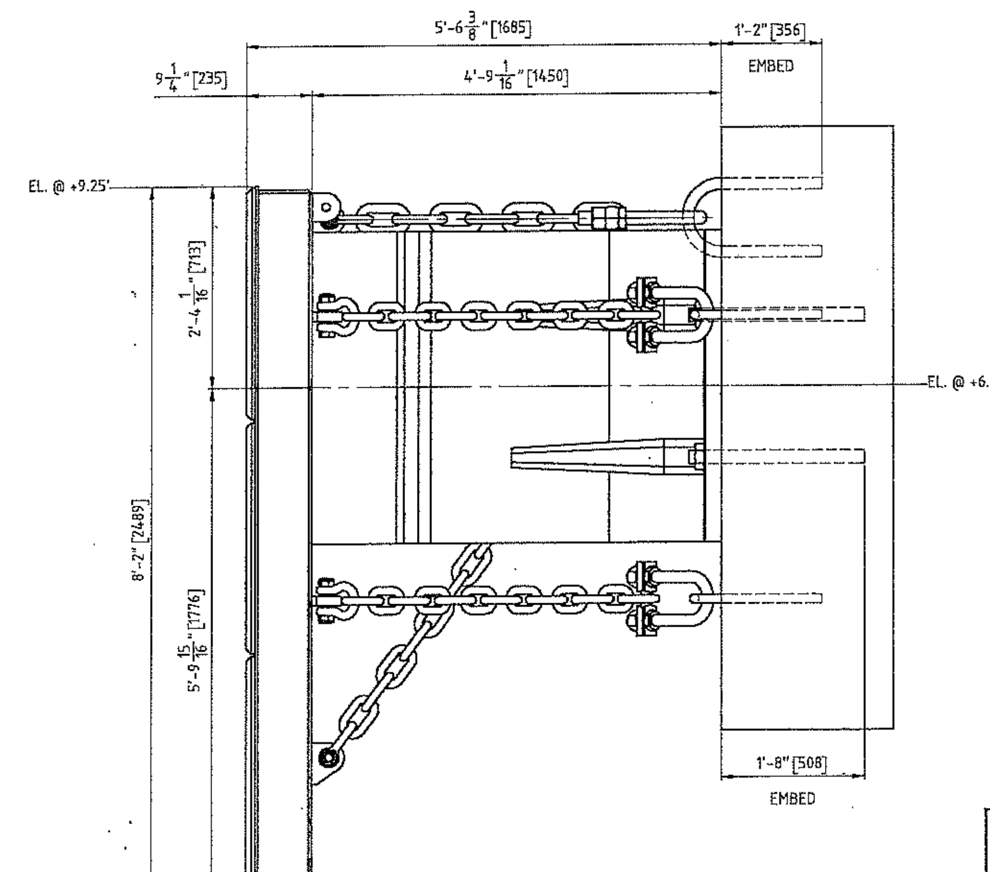
A PLAN VIEW
SCALE: 1:12



D ANCHOR BOLT LAYOUT/CONCRETE ELEVATION
SCALE: 1:16



B FRONT ELEVATION
SCALE: 1:12



C SIDE ELEVATION
SCALE: 1:12

TRELLEBORG

PROJECT TITLE
PORT OF FERNANDINA DOCK FENDER

DRAWING TITLE
FENDER PLANS

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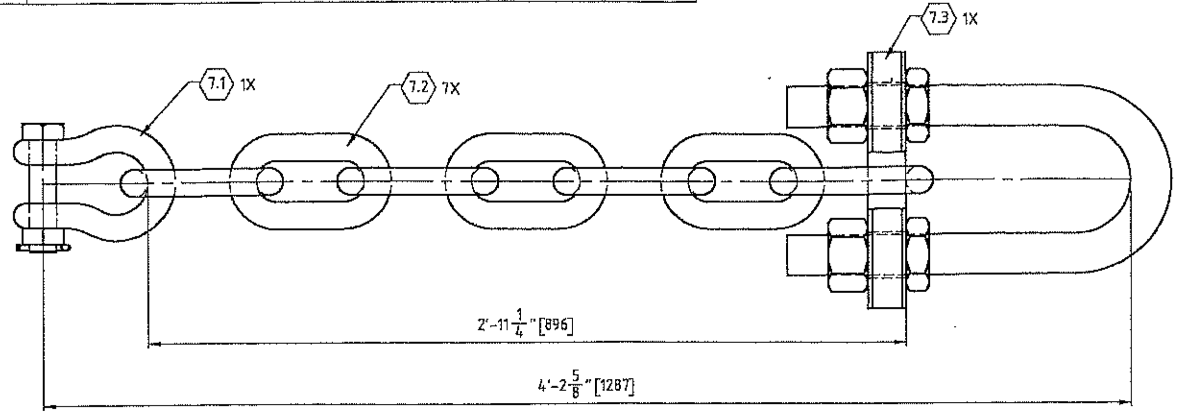
SCALE:	DRAWN BY:	CHECKED BY:	APPROVED BY:
AS NOTED	KLG	KPT	KPT

SHEET	PROJECT NUMBER:	DRAWING NUMBER:	REV
D	61537	61537 -02	1

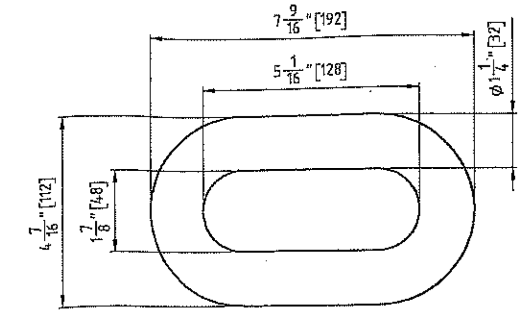
REVISIONS

REV.	BY	DESCRIPTION	DATE
1	KLG	ADDED SHEAR CHAINS & U-ANCHORS	10/30/2017

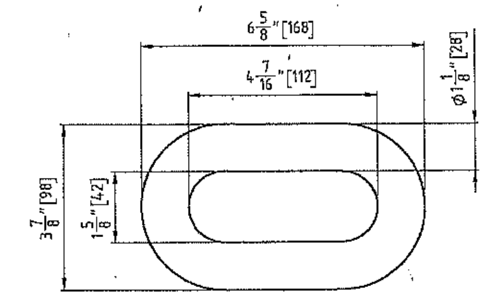
TENSION CHAIN ASSEMBLY				
ITEM NO.	DESCRIPTION	QTY.	MATERIAL	FINISH
7.1	1 1/8" SAFETY BOLT ANCHOR SHACKLE	1	G-2130	H.D.G.
7.2	32mm OPEN LINK CHAIN	7	GR. 3	H.D.G.
7.3	1 7/8" DOGBONE SHACKLE ASSEMBLY	1	SEE DETAIL	H.D.G.



7 TENSION CHAIN ASSEMBLY
SCALE: 1:4
(17 REQ'D)

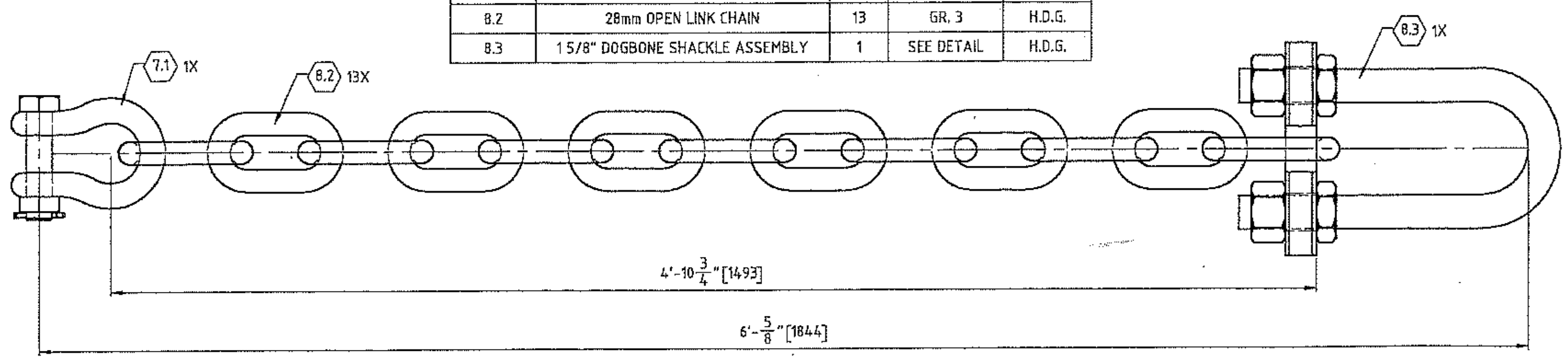


7.2 32mm OPEN LINK CHAIN
SCALE: 1:2

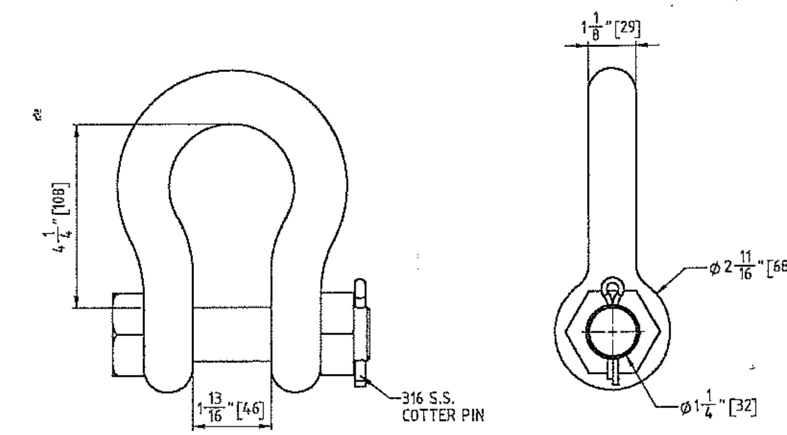


8.2 28mm OPEN LINK CHAIN
SCALE: 1:2

SHEAR CHAIN ASSEMBLY				
ITEM NO.	DESCRIPTION	QTY.	MATERIAL	FINISH
7.1	1 1/8" SAFETY BOLT ANCHOR SHACKLE	1	G-2130	H.D.G.
8.2	28mm OPEN LINK CHAIN	13	GR. 3	H.D.G.
8.3	1 5/8" DOGBONE SHACKLE ASSEMBLY	1	SEE DETAIL	H.D.G.

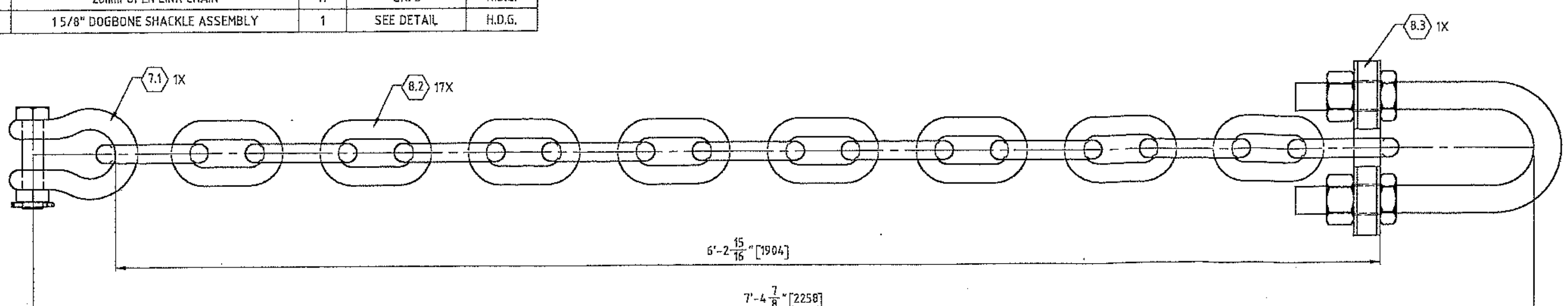


9 SHEAR CHAIN ASSEMBLY
SCALE: 1:4
(68 REQ'D)



7.1 1 1/8" SAFETY BOLT ANCHOR SHACKLE
SCALE: 1:2
(102 REQ'D)

WEIGHT CHAIN ASSEMBLY				
ITEM NO.	DESCRIPTION	QTY.	MATERIAL	FINISH
7.1	1 1/8" SAFETY BOLT ANCHOR SHACKLE	1	G-2130	H.D.G.
8.2	28mm OPEN LINK CHAIN	17	GR. 3	H.D.G.
8.3	1 5/8" DOGBONE SHACKLE ASSEMBLY	1	SEE DETAIL	H.D.G.



8 WEIGHT CHAIN ASSEMBLY
SCALE: 1:4
(17 REQ'D)

REV.	BY	DESCRIPTION	DATE
1	KLG	ADDED SHEAR CHAINS	10/30/2017

REVISIONS

TRELLEBORG

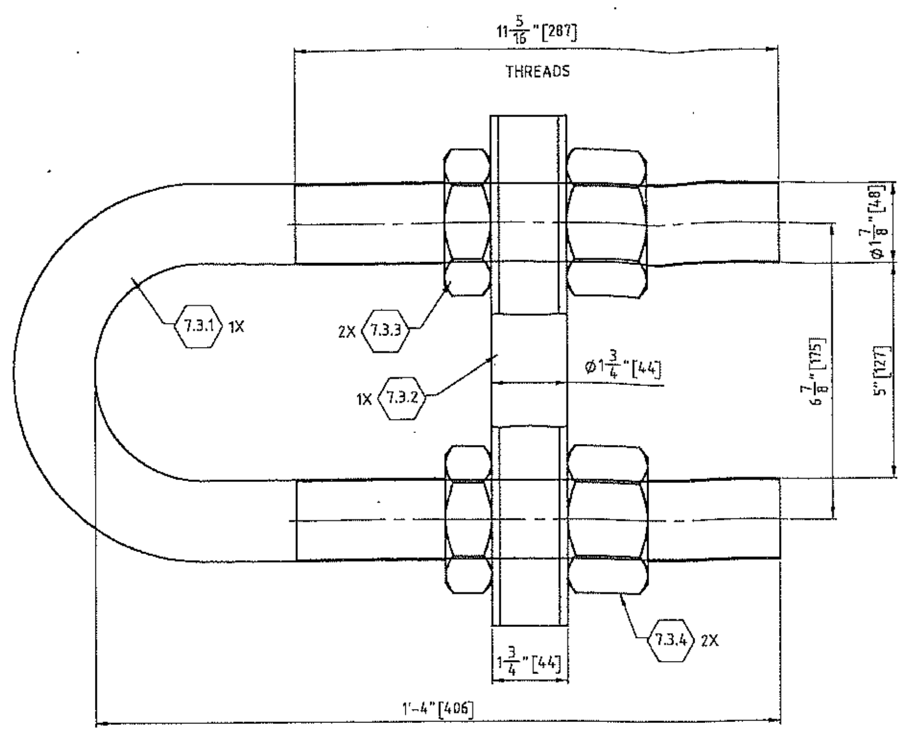
PROJECT TITLE: PORT OF FERNANDINA DOCK FENDER

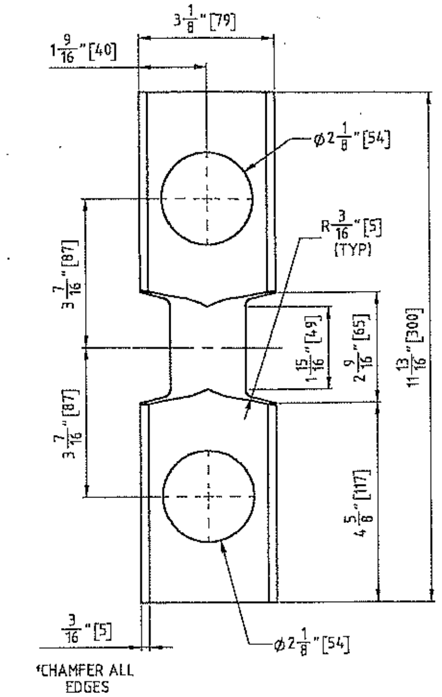
DRAWING TITLE: CHAIN ASSEMBLIES & DETAILS

SCALE:	DRAWN BY:	CHECKED BY:	APPROVED BY:
AS NOTED	KLG	KPT	KPT

SHEET	PROJECT NUMBER:	DRAWING NUMBER:	REV
D	61537	61537-04	1

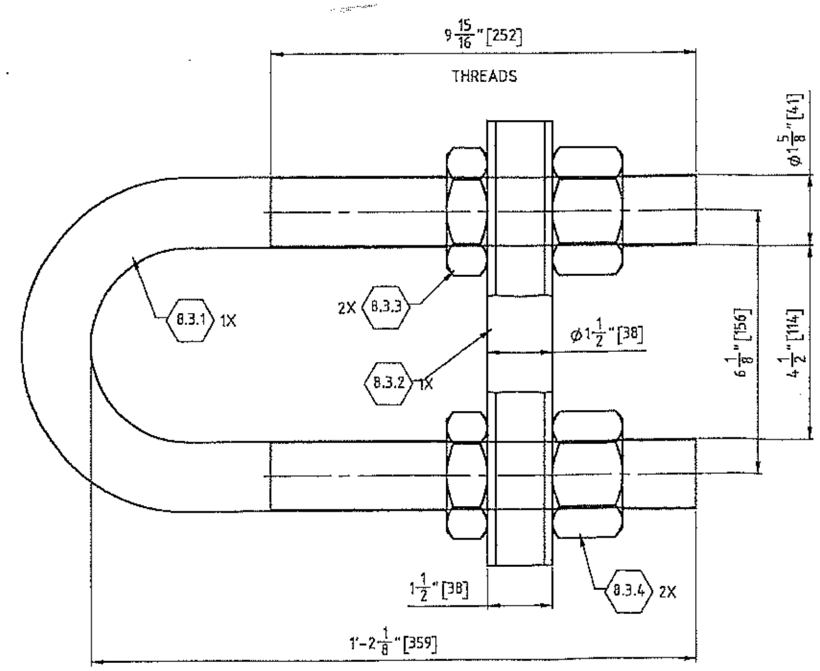
1 7/8" DOGBONE SHACKLE ASSEMBLY				
ITEM NO.	DESCRIPTION	QTY.	MATERIAL	FINISH
7.3.1	1 7/8"-5 UNC-2A U-BOLT	1	AISI 4140 HR	H.D.G.
7.3.2	1 7/8" DOGBONE SHACKLE CROSS BAR	1	GR. 50 MINIMUM	H.D.G.
7.3.3	1 7/8"-5 UNC-2B HEAVY HEX JAM NUT	2	ASTM A563 DH	H.D.G.
7.3.4	1 7/8"-5 UNC-2B HEAVY HEX NUT	2	ASTM A563 DH	H.D.G.

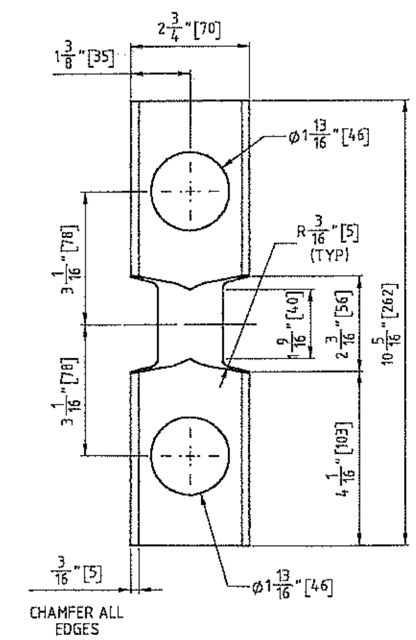




7.3 1 7/8" DOGBONE SHACKLE ASSEMBLY
SCALE: 1:2
(17 REQ'D)

1 5/8" DOGBONE SHACKLE ASSEMBLY				
ITEM NO.	DESCRIPTION	QTY.	MATERIAL	FINISH
8.3.1	1 5/8"-5 1/2 UNC-2A U-BOLT	1	AISI 4140 HR	H.D.G.
8.3.2	1 5/8" DOGBONE SHACKLE CROSS BAR	1	GR. 50 MINIMUM	H.D.G.
8.3.3	1 5/8"-8 UNC-2B JAM NUT	2	ASTM A563 DH	H.D.G.
8.3.4	1 5/8"-8 UNC-2B HEAVY HEX NUT	2	ASTM A563 DH	H.D.G.





8.3 1 5/8" DOGBONE SHACKLE ASSEMBLY
SCALE: 1:2
(85 REQ'D)

REV.	BY	DESCRIPTION	DATE
1	KLG	ADDED 1 5/8" DOGBONE SHACKLES	10/30/2017

REVISIONS

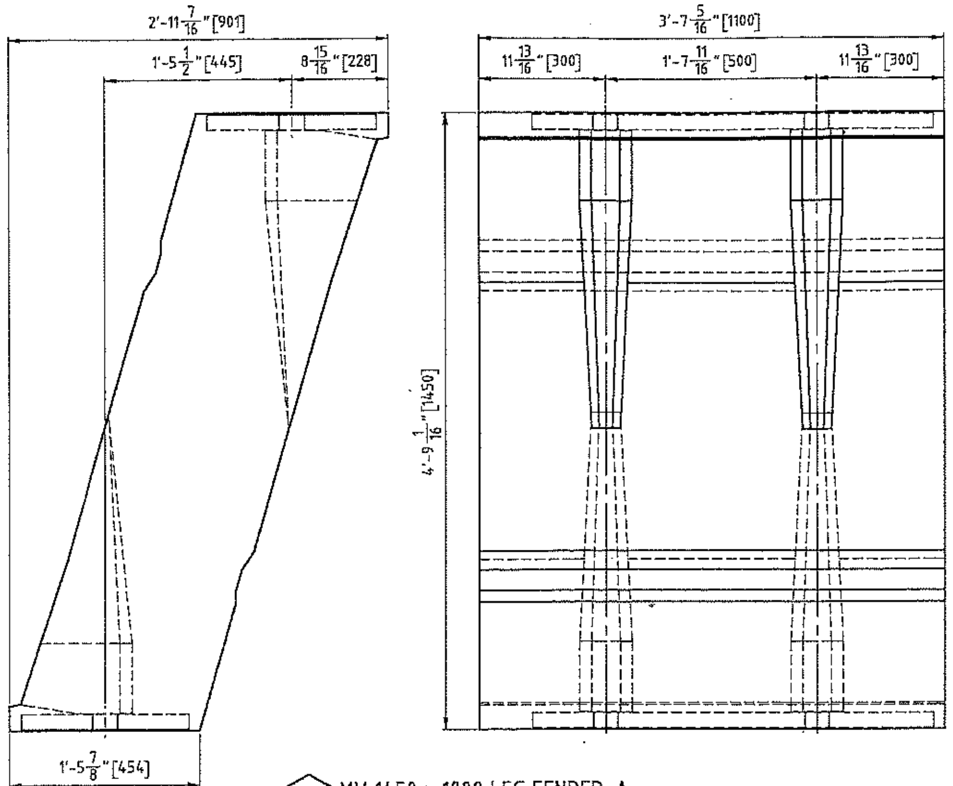
TRELLEBORG

PROJECT TITLE: PORT OF FERNANDINA DOCK FENDER

DRAWING TITLE: DOGBONE SHACKLE DETAILS

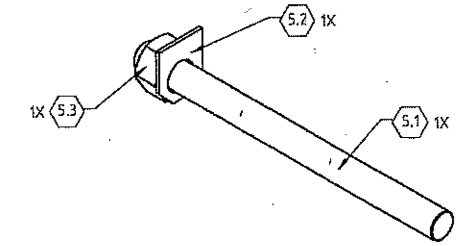
SCALE: AS NOTED	DRAWN BY: KLG	CHECKED BY: KPT	APPROVED BY: KPT
SHEET: D	PROJECT NUMBER: 61537	DRAWING NUMBER: 61537-05	REV: 1

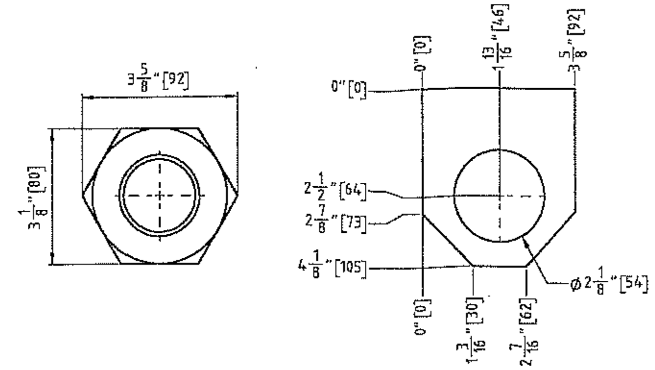
FENDER PERFORMANCE (EACH)				
FENDER	REACTION	ENERGY	DEFLECTION	TOLERANCE
EACH	188 kips [835 kN]	411 ft-kips [557 kN-m]	57.5%	+/-10%

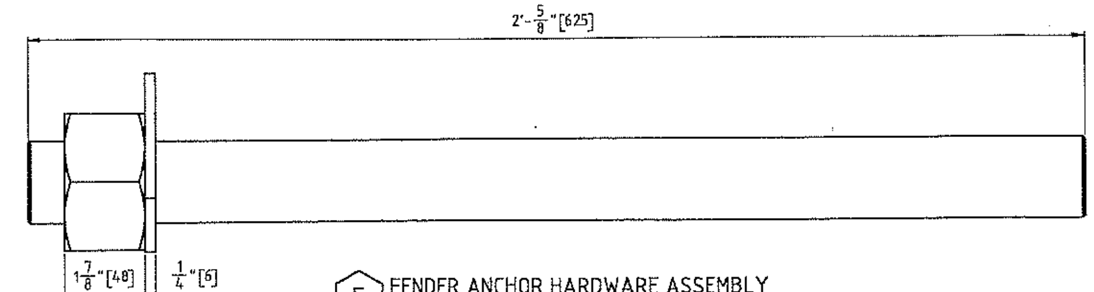


1 MV 1450 x 1000 LEG FENDER–A
SCALE: 1:8
(34 REQ'D)

FENDER ANCHOR HARDWARE ASSEMBLY				
ITEM NO.	DESCRIPTION	QTY.	MATERIAL	FINISH
5.1	M48x5 X 625 THREADED ROD	1	GR. 4.6	H.D.G.
5.2	MV 1450 FENDER WASHER	1	ASTM A36	H.D.G.
5.3	M48x5 HEX NUT	1	SAE Gr. 8	H.D.G.

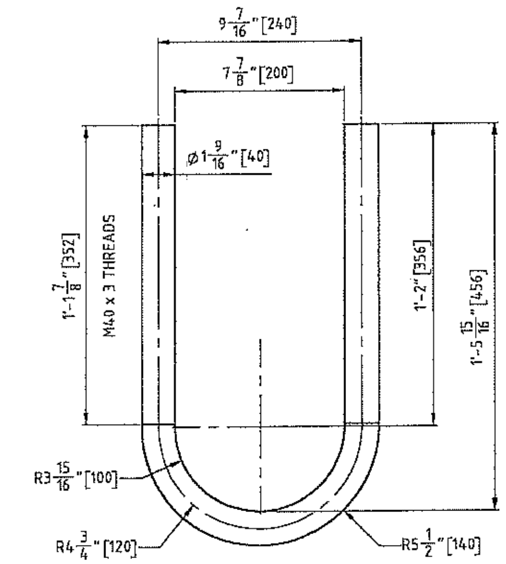






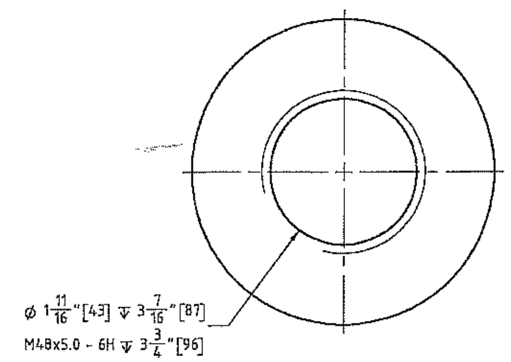
5 FENDER ANCHOR HARDWARE ASSEMBLY
SCALE: 1:2
(68 REQ'D)

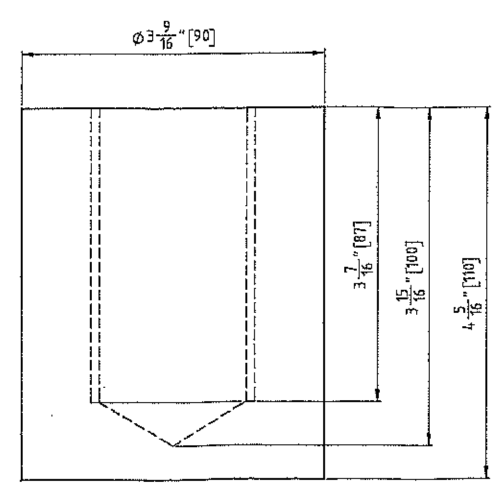
M40 U-ANCHOR DETAIL				
ITEM NO.	DESCRIPTION	QTY.	MATERIAL	FINISH
6	M40 U-ANCHOR	1	ISO Gr. 8.8	H.D.G.



6 M40 U-ANCHOR
SCALE: 1:4
(17 REQ'D)

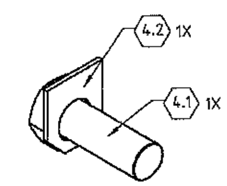
M48 PANEL SOCKET				
ITEM NO.	DESCRIPTION	QTY.	MATERIAL	FINISH
2.24	M48 PANEL SOCKET (WELDED INSIDE OF PANEL)	1	AISI TYPE 304	S.S.

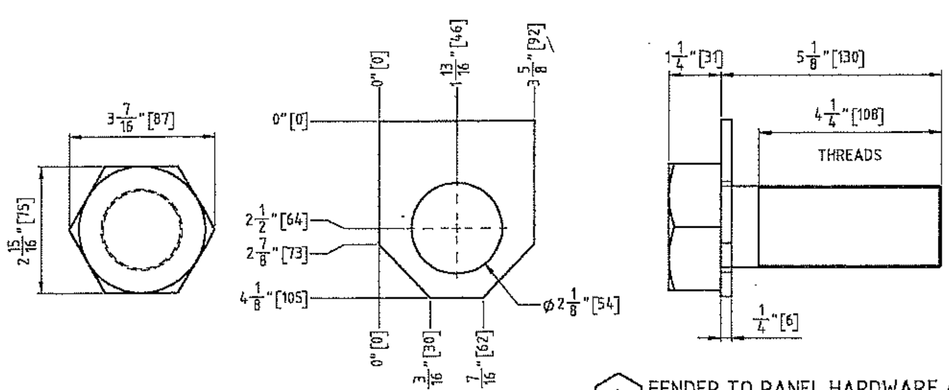




2.24 M48 PANEL SOCKET (WELDED INSIDE OF PANEL)
SCALE: 1:1
(68 REQ'D)

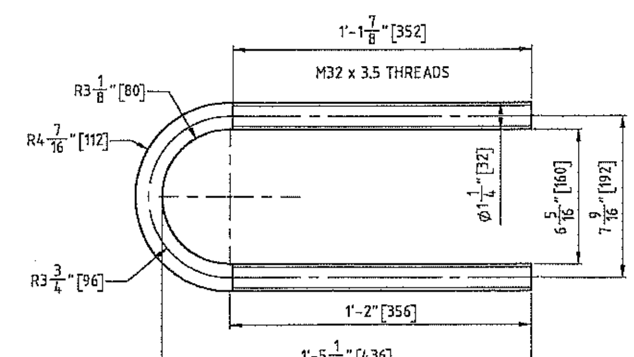
FENDER TO PANEL HARDWARE ASSEMBLY				
ITEM NO.	DESCRIPTION	QTY.	MATERIAL	FINISH
4.1	M48x5 X 130 HEX BOLT	1	316	S.S.
4.2	MV 1450 FENDER WASHER	1	316	S.S.





4 FENDER TO PANEL HARDWARE ASSEMBLY
SCALE: 1:2
(68 REQ'D)

M32 U-ANCHOR DETAIL				
ITEM NO.	DESCRIPTION	QTY.	MATERIAL	FINISH
10	M32 U-ANCHOR	1	ISO Gr. 8.8	H.D.G.



10 M32 U-ANCHOR
SCALE: 1:4
(68 REQ'D)

REV.	BY	DESCRIPTION	DATE
1	KLG	ADDED U-ANCHORS	10/30/2017

REVISIONS

TRELLEBORG

PROJECT TITLE: PORT OF FERNANDINA DOCK FENDER

DRAWING TITLE: FENDER & HARDWARE DETAILS

SCALE:	DRAWN BY:	CHECKED BY:	APPROVED BY:
AS NOTED	KLG	KPT	KPT

SHEET	PROJECT NUMBER:	DRAWING NUMBER:	REV
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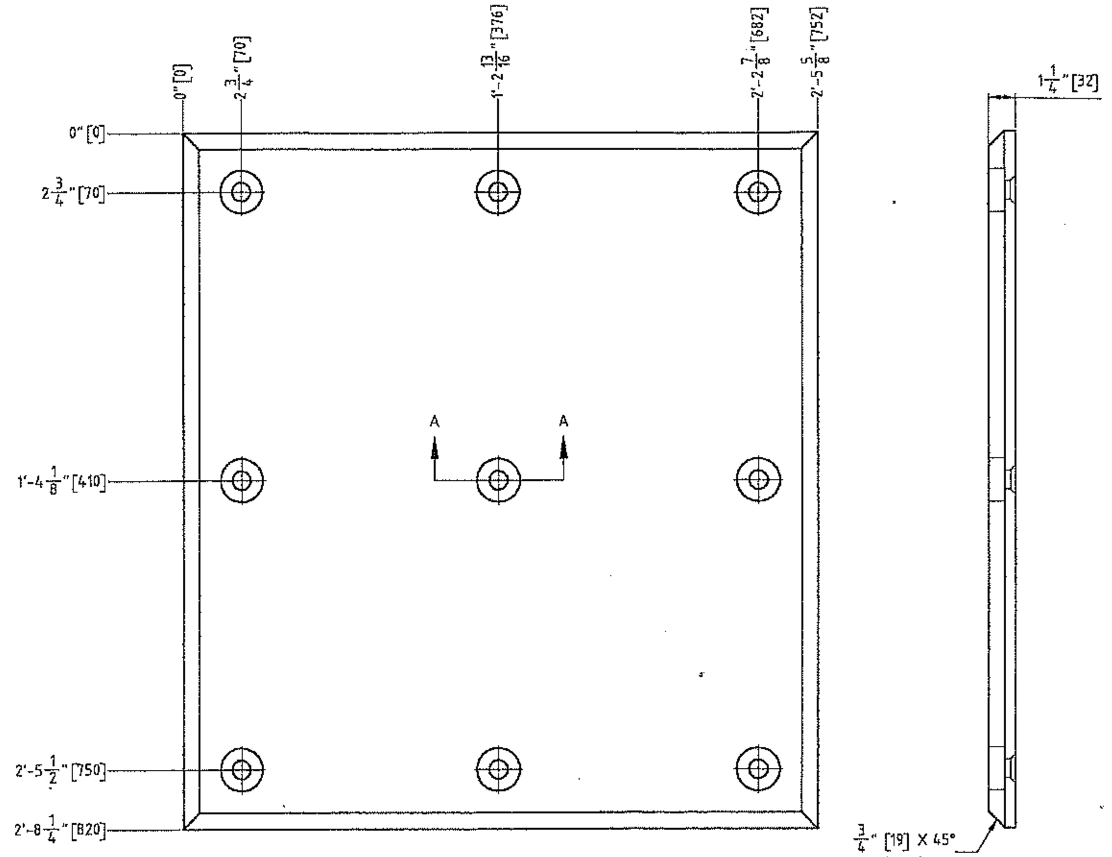
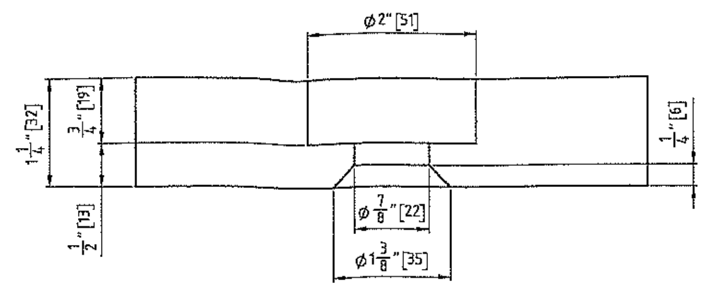
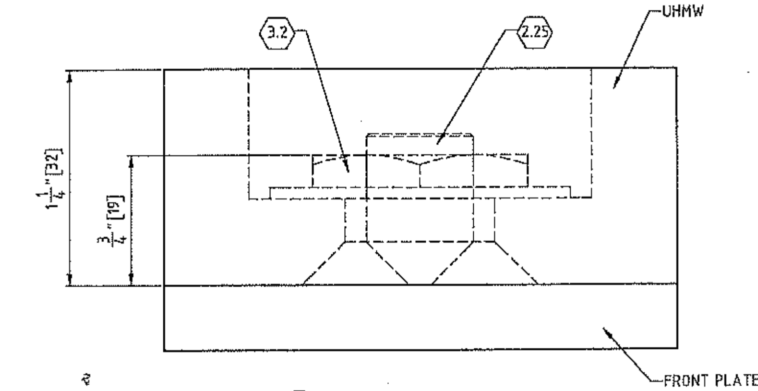


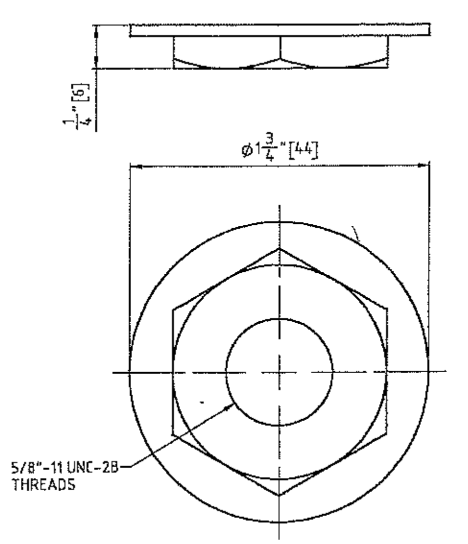
3.1 UHMW DETAIL
SCALE: 1:4
(153 REQ'D)



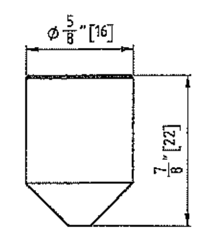
A-A SECTION
SCALE: 1:1



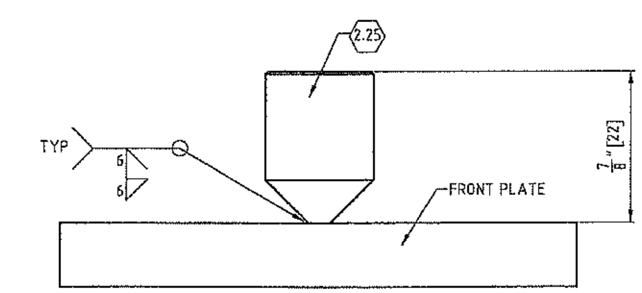
C UHMW TO PANEL DETAIL
SCALE: 2:1



3.2 5/8" LOW PROFILE UHMW NUT, 316 S.S.
SCALE: 2:1
(1377 REQ'D)



2.25 5/8" UHMW STUD (WELDED TO FRONT PLATES), 316 S.S.
SCALE: 2:1
(1377 REQ'D)



D/10 UHMW STUD WELD DETAIL
SCALE: 2:1

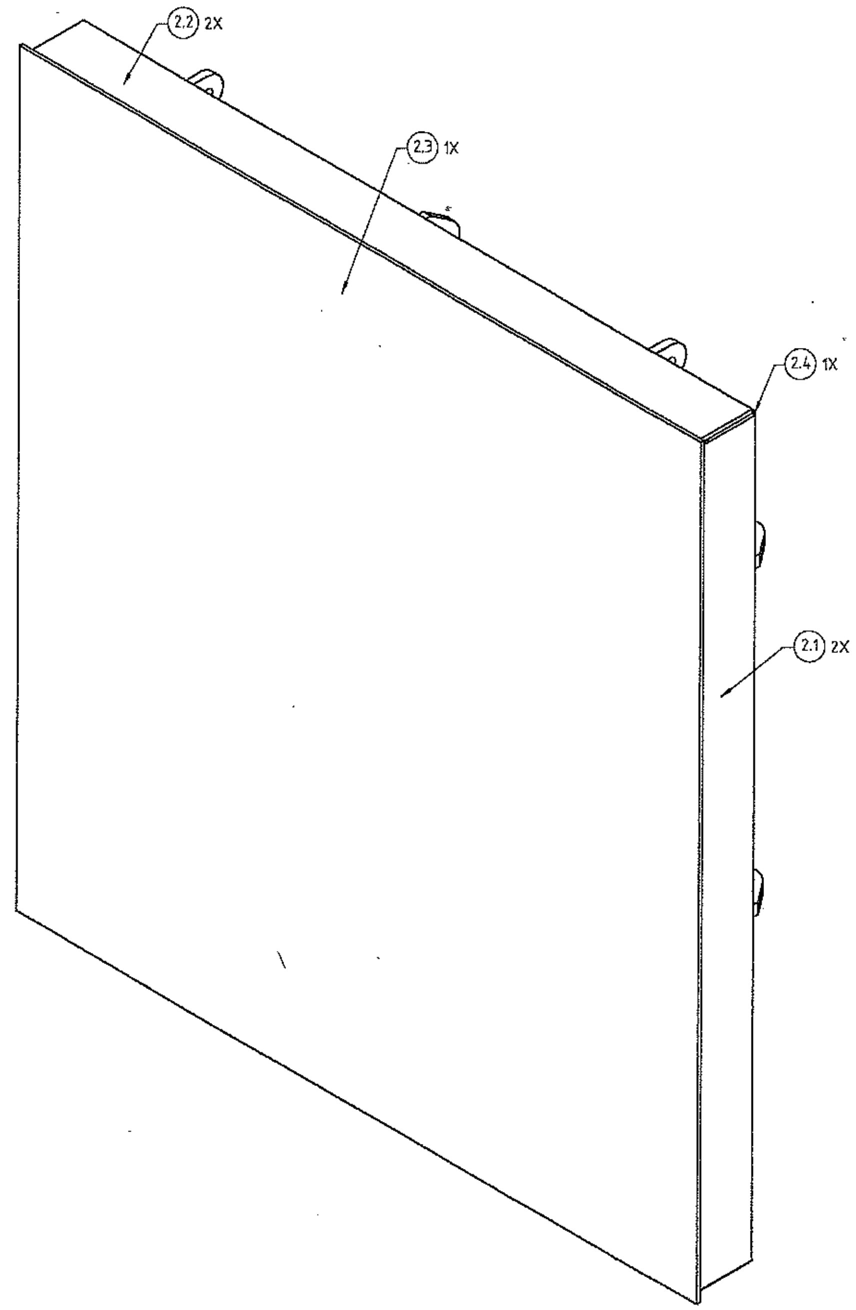
TRELLEBORG

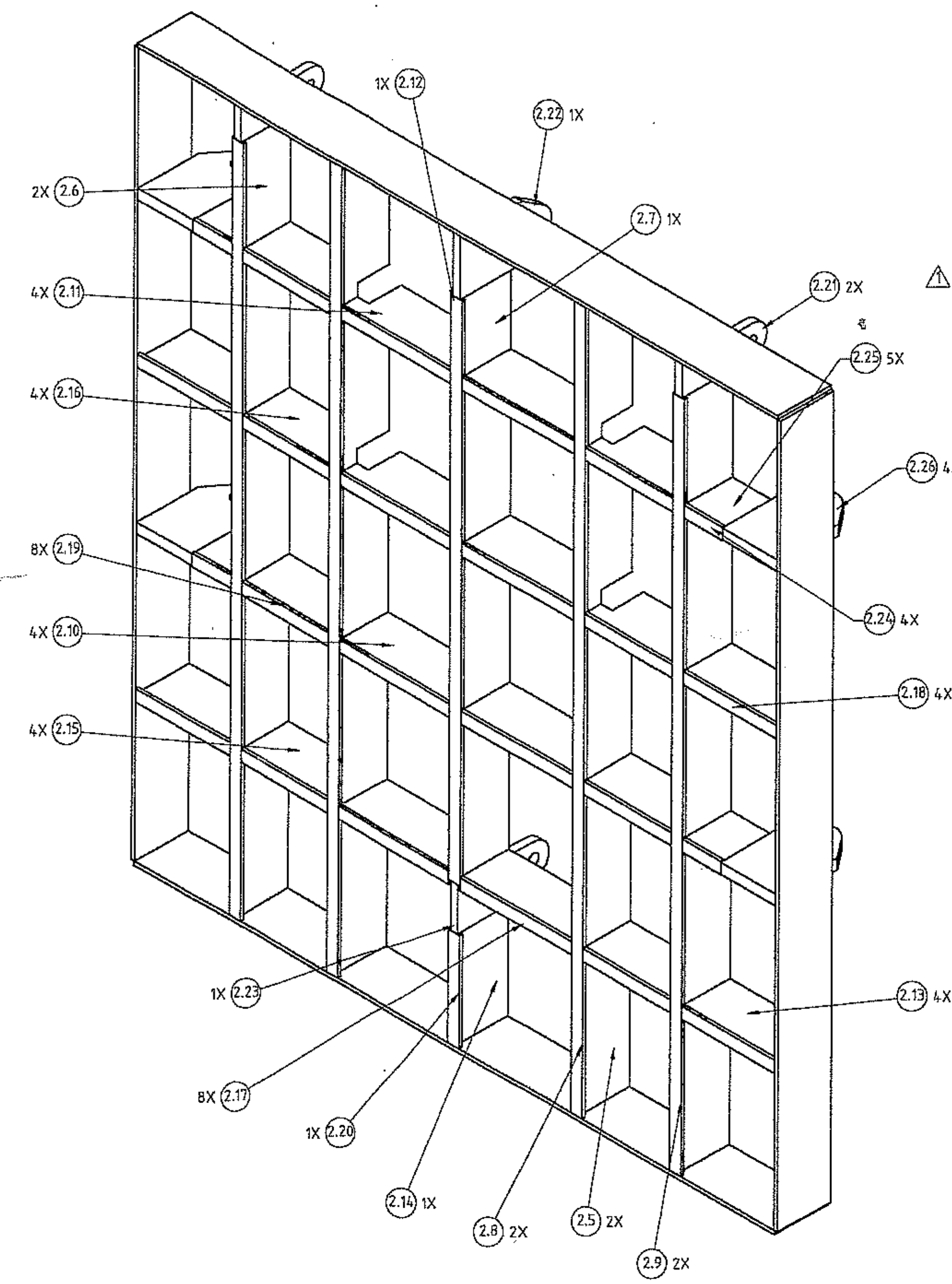
PROJECT TITLE: PORT OF FERNANDINA DOCK FENDER

DRAWING TITLE: UHMW DETAILS

SCALE: AS NOTED	DRAWN BY: KLG	CHECKED BY: KPT	APPROVED BY: KPT
SHEET: D	PROJECT NUMBER: 61537	DRAWING NUMBER: 61537-07	REV: 0

PANEL ASSEMBLY				
ITEM NO.	DESCRIPTION	MATERIAL	WEIGHT	QTY.
2.1	1/2" [12] THICK PLATE	Q345 [50 KSI]	93	2
2.2	1/2" [12] THICK PLATE	Q345 [50 KSI]	85	2
2.3	3/8" [10] THICK PLATE	Q345 [50 KSI]	985	1
2.4	3/8" [10] THICK PLATE	Q345 [50 KSI]	939	1
2.5	3/8" [10] THICK PLATE	Q345 [50 KSI]	70	2
2.6	3/8" [10] THICK PLATE	Q345 [50 KSI]	70	2
2.7	3/8" [10] THICK PLATE	Q345 [50 KSI]	53	1
2.8	3/8" [10] THICK PLATE	Q345 [50 KSI]	17	2
2.9	3/8" [10] THICK PLATE	Q345 [50 KSI]	16	2
2.10	3/8" [10] THICK PLATE	Q345 [50 KSI]	12	4
2.11	3/8" [10] THICK PLATE	Q345 [50 KSI]	12	4
2.12	3/8" [10] THICK PLATE	Q345 [50 KSI]	12	1
2.13	3/8" [10] THICK PLATE	Q345 [50 KSI]	10	4
2.14	3/8" [10] THICK PLATE	Q345 [50 KSI]	10	1
2.15	3/8" [10] THICK PLATE	Q345 [50 KSI]	10	4
2.16	3/8" [10] THICK PLATE	Q345 [50 KSI]	9	4
2.17	3/8" [10] THICK PLATE	Q345 [50 KSI]	3	8
2.18	3/8" [10] THICK PLATE	Q345 [50 KSI]	2	4
2.19	3/8" [10] THICK PLATE	Q345 [50 KSI]	2	8
2.20	3/8" [10] THICK PLATE	Q345 [50 KSI]	2	1
2.21	1" [25] THICK PLATE (LIFTING EYE)	Q345 [50 KSI]	12	2
2.22	1" [25] THICK PLATE (TENSION CHAIN PADEYE)	Q345 [50 KSI]	22	1
2.23	1" [25] THICK PLATE (WEIGHT CHAIN PADEYE)	Q345 [50 KSI]	18	1
2.24	3/8" [10] THICK PLATE	Q345 [50 KSI]	1	4
2.25	3/8" [10] THICK PLATE	Q345 [50 KSI]	4	5
2.26	1 3/8" [35] THICK PLATE (SHEAR CHAIN PADEYE)	Q345 [50 KSI]	30	4





1	KLG	ADDED SHEAR CHAIN PADEYES	10/30/2017
REV.	BY	DESCRIPTION	DATE
REVISIONS			

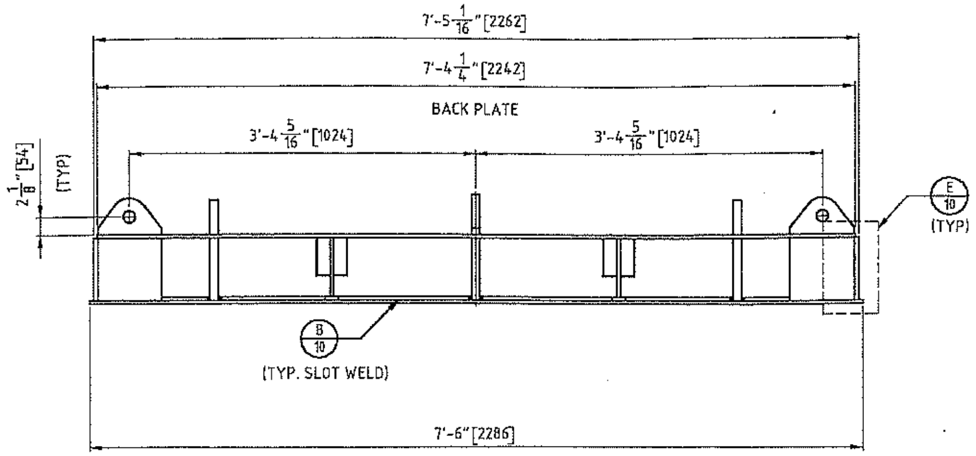
TRELLEBORG

PROJECT TITLE: PORT OF FERNANDINA DOCK FENDER

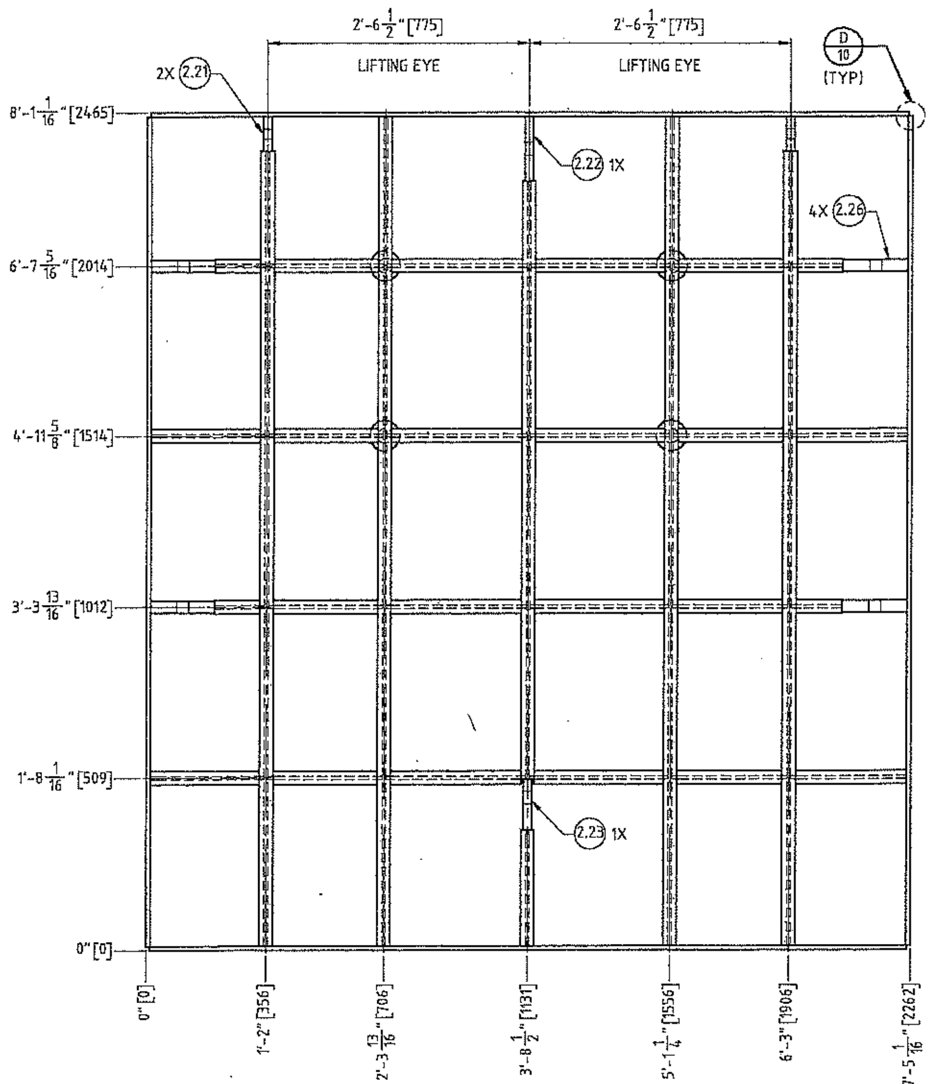
DRAWING TITLE: PANEL ASSEMBLY

SCALE:	DRAWN BY:	CHECKED BY:	APPROVED BY:
AS NOTED	KLG	KPT	KPT

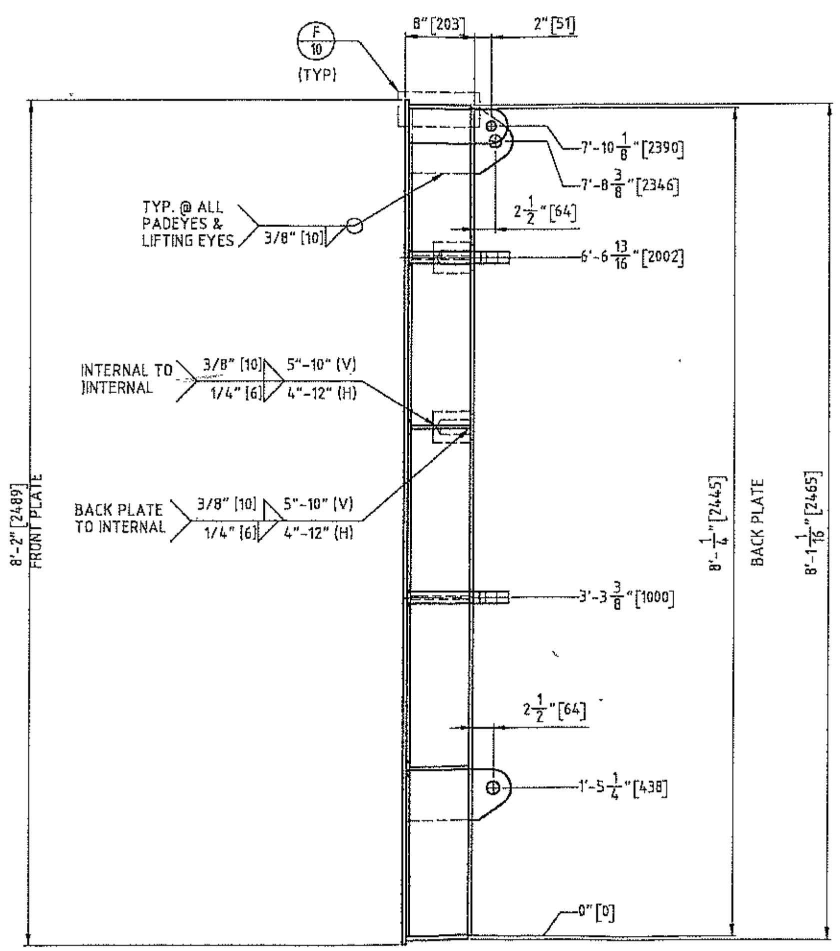
SHEET	PROJECT NUMBER:	DRAWING NUMBER:	REV
D	61537	61537 -08	1



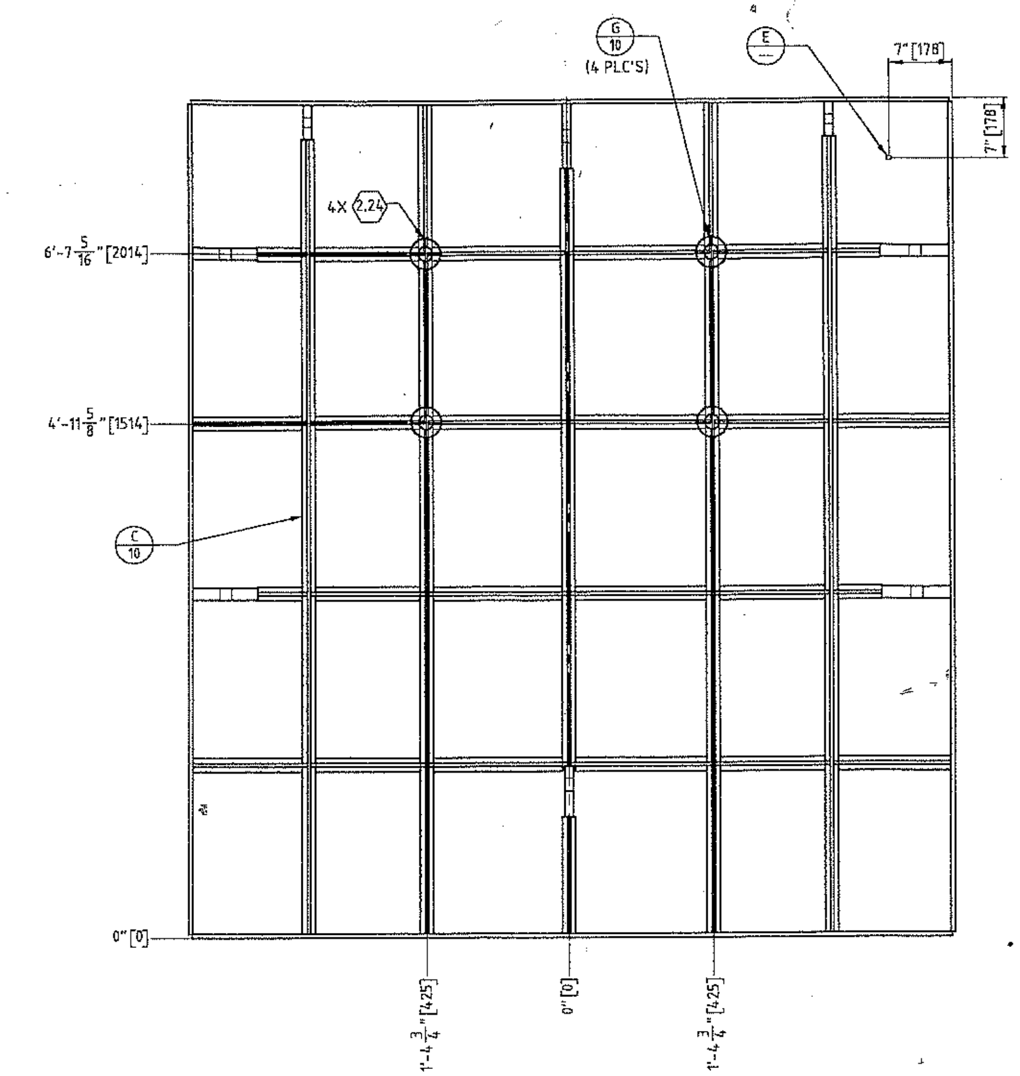
A TOP SECTION
SCALE: 1:10



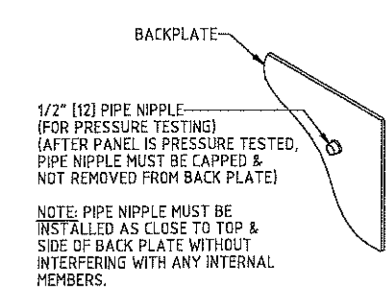
B FRONT ELEVATION
SCALE: 1:10
(FRONT PLATE REMOVED)



C SIDE SECTION
SCALE: 1:10



D REAR ELEVATION
SCALE: 1:10
(BACK PLATE REMOVED)



E PRESSURE TEST PIPE NIPPLE LOCATION
SCALE: N.T.S.

REV.	BY	DESCRIPTION	DATE
1	KLG	ADDED SHEAR CHAIN PADEYES	10/30/2017

REVISIONS

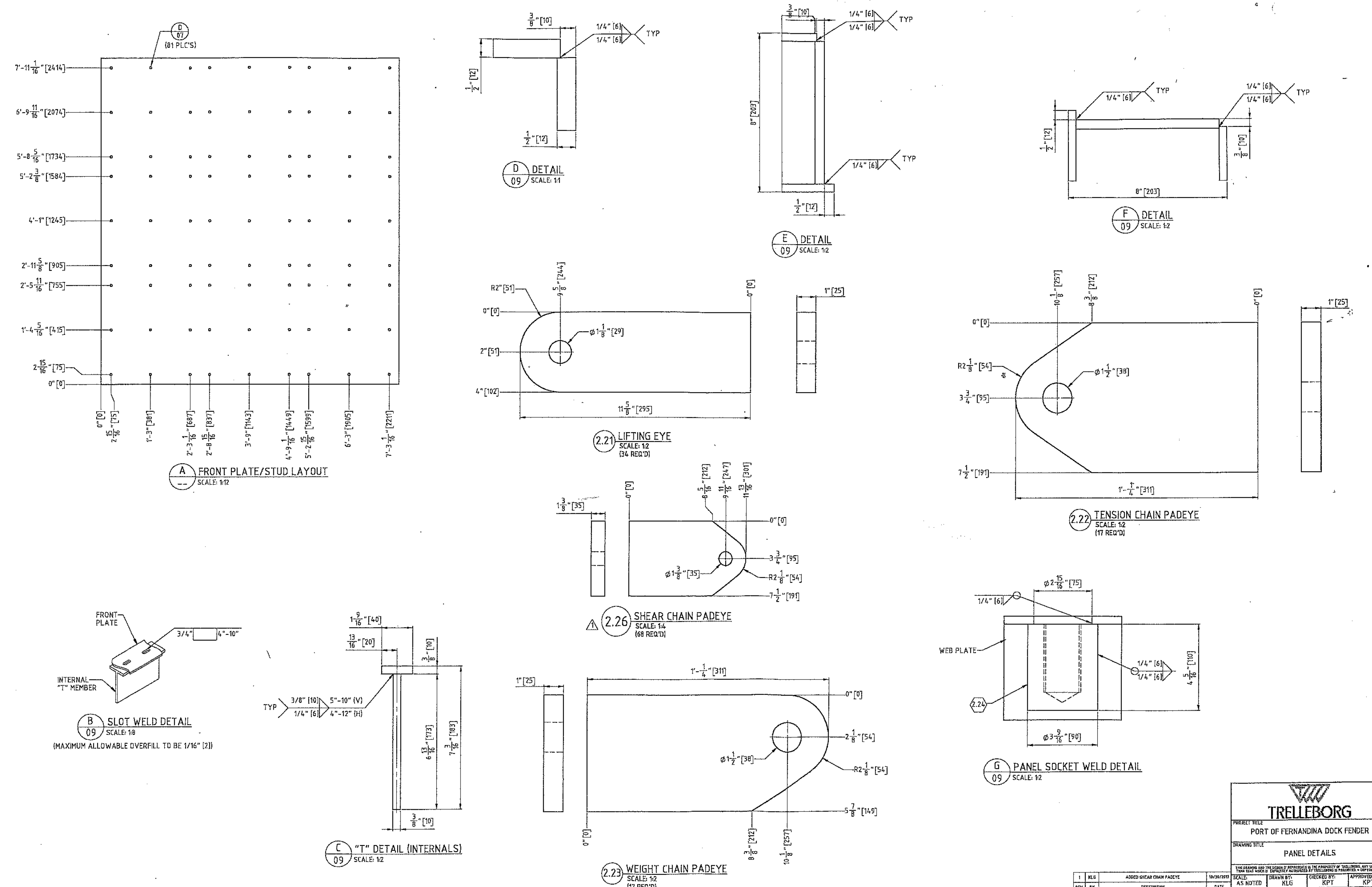
TRELLEBORG

PROJECT TITLE: PORT OF FERNANDINA DOCK FENDER

DRAWING TITLE: PANEL ASSEMBLY

SCALE:	DRAWN BY:	CHECKED BY:	APPROVED BY:
AS NOTED	KLG	KPT	KPT

SHEET	PROJECT NUMBER:	DRAWING NUMBER:	REV
D	61537	61537-09	1



TRELLEBORG

PROJECT TITLE: PORT OF FERNANDINA DOCK FENDER

DRAWING TITLE: PANEL DETAILS

REV.	BY	DESCRIPTION	DATE
1	KLG	ADDED SHEAR CHAIN PADEYE	10/30/2017

REVISIONS

SCALE:	DRAWN BY:	CHECKED BY:	APPROVED BY:
AS NOTED	KLG	KPT	KPT

SHEET	PROJECT NUMBER:	DRAWING NUMBER:	REV
D	61537	61537 -10	1

TRELLEBORG

Technical Design Package

Project No.:	61537
Project Name:	Port of Fernandina Dock Fender
Submission Date:	Wednesday, March 29, 2017
Revision:	0

Prepared by: Kurt Trahan
Name, Title

Reviewed by: ____________________
Name, Title

This packet includes calculations or technical information verifying design of components detailed in the supporting technical drawings, which includes the following components:

Fender Performance	☑	Tension Chains	☑
Steel Panel Design	☑	Weight Chains	☑
UHMW-PE	☑	Uplift/Surge Chains	☐
Coating	☐	Shear Chains	☐
Hardware	☐	Anchorage	☐

Please review the contents of this packet, sign if applicable, and return to TMS representative. By signing below, you are authorized Maritime to continue with manufacturing of goods as detailed in the submitted drawings. If 'approved as noted' please note all necessary deviations on drawings or calculations.

Approved by: ____________________
Signature

____
Print Name, Title

Performance Curve

Fenders

TRELLEBORG

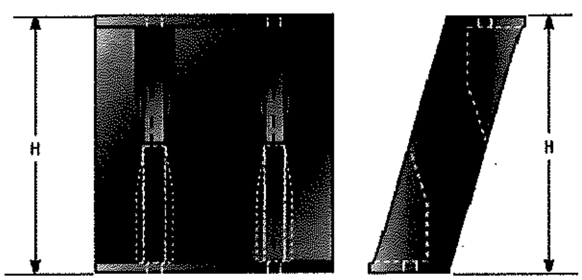
Project Information:

Project Number: 61537
Project Name: Port of Fernandina Dock Fender
Author: Kurt Trahan
Comments:

Fender Details:

Fender Type	MV		Hor. No. of fenders	2
Fender Height	1450	mm	Vert. No. of fenders	1
Rubber Grade	Compound A		Total No. of fenders	2
Fender Length	1100	mm		
Standard Deflection	57.5	%	Per Fender Weight	2115 lb
Performance Unit	English		Load Factor	1
RPD Adjusted*:	Yes			

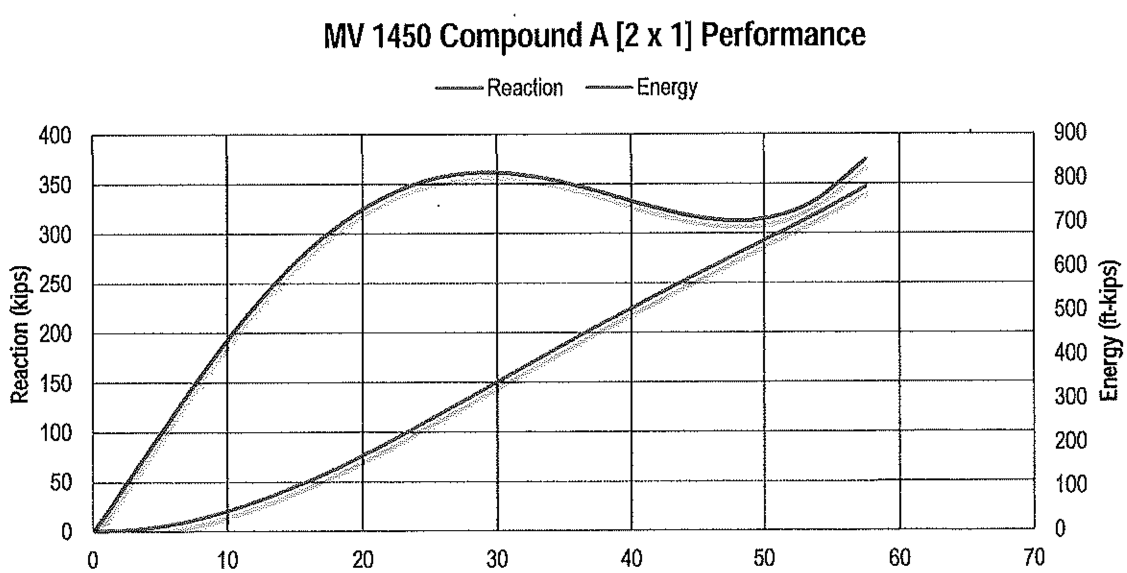
*RPD: Rated Performance Data according to PIANC



Fender Performance:

Reaction = F_r = 187 kips
Energy = F_e = 411 ft-kips

Total Reaction = R = 374 kips
Total Energy = E = 822 ft-kips



Panel Design Information

TRELLEBORG

Project Information

Project Number: 61537
Project Name: Port of Fernandina Dock Fender
Author: Kurt Trahan
Comments:

Panel Dimensional Layout

Overall Panel Width:	W_{OA} =	90.00	in =	7.50	ft
Overall Panel Length:	L_{OA} =	98.00	in =	8.17	ft

Panel Edge Effects

Edge	Type
Top	(A) - None
Bottom	(A) - None
Left	(A) - None
Right	(A) - None

EDGE EFFECT DIMENSIONS

Length (L_{EF})		Width (W_{EF})		Depth (D_{EF})	
	in		in		in
	in		in		in
	in		in		in
	in		in		in

Panel Dimensions Adjusted for Edge Effects:

Flat Width	W_F =	$W_{OA} - \Sigma W_{EF}$ =	90.00	in
Flat Length	L_F =	$L_{OA} - \Sigma L_{EF}$ =	98.00	in

Panel Effective Area:

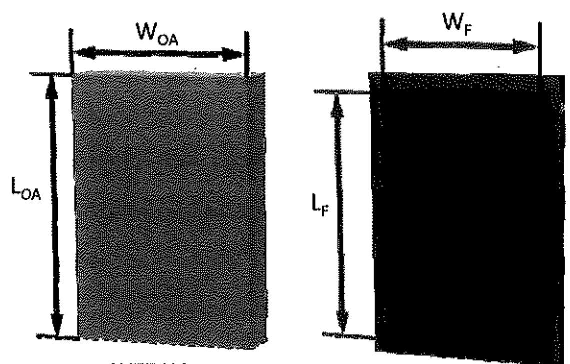
A_E = $W_F * L_F$ = 61.25 ft²

Hull Pressure:

P_h = R / A_e = 6.11 ksf

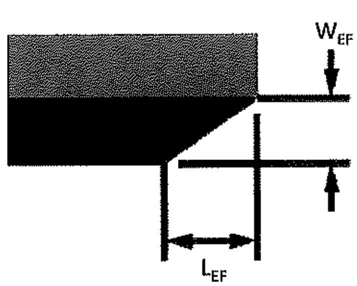
Panel Exterior Plates:

Front Plate:	t_f =	0.394	in
Back Plate:	t_b =	0.394	in
Side Plates:	t_s =	0.472	in

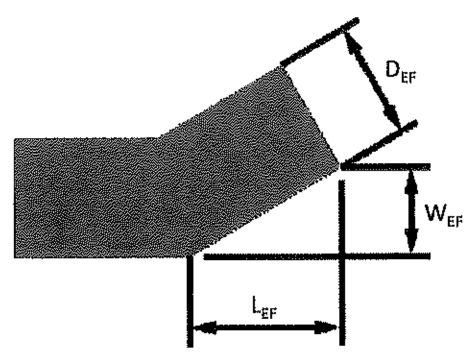


OVERALL DIMENSIONS

EFFECTIVE DIMENSIONS



(B) - CHAMFER



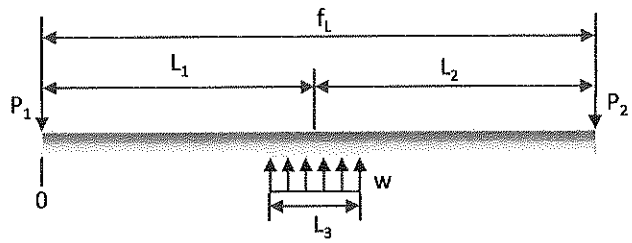
(C) - WING

Panel Design Information

TRELLEBORG

Panel Loading: Horizontal Section

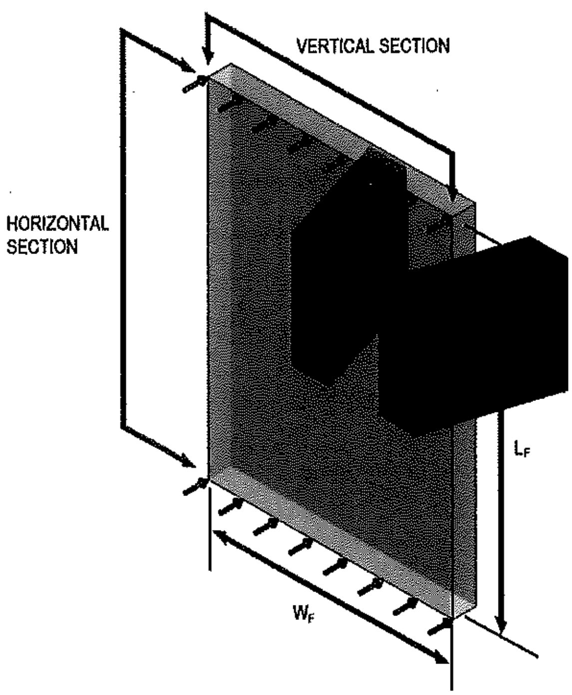
Lengths:	L_1=	70	in
	L_2=	28	in
	L_3=	43.3	in
	f_L=	98	in
Loads:	w_1=	-8.64	kip/in

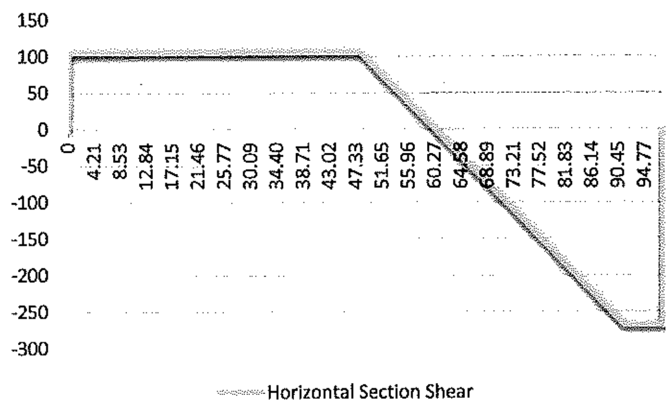


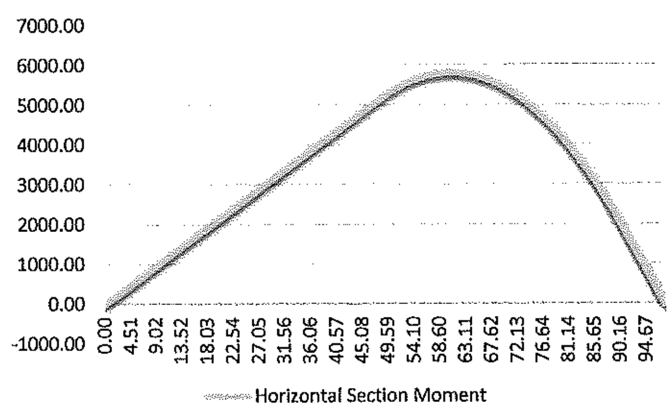
P_1 =	106.86	kip
P_2 =	267.14	kip

Horizontal Section Max Internal Loads

Shear	1188.9	kN	267.28	kip
Moment	656.4	kN-m	484.12	ft-kip





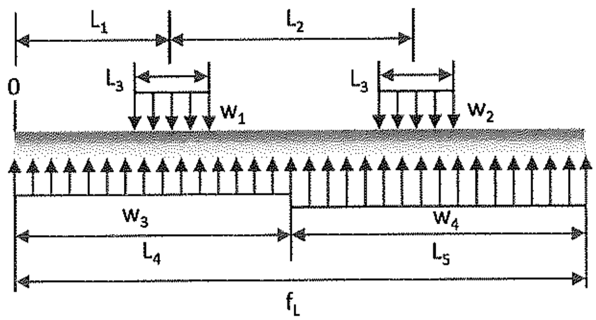


Panel Design Information

TRELLEBORG

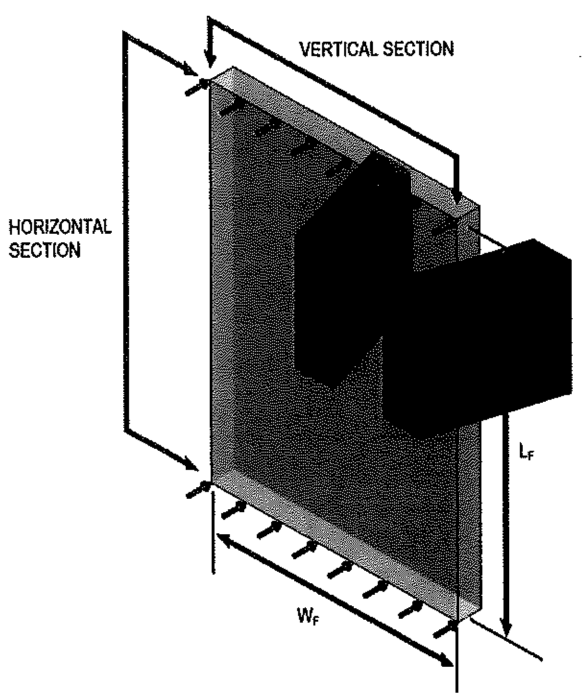
Panel Loading: Vertical Section

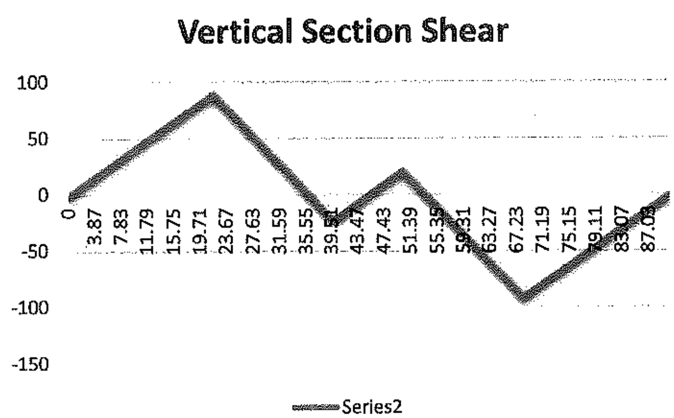
Lengths:	L_1=	30.75	in
	L_2=	28.5	in
	L_3=	17.875	in
	L_4=	45	in
	L_5=	45	in
	f_L=	90.00	in
Loads:	w_1=	-10.46	kip/in
	w_2=	-10.46	kip/in
	$w = R/L_3$ =	4.16	kip/in
	w_4=	4.16	kip/in

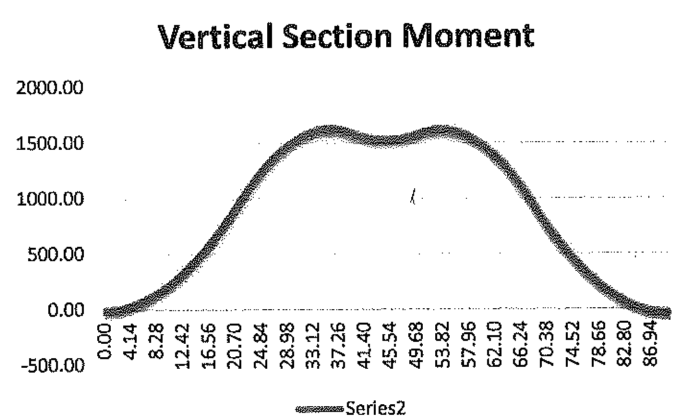


Vertical Section Max Internal Loads

Shear	405.0	kN	91.06	kip
Moment	184.7	kN-m	136.26	ft-kip







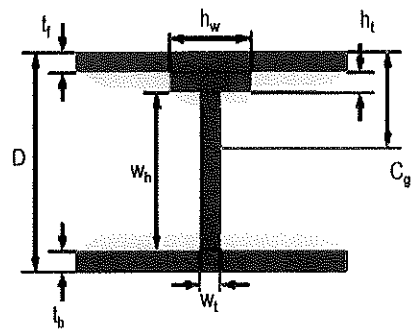
Panel Design Information

TRELLEBORG

Internal Members:

Internal Type: Fabricated T Shape

T Orientation: Normal



Panel Depth		D_p=	8	in		
			Type 1		Type 2	
Head		h_t =	0.394	in	.315	in
Head Width		h_w =	1.575	in	1.575	in
Web		w_t =	0.394	in	.315	in
Web Height	w_h =	D_p-t_f-t_b-h_t =	6.818	in	6.897	in
Tee Area		A_T=	2.84	in	2.27	in
C of G	C_g=	$\Sigma Ad / \Sigma A$=	3.61	in	3.61	in
Moment of Inertia		$I = \Sigma(^1/_{12})bh^3+Ad^2$=	12.32	in^4	9.85	in^4

	Type 1	Type 2
Vertical Internal Quantity:	5	0
Horizontal Internal Quantity:	4	

Spacing:

Based upon stated dimensionsand edge effects

Horizontal Spacing of Vertical Members

Panel Width	90.00	in
Left Edge	0	in
Right Edge	0	in
Stand Off	0.5	in
Effective W	90.00	in

Vertical Spacing of Horizontal Members

Panel Height	98.00	in
Top Edge	0	in
Bottom Edge	0	in
Stand off	0.5	in
Effective H	98.00	in

Spacing based upon 5 vertical Internals:

$S_h = H_{eff} / q_v$ = 15.00 in

Spacing based upon 4 horizontal Internals:

$S_v = H_{eff} / q_h$ = 19.60 in

Material Properties:

External Members:

Material ASTM A572 Gr.50 (or GBT1591-1994 Q345B)

Yield Strength	50	ksi
	345	MPa

Internal Members:

Material ASTM A572 Gr.50 (or GBT1591-1994 Q345B)

Yield Strength	50	ksi
	345	MPa

Panel Design Information

TRELLEBORG

Horizontal Section Properties:

		Cross-sectional Areas		d_{ref}		I_{xx}		Qty:
Front Plate	$A_{fp} = L_{OA} * t_f =$	35.46	in²	7.80	in	0.46	in⁴	1
Back Plate	$A_{bp} = L_{OA} * t_b =$	35.46	in²	0.20	in	0.46	in⁴	1
Side Plates	$A_{sp} = D * t_s =$	3.40	in²	4.00	in	14.75	in⁴	2
Internals	$A_i =$	2.84	in²	4.00	in	12.32	in⁴	5

Neutral Axis: $N_A = \Sigma A * d_{ref} / \Sigma A =$ 4.00 in (From Back Plate)

Neutral Axis Properties

	Moment of Inertia About the Neutral Axis				Component centroid from neutral axis	
Front Plate	$I_{NAF} =$	$I_{XX} + Ad^2 =$	5.13E+02	in⁴	dNAf =	3.803 in
Back Plate	$I_{NAB} =$	$I_{XX} + Ad^2 =$	5.13E+02	in⁴	dNAb =	3.803 in
Side Plates	$I_{NAS} =$	$I_{XX} + Ad^2 =$	2.95E+01	in⁴	dNAS =	0 in
Internals	$I_{NAI} =$	$I_{XX} + Ad^2 =$	6.16E+01	in⁴	dNAi =	0 in
	$I_{NATOT} =$	$\Sigma I_{NA} =$	1.12E+03	in⁴		

Max Distance from Neutral Axis: $C =$ 4.00 in

Shear Area: $A_{shear} =$ 20.16 in²

Horizontal Section Stresses:

Bending Stress $\sigma_V = {}^{MC}/_{I} =$ 20.79 ksi

Shear Stress $\tau_V = {}^{V}/_{A} =$ 13.26 ksi

Vertical Section Properties:

		Cross-sectional Areas		C_g		I_{xx}		Qty:
Front Plate	$A_{fp} = L_{OA} * t_f =$	38.61	in²	7.80	in	0.50	in⁴	1
Back Plate	$A_{bp} = L_{OA} * t_b =$	38.61	in²	0.20	in	0.50	in⁴	1
Side Plates	$A_{sp} = D * t_s =$	3.40	in²	4.00	in	14.75	in⁴	2
Internals	$A_i =$	2.84	in²	4.00	in	12.32	in⁴	4

Neutral Axis: $N_A =$ $\Sigma A * C_G / \Sigma A =$ 4.00 in (From Back Plate)

Neutral Axis Properties

	Moment of Inertia About the Neutral Axis				Component centroid from neutral axis	
Front Plate	$I_{NAF} =$	$I_{XX} + Ad^2 =$	5.59E+02	in⁴	dNAf =	3.803 in
Back Plate	$I_{NAB} =$	$I_{XX} + Ad^2 =$	5.59E+02	in⁴	dNAb =	3.803 in
Side Plates	$I_{NAS} =$	$I_{XX} + Ad^2 =$	2.95E+01	in⁴	dNAS =	0 in
Internals	$I_{NAI} =$	$I_{XX} + Ad^2 =$	4.93E+01	in⁴	dNAi =	0 in
	$I_{NATOT} =$	$\Sigma I_{NA} =$	1.20E+03	in⁴		

Max Distance from Neutral Axis: $C =$ 4.00 in

Shear Area: $A_{shear} =$ 23.31 in²

Vertical Section Stresses:

Bending Stress $\sigma_H = {}^{MC}/_{I} =$ 5.47 ksi

Shear Stress $\tau_H = {}^{V}/_{A} =$ 3.91 ksi

Panel Design Information

TRELLEBORG

Panel Stress Check

Total Stresses:

Bending Stress	σ =	21.50	ksi
Shear Stress	τ =	9.21	ksi

Allowable Factors:

Bending:	Ω_B =	0.6
Shear:	Ω_S =	0.4

Allowable Stresses:

Bending:	σ_{ALL} =	$F_Y * \Omega_B$ =	30.0	ksi
Shear:	τ_{ALL} =	$F_Y * \Omega_B$ =	20.0	ksi

Interaction Ratio:

Bending:	σ / σ_{ALL} =	0.72
Shear:	τ / τ_{ALL} =	0.46

Panel Weights

Density ρ = 0.284 lb / in³

Item	*Length* (in)	*Width* (in)	*Area* (in²)	*Thickness* (in)	*Volume* (in³)	*Quantity*	*Weight* (lb)	*Weight* (kg)
Structural Components:								
Front Plate	98.00	90.00	8820.00	0.39	3475.08	1.00	985.5	447.0
Back Plate	97.00	89.00	8633.00	0.39	3401.40	1.00	964.6	437.6
Side Plates	97.00	7.21	699.56	0.47	330.19	2.00	187.3	85.0
Top/Bottom	89.00	7.21	641.87	0.47	302.96	2.00	171.8	77.9
Vertical 1	96.06		2.842		272.95	5.00	387.0	175.6
Vertical 2	96.06		2.272		218.22	0.00	0.0	0.0
Horizontal 1	88.06		2.842		250.21	4.00	283.8	128.7
Horizontal 2	88.06		2.272		200.04	0.00	0.0	0.0
						Structural Component Subtotal:	2980.17	1351.8
Padeyes:								
Tension 1			22.13	1.00	22.130	3.00	18.8	8.5
Tension 2			17.23	1.00	17.230	0.00	0.0	0.0
Weight			19.04	1.00	19.040	2.00	10.8	4.9
Shear 2			22.50	1.25	28.125	0.00	0.0	0.0
Surge			54.96	1.75	96.180	0.00	0.0	0.0
Lifting			0.04	0.03	0.001	4.00	0.0	0.0
						Padeye Subtotal:	29.63	13.4

Miscellaneous Items:

Description:	Material:		
			0.00
			0.00
			0.00
			0.00
	Miscellaneous Items Subtotal:	0	0
	Total System Weight:	3009.80	1365.20

Panel Design Information

TRELLEBORG

HORIZONTAL SECTION CRITERIA CHECK

Project Information

Project Number: 61537
Project Name: Port of Fernandina Dock Fender
Author: Kurt Trahan
Comments:

Assumptions

1. Design according to AISC 14th ed. section F7
2. Webs must be relatively evenly spaced
3. No panel chamfers or wings included, only flat length of panel
4. Maximum web spacing will be used to determine effective flange width for all flanges

Horizontal Section Check

Service Level Moment :	Max Horiz Moment	$M =$	484.1	kip-ft	
Load Factor :	USER INPUT	$\varphi =$	1.6		
Req'd flexural strength :	$\varphi M = M * \varphi$	$\varphi M =$	774.6	kip-ft	
Effective Panel Width :	W_F (Flat Width)	$P_{w,eff} =$	98.0	in	
Front/Back Plate Thk :		$t_f =$	0.394	in	
Panel Thickness :		$P_t =$	8.0	in	
Flange Spacing :	$h = P_t - 2 * t_f$	$h =$	7.21	in	
Number of Webs :	$n_w = q_h + 2$	$n_w =$	6		Including edges
Effective Flange Qty :	$n_f = n_w - 1$	$n_f =$	5		Assume 1 less than webs
Web Height :	$h_w = P_t - 2 * t_f$	$h_w =$	7.21	in	
Flange yield strength :	USER INPUT	$F_{yf} =$	50.0	ksi	
Web yield strength :	USER INPUT	$F_{yw} =$	50.0	ksi	
Youngs modulus :	USER INPUT	$E =$	29000	ksi	
Average web spacing :	$s_{w,avg} = P_{w,eff} / n_f$	$s_{w,avg} =$	19.6	in	
Max web spacing :	USER INPUT	$s_{w,max} =$	21.3	in	
Thickness of webs :		$t_w =$	0.394	in	
Max web spacing - inside :	$b = s_{w,max} - t_w$	$b =$	20.91	in	

Flange Classification Check

$b/t_f =$	53.1		Table B4.1b, Case 17 limiting ratio	
Upper limit of compact b/t ratio = $l_p =$	27.0	<	53.1	Non-compact
Upper limit of non-compact b/t ratio = $l_r =$	33.7	<	53.1	Slender

Compression flange classification = Slender: Use eq. (F7-1, F7-3 and F7-4)

Panel Design Information

TRELLEBORG

HORIZONTAL SECTION CRITERIA CHECK

Project Information

Project Number: 61537
Project Name: Port of Fernandina Dock Fender
Author: Kurt Trahan
Comments:

Web Classification Check

h/t_w =	18.3		Table B4.1b, Case 19 limiting ratio	
Upper limit of compact h/t_w ratio = l_p =	58.3	>	18.3	Compact
Upper limit of non-compact h/t_w ratio = l_r =	137.3	>	18.3	Non-compact

Web classification = Compact: Web Local Buckling does not apply

Compact flange classification code check

Cross sectional area :	ENTIRE PANEL	A =	94.27	in²			
NA to comp./ten. centroid :		d_{NA} =	3.36	in			
Plastic modulus :	$Z = A * d_{NA}$	Z =	316.47	in³			
Nominal Flexural Strength :	$M_n = M_p = F_yZ$ =	M_n =	15823.6	kip-in			Eq. (F7-1)
			1318.6	kip-ft			
Factor :	LRFD	Φ_b =	0.90				
Design Flexural Strength :	$\Phi_bM_n = \Phi_b * M_n$	Φ_bM_n =	1186.8	kip-ft	>	774.6	kip-ft

Panel Design Information

HORIZONTAL SECTION CRITERIA CHECK

TRELLEBORG

Project Information

Project Number: 61537
Project Name: Port of Fernandina Dock Fender
Author: Kurt Trahan
Comments:

Assumptions

1. Design according to AISC 14th ed. section F7
2. Webs must be relatively evenly spaced
3. No panel chamfers or wings included, only flat width of panel
4. Maximum web spacing will be used to determine effective flange width for all flanges

Horizontal Section Check

Service Level Moment :	Max Horiz Moment	$M =$	484.1	kip-ft	
Load Factor :	USER INPUT	$\varphi =$	1.6		
Req'd flexural strength :	$\varphi M = M * \varphi$	$\varphi M =$	774.6	kip-ft	
Effective Panel Width :	W_F (Flat Width)	$P_{w,eff} =$	90.0	in	
Front/Back Plate Thk :		$t_f =$	0.394	in	
Panel Thickness :		$P_t =$	8.0	in	
Flange Spacing :	$h = P_t - 2 * t_f$	$h =$	7.21	in	
Number of Webs :	$n_w = q_h + 2$	$n_w =$	7		Including edges
Effective Flange Qty :	$n_f = n_w - 1$	$n_f =$	6		Assume 1 less than webs
Web Height :	$h_w = P_t - 2 * t_f$	$h_w =$	7.21	in	
Flange yield strength :	USER INPUT	$F_{yf} =$	50.0	ksi	
Web yield strength :	USER INPUT	$F_{yw} =$	50.0	ksi	
Youngs modulus :	USER INPUT	$E =$	29000	ksi	
Average web spacing :	$s_{w,avg} = P_{w,eff} / n_f$	$s_{w,avg} =$	15.0	in	
Max web spacing :	USER INPUT	$s_{w,max} =$	15.0	in	
Thickness of webs :		$t_w =$	0.394	in	
Max web spacing - inside :	$b = s_{w,max} - t_w$	$b =$	14.61	in	

Flange Classification Check

$b/t_f =$	37.1		Table B4.1b, Case 17 limiting ratio	
Upper limit of compact b/t ratio = $l_p =$	27.0	<	37.1	Non-compact
Upper limit of non-compact b/t ratio = $l_r =$	33.7	<	37.1	Slender

Compression flange classification = Slender: Use eq. (F7-1, F7-3 and F7-4)

Panel Design Information

HORIZONTAL SECTION CRITERIA CHECK

TRELLEBORG

Project Information

Project Number: 61537
Project Name: Port of Fernandina Dock Fender
Author: Kurt Trahan
Comments:

Web Classification Check

h/t_w =	18.3		Table B4.1b, Case 19 limiting ratio	
Upper limit of compact h/t_w ratio = l_p =	58.3	>	18.3	Compact
Upper limit of non-compact h/t_w ratio = l_r =	137.3	>	18.3	Non-compact

Web classification = Compact: Web Local Buckling does not apply

Compact flange classification code check

Cross sectional area :	ENTIRE PANEL	A =	90.81	in^2			
NA to comp./ten. centroid :		d_{NA} =	3.33	in			
Plastic modulus :	$Z = A * d_{NA}$	Z =	302.73	in^3			
Nominal Flexural Strength :	$M_n = M_p = F_y Z$ =	M_n =	15136.7	kip-in			Eq. (F7-1)
			1261.4	kip-ft			
Factor :	LRFD	Φ_b =	0.90				
Design Flexural Strength :	$\Phi_b M_n = \Phi_b * M_n$	$\Phi_b M_n$ =	1135.3	kip-ft	>	774.6	kip-ft

Panel Design Information

UHMW

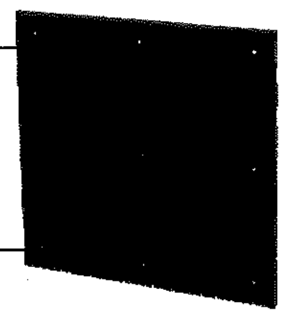
TRELLEBORG

Project Information

Maritime Project Number: 61537
Maritime Project Name: Port of Fernandina Dock Fender
Author: Kurt Trahan
Comments:

UHMW Characteristics

Material Class:	Virgin		Thickness:	1.25	in
Color:	Green		Thickness under nut:	0.50	in
Supplied From:	Foreign		Edge Chamfers:	0.75	in x 45 °
UHMW Density: δ =	58.01	lb/ft³	Total Weight:	362.27	lb



Hardware Information

Fastener Type:	Weld Stud		Edge Distance:	2.38	in
Fastener Size:	0.625	in	Max Spacing:	18.00	in
Material:	316 Stainless Steel		Total Qty:	81	

UHMW Layout

Front Face:

Pads Across Width:	User Input	N_{FW} =	3	
Pads Across Length:	User Input	N_{FL} =	3	
Flat Width:	Panel adjusted width	W_F =	90.0	in
Flat Length:	Panel adjusted length	L_F =	98.0	in
Pad width†:	$W_{fp} = (W_F - N_{FW+1} * 0.25) / N_{FW}$	Wfp =	29.67	in
Pad length†:	$L_{fp} = (L_F - N_{FL+1} * 0.25) / N_{FL}$	Lfp =	32.33	in
Volume per pad:	$V_{Fp} = W_F * L_F * thk$	V_{Fp} =	1199.0	in³ = 6.94E-01 ft³
Weight per pad:	$W_{Fp} = V_{Fp} * \delta$	W_{Fp} =	40.3	lb
Front Face Pad Quantity:	$N_F = N_{FW} * N_{FL}$	N_F =	9.0	
Total UHMW Weight:	$W_F = N_F * W_{Fp}$	W_F =	362.27	lb
Hardware Qty - Width:	$Q_{FA} = (W_{fp} - 2 * D_e) / S_{max} + 1$	Q_{FA} =	3	
Hardware Qty - Length:	$Q_{FD} = (L_{fp} - 2 * D_e) / S_{max} + 1$	Q_{FD} =	3	
Hardware per Pad:	$Q_{HF} = Q_{FA} * Q_{FD}$	Q_{HF} =	9	
Hardware per Panel:	$Q_F = N_{FW} * N_{FL} * Q_{HF}$	Q_F =	81	

†Takes into account gaps on edges and between pads

Panel Design Information

TENSION CHAINS

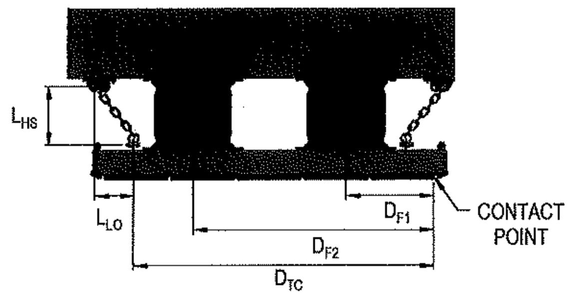
TRELLEBORG

Project Information

Project Number: 61537
Project Name: Port of Fernandina Dock Fender
Author: Kurt Trahan
Comments:

TENSION CHAIN 1:

Note: Images may not reflect actual system



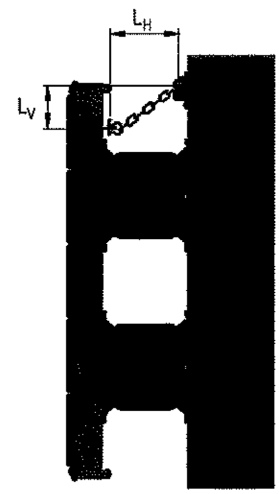
Loading Scenario: Horizontal

Chain Qty:	n=	1	
Fenders Per Row:	N=	1	

Chain System Dimensional Layout:

Horiz Standoff:	L_{HS} =	57	in
Lateral Offset:	L_{LO} =	0	in
Vertical Offset:	L_{VO} =	0	in

Panel System Layout:



Contact Point to First Fender Row:	D_{F1} =	70	in
Contact Point to Second Fender Row:	D_{F2} =	0	in
Contact Point to Tension Chain Set:	D_{TC} =	89.625	in

System Dynamics:

Fender Row 1 Deflection:	USER INPUT	δ_1 =	10	%
Fender 1 Reaction % at δ_1:	SEE CATALOG	R_{F1} =	53	%
Fender Row 2 Deflection:	$\delta_2 = \delta_1 * (D_{TC} - D_{F2}) / (D_{TC} - D_{F1}$	δ_2 =	0	%
Fender 1 Reaction at δ_2:	SEE CATALOG	R_{F2} =	0	%
Panel Tilt Angle:	$\Phi = \tan^{-1}((H * \delta_1) / D_{F1})$	Φ=	16.2	°
Angular Reduction Factor:	USER INPUT		90	%

Tension Chain Definitions

Calculated Chain Length:	$L_{TC} = \sqrt{(L_{HS}^2 + L_{LO}^2 + L_{VO}^2)}$	L_{TC} =	4.75	ft
Normal Reaction Per Chain:	$T_N = R * N * (D_{F1} + D_{F2}) / (D_{TC}$ '	T_N =	61.6	kips
Chain Load:	$T = T_N * L_{TC} / L_{HS}$	T =	61.6	kips

Panel Design Information

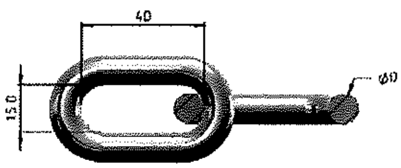
TENSION CHAINS

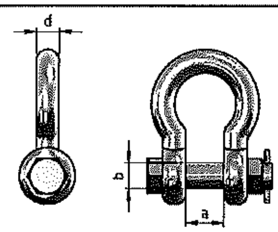
TRELLEBORG

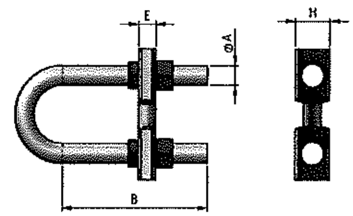
Project Information

Project Number: 61537
Project Name: Port of Fernandina Dock Fender
Author: Kurt Trahan
Comments:

Tension Chain 1 System Components







Required FOS: 2

Chains

Link Type:	Open		Breaking Load:	167.62	kips
Link Size:	32	mm	FOS on Breaking:	2.7	
Grade:	3				

Shackles

Shackle Size: d =	1.125	in	Breaking Load:	125.7	kips
Shackle Throat: a =	1.81	in	FOS on Breaking:	2.0	
Shackle Pin: b =	1.25	in	Chain to Shackle:	YES	

Dogbone Shackles

Shackle Size: A =	1.875	in	Breaking Load:	147.7	kips
Crossbar Thickness: E =	1.75	in	FOS on Breaking:	2.4	
Crossbar Width: H =	3.13	in	Chain to Dogbone:	YES	

Panel Design Information

WEIGHT CHAINS

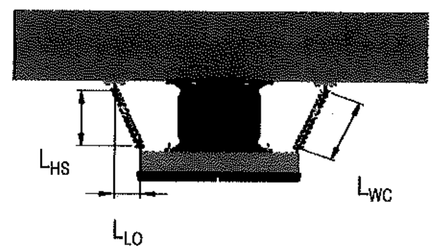
TRELLEBORG

Project Information

Project Number: 61537
Project Name: Port of Fernandina Dock Fender
Author: Kurt Trahan
Comments:

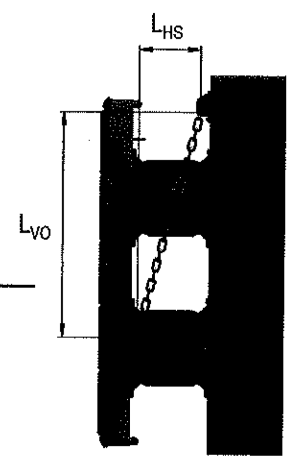
Weight Chain Setup:

Loading Scenario: Ship Roll			
Chain Qty	$n=$	1	
Number of Fenders in System	$N=$	2	
UHMW Coefficient of Friction	$\mu=$	0.20	
Fender Shear Capacity	$\tau_{cap}=$	8.0	%



Chain System Dimensional Layout:

Horiz Standoff	$L_{HS}=$	55.00	in		
Lateral Offset	$L_{LO}=$	0.00	in		
Vertical Offset	$L_{VO}=$	98.00	in		
Calculated Chain Length	$L_{WC}=$	112.38	in =	9.36	ft

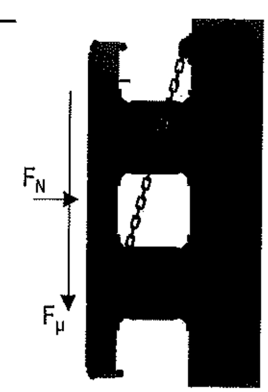


System Dynamics

Buckling Deflection:	Point of Max Reaction	$\delta_B=$	30	%
Change in Fender Height:	$\Delta H=\delta_B * H$	$\Delta H=$	17.1	in
Fender Vertical Shearing:	$\tau_v=\sqrt{(L_{WC}^2-(L_{HS}-\Delta H)^2-L_{LO})}-L_{VO}$	$\tau_v=$	7.8	in
Fender Normal Load:	$F_N=N*R$	$F_N=$	374.0	kips

System Loading

½ Fender Weight:	$W_{half}=½*N*W$	$W_{half}=$	2.12	kips
Panel Weight:	Calculated weight + 5%	$W_P=$	3.16	kips
UHMW Weight:	Calculated Weight	$W_{UHMW}=$	0.36	kips
Total Weight:	$W_{tot}=W_{half}+W_P+W_{UHMW}$	$W_{tot}=$	5.64	kips
Frictional Force:	$F_\mu=F_N*\mu$	$F_\mu=$	74.80	kips
Resisted By Fender(s):	$F_\tau=\tau_{cap}*N*R$	$F_\tau=$	29.92	kips
Vert Load Per Chain:	$F_y=W_{tot}+F_\mu-F_\tau$	$F_y=$	50.52	kips
Chain Load:	$F_{WC}=F_y*L_{WC}/(L_{VO}+\tau_v)$	$F_{WC}=$	53.66	kips



Panel Design Information

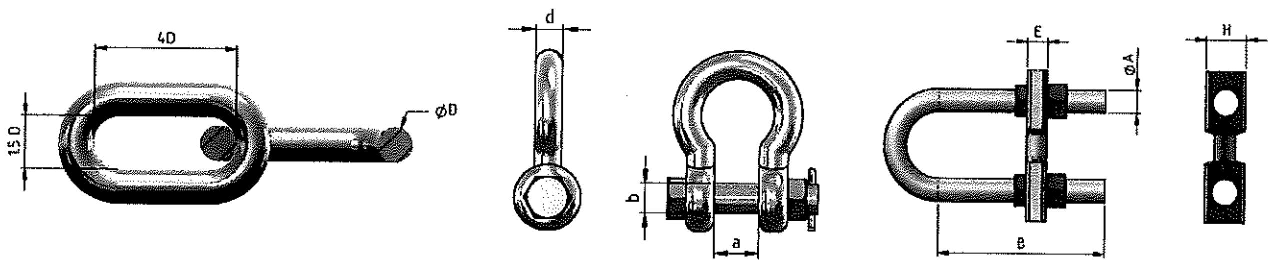
WEIGHT CHAINS

TRELLEBORG

Project Information

Project Number: 61537
Project Name: Port of Fernandina Dock Fender
Author: Kurt Trahan
Comments:

Chain System Components



Required FOS: 2

Chains

Link Type:	Open		Breaking Load:	127.92 kips
Link Size:	28	mm	FOS on Breaking:	2.4
Grade:	3			

Shackles

Shackle Size: d =	1.125	in	Breaking Load:	125.7 kips
Shackle Throat: a =	1.81	in	FOS on Breaking:	2.3
Shackle Pin: b =	1.25	in	Chain to Shackle:	YES

Dogbone Shackles

Shackle Size: A =	1.63	in	Breaking Load:	112.5 kips
Crossbar Thickness: E =	1.50	in	FOS on Breaking:	2.10
Crossbar Width: H =	2.75	in	Chain to Dogbone:	YES