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TECHNICAL REPORT

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		Department 032	Project No. 322852

Title of Report

FRIGG FIELD FLARE PLATFORM
REVISED DESIGN,FABRICATION
AND INSTALLATION RESUMÉ

Approved by

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This report is a revision of the original design, fabrication and installation resymé of the Frigg Field Flare Platform. The new revision includes all changes, repairs and modifications compared with the original structural design.

CONTENTS

1. INTRODUCTION

1.1 General

This report is a revision of the original design, fabrication and installation resymé of the Frigg Field Flare Platform. The new revision includes all changes, repairs and modifications compared with the original structural design.

1.2 Background for the modification

In the middle of October 1979, increasing back pressure on the 24" line from TP1 to FP was observed. Increase in back pressure was approximately 0.25 bar per 48 hours.

Observations made during flushing of the line, indicated that seawater had entered into the 24" line. Investigations, surveys and pressure testing of the different parts revealed that the leak was localized to one of the circuits between 24" valve on seabotttom and flare tip. Damages were discovered in way of inlet/outlet torsion seals and this circuit was therefore fully isolated.

EAN decided to bring the flare structure ashore after reduction in BGC's gas demand in May 1980.

2. INVESTIGATIONS

2.1 Inspection of articulation

Inspection of the articulation was carried out on site and in dock. The intensive search for the leak and findings made, are summarized in EAN's report (1). In dock in Haugesund, the articulation was inspected by DnV, ref. reports (2) and (3).

The damages and other findings revealed during inspection, is summarized in the following paragraphs. For reference, gas circuit leading through torsion seal no. 1 and 2 is noted as circuit A, and the other circuit is noted as B, i.e. riser/leg MA and MC on revised drawings.

2.1.1 Inlet pipe circuit A

Findings:

- Crack in flange material of torsion seal support no. 1 from about 11 o'clock to 2 o'clock, see fig. 2.1.
- The ribs on torsion seal supports were not gradually rounded near the pipe/flange weld as indicated on drawings.
- The axial weld on pipe corresponded to the most stressed rib on the torsion seal support.

2.1.2 Outlet pipe circuit A

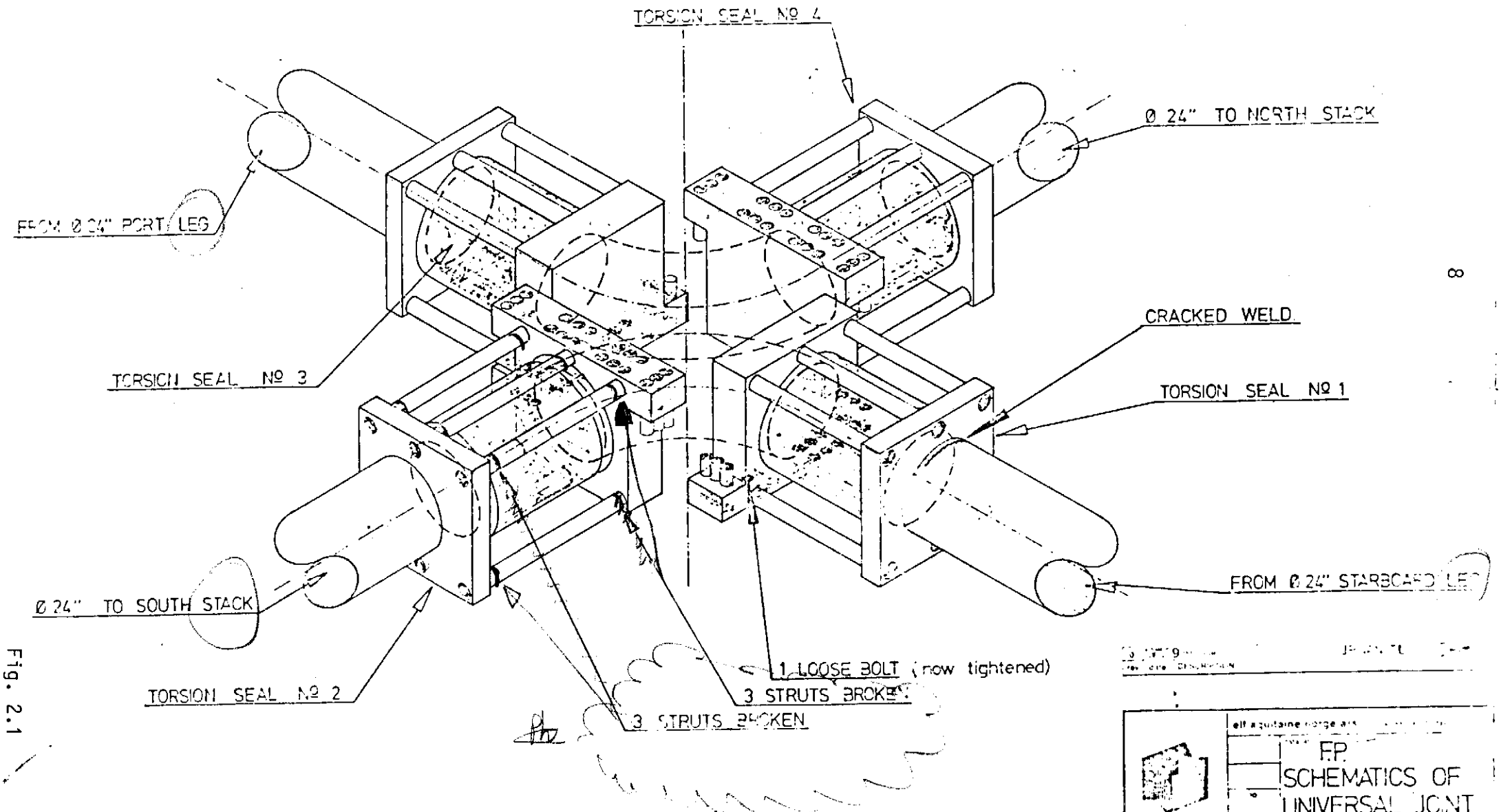
Findings:

- All 6 struts were broken. The upper 3 struts were broken at the bearing side and the lower 3 at the flange side, see fig. 2.1.
- The seal had been displaced in lateral and vertical direction.

2.1.3 Outlet pipe circuit B

Findings:

- For dismounting, the pipe had been cut and a horizontal displacement of 10-15 cm arised, see fig. 2.2. Thus indicating that the pipe may have been forced in place during mounting.
- The pipe was deformed at the weld between bend and horizontal pipe, see fig. 2.2.
- The pipe was resting against the yoke, see fig. 2.2.
- Some of the stiffening around the hole in the yoke was cut away to make the pipe fit in the hole.



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DAMAGE REPORT

Fig. 2.1

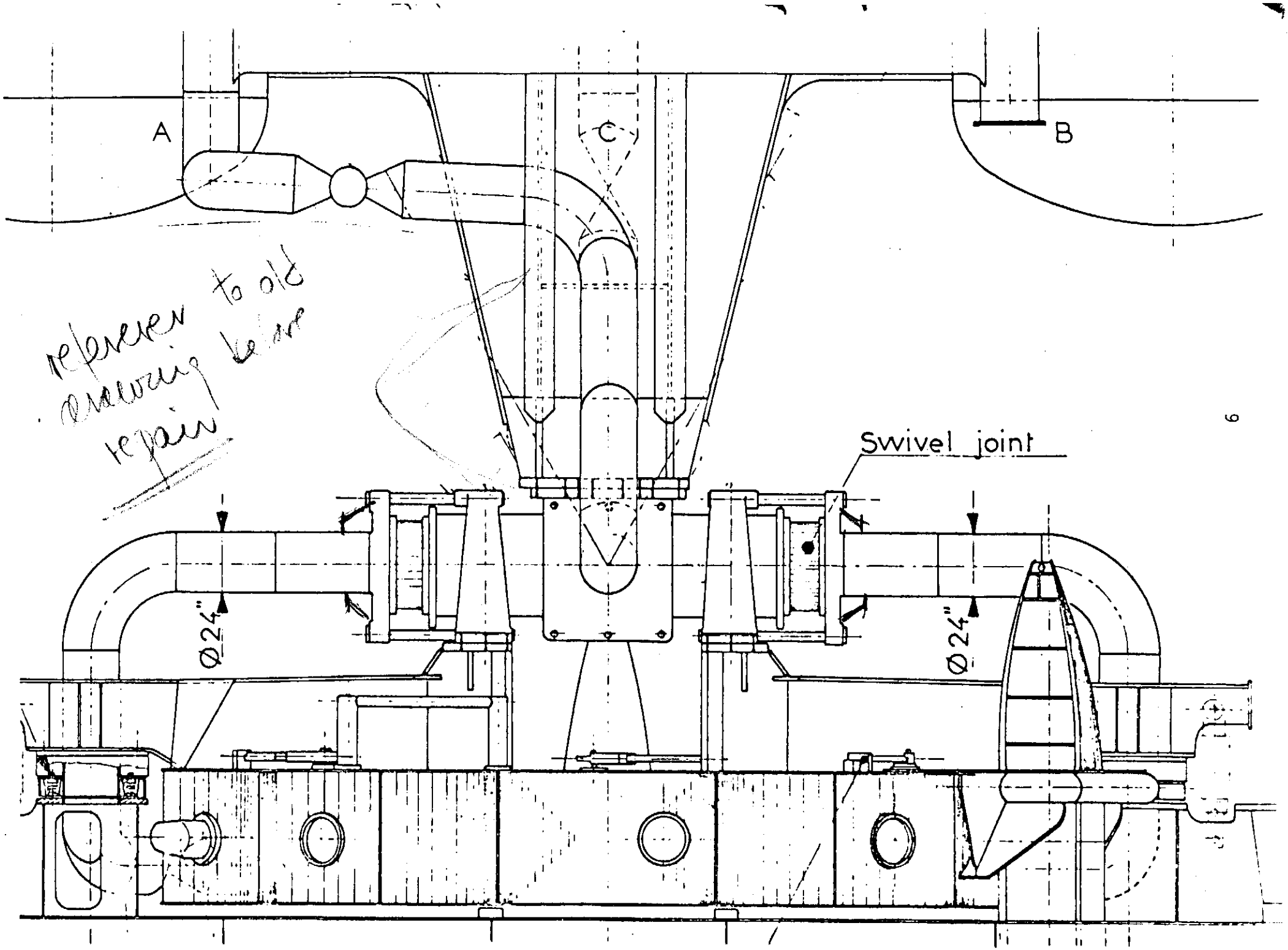


FIG. 2.2

2.2 Inspection of connection plate

The inspection of items on connection plate was performed in dry dock in Haugesund. The survey carried out in accordance with "Frigg Field In-Service Inspection System" did not reveal any serious damages, ref. reports (2), (3), and (5). The findings are summarized in the following paragraphs.

2.2.1 Locking system

Findings:

- All 3 locking bolts had 1 to 2 mm radial abration, most at the upper part but also underneath and on the sides.
- The cover for the outer seal was cracked on all 3 working jacks.

2.2.2 Connection joint

Findings:

- Some pieces had fallen off the rubber seal along the outer edge, ~~but the contact area seemed to be O.K.~~
- Some of the bolts connecting the inlet pipe to the connection plate was loose. These bolts do not have any operational function according to EMH.

2.3 Inspection of column

The inspection mainly followed the check list as outlined in Table 3 of Volume 8 of the "Frigg Field In-Service Inspection System". The surveys were carried out in dock in Haugesund, ref. reports (3), (4), (5) and (6). The major findings are summarized in the following paragraphs.

2.3.1 Triangular ballast

Findings:

- Ballast tanks had no internal coating or anodes, thus thick layers of corrosion products was found.
  Sacrifical anodes was recommended.

2.3.2 Lattice structure

Findings:

- On riser MC at elevation 8400mm, a wire had chafed off about half the wall thickness. This was buttered up and ground flush.

2.3.3 Main float

- Cracks were found where riser MA and MB (MC on revised drawings) are penetrating the main float bottom plate. All cracks were repaired.
- Crack in full penetration weld in tank IV was permanently repaired by welding and buttering to original shape and thickness. This crack, caused by a wire, was revealed in August 1978.
- Some general corrosion were found in tank I,II, IV, VI and centre tank.

2.3.4 Tidal tank ~ Ballast tank ?

Findings:

- Riser MC (MB on revised drawings) is not situated centrically in the bulkhead cutouts. It is nearly touching the bulkhead.
- Som general corrosion and pits found where primer was damaged or removed.

2.3.5 Flare stacks

Findings:

- Cracks were found in tubular joints, around the top of the stacks and around brackets. All cracks were repaired and accepted.

2.4 Inspection, investigation and repair of base

During inspection of base, som large cracks were revealed at 4 bollards welded to the base plate, see fig. 2.3. For details, ref.reports (7), (8). (9) and (10).

An investigation was done by EMH (19) to investigate the influence of the cracks and to define the necessity of repair. It was concluded that the

stress level in the affected plates was very low and that it was sufficient to remove the bollards and to stop the cracks.

The bollards were removed and stopper holes were drilled at the cracks. Underwater work was performed in accordance with the procedures (11) and (12). A part of the base plate at bollard 4 was cut out for examination, see paragraph 2.7.4.

2.5 Theoretical investigations of original design

In telex of 28th Novenber 1979, DnV was requested to investigate and report possible causes for the leak and propose modifications of the design.

The theoretical investigations resulted in 3 technical reports (13), (14) and (15) which are summarized in the following paragraphs.

2.5.1 Deformation of upper and lower bearing support

The operating condition gives resulting dynamic forces on the pivot of $\pm$ 63 t horizontal and $\pm$ 102t vertical. Applying these forces on the bearing, shear and bending deflection of the yoke and support frame and the resulting stresses in the bolts were calculated. The results for upper yoke are summarized in table 2.1.

Table 2.1

	Design load tonnes	Total shear deflection cm	Total bending deflection cm	Total deflection cm	Alternating nominal stress in bolt kp/cm^2
x-direction	± 63	0.21	0.082	0.296	143.
y-direction	± 63	0.075	0.068	0.143	605.
z-direction	± 102	-		0.02	222.

For reference, see fig. 2.4

The stress concentration factor is approximately 10.

Mechanical properties for the bolts are:

Ultimate strength: = 5360 N/cm^2
Minimum yield strength = 2800 N/cm^2

Thus, the nominal stress multiplied with the stress concentration factor is far beyond the minimum yield strength. Local yielding will take place during the initial load cycles, and a fatigue damage of the bolt is expected.

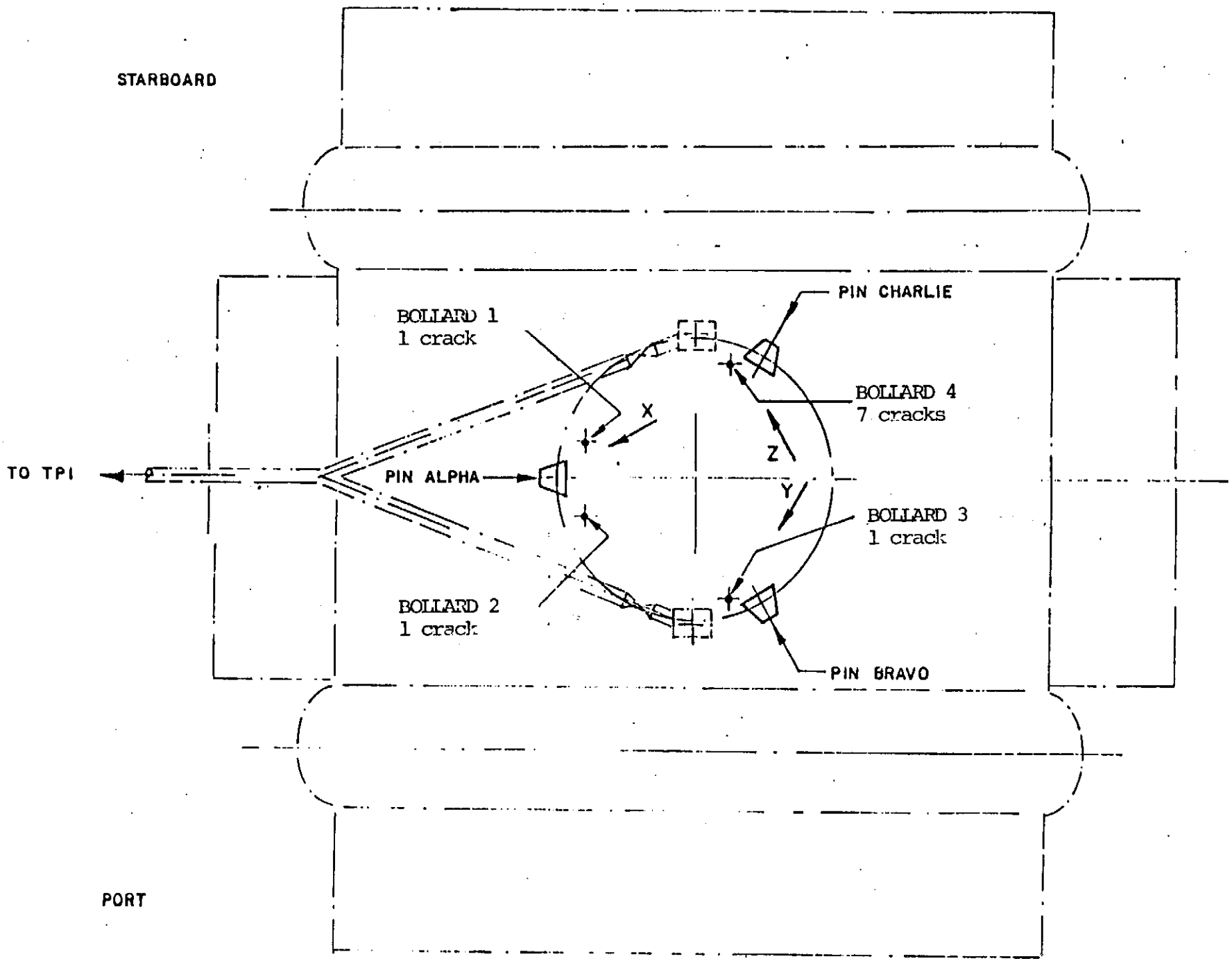


FIG. 2.3

PLAN VIEW OF BASE

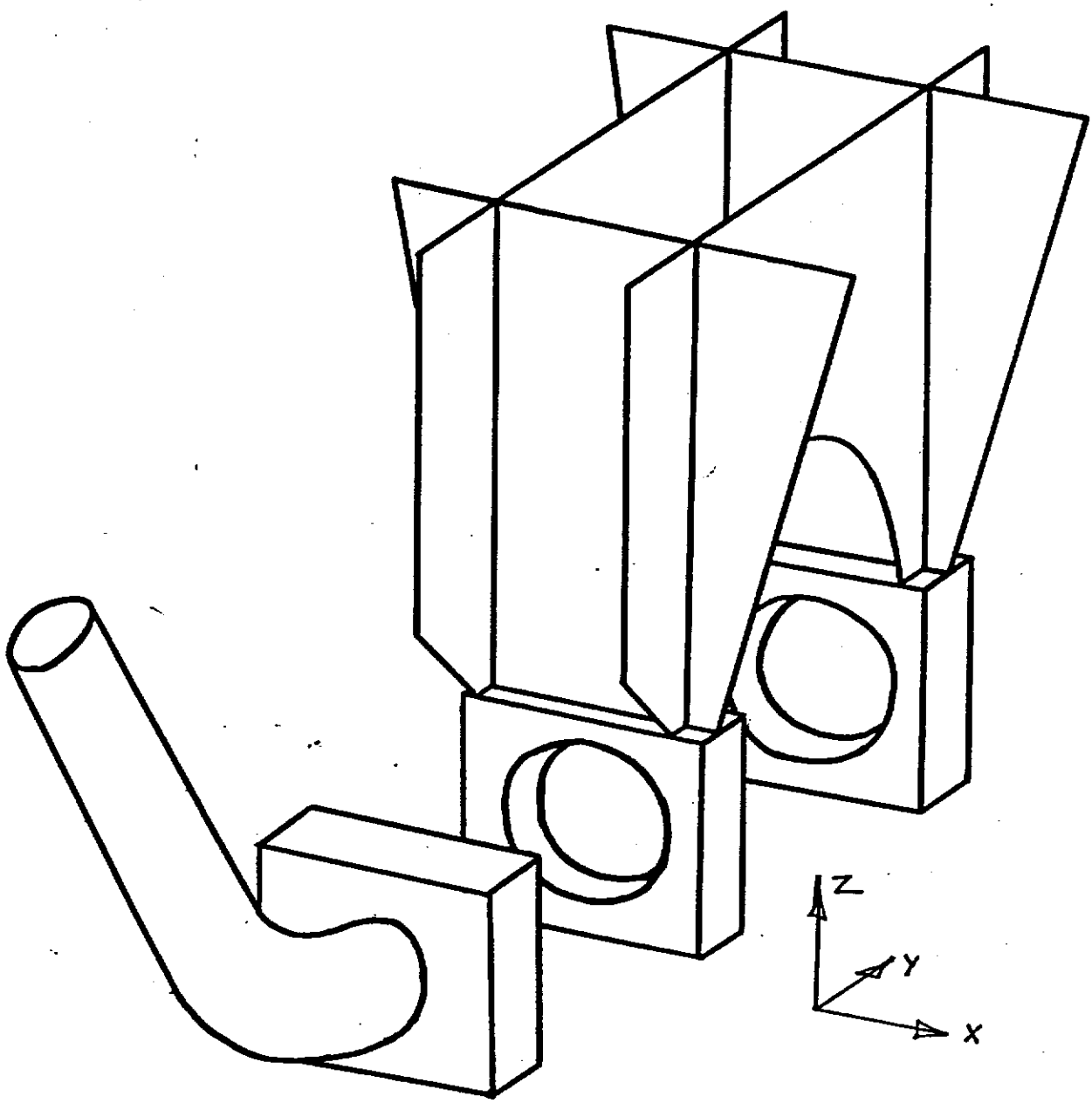


FIG. 2.4

The calculations of the lower yoke showed deformations less than those in upper yoke.

On the basis of the calculations, it was recommended to modify the design either by increasing the stiffness of structural parts or make the piping more flexible. In both cases, the struts should be made to withstand fatigue stresses.

2.5.2. Analysis of torsion seal supports

The results presented under paragraph 2.5.1. were not conclusive.

A calculation of the stresses in the inlet flange was made. The results showed that the nominal stress 57.6 N/mm^2 for 1 month wave multiplied with a stress concentration factor k=3.0, will result in a cumulative fatigue damage greater than 1.0 after 4 years of operation. This is in the range where a fatigue damage may be expected. The stress concentration factor for the pipe/flange connection is difficult to determine exactly and might be greater than 3.0.

A detailed finite element analysis of pipe/flange connection for inlet and outlet pipe was also performed. The results for the torsion seal support on the inlet side are summarized below:

- Maximal stresses range due to 1 month wave loads is approximately 190 N/mm^2.
- Maximal equivalent stress at storm condition is approximately 483 N/mm^2. Approximately 75% consists of local bending stresses and 25% consists of membrane stresses. Thus, only a part of the pipe wall thickness is beyond the yield point for the material.

- Fatigue analysis indicate that this is a critical connection. Expected fatigue life was found to be approximately 3 years.

The results for the torsion seal support on the outlet side are summarized below:

- Maximal stress range due to 1 month wave loads is approximately 10 N/mm^2.

- Maximal equivalent stress, storm condition, is approximately 335 N/mm^2 which is behond the yield point for the material:
  σ_F/γ_m = 360/1.15 = 313 N/mm^2.
  Approximately 70% of this equivalent stress consists of local bending stresses and 30% consists of membrane stresses. Therefore, only a small part of the pipe wall thickness is high stressed.

- No fatigue problem is expected for the pipe/flange connection.

2.5.3. Analysis of piping system

A computer analysis of the stiffness of the piping system gave the following results:

- The original inlet pipe will give relatively high horizontal forces along the pipe axis. This is causing high local bending stresses in the flange.

- The original outlet pipe will give relatively high vertical forces in the piping. This is a critical loading condition for the struts which in this case will be subjected to bending.

2.6. Theoretical investigation of modified design

For the final design, Elf selected a U-shaped outlet pipe with improved struts and flange. The inlet pipe design was selected with original pipe shape, but improved flanges, struts and pipe embedment.

2.6.1. Analysis of piping system

The computer analysis gave the following results for the final design:

- The inlet pipe will give relatively high horizontal forces along the pipe axis. This is causing high local bending stresses in the flange.

  The improved pipe embedment on the connection plate will reduce the loads on the pipe somewhat, but the main characteristics of the pipe will be the same.

- Outlet pipe with extra bends shows relatively low forces in the piping system. Different shapes of the bend does not seem to have much influence on the forces.

2.6.2. Analysis of torsion seal supports

The results of the calculations may be summarized as follows:

Torsion seal support with brackets and ringstiffener, inlet side:

- Maximal stress range due to 1 month wave loads is approcimately 54 N/mm^2.

- Maximal equivalent stress for full flaring condition is approximately 230 N/mm^2. Maximal equivalent stress at storm condition was found to be smaller.
- The fatigue analysis was found satsifactory for a life of 20 years.

Torsion seal support without ringstiffener, outlet side, ref. paragraph 2.5.2.

2.7. Investigation of broken parts

DnV was requested to perform damage investigation on 24 struts and 4 torsion seal supports in letter of 13.06.80.

The results of the investigation, ref. technical reports (16), (16.1), (17) and (18), are summarized in the following paragraphs.

2.7.1. Investigation of torsion seal supports

The suports were subjected to visual inspection, magnetic particle inspection, fracture surface examination and metallographic examination. Some of the findings are summarized below:

Visual inspection:

- Crack on torsion seal support No. 1 showed one side bending fatigue fracture, initiated in the heat affected zone just above the cast steel ribs.
- The crack had propagated in the cast steel only.
- No pre-existing defects which could have contributed to the crack indication were revealed.
- On support No. 2 and on pipe, damages caused by a steel rope were observed.
- Support Nos. 1, 3 and 4 showed no significant surface defects.

Metallographic examination:

- The examination showed that the fracture had been initiated in the heat affected zone at the weld/cast steel.

- The transition weld/cast steel seemed to be rather sharp, which gives a notch effect and locally increases the stress level.

- The heat affected zone of the weld/pipe had indications of a certain amount of martensite. The HAZ-hardness using Vickers apparatus with 5 kp gave results in the range 183-401.

- The damage on the support caused by a wire, showed a severe heat affection probably due to friction. A hardness test showed hardness values in the range of 426-660HV_1.

Ref. fig. 2.1

2.7.2 Investigation of struts

The major findings from the investigation are summarized below.

Visual inspection:

- 6 struts from torsion seal support No.2 had fatigue fractures, caused by one-side bending.

- Fractures initiated in sharp fillet. However, the fillet radius was in accordance with drawings, specifying R≤0,5.

Magnetic particle inspection:

- Cracks were found in all the struts, in one of or both the sharp fillets.

Metallographic examination:

- The struts showed typical sign of a beginning fatigue crack starting in the fillet.

2.7.3 Internal corrosion of 24" lines.

Four 24" riser/pipe ends attached to square flanges (torsion seal supports) were received for examination. A part of the riser bend was also included on the pipe ends attached to square flange no 2 and no. 1 according to the Fig. 2.1 originating from E.A.N.

Indications of internal corrosion were founded by visual inspection on the locations marked 1),2) and 3) .

1) Indications of corrosion/erosion in the bend outer wall
2) Corrosion in the form of pits along the circumferential weld of maximum depth about 2,5 mm.
3) Localized corrosion along about 1/4 of the pipeline circumference at the pipe bottom, mainly was found in the ring weld.

General corrosion in a bend was measured to 0.4 - 0.6 mm, maximum localized corrosion depth in a weld was measured to 2.5 mm.

2.7.4. Cracks in base plate

A part of the oblong plate containing cracks, from base plate at pin C bollard 4, together with 4 bollards were examined. The major findings are summarized below:

Visual inspection:

- The plate contained cracks in circumferential and radial direction.
- The crack surfaces indicated fatigue with more or less typical pattern, starting from the toe of the weld.
- The radial cracks showed fatigue pattern. The circumferential crack is partly fatigue, partly overload fracture.

- All 4 bollards gave the impression of being deformed at the opposite end of the weld. Thus, it was assumed that they had been subjected to bending from several directions.

Metallographic examination:

- Based upon macroanalysis, the crack had started at the weld toe and propagated as fatigue approximately 1/3 of the plate thickness and then continued as a ductile overload fracture.

- A crack starting in the gap and propagating into the fillet weld metal was observed.

2.8. Disconnection, towing and docking

DnV involvement as a certifying authority was explained in telex No. 51852 of 23.05.80. It was stated that the towage and docking phases were outside DnV's scope as a certifying authority. Due to the fact that the platform would revert to its designated location, DnV as a certifying authority would follow the operations to ensure that the platform was not exposed to loads beyond design limits.

In connection with the intended towing, DnV contacted Elf in January 1980 and offered to perform a complete review of the relevant safety aspects including a complete marine survey. No contract was awarded. However, 22.05.80 DnV was approached by Elf with a request for review of structural strength, watertight closing and hydrostatic stability to obtain towing permission in Norwegian waters.

The review was based on general knowledge accumulated as certifying authority for the structure and experience from the original towout.

2.8.1 Structural strength

The evaluations made by DnV were based on verbal information by EMH because the different loading conditions were not documented with calculations of loads and stresses.

The towing was carried out in vertical position with draught 95-100 m. Thus, the loads on the column are similar to operating state and for the limited seastate during towing, max. wave height 5 m, the loads are expected lower than design storm condition. Ballasting and deconnection were considered less severe than design loads on the structure in service. Tilting of column, handling and towing in horizontal position were not expected to give higher loads than the same operations in 1975.

A summary of calculations made in 1975 (20) and a calculation of the behaviour of the disconnected column (21) were prepared by EMH.

The towing brackets were originally designed with adequate strength for the intended ballast pull of 30 tons.

2.8.2 Watertight closing

The watertight closing of the structure was considered adequate provided it was accepted by the DnV surveyor attending the towing.

2.8.3. Hydrostatic stability

For normal towing draught, the hydrostatic stability was found adequate provided no ballast was removed from the lower part of the towed object. Consequenses of leakage/damages were not considered prior to inspection.

2.8.4. Inspection

For details, see survey reports (22) and (23)

The disconnection was successful and did not cause any mechanical damage to the structure or baseplate. However, it should be noted that emergency jacks had to be activated in order to remove locking bolts from guide pins.

To obtain towing permission in Norwegian waters, DnV approval was needed on some items. Towing lugs were found acceptable based on divers' report. Stability were found adequate based on presented "stability booklet". To meet the damaged stability requirement, it was concluded that hatch on roof top needed to be closed. Navigation lights, tidal tank water level, hull penetrations, valves and all towing gear were inspected and accepted.

The tow started on 26th May and was completed on 29th May. The waves were in the range 1.2-4.6 m and wind 10-30 knots. The operation was completed without exposing the flare to any extreme loads that could have influence on the integrity of the structure or its equipment, as far as observed by the surveyor.

The flare was installed in dock 12th June.

3. MODIFICATIONS

In the following paragraphs all modifications of the complete structure will be described. Most of the modifications are mentioned in survey report (26).

3.1. Base structure

The modification on base was done after the reconnection. Ref. survey reports (24) and (25).

3.1.1. Sealing of the pins

Oil seals were installed on pin A, B and C to make them oil-tight. When oil was injected in the pins some leakage occured. This was preliminarily repaired, and will be permanently repaired during the summer 1981. The sealing has not been evaluated by DnV because no drawings or specifications have been submitted.

3.2. Connection plate

The major modifications on connection plate were done in yard. Only minor modifications were done after recommention. Ref. survey reports (24), (25), (26) and (27).

recommentation ?
reconnection ?

3.2.1. Locking system

A completely new locking system has been designed and manufactured. Ref. fig. 3.1. It consists of the following main parts:

- Guide bolts (3 off)
- Locking bolts (3 off)
- Hydraulic cylinders (3 off)
- Hydralic pipes for maneuvering the bolts and lubrication pipes.

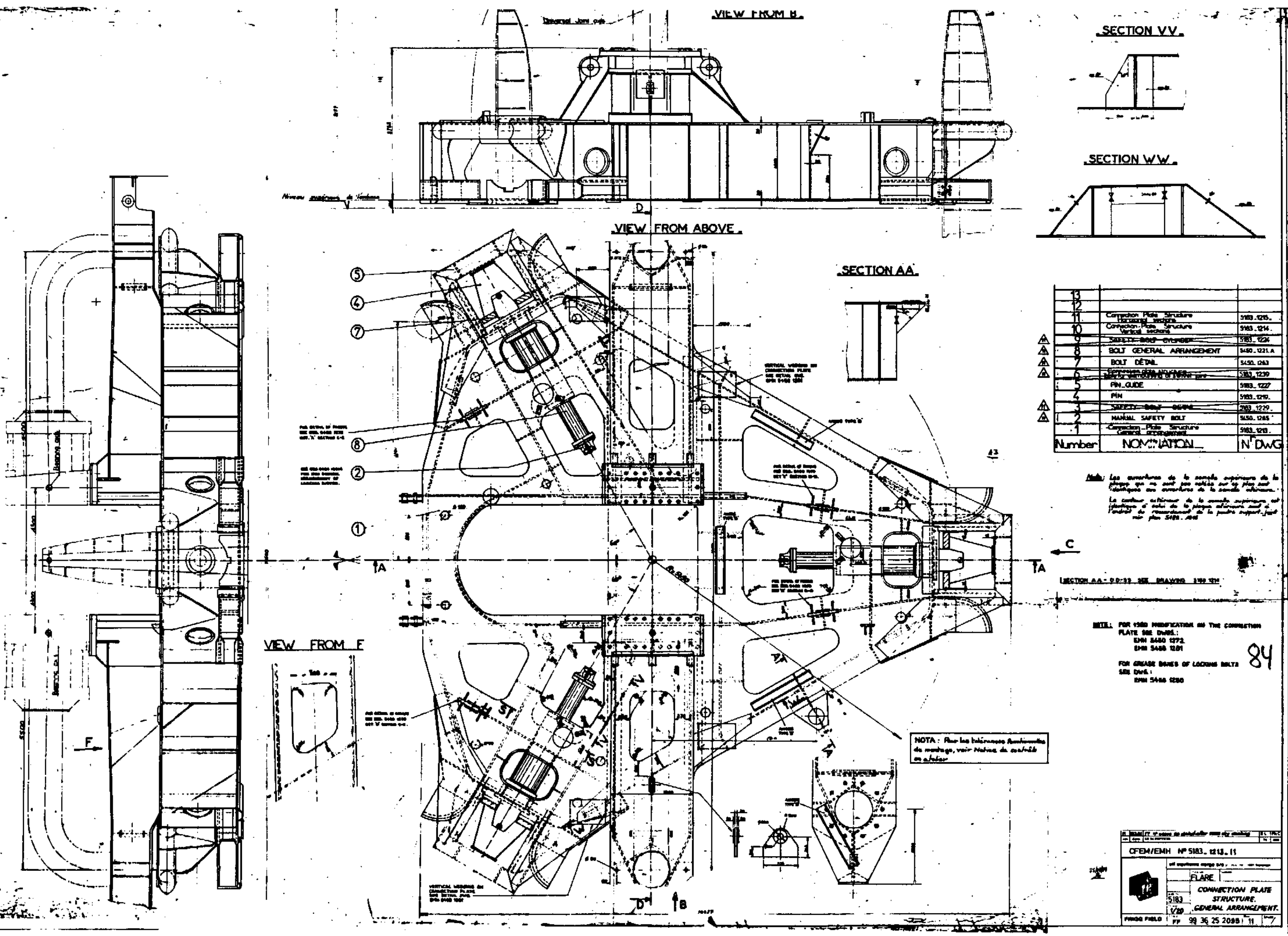

VIEW FROM B.
SECTION VV.
SECTION WW.
VIEW FROM ABOVE.
SECTION AA.
VIEW FROM C
VIEW FROM F
C
F
D
A
B
1
2
4
5
7
8
13
12
11 Connection Plate Structure Horizontal sections 5183.1215.
10 Connection Plate Structure Vertical sections 5183.1214.
9 SAFETY BOLT CYLINDER 5183.1226
8 BOLT GENERAL ARRANGEMENT 5450.1221.A
7 BOLT DÉTAIL 5450.1263
6 5183.1239
5 PIN_GUIDE 5183.1227
4 PIN 5183.1219.
3 SAFETY BOLT 2183.1229.
2 MANUAL SAFETY BOLT 5450.1265
1 Connection Plate Structure General arrangement 5183.1213.
Number NOMINATION N° DWG
PLATE SEE DWGS.:
FOR GREASE BOXES OF LOCKING BOLTS
NOTA : Pour les tolérances fonctionnelles de montage, voir Notice de contrôle en atelier
CFEM/EMH N° 5183.1213.11
FLARE
5183
1/20
CONNECTION PLATE STRUCTURE. GENERAL ARRANGEMENT.
FRIGG FIELD
FF 99 36 25 2098 11

FIG. 3.1

DnV did review drawings of locking bolt system and had no comments to the principal solution. No documentation of loads or calculation of critital parts were submitted, and DnV was not able to perform an evaluation of the strength of the design.

A stress check of the plate supporting the hydraulic jacks was suggested. The ribs supporting this plate were suggested to be made more gradual at the free corner.

Material in all casted parts in locking system, except guide bolts, is S1299. Material in guide bolts is SE2M. Both material types have specified minimum yield point 300N/mm^2 and minimum tensile strength 500 N/mm^2.

3.2.2 Sealing between connection plate and base

A completely new connection joint has been designed. The modifications were done to improve the pipe embedment in the connection plate, see fig. 3.2. The new flange is not fastened to the connection plate except for two bolts in way of the axes.

Calculations were performed to evaluate the effect of the new design. It was concluded that the improved pipe embedment will reduce the loads on the pipe somewhat, but the main characteristics of the pipe will be the same.

Material in welding-neck flanges is A 350 LF2 with yield point 336 N/mm^2 and tensile strength 504 N/mm^2.

Material in pipe welded to the underside of flange is TT St. E 36 with yield point 355 - 512 N/mm^2 and tensile strength 535 - 602 N/mm^2.

All other parts also have certified materials.

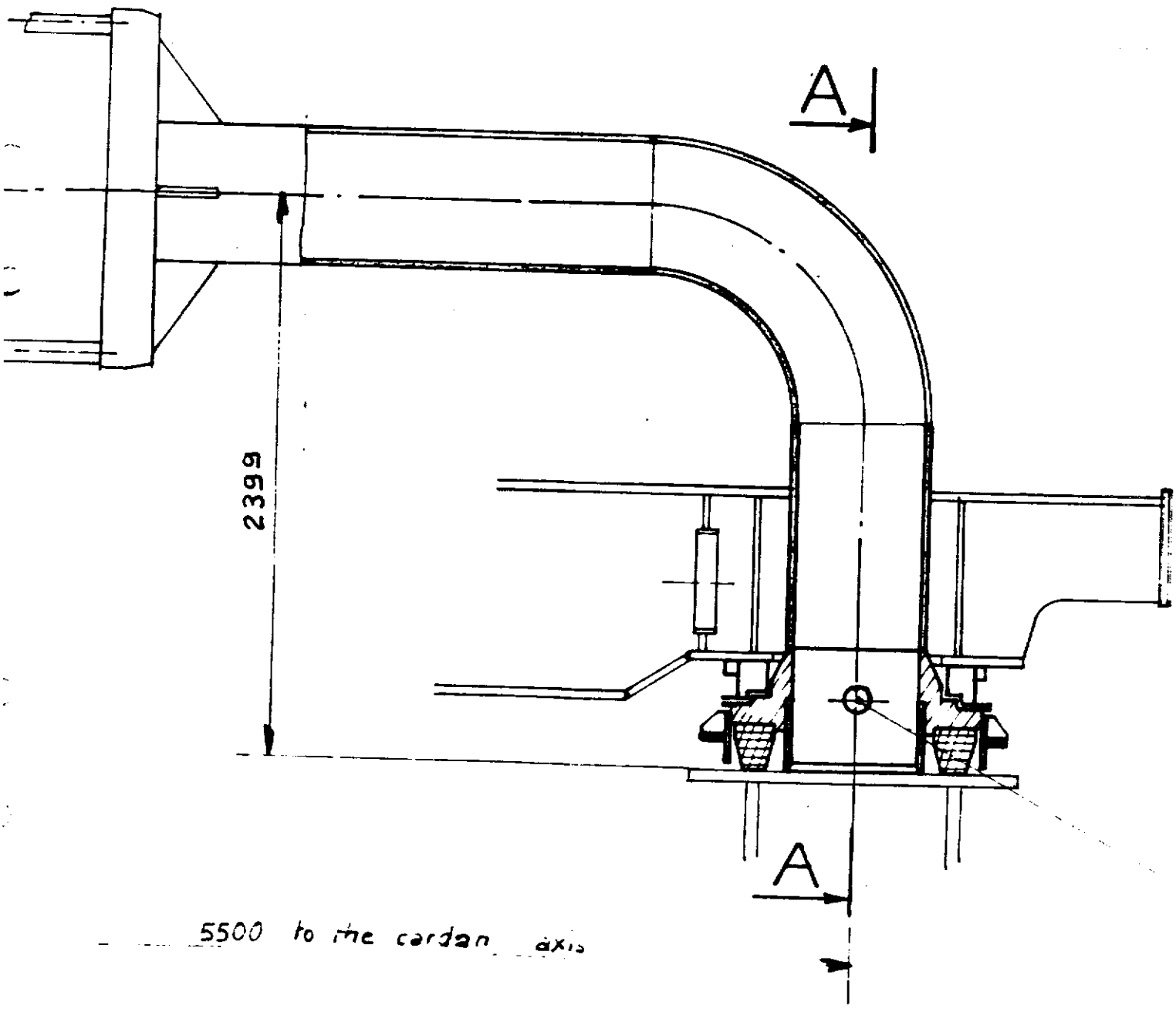


Fig. 3.2

3.2.3 Wedging of connection plate

The 3 pin guides on connection plate were modified to minimize horizontal and vertical movement of connection plate. Excessive movement may be caused by locking bolt failure or corrosion of the bolts.

Drawing and EMH-calculations were accepted by DnV. Horizontal and vertical movements of connection plate are minimized by wedges.

Material used is St. 52.3 in 16 mm pl., NVE - 36 in 30 mm pl., OX 522 D in 40 mm pl., St. 52 - 3/XX in 50 mm pl. and St. 52 - 3 in 160 mm pl.
Wedge material 37 mm 2N

3.2.4 Padeyes and damping devices

4 padeyes were fabricated and welded to the connection plate. The padeyes were used for fastening of the plate in an upright position during towing and tilting.
Padeyes were made of certified material.

Damping devices were bolted to each end of connection plate arm. These were used during reconnection.

3.3 Articulation

A complete universal joint was manufactured. Only few modifications were made compared with the original design. However, there were some discussion regarding the minimum gas temerature occuring in the system. DnV did state that a calculation of the temperature at the universal joint, corresponding to a pressure of 150 atm and a temperature of + 35° C in the gas on TP 1, should be carried out and submitted for approval. A study performed by Technip indicated the lowest temperature to be - 18.6°C. This study were not based on the proposed values, thus DnV performed a rough analysis of the temperature of the universal joint during flaring based on:

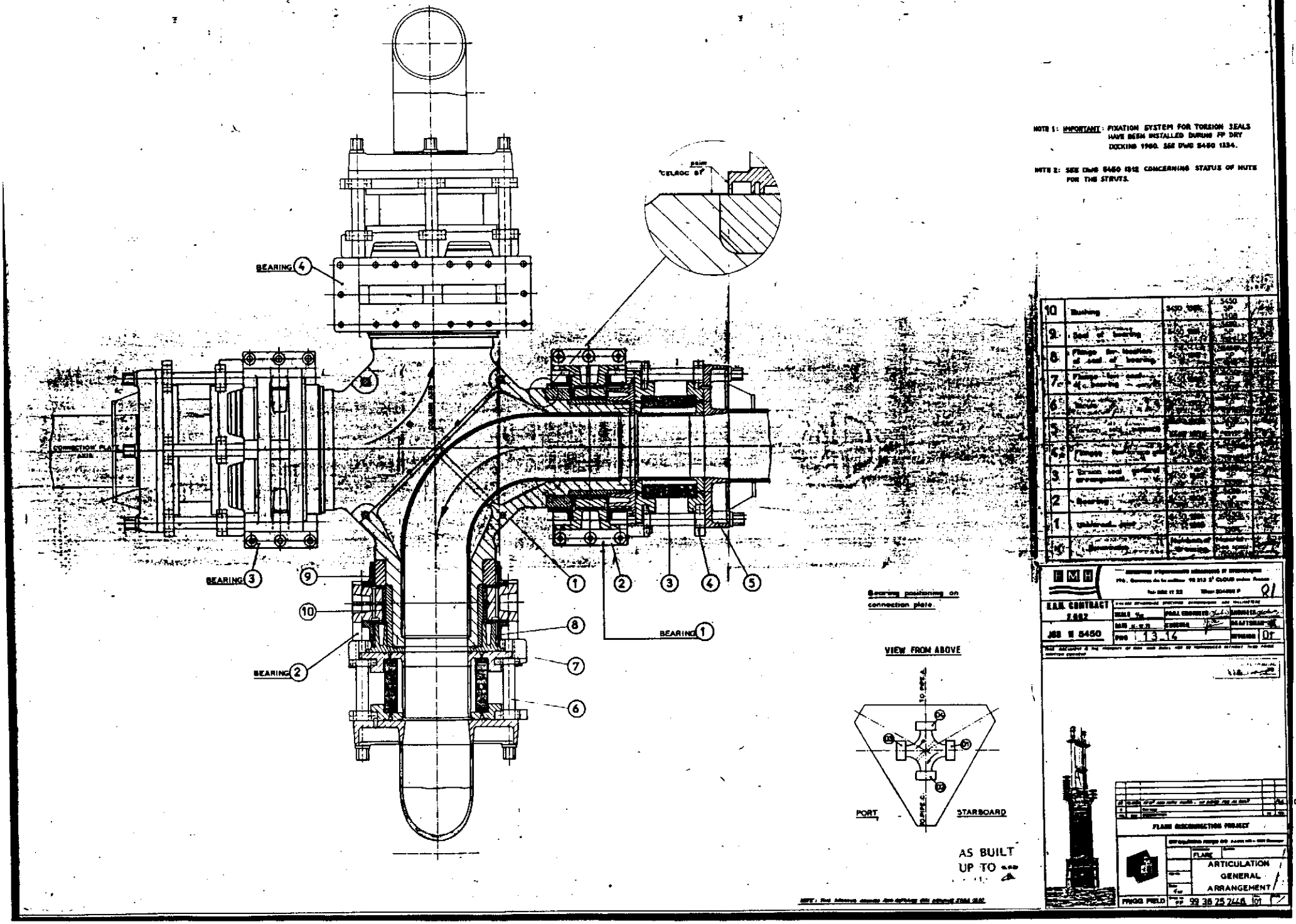

NOTE 1: IMPORTANT : FIXATION SYSTEM FOR TORSION SEALS HAVE BEEN INSTALLED DURING FP DRY DOCKING 1980. SEE DWG 5450 1334.
NOTE 2: SEE DWG 5450 1312 CONCERNING STATUS OF NUTS FOR THE STRUTS.
BEARING 4
BEARING 3
BEARING 2
BEARING 1
CONNECTION PLATE
Bearing positioning on connection plate.
VIEW FROM ABOVE
PORT
STARBOARD
AS BUILT UP TO
FLARE DISCONNECTION PROJECT
FLARE
ARTICULATION GENERAL ARRANGEMENT
PROG FIELD
99 38 25 2446 101

FIG. 3.3

gas flowrate:	37 MM SCMD
pressure, TP 1:	150 barg
temperature, TP 1:	35^{O} C
pressure, universal joint	10 barg
gas speed, universal joint	0.2 mach

The calculations indicated a minimum gas temperature of -24.5^{O} C thus the minimum $T_D = -24.5^{O}$ C for components in direct contact with the cold gas. Components not in direct contact with the gas should have a design temperature of approximately -5^{O} C. This indicated that additional Charpy V tests had to be broken. Additional tests at -50^{O} C and -60^{O} C were broken for some of the parts with acceptable results.

3.3.1 Bearings

Only minor modifications in the bore for the struts were made to make the struts better with respect to fatigue.

DnV did review the design and had no other comments than the above mentioned.

The bearings were made of cast steel with good welding characteristics and specified minimum yield point 300 N/mm^2.

The set screws of bearings are high strength bolts and may be susceptible to stress corrosion cracking. To avoid this, they have been corrosion protected by sheradizing, polyurethare paint and complete encapsulation by Sikaflex Special KW2.

3.3.2 Struts

The struts were modified to make them better with respect to fatigue. The wave induced stresses calculated for both inlet and outlet side did not indicate danger for fatigue damage.

Material in struts is CREUSELSO 38 or DIN ST E 43 and in nuts AFNOR XC 38 or DIN CK 35.

3.3.3 Torsion seal supports

The torsion seal supports were modified to make the transition at the ribs more graduate. After casting, the supports on the inlet side were modified by welding brackets to the eight ribs supported with a ringstiffener welded to the pipe. This was required to improve fatigue life, ref. paragraph 2.6.2.

DnV did also state that special attention should be taken when welding the supports to the pipe because of low quality of pipe material. Further, it was suggested that the welds were made with full penetration and ground smooth.

3.3.4 Additional modifications

In addition to the modifications already mentioned, some modifications were made to simplify a change of the torsion seal on site.

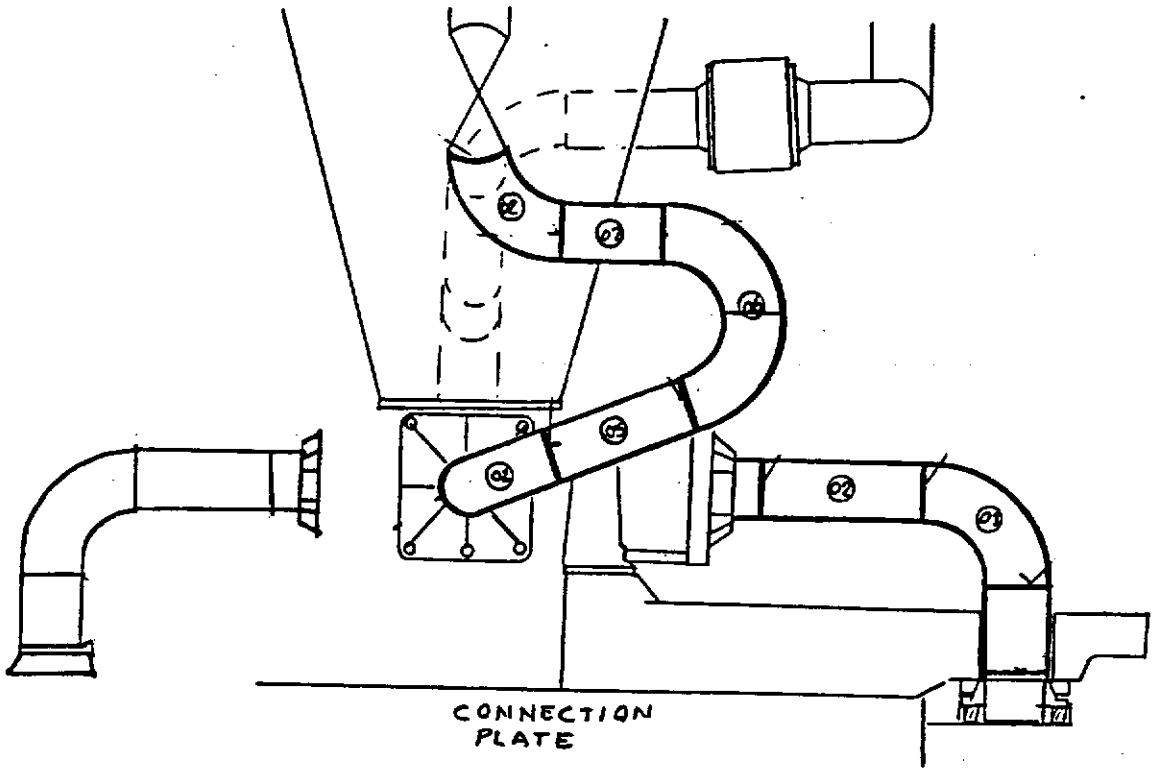
3.3.5 Gas piping

The piping was modified to reduce the loads on the pipe, thus reducing stresses in struts, bearings and supports. The inlet pipe has the same shape as the original. It is not embedded in connection plate arm to be free to slip under temperature shrinkage of the pipe. However, there is little clearance between pipe and hole in connection plate to avoid too much deflection in case of horizontal movements of the connection plate. The improved embedment will reduce the loads somewhat, but the main characteristics of the pipe will be the same. See fig. 3.4.

The improved shape of the outlet pipe gives the pipe better flexibility. Based on the calculations made, the experienced problem with broken struts and leaks was expected to be eliminated.

Material in elbows and tubes is TT st E 36 with yield point 355-512 N/mm^2 and tensile strength 535-706 N/mm^2. This material is equivalent to the specified St.52-3N.

Thickness in tubes is 20 mm and 17.5 mm in elbows.



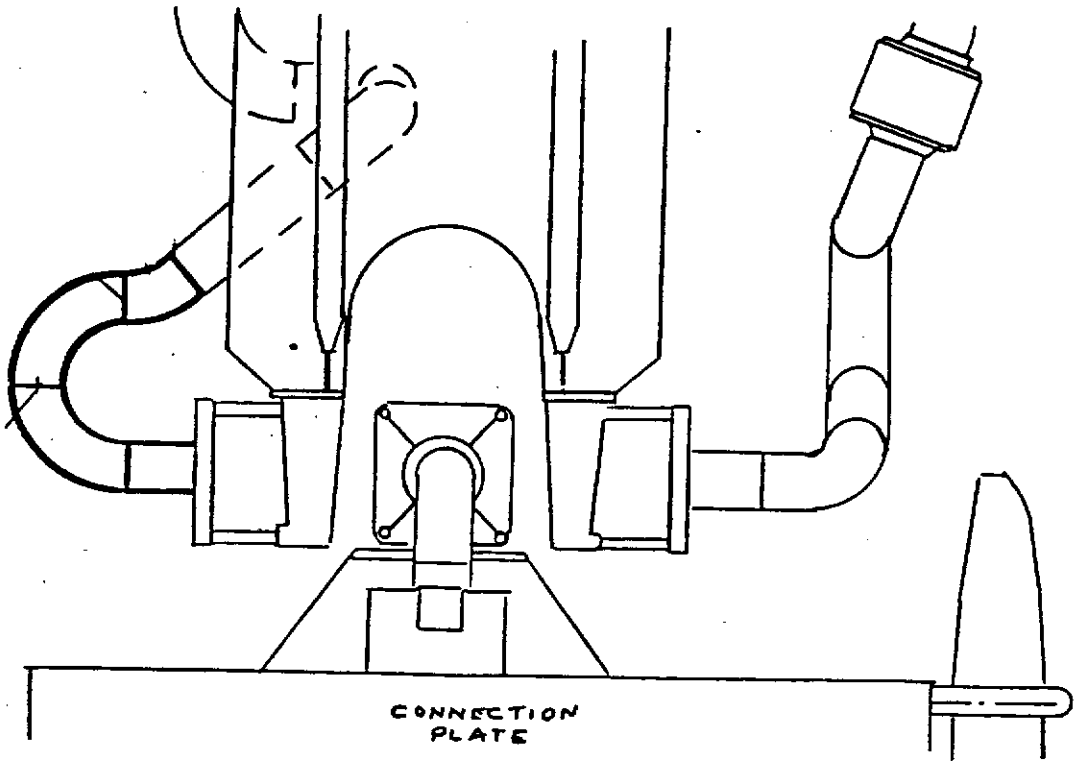


Fig. 3.4

3.4 Concrete and water ballast

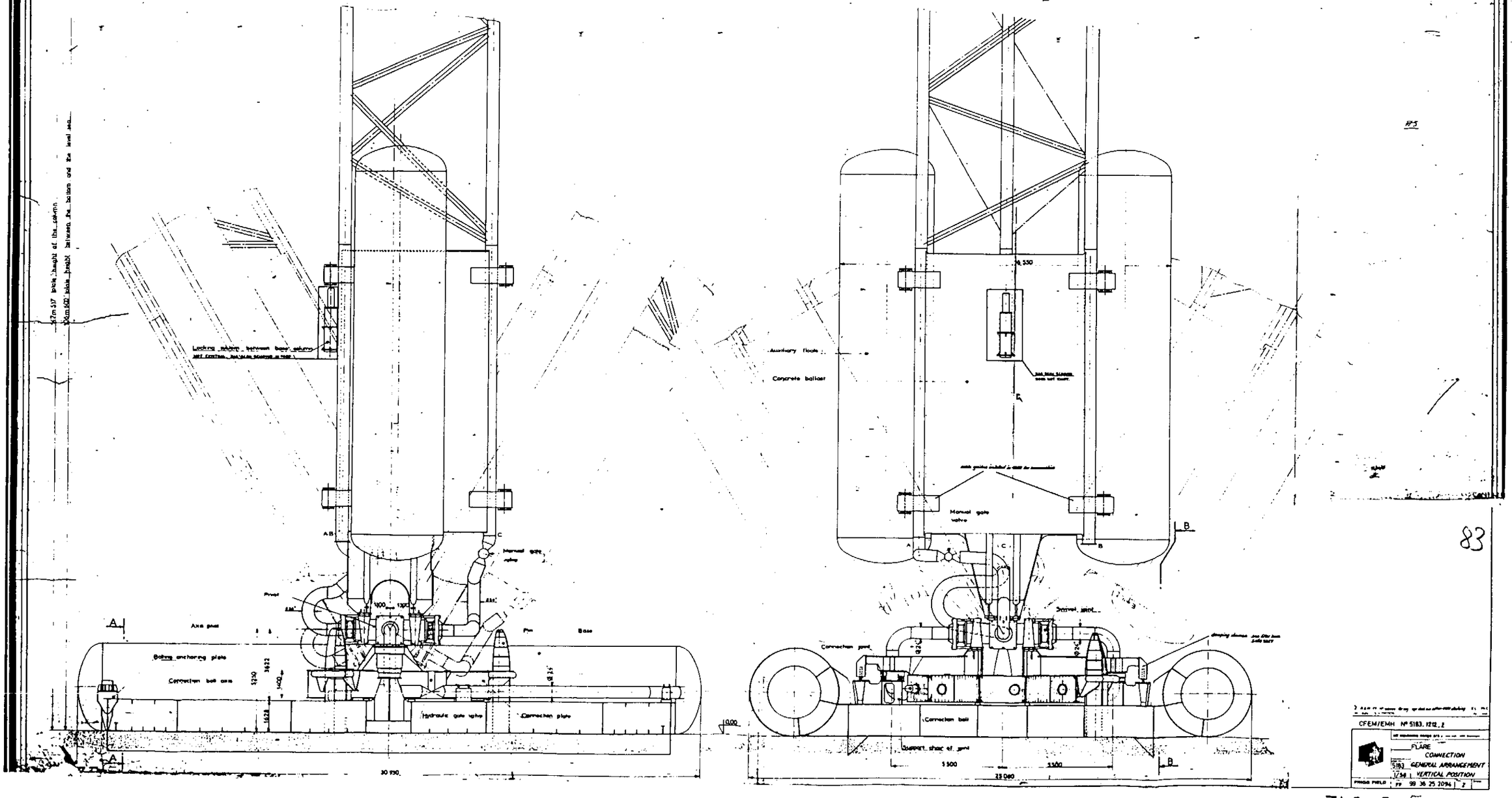
6 cable guides were made and welded to the triangular ballast tank. Two off around each of the members MA,MB and MC. These cable guides were only to be used during reconnection. Material in cable guides is st 52 - 3 N.

2 padeyes were welded to bottom of concrete ballast. These were used for clamping of connection plate to maintain it in perpendicular position with the flare axis during horizonatal towing, tilting and vertical towing.
Material used in padeyes is st 52 - 3N.

Floor plates around cable guides on MC were modified.

SECTION B-B

SECTION A-A



83

FIG. 3.5

3.5. Lattice structure

Handrail on MC was suppressed and additional anodes were fitted, see paragraph 3.10. Codification of all nodes were performed.

During inspection it was observed that the original lay-out was not in accordance with the actual structure. Updated drawing is shown in fig.3.6.

3.6. Main float

6 cable guides were made and welded to the main float. These were used for the reconnection operation. Material used in cable guides is St 52-3N.

Only two tanks, No. 1 and 2, were coated due to lack of time.

3.7. Tidal tank

Boat landing was extended downwards with two more rings and wooden rail. Ladders on funnel and ladders for access to anchor brackets were extended.

3 anchor brackets for towing and reconnection operations were made and welded to the tidal tank just above the boat landing.

3.8. Roof

A winch and A-frame for pulling of electrical cables was installed.

3.9. Flare stacks

The following modifications of the flare stacks were done at H.M.V. during docking phase.

- Flare stacks from el. 131.29 m to 147.17 m were replaced with two new ones.

- Earlier ladders and walkways between the flare stacks (see fig. 3.7) are now removed and new ones are installed on flare stack C (fig. 3.8).

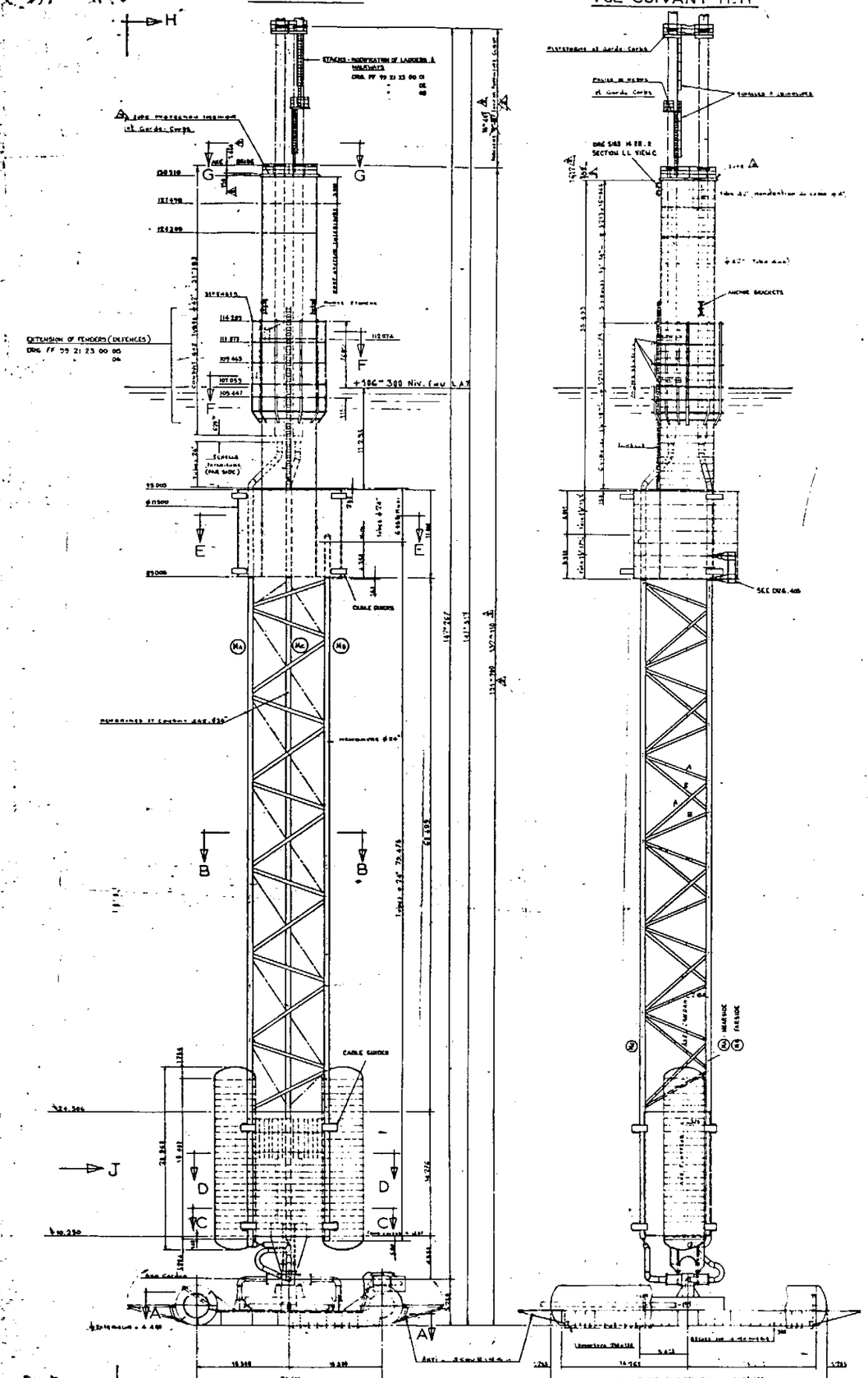
- The 10 inch connection pipe between the flare stacks are removed. See fig. 3.7 and 3.8.

No drawings showing the modified stacks have been submitted to DnV for review.

Do you have updated construction drawings?
Not as built!

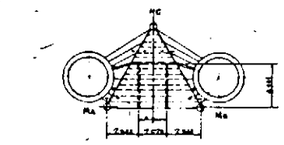
LA

ELEVATION

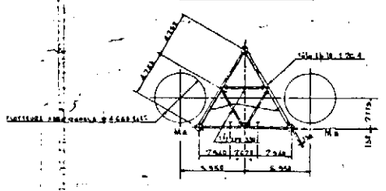


VUE SUIVANT H.H

COUPE D.D

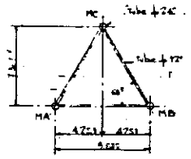


COUPE C.C



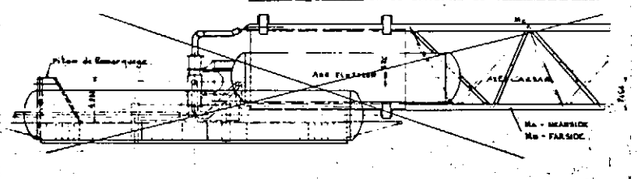
COUPE B.B

ESSATURE TREILLIS



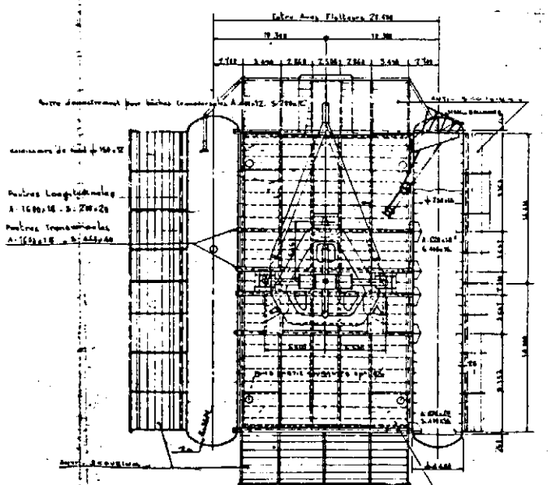
VUE S^T J

COLONNE 5^H POSITION DE REMORQUAGE (INSTALLATION DE LA BRACE)



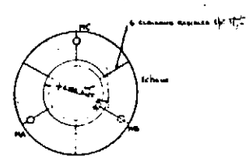
VUE SUIVANT A_A

EMBASE



COUPE E.E

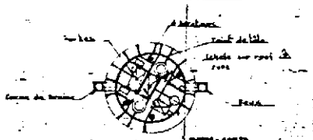
FLOTTEUR PRINCIPAL



COUPE F.F

CHEMINEE

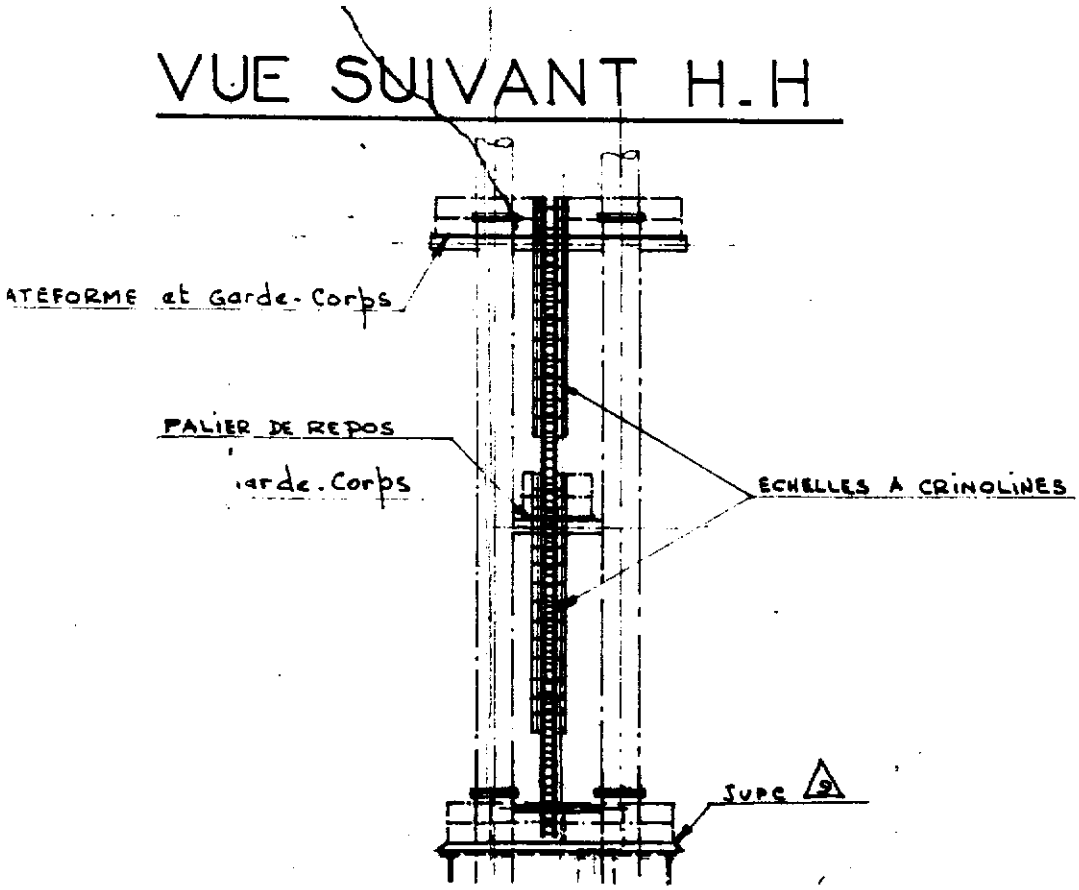
COUPE G.G



AS BUILT UP TO

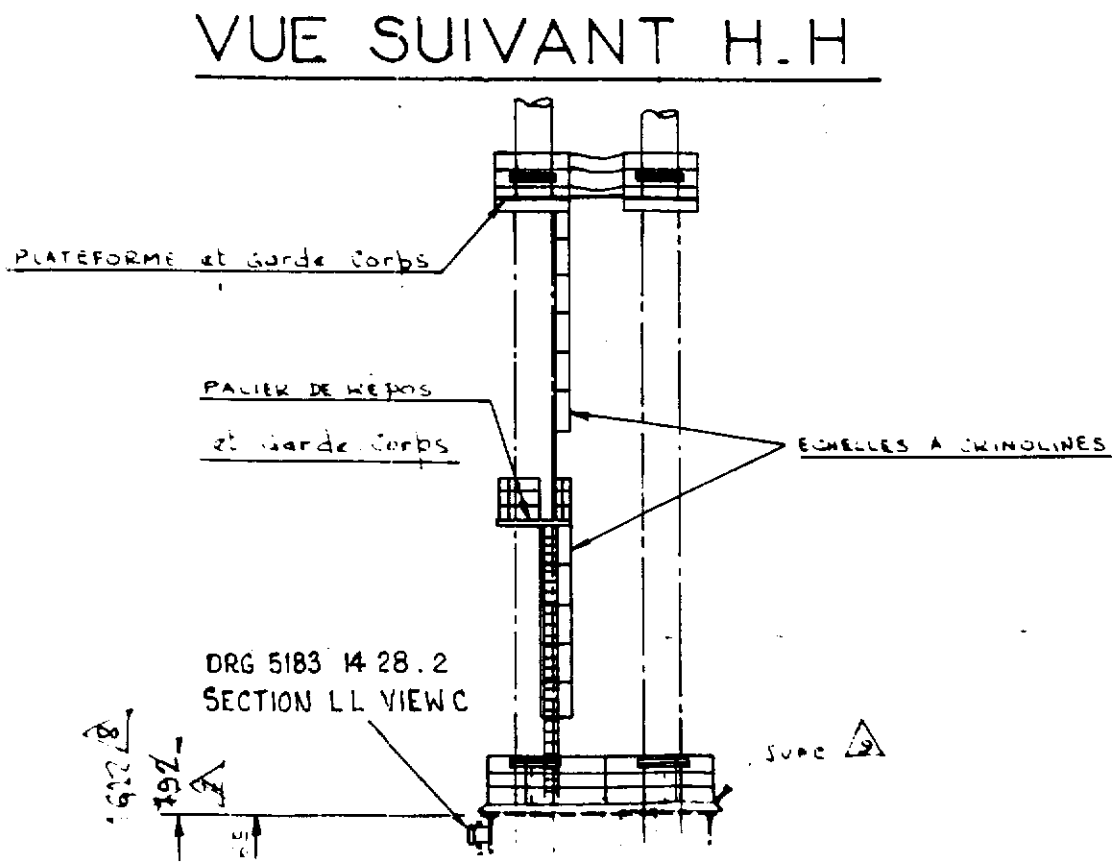
FIG. 3.6

CFEM/EMH N° 5183_023_1Z			
	FLARE		
FRIGG FIELD	5183	FLARE PLATFORM. GENERAL ARRANGEMENT	
	FF 99 36 25 2000 1 1Z		



Before modification

Fig. 3.7.



After modification

Fig. 3.8

3.10. Anodes

New anodes wer fitted on main float, on lattice structure and on lower part of tidal tank. Also both triangular ballast tanks had two new anodes, each installed on the inside. Ref. fig. 3.9.

No specification on anodes were submitted to DnV for approval, i.e. anodes has not been evaluated with respect to material, fabrication, design and cathodic protection potential.

Lattice:	9 additional anodes
Tidal tank:	11 new anodes
Main float:	2 dismounted
	checked and reinstalled
Chimney:	2 dismounted
	checked and reinstalled
Foot of column:	2 dismounted
	checked and reinstalled

3.11. Electrical

John Zink ignition plant has been permanently disconnected in supply end and the cables are earthed. This plant will not be used any more.

The main drain ballasting pump (submerged) has been permanently removed.

The telecommunication cable connection has been modified to be used as power cable. This had to be done due to loss of power cable.

Tideland navigation aids were modified and completely overhauled. All cables were replaced with cable type RCOP. New control box type ECU-645 was installed in electric control and distribution room.

The rest of the electrical plant was overhauled and brought in order.

Reference is made to survey reports (28) and (29).

LOCATION OF ANODES

AREA	TYPE OF ANODE A	B	C	D		REFERENCE DRAWING
CHIMNEY INSIDE		24				FF 99 36 25 2227
CHIMNEY OUTSIDE		9	26			
MAIN FLOAT		20				FF 99 36 25 2227
LATTICE STRUCTURE	37	1			5	FF 99 36 25 2379
CONCRETE BALLAST		17				FF 99 36 25 2229
AUXILIAR FLOATS		32				FF 99 36 25 2229
UPPER SEATING		7		2		FF 99 36 25 2228
CONNECTION PLATE			10	43		FF 99 36 25 2380
BASE		10 on each column 42 on each				FF 99 36 25 2228

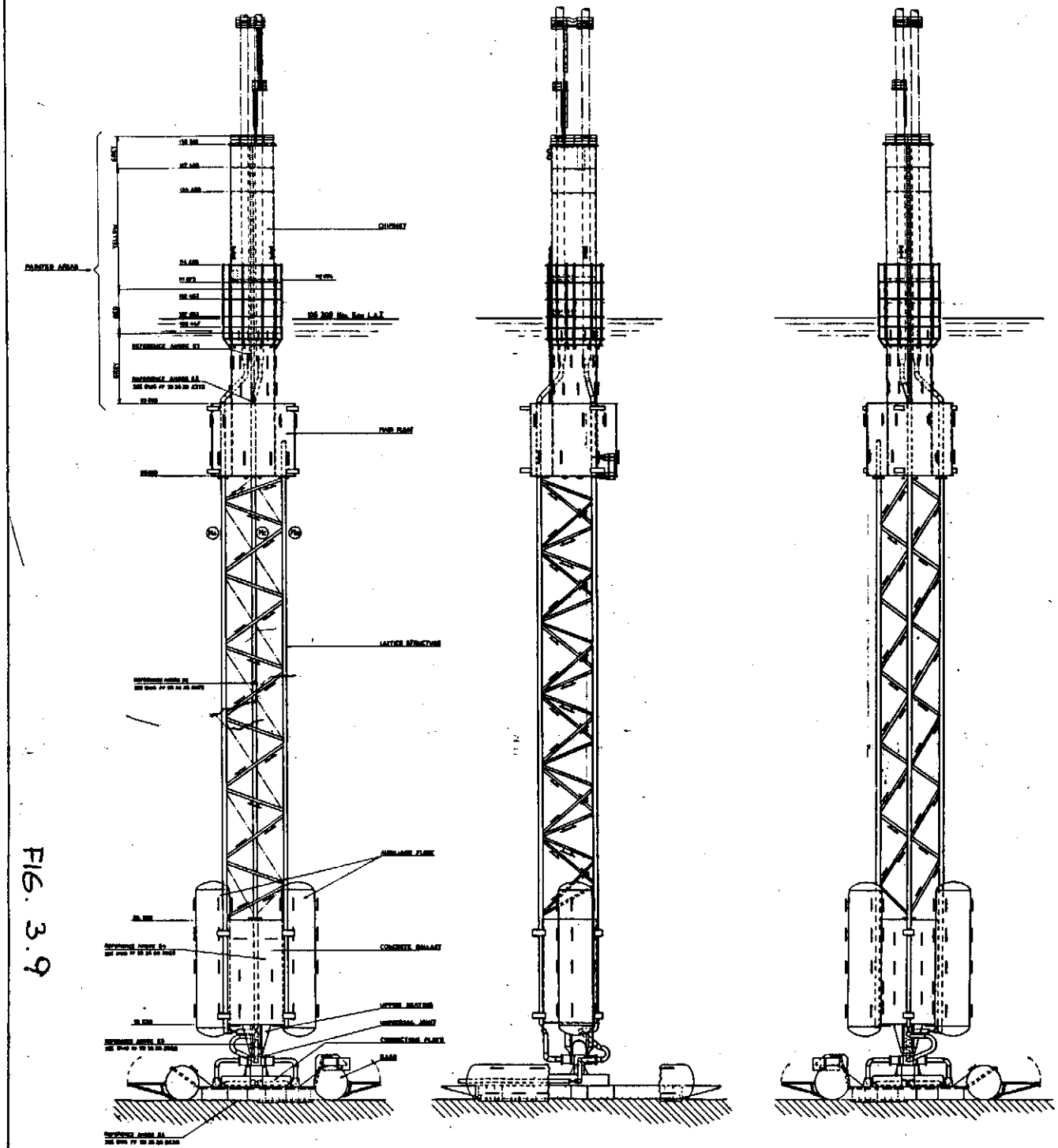


FIG. 3.9

38

FLARE
ANODES POSITIONS ON STRUCTURE. GENERAL ARRANGEMENT
PAGGO FIELD
FF 99 36 25 2381

3.12. Piping systems

Air and gas lines in connection with ignition system on the stacks were suppressed.

Lubrication circuit on articulation was modified with additional valves in order to keep oil in universal joint during towing, upending and installation.

Hydraulic circuits for hydraulic jacks on torsion seals were suppressed.
Hydraulic circuits for safety jacks on locking system were suppressed.
Hydraulic panel in tidal tank has been suppressed.

4. FABRICATION AND REASSEMBLY

4.1. General

This chapter reviews the fabrication of the new parts to the Flare Platform.

The associated control activities performed by DnV are also described.

The fabrication and the associated inspection activities are only briefly reviewed and summarized since these aspects are described in the respective reports and certificates.

DESCRIPTION	FABRICATION	MATERIAL	DNV INVOLVED
LOCKING SYSTEM			
Seals for guide pins	Pronal		
Locking system, casting	Nye Stavanger Staal	S 1299	
Locking system, machining	H.M.V. Haugesund		DnV
Guide bolt		SE 2M	
CONNECTION PLATE			
Connection seal	EMH St Cloud, France		DnV, Le Havre
Welding neck flanges	Brück GmbH, Ensheim, Germany	A 350 LF 2	
Connection joint	H.M.V. Haugesund		
Connection plate, wedging All 16 mm plate		St 52-31	
All 30 mm plate	Svenska Stål Oxelsund	NVE 36	DnV, Stockholm
All 40 mm plate	Svenska Stål Oxelsund	OX 522 D	DnV, Stockholm
All 50 mm plate	Svenska Stål Oxelsund	St 52-3/xx	DnV, Stockholm
All 160 mm plate	A/S Norsk Jernverk	St 52-3	DnV, Mo i Rana

DESCRIPTION	FABRICATION	MATERIAL	DNV, INVOLVED
Connection plate, padeyes: (Fig. 4.1)			
1	Rautaruukki oy	St 52-3N	DnV
2	Thyssen Henrichshutte, W.Germany	Grade 3 SP-JJ-001 Rev. 1	DnV, Essen
3	Kawasaki steel works	St 52-3N	DnV, Yokohama

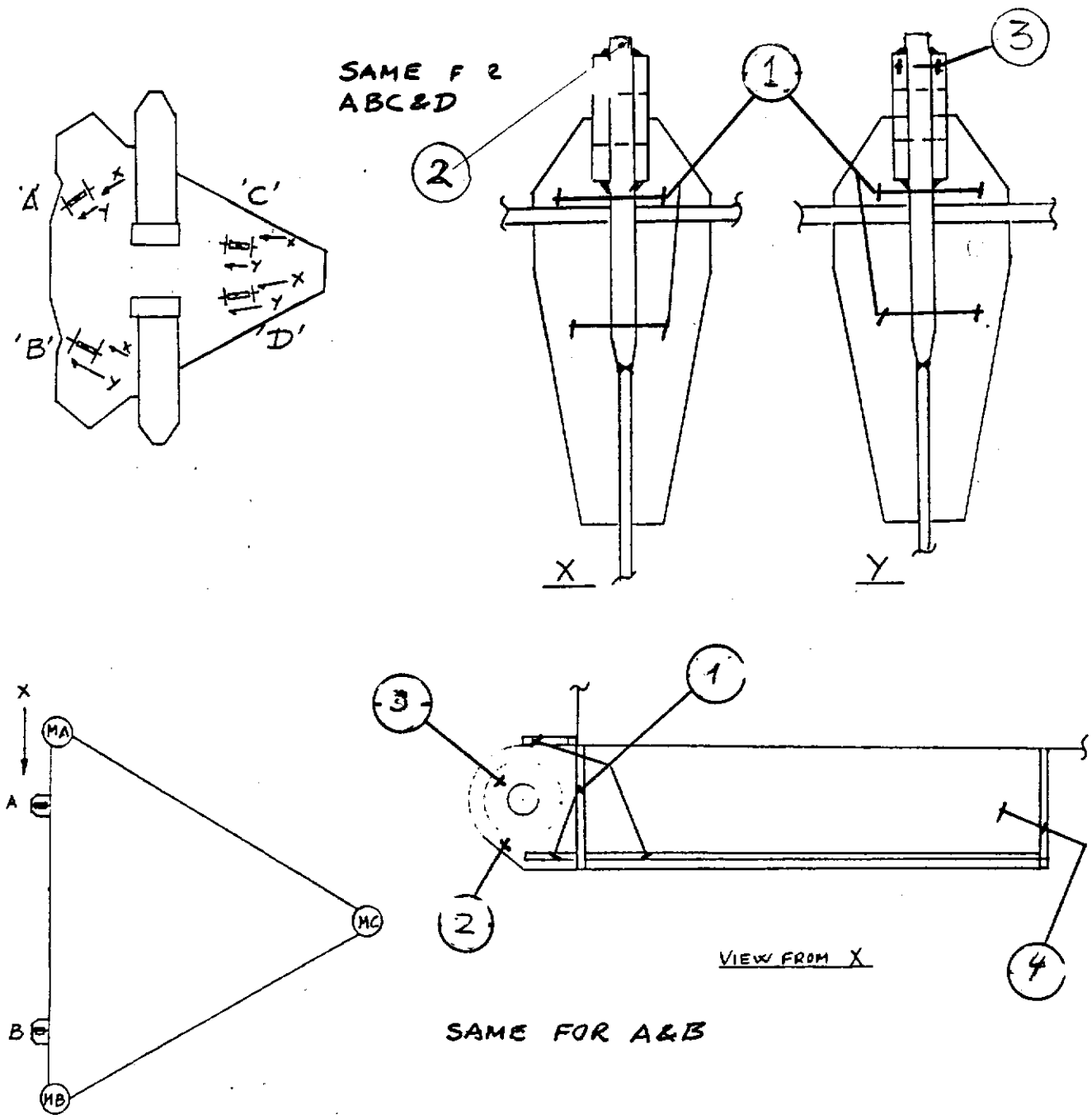


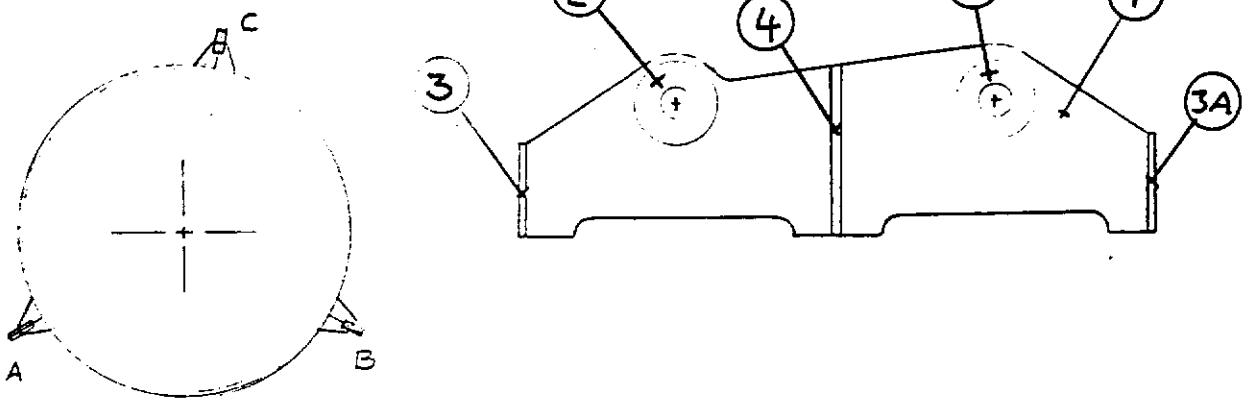
Fig. 4.1

DESCRIPTION	FABRICATION	MATERIAL	DNV, INVOLVED
Torsion seal	EMH St Cloud, France		DnV, Le Havre
Torsion seal support	Ferry-Capitain	12M6M	DnV, Metz
Centering pins	Ferry-Capitain	XC Din 17200 CX35	DnV, Metz
Nuts		Steel AFNOR XC38 DIN CX35	
Struts	Beck-Crespel	Creuselso 38	DnV, Dunkerque
Flanges for torsion seal	Ferry-Capitain	12 M6M	DnV, Metz
Flanges for seal of bearing	Ferry-Capitain	12 M6M	DnV, Metz
Flanges for Location	Ferry-Capitain	12 M6M	DnV, Metz
Bearing	Ferry-Capitain	12 M6M	DnV, Metz
Stud. Bolt	Beck-Crespel	30 NCD 16	DnV Dunkerque
Blind. nuts	Beck-Crespel	XC 48	DnV, Dunkerque
Wedging disc	Ferry-Capitain	12 M6M	DnV, Metz
Bushing	Merriman	Lubrite bronze ASTM 905 MOD (Alloy 237)	DnV, New York
O Ring ø 1110	Vestpak		
O Ring Ø678	Vestpak		
Ferrule	Fabricom Grinberrgen,Belgium	St 52-3N	

DESCRIPTION	FABRICATION	MATERIAL	DNV INVOLVED
ARTIGULATION			
Cardan spider No. 1	Ferry Capitain	12 M6M	DNV, Metz
Cardan spider No. 2	Ferry Capitain	12 M6M	DnV, Metz
Pedestal for jack	Maritime GMC	E 26.3 or 4 (Din st 42-3N)	
Jack Enerpac		E 26.3 or 4 (Din st 42-3N)	
Nut of Bearing	Beck-Crespel	ACIER CREUSELSO 38	DnV, Dunkerque
Nut	Beck-Crespel	XC 48	DnV, Dunkerque
Spacers	Beck-Crespel	XC 48	DnV, Dunkerque
Teflon strut	Dupont de Nemours, France	Charged with carbon graphite for 25% 1191N	
Clamp		A 50.1 (DIN 17100 St 50.1)	

DESCRIPTION	FABRICATION	MATERIAL	DNV INVOLVED
CONCRETE AND WATER BALLAST			
Cable guide concrete and water ballast tank	HMV, Haugesund	St 52-3N	DnV at HMV
Padeyes welded to bottom of concrete, see Fig. 4.1.	Rautaruukki oy	St 52-3N	DnV
1 2	Thyssen Henrichshutte, W.Germany	Grade 3 SP-JJ-001 Rev.1	DnV, Essen
3	Kawasaki steel works	St 52-3N	DnV, Yokohama
4	S.A. des Forges de Claberg	Acier E36-2NFA 35501/77	DnV
MAIN FLOAT 6 cable guides welded to the main float	H.M.V., Haugesund	Assumed, material St 52-3N	DnV at HMV
TIDAL TANK 3 anchor bracket for towing and reconnection see fig. 4.2.	H.M.V. Haugesund		DnV at HMV
RR147	Svenska Stål Oxeløsund	OX 522D	
IR 110	Firma Dillinger Huttenwerke A.G.	Grade IZ Brown & Root "Sp.-JJ-001"	DnV, Saarbrucken
UO 107			
UL 91	August Thyssen Hutte A.G.	Grade C-36	DnV, Essen
MH 103	Kawasaki steel coor	Din 17100 St 52-3N	DnV, Yokohama

DESCRIPTION	FABRICATION	MATERIAL	DNV INVOLVED
MA 103			
ROOF			
Installation of a winch for pulling electrical cables + a A frame	Atlas Copco	Type: OWK 213-56	
FLARE STACKS			
On both stacks two parts of the pipes were cut off due to crack appearance. New pipes were made and welded on. See fig. 4.2	Rautaruukki OY	E36	DnV at HMV



	1	2	3	3A	4
A	RR 147	UO 107	UL 91	UL 91	UL 91
B	IR 110	UO 107	MH 103	MH 103	MH 103
C	RR 147	UO 107	MA 103	UL 91	UL 91

Fig. 4.2

4.3. Inspection of fabrication and assembling

Inspection, including the required amount of NDT control at the different fabricators and assembly sites, was generally carried out by the relevant fabricators (or inspection firms hired by them) as well as by ELF and DnV.

Fabrication and inspection performed, were essentially based on the criteria laid down in the relevant material and fabrication specification. See enclosed list of specifications, appendix B.

Most of the items were fabricated and inspected in accordance with the specifications. Some discrepancies and problems did however occur during fabrication and installation. This will be commented in the following paragraphs.

4.3.1. Locking system

Tensile strength for a test on locking bolts did not satisfy requirements, but was accepted by ELF and DnV.

On guide bolt No. 3, beneath member MA, small cracks and casting defects were revealed when machining. The defects were removed by grinding, rechecked and accepted. The defects were on the part between the bearing surfaces, thus no further repair was decided neccessary. Maximum depths of defects were 8 mm.

4.3.2 Wedging of connection plate

U.S. examination of welds on wedging revealed lack of penetration on welds A1, B1 and B2 according to enclosed test report, ref. figs. 4.4, 4.5, 4.6. The U.S. examination was conducted less than 12 hours after final welding. The EAN site management decided to carry out repairs on weld B2, and leave the other welds in present condition. The repair of B2 was done and U.S. examination less than one hour after completion of welding showed no defects present. The flooding of the flare was carried out while the surface temperature of the repaired weld was about 50°C. The NDT-inspection carried out was not accepted by the DnV surveyor. The brackets are welded to primary structure and any cracks or cracklike defects in this will affect the fatigue life. Thus, it seems appropriate that these welds are subjected to regular and close inspection in the future.

4.3.3 Cardan spider

Mechanical testing of coupling bolts failed. The results were, however, accepted considering the purpose of the bolts. They should maintain the two parts during assembly and welding and were not taken into account in the calculation of the spider.

Some defects with length up to 1.2 m and depth up to 45 mm had to be repaired after casting. These defects were repaired and accepted.

4.3.4 Bearings

All 3 bearings had significant casting defects which had to be repaired. Max. depth 146 mm.

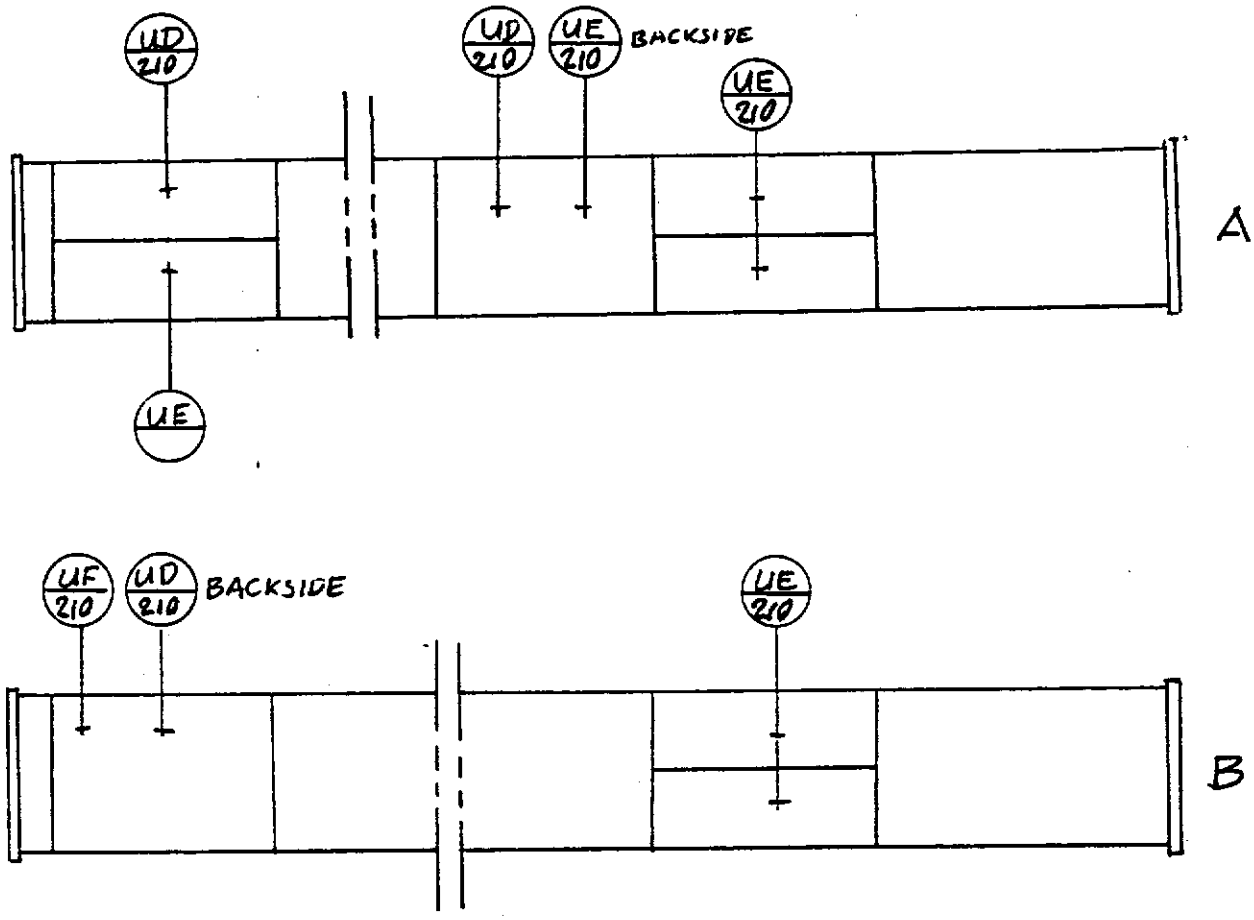
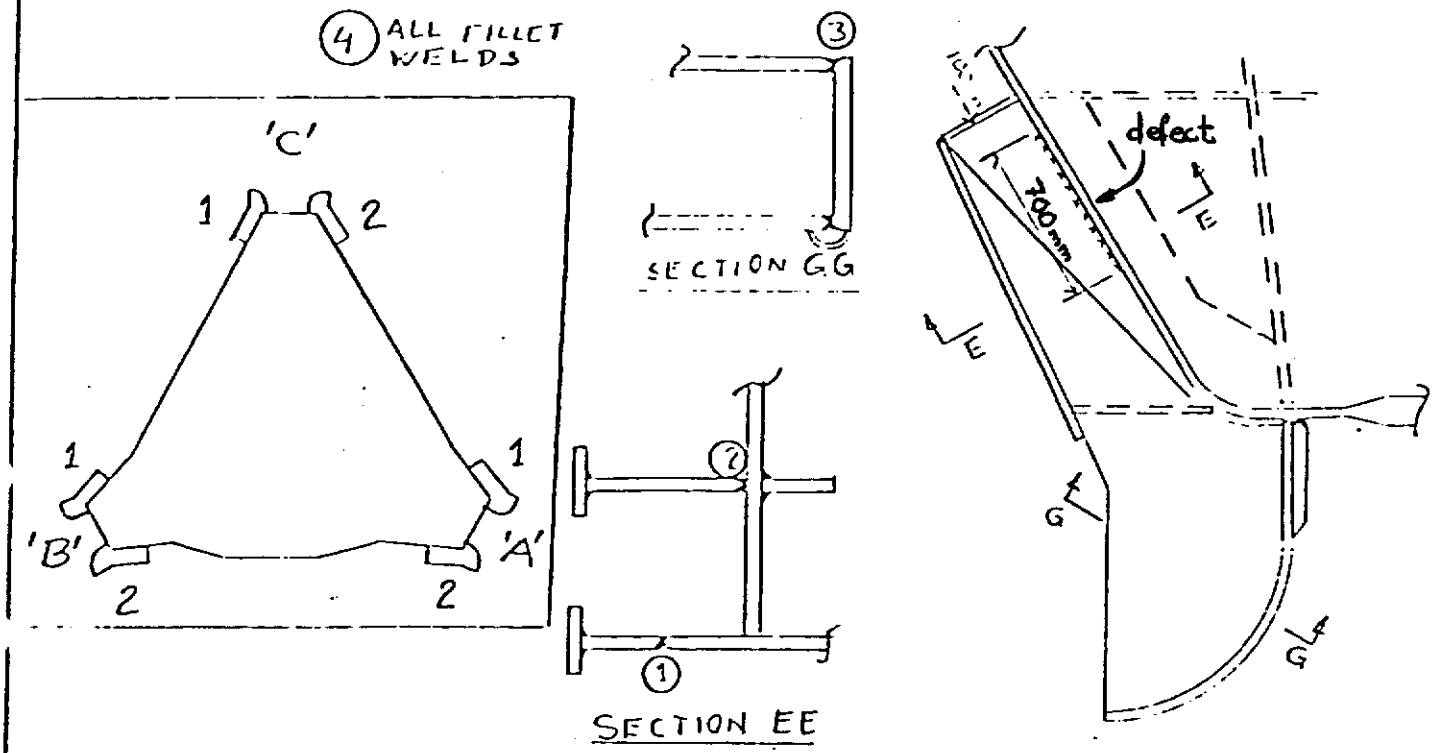
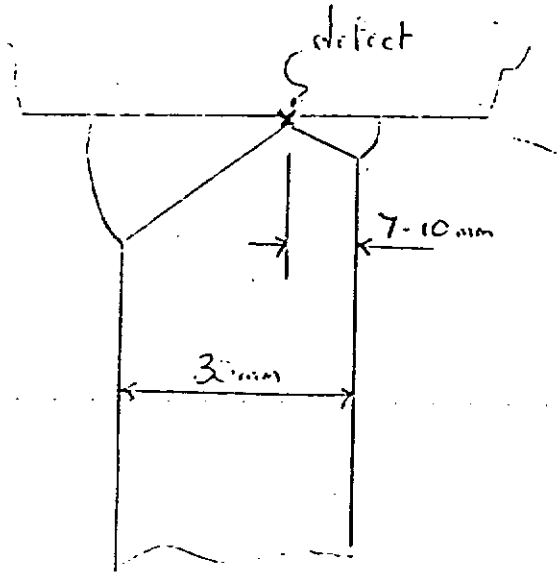

UD 210
UD 210
UE 210
BACKSIDE
UE 210
UE
A
UF 210
UD 210
BACKSIDE
UE 210
B

Fig. 4.3

ELF - TRIGG FLARE STRUCT., DRY DOCKING

DOC. NO. 77.72
WELDING OF CONNECTION PLATE





defect - Lack of Penetration

NOTED

SKETCH 1

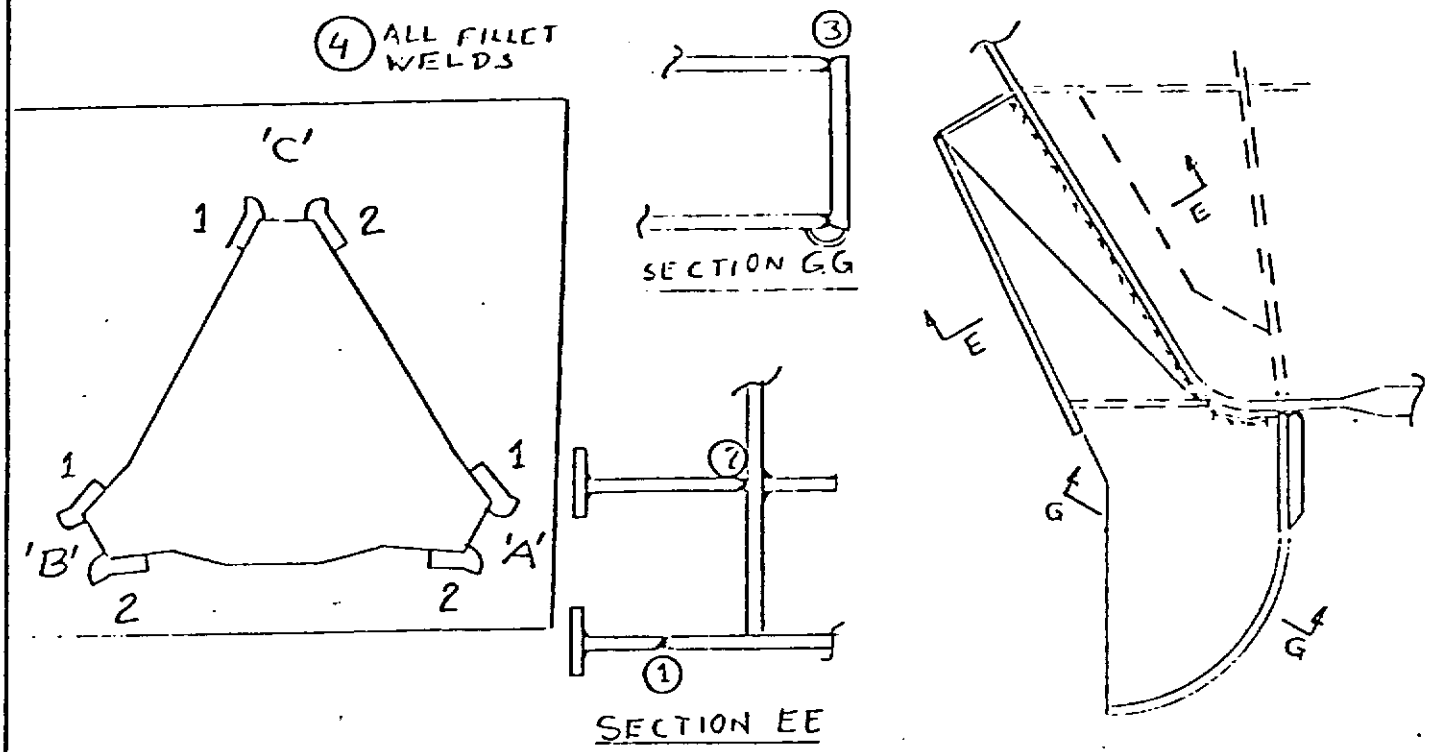
N.T.S

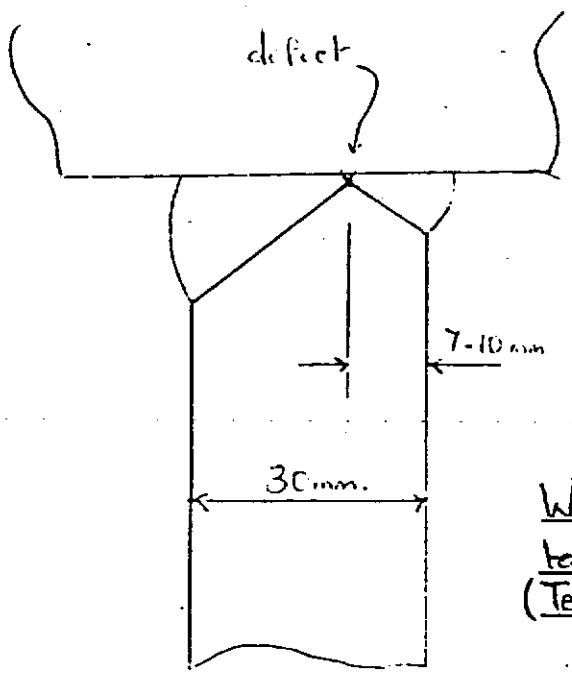
FIG. 4.4 WELDS ON BRACKET A1

WELDING DOCUMENTATION

ELF - TRIGG FLARE STRUCT., DRY DOCKING

Page 6
DRG. NO. 12.72
WELDING OF CONNECTION PLATE





defect - Lack of fusion, for full length of weld (max 1500mm) also cracking 150 mm long

Weld re-tested after repair and found to be acceptable
(Tested immediately after welding)

N.T.S

SKETCH '3'

FIG. 4.5 WELDS ON BRACKET B2

4.3.5 Set screw of bearing

Two tensile tests (864 and 865) showed low values. Plug M20-MFE 29582 had threaded length 10.5mm instead of 13 mm.

Sheradized parts had coating thickness 35M instead of specified 50 M. All deviations were accepted by ELF.

4.3.6 Struts

MPI inspection of the struts revealed crack indications. An examination (39) found a defect in the form of non-metallic inclusion approximately 0.2 mm beneath the surface. The inclusion mainly consisted of aluminium, probably aluminium oxide and are considered not to affect the strength of the struts.

4.3.7 24" Piping

The pipe material is TT St. E36 which can be described as equivalent to the specified St 52-3N. The base material was originally impact tested according to DVM test method. This method is not approved by DnV. Thus, retesting according to ISO-V was performed.

DnV stated that the Z-quality of the pipe material probably is low and special care should be taken when making the welds to the pipe.

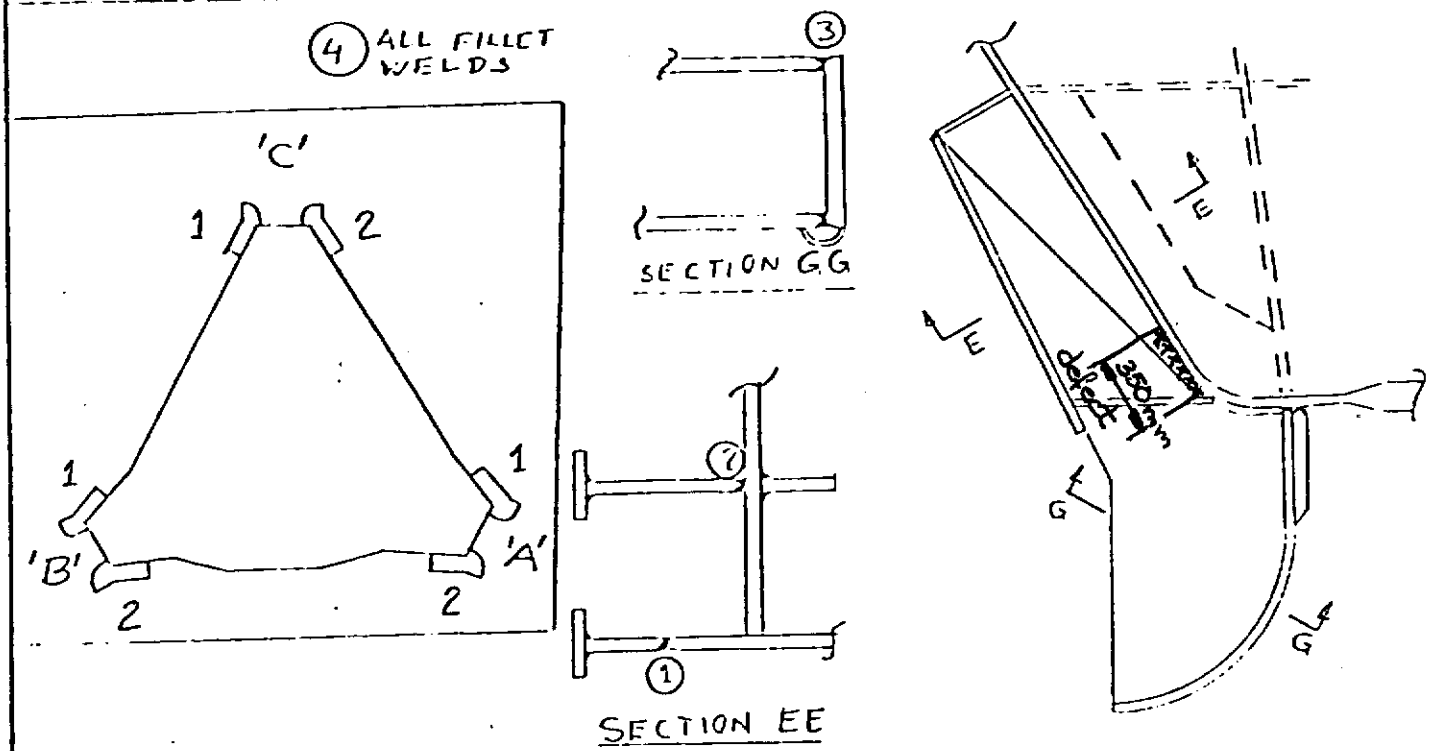
During assembling at HMV, it was discovered that the materials were delivered with 1/2-x groove instead of specified V-groove. It was also discovered misalignment in the piping, mainly due to ovality in the tubes and elbows. Maximum misalignment were measured to 10 mm over 150 mm length. Inside misalignments were ground to smooth transition with inclination 1:4. Outside misalignments in way of longitudinal weld seam were compensated for by buttering in order to maintain specified wall thickness. The welds that were repaired are specified in the attached copies from HMV, fig. 4.7 and 4.8.

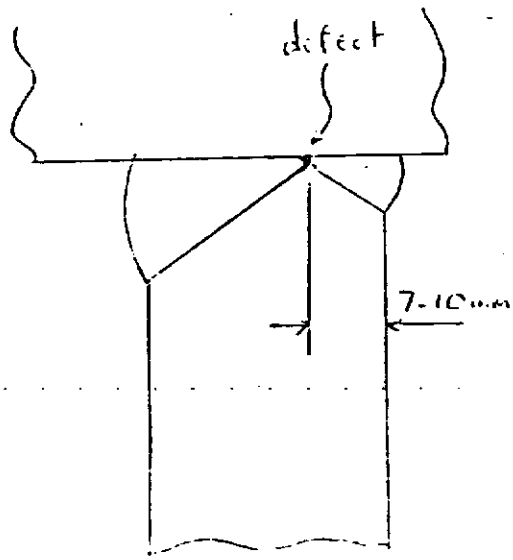
4.3.8. Anodes

Welding of anodes in triangular ballast tanks were not NDT inspected.

4.3.9 Lubrication and hydraulic piping

Some of the parts were delivered without certificates. For details, reference is made to HMV's "Documentation of work for Frigg Flare docking phase".





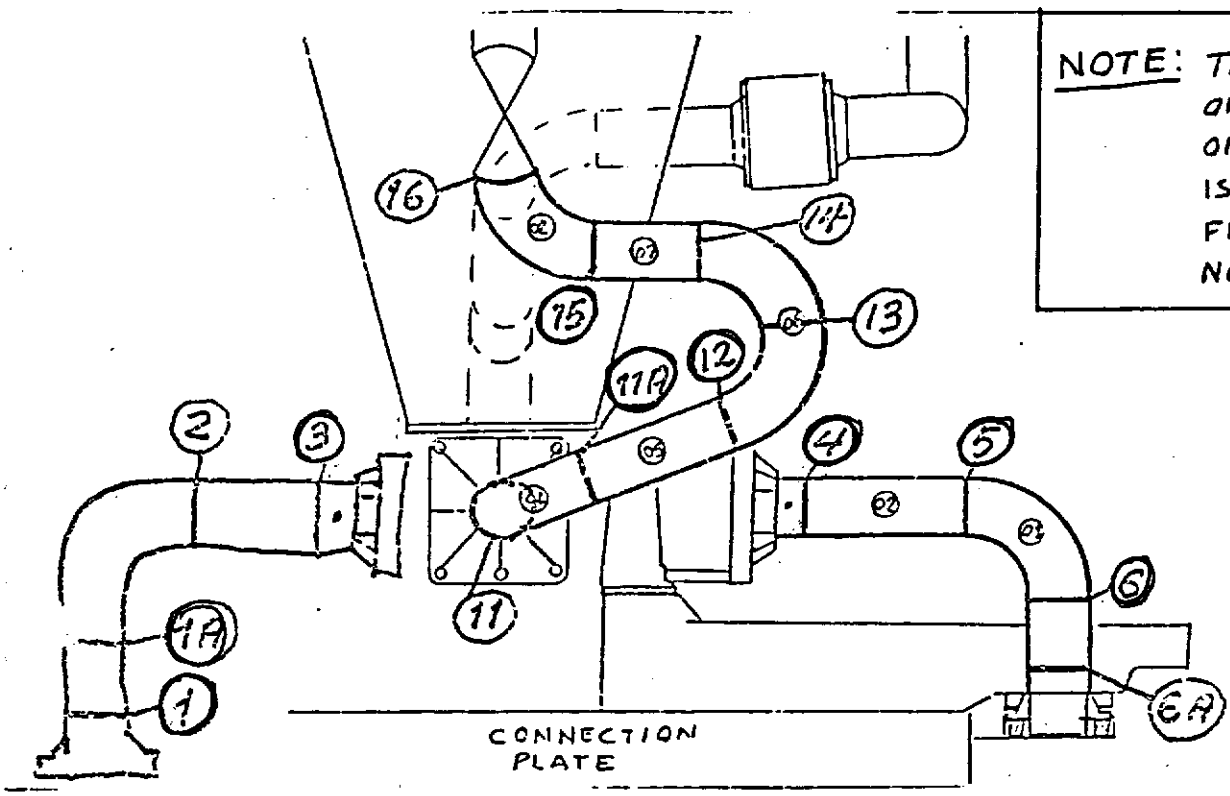
defect - lack of Penetration

SKETCH '2'

N.T.S.

FIG. 4.6 WELDS ON BRACKET B1

REPAIRS OF 24" GASLINE



NOTE: THE NUMBERING OF WELD SEAMS ON THIS SKETCH IS DIFFERENT FROM HMV'S NUMBERING.

WELD NO	OUTSIDE OF WELD	INSIDE OF WELD
1	OK!	ok TO BE GRINDED
1A	OK!	ok TO BE GRINDED AND BACKWELDED
2	OK!	OK!
3	BUTTERING ok	TO BE GRINDED BEFORE BUTTERING AND BACKWELDING ok
4	BUTTERING ok	ok
5	BUTTERING ok	TO BE INSPECTED AFTER ok
6	TO BE GRINDED ok	FINISHING OF GRINDING ok
6A	OK!	ok
11	OK!	ok
11A	OK!	ok After Grinding done
12	BUTTERING AND GRINDING SMOOTH ok	ok After Grinding "
13	OK!	ok
14	OK!	ok
15	BUTTERING AND GRINDING SMOOTH ok	ok
16	OK!	ok

All requirements on welds 1-16 carried out And found acceptable
28/7-80 J. Strandlund

DET NORSKE VERITAS OPPRETTET 1864

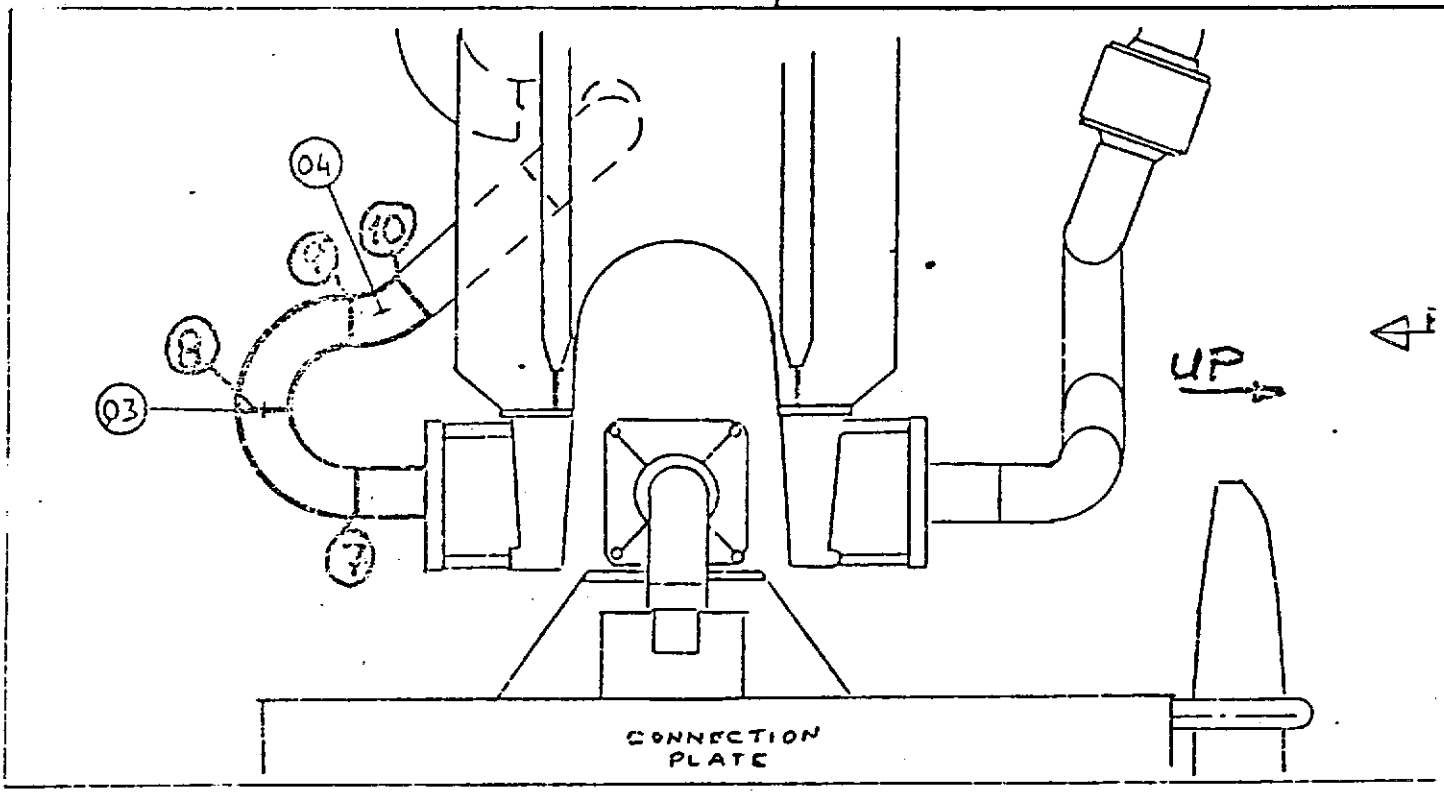
28 G.E. Sleaford Welder

FIG. 4.7

PAGE 2 OF 2

REPAIRS OF 24" GASLINE

NOTE: THE NUMBERING OF WELD SEAMS ON THIS SKETCH IS DIFFERENT FROM HMV'S NUMBERING.



WELD NO.	OUTSIDE OF WELD	INSIDE OF WELD
7	IN PROGRES ok	ok
8	OK!	ok
9	OK!	ok
10	IN PROGRES ok	NO ACCESS

All requirements on welds 1-16 carried out and found acceptable.

25/7-80 J. Hagelund

24/7-80 G.E. Skeet

31/7 P.A. Walden

DET NORSKE VERITAS OPPRETTET 1864

FIG. 4.8

5. INSTALLATION

The different phases are described in procedures (31)

The flooding of the flare structure was carried out in accordance with the procedures established for this part of the repair project, ref. survey report (27).

The flare structure was then towed horizontally to Austdjupet, using 3 tugs. Two tugs were connected to the chimney and the astern-tug was moored to the foot bit. The connection plate was clamped in vertical position using 4 wires with hydraulic turnbuckles.

After tilting and completion, the flare was towed to site in veritcal position. Three tugs were used for towing inshore and one main tug with bollard pull 40/50 tons in open sea. Draught during towing was 98 m and towing speed was 2 knots.

DnV did not attend tilting and towing phases.

13th August the flare arrived the site and the reconnection operation started. Three tugs were used to keep the flare in position during lowering. The reconnection operation was performed in accordance with the procedures and no irregularities were noticed, ref. survey report (32).

Pressure testing of the seals did not reveal any leakage, ref. survey report (24).

During pulling of communication cable, the tugger wire broke and the cable fell to the seabottom. However, no damage was revealed during testing. During installation of the power cable, the cable fell down the riser. It was decided to leave it where it was, and use the communication cable for the power supply, ref. survey report (33).

Injection of epoxy in seals on locking bolts/pins was not successful and leakage occured when oil was injected. This was temporarily repaired by applying sealing compound on the outside of the seals, ref. survey report (25).

The flare was back in service the last week of September.

6. ITEMS TO BE INCLUDED IN INSPECTION PROGRAM

6.1. General

During design review and inspection during fabrication and installation, some items which are considered necessary to be subjected to future inspection were revealed. It is recommended that these items are included in the inspection program.

6.2. Locking system

Inspection of the old locking bolts did reveal radial abrasion on the bolts, caused by a combination of mechanical and corrosice influence. The modified locking system includes seals around the locking bolts to keep the oilfilled pin oiltight. Thus, it is not possible to inspect for abrasion. However, it is important to inspect the seals for tightness.

6.3. 24" Piping

The theoretical analysis of the inlet circuit showed that the improved embedment will reduce the loads somewhat but the loads are still relatively high. All the welds on the inlet pipes were repaired because of misalignments. Thus, it is recommended that these welds are subjected to regular type III inspection in the future.

Several welds on the outlet pipes were also repaired but the forces in these systems are relatively low. However, a close inspection of the repaired welds is recommended. Special attention should also be paid to the outlet pipe which is going through the hole in the upper yoke, to make sure that there is sufficient clearance around the pipe.

6.4. Torsion seal supports

The theoretical investigation of the inlet side supports show relatively high equivalent stress in full flaring condition as well as high local bending stresses. The pipe material has probably low Z-quality. Thus, regular MPI-inspection of the welds on brackets and ringstiffeners as well as lamination check of the pipe material is recommended to reveal any defects that can reduce the fatigue life.

On the outlet side, it is recommended to subject the weld at the transition between the support and the pipe to regular MPI-testing to detect any cracklike defect that can reduce the fatigue life.

6.5. Struts

No fatigue problem is expected for the struts. However, because of their importance to avoid leakage, regular type II inspection is recommended in the future.

6.6. Upper bearing support

Survey in dry dock revealed that some stiffening around hole for 24" pipe was cut away. The upper support is subjected to a constant vertical force with varying horizontal and vertical forces caused by environmental conditions. Thus, fatigue might be a possible mode of failure. It is recommended that the condition of the hole is inspected in the future to detect any defects that could reduce the fatigue life.

6.7. Gas risers MA and MC

The two outlet circuits continues as members on the lattice structure. Due to forces and vibrations in the piping system, it is recommended that the condition of the welds between the bottom part of the triangular ballast and the members MA and MC are subjected to regular MPI-testing in the future.

6.8. Anchor brackets

The anchor brackets used for towing from Frigg to dry dock are welded to the top of the main float. High forces during towing may have given defects in the welds, and problems with leakages in the main float. Thus, it is recommended to MPI-test these welds.

It is also recommended to perform similar testing of the anchor brackets welded to the tidal tank.

6.9. Flare stacks

Several cracks have been revealed on the flare stacks during inspection. Special attention should be paid to all attachment welds to the two 42" pipes.

7. REFERENCES

1. EAN Report "The Leak of Flare System" of 19.11.79.
Ref. 311E-OCD 79/1447/EH/tt

2. DnV "Travel Note", Inspection of Frigg Flare Piping Leaks.
Note No. 70-37-80
Survey period: 17.06.80.

3. DnV Survey Report, Inspection in dry dock.
Survey period: 16.06.-20.06.80.

4. DnV Survey Report, Inspection in dry dock
Report No. DnV-FRI-AW-8/80
Survey period: 23.06.80-27.06.80

5. DnV Survey Report, Inspection in dry dock
Survey period: 26.06.80

6. DnV Survey Report, Inspection in dry dock
Survey period: 30.06.-19.07.80 and 25.07.-02.08.80.

7. DnV Survey Report, Disconnection of flare platform and subsequent inspection of flare base according to special inspection program.
Survey period: 24.05.-03.06.80.

8. DnV Survey Report No. DnV-FRI-BW-1/80
Concerning the inspection of the flare base plate.
Survey period: 02.06.-09.06.80

9. DnV Survey Report No. DnV/FP/80/1
Crack repair
Survey period: 07.08.-17.08.80

10. Comex Report, Flare Base inspection
Special Report on Cracks Found on Pin Base
Dated 17th June 1980

11. EAN Phase IX, Under water work on base
Operation 1: Stopping of cracks found on base.
Drwg. No. FF 99 36 25 23 09 rev. 0

12. Comex Subsea procedures, Stopping Cracks Found on Base of Frigg Flare, revision 1.
Dated 22.07.80.

13. DnV Technical Report.
Failure analysis of Frigg Flare platform leakage.
Dated 24.01.80.

14. DnV Technical Report No. 80-0433
Frigg Flare, analysis of piping system.
Dated 11.06.80.

15. DnV Technical Report No. 80-0487
Frigg Flare, analysis of flange
Dated 10.07.80

16. DnV Technical Report No. 80-0608
Frigg FP, Investigation of broken parts
Dated 4th September 1980

16.1 DnV Technical Report No. 32 28 5512
Frigg FP Investigation of internal corrosion of 24" lines.

17. DnV Technical Report No. 80-1158
Frigg FP, Investigation of struts, torsion seals Nos. 1,2,3 and 4.
Dated 22nd December, 1980

18. DnV Technical Report No. 80-0630
Frigg FT, Additional Survey COF
Dated 10th September, 1980.

19. EMH Investigation
Cracks on base
Dated 30.06.80

20. Strength calculations for flare installation
Drwg No. FF 99 36 25 23 21 rev. 0
Dated 21.04.80

21. EMH calculation No. 17-01 rev. 00
Behavoiur of the disconnected column.

22. DnV Survey Report
Disconnection of Flare Platform and subsequent inspection
of Flare base according to special inspection program
Survey period: 24.05.-03.06.80.

23. DnV Survey Report
Disconnection and tow of Frigg articulated Flare Tower, May 1980

24. DnV Survey Report No. DnV-FRI-AW-14-80.

Reconnection of flare platform
Survey period: 16.08.-25.08.80

25. DnV Survey Report No. DnV/FP/80/3
Survey period: 01.09.-09.09.80.

26. DnV Survey Report
Additional survey certificate of fitness
Survey period: 30.06.-19.07. and 25.07.-02.08.1980

27. DnV Survey Report No. STG-FRI-AW-17/80
Survey period: 02.08.-03.08.1980

28. DnV Survey Report No. STG-FRI-AW-13/80
Annual survey - electrical installation
Survey peiod: 30.06.-01.07.1980

29. DnV Survey Report No. STG-FRI-AW-20/80
Annual survey - electrical installation
Survey period: 05.09.1980

30. DnV Technical Report No. 15 2469/80
Examination of crack indication detected in bolt.
Dated 10th July, 1980.

31. Frigg Flare Disconnection Project, Precedures.
Drwg No. 99 36 25 23 00 rev. 2

32. DnV Survey Report No. DnV-FRI-AW-13/80
Reconnection of Flare Platform
Survey period 13.08.-17.08.1980

33 DnV Survey Report No. DnV/FP/80/2
Additional survey
Survey period 25.08.-31.08.1980

APPENDIX A:
List of specifications

FRIGG FP REP SPECIFICATIONS

Sp 12-20 Rev. 03	Connection seal
Sp 12-21A Rev. 00	Seal for mechanical guide bolt
Sp 12-23 Rev. 00	Locking jacks Emergency jacks
Sp 12-38 Rev. 00	"O" rings joint out of piping
SP 12-62 Rev. 01	Guide bolt
Sp 12-63 Rev. 01	Locking bolt
Sp 12-67 Rev. 01	Connection damping device
Sp 13-03 Rev. 00	"O" rings joint
Sp 13-03 Rev. 00	"O" rings joint
Sp 13-04 Rev. 02	Cardan spider
Sp 13-04A Rev. 02	Internal pipes in cardan spider and ferrule for flanges of torsion seal
SP 13-04B Rev. 02	Shrunks for cardan spider
Sp 13-06 Rev. 01	Cardan bearing
Sp 13-08 Rev. 01	Cardan lubrite bushing
Sp 13-09 Rev. 01	Flange for seal of bearing
Sp 13-10 Rev. 00	Flange for location of seal of bearing
Sp 13-10A Rev. 00	Protection joint for seal of bearing
Sp 13-11 Rev. 01	Torsion seal support
Sp 13-12 Rev. 00	Struts
Sp 13-13 Rev. 01	Flanges for torsion seal
Sp 13-15 Rev. 00	Set screw of bearing
Pr 13-15 Rev. 00	Injection of polyurethan in set screws of bearing
Sp 13-21 Rev. 00	Seal of bearing
Sp 13-30 Rev. 03	Torsion seal
Sp 18-01 Rev. 01	Piping and equipment specification Hydraulic system
Sp 19-05 Rev. 00	Gas piping at articulation level.

APPENDIX B:

List of drawings

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DRAWING REGISTER

CFEM/EMH DRAWINGS 1975

ELF DRAWING No.	REVISION INDEX	REVISION DATE	ORIGINATOR REF. NUMBER	TITLE		SHEETS	STEP A
FF 99 36 25 2020	6	15.03.81	CFEM/EMH 5183 063	POSITIONNING OF AUXILIARY FLOAT			0
FF 99 36 25 2021	11	16.11.80	CFEM/EMH 5183 064	CONCRETE BALLAST GENERAL ARRANGEMENT			0
FF 99 36 25 2022	5	16.11.80	CFEM/EMH 5183 065	SUPPORT ON CONCRETE BALLAST FOR BASE LOCKING			0
~~FF 99 36 25 2023~~	~~3~~	~~16.11.80~~	~~CFEM/EMH 5183 066~~	~~CONCRETE BALLAST - TOWING BITT~~	Cancelled		0
~~FF 99 36 25 2024~~	~~4~~	~~16.11.80~~	~~CFEM/EMH 5183 067~~	~~CONCRETE BALLAST - ANTI YAWING CONNECTIONS ON BOTTOM~~			0
~~FF 99 36 25 2025~~	~~2~~	~~15.03.81~~	~~CFEM/EMH 5183 068~~	~~CLAMPING OF COLUMN ON CONNECTION PLATE~~			1
~~FF 99 36 25 2026~~	~~9~~	~~15.03.81~~	~~CFEM/EMH 5183 081~~	~~BASE - GENERAL DISPOSITIONS - BEAMS AND FLOATS~~			0
FF 99 36 25 2027	6	11.02.81	CFEM/EMH 5183 082	BASE FLOATS - POSITION OF MANHOLES			1
FF 99 36 25 2028	4	11.02.81	CFEM/EMH 5183 083	BASE - EMBEDMENT OF PINS - PRINCIPLE			1
FF 99 36 25 2029	5	15.03.81	CFEM/EMH 5183 084	BASE - ANTI YAWING DEVICE			0
FF 99 36 25 2030	4	15.03.81	CFEM/EMH 5183 300	LATTICE STRUCTURE - GENERAL ARRANGEMENT			0
FF 99 36 25 2031	3	15.03.81	CFEM/EMH 5183 301	LATTICE STRUCTURE - DETAILS 1 AND 2			0
FF 99 36 25 2032	5	15.03.81	CFEM/EMH 5183 302	LATTICE STRUCTURE - DATA OF 24" MEMBERS			0
FF 99 36 25 2033	2	15.03.81	CFEM/EMH 5183 303	LATTICE STRUCTURE - DETAILS 3 AND 4			0
FF 99 36 25 2034	4	15.03.81	CFEM/EMH 5183 304	LATTICE STRUCTURE - CONDUCTOR CABLES			0
FF 99 36 25 2035	4	07.04.81	CFEM/EMH 5183 400	MAIN FLOAT - GENERAL ARRANGEMENT			0
FF 99 36 25 2036	10	15.03.81	CFEM/EMH 5183 401	MAIN FLOAT - SECTION 1.1 AND 4.4			0
FF 99 36 25 2037	8	15.03.81	CFEM/EMH 5183 402	MAIN FLOAT - SECTION 2.2, 2.2' AND 3.3			0
FF 99 36 25 2038	12	15.03.81	CFEM/EMH 5183 403	MAIN FLOAT - SECTIONAL ELEVATION			0
FF 99 36 25 2039	9	15.03.81	CFEM/EMH 5183 404	MAIN FLOAT - ACCESSORY			0

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CFEM/EMH DRAWINGS 1975

ELF DRAWING No.	REVISION INDEX	REVISION DATE	ORIGINATOR REF. NUMBER	TITLE		SHEETS	SIZE A
~~FF 99 36 25 2000~~	~~12~~	~~14.11.80~~	~~CFEM/EMH 5183 023~~	~~FLARE PLATFORM GENERAL ARRANGEMENT~~			~~0~~
~~FF 99 36 25 2001~~			~~CFEM/EMH 5183 031~~	~~LATTICE STRUCTURE - GENERAL DISPOSITIONS - STUDY~~ (Missing)			~~1~~
FF 99 36 25 2002	3	11.02.81	CFEM/EMH 5183 033	LATTICE STRUCTURE - PREPARATION OF ELEMENTS			1
FF 99 36 25 2003	4	15.03.81	CFEM/EMH 5183 034	LATTICE STRUCTURE - PREPARATION OF ELEMENTS			0
FF 99 36 25 2004	2	11.11.80	CFEM/EMH 5183 035	LATTICE STRUCTURE - DETAIL N.R. OF DWG 0031			0
FF 99 36 25 2005	2	11.02.81	CFEM/EMH 5183 036	LATTICE STRUCTURE - PREPARATION OF ELEMENTS			2
FF 99 36 25 2006	7	15.03.81	CFEM/EMH 5183 037	LATTICE STRUCTURE - PRESSURE DISTRIBUTOR			0
FF 99 36 25 2007	5	14.11.80	CFEM/EMH 5183 038	LATTICE STRUCTURE - GUIDES OF ELECTRICAL CABLES			0
FF 99 36 25 2008	16	11.11.80	CFEM/EMH 5183 041	MAIN FLOAT - STRUCTURE			0
FF 99 36 25 2009	2	11.02.81	CFEM/EMH 5183 042	MAIN FLOAT FIXATION OF MOORING BITTS			2
FF 99 36 25 2010	20	15.03.81	CFEM/EMH 5183 051	CHIMNEY AND ROOF - GENERAL DISPOSITIONS			0
FF 99 36 25 2011	17	14.11.80	CFEM/EMH 5183 052	APPOINTMENT ON ROOF - PROJECT			0
FF 99 36 25 2012	11	14.11.80	CFEM/EMH 5183 053	BOAT LANDING AND PLATFORM - GENERAL ARRANGEMENT			0
FF 99 36 25 2013	9	15.03.81	CFEM/EMH 5183 054	CHIMNEY AND MAIN FLOAT - CABLES DISPOSITION			0
~~FF 99 36 25 2014~~	~~10~~	~~14.11.80~~	~~CFEM/EMH 5183 055~~	~~LADDERS AND PLATFORM ON FLARE STACKS~~	Cancelled		0
FF 99 36 25 2015	2	14.11.80	CFEM/EMH 5183 056	42" STACKS. PREPARATION OF ELEMENTS			1
~~FF 99 36 25 2016~~	~~8~~	~~14.11.80~~	~~CFEM/EMH 5183 057~~	~~LIFTING OF STACKS. GUIDING PRINCIPLE~~	Cancelled		0
FF 99 36 25 2017	2	16.11.80	CFEM/EMH 5183 058	CHIMNEY - LADDERS ON BOAT LANDING			0
FF 99 36 25 2018	14	06.11.80	CFEM/EMH 5183 061	CONCRETE BALLAST. GENERAL DISPOSITIONS			0
FF 99 36 25 2019	9	16.11.80	CFEM/EMH 5183 062	AUXILIARY FLOATS. GENERAL DISPOSITIONS			0

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CFEM/EMH DRAWINGS 1975

ELF DRAWING No					REVISION INDEX	REVISION DATE	ORIGINATOR REF NUMBER	TITLE		SHEET
FF	99	36	25	2040	3	5.03.81	CFEM/EMH 5183 405	MAIN FLOAT - DISPOSITIONS FOR JACKS		0
FF	99	36	25	2041	4	1.02.81	CFEM/EMH 5183 406	MAIN FLOAT - LADDERS		0
FF	99	36	25	2042	3	5.03.81	CFEM/EMH 5183 407	ANCHORAGE ARRANGEMENT ON TOP OF MAIN FLOAT		0
FF	99	36	25	2043	6	5.03.81	CFEM/EMH 5183 500	CHIMNEY - GENERAL ARRANGEMENT		0
FF	99	36	25	2044	10	5.03.81	CFEM/EMH 5183 501	CHIMNEY - ELEVATION		0
FF	99	36	25	2045	9	5.03.81	CFEM/EMH 5183 502	CHIMNEY - SECTION		0
FF	99	36	25	2046	11	5.03.81	CFEM/EMH 5183 503	CHIMNEY - SECTION KK - PIPE		0
FF	99	36	25	2047	6	5.03.81	CFEM/EMH 5183 504	CHIMNEY - APPOINTMENT OF ROOF		0
FF	99	36	25	2048	6	5.03.81	CFEM/EMH 5183 505	CHIMNEY - WATERTIGHT DOOR		0
FF	99	36	25	2049	6	5.03.81	CFEM/EMH 5183 506	THERMAL SHIELD		0
FF	99	36	25	2050	5	5.03.81	CFEM/EMH 5183 508	CHIMNEY - INTERMEDIATE FLOORS		0
FF	99	36	25	2051	6	5.03.81	CFEM/EMH 5183 509	CHIMNEY - INNER LADDER		0
FF	99	36	25	2052	6	5.03.81	CFEM/EMH 5183 510	DEFENSES AND LANDINGS		0
FF	99	36	25	2053	6	5.03.81	CFEM/EMH 5183 511	BOAT LANDING - ROULING LADDER		0
FF	99	36	25	2054	5	5.03.81	CFEM/EMH 5183 512	CHIMENY - WATERTIGHT DOOR. LEVEL 112.024		0
~~FF~~	~~99~~	~~36~~	~~25~~	~~2055~~	~~6~~	~~5.03.81~~	~~CFEM/EMH 5183 513~~	~~LADDER AND PLATFORM ABOVE ROOF~~	Cancelled	0
FF	99	36	25	2056	6	5.03.81	CFEM/EMH 5183 514	CHIMNEY CONDUCTOR CABLE		
FF	99	36	25	2057	3	5.03.81	CFEM/EMH 5183 515	CHIMNEY BOAT LANDING - GRATING		0
FF	99	36	25	2058	4	1.02.81	CFEM/EMH 5183 516	42" STACKS ABOVE ROOF		1
FF	99	36	25	2059	4	1.02.81	CFEM/EMH 5183 517	FLANGES LEVEL 131.66 ON THE GAS PIPE ABOVE SHIELD		1

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ELF DRAWING No.					REVISION INDEX	REVISION DATE	ORIGINATOR REF. NUMBER	TITLE		SHEETS	SIZE
FF	99	36	25	2060	4	15.03.81	CFEM/EMH 5183 518	ROULING LANDING ABOVE ROOF			0
FF	99	36	25	2061	3	15.03.81	CFEM/EMH 5183 519	ROOF DETAILS			0
FF	99	36	25	2062	5	24.03.81	CFEM/EMH 5183 520	PRESSURE DISTRIBUTION			0
FF	99	36	25	2063	4	24.03.81	CFEM/EMH 5183 521	TRAP DOORS ON THE SHIELD			0
FF	99	36	25	2064	3	24.03.81	CFEM/EMH 5183 522	RAILING ON THE THERMAL SHIELD			0
FF	99	36	25	2065	3	24.03.81	CFEM/EMH 5183 523	HALF LANDING			0
FF	99	36	25	2066	2	11.02.81	CFEM/EMH 5183 524	CHIMNEY SECTION SS. DWG 501 REINFORCEMENTS			1
~~FF~~	~~99~~	~~36~~	~~25~~	~~2067~~	~~3~~	~~24.03.81~~	~~CFEM/EMH 5183 525~~	~~GUIDING DEVICES FOR STACKS INSTALLATION~~	Cancelled		0
FF	99	36	25	2068	2	11.02.81	CFEM/EMH 5183 526	CHIMNEY RAILING			1
FF	99	36	25	2069	2	11.02.81	CFEM/EMH 5183 527	ROOF WATERTIGHTNESS DURING HORIZONTAL TOWING			1
~~FF~~	~~99~~	~~36~~	~~25~~	~~2070~~	~~2~~	~~24.03.81~~	~~CFEM/EMH 5183 528~~	~~REINFORCEMENTS OF BOARDING PIPES~~	Cancelled		0
FF	99	36	25	2071	6	24.03.81	CFEM/EMH 5183 600	CONCRETE BALLAST - GENERAL ARRANGEMENT			0
FF	99	36	25	2072	2	11.02.81	CFEM/EMH 5183 601	CONCRETE BALLAST - PENETRATION GAS PIPE			1
FF	99	36	25	2073	18	24.03.81	CFEM/EMH 5183 602	CONCRETE BALLAST - GENERAL VIEW AND DETAILS			0
FF	99	36	25	2074	2	11.02.81	CFEM/EMH 5183 603	CONNECTION CONCRETE BALLAST AND SWIVEL BEARING			1
FF	99	36	25	2075	16	24.03.81	CFEM/EMH 5183 604	CONNECTION CONCRETE BALLAST AND SWIVEL BEARING			0
FF	99	36	25	2076	7	24.03.81	CFEM/EMH 5183 605	CONCRETE BALLAST - MANHOLES ACCESSORY			0
FF	99	36	25	2077	16	24.03.81	CFEM/EMH 5183 606	CONCRETE BALLAST - AUXILIARY FLOATS			0
FF	99	36	25	2078	5	24.03.81	CFEM/EMH 5183 607	CONCRETE BALLAST - LOCKING ON THE BASE			0
FF	99	36	25	2079	6	24.03.81	CFEM/EMH 5183 608	CONCRETE BALLAST - ANTI YAWING ON BOTTOM			0

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ELF DRAWING No.					REVISION INDEX	REVISION DATE	ORIGINATOR REF NUMBER	TITLE		SHEETS	SIZE A
FF	99	36	25	2080	5	24.03.81	CFEM/EMH 5183 800	BASE STRUCTURE. GENERAL ARRANGEMENT			0
FF	99	36	25	2081	7	24.03.81	CFEM/EMH 5183 801	BASE STRUCTURE - PINS FIXING			0
FF	99	36	25	2082	10	24.03.81	CFEM/EMH 5183 802	BASE STRUCTURE - BASE FLOATS			0
FF	99	36	25	2083	12	24.03.81	CFEM/EMH 5183 803	BASE STRUCTURE - PLAN VIEW			0
FF	99	36	25	2084	9	24.03.81	CFEM/EMH 5183 804	TRANSVERSAL SECTION PLANCHE 1			0
FF	99	36	25	2085	12	24.03.81	CFEM/EMH 5183 805	LONGITUDINAL SECTION			0
FF	99	36	25	2086	7	24.03.81	CFEM/EMH 5183 806	TRANSVERSAL SECTION PLANCHE 3			0
FF	99	36	25	2087	3	24.03.81	CFEM/EMH 5183 807	TOWING SUPPORT - BASE LOCKING			0
FF	99	36	25	2088	2	24.03.81	CFEM/EMH 5183 808	BASE - BATARDEAU - TOWING SIDE			0
FF	99	36	25	2089	2	24.03.81	CFEM/EMH 5183 809	BASE - BATARDEAU - LOCKING SIDE			0
FF	99	36	25	2090	3	24.03.81	CFEM/EMH 5183 810	BASE - ANTI YAWING DEVICE			0
~~FF~~	~~99~~	~~36~~	~~25~~	~~2091~~	~~3~~	~~13.02.81~~	~~CFEM/EMH 5183 1103~~	~~RECONNECTION PRINCIPLE~~	Cancelled		0
FF	99	36	25	2092	5	12.02.81	CFEM/EMH 5183 1111	OPERATION OF SWIVEL JOINT DURING TILTING			0
FF	99	36	25	2093	2	12.03.81	CFEM/EMH 5183 1211	CONNECTION. GENERAL ARRANGEMENT HORIZONTAL POSITION			0
FF	99	36	25	2094	2	12.02.81	CFEM/EMH 5183 1212	CONNECTION. GENERAL ARRANGEMENT VERTICAL POSITION			0
FF	99	36	25	2095	11	25.03.81	CFEM/EMH 5183 1213	CONNECTION PLATE STRUCTURE. GENERAL ARRANGEMENT			0
FF	99	36	25	2096	13	29.02.81	CFEM/EMH 5183 1214	CONNECTION PLATE STRUCTURE VERTICAL SECTIONS			1
FF	99	36	25	2097	2	11.02.81	CFEM/EMH 5183 1214(1)	MODIFICATION OF BALLASTING PIPING ON BOAT LANDING			1
FF	99	36	25	2098	13	25.03.81	CFEM/EMH 5183 1215	CONNECTION PLATE STRUCTURE HORIZONTAL SECTIONS			0
FF	99	36	25	2099	2	29.02.81	CFEM/EMH 5183 1218	STIFFENERS AT LOCKING BOLTS LEVEL			0

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ELF DRAWING No.				REVISION INDEX	REVISION DATE	ORIGINATOR REF. NUMBER	TITLE		SHEETS	RE
FF	99	36	25	2100	13	29.02.81	CFEM/EMH 5183 1219	PINS			
~~FF~~	~~99~~	~~36~~	~~25~~	~~2101~~	~~5~~	~~11.03.81~~	~~CFEM/EMH 5183 1220~~	~~SEAL BETWEEN CONNECTION PLATE AND BASE~~	Cancelled		1
~~FF~~	~~99~~	~~36~~	~~25~~	~~2102~~	~~10~~	~~13.02.81~~	~~CFEM/EMH 5183 1221~~	~~BOLTS - GENERAL ARRANGEMENT~~	Cancelled		0
~~FF~~	~~99~~	~~36~~	~~25~~	~~2103~~	~~12~~	~~13.03.81~~	~~CFEM/EMH 5183 1222~~	~~BOLTS - DETAILS~~	Cancelled		0
~~FF~~	~~99~~	~~36~~	~~25~~	~~2104~~	~~4~~	~~13.02.81~~	~~CFEM/EMH 5183 1223~~	~~WORKING JACKS~~	Cancelled		0
~~FF~~	~~99~~	~~36~~	~~25~~	~~2105~~	~~4~~	~~11.02.81~~	~~CFEM/EMH 5183 1224~~	~~SAFETY JACKS~~	Cancelled		1
~~FF~~	~~99~~	~~36~~	~~25~~	~~2106~~	~~10~~	~~13.02.81~~	~~CFEM/EMH 5183 1225~~	~~GENERAL SYSTEM FOR SAFETY BOLT~~	Cancelled		0
~~FF~~	~~99~~	~~36~~	~~25~~	~~2107~~	~~4~~	~~29.02.81~~	~~CFEM/EMH 5183 1227~~	~~PIN GUIDE~~	Cancelled		0
~~FF~~	~~99~~	~~36~~	~~25~~	~~2108~~	~~18~~	~~13.02.81~~	~~CFEM/EMH 5183 1228~~	~~GUIDE BOLT~~	Cancelled		0
~~FF~~	~~99~~	~~36~~	~~25~~	~~2109~~	~~9~~	~~13.02.81~~	~~CFEM/EMH 5183 1229~~	~~SAFETY BOLT DETAIL~~	Cancelled		0
~~FF~~	~~99~~	~~36~~	~~25~~	~~2110~~	~~3~~	~~12.02.81~~	~~CFEM/EMH 5183 1230~~	~~JOINTING BETWEEN ARTICULATION AND CONNECTION PLATE~~	Cancelled		0
~~FF~~	~~99~~	~~36~~	~~25~~	~~2111~~	~~2~~	~~11.02.81~~	~~CFEM/EMH 5183 1231~~	~~FIXING OF THE BEARINGS~~	Cancelled		2
FF	99	36	25	2112	3	11.02.81	CFEM/EMH 5183 1233	DRILLING FORMER FOR BEARINGS SEATINGS			1
~~FF~~	~~99~~	~~36~~	~~25~~	~~2113~~	~~5~~	~~13.02.81~~	~~CFEM/EMH 5183 1235~~	~~SEALING BETWEEN CONNECTION PLATE AND BASE~~	Cancelled		0
FF	99	36	25	2114	3	29.02.81	CFEM/EMH 5183 1236	CONNECTION PLATE STRUCTURE DETAIL			0
~~FF~~	~~99~~	~~36~~	~~25~~	~~2115~~	~~4~~	~~11.02.81~~	~~CFEM/EMH 5183 1237~~	~~CONNECTION JOINT SUPPORT ON PLATE~~	Cancelled		1
FF	99	36	25	2116	8	13.02.81	CFEM/EMH 5183 1238	CONNECTION JOINT SUPPORT ON BASE AND STABILIZERS			0
~~FF~~	~~99~~	~~36~~	~~25~~	~~2117~~	~~4~~	~~29.02.81~~	~~CFEM/EMH 5183 1239~~	~~CONNECTION PLATE. TABLE FOR DISMOUNTING OF SWIVEL JOIN~~	Cancelled		0
FF	99	36	25	2118	2	13.02.81	CFEM/EMH 5183 1241	EMERGENCY JACK SUPPORT			0
FF	99	36	25	2119	5	29.02.81	CFEM/EMH 5183 1242	CONNECTION PLATE FORK			0

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~~FF 99 36 25 2120~~	~~2~~	~~13.02.81~~	~~CFEM/EMH 5183 1243~~	~~WEDGING UNDER SUPPORT OF CONNECTION JOINT~~	~~Cancelled~~		0
~~FF 99 36 25 2121~~	~~2~~	~~29.02.81~~	~~CFEM/EMH 5183 1244~~	~~ELECTRICAL CONNECTIONS OF LOCKING SYSTEM~~	~~Cancelled~~		0
~~FF 99 36 25 2122~~	~~3~~	~~29.02.81~~	~~CFEM/EMH 5183 1245~~	~~ELECTRICAL CONNECTION U. JOINT/CONNECTION PLATE~~	~~Cancelled~~		0
FF 99 36 25 2123	2	13.02.81	CFEM/EMH 5183 1246	PROTECTION ON GAS VALVES ON BASE			0
FF 99 36 25 2124	3	29.03.81	CFEM/EMH 5183 1247	CONNECTION PLATE/COLUMN CLAMPING. GENERAL ARRGT.			0
~~FF 99 36 25 2125~~	~~1~~	~~11.02.81~~	~~CFEM/EMH 5183 1248~~	~~CONCRETE BALLAST TOWING DEVICES~~	~~Cancelled~~		1
~~FF 99 36 25 2126~~	~~3~~	~~29.02.81~~	~~CFEM/EMH 5183 1249~~	~~CONNECTION PLATE FORK DETAIL FOR CLAMPING~~			
~~FF 99 36 25 2127~~	~~2~~	~~11.02.81~~	~~CFEM/EMH 5183 1250~~	~~PROTECTION OF SAFETY LOCKING JACKS~~	~~Cancelled~~		1
FF 99 36 25 2128	3	29.02.81	CFEM/EMH 5183 1251	ANTI YAWING CABLE. GENERAL ARRANGEMENT			0
FF 99 36 25 2129	4	13.02.81	CFEM/EMH 5183 1252	ANTI YAWING CABLE DETAILS			0
FF 99 36 25 2130	2	29.02.81	CFEM/EMH 5183 1253	ANTI YAWING CONNECTIONS. COLUMN IN HORIZONTAL POSITION			0
FF 99 36 25 2131	1	29.02.81	CFEM/EMH 5183 1254	BASE/COLUMN CONNECTION - GUIDING PIECES			0
~~FF 99 36 25 2132~~	~~1~~	~~13.02.81~~	~~CFEM/EMH 5183 1255~~	~~MECHANICAL LOCKING OF SAFETY JACKS. (PROJECT)~~	~~Cancelled~~		0
~~FF 99 36 25 2133~~	~~1~~	~~11.02.81~~	~~CFEM/EMH 5183 1256~~	~~MECHANICAL SAFETY LOCKING SYSTEM. (PROJECT)~~	~~Cancelled~~		1
~~FF 99 36 25 2134~~	~~4~~	~~11.02.81~~	~~CFEM/EMH 5183 1300~~	~~DATA ARTICULATION (NOMENCLATURE)~~	~~Cancelled~~		2
~~FF 99 36 25 2135~~	~~8~~	~~12.02.81~~	~~CFEM/EMH 5183 1303~~	~~GENERAL ARRANGEMENT ON UNIVERSAL JOINT~~	~~Cancelled~~		0
~~FF 99 36 25 2136~~	~~15~~	~~12.02.81~~	~~CFEM/EMH 5183 1304~~	~~UNIVERSAL JOINT ASSEMBLING~~	~~Cancelled~~		0
~~FF 99 36 25 2137~~	~~9~~	~~12.02.81~~	~~CFEM/EMH 5183 1305~~	~~UNIVERSAL JOINT BEFORE ASSEMBLING~~	~~Cancelled~~		0
~~FF 99 36 25 2138~~	~~12~~	~~13.02.81~~	~~CFEM/EMH 5183 1306~~	~~BEARING~~	~~Cancelled~~		1
~~FF 99 36 25 2139~~	~~3~~	~~11.02.81~~	~~CFEM/EMH 5183 1308~~	~~BUSHING~~			

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ELF DRAWING No.	REVISION INDEX	REVISION DATE	ORIGINATOR REF. NUMBER	TITLE		SHEETS	SIZE A
FF 99 36 25 2140	6	29.02.81	CFEM/EMH 5183 1309	FLANGE FOR SEAL OF BEARING	Cancelled		0
FF 99 36 25 2141	6	12.02.81	CFEM/EMH 5183 1310	FLANGE FOR LOCATION OF SEAL OF BEARING	Cancelled		0
FF 99 36 25 2142	10	12.02.81	CFEM/EMH 5183 1311	SWIVEL JOINT SUPPORT	Cancelled		0
FF 99 36 25 2143	6	11.02.81	CFEM/EMH 5183 1312	STRUTS	Cancelled		1
FF 99 36 25 2144	15	12.02.81	CFEM/EMH 5183 1313	FLANGES FOR SWIVEL JOINT	Cancelled		0
FF 99 36 25 2145	9	12.02.81	CFEM/EMH 5183 1314	ARTICULATION GENERAL ARRANGEMENTS	Cancelled		0
FF 99 36 25 2146	6	11.02.81	CFEM/EMH 5183 1315	SET SCREW OF BEARING	Cancelled		1
FF 99 36 25 2147	4	13.02.81	CFEM/EMH 5183 1316	STOP PIECE FOR ROTATION OF SWIVEL JOINT FLANGE	Cancelled		0
FF 99 36 25 2148	3	11.02.81	CFEM/EMH 5183 1317	CONDUCTOR RAILS FOR SWIVEL JOINT	Cancelled		1
FF 99 36 25 2149	2	11.02.81	CFEM/EMH 5183 1318	CONDUCTOR RAILS	Cancelled		1
FF 99 36 25 2150	3	13.02.81	CFEM/EMH 5183 1319	STOP PIECE FOR ROTATION OF SWIVEL JOINT FLANGE ON BEARING	Cancelled		0
FF 99 36 25 2151	6	12.03.81	CFEM/EMH 5183 1320	SEALING FOR BEARING	Cancelled		0
FF 99 36 25 2152	3	13.02.81	CFEM/EMH 5183 1321	SEAL OF BEARING STRUTS AND ERECTION SYSTEM	Cancelled		0
FF 99 36 25 2153	2	11.02.81	CFEM/EMH 5183 1322	SPRINGS	Cancelled		
FF 99 36 25 2154	2	13.02.81	CFEM/EMH 5183 1323	FLANGE FOR BEARING JOINT SUPPORT ASSEMBLING	Cancelled		0
FF 99 36 25 2155	3	11.02.81	CFEM/EMH 5183 1324	UNIVERSAL JOINT AND BEARING ASSEMBLING	Cancelled		1
FF 99 36 25 2156	2	29.02.81	CFEM/EMH 5183 1328	DIAGRAM FOR TIGHTNESS TEST OF UNIVERSAL JOINT			0
FF 99 36 25 2157	2	13.02.81	CFEM/EMH 5183 1329	PIPING FOR TIGHTNESS TEST OF UNIVERSAL JOINT			0
FF 99 36 25 2158	3	11.02.81	CFEM/EMH 5183 1330	SWIVEL JOINTS GENERAL ARRANGEMENT	Cancelled		1
FF 99 36 25 2159	6	11.02.81	CFEM/EMH 5183 1332	JACKS FOR SWIVEL JOINTS	Cancelled		1

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~~FF~~	~~99~~	~~36~~	~~25~~	~~2160~~	~~3~~	~~11.02.81~~	~~CFEM/EMH 5183 1333~~	~~CLAMPS FOR CARRIAGE OF SWIVEL JOINT~~	Cancelled	A1
~~FF~~	~~99~~	~~36~~	~~25~~	~~2161~~	~~1~~	~~06.04.81~~	~~CFEM/EMH 5183 1334~~	~~FIXATION SYSTEM FOR SWIVEL JOINT~~	Cancelled	A1
~~FF~~	~~99~~	~~36~~	~~25~~	~~2162~~			~~CFEM/EMH 5183 1335~~	~~TESTING MACHINE. GENERAL ARRANGEMENT~~	Missing	
FF	99	36	25	2163	1	11.02.81	CFEM/EMH 5183 1336	SWIVEL JOINT TESTING MACHINE. DETAILS		A1
~~FF~~	~~99~~	~~36~~	~~25~~	~~2164~~	~~2~~	~~13.02.81~~	~~CFEM/EMH 5183 1337~~	~~STOPPLATE FOR TORSION SEAL. ASSEMBLING~~	Cancelled	A0
FF	99	36	25	2165	1	13.02.81	CFEM/EMH 5183 1350	ARTICULATION FORMER FOR PIPING ASSEMBLING		A0
FF	99	36	25	2166	2	11.02.81	CFEM/EMH 5183 1351	SPACE OCCUPATED BY UNIVERSAL JOINT FOR CARRYING		A1
FF	99	36	25	2167	11	13.02.81	CFEM/EMH 5183 1402	GENERAL PIPING GAS 24" BETWEEN BASE AND COLUMN		A0
~~FF~~	~~99~~	~~36~~	~~25~~	~~2168~~	~~8~~	~~13.02.81~~	~~CFEM/EMH 5183 1409~~	~~HYDRAULIC PIPING SCHEME~~	Cancelled	A0
~~FF~~	~~99~~	~~36~~	~~25~~	~~2169~~	~~6~~	~~12.02.81~~	~~CFEM/EMH 5183 1410~~	~~BALLAST PIPING SCHEME~~	Cancelled	A0
FF	99	36	25	2170	7	29.02.81	CFEM/EMH 5183 1411	HYDRAULIC AND BALLASTING PIPING ON LATTICE STRUCTURE		A0
FF	99	36	25	2171	6	29.02.81	CFEM/EMH 5183 1412	HYDRAULIC AND BALLASTING PIPING ON MAIN FLOAT AND CHIMNEY		A0
FF	99	36	25	2172	5	29.02.81	CFEM/EMH 5183 1413	HYDRAULIC AND BALLASTING PIPING ON AUXI. FLOATS AND BALLASTS		A0
FF	99	36	25	2173	6	29.02.81	CFEM/EMH 5183 1415	BALLASTING CONNECTION MAIN FLOAT		A0
FF	99	36	25	2174	4	29.02.81	CFEM/EMH 5183 1416	BALLASTING CONNECTION AUXILIARY FLOATS		A0
FF	99	36	25	2175	4	29.02.81	CFEM/EMH 5183 1417	BALLASTING CONNECTION BASE FLOATS		A0
FF	99	36	25	2176	7	29.02.81	CFEM/EMH 5183 1418	BASE BALLASTING DRAWING. DETAIL OF CONNECTION PIPING		A0
FF	99	36	25	2177	2	29.02.81	CFEM/EMH 5183 1419	HYDRAULIC PIPING AIR & GAS - CHIMNEY - ROOF		A0
FF	99	36	25	2178	8	25.03.81	CFEM/EMH 5183 1422/1	LOCATION OF ANTI-SCOURING DEVICE		A0
FF	99	36	25	2179	5	25.03.81	CFEM/EMH 5183 1422/2	FITTING FOR ANTI-SCOURING PROTECTION TYPE A		A0

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FF	99	36	25	2180	5	25.03.81	CFEM/EMH 5183 1422/3	FITTING FOR ANTI-SCOURING PROTECTION. TYPE C			0
FF	99	36	25	2181	5	25.03.81	CFEM/EMH 5183 1422/4	FITTING FOR ANTI-SCOURING PROTECTION TYPE B			0
FF	99	36	25	2182	2	25.03.81	CFEM/EMH 5183 1422/5	PLATFORM ON ANTI SCOURING PROTECTION			0
FF	99	36	25	2183	4	25.03.81	CFEM/EMH 5183 1422/6	LOCKING SYSTEM FOR ANTI-SCOURING			0
FF	99	36	25	2184	6	13.02.81	CFEM/EMH 5183 1424/1	BASE TOWING ARRANGEMENT			0
FF	99	36	25	2185	2	13.02.81	CFEM/EMH 5183 1424/2	OPENING IN STRUCTURE EYE OF TOWING			0
FF	99	36	25	2186	7	13.02.81	CFEM/EMH 5183 1427/1	TOWING AND ANCHORAGE GENERAL ARRANGEMENT			0
FF	99	36	25	2187	1	29.02.81	CFEM/EMH 5183 1427/3	ANCHORAGE ARRANGEMENT ON TOP OF MAIN FLOAT			0
FF	99	36	25	2188	2	29.02.81	CFEM/EMH 5183 1428/1	LADDERS. GENERAL ARRANGEMENT ON MAIN FLOAT AND CHIMNEY			
FF	99	36	25	2189	4	29.02.81	CFEM/EMH 5183 1428/2	LADDERS. GENERAL ARRANGEMENT ON MAIN FLOAT AND CHIMNEY			
FF	99	36	25	2190	2	29.02.81	CFEM/EMH 5183 1429	CONCRETE BALLAST FLOODING VALVE. CONNECTION			0
FF	99	36	25	2191	1	13.02.81	CFEM/EMH 5183 1430	DETAILS OF STEEL BELLMOUTH			0
FF	99	36	25	2192	4	13.02.81	CFEM/EMH 5183 1431	FILLING AND DRAINING ON CHIMNEY AND MAIN FLOAT			0
~~FF~~	~~99~~	~~36~~	~~25~~	~~2193~~	~~5~~	~~29.02.81~~	~~CFEM/EMH 5183 1432~~	~~HYDRAULIC PIPING AND PANEL. CHIMNEY 112, 024~~	Cancelled		0
~~FF~~	~~99~~	~~36~~	~~25~~	~~2194~~	~~2~~	~~11.02.81~~	~~CFEM/EMH 5183 1432/1~~	~~ACCES LADDER TO HYDRAULIC PANEL~~	Cancelled		1
FF	99	36	25	2195	4	29.02.81	CFEM/EMH 5183 1433	GENERAL ARRANGEMENT OF HYDRAULIC, AIR, GAS PIPING ON BASE			0
FF	99	36	25	2196	3	29.02.81	CFEM/EMH 5183 1434	REMOTE CONTROL FOR RISE AND FALL VALVE			0
FF	99	36	25	2197	4	13.02.81	CFEM/EMH 5183 1435	STEEL BELLMOUTN. GENERAL ARRANGEMENT			0
~~FF~~	~~99~~	~~36~~	~~25~~	~~2198~~	~~4~~	~~13.02.81~~	~~CFEM/EMH 5183 1437~~	~~AIR-AND GAS LINES ON 42" STACKS~~	Cancelled		0
~~FF~~	~~99~~	~~36~~	~~25~~	~~2199~~	~~3~~	~~13.02.81~~	~~CFEM/EMH 5183 1438~~	~~CARDAN LUBRICATION PIPING~~	Cancelled		0

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FF	99	36	25	2200	4	12.02.81	CFEM/EMH 5183 1439/0	PIPING ON BOTTOM OF CONCRETE BALLAST	Cancelled	0
FF	99	36	25	2201	1	29.02.81	CFEM/EMH 5183 1439/1	24" GAS VALVES HYDRAULIC PIPING. BELOW CARDAN		0
FF	99	36	25	2202	2	29.02.81	CFEM/EMH 5183 1440	DRAUGHTS INDICATIONS ON MEMBER C		0
FF	99	36	25	2203	4	11.02.81	CFEM/EMH 5183 1441	AUXILIARY FLOATS FILLING UP BY GRAVITY		1
FF	99	36	25	2204	2	13.02.81	CFEM/EMH 5183 1443	BALLASTING PANEL ON SUPPLY	Cancelled	0
FF	99	36	25	2205	2	13.02.81	CFEM/EMH 5183 1444	BALLASTING PANEL PROTECTION	Cancelled	0
FF	99	36	25	2206	1	13.02.81	CFEM/EMH 5183 1446	CONNECTION PLATE FLEXIBLE HOSES ENDS LOCATION	Cancelled	0
FF	99	36	25	2207	2	13.02.81	CFEM/EMH 5183 1446	CONNECTION PLATE FLEXIBLE HOSES END LOCATION	Cancelled	0
FF	99	36	25	2208	3	13.02.81	CFEM/EMH 5183 1447	CONNECTION PLATE FLEXIBLE HOSES	Cancelled	0
FF	99	36	25	2209	4	11.02.81	CFEM/EMH 5183 1448	MESSENGER LINES IN CONDUCTOR CABLE		1
FF	99	36	25	2210	3	11.02.81	CFEM/EMH 5183 1449	DRAUGHTS SCALE IN HORIZONTAL POSITION		1
FF	99	36	25	2211	5	29.02.81	CFEM/EMH 5183 1450	LOCKING SYSTEM BETWEEN BASE AND COLUMN		0
FF	99	36	25	2212	6	29.02.81	CFEM/EMH 5183 1451	LOCKING SYSTEM. DETAIL	Cancelled	0
FF	99	36	25	2213	11	13.02.81	CFEM/EMH 5183 1452	LOCKING SYSTEM. GUIDE BOLT DETAIL	Cancelled	0
FF	99	36	25	2214	5	13.02.81	CFEM/EMH 5183 1453	LOCKING SYSTEM. BOLT DETAIL	Cancelled	0
FF	99	36	25	2215	5	13.02.81	CFEM/EMH 5183 1454	LOCKING SYSTEM. BOLT GENERAL ARRANGEMENT	Cancelled	0
FF	99	36	25	2216	2	13.02.81	CFEM/EMH 5183 1455	LOCKING SYSTEM. WORKING JACK	Cancelled	0
FF	99	36	25	2217	5	13.02.81	CFEM/EMH 5183 1456	LOCKING SYSTEM. BOLTING ANCHORING PLATE		0
FF	99	36	25	2218	10	29.02.81	CFEM/EMH 5183 1457	LOCKING SYSTEM. BOLTING ANCHORING PLATE. DETAIL		0
FF	99	36	25	2219	2	13.02.81	CFEM/EMH 5183 1458	LOCKING SYSTEM. BASE FOOT GENERAL ARRANGEMENT		0

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FF	99	36	25	2220	3	29.02.81	CFEM/EMH 5183 1459	LOCKING SYSTEM. COLUMN FOOT. GENERAL ARRANGEMENT			0
FF	99	36	25	2221	1	3.02.81	CFEM/EMH 5183 1460	LOCKING SYSTEM. COLUMN FOOT AND BASE FOOT. DETAIL			0
~~FF~~	~~99~~	~~36~~	~~25~~	~~2222~~	~~3~~	~~3.02.81~~	~~CFEM/EMH 5183 1461~~	~~LOCKING SYSTEM. ANCHORING PLATE MOUNTING~~	Cancelled		0
~~FF~~	~~99~~	~~36~~	~~25~~	~~2223~~	~~2~~	~~3.02.81~~	~~CFEM/EMH 5183 1462~~	~~LOCKING SYSTEM. LOCKING POSITION~~	Cancelled		0
~~FF~~	~~99~~	~~36~~	~~25~~	~~2224~~	~~3~~	~~3.02.81~~	~~CFEM/EMH 5183 1463~~	~~LOCKING SYSTEM. LOCKING BOLTS PROTECTION~~	Cancelled		0
FF	99	36	25	2225	2	3.02.81	CFEM/EMH 5183 1464	LOCKING SYSTEM. JACKS CLAMPING PLATES			
~~FF~~	~~99~~	~~36~~	~~25~~	~~2226~~	~~1~~	~~3.02.81~~	~~CFEM/EMH 5183 1466~~	~~LOCKING SYSTEM BETWEEN BASE AND COLUMN~~	Cancelled		0
FF	99	36	25	2227	2	25.03.81	CFEM/EMH 5183 1471	CATHODIC PROTECTION. MAIN FLOAT. TIDAL TANK			0
FF	99	36	25	2228	3	25.03.81	CFEM/EMH 5183 1472	CATHODIC PROTECTION. INSTALLATION ON BASE			0
FF	99	36	25	2229	2	25.03.81	CFEM/EMH 5183 1473	CATHODIC PROTECTION. AUXILIARY FLOATS			0
FF	99	36	25	2230	3	11.02.81	CFEM/EMH 5183 1474	PLATFORMS IMPLANTATION			1
FF	99	36	25	2231	4	13.02.81	CFEM/EMH 5183 1475	ARTICULATED SUPPORT FOR HOSES			0
FF	99	36	25	2232	4	13.02.81	CFEM/EMH 5183 1476	REMOTE CONTROL OF BALLASTING VALVES			0
FF	99	36	25	2233	3	29.02.81	CFEM/EMH 5183 1477	PIPING OF LOCKING BOLT FOR TOWING			0
FF	99	36	25	2234	2	29.02.81	CFEM/EMH 5183 1501	DRAUGHTS I, II, III, IV			0
FF	99	36	25	2235	2	29.02.81	CFEM/EMH 5183 1502	DRAUGHTS V, VI, VII, VIII			0
FF	99	36	25	2236	1	29.02.81	CFEM/EMH 5183 1503	DRAUGHTS			0
FF	99	36	25	2237	1	06.04.81	CFEM/EMH 5183 1504	DRAUGHTS			0
FF	99	36	25	2238	2	29.02.81	CFEM/EMH 5183 1505	WATERLINES OF THE HORIZONTAL COLUMN			0
FF	99	36	25	2239	1	29.02.81	CFEM/EMH 5183 1506	HULL CURVES			0

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FF							~~CFEM/EMH 5183 1520~~	~~PROCEDURE D'INSTALLATION VERSION I~~	Missing		
FF							~~CFEM/EMH 5183 1521~~	~~PROCEDURE D'INSTALLATION VERSION II~~	Missing		
FF							~~CFEM/EMH 5183 1522~~	~~PROCEDURE DE BASCULEMENT~~	Missing		
FF	99	36	25	2240	1	29.02.81	CFEM/EMH 5183 1523	TILTING CURVES			0
FF							CFEM/EMH 5183 1524	PROCEDURE DE PREPARATION AU BASCULEMENT II	Missing		
FF							~~CFEM/EMH 5183 1525~~	~~PROCEDURE D'INSTALLATION~~	Missing		
FF	99	36	25	2241	1	29.02.81	CFEM/EMH 5183 1526	INCLINOMETER. GENERAL ARRANGEMENT			0
FF	99	36	25	2242	1	29.02.81	CFEM/EMH 5183 1527	INCLINOMETER DETAIL			0
FF	99	36	25	2243	1	29.02.81	CFEM/EMH 5183 1530	TILTING CURVES "COURBES MINI"			0
FF	99	36	25	2244	1	29.02.81	CFEM/EMH 5183 1531	TILTING CURVES "COURBES MOYENNES"			0
FF	99	36	25	2245	1	29.02.81	CFEM/EMH 5183 1532	TILTING CURVES "COURBES MAXI"			0
FF											
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DRAWING REGISTER

EAN/OCD DRAWINGS 1980

ELF DRAWING No.	REVISION INDEX	REVISION DATE	ORIGINATOR REF NUMBER	TITLE		SHEETS
FF 99 36 25 2300	2	30.7.80	EAN	PROCEDURES - LIST OF PHASES	BOOK	
FF 99 36 25 2301	0	14.4.80	EAN	PROCEDURES - PHASE I PREPARATION FOR DISCONNECTION	"	4
FF 99 36 25 2302	0	14.4.80	EAN	PROCEDRUES - PHASE II MARINE PREPARATION FOR TOWING	"	4
FF 99 36 25 2303	0	14.4.80	EAN	PROCEDURES - PHASE III BASE/COLUMN DISCONNECTION	"	4
FF 99 36 25 2304	0	14.4.80	EAN	PROCEDURES - PHASE IV TOWING FROM FRIGG TO FJORD-MOORING	"	4
FF 99 36 25 2305	0	14.4.80	EAN	PROCEDURES - PHASE V WORK TO BE DONE BEFORE TILTING	"	4
FF 99 36 25 2306	0	14.4.80	EAN	PROCEDURES - PHASE VI TILTING TO HORIZONTAL POSITION	"	4
FF 99 36 25 2307	0	14.4.80	EAN	PROCEDURES - PHASE VII INSTALLATION IN DRY DOCK	"	4
FF 99 36 25 2308	0	22.5.80	EAN	PROCEDURES - PHASE VIII WORK TO BE DONE IN DRY DOCK	"	4
FF 99 36 25 2309	2	30.7.80	EAN	PROCEDURES - PHASE IX UNDER WATER WORK ON BASE	"	4
FF 99 36 25 2310	0	14.4.80	EAN	PROCEDURES - PHASE X TOWING OUT OF DRY DOCK AND MOORING	"	4
FF 99 36 25 2311	0	30.7.80	EAN	PROCEDURES - PHASE XI TILTING TO VERTICAL POSITION	"	4
FF 99 36 25 2312	0	30.7.80	EAN	PROCEDURES - PHASE XII WORK TO BE DONE AFTER TILTING	"	4
FF 99 36 25 2313	0	14.4.80	EAN	PROCEDURES - PHASE XIII TOWING FROM FJORD TO FRIGG FIELD	"	4
FF 99 36 25 2314	0	30.7.80	EAN	PROCEDURES - PHASE XIV UNDER WATER BASE INSPECTION FOR RE	0"	4
FF 99 36 25 2315	0	30.7.80	EAN	PROCEDURES - PHASE XV BASE/COLUMN CONNECTION	"	4
FF 99 36 25 2316	0	30.7.80	EAN	PROCEDURES - PHASE XVI COMPLETION	"	4
FF 99 36 25 2317	1	21.8.80	EAN	HYDROSTATIC AND AIR PRESSURES DURING TILTING		1
FF 99 36 25 2318	1	11.11.80	EAN	TILTING OF HORIZONTAL POSITION DIAGRAM		1
FF 99 36 25 2319	0	14.8.80	EAN	DETAIL OF DRAIN AND VENT VALVES IN BALLAST BOX		1

INSTALLATION: FLARE

SPECIALITY:

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EAN/OCD DRAWINGS 1980

	ELF DRAWING No.					REVISION INDEX	REVISION DATE	ORIGINATOR REF NUMBER	TITLE		SHEETS SIZE A
	~~FF~~	~~99~~	~~36~~	~~25~~	~~2320~~	~~0~~	~~26.6.80~~	~~EAN~~	~~LIFTING BEAM FOR 42" STACKS~~	Cancelled	1
	FF	99	36	25	2321	1	25.7.80	EAN	DETAIL OF PADEYES FOR 42" NB STACKS		1
	FF	99	36	25	2322	0	9.7.80	EAN	ELECTRICAL BATTERY STORAGE BOX		1
	FF	99	36	25	2323	0	24.6.80	EAN	TIGHTENING COVER FOR GUIDE BOLT	Cancelled	
X	~~FF~~	~~99~~	~~36~~	~~25~~	~~2324~~	~~1~~	~~22.5.80~~	~~EAN~~	~~MANHOLE EXTENSION TO CARRY FLEX. PIPE AND ELECT. CABLE~~		4
X	~~FF~~	~~99~~	~~36~~	~~25~~	~~2325~~	~~0~~	~~7.5.80~~	~~EAN~~	~~BLIND FLANGES FOR CLOSING THE 2 CONDUCTOR CABLES~~		4
X	~~FF~~	~~99~~	~~36~~	~~25~~	~~2326~~	~~0~~	~~7.5.80~~	~~EAN~~	~~LUG FOR BLIND FLANGES~~		4
X	~~FF~~	~~99~~	~~36~~	~~25~~	~~2327~~	~~0~~	~~12.5.80~~	~~EAN~~	~~COVER PLATE FOR CONNECTION SEALS SEATS ON BASE~~		4
X	~~FF~~	~~99~~	~~36~~	~~25~~	~~2328~~	~~0~~	~~6.5.80~~	~~EAN~~	~~CENTERING PIN FOR INSTALLATION OF ARTICULATION~~		4
	FF	99	36	25	2329	0	18.4.80	EAN	EMERGENCY JACKS AS PER CYLINDER SERVICE DWG 445.32		1
	FF	99	36	25	2330	0	21.4.81	EAN	REMOVAL OF ELECTRICAL CABLES -ARTIFICIAL BELLMOUTH		
	FF	99	36	25	2331	1	1.5.80	EAN	REMOVAL OF ELECTRICAL CABLES -SUPPORT FRAME GENER. ARRGT		1
	FF	99	36	25	2332	2	7.8.80	EAN	REMOVAL OF ELECTRICAL CABLES -SUPPORT FRAME (ABOVE MANHOLE)		1
	FF	99	36	25	2333	0	21.4.80	EAN	REMOVAL OF ELECTRICAL CABLES -SUPPORT FRAME (SUPPLY BOAT SIDE)		1
	FF	99	36	25	2334	3	11.11.80	EAN	MOUNTING OF WINCH ON TOP OF CHIMNEY - PLATFORM		1
	FF	99	36	25	2335	1	11.11.80	EAN	PIN AND EMERGENCY JACK SUPPORT. WOOD MODEL		1
	FF	99	36	25	2336	1	11.11.80	EAN	COVER COUNTER BALANCE WEIGHT ASSEMBLY		2
	FF	99	36	25	2337	0	18. 4.80	EAN	JIB ARRANGEMENTS FOR LIFTING ATLAS COPCO WINCH & ELECT. CABLE	Project	
	FF	99	36	25	2338	0	18. 4.80	EAN	JIB FOR LIFTING ATLAS COPCO WINCH	Project	1
	FF	99	36	25	2339	0	18. 4.80	EAN	JIB SUPPORT	Project	1

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DRAWING REGISTER

EAN/OCD DRAWINGS 1980

ELF DRAWING No.					REVISION INDEX	REVISION DATE	ORIGINATOR REF NUMBER	TITLE		SHEET	No. OF SHEETS
FF	99	36	25	2340	0	18.4.80		PIVOT BRACKET FOR JIB	Project		1
FF	99	36	25	2341	0	18.4.80		PIVOT BRACKET FOR JIB SUPPORT	Project		1
FF	99	36	25	2342	0	18.4.80		JIB ATTACHEMENTS	Project		1
FF	99	36	25	2343	0	18.4.80		JIB CABLE STAY ANCHOR	Project		1
FF	99	36	25	2344	0	18.4.80		PULLEY CABLE ANCHOR	Project		1
FF	99	36	25	2345	0	18.4.80		WINCH SUPPORTS	Project		1
FF	99	36	25	2346	0	18.4.80		REINFORCEMENT TO TOP OF FUNNEL FOR JIB CRANE	Project		1
X ~~FF~~	~~99~~	~~36~~	~~25~~	~~2347~~	~~0~~	~~18.4.80~~		~~BACKSTOP FOR JIB~~	~~Project~~		~~1~~
FF	99	36	25	2348	1	11.11.80		MOUNTING ON INGERSOLL WINCH ON TOP OF CHIMNEY			1
FF	99	36	25	2349	0	20.6.80		MODIFICATION TO FITTING OF 42" STACKS	Cancelled		1
FF	99	36	25	2350	1	11.11.80		CABLE GUIDE - CONCRETE BALLAST			1
FF	99	36	25	2351	1	11.11.80		CABLE GUIDE - WATER BALLAST TANK			1
FF	99	36	25	2352	1	11.11.80		CABLE GUIDE - MAIN FLOAT			1
FF	99	36	25	2353	1	11.11.80		MODIFICATION TO FLOOR PLATES AROUND WATER BALLAST (MC)			1
~~FF~~	~~99~~	~~36~~	~~25~~	~~2354~~	~~0~~	~~18.04.80~~		~~MODIFICATION TO NAVIGATION LIGHTS SUPPORT COLUMN FOOT~~	Cancelled		1
FF	99	36	25	2355	1	11.11.80		MODIFICATION TO FLOOR PLATES AROUND CONCRETE BALLAST (MC)			1
FF	99	36	25	2356	1	11.11.80		MODIFICATION TO EXISTING FUNNEL LADDER			1
FF	99	36	25	2357	1	11.11.80		ANCHOR BRACKET FOR RECONNECTION			1
FF	99	36	25	2358	1	11.11.80		ADDITIONAL LADDERS, GRATINGS AT LEVEL 114,283			1
FF	99	36	25	2359	3	11.11.80		COVER FOR INGERSOLL WINCH			1

INSTALLATION: FLARE

SPECIALITY:

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EAN/OCD DRAWINGS 1980

ELF DRAWING No.					REVISION INDEX	REVISION DATE	ORIGINATOR REF. NUMBER	TITLE		SHEETS
FF	99	36	25	2360	1	11.11.80	EAN	FLARE STACK LIFTING WITH FLOATING CRANE		1
FF	99	36	25	2361	1	11.11.80	EAN	MOORING PATTERN IN FRIGG FIELD (PHASE III)		1
FF	99	36	25	2362	1	11.11.80	EAN	MOORING PATTERN IN AUSTJUPET		1
FF	99	36	25	2363	2	11.11.80	EAN	RIGGING EQUIPMENT		1
FF	99	36	25	2364	0		EAN	PROCEDURES -PH.1. OPER.P. PIPE FOR VALVE NO.33 SKETCH 1		4
FF	99	36	25	2365	0		EAN	PROCEDURES -PH.1. OPER.P. HOSE FOR VALVE NO.33 SKETCH 1b		4
FF	99	36	25	2366	0		EAN	PROCEDURES -PH.1. OPER.P. PIPE FOR VALVE NO.34&36 SKETCH 2		4
FF	99	36	25	2367	0		EAN	PROCEDURES -PH.1. OPER.B. MANOMETRE FOR M.F VALVE SKETCH 3		4
FF	99	36	25	2368	0		EAN	PROCEDURES -PH.1. OPER.P. BALLASTING CIRCUIT SKETCH 4		4
FF	99	36	25	2369	0		EAN	PROCEDURES -PH.1. OPER.F. CROSS PIPE FOR EM. JACKS SKETCH 5		4
FF	99	36	25	2370	0		EAN	PROCEDURES -PH.8. AXLE FOR 42" PIPE IN CHIMNEY	1/2	4
FF	99	36	25	2371			EAN	PROCEDURES -PH.8 AXLE FOR 42" PIPE IN CHIMNEY	2/2	4
FF	99	36	25	2372	0	30.7.80	EAN	CABLES OUTLET TO FOG HORN & LIGHTS		2
FF	99	36	25	2373	3	17.11.80	BJERCK S.328 1760	HYDRAULIC TENSIONNING DEVICE FOR CONNECT PLATE CLAMPING		1
FF	99	36	25	2374	1	17.11.80	EAN	OPERATIONAL LENGTH OF HYDRAULIC TENSIONN. DEVIC.		2
FF	99	36	25	2375	1	17.11.80	EAN	IDENTIFICATION MARKS ON F.P. STRUCTURE		3
FF	99	36	25	2376	0	17.11.80	CYLINDER SERVICE 447.56	WORKING JACKS. GENERAL ARRANGEMENT	1/2	3
FF	99	36	25	2377	0	17.11.80	CYLINDER SERVICE 449.01	WORKING JACKS. ASSEMBLY	2/2	2
FF	99	36	25	2378	0	17.11.80	CYLINDER SERVICE 445.32	EMERGENCY JACKS		2
FF	99	36	25	2379	0	31.03.81	EAN	POSITION OF ANODES ON LATTICE STRUCTURE		1

INSTALLATION: FLARE

SPECIALITY:

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EAN/OCD DRAWINGS 1980

ELF DRAWING No	REVISION INDEX	REVISION DATE	ORIGINATOR REF NUMBER	TITLE	CANCELLED
FF 99 36 25 2380	0	01.04.81	EAN	POSITION OF ANODES ON CONNECTION PLATE	
FF 99 36 25 2381	0	29.04.81	EAN	ANODES POSITION ON STRUCTURE GENERAL ARRANGEMENT	

INSTALLATION FLARE

SPECIALITY:

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DRAWING REGISTER

EMH DRAWINGS 1980

ELF DRAWING No.	REVISION INDEX	REVISION DATE	ORIGINATOR REF. NUMBER	TITLE		SHEETS	SIZE
FF 99 36 25 2400	3	12.11.80	EMH 5450 1220	SEAL BETWEEN CONNECTION PLATE AND BASE			1
FF 99 36 25 2401	5	18.12.80	EMH 5450 1221 A	LOCKING SYSTEM GENERAL ARRGT. SOLUTION A			0
~~FF 99 36 25 2402~~	~~3~~	~~12.11.80~~	~~EMH 5450 1221 B~~	~~LOCKING SYSTEM GENERAL ARRGT. SOLUTION B~~	Cancelled		0
FF 99 36 25 2403	4	12.11.80	EMH 5450 1223	WORKING JACKS			0
FF 99 36 25 2404	1	12.11.80	EMH 5450 1230	JOINING BETWEEN ARTICULATION AND CONNECTION PLATE			0
FF 99 36 25 2405	2	11.11.80	EMH 5450 1231	FIXING OF THE BEARINGS			2
FF 99 36 25 2406	3	12.11.80	EMH 5450 1235	SEALING BETWEEN CONNECTION PLATE AND BASE - GENERAL ARRGT.			0
FF 99 36 25 2407	4	12.11.80	EMH 5450 1237	SEAT OF CONNECTION JOINT ON PLATE			0
FF 99 36 25 2408	2	12.11.80	EMH 5450 1260	EMERGENCY JACKS			0
FF 99 36 25 2409	2	12.11.80	EMH 5450 1261	MACHINING ON C.PLATE FOR MECHANICAL GUIDE BOLTS			0
FF							
FF 99 36 25 2410	4	12.11.80	EMH 2450 1262 A	MECHANICAL GUIDE BOLT SOLUTION A NO. 1 NO. 3			0
FF 99 36 25 2411	4	12.11.80	EMH 5450 1262 B	MECHANICAL GUIDE BOLT SOLUTION A NO. 2			0
FF 99 36 25 2412	5	12.11.80	EMH 5450 1263	LOCKING BOLT FOR MECHANICAL GUIDE BOLT. SOLUTION A			0
~~FF 99 36 25 2413~~	~~1~~	~~12.11.80~~	~~EMH 5450 1264~~	~~MANUAL LOCKING OF SAFETY JACK~~	Cancelled		0
FF 99 36 25 2414	1	12.11.80	EMH 5450 1265	MANUAL SAFETY BOLT			0
FF 99 36 25 2415	1	12.11.80	EMH 5450 1266	LOCKING SYSTEM SOLUTION B PARTS DETAILS	Cancelled		1
FF 99 36 25 2416	2	12.11.80	EMH 5450 1267	DAMPING DEVICE			0
FF 99 36 25 2417	1	12.11.80	EMH 5450 1268	CLAMPING ON EMERGENCY JACKS			0
~~FF 99 36 25 2418~~	~~2~~	~~12.11.80~~	~~EMH 5450 1269~~	~~CONNECTION PLATE CLAMPING. TURN BUCKLE~~	Cancelled		0

INSTALLATION: FLARE

SPECIALITY:

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DRAWING REGISTER

EMH DRAWINGS 1980

ELF DRAWING No.					REVISION INDEX	REVISION DATE	ORIGINATOR REF. NUMBER	TITLE		SHEETS	SIZE A
FF	99	36	25	2419	1	12.11.80	EMH 5450 1269 A	CONNECTION PLATE CLAMPING HYDRAULIC TENSIONNING DEVICE			0
FF	99	36	25	2420	1	12.11.80	EMH 5450 1270	PADEYES FOR CLAMPING OF CONNECTION PLATE			0
FF	99	36	25	2421	1	12.11.80	EMH 5450 1271	COVER PLATE FOR TESTING PRESSURE AT CONNECTION SEAL			0
FF	99	36	25	2422	3	12.11.80	EMH 5450 1272	WEDGING OF CONNECTION PLATE			0
FF	99	36	25	2423	1	12.11.80	EMH 5450 1273	STOPPING FOR HOLE Ø 200 IN THE PINS			1
FF	99	36	25	2424	1	12.11.80	EMH 5450 1274	FLANGE ON GUIDE BOLT FOR SEAL BETWEEN C.P AND PIN			1
FF	99	36	25	2425	1	12.11.80	EMH 5450 1275	FLANGES FOR SEAL BETWEEN C. P AND PIN			0
FF	99	36	25	2426	1	12.11.80	EMH 5450 1276	FLANGE ON PIN FOR SEAL BETWEEN C. P AND PIN			0
FF	99	36	25	2427	1	12.11.80	EMH 5450 1277	MODIFICATION OF THE PIN GUIDE			0
FF	99	36	25	2428	1	12.11.80	EMH 5450 1278	CLAMP WASHER AND PIN FOR SEAL BETWEEN C.P AND PIN			1
FF	99	36	25	2429	1	12.11.80	EMH 5450 1279	SEAL BETWEEN C.P AND PIN GENERAL ARRANGEMENT			0
FF	99	36	25	2430	1	12.11.80	EMH 5450 1280	SEAL BETWEEN C. P. AND PIN-PIPING INJECTION			0
FF	99	36	25	2431	3	12.11.80	EMH 5450 1281	WEDGING OF THE CONNECTION PLATE DETAIL			0
FF	99	36	25	2432	1	12.11.80	EMH 5450 1282	MAIN FLOAT RENFORCEMENT (PROJECT ONLY)			0
FF	99	36	25	2433	6	13.11.80	EMH 5450 1300	DATA ARTICULATION			1
FF	99	36	25	2434	6	13.11.80	EMH 5450 1303	GENERAL ARRANGEMENT ON UNIVERSAL JOINT			0
FF	99	36	25	2435	3	13.11.80	EMH 5450 1304	UNIVERSAL JOINT ASSEMBLING			0
FF	99	36	25	2436	1	13.11.80	EMH 5450 1305	UNIVERSAL JOINT BEFORE ASSEMBLING			0
FF	99	36	25	2437	6	13.11.80	EMH 5450 1306	BEARING			0
FF	99	36	25	2438	1	13.11.80	EMH 5450 1308	BUSHING			1

INSTALLATION: FLARE

SPECIALITY:

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DRAWING REGISTER

EMH DRAWINGS 1980

ELF DRAWING No.					REVISION INDEX	REVISION DATE	ORIGINATOR REF NUMBER	TITLE		SHEETS	SIZE A
FF	99	36	80	2479	1	14.11.80	EMH 5450 1807	CONCRETE BALLAST BOTTOM HYDRAULIC PIPING			0
~~FF~~	~~99~~	~~36~~	~~80~~	~~2480~~	~~1~~	~~14.11.80~~	~~EMH 5450 1808~~	~~COLUMN FOOT GAS VALVES HYDRAULIC PIPING~~	Cancelled		0
FF	99	36	80	2481	1	14.11.80	EMH 5450 1809	CONNECTION PLATE HYDRAULIC PIPING			0
FF	99	36	80	2482	1	14.11.80	EMH 5450 1810	CONNECTION PLATE FLEXIBLE HOSES ENDS LOCATION			0
~~FF~~	~~99~~	~~36~~	~~80~~	~~2483~~	~~2~~	~~25.11.80~~	~~EMH 5450 1901~~	~~EXPANSION JOINT (NON RETAINED SOLUTION)~~	Cancelled		1
~~FF~~	~~99~~	~~36~~	~~80~~	~~2484~~	~~3~~	~~25.11.80~~	~~EMH 5450 1902~~	~~PIPING 24" MODIFICATION SOLUTION NO. 1~~	Cancelled		0
FF	99	36	80	2485	4	14.11.80	EMH 5450 1903	PIPING 24" AT ARTICULATION LEVEL			0
~~FF~~	~~99~~	~~36~~	~~80~~	~~2486~~	~~3~~	~~25.11.80~~	~~EMH 5450 1904~~	~~EXPANSION JOINT GENERAL ARRANGEMENT (NON RETAINED SOL.)~~	Cancelled		1
FF											
FF											
FF											
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FF											
FF											
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FF											
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FF											

INSTALLATION: FLARE

SPECIALITY:

ELF DRAWING No	REVISION INDEX	REVISION DATE	ORIGINATOR REF NUMBER	TITLE		SHEETS	LIST
FF 99 36 25 2459	2	13.11.80	EMH 5450 1333	CLAMPS FOR TORSION SEAL			1
FF 99 36 25 2460	1	13.11.80	EMH 5450 1334	FIXATION SYSTEM FOR TORSION SEAL			1
FF 99 36 25 2461	2	13.11.80	EMH 5450 1337	STOP PLATE FOR TORSION SEAL ASSEMBLING			0
FF 99 36 25 2462	4	13.11.80	EMH 5450 1338	LUBRICATION PIPING OF UNIVERSAL JOINT OIL TANK			0
FF 99 36 25 2463	1	13.11.80	EMH 5450 1338 A	CARDAN LUBRICATION. WATER AND OIL TESTS			0
FF 99 36 25 2464	3	13.11.80	EMH 5450 1360	CLAMPING OF BEARING ON CARDAN SPIDER			0
FF 99 36 25 2465	3	13.11.80	EMH 5450 1361	SETTING ON JACKS OF TORSION SEAL			0
FF 99 36 25 2466	1	13.11.80	EMH 5450 1700	RECONNECTION PRINCIPLE SOLUTION NO. 1			0
~~FF 99 36 25 2467~~	~~1~~	~~13.11.80~~	~~EMH 5450 1701~~	~~RECONNECTION PRINCIPLE SOLUTION NO. 2~~	Cancelled		0
FF 99 36 25 2468	1	13.11.80	EMH 5450 1702	~~RECONNECTION PRINCIPLE SOLUTION NO. 3~~	Cancelled		0
FF 99 36 25 2469	2	13.11.80	EMH 5450 1705	ATTACHEMENT CONNECTION LINE			0
FF 99 36 25 2470	1	13.11.80	EMH 5450 1706	BASE COLUMN CONNECTION. CABLES GUIDES. POSITION. LINES			0
FF 99 36 25 2471	1	13.11.80	EMH 5450 1707	CABLE GUIDES PRINCIPLE			0
FF 99 36 25 2472	1	13.11.80	EMH 5450 1708	TOWING RIGS FOR DISCONNECTION AND TOWING			0
FF 99 36 25 2473	1	13.11.80	EMH 5450 1710	BALLASTING PIPES LAYOUT			0
~~FF 99 36 25 2474~~	~~3~~	~~13.11.80~~	~~EMH 5450 1800~~	~~HYDRAULIC DIAGRAM FOR DISCONNECTION~~	Cancelled		0
FF 99 36 25 2475	3	14.11.80	EMH 5450 1801	HYDRAULIC DIAGRAM			0
FF 99 36 25 2476	1	14.11.80	EMH 5450 1801 A	HYDRAULIC DIAGRAM FRESH WATER AND OIL TESTS			0
~~FF 99 36 25 2477~~	~~4~~	~~14.11.80~~	~~EMH 5450 1805~~	~~SPECIAL FLANGES FOR HYDRAUXIM 300 VALVES~~	Cancelled		1
FF 99 36 25 2478	2	14.11.80	EMH 5450 1806	HYDRAULIC PIPING IN CHIMNEY AT LEVEL 112,024			0

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DRAWING REGISTER

EMH DRAWINGS 1980

ELF DRAWING No.					REVISION INDEX	REVISION DATE	ORIGINATOR REF NUMBER	TITLE		SHEETS	SIZE
FF	99	36	25	2439	2	13.11.80	EMH 5450 1309	FLANGE FOR SEAL OF BEARING			0
FF	99	36	25	2440	1	13.11.80	EMH 5450 1310	FLANGE FOR LOCATION OF SEAL OF BEARING			0
FF	99	36	25	2441	6	13.11.80	EMH 5450 1311 A	TORSION SEAL SUPPORT COLUMN SIDE			0
FF	99	36	25	2442	1	13.11.80	EMH 5450 1311 B	TORSION SEAL SUPPORT CONNECTION PLATE SIDE			0
FF	99	36	25	2443	5	13.11.80	EMH 5450 1312	STRUTS			1
~~FF~~	~~99~~	~~36~~	~~25~~	~~2444~~	~~1~~	~~13.11.80~~	~~EMH 5450 1312 A~~	~~STRUTS FOR EXISTING BEARINGS (CANCELLED)~~	Cancelled		0
FF	99	36	25	2445	3	13.11.80	EMH 5450 1313	FLANGES FOR TORSION SEAL			0
FF	99	36	25	2446	1	13.11.80	EMH 5450 1314	ARTICULATION GENERAL ARRANGEMENT			0
FF	99	36	25	2447	2	13.11.80	EMH 5450 1315	SET SCREW OF BEARING			1
FF	99	36	25	2448	3	13.11.80	EMH 5450 1317	CONDUCTOR RAILS FOR TORSION SEAL			1
FF	99	36	25	2449	3	13.11.80	EMH 5450 1318	CONDUCTOR RAILS			1
FF	99	36	25	2450	2	13.11.80	EMH 5450 1319	STOP PIECE FOR ROTATION OF TORSION SEAL FLANGE			0
FF	99	36	25	2451	1	13.11.80	EMH 5450 1320	SEALING FOR BEARING			0
FF	99	36	25	2452	1	13.11.80	EMH 5450 1321	SEAL OF BEARING STRUTS AND ERECTION SYSTEM			0
FF	99	36	25	2453	1	13.11.80	EMH 5450 1322	SPRING			1
FF	99	36	25	2454	1	13.11.80	EMH 5450 1323	FLANGE FOR BEARING JOINT SUPPORT ASSEMBLING			0
FF	99	36	25	2455	2	13.11.80	EMH 5459 1324	UNIVERSAL JOINT AND BEARING ASSEMBLING			1
FF	99	36	25	2456	2	13.11.80	EMH 5450 1330	TORSION SEAL GENERAL ARRANGEMENT			0
FF	99	36	25	2457	1	13.11.80	EMH 5450 1331	PROTECTION CAP FOR TORSION SEAL			1
FF	99	36	25	2458	3	13.11.80	EMH 5450 1332	JACKS FOR TORSION SEAL			1

INSTALLATION: FLARE SPECIALITY:

APPENDIX C:

List of procedures

ORIGINALS OF PROCEDURES FOR FRIGG FLARE DISCONNECTION PROJET

– Phase I	Preparation for disconnection	FF 99 36 25 23 01	1 book
– Phase II	Marina preparation for towing	FF 02	1 book
– Phase III	Base/column disconnection	FF 03	
– Phase IV	Towing from frigg to fjord and mooring	FF 04	
– Phase V	work to be done before tilting	FF 05	1 book
– Phase VI	Tilting to horizontal position	FF 06	1 book
– Phase VII	Installation in dry dock	FF 07	
– Phase VIII	Work to be done in dry dock	FF 08	2 books
– Phase IX	Under water works on base	FF 09	1 book
– Phase X	Towing out of dry dock and mooring	FF 10	1 book
– Phase XI	Tilting to vertical position	FF 11	
– Phase XII	Work to be done after tilting	FF 12	1 book
– Phase XIII	Towing from fjord to Frigg	FF 13	1 book
– Phase XIV	Underwater base inspection for reconnection	FF 14	
– Phase XV	Base/column connection	FF 15	
– Phase XVI	Completion	FF 16	

- [illegible] CCD procedure for disconnection of FP electrical cables — 1 book
- Fugro field anchoring instructions
- Blom's Oppmaling drawings (mooring - towing) — 1 book
- Marrama drawings
- Base IX underwater works on base (preliminary)
- Photogrammetry on base — 1 book
- Cracks on FP base
- Copies of procedures for flare disconnection / reconnection — 5 books