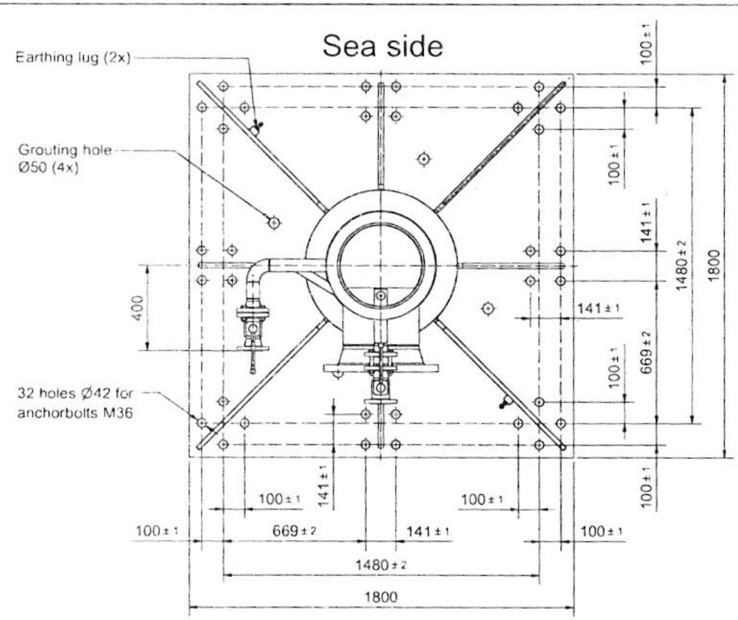
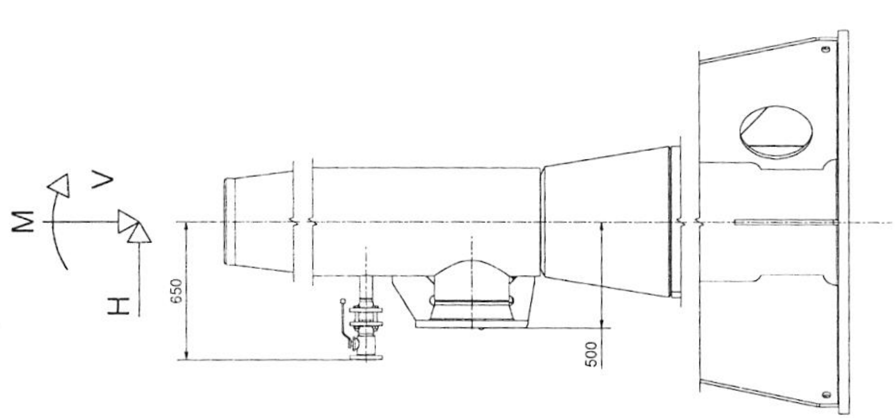
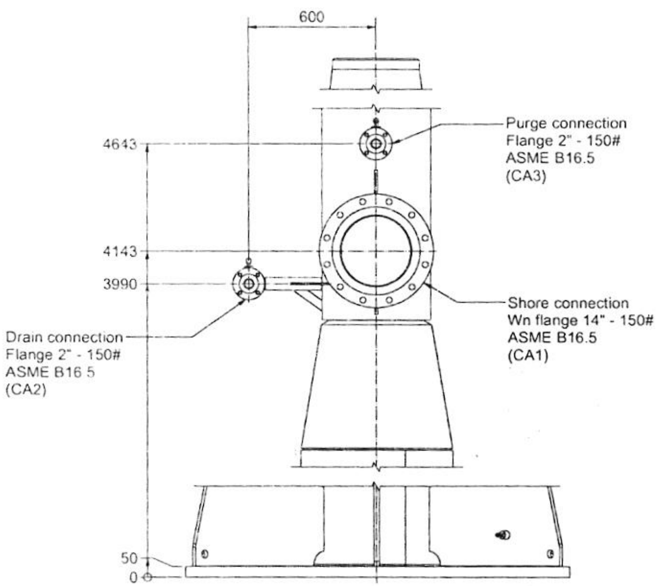
ANEXO 1. DATOS DE LOS BRAZOS DE CARGA

MU1-LA-001/002







Maximum loads at the baseplate of the loading arm:
- Without extra safety factors.
- V [kN] deadload (DL) and fluid load (FL).
- H [kN] windload (WL) worst direction and earthquake load (EL).
- M [kNm] windload (WL) worst direction and earthquake load (EL).

Seismic factor: 0,72g
Wind speed: 40 m/s

Ident. no.	Tag no.	Rating	V (kN)	H (kN)	M (kNm)	MLA length (m)
P152057A10	MU1-LA-001	10" - 150#	286	190	1525	9,75 x 10,0 x 9,5

Revision 3		
Revision 2		
Revision 1		
Check	3-2-16	
Drawn	08-12-2015	VH
Scale: 1 : 15		A2

Baseload diagram

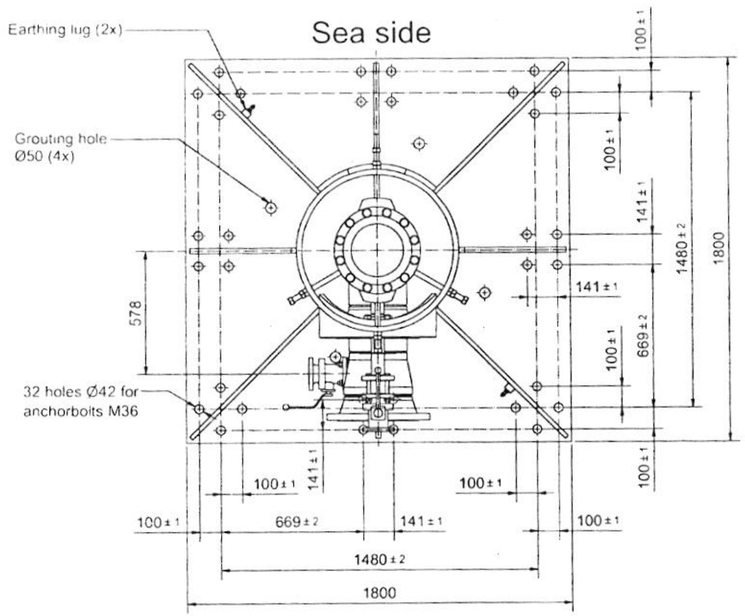
For MLA260

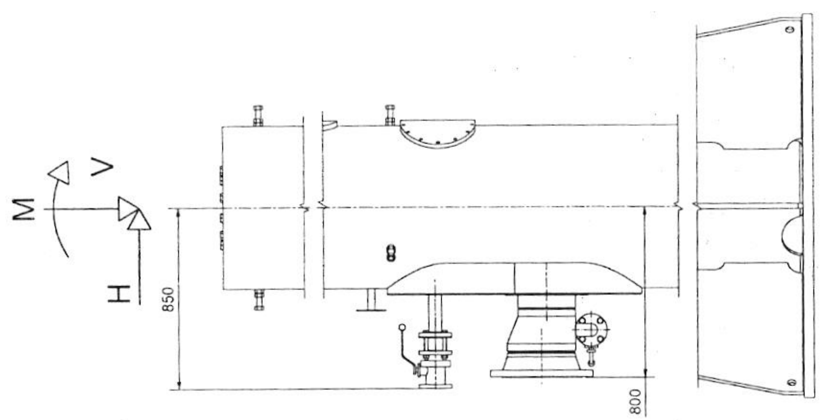
KANON LOADING EQUIPMENT
P.O. Box 385, 3840 AJ Harderwijk

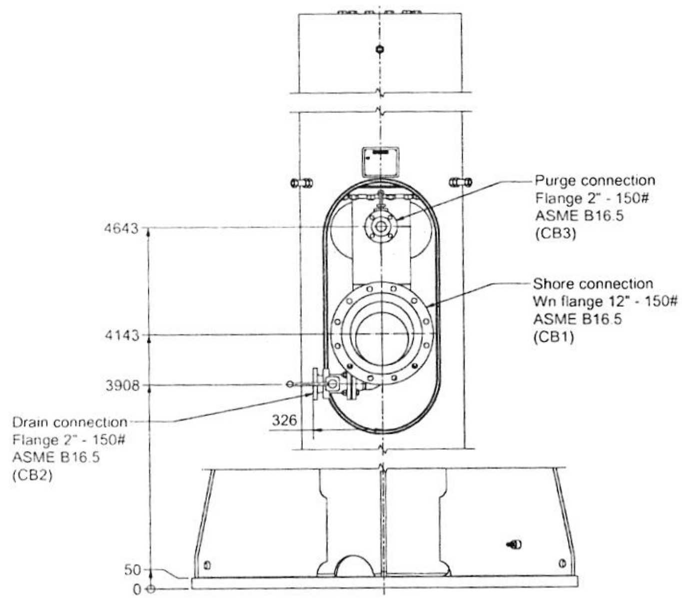
American Projection

Drawing number: P152057A06
Revision: 0

Sheet 1 of 1







Maximum loads at the baseplate of the loading arm:
- Without extra safety factors.
- V [kN] deadload (DL) and fluid load (FL).
- H [kN] windload (WL) worst direction and earthquake load (EL).
- M [kNm] windload (WL) worst direction and earthquake load (EL).

Seismic factor: 0,72g
Wind speed: 40 m/s

Ident. no.	Tag no.	Rating	V (kN)	H (kN)	M (kNm)	MLA length (m)
P152057B10	MU1-LA-002	10" - 150#	419	267	2500	9,75 x 10,0 x 9,5

Revision 3			
Revision 2			
Revision 1	07-04-2016	JH	Drawing updated after design update
Check	18/4/16		
Drawn	21-03-2016	JH	
Scale 1 : 15		A2	

Baseload diagram

For MLA260

KANON LOADING EQUIPMENT
P.O. Box 385, 3840 AJ Harderwijk

American Projection

Drawing number: P152057B06 Revision: 1

Sheet 1 of 1

ANEXO 2. MEMORIA DE CÁLCULO DE LOS BRAZOS DE CARGA

ANEXO 3. ANCLAJE PROPUESTO

Manuel Dias Mateo

From:	Manuel Dias Mateo
Sent:	Friday, January 26, 2018 9:53 AM
To:	Rafael Bastida Martinez
Cc:	Laura Moreno del Campo; Gines Lozano Roca
Subject:	FW: Talara Project. 020700222 Additional anchor Bolts

Buenos dias

Rafael, tenemos aprobación del vendedor, procedo a liberar la EI para la instalación de los pernos.

Un saludo

Manuel Dias Mateo
Civil & Structural Engineer

TECNICAS REUNIDAS TALARA S.A.C.
Proyecto Modernización Refinería de Talara
Carretera Negritos S/N Edificio de TRT Chatarreros
Talara – Piura - Perú
Extensión teléfono fijo: 614100
Móvil: +51 942866613

From: KANON.nl / Sjoerd Hettinga [mailto:sh@kanon.nl]
Sent: Friday, January 26, 2018 8:11 AM
To: Rafael Bastida Martinez <rbastida@tecnicasreunidas.es>; KANON.nl / Martine Luhrs <ml@kanon.nl>; KANON.nl / Manuel A. Riera <mar@kanon.nl>; KANON / Henrik Laseur <hl@kanon.nl>
Cc: Rafael Martin Tamayo <mtamayo@tecnicasreunidas.es>; Lina Montoiro Cordero <montoiro@tecnicasreunidas.es>; Borja Sanfeliz Cienfuegos <bsanfeliz@tecnicasreunidas.es>; Manuel Dias Mateo <mdias@tecnicasreunidas.es>
Subject: RE: Talara Project. 020700222 Additional anchor Bolts

Dear Rafael,

The plates are used as a distance keeper between the anchors to have them remain their position during pouring of the concrete.
When you drill the anchor rods, you don't need these plates.
Your structural engineer has to decide if the proposed fixing of the anchors will be sufficient.

Best regards,

Sjoerd Hettinga
Project Manager

KANON Loading Equipment BV
Edisonweg 27
3899 AZ ZEEWOLDE
The Netherlands
Chamber of Commerce Lelystad 08013878

Mobile: : **+31 (0)6 1314 7478**
Telephone: *+31 (0)36 521 9777*
Fax: *+31 (0)36 521 9770*
E-mail: *sh@kanon.nl*
Web: *www.kanon.nl*

Van: Rafael Bastida Martinez [mailto:rbastida@tecnicasreunidas.es]
Verzonden: donderdag 25 januari 2018 23:02
Aan: KANON.nl / Sjoerd Hettinga; KANON.nl / Martine Luhrs; KANON.nl / Manuel A. Riera; KANON / Henrik Laseur
CC: Rafael Martin Tamayo; Lina Montoiro Cordero; Borja Sanfeliz Cienfuegos; Manuel Dias Mateo
Onderwerp: RE: Talara Project. 020700222 Additional anchor Bolts

Dear Sjoerd,

Could you please respond to our request?

Thanks you for your support, this is an urgent issue for us.

KR.

Rafael Bastida Martínez
Div. Industrial / Dpto. de Proyectos
GERENTE DE PROYECTO DE ÁREA 3
TÉCNICAS REUNIDAS DE TALARA S.A.C
Proyecto Modernización Refinería Talara
Carretera Negritos s/n. Planta nº1.
Edificio de Tecnicas Reunidas de Talara.
Talara – Piura – Perú
Telf: **(+51) 01 7014132**
Ext: **614132**
Telf Móvil: **+51 942988596**

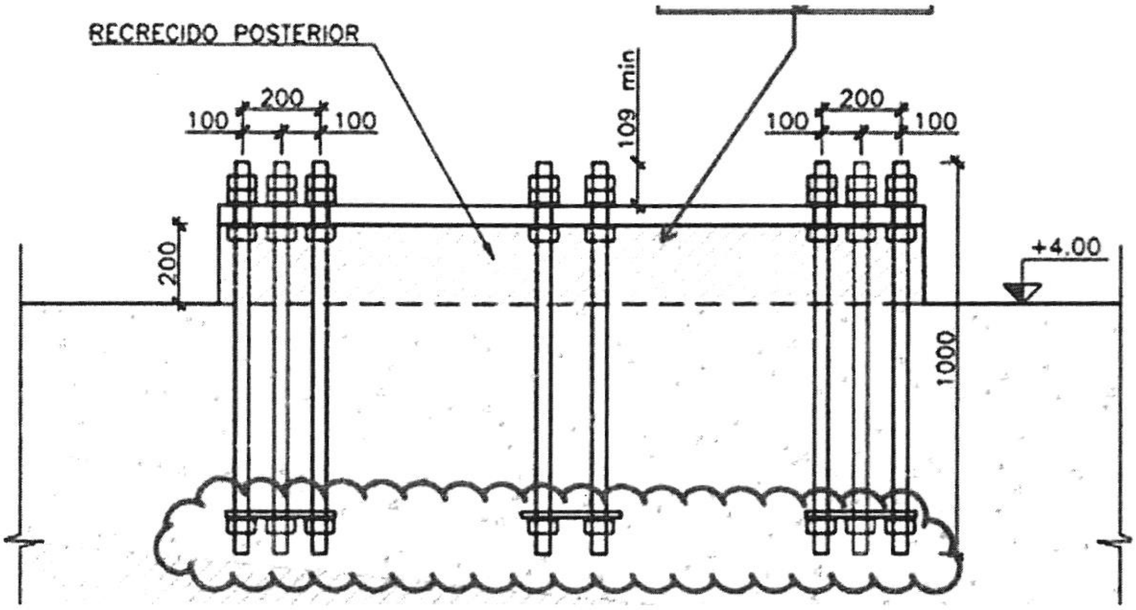
De: Rafael Bastida Martinez
Enviado el: martes, 23 de enero de 2018 12:26
Para: 'KANON.nl / Sjoerd Hettinga' <sh@kanon.nl>; KANON.nl / Martine Luhrs <ml@kanon.nl>; KANON.nl / Manuel A. Riera <mar@kanon.nl>; KANON / Henrik Laseur <hl@kanon.nl>
CC: Rafael Martin Tamayo <mtamayo@tecnicasreunidas.es>; Lina Montoiro Cordero <montoiro@tecnicasreunidas.es>; Borja Sanfeliz Cienfuegos <bsanfeliz@tecnicasreunidas.es>; Manuel Dias Mateo <mdias@tecnicasreunidas.es>
Asunto: RE: Talara Project. 020700222 Additional anchor Bolts

Dear Sjoerd,

Thank you for your prompt answer.

Due to the fact that Loading Arms in Jetty Nº1 will be installed on existing concrete, our civil department has the following proposal in order to proceed with the civil works minimizing impacts on existing Jetty.

1.) Drill existing concrete
2.) Install anchor bolts
3.) Do no install nuts and plates (as marked bellow) inside concrete
4.) Use chemical anchoring in order to fullfill the foundation



Please tell us if you any comment to this proposal.

Kind regards,

Rafael Bastida Martínez
Div. Industrial / Dpto. de Proyectos
GERENTE DE PROYECTO DE ÁREA 3
TÉCNICAS REUNIDAS DE TALARA S.A.C
Proyecto Modernización Refinería Talara
Carretera Negritos s/n. Planta nº1.
Edificio de Tecnicas Reunidas de Talara.
Talara – Piura – Perú
Telf: **(+51) 01 7014132**
Ext: **614132**
Telf Móvil: **+51 942988596**

PETROPERU Consorcio PMC Talara
CPT

PROYECTO DE MODERNIZACIÓN REFINERÍA TALARA
CALIFICACIÓN DEL DOCUMENTO:

☑ 1. APROBADO
☐ 2. APROBADO CON COMENTARIOS
☐ 3. NO APROBADO
☐ 4. REVISADO SIN COMENTARIOS
☐ 5. REVISADO CON COMENTARIOS

NOTA: LA APROBACIÓN Ó REVISIÓN DEL DOCUMENTO NO EXONERA AL CONTRATISTA DE SU RESPONSABILIDAD CON RESPECTO AL DISEÑO Y CALIDAD DE LA INGENIERÍA REALIZADA.

CPT	
NOMBRE Benjamín Quintero CARGO Ingeniero Civil FIRMA	NOMBRE Angel Rodríguez CARGO Gerente de Ingeniería FIRMA

FECHA: 05/02/2018

INSTRUCCIÓN DE INGENIERÍA (ENGINEERING INSTRUCTION)

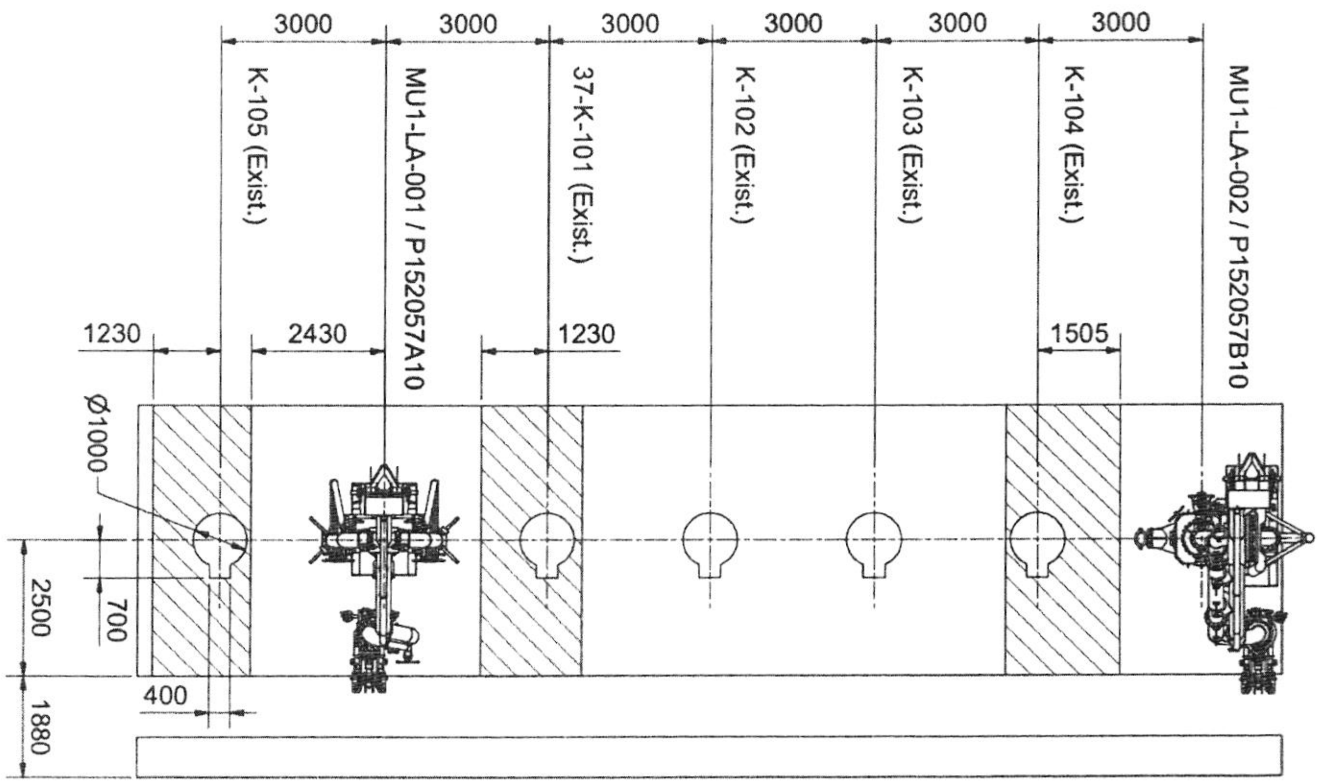
REFERENCIA DOCUMENTO/PLANO (indicar revisión):	Fecha de emisión :	CÓDIGO (EI-Nº de plano-RA-NNNN)
02070-MU-CIV-DRW-701-R00	23/01/18	EI-02070-MU-CIV-DRW-701-R00-0001

ASUNTO DETALLE DE INSTALACIÓN DE PERNOS Y DEL RECRECIDO POSTERIOR A EJECUTAR PARA LA INSTALACIÓN DE LOS BRAZOS DE CARGAS EN MU-1

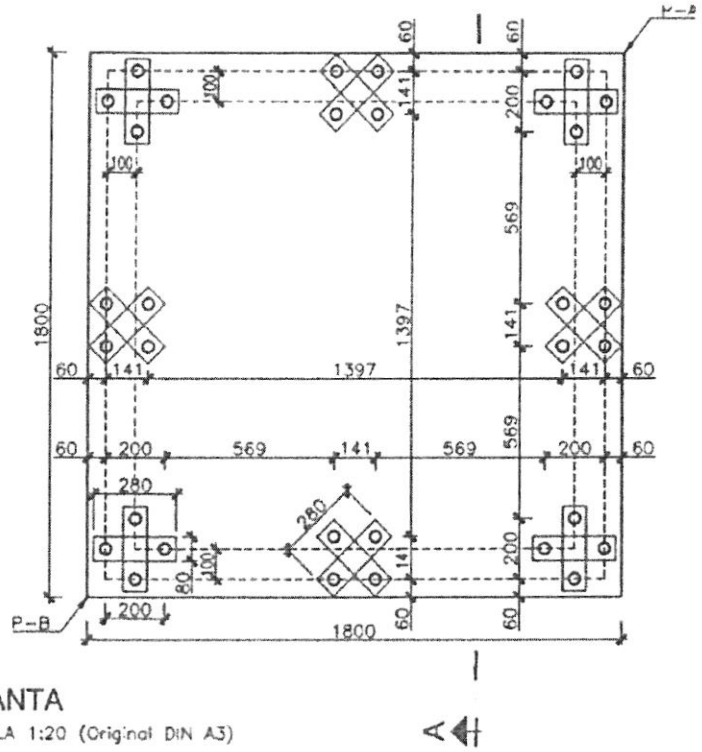
INSTRUCCIÓN:

Mediante la presente instrucción de ingeniería, se define el detalle de los pernos a colocar en la losa del MU-1 para la instalación de brazos de carga, así como del recrecido posterior a realizar.

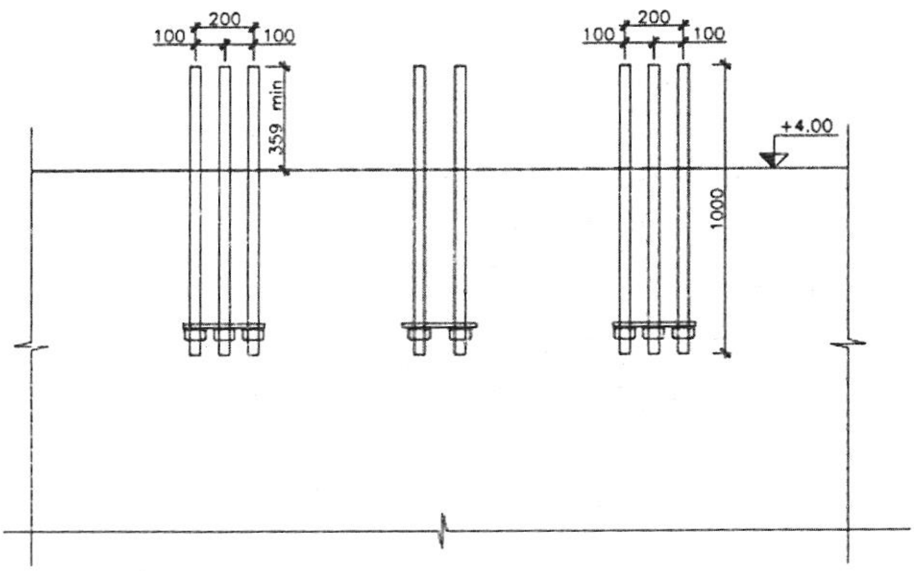
La ubicación de los brazos de carga a instalar se muestra a continuación:



Cada uno de los brazos de carga, tiene una serie de pernos, que han de ser instalados de acuerdo a la siguiente disposición:



PLANTA
ESCALA 1:20 (Original DIN A3)



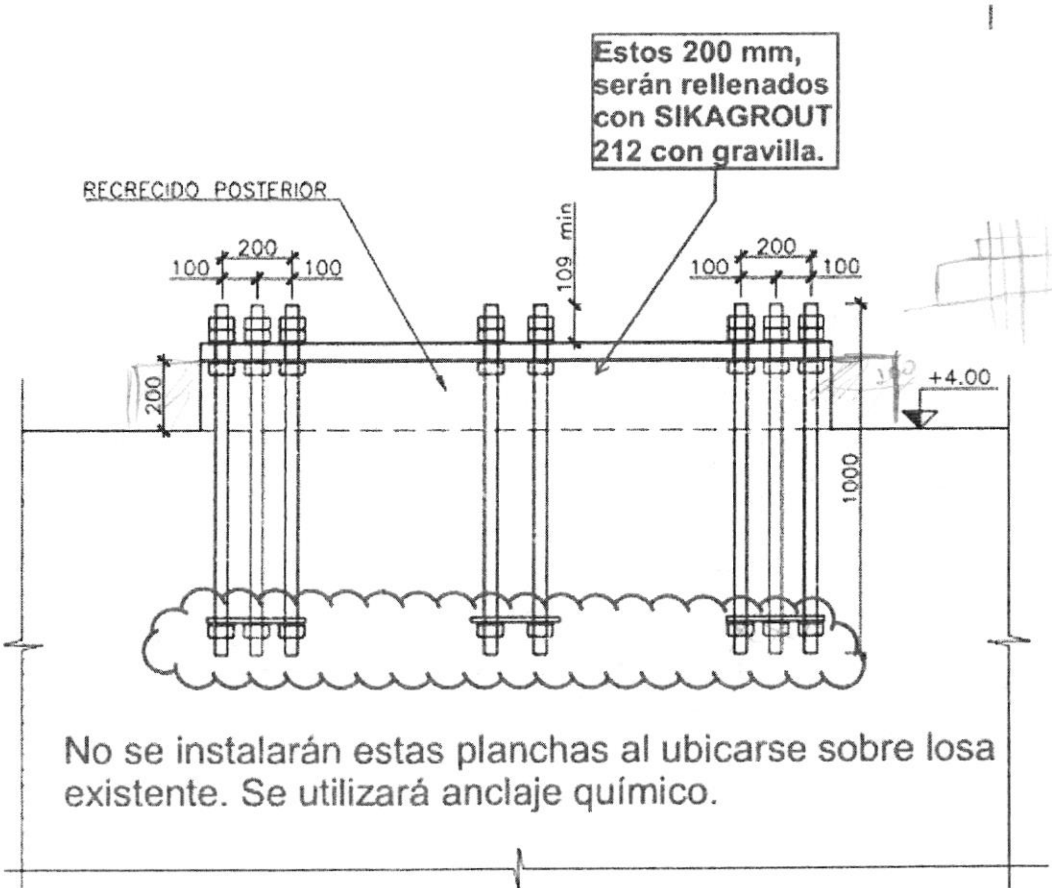
SECCIÓN A-A. FASE 1
ESCALA 1:20

Los pernos y las tuercas a instalar serán pernos galvanizados de 1000 mm de longitud y métrica M36 y serán suministrados por el Vendor.

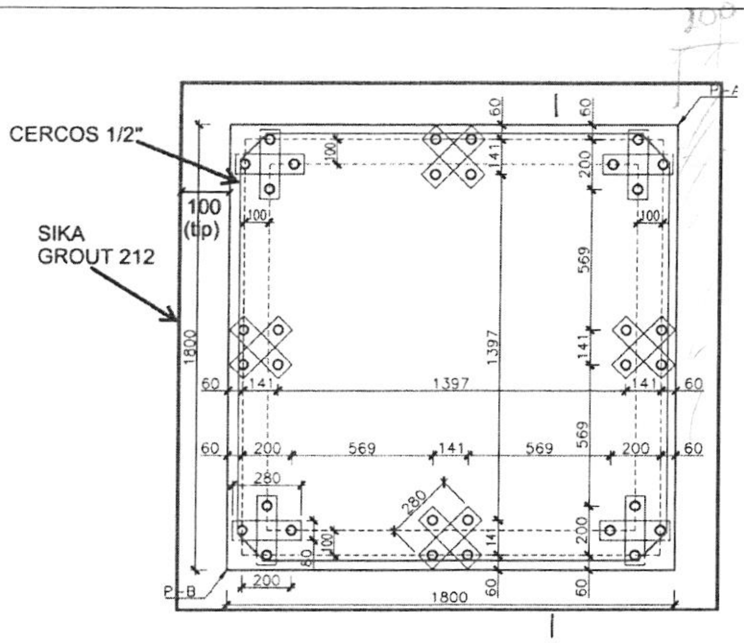
En lugar de con planchas en su parte inferior, puesto que la losa es existente, estos serán instalados mediante adhesivo epóxico, manteniendo las dimensiones y empotramiento dados en el detalle anterior. Así, la instrucción será:

"Repicar superficie de la losa existente hasta descubrir los aceros, antes de taladrar, limpiar y rellenar con resina epóxica HIT RE 500 V3 antes de insertar pernos M36 galvanizados con Lemp = 640 mm; P = 360 mm; Ltotal = 1000 mm."

Una vez colocados los pernos e instalados los brazos de carga, se realizará un recrecido posterior de 200 mm bajo la placa del brazo de carga, mediante la utilización SIKAGROUT 212 con gravilla de 10 mm de tamaño máximo, de acuerdo a lo indicado en la ficha técnica del producto (adjunta).



La aplicación del GROUT se extenderá 100 mm hacia el exterior del borde de la placa, instalando además dos conjuntos de cercos de 1/2 " alrededor de los pernos, estando el primero a 50 mm del NSP y el segundo a 100 mm.



PLANTA

REQUIERE APROBACIÓN EMPLEADOR : SI [X] NO **FECHA REQUERIDA RESPUESTA:** 02/02/2018

	CÓDIGO DE LOS SKETCHES ADJUNTADOS:	OTRA DOCUMENTACIÓN ADJUNTA:

APROBADO POR LA DISCIPLINA DE INGENIERÍA:	**APROBADO POR EL ENGINEERING MANAGER O ING. DE PROYECTO AUTORIZADO :**
NOMBRE: Manuel Días Mateo FIRMA: [firma]	PA. RAFAEL BASTIDA NOMBRE: Héctor Méndez Martín FIRMA: [firma]
PUESTO: Líder de Civil en Obra FECHA: 23/01/2018	PUESTO: Gerente Ingeniería Campo FECHA: 26/01/18
APROBADO POR EL EMPLEADOR (SI APLICA): NOMBRE: FIRMA: ______ PUESTO: Líder de Disciplina de ______ / FECHA:	

DISTRIBUCIÓN A (marcar las casillas que correspondan. Las posiciones marcadas (X) deben estar siempre en la distribución):

DIRECTOR DE CONSTRUCCIÓN EN OBRA	ING. DE PROYECTO	AREA MANAGER AREA:	RESPONSABLE INGENIERÍA EN OBRA	RESPONSABLE CALIDAD EN OBRA	CONTROL DE COSTES EN OBRA	ADMINISTRACIÓN DE SUBCONTRATOS
X	X.	X	X	X	X	X
LIDER CIVIL Y ESTR.	**LIDER TUBERIAS**	**LIDER MECÁNICA, M. SOLIDOS Y U. PAQUET.**	**LIDER ELECTRICIDAD**	**LIDER INSTRUMENT.**	**LIDER CALDERERIA**	**CLIENTE (SI APLICA)**

MODERNIZACION REFINERIA de TALARA
PETROPERU, S.A.;

PETROPERU

TECNICAS REUNIDAS

PROJECT: **MODERNIZACION REFINERIA DE TALARA**	CONTRAC T.R PROJECT Nº: 02070
PURCHARSE ORDER No. 020700222-K196	EQUIPMENTS / TAGS No. MU1-LA-002
DOCUMENT CODE: CAL-0005	DOCUMENT No. V-020700222-K196-MU1-LA-002-0001-B

REVIEW RESPONSE BY PURCHASER:

☐ REJECTED ☐ REVIEWED WITH COMMENTS ☐ REVIEWED WITHOUT COMMENTS

☐ COMMENTS AS NOTED ☐ REVIEWED AS BUILT ☒ FOR INFORMATION

☐ VOID

DATE 07/07/2017

VENDOR IDENTIFICATION:

KANON Loading Equipment BV

KANON LOADING EQUIPMENT

DOCUMENT TITLE
MECHANICAL CALCULATIONS MU1-LA-002

VENDOR DOCUMENT NUMBER : P152057B07.1 Rev. 1

KANON LOADING EQUIPMENT

Edisonweg 27
3899AZ Zeewolde
Holland

P.O. box 385
3840 AJ Harderwijk

Design calculation MLA according OCIMF

of a Marine Loading Arm with single inboard line

Kanon document number	:	P152057B07.1
Kanon revision number	:	1
Client document number	:	
Client revision number	:	
Made by	:	J Hendriks
Date of creation	:	11 January 2016
Date of issue	:	28 February 2017
Dimensions	:	9750 x 10000 x 9500 mm
Diameter product line	:	10" nominal diameter
Products	:	Sulphuric Acid (98%)
Loading arm ident no	:	P152057B10
Tag no	:	MU1-LA-002
Purchase order	:	
Ordered by	:	Tecnicas Reunidas
Owner	:	Petro Peru

Notes revision 1

Date : 31-10-2016

Remarks : ASCE-7 calculation uploaded

20/2/17

CONTENTS:

GENERAL

The Marine Loading Arm model 260 is a selfbearing type.
By means of a counterweight mounted at the tail of the inboard arm the inner arm is balanced.
The counterweight is coupled with a pantograph construction to the outer arm to balance the outboard arm with the same counterweight. The loading arm is balanced for empty condition.

If ice build-up is applicable according OCIMF 4.2.6 the calculation follows:

	No insulation			Insulation		
	6 mm	10 mm	25 mm	6 mm	10 mm	25 mm
WLs	x	N.A.	N.A.	x	N.A.	N.A.
WLo	x	x	x	x	N.A.	N.A.
WLm	x	N.A.	N.A.	x	N.A.	N.A.
DL	x	x	x	x	N.A.	N.A.

OPERATING / LOADING CONDITIONS.

The loading arm attitudes can be deducted from the operating envelope drawing A2-P152057B09
The calculated cases are defined OCIMF table 17 for the empty counterweighted condition.
Table 17 defines the load combinations and allowable stressfactor combinations.

The loading arm is constructed in a way that the TL (=Thermal Load) doesn't result in serious additional stresses. These very small stresses are not calculated.

As soon as the loading arm is connected to the ship the loading arm should be switched into floating / freewheel mode. A warning signal will be given if the loading arm is connected to the ship and not switched into floating within 2 minutes. (Adjustable from 1 to 10 min.).

The allowed PCA by Kanon is tested to be maximum for:

Swivel joint 10"	SAN 812 is	630000 N	at riser
Swivel joint 10"	SAN 812 is	630000 N	at inboard heel
Swivel joint 10"	SAN 812 is	630000 N	at inboard apex
Swivel joint 10"	SAN 812 is	630000 N	at outboard / triple

Material constants	A106 Grade B	SW steel	78,5	N/dm^3
		Modulus of elasticity	210000	N/mm^2
		σ max	149	N/mm^2

Material	σ tensile	σ yield	σ OCIMF	Kanon Safety factor	σ max	Corrosion allowance
A106 Grade B	414	241	161	**1,08**	149	0
A333 Grade 6	414	241	161	1,08	149	0
A312 TP304L	483	172	115	1,08	106	0
A312 TP316L	483	172	115	1,08	106	0

Table of tensile-, yield- and allowable stresses for the used material in N/mm^2 according OCIMF 4.2.2

Case no	Mode	Loading Combination	Allowable Stress (σ) K x Sd
1	Stored	DL+WLs	1,2x Sd
2	Stored	DL+EL	1,2x Sd
3	Manoeuvring	DL+WLo	0,9x Sd
4	Connected	DL+WLo	0,8x Sd
5	Connected	DL+FL+PL+WLo	0,8x Sd
6	Connected	DL+FL+PL+WLo+TL	1,5x Sd
7	Emergency Release	DL+WLo	1,1x Sd
8	Emergency Release	DL+FL+PL+WLo	1,1x Sd
9	Maintenance	DL+WLm	0,9x Sd
10	Hydrostatic test	DL+FL+PLt+WLo	1,3x Sd

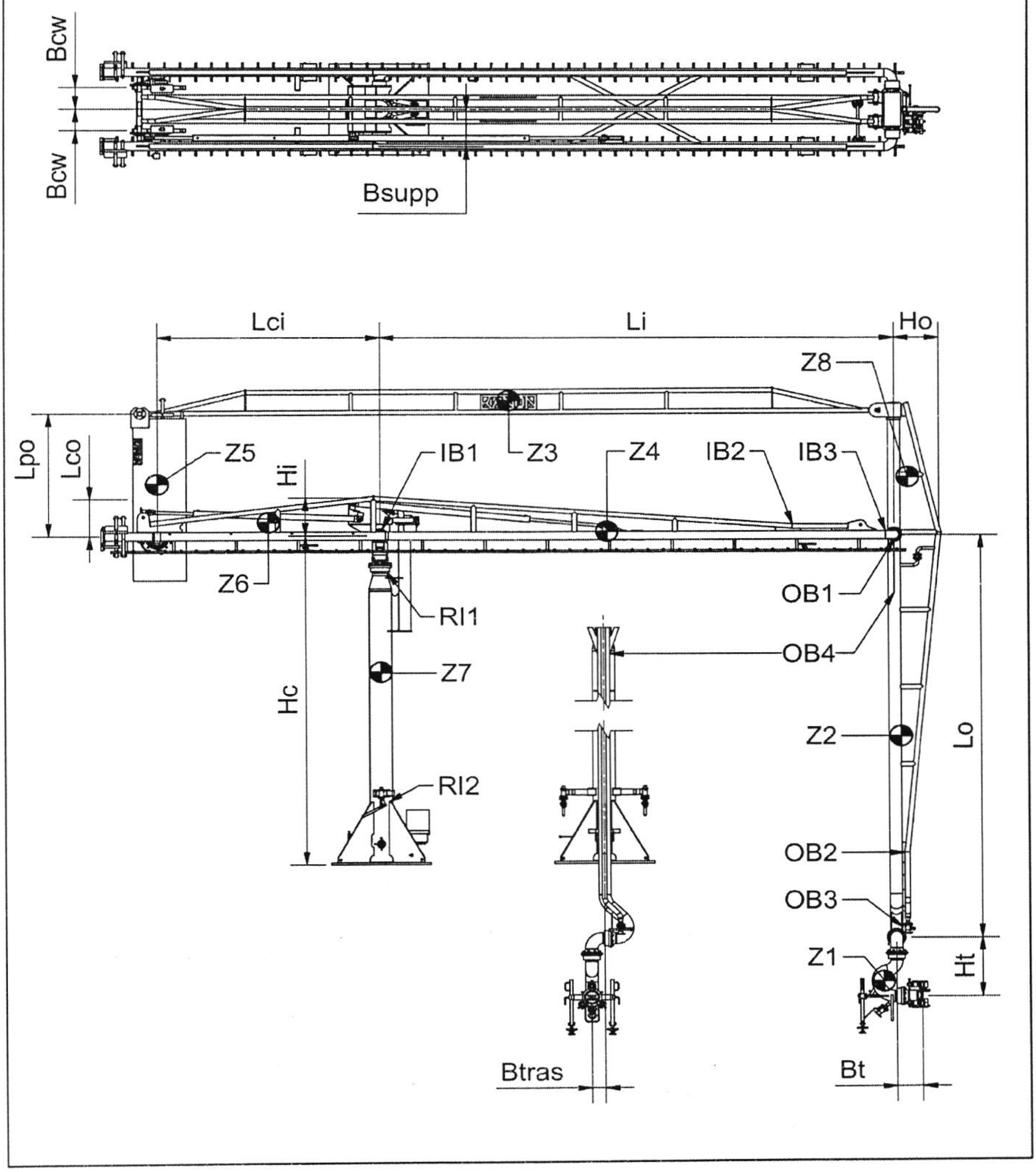
Table 17 - Design Load Cases (OCIMF 1999)

USED ABBREVIATIONS

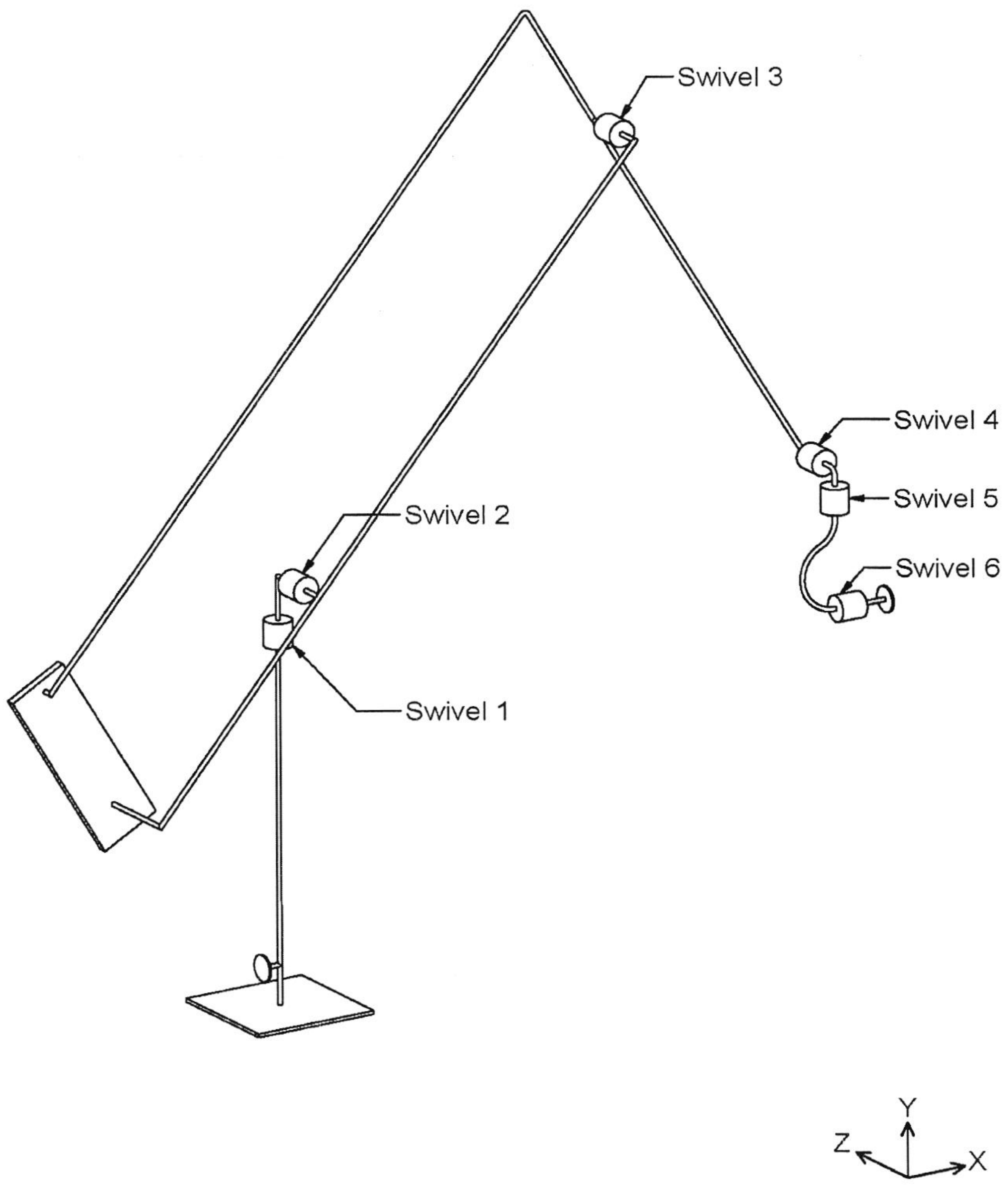
A-	Area with a flat shape
Ao	Area with a cylindrical shape
AP	Cross section of pipe
Ared	Area corrected with shape factor
b	Bearing width of baseplate
Bapex	Distance of product pipes at apex
Bcw	Distance counterweight to center column
Bpar	Distance of parallel rod to centreline column in Z-direction
Bsupp	Distance of product pipes at support angle
Bt	Width of triple assy
Btras	Distance of product pipes at triple assembly
C_	Force coëfficient wind effects flat or angular
Co	Force coëfficient wind effects round
D	Force coëfficient wind effects round
Dv	Diameter of vapor or stiffening pipe
DL	Dead Load
dZ	Distance to point of gravity from centreline of column
EL	Earthquake load
F	Load
Fax	Axial Load
Frad	RadiaL Load
FDL	Load through DL
FL	Fluid Load
Fz	Load in Z direction
Gust	Gust effect factor
Hc	Height of the riser or column
Hj	Height of the jetty
Hk	Angle
Hi	Height of stiffening construction on Inboard at heel
HkI	Angle between inboard and riser
HkO	Angle between inboard and outboard
HL	Load through the frictions in the arm
Ho	Height of stiffening construction on outboard at apex
Hw	Height between datum and LLW
Ht	Height of the triple assy
IBx	Location x in inboard
Lb	Critical Length for buckling
Lci	Length inboard tail
Li	Length of the inboard arm
LMAN	Support distance from ships manifold
Lco	Distance from point of gravity of counterweight to inboard pivot
Lo	Length of the outboard arm
Lpo	Length of tail for parallel rod
M	Moment
Mi	Inboard moment
Mo	Outboard moment

MROT	Rotation moment
MTY	Sum of moments over the Y-axe
Mx	Moment over the X-axis
My	Moment over the Y-axis
Mz	Moment over the Z-axis
OBx	Location x in outboard
p	pressure in barg
pwind	Wind pressure in N/m² (qz in OCIMF)
PCA	Swivel Load in N calculated acc OCIMF
PIPE D	Outside pipe diameter
PIPE S	Wall thickness of pipe
PL	Pressure Load
PLt	Test pressure load
RIx	Location x in riser
S	Stress
s	Wall thickness
Sb	Bending stress
Se	Equiv. stress
Sd	Design stress
Sv	Wall thickness of vapour or stiffening pipe
T	Shear stress
TF	Sum of loads
TFX	Sum of loads in X-direction
TFY	Sum of loads in Y-direction
TFZ	Sum of loads in Z-direction
TL	Thermal load
TM	Sum of moments
TMX	Sum of moments in X-direction
TMY	Sum of moments in Y-direction
TMZ	Sum of moments in Z-direction
WL	Wind Load
WLm	Wind load in maintenance mode
WLo	Wind Load while operating
WLs	Wind Load in stored condition
WP	Section modulus of pipe in cm³
XA	X-coordinate of point A
XB	X-coordinate of point B
XC	X-coordinate of point C
Xz	Distance to centreline of column in x direction
YA	Y-coordinate of point A
YB	Y-coordinate of point B
YC	Y-coordinate of point C
Yz	Distance from centre to Datum in y direction
Zg	Gradient height
Zi	Distance to centre of gravity for inboard effect
Zo	Distance to centre of gravity for outboard effect

Dimensions and references Used in calculations	MLA260 DI



Location of swivel joints Used in calculations	MLA260 SI



BALANCE OF THE LOADING ARM
Tag. nr: MU1-LA-002

Length Column	Hc	9750mm	Design pressure	10,4 barg
Length inboard arm	Li	10000mm	Corrosion allowance	0,0 mm
Length outboard arm	Lo	9500mm	Specific Gravity	18,4 N/dm³
Inboard tail length	Lci	4000mm	S.G. water	10 N/dm³
Outb. tail length for par. rod	Lpo	3800mm		

	Diameter	Wall thickness
Triple	273,1	9,27
Triple vapour	0,0	0,00
Outboard product	273,1	9,27
Outboard vapour	0,0	0,00
Inboard R	273,1	9,27
Inboard L / vapour	0,0	0,00
Riser	762,0	15,87

Product	Sulphuric Acid (98%)
Size	10" nominal diameter
Volume	Empty balanced
Material	A106 Grade B

1st PRODUCT ARM	m [kg]	F [N]	Zi [m]	Mi [Nm]	Zo [m]	Mo [Nm]
Triple assy	1606,9	16069	10,0	160688	9,5	152653
Outboard arm	2633,6	26336	10,0	263362	2,7	70133
Outboard hydraulics	49,4	494	10,0	4935	4,8	2344
Bridge between triples	0,0	0	10,0	0	9,5	0
Inboard arm structure	4873,9	48739	2,7	132471	0,0	0
Inboard hydraulics	22,8	228	5,0	1140	0,0	0
2nd PRODUCT ARM		F [N]	Zi [m]	Mi [Nm]	Zo [m]	Mo [Nm]
Triple assy 2nd	0,0	0	10,0	0	9,5	0
Outboard arm 2nd	0,0	0	10,0	0	0,000	0
Inboard arm product	0,0	0	0,000	0	0,0	0
STRUCTURE		F [N]	Zi [m]	Mi [Nm]	Zo [m]	Mo [Nm]
Wind bracing (or 1st buckling rod)	0,0	0	0,0	0	0,0	0
Vapour line inboard (or 2nd buckling rod)	0,0	0	0,0	0	0,0	0
Parallel structure	634,4	6344	3,0	19049	-3,8	-24106
Parts counterweights	530,2	5302	-4,0	-21209	-1,9	-10113
Hydraulic cylinders slewing 80/35x400	43,6	436	0	0	0	0
Hydraulic cylinders inboard 160/90/90x1350	418,8	4188	0	0	0	0
Hydraulic cylinders outboard 160/90/90x1150	373,2	3732	0	0	0	0
Valve block	140,0	1400	0	0	0	0
Electric & hydraulic piping (weight A99)	150,0	1500	0	0	0	0
Pipe tolerance	12,5%	17990	0	0	0	0
CONTENTS	L	F	Zi	Mi	Zo	Mo
Empty balanced	[m]	[N]	[m]	[Nm]	[m]	[Nm]
Triple assy	2,5	0	10,0	0	9,5	0
Outboard arm	9,5	0	10,0	0	4,8	0
Inboard arm R	10,0	0	5,0	0	0	0
Inboard arm L / vapour	10,0	0	5,0	0	0	0
Riser	9,8	0	0	0	0	0
TOTAL		132757	M inb max=	560436	M outb max=	190912
Extra balance weight inboard / Cwght3 (2x)		0	-4,0	0	0,4	0
Pivot + adjusting inboard (broodjes)	0,1	39	-4,0	-154		
Outboard adjusting (broodjes)	0,0	-12	-4,0	50	2,9	-36
Counterweight plate 1 / liquid		70041	-4,0	-280166	-1,4	-95438
Counterweight plate 2 / vapour		70041	-4,0	-280166	-1,4	-95438
Riser turning part	1062,4	10624		Cwght	Cwght2	Cwght3
Riser (including insulation)	6249,7	62497	length	3,525	3,525	0,001
			width	1,582	1,582	0,000
Ix1	0,400		thickness	0,160	0,160	0,000
TOTAL		345987		0		0

UNBALANCE BY PRODUCT		0	corrections	0	0
ERC. RELEASE WEIGHT	1046,7	10467			

LOADS IN MARINE LOADING ARM BY DEADWEIGHT IN STORED POSITION

Tag. nr: MU1-LA-002

	Liquid	Pipe1	Pipe 2	Vapour
Triple assy / riser	Btras	-1057,4	0,0	Btrasv
Z outboard arm / riser	Bapex	-568,2		
Inboard arm / riser	Bsupp	-1080,6	0,0	Bsuppv
Parallel structure / riser	Bpar	-930,1		
Counterweight / riser	Bcw	-934,7	0,0	Bcwv

Centre line riser

\- ← → +

No Ice build-up is calculated to DL.

Empty balanced

1st PRODUCT ARM		F [N]	dZ [mm]	Mx [Nm]	TFy [N]	TMx [Nm]
Triple assy		16069	-1057	-16992	16069	-16992
Outboard arm		26336	-568	-14963	42405	-31954
Outboard hydraulics		494	0	0	42899	-31954
Bridge between triples		0	-529	0	42899	-31954
Inboard arm structure		48739	-1081	-52668	91638	-84622
Inboard hydraulics		228	0	0	91866	-84622
2nd PRODUCT ARM		F [N]	dZ [mm]	Mx [Nm]	TFy [N]	TMx [Nm]
Triple assy 2nd		0	0	0	0	0
Outboard arm 2nd		0	0	0	0	0
Inboard arm product		0	0	0	0	0
		0	0	0	0	0
STRUCTURE		F [N]	dZ [mm]	Mx [Nm]	TFy [N]	TMx [Nm]
Wind bracing (or 1st buckling rod)		0	-540	0	0	0
Vapour line inboard (or 2nd buckling rod)		0	-540	0	0	0
Parallel structure		6344	-930	-5900	6344	-5900
Parts counterweights		5302	-930	-4932	11646	-10832
Hydraulic cylinders slewing 80/35x400		436	0	0	12082	-10832
Hydraulic cylinders inboard 160/90/90x1350	One side	4188,0	-720	-3015	16270	-13848
		0,0	0	0	16270	-13848
Hydraulic cylinders outboard 160/90/90x1150	One side	3732,0	-740	-2762	20002	-16609
		0,0	0	0	20002	-16609
Valve block		1400	0	0	21402	-16609
Electric & hydraulic piping (weight A99)		1500	0	0	22902	-16609
Pipe tolerance		17990	0	0	40892	-16609
CONTENTS		F [N]	dZ [mm]	Mx [Nm]	TFy [N]	TMx [Nm]
Triple assy		0	0	0	0	0
Outboard arm		0	-568	0	0	0
Inboard arm R		0	0	0	0	0
Inboard arm L / vapour		0	-1081	0	0	0
Riser		0	0	0	0	0
SUBTOTAL				-101231	114540	-101231
Extra balance weight inboard / Cwght3 (2x)		0	-467	0	114540	-101231
Pivot + adjusting inboard (broodjes)		39	0	0	114578	-101231
Outboard adjusting (broodjes)		-12	0	0	114566	-101231
Counterweight plate 1 / liquid		70041	-935	-65471	184607	-166702
Counterweight plate 2 / vapour		70041	0	0	254649	-166702
Riser turning part		10624	0	0	265273	-166702
Riser (including insulation)		62497	0	0	327770	-166702
No ice or snow build-up		0				
TOTAL		345987 N		166702 Nm		

FORCES IN MARINE LOADING ARM BY WIND IN THE STORED POSITION.

Tag. nr: MU1-LA-002

Columnheight	Hc	9750	mm
Jetty height	Hj	5100	mm
Height triple assy	Ht	1806	mm
Width triple assy	Bt	832	mm
L inb	Li	10000	mm
L outb	Lo	9500	mm
Length inboard tail	Lci	4000	mm
C'wght parallel rod	Lpo	3800	mm
Centre of c'wght	Lco	1363	mm
Datum-LLW	LLW	0	mm

Wind	40	m/s
Exposure	D	
alfa	11,5	
Zg	213	
H	0,174	=2/alfa
C__	1,7	
Co	0,7 or 1,2	
Gust	0,85	
Hkl	0°	
HkO	11°	

Wind	Yz	Xz	ΣA-	ΣACo=0,7	ΣACo=1,2	Ared	pwind	Fz	TMx	TMy	TF
Triple assy	14622	1813	0,00	1,01	0,00	0,71	1237	742	7069	1346	742
Outb arm ex tail	20187	906	0,37	2,34	0,98	3,43	1309	3818	64679	4807	4561
Tail outb arm	26715	-363	0,15	0,93	0,39	1,37	1374	1604	99342	4225	6165
Parall.struc.	21504	-1118	0,16	0,00	1,60	2,19	1323	2465	139785	1470	8630
Inb arm ex tail	19850	0	0,44	7,51	2,62	9,15	1305	10152	289525	1470	18782
Counterweight	12187	-260	5,58	0	0	9,48	1199	9659	357983	-1042	28441
Tail inb arm	12850	0	0	1,77	0,00	1,24	1210	1271	367832	-1042	29712
Column	9975	0	0	7,43	0,00	5,20	1158	5117	392779	-1042	34829

Hkl	0°	Angle between inboard and riser	
HkO	11°	Angle between inboard and outboard	
TMx	Windmoment related to baseplate		[Nm]
Tmy	Windmoment related to centre column		[Nm]

Exposure C covers open terrain with scattered obstructions having heights generally less than 10m.

Exposure D should be generally used for loading arms except where Exposure C could be justified.

Exposure D covers flat unobstructed locations which are exposed to wind flowing over open water for a distance of at least 1,6km.

Exposure D extends 4,1km inland from the shoreline.

The Wind Load is based on a design wind speed of 40 m/s
which is the speed at 4,6 mtrs above low low water.
For other heights the windspeed is corrected according 4.2.8 of OCIMF.

FORCES IN MARINE LOADING ARM BY WIND WHILE MANOEUVRING / OPERATING
Tag. nr: MU1-LA-002

Columnheight	Hc	9750	mm
Jetty height	Hj	5100	mm
Height triple assy	Ht	1806	mm
Width triple assy	Bt	832	mm
L inb	Li	10000	mm
L outb	Lo	9500	mm
Length inboard tail	Lci	4000	mm
C'wght parallel rod	Lpo	3800	mm
Centre of c'wght	Lco	1363	mm
Datum-LLW	LLW	0	mm

Wind	17,5	m/s
Exposure	D	
alfa	11,5	
Zg	213	
H	0,174	=2/alfa
C__	1,7	
Co	0,7 or 1,2	
Gust	0,85	
Hkl	75°	
HkO	135°	

Wind	Yz	Xz	ΣA-	ΣACo=0,7	ΣACo=1,2	Ared	pwind	Fz	TMx	TMy	TF
Triple assy	11785	17886	0	0,00	1,01	1,21	228	235	1569	4197	235
Outb arm ex tail	15063	13773	0,37	0,00	3,31	4,60	238	931	10843	17017	1165
Tail outb arm	18388	8014	0,15	0,00	1,32	1,84	246	385	15965	20106	1551
Parall.struc.	17267	-543	0,16	0,00	1,60	2,19	244	454	21491	19859	2005
Inb arm ex tail	16144	4830	0,44	0,00	10,13	12,91	241	2643	50683	32625	4648
Counterweight	14496	-5044	5,58	0	0	9,48	236	1905	68586	23015	6554
Tail inb arm	14332	-1932	0	0,00	1,77	2,12	236	425	72510	22194	6979
Column	9975	0	0	7,43	0,00	5,20	222	979	77285	22194	7958

Hkl 75° Angle between inboard and riser
HkO 135° Angle between inboard and outboard
TMx Windmoment related to baseplate [Nm]
Tmy Windmoment related to centre column [Nm]

FORCES IN MARINE LOADING ARM BY WIND WHILE MAINTENANCE

Tag. nr: MU1-LA-002

Columnheight	Hc	9750	mm
Jetty height	Hj	5100	mm
Height triple assy	Ht	1806	mm
Width triple assy	Bt	832	mm
L inb	Li	10000	mm
L outb	Lo	9500	mm
Length inboard tail	Lci	4000	mm
C'wght parallel rod	Lpo	3800	mm
Centre of c'wght	Lco	1363	mm
Datum-LLW	LLW	0	mm

Wind	17,5	m/s
Exposure	D	
alfa	11,5	
Zg	213	
H	0,174	=2/alfa
C__	1,7	
Co	0,7 or 1,2	
Gust	0,85	
Hkl	104°	
HkO	45°	

Wind	Yz	Xz	ΣA-	ΣACo=0,7	ΣACo=1,2	Ared	pwind	Fz	TMx	TMy	TF
Triple assy	6635	1560	0	0,00	1,01	1,21	206	212	326	331	212
Outb arm ex tail	9984	5631	0,37	0,00	3,31	4,60	222	867	4559	5211	1079
Tail outb arm	13409	11332	0,15	0,00	1,32	1,84	233	365	7590	9346	1444
Parall.struc.	16339	6014	0,16	0,00	1,60	2,19	241	450	12647	12051	1894
Inb arm ex tail	13640	4851	0,44	0,00	10,13	12,91	234	2567	34568	24504	4461
Counterweight	16519	-2713	5,58	0	0	9,48	242	1949	56827	19216	6410
Tail inb arm	15334	-1941	0	0,00	1,77	2,12	239	430	61228	18381	6840
Column	9975	0	0	7,43	0,00	5,20	222	979	66003	18381	7819

Hkl	**104°**	Angle between inboard and riser	
HkO	**45°**	Angle between inboard and outboard	
TMx	Windmoment related to baseplate		[Nm]
Tmy	Windmoment related to centre column		[Nm]

OUTBOARD ARM

Tag. nr: MU1-LA-002

		Length of outboard arm		Lo	9500	mm
		Weight of Triple assy		DL	16069	N
				Foutb	42405	N
	Outboard Product	Vapour				
D	273,1	-	mm	Apipe	7683	mm²
s	9,3	-	mm	Wpipe	490181	mm³
C.A.	0,0	-	mm	Ipipe	66934185	mm⁴
s *	9,3	-	mm	Wght	603	N/m

Stiffening of outboard pipe with a pipe

Dv	114,3	mm	Wv	52530	mm³
Sv	6,0	mm	Iv	3002116	mm⁴
Av	2041	mm²	Wghtv	160	N/m

PL

Design pressure	pd 10,4 bar	1,0	N/mm²
Stress in axial direction	σax_{PL}=pd*(D-2*s)/4*s	7	N/mm²
Stress in tangential direction	σtan_{PL}=pd*(D-2*s)/2*s	14	N/mm²
Stress in radial direction	σrad_{PL}= -pd/10	-1,0	N/mm²
Equivalent stress von Mises	σe_{VM}	13	N/mm²

OB1

Determining the stresses in the stiffening pipe by breaking
down the radial weightload to axial loads in the main pipe and stiffening pipe.

Lo	9500	mm	tangent	10,00
Ho	**1007**	mm	angle	6,10°

Outboard horizontal

Force in axial direction by DL:	Fax_{DL}	196949	N
Stress in axial direction by DL:	σax_{DL}	26	N/mm²
Stress in axial direction by DL + PL:	σax_{DLPL}	33	N/mm²
-	-	-	-
-	-	-	-
-	-	-	-

OB1/4 reinforcement		0	mm						
	Mwind WLs	25191	Nm	$\sigma_{OB1/4Wls}$	49	N/mm²			
	Mwind WLo	6650	Nm	$\sigma_{OB1/4Wlo}$	13	N/mm²			
Case 1	DL+WLs		Stored	σe	55	N/mm²	<1,2x Sd	=	179N/mm²
Case 3	DL+WLo		Manoeuvring	σe	39	N/mm²	<0,9x Sd	=	134N/mm²

Force in axial direction by DL in stiffening pipe			Fax_{stif}	185427	N			
Stress in stiffening pipe:			σax_{stif}	91	N/mm²	<1,0x Sd	=	149N/mm²
	Z-deflection	38 mm	at triple assy					
	Z-deflectionfactor	**252**					>	150

OB2

Data of outboard pipe stiffened by a parallel pipe.

Plate height between pipes	Pho	50	mm
Distance of the pipes	hohOB2	244	mm
Point of inertia	zOB2	51	mm
Moment of Inertia	Iob	165724756	mm^4
Section modulus product pipe	Wob	882891	mm^3
Section modulus vapour pipe	Wobv	663714	mm^3

The non stiffened length will be:

	Lob2	1866 mm							
	Mb	31305 Nm							
Stress at bending moment in product pipe:				σb_{prod}	35	N/mm^2	<1,0x Sd	=	$149 N/mm^2$
Stress at bending moment in stiffening pipe:				σb_{stif}	47	N/mm^2	<1,0x Sd	=	$149 N/mm^2$
Stress in axial direction by DL + PL				σax	43	N/mm^2	<1,0x Sd	=	$149 N/mm^2$
	Mwind WLs	1385 Nm		σ_{OB2Wls}	3	N/mm^2			
	Mwind WLo	438 Nm		σ_{OB2Wlo}	1	N/mm^2			
Case 1	DL+WLs		Stored	σe	38	N/mm^2	<1,2x Sd	=	$179 N/mm^2$
Case 3	DL+WLo		Manoeuvring	σe	36	N/mm^2	<0,9x Sd	=	$134 N/mm^2$

OB3

Non stiffened length:

	Lob3	831 mm							
	Mb	13360 Nm		σb	27	N/mm^2			
Stress in axial direction by DL + PL				σax	34	N/mm^2			
	Mwind WLs	617 Nm		σ_{OB3Wls}	1,2	N/mm^2			
	Mwind WLo	195 Nm		σ_{OB3Wlo}	0,4	N/mm^2			
Case 1	DL+WLs		Stored	σe	28	N/mm^2	<1,2x Sd	=	$179 N/mm^2$
Case 3	DL+WLo		Manoeuvring	σe	28	N/mm^2	<0,9x Sd	=	$134 N/mm^2$

Deflection through DL when outboard arm is horizontal.

xl1	1,160	mm	Compression product pipe	
xl2	4,364	mm	Elongation stiffening pipe	
xl1+xl2	5,52	mm		
Y-deflection	55	mm	at triple assy	
Y-deflectionfactor	**172**			> 150

INBOARD ARM

Tag. nr: MU1-LA-002

Forces working on the inboard support structure are the windload, deadload and earthquake load. These forces are discribed below;

DL	=	Ftriple + Foutb + Fpari
	=	155,5 kNm
WLs	=	MWLsIB1290
	=	124,7 kNm
EL	=	MELIB1290
	=	402,1 kNm

The OCIMF gives us several cases to consider. Relevant cases 1 and 2 are listed below;

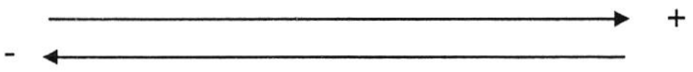
Case 1	=	DL + WLs
Case 2	=	DL + EL

Case 1	=	DL + WLs	*without plate between inboard supports*
	=	280,2 kNm	
Case 2	=	DLTinb + ElTinb	*EL calculated from gravity point to ground level*
	=	557,6 kNm	
Highest value at IB1	=	557,6 kNm	

Deadload moment due to asymmetrical design

	F [N]	dZ [mm]	Mx [Nm]
Triple	16069	-1057,4	-16991,5
Outboard	25921	-568,2	-14726,8
Fpari	58110	-1163,0	-67583,4
Inboard	48063	-1168,3	-56149,1

DLTinb = 155450,8 Nm
DLTinb = 155,5 kNm



Wind load in stored position

MWLsIB1290 = 124731952,4 Nmm
= 124,7 kNm

Earthquake load

MELIB1290 = 402103335,6 Nmm

402,1 kNm

INBOARD ARM

Tag. nr: MU1-LA-002

Modulus of elasticity	E	210000 N/mm^2
Shear modulus G	G	81000 MPa

<u>Inboard support pipes:</u>

Distance between support pipes	B	1200 mm
Diameter support pipes	D	168,3 mm
Wall thickness support pipes	s	7,1 mm
Area of a singe support pipe	Apipe	3596 mm²
Moment of inertia of a single support pipes	Ipipe	11701864 mm⁴

<u>Assembly inboard support structure:</u>

Support pipes	3x pipe:	168,3 x 7,1
Centroid about x	Zx	600 mm
C.t.c. distance of support pipes along x	Hy	1039,2 mm
Centroid about y	Zy	346 mm
Combined area	ΣA_supp	10787 mm²
Combined moment of inertia x	I_{x_supp}	2623948840 mm^4
Combined moment of inertia y	I_{y_supp}	2623952436 mm^4
Combined moment of resistance x	Wx_supp	3835341 mm³
Combined moment of resistance y	Wy_supp	3377159 mm³

IB1

Highest load in y-direction caused by DL, WLs or EL. See sheet 'Forces inboard at IB1'.

Length inboard	Li	10000 mm
Highest load at point IB1	$M_{b\ max}$	557554176,3 Nmm
Stress (Mb/Wy_supp)	σb	165 N/mm²
Deflection y	f	50,59 mm
Deflection factor	150 <	198
	Inboard deflection satisfied.	

Load in x-direction caused by DL. See sheet 'Forces inboard at IB1'.

Load at point IB1	$M_{b\ max}$	155450841 Nmm
Stress (Mb/Wx_supp)	σb	41 N/mm²
Deflection y	f	14 mm
Deflection factor	150 <	709
	Inboard deflection satisfied.	

PARALLEL CONSTRUCTION

Tag. nr: MU1-LA-002

SF	2,0	Safety factor for buckling
Sy	240	N/mm²

Maximum compression load in parallel rod:

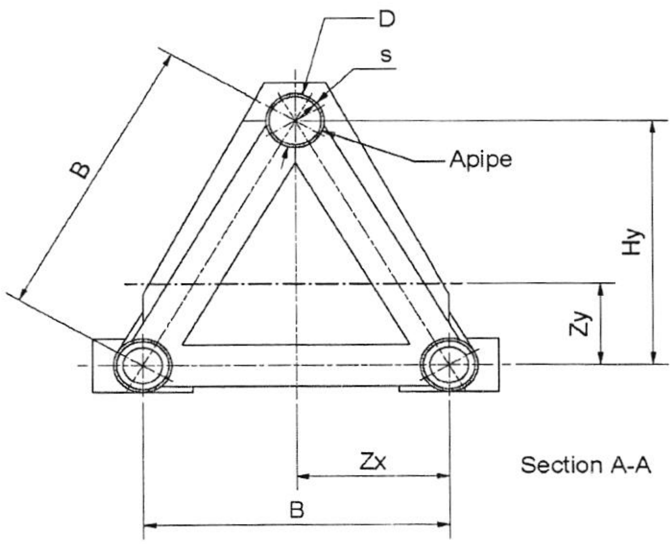
Fbuckling	38895	N

Pipes parallel structure:

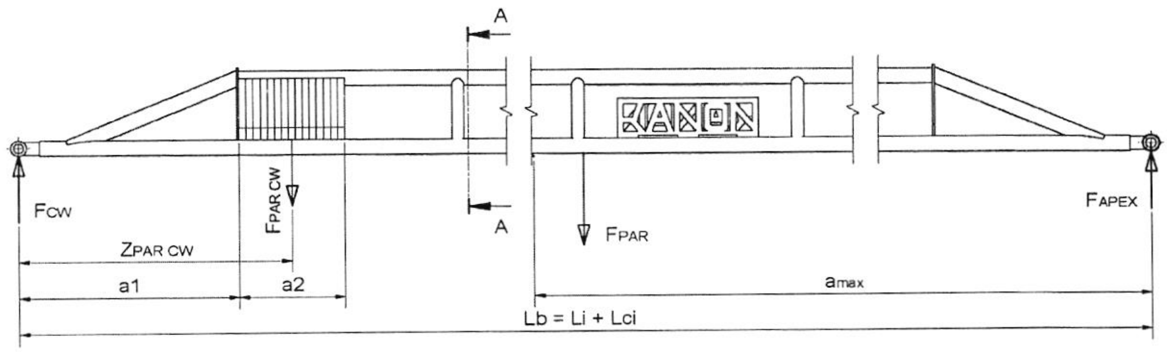
B	475	mm
D	88,9	mm
s	5,5	mm
Apipe	1439	mm²
Ipipe	1256504	mm⁴
Sc	14	N/mm²

Assembly parallel structure:

3x pipe:	88,9 x 5,49	
Zx	237,5	mm
Hy	411,4	mm
Zy	137	mm
ΣApar	4316	mm²
$I_{par\,x} = I_{par\,y}$	166061681	mm⁴
$i_{par\,x} = i_{par\,y}$	196	mm
Wparx	588976	mm³
Wpary	521074	mm³



Lb	14000 mm		$S_{KT\,max}$	229	N/mm²
λg	111		$F_{KT\,max}$	986751	N
λ	71		F_{Kmax}	986751	N
$F_{KE\,max}$	1756032 N		Sf_{BUC}	25,4	Oké



ΣF_{PAR}	6344 N	Weight parallel structure including $F_{PAR\,CW}$
$N_{PAR\,CW}$	0	Number extra CW
$F_{PAR\,CW}$	0 N	
F_{PAR}	6344 N	
$Z_{PAR\,CW}$	0 mm	
F_{APEX}	3172 N	
F_{CW}	3172 N	

$M_{b\,max}$	11101545	Nm
$S_{b\,max}$	21	N/mm²
f max	6	mm
Lb / f	2154	

RISER

Tag. nr: MU1-LA-002

Earthquake data

ASCE 7-10	Cs xy	0,300
	Cs yz	0,315
	Importance Factor	1,0
	Site Class D	

Length of column	9750	mm
Design pressure	10,4	bar

The loads at the top of riser / heel are:

	Force		Torque	
DL	265273	N	166702	Nm
WLs	29712	N	78143	Nm
WLo	6979	N	4467	Nm
WLm	6840	N	5459	Nm
EL	98530	N	273199	Nm

Neck of bearing

Ds	765,0	mm	As	37349	mm²
ssw	15,9	mm	Is	2621218607	mm⁴
Corrosion allowance	0,0	mm	Ws	6852859	mm³
ssw *	15,87	mm	Ix	N.A.	mm⁴
			Wx	N.A.	mm³
			Iz	N.A.	mm⁴
			Wz	N.A.	mm³

PL

				PLt	
Stress in axial direction	σax_{PL} =pd*(D-2*s)/4*s	12,0	N/mm²	18,0	PL-ax
Stress in tangential direction	σtan_{PL} =pd*(D-2*s)/2*s	24,0	N/mm²	36,0	PL-tan
Stress in radial direction	σrad_{PL}= -pd/10	-1,0	N/mm²	-1,6	PL-rad
Equivalent stress von Mises	σe_{VM}	21,7	N/mm²	32,6	

RI1

Just under the bearing:

Distance heel / inboard - bottom upper bearing	Hs	618	mm	
Distance heel / inboard - pin locking device	Hl	5000	mm	
Stress caused by Dead Load	σa	7,1	N/mm²	Dl-ax
	σb	24,3	N/mm²	DL-b
Stress caused by Fluid Load	σa	1,4	N/mm²	FL-ax
Stress caused by Wind Load stored	τ	0,8	N/mm²	WLs-t
	σb	4,1	N/mm²	WLs-b
Stress caused by ERC release part of triple assembly	σb	27,5	N/mm²	ERC-b
Stress caused by Seismic Load	τ	2,6	N/mm²	EL-t
at baseplate and bearing pipe assumed	σb	39,9	N/mm²	EL-b
Stress caused by Wind Load while operating	τ	0,2	N/mm²	WLo-t
	σb	1,3	N/mm²	WLo-b
Stress caused by Wind Load while maintenance	τ	0,2	N/mm²	WLm-t
	σb	1,4	N/mm²	WLm-b

Equivalent stress von Mises

Case 1	DL+WLs	Stored	σe	36 N/mm²	<1,2x Sd	=	179N/mm²
Case 2	DL+EL	Stored	σe	71 N/mm²	<1,2x Sd	=	179N/mm²
Case 3	DL+WLo	Manoeuvring	σe	33 N/mm²	<0,9x Sd	=	134N/mm²
Case 4	DL+WLo	Connected	σe	33 N/mm²	<0,8x Sd	=	119N/mm²
Case 5	DL+FL+PL+WLo	Connected	σe_{VM}	31 N/mm²	<0,8x Sd	=	119N/mm²
Case 6	DL+FL+PL+WLo+TL	Connected	σe_{VM}	31 N/mm²	<1,5x Sd	=	223N/mm²
Case 7	DL+WLo	Emergency Release	σe	60 N/mm²	<1,1x Sd	=	164N/mm²
Case 8	DL+FL+PL+WLo	Emergency Release	σe_{VM}	55 N/mm²	<1,1x Sd	=	164N/mm²
Case 9	DL+WLm	Maintenance	σe	33 N/mm²	<0,9x Sd	=	134N/mm²
Case 10	DL+FL+PLt+WLo	Hydrostatic test	σe_{VM}	37 N/mm²	<1,3x Sd	=	193N/mm²

RISER

Tag. nr: MU1-LA-002

Height of stiffening from bottom of baseplate	Hst	3050	mm
Gravity point of the total arm based from the baseplate	Hg	8421	mm

The loads at top of baseplate stiffening are:

	Force		Torque	
DL	345987	N	166702	Nm
WLs	34829	N	286550	Nm
WLo	7958	N	57479	Nm
WLm	7819	N	47614	Nm
EL	108951	N	1064633	Nm

Bearing pipe

Dr	762,0	mm	Ar	37200	mm^2
Sr	15,87	mm	Ir	2589862758	mm^4
Corrosion allowance	0,0	mm	Wr	7216447	mm^3
Sr *	15,87	mm	Ix	N.A.	mm^4
			Wx	N.A.	mm^3
			Iz	N.A.	mm^4
			Wz	N.A.	mm^3

PL

				PLt	
Stress in axial direction	σax_{PL} =pd*(D-2*s)/4*s	12,0	N/mm^2	17,9	PL-ax
Stress in tangential direction	σtan_{PL} =pd*(D-2*s)/2*s	23,9	N/mm^2	35,9	PL-tan
Stress in radial direction	σrad_{PL}= -pd/10	-1,0	N/mm^2	-1,6	PL-rad
Equivalent stress von Mises	σe_{VM}	21,6	N/mm^2	32,4	

RI2

At top of baseplatestiffening, directly above the stiffening plates:

Stress caused by Dead Weight	σa	9,3	N/mm^2	Dl-ax
	σb	23,1	N/mm^2	DL-b
Stress caused by fluid load	σa	1,4	N/mm^2	FL-ax
Stress caused by Wind Load stored	τ	0,9	N/mm^2	WLs-t
	σb	39,7	N/mm^2	WLs-b
Stress caused by ERC release part of triple assembly	σb	26,1	N/mm^2	ERC-b
Stress caused by Seismic Load	τ	2,9	N/mm^2	EL-t
at baseplate and bearing pipe assumed	σb	147,5	N/mm^2	EL-b
Stress caused by Wind Load while operating	τ	0,2	N/mm^2	WLo-t
	σb	8,0	N/mm^2	WLo-b
Stress caused by Wind Load while maintenance	τ	0,2	N/mm^2	WLm-t
	σb	6,6	N/mm^2	WLm-b

Equivalent stress von Mises

Case 1	DL+WLs	Stored	σe	72 N/mm^2	<1,2x Sd	= 181N/mm^2
Case 2	DL+EL	Stored	σe	180 N/mm^2	<1,2x Sd	= 181N/mm^2
Case 3	DL+WLo	Manoeuvring	σe	40 N/mm^2	<0,9x Sd	= 136N/mm^2
Case 4	DL+WLo	Connected	σe	40 N/mm^2	<0,8x Sd	= 121N/mm^2
Case 5	DL+FL+PL+WLo	Connected	σe_{VM}	37 N/mm^2	<0,8x Sd	= 121N/mm^2
Case 6	DL+FL+PL+WLo+TL	Connected	σe_{VM}	37 N/mm^2	<1,5x Sd	= 227N/mm^2
Case 7	DL+WLo	Emergency Release	σe	66 N/mm^2	<1,1x Sd	= 166N/mm^2
Case 8	DL+FL+PL+WLo	Emergency Release	σe_{VM}	60 N/mm^2	<1,1x Sd	= 166N/mm^2
Case 9	DL+WLm	Maintenance	σe	39 N/mm^2	<0,9x Sd	= 136N/mm^2
Case 10	DL+FL+PLt+WLo	Hydrostatic test	σe_{VM}	41 N/mm^2	<1,3x Sd	= 197N/mm^2

BASE PLATE
MU1-LA-002

The MLA baseplate and its gussets are designed to mount the arm on the jetty / berth.
Only the area close to and under the stiffened parts of the baseplate will really bear the loads of the MLA.
The bearing width for concrete stress, under the gussets and the riserpipe, welded on the baseplate is calculated acc. D 1302 of the Rules of Stoomwezen (RTOD) (Dutch law for pressure vessels)

For:	Baseplate surface	1800 x 1800 mm
	Baseplate thickness	50 mm
	Diameter anchorbolts	36 mm
	Number of anchors	32
	Allowable stress concrete	20 N/mm²
	Yield stress in base plate	240 N/mm²

Which results in following data of baseplate:

A	727762 mm²
W	169536144 mm³
I	197679143584 mm⁴

F deadload					345987 N
F fluid load					53594 N
-					0 N
				Σ V=	399582 N
F lateral					
	Case 1	DL+WLs	Stored		34829 N
	Case 2	DL+EL	Stored		108951 N
				Σ H=	108951 N
M deadload moment					166702 Nm
M_{ERC}					188580 Nm
M wind stored position					392779 Nm
Seismic load					108951 N
Seismic load moment					1491959 Nm
M inlet nozzle					0 Nm
	Case 1	DL+WLs	Stored		559481 Nm
	Case 2	DL+EL	Stored		1658661 Nm
	Case 7	DL+WLo	Emergency Release		251699 Nm
				Σ M=	1658661 Nm

Bearing stress on concrete through dead load and total moment:

Stress caused by Dead Load	σ d	0,48 N/mm²
Stress caused by Total moment	σ b	9,78 N/mm²
Equivalent stress	σe	10,26 N/mm²
Allowable stress concrete	σ 2max	20 N/mm²

Strength check of anchors through total moment:

The 32 anchorbolts are positioned at a pcd of 2093 mm.
The anchorbolts M36 will have following maximum tensile stress:

Fbolt = ((4*ΣM/pcd) - F.DL) / N anchor	Fbolt	86571 N
Tensioned cross section	At	817 mm²
Fbolt / At	σ t	106,0 N/mm²
Allowable stress for 8.8 anchors = yield stress / 2,5	σ e	256,0 N/mm²

KANON LOADING EQUIPMENT

Edisonweg 27
3899AZ Zeewolde
The Netherlands

P.O. box 385
3840 AJ Harderwijk

EARTHQUAKE DESIGN LOAD CALCULATION according ASCE 7-10

of a Marine Loading Arm type MLA260 with double inboard line

Kanon document number	:	P152057B07.4
Kanon revision number	:	0
Client document number	:	
Client revision number	:	
Made by	:	HJS
Date of creation	:	14 January 2016
Date of issue	:	28 February 2017
Dimensions	:	9750 x 10000 x 9500 mm
Diameter product line	:	10" nominal diameter
Products	:	Sulphuric Acid (98%)
Loading arm ident no	:	P152057B10
Tag no	:	MU1-LA-002
Purchase order	:	
Ordered by	:	Tecnicas Reunidas
Owner	:	Petro Peru

20/2/17

CONTENTS:

GENERAL

This seperate earthquake design load calculation for Marine Loading Arms calculates the critical moments:
At baseplate
At height of stiffening from bottom of baseplate
At neck of swiveljoint

These critical moments shall be implemented at the "STATIC- and DESIGN CALCULATION according OCIMF".

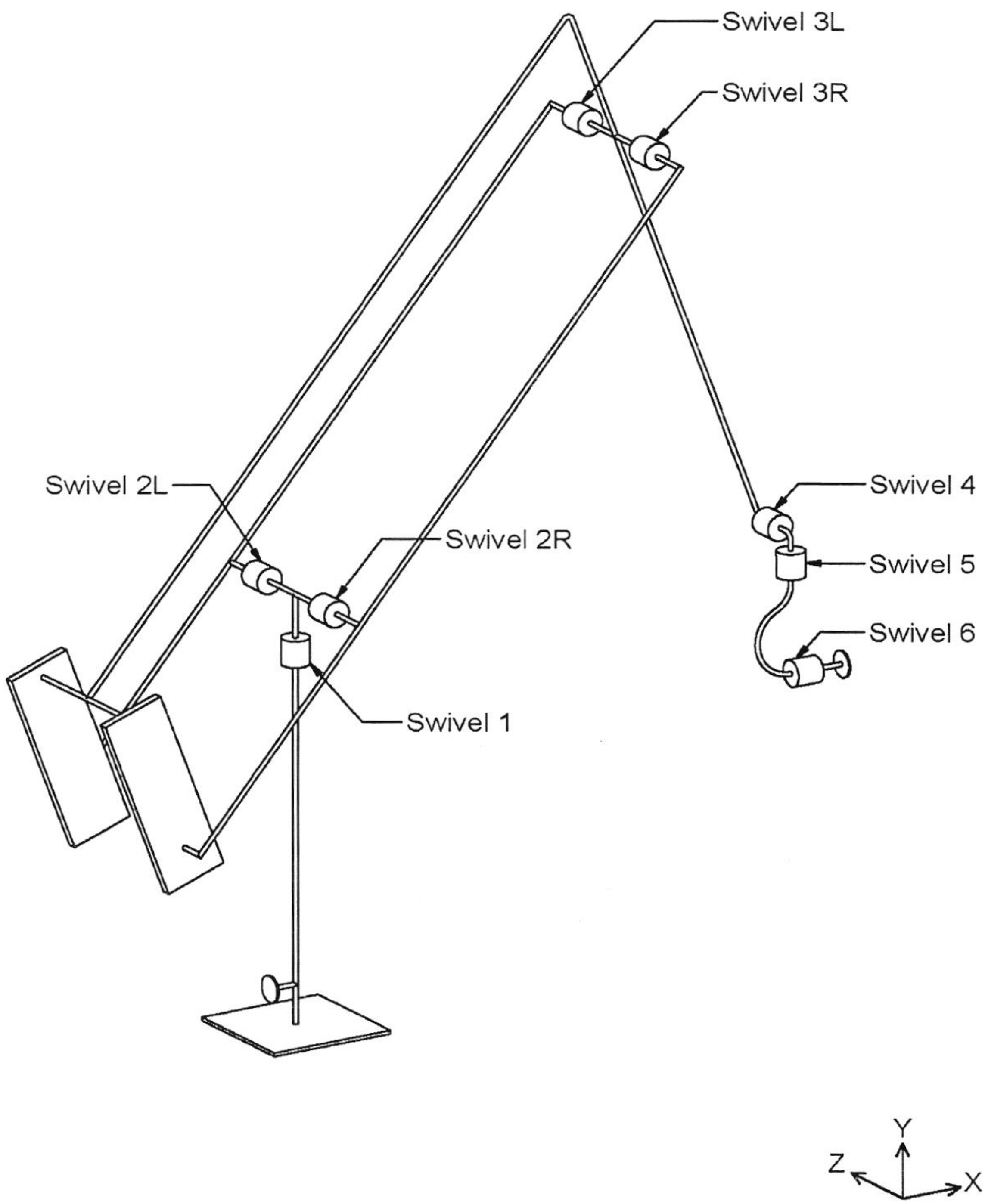
Following chapters of the ASCE 7-10 have been used to develop this calculation:

Chapter 1	Importance factor
	Risk categorization
Chapter 11	Symbols
	Design response spectrum
	Mapped acceleration parameters
	Site class
	S_{MS}, S_{M1}
	S_{DS}, S_{D1}
	Seismic design category
Chapter 12	Redundancy
	Direction of loading
	Analysis procedure selection
	Equivalent lateral force procedure
Chapter 15	Non building structures not similar to buildings
	Structural design requirements
	Respons modification coefficient

The following values, determined within this calculation, shall be implemented into the OCIMF calculation:

$C_{s\ XY}$	Seismic respons coefficient in XY direction	
$C_{s\ YZ}$	Seismic respons coefficient in YZ direction	
F_{BP}	Lateral seismic force related to baseplate	N
M_{BP}	Seismic moment related to baseplate	Nm
M_{SB}	Seismic moment related above stiffening baseplate	Nm
F_{NECK}	Lateral seismic force related to neck first swiveljoint	N
M_{NECK}	Seismic moment related to neck first swiveljoint	Nm

Location of swivel joints Used in calculations	MLA260 DI

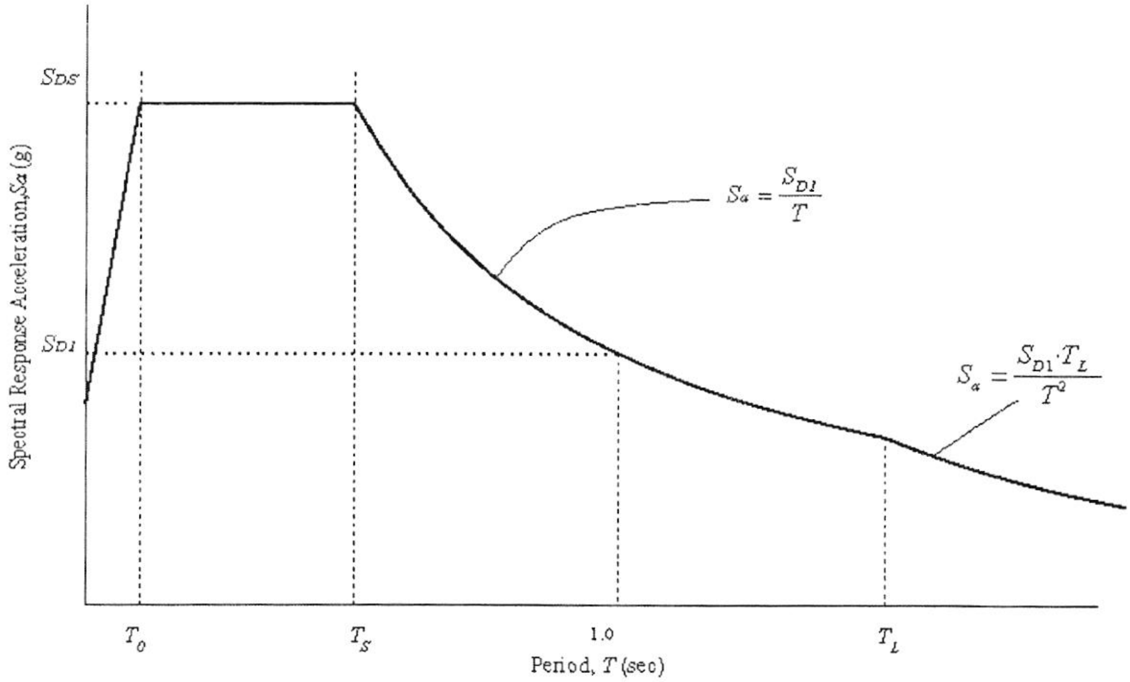


ANALYTIC PROCEDURE

					Section / Table / Equation
Risk Category	II ▾				Table 1.5-1
Risk Category II			I_e	1,00	
Site Class	D ▾				11.4.2
Site Class D					
I_e	1,00				Table 1.5-2
S_S	2,64				11.4.1
S_1	0,67	Caution, zeer dikwandige riser, grote eer			11.4.1
R	2,0				Table 15.4-2
F_a	1,0000				Table 11.4-1
F_v	1,5000				Table 11.4-2
S_{MS}	2,6420				11.4.3
S_{M1}	1,0050				11.4.3
S_{DS}	1,7613				11.4.4
S_{D1}	0,6700				11.4.4

Seismic Design Category D	Table 11.6-1 and 11.6-2
Highest value (100% XY + 30% YZ) and (100% YZ + 30% XY)	12.5
Equivalent Lateral Force Analysis Section 12.8	Table 12.6-1

CALCULATION PROCEDURE 1



Section / Table / Equation

T_0	0,076 s				
T_S	0,380 s	C_s	0,8806667		
T_L	100,000 s				
	XY		YZ		
f_{XY}	0,896 Hz	f_{YZ}	0,940 Hz		
T_{XY}	1,116 s	T_{YZ}	1,064 s		
C_s	0,300	C_s	0,315		Equation 12.8-3 and 12.8-4
C_s	0,077 ≥ 0,03	C_s	0,077 ≥ 0,03		Equation 15.4.1
C_s	0,268	C_s	0,268		Equation 15.4.2
$C_{s\,XY}$	0,300	$C_{s\,YZ}$	0,315		
k	1,308	k	1,282		
W	345987 N	W	345987 N		
V	103851 N	V	108951 N		Equation 12.8-1

CALCULATION PROCEDURE 2

				XY			YZ	
				W	345987 N		W	345987 N
				V	103851 N		V	108951 N
At baseplate				k	1,308		k	1,282

F_{TR}	1607 N	h_{TR}	9522 mm	$F_{TR\,XY}$	550 N		$F_{TR\,YZ}$	577 N
F_{OUT}	21155 N	h_{OUT}	15087 mm	$F_{OUT\,XY}$	13215 N		$F_{OUT\,YZ}$	13704 N
$F_{OUTB\,TAIL}$	5182 N	h_{OT}	21615 mm	$F_{OT\,XY}$	5181 N		$F_{OT\,YZ}$	5322 N
F_{PAR}	6344 N	h_{PAR}	16404 mm	$F_{PAR\,XY}$	4421 N		$F_{PAR\,YZ}$	4575 N
F_{INB}	35928 N	h_{INB}	14750 mm	$F_{INB\,XY}$	21790 N		$F_{INB\,YZ}$	22610 N
F_{CW}	145264 N	h_{CW}	7087 mm	$F_{CW\,XY}$	33775 N		$F_{CW\,YZ}$	35723 N
$F_{INB\,TAIL}$	12826 N	h_{IT}	7750 mm	$F_{IT\,XY}$	3352 N		$F_{IT\,YZ}$	3537 N
F_{COL}	73121 N	h_{COL}	4875 mm	$F_{COL\,XY}$	10422 N		$F_{COL\,YZ}$	11131 N
F_{REST}	44560 N	h_{REST}	7494 mm	$F_{REST\,XY}$	11146 N		$F_{REST\,YZ}$	11771 N
Σ	345987 N				103851 N			108951 N
				M_{XY}	1110199 Nm		M_{YZ}	1158899 Nm

At baseplate and anchorbolts

Highest value (100% XY + 30% YZ) and (100% YZ + 30% XY)

F_{BP}	108951 N
M_{BP}	1491959 Nm

At height of stiffening from bottom of baseplate

Hst	3050 mm	M_{XY}	793452 Nm	M_{YZ}	826598 Nm

Highest value (100% XY + 30% YZ) and (100% YZ + 30% XY)

M_{SB}	1064633 Nm

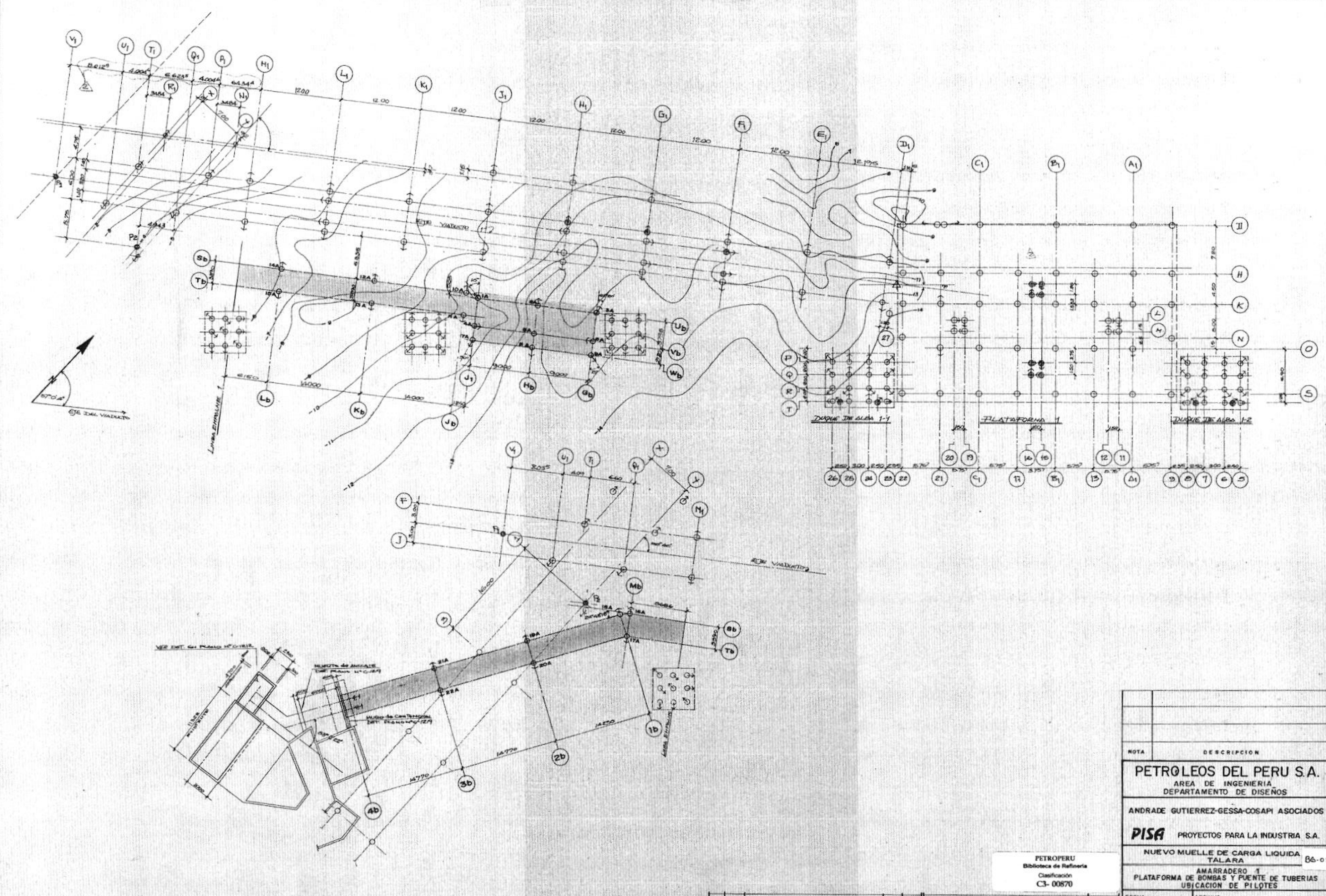
At neck of swiveljoint

Hc	9750 mm	Hs	618 mm	M_{XY}	206193 Nm	M_{YZ}	211341 Nm
Hneck	9132 mm	sts	0 mm				

Highest value (100% XY + 30% YZ) and (100% YZ + 30% XY)

F_{NECK}	98530 N
M_{NECK}	273199 Nm

ANEXO 4. PLANOS MUELLE EXISTENTE



Nº	FECHA	DESCRIPCION	POR	APROB.
3		PLANO TAL COMO FUE CONSTRUIDO	VEV	L.A.L.L.
2	2/7/93	APROBADO PARA CONSTRUCCION	VEV	L.A.L.L.
A	8/93	EMISION GENERAL	JRK	

REVISIONES

TITULO	Nº PLANO
CUADRO DE PILOTES	C-1201

REFERENCIAS

NOTA	DESCRIPCION

PETROLEOS DEL PERU S.A.
AREA DE INGENIERIA
DEPARTAMENTO DE DISEÑOS

ANDRADE GUTIERREZ-GESSA-COSAPI ASOCIADOS

PISA PROYECTOS PARA LA INDUSTRIA S.A.

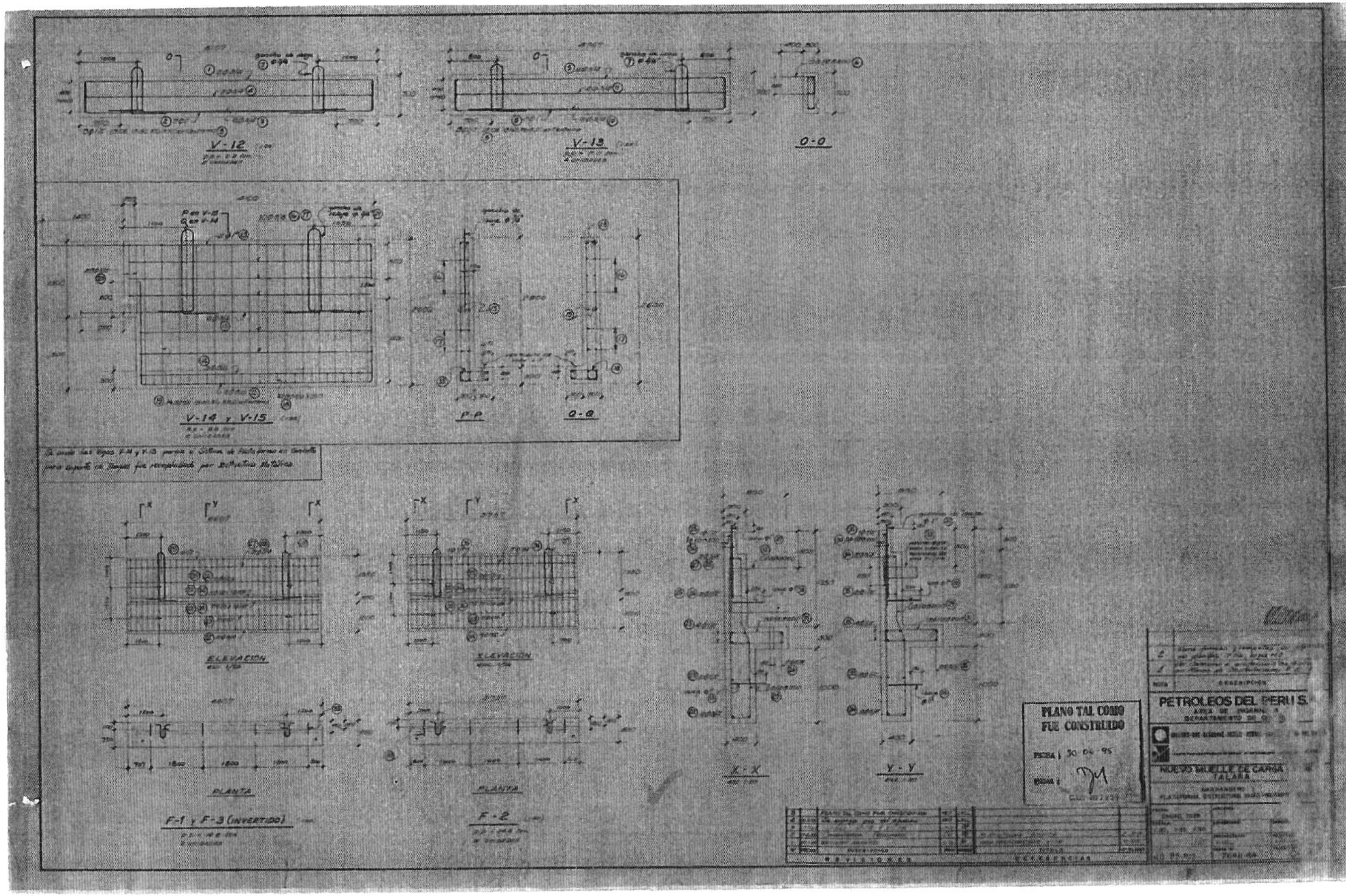
NUEVO MUELLE DE CARGA LIQUIDA
TALARA

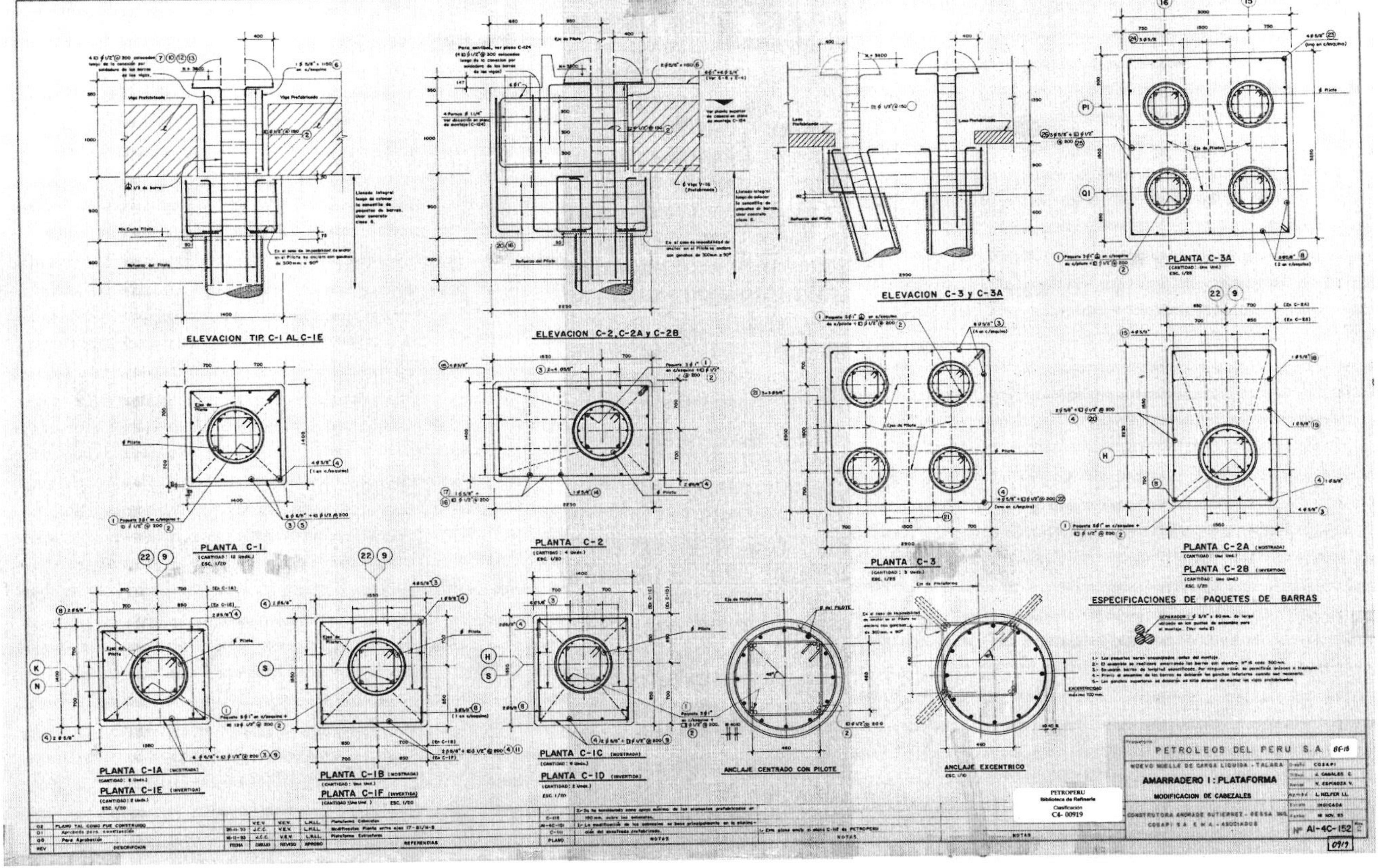
B6-08

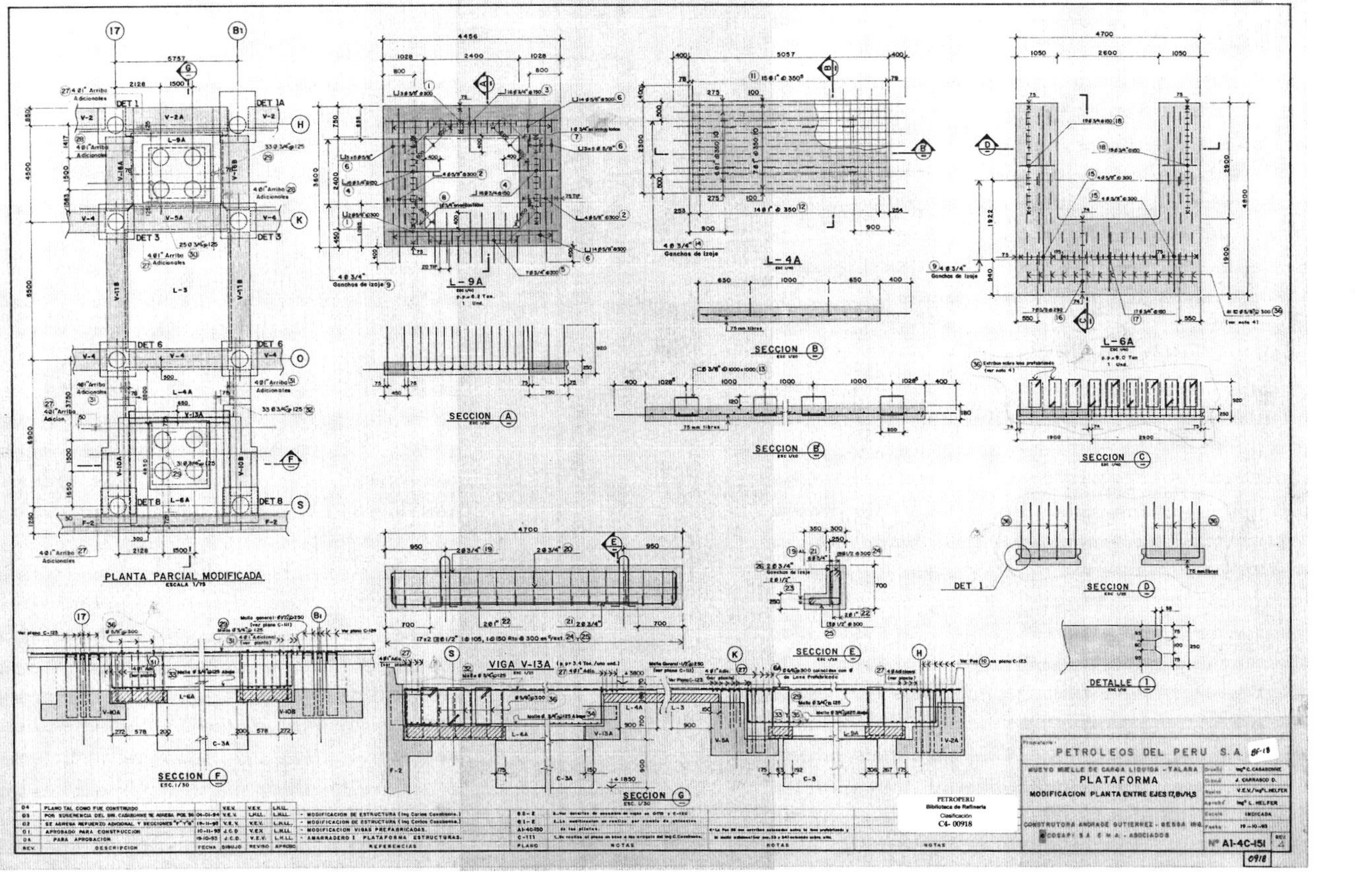
AMARRADERO 1
PLATAFORMA DE BOMBAS Y PUENTE DE TUBERIAS
UBICACION DE PILOTES

FECHA MARZO-93	ARCHIVO:	
ESCALA 1/250	LEVANTADO:	DIBUJADO: B.L.Q.
	PROYECTADO	REVISADO: JAP
	OBRA Nº	PLANO Nº C-1200

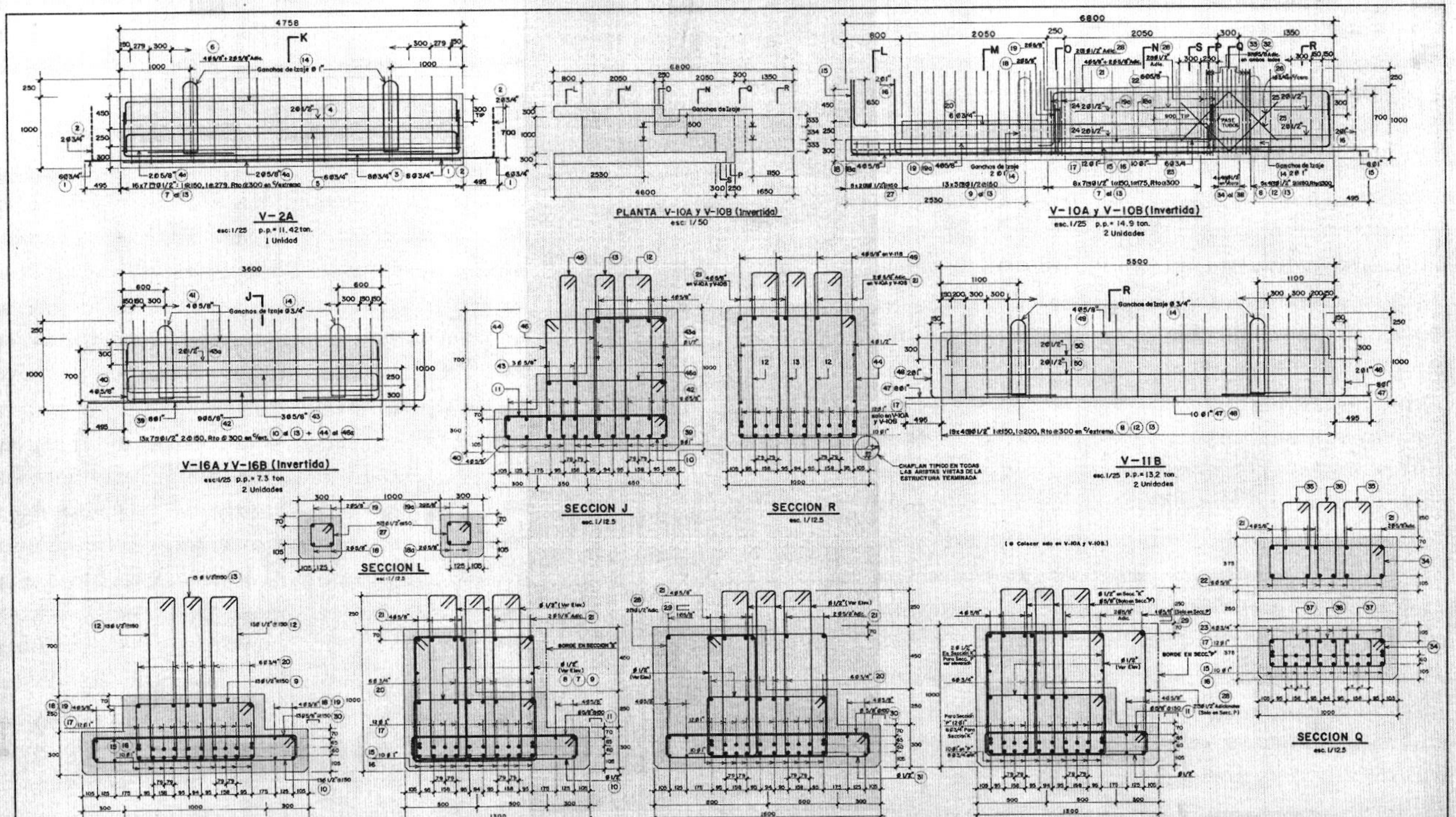
0870


V-12
V-13
O-O
V-14 y V-15
P-P
Q-Q
ELEVACION
PLANTA
F-1 y F-3 (INVERTIDO)
F-2
X-X
Y-Y
PLANO TAL COMO FUE CONSTRUIDO
FECHA : 30-04-95
PETROLEOS DEL PERU S.
NUEVO MUELLE DE CARGA
TALARA


ELEVACION TIP. C-1 AL C-1E
ELEVACION C-2, C-2A y C-2B
ELEVACION C-3 y C-3A
PLANTA C-3A
PLANTA C-1
PLANTA C-2
PLANTA C-3
PLANTA C-2A (MOSTRADA)
PLANTA C-2B (INVERTIDA)
PLANTA C-1A (MOSTRADA)
PLANTA C-1E (INVERTIDA)
PLANTA C-1B (MOSTRADA)
PLANTA C-1F (INVERTIDA)
PLANTA C-1C (MOSTRADA)
PLANTA C-1D (INVERTIDA)
ANCLAJE CENTRADO CON PILOTE
ANCLAJE EXCENTRICO
ESPECIFICACIONES DE PAQUETES DE BARRAS
PETROLEOS DEL PERU S.A.
NUEVO MUELLE DE CARGA LIQUIDA - TALARA
AMARRADERO I : PLATAFORMA
MODIFICACION DE CABEZALES
COSAPI S.A. E.M.A. - ASOCIADOS
PETROPERU
Biblioteca de Refinería
Clasificación
C4- 00919
Nº AI-4C-152
0919



PLANTA PARCIAL MODIFICADA
ESCALA 1/75
L-9A
L-4A
L-6A
SECCION A
SECCION B
SECCION B'
SECCION C
SECCION D
SECCION E
SECCION F
SECCION G
VIGA V-13A
DET 1
DETALLE 1
Ganchos de izaje
PETROLEOS DEL PERU S.A.
BF-18
NUEVO MUELLE DE CARGA LIQUIDA - TALARA
PLATAFORMA
MODIFICACION PLANTA ENTRE EJES 17,B1/H,S
CONSTRUTORA ANDRADE GUTIERREZ - GESSA ING.
COSAPI S.A. E.M.A. - ASOCIADOS
Ing° C. CASABONNE
J. CARRASCO D.
V.E.V./Ing° L. HELFER
Ing° L. HELFER
INDICADA
19-10-93
N° A1-4C-151
REV. 4
0918
PETROPERU
Biblioteca de Refinería
Clasificación
C4-00918
04 PLANO TAL COMO FUE CONSTRUIDO
03 POR SUGERENCIA DEL ING. CASABONNE SE AGREGA POS. 36
02 SE AGREGA REFUERZO ADICIONAL Y SECCIONES "F" Y "G"
01 APROBADO PARA CONSTRUCCION
0A PARA APROBACION
REV. DESCRIPCION FECHA DIBUJO REVISO APROBO
- MODIFICACION DE ESTRUCTURA (Ing Carlos Casabonne.)
- MODIFICACION DE ESTRUCTURA (Ing Carlos Casabonne.)
- MODIFICACION VIGAS PREFABRICADAS.
- AMARRADERO I PLATAFORMA ESTRUCTURAS.
REFERENCIAS
A1-4C-150
C-111
PLANO
NOTAS



Rev	DESCRIPCION	Fecha	Dibujo	Revisó	Aprobó	REFERENCIAS	PLANO
02	PLANO TAL COMO FUE CONSTRUIDO		V.E.V.	V.E.V.	L.H.LL.	MODIFICACION DE ESTRUCTURA (ING. CARLOS CASABONNE).	42-2
01	APROBADO PARA CONSTRUCCION	11 9 98	J.C.D.	V.E.V.	L.H.LL.	MODIFICACION DE ESTRUCTURA (ING. CARLOS CASABONNE).	41-2
0A	PARA APROBACION	30 6 98	J.C.D.	V.E.V.	L.H.LL.	PLATAFORMA ESTRUCTURAS VIGAS PREFABRICADAS III	C-118

NOTAS

2- SE REALIZO EL PLANO EN BASE A LOS CROQUIS DEL ING. CARLOS CASABONNE.
1- LAS VIGAS CORRESPONDEN A LA PLATAFORMA ENTRE LOS EJES 5-H/17-B, QUE SE MODIFICA POR CAMBIO DE UBICACION DE PILOTES.

PETROLEOS DEL PERU S.A. BF-16

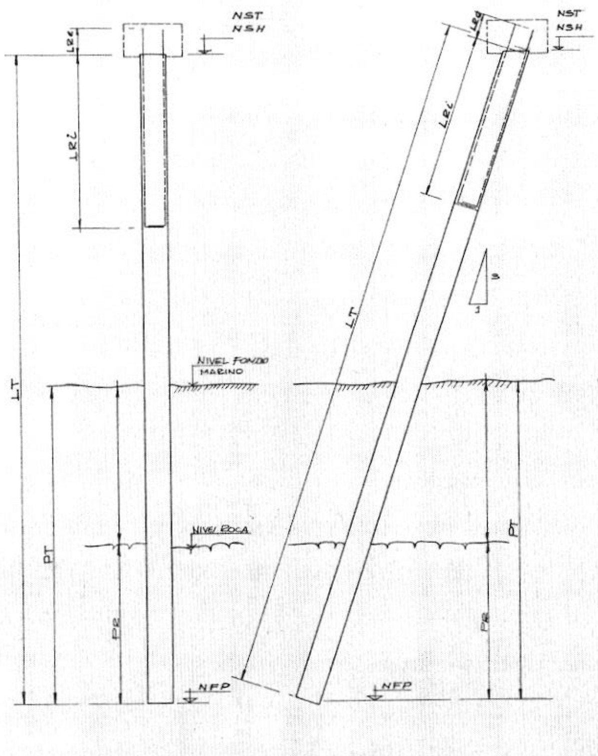
NUEVO MUELLE DE CARGA LIQUIDA - TALARA
AMARRADERO 1: PLATAFORMA
MODIFICACION EN VIGAS PREFABRICADAS

Diseño: ING. C. CASABONNE
Dibujo: J. CARRASCO D.
Revisó: V.ESPINOZA / ING. L. HELFER
Aprobó: ING. S. ZAVALETA N.
Escala: 1/25, 1/12.5
Fecha: 17 JULIO 1998

CONSTRUTORA ANDRADE GUTIERREZ - GESSA ING.
COSAPI S.A. E.N.A. - ASOCIADOS

Nº A1-4C-150 Rev. 2

0917



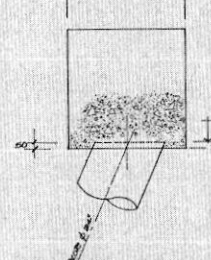
PILOTE VERTICAL

PILOTE INCLINADO

PILOTE Nº	UBICACION	EJES	DIAMETRO mm.	POSICION	NIVELES NST	NSH	NFP	PENETRACION PT	PA	PR	LONG. LT (m)	PESO TOTAL PILOTE (*)	REFUERZO SUP. TIPO	LRi	LRe	ANCLAJE INF. EN ROCA	CARGAS DE SERVICIO COMPRESION	TRACCION
1A	PLATAF. BOMBAS	J5-U6	ϕ609	INCLIN.	1.50	2.765	[illegible]	8.88	2.51	3.38	17.46	4090	R-3A	5.00	1.50	SI	100	—
2A	"	H6-U6	"	"	"	"	-17.750	9.10	3.29	3.81	20.80	4780	"	"	—	"	140	—
3A	"	G1-2U6	"	"	"	"	-15.131	10.067	6.164	3.50	24.81	5104	"	"	"	"	100	—
4A	"	J1-V6	"	"	"	"	-19.30	8.60	3.33	5.27	22.56	5275	"	"	"	"	140	—
5A	"	U6-V6	"	VERTICAL	"	"	-22.908	12.88	3.60	5.23	23.84	5579	"	"	"	"	140	—
6A	"	E6-V6	"	INCLINADO	"	"	-17.60	10.38	5.790	4.532	20.145	4714	"	"	"	"	140	—
7A	"	J1-W6	"	INCLINADO	"	"	-17.369	8.19	1.15	7.04	19.83	4454	"	"	"	"	100	—
8A	"	U6-W6	"	"	"	"	-21.07	11.547	7.61	3.937	23.84	5579	"	"	"	"	140	—
9A	"	E6-W6	"	"	"	"	-20.43	10.742	6.61	4.132	23.33	5459	"	6.00	1.50	"	100	—
10A	PUENTE TUBERIAS	J6-S6	ϕ609	"	[illegible]	3.425	-15.38	4.32	1.62	2.70	18.34	4292	R-1	—	—	"	40	—
11A	"	J6-T6	"	"	"	"	-19.18	6.34	3.17	3.17	22.48	5260	"	—	—	"	40	—
12A	"	K6-S6	"	"	"	"	-13.061	8.72	5.87	2.85	16.04	3753	"	—	—	"	"	—
13A	"	K6-T6	"	"	"	"	-14.348	9.84	7.06	2.78	17.39	4069	"	—	—	"	"	—
14A	"	L6-S6	"	"	"	"	-10.670	8.08	4.82	3.26	13.52	3164	"	—	—	"	"	—
15A	"	L6-T6	"	"	"	"	-11.154	7.45	4.61	2.84	14.07	3292	"	—	—	"	"	—
16A	"	M6-S6	"	"	"	"	-8.14	6.85	3.51	3.36	10.85	2539	"	—	—	"	"	—
17A	"	M6-T6	"	"	"	"	-9.06	6.73	4.53	2.20	11.81	2764	"	—	—	"	"	—
18A	"	16-10b	"	"	"	"	-8.13	5.94	2.11	3.83	10.84	2537	"	—	—	"	"	—
19A	"	20-10b	"	"	"	"	-4.14	4.00	1.74	2.26	6.64	1554	"	—	—	"	"	—
20A	"	20-11b		"	"	"	-6.09	6.00	2.86	3.14	8.50	2083	"	—	—	"	"	—
21A	"	30-10b	"	"	"	"	-2.63	3.40	0.43	2.97	5.04	1181	"	—	—	"	"	—
22A	"	40-10b	"	"	"	"	-2.86	2.98	0.50	2.48	5.21	1219	"	—	—	"	"	—

(*) Peso total sin incluir concreto

1. Pilotes: Tubos para pilote de acuerdo a la Norma ASTM A 252 Grado 2
2. Ver Ubicacion de pilotes en plano C-1200
3. Ver detalle de fabricación y anclaje en plano C-104
4. Para fabricacion hinca, control y protección contra la corrosión Ver Especificaciones del proyecto
5. Las profundidades "P" indicadas en los planos son estimadas en función del levantamiento batimétrico (Ver Plano C-1200) y de las investigaciones de suelos. Cualquier variación deberá ser reportada a la supervisión
6. De acuerdo al procedimiento de clavado establecido en campo, los pilotes penetraron en roca no menos de 6.00 metros, considerandose empotrado a 1.60 mts del fondo



DETALLE DE PENETRACION DE CABEZA DE PILOTE EN FONDO DE VIGA

NOMENCLATURA	
NST	Nivel Superior Topográfico
NSH	Nivel Superior Hidrográfico
NFP	Nivel fondo de Hincado (Base del Pilote)
PT	Penetración total minima en fondo marino
PA	Penetracion minima en Arcilla compacta
PR	Penetracion minima en Roca arenisca
LT	Longitud Total (estimada)
LRi	Longitud Refuerzo interior
LRe	Longitud Refuerzo exterior

DIAMETRO mm	DIAMETRO pulg	ESPESOR mm	ESPESOR pulg	PESO kg/ml
812	32	16	5/8	314
711	28	16	5/8	277
609	24	16	5/8	234

CARACTERISTICAS DEL REFUERZO TIPO R-3A

Refuerzo Principal: 12 ϕ 1"
Zuncho Estribado: ϕ 3/8" paso @ 100 (L=3000); ϕ 3/8" paso @ 100 (L=2000)

Nota: El Tipo R-1, son pilotes sin refuerzo

Nº	FECHA	DESCRIPCION	POR	APROB.
6		PLANO TAL COMO FUE CONSTRUIDO	VEY	LKB
5	4/2/[illegible]	[illegible]	JRA	
4	[illegible]	[illegible] NOTA 6	JRA	
3	[illegible]	[illegible]	JRA	
2	[illegible]	NOTA 6 [illegible]	JRA	
1	[illegible]	[illegible]	JRA	

REVISIONES

TITULO	Nº PLANO
UBICACION DE PILOTES	C-1200

REFERENCIAS

NOTA	DESCRIPCION

PETROLEOS DEL PERU S.A.
AREA DE INGENIERIA
DEPARTAMENTO DE DISEÑOS

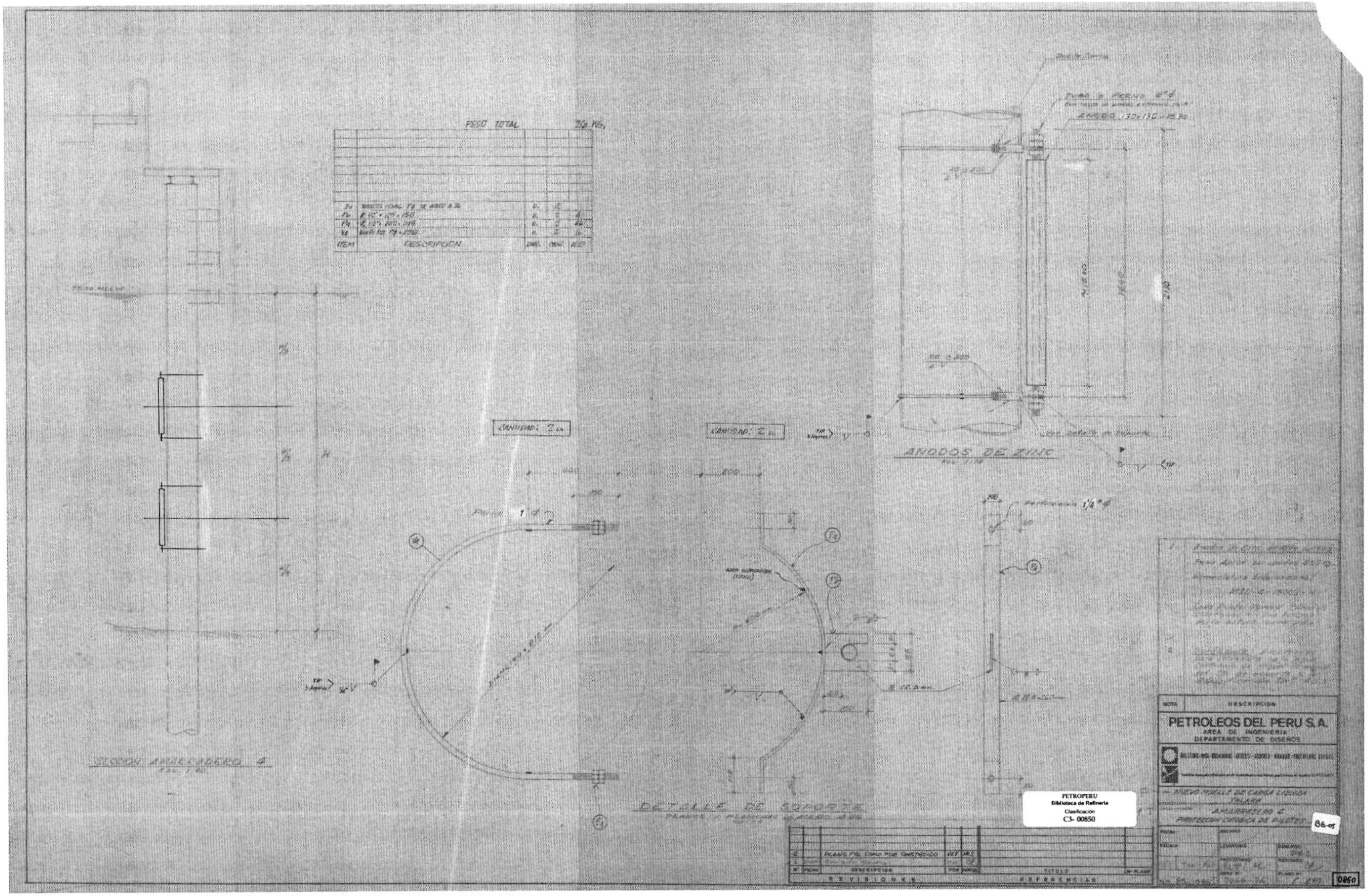
ANDRADE GUTIERREZ-GESSA-COSAPI ASOCIADOS

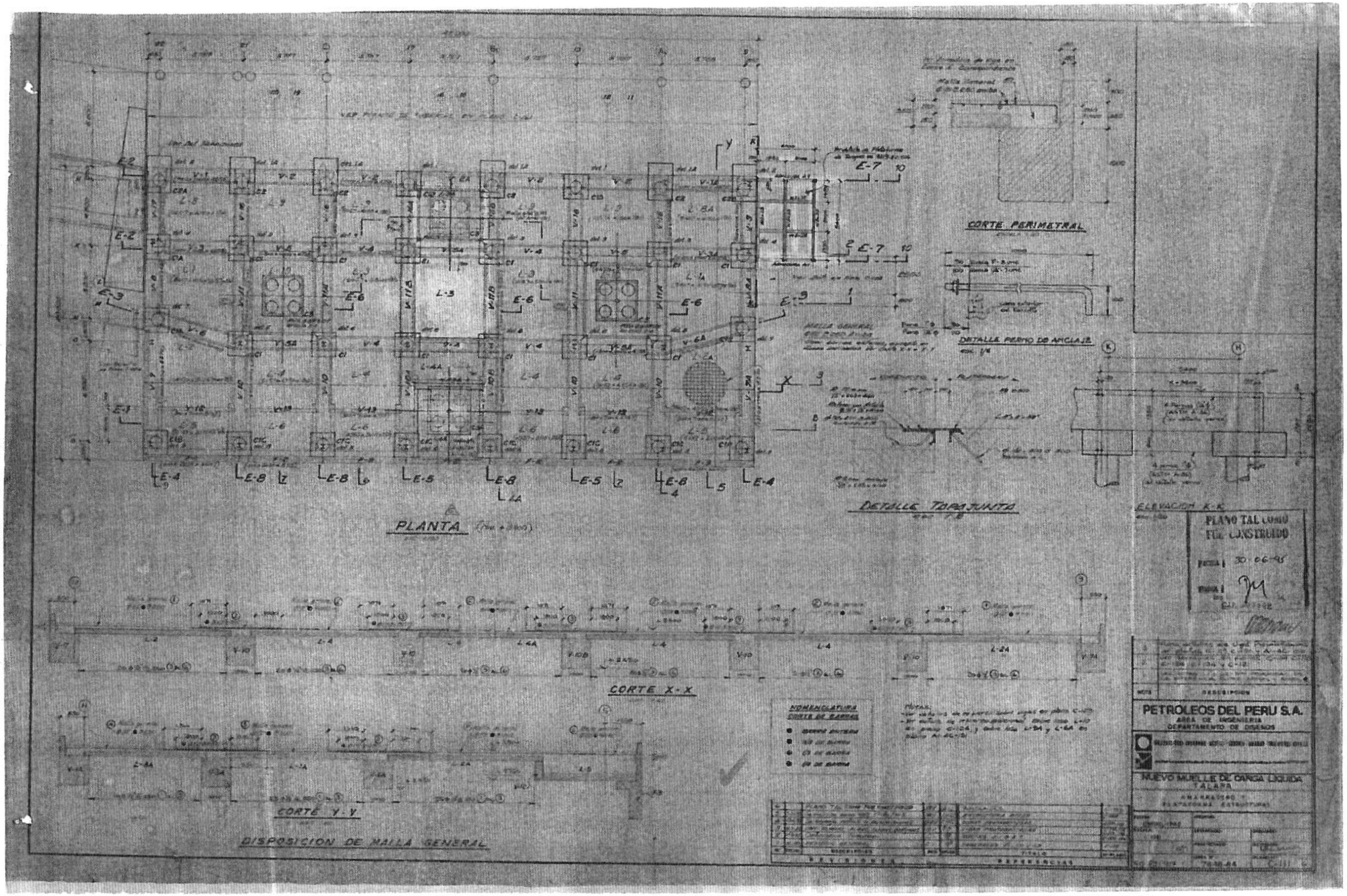
PISA PROYECTOS PARA LA INDUSTRIA S.A.

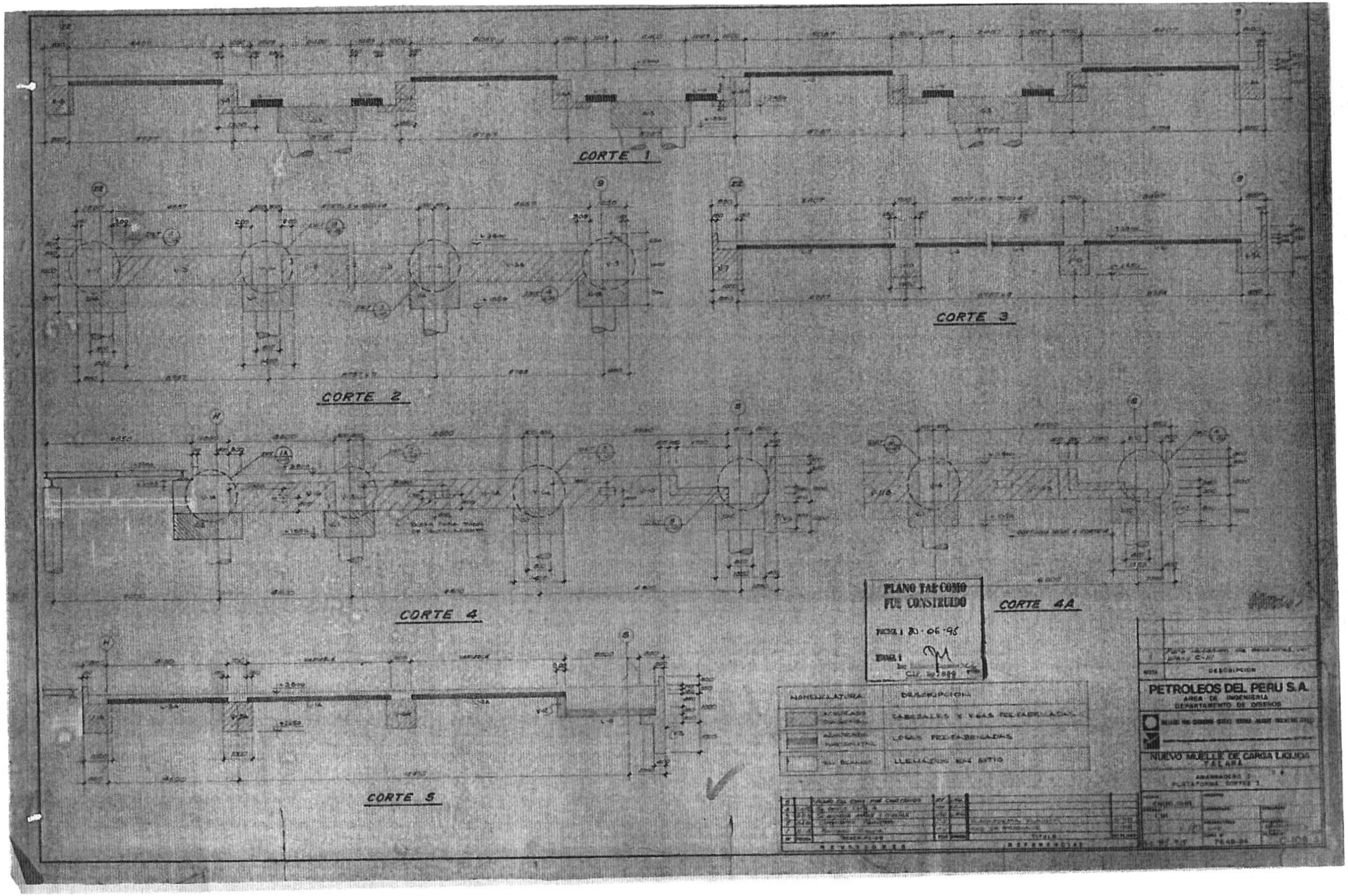
NUEVO MUELLE DE CARGA LIQUIDA TALARA

AMARRADERO 1
PLATAFORMA DE BOMBAS Y PUENTE DE TUBERIAS
CUADRO DE PILOTES

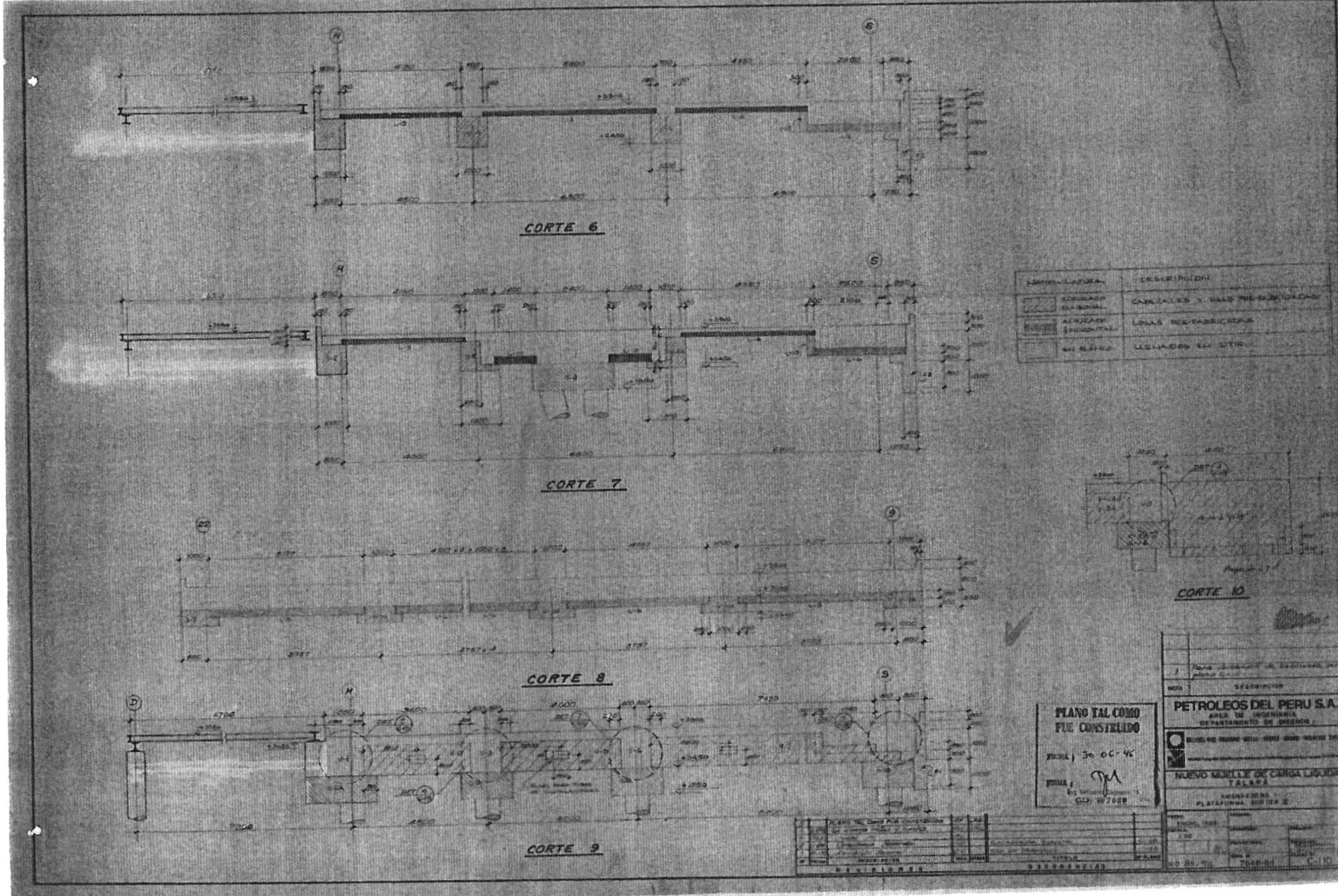
FECHA: MARZO-93	ARCHIVO: 86-08	
ESCALA: S/E	LEVANTADO:	DIBUJADO: BLG
	PROYECTADO:	REVISADO: JRA
NO.	OBRA Nº:	PLANO Nº: C-1201


PESO TOTAL
26 KG.
ITEM
DESCRIPCION
CANTIDAD: 2 u.
CANTIDAD: 2 u.
ANODOS DE ZINC
Perforacion 1/4" Ø
DETALLE DE SOPORTE
SECCION AMARRADERO 4
NOTA
DESCRIPCION
PETROLEOS DEL PERU S.A.
AREA DE INGENIERIA
DEPARTAMENTO DE DISEÑOS
NUEVO MUELLE DE CARGA LIQUIDA
TALARA
AMARRADERO 4
PROTECCION CATODICA DE PILOTES
FECHA
ESCALA
DIBUJADO
REVISADO
PLANO N°
REVISIONES
REFERENCIAS
TITULO
DESCRIPCION
0850
86-05

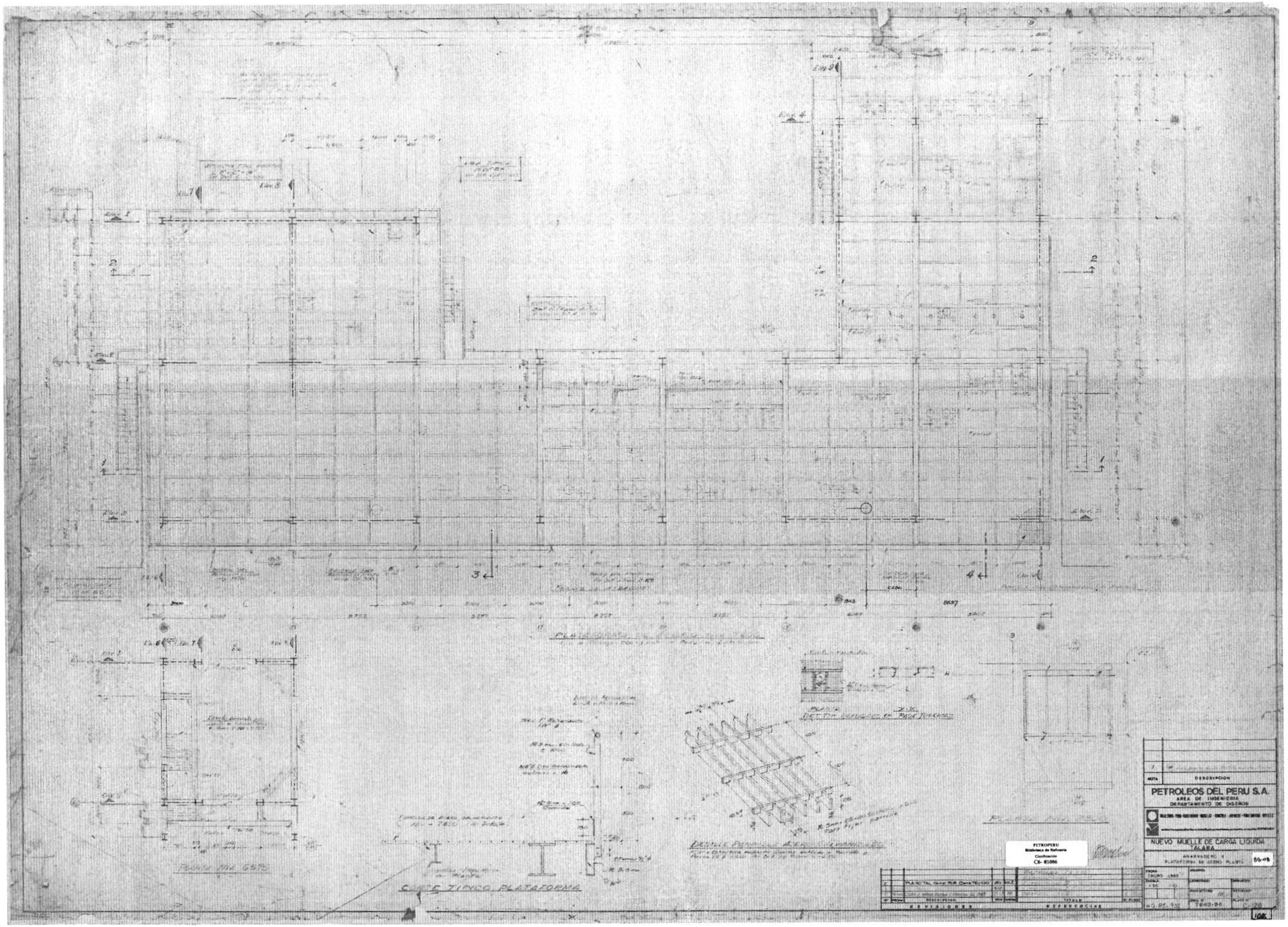

PLANTA
CORTE PERIMETRAL
DETALLE PERNO DE ANCLAJE
DETALLE TAPAJUNTA
ELEVACION K-K
CORTE X-X
CORTE Y-Y
DISPOSICION DE MALLA GENERAL
NOMENCLATURA CORTE DE BARRAS
PLANO TAL COMO FUE CONSTRUIDO
30-06-95
PETROLEOS DEL PERU S.A.
AREA DE INGENIERIA
DEPARTAMENTO DE DISEÑOS
NUEVO MUELLE DE CARGA LIQUIDA
TALARA



CORTE 1
CORTE 2
CORTE 3
CORTE 4
CORTE 4A
CORTE 5
PLANO TAL COMO
FUE CONSTRUIDO
FECHA: 30-06-95
NOMENCLATURA
DESCRIPCION
CABEZALES Y VIGAS PREFABRICADAS
LOSAS PREFABRICADAS
LLENADOS EN SITIO
DESCRIPCION
PETROLEOS DEL PERU S.A.
AREA DE INGENIERIA
DEPARTAMENTO DE DISEÑOS
NUEVO MUELLE DE CARGA LIQUIDA
TALARA
REVISIONES
REFERENCIAS



CORTE 6
CORTE 7
CORTE 8
CORTE 9
CORTE 10
PLANO TAL COMO
FUE CONSTRUIDO
FECHA: 30-06-95
PETROLEOS DEL PERU S.A.
NUEVO MUELLE DE CARGA LIQUIDA
TALARA
C-110



PETROLEOS DEL PERU S.A.
AREA DE INGENIERIA
DEPARTAMENTO DE DISEÑOS
NUEVO MUELLE DE CARGA LIQUIDA
TALARA
86-08
DESCRIPCION
NOTA
REFERENCIAS
REVISIONES
PETROPERU
Biblioteca de Refinería
Clasificación
C6- 01086
CORTE TIPICO PLATAFORMA
DETALLE PARRILLA ACERO GALVANIZADO
108