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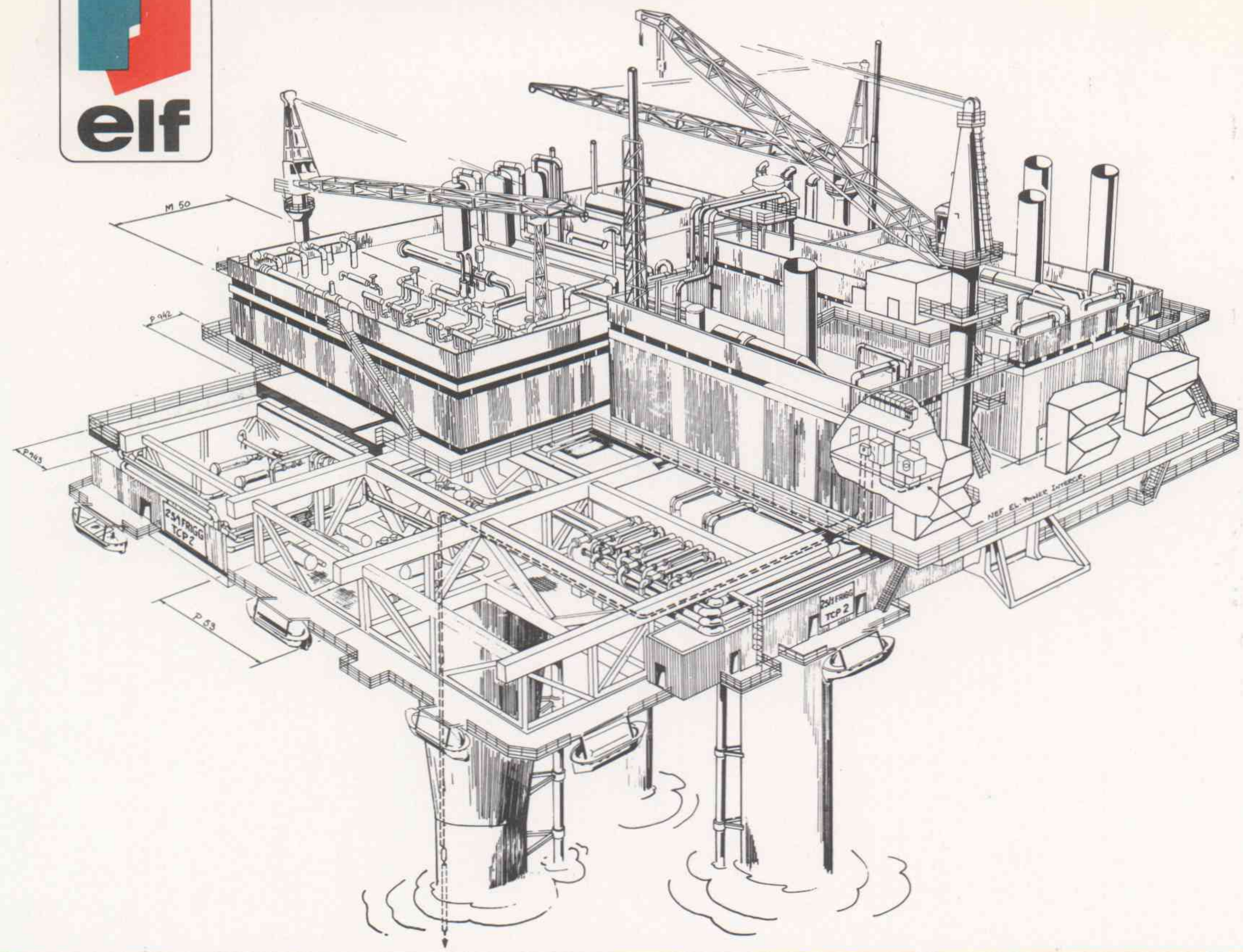

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FRIGG FIELD — TCP2 EXTENSION

FINAL REPORT

VOLUME 2

PROJECT DEVELOPMENT

STAVANGER **FEBRUARY 1984**

TCP-2 EXTENSION FINAL REPORT

V O L U M E II

PROJECT DEVELOPMENT

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VOLUME II - PROJECT DEVELOPMENT

AKKA 5310

TCP-2 EXTENSION FINAL REPORT

DETAILED INDEX - VOLUME II

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1 OVERALL PROJECT DEVELOPMENT

1.1 SCOPE OF WORK

The "TCP-2 Extension Project" has been responsible for all works on Frigg related to the tie in of the ODIN and NEF gas on TCP-2.

The works included:

- Engineering
- Procurement
- Construction of Modules
- Transportation and Lifting
- Hook Up and Commissioning

Major contracts were awarded for these services, and managed by the project team.

1.2 ORGANIZATION

The project team was organized as a department within the "Construction Sub-Division" as shown on the company organization chart Figure 1.1.

During the different phases of the project, the team changed, and this is described under the relevant chapters. A principle sketch of the organization is shown in Figure 1.2.

The project team acted not only as a Management and Supervision team, but played an active role in the execution of the various phases of the work.

1.3 PLANNING AND EXECUTION

The initial Overall Project Schedule established by the end of 1980 (Figure 1.3) showed a Start-Up time of December 1983.

The total project execution time from the start of the detailed Engineering works until Production Start-Up was planned with 36 months.

The project was executed according to this master schedule.

The project team was established in Stavanger in November 1980. Prior to that, basic engineering and preparation of engineering tenders had been worked out in Paris.

The engineering and procurement activities were carried out by Sofresid Norge A/S, mainly from Stavanger.

The works started in January 1981, and the major part of the works were completed by spring 1982.

The construction of the modules took place at Ponticelli Freres (PF) in Bordeaux from March 1982 until completion in April 1983.

ELF AQUITAINE NORGE A/S

OPERATIONAL MANAGEMENT

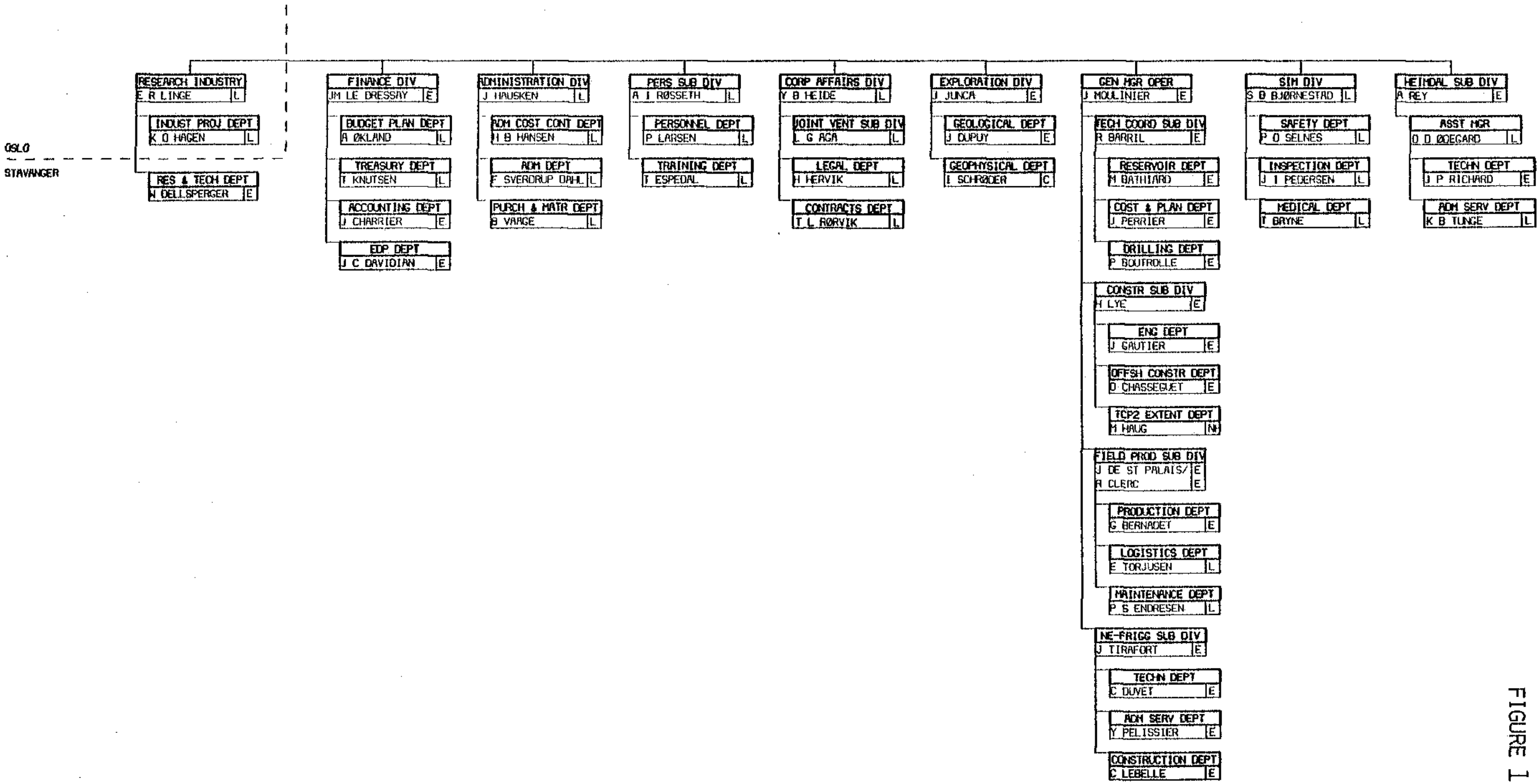
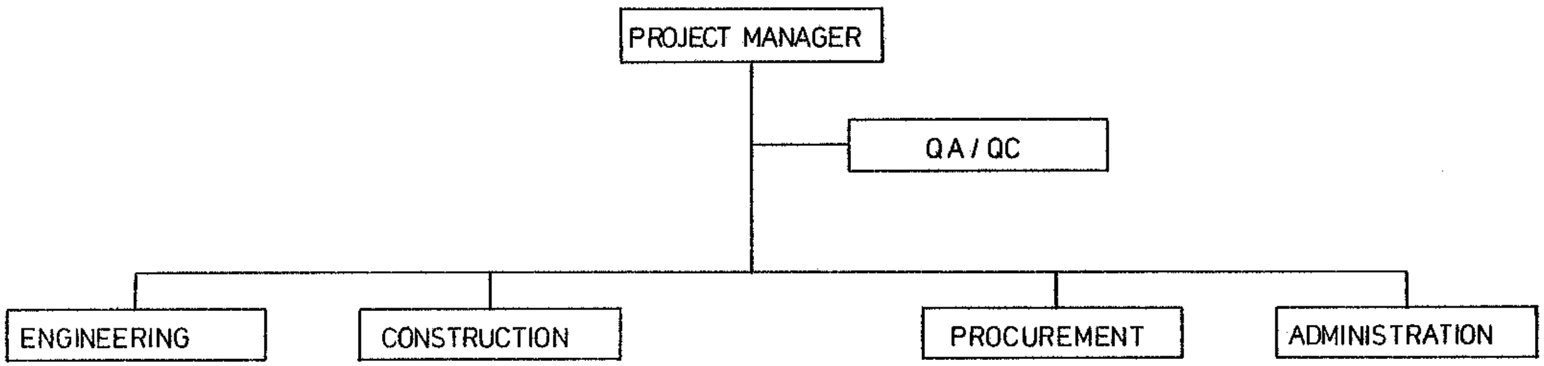


FIGURE 1.1

OCTOBER 1ST. 1982

FIG. 1.2.

TCP 2 EXTENSION
PRINCIPLE OF ORGANISATION



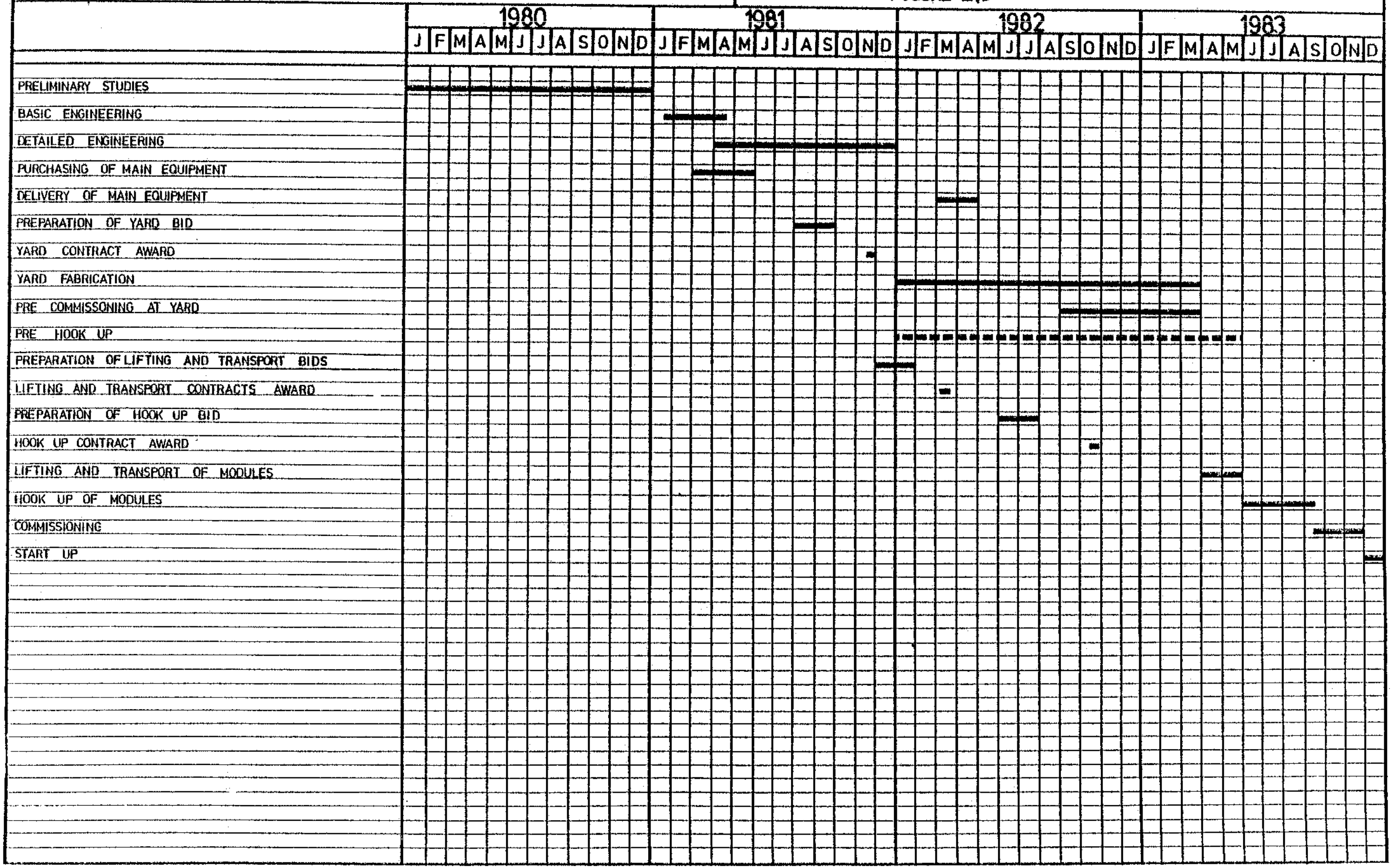
TCP 2 EXTENSION
OVERALL PROJECT SCHEDULE

elf aquitaine ·orge a/s

PROGRAM

FIGURE 1.3

by: KMM
page 1 of 1
rev.: 1 date: 10.2-81



The modules were transported to Stavanger by Neptun Transport Marine Services A.B. and lifted onto TCP-2 at the end of May 1983 by K/S Heerema Seaway A/S´s SSCV "BALDER".

"Treasure Supporter" from W. Wilhelmsen was connected to TCP-2 from 1st June until 21st October 1983 during the hook-up period.

Haugesund de Groot Offshore A/S & Co. carried out the hook-up works and assisted in the commissioning works which were managed by the project team.

Gas production started on NEF 10th December 1983.

1.4 QUALITY ASSURANCE PRINCIPLES

1.4.1 General

The Quality Assurance (QA) function in the project was placed in staff to project manager with a communication line to Safety/Inspection/Medical Division Management (SIM DM)

The communication line to SIM DM was established to ensure necessary independence in case of conflicts with project management.

The main area of responsibilities of the QA section were:

- To develop, implement and maintain the QA system (including project procedures).
- To approve Vendor/Contractor QA system
- To perform Quality Control (QC)
- To perform Audit(s)
- To coordinate relations with Det norske Veritas (DnV).
- Autority coordination (certification)

(For definitions of QA, QC etc. see Quality Management Manual).

All Vendors and Contractors performing services for the TCP-2 Extension were requested to comply with relevant QA standard, i.e. NS 5801, 2 or 3, BS or similar.

1.4.2 Responsibility for Quality

The governing idea through all phases of the project was to delegate the responsibility for the quality to each section/project participant executing work within the project.

The QA section based their control primary on spot checks and system audits.

QC/system audit groups were established and frequently carried out audits during all project phases both with use of external and internal expertise.

1.4.3 Project Phases

The main phases of the project were as follows:

1 - Engineering
2 - Procurement
3 - Yard Construction
4 - Pre-Hook-Up
5 - Transport & Lifting
6 - Hook-Up & Commissioning

The involvement of the QA/QC section during the different phases of the project is elaborated under each relevant chapter.

Project procedures for the above mentioned phases are compiled in the following three documents:

- TCP-2 Extension Own Control Procedure (1, 2 and 5)
- Qúality Assurance Manual - Fabrication Phase (3)
- Quality Management Manual (6)

The pre-hook-up works were carried out in accordance with Platform Management Manual Procedure No. 15.

1.5 INSURANCE

The risks related to the TCP-2 Extension works have been covered through a "Builder´s Risk Insurance Policy" underwritten by Storebrand from 1st January 1982 till 30th november 1983.

No accident has been reported.

1.6 FILING KEY

The Project File consisted of the following four principally different types of files:

- Chronological File
- General Service - Contracts File
- Authority File
- Technical File

The main structure of these files are listed below.

The Quality Assurance Manuals give all the details about the files.

TCP-2 EXTENSION FILING KEY

Chrono File	A-H
General Service File	J
Authorities File	K
Technical File	L-S

Chrono File

A. EAN Inside Contacts
B. SNEA(P) - Contact in Paris & Pau
C. Partners
D. Engineering Companies
E. Contractors/Suppliers
F. Esso
G. Authorities
H. Others

General Service File

J. General Service File
J.1 Bids
J.2 Heads of Agreement
J.3 Contracts
J.4 Purchase Orders
J.5 Service from SNEA(P)
J.6 Personnel EAN
J.7 Engineering/Modification Request
J.8 Planning
J.9 Regular Reports
J.10 Budget Revisions
J.11 Procedures
J.12 Cost Estimate
J.13 Training
J.14 Minutes of Meeting
J.15 EAN Form - Internal Procedures
J.16 EAN Internal Correspondence

Authority File

K. Authorities
K.1 Norwegian Petroleum Directorate (NPD)
K.1.02 Manuals
K.1.03 General Correspondence NPD
K.1.04 Correspondence Maritime Directorate
K.1.05 Correspondence Coast Directorate
K.1.06 Correspondence Telecommunication Board
K.1.07 Correspondence Ministry of Labour and Environment
K.1.08 Correspondence Ministry of Oil and Energy
K.1.09 Correspondence Ministry of Industry
K.1.10 Correspondence Department of Energy
K.1.11 Correspondence Department of Trade
K.1.12 Correspondence Det norske Veritas

Technical File

- Enginering	L.	Engineering
	L.1	General
	L.2	Process
	L.3	Instrument
	L.4	Electrical
	L.5	Piping
	L.6	Mechanical
	L.7	Structural
- Procurement	M.1	General
	M.2	Process
	M.3	Instrument
	M.4	Electrical
	M.5	Piping
	M.6	Mechanical
	M.7	Structural
- Construction	N.	Yard Construction
	N.1	Work Preparation
	N.2	General Management
	N.3	Contract
	N.4	Supervision
	N.5	Contractor Equipment and Facilities
	N.6	Work
- Transportation/ Lifting	P.	Transportation/Lifting
	P.1	Work Preparation
	P.2	General Management
	P.3	Contract
	P.4	Supervision
	P.5	Contractor Equipment and Facilities
- Prehook-Up Integration	Q	Prehook-Up Integration
	Q.1	Work Preparation
	Q.2	General Management
	Q.3	Contract
	Q.4	Supervision
	Q.5	Contractor Equipment and Facilities
	Q.6	Modification Request Master File
	Q.7	Work Order
- Hook-Up	R	Hook-Up
	R.1	Work Preparation
	R.2	General Management
	R.3	Contract
	R.4	Supervision
	R.5	Contractor Equipment and Facilities
	R.6	Work
- Commissioning	S	Commissioning
	S.1	Work Preparation
	S.2	General Management
	S.3	Contract and Vendors
	S.4	Supervision
	S.5	Commissioning Equipment and Facilities
	S.6	Commissioning Work Per System

2 ENGINEERING

2.1 GENERAL

The major part of the engineering works were carried out by Sofresid Norge A/S mainly from Stavanger.

The electrical and instrumentation works were subcontracted to Sønnico A/S.

The lump sum contract comprised engineering and procurement.

The engineering works were split in three activities:

- Module 50
- Pancake 53
- Integration works

Later on it was decided to supply NEF with electrical power from Frigg.

These works were carried out by Aker Engineering A/S.

2.2 ORGANIZATION

2.2.1 EAN´s Organization

The engineering function was organized as a section in the project organization.

The responsibility was split by the following disciplines:

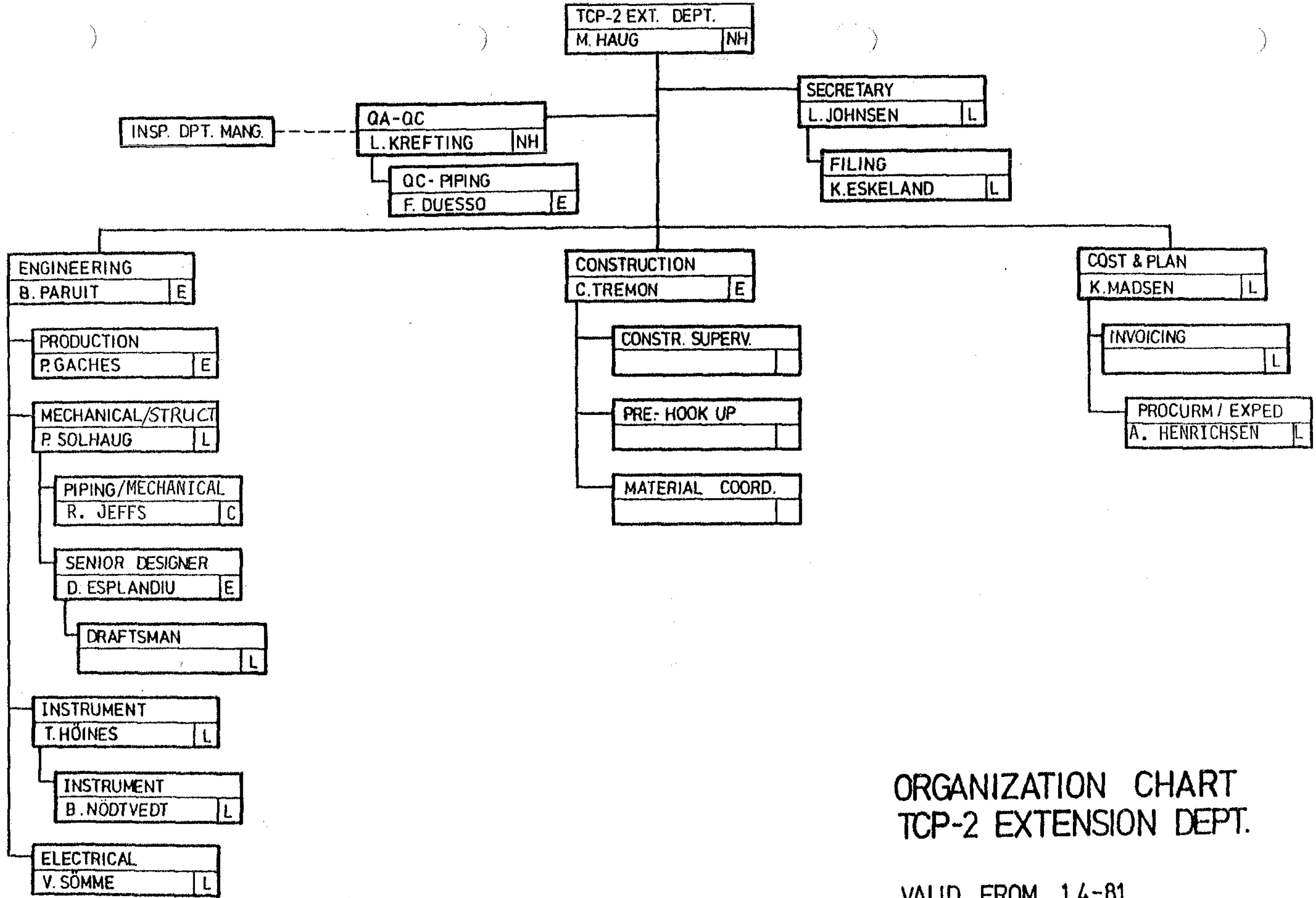
- Production (Process)
- Mechanical
- Structural
- Piping
- Instrument
- Electrical

The organization chart from the first period of the project is shown in Figure 2.1.

2.2.2 Sofresid Norge A/S´s Organization

The organization chart from the first phase of the project is shown in Figure 2.2, and Figure 2.3 shows SN´s organization during the inspection/expediting phase.

When the engineering workload decreased in 1982 the project team gradually moved to Oslo.



ORGANIZATION CHART
TCP-2 EXTENSION DEPT.

VALID FROM 1.4-81

FIGURE 2.1

PROJECT ORGANIZATION

TCP 2 EXTENSION

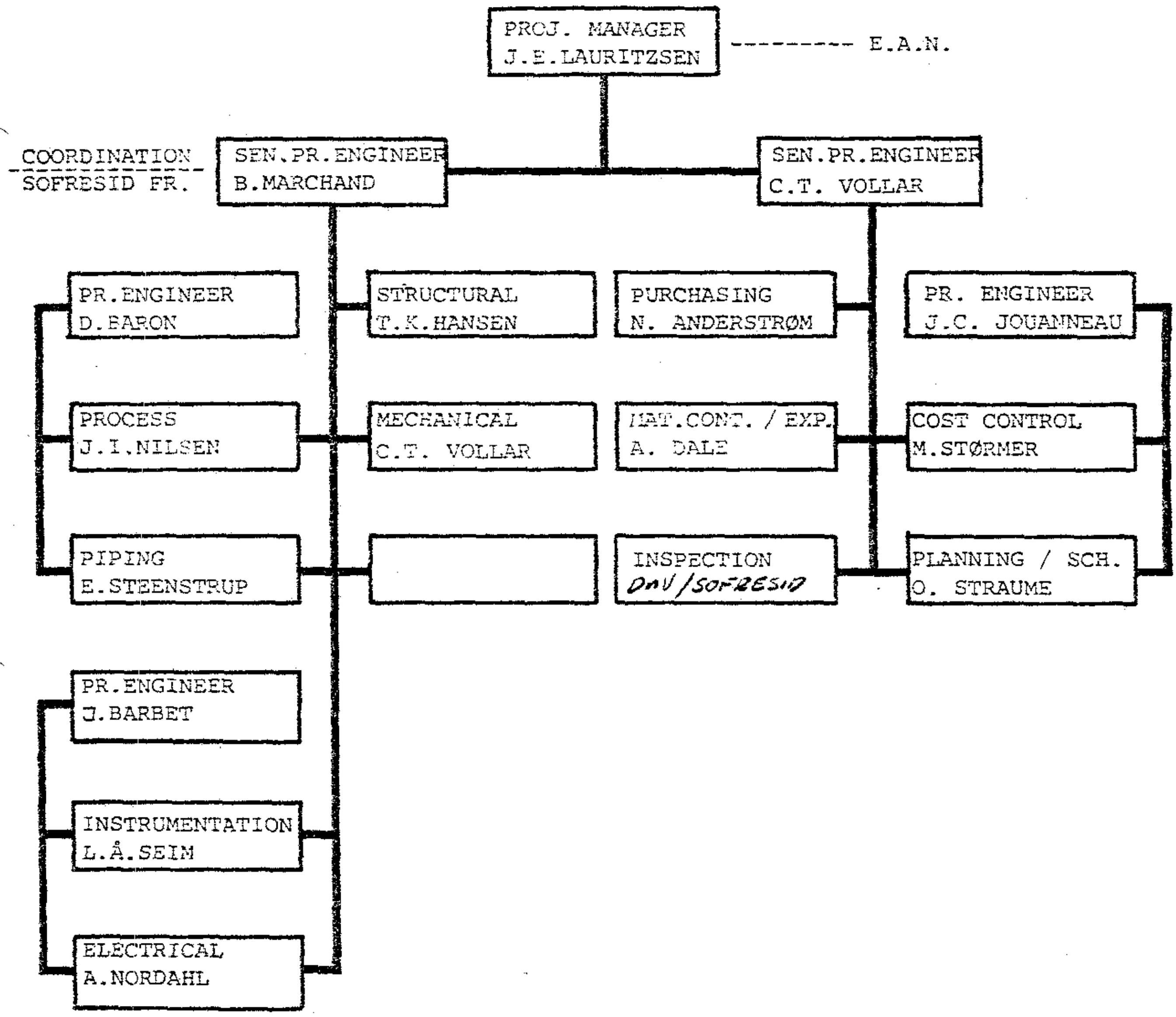


FIGURE 2.2.

Stavanger, 25.05.81

2.3 QUALITY ASSURANCE (QA) / QUALITY CONTROL (QC)

The project internal control procedures were laid down in "TCP-2 Extension Own Control Document".

This procedure outlined the identification distribution, filing and internal review/approval procedure applicable for the Engineering and Procurement phases.

The principles are shown in the flow chart in figure 2.4.

Further this procedure outlines the extent of the use of external independent contractors, established prior to start of the basic engineering, Figure 2.5.

The project engineer/specialist engineers were responsible to check and confirm that all work performed by our engineering contractor was according to our specifications, codes and authority requirements. The details of this "Internal Procedure for Design review" is shown in Appendix 1.

It was the responsibility of the specialist engineer to coordinate all comments - from QA, external/internal consultants - and to prepare answer(s) back to SN through the project engineer.

The main QA function was to monitor the reviewing procedure and ensure that comments from external consultants were taken into consideration when applicable or required by law/regulation.

The Own Control document was forwarded to Norwegian Petroleum Directorate (NPD) and approved without comments and thus binding for the project.

Transportation and Sea Fastening were not, as indicated, checked by DnV, but by Noble Denton & Associates Norge A/S.

The same principles of project control were applied on work not covered by the contract between SN and EAN.

2.4 PLANNING AND PROGRESS

2.4.1 Planning

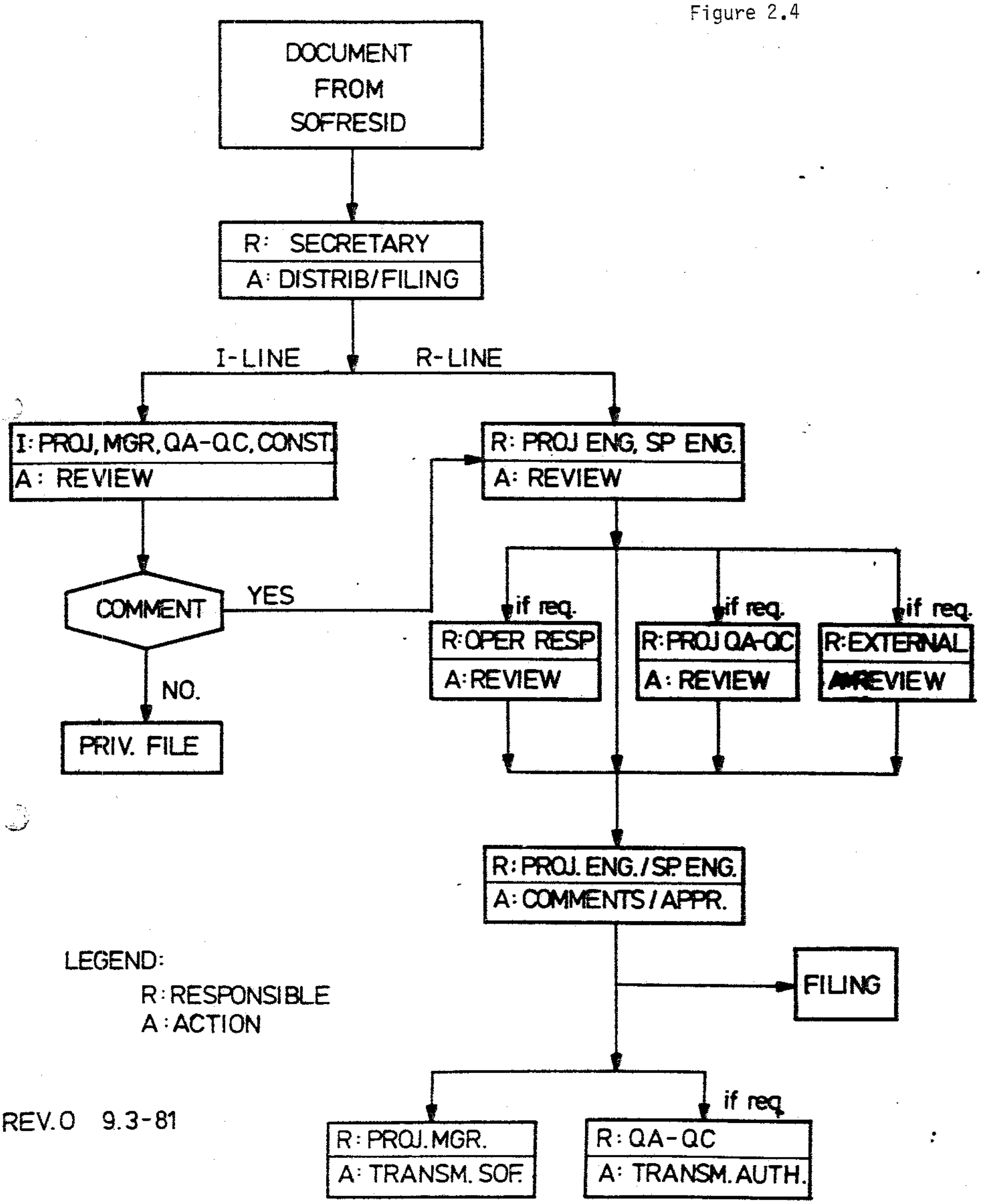
The engineering master schedule was established based upon the following three major contractual milestones:

Complete construction bid package	week 41/81.
Complete transportation/lifting bid package	week 5/82.
Complete hook-up bid package	week 32/82.

The master schedule is shown in Figure 2.6.

REVIEW PROCEDURE FOR ENGINEERING DOCUMENTS RECIEVED FROM SOFRESID

Figure 2.4



REV.0 9.3-81

EXTERNAL ASSISTANCE FOR DESIGN REVIEW:

Discipline 021 Structural

	- Support Frame (load, stresses etc)	KE
312 1227	- Structure Design Final Report	DnV/EAN
313 1232	- Struc. Lift Final Study & Inot Procedure	"
314 1306	- M50-P53 Load out Procedure	"
315 1229	- Struc. Transportation & Fastening	"

Discipline 026 Mechanical

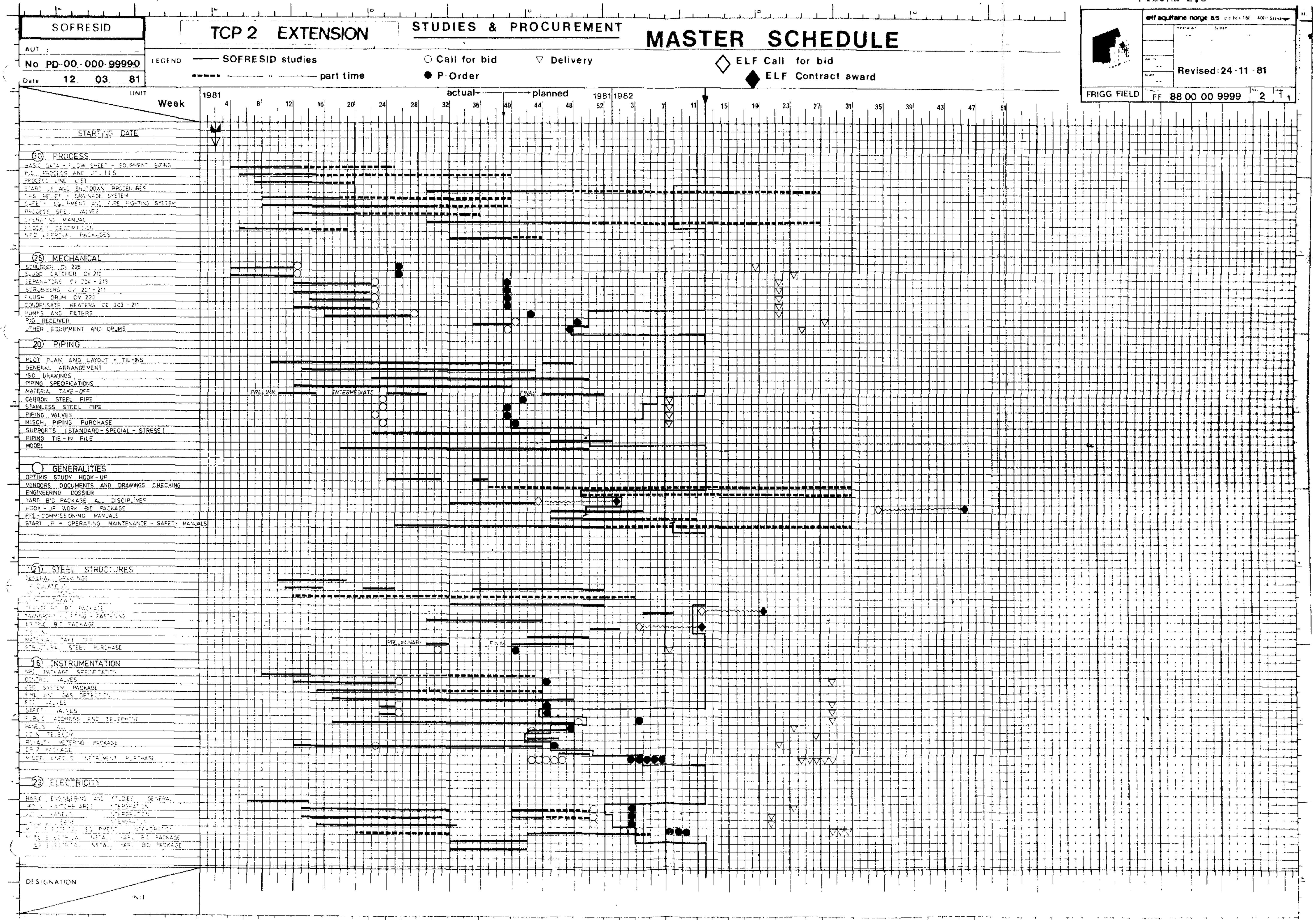
	- Design Review of all Pressure Vessels	DnV/E.A.N

Discipline 030 Process

109 636	- Gas Relief System	DnV/EAN
114 672	- SAFE Charts /SAT´s	"

If we deem necessary this list will be extended during the course of the project.

FIGURE 2.6



SOFRESID
No PD-00-000-99990
Date 12 03 81
TCP 2 EXTENSION
STUDIES & PROCUREMENT
MASTER SCHEDULE
LEGEND
SOFRESID studies
part time
Call for bid
P Order
Delivery
ELF Call for bid
ELF Contract award
actual
planned
elf aquitaine norge a/s
Revised: 24-11-81
FRIGG FIELD
FF 88 00 00 9999
UNIT
Week
1981
1982
STARTING DATE
30 PROCESS
PROCESS LINE LIST
OPERATING MANUAL
26 MECHANICAL
SCRUBBER CV 226
CATCHER CV 210
SCRUBBERS CV 201 - 211
CONDENSATE HEATERS
PUMPS AND FILTERS
RECEIVER
EQUIPMENT AND DRUMS
20 PIPING
PLOT PLAN AND LAYOUT + TIE-INS
GENERAL ARRANGEMENT
ISO DRAWINGS
PIPING SPECIFICATIONS
MATERIAL TAKE-OFF
CARBON STEEL PIPE
STAINLESS STEEL PIPE
PIPING VALVES
MISCH. PIPING PURCHASE
SUPPORTS (STANDARD - SPECIAL - STRESS)
PIPING TIE-IN FILE
MODEL
PRELIMIN
INTERMEDIATE
FINAL
GENERALITIES
OPTIMIS STUDY HOOK-UP
VENDORS DOCUMENTS AND DRAWINGS CHECKING
ENGINEERING DOSSIER
YARD BID PACKAGE ALL DISCIPLINES
WORK BID PACKAGE
MANUALS
OPERATING MAINTENANCE - SAFETY MANUALS
21 STEEL STRUCTURES
STRUCTURAL STEEL PURCHASE
PRELIMINARY
FINAL
16 INSTRUMENTATION
23 ELECTRICITY
DESIGNATION
INIT

2.4.2 Progress

The progress was calculated discipline by discipline based upon the physical progress.

A weighing factor was computed for each discipline based upon the original estimations.

Figure 2.7 shows an example of the progress by discipline, and Figure 2.8 the calculated overall progress curve compared to the original planned.

There was a general delay of approximately one month early in the project which was not catched up, but this did not cause any major problems.

The bid packages were all detailed and of a good quality when they were issued the following dates:

	Bid package issued	Contract awarded
- Yard construction	November 1981	March 1982
- Transportation/Lifting	December 1981	April 1982
- Hook-Up	November 1982	March 1983

2.5 ENGINEERING DISCIPLINE REPORT

2.5.1 General

Three different phases of the project have been described:

- The Conceptual Phase - Basic Engineering
- The Detailed Engineering Phase
- The Follow Up Phase

2.5.1.1 Basic Engineering - Conceptual Phase

The conceptual data, drawings and documents have been developed in Paris by a small preparation team. During this time the TCP-2 Extension Technical Specifications were produced and ready to be sent away for bidding purposes.

These Technical Specifications contain eight volumes which outline the existing Frigg facilities and the new facilities which must be integrated into the existing units.

At that stage the conceptual data and drawings were already well advanced and very unknown points or uncertainties were remaining.

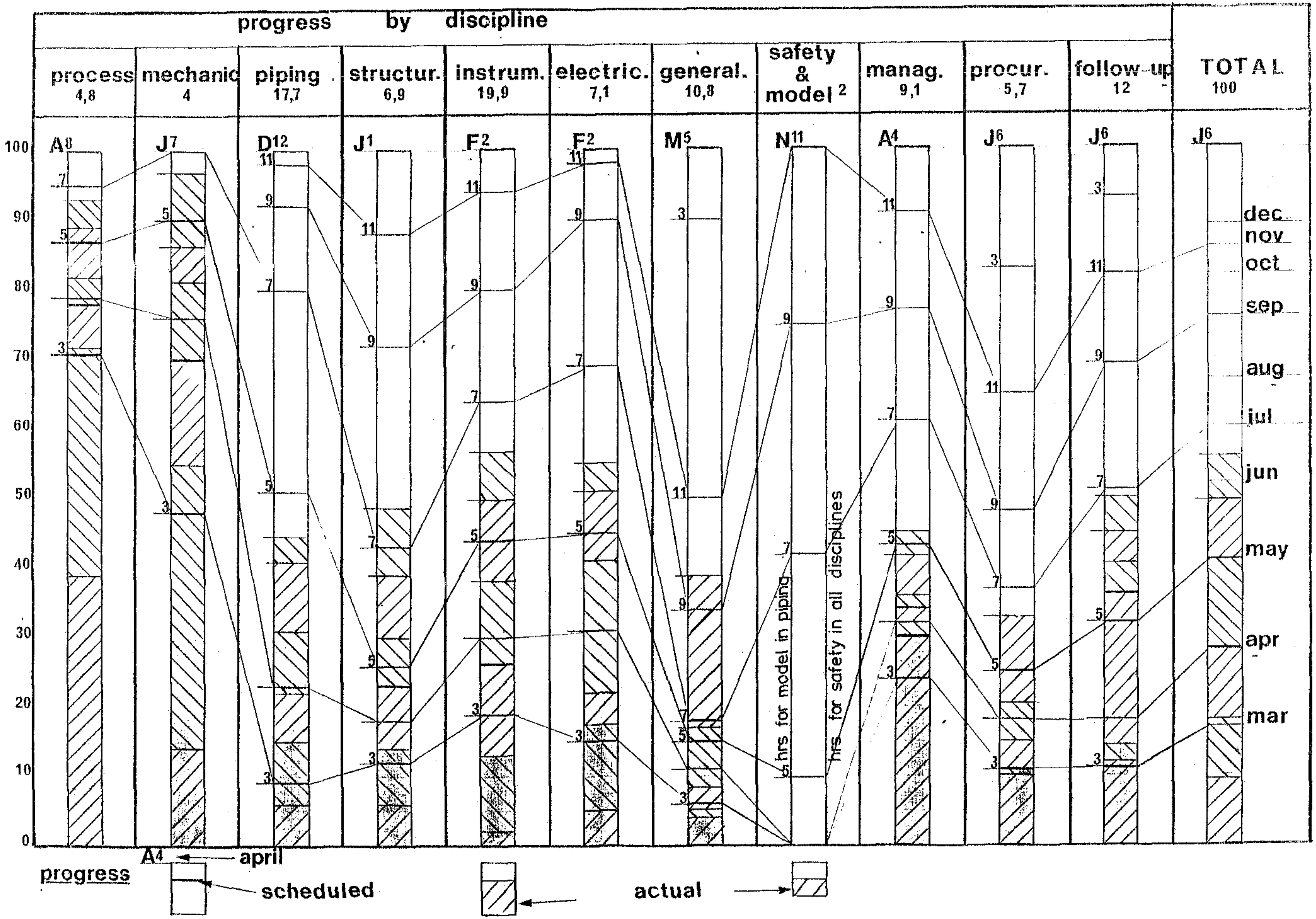
However, two main changes occurred at the last minute:

. Changing of the flare system
. Cancellation of a general electrical supply room

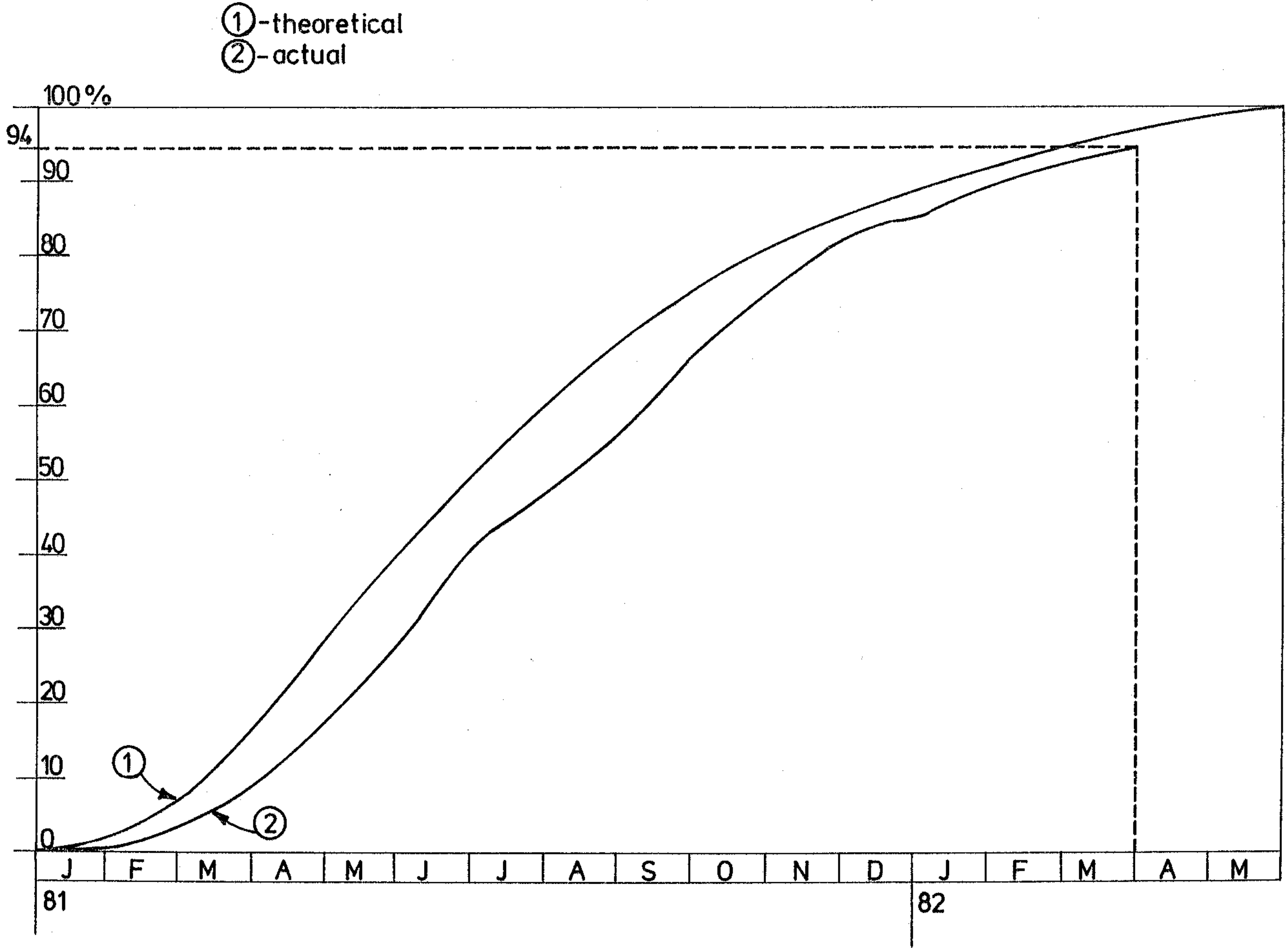
TCP-2 EXTENSION

ENGINEERING PROGRESS

FIG. .7



TCP-2 EXTENSION — PROGRESS CURVES (Studies) FIGURE 2.8



2.5.1.2 Detailed Engineering

The detailed phase was performed by Sofresid Norge A/S (SN) in Stavanger under the term of a lump sum contract.

The EAN engineering team was checking all documents produced by SN and was guiding SN whenever necessary. A special engineering check loop was established to make sure that all documents were thoroughly checked and commented by the EAN responsible specialists.

Two weekly meetings were performed, one internal within EAN TCP-2 Extension Engineering team and one external with SN Engineering team.

The project suffered from a delay of approximately 4 weeks in the beginning of the project. This was difficult to catch up later, but had no impact on the Overall Schedule of the Project.

The results of this detailed Engineering phase were as follows:

- All required detailed Engineering documents and data were totally finished and approved by TCP-2 Extension Project and other responsible departments within EAN; Production, Maintenance, Logistics, Safety etc. (P & ID´s, lay-out, line list, equipment list, instrument list and specifications etc.).

- Completion of Construction Bidding Package.
  All ISO´s were included, all lay-outs, all piping specifications etc.

- Procurement phase was well advanced and equipment was ready to be shipped to yards.

- All necessary NPD documents were made.

- A complete model 1/33 scale was completely finished including all equipment and lines (except the 2").

- Precommissioning/Commissioning manuals were well advanced.

- Several manuals were finished (Operational, Start-Up etc.).

2.5.1.3 Follow-Up

During this phase, manuals were completed, and drawings from the yard and offshore were updated.

All necessary modifications were performed by the follow up team, who also assisted in vendor inspection and follow up.

2.5.2 Process

Most of the basic process studies were performed during the conceptual phase of the project. They consisted in making a similar design to the existing ones for the gas treatment and condensate treatment.

During this conceptual phase another aspect of the process activities was the integration of the new facilities into the existing ones. In some cases extensive calculations and material balances were made to derive the right process specifications especially for the flare system, the drainage system and basically all existing process utilities which have to be connected to the new facilities and equipment.

By the end of the conceptual phase a set of P. & I. D.s was made. Process flow diagrams were made, one for the gas one for the condensate. All the process specifications for mechanical equipment and the instrument were done. These specifications were preliminary only.

During the detailed engineering phase several process computer simulations were made to finalize the material and energy balances. Process flow diagrams for the gas and condensate were finalized as well as the P. & I.D.s and all the process specifications. Special studies have been made for the depressurization/blowdown of the NEF and ODIN pipeline and also for the metering system requiring extensive pressure drop calculations in two phase fluid.

These finalizations were made with the assistance and approval of the EAN Production Department and sometimes with the Maintenance Department.

2.5.3 Instrumentation

2.5.3.1 General

Since the TCP-2 Extension project was an addition to the already existing treatment units we aimed to follow the existing Frigg philosophy concerning the process instrumentation and the "Emergency Shut Down" systems.

The only major change in this philosophy was the Royalty Metering which is measured with conventional instruments, computed with Spectra-Tek computers and the result is subtracted from the main stream. The reason for this was that the ODIN and NEF gas and condensate is mixed with the Frigg production before the final measurement.

Instrument work was performed on QP, TCP-2 and DP-2 and telemetry of signals is used to obtain the needed supervision and control from the central control room (CCR) on QP. The control and supervision instruments in CCR were selected and installed according to the existing philosophy.

In addition to the NPD/DOE rules and regulations the following standards and codes were used:

ISO 5167	Measurement of Fluid Flow by Means of Orifice Plate etc.
API RP 14 C	Analysis, Design, Installation and Testing of Basic Safety System on Offshore Production Platforms
API St 2534	Measurement of Liquid Hydrocarbons by Turbine Meter Systems.

For electronic / electrical instrumentation the CENELEC and British Standards were used.

Sønnico A/S acted as a sub-contractor to Sofresid Norge A/S for the instrument works.

2.5.3.2 Instrument Section Responsibility

The instrument engineering section responsibilities during the project were:

Process Instrumentation

This includes pneumatic, electronic and electrical instruments, their associated signal transmission with cable/tube trays and wall penetrations. Calculations of control valves, relief valves, flow meters and silencers were also part of this.

Safety Instrumentation

This included fire and gas detection of different types, automatic fire extinguishing systems, control room alarms and emergency shut down systems.

To obtain the required safety level the "Safety Analysis Tables and Charts" were developed together with the EAN Production Department repsonsible person.

Public Alarm Systems

This included the public address and flashing light systems.

Royalty Metering

This included the conventional electronic process instruments, turbine meters, Daniel senior orifice fittings and meter tubes for gas and condensate metering and the Spectra-Tek computer system.

Calculations and documents for authority approval were also part of instrument section's responsibility.

Telecommunication Systems

This included telephone, signal telemetry to / from NEF field control station, ODIN platform, TCP-2 and DP-2, telecommunication equipment to / from NEF field control station, ODIN platform and to shore via satelite.

2.5.3.3 Instrument Section Organization

It was foreseen to have one man during the whole project period from basic engineering to the end of the final documentation with one extra man in the detailed engineering period up to the start of yard construction. It soon showed that this would be inadequate because of the low internal control standard within the Engineering Contractor's office. Due to this, one additional man was contracted for the detailed engineering and integration engineering phases.

Other engineers were contracted for special tasks like:

Vendor Inspection/Expediting/Precommissioning Document Preparation/ Commissioning Document Preparation/Offshore Task Sheet Preparation.

These six engineers, in the peak period, were controlled by the Instrument Section Head and given a basic introduction to the project in the engineering group and were later used as a pool for supplying engineers to the Yard Construction Team and later the Offshore Hook-Up Team.

This early introduction to the project in the engineering phase before later use in the Yard and Hook-Up teams was of a great advantage to the project.

2.5.3.4 Engineering Phases

Basic Engineering

During this phase all the basic instrument documents should be finalized like; Piping and Instrument Diagrams, Safety Analysis Tables, Safety Analysis Charts and Process Data List as the most important. This was not achieved and the lack of basic instrument documents caused some delay and "Change Orders" in the beginning of the engineering phase.

During this phase a careful offshore survey should also be performed to update existing drawings to "As-Built" standard. Because of a limited number of engineers with offshore certificate in the contractor's organization this was not performed to a satisfactory level.

Detail Engineering

During this phase all the detailed drawings for the different instrument systems on Module 50 and Pancake 53 were established. This was a simple engineering task and did not create any serious problems. But minor problems occurred because of lack of basic data in the start phase and the poor internal control and coordination inside the contractor's office.

Procurement

The responsibilities for the instrument engineering section in this phase was first of all to make the technical specifications for the different instruments and instrument equipment.

Further responsibilities were to establish a "Bidders List", prepare "Call for Tender" and evaluate the technical parts of the bids.

During the rest of the procurement phase we were only participating in the technical discussions, performed the technical inspections/approvals and evaluation/approval of final documents and certificates.

Integration Engineering

This was a very specialised task and involved the engineering work needed for integration of the TCP-2 Extension modules into the already existing units and instrument systems. Here we suffered greatly beacuse of our engineering contractor's limited knowledge of the Frigg Field and his lack of sufficient number of engineers with offshore certificate. As we were approaching the time limits for the integration engineering drawings we had to take over this ourselves and completed the studies for fire and gas integration on QP - TCP-2, telemetry integration and shut down on DP-2 and the updating of the existing mimic panel on QP central control room.

Cleaning Study

This was not a big task on the instrument side, but the aim was to prepare TCP-2 for receiving Module 50 and Pancake 53 with a minimum of work performed while the costly crane barge was out on the field.

Work to be performed was moving of already existing instruments and rerouting of cables, tubes and trays.

Document Preparation

Here we prepared the documents to be used during the Yard and Offshore Precommissioning and Commissioning Phases. The documents produced consisted of both the procedures for the test sequence and the document for collection of the approval signatures.

The Hook-Up job was split in several "Task Sheet" and these were also prepared by the engineering team.

Follow Up

During Yard Construction and offshore Hook-Up phases engineering support was needed to some extent. This support was needed for taking care of unexpected problems and modifications requested by Production Department.

The support given during the Offshore Hook-Up phase was adequate, but during Yard Construction the support given was not good enough because of the heavy work load at that time caused by the integration engineering studies.

"As-Built" Documentation

This was the final stage performed by the engineering section where all the "As-Built" information was collected and coordinated from the; Yard Construction, Prehook-Up, Hook-Up, Commissioning and Vendors and the "As-Built" drawings were produced.

Changes made on existing EAN drawings were at this stage transferred from the preliminary drawings to the original drawings in the Central File.

2.5.3.5 Technical Choices

During all the engineering phases different technical choices were available even though the main target was to follow existing Frigg philosophy.

- Also for instrument vendor selection the existing Frigg instrumentation was considered and selected if no major technical or economical reason indicated other vendors. The reason for this was to keep the maintenance spare parts stock as low as possible.

- Selection between electronic and pneumatic instruments were done so that if possible pneumatic type should be preferred, but for "Fiscal Metering" electronic were selected because of higher accuracy. For transmitters and alarm switches with only direct connection via telemetry system to OP, electronic instruments were chosen.

- Pressure switches were changed from the existing, which involved local on/off controllers with setpoint adjustment, to a direct pneumatic signal switch. This change was performed to make it more difficult to make an unauthorized setpoint change.

- Max. allowable time delay on ESD valves was set to 45 seconds from initiation of any shutdown signal to the last shutdown valve was closed. To obtain this pneumatic "Quick Dump" valves were installed in strategic positions on the pneumatic tubes between the interface room and the valves. On the telemetry side a new generation of the CETT system was installed and this system was fast enough to avoid the existing priority system for ESD signals.

- To improve the existing "Fiscal Metering" instruments tendency to drift with ambient temperature variations, a temperature controlled enclosure was designed. Here all the normal tests and adjustment functions could be performed without interferring with the instruments ambient temperature.

- To facilitate for future release of the deluge system during a major gas leakage, the relay wiring in the gas detection logic system was done, but not finally connected.

- During detail engineering we allowed for up to 20% spare tubes and cores in multitubes and electrical cables.

- The range of cable types were limited, but have to be more limited in the future. We selected 1.5 sq. mm as a standard for instrument signals, either flame retardant or flame resistant and only two colours, black or blue.

- Concerning instrument earthing we adapted to the NPD standards as close as possible with 3 separate earth systems.

  a) Electrical earth, for power supplies 50 volts and above for personnel protection.

  b) Intrinsically safe earth, for signals requiring this.

  c) Instrument earth, for cable screens on cables which required a "clean" earthing system.

All these three earthing systems were separately connected to the main structure (the electrical earth via the power supply cable). Screenconnections between cables were linked together without any earthconnection in the field and it was isolated on the instrument with an isolation adaptor to prevent earth loops.

Where Exd type instrument enclosures had to be used a special earth connection had to be done at the instrument and an "earth core" had to be used and terminted to the "electrical earth" at the power supply end.

- Where possible intrinsically safe circuits instruments and junction boxes with increased safety were chosen instead of Exd enclosures, this to avoid water ingress and corrosion in the enclosures. A weak point on the plastic junction boxes showed up to be the screws for fastening of the cover, these were sensitive for overtightening and sand from the sand blasting.

- Parker fittings were used for instrument air signals and Autoclave fittings for the process connections. These were selected because of Maintenance Department requirements and to be consistent with the latest installations.

2.5.3.6 Instrumentation Documents

Drawings

A total of about 1.300 drawing sheets were produced and mainly A3 and A1 sizes were used. A rough split of these will give:

Logic and Schematic Diagrams	about	60	pcs
Layouts and Routings	"	70	"
Loop Diagrams	"	270	"
Wiring and Hook-Up Diagrams	"	530	"
Equipment Drawings	"	90	"
Arrangement Drawings	"	60	"
Different Lists	"	180	"
Miscellaneous	"	40	"

Specifications and Calculations

A total of about 100 specifications and calculations were produced. These included Instrument Material Specifications, Instrument Calculations and Installation Specifications.

Procedures

A total of about 85 procedures were produced and covered the instrument tests at vendor workshops, precommissioning at the yard and the precommissioning offshore.

2.5.3.7 Instrument Key Figures

- The Instrument Index contains 1.350 tagged instrument items and this figure includes: Pressure Gauges, Level Gauges, Temperature Ind., Thermowells, Orifice Units, Pneumatic and Hydraulic Pilot Valves, Quick Dump Valves, Speed Control Valves, Solenoid Valves, Switches, Lamp Units, Loudspeakers.

  The following instrument equipment is not included in the index: Electrical Relays, Alarm Units, Telemetry Units, Public Address Amplifiers, Fire Control Units.

- The instrument part of the hours spent by our Engineering Contractor amounted to about 26.000 hrs. This includes also time spent on change orders.

- The instrument part of the hours spent by our Yard Contractor amounted to about the same as the engineering part 26.500 hrs.

- Actual direct manhours used during Offshore Hook-Up was 11.600 hrs for instrumentation, but after inclusion of overhead direct related to instrumentation this figure was increased to about 17.500 hrs.

2.5.3.8 Experience

During the different phases controlled by the EAN Engineering Team, experience has been gained and below are some thoughts/comments given:

- The idea of having the same Engineer/Engineer Team responsible during all the different Engineering phases was good. Ideas developped during the Basic Enginnering phase could be followed during the other phases and no unnecessary philosophy changes occurred. The people used during these Engineering phases showed to be a good pool for supplying manpower into the different Construction teams. These people were already acquainted with the Frigg field, the EAN way of working, the procedures and the different philosophies within the project.

- Appointed responsible persons within each operational responsible department and in particular to integrate a Production Department representative into the Engineering team worked out very well. Since these persons were experienced and had to follow the project development closely they had a good influence on the project and saved us a lot of late discussions during the final documentation circulation. Also on vendor selection we profitted on them.

- We sufferred to some extent by the lack of good coordination within the Engineering Contractor´s office between the different disciplines and between the Engineering and the Procurement sections. These problems were compensated to some extent by their office location close to our own. Because of this we could involve ourself directly in their work, in informal discussions and have a better influence on the work.

- The Integration Engineering phase was the most troublesome for the Instrument section. First of all, the so called "As Built" drawings were in some cases to very little help. The reasons for this might have been the very long time lag between minor offshore modifications and the updating of the relevant drawing. Also the heavy procedure to follow in such cases were not always followed. The Engineering Contractor had a limited number of engineers with integration experience and not sufficient amount of engineers with proper offshore safety certificate to perform the offshore surveys required for this integration. Also within our own organization too little emphasis was paid to the integration problems in the beginning because of many other tasks.

  My recommendation to this problems is, to assign a special *Integration Group in the Enginneing Contractor´s organization* early in the project with experienced engineers so that these studies can be solved before they become a problem.

- Another problem which arose during the project and which can be handled better was the inspections at vendor workshops. These inspections were mainly handled in an individual way, in most cases in a good way, but in some cases, when time or other thing were not adequate, not good enough. This created some unnecessary offshore problems and most of them can be overcome with a more consistant inspection with written procedures.

- Another item creating some problems on the Yard and during Offshore Hook-Up was the late arraival of vendors´ documentation, instructions and drawings. This can be overcome by requesting one or two extra sets for early delivery in addition to the final documenation.

- The amount of different cable types used within instrumentation can still be reduced. This will minimize the number of expensive late purchases in the end of the Hook-Up phase. As it is today, we try to have a maximum limit of 20 % spare cores in a cable and sellect therefore different multicorecables and when we in addition must have different colour coding, screening, armouring and fire resistancy we end up with too many different types just to facilitate for the lowest price and weight.

  So, the conclusion is that it is cheaper with some extra spare cores than late purchases and a too good cable quality instead of preliminary cables which need to be replaced later.

- After "Start-Up" it has showed that our pipe flushing procedures are not good enough. Several inline instruments (turbine meters and orifice plates) are already after a few weeks of operation *damaged. The problem is the same for both small and large pipe* diameters.

- The Artemis project control computer system was in use during the Engineering Follow Up phase. The benefits from this was limited due to the late arrival of the system and the limited training given. But, in the future, when the different Engineering phases are geared for this, it will be a good and powerful tool.

2.5.4 Mechanical

The mechanical work in the engineering phase was contracted to Sofresid Norge A/S (SN) under the control of an EAN review team. The formative phase was handled in EAN by the discipline leader of the combined Mechanical/Piping Group. Later a mechanical engineer was recruited, first to assist in both activities, and subsequently to handle this function alone.

This worked well, but it is recommended that any future EAN project teams include a mechanical engineer earlier in the project.

Engineering contractor SN sub-contracted mechanical design work to Heurtey Industries, who did all the basis design in Paris with only occasional liaison visits by Heurtey staff to Stavanger. For these reasons the discipline work started slowly with poor progress in the early stages.

SN were pressed by EAN to establish a mechanical discipline function in Stavanger but only did this halfway through the Engineering phase, when 1 engineer was appointed. This proved to be insufficient staff but no increase was made until very late in this phase when 1 additional engineer arrived.

As a result an unnecessarily high work load fell on EAN review staff. The lessons for any future projects are clear - either insist on contractor design work being done locally, or install an EAN discipline engineer in a remote contractor's office for the duration of the work.

For Procurement purposes the equipment was divided into appropriate packages. These proved satisfactory except for the lead package, comprising both the Slug Catcher CV 210 and the LT Relief Scrubber CV 226. The Slug Catcher, a large heavy-walled (110 thick) vessel in low alloy steel, was correctly designated the lead item, especially because it was planned to build the module structure around it, in view of its size, requiring its presence at the yard at an early date in the fabrication. The LT Relief Scrubber, a thin wall vessel in 316L SS was not a lead item and did not form a logical combination with CV 210, essentially requiring a different manufacturer. The resulting sub-contract problems may well have been avoided with local manufacture.

The Engineering work done by the Contractor was of satisfactory quality, with one major omission - Quality Control procedures required for the Procurement phase were inadequately specified, giving rise to problems later in the follow-up period.

In general the discipline work went satisfactorily with no major difficulties.

2.5.5 Piping

2.5.5.1 General

The piping part of TCP-2 Extension project was consisting of the main parts:

- Design, build and erect the necessary facilities to process ODIN and NEF gas through Module 50 and Pancake 53.

- Integrate these, Module and Pancake, to the existing TCP-2 Treatment and Compression facilities.

In order to achieve this goal a first direct design requirement was outlined by SNEA(P) consisting of:

- Preliminary design study for Module, Pancake and Integration (Tie-In).

- Technical specifications.

These data were the basis for the engineering contract F.087 awarded to Sofresid Norge A/S (SN).

2.5.5.2 Technical Solutions

One of the main criteria for the design was to be consitent with the existing treatment facilities of the concerned area of TCP-2. In this way the Module 50 is similar to M01, M02 for the following parameters:

- length
- elevation of main deck
- elevation of upper deck
- space between module
- reference truss location

. Regarding the same philosophy, the Slug Catcher CV 210 was nearly identical to the existing CV 1A, same design of instrumentation. The choke valves of NEF gas inlet were the same installed on DP-2 etc.

. All process equipment installed on skid.

. In Pancake 53 was foreseen a mezzanine deck to assume the charge of condensate separator to four pumps. This solution was deleted as soon as the pumps were cancelled by process further investigation.

. The temporary NEF dewatering pig station was skid mounted in order to be easily removable after use.

2.5.5.3 Module 50 - Pancake 53

Module 50

The basic study was slightly detailed and the plot plan and lay-out phases went through in good way, after a slow start due to unmanned team and office moving in Dusavik at the early period of '81.

The general arrangement of the module did not change and the main engineering questions were about:

- length of ODIN and NEF metering
- length and supports of the mezzanine deck above CV
- height of the vertical CV 211 & CV 201 scrubbers and their corresponding outlet piping
- low temperature vent system

The stress calculations were made by SN and checked by EAN through a contractor DAMPKJELFORENINGEN A/S.

Pancake 53

During the plot plan stage of the pancake study several alternatives were designed.

- with or without mezzanine deck
- with or without condensate pumps
- different dimension of electrical cabinet
- several locations of L.T. vent scrubber CV 226

2.5.5.4 Integration

Connection Module to Pancake.

The piping process and utility connections were designed to be installed on a big partly prefabricated pipe rack: tricky points dispatching of the pipes at limit of Pancake 53 in cellar deck, connection to the existing rack in P07.

Tie in existing facilities.

For small diameter lines, in split of several SN offshore surveys it remained a lack of accuracy due to the non correspondence of the existing as-built drawing.

For big diameter tie-in i.e. 20" gas to and from compression Phase I no problem.

Pipe support

Following comments from the Hook-Up Team; it seems necessary to foresee extra length adjustment on the legs of hook up erected supports even for big pipes, the platform never being at the millimeter of accuracy.

2.5.5.5 Hook-up preparation

This work can be split into several items:

- platform cleaning task
- hook-up task
- pressure test task

The platform cleaning task sheets were made by SN and EAN. Offshore surveys were necessary and many comments were made.

The hook-up task sheets carried out by SN. Few comments in spite of the complexity of the integration.

Pressure test task sheets done by EAN, being out of SN scope of work. The material used during these tests was purchased by EAN. It appeared faster, easier and cheaper to give the full package to be furnished by hook-up contractor.

2.5.5.6 Construction (Prefabrication).

This part was followed up by a separate construction team.

It is necessary to emphasize the interest of a "pre-fabrication" survey on this yard, by the discipline leader involved. It allows him to give direct answers to the first questions raised at this stage by the prefabrication contractor.

2.5.6 Structural

The Sofresid Norge A/S (SN) Structural Discipline was headed by a senior engineer employed in January '81 (after the contract was given to SN). The engineering was performed with two structural engineers plus two draftsmen.

Structurally the Module 50 (M50) and Pancake 53 (P53) is traditional H-beams design. The main difference between the neighbour modules and M50 is that the main verticals and skew beams were turned 90 deg. on M50. This was done to have a more correct transition of forces through the nodes, and to save weight.

Lifting "ears" instead of normal lifting "eyes" was a disadvantage for a relative small lift as M50. It led to complicated design and it was difficult to adjust length of lifting sling by inserting shackles.

The computer model for M50 was established in SOFRESID Paris and the computer runs were done in Paris. This was a clear disadvantage. After the computer calculations had been done (one week in Paris) it was difficult to have rerun after errors were found. The errors were evaluated and justified by handcalculations. The transport condition was also evaluated by handcalculations.

The Pancake was checked for structural integrity by hand, this was a clear disadvantage.

The final structural report is good except for the fact that it is very difficult to follow or update the handcalculations. The report was finalized by SN before yard construction started. However, due to comments from lifting contractor some minor revisions were done for the detailed handcalculations of lifting frame in August 1982. Final acceptance from DnV was not received before just prior to load out as details concerning jacking, load out and seafastening conditions had to be clarified.

A close cooperation existed between the EAN and the engineers' discipline leader. Prior to submittal for approval, the drawings were normally checked on the draftstable. A monthly weight report was issued. The work was performed to a proper quality level and completed on time.

Design work not covered by SN was performed by R. Bjerck A/S (various supports) and Kvaerner Engineering Ltd., London (temporary pancakes). Structural check of anchor flange platform supporting ODIN and NEF risers was done by Kvaerner Engineering A/S in Stavanger.

For strength of TCP-2 main support frame documentation was based upon existing analysis from 1980 by Kvaerner Engineering A/S. Analysis of 1980 includes loads from future modules at south end of TCP- 2, but the imbalance caused by the fact that these modules are not present now, was regarded to have a small effect on the most loaded frame members.

A study was performed by Kvaerner Engineering A/S to check deflections of support frame below the four support points of M50 for present and future conditions.

One of the aims of that study was to be able to build shims into the Module on the yard and avoid offshore shimming. Basis for the study was offshore measurements made by Bloms Oppmåling A/S May 1982.

Kvaerner Engineering A/S also made a computer analysis to check strength of Pipe Support Frame No. 1 supporting new temporary storage pancakes fully loaded. Local handcalculations of south west corner of support frame were also performed for the same loads.

2.5.7 Electrical

2.5.7.1 General

The electrical part of TCP-2 Extension project was consisting of three main objectives:

- To provide electrical power to process - facilities in Module 50 and Pancake 53.
- To intergrate these power requirements to the existing TCP-2 Treatmen and TCP-2 Compression power generation and distribution systems.
- To install new electrical equipment such as normal & emrg. lightings.

In order to achieve this goal the direct design requirement was outlined by SNEA(P) consisting of:

- Technical specifications
- *Preliminary design study*

These data were the basis for the engineering contract F.087.

SØNNICO A/S acted as a subcontractor to Sofresid Norge A/S (SN) for the electrical part of TCP-2 Extension project.

2.5.7.2 Technical Description

TCP-2 Extension together with contractor made a study of the SNEA(P) design proposal.

The consequence of this study showed that the foreseen new electrical room to be located in the process area of P53 could with advantage be fully integrated to the existing facilities in TCP-2 Treatment and TCP-2 Compression areas.

The Benefits Are:

- Reduction of engineering work
- Reduction in installed weight
- Cancelling of inverters
- Cancelling of static switches
- Cancelling of battery banks and room
- Cancelling of electrical room facilities for switchgear and MCCs
- Cancelling of H.V.A. system for electrical & battery rooms
- Cancelling of shut down intergration
- Reduction of construction work (all trades)
- Centralizing of electrical operational MCC & DBs equipment
- Optimilizaton of existing systems
- Reduced maintenance prospects

380 V AC Network MCC A and MCC B

TCP-2 Extension power requirements (load & units) were reduced during the engineering process.

Two MCCs (A and B) were installed in TCP-2 Compression low voltage room. They became a natural extension of the existing TCP-2 Compression MCC A & MCC B, based upon the same drive and shut down criteria as for compression power feeding.

However, a fully equipped ACB was installed between TCP-2 Compression MCCs and the TCP-2 Extension new MCCs. This opens the possibility of selectivity and busbar protection for the individual process supply (Extension and Compression). This enables independent maintenance of TCP-2 Extension MCCs without interrupting TCP-2 Compression 380V AC feeders. However, the extended MCC's are at all times depending on compression part in service. The balance of consumers between MCC A & B enables the same guarantee of continued drivecondition for TCP-2 Extension as for TCP-2 Compression 380VAC power feeding.

TCP-2 Extension - MCC A No. S 52.32.2.2. is extended from TCP-2 Compression MCC A compartment No. 7, which houses the commen feeder from switch board S 52.32.2.1. bar "A" compartment 3, air circuit breaker 643. The TCP-2 Extension MCC B S 52.32.2.3. follows the same set up as for A.

The TCP-2 Extension MCC A and MCC B have been installed with a large physical non equipped spare space. With respect to possible future needs and seen in prospect of engineering cost the difference in total installation cost was neglectable.

The physical size of MCC A and B was therefore designed based upon natural extention of existing MCCs for optimal use of available space/area in TCP-2 C low voltage room Module 32.

With respect to the existing MCC design and manufacture the TCP-2 Extension followed the recommendation given in TCP-2 Extension final report.

The TCP-2 Extension MCC A and B equipped section have all signal/control cable running to marshalling cab. 5 in TCP-2 Treatment interface room ready to be terminated according to interconnection needs.

With respect to future installations of spare non equipped TCP-2 MCC sections, the load prospect seen in connection with upstream cable feeder characteristics must be calculated.

Normal Lighting 220 V AC DB 321

DB 321 is fed from MCC B S 52.32.2.3. compartment 23 GH to TCP-2 Treatment cabling room. The system is balanced of one phase neutral 380V supply protected at the power feeding breaker in MCC TCP-2 Extension located in TCP-2 Compression low voltage room Module 32.

The consumers are practically arranged and located in the process areas of P53 and M50. Circuit protection is in DB 321. The normal lighting consumers were installed at yard. Power feeding cables entering M50 & P53 are centralized to one marshalling box in respective modules. The fixtures and DBs were chosen in cooperation with operational responsible department. Shut down of DB 321 is on line with MCC B TCP-2 Extension in TCP-2 Extension low voltage room.

Emergency Lighting 220 V AC DB 322

DB 322 is fed from DB 308 in TCP-2 Treatment emergency room circuit 89/30A. The shut down and feeding as for the existing emergency supply DB 308.

The consumers are battery/inverter individuals, practically arranged in the location of P53 and M50. Type and manufacture of fixtures and DB selected on line with operational deptartment. Consumer power cable feeding to P53 and M50 centralized through BBC marshalling box at modules.

Emergency Supply 24 V DC DB 321

Located in TCP-2 Treatment interface room first floor. Supplied from DB 310 24V DC emergency located in same area. Shut down level as for 310. Protected in 310, circuit D 10. Panel type and manufacture Eldon/NE construction as for all other TCP-2 Extension panels.

Emergency Supply 110 V DC DB 323 No Break

Location in TCP-2 Treatment interface room first floor. Supplied from TCP-2 Compression M44 emergency S.53.44.3.9. - A 4. Shut down level as for DB S 53.44.3.9. Protection in S 53.44.3.9. A 4. Panel type and manufacture Eldon/NE construction as for all other TCP-2 Extension panels.

Process Heat Tracing DB 316

The TCP-2 Extension power need with respect to heat tracing changed through the process of engineering and during yard construction (increased).

The power distribution panel DB 316 is located in TCP-2 Treatment cabling room servicing other consumers than TCP-2 Extension.

The design, engineering and installation of DB 316 were done by Maintenance department taking into account the forcasted power/distribution need of TCP-2 Extension.

Cable Tray/Ladders and Cable Installation

The cable and cable installation caused in general no specific problems.

Due to cable manufacturing tolerances with respect to cable diameters the selection of gland caused installation problems.

Cable Tray / Ladder

Stainless steel trays (Øglænd) were used for the installation. Some practical problems occurred during installation with respect to details of galvanical isolation and earthing of the cable tray. This can be traced to inefficient detailed engineering and specifications of bolts and nuts.

Bulk Material and Consumables

A more specific discrimination between the two groups bulk and consumable of material in the engineering contract would have been to an advantage. Specification with respect to EXE (d) classified material within both groups was missing.

In general, the bulk and consumable should not be separated "deliveries" and should be the total responsibility of the engineering services to specify and ordinary inspection/quality control should be valid.

Operational Considerations

General (Power Supply)

All electrical MCC and DB supplies are extension of the existing in service systems.

Consequently the shut down level prospect of TCP-2 Extension installed MCC and DBs are all following the philosophy of the upstreams equipment with respect to drive condition.

With exception from the welding socket outlets all MCC A, B and DB power supplies are integrated to the existing network drive philosophy.

General (individual consumer supply)

The authomatism/stand by philosophy for the individual consumer drive condition is to be found in the system description for respective units and systems.
General black start

MCC A & B respective ACBs are provided with undervoltage relays which require manual operation of ACB after shut down or trip of TCP-2 Compression switchboard S52.32.2.1. & 2.2. All DBs follow the condition for upstreams feeding boards and have not been foreseen with individual trip functions.

Trouble Shooting Diagram

TCP-2 Extension/Engineering department was undertaking this part of the work with assistance from outside drafting companies.

The trouble shooting drawings will be produced after finalization of construction as built drawings.

However, TCP-2 Extension took notice of the TCP-2 Compression recommendation with respect to drawing-lay-out of the construction engineering drawings to be directly transferred to trouble shooting diagrams. This set will be part of the Maintenance Manuals.

2.5.7.3 Enginneering Development

Schedule/Phases

Following the contract F.087 the engineering schedule was worked out in cooperation with the contractor.

Contractor transfer to Stavanger, combined with office facility problems created some starting difficulties and the electrical trade was undermanned during the first period of the basic engineering phase.

For the engineering part of the services performed by contractor this was within tolerances of the schedule, but gave some negative downstream engineering effects. For some activities, procurement inspection and workshop follow up as well as commissioning activities *outlined in F.087, the contractor did not perform as expected.* EAN/TCP-2 Extension project team had to reinforce projectinternal manforce as well as requesting assistance from EAN inspection and other departments in order to perform these activities.

Reason for Difficulties

- Dissent in definition of scope of work laid down in contract F.087 between company and contractor.
- Coordination within the contractor team. (Subcontracting prospects).
- Location of the engineering services (Sønnico) and the "main" office of SN in Dusavik.
- Head of electrical engineering (Sønnico) changed.
- Underestimated lump sum contract resulted in change order (extra work) hunting.
- Lack of understanding from contractor with respect to offshore *engineering difficulties.*
- Change in EAN specification.
- Change in trace heating scope of work.
- Integration problems with respect to find updated as built drawings in EAN Central Filing.
- Often lack of internal control by the contractor before issuing a document.

3 PROCUREMENT

3.1 GENERAL

3.1.1 EAN Procurement Function

The procurement function was established as a section within the TCP-2 Extension Department. The section was responsible for the purchase orders, inspection, expediting, transportation and material handling.

The major task was to follow up the procurement activity performed by the various contractors.

The work did change a lot during the different phases of the project. At the beginning the work was related to follow up of main engineering contractor and assuring a proper review within the project.

As it during the project turned out that our main engineering contractor was not prepared for the heavy peak workload involved in the activities covered under procurement services, EAN had to play a more active role. This additional work was coordinated through the procurement section with support from responsible engineers.

During the construction, the procurement section had a split function between procurement coordination in Stavanger and material coordination of the construction site in Bordeaux. During the hook up phase, both procurement and material handlings were coordinated through the procurement section.

EAN did all the supplementary purchasing from autumn 1982. The major part of this work was handled through the procurement section within the project with some assistance from Purchase & Material Department.

3.1.2 Contractor Scope of Work

SOFRESID NORGE A/S (SN)

SN who was the main engineering contractor was also assigned to perform all procurement services required for the project. This covered stages from call for tender issue up to arrangement of transportation. Included in this was bid evaluation/recommendation, purchase order issue, expediting, inspection and all coordination of paperwork for approval.

AKER ENGINEERING A/S (AE)

AE was responsible for procurement related to the NEF Power Supply Project. Their scope of work was the same as for SN. The only difference was that the contract with SN was on lump sum basis while the AE contract was based upon reimburse.

PONTICELLI FRERES (PF)

The scope of supply for PF was limited. All major equipment was purchased through SN. The only supply left for construction was secondary steel, small piping material and consumables.

HAUGESUND DE GROOT OFFSHORE A/S & CO. (HDG)

The procurement was limited to minor items and consumables. The EAN scope of supply was defined through the task sheets and it was the intention that HDG should supply material not defined by EAN.

3.1.3 Artemis

During early 1983 it was decided to introduce a computerized management system for the follow up during summer 1983. In the procurement section there was developed a system related to materials. This was a system crossreferencing quantity available with quantity needed. This system gave a very good control of material supplies to the platform.

3.2 QUALITY ASSURANCE (QA) / QUALITY CONTROL (QC)

3.2.1 Quality Assurance

The procurement section was responsible for all coordination of the procurement activities from signature of the purchase orders (POs) until delivery.

Appendix No. 2 "Internal Procedure Procurement Follow Up" shows the detail procedure for this work.

All Vendors or Contractors performing services for the TCP-2 Extension Project were requested to comply with our minimum QA requirements. Depending upon the criticality of their deliveries NS 5801, 5802 or 5803 (or equivalent recognized standards - BS etc.) were to be applied.

QA audits on supplier´s premises were undertaken for all critical items.

3.2.2 Quality Control (QC)

3.2.2.1 General

The basis for the QC was:

- The required codes and standars
- EAN specifications
- DnV Technical Notes Vol. B.

The quality control of the vendors was the scope of work of Sofresid Norge A/S, but EAN´s project team was heavily involved especially in the welding/mechanical side.

At the beginning of the Procurement phase during the clarification meetings we discovered that the vendors did not know the contractual documents and specially not the Technical Notes Volume B from Det norske Veritas (DnV).

The main reason of these problems was often the low temperature properties required for the material ordered (i.e. pressure vessels). Also, some manufacturers employed a sub-contractor for fabrication, and this complicated the follow-up.

3.2.2.2 Welding

One of the main goals of the QC section was to approve all welding procedures. The first step of each Purchase Order was to solve welding matters by qualification tests, and by doing so we discovered that some vendors believed to be competent for low temperature properties but they failed and all the parties involved agreed about the importance of these qualifications before starting the production.

The QA/QC section has commented and approved, with the different discipline leaders, all QC programmmes and NDT procedures. Inspection during fabrication of the equipment was carried out by the QC section with a small SN team. Our involvement was higher than foreseen because our contractor started with a too small team. Later on, Sofresid Paris was involved particularly for material procurement.

3.2.2.3 Slug Catcher CV 210

The biggest and most important single equipment is the NEF Slug Catcher - CV 210.

Below are summarized the main problems met during the fabrication of this vessel:

This order was placed with the British company Babcock Power Ltd in the Glasgow area.

Considering the big problem encountered at Frigg with similar vessels (Separators CV 1A/B/C and Contactors CV 2 A/B/C) the TCP-2 Extension team requested doubling plates for fixing internals. For the NDT examination we extended the control after hydrotest.

Babcock was apparently unfamiliar with the design/fabrication codes despite assurances to the contrary at the bid stage. As an example, only two weld procedures qualification tests were first offered when the codes clearly require six as later agreed.

Babcock was reluctant to alter their procedures in order to meet our requests. Also, at the first stage some specilists were in obstructive and unconstructive attitude towards EAN´s requests. But, after the bad results obtained at the first welding qualification test, they finally accepted our requests.

The first fault was done with the welding procedure qualification for longitudinal seams because of the moisture of the flux, resulting in micro-cracks discovered during the metallurgical investigation following low results at the mechanical test stages. This excessive moisture of the flux induced hydrogen cracking in the weld. QC section had pressed Babcock for prework monitoring of flux humidity and for maintenance of the preheat treatment after welding to obtain better hydrogen release. These proposals were strongly resisted, finally after the failure they were accepted.

When these problems were overcome, no particular problems were encountered during the fabrication phase of the vessel.

3.3 PURCHASING

3.3.1 Sofresid Norge A/S (SN)

The procurement services was part of the whole engineering contract (Contract F.087). The work was organized jointly between SN engineering and procurement. The engineering responsibility ended at the issue of the call for tender package, which again was approved by EAN. The procurement section issued call for tender to bidders and organized the bid opening. The bid evaluation was coordinated by procurement section while engineering section made the technical part. After the preparation a bid evaluation with recommendation was issued to EAN for approval. After selection of bidder SN was instructed to issue purchase order.

Due to documents being sent back and forth several times for comments/approval too much time in the purchasing process was used before order was placed. The time spent from call for tender was issued until purchase order issue varies between 20 - 30 weeks (this is based upon control of 30% of purchase orders). The reason for the documents being sent back and forth several times was very often the quality of documents received.

3.3.2 Aker Engineering (AE)

As part of the engineering work for NEF Power Project AE Engineering was requested to undertake the procurement related to this work. Approx. 30 orders were issued with a total value of NOK 1.402.120. The work from AE was not satisfactory. They were not prepared to do the job as extensive as required by EAN and we made a lot of efforts in explaining how we wanted the job performed.

This problem arised due to the fact that AE did not have any experienced personnel with background on procurement and inspection activities assigned to the project. A lot of the work had therefore to be undertaken by staff from TCP-2 Extension Department.

3.3.3 Ponticelli Freres (PF) and Haugesund de Groot Offshore A/S & Co. (HDG)

The purchasing activity during these contracts was very limited and the amount involved was part of the lump sum contract. EAN was therefore not involved in these purchases except for quality acceptance.

3.3.4 EAN Purchased Material

During the last half of 1982 and 1983 all material needs which arised was handled by the project itself. This was mainly taken care of by TCP-2 Extension own procurement team but also with assistance from EAN Purchase & Material Department. As most of the orders were fairly small we did not face any big problems to the deliveries. The amount of EAN issued orders was approx. NOK 6.211.000. That is approx. 13% of the materials ordered for the project.

3.4 INSPECTION/EXPEDITING

3.4.1. Work Execution

This work should according to contract with SN be performed by this company. To a great extent EAN had to take over a lot of these duties especially near the end of the project. In general SN limited the inspection/expediting to 2 visits because this was foreseen when calculating offer to EAN. For many orders this was too little. For the inspection of fabricated equipment as pressure vessels, visits had to be performed once a week to keep up with quality and delivery time. Due to lack of SN attendance TCP-2 Extension nominated the procurement section to be responsible for organizing inspectors and expedite. In most casesthe inspector was the person performing the engineering within the project group but in some areas external inspectors were hired.

3.4.2 Reporting / Acceptance

The inspection/expediting side within SN was relatively weak, and the project team had to support SN extensively.

On the inspection side we suffered from lack of inspection forms (list of check points) and partly inspection reports and minutes of meetings taken place. This caused trouble at later stages as both parties referred to mutual agreements/opinions. Due to this it was difficult for the responsible within the project to follow up and do audit on equipment deliveries.

3.4.3 Subcontractor

Part of the work was placed at sub-contractors, occasionally without our previous permission. The sub-contractors were often not aware of our acceptance/certification requirements. That caused us, in many cases, to work directly with the sub-contractors. The experience gained here is that vendors pay little attention to sub-contracted work and we should avoid to place purchase orders through "paper agencies".

3.5 TRANSPORTATION / CUSTOMS

3.5.1 Transportation

This part of the work was performed without any major problems.

The work related to transportation to the fabrication sites in Port Jerome, Bordeaux and Stavanger was organized through EAN Purchase & Material department and the contract they have with Limaterminalen.

Two transports were performed on chartered boats. That was the structural steel from Horten to Bordeaux and CV 210 from Glasgow to Bordeaux. The reason for this was for the first case the extreme lengths and for the other the heavy weight. The remaining, 90 % was performed by surface freight and 10 % on airfreight.

3.5.2 Custom Handling in Bordeaux

The transport companyMory SA´s branch office in Bordeaux was awarded the contract related to custom clearance and warehousing in Bordeaux. This contract was fullfilled to our fully satisfaction. They did the work with clearance in and out from PF including the cardex system.

3.6 MATERIALS HANDLING

3.6.1 Construction

The fabricator Ponticelli Freres (PF) had the responsibility of materials handling on the different fabrication sites. The material was received by them and was from the time of acceptance their responsibility.

For the piping fabrication PF computerized system which gave a good view of quantity needed. This system gave EAN the opportunity to purchase additional requirements in time before needed.

3.6.2 Hook-Up

During preparation for hook-up the "Artemis" computerized management system was introduced. Procurement was part of this with main activity based upon materials.

The system was built up with a crossreference of material ordered and material needed. All purchase order items were entered. The same was the material described on each task sheet. By crossing this information we were at any time updated with quantity of missing material. This made the opportunity to order and have available all material before needed offshore. Based upon the information implemented with reference to each task sheet we were also able to issue shipment documents for each task (Stock Request (SR)).

The original intention was to have printed automatically the SRs based upon the opening of task offshore according to planning. This failed and we had to initiate SR after receiving weekly call ups from offshore. For each SR all shipping data and quantity shipped/missing was entered and was available on offshore terminal at time of departure for supply vessel. This was an acceptable solution.

3.7 SURPLUS

Due to good control of materials both during construction and especially during hook-up the surplus equipment is very limited.

The surplus only amounts to approx. NOK 1.600.000 which is about 4 % of total purchase for the project.

3.8 VENDOR DOCUMENTATION

To obtain the final vendor documentation has been a problem during the project. This especially applies for special made equipment. The suppliers were not prepared for the amount of documentation required. The quality is often not good enough and quite few vendors are reluctant to give away the information we want. The experience is at we should be better in redefining the exact definition of documentation required to avoid long discussions during fabrication.

3.9 KEY FIGURES

The total number of purchase issued in the project was 567.

This was split as follows:

Purchase Orders issued by Sofresid Norge A/S:	99	(MNOK 46.1)
Purchase Orders issued by EAN :	468	(MNOK 6.2)

4 CONSTRUCTION ON YARD

4.1 GENERAL

The yard fabrication works were awarded to Ponticelli Freres (PF) in Bordeaux in February 1982, and the works started in March.

The main lump sum scope of work was:

- Fabricate, erect and precommission of Module 50, Pancake 53 and connection pices (Tie-In Spools).

- Load out and seafastening of the same.

The main works were performed on the following sites:

- Piping prefabrication: June 1981 - December 1982 at Lillebonne (outside Le Havre).

- Structural prefabrication: at Ambes (outside Bordeaux) next to Ponticelli main offices and drafting offices.

- Erection and outfitting: at Bassens (outside Bordeaux) 18 km from Ambes.

The scope was in detail defined in drawings and specifications which formed the Technical Specifications of the Construction Contract F.142.

The overall dimensions and weight were:

	Weight	Dimension
M50	800 T	31 x 9 m
P53	100 T	13 x 12 m
Tie-In Spools	90 T	NA

The works were completed in April 1982, and the module, pancake and tie-in spools were then transported to Stavanger.

4.2 ORGANIZATION

4.2.1 EAN Organization

The Overall Organization of EAN is shown in Chapter 1, Figure 1.1.

The Site Team was organized to handle all the main problems on the site and were responsible to assure that the quality of the work was in accordance with the requirements.

The main principles laid down for organization and the communication to the support team in Stavanger was:

- A responsible supervision team on the site.
- Approval of shop drawings by site supervision team.
- Functional communications between discipline supervisors on site team and discipline leaders on engineering section.
- A continuous updating of yard scope of work from downstream activities (transport, lifting, hook-up).
- A strong back-up for electrical and instrumentation disciplines available at Dusavik.
- Visists by the support team in Stavanger when necessary.

The yard organization chart is shown in figure 4.1 and table 4.2 gives the schedule of personnel.

ELF AQUITAINE NORGE A/S SITE TEAM PONTICELLI

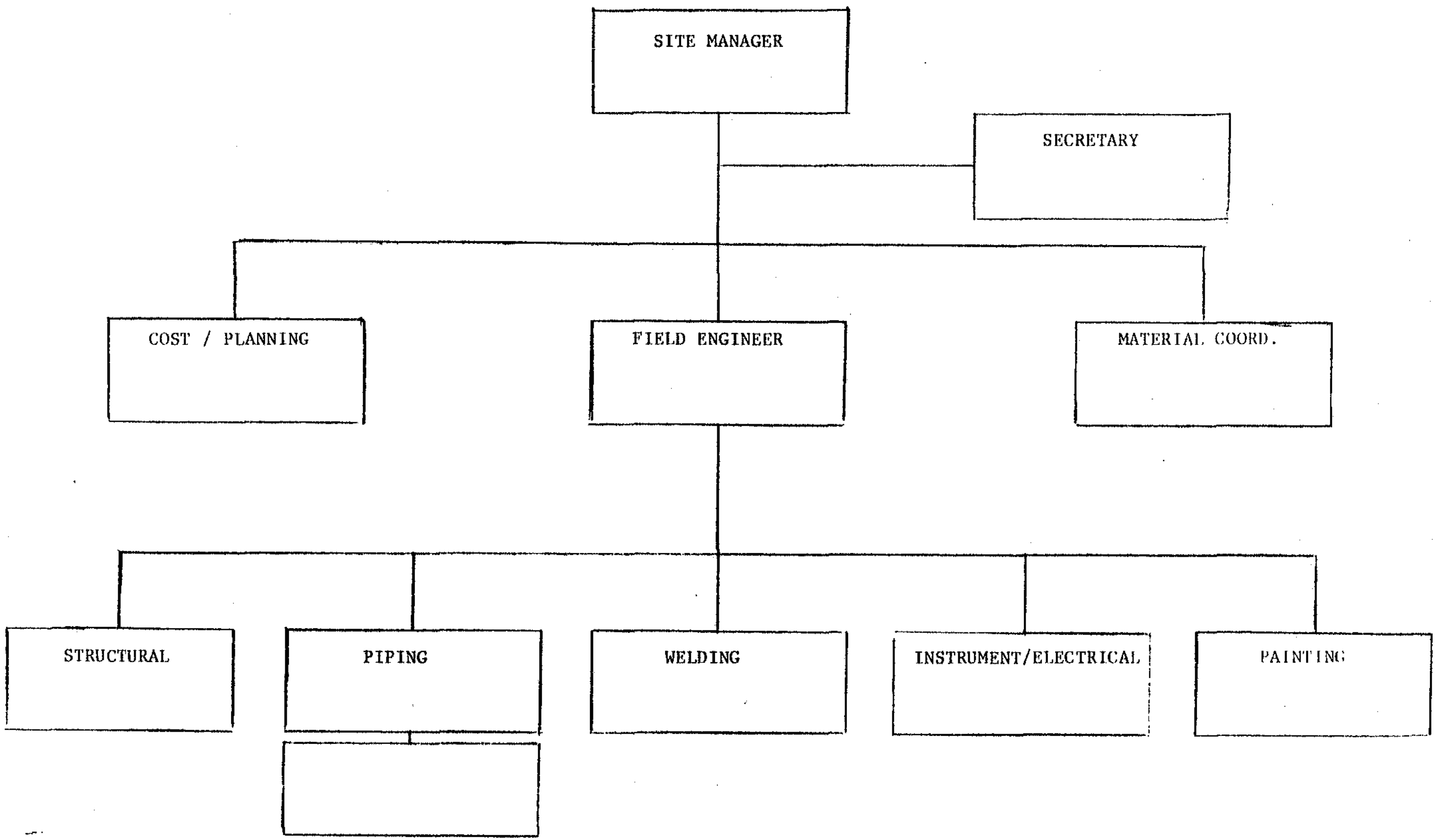


FIGURE 4.1

TABLE 4.2

Schedule of Personnel

	Name	Title	Company	Nat.	Assignment
1.	AMORY Michel	Piping Engineer	IS	Fr	Oct 82 - Apr 83
2.	COULOMBEL Daniel	Painting Insp.	Qualitest	Fr	May 82 - Sep 82
3.	CROMSTEDT Ulf	Instr.Pre-Commiss.	PSC	Sw	Mar 83 - May 83
4.	GARCIA Theresa	Secretary	PF	Fr	Apr 82 - May 83
5.	HAMMERSTRØM Øystein	Cost & Planning	AKER C.	N	" "
6.	HANSEN Thor	Struct.Superv.	SN	N	Apr 82 - Dec 82
7.	HENRICHSEN Arne	Material Coord.	EAN	N	Apr 82 - May 83*
8.	JOHANSEN Jarle	Struc./Sea Fast.	Midnoco	N	Jan 83 - Apr 83
9.	LANGVIK Svein	Field Engineer	Norsea	N	Apr 82 - May 83
10.	LE DUFF Alain	Paint.Insp.	Qualitest	Fr	Oct 82 - May 83
11.	NØDTVEDT Bjørn	Inst./Elec.Superv.	EAN	N	Oct 82 - May 83
12.	PAISLEY James	Welding Superv.	Qualitest	Br	Apr 82 - May 83
13.	RØNNING Jon	Piping Superv.	DnV	N	Apr 82 - Apr 83
14.	SOLHAUG Petter	Site Manager	EAN	N	Apr 82 - Apr 83
15.	SØMME Victor	Elect.Pre-Commiss.	EAN	N	" "
16.	THORSEN Leif	Material Coord.	EAN	N	Apr 82 - Apr 83*

* in rotation Bordeaux/Stavanger

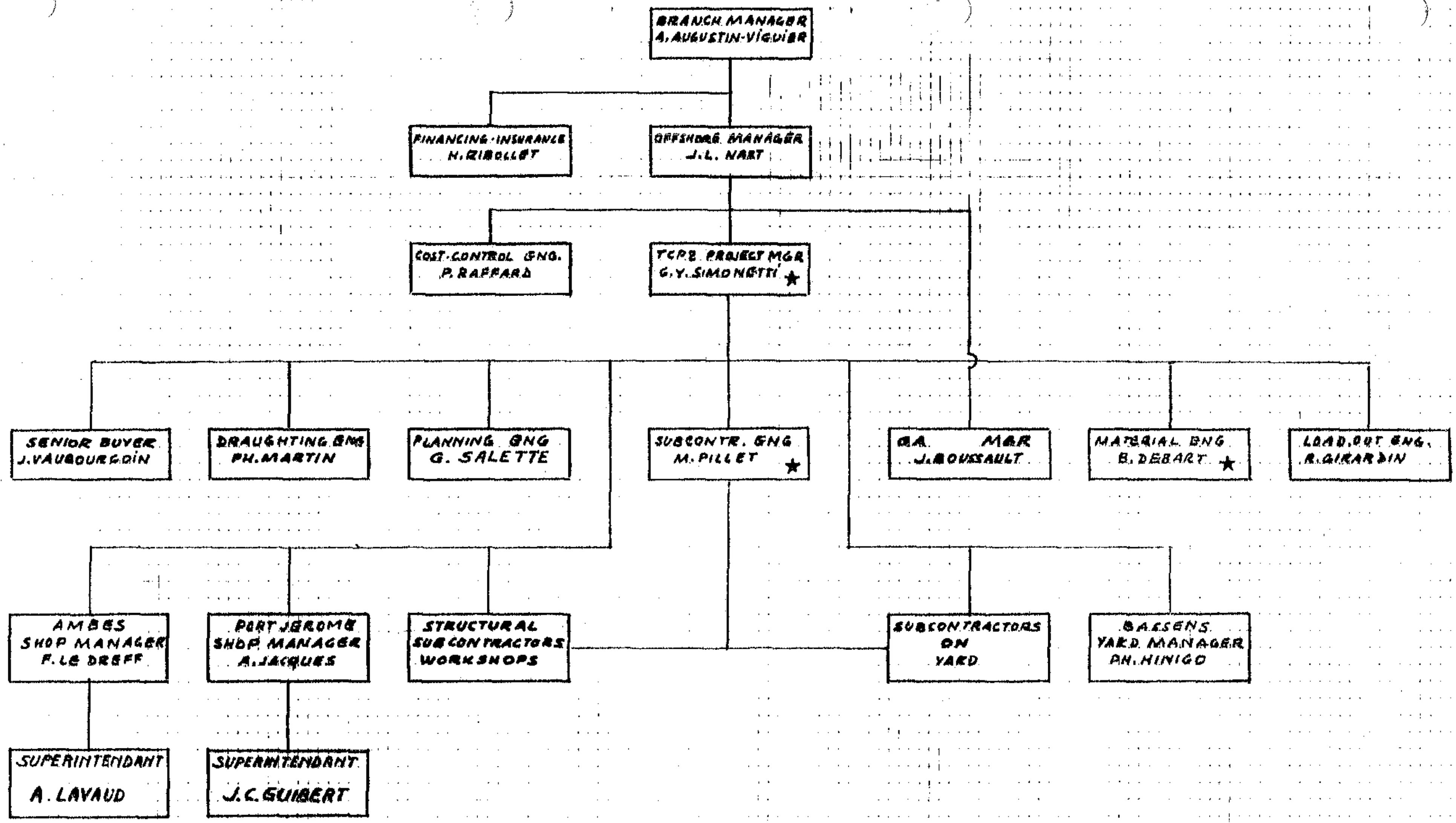
4.2.2 Ponticelli's Organization

Ponticelli's project organization is shown on figure 4.3.

The following sub-contractors were used:

- DUPIN	Sandblasting & Painting
- ROUBINET	id.
- PEINTURE NAVALE	id. (Le Havre)
- COMSIP/CGEE-ALSTHOM	Electrical & Instrumentation
- FORT	Prefabrication Secondary Structures
- S.E.T.	id.
- I.C.A.	Stainless Steel Cladding.
- AGMT	Galvanization
- GISOL	Insulation
- S.M.I.	Prefab.Pipe Supports (Le Havre)
- FOURE-LAGADEC	Post Heat Treatment (Le Havre)
- LETHUILIER	id. (Le Havre)

The line organization of the Quality Assurance / Quality Control section in Ponticelli is shown in figure 4.4.



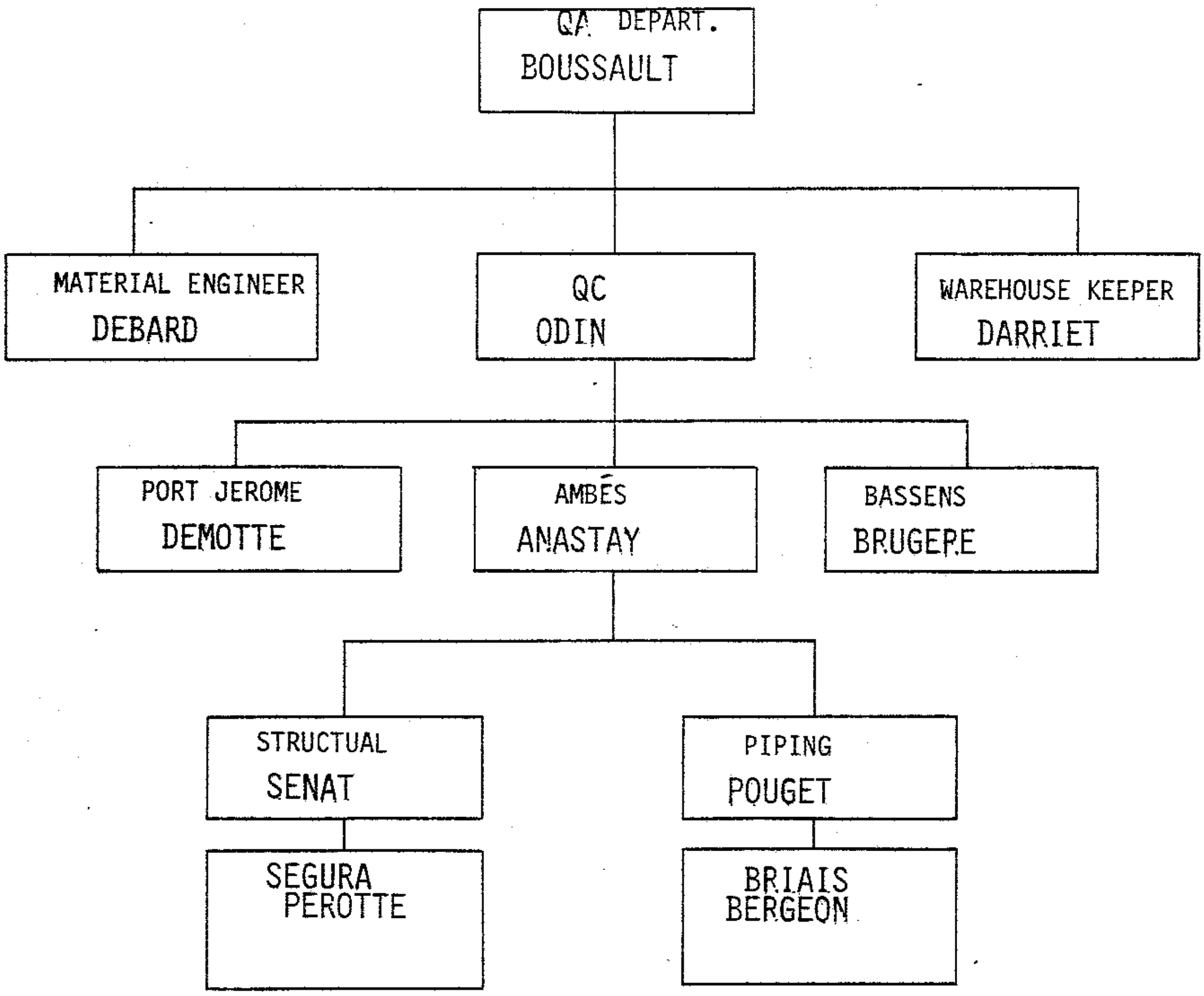
★ DEDICATED TO JOB.

FIGURE 4.3

TCP2 EXTENSION PROJECT
ORGANIZATION CHART
P.F. PROJECT GROUP

PONTICELLI frères
AGENCE DU SUD-OUEST - 33530 AMBÈS

DESS —— | DATE 09-08-82 | ECHELLE ——
N° | REVISIONS 1



QA DEPART.
BOUSSAULT
MATERIAL ENGINEER
DEBARD
QC
ODIN
WAREHOUSE KEEPER
DARRIET
PORT JEROME
DEMOTTE
AMBÈS
ANASTAY
BASSENS
BRUGERE
STRUCTUAL
SENAT
PIPING
POUGET
SEGURA
PEROTTE
BRIAIS
BERGEON

FIGURE 4.4

4.3 QUALITY ASSURANCE / QUALITY CONTROL (QA/QC)

4.3.1 Quality Assurance

The project worked out the required QA procedures in close cooperation both with the Fabricator - Ponticelli Freres (PF) and De norske Veritas (DnV). Besides, Dnv acted as our consultant during this phase. In general PF had some problems in meeting our requirement to QA.

QA measures in access of QA work performed and delegated to the Site Team consisted of Quality Audits managed from project head office in Stavanger.

Both System and Technical Audits were taken:

- NDT system/performance
- Welding (including procedure/qualifications)
- Project Procedure (approval procedure, distribution, marking, etc.)

The project requirements to Project Procedures were laid down in the - Quality Assurance Manual Fabrication Phase. The procedures in this QA manual gave instructions/guidelines to how the internal/external communications should be handled and the responsibilities. The following major procedure is listed below. For details reference is made to the QA Manual Fabrication Phase.

List of Project Procedures:

Documentation Routing Procedures

- Document Routing Procedures
- General Correspondence
- Shop Drawings
- Additional Work/Changes
- Welding Procedure Specification (WPS)
- Welding Procedure Qualification (WPQ)
- Non Destructive Testing (NDT)
- EAN Site Team internal correspondence distribution

The procedure for approval of shop drawings is shown in figure 4.5 and the material handling procedure in Port Jerome in figure 4.6 and in Bordeaux in 4.7.

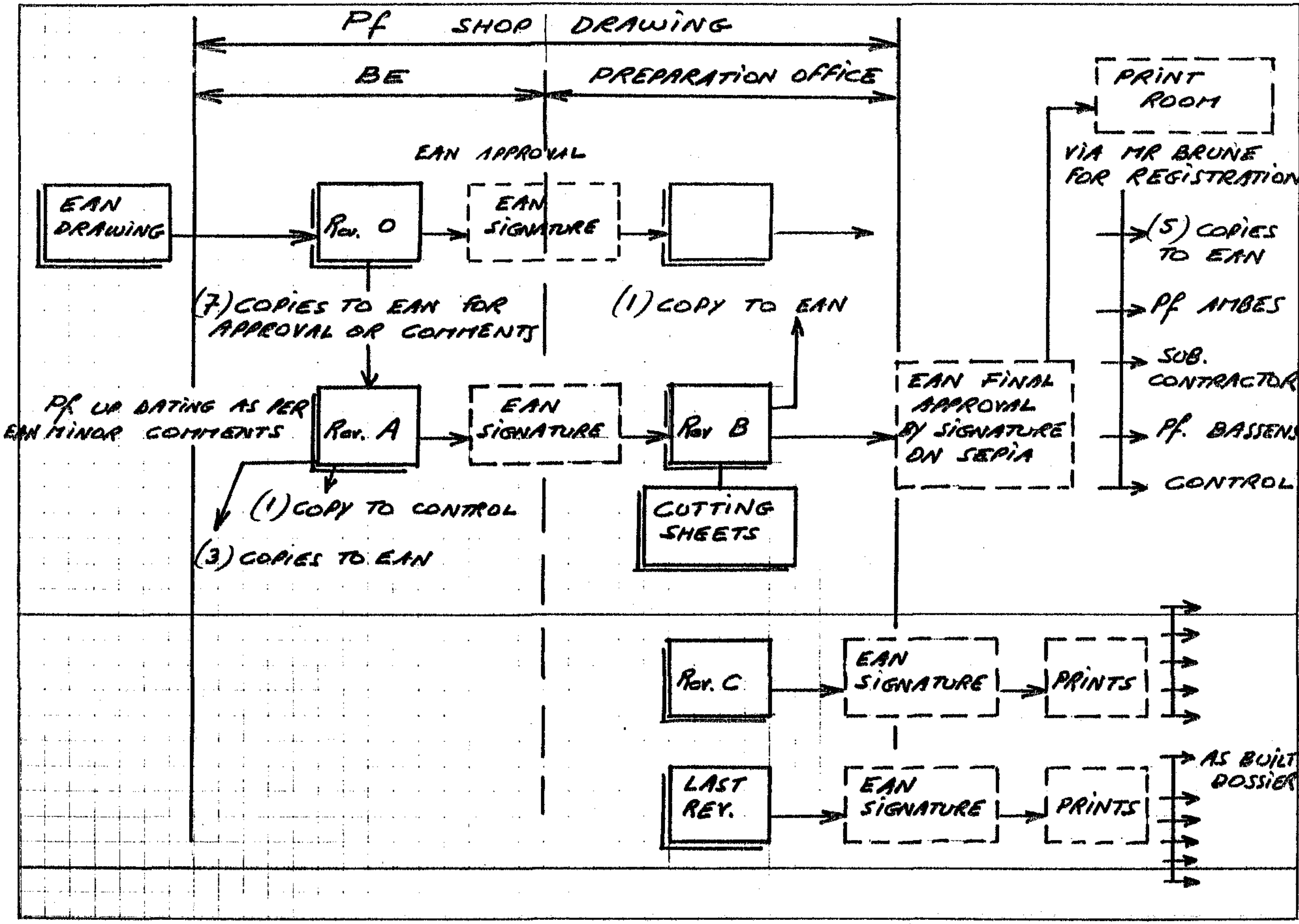
4.3.2 Quality Control

QC during the Fabrication phase at Ponticelli yard was achieved by:

- Ponticelli´s quality control team.
- TCP-2 Extension supervision team.
- TCP-2 Extension QC at Stavanger.

Mod. 503

FIGURE 4.5 - "APPROVAL OF SHOP DRAWING"



PONTICELLI Frères
Agence du Sud-Ouest
33810 AMBES

CLIENT et LIEU: EAN AMBES
PROJET: TCP 2 EXTENSION
SUJET: SHOP DRAWINGS

Feuille N°
Date: 26 MAI 82
Par: MARTIN

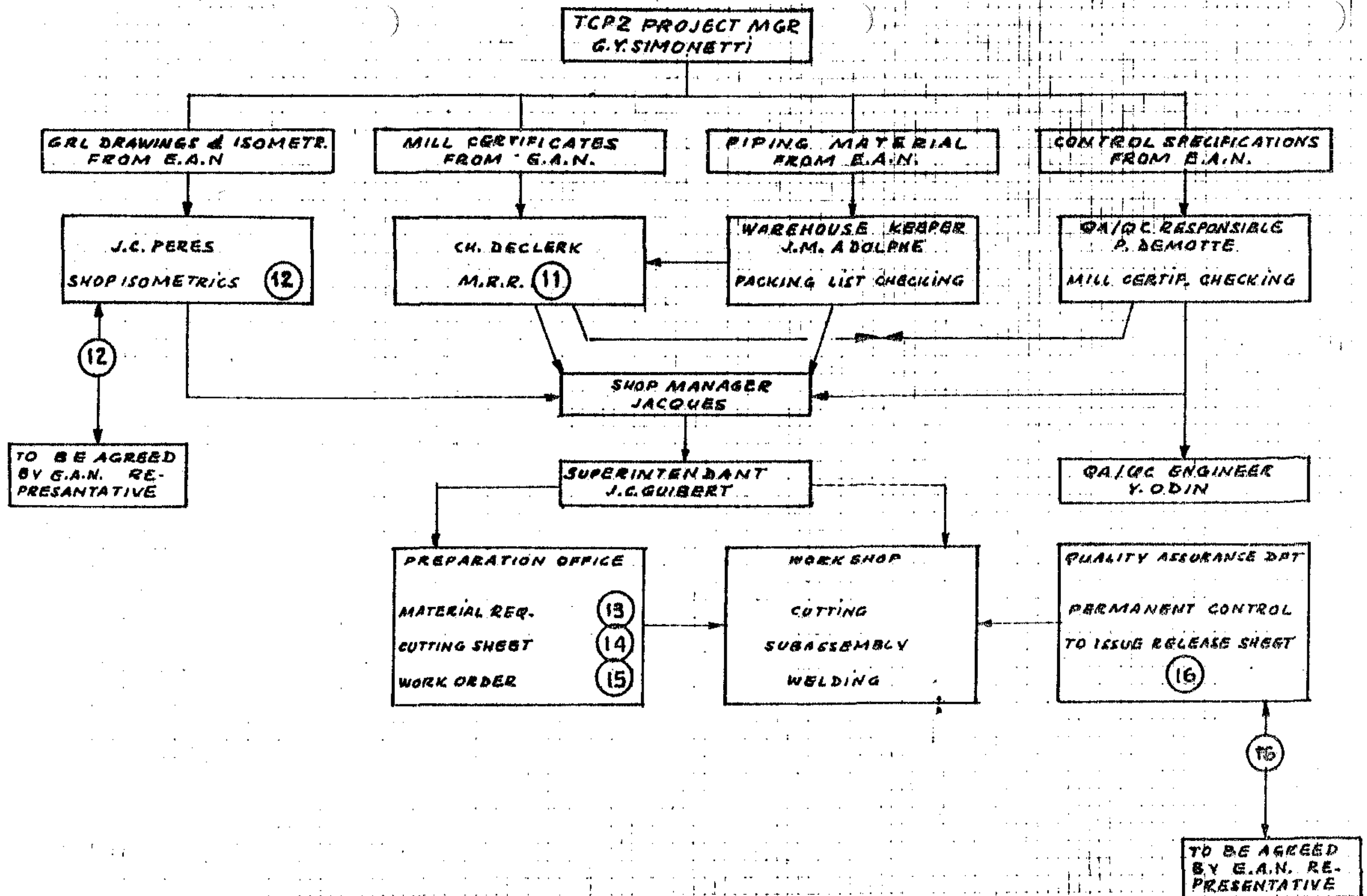


FIGURE 4.6 - MATERIAL HANDLING PROCEDURE

TCP2 EXTENSION PROJECT
MATERIAL HANDLING PROCEDURE
PORT JEROME WORKSHOP ORGANIZATION

PONTICELLI frères
AGENCE DU SUD-OUEST - 33210 AMBÈS

DESS. DATE ECHELLE REVISIONS

N° S-541-4

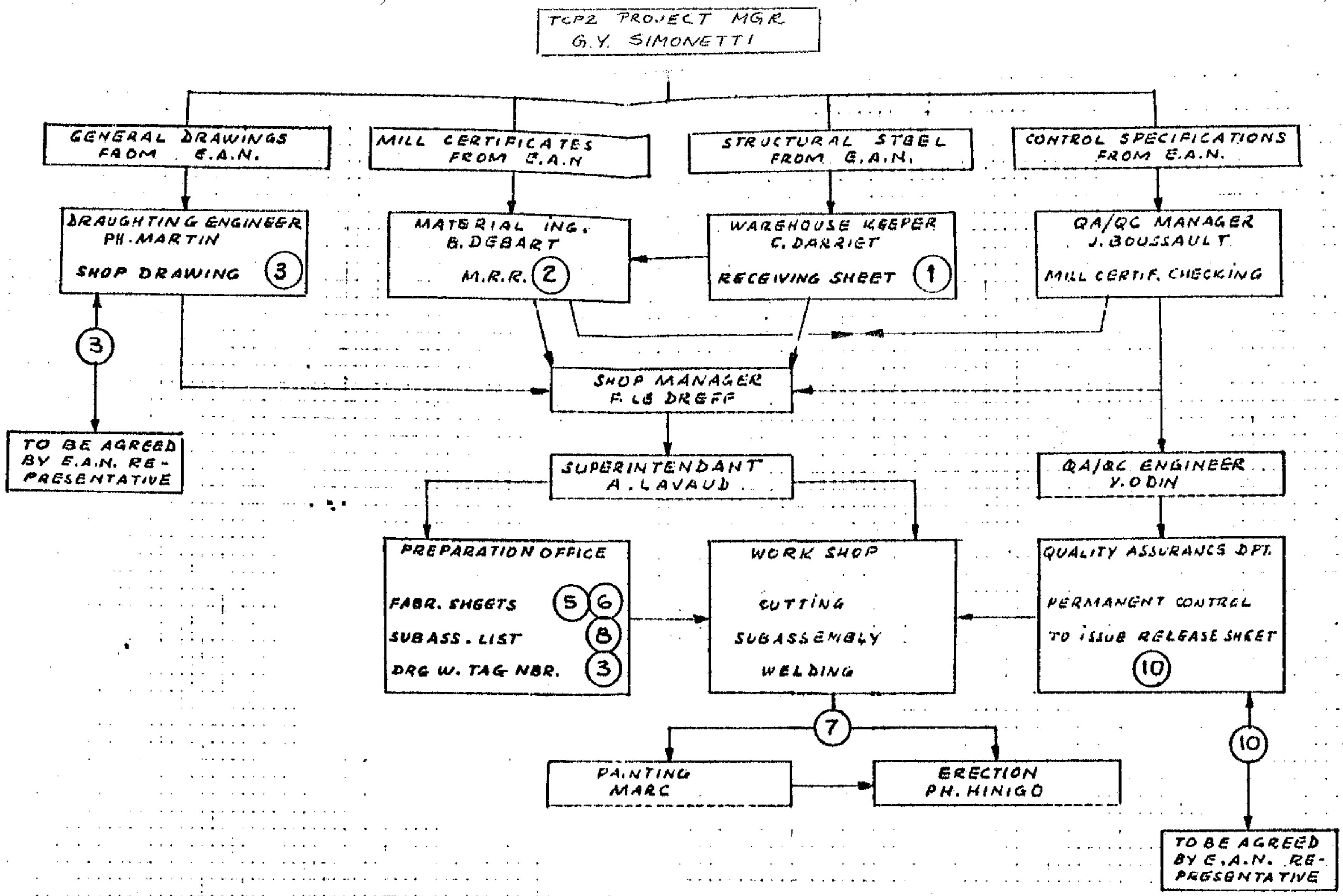


FIGURE 4.7 - MATERIAL HANDLING PROCEDURE

TCP2 EXTENSION PROJECT
MATERIAL HANDLING PROCEDURE
AMBES WORKSHOP ORGANIZATION

PONTICELLI frères
AGENCE DU SUD-OUEST - 33810 AMBES

DESS | DATE | ECHELLE | REVISIONS

N° S-541-3

4.3.2.1 Ponticelli Quality Control

QC organization within Ponticelli consists of:

- A Ponticelli staff responsible for:

  . preparation of inspection orders
  . preparation of control drawings
  . preparation of work specifications
  . training and education of prersonnel

- A team of NDT operators trained and assigned by an independent company (Qualitest).

4.3.2.2 TCP-2 Extension Supervision Team

To help the discipline supervisors in assessing the level of quality, two inspectors with a solid background in welding and NDT were assigned to the team. They reported to Field Engineer for all matters concerning routing work, and reported to Site Manager for all matters concerning non-conformities. The two inspectors, one being assigned to structural welding, the other one to pipe welding had also the possibility to report directly to QC section in Stavanger.

4.3.2.3 TCP-2 Extension Quality Control Section (Stavanger)

This section was dealing with approbation of welding procedures, internal audit of the work done by the supervision team and organization of external audit on fabrication works.

Regular audits were performed by QC section on a monthly basis, in addition 3 external audits were organized:

1 - at piping prefabrication site in Port Jerome
2 - at Ambes workshop
3 - at Bassens erection site

Major finding was lack of Ponticelli's own internal audit procedure. Otherwise all other results were deemed satisfactory by the Audit team.

The Appendices 3 and 4 are given to illustrate the above action

- Appendix 3 - Report on internal audit at Ponticelli.
- Appendix 4 - Report on external audit at Ponticelli.

4.3.2.4 General

All findings outlined in non-conformities reports, internal audits reports and external audits reports were distributed and evaluated within the Project, with assistance when necessary of EAN Inspection Department and Det norske Veritas (DnV) as consultant.

The same principles applied to electrical and instrumentation where the Project called for its own expertise and also external expertise from Driftsleader and DnV.

4.4 PLANNING AND PROGRESS

4.4.1 Planning - Levels 1, 2 and 3

The following planning levels were established:

Level I planning : over project duration, about 25 activities split by module and discipline. Figure 4.8.

Level II planning : over project duration, one for each module, about 50 activities split by discipline and main sub-assemblies. Figures 4.9 and 4.10.

Level II network : over project duration, one for each module, gives precedence relations against a time schedule.

Level III planning: also 6 week look ahead, was a handmade planning derived from Level II network. It was drafted every time the critical path line changed, mainly for the following activities:

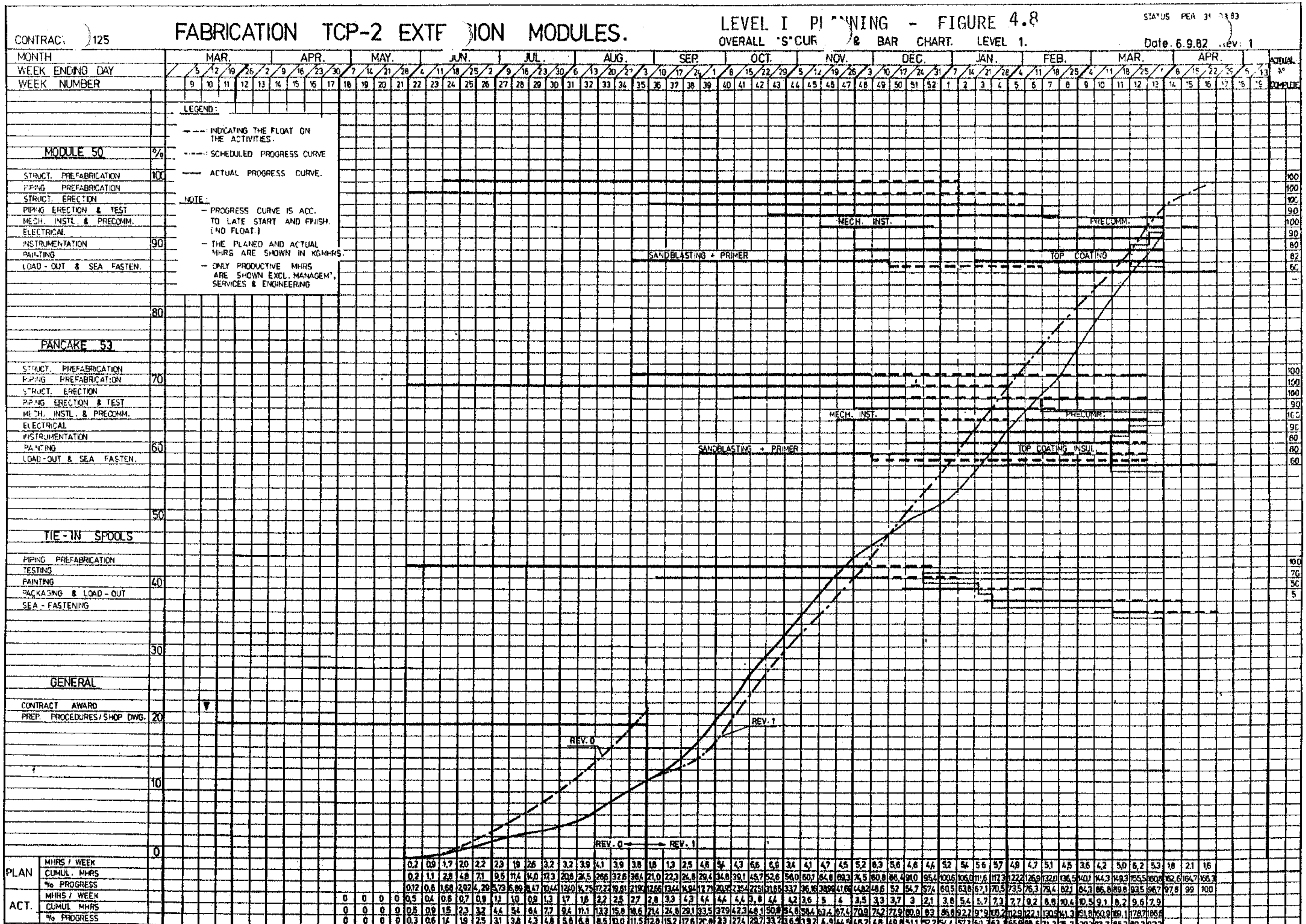
- A - Module 50 erection up to "box complete"
- B - Pancake 53 erection
- C - Piping erection, flushing, testing on Module 50
- D - Electrical and instrumentation works

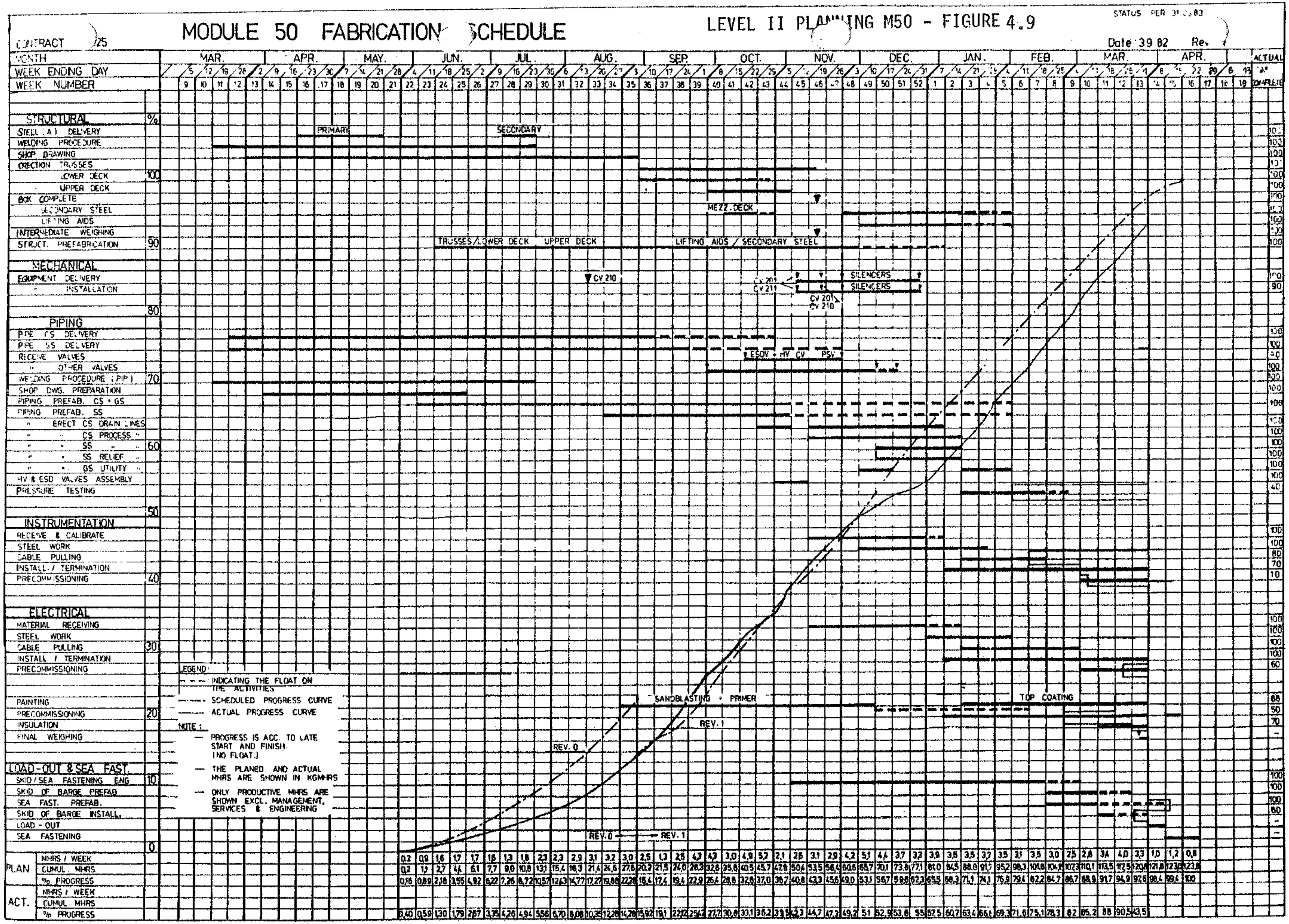
4.4.2 Progress

Progress measured by activity was plotted on Level I and II plannings. It was obtained by means of weight factor related to completion of each work item.

The Progress Curve is shown on the schedules figures 4.8, 4.9 and 4.10.

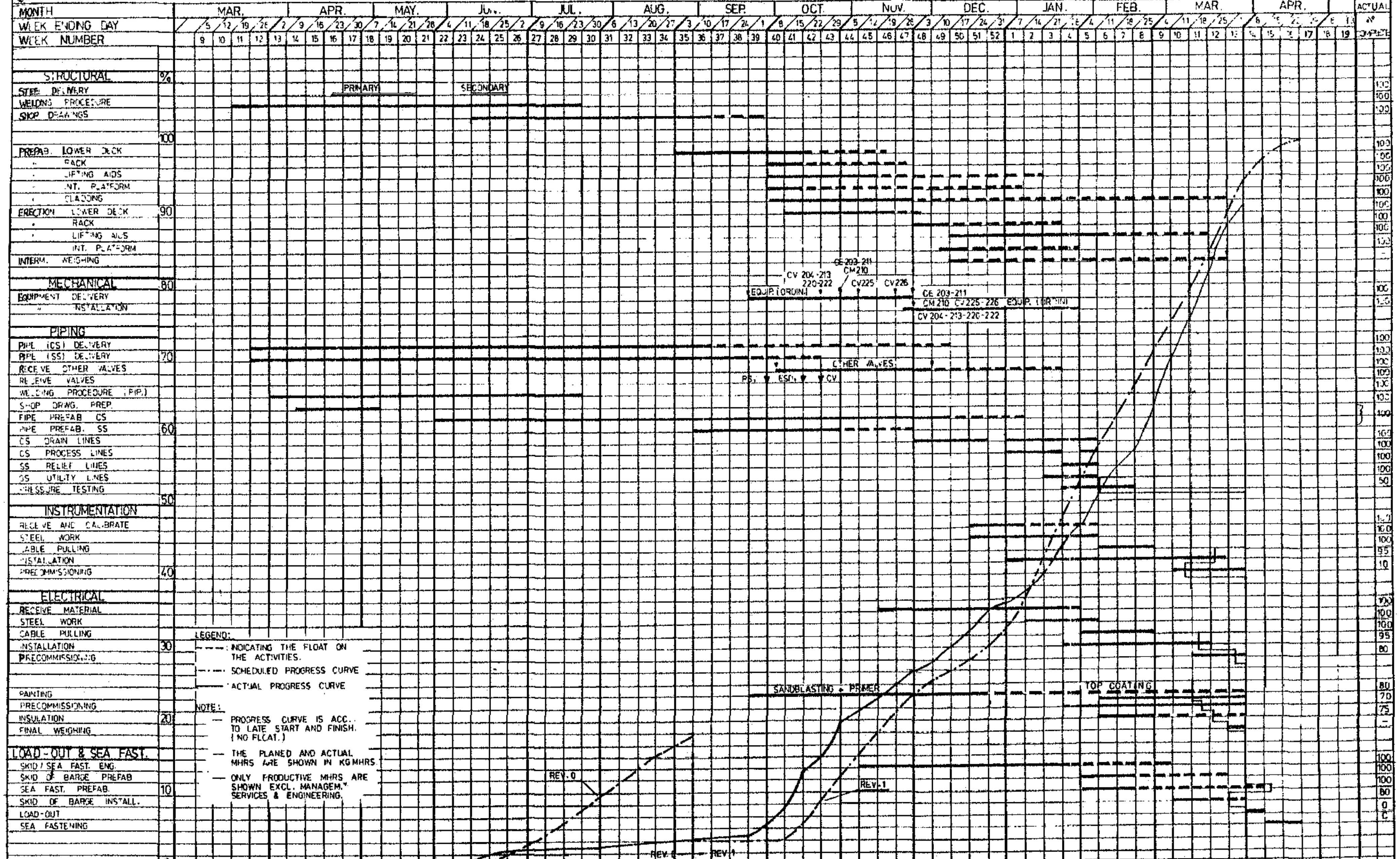
The Weekly Overall Progress Report is shown on figure 4.11 and by Discipline on figure 4.12.


CONTRACT 125
FABRICATION TCP-2 EXTENSION MODULES.
LEVEL I PLANNING - FIGURE 4.8
OVERALL 'S' CURVE & BAR CHART. LEVEL 1.
Date 6.9.82 Rev: 1
MONTH
WEEK ENDING DAY
WEEK NUMBER
LEGEND:
INDICATING THE FLOAT ON THE ACTIVITIES.
SCHEDULED PROGRESS CURVE
ACTUAL PROGRESS CURVE.
NOTE:
- PROGRESS CURVE IS ACC. TO LATE START AND FINISH. (NO FLOAT)
- THE PLANED AND ACTUAL MHRS ARE SHOWN IN KGMHRS.
- ONLY PRODUCTIVE MHRS ARE SHOWN EXCL. MANAGEM', SERVICES & ENGINEERING
MODULE 50
STRUCT. PREFABRICATION
PIPING PREFABRICATION
STRUCT. ERECTION
PIPING ERECTION & TEST
MECH. INSTL. & PRECOMM.
ELECTRICAL
INSTRUMENTATION
PAINTING
LOAD-OUT & SEA FASTEN.
PANCAKE 53
STRUCT. PREFABRICATION
PIPING PREFABRICATION
STRUCT. ERECTION
PIPING ERECTION & TEST
MECH. INSTL. & PRECOMM.
ELECTRICAL
INSTRUMENTATION
PAINTING
LOAD-OUT & SEA FASTEN.
TIE-IN SPOOLS
PIPING PREFABRICATION
TESTING
PAINTING
PACKAGING & LOAD-OUT
SEA-FASTENING
GENERAL
CONTRACT AWARD
PREP. PROCEDURES/SHOP DWG.
MECH. INST.
PRECOMM.
SANDBLASTING + PRIMER
TOP COATING
TOP COATING INSUL.
REV. 0
REV. 1
PLAN
MHRS / WEEK
CUMUL. MHRS
% PROGRESS
ACT.
MHRS / WEEK
CUMUL. MHRS
% PROGRESS
ACTUAL % COMPLETE


MODULE 50 FABRICATION SCHEDULE
LEVEL II PLANNING M50 - FIGURE 4.9
STATUS PER 31.3.83
CONTRACT /25
Date 3.9.82 Rev.
MONTH
WEEK ENDING DAY
WEEK NUMBER
MAR. APR. MAY. JUN. JUL. AUG. SEP. OCT. NOV. DEC. JAN. FEB. MAR. APR.
ACTUAL "A" COMPLETE
STRUCTURAL
STEEL (A) DELIVERY
WELDING PROCEDURE
SHOP DRAWING
ERECTION TRUSSES
LOWER DECK
UPPER DECK
BOX COMPLETE
SECONDARY STEEL
LIFTING AIDS
INTERMEDIATE WEIGHING
STRUCT. PREFABRICATION
PRIMARY
SECONDARY
MEZZ. DECK
TRUSSES / LOWER DECK UPPER DECK
LIFTING AIDS / SECONDARY STEEL
MECHANICAL
EQUIPMENT DELIVERY
INSTALLATION
CV 210
CV 201
CV 211
SILENCERS
PIPING
PIPE CS DELIVERY
PIPE SS DELIVERY
RECEIVE VALVES
OTHER VALVES
WELDING PROCEDURE (PIP)
SHOP DWG. PREPARATION
PIPING PREFAB. CS + GS
PIPING PREFAB. SS
ERECT CS DRAIN LINES
CS PROCESS
SS
SS RELIEF
GS UTILITY
HV & ESD VALVES ASSEMBLY
PRESSURE TESTING
ESDV + HV CV PSV
INSTRUMENTATION
RECEIVE & CALIBRATE
STEEL WORK
CABLE PULLING
INSTALL. / TERMINATION
PRECOMMISSIONING
ELECTRICAL
MATERIAL RECEIVING
STEEL WORK
CABLE PULLING
INSTALL / TERMINATION
PRECOMMISSIONING
PAINTING
PRECOMMISSIONING
INSULATION
FINAL WEIGHING
SANDBLASTING + PRIMER
TOP COATING
REV. 0
REV. 1
LOAD-OUT & SEA FAST.
SKID / SEA FASTENING ENG.
SKID OF BARGE PREFAB.
SEA FAST. PREFAB.
SKID OF BARGE INSTALL.
LOAD - OUT
SEA FASTENING
REV. 0 REV. 1
LEGEND:
INDICATING THE FLOAT ON THE ACTIVITIES
SCHEDULED PROGRESS CURVE
ACTUAL PROGRESS CURVE
NOTE:
— PROGRESS IS ACC. TO LATE START AND FINISH. (NO FLOAT.)
— THE PLANED AND ACTUAL MHRS ARE SHOWN IN KGMHRS
— ONLY PRODUCTIVE MHRS ARE SHOWN EXCL. MANAGEMENT, SERVICES & ENGINEERING
PLAN MHRS / WEEK: 0,2 0,9 1,6 1,7 1,7 1,6 1,3 1,8 2,3 2,3 2,9 3,1 3,2 3,0 2,5 1,3 2,5 4,3 4,3 3,0 4,9 5,2 2,1 2,6 3,1 2,9 4,2 5,1 4,4 3,7 3,3 3,9 3,5 3,5 3,7 3,5 3,1 3,5 3,0 2,5 2,8 3,4 4,0 3,3 1,0 1,2 0,8
PLAN CUMUL. MHRS: 0,2 1,1 2,7 4,4 6,1 7,7 9,0 10,8 13,1 15,4 18,3 21,4 24,6 27,6 20,2 21,5 24,0 26,3 32,6 35,6 40,5 45,7 47,8 50,4 53,5 56,4 60,6 65,7 70,1 73,8 77,1 81,0 84,5 88,0 91,7 95,2 98,3 101,8 104,9 107,3 110,1 113,5 117,5 120,8 121,8 123,0 123,8
PLAN % PROGRESS: 0,16 0,89 2,18 3,55 4,92 6,22 7,26 8,72 10,57 12,43 14,77 17,27 19,88 22,28 16,4 17,4 19,4 22,9 26,4 28,8 32,8 37,0 38,7 40,8 43,3 45,6 49,0 53,1 56,7 59,8 62,3 65,5 68,3 71,1 74,1 76,9 79,4 82,2 84,7 86,7 88,9 91,7 94,9 97,6 98,4 99,4 100
ACT. MHRS / WEEK
ACT. CUMUL. MHRS
ACT. % PROGRESS: 0,40 0,59 1,30 1,79 2,67 3,35 4,26 4,94 5,56 6,70 8,08 10,35 12,28 14,28 15,92 19,1 22,12 25,42 27,7 30,8 33,1 36,2 39,5 42,3 44,7 47,3 49,2 51 52,9 53,8 55 57,5 60,7 63,4 66,6 69,3 71,6 75,1 78,3 82 85,2 88 90,5 93,5

PANCAKE 53 FABRICATION SCHEDULE. LEVEL II PLANNING P53 - FIGURE 4.10

CONTRACT 25 — Date: 5.9.82 Rev.



Week number	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
PLAN MHRS / WEEK		0.1	0.2	0.3	0.5	0.4	0.5	0.5	0.6	0.6	0.6	0.3	0.4	—	—
PLAN CUMUL. MHRS		0.1	0.3	0.7	1.3	1.8	2.4	3.0	3.6	4.2	4.8	5.2	6.4	1.0	1.0
PLAN % PROGRESS		0.31	1.14	2.35	4.17	5.65	7.48	9.3	11.15	13.07	15.08	16.28	17.61	3.15	3.15
ACT. MHRS / WEEK															
ACT. CUMUL. MHRS															
ACT. % PROGRESS	0.56	1.60	1.96	1.96	1.97	2.05	2.03	2.20	2.21	2.82	2.87	3.12	3.15	3.42	3.63

Week number	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
PLAN MHRS / WEEK	—	—	0.03	0.6	1.0	1.0	0.3	1.0	1.0	0.8	0.5	0.4	0.4	0.4	0.6
PLAN CUMUL. MHRS	1.0	1.0	1.0	1.7	2.7	3.7	4.6	5.6	6.7	7.6	8.1	8.5	9.0	9.4	10.1
PLAN % PROGRESS	3.15	3.15	3.2	5.3	8.5	11.7	14.4	17.6	20.8	23.5	25.1	26.5	27.9	29.2	31.3
ACT. MHRS / WEEK															
ACT. CUMUL. MHRS															
ACT. % PROGRESS	3.88	5.4	7.2	12.5	14.5	18.9	20.7	22.2	24.5	26.8	27.7	29.9	32	34.9	35.5

Week number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
PLAN MHRS / WEEK	1.3	1.7	2.1	1.7	1.3	1.4	1.5	1.3	1.0	1.2	1.5	2.0	1.8	0.6	0.7	0.5
PLAN CUMUL. MHRS	11.4	13.1	15.2	17.0	18.4	19.8	21.3	22.6	23.7	24.9	26.4	28.5	30.4	31.0	31.8	32.3
PLAN % PROGRESS	35.3	40.7	47.2	52.7	57	61.4	66	70.1	73.2	77.1	81.8	88.1	93.9	96	98.2	100
ACT. MHRS / WEEK																
ACT. CUMUL. MHRS																
ACT. % PROGRESS	37.3	40.1	44	44.5	50.8	54.6	56.8	62.6	69.5	75.1	81.6	87.7	90.7			

WEEKLY PROGRESS OVERALL FIGURE 4.11

PROGRESS PER END OF WEEK : 9

	ACTUAL		SCHEDULED	
	THIS WEEK	GAIN THIS WEEK	LATE START THIS WEEK	GAIN THIS WEEK
OVERALL	79.26	4.09	84.3	2.2
M 50	81.97	3.71	86.7	2
P 53	69.45	6.87	73.2	3.1
T 80	77.62	—		

EXPENDED MHR'S THIS WEEK : 10.523

SCHEDULED EXPENDITURE THIS WEEK : 3.600

PROD. FACT. : 0,65

FORECASTED MANHOURS : 131.809

ACTUAL MANHOURS : 151.877

DETAILED PROGRESS REPORT

FIGURE 4.12

	ACTIVITY	MHS	% WEIGHT	% COMPL.	WEIGHT COMPL
STRUCTURAL	SO 1 PREFAB TRUSSES	6280	5,07	100	5,07
	SO 2 LOWER DECK	4460	3,60	100	3,60
	SO 3 UPPER DECK	4620	3,73	100	3,73
	SO 4 MISCELLANEOUS	5510	4,45	100	4,45
	SO 5 LIFT AID	5240	4,23	100	4,23
	S 10 SUB-TOTAL	26110	21,08	100	21,08
	S 11 ERECT TRUSSES	6230	5,03	100	5,03
	S 12 ERECT LOWER DECK	4460	3,60	100	3,60
	S 13 ERECT UPPER DECK	5060	4,08	100	4,08
	S 14 ERECT MISCELLANOUS	5900	4,76	100	4,76
	S 15 LIFT AID	4080	3,29	100	3,29
	S 16 WEIGHING	400	0,32	50	0,16
	S 20 SUB-TOTAL	26130	21,09	99,24	20,93
	S 30 TOTAL	52240	42,17	99,62	42,01
PIPING	P 01 PREFAB PIPING	16000	12,92	100	12,92
	P 02 ERECT PIPING	14000	11,30	100	11,3
	P 03 TESTING	2000	1,61	100	1,61
	P 40 TOTAL	32000	25,83	100	25,83
MECHANICAL	M 50 INSTALL	7150	5,77	100	5,77
ELECTRICAL	E 60 INSTALL	4000	3,23	100	3,23
INSTRUMENT	I 70 INSTALL	11000	8,88	100	8,88
COATING	C 80 PAINTING-INSULATION	9900	8,00	96,25	7,7
LOAD OUT	L 90 LOAD-OUT SEA FAST	7600	6,13	98	6,01
	T 100 TOTAL	123890			
			% COMPLETE		99,42
			LAST % COMPLETE		97,40
			PROGRESS		2,02

EAN M50

WEEKLY PROGRESS REPORT

WEEK 16

DATE 22/04/83

4.5 WORK REPORT

4.5.1 Piping

Introduction

The piping work was split into 3 parts: Module 50, Pancake 53 and Tie-In.

The pipes in Module 50 were mostly big, heavy wall-thickness pipes. The Pancake 53 pipes were small and low pressure pipes. The Tie-In pipes were both big and small pipes.

The piping work was split into 2 parts: "Prefabrication" and "Erection".

Prefabrication

The prefabrication took place on Ponticelli´s yard in Port-Jerome outside Le Havre.

The workshop is a typical piping yard with good facilities for prefabrication of piping spools, with references in refinery and nuclear plants.

Delivery of piping equipment was prevented from starting full production right away. Most of the pipe was delivered at the intended starting date, but some fittings (elbows, tees) and some welding neck flanges to be dismantled from Mapegaz valves were missing. So prefabrications started with low pressure piping.

In fact it turned out that mobilization of welders was easily postponed and that a full supervision team was then devoted to the preparation of the work. This situation had a positive impact on QA/QC for piping prefabrication.

Ponticelli had a system to put all needed and incoming material into a computer. Before the production started for a spool, all the necessary material had to be available. That broght problems in the beginning, but Ponticelli showed good willingness to start the production.

All the welding procedures for piping were made in Port Jerome in right time and did not delay the production. The welding procedures were made according to ASME IX and all the welders qualification certificates followed the requirements according to ASME IX.

The repair rate of the prefabricated work was low (3.67%). The workmanship of the prefabricated work was satisfactory and same for the documentation. The only thing which was missing was a quality responsible in the workshop, so EAN had to do this work.

All the material used were marked with heat number. All welds were marked with the welders numbers which corresponded with the one marked on the welders qualification certificate.

All the supports were also prefabricated in Port-Jerome by a sub-contractor under Ponticelli´s supervision and responsibility. All spools and supports were sandblasted and primed before shipment to Ponticelli´s yard in Bassens.

The shipment took place by truck, and only one spool was damaged during the transport (2" sch 40 pipe).

Erection

The piping erection started first in Module 50 under the main deck (open and process drainages).

Then the four metering lines and the piping to/from slug catcher/ gas scrubbers were installed, using the three vessels as origin.

One major clash was discovered at the upper deck between the pipes downstream silencers and the lifting structure. This was due to a change in the outside diameter of ESDV Mapegaz, which was not recorded (the theoretical gap was only 10 mm).

The general comments were that Ponticelli was poorly equipped with piping erection equipment on the yard in Bassens.

The repair rate for carbon steel welds has been low, although higher than for the prefabrication.

For stainless steel piping, the repair rate was abnormally high (over 30%), due to gas flux problems, and the control was extended to 100 %.

Testing and Documentation

The documentation and testing were split into tests systems. All the systems were mechanical accepted before testing.

A very strict procedure was followed to ensure completeness of the documentation in the form prescribed in "Completion File" prior to release a line for hydrotest. In average all dossier had to be corrected and given back to Ponticelli due to missing information.

The flushing and pressure testing works took place without problems.

The tie-in spools were documented, flushed and pressure tested in the same way as the piping work in Module and Pancake. Each isometric had been documented separately.

The transportation of tie-in spools above 6" took place on the barge. The rest of the tie-in supports were transported by truck.

4.5.2 Structural

Prefabrication

The prefabrication has been performed in Ponticelli's workshop in Ambes. The size of prefabricated sections is limited by the road transport to Bassens and the weight by the truck capacity (18-20 tons).

The workmanship and housekeeping in the Ambes workshop are good. The skilled workers and foremen are well qualified and the work performed up to satisfactory standard. The documentation system (material lists, cutting sheets etc...) was very detailed and enabled a good control of the quality and progress.

Erection

Some problems occurred during erection phase of the Module, mainly due to an overbooking of the yard capacity (three major projects being executed at the same time).

4.5.3 Instrument / Electrical

The instrument and electrical scope part of work has been performed by the sub-contractors CGEE ALSTHOM - COMSIP who installed and tested all instruments, tubing, cables, junction boxes, lighting, cable ladders also including all of the safety related equipment.

Project Specifications

The specifications used during the construction period at the yard are exclusively the ones issued by EAN.

Document System

Document system established is the completion file with introduction to the filing key.

The essence of the system is to achieve compatibility with the other disciplines by use of the 54 established systems for the entire project.

Installation

During the installation phase the main problems have been the difficulty to coordinate and obtain access to the equipment to be hooked up which is entirely dependent on completion by the structural and piping disciplines.

Comsip managed to overcome these problems by using previously gained experience and know how.

Concerning quality of the installation there are some minor adds and ends which will have to be corrected, but compared to similar projects, the result is as a whole good.

Comsip have during the entire project shown a very willingly and cooperative attitude to EAN requirements although many of these were previously unknown to them.

An indication of this is that the amount of outstanding items on the EAN instrument and electrical punch list at tow out was negligible.

Testing

Concerning testing result has been very good showing no damages and satisfactory function on all equipment involved with exception for those which appear on punch list.

4.6 KEY FIGURES

4.6.1 Total Manhours Consumption

MANHOUR CONSUMPTION AT PONTICELLI FRERES
SUMMARY SHEET

Planned mhrs: Manhour consumption according to contractual estimate.

Real whs : Actual manhours spent during fabrication.

ACTIVITY	PLANNED MHS	REAL MHS	PLANNED / REAL
M50	115.890	155.659	0.74
P53	26.670	38.746	0.69
T80	9.600	10.495	0.91
LOAD OUT/WEIGHTING/SEA FASTENING	14.200	12.580	1.13
TOTAL PRODUCTIVE HRS	166.360	217.480	0.76
"NON PRODUCTIVE HRS" (According to contract estimate)		22.220	
TOTAL SCOPE OF WORK		239.700	
EXTRAS		11.928	

MANHOUR CONSUMPTION MODULE - 50

	ACTIVITY	PLANNED MHS	REAL MHS	PLANNED / REAL
STRUCTURAL	PREFAB TRUSSES	6.280	9.672	0.65
	LOWER DECK	4.460	3.171	1.41
	UPPER DECK	4.620	4.913	0.94
	MISCELLANEOUS	5.510	4.416	1.25
	LIFT AID	5.240	7.314	0.72
	SUB-TOTAL PREFAB.	26.110	29.486	0.89
	ERECT TRUSSES	6.230	4.480	1.39
	ERECT UPPER DECK	5.060	6.837	0.74
	ERECT LOWER DECK	4.460	7.623	0.59
	ERECT MISC.	5.900	15.107	0.39
	LIFT AID	4.080	4.622	0.88
	SUB-TOTAL ERECTION	25.780	38.669	0.67
	TOTAL STRUCTURAL	57.840	68.155	0.76
PIPING EQUIPMENT	PREFAB PIPING	16.000	12.828	1.25
	ERECT/TEST	25.150	39.813	0.58
	TOTAL	39.150	52.641	0.74
ELECTRICAL/ INSTRUMENT	INSTALLATION	15.000	25.583	0.59
COATING	PAINTING-INSULATION	9.900	9.280	1.07
	TOTAL	115.890	155.659	0.74

MANHOUR CONSUMPTION PANCAKE - 53

	ACTIVITY	PLANNED MHS	REAL MHS	PLANNED / REAL
STRUCTURAL	PREFAB	4.830	3.743	1.29
	ERECT LOWER DECK	2.200	3.611	0.61
	ERECT PIPERACK	400	747	0.54
	ERECT LIFTING AID	990	1.124	0.88
	ERECT INT PLATFORM	200	65	3.08
	TOTAL - ERECT	3.790	5.547	0.68
	TOTAL - STRUCT	8.620	9.290	0.93
PIPING EQUIPMENT	PREFAB PIPING	4.700	2.673	1.76
	ERECT/TEST	4.450	10.999	0.40
	TOTAL	9.150	13.672	0.67
ELECTRICAL/ INSTRUMENT	INSTALLATION	6.500	12.032	0.54
COATING	PAINTING	2.400	3.752	0.64
	TOTAL	26.670	38.746	0.69

MANHOUR CONSUMPTION TIE-IN

	ACTIVITY	PLANNED MHS	REAL MHS	PLANNED / REAL
	PIPING	7.700	4.491	1.71
TESTING/ PACKAGING		1.400	5.480	0.26
COATING	TOTAL	500	524	0.95
	TOTAL	9.600	10.495	0.91

4.6.2 Ratios

4.6.2.1 Structural

Module	M50	P53
Structural weight	294 T	54 T
Prefabrication MH	29.486 MH	3.743 MH
Prefabrication H/Ton	100 H/T	70 H/T
Erection MH	38.669 MH	5.547 MH
Erection MH/Ton	132 H/T	103 H/T
Total MH	6.8155 MH	9.290 MH
Total MH/Ton	232 H/T	173 H/T
Projected area	248 sqm	156 sqm
Structural weight excluding lifting aids	215 T	40 T
Structural weight per proj.sqm	0.87 T/m^2	0.26 T/m^2

4.6.2.2 Piping Prefabrication

Module	Total	M50	P53	Tie-In	
Prefabrication weight*	287 T	190 T	18 T	79 T	
Nb isometrics/spools	282	144 iso	49 iso	89 spools	
Manhours total hrs	19.992	12.828	2.673	4.491	
Productive manpower					
Welders + fitters mhrs	14.216	9.120	1.896	3.200	
Manday	1.777	1.140	237	400	
Number of butt welds N	3.796	1.971	1.172	653	) **
Average diameter D	4.4 in	5.9	2.6	3.2	)
Average thickness e	13.3 mm	17.3 mm	5.2 mm	3.12 mm	)
Welding length <ND	16.840 in	11.614 in	3.089 in	2.137 in	)
Welding quantity <NDe	224.292 in mm	201.486 in mm	16.131 in mm	6.675 in mm	
Productive ratio MHRS					
Per ton	50	48	105	40	
Per iso		63/iso	39/iso	36/spool	
Productive ratio per manday					
Welding length:	9.5 in/m.d	10.2	13	5.3	)**
Welding quantity:	126 in mm/m.d	176	68	16.7	)

Note *: Piping weight includes pipe and fittings; does not includ valves and supports.

Note **: Welding ratio for tie-in spools are out of range because compared to M50 and P53 quantity of welds is much lower (i.e. pipe cut and bevelled only for transportation to field).

4.6.2.3 Piping Erection

Module	Total	M50	P53
Erection weight *	377 T	355 T	33 T
Nb isometrics	193 iso	144 iso	49 iso
Total Manhours	30.954	24.234	6720
Productive manpower			
MHRS**	27.500	21.660	5.840
Manday	3.375	2.645	730
Number of sock.welds	1.040	880	160
Number of butt welds**	264	244	20
Average diameter		3.85 in	Not applicable***
Average thickness		14.4 mm	"
Welding length		4.330 in	"
Welding quantity		62.664	"
Productive ratio MHRS			
Per ton	73	61	265
Per iso	142	150	120
Productive ratio per manday			
Welding length:		16 in m.d.	
Welding quantity:		23 in mm/m.d.	
Ratio socket/butt welds		360 %	

Note * : Erection weight includes valves and pipe supports.

Note ** : Welds to be cut as a consequence of clashes, repairs etc. are considered in productive manpower, but not recorded on number of welds.

Note ***: P53 and M50 figures can not be compared because M50 pipe is mainly high pressure class for gas process, and P53 is low pressure class for condensate process, together with numerous bolted connections.

4.6.2.4 Piping Test, Flushing, Preparation for Testing

Module	Total	M50	P53	Tie-In
Piping weight		355	22	79
Nb isometrics/spools		144 iso	49 iso	89 spools
Nb of test systems		49	43	21
Manpower (productive)				
MHRS		9.936	3.264	4.368
Manday		1.242	408	546
Productive ratio in mandays				
Per ton		3.5	18.5	6.9
Per iso or spool		8.6/iso	8.3/iso	6.1/spool
Per test system		25	9.5	26

Note : Test operations were time-consuming mainly for three reasons:

- Flushing was carried out with conventional circulation of water inside each "test system" pipes, where Contractor could have saved time and money by flushing with a mobile jet tool.
- Preparation for testing was long and fastidious due and not very well planned in advance.
- Contractor had to present all fabrication records in the form described in the Completion File Manual prior to executing the hydrotest. This was a tough procedure, but appeared to be the only way to gat the Completion File ready and submitted when Modules are shipped.

4.6.3 Weights

Weights based upon Ponticell's weight is estimated dated March 1983.

ITEM	MODULE 50 TONS	PANCAKE 53 TONS	TIE-IN TONS
ELECTRICAL	10.0	5.0	
INSTRUMENT	30.0	3.0	
MECHANICAL	123.5	19.0	
CM 210		5.3	
PIPING	318	18.4	79
STRUCTURE	251.0	41.5	8
LIFTING FRAME	79.0	14.5	
TOTAL	812.0	106.7	87
WEIGHTING RESULT			
PRIOR TO LOAD OUT	799.9	99.0	Not performed

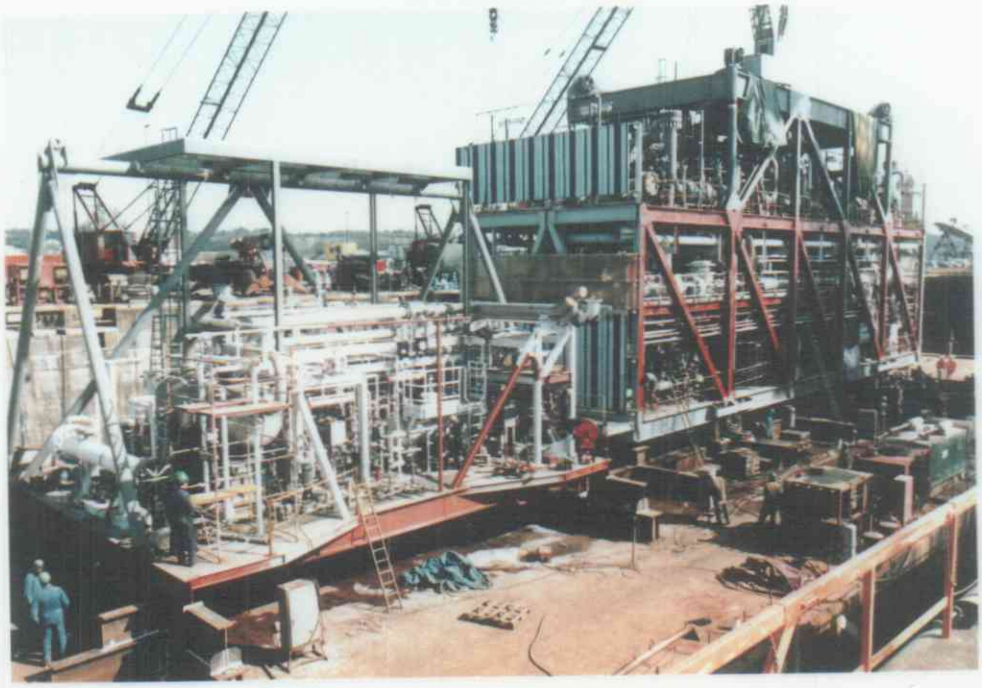
4.7 FINAL ACCEPTANCE DOCUMENTATION

The aim of the "Final Acceptance Documentation" defined in the Contract as Annexes and in the Quality Assurance Manual, is to give a complete traceability for all works performed and material incorporated in the work.

In order to achieve this result, the project had defined a method to continuously build up the documentation and update it during all construction phase.

In Appendix 5 is shown by an example how to trace back construction documents in the "Completion File".

Fabrication Of Module 50
And
Pancake 53



5 PRE HOOK UP

5.1 GENERAL

From an early stage in the project, some works were separated from the original hook up scope and were executed in advance (pre-hook-up).

The works were executed under the supervision of the Offshore Construction Department (OCD).

The Platform Management Manual Procedure No. 15 was followed for these works.

The works were defined and split under different Modification Requests regarding:

- the time of requested completion
- the budget allocation
- the operational problems

The Modification Requests can be grouped in 3 sections:

A. Works on the Risers TCP-2 - Column 5.

MR 88007 - Installation of ODIN pig-trap (temp).
MR 88004 - Extension of ODIN and NEF risers.
MR 88005 - Installation of NEF pig trap (temporary).

B. Works on TCP-2.

MR 88009/MR 88012	- Cleaning and preparation of the platform prior to lifting.
MR 88010	- Installation of MCCA and B.
MR 88011	- Extension of P.A. system
MR 40004	- Inst. of ODIN Telecom/Teletrans.
MR 60016	- Inst. of NEF Power Supply.
MR 60017	- Inst. of NEF Teletrans.

C. Works on DP-2.

MR 88007 - Reconnection of 4" line between TCP-2 and DP-2.

5.2 RISERS EXTENSION IN COLUMN 5

5.2.1 Scope of work

In order to cope with the NEF and ODIN ESSO planning for laying and testing of the respective pipe lines to NEF and ODIN fields, some work had to planned ahead of the TCP-2 Extension offshore work. The summaring of the works, which are developed hereafter is:

- Modification request 88004: Extension of R5E-16" NEF & R6E-20" ODIN risers.
- Modification request 88005: Installation of the test pig station for NEF pipe line.
- Mod. req. 40003: Installation of the test pig station for ODIN pipe line.
- Modification request 88006: Pigging of R5E-16" NEF & R6E-20" ODIN riser.

5.2.2 Extension of R5E-16" NEF and R6E-20" ODIN Risers (MR 88004).

Purpose

To extend the 2 existing risers R5E & R6E from the anchor flange platform El.84.550 to above the cellar deck El.100.000 in order to

- connect temporary equipment for testing, pigging and dewatering the pipelines.

- further connect the riser to the process lines which are part of the permanent facilities under fabrication by Module 50.

Scope

The scope of work was defined as follows:

- prefabrication of spool pieces
- offshore installation
- pressure testing

Engineering

The engineering was made by TCP2 Extension project without external assistance. Procurement was also carried out by TCP2 Extension 16" and 20" pipes existed in stock. 16" ESD valve existed in stock, was sent to Mapegaz for overhauling and modification. 20" ESD valve was ordered new but it became obvious that it could not be delivered on time for pre-hook up.

Schedule

Modification request approved	: 17.11.81
Call for bid	: January '82
State of commitment and work order	: 15.02.82 (WO-OCD TCP2-175)
Selected contractor	: CON-ECOSSE CO. LTD
Start date	: 22.02.82
Completion date	: 22.03.82
Lump sum	: 545.500 NOK
Manhours	: Total for all Mod.Req. described under 5.1. is about 2.200 mhrs.

Conduct of the work

The works were conducted under OCD's supervision with assistance of TCP2 Extension piping and QC sections, and of Mapegaz representative for final assembly of 16" ESDV.

5.2.3. Installation of the Test Pig Station for NEF Pipeline (MR 88005)

Purpose and scope

To install a temporary pig station for testing, pigging, dewatering the 16" pipe line from NEF, and hydrotest the NEF riser from the cap at the bottom of the platform to the pig station.

Engineering

The engineering was made by TCP2 Extension without external assistance. The pig station was fabricated by MONBERG & THORSEN under TCP2 Extension supervision.

Schedule and conduct of the work

Same as for MR 88004 under same work order lump sum cost: NOK 30.241.

5.2.4 Installation of the Test Pig Station for ODIN Pipe Line (MR 40003)

Purpose and scope

Same as for MR 88005.
Note: The pig station was not used for dewatering the ODIN pipe line.

Engineering

Studies and procurement were made by ESSO.

Schedule and conduct of the work

Same as for MR 88004 under same work order, but with assistance of Brown & Root representatives on behalf of ESSO.

Lump sum cost: NOK 60.100.

5.2.5 Pigging of R5E-16" NEF and R6E-20" ODIN Risers (MR 88006).

Purpose

To assure that the abovementioned risers are free from any obstruction.

Scope

Insert a "Polly-pig" in the respective pig stations and displace the pig with water.

Schedule

Under same W.O. as MR 88004 lump sum cost of NOK 81.260.

Conduct of the work

The pig was displaced with "wash down water".
In case of obstruction/pig being stuck, the following contingency plan was made available:

1. To push the pig with a high pressure pump, pressure rated below working pressure of the riser.

2. To reverse circulation from the bottom of the riser by means of a connecting device available on board the pipe laying barge operating in the neighbourhood.

The pigging operation had to be carefully planned in time as being dependent on:

Downstream: cut of the cap outside platform at sea-level, the latter being dependent upon performance of the hydrotest.

Upstream: positioning of the spool piece just before performance of the hyperbaric welds.

5.3 WORKS ON TCP-2

5.3.1 Cleaning and Prep. of the Platform before Lifting (MR 88009/88012)

The works were divided in 2 Modifications Requests

- the MR 88009 carried out by OCD in March '83 which will be developed hereafter

- the MR 88012 carried out by HEEREMA in June '83 which will be presented in the chapter lifting of this book.

Purpose

The aim of this work was to prepare the platform before the lifting operations.

So, a lot of equipment which would be moved during the TCP-2 Extension lifting operations might have to be "passivated" to avoid any interferences or incidents during the lifting operation.

Scope

- Removal of lighting fixtures installed in pancakes southern part of TCP-2, and in Module M01.
- Cleaning of P962.
- Rerouting/Removal of electrical/instrument wires connected to the equipment removed.
- Storage of removed items in view of future reinstallation.

Engineering

The complete engineering was performed by TCP2 Extension team after several offshore surveys.

The engineering package was delivered for comments/information to the OCD Department in January 1983.

A revised package was delivered to OCD for "Call for Bid" and "Work Order" (contractual package).

Schedule

Call for bid	:	14.02.83
Work order	:	10.03.83 (W.O. OCD - TCP2 218)
Selected contractor	:	Roco - Inspection A/S
Offshore starting date	:	12.03.83
Offshore completion date	:	28.03.83
Number of manhours	:	1824 mhrs

Conduct of the works

Due to heavy summer work load in '83, OCD decided to carry out these works as early as possible in spring '83; so it did not create any problems regarding the completion date.
Generally speaking the works went smoothly under OCD supervision and the lifting operations, further on, proved the success of this work. "As-built" documentation were delivered by OCD to the project in due time prior the hook up start.

5.3.2 Extension of MCC A and MCC B (MR 88010).

Purpose

The works covered by this modification request were part of the original scope of the TCP2 Extension Project.
So in order to have electrical power supply systems operational as early as possible in the hook up, the project decided to install and integrate distribution panels as pre hook up works.

Scope

The scope of work was defined as follows:

- Installation of Extension of MCCA and B and tie-in with existing MCC's.
- Installation of DB 321 "Normal Lighting Panel" with power supply line from MCC A/B.
- Installation of DB 322 "Maintained Lighting" panel with power supply line from existing cabinet S 53.44.3.9.
- Installation of DB 324 "Emergency 24 DC" panel with power supply line from existing DB 310.

The work also covered all control lines to and from the existing equipment.

The work included pre-commissioning of all the installation but final commissioning was reserved to hook up responsibility.

Engineering

The engineering was made by Sofresid Norge A/S under the project responsibility. The pre-hook up package was built-up as a part of the normal hook up package with the works described on drawings and specifications and split by tasks, supported by means of task sheets. For that MR we had 54 electrical tasks.

The task sheets were based upon the same model as the one used for the hook up itself with pre-commissioning sheet attached; the codification was the same as for the hook up (see part § 7).

This system permitted the total use of the "pre hook up" "as built" documentation for hook up loop testing and final commissioning of the installation. A master copy of the engineering package was delivered to OCD for comments in January '83 and revised packages were delivered for "Call for Bid" and "Work Order" phases.

Schedule

Call for bid	:	14.02.83
Work order	:	14.03.83 (W.O. OCD TCP2 220)
Selected contractor	:	P.S. Contractor
Offshore starting date	:	07.04.83
Offshore completion	:	10.06.83
Number of manhours	:	1672 mhrs.

Conduct of the work

The works were conducted under OCD's supervision with assistance of Vendor's representative for installation works and TCP2 Extension personnel for witness of testing and final approval.
90 % of the works were completed prior hook up started and the remaining work was carried out during the hook up without any influence on it.

5.3.3 Extension of PA System (MR 88011).

Purpose

The public address system was requested to be operational the first week of hook up; so, to have it possible, it was foreseen to make some part of the job in advance.

Scope

The scope was defined as follows:

- Installation of cable trays, from interface room to M50/P53 areas and inside interface room.
- Modification on existing public address cabinet.
- Installation of cable transits.

The only work left for hook up was:

- Tie-in of cable on one and into existing systems.
- Connection on M50 and P53 when arrived.
- Testing.

Engineering

The engineering study was made by Sofresid Norge A/S as the whole project; the split hook up / pre hook up was made later on. The works were split in 7 instrumentation tasks.

The master package was delivered to OCD for comments in January '83 and updated packages were delivered for "Call for Bid" and "Work Orders" signature steps.

Schedule

Call for bid	:	02.02.83
Work order	:	01.03.83 (W.O. OCD TCP2 219)
Selected contractor	:	GMC Electro A/S
Offshore starting date	:	15.03.83
Offshore comp. date	:	29.05.83
Number of manhours	:	1261 mhrs.

Conduct of the work

The selected contractor GMC Electro A/S worked under OCD's supervision.

No major problems were met on this easy work except a shortage on cable-trays length. This was common materials with short delivery time so the completion date was not delayed.

As built documentation was available before hook up start.

5.3.4 Odin Telecom/Teletrans (MR 40004)

Purpose

The works covered by this MR were carried out during the pre hook up mainly because they were the same type as those involved in MR 60017 (See § 5.3.6).

The result was a cost reduction and a system operational far in advance compared to the ESSO's request.

Scope

The scope of work was the following:

- Installation of ODIN cabinets in OP platform.
- Installation of QP tower.
- Installation of electrical power supply for those.
- Connection and tie-in of the control cables.
- The final commissioning was not included in the scope and reserved for the hook up.

Engineering

The engineering was made by Sofresid Norge A/S as the whole part of the project; the split hook up/pre hook up was made later on. The work was split in tasks:

	Struct.	Electrical	Instrumentation
No of tasks	1	2	13

The master package was delivered to OCD for comments in January '83 and updated packages were delivered for "call for bid" and "work order" signature steps.

Schedule

Call for bid	:	02.02.83
Work order	:	01.03.83 (WO OCD TCP2 219)
Selected contractor	:	G.M.C. Electro A/S
Offshore starting date	:	15.03.83
Offshore compl. date	:	29.05.83

Conduct of the works

The selected contractor GMC Electro A/S worked under OCD's supervision with intervention of TCP-2 Extension specialist for pre-commissioning test and Vendor assistance for the cabinets and antennas.

The work was carried out without major problems and all "as built" and test result documentation was available prior to hook up start.

5.3.5 NEF Power Supply (MR 60016).

Purpose

Upon North East Frigg project request, full electrical power supply should be available by the 10.07.84. Due to hook up start on May 31st it was estimated difficult to reach this date without any back-up in case of failure of one equipment; so we decided to undertake the major part of the installation as pre hook up.

Scope of works

- Structural modifications inside old work shop for use as high voltage room.
- Modification in HVAC system.
- Installation of high voltage equipment (transformers, breakers, cells ....)
- Installation and connection of high voltage cables.
- Installation and tie-in of control cables into existing equipment.

The final commissioning of the installation was not in the scope and reserved for the hook-up.

Engineering

The engineering was performed by Aker Engineering A/S as the whole part of the NEF power supply of the project. This was done under TCP2 Extension responsibility in cooperation with NEF project. The split between hook up and pre hook up was made during the engineering phase. The work was split in tasks:

	Structural	Piping	Electr.	Instrument
No. of tasks	20	7*	74	18

* 5 of them were related to HVAC modifications.

Schedule

Call for bid	:	25.02.83
Work order	:	28.03.83 (WO TCP2 OCD 221)
Selected contractor	:	P.S. Contractor
Offshore starting date	:	15.04.83
Offshore completion date	:	27.06.83
Number of manhours	:	6564 mhrs.

Conduct of the work

The work was carried out by P.S. Contractor A/S under OCD supervision. TCP2 Extension specialist witnessed the pre-commissioning tests and vendor assistance for the H.V. equipment.

Due to practical problems the expected completion date was delayed and the remaining works interfaced with the hook up part of them (failure of HVAC system, failure of H.V. cable during HV tests). But the transfer from pre hook up to hook up was well handled and the final date of July 10th was respected.

5.3.6 <u>NEF Teletrans</u> (MR 60017).

Purpose

Upon NEF project request this system might be operational also in July '83 so we decided to include it in the pre hook up phase of the works.

Scope

- Installation of cabinets in QP platform.
- Installation of antennas in QP tower.
- Installation of cable transits.
- Pulling and connection of control and power cables.

Pre-commissioning of installation was part of the scope but commissioning was NEF project responsibility.

Engineering

This work was engineered by Sofresid Norge A/S under TCP2 Extension supervision in cooperation with NEF project. This was part of the original scope of the project and split between hook up and pre hook up during the engineering phase.
The works were divided in tasks.

	Structural	Electrical	Instrument
No. of tasks	2	6	18

The master file was delivered for comments to OCD in January '83 and updated documents were delivered for "call for bid" and "work order" steps.

Schedule

Call for bid	:	02.02.83
Work order	:	01.03.83
Selected contractor	:	GMC Electro
Offshore starting date	:	15.03.83
Offshore completion date	:	29.05.83
Manhours	:	762 mhrs.

Conduct of the works

The works were carried out by GMC Electro under OCD's supervision with assistance of vendor's representative.
The pre-commissioning tests were witnessed both by TCP2 Extension and NEF representatives. No major problems were met on this phase and the system delivered in due time. As built documentation was received during the hook up phase.

5.4 WORKS ON DP-2

5.4.1 Historical

Following the discovery of the fact that contact was existing between the Ø4 1/2" JI riser and at one side the Ø26" production riser R2, and at the other side the jacket structure, cutting of JI riser was decided.

Due to the fact that this riser was intended to be used to inject on a DP-2 well methanolated water recovered from the NEF and ODIN gas treatment, under the MR 88007, TCP-2 Extension requested ODC:

1) To study a reconnection solution for the riser.
2) To have the riser operational again in August '83.

5.4.2 Engineering

The study was performed by OCD's sub-sea operation specialists. The solution proposed and accepted was the installation of a mechanical gripper, installed after cutting which permitted a bolted connection with the flexible hose laying on the seabed.

5.4.3 Schedule

	Disconnection	Reconnection
Sub sea tasks No.	1626	3061 and 3414
Selected contractor	WOS U/E	WOS U/E
Offshore starting date	04.10.82	04.04.83
Offshore compl. date	10.10.82	15.08.83
During manhours *	19 mhrs	134 mhrs

* represent the effective during manhours and do not include the surface assistance, etc....

5.4.4 Conduct of the Works

The work was carried out by the contractor WOS U/E under a yearly diving contract for inspection, maintenance and repair; on Frigg Field Installation. Our job was defined by the sub sea tasks 1626 - 3061 - 3414. The work was performed under OCD sub sea group supervision.

The pressure test of the whole sea line and risers on DP2 and TCP-2 side was performed by OCD and riser declared operational again.

5.5 KEY FIGURES

5.5.1 Number of Tasks

	Struct.	Pip.	Mech.	Electr.	Instr.
Pre-hook up	23	7	0	136	56
Orig.scope	85	227	4	251	333
Ratio	27 %	3 %	0 %	54 %	17 %

5.5.2 Number of Manhours *

Total manhours spent in pre hook up	:	12.661 mh
Hook up hours:	:	100.000 mh
Ratio:	:	12 %

* Not including the hours spent in diving operations and extension of the risers.

6 TRANSPORTATION AND LIFTING

6.1 GENERAL

6.1.1 Introduction

TCP-2 Extension Project has managed all technical matters related to transport and lifting of the modules.

From an early stage during engineering phase, a basic data for lifting operation was distributed and commented within the team in order to serve as a check list in matter of:

- Geometry and lay-out of modules.
- Design and construction of lifting gear and lifting-aids.
- Lifting procedure.
- Lifting barge specification.
- Cargo barge specification.
- Special operations.
- Warranty surveyor.

6.1.2 Organization

This project phase was supervized by Construction Manager in a task force consisting of the following persons:

- Structural leader from engineering section.
- Structural supervisor from construction team.
- Barge supervisor on a short-term appointment.

The team internally liaised with:

- QA/QC section: for all matters of authority approvals.
- Offshore Construction Department (OCD) - as responsible for anchoring operations at Frigg.
- EAN Inspection Department - to insure that the marine equipment to be used would comply with EAN specifications and policies.
- Production Department - to coordinate preparation of the TCP-2 platform before and during lifting operations.

6.1.3 Main Contractors

The following Contractors played an active part during transport and lifting phases.

Ponticelli Freres :	- Load out procedure - Load out operation - Sea fastening - Safe keeping, ballasting of the cargo barge.
Neptun Transport &: Marine Services A.B.	- Provided the cargo barge - Tow out to Stavanger and to Frigg - Review sea fastening calculation - Towing procedure

K/S Heerema Seaway A/S	:	- Detailed engineering for lifting gear and lifting aids. - Detailed engineering of sea fastening - Detailed engineering for platform preparations. - Lifting procedures - Execution of preparation works on platform - Execution of lifting programme.
North Sea Exploration A/S	:	- Rigging module and pancake
Maritime GMC A/S	:	- Cleaning cargo barge
Bloms Oppmåling A/S	:	- Module and site geometry surveys.
Scope Oceanographie	:	- Meteorological assistance
Noble Denton and Associates A/S	:	- Warranty Surveyor giving advice and approvals.

6.1.4 Quality Assurance Principle

The main objectives of the Quality Assurance procedures were:

- Avoid accident of personnel.
- Avoid damages of equipment.
- Execute the operations within the schedule and budget.

Basically, each action, in addition of being handled within the Project Team according to Project Procedures, was also submitted for comments to a "Compentent Person" (Noble Denton & Associates A/S (ND) or DnV) and where the action involved a split of responsibility between two contractors, then a thorough preparation was planned between involved contractors.

6.2 TRANSPORTATION

6.2.1 Contract Award

The transportation contract was originally intended to be part of the lifting contract and as such included in the lifting tender documents. It became obvious at evaluation of the offers that the Heerema's monopoly of derrick barges was not in favour of EAN as far as cargo barge and transport concerned. The Project then decided to call for separate transportation Tenders.

Final choice of Contractor was evaluated among the tenders received from the following companies:

- K/S Heerema Seaway A/S (HS)
- Neptun Transport & Marine Services A.B. (NT)
- Grieg Offshore

NT was finally selected on the basis of:

- Lowest predicted cost
- Cargo barge and tug owned by Contractor
- Cargo barge and tug dedicated to the work from contract signature date (Cargo barge GOLIAT 9 and tug POSEIDON).
- Contractor's experience

6.2.2 Schedule

- Call for Tender	:	Mar 82
- Offers	:	Apr 82
- Evaluation	:	May 82
- Assessment of cargo barge and tug by ND	:	May 82
- Partners approval	:	14th Jun 82
- Telex of intent to NT	:	5th Jul 82
- Contract signature	:	Feb 83
- Documents sent to NT for review	:	3rd Jan 83
- Notice for mobilization of cargo barge given on	:	10th Feb 83
- Cargo barge arrival at Ponticelli yard	:	6th Mar 83
- On-hire survey by EAN, ND and NT representatives	:	10th Mar 83
- Ballasting, load-out preparation, load-out of modules in the period		1-15th Apr 83
- Certificate of approval for load-out M50+P53 on	:	14th Apr 83
- Tug Poseidon on hire at Gothenburg	:	20th Apr 83
- Tug Poseidon arrived Bordeaux	:	25th Apr 83
- Certificate of approval for transportation of modules.	:	26th Apr 83
- Tow departure from Bordeaux	:	28th Apr 83
- Tow arrival Stavanger	:	4th May 83
- Tow departure to Frigg	:	22nd May 83
- Tow departure from Frigg and arrival Stavanger	:	25th May 83
- Tug Poseidon redelivered same day	:	25th May 83
- Cargo barge cleaning, offhire survey and redelivery	:	30th May 83

6.3 LIFTING

6.3.1 Contract Award

After a prequalification enquiry made during the 4th term 1981, a call for tender for lifting, transportation, and associated works was sent out in February 1982 to the three following companies:

- ETPM, France
- K/S Heerema Seaway A/S, Netherlands (HS)
- McDermott International, Inc., Belgium (MCD)

Bids from HS and MCD were received on 25th March, 1982. ETPM declined on the ground that ETPM 1601 was not available in 1983.

Offers from HS and MCD were about the same in terms of value. HS guaranteed the derrick barge availability during the intended lifting period and included for unlimited weather stand-by. At the opposite MCD did not guarantee the availability of the derrick barge and dit not include weather stand-by.

K/S Heerema Seaway A/S was awarded the contract.

6.3.2 Engineering Studies

K/S Heerema Seaway A/S scope of work included:

1. Review modules structural information.
2. Monitor weights and center of gravity.
3. Cargo barge ballast and trim calculations.
4. Cargo barge intact stability calculations.
5. Cargo barge damaged stability calculations.
6. Review barge grillages design.
7. Design all seafastenings.
8. Prepare towing script.
9. Review padeyes design.
10. Design missing padeyes on modules to be removed.
11. Review rigging platforms.
12. Design lifting rigging for all lifts.
13. Design tugger bollards.
14. Prepare slings lay-out.
15. Review lifting frames M50 + P53.
16. Design guides and bumpers to be placed on existing modules on TCP-2
17. Review guides and bumpers on M50 and P53.
18. Design modules skidding aids on TCP-2.
19. Design lifting cage for 20" ESD valve.
20. Prepare anchor plan.
21. Perform anchor calculation for derrick barge.
22. Prepare removal procedures/detailed design for platform preparation
23. Prepare installation procedures.
24. Prepare contingency plans.

6.3.3 Planning

All above activities were planned from the beginning of the contract so as to match with the selection of the cargo barge, the issue of fabrication shop drawings, the actual construction sequences and the type of derrick barge to be used.

The progress of the work was calculated every month by K/S Heerema Seaway A/S.

A meeting was held in Stavanger every month during the preparation phase, then it became weekly from the date of load-out.

6.3.4. Platform Preparation

6.3.4.1 Scope

1. & 2. Installation of padeye on NW corner of P963.
3. Removal of deck plate infills local to P962.
4. Removal of stairway and landing on south side of M01.
5. Removal of cladding panels and frames at south side of M01.
6. Removal of walkway and lighting masts on west side of P941.
7. Removal of walkway and stair at pipe rack on west of P941.
8. Installation of temporary supports for lifting bars on P947 & P962
9. Made holes in deckplate of P945 for access to padeyes.
10. & 11. Precut 75 % of horizontal braces above P962.
12. Removal of deck infill between P941 and P947.
13. Removal of walkway between P947 and P969.
14. Removal of walkway between M01 and P946.
15. Removal of walkway on south side of M01.
16. Erection of guides for P53.
17. Installation of support frame for P943.
18. Removal of electrical panel on P941.

6.3.4.2 Execution

Due to production constraints all above hot works had to be performed while TCP-2 was still in production. A crew of 12 persons did it in 10 days from 10 to 19th May 83.

Safety precautions were planned up to the smallest detail such as activation of deluge water, partials, shut down etc...

6.3.5 Lifting Report

6.3.5.1 Mobilization of Crane Barge

Preparations for use of crane ship Odin were made such as, anchoring procedure, anchor analysis and contingency plan, were all well accepted by NPD and NMD, but on 16th May K/S Heerema Seaway A/S (HS) altered the plans and decided to use the crane barge Balder to perform the work. Immediate actions were taken by EAN. New anchoring procedures and analysis were issued and approved. HS contingency plan was very good and could be used on both vessels. New approvals were given by NMD and NPD on 20th May 83.

EAN paid a visit to the barge "Balder" on 19th May and found the barge to be acceptable.

EAN gave HS green light for use of the crane barge Balder on the 20th May.

On 23rd May at 06.20 hrs at Beryl Field the Balder started mobilizing for EAN.

6.3.5.2 Daily Progress Report

DAILY PROGRESS REPORT FOR MONDAY, MAY 23rd 1983

06.20 - 11.30	Mobilizing for TCP-2 Extension work.
06.20 - 11.30	Proceeding to location under own power.
11.30 - 12.09	Proceeding to anchorrun position with tug Husky on P-1 anchorwire, Switzer Jarl on S-6 anchorwire.
12.09 - 19.40	Running anchors.
20.00 - 20.15	Moving in.
20.45 - 21.15	Mooring barge Goliat 9 sb alongside bow/stern tugs Husky and Poseidon.
21.30 - 21.45	Moving in.
22.10 - 22.20	Moving 10 m astern.
22.20 - 24.00	Material transfers to and from platform.

DAILY PROGRESS REPORT FOR TUESDAY, MAY 24th 1983

00.00 - 24.00	Anchored out E site TCP-2 Frigg.
00.00 - 00.50	Hook-on and transfer P945 to Balder.
00.00 - 11.00	Installation bumpers for M50.
00.50 - 03.40	Preparations to hook on and transfer P947 to Balder.
03.40 - 07.00	Cut and remove horizontal bracings above P962 and support for P947.
07.00 - 10.00	Cutting seafastenings P962 on platform.
08.30 - 10.00	20" valve to platform.
10.15	Hook on P962, postponed due to barge movements.
15.00 - 16.15	Preparations to hook on and transfer P962 to Balder.
17.00 - 18.40	Hook on, transfer and install P53.
18.40 - 19.10	Awaiting approval.
19.10 - 19.40	Unhook P53.
19.40 - 21.00	Cutting seafastenings M50.
18.00 - 21.00	Hook on M50.
21.00 - 21.38	Lift and transfer M50 in 3000 tons crane (880 t/s)
21.38 - 22.05	Unhooking M50.
22.05 - 23.00	Cut off and transfer lifting frame M50.
23.00 - 23.18	Transfer P942 to Balder.
23.40 - 24.50	Installation jacks M50.
23.40 - 24.50	Unmooring barge Goliat 9 with Husky and Poseidon.
23.18 - 23.30	Transfer P943 to Balder deck.

DAILY PROGRESS REPORT FOR WEDNESDAY, MAY 25th 1983

00.00 - 22.36	Anchored out E site TCP-2 Frigg.
00.00 - 11.30	Removing rigging platform M50, grinding cut of areas. Installing skidding equipment and skidding M50.
03.50 - 04.10	Skidding M50.
04.10 - 04.50	Skidding delayed by removing of bumpers.
04.50 - 11.30	Skidding M50.
06.30	Installing horizontal beams P53.
08.00 - 10.55	Re-install beam P947 and supports.
10.55 - 11.40	Re-install P947.
11.30 - 11.40	Awaiting approval of M50.
11.40 - 12.10	Installing P942.
14.25 - 15.00	Installing P943.
15.00 - 17.00	Completing installation welding A.O.
17.00 - 18.00	Materials back to Balder and shuttling personnel back to Balder by helicopter.
18.00 - 18.06	Moving out.
18.06 - 22.36	Running anchors.

PROGRESS REPORT FOR THURSDAY MAY 26th 1983

00.00 - 04.30 Demobilizing (underway to Beryl B)

BUNKER CONSUMPTION

DATE	Derrick Barge BALDER	Tug HUSKY	Tug SWITZER JARL		
23 May	33	5	2		
24 "	31	3	00,5		
25 "	40	3	4,5		
26 "	18	4	3		
	122	15	10	TOTAL	147 M^3

TOTAL FUEL CONSUMED 147 m^3

6.3.5.3 Particular Problems

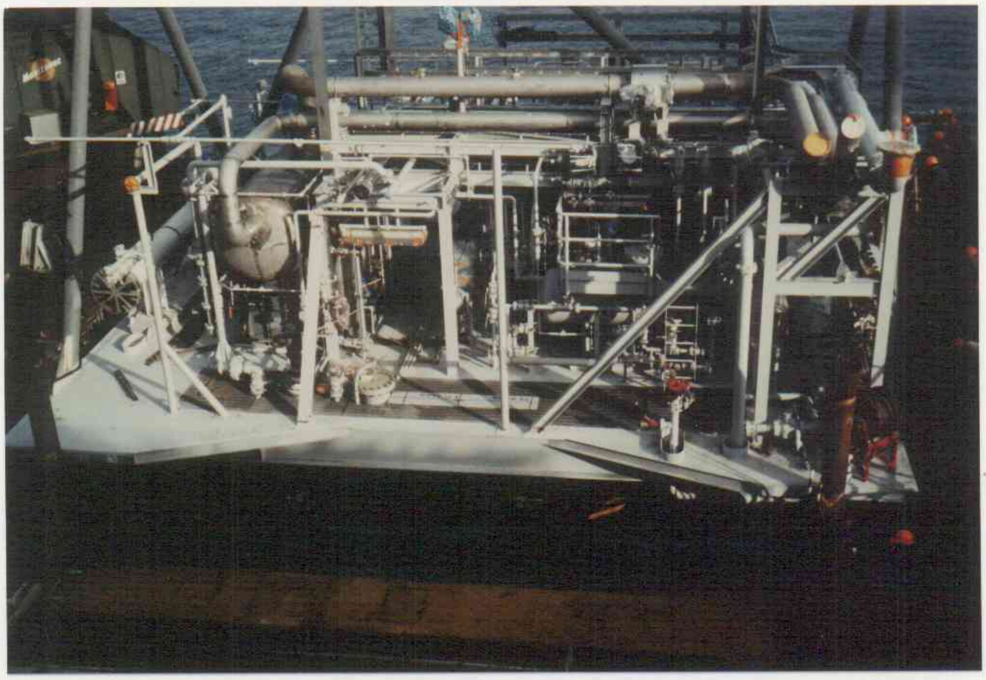
- Riser 20" cut too high (ref. for 100 FL was taken above grating instead of above steel). Result was that 20" valve could not be placed on right location. This was further adjusted by the Hook-Up Contractor.

- Bumpers for M50, to be fixed on M01, prefabricated by Heerema, as per M01 as built drawing. Found differences between as-built and structure, so that Heerema had to cut to suit the bumpers - lost time ca. 6 hours.

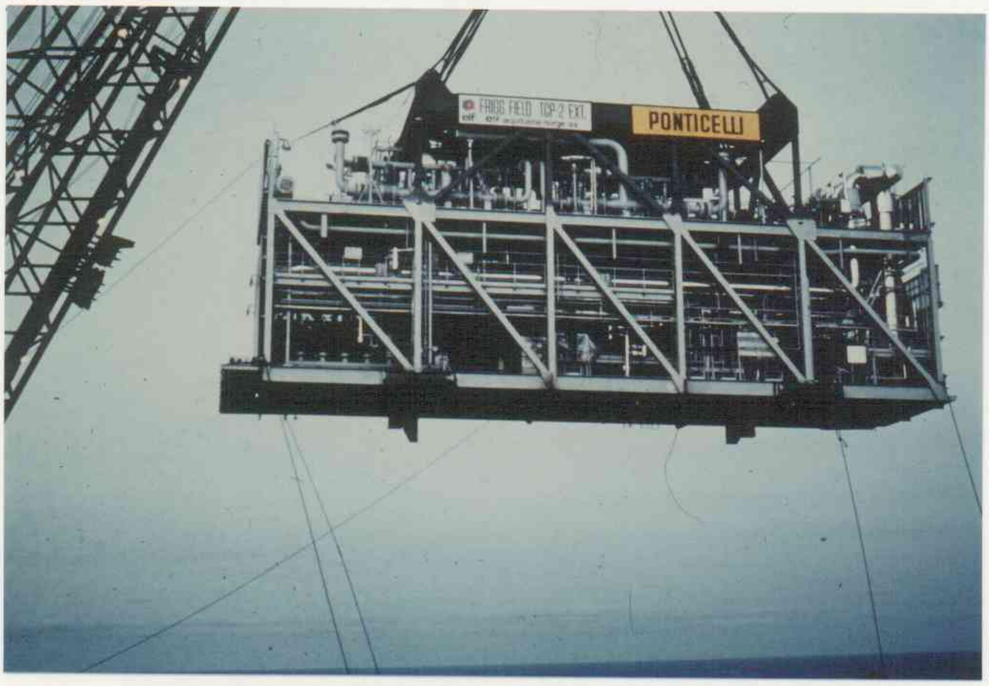
- Horizontal bracing for support of cladding section south of P53 interferred with a 2" fire water line. The latter could not be modified in due time, so that installation of cladding was not done.

- P53 north skidding shoes (engineering design) interferred with bracing of support frame, so that pancake was resting on such skidding shoes instead of on the support. To be jacked and cut later during hook-up.

Module 50
on the
barge
Goliat 9



Pancake 53
after lifting



Lifting of
Module 50
by the
crane barge
Balder

7 HOOK UP

7.1 GENERAL

The Hook-Up, Precommissioning and Commissioning have been managed by EAN - TCP2 Extension Department.

The preparation started in March '83 and the mission was completed in October '83 for both Hook-Up and Commissioning works.
The Hook-Up and Commissioning works were carried out by Haugesund de Groot Offshore A/S & Co. (HDG).

The overall schedule of the work was based on the three following milestones:

A. Platform ready for gas in 15.08. (treatment facilities may restart at any time due to contractual gas delivery to BGC.

B. Safety system automatically operational on the whole platform including the new module and pancake by 15.06.83.

C. Power Supply to NEF FCS operational for the 10.07.83.

7.2 HOOK UP ORGANIZATION

7.2.1 EAN Organization

The TCP-2 Extension hook up team organization chart is shown on Figure 7.1.

All personnel was mobilized at the flotel arrival and demobilized before or at the flotel departure.

The TCP-2 offshore team was also integrated in the Frigg Field organization. The reporting line is shown in the chart in Figure 7.2.

7.2.2 Haugesund de Groot Offshore A/S & Co. Organization

The contractor's organization is shown in the organization chart in Figure 7.3.

The contact point offshore between EAN and HDG was "Site Manager" on EAN side and "Construction Superintendent" on HDG side.

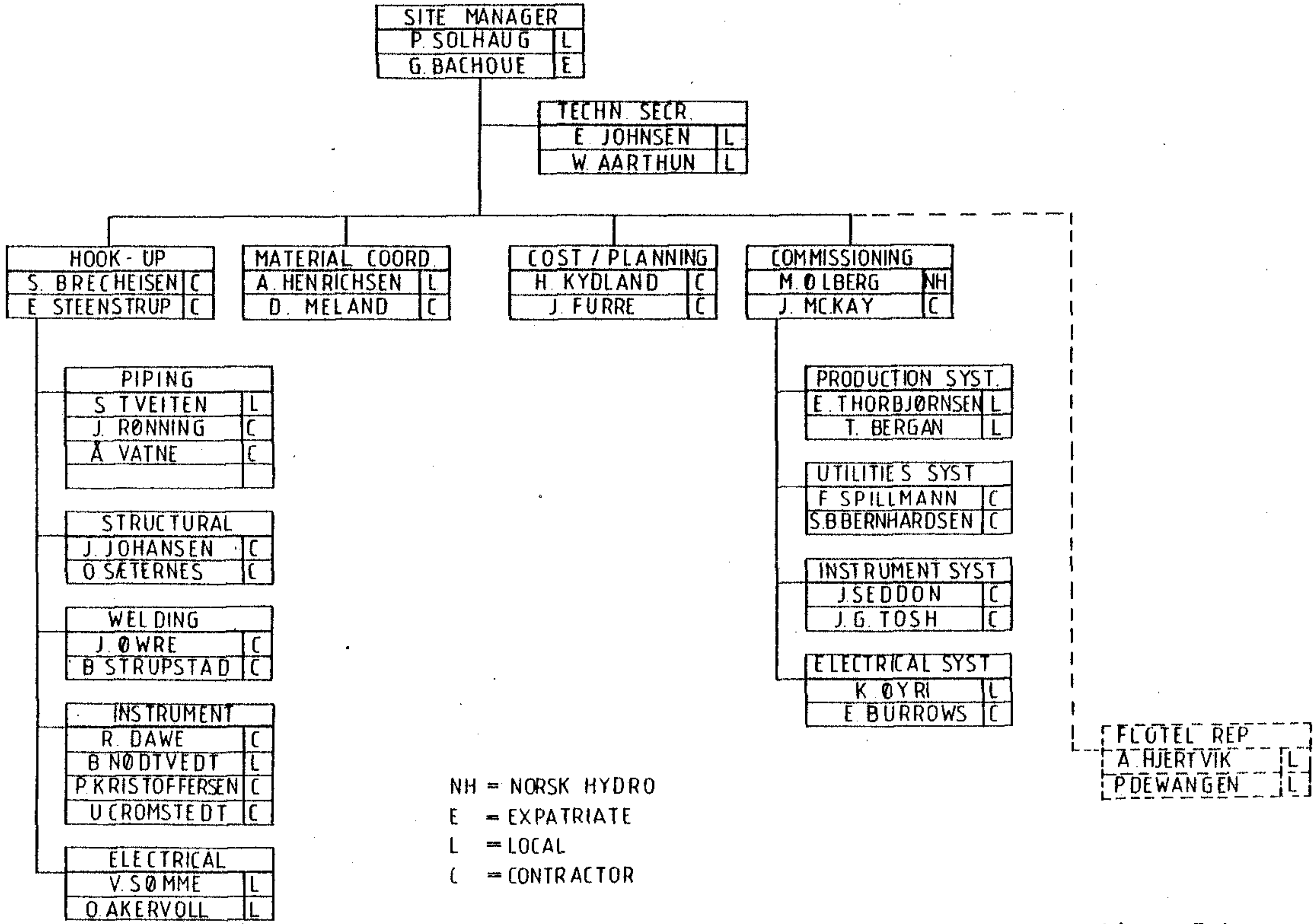
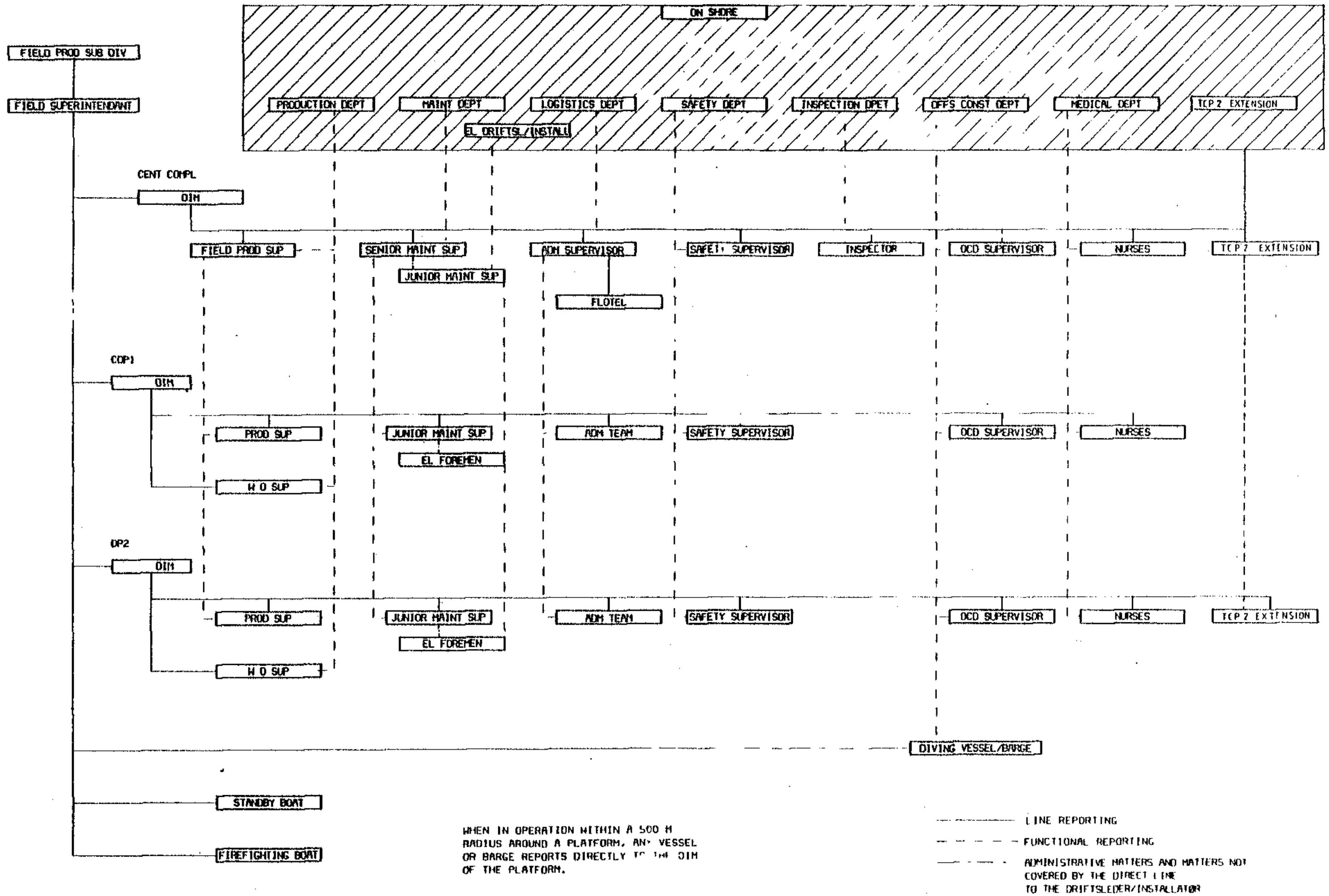

SITE MANAGER
P. SOLHAUG L
G. BACHOUE E
TECHN. SECR.
E. JOHNSEN L
W. AARTHUN L
HOOK - UP
S. BRECHEISEN C
E. STEENSTRUP C
MATERIAL COORD.
A. HENRICHSEN L
D. MELAND C
COST / PLANNING
H. KYDLAND C
J. FURRE C
COMMISSIONING
M. OLBERG NH
J. MCKAY C
PIPING
S. TVEITEN L
J. RØNNING C
Å. VATNE C
STRUCTURAL
J. JOHANSEN C
O. SÆTERNES C
WELDING
J. ØWRE C
B. STRUPSTAD C
INSTRUMENT
R. DAWE C
B. NØDTVEDT L
P. KRISTOFFERSEN C
U. CROMSTEDT C
ELECTRICAL
V. SØMME L
O. AKERVOLL L
PRODUCTION SYST.
E. THORBJØRNSEN L
T. BERGAN L
UTILITIES SYST
F. SPILLMANN C
S.B. BERNHARDSEN C
INSTRUMENT SYST
J. SEDDON C
J. G. TOSH C
ELECTRICAL SYST
K. ØYRI L
E. BURROWS C
FLOTEL REP
A. HJERTVIK L
P. DEWANGEN L
NH = NORSK HYDRO
E = EXPATRIATE
L = LOCAL
C = CONTRACTOR

Figure 7.1

OFFSHORE ORGANISATION AND OFFSHORE/ONSHORE LIAISONS



APRIL 1ST. 1982
REVISION 31.05.83

Figure 7.2

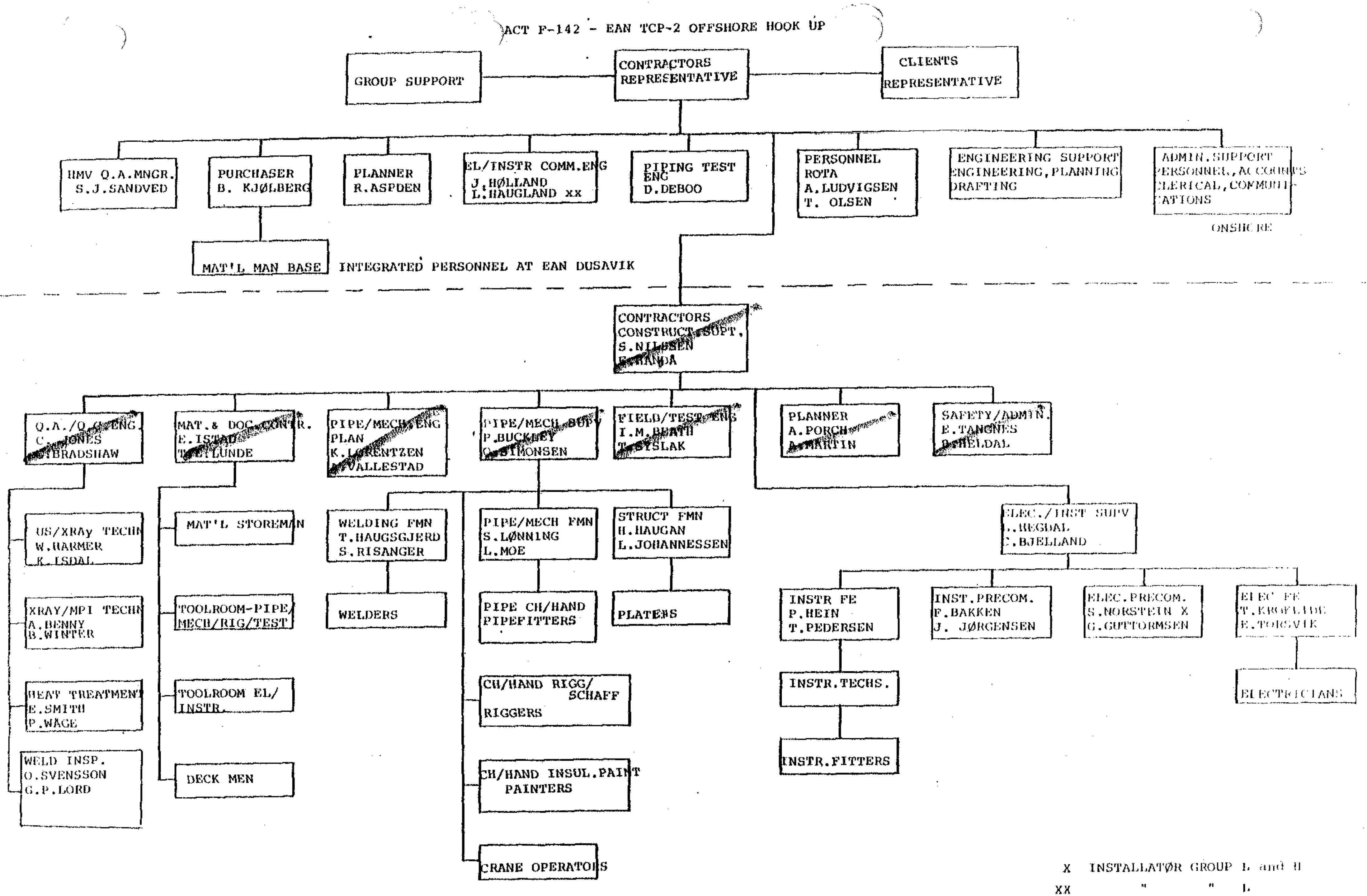

ACT F-142 - EAN TCP-2 OFFSHORE HOOK UP
GROUP SUPPORT
CONTRACTORS REPRESENTATIVE
CLIENTS REPRESENTATIVE
HMV Q.A.MNGR. S.J.SANDVED
PURCHASER B. KJØLBERG
PLANNER R.ASPDEN
EL/INSTR COMM.ENG J.HØLLAND L.HAUGLAND xx
PIPING TEST ENG D.DEBOO
PERSONNEL ROTA A.LUDVIGSEN T. OLSEN
ENGINEERING SUPPORT ENGINEERING, PLANNING DRAFTING
ADMIN.SUPPORT PERSONNEL, ACCOUNTS CLERICAL, COMMUNICATIONS
ONSHORE
MAT'L MAN BASE
INTEGRATED PERSONNEL AT EAN DUSAVIK
CONTRACTORS CONSTRUCT.SUPT. S.NILSSEN
Q.A./Q.C.ENG. C. JONES BRADSHAW
MAT.& DOC.CONTR. E.ISTAD LUNDE
PIPE/MECH ENG PLAN K.LORENTZEN VALLESTAD
PIPE/MECH SUPV P.BUCKLEY SIMONSEN
FIELD/TEST ENG I.M.BEATH SYSLAK
PLANNER A.PORCH MARTIN
SAFETY/ADMIN. E.TANGNES
US/XRAY TECHN W.HARMER K.ISDAL
XRAY/MPI TECHN A.BENNY B.WINTER
HEAT TREATMENT E.SMITH P.WAGE
WELD INSP. O.SVENSSON G.P.LORD
MAT'L STOREMAN
TOOLROOM-PIPE/MECH/RIG/TEST
TOOLROOM EL/INSTR.
DECK MEN
WELDING FMN T.HAUGSGJERD S.RISANGER
WELDERS
PIPE/MECH FMN S.LØNNING L.MOE
PIPE CH/HAND PIPEFITTERS
CH/HAND RIGG/SCHAFF RIGGERS
CH/HAND INSUL.PAINT PAINTERS
CRANE OPERATORS
STRUCT FMN H.HAUGAN L.JOHANNESSEN
PLATERS
ELEC./INST SUPV L.HEGDAL C.BJELLAND
INSTR FE P.HEIN T.PEDERSEN
INSTR.TECHS.
INSTR.FITTERS
INST.PRECOM. F.BAKKEN J. JØRGENSEN
ELEC.PRECOM. S.NORSTEIN X G.GUTTORMSEN
ELEC FE T.KROGLIDE E.TORSVIK
ELECTRICIANS
X INSTALLATØR GROUP L and H
XX " " L

Figure 7.3

7.3 QUALITY ASSURANCE / QUALITY CONTROL

7.3.1 Quality Assurance Principles

NS 5801 or equal was a requirement to our Contractor´s Quality Assurance (QA) system covering this phase.

Prior to award of contract and start of the work, Contractor´s QA system was evaluated and improved by all key personnel within our project. The major part of our work in this phase consisted of follow up of Contractor´s implementation of his, by Company, approved QA - system.

To perform this daily follow-up, a Site Team was established, in line with the onshore module fabrication. Quality control activities within our project team, was as for the onshore fabrication, not dedicated to a special QA group within the site team, but ensured by a wide and highly technical qualified project organization located on site.

This site team, which covered all disciplines, was responsible to ensure that all specified quality requirements were met and that Contractor worked according, and documented his work, as outlined in this QA system.

Quality control in access of the site teams follow-up, were initiated through system/work performance audits from project management in Stavanger.

During these audits both external and internal expertice were utilized.

7.3.2 Project Procedures

Project procedures were jointly established by the QA section and the construction section in the project.

The Project Procedures were systematically gathered in the Quality Management Manual (QMM) for the Hook-Up and Commissioning phase, which were made available to all project participants.

The most important procedures are shown in Appendix 6 and are:

- General Correspondence
- EAN Site Team Internal Procedure
- Request for Modification/Engineering
- Onshore Issued Task/Change Order
- Offshore Issued Task/Change Order
- Site Instruction/Change Order
- Material Handling Procedure
- Task Sheet Approval
- Non-Conformance Reporting
- Corrective Action
- Commissioning System

7.3.3 Quality Control (QC)

QC during the Hook-Up phase on TCP-2 was achieved by:

- Haugesund de Groot Quality Control Team
- TCP-2 Extension Supervision Team
- TCP-2 Extension QC in Stavanger

7.3.3.1 Haugesund De Groot Offshore A/S & Co. (HDG) Quality Control

The QC of welding with HDG organization was entirely sub-contracted to Mapel Norge A/S, responsible for:

- QC Procedures
- Non-destructive examinations
- Reporting
- QC drawings

Other control were carried out by HDG´s own personnel.

7.3.3.2 TCP-2 Extension Supervision Team

To help the discipline supervisors in assessing the level of quality, one inspector with a solid background in welding and NDT was permanently assigned to the team. He reported to Hook-Up Superintendent for all matters concerning work routing, and to Site Manager for all matters concerning non-conformities. He also reported to QC section in Stavanger when conflictual situation arose.

7.3.3.3 TCP-2 Extension Quality Control Section

This section was dealing with approbation of welding procedures, internal audit of the work done by the supervision team, and organization of external audits on hook-up works.

Regular audits were performed by QC section on a monthly basis. In addition one external audit was organized.

The Appendix 7 illustrates by an example how an external audit was performed.

7.3.3.4 General

All findings outlined in non-conformities reports, internal audit reports and external audit reports were distributed and evaluated within the Project, with assistance when necessary of EAN Operational Responsible Departments and DnV as consultant.

The same principles applied to electrical and instrumentation where Project called for its own expertise, and also external expertise form Driftsleader and DnV.

7.4 PLANNING AND PROGRESS

7.4.1 Planning

A network planning of the Hook-Up works was prepared on the Artemis computer system.

The network consisted of 700 activities, each activity being a task. Three levels of planning was worked out:

- Level I by major milestones
- Level II by system/sub-systems
- Level III by detailed tasks

The major milestones of the level I planning were:

- Safety systems	completed week 24
- NEF electrical works	completed week 29
- Production systems	completed week 33
- Remaining work	completed week 40

The hook-up and commissioning works were planned as one integrated activity.

The schedule of the work for the main systems were:

System	Sub System	Designation	Completion Date
		ON TCP2 EXT. (88)	
S.01		Instrument and Plant Air net work	
	S01A	Instrument air distribution	31/07/83
	S01B	Service air distribution	31/07/83
S.02		Fuel Gas System	15/08/83
S.03		Electrical Systems	
	S03A	Cable trays	
	S03B	380V power distribution	15/08/83
	S03C	Normal lighting	15/06(73
	S03D	Emergency lighting	15/06/83
	S03E	Emergency power (220V no break)	30/06/83
	S03F	24V DC	15/08/83
	S03G	Grounding	15/08/83
	S03H	Trace heating	15/08/83
	S03I	General	15/08/83
S.04		High Pressure Relief System	
	S04A	High pressure relief	15/08/83
	S04B	Low temperature relief	15/08/83

System	Sub System	Designation	Completion Date
S.06		**Safety Systems**	
	S06A	Public address and public alarm	07/06/83
	S06B	Gas detection	30/07/83
	S06C	Fire detection	30/07/83
S.08		**Methanol System**	
	S09A	High pressure methanol	20/08/83
	S09B	Methanol injection to NEF	20/08/83
S.10		**Drainage System**	
	S10A	Open drainage	30/07/83
	S10B	Closed drain	15/08/83
	S10C	Methanolated water	20/08/83
S.11		**Condensate Separation Systems**	15/08/83
S.12		**Gas Treatment Systems**	
	S12A	NEF gas treatment line	15/08/83
	S12B	Odin gas treatment line	15/08/83
S.14		**Gas supply Network**	
	S14A	NEF gas supply line	30/08/83
	S14B	Odin gas supply line	15/08/83
S.16		**Glycol Circulation Network**	15/08/83
S.17		**Fire Fighting Systems**	
	S17A	Fire water	30/06/83
	S17B	Deluge water	01/09/93
	S17C	Extinguishing equipment	30/07/83
S.18		**Wash Down System**	30/09/83
S.22		Miscellaneous Equipment	30/09/83
		(instrument in interface rooms)	15/09/83
S.25		**Structure and Modules**	
	S25A	Structure	15/09/83
	S25B	Access and escape ways	15/06/83
S.27		**Corrosion inhibitor Equipment**	15/09/83
S.29		**Lifting Equipment**	15/09/83

System	Sub System	Designation	Completion Date
S.33		<u>Utility water</u>	
		<u>On DP2 (83)</u>	
S.01		Air system	
S.53		Control room	30/08/83
S.54		Methanolated water disposal network	30/08/83
		<u>On OP (96)</u>	
S.11		Telecommunications, Telemetry	15/08/83
S.14		Control room	15/08/83
		<u>On TCP2 Compression (87)</u>	
S.02		Grounding and cable trays	
S.20		Power Generation 5.5 kV/NEF Power Supply	10/07/83
S.21		Power distribution 380 V	
S.22		Normal and emergency lighting	
S.26		Safety fire and gas detection	
S.27		Safety fire fighting	
S.28		Emergency Shut Down (PLC)	
S.29		HVAC on NEF 12kV high voltage room	
		<u>On TCP2 T (85)</u>	
S.03		Electrical systems	

The Level II bar chart is shown in Appendix 8 together with an example of Level III.

7.4.2 Progress

Each task was represented by a certain "weight" corresponding mainly to the direct manhours estimate. The multiplication of the progress of the work by the weight of the task allowed to measure the progress; this was done for each task. The progress was available on the 3 previous planning levels, with, in addition "by discipline" planning.

The overall progress measurement is shown on Figure 7.4. and the progress curve by discipline:

Structural	Figure 7.5
Piping	Figure 7.6
Electrical	Figure 7.7
Instrument	Figure 7.8

7.5 HOOK UP PREPARATION

7.5.1 Phases

- Hook up bid package (1st draft for comments)	: Aug. '82
- Hook up bid package (final)	: Mid Oct. '82
- Final definition of pre hook up scope of work	: June '82
- Call for tender issue	: Nov. '82 (15th)
- Bids received	: Jan. '83 (18th)
- Contract awarded	: March '83 (31st)
- Selected contractor in our offices in Dusavik for common prep.	: Apr. '83 (15th)
- Updated HU package with additional infos.	: May '83 (29th)

7.5.2 Presentation of the Work - Task Preparations

The work was split into the 5 major disciplines:

- Structural (including paining)
- Piping (including insulation)
- Mechanical
- Electrical
- Instrumentation

The work in those disciplines were split and defined by tasks; each task supported by a task sheet. Each task sheet contained all necessary information for:

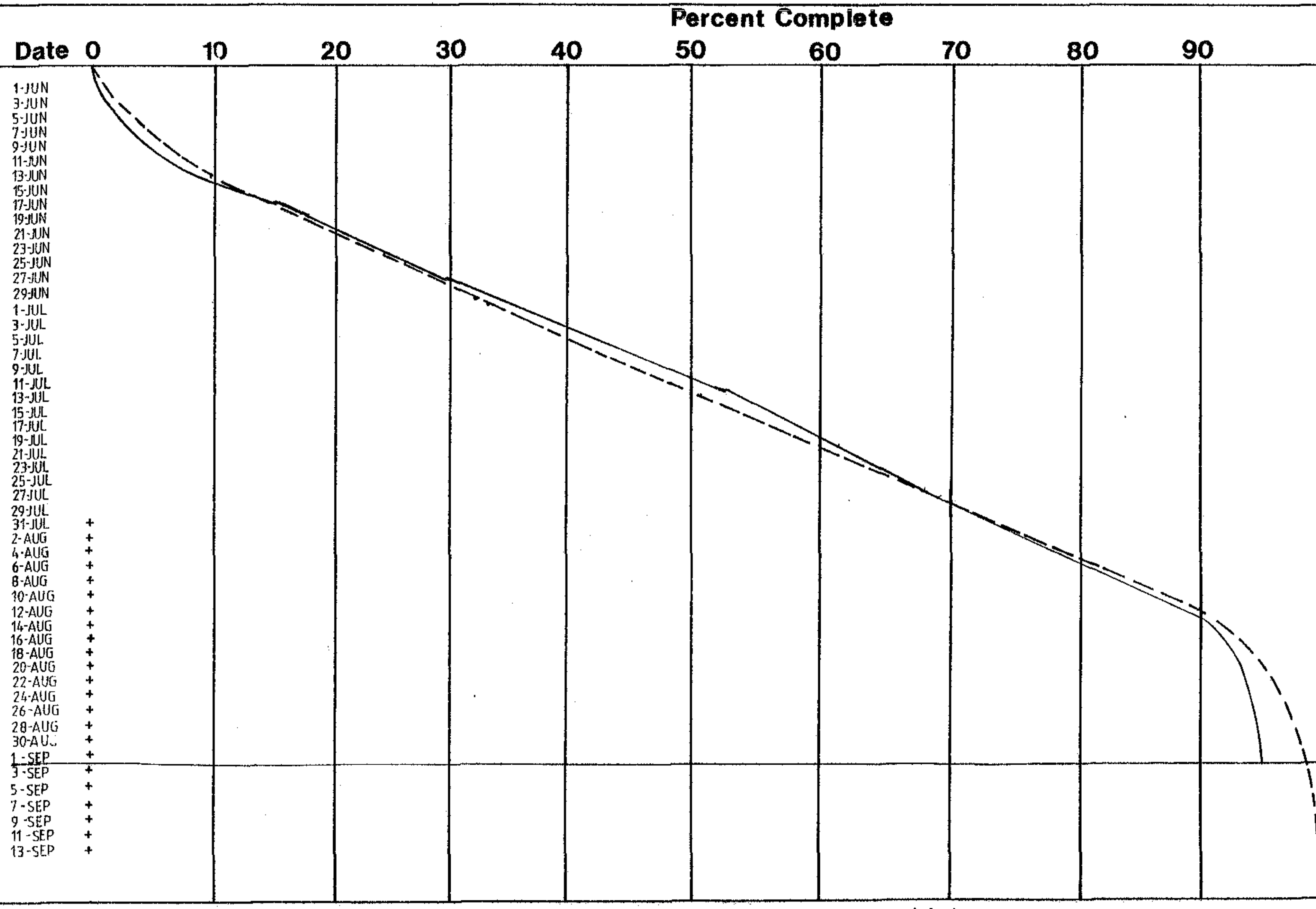
- Performance of the work itself
- Computerized follow up.

Elf Aquitaine Norge a/s Frigg TCP2 Extension
Proj[illegible]t by Haugesund de Groot
ID:50 Project:TCP2

Project S Curv[illegible]
Report Number: TCURV

RUN DATE 3[illegible] AUG·83
SORTED BY PLANNED START
DATASET: CURVE 1

TOTAL



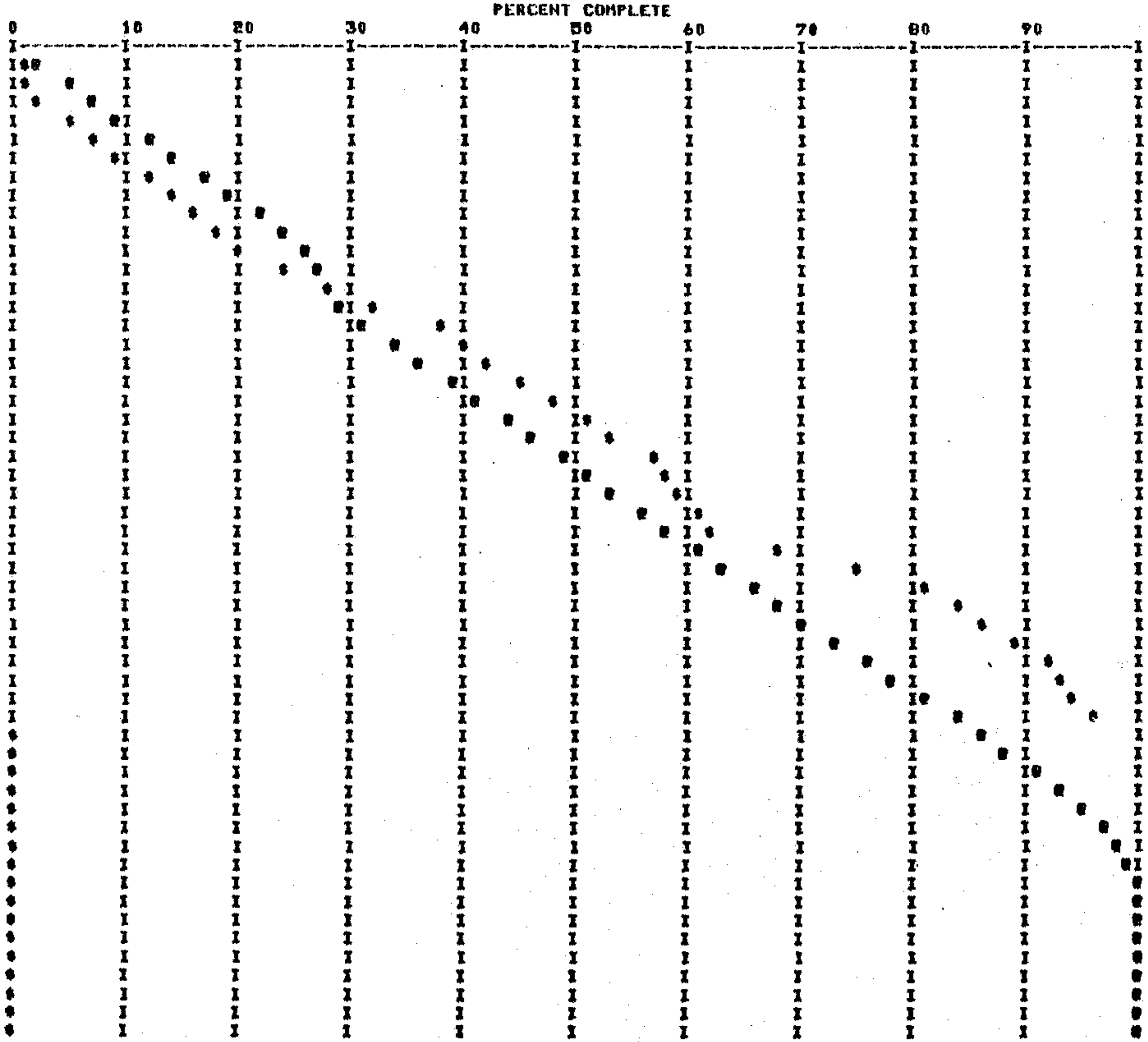
Date		CUML %PLAN	WEEKLY %PLAN	ACT %COMP
1-JUN		1,19	1,19	0,44
3-JUN		2,38	1,19	1,68
5-JUN		3,57	1,19	2,82
7-JUN		4,98	1,41	4,23
9-JUN		6,56	1,58	5,81
11-JUN		8,17	1,62	7,42
13-JUN		9,78	1,61	9,03
15-JUN		12,65	2,87	11,90
17-JUN		15,52	2,87	15,30
19-JUN		18,30	2,78	18,30
21-JUN		20,99	2,69	21,60
23-JUN		23,82	2,83	23,80
25-JUN		26,40	2,58	27,20
27-JUN		28,89	2,49	29,30
29-JUN		31,55	2,67	32,10
1-JUL		34,40	2,85	36,06
3-JUL		37,20	2,80	39,10
5-JUL		39,94	2,73	42,20
7-JUL		42,65	2,71	45,60
9-JUL		45,37	2,72	49,10
11-JUL		48,15	2,78	52,50
13-JUL		50,87	2,72	55.70
15-JUL		53,70	2,83	57,10
17-JUL		56,49	2,79	58.80
19-JUL		59,30	2,81	60.10
21-JUL		62,14	2,84	61,80
23-JUL		64,83	2,69	64.50
25-JUL		67,53	2,70	67,30
27-JUL		70,26	2,73	70 00
29-JUL		72,93	2,67	72,4
31-JUL	+	75,62	2,69	74,8
2-AUG	+	78,35	2,73	77,2
4-AUG	+	81,08	2,73	79,6
6-AUG	+	83,80	2,72	82,1
8-AUG	+	85,85	2,05	84 6
10-AUG	+	88,06	2,21	87,2
12-AUG	+	90,03	1,97	88,8
14-AUG	+	91,99	1,96	90,4
16-AUG	+	93,87	1,89	92,0
18-AUG	+	94,99	1,12	92,6
20-AUG	+	95,87	0,88	93,1
22-AUG	+	96,53	0,65	93,7
24-AUG	+	97,00	0,48	94,2
26-AUG	+	97,48	0,48	0,00
28-AUG	+	97,95	0,46	0,00
30-AU[illegible]	+	98,26	0,32	0,00
1-SEP	+	98,58	0,32	95,8
3-SEP	+	98,91	0,32	0,00
5-SEP	+	99,21	0,30	0,00
7-SEP	+	99,48	0,28	0,00
9-SEP	+	99,91	0,42	0,00
11-SEP	+	100,00	0,10	0,00
13-SEP	+	100,00	0,00	0,00

Figure 7.4

PRODUCED BY HAUGESUND - DE GROOT — PROJECT S CURVE — SORTED BY PLANNED START

ID:50 PROJECT: TCP2 — REPORT NUMBER : TCURV — DATASET : CURV1

STRUCTURAL

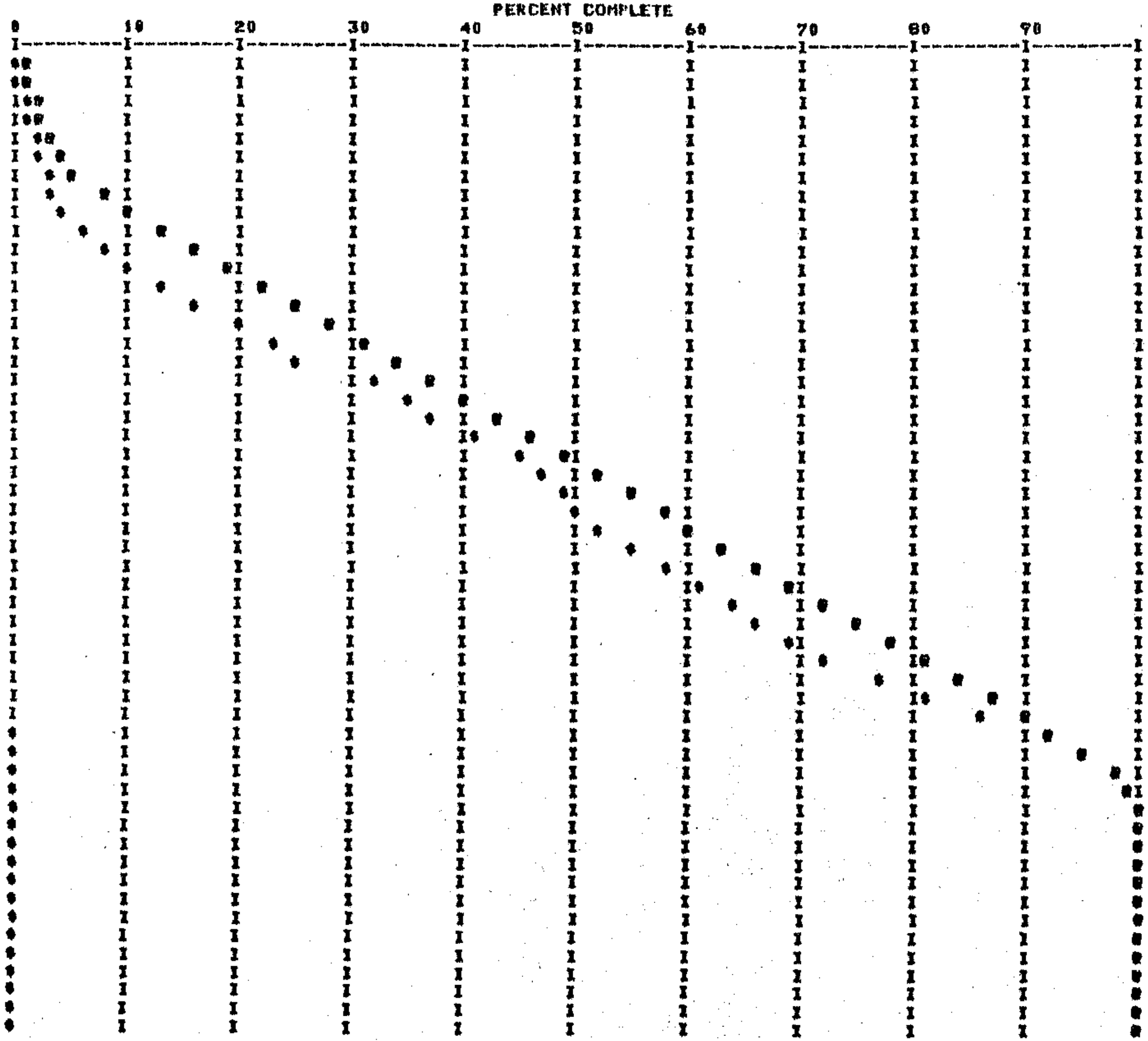


DATE	CUML %PLAN	WEEKLY %PLAN	ACT %COMP
1-JUN	2.31	2.31	0.52
3-JUN	4.63	2.31	1.13
5-JUN	7.02	2.40	2.22
7-JUN	9.44	2.42	4.64
9-JUN	11.68	2.24	6.88
11-JUN	14.07	2.39	9.27
13-JUN	16.61	2.54	11.81
15-JUN	19.20	2.60	14.40
17-JUN	21.86	2.66	15.80
19-JUN	24.00	2.14	17.70
21-JUN	25.75	1.75	19.90
23-JUN	26.88	1.13	23.90
25-JUN	28.05	1.17	28.20
27-JUN	29.40	1.35	31.80
29-JUN	30.98	1.59	37.80
1-JUL	33.56	2.58	40.00
3-JUL	36.11	2.55	42.40
5-JUL	38.74	2.63	45.10
7-JUL	41.18	2.44	48.00
9-JUL	43.63	2.44	51.20
11-JUL	46.07	2.44	53.40
13-JUL	48.51	2.44	57.00
15-JUL	50.95	2.44	58.10
17-JUL	53.40	2.44	59.30
19-JUL	55.83	2.44	60.50
21-JUL	58.30	2.46	61.70
23-JUL	60.76	2.46	68.10
25-JUL	63.23	2.46	74.50
27-JUL	65.59	2.36	80.00
29-JUL	67.95	2.36	83.50
31-JUL	70.47	2.51	86.20
2-AUG	73.13	2.67	89.00
4-AUG	75.80	2.67	91.70
6-AUG	78.47	2.67	93.00
8-AUG	81.12	2.65	94.20
10-AUG	[illegible]	2.61	[illegible]
12-AUG	85.98	2.25	0.00
14-AUG	88.25	2.26	0.00
16-AUG	90.51	2.26	0.00
18-AUG	92.77	2.26	0.00
20-AUG	95.04	2.26	0.00
22-AUG	96.72	1.68	0.00
24-AUG	97.81	1.10	0.00
26-AUG	98.91	1.10	0.00
28-AUG	100.00	1.10	0.00
30-AUG	100.00	0.00	0.00
1-SEP	100.00	0.00	0.00
3-SEP	100.00	0.00	0.00
5-SEP	100.00	0.00	0.00
7-SEP	100.00	0.00	0.00
9-SEP	100.00	0.00	0.00
11-SEP	100.00	0.00	0.00
13-SEP	100.00	0.00	0.00

Figure 7.5

PRODUCED BY HAUGESUND - BE GROUP	PROJECT S CURVE	SORTED BY PLANNED START
ID:50 PROJECT: TCP2	REPORT NUMBER : TCURV	DATASET : CURV1

PIPING



DATE	CUML %PLAN	WEEKLY %PLAN	ACT %COMP
1-JUN	0.57	0.57	0.00
3-JUN	1.13	0.57	0.30
5-JUN	1.72	0.58	1.10
7-JUN	2.39	0.68	1.40
9-JUN	3.12	0.73	2.00
11-JUN	3.86	0.74	2.20
13-JUN	4.59	0.73	3.00
15-JUN	7.54	2.95	3.10
17-JUN	10.45	2.91	4.30
19-JUN	13.33	2.88	6.10
21-JUN	16.25	2.92	8.40
23-JUN	19.21	2.96	10.10
25-JUN	22.15	2.95	12.80
27-JUN	25.08	2.93	16.20
29-JUN	28.00	2.93	20.00
1-JUL	30.96	2.96	22.80
3-JUL	33.91	2.95	25.40
5-JUL	36.84	2.92	32.20
7-JUL	39.79	2.95	34.80
9-JUL	42.78	2.99	37.20
11-JUL	45.75	2.97	40.95
13-JUL	48.74	2.98	44.80
15-JUL	51.66	2.93	46.60
17-JUL	54.60	2.94	48.50
19-JUL	57.51	2.91	50.40
21-JUL	60.48	2.97	52.30
23-JUL	63.46	2.99	55.10
25-JUL	66.43	2.97	57.90
27-JUL	69.36	2.93	60.70
29-JUL	72.30	2.93	63.60
31-JUL	75.21	2.91	66.40
2-AUG	78.13	2.92	69.20
4-AUG	81.07	2.93	72.10
6-AUG	83.96	2.90	76.60
8-AUG	86.79	2.83	81.20
10-AUG	[illegible]	2.97	[illegible]
12-AUG	92.46	2.70	0.00
14-AUG	95.26	2.81	0.00
16-AUG	98.11	2.85	0.00
18-AUG	99.28	1.17	0.00
20-AUG	99.83	0.55	0.00
22-AUG	100.00	0.17	0.00
24-AUG	100.00	0.00	0.00
26-AUG	100.00	0.00	0.00
28-AUG	100.00	0.00	0.00
30-AUG	100.00	0.00	0.00
1-SEP	100.00	0.00	0.00
3-SEP	100.00	0.00	0.00
5-SEP	100.00	0.00	0.00
7-SEP	100.00	0.00	0.00
9-SEP	100.00	0.00	0.00
11-SEP	100.00	0.00	0.00
13-SEP	100.00	0.00	0.00

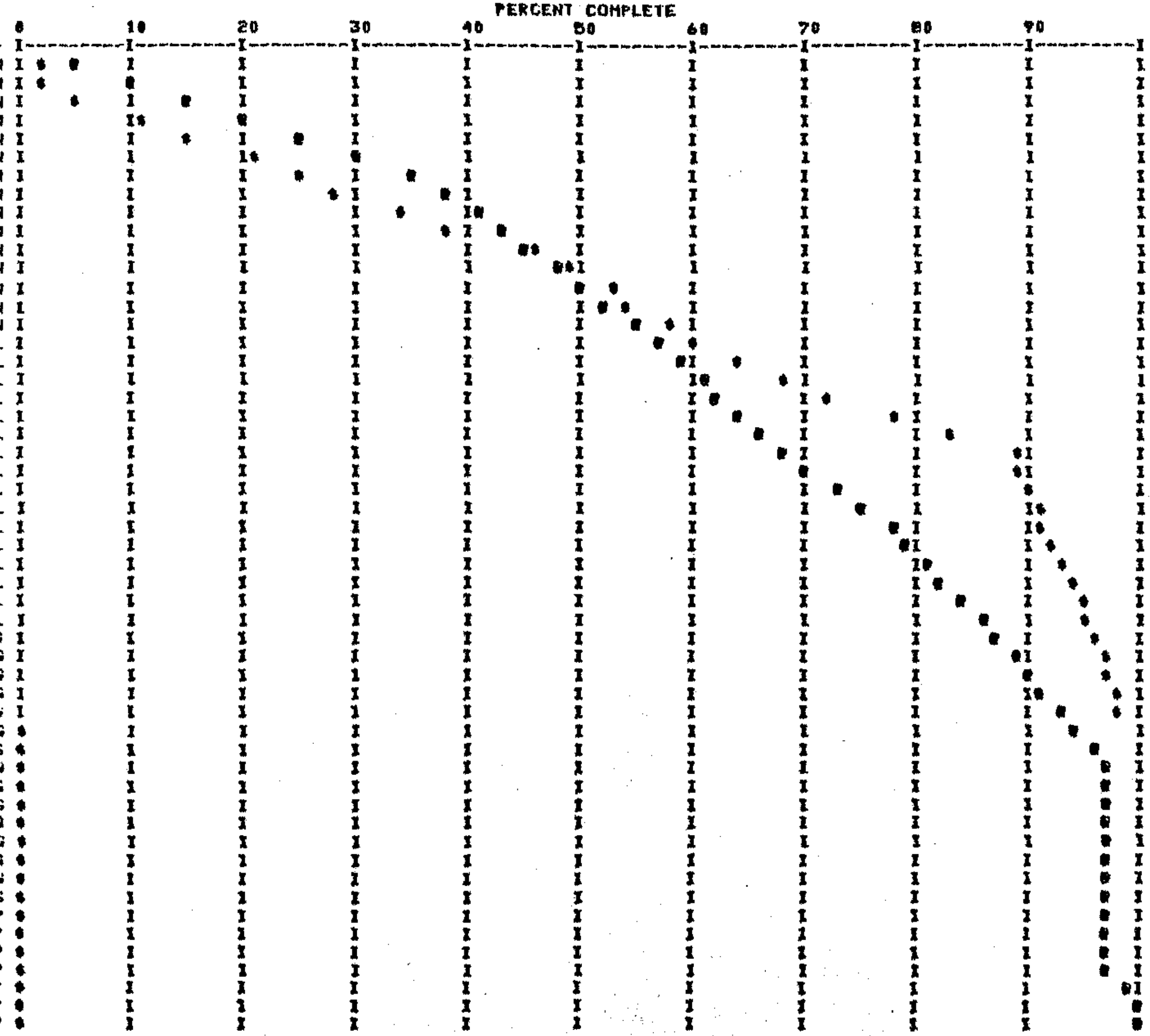
Figure 7.6

PRODUCED BY HAUGESUND - DE GROOT | PAGE : 1 | RUN DATE 10-AUG-83

ID;50 PROJECT: TCP2 | PROJECT S CURVE | SORTED BY PLANNED START

REPORT NUMBER : TCURV | DATASET : CURV1

ELECTRICAL



DATE	CUML %PLAN	WEEKLY %PLAN	ACT %COMP
1-JUN	5.17	5.17	1.75
3-JUN	10.33	5.16	2.42
5-JUN	15.24	4.92	5.33
7-JUN	20.24	5.00	11.10
9-JUN	25.22	4.98	15.31
11-JUN	30.31	5.09	21.10
13-JUN	35.20	4.89	25.29
15-JUN	37.81	2.61	27.90
17-JUN	40.51	2.70	34.30
19-JUN	43.20	2.69	38.10
21-JUN	45.45	2.25	45.60
23-JUN	47.85	2.40	49.10
25-JUN	49.79	1.94	52.80
27-JUN	52.40	2.61	54.00
29-JUN	54.64	2.24	57.60
1-JUL	57.17	2.53	60.40
3-JUL	59.36	2.19	63.90
5-JUL	60.87	1.51	67.70
7-JUL	62.48	1.61	72.10
9-JUL	64.09	1.60	77.50
11-JUL	66.15	2.07	82.70
13-JUL	67.67	1.51	88.60
15-JUL	70.38	2.71	89.20
17-JUL	72.63	2.26	89.90
19-JUL	75.20	2.57	90.50
21-JUL	77.69	2.48	91.20
23-JUL	79.13	1.44	92.10
25-JUL	80.62	1.49	93.00
27-JUL	82.43	1.81	93.80
29-JUL	84.12	1.69	94.60
31-JUL	85.59	1.47	95.40
2-AUG	87.06	1.47	96.10
4-AUG	88.53	1.47	96.90
6-AUG	90.00	1.47	97.20
8-AUG	91.46	1.46	97.60
10-AUG	[illegible]	1.46	[illegible]
12-AUG	94.38	1.46	0.00
14-AUG	95.84	1.46	0.00
16-AUG	96.52	0.68	0.00
18-AUG	96.52	0.00	0.00
20-AUG	96.52	0.00	0.00
22-AUG	96.52	0.00	0.00
24-AUG	96.52	0.00	0.00
26-AUG	96.52	0.00	0.00
28-AUG	96.52	0.00	0.00
30-AUG	96.52	0.00	0.00
1-SEP	96.52	0.00	0.00
3-SEP	96.52	0.00	0.00
5-SEP	96.52	0.00	0.00
7-SEP	96.52	0.00	0.00
9-SEP	99.14	2.62	0.00
11-SEP	100.00	0.86	0.00
13-SEP	100.00	0.00	0.00

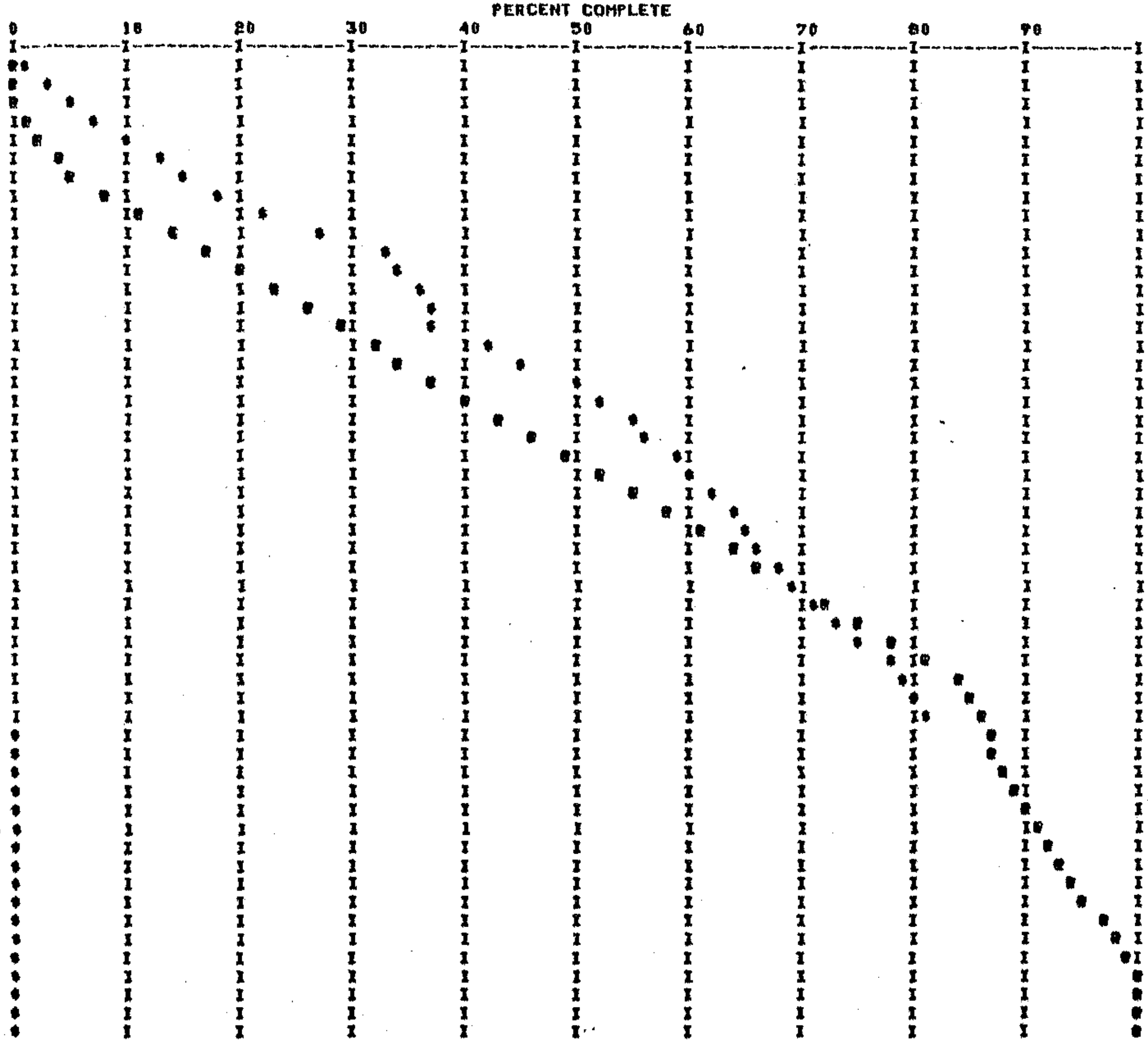
Figure 7.7

PRODUCED BY HAUGESUND - DE GROOT
ID:50 PROJECT: TCP2

PROJECT S CURVE
REPORT NUMBER : TCURV

SORTED BY PLANNED START
DATASET : CURV1

INSTRUMENT



DATE	CUML %PLAN	WEEKLY %PLAN	ACT %COMP
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3-JUN	0.25	0.12	3.10
5-JUN	0.37	0.12	5.40
7-JUN	1.08	0.71	7.00
9-JUN	2.36	1.28	9.89
11-JUN	3.64	1.28	13.45
13-JUN	4.91	1.27	14.72
15-JUN	7.89	2.98	17.70
17-JUN	10.86	2.97	22.30
19-JUN	13.82	2.97	27.40
21-JUN	16.79	2.96	33.40
23-JUN	19.75	2.96	34.30
25-JUN	22.69	2.95	35.50
27-JUN	25.65	2.96	36.50
29-JUN	28.60	2.95	37.40
1-JUL	31.53	2.93	41.90
3-JUL	34.46	2.93	44.90
5-JUL	37.40	2.95	49.60
7-JUL	40.29	2.88	52.10
9-JUL	43.15	2.87	54.60
11-JUL	46.06	2.91	56.40
13-JUL	48.97	2.92	58.80
15-JUL	51.89	2.92	60.30
17-JUL	54.81	2.92	61.90
19-JUL	57.73	2.92	63.50
21-JUL	60.69	2.96	65.10
23-JUL	63.52	2.83	66.40
25-JUL	66.37	2.86	67.70
27-JUL	69.32	2.94	69.00
29-JUL	72.12	2.80	71.10
31-JUL	74.99	2.87	73.30
2-AUG	77.93	2.94	75.40
4-AUG	80.86	2.93	77.60
6-AUG	83.80	2.95	78.60
8-AUG	84.59	0.79	79.60
10-AUG	[illegible]	1.14	[illegible]
12-AUG	86.65	0.92	0.00
14-AUG	87.37	0.71	0.00
16-AUG	88.06	0.69	0.00
18-AUG	88.98	0.92	0.00
20-AUG	90.03	1.05	0.00
22-AUG	91.16	1.13	0.00
24-AUG	92.25	1.09	0.00
26-AUG	93.33	1.09	0.00
28-AUG	94.37	1.04	0.00
30-AUG	95.44	1.06	0.00
1-SEP	96.52	1.09	0.00
3-SEP	97.61	1.09	0.00
5-SEP	98.63	1.01	0.00
7-SEP	99.55	0.93	0.00
9-SEP	100.00	0.45	0.00
11-SEP	100.00	0.00	0.00
13-SEP	100.00	0.00	0.00

Figure 7.8

7.5.2.1. Information Related to Preparation of the Work

- Scope of the work
- Material list
- Drawing and specification references
- Area location (with sketch)
- Extra information such as crane access, if cold or hot work, etc.

7.5.2.2 Information Related to the Computerized Follow Up

- Task number
- Discipline
- Syst./sub-syst.
- Cost code allocation

7.5.2.3 Codification

All this information was codified according to the following numbering system.

Task numbering system

0001	to	0999	Structural
1001	to	1999	Mechanical (including HVAC)
2001	to	2499	Piping - Construction
2500	to	2999	Piping - Flushing and Hydrotesting
3001	to	3999	Electrical
4001	to	4999	Instrumentation
6500	to	6999	Loop test tasks for instrum. and Electrical.
7001	to	7999	Reserved for tasks issued offshore
8001	to	8999	General tasks.

Discipline numbering system

16 : Instrumentation
20 : Piping, insulation
21 : Structural, painting
23 : Electrical, heat tracing
26 : Mechanical

Code numbering system

A - Original scope of work
B - Extra work (approved on site)
C - Modification work (approved by management)
D - Repair work (subject to insurance claim)
E - Commissioning assistance

1 - Work related to TCP-2 Extension budget
2 - Work related to NEF budget
3 - Work related to ODIN

Systems / Sub systems codificaton

On Frigg Field each installation is our codification for its systems.

Installation		Code
TCP-2	Treatment	85
TCP-2	Compression	87
TCP-2	Extension	88
QP		96
DP-2		83

System codification

ON TCP2 EXT. (88)

Syst.	Sub Syst.	
S.01		Instrument and Plant Air Network
	S01A	Instrument air distribution
	S01B	Service air distribution
S.02		Fuel Gas System
S.03		Electrical Systems
	S03A	Cable trays
	S03B	380V power distribution
	S03C	Normal lighting
	S03D	Emergency lighting
	S03E	Emergency power (220V no break)
	S03F	24V DC
	S03G	Grounding
	S03G	Trace heating
	S031	General
S.04		High Pressure Relief System
	S04A	High pressure relief
	S04B	Low temperature relief
S.05		Low Pressure Relief System
S.06		Safety Systems
	S06A	Public address and public alarm
	S06B	Gas detection
	S06C	Fire detection
S.08		Hydraulic and Shut Down System
S.09		Methanol System
	S09A	High pressure methanol
	S09B	Methanol injection to NEF

System Codification Continued:

S.10		Drainage System
	S10A	Open drainage
	S10B	Closed drain
	S10C	Methanolated water
S.11		Condensate Separation Systems
S.12		Gas Treatment Systems
	S12A	NEF gas treatment line
	S12B	Odin gas treatment line
S.14		Gas supply network
	S14A	NEF gas supply line
	S14B	Odin gas supply line
S.16		Glycol Circulation Network
S.17		Fire Fighting Systems
	S17A	Fire water
	S17B	Deluge water
	S17C	Extinguishing equipment
S.18		Wash Down System
S.22		Miscellaneous Equipment (instrument in interface rooms).
S.25		Structure and Modules
	S25A	Structure
	S25B	Access and escape ways
S.27		Corrosion inhibitor Equipment
S.33		Utility water
		On DP2 (83)
S.01		Air system
S.53		Control room
S.54		Methanolated water disposal network
		On QP (96)
S.11		Telecommunications, Telemetry
S.14		Control room

System Codification Continued:

	On TCP2 Compression (87)
S.02	Grounding and cable trays
S.20	Power Generation 5.5kV/NEF Power Supply
S.21	Power distribution 380 V
S.22	Normal and emergency lighting
S.26	Safety fire and gas detection
S.27	Safety fire fighting
S.28	Emergency Shut Down (PLC)
S.29	HVAC on NEF 12kV high voltage room
	On TCP2 T (85)
S.03	Electrial systems

Area codification system

50 - Module 50
53 - Pancake 53
65 - Top of Column 5
85 - TCP-2 Facilities Treatment Area including Columns, Support Frame Bridge to TP1.
87 - TCP-2 Facilities Compression Area
83 - DP-2
95 - TP-1, including Bridge to QP
96 - QP

7.5.2.4 Preparation

The tasks were prepared by the engineering contracted companies (Sofresid Norge A/S and Aker Engineering A/S) under the responsibility of hook up preparation group and were delivered to the hook up bidders for bid evaluation (1st package) and to the selected contractor (updated package) for planning and organization of the work.

7.5.3 Artemis Management and Planning System

To assist in the efficient management and control of the Hook-Up and Commissioning of the Project, a computer based control and information system was used. The system runs on a dedicated Hewlett-Packard 1000 minicomputer, using the Metier Artemis Management System and special application software provided by MOM (Offshore)Ltd.

The system was designed to monitor and control three key aspects of the project:

1. The maintenance of technical standards

2. Performance within the timescale allowed

3. Performance within the allocated budget

7.5.3.1 Description of the System

Task Sheets

Central to this concept is the Task Sheet System which (by reference to the Project Specifications and Drawings) defines the Scope of Work for the hook-up and provides the essential link to related areas. (See figures 7.9, 7.10 and 7.11). The work has, therefore, been broken down into around 700 individual tasks, each involving a readily identifiable work content with relevant drawings, specifications and material requirements. To improve the usefulness of the task sheet as a working rather than a contractual document, further details are also incorporated including reference to special work procedures, inspection requirements, platform conditions (the work permits required) and the availability or otherwise of craneage for heavier lifts etc. Details of all Task Sheets are held in a Task Sheet Register. In addition to this Register, a separate Task Sheet Index is also held on the system. This is used specifically to monitor revisions made to the task sheets during the Hook-up and to record the reasons for such changes. The system is designed in such a way that new tasks, task revisions and task deletions are automatically flagged for formal review at management level before implementation offshore.

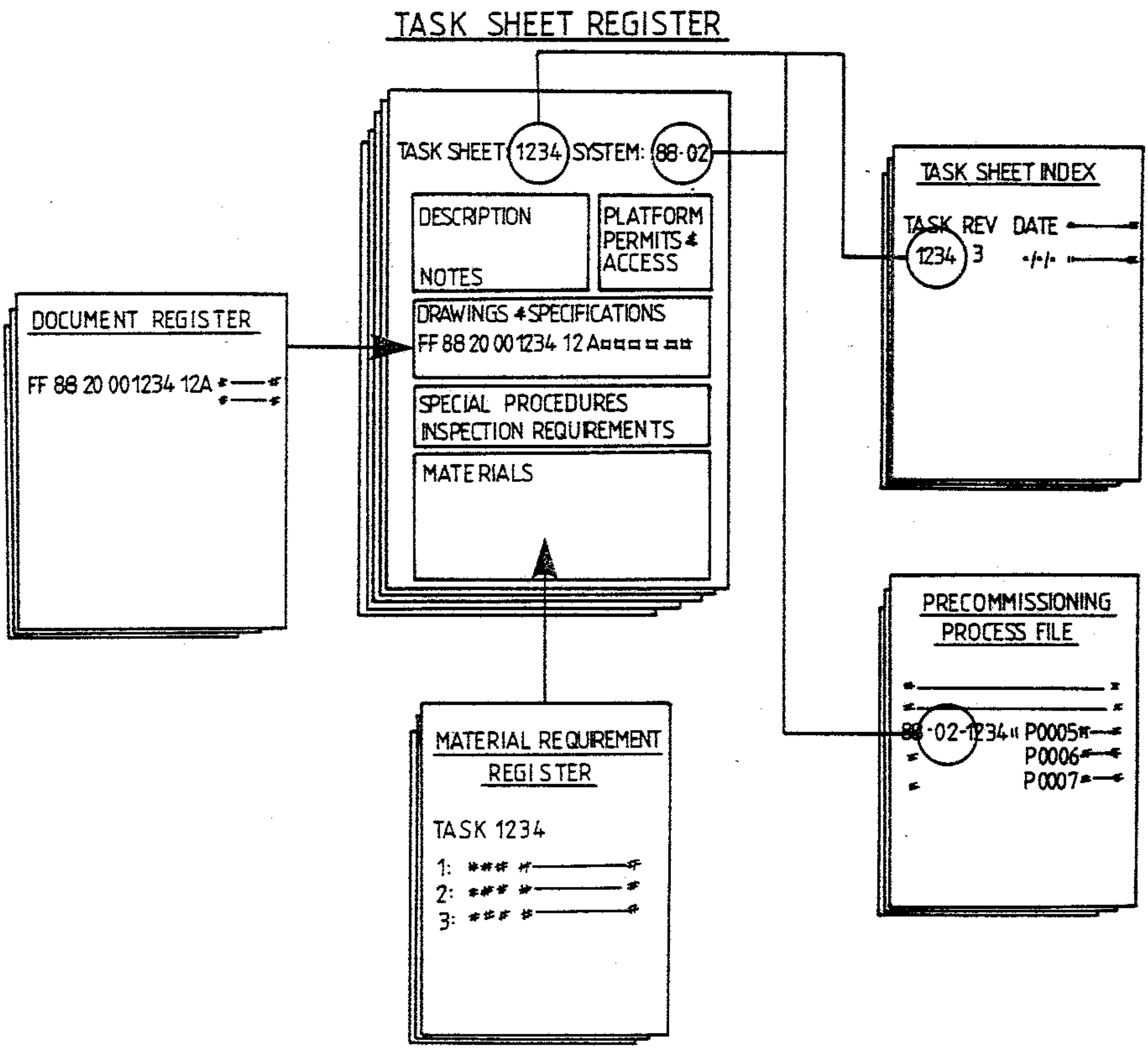
Document Control

Each Task Sheet contains a list of relevant drawing, specification or procedure numbers. Information regarding the history and present status of each of these documents is held in a Document Register (the Engineering Document Control Register) which is linked (via the document number) to the Task Sheet. In this way, provided that the Document Register is updated regularly, enquiries directed to a particular Task Sheet will always address the latest drawing or specification revision. Since this is obviously vital to the maintenance of technical standards, the system is designed to flag those Task Sheets affected by recent document revisions for review at management level before implementation offshore.

In addition to those documents necessarily required to progress work offshore, the Document Register of course also includes reference to Yard Fabrication drawings and Engineering drawings required for Authority Approval.

Figure 7.9

THE INTEGRATED TASK SHEET SYSTEM



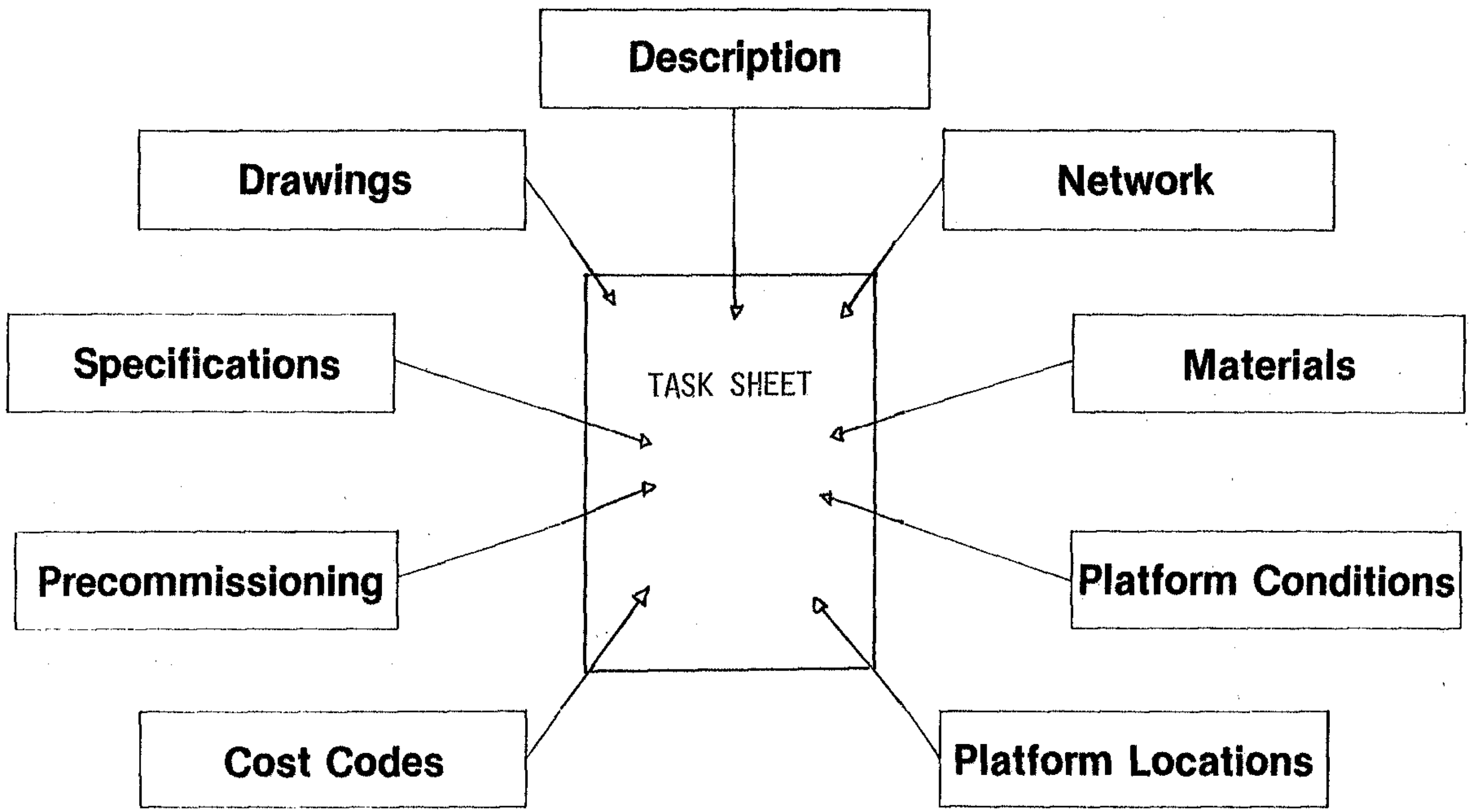

Description
Drawings
Network
Specifications
TASK SHEET
Materials
Precommissioning
Platform Conditions
Cost Codes
Platform Locations

Figure 7.10

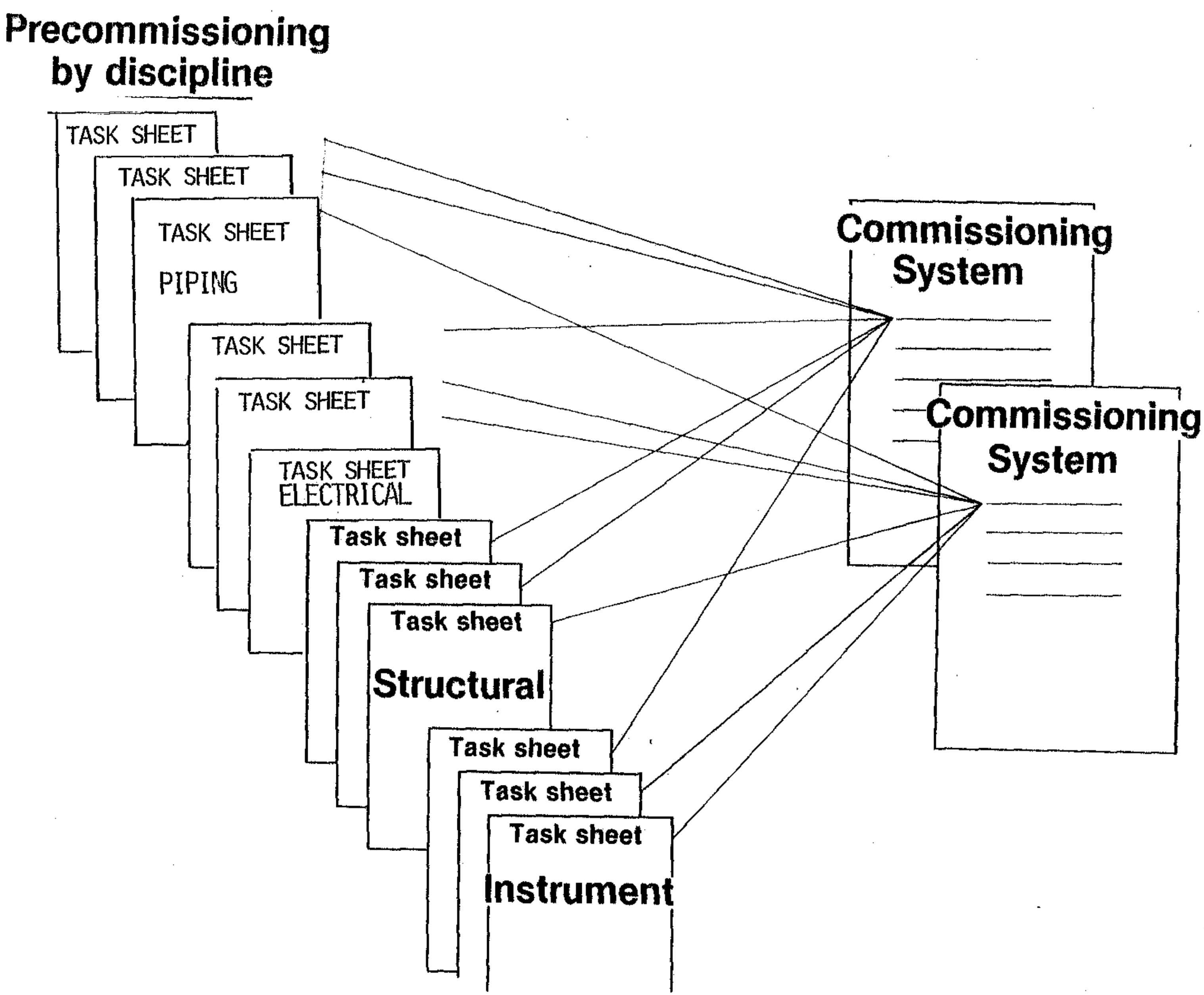

Precommissioning by discipline
TASK SHEET
TASK SHEET
TASK SHEET
PIPING
TASK SHEET
TASK SHEET
TASK SHEET
ELECTRICAL
Task sheet
Task sheet
Task sheet
Structural
Task sheet
Task sheet
Task sheet
Instrument
Commissioning System
Commissioning System

Figure 7.11

Materials Co-ordination

Details of the materials required are held in a Materials Requirements Register under the direct control of the Materials Section. Each material item can be linked to a specific Task Sheet via the Task Sheet Number. It can also be linked to a Purchase Order Register and to a Stock Movement (Material Request for shipment offshore) Register via a unique Material Code. Thus materials can be identified and tracked through from delivery by the supplier to incorporation in the offshore works. In addition a program can be called (when required) to compare material requirements with material orders, deliveries and offshore shipments to identify shortfalls which will delay or halt particular tasks. It is intended that the materials required for each task will be shipped as a kit, specifically identified and marked to provide for efficient material coordination and handling offshore.

Precommissioning Documentation

The early involvement of commissioning personnel is of course a vital factor in the ultimate completion and hand-back of the works; but is often difficult to coordinate in a Task Sheet orientated system. To expedite the precommissioning works (following mechanical completion), a large number of precommissioning documents have been raised, each detailing the specific installation checks, calibrations, and function tests required before System Commissioning can commence. Each of these documents is linked to a specific Task Sheet, via the Task Sheet number and each Task Sheet has beed coded to carry a unique Commissioning system reference.

Additional Information

In addition to the information detailed above which is incorporated into an integrated project control system, a number of other registers have been implemented on the system. There are essentially specialist lists or schedules prepared by the individual Engineering disciplines to coordinate their own activities and as a source of reference for the Construction and Commissioning teams. The lists included are as follows:

Piping	: Line List (incorporating the Tie-in Line List) : Pipe Support Index : Piping Conversion Index (cross referencing isometric drawing, line reference and relevant task sheets)
Instruments	: Instrument Index : Cable List : Tube List
Electrical	: Cable List

These specialist lists are included since implementation on the computer should improve access to the information which they contain at all levels and help to ensure that work always proceeds in accordance with the latest information available within the group as a hole.

Information Access

One of the major aims in implementation of the computer system has been to improve access to information at all levels and to maintain a high standard of communication (and thus coordination) between elements of the project team, and the hook-up contractor.

The problem of access has, therefore been approached in two complementary ways: -

1. Distribution of hardware

2. Basic system design

Distribution of Hardware

A minicomputer system was chosen to offer a dedicated capability to the EAN project team, and the system was configured to support six separate work stations. The most important features of the system are that two work stations are located offshore to provide real time access to the system reinforcing communications between platform and beach; and that two work stations are allocated to the Hook-Up Contractor to provide common and efficient access to shared information. Adequate provision has been made (using slave printers) to ensure the availability of hard copy when and where required.

7.5.3.2 Basic System Design

To reduce "queuing" time and optimise access to the system, the whole Project Control system has been divided into a number of sub-projects or so called User Areas. Each area is identified by its own User Number and the individual areas are listed below.

User Number	Functions
90	Master Engineering (Main Task Sheet Req. & Index) (Document Registeers)
91	Piping Tasksheet Register, Index and Lists
92	Instrument " " " "
93	Electrical " " " "
94	Mechanical/Structual " " "
95	Precommissioning Progress Registers and Summaries
96	Materials Co-ordination and Control
97	Cost Control
98	Planning (Level I, II and III)
99	Contractor Access (Timesheet & Task Progress Updating)

Each individual user group has responsibility for the entry, updating, revision etc. of its own information and may protect this information by the use of passwords if required. (The main Task Sheet Register and Index in 90 is produced automatically by copying details from the individual discipline registers in areas 91, 92, 93 and 94).

In addition information which is of interest to more than one user (i.e. material or document information) group is "shared" by use of the Library facility. Special routines are used to place copies of these registers in the Library area and to update those copies on a regular basis. (The individual user areas are defined in such a way as to access the library information provided, automatically as required).

Any terminal can be used to access any user area as required, but only one user may use any user area at one time.

Finally the system has deliberately been designed on a menu-driven basis, so that it can be used at the workface by Engineering, Construction, Commissioning and Contractor personnel etc. without any specialist knowledge of the computer or its programming language and with the minimum of preliminary training. Documentation has been provided for each user area including detailed Operating Instructions.

Details of the individual of pre-commissioning documents are held in discipline Pre-Commissioning Progress Registers which are updated automatically upon Task Sheet completion. In this way the Commissioning team can track progress at the detail level. Using the system coding contained in the Task Sheet Register, the detailed requirements can then be summarised both at discipline level and at system level, giving the earliest indication of those disciplines and/or systems which are not progressing satisfactorily; and highlighting those systems for which all pre-commissioning is complete and where commissioning can effectively commence.

Planning

In view of the size of the TCP-2 Extension Project and to reflect the real constraints a detailed planning has been established at the Task Sheet level. A planning network has, therefore, been produced in which every task sheet is represented by a single planned activity, but in which only the most essential constraints have been established in order not to restrict unnecessarily the flexibility of the offshore work team.

On this level III, each task was scheduled into a floating period between earliest start and latest completion dates. In addition, a three-week-look-ahead was used for material call-up.

At the detail level, the tasks have been grouped by discipline and by system.

The system grouping was particularly relevant with regard to the activities of the Commissioning team as described above, and was carefully evaluated by the Production Department to ensure that work was concentrated in one area at a time. This in itself was important since gas production via TCP-2 could have been restarted at short notice during the Hook-up period.

From level III planning a level II summary was produced, showing one reference for each system/sub-system. In addition to providing a short-form summary of Level III, Level II was also tied to the Hook-up contractual milestones, and indicated the priorities assigned by the Hook-up Contractor to each system.

A further summary was also provided for management information showing the 10-12 most important Project Milestones.

The detail planning was used as a trigger for material requests and an automatic update function for pre-commissioning documentation.

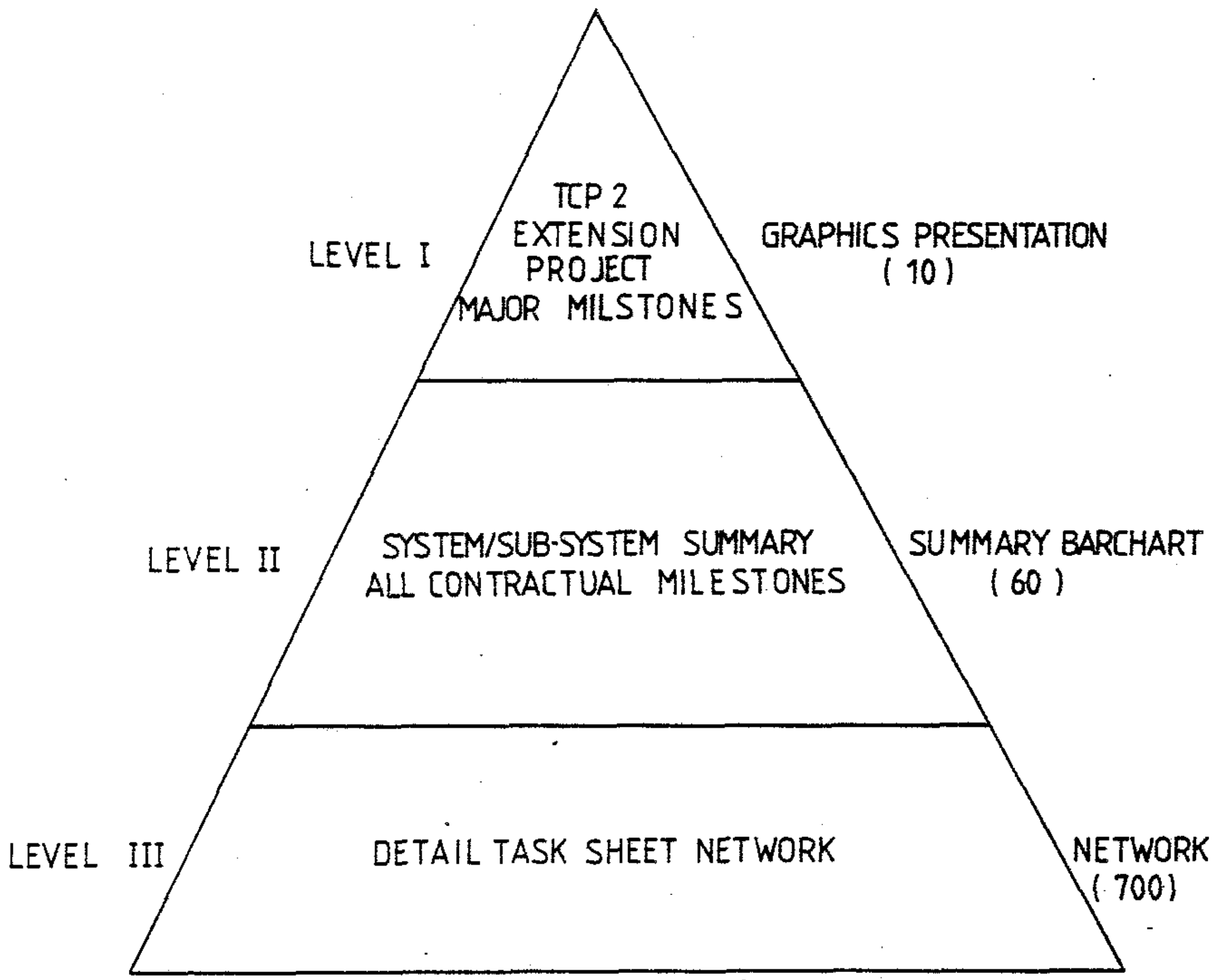
A principle sketch of the different levels of planning is shown in Figure 7.12.

Progress - Follow Up

Each task was represented by a certain "weight" corresponding mainly to the direct manhours estimate. The multiplication of the progress of the work by the weight of the task allowed to measure the progress; this was done for each task. So progress was available on the 3 previous planning level, with, in addition "by discipline" planning.

Figure 7.12

INFORMATION SUMMARY



7.6. MOBILIZATION

7.6.1 EAN Personnel

The EAN supervision team was gradually built up and mobilized from beginning of 1983. The personnel mobilized was involved in the hook up preparation phase and delegated to the following tasks:

- Finalization of hook up tasks
- Planning, preparation
- Checking of the platform preparation
- Coordination with Frigg Field
- Yard survey and establishment of punch list
- Checking and follow up of the pre hook up works
- Precommissioning sheet
- Commissioning dossiers

7.6.2 Haugesund de Groot Offshore A/S & Co. Personnel

From April 15th the contractor's preparation staff was located in our offices in Dusavik for the detailed preparation of the job in cooperation with EAN project personnel.

The main tasks from that date until the offshore works started were:

- Detailed preparation of the work
- Issue of different plannings requested by EAN in accordance with the system target dates
- Level one - general
- Level two - by system/sub system
- Level three - by task (3 week look ahead)
- Ensure the compatibility of the contractor computerized work follow up system with the corresponding one in EAN side.

7.6.3 Mobilization Offshore

7.6.3.1 Personnel

The EAN hook up team arrived on site Tuesday May 31st.
The contractor had already a light preparation staff onboard TCP-2 prior that date; the official mobilization date for hook up contractor was June 1st.

7.6.3.2 Flotel

Treasure Supporter was connected to TCP-2 during the day of June 1st. During the hook up, in normal condition, the flotel was connected to TCP-2 by mean of a telescopic bridge; consequently, helicopter schuttle was avoided during the most part of the hook up.

7.6.3.3 Site Facilities

Power generation

This was hook up contractors responsibility same as plant air supply. These were fully operational one week after hook up start.

Offices

On TCP-2: One office ($48m^2$) in 948 module and one office ($30m^2$) in Module 32 for EAN supervision team.
4 office containers were allocated to contractors.

On flotel: 4 office containers were allocated to EAN.
6 office containers were allocated to contractor.

Storage areas

On TCP-2 : Pancakes 941, 946, 947 were available for material storage.

In addition the project installed to new P942 (in replacement of old P945) and P943.

In addition, small material was stored in a warehouse in P948 ($20m^2$).

Crane facilities

On TCP-2 : The project used the Bucyrus crane in M.01, the Nyland crane in M.32 and the Manitowoc rane in P969.

The project did not use the flotel cranes except during a few hours at the mobilization and demobilization phases.

Communication facilities

On TCP-2 : Each office was equipped with stentophone extension connected to the Frigg Field network.

Two offices were equipped with telephone extension connected to the Frigg Field network.

One office (in P948) was equipped with telephone extension connected to the flotel network.

One computer terminal linked to the Artemis system in Dusavik.

On the flotel : Each office container was equipped with telephone extension connected to the flotel network.
Four office containers were equipped with stentophone extension connected to the Frigg Field network.
One office container (EAN site mgr.) was equipped with telephone extension connected to the Frigg Field network.

General : 4 UMF and 6 UMF sets were distributed to EAN supervision team and contractor team for quick communication on the spot.

7.7 EXECUTION OF THE WORK

7.7.1 Tasks Follow Up - Progress Reports

On a weekly base, progress of each task was given by contractor and approved by EAN site team according to a milestone ladder pre-established.

This status was punched into the Artemis computer system to get the different progress and planning figures requested by company. The example of progress curves must be used only as reflect of the site progress. In case of changes (see following paragraph) updated information, new tasks were punched into the different relevant registers of the computer and automatically integrated in the output.

7.7.2 Changes

During the works, discrepencies were discovered creating changes and extra works. They were divided in two groups depending upon the importance:

1) The decision was taken offshore because it was small modification and treated by either:

   - alteration of existing task by mean of site integration issued by contractor and evaluated by EAN team.

   or:

   - issuing an offshore task covering the work

2) The decision could not be taken offshore and offshore team issued a modification request to onshore team for evaluation; if approved onshore task was issued covering the work.

7.7.3 Evaluation of Change

For any change, contractor claimed compensation by mean of change order request (C.O.R). This was evaluated offshore but not approved; only advise was given onshore for further discussion.

7.7.4 Material Follow Up

The material follow up was also computerized. The material call up was made by EAN Material Coordinator and based on the 3 week look ahead, planning given by contractor.

EAN onshore arranged shipping and computerized shipping list could be obtained at anytime offshore. At reception on the site, jointed checking was performed by contractor and EAN material coordinators; at that time, contractor acknowledged receipt of material. Material handling was contractor responsibility.

7.7.5 Pre-Commissioning

Pre-commissioning was total part of hook up responsibility so with each hook up task was attached pre-commissioning sheet (except for piping and structural were pre-commissioning was carried out through daily welding reports and normal NDT controls). Each task was reported completed when pre-commissioning was done.

When a system was completed, a provisional acceptance certificate (Figure 7.13) was issued to transfer responsibility of the system from hook-up to commissioning team.

Loop testing was covered by separate tasks and carried out under pre-commissioning responsibility with assistance of commissioning team.

7.7.6 Vendor Assistance

Vendor assistance was requested for:

- Assistance to installation/commissioning of high voltage equipment.
- Assistance to commissioning of teletransmission equipment.
- Assistance to installation/modification in Royalty Metering Computer.

COMMISSIONING	PROVISIONAL ACCEPTANCE CERTIFICATE	1871
ELF AQUITAINE NORGE A/S elf	PROJECT **TCP 2 EXTENSION**	

The system : 88-27 CORROSION INHIBITOR EQUIPMENT
subsystem :
equipment :

has been provisionally accepted on:

Year .... Month .... Day ......

At this date, safety regulations will be inforced. All personnel involved in any work on this system, subsystem or equipment must have a work permit.

The Work Permit will be obtainable from the E.A.N. Commissioning Coordinator responsible in accordance with the Frigg Field work permit and isolation procedures.

This certificate relieves the contractor or the vendor of his responsibility as far as safekeeping, protection and performance tests are concerned with the exception of outstanding works as per "commissioning exception report" attached, if any.

	Contractor	Hook-Up	Commissioning	Site Manager
Name:	S. Nilssen	E. STEENSTRUP	M. Olberg	G. BACHOUE Site Manager
Sign:	[signature]	[signature]	[signature]	[signature]
Date:	7/8-83	9/8-83	9/8-83	11-8-83

Documents attached:

Figure 7.13

ORIGINAL #2

7.8 KEY FIGURES

7.8.1 Task Status

The final task status consist of:

Original issued task
Onshore issued task
Offshore issued task

The onshore and offshore issued taks were issued when:

- Changes in basic engineering
- New arrangement of the works.
- Extra-work not covered in the original scope.
- Commissioning assistance from contractor.
- Personnel after lump sum period.

The final status of tasks was the following:

DISCIPLINE	ORIGINAL		ONSHORE		OFFSHORE		OVERALL
	orig.	canc.	orig.	canc.	orig.	canc.	
ELECT.	115	42	69	3	40	2	
INST.	217	32	70	7	61	7	
MECH.	4	0	0	-	0	-	
PIPING	220	7	30	2	38	2	
STRUCT.	62	8	10	0	71	4	
COMM. ASSISTANCE	-	-	-	-	68	-	
TOTAL	529		167		195		891

7.8.2 Manpower Schedule

The curves on figure 7.14 show the manpower histogram during the hook up phase of the project from mobilization of the contractor´s personnel.

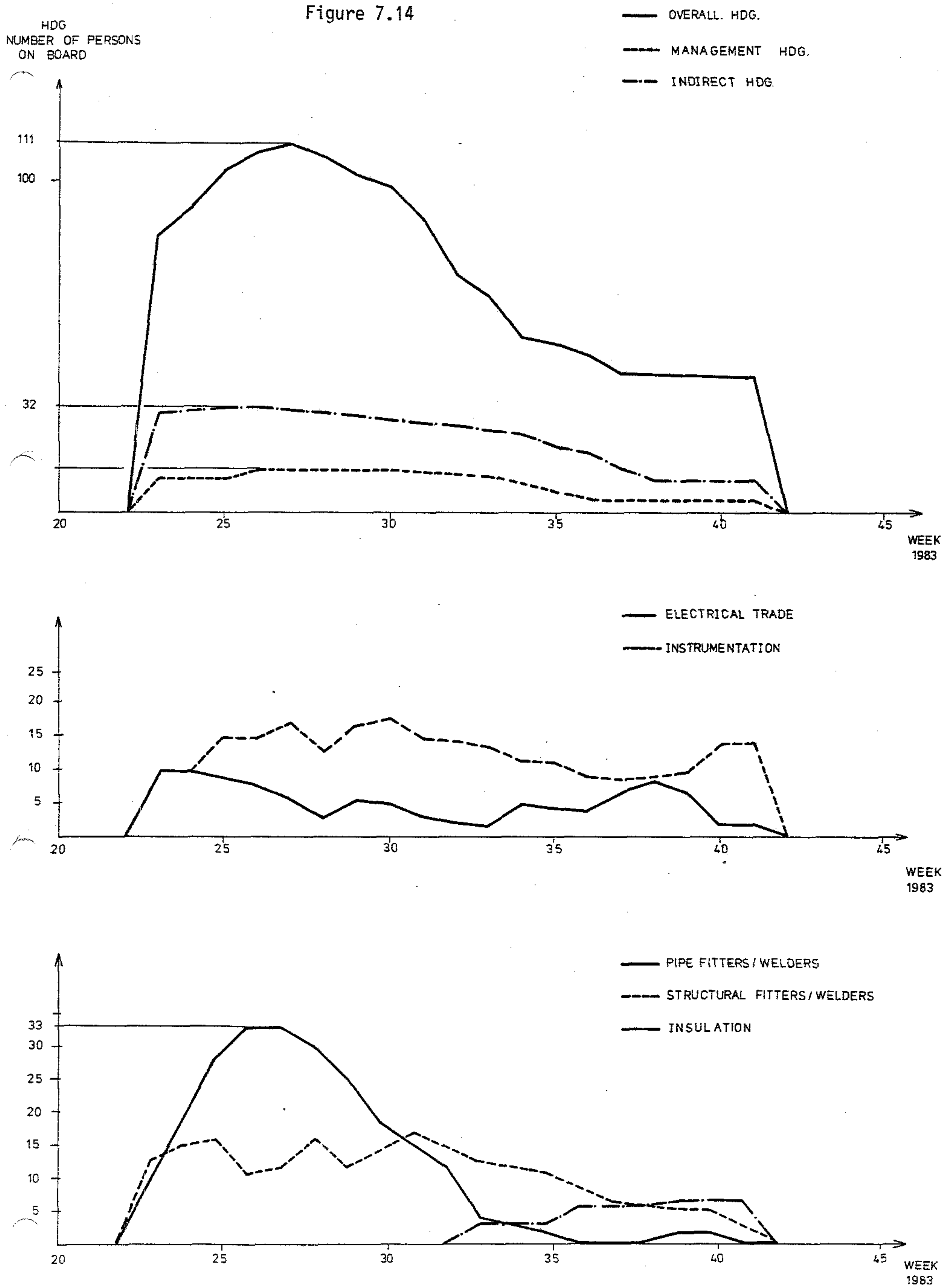
- Management includes:

  . Construction Superintendent
  . Field Engineers
  . Safety Officers
  . Planners
  . Material Coordinator

- Yard facilities:

  . Crane operator
  . Toolroom operator
  . Riggers/helpers
  . Scaffolders

Figure 7.14


HDG
NUMBER OF PERSONS
ON BOARD
OVERALL HDG.
MANAGEMENT HDG.
INDIRECT HDG.
111
100
32
20
25
30
35
40
45
WEEK
1983
ELECTRICAL TRADE
INSTRUMENTATION
25
20
15
10
5
20
25
30
35
40
45
WEEK
1983
PIPE FITTERS / WELDERS
STRUCTURAL FITTERS / WELDERS
INSULATION
33
30
25
20
15
10
5
20
25
30
35
40
45
WEEK
1983

7.8.3 Manhours

Management	20.590 hrs
Indirect work	26.750 hrs
Productive work	66.900 hrs
Total	114.240 hrs

+ Split of productive work by discipline:

Structural	9.800 hrs
Piping	27.000 hrs
Instrument	8.900 hrs
Electrical	6.800 hrs
Insulation	4.400 hrs
Total	66.900 hrs

Split of productive work by acitivty:

Original Scope	:	45.660 hrs
Additional Scope	:	12.140 hrs
Commissioning	:	7.520 hrs
Stand by	:	1.580 hrs
Total		66.900 hrs

The split of work by discipline is shown in Figure 7.15.

7.8.4 Stand By

Stand by hours represent 1,53% of the total manhours.
Stand by was due to:

6/7	: blocked drain system on TCP2	:	1008 mhrs
18/7-21/7	: disconnection of flotel due to NEF power cable pulling	:	373 mhrs.
others	: - delay when shuttling	:	151 mhrs.
	- bad weather	:	50 mhrs
	Total	:	1582 mhrs

TCP2 EXTENSION LABOUR SPLIT

BY DISCIPLINE

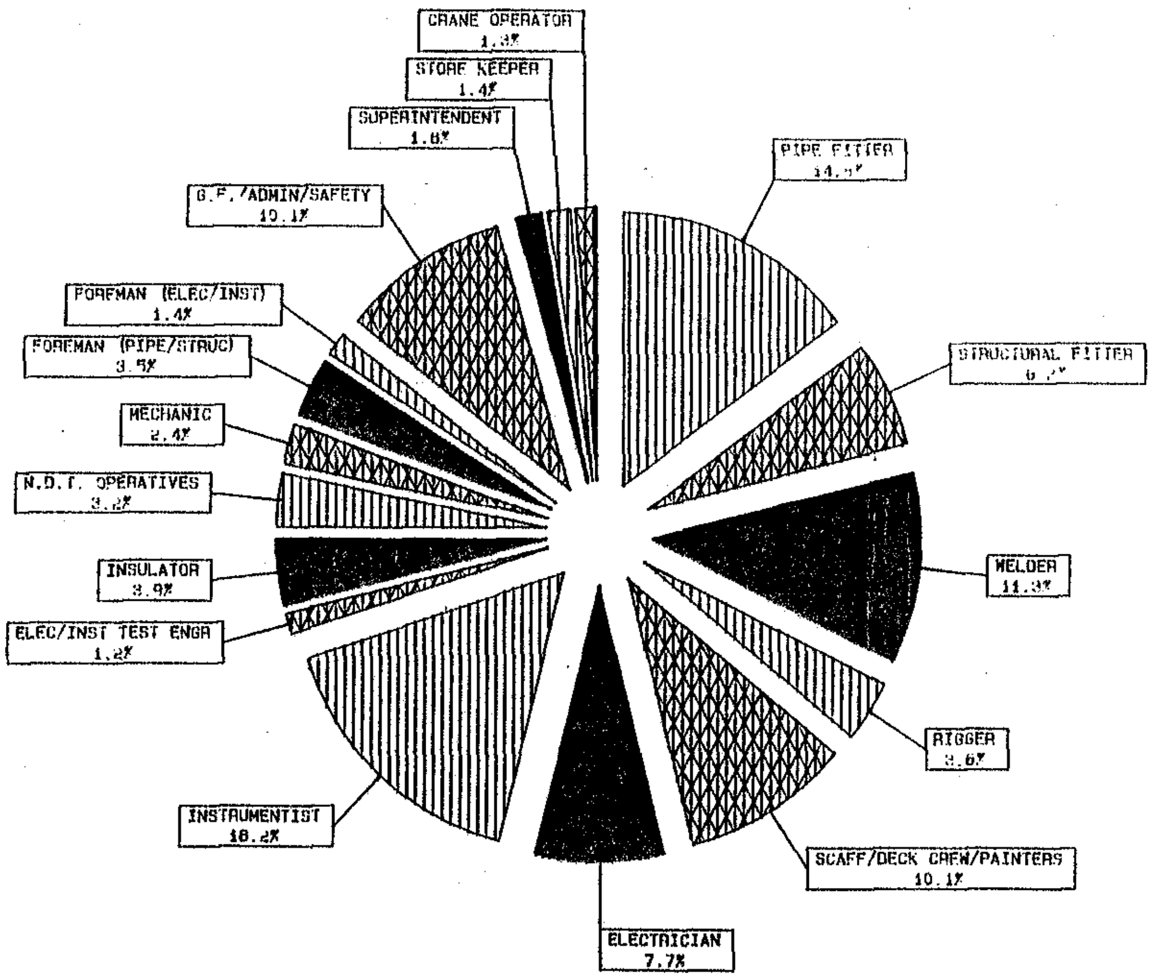


Figure 7.15

7.8.5 Ratios

7.8.5.1 Piping

General

Total manhours in piping (effective)	24000
Total weight of spools installed	80 T
Total number of weld performed	759

Range.

The range of diameter was from 2" to 26" pipe.

Detailed welding summary

	Carbon steel	Stainless steel	Monel
Butt weld	545	24	8
Socket weld	111	50*	-
"olet" weld	20	1	-

Socket welds between stainless steel and monel incl.

+ Butt welds average characteristics:

	Carbon steel	Stanless steel
Average diameter (inches)	4,19	8,67
Average thickness: 1"-4"	5,75mm	-
6"-12"	11,87mm	4,08
14"-18"	23,39mm	-
20"-26"	30,71mm	-

- Welding performance (all weld)

. Average weld diameter	4	in
. " weld thickness	10.3	mm
. Welding quantity	31.572	in mm
. Daily performance in mhrs ; per weld	31.5	mhrs
per ton	303	mhrs
per length of dia.	7.9	mhrs/in
. Daily welding quantity	14.5	in mm/day

7.8.5.2 Electrical / Instrumentation

	Electrical	Instrument
length of cable tray installed	1608	
" " power cable -	13955	
" " control -		20045
" " earthing -		

No. of tag items installed 1174

7.9 FINAL ACCEPTANCE DOCUMENTATION

The final acceptance documentation is filed in a set of volumes

FRIGG FIELD - TCP2 EXTENSION
OFFSHORE HOOK UP
CONTRACT F 142
FINAL ACCEPTANCE DOCUMENTATION

7.9.1 Structural - Piping

This part is split in 21 volumes containing all documentation related to acceptance of the work such as :

- NDT reports
- Pre-commissioning reports
- Pressure test records
- Welders identification

As built drawings are not included in those sets and are available in the EAN filing room.

Contents of the volumes:

VOLUME 1	PIPING	INDEX & LINE LISTS (TCP2)
VOLUME 2	PIPING	SECTION 1S MAIN FILE (TCP2) SYSTEMS 01A,01B,02,04A,04B
VOLUME 3	PIPING	SECTION 1S MAIN FILE (TCP2) SYSTEMS 05,08,09A,09B,10A
VOLUME 4	PIPING	SECTION 1A MAIN FILE (TCP2) SYSTEMS 10B,10C
VOLUME 5	PIPING	SECTION 1A MAIN FILE (TCP2) SYSTEM 11
VOLUME 6	PIPING	SECTION 1A MAIN FILE (TCP2) SYSTEMS 12A,12B,14A
VOLUME 7	PIPING	SECTION 1A MAIN FILE (TCP2) SYSTEMS 14B,16 (PART 1)
VOLUME 8	PIPING	SECTION 1A MAIN FILE (TCP2) SYSTEM 16 (PART 2)
VOLUME 9	PIPING	SECTION 1A MAIN FILE (TCP2) SYSTEMS 17A,17B,18,22,33
VOLUME 10	PIPING	SECTION 3A MATERIAL CERTIFICATION (TCP2)
VOLUME 11	PIPING	SECTION 3A (CONT'D) MATERIAL CERTIFICATION (TCP2)

VOLUME 12	PIPING	SECTIONS 2A, 4, 5A (TCP2) VISUAL ACCEPTANCE REPORTS RADIOGRAPHIC REPORTS ULTRASONIC REPORTS
VOLUME 13	PIPING	SECTIONS 6A, 7 (TCP2) M.P.I. & DYE PEN. REPORTS P.W.H.T. REPORTS
VOLUME 14	PIPING	SECTIONS 8A,9A,10A,11A,12A WELD REPAIR NOTIFICATIONS WELD PROCEDURE SPECS. WELD PROCEDURE QUALIFICATIONS WELDERS' QUALIFICATIONS NDT & QC PERSONNEL CERTS
VOLUME 15	STRUCTURAL	INDEX SECTION 1B MAIN FILE (TCP2) SYSTEMS 04B,10C,14A,16,17C,22,25
VOLUME 16	STRUCTURAL	SECTION 1B MAIN FILE (TCP2) SYSTEM 25A (PART 1)
VOLUME 17	STRUCTURAL	SECTION 1B MAIN FILE (TCP2) SYSTEM 25A (PART 2)
VOLUME 18	STRUCTURAL	SECTION 1B MAIN FILE (TCP2) SYSTEM 25B
VOLUME 19	STRUCTURAL	SECTION 2B,3B,5B,6B (TCP2) VISUAL ACCEPTANCE REPORTS MATERIAL CERTIFICATION ULTRASONIC REPORTS M.P.I. & DYE PEN. REPORTS
VOLUME 20	STRUCTURAL	SECTIONS 9B,10B,11B,12B WELD PROCEDURE SPECS. WELD PROCEDURE QUALIFICATIONS WELDERS' QUALIFICATIONS NDT & QC PERSONNEL CERTS
VOLUME 21	<u>DP2 - PIPING & STRUCTURAL</u>	
	PIPING	INDEX & LINE LIST SECTION 1A MAIN FILE SYSTEMS 01, 54 SECTIONS 2A, 3A,4,6A,8A VISUAL ACCEPTANCE REPORTS MATERIAL CERTIFICATION RADIOGRAPHIC REPORTS MPI & DYE PEN REPORTS WELD REPAIR NOTIFICATIONS
	STRUCTURAL	SECTION 1B MAIN FILE SECTIONS 2B, 6B VISUAL ACCEPTANCE REPORTS MPI & DYE PEN REPORTS

The photo overleaf shows

Module 50 and Pancake 53 after installation

on the TCP-2 platform.


25/1-FRIGG
TCP2

8 COMMISSIONING

8.1 GENERAL

The commissioning works were managed and carried out by EAN´s own organization, supported when necessary by Haugesund de Groot Offshore A/S & Co. and vendors.

The works started in parallel to the hook-up works.

All systems were handed over to the operational departments by 9th October 1983.

8.2 ORGANIZATION

Due to the nature and the size of the project, and in order to obtain optimum efficiency, a separate commissioning team was integrated into the TCP-2 Extension offshore supervision force under the responsibility of the Site Manager. In order to ensure a smooth start up operation, personnel from the production department was integrated in the commissioning team. The team was in fact given larger responsibilities than commissioning only, such as:

- Active part in precommissioning activities (leak tests, instrument calibration etc..).
- Active part in start-up activities, except for process and electrical systems.

Figure 8.1 shows the detailed organization chart of the commissioning team.

8.3 QUALITY ASSURANCE - QUALITY CONTROL

All commissioning operations were planned and described in commissioning procedures and executed in accordance with the Project Quality Assurance manual for the Hook-Up and Commissioning.

In particular, Commissioning liaised with Operational Responsible departments in order to achieve the work within an acceptable level of quality.

The same principles were applied for the Commissioning as for the Hook-Up.

TCP 2 Ext. Offshore Commissioning Team

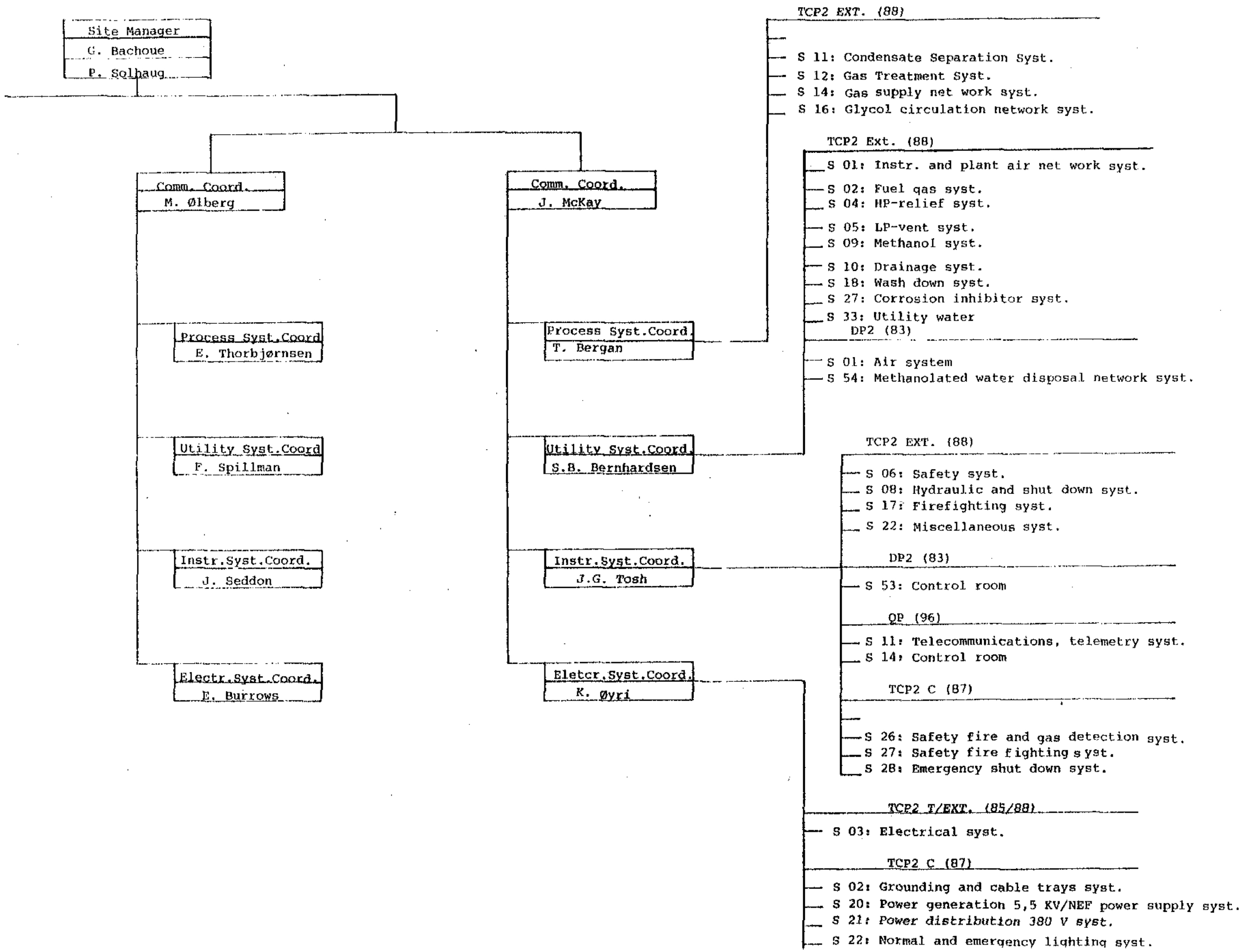


Figure 8.1

8.4 PLANNING AND PROGRESS

8.4.1 Planning and Milestones

Four major milestones were established:

- Safety systems	completion week 24
- NEF works	completion week 29
- Systems completed before TCP-2 start-up	completion week 33
- Remaining works	completion week 40

Figure 8.2 shows the bar chart.

Table 8.3 shows the detailed planning by system.

It should be noted that the hand over date to the operational department correspond to the Final Acceptance including all the formal approvals. The actual completion of the work "Provisional Acceptance" was completed prior to that.

TCP2 Extension Milestone Plan

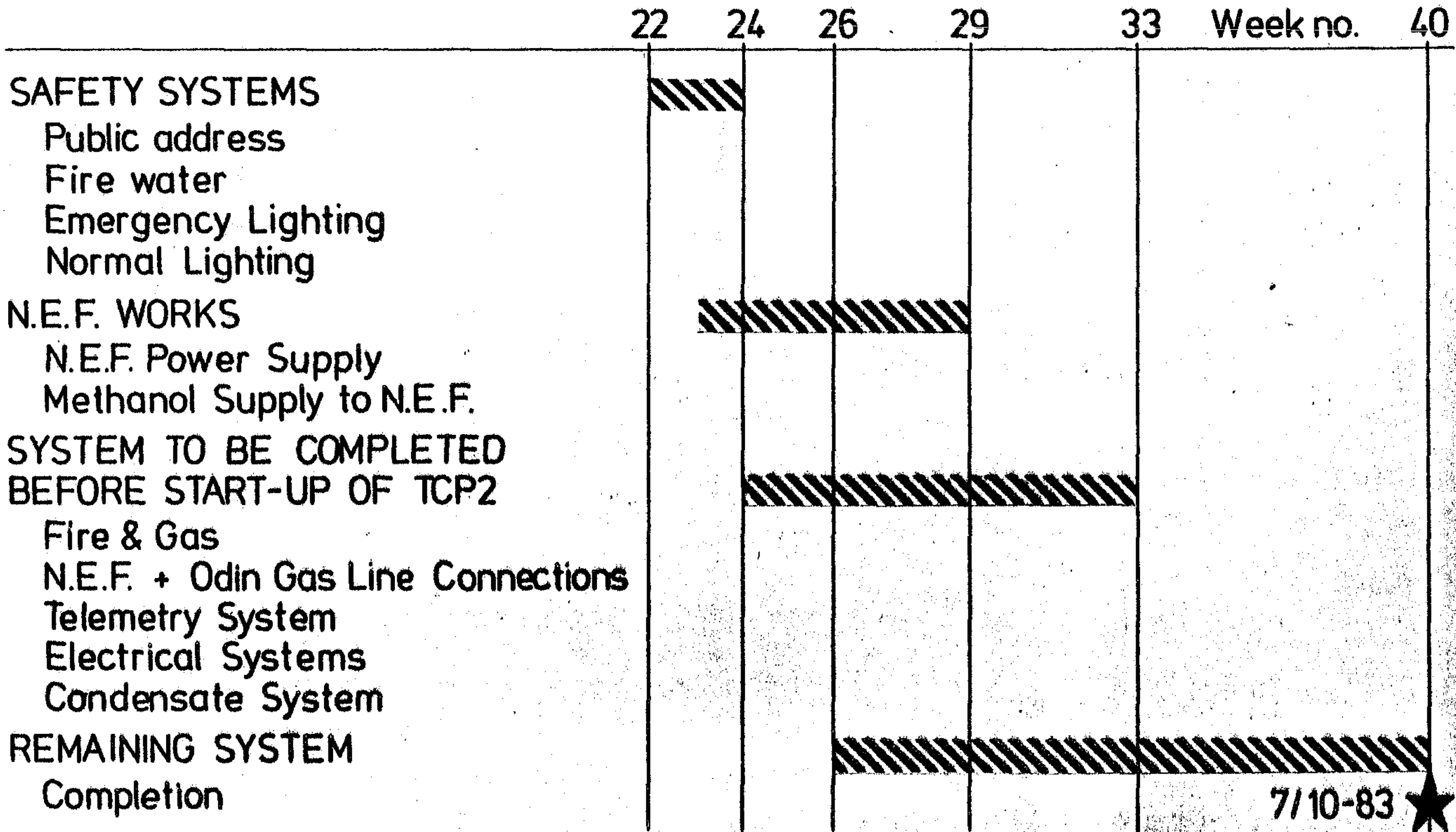


TABLE 8.3.

1 System	2 Required System Completion Date	3 Estimate of Commissioning Manhours	4 Latest start for Comm. to meet 2	5 Actual Comm. Start Date	6 Actual Hand-over Date
88-01A	31.07.83	50	29.07.83	24.07.83	28.07.83
88-01B	31.07.83	50	29.07.83	24.07.83	26.07.83
88-02	15.08.83	75	12.08.83	28.07.83	02.08.83
88-03A	15.08.83	50	13.08.83	20.06.83	24.09.83
88-03B	15.08.83	175	08.08.83	15.07.83	02.10.83
88-03C	15.06.83	50	13.08.83	20.06.83	29.09.83
88-03D	15.06.83	50	13.08.83	20.06.83	29.09.83
88-03E	30.06.83	125	25.06.83	20.06.83	07.08.83
88-03F	15.08.83	125	10.08.83	09.07.83	07.08.83
88-03G	15.08.83	0	15.08.83	20.06.83	11.10.83
88-03H	15.08.83	250	05.08.83	18.08.83	02.10.83
88-03J	20.08.83	0	20.08.83	20.06.83	11.10.83
88-04A	15.08.83	75	12.08.83	01.08.83	04.08.83
88-04B	15.08.83	75	12.08.83	26.09.83	29.09.83
88-05	15.08.83	50	13.08.83	04.08.83	06.08.83
88-06A	07.06.83	50	05.06.83	16.06.83	03.09.83
88-06B	30.07.83	75	27.07.83	31.07.83	05.09.83
88-06C	30.07.83	100	26.07.83	31.07.83	05.09.83
88-08	30.08.83	350	16.08.83	02.08.83	11.10.83
88-09B	20.08.83	100	16.08.83	29.08.83	29.09.83
88-10A	30.07.83	25	29.07.83	15.07.83	27.07.83
88-10B	15.08.83	75	12.08.83	12.09.83	21.09.83
88-10C	20.08.83	100	16.08.83	12.09.83	11.10.83
88-11	15.08.83	450	28.07.83	12.09.83	11.10.83
88-12A	15.08.83	875	11.07.83	20.09.83	11.10.83
88-12B	15.08.83	875	11.07.83	22.09.83	11.10.83
88-14A	30.08.83	150	24.08.84	03.10.83	11.10.83
88-14B	15.08.83	150	09.08.83	03.10.83	12.10.83
88-16	15.08.83	125	10.08.83	25.09.83	29.09.83
88-17A	30.06.83	50	28.06.83	05.07.83	11.07.83
88-17B	01.09.83	150	26.08.83	14.09.83	12.10.83
88-17C	30.07.83	50	24.07.83	01.09.83	04.09.83
88-18	30.09.83	50	28.09.83	05.07.83	21.09.83
88-22	15.09.83	0	15.09.83	25.10.83	
88-25A	15.09.83	0	15.09.83	10.10.83	12.10.83
88-25B	15.06.83	0	15.06.83	10.10.83	12.10.83
88-27	15.09.83	50	13.09.83	29.07.83	09.08.83
88-29	15.09.83	0	15.09.83	10.06.83	10.06.83
88-33	20.08.83	25	19.08.83	06.07.83	21.09.83
83-01	20.08.83	25	19.08.83	31.07.83	05.08.83
83-53	30.08.83	0	30.08.83	26.08.83	12.10.83
83-54	30.08.83	75	27.08.83	01.08.83	05.08.83
96-11	15.08.83	350	01.08.83	15.07.83	07.10.83
96-14	15.08.83	0	15.08.83	11.10.83	12.10.83
96-17	15.08.83	0	15.08.83	08.08.83	09.08.83
87-02	15.08.83	25	14.08.83	01.09.83	24.09.83
87-20	10.07.83	600	16.06.83	13.06.83	12.08.83
87-21	20.07.83	100	16.07.83	01.08.83	07.08.83
87-22	10.07.83	50	08.07.83	20.06.83	28.09.83
87-26	31.07.83	25	30.07.83	31.07.83	06.08.83
87-27	20.07.83	25	19.07.83	06.08.83	08.08.83
87-28	20.07.83	125	15.07.83	31.07.83	06.08.83
87-29	10.07.83	175	03.07.83	14.06.83	08.08.83
85-03	15.08.83	75	12.08.83	26.08.83	25.09.83
85-08	20.07.83	25	19.07.83	27.08.83	
85-12	15.08.83	0	15.08.83	29.08.83	29.08.83
85-14	15.08.83	0	15.08.83	29.08.83	29.08.83
85-35	15.08.83	0	15.08.83	29.08.83	
87-17	30.07.83	0	30.07.83	31.07.83	04.08.83

Comments to table 8.3.

- Sub-systems within system 88-03 were very much delayed by the significant increase in their work scope. As previously detailed, this was primarily a result of a change in grounding philosophy coupled with the design completion of the trace heating system.

- The delay to system 88-06A was caused by the need to keep the flotel connected to the platform P.A. system.

- Systems 88-06B and 88-06C were delayed by the problems, previously described, within the vendor supplied equipment.

- The hydraulic system, 88-08, was tied in with all other systems which used this service, so its completion depended on the completion of the other systems.

8.4.2 Progress

The calculation of the progress was based upon the following:

- The commissioning manpower requirement during the offshore phase was estimated as 6700 hours. Using this figure and the corresponding figures per system, we were able to give overall completion percentage "weightings" to each system.

Example:

- An example of a weighting was the figure of 0,746% for the Instrument Air System (88-01A). If this system were 100% completed, a total of 0,746% would be added to the commissioning percentage completion.

- To arrive at the percentage completion for a particular system, the following format was used:

  10% Checking and accepting the "Provisional Acceptance Certificate" from hook-up.
  20% Preparation for the commissioning tests.
  30% Execution of the commissioning tests.
  10% Compilation of dossier for hand-over.
  10% Punch list items on the system.
  20% On completion of "System Acceptance Certificate" including dossier hand-over and witnessing by production/maintenance

Weightings for individual systems are listed below:

System no.	Est. Mandays	X	Factor	Weighting %
88-01A	2	x 1.00	2.00	0.643
88-01B	2	x 1.00	2.00	0.643
88-02	3	x 1.00	3.00	0.965
88-03A	2	x 1.00	2.00	0.643
88-03B	7	x 1.10	7.70	2.478
88-03C	2	x 1.00	2.00	0.643
88-03D	2	x 1.00	2.00	0.643
88-03E	5	x 1.10	5.50	1.770
88-03F	5	x 1.10	5.50	1.770
88-03H	10	x 1.10	11.00	3.540
88-04A	3	x 1.10	3.30	1.062
88-04B	3	x 1.00	3.30	1.062
88-05	2	x 1.00	2.00	0.643
88-06A	2	x 1.00	2.00	0.643
88-06B	10	x 1.00	10.00	3.218
88-06C	10	x 1.00	10.00	3.218
88-08	14	x 1.25	17.50	5.632
88-09B	4	x 1.25	5.00	1.609
88-10A	1	x 1.00	1.00	0.321
88-10B	3	x 1.25	3.75	1.206
88-10C	4	x 1.25	5.00	1.609
88-11	18	x 1.10	19.80	6.372
88-12A	35	x 1.25	43.75	14.081
88-12B	35	x 1.25	43.75	14.081
88-14A	6	x 1.25	7.50	2.413
88-14B	6	x 1.25	7.50	2.413
88-16	5	x 1.40	7.00	2.252
88-17A	2	x 1.00	2.00	0.643
88-17B	6	x 1.25	7.50	2.413
88-17C	2	x 1.00	2.00	0.643
88-18	2	x 1.00	2.00	0.643
88-27	2	x 1.10	2.20	0.708
88-33	1	x 1.00	1.10	0.354
83-01	1	x 1.10	1.00	0.321
83-54	3	x 1.00	3.30	1.062
96-11	14	x 1.00	14.00	4.505
87-02	1	x 1.10	1.10	0.354
87-20	24	x 1.10	26.40	8.496
87-22	2	x 1.00	2.00	0.643
87-29	7	x 1.25	8.75	2.816
85-03	2	x 1.25	2.50	0.804
TOTAL	272		310.70	100%

NOTE:

One discipline involved in the system : x 1.00
Two disciplines involved in the system : x 1.10
Three disciplines involved in the system: x 1.25
Four disciplines involved in the system : x 1.40

The commissioning progress curve is shown in Figure 8.4.

In general terms, all systems were handed over to the operational responsible departments before the flotel departed. Very few outstanding items remained as exception report items and those which did remain were primarily concerned with vendor supplied equipment. A typical example would be the flow totalisers from Daniel, where the designed flow rate through these measuring devices appeared to be below that at which they could accurately register.

When the commissioning team were de-mobilized from TCP2, all systems had been handed over to either production or maintenance departments and all available documentation had accomparised the System Acceptance Certificates. Onshore, the task of providing additional vendor data and as-built drawings was well in hand. The contractor was preparing the completion file which would contain all certification documentation for welding, NDT, materials and precommissioning tests.

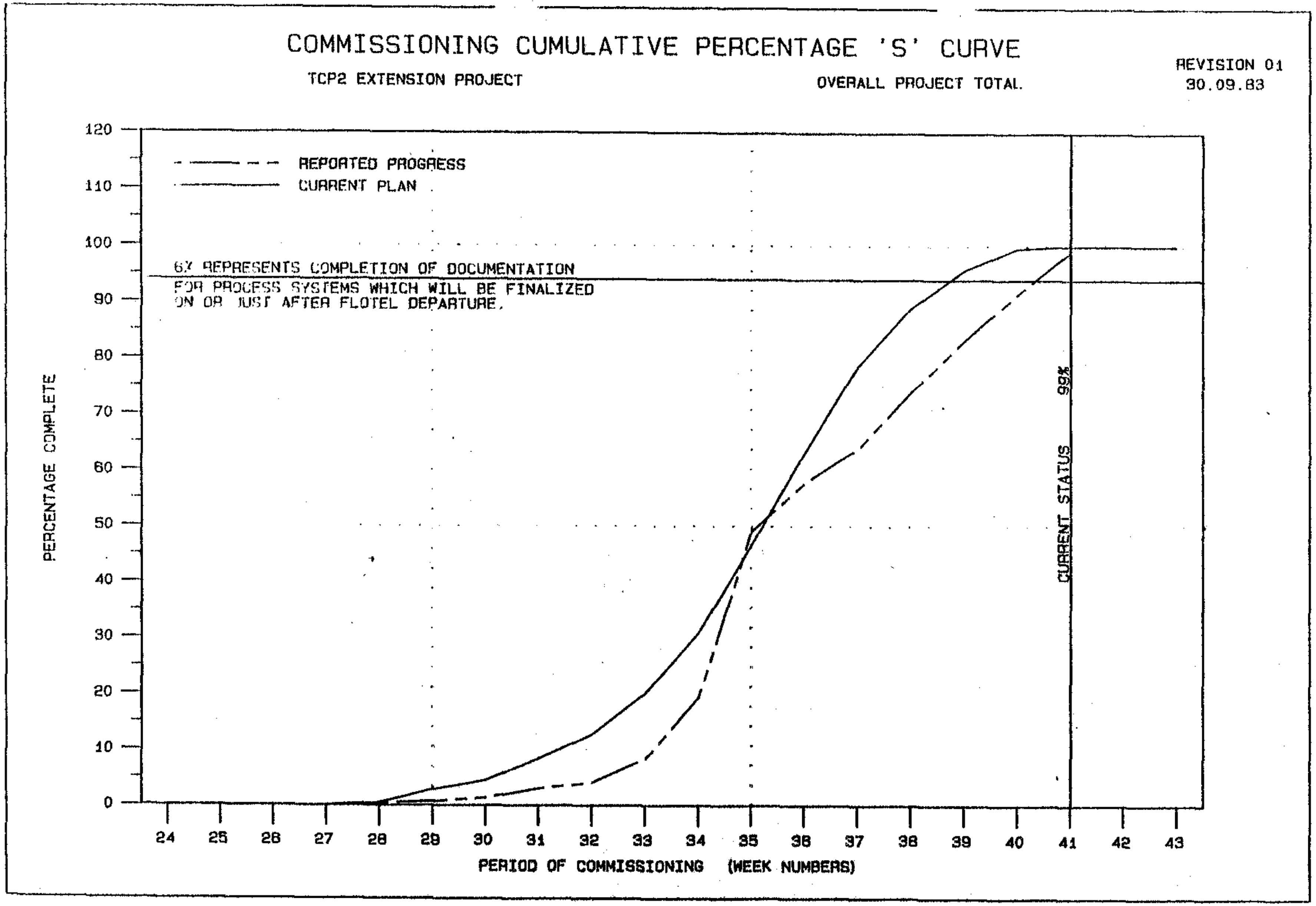

COMMISSIONING CUMULATIVE PERCENTAGE 'S' CURVE
TCP2 EXTENSION PROJECT
OVERALL PROJECT TOTAL
REVISION 01
30.09.83
REPORTED PROGRESS
CURRENT PLAN
6% REPRESENTS COMPLETION OF DOCUMENTATION
FOR PROCESS SYSTEMS WHICH WILL BE FINALIZED
ON OR JUST AFTER FLOTEL DEPARTURE.
CURRENT STATUS 99%
PERCENTAGE COMPLETE
120
110
100
90
80
70
60
50
40
30
20
10
0
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
PERIOD OF COMMISSIONING (WEEK NUMBERS)

Figure 8.4

8.5 WORK REPORT

8.5.1 Scope of Work and Execution

8.5.1.1 General

Commissioning were able to start their work on a system when hook-up acknowledge completion of their work by issuing a "Provisional Acceptance Certificate" (PAC). Due to the circumstances, commissioning work was started before the issue of the PAC for a few systems.

All work on the TCP-2 Extension project was allocated by system, including commissioning.

The commissioning required for any individual system was then subdivided by discipline.

The project manpower block diagram for the commissioning team details the Co-ordinators responsible for each complete system.

Procedures were compiled for each discipline in each system, and consisted of a narrative section followed by test record sheets. The narrative was intended to provide the reader with sufficient information to enable him/her to: Confirm the completion of precommissioning checks; Prepare for testing; Carry out the tests; Leave the system in a specific condition following testing; Complete all test records correctly.

All tests were carried out under the security of a representative from maintenance/production, who witnessed the test record.

When the involvement of all disciplines on a system was complete, the commissioning Co-ordinator issued a "System Acceptance Certificate" together with a dossier containing: Copies of all procedures relating to the system; Copies of all engineering and vendor data available on the platform; Copies of all test records.

If there had been items which could not for reasons of prolonged delivery etc., have been installed or completed, then an "Exception Report" would have been appended to the "System Acceptance Certificate".

When the occasion arose that these items were completed, a "Clearance Certificate" was issued.

The acceptance by production/maintenance of a system by signing the System Acceptance Certificate, or of punch list items by signing the Clearance Certificate, relieved commissioning of any further responsiblity for the system regarding operation, maintenance, spares or safety.

8.5.1.2 Instrumentation

i) This discipline had involvements in almost every system. The following items attempt to detail the work of this discipline in general terms rather than to repeat the majority of these involvements for each system.

ii) Process indication. To check the calibration of instruments, particularly in the zone of future operation if this were known.

iii) Process control. To loop check cause and effects pertinent to specific loops such that all such combinations were exhaustively checked and verified as desirable.

iv) Operating times. Where ESDV's and the like had variable operating times, to test, monitor and adjust as required to bring the operating time, under process conditions, to a pre-determined, acceptable figure.

v) Telemetry system. To ensure,in co-operation with the vendor, that all transmissions of data (eg. alarm conditions, process operating levels, shut-down/control initiations, status indications) were received and printed out with the required accuracy and security.

vi) Fire and gas systems. To function test all detectors and to carry out cause and effect tests covering all combinations.

vii) Generally to test: Cable/gland sizing and continuity/insulation; Junction box termination and grounding; Instrument pneumatic and hydraulic lines for leakages; All process mounted actuation devices for required functions.

8.5.1.3 NEF Electrical Power Supply

This comprised of: A 5kV breaker installed into the existing TCP-2 5kV switchgear; A 5kV/12kV natural air cooled transformer; A new 12kV switchgear cubicle; H.T. cabling between these items; HT multicore and signal submarine cable between TCP-2 and NEF.

Commissioning were responsible for: H.T. cable testing; Intertripping checks between breakers and TCP-2 and between TCP-2 and NEF; Breaker status indication verification; HVAC start-up for pressurization/ventilation system in the transformer/switchgear bay; Shut-down logic function testing.

8.5.1.4 Process and Utility

Main task and execution:

These disciplines in practice worked as a common team. They too were involved with the majority of systems and the following items attempt to clarify their work load.

Interconnection and testing of sub-systems which were tied into existing systems. Examples of this were the instrument and hydraulic systems. When testing was completed and the systems handed over, they were left in the process condition.

Performance checks of plant items. This involved testing pumping systems with glycol, methanol, water etc. in order to, as closely as possible, simulate process conditions, and then to verify the required performance figures.

Leak testing. For these disciplines this was the major involvement. All of the process pipework and vessels were subjected to leak testing, using nitrogen as the blanket gas with a 1% trace of helium gas as the detectable source. A mass spectrometer, calibrated to detect only helium, was used to check for leakage. Using an acceptable figure of 5 scf/year (comparable figures for the soap film and bubble technique would have been 200 scf/year) for the leakage rate, all connection points, flanges, sight glasses etc. were tested and repairs carried out until this figure, or better, was achieved.

Passing valves. During leak testing, an ultra sonic detection device was used to check for gas passing through valves across which there was differential pressure. All passing valves were removed, repaired and re-tested.

8.5.1.5 Electrical Systems

i) These comprised of: Cable trays, including the H.T. cable tray into column 5; 380 volt power distribution; Normal and emergency lighting; 220 volt no-break distribution; 24 volt D.C. distribution; Trace heating; Grounding.

ii) Cable tray installations were checked for: Correct supports; Span lengths; Standard of fabrication of take-off points etc.; Segregation of I.S. cabling; Warnings and covers on H.T. route; Additional mechanical protection around deck penetrations; Grounding.

iii) 380 volt power distribution was checked for: Cable/gland sizing and continuity/insulation; MCC and remote devices correctly wired; Function testing of all control devices; Rotation of drives; Suitable temperature maintenance of drives by the anti-condensation heaters.

iv) Normal and emergency lighting was checked for: Illumination levels; Rate of discharge of the emergency battery packs; Cable/gland sizing and continuity/insulation; Junction box terminations and grounding; Function testing of individual circuits.

v) 220 volt no-break distribution was tested for: Cable/gland sizing and continuity/insulation; Junction box terminations and grounding; Function testing of individual circuits; Continuity of supply in the event of disconnection of the primary source of supply.

vi) 24 volt D.V. distribution was tested for: Polarity at all user points; Voltage swing under extremes of load conditions; Function testing of individual circuits.

vii) Trace heating was tested for: Adequate provision of supplies under lowest temperature of process and ambient start conditions; Adequate mechanical protection of tapes; Cable/gland sizing and continuity/insulation; Junction box terminations and grounding; Acceptable application of tapes to removable items i.e. valves; Correct type and length of tape for required duty.

viii) Grounding of both process and electrical equipment was checked for concurrence with the company's specification.

8.5.2 Chronological Work Report

1. The platform's nitrogen compressor, which we intended to use as the source of nitrogen for leak testing, was in need of extensive repair. Although the spares had been on order for some considerable time, this plant was never put back into service. As a result, we organized the hire of a "NOWSCO" compression unit and changed from the soap film and bubble testing philosophy to that of helium traced nitrogen.

2. 10th June. System 88-29, the lifting equipment, was tested and handed over.

3. 13th June. Vendor representative from Merlin Gerin came on site to carry out tests on the 12kV switchgear for system 87-20.

4. 14th June. Our involvement in the HVAC, system 87-29, began.

5. 15th June. Merlin Gerin completed the secondary and primary injection testing of relays and the insulation testing of the 12kV breaker.

6. 18th June. First involvement with the deluge system 88-17B. The commissioning procedure had to be rewritten because the installation differed in material content from the design data.

7. 20th June. It came to our attention that no checks were being made by the Hook-Up Contractor regarding cable stocks on the platform. Further investigation revealed that no cutting list existed. This could, and eventually did, place us in the position of having inadequate cable lengths for some runs with much wastage of short unusable lengths.

8. 4th July. Whilst working on the HVAC, a Halon release was inadvertantly caused. The maintenance instrument technician who was involved with this work had neglected to isolate the bottle bank, and a faulty card, when inserted, initiated the release. In this instance, the operation of by-pass switches proved to be an inadequate means of isolation.

9. 5th July. Started work on the fire water, system 88-17A, and the wash down, system 88-18.

10. 6th July. Purging fan on HVAC system, when tested, was binding on the enclosure. This required scaffolding to gain access. It could have been checked for rotation before it was installed and the problem solved at that time.

11. 9th July. Started work on the 24 volt DC system 88-03F.

12. 12th July. Had to draw the contractor's attention to safe working practices. One of the electricians was grounding the HVAC I/D fan motor with the drive belts still attached and the motor not isolated.

13. 15th July. CETT arrived on site to check out the vendor package on the telemetry, system 96-11. They arrived, despite voluminous information on the P.O. and in back-up telexes, without adequate test equipment.

14. 17th July. The cable lay barge arrived on location to install the submarine cable between TCP2 and NEF. This meant that the Flotel bridge was disconnected and the Flotel anchor on the south west side was taken up and temporarily replaced by an anchor tug. All personnel began a five day shuttling exercise with consequent loss of productive hours.

15. 18th July. The Programmable Logic Control which provided monitoring and shut-down facilities for the HVAC system, amongst others, had not been reprogrammed when we started commissioning. In addition, the information available to us on the P.L.C. was poor. Eventually, by expediting the updated tape and by modifying the design drawings and control circuit to suit the HVAC system was made to function as required. One of the areas open to some criticism was the fact that loss of pressurization, which could easily happen if both air lock doors were opened at the same time, resulted in the tripping of the NEF power supply.

16. 22nd July. Vendor equipment for the 12kV/5kV transformer on system 87-20 was supplied with relays which had unsuitable control circuit voltage requirements. Replacement relays were ordered.

17. 23rd July. Tested all H.T. cabling on system 87-20. S.T.K. had been awarded the contract for testing all the H.V. equipment with their DC injection set, including the submarine cable. All switchgear, bus sections and cabling was satisfactory with the exception of the cable between the 5kV switchgear and transformer. This cable had been called out from stock at Dusavik Base, unlike all the other cables which had been specifically purchased for the project. When this cable had been cut from the drum, water had spilled from the severed ends. Although this was observed by the Hook-Up contractor and EAN representative the cable was still installed in its primarily vertical route and left untested for some weeks before the responsibility for its testing was handed over to commissioning. When the cable failed its test, we had the stress cones and joint removed from the lowest point at the transformer. More water was seen and it was at this point that the above information was disclosed to us. Because the NEF requirement for power was reaching a critical point, waiting for a replacement cable and the effort required in locating and expediting its delivery, was extremely costly. With hindsight, the comment must be made that storage of cables, particularly H.T. cables, must be carried out in such a manner that ingress of moisture is prevented. In addition, before any cable leaves the store it should be tested and the test documentation should accompany it to wherever it is transported. We would also have benefited from the adoption of a more responsible attitude by those persons who witnessed the cutting and installation of the faulty cable.

18. 27th July . Several globe valves had fractured positioning stops and mounting plates. This meant that it was very difficult to know whether a valve was open or closed. Spares were ordered.

19. 28th July. Instrument Air, system 88-01A, was handed over.

20. 4th August. H.P. Relief, system 88 - 04 A, and Open Drains, system 88-10 A, were handed over.

21. 6th August. Safety Fire and Gas detection, system 87-26, Emergency Shutdown, system 87-28 and Low Pressure Relief, system 88-05 were handed over.

22. 7th August. Power Distribution at 380 volt, system 87-21, 24 volt D.C., system 88-03F and Emergency Power (220 volt No - Break), system 88-03E were handed over.

23. 8th August. HVAC on NEF H.V. Station, system 87-29, was handed over.

24. 9th August. Electrical, system 96-17, and Corrosion Inhibitor Equipment, system 88-27, were handed over.

25. 12th August. Worked on Power Generation to NEF, system 87-20. The P.T.'s were not functioning when we energised the transformer for the "soak test". The 12kV switchgear had had a "shipping break" about its centre line, and after checking, it was found that a set of control wiring links across this break had not been re-installed. When the 12kV breaker between the transformer and submarine cable to NEF was first closed, NEF suffered a platform black-out. Obviously they had not followed the procedure previously agreed to, for, the next day, all was retested to this procedure with satisfactory results. Two points must be raised:

A. Once we had energised the submarine cable and NEF had blacked-out, the person in contact with TCP-2 from NEF via the Stentaphone panicked and ran off so that although we could hear people running and shouting, actual communication was lost. Some minutes elapsed before this was restored and we were asked to isolate the supply from TCP-2. When one is energising a remotely fed supply such as this, communication must be maintained and a more experienced leader should have been available on NEF to prevent this situation from getting out of hand.

B. The procedure should have been followed the first time. All the efforts made were wasted by this mistake and a costly accident in both financial and personnel terms could have been the result.

26. 14th August. Worked on Fire and Gas system 88-06B and 88-06C. The I.S. Barrier grounds should have been connected to a dedicated grounding network but were only connected to structural ground. This was made the subject of a Site Modification Request to the Engineering Department.

A modification which had proved necessary on existing A.F. Minerva equipment was not made to the equipment supplied for the TCP-2 Extension Project. The result was the development of a number of fault conditions, all of which pointed to the vendors equipment, but which could not be resolved until copies of drawings of the existing equipment were compared with copies of drawings for the new. When the new equipment was modified accordingly, the fault conditions were eliminated.

27. 15th August. The smoke detection, system 88-06C, required on inordinate amount of time spent on it in order to achieve acceptable results. A.F.A. Minerva equipment was installed and did not function correctly. Various explanations for the malfunction of their equipment were given by the vendor, none of which was of any assistance in solving the problem. Eventually, it was discovered that the inclusion of vendor supplied I.S. barriers in the output circuits from their control and monitoring unit was responsible for our difficulties. When these barriers were put into circuit, the End-of-Line resistor could no longer be a permanently connected device, for with it in circuit, the detectors would not operate.

Removal of the E.O.L. resistor from a circuit meant that the detectors would operate correctly but that the facility for continuous monitoring for zone faults and the zone fault indication on the control and monitoring unit were rendered inoperative. A.F.A. Minerva provided E.O.L. resistors and series mounted switches in standard lighting switch enclosures for connection across the end of every circuit. These would have necessitated the installation of additional cables between the Interface Room and the end of circuit detectors. They would have provided a circuit monitoring facility when operated but would have at the same time prevented the detectors from operating. It was therefore decided by engineering not to fit these units but to rely on regular maintenance checks for the correct functioning of each and every detector. It must be stressed that the continuous monitoring facility for the smoke detectors was, as a result, left inoperative.

28. 17th August. Worked on fire and gas, systems 88-06 B and 88-06C The difficulty of obtaining insulating bushes for placement between cable glands and detectors meant that either we had to delay the completion of this work or accept that we would need to disconnect cabling, install the bushes, regland, terminate and test at a later

29. 18th August. Trace Heating, system 88-03 H, was developing from being a minor work item to a major problem area. Engineering were making offshore visits to compile design data whilst alongside them, the Hook-Up contractor was carrying out the installation. Because of conflicting grounding philosophies, the work content was far greater than had been envisaged.

30. 19th August. Although we were taking over part of the existing plant for inclusion within the Odin process stream, it was decided to subject all of it to the full leak testing procedure. Accordingly, all insulation around flanges etc. was removed.

31. 20th August. The main mimic panel in QP control room for TCP-2 Extension had been provided by the vendor with L.E.D. pairs which had an integral common connection. Unfortunately, this would only be acceptable with reversed polarity to that used on the platform. It was therefore necessary to call out the vendor and have him completely rewire the panel using individual L.E.D.´s.

32. 20th August. In association with this circuitry was the work carried out by the Hook-Up contractor in relay cabinet No. 9 located in QP control room. Due to the problems with the mimic panel, he had reversed the polarity within the relay cabinet, thus partially solving the problem in the mimic panel. However, this produced a multiplicity of other problems and had to be corrected.

33. 21st August. Installed, temporarily, a visible warning of an ESD local to the nitrogen compression unit, which we had offloaded to the south of M50. We had managed to obtain waivers for some of the more stringent requirements of the Platform Management Manual and had provided alternatives for others. This was one subject, however, in which we should have been better informed and should have been better prepared. As it was, there was a real possibility that the leak testing could have been seriously delayed whilst modifications were carried out to the compressor units.

It is recommended that either the Platform Management Manual requirements, or the compression equipment packages are modified so as to prevent any recurrence of this problem.

34. 22nd August. Commenced the leak test sequence on the Odin process stream, starting at the pig receiver. We immediately had problems with loose flanges and with the "O" ring for the pig receiver end flange. This "O" ring had obviously been damaged at the construction site, for the seat had been packed with heavy grease. This grease held pressure up to 30 barg and then blew out. On inspection, the "O" ring had been damaged on one edge over a 40 mm length.This was replaced, the seat cleaned, and all was satisfactory. Loose flanges continued to be a problem until we organised a team of pipefitters to work ahead of the leak test zone, tightening up every flange. With this system put into effect, the number of faults rapidly decreased.

35. 22nd August. One of the ferrules on the high pressure hoses was loose and leaked badly. This was tightened and appeared to be satisfactory. Nowsco assured us that all the hoses had been newly assembled, specifically for the work on TCP2.

36. 23rd August. Despite these assurances from Nowsco, one of the ferrules on the high pressure hoses actually fell off during handling. From this time on, all hoses were secured to structural items either side of all connections.

37. 23rd August. The by-pass globe valve for ESDV.CV1A.1 was passing very badly. When it was checked, it was found that, due to lack of use, the valve couldn't be closed properly until the threaded section had been cleaned and greased. Subsequently this valve was found to be operating satisfactorily.

38. 23rd August. The 20 inch check valve out of CV1A was leaking badly through one of the spindle seals. This valve had been maltreated in that one cup-screw for the spindle had been subjected to a severe peining or punching action. It appeared as though the intention of this action was to rivet over the cupscrew and thus form a better seal. The check valve was removed and further testing carried out with a blind flange in its place.

39. 23rd August. Valve ESDV.V1A.4 out of CV 1A and immediately downstream of the check valve referred to in 5.38 was passing so badly that it was impossible to maintain a pressure differential across it. This valve had been a part of the existing production stream.

40. 28th August. Completed the leak testing of the Odin process stream.

41. 29th August. Fire and Gas, systems 88 - 06 B and 88 - 06 C, were tied into existing systems and handed over.

42. 31st August. Completed the leak testing of the NEF process stream and started demobilization of the Nowsco crew and compression unit.

43. 1st September. The Maxiprint for the NEF power supply, system 87-20, did not function. Vendor was called out to investigate after we had ensured that all inputs to it were as required.

44. 2nd September. All PSV's were to be removed and shipped ashore for final calibration and certification. This work was put into effect.

45. 2nd September. System 88-16, glycol circulation, was filled with glycol and the pumps tested for the required delivery.

46. 3rd September. System 88-09B, Methanol injection to NEF, was filled with methanol and the pumps tested for the required delivery.

47. 3rd September. System 88-06A, public address and public alarm, was tested and handed over.

48. 4th September. System 88-17C, Extinguishing equipment, was handed over.

49. 4th September. The last of the PSV's was taken out and shipped onshore.

50. 6th September. Production asked that the blind flange, which we had installed as a temporary replacement for the check valve out of CV 1A, be left in position. They intended to carry out a full survey of CV 1A and the blind would be required for this purpose. When the ceck valve replacement arrived on the platform, it was to be stored and production would organize its reinstallation.

51. 10th September. Agreed with production to transfer as much nitrogen as possible from our systems to storage in the mud kill line and wet gas header. This gas could then be used for start-up/purging.

52. 11th September. Made a site visit with engineering and maintenance to check the extent of the problem regarding the installation of cable glands which were not compatible with the respective cables. Agreed to have changed those which were not of the correct size and to have reterminated those which had not been made-off to the specification.

53. 12th September. The third level ESD was proved as far as panel ESD2. This meant that all third level ESD's on the project could be tested from panel ESD2.

54. 12th September. System 88-10B, closed drain, was worked on and pump CP 224 failed to deliver the required head or flowrate. The vendor was requested to investigate.

55. 14th September. System 88-17B, deluge water, was tested.

56. 15th September. The insulators were working in several areas and much care was required when releasing deluge water or when re-setting deluge flapper valves in order not to soak their work so necessitating re-work.

57. 16th September. The hand operated releases on system 88-17B, deluge water, did not operate the flapper valves even though the process water flow through them was as expected. The problem was solved by installing restrictors into the process connections which fed fire water to the flapper valve actuators This meant that flow into the actuators was less than that required to maintain pressure on the flapper valve spring releases when the hand operated valves were open.

58. 17th September. On system 88-17B, deluge water, the control pipework for the flapper valves and the associated pressure switches were all manufactured from a variety of materials. This meant that the pressure switches were quickly corroded beyond use and that the pipework could not be made leak tight for more than a few hours at a time. The decision was taken to change out all these componants for stainless steel.

59. 19th September. Pump CP 224, see item 54, was checked out by the vendor. A sealing plug had been omitted from the pump string causing eddy currents within the string and hence a reduction in the output head and flow. A temporary plug was installed, the pump delivery was checked and accepted, and a manufactured plug was ordered to replace the temporary fitting.

60. 21st September. Systems 88-18, wash down, 88-33, utility water and 88-10B, closed drains, were all handed over.

61. 22nd September. System 96-11, telemetry, was worked on by the CETT representative in order to seek rectification of the system faults.

62. 24th September. Systems 88-03A, cable trays and 87-02, grounding and cable trays, were handed over.

63. 25th September. System 85-03, electrical systems, was handed over.

64. 26th September. System 88-03H, trace heating, was being worked on. The scope of work on this system had increased remarkably when compared with the engineering data available to hook up during the planning and mobilization periods.

65. 28th September. System 87-22, normal and emergency lighting, was handed over.

66. 29th September. Systems 88-03 C, normal lighting, 88-03D, emergency lighting, 88-04B, low temperature relief, 88-16, glycol circulation network and 88-09B, methanol injection to NEF, were all handed over.

67. 29th September. The CETT representative completed his work on the telemetry system, 96-11. The only outstanding problem left on this system was the printer which was to be re-programmed by maintenance as soon as they had received the data from the vendor.

68. 1st October. Spectra-Tek representatives arrived on site to commission their equipment.

69. 2nd October. Systems 88-03H, trace heating and 88-03B, 380 volt power distribution, were handed over.

70. 3rd October. System 87-20, NEF power supply, was worked on. The maxiprinter was checked by the vendor representative and was returned to the vendor for repair. The maxiprinter fault was found to be of mechanical character. The maxiprinter was replaced with a new modified type and is now functioning.

71. 7th October. System 96-11, telemetry, was handed over.

72. 9th October. System 88-17B, deluge water, retested and was handed over.

8.6 MANHOURS

8.6.1 General

As with all other work on this project, the offshore time consumptions compiled relative to specific systems.

For each system the time consumptions are sub-divided into supervision, Hook-up contractor and others, which include work by vendors, Maint. Dept. and Nowsco.

"Supervision" records the time spent on the system by the Commissioning Co-ordinator and Commissioning System Co-ordinator.

The Hook-up contractors work has been split into disciplines.

"Piping" records the time spent on the system by the contractors pipefitters.

"Instrumentation" records the time spent on the system by the sub-contractors instrument technicians and instrument engineers.

"Electrical" records the time spent on the system by the sub-contractors electrical technicians and electrical engineers.

For the contractor and his sub-contractor, all work was initiated by task sheets. These are also itemised on the time consumption reports by system.

Table 8.5 shows the manhours.

OFFSHORE TIME CONSUMPTION

TABLE 8.5

System/sub-system			Manhours Supv. team	Hook-up contractor	Others (Vendors, Maint. Nowsco)	Total
88-01A	:	Instrument air distribution	44	6	-	50
88-01B	:	Service air distribution	32	12	-	44
88-02	:	Fuel gas system	74	24	-	98
88-03A	:	Cable trays	44	143	-	187
88-03B	:	380V Power distribution	144	498	72	714
88-03C	:	Normal lighting	88	329	6	423
88-03D	:	Emergency lighting	76	271	6	353
88-03E	:	Emergency power	68	97	-	165
88-03F	:	24V DC	44	97	-	141
88-03G	:	Grounding	44	143	-	187
88-03H	:	Trace heating	90	92	-	182
88-04A	:	High pressure relief	38	-	60	98
88-04B	:	Low temp. relief	92	168	-	260
88-05	:	Low pressure relief	44	5	-	49
88-06A	:	Public address and public alarm	56	-	48	104
88-06B	:	Gas detection	146	60	168	374
88-06C	:	Fire detection	146	185	168	499
88-08	:	Hydraulic shut down	140	4	72	216
88-09B	:	Methanol injection to NEF	150	127	48	325
88-10A	:	Open drain	44	-	-	44
88-10B	:	Closed drain	152	76	60	288
88-10C	:	Methanolated water	164	82	48	294
88-11	:	Condensate separation system	482	464	114	1060
88-12A	:	NEF gas treatment line	821	1482	645	2948
88-12B	:	Odin gas treatment line	809	1275	645	2729
88-14A	:	NEF gas supply line	408	420	209	1037
88-14B	:	Odin gas supply line	408	421	209	1038
88-16	:	Glycol circulation network	150	154	48	352
88-17A	:	Fire water	68	-	-	68
88-17B	:	Deluge water	132	297	144	573
88-17C	:	Extinguishing equipment	44	-	-	44
88-18	:	Wash down	68	-	-	68
88-27	:	Corrosion inhibitor equipment	92	-	48	140
88-29	:	Lifting equipment	20	-	-	20
88-33	:	Utility water	68	-	-	68
83-01	:	Air system	24	-	-	24
83-54	:	Methanol.water disp.network	84	21	24	129
96-11	:	Telecommunications, telemetry	140	102	252	494
96-17	:	Electrical	32	-	-	32
87-02	:	Grounding and cable trays	44	-	-	44
87-17	:	Open drainage	20	-	-	20
87-20	:	Power gener.5.5kV/NEF power	264	313	154	731
87-21	:	Power distribution 380 V.	32	24	-	56
87-22	:	Normal and emergency lighting	32	-	-	32
87-26	:	Safety fire and gas detection	32	-	12	44
87-27	:	Safety fire fighting	32	-	12	44
87-28	:	Emergency shutdown	32	-	12	44
87-29	:	HVAC on NEF HV station	318	129	204	651
85-03	:	Electrical system	44	-	-	44
85-12	:	Gas CV1A/B/C to sales header, metering	20	-	-	20
85-14	:	Gas inlet	20	-	-	20
		TOTAL	6660	7521	3488	17669

9 LOGISTICS

9.1 FLOTEL

9.1.1. Contract Award

The flotel contract was awarded to W. Wilhelmsen for the use of "Treasure Supporter".

The initial duration was 4 1/2 months with an option of extension with one month. This option was not used.

9.1.2 Performances

"Treasure Supporter" proved her good stationkeepingability at the Frigg Field, with an efficiency factor close to 97 %.

During the cable laying operations in July 1983, the flotel was moved back and forth from/to TCP-2 in order to allow other marine operations, but to enable personnel transfer by bridge at scheduled periods of time.

"Treasure Supporter" was mobilized on Frigg 31st May, 1983, and demobilization took place on 21st October, 1983 instead of the planned date of 15th October 1983. The delay was due to adverse weather condition. Refer to special log of events given in Appendix 9.

9.1.3 Social Report

The TCP-2 Extension team used the living facilities of Treasure Supporter during the Hook-Up period. A few offices were also occupied.

Some remarks are made herebelow:

- Several recreation rooms were available, but EAN personnel tended to gather in their own office, which was also used as a conference room. The other recreation rooms were crowded, full of smoke and the furniture was of a poor standard.

- Evenings were spent watching television, video, film, reading newspaper, training and table tennis. More and complete games could have been provided. The standard of the library could have been improved, this involving a better choice of both English and Norwegian books.

- A few social evenings were arranged. However, this did not turn out to be a success. People's attitude was to have something organized, but nobody contributed with entertainment and participation was very low.

Otherwise other facilities such as; dining, food, cabins, cleaning were of good standard.

9.2 MARINE SERVICES

9.2.1 Supply Boats

To satisfy TCP-2 Extension needs, the number of supply boats departure to Frigg was increased from 2 to 3 every week.

9.2.2 Tugs

When needed, tugs were directly chartered on spot on the following occassions:

- flotel mobilization
- flotel disconnection while laying electrical cable from NEF
- flotel demobilization

9.2.3 Stand By Vessel

Because of the number of persons working on TCP-2 during the hook-up period, an additional stand by boat was chartered.

Stand By Master was on Frigg from 1st July to 14th October 1984.

9.3 HELICOPTER TRANSPORTATION

Number of flights for TCP-2 Extension was on an average of 5 pr week, i.e.:

Haugesund de Groot average	75 persons
EAN	25 persons
W. Wilhelmsen	45 persons

to be transported every 2 weeks during 20 weeks.

Thanks to early contacts being established between the Project and the Logistics Section within EAN, all transport aspects (schedule, booking, percent of seats used) were satisfactory.

Sikorsky 61 and Super Puma machines were regularly flown to Frigg, with some additional flights of Boeing Chinook on exceptional circumstances (after fog, demobilization).

APPPENDICES

APPENDIX 1

APPENDIX 1

TCP-2 EXTENSION

INTERNAL PROCEDURE FOR DESIGN REVIEW

---ooOoo---

INTRODUCTION

All activity within TCP-2 Extension is to be performed in close relationship and coordination with the normal E.A.N. organization.

During the various project phases the TCP-2 Extension Team should consult operational departments for the various systems and the separate North East Frigg and ODIN project organizations.

(See enclosed list of Operational Supervisors - Attachment I).

In addition all activity is to be performed according to existing, relevant procedures in force within E.A.N. normal organization.

RESPONSIBILITIES

It will be the responsibility of the Project Engineer and the Specialist Engineer to check and confirm that the work performed by any engineering contractor is according with specifications and the official regulation(s).

The responsible engineers are:

00 - General	B. Paruit
16 - Instrumentation	T. Høines
20 - Structural	P. Solhaug
21 - Piping	P. Solhaug
23 - Electrical	V. Sømme
26 - Mechanical	R. Jeffs
30 - Process	B. Paruit

The Project Engineer and Specialist Engineer will at all times have access to the expertise and knowledge which are available in the Company and it will be their responsibility to obtain approval from Operational Supervisor when required.

If potential problems are foreseen or occur and if adequate assistance not is available within the company, the Project Engineer and Specialist Engineer will require external assistance from relevant Institution/Consultants.

A provisional list which constitute a minimum of topics to be reviewed by external consultants is established in Attachment list No. 2.

It will be the Quality Assurance/Quality Control function within the project to verify that established procedures are followed and that the design's not is in conflict with the minimum requirements laid down in the relevant Norwegian regulations and to report to the management through the Insp. Dpt in case of disagreements with the project team.

DESIGN REVIEW PROCEDURE

Engineering documents (drawings, calculations etc...) will be received and registered by the secretary.

The Specialist Engineers or the Project Engineer will identify the filing key.

The document review shall follow the principle routing as shown in Attachment No. 3.

R-Responsible Line

Both Project Engineer and Specialist Engineer will receive one copy of the document to be approved.

Project Engineer or Specialist Engineer will initiate his copy in the loop system and ensure that other specialist within the project (in case of interdiscipline document), or operational responsible are on the loop, in the correct sequence, if required.

To ensure that this procedure is followed a special "front page", indicating the loop is to be filled in by Project Engineer or Specialist Engineer and submitted with the document. (See Attachment No. 4).

On this "front page" the Specialist Engineer(s) and the operational responsible supervisor (if required) will have to give their comments, and/or their approval. If external assistance is used this will be indicated on the front page.

Based upon the comments given during the review, the responsible engineer shall prepare the answer to the engineering contractor and sign the transmittal letter (Attachment No. 5) and the circulation "front page" in the Approval/Comment column.

The Project Engineer shall afterwards sign the same "front page".

When the document has obtained the final approval and signed both by Project Engineer and Specialist Engineer, a copy of the "front page" will be forwarded to QA/QC, who will verify that the procedure is followed/or initiate adequate action if not.

The transmittal letter will be signed by the Project Manager, and registered by the secretary before transmittal.

I-Information Line

Project Manager, Construction Project Engineer and Quality Assurance/Certification Project Engineer will receive a copy of document for approval either directly or on a special loop.

If there are comments, they shall be reported to the Project Engineer or the Specialist Engineer directly.

TP1 - TCP2 PLATFORMS

OPERATIONAL SUPERVISORS

PRODUCTION	MAINTENANCE	SAFETY	ADMINISTRATION	O.C.D.
Gas system	Utility water	Fire and gas detection	Offices	Primary structures
Metering-calibration	Washdown water	Fire water	Warehouses	Risers
Glycol system	Diesel oil	Mobile firefighting equipment	Mooring devices	Sea lines
Fuel gas system			Sewage Treater	Underwater cables
Condensate syst.	Heating, ventilation, and pressurization	Fixed firefighting equipment		Syminex system
Mud system		P.A. system/alarm syst.		Elevator in legs
Water circulation pumps	Electrical generation and distribution	Emergency Lighting		Dewatering system
Process instrument		Life boats, liferafts		
ESD system	Batteries and chargers	Navigation aids		
Hydraulic system*	Main lighting			
HP flare - HP relief	Telemetry			
LP vent	Secondary structures (walkways, ladders..)			
Drain system	Workshops			
Corrosion inhibitor in 32"				
Methanol system				
Compressed air*				

* First degree maintenance carried out by maintenance

ATTACHMENT 1

ATTACHMENT NO. 2

EXTERNAL ASSISTANCE FOR DESIGN REVIEW:

Discipline 021 Structural

	- Support Frame (load, stresses etc)	KE
312 1227	- Structure Design Final Report	DnV/EAN
313 1232	- Struc. Lift Final Study & Inot Procedure	"
314 1306	- M50-P53 Load out Procedure	"
315 1229	- Struc. Transportation & Fastening	"

Discipline 026 Mechanical

	- Design Review of all Pressure Vessels	DnV/E.A.N

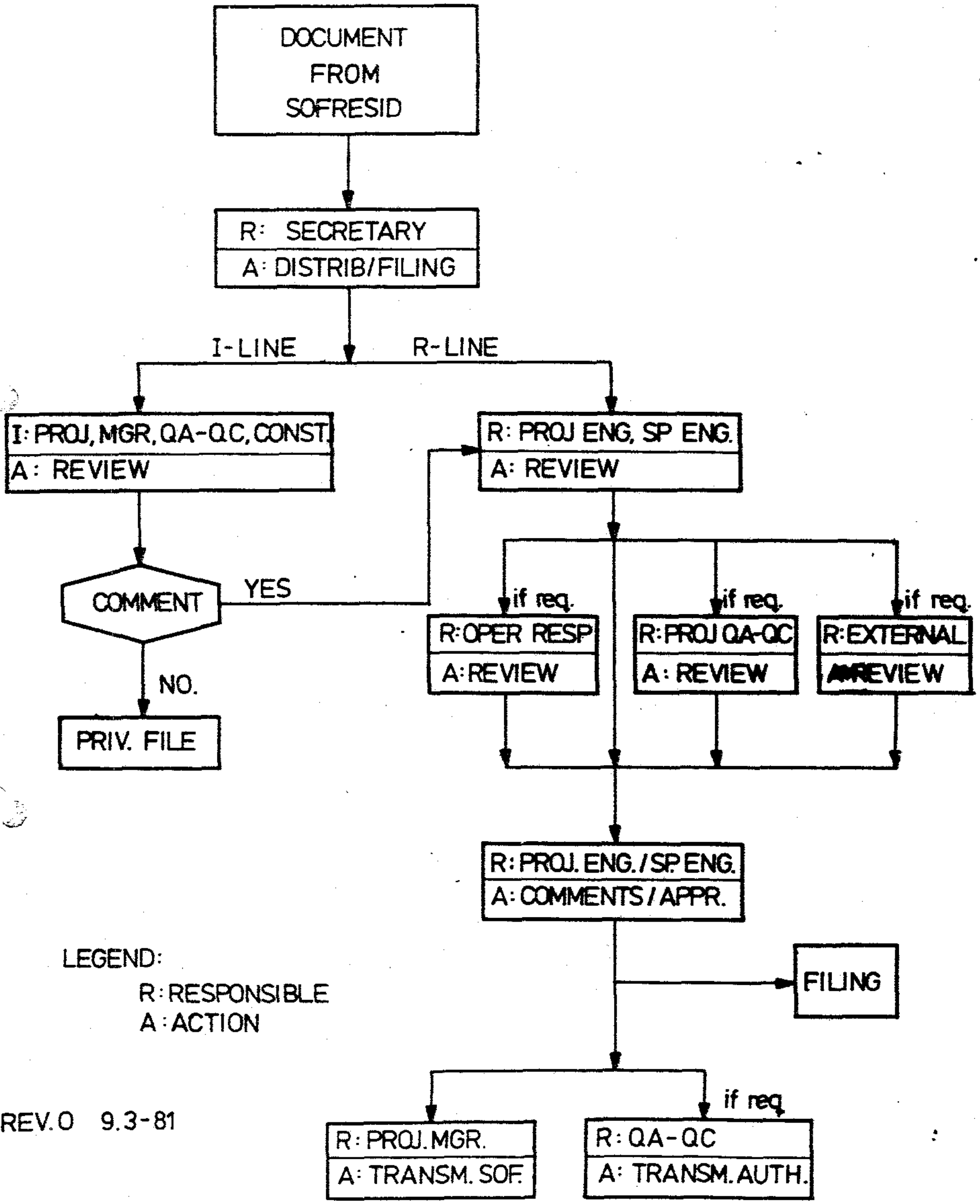
Discipline 030 Process

109 636	- Gas Relief System	DnV/EAN
114 672	- SAFE Charts /SAT´s	"

If we deem necessary this list will be extended during the course of the project.

REVIEW PROCEDURE FOR ENGINEERING DOCUMENTS RECIEVED FROM SOFRESID

ATTACHMENT 3



LEGEND:
R: RESPONSIBLE
A: ACTION

REV.0 9.3-81

ATTACHMENT NO. 4

TCP-2 EXTENSION DOCUMENT REVIEW

SUBJECT:

SOFRESID REF:

TCP-2 EXT. / SOFRESID

Received: ....

File: Chrono ....

Techn. / Adm. ....

RESPONSIBLE:	DC	L	Due	Comments
B. Paruit				
P. Gaches				
P. Solhaug				
T. Höines				
V. Sömme				
INFORMATION:				
M. Haug				
L. Krefting				
C. Tremon				

Return to:

FOR REVIEW	DATE	COMMENTS
B. Paruit		
P. Solhaug		
T. Höines		
V. Sömme		
P. Gaches		
Oper. Resp.		
QA - QC		

APPROVALS / COMMENTS

PROJ. ENG.: DATE:	SP. ENG.: DATE:	SP. ENG.: DATE:

elf aquitaine norge a/s

ATTACHMENT 5

SOFRESID NORGE A/S
P.O.Box 138

4001 STAVANGER

Att: Proj. Mgr. J.E. Lauritzsen

Your date:	Your ref.:	Our ref.:	Our date:
	LEC	311E-TCP2 EXT 81/ / /ej LCE	. .81

SUBJECT : TCP-2 EXTENSION DESIGN REVIEW

DISCIPLINE :

DESCRIPTION :

ACTIVITY :

FILE :

Please find herewith our : ( ) COMMENTS ( ) APPROVAL

Enclosure(s):

M.Haug
TCP-2 Extension Dpt. Mgr.

APPENDIX 2

APPENDIX 2

TCP-2 EXTENSION

INTERNAL PROCEDURE

PROCUREMENT FOLLOW UP

---ooOoo---

RESPONSIBILITIES DURING THE PROCUREMENT PHASE

Definition of Tasks

The procurement phase from purchase order signature until delivery of the material can be split into the following phases:

- Engineering (Drawings, calculations, equipment data, welding procedures, test procedures etc.)
- Fabrication
- Tests
- Transportation

The purpose of this note is to define the responsibilities, and the executors of the different tasks.

Executors and Responsibilities

AH/LT shall be responsible for the procurement phase from and including P.O. sign. until delivery on yard.

Appendix No. 1 defines the responsibilities and the procedures to be followed during the "Engineering Phase".

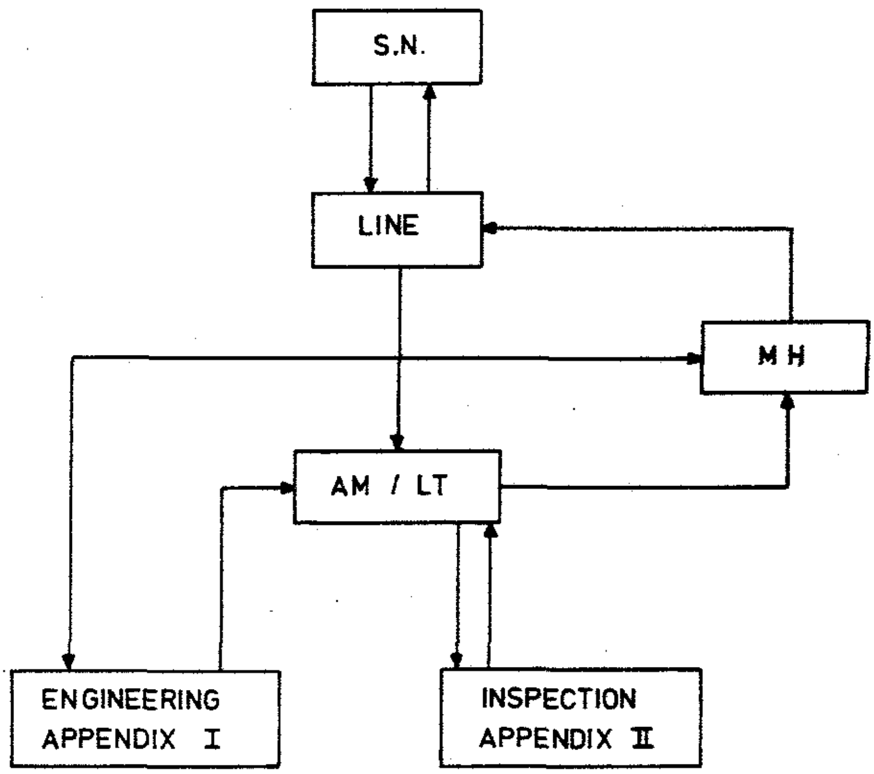
Appendix No. 2 defines the responsibilities and the procedures to be followed during "Fabrication and Test Periods" (called inspections).

The responsabilities/executors can be summarized as follows:

		Executor	Responsible
Engineering	I————I	Sp.eng.	AH/LT
Fabrication	I——————I	Inspectors	AH/LT
Tests	I————I	Inspectors	AH/LT
Transport	I——I	AH/LT	AH/LT
Inspection	I————————I	AH/LT	AH/LT
Expediting	I————————I	AH/LT	AH/LT

The principle lines of communication during the procurement phase is shown on the schematic: "Principle routing of documents during the Procurement Phase".

PRINCIPLE ROUTING OF DOCUMENTS DURING THE PROCUREMENT PHASE.



1. PURCHASE ORDER

Until the yard construction starts, the signed Purchase Orders shall be distributed by Line as follows:

(Original	- Vendor)
(Copy 1	- Vendor (acknowledgement of order))
Copy 2	- Receiving yard (contractor copy, AH/LT)
Copy 3	- Cost Control, KM/KG
Copy 4	- File, KE
Copy 5	- Originator (Responsible engineer)
Copy 6	- EAN rep. at yard (Materials coordinator, AH/LT)
(Copy 7	- Expediting (Sofresid))
2EA photoc.	- KM/AH/LT

Order for confirmation to be distributed as follows:

Copy 1	- AH/LT
Copy 2	- Technically responsible
Copy 3	- File, KE
Copy 4/5	- Spares

2. DESIGN REVIEW OF PROCUREMENT DOCUMENTS

Procurement documents are defined as tlx related to a P.O. and other Vendor documents.

Line registers and prepares cover page with distribution as follows:

R-Line

- The following persons shall perform the review, fill out the filing key, and prepare the answer to S.N. In case of multidiscipline matters, the loop and the due dates shall be established by B.P.

16 - Instrument	TH
20 - Piping	PS
21 - Structural	PS
23 - Electrical	VS
26 - Mechanical	RJ

- In case of 20, 21, 26, FD shall always be on the R-loop and have a direct copy.

I-Line

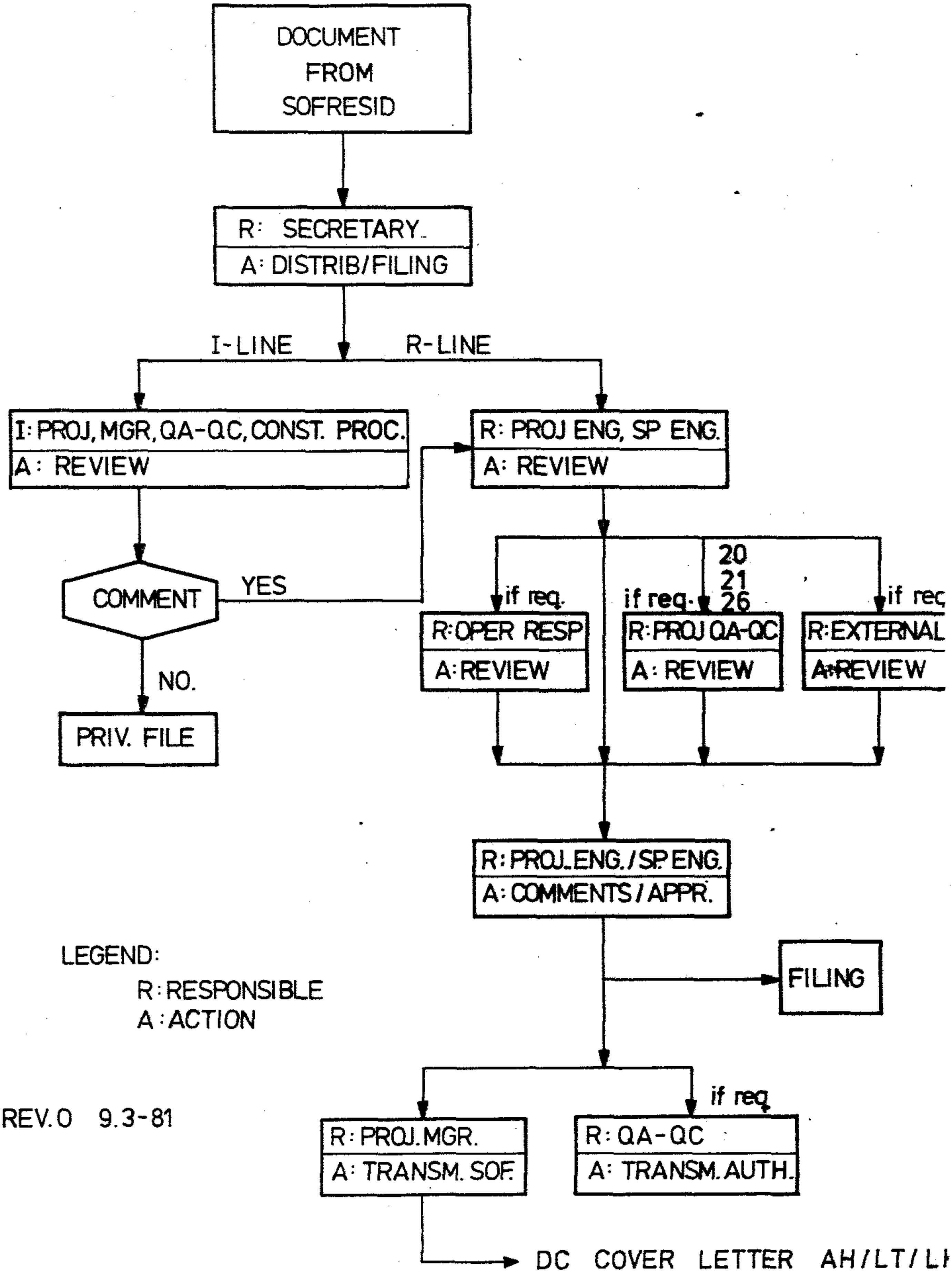
- AH/LT shall receive one DC for all disciplines
- MH, LK, CT shall be on I-loop.

1. All the copies shall be distributed with the distribution/loop/due dates/ filing key/filled out.
2. After design review according to the procedure, the respective engineer shall prepare the answer to S.N.

   The circulation cover letter shall be signed by those who have reviewed the document, and shall in addition be signed under "Approvad for Transmittal" by the resp. engineer, AH/LT and BP.

   The transmittal letter shal be signed by the responsible eng. and MH.
3. KE/LJ shall distribute as follows:
   - AH/LT, LK copy of the filled out cover page for doc. review and the answer to S.N.

REVIEW PROCEDURE FOR ENGINEERING DOCUMENTS RECEIVED FROM SOFRESID.



LEGEND:

R: RESPONSIBLE
A: ACTION

REV. 0 9.3-81

TCP-2 EXTENSION DOCUMENT REVIEW

SUBJECT:

SOFRESID REF:

TCP-2 EXT. / SOFRESID

Received: . . . .
File: Chrono . . . .
Techn. / Adm. . . . .

RESPONSIBLE:	DC	L	Due	Comments
B.Paruit				
P.Gaches				
P.Solhaug				
T.Höines				
V.Sömme				
R.Jeffs				
F.Duesso				
INFORMATION:				
M.Haug				
L.Krefting				
AH / LT				
C.Tremon				
K.E. File				

Return to:

FOR REVIEW	DATE	COMMENTS
B.Paruit		
P.Solhaug		
T.Höines		
V. Sömme		
P. Gaches		
R.Jeffs		
Oper. Resp.		
QA / QC		
AH / LT		

APPROVALS FOR TRANSMITTAL:

PROJ. ENG.:	PROCUREMENT:	SP. ENG.:
DATE:	DATE:	DATE:

APPENDIX NO. 2

INSPECTIONS

Depending upon the nature of the inspection and the availability of the personnel, AH/LT shall selext the inspector among the following personnel:

16 - TH/BN/BD/LT
20 - PS/FD/DE/AH/Skaret[x]/Pedersen[x]
21 - PS/FD/AH/Skaret/Pedersen
23 - VS/Løland/LT/Ormøy[x]
26 - RJ/FD/Skaret/Pedersen

Upon receiption of S.N. Monthly Inspection Programme, AH/LT shall establish a provisional programme for own inspectors.

Upon receiption of S.N. Weekly Inspection Programme, AH/LT shall establish the final programme for the next week.

The inspector shall write an inspection report after each inspection.

AH/LT shall be responsible for the filing of documents related to inspection.

[x] To be confirmed.

TCP-2 EXTENSION

INTERNAL PROCEDURE

TENDER DOCUMENT REVIEW

---ooOoo---

1. DEFINITION

The tender period includes the activities from the issue of the Call for Tender, CFT, up to the approval of the material requisition (internal commitment).

2. ACTIVITIES AND RESPONSIBILITIES

The activities and the responsibilities are defined in APPENDIX I.

The review of the CFT and Bid Evaluations shall follow the loop as defined in the Design Review Procedure, but AH/LT shall have a direct copy and shall be on the R-line loop as indicated on Appendix II.

AH/LT shall be responsible for the follow up of all tenders for all disciplines as indicated in Attachment III.

This shall be updated on a weekly basis.

PROCEDURE FOR TENDER DOCUMENT REVIEW

TCP-2 EXTENSION

APPENDIX I

LEGEND :
E: ENGINEER C: COST Y: YARD
P: PROCUREMENT S: SECRETARY

ACTIVITY	RESP.	ACTIONS	COMMENTS
CFT	E	INITIATE LOOP (FILING, DCP)	P: AGREE BIDDER
		PREPARE ANSWER TO S.N	Y: CHECK DELIVER TIME
	S	CIRC. LETTER S.N TO E, P	
	P	ESTABLISH „TENDER STATUS"	
TENDER PERIOD	S	DC ALL CORRESP. TO E, P	NO DIRECT CONTAC WITH VENDORS
	E	RESP. FOR ALL TECHN. MATTERS (FILING, OPER. RESP. ARRANG PREP. MEETING PRIOR. TO S.N AND VENDORS)	COMMENTS TO S.N COPY TO P.
	P	RESP. PO CONDITIONS	
BID EVALUATION	E	INITIATE LOOP (DCP, FILING) OVERALL RESP.	
		PREP. ANSWER TO S.N	S.N PREP. REQ.
	P	FOLLOW UP „TENDER STATUS" EVALUATE TERMS	
	S	COPY S.N LETTER TO P.E	
MPE	C	FILL OUT FORMS (FILE)	
COMMITMENT	C	PROVIDE RELEVANT SIGN. REQ.	BUDGET, FORMS, EV
	P	ANSWER TO S.N FOR P.O ISSUE	
P.O.	P	ISSUE P.O. RESPONSIBLE FOR ALL COORDINATION AFTER P.O. CORRESP., MEETINGS, INSPECTIONS, Etc. FOLLOW UP „P.O"	FILING KEY

APPENDIX II

TCP-2 EXTENSION DOCUMENT REVIEW

Tender Document Review

SUBJECT:

SOFRESID REF:

TCP-2 EXT. / SOFRESID

Received: . . . .

File: Chrono . . . .

Techn. / Adm. . . . .

RESPONSIBLE:	DC	L	Due	Comments
B.Paruit				
P.Gaches				
P.Solhaug				
T. Höines				
V.Sömme				
R. Jeffs				
AH/LT	X			
INFORMATION :				
M. Haug				
L.Krefting				
C. Tremon				
K.E. File				

Return to :

FOR REVIEW	DATE	COMMENTS
B.Paruit		
P.Solhaug		
T.Höines		
V. Sömme		
P. Gaches		
R.Jeffs		
Oper. Resp.		
QA / QC		
AH / LT		

APPROVALS:

PROJ. ENG.: DATE:	SP. ENG.: DATE:	SP. ENG.: DATE:

ELF AQUITAINE NORGE A/S
TCP 2 EXTENSION

TENDER STATUS

ATTACHMENT III

EQUIPMENT – MATERIAL STATUS.

	Release for Purchase
Schedule :	
Actual :	

Issue No. : 1
Date : 091081
Page 1 of 5

CALL FOR TENDER	P.O. No.	EQUIPMENT / MATERIAL DESCRIPTION	CFT RECEIVED	CFT RETURNED W/COMMENTS DISCUSSED	ORIGINAL CFT APPROVED BY TCP 2 EXT.	CFT SENT OUT	SOFN. OBTAIN QUOTE & PREP. COMM. BID.	TCP 2 EXT. RECEIVE BID EVALUATION PROPOSE VENDOR	DUE DATE FOR OFFER	PURCH. ORDER PLACED	DELIVERY-TIME EX WORK	VENDORS ORDER CONFIRMATION	SCHEDULED DELIVERY-TIME SITE	REQUIRED DELIVERY-TIME SITE	VENDOR	RESPONS.	REMARKS
16000100	FO 1-16 0007-00	METERING RUN	030681	040681	060681	060681	020781	170781		72X2909	WEEK 20 1982		WEEK 23 1982		HELTA & HANSEN		
16000200		CONTROL VALVES	170681	190681	250681	240681	170881	080981	180981								
16000300		ESD VALVES	170681	190681	250681	240681	270881	090981	101081								
16000400		MASONEILAN CHOKE VALVE MODIFICATION				220681											AWAITING ANSWER FROM MASONEILAN
16000600		PRESS TRANSMITTER TEMP SENSOR THERMOWELL	220781	YES	YES	YES	YES										
16000[illegible]00		ELECTRONIC DENSITY TRANSDUCER															CFT NOT ACCEPTED BY EAN
16000700		TRANSMITTERS CONTROLLERS SELECTOR RELAY LOAD STATION	220781		240781	YES	021081										
16000800		WILLIS CHOKE VALVE	071081				021081										

APPENDIX 3

elf aquitaine norge a/s

APPENDIX 3

elf	Subject: AUDIT EVALUATION OF PIPING PREFABRICATION	Date: 17.12.1982
	Action: L. Krefting	From: F. Duesso
IM	Info. : MH, [redacted]	Ref. No.: 311E TCP2 Ext. 82/2231/FD/ket

Wednesday 17. November audit evaluation was done at Ponticelli, Port Jerome, for the piping prefabrication. The team for this audit consisted of Mr. Duesso, quality control engineer and Mr. Vatne, piping specialist, both from the TCP-2 Extension Project.

During this audit we met Mr. Rønning, EAN representative on this Yard, and Mr. Guibert, Yard manager on behalf of Ponticelli.

We started with an introduction meeting where some questions were asked to Ponticelli representative and Mr. Rønning covering the quality system. Some documents were looked at, to be sure that the quality assurance was done according to the QA/QC Manual.

Principal points summarized below:

- Control of preheat : Temper stick used, handled by every welder.
- Welding procedures : We found copies of these. Orifinals are probably in Bordeaux. All these welding procedures are qualified and the welding qualification records have already been checked by the undersigned.
- Welders qualification records:

  OK

  One welder had been taken out of this fabrication because of bad weld visually examined.
- Status of the welds performance at week 45:

  Maximum repair 3,61%
  1191 radios have been done, followed by 43 repairs. The worst performance is 7,9% weld repairs for one welder, but it is acceptable.
- Stress relieved reports were found according to the isometric references.
- NDT procedures were found according to the Quality Assurance Manual.

- The dimensional check will be performed after the hydrotest for the tie-in lines, and the as built dimensions will be marked on the fabrication drawings.

  For the module M50 and pancake P53 the as built dimensional check will be performed after assembly on the Yard in Bordeaux, prior to the pressure test, and also for these pipes the as built dimensions will be marked on the fabrication drawings.

- Painting reports concern only one coat (primer coat).

- The traceability of the material is on the isos.

- QA Manual is available, at the TCP-2 Extension Team and Ponticelli offices at Port Jerome.

To complete the audit evaluation, we decided to choice spool piece in order to check fabrication system and the Quality control.

Iso C2000 EFS 20" was chosen and the control was performed to the audit check list enclosed.

We looked at the weld no. 6: (MMAW + SAW processes)

Welding

1st process MMAW has been welded by welder P_2 Mr. BOU DE ROUAY.
Welder perfomance certificate 82/166 qualified at 6. April 1982.
Range of qualification 1,6 mm to 44mm.Ø3" and above.
Certificate 80/934 - qualified until November 5, 1982.

The welding procedure specifications used is WPS 20P qualified by PQR AO/MA + aut/50 which it is on the welding book.

NDT

- Radiograph has been done October 6, 1982. Report page 80 on the gamma ray book. 6 pictures have been taken and found acceptable according to the specifications.

- Ultrasonic examination done after stress relieved, report page 14 in the US book.

Heat treatment

Stress relieved has been done September 21, 1982 during 2 hours at 600°C. The chart of that is on the documentations.

Materials

A reference number is shown on the isometric drawing for each piece of material, referring to the material certificate with the actual heat number.

After this evaluation we made a visit on the workshop (welding, painting, storage, gamma room). We found everything very well and tidy. We witnessed some welding operations and the job was done according to the specifications:

- Welders were qualified
- Preheat was controlled
- Electrodes were handled as described in QA/QC Manual
- Parameters according to WPS

We looked at films in the inspection room, concerning the 18" pipe. The quality of these films was very good.

Conclusion of audit:

After this QA/QC section and the piping specialist of TCP-2 solution conclude that quality system at the Port Jerome Yard is working satisfactory according to the Quality Assurance Manual and the specifications valid for the project.

Å. Vatne

F. Duesso

		Ref. No.:
elf	PIPING CHECK LIST QA/QC SYSTEM AUDIT NO. 1	Date effective: Revision No. : Date revised : Page :

Isometric drawings no.: FF 88 20 14 2000

Spool no.: - Piping class: EFS

Items to be checked	Comments or approval
1. Quality of workmanship	approved
2. Handling of elektrodes	*
3. Control of preheat	*
4. Welding procedure used	approved
5. Traceability of welder	approved
6. Welders qualification	approved
7. NDT-reports	approved
8. Stress receiving reports	approved
9. Dimensional check reports (Ref. QAP procedure S502-page 3.sec.7)	not performed, see report
10.Painting reports (Ref. QAP Procedure S510)	primer coat only, further painting in Bordeaux
11.Traceability of materials	approved
12.Material certificates	approved
13.Pipe support	only dubbling plate welded to spool, approved
14.Hydrotest	not performed yet
15.Availibility of QA-Manual - TCP-2 Extension - Ponticelli (Controlled and latest rev.)	yes

* As the spool was finished these items was not checked for this pipe, but spot checks on similar work carried out in the workshop showed no unconformity with given procedures.

100 Randaberg Trykk A.s

APPENDIX 4

APPENDIX 4

DET NORSKE VERITAS
NORWAY

ADDRESS:	VERITASVEIEN 1, HØVIK
POSTAL ADDRESS:	P.O. Box 300, N-1322 HØVIK, OSLO, NORWAY
TELEPHONE:	(02) 12 99 00/12 99 55
CABLE ADDRESS:	VERITAS, OSLO
TELEX:	76192 VERIT N
FACSIMILE:	(02) 12 98 71
BANKERS:	DEN NORSKE CREDITBANK ACCOUNT NO. 7131.05.05700 FELLESBANKEN A/S, OSLO ACCOUNT NO. 8200.01.33554

Elf Aquitaine Norge A/S
TCP-2 Extention Project
P.O. Box 168

4001 STAVANGER

Att: Lars Krefting

YOUR REF.	OUR REF.	DATE
	IOD/89/DMol/KØ/83/107	8 April 1983

AUDIT-REPORT FROM AUDIT OF PONTICELLI FRÈRES
23 - 25 MARCH 1983

Enclosed, please find the abovementioned Audit Report.

Yours faithfully
for DET NORSKE VERITAS

Ø. Kjus
Principal Surveyor

D. Molvig

Enclosure

Det norske Veritas
Industrial and Offshore Division

POSTAL ADDRESS: P.O.BOX 300, 1322 HØVIK, NORWAY TELEPHONE: +47(02) 12 99 55
CABLE ADDRESS: VERITAS, OSLO TELEX: 76 192 VERIT N

TECHNICAL REPORT

Date	5 April 1983
VERITAS Report No.	
Subject Group	
Department	
Project No.	82 20 18
Title of Report	AUDIT OF PONTICELLI FRÉRES BORDEAUX 23-25 March 1983
Approved by	[signature]
Client/Sponsor of project	ELF TCP-2 Extention
Client/Sponsor ref.	L. Krefting/Elf TCP-2 Ext.
Work carried out by	D. Molvig O. Møller
Reporters sign.	[signature]

INDEX

1. PREFACE

The audit described in this report was instituted and supported by Elf TCP-2 Ext. project management.

The audit was carried out during the period 23/3 - 25/3-83.

The main basis for the audit was the Quality Assurance Program of Ponticelli fréres and the Quality Assurance Manual of Elf TCP-2 Ext. project.

All details on planning, execution and results are given in section 2-7.

It should be noted that the collected documentary evidences of the reported findings are not a part of this report, but are kept in the possession of the audit team leader.

2. THE AUDIT PLAN

2.1 Introduction

The audit plan described in this chapter was worked out in close cooperation with Elf TCP 2 Ext. Quality Assurance Manager and was agreed upon before the audit start up.

2.2 Objectives

The main objectives of this scheduled audit was to:

- Provide objective evidence to what extent the prescribed procedural requirements were adhere to

- Evaluate the adequacy of the prescribed procedural requirements

- Reveal the Ponticelli's personnel experiences on significant areas.

NOTE:

This audit was introduced at such a late stage in the fabrication phase that the audit results in a very little extent can be used to initiate corrective actions. However, the results can be used as experience to improve projects in the future.

3. AUDIT PLANNING

3.1 Selection of activities and areas

Due to the budgeted hours available, the planned activities were restricted to cover the areas shown in appendix A. Special attention was also paid to the non conformances found during the audit in December 1982.

3.2 Selection of the audit-team

The audit team consisted of:

Dag Molvig,	DnV
Odd Møller,	DnV
Lars Krefting	Elf TCP-2 Extention

3.3 Preparation of Questionnaries

The questions that were asked during the audit are to be classified in 2 groups:

Group 1. Informal questions

These are questions of general natur and do not necessarily refer to any particular written requirements.

These questions will allow the auditeé to present their personal opinion.

Group 2. Verification questions

These questions shall reveal the adherence to prescribed project requirements. Such questions will be referred to appropriate paragraphs, sections, procedures etc. in the Quality Assurance Programme (Manual).

The planned questions are presented in the checklists appendix B.

3.4 Pre and Post Audit Meetings

Pre and post audit meeting were held. The participants were:

Mr. Simonetti	Ponticelli fréres
Mr. Boussault	Ponticelli fréres
Mr. Pillet	Ponticelli fréres
Mr. Langvik	Elf Site Team
Mr. Paisley	Elf Site Team
Mr. Krefting	Elf Stavanger
Mr. Møller	Det norske Veritas
Mr. Molvig	Det norske Veritas

4. THE EXECUTION

The audit was executed in close compliance with the audit plan and check lists. However, too much time was lost because of meetings internally at Ponticelli and meeting rooms that were not prepared in right time.

5. FINDINGS

The following non-conformances from the dec. 82 audit were checked:

5.1 Procedure S531: Worked out and implemented

5.2 Procedure S546: Worked out and implemented

5.3 Destruction of old and obsolite drawings:
New instructions are given to the persons that are in possession of drawings. All obsolite and old drawings are to be marked with a cross.
This instruction is implemented.

5.4 Drawing 2025 rev. 5: OK

5.5 Shop drawing M 5025 rev. H: This findings is checked by Ponticelli. Audit-team has not re-checked because of the location of the drawing (Ambées).

5.6 Non-conformance reports: From dec. audit only no. 6 and no. 12 are outstanding.

5.7 Completion file: A lot of work regarding the completion file is outstanding. The completion file must be updated within 14 days after "tow out".

5.8 Audit System: An audit system was not described or implemented by Ponticelli. This should have been done according to the contract.

However, some unofficial audits have been performed by the Quality Assurance Manager. These audits were not documented.

In addition to the abovementioned, some additional findings were observed.

5.9 Procedure S 530: Outstanding

5.10 Non-conformance reports: In addition to the reports mentioned above (6) there were 28 non-conformance reports outstanding. 2 of these reports were outstanding because the work was not completed. The other 26 were waiting for final decision.

5.11 Completion file: A little progress was made regarding the completion file. Ponticelli's representatives promissed to complete this work in due time.

5.12 Audit system: It is not Ponticelli's intention to implement a documented audit system.

5.13 Procedures: The headings on some procedures were not filled in with date, page no, revision no. etc.

6. CONCLUSION

If the abovementioned findings were corrected, the system for Quality Assurance at Ponticelli fréres would be in accordance with quality standards.

However, the items nonconformity, corrective action and quality audits are some of the most vitale activities within a quality assurance system and must be implemented before the system can be accepted.

7. APPENDICES

Appendix A Audit lists

Appendix B NDT report w/checklists

AUDIT OF THE NDT PERFORMANCE AT
PONTICELLI FRÈRES BORDEAUX
23-25 March 1983

1. Scope

The scope of the audit was to check the practical performance and reporting of NDT that were performed during the fabrication phase at Ponticelli.

2. Findings

The findings during the NDT Audit are given in the attached checklist. Below we will give a short summary of the NDT general performance.

2.1 Procedures

The NDT procedures S 501 and S 507 are approved by Elf TCP-2 Ext. and upon request, said to be approved by NDP. To some extent, additional technical information should have been included in procedure S 504 and S 503.

2.2 Personnel

The audit proves that qualified personnel have been used.

2.3 Materials

The traceability from the NDT reports to the materials is acceptable.

2.4 Equipment

Acceptable equipment is used during the performance of the NDT.

2.5 Inspection routines and practical performance. (See also 2.7)
The inspection routines and the practical performance of NDT are in accordance with approved procedures.

2.6 Reporting

The information concerning materials and location of welds, drawings etc. are acceptable, but the technical information about the NDT carried out is missing. Other forms than those described in the procedures S 503 and S 504 have to some extent been used for reporting.

2.6.1 Random test of Radiographic inspection report. Ref. report dated 10.09.82 page 34. F.F.D. density and sensitivity information are missing. (Ref. radiographic procedure).

2.6.2 Random test of Ultrasonic report no. B 96. Information about angle used, gain level, calibration range scanning, transfer correction etc. are missing. Together with the form "Welding piece reference" it is possible to get information about the scanning procedure, but mandatory information necessary to reconstruct the control is missing.

2.7 Calibration

To construct the DAC-curve the ASME reference block must be used according to procedure S 504 (page 8 and 9). We will draw your attention to the fact that if this block is constructed to minimum length, it will be impossible to construct the DAC-curve for full skip examination (60° and 70°).

The way of constructing DAC as shown on page 9/9 is a typical example (fig. 4), but is not acceptable for full skip examination. The operators have been aware of this, and have raised the gain during the full skip examination. Unfortunately this is not reported.

3. Conclusion

The NDT has been performed by qualified personnel. Even if the reporting of the examination is not detailed enough to reconstruct the performed control, we are of the opinion that the quality of the NDT performance is acceptable.

DET NORSKE VERITAS

AUDIT CHECKLIST

Audit No/Date	22-25/3-83
Page	1 of 3
Client	ELF NORGE
Project	822018

Location/Organizational unit

Subject/Element: NDT GENERAL

Reg. No.

No.	Checkpoint description	Document references: External	Document references: Internal	Evaluation: Yes	No	Comments*	Not applic	Not checked
1.	<u>PROCEDURES</u>							
1.1	Are the NDT procedures approved by VERITAS?						X	
1.2	Are the NDT procedures approved by client/purchaser?			X				
1.3	Are the NDT procedures approved by certifying authority? * Confirmed by Krefting.			X		*		
1.4	Is NDT carried out according to latest revision of these procedures?	Rev. 1		X				
2.	<u>PERSONNEL</u>							
2.1	Are the operators/inspectors qualified according to valid certification scheme?			X				
2.2	Is this scheme approved/accepted by all parts involved?			X				
2.3	Have any additional qualification tests been carried out?				X			
2.4	Are the operators' certificates available?			X				
3.	<u>MATERIALS</u>							
3.1	Is the base material as prescribed?			X				
3.2	Is the preparation of bevels and welds as prescribed?			X				
3.3	Will the NDT personnel be informed in case of change in working procedures?							X

*Finding Observation to be described in the audit report

Diskette reference	Date/Sign. of auditor
IOD/99-D6	25/3-83 [signature]

DET NORSKE VERITAS	AUDIT CHECKLIST	Audit No/Date: 22-25/3-83	Page 2 of 3
		Client: ELF NORGE	
		Project: 822018	

Location/Organizational unit:

Subject/Element: NDT GENERAL

Reg. No.:

No.	Checkpoint description	Document references: External	Document references: Internal	Yes	No	Comments*	Not applic.	Not checked
3.4	Is all necessary information regarding weld configuration, materials etc. available for NDT inspectors?			X				
3.5	If the base material or prefabricated details have been inspected before, will information about this be known to the operators?							X
3.6	Will the base material be checked for correct thickness?			X				
4.	EQUIPMENT							
4.1	Is the NDT equipment in use as described in the procedures?			X				
4.2	Is the NDT equipment maintained as required?			X				
4.3	Is the maintenance documented?			X				
4.4	Is all the equipment as described in the procedure available at site? (SAID TO BE)			X				X
5.	INSPECTION ROUTINES AND PLANNING							
5.1	Are the operators provided with sufficient information from the QA/QC department?							X
5.2	Is a unambiguous weld identification system available?			X				
5.3	Will each weld be marked before testing? * THEY ARE MARKED ON DRAWINGS - NOT ON SPOT			X		*		
5.4	Is the time span between welding and testing kept in practice?			X				

*Finding/Observation to be described in the audit report

Diskette reference	Date/Sign. of auditor
IOD/99-D6	25/3-83 [signature]

DET NORSKE VERITAS

AUDIT CHECKLIST

Audit No./Date	Page
22 - 25/3 - 83	2 of. 3
Client: ELF NORGE	
Project: 822018	

Location/Organizational unit:

Subject/Element: NDT GENERAL

Reg. No.:

No.	Checkpoint description	Document references: External	Document references: Internal	Yes	No	Comments*	Not applic.	Not checked
5.5	Has sufficient time been planned for the testing?			X				
5.6	Is 5.5 complied with in practical working conditions?			X				
6.	REPORTING							
6.1	Have the report forms been approved?			X				
6.2	Do the report forms contain all necessary information to code requirements? * See findings				X	*		
6.3	Are the records correctly filled in?				X	*		
6.4	Will it be possible to trace back all repairs carried out?			X				
6.5	Are the reports signed by approved personnel?			X				
6.6	Is the report routine satisfactory?			X				

*Finding/Observation to be described in the audit report

Diskette reference	Date/Sign. of auditor
IOD/99-D6	25/3-83 [signature]

DET NORSKE VERITAS

AUDIT CHECKLIST

Audit No./Date: 22-25/3-83

Page 1 of 3

Client: ELF NORGE

Project: 82 2018

Location/Organizational unit:

Subject/Element: RADIOGRAPHIC EXAMINATION

Reg. No.:

No.	Checkpoint description	Document references: External	Document references: Internal	Evaluation: Yes	No	Comments*	Not applic.	Not checked
1.	PROCEDURES							
1.1	Are the radiographic examination procedures approved?			X				
1.2	Are the procedures approved by certifying authorities? * Confirmed by Krefting.			X		X		
1.3	Is the practical performance in accordance with these procedures?			X				
1.4	Are the procedures known among the inspectors involved?			X				
2.	PERSONNEL							
2.1	Is the personnel's (operators') qualifications sufficient according to the procedure requirements?			X				
2.2	Is a list with names and copies of certificates for the different operators available?			X				
2.3	Has any examination been carried out by personnel not qualified according to specification?				X			
2.4	Is the personnel approved for handling of radioactive materials?							X
3.	EQUIPMENT							
3.1	Is the gamma source container approved for radiation hazards?							X

*Finding/Observation to be described in the audit report

Diskette reference: IOD/99-D6

Date/Sign. of auditor:

DET NORSKE VERITAS

AUDIT CHECKLIST

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Client: ELF NORGE	
Project: 822018	

Location/Organizational unit

Subject/Element: RADIOGRAPHIC EXAMINATION

Reg No.

No.	Checkpoint description	External	Internal	Yes	No	Comments*	Not applic.	Not checked
3.2	Is the X-ray equipment approved by national authority(ies)?							X
3.3	Is necessary safety handling equipment available?							X
3.4	Is all necessary equipment as described in the procedure available?							X
4.	PRACTICAL PERFORMANCE							
4.1	Do the operators follow the procedure requirements by using the right technique and extent of testing?			X				
4.2	Are the time span requirements between welding and inspection met?			X				
4.4	Do the radiographs have the required quality as to film type, density and sensivity?			X				
4.5	Are all radiographs marked adequately and identified by lead letter and figures?			X				
4.6	Is the correct type of parameters (IQI) used?			X				
4.7	Are the radiographs marked for registration of backscattered irradiation?				X			
4.8	Is the film processing procedure strictly adhered to?			X				
4.9	Is the illumination intensity of graph viewers sufficient? * Type: NEGASCOPE			X		*		
4.10	Are all radiographs recorded and stored properly?			X				

*Finding Observation to be described in the audit report

Diskette reference	Date/Sign. of auditor
IOD/99-D6	

Client: ELF NORGE

Project: 822018

Location/Organizational unit:

Subject/Element: RADIOGRAPHIC EXAMINATION

Reg. No.:

No.	Checkpoint description	Document references External	Document references Internal	Yes	No	Comments*	Not applic.	Not checked
5.	REPORTING							
5.1	Have the reports been prepared, reviewed, endorsed, distributed and compiled in accordance with approved procedures?			X				
5.2	Is the recording carried out in such manner than the results of the examination easily can be traced back and reproduced if necessary?				X	*		
	* See findings.							

*Finding Observation to be described in the audit report

Diskette reference: IOD/99-D6

Date/Sign. of auditor: 25/3-83 [signature]

DET NORSKE VERITAS	AUDIT CHECKLIST	Audit No./Date: 22-25/3-83	Page 1 of 4
		Client: ELF NORGE	
		Project: 822018	

Location/Organizational unit

Subject/Element: ULTRASONIC EXAMINATION

Reg. No.

No.	Checkpoint description	Document references External	Document references Internal	Yes	No	Comments*	Not applic	Not checked
1.	PROCEDURES							
1.1	Are the ultrasonic examination procedures approved?			X				
1.2	Are the US-procedures approved by certifying authorities? * Confirmed by Krefting.			X		*		
1.3	Is the practical performance in accordance with these procedures?			X				
1.4	Are the procedures known among the inspectors involved?			X				
2.	PERSONNEL							
2.1	Are the personnel's (operators') qualifications sufficient according to the procedure requirements?			X				
2.2	Has this (2.1) been proved through additional tests?				X			
2.3	Is a list with names and copies of certificates available?			X				
2.4	Has any examination been carried out by personnel not qualified/approved? x Said to be.			X		*		
3.	EQUIPMENT							
3.1	Are the ultrasonic flaw detectors in accordance with code requirements?			X				
3.2	Are ultrasonic flaw detectors other than those mentioned in the procedures used?				X			

*Finding Observation to be described in the audit report

Diskette reference	Date/Sign. of auditor
IOD/99-D6	

DET NORSKE VERITAS	AUDIT CHECKLIST	Audit No./Date: 22-25/3-83	Page 2 of 4
		Client: ELF NORGE	
		Project: 82 2018	

Location/Organizational unit

Subject/Element: ULTRASONIC EXAMINATION

Reg. No.

No.	Checkpoint description	Document references: External	Document references: Internal	Yes	No	Comments*	Not applic.	Not checked
3.3	Is the maintenance with respect to the horizontal and vertical linearity in accordance with procedure requirements?			X				
3.4	Has this (3.3) been documented?			X				
3.5	Are sufficient test/calibration blocks available? * See findings. According to procedure 504 OK, but not OK for full skip examination.			X	X	*		
3.6	Are the test blocks marked for material identification?				X			
3.7	Are the test blocks heat treated?							X
3.8	Is the selection of test probes satisfactory to code requirements?			X				
3.9	Are these probes maintained and calibrated satisfactorily?			X				
3.10	Has beam spread been determinated for a sufficient numbers of probes.							X
3.11	Do the operators have the necessary tools (flaw locator plots, calculators etc.) for flaw evaluation?			X				
4.	PRACTICAL PERFORMANCE							
4.1	Do the operators receive the information needed to familiarise themselves with joint design, welding procedure, type of material etc. before starting the examination?				X			
4.2	Is the required time span between welding and start of examination complied with?			X				

*Finding Observation to be described in the audit report

Diskette reference	Date/Sign. of auditor
IOD/99-D6	

DET NORSKE VERITAS

AUDIT CHECKLIST

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Project	822018

Location/Organizational unit

Subject/Element: ULTRASONIC EXAMINATION

Reg. No.

No.	Checkpoint description	Document references: External	Document references: Internal	Evaluation: Yes	No	Comments*	Not applic	Not checked
4.3	Is the couplant of correct type?			X				
4.4	Is distance and sensivity calibration (DAC) carried out before commencement of examination?			X				
4.5	Is this (4.4) regularly checked?			X				
4.6	Is transfer correction carried out regularly?				X			
4.7	Is the weld properly marked and fit-up checked for root face location?				X			
4.8	Is the joint properly marked for identification? ON DRW. NOT ON SPOT			X		X		
4.9	Is the base material within scanning-area tested with compression waves?			X				
4.10	Are the thickness(es) of the base material checked?			X				
4.11	Is the scanning performed as indicated in the procedure? * THE SCANNING IS NOT INDICATED IN THE PROCEDURE 504.					X		
4.12	Has scanning for transverse defects been performed?			X				
4.13	Has distance calibration been checked to cover the scanning area? (Full skip) * See findings					X		
4.14	Has the flaw evaluation (shape, size, echo response) been carried out according to code/procedure requirements? See findings.					X		
4.15	Is the calibration checked after finished examination of each weld.			X				

*Finding/Observation to be described in the audit report

Diskette reference	Date Sign. of auditor
IOD/99-D6	

DET NORSKE VERITAS

AUDIT CHECKLIST

Audit No /Date	22-25/3-83
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Client	ELF NORGE
Project	82 2018

Location/Organizational unit

Subject/Element: ULTRASONIC EXAMINATION

Reg. No.:

No.	Checkpoint description	Document references: External	Document references: Internal	Yes	No	Comments*	Not applic.	Not checked
5.	REPORTING							
5.1	Have the report forms been approved?			X				
5.2	Are the reports detailed enough to permit repitition of the examination? * See findings.				X	X		
5.3	Have the report forms been correctly filled in? x See findings.				X	X		
5.4	Have sketches showing scanning/patterns been attached to, or implemented in the reports?			X				
5.5	Is the distribution of the report correct?			X				
5.6	Is any mandatory information missing in the report(s)? * See findings.			X		X		

*Finding Observation to be described in the audit report

Diskette reference	Date/Sign. of auditor
IOD/99-D6	25/3.83 [signature]

DET NORSKE VERITAS

AUDIT CHECKLIST

Audit No./Date	Page
22-25/3-83	1 of 3
Client: ELF NORGE	
Project: 822018	

Location/Organizational unit

Subject/Element: MAGNETIC PARTICLE INSPECTION

Reg. No.

No.	Checkpoint description	Document references: External	Document references: Internal	Yes	No	Comments*	Not applic.	Not checked
1.	PROCEDURES							
1.1	Are the MPI procedures approved by all parties involved?			X				
1.2	Are the MPI procedures approved by certifying authorities?			X				
1.3	Is the practical performance in accordance with these procedures?			X				
1.4	Are the procedure known to the inspectors involved?							X
2.	PERSONNEL							
2.1	Do the operators have sufficient qualifications according to procedure requirements?			X				
2.2	Has this been proved through practical tests?			X				
2.3	Is a list with names and copies of certificates available?			X				
3.	EQUIPMENT							
3.1	Is all the equipment mentioned in the procedure available?			X				
3.2	Is the maintenance regularly carried out?				X			
3.3	Is the check for correct lifting force regularly carried out?							X
3.4	If permanent magnets are used, is necessary recharging equipment available?				X			

*Finding Observation to be described in the audit report

Diskette reference	Date/Sign of auditor
IOD/99-D6	

DET NORSKE VERITAS	AUDIT CHECKLIST	Audit No. Date: 22-25/3-83	Page 2 of 3
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		Project: 822018	

Location/Organizational unit		Document references: External	Document references: Internal	Evaluation: Yes	No	Comments*	Not applic	Not checked
Subject/Element: MAGNETIC PARTICLE INSPECTION	Reg. No.							
No.	**Checkpoint description**							
3.5	Is field indicator available?			X				
3.6	Is electronic field measuring equipment available?				X			
4.	<u>PRACTICAL PERFORMANCE</u>							
4.1	Are both wet and dry methods used? * Only wet method.				X	*		
4.2	Are the magnetization technique correct according to the procedure?			X				
4.3	Is the magnetic field regularly checked?				X			
4.4	Is the prod/pool spacing within requirements? * Not given in the procedure.					*		X
4.5	Is it always possible to obtain the correct field in two directions?							X
4.6	Is demagnetization carried out?				X			
4.7	Is the suspension used (wet method) correct?							X
4.8	Has this (4.7) been checked?				X			
4.9	In case of examination with fluorescent particles, are the brightness and the viewing facilities sufficient?						X	
4.10	Is the surface preparation sufficient?			X				
4.11	Is the suspension regularly aggitated when used?			X				

*Finding/Observation to be described in the audit report

Diskette reference	Date/Sign. of auditor
IOD/99-D6	

Location/Organizational unit:

Subject/Element: MAGNETIC PARTICLE INSPECTION

Reg. No.:

No.	Checkpoint description	Document references: External	Document references: Internal	Yes	No	Comments*	Not applic	Not checked
5.	REPORTING							
5.1	Have the MPI reports been prepared, reviewed, endorsed, distributed and compiled in accordance with accepted procedures?			X				
5.2	Has the recording been carried out in such manner that the examination easily can be traced back and reproduced?			X				

*Finding/Observation to be described in the audit report

Diskette reference: IOD/99-D6

Date/Sign. of auditor: 25/3-83 [signature]

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AUDIT CHECKLIST

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Client: ELF NORGE

Project: 82 2018

Location/Organizational unit:

Subject/Element: LIQUID PENETRANT INSPECTION

Reg. No.:

No.	Checkpoint description	Document references: External	Document references: Internal	Yes	No	Comments*	Not applic	Not checked
1.	PROCEDURES							
1.1	Are the LPI procedures approved?			X				
1.2	Are the LPI procedures approved by certifying authorities?			X				
1.3	Is the practical performance in accordance with these procedures?			X				
1.4	Are the procedures known among the inspectors involved?							X
2.	PERSONNEL							
2.1	Is the personnel's (operators') qualification sufficient according to the procedure requirements?			X				
2.2	Have this been proved through practical tests?				X			
2.3	Is a list with operators' names and copies of certificates available?			X				
2.4	Has any examination been carried out by personnel not qualified to code requirements?				X			X
3.	EQUIPMENT							
3.1	Are all the penetrant and developer types used acceptable to code requirements?			X				
3.2	Are both water washable, post emulsifying and solvent removalable available? * ONLY WATER WASHABLE HAVE BEEN SEEN USED				X	X		

*Finding/Observation to be described in the audit report

Diskette reference	Date/Sign. of auditor
IOD/99-D6	

DET NORSKE VERITAS	AUDIT CHECKLIST	Audit No /Date 22-25/3-83	Page 2 of 3
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		Project: 82 2018	

Location/Organizational unit

Subject/Element: **LIQUID PENETRANT INSPECTION**

Reg. No.

No.	Checkpoint description	Document references – External	Document references – Internal	Yes	No	Comments*	Not applic.	Not checked
3.3	Are fluorescent types available?				X			
3.4	Are test blocks or liquid penetrant comparators available?				X			
3.5	Are penetrants for use at temperatures above 60°C available?				X			
4.	<u>PRACTICAL PERFORMANCE</u>							
4.1	Has the technique used been demonstrated under normal working conditions.				X			
4.2	Is the required time span between welding and testing complied with?			X				
4.3	Is the pre-cleaning acceptable?			X				
4.4	Is the surface temperature acceptable for the penetrant used?			X				
4.5	Does the penetrant contain elements which may harm the material examined?				X			
4.6	Is the penetration time sufficient?							X
4.7	Is the cleaning and removal of excess penetrant sufficient? * ON SOME PLACES OBSERVED ON SITE IT SEEMS NOT SUFFICIENT					*		
4.8	Is the application of developer according to requirements? * SAID TO BE			X		*		X
4.9	Is the interpretation condition sufficient?			X				

*Finding Observation to be described in the audit report

Diskette reference	Date Sign. of auditor
IOD/99-D6	

DET NORSKE VERITAS

AUDIT CHECKLIST

Audit No. Date	Page 3 of 3
22-25/3 - 83	
Client	ELF NORGE
Project	82 2018

Location/Organizational unit		Document references		Evaluation				
Subject/Element: LIQUID PENETRANT INSPECTION	Reg. No.	External	Internal	Yes	No	Comments*	Not applic.	Not checked
No.	Checkpoint description							
5.	REPORTING							
5.1	Have the reports been prepared in such manner that the result of the examination easily can be traced back and reproduced?			✓				
5.2	Have the reports been prepared, reviewed, endorsed, distributed and compiled in accordance with the accepted procedures?			✓				

*Finding/Observation to be described in the audit report

Diskette reference	Date/Sign. of auditor
IOD/99-D6	25/3-83 [signature]

APPENDIX 5

APPENDIX 5

TRACING ONE PIPING MATERIAL CERTIFICATE IN THE TCP-2 EXTENSION FABRICATION COMPLETION FILE.

How to find the material certificate for a piece of pipe.

TARGET

Find the material certificate for the exit line LT relief scrubber (CV 226) at the position "First bend downstream of the tagged valve H.V. 226.1".

STEP 1

Which system covers the LT relief

In the table of content (which is the first page in all the books). The as-built dossier for piping is covered in Volume 2 Section 3 Piping.

VOLUME 2 SECTION 3 In the Book 1, introduction is given, and the test system definition is given for Module 50 (3.2.1) Pancake 53 (section 3.2.2) and Tie-In (section 3.2.3).

Pick out the system identification

STEP 2 Right most column "LT Relief" is found left most column gives "TS 04 B 01 P" to "TS 04 B 12 P".

SYSTEM TS04B01P TS is abbreviation for Test System 04 B in the Process System No. 01 B to 12 B is the Test System No.

STEP 3

Pick out the relevant P & I D.

VOLUME 3 SECTION 4 In Volume 3 Section 4 Piping Isometric all the piping as-built documents are located sorted test system by test system. To find TS 04 B 01 P - 12 P, the first Pancake 53 Book (one start *), and the fourth chapter concerns the test system TS 04 B 01 P (i.e. the first test system for process system number "04 B LT relief".

The P + ID FF 88 00 04 5090 Rev. 5 is the first drawing to be found. The test systems are defined on this drawing.

STEP 4

Pick out the isometric line number

C 2270 The valve HV 226.1 can be found, and the ISO number is C 2270 EAT 12" R. The relevant test system is noted TS 04 B 01 P.

STEP 5

Pick out the material certificate number

Between weld Nos. 2 and 3 (noted in circles on the iso), the square box with the material certificate, normally the heat-number 38 25 51 is found.

The weld No. 101 is an erection yard weld and the weld No. 3 is a prefab. weld. (Can be seen from the welding summary sheet enclosed in the same chapter).

STEP 6

Pick out the material certificate

Behind the iso, all the material certs are filed for this test system.

It can be seen that the heat number (Nombre de Coulée) 38 25 51 certificate covers for 90 deg bends material ASTM A 312 T8 316 L.

GENERAL

The weld Nos. 2 and 3 were prefabrication welds (opposite to the weld Nos. above 100 which were erection yard welds).

The Welding Procedure Specification (WPS) for welds 2 and 3 was "25 P" (can be seen from Welding Summary sheet enclosed in Test System chapters).

Weld No. 6 was radiographically tested (described on page 260 in the RADIOGRAPHIC INSP. REPORT) see chapter 3.3.1 (Volume 2 Section 3 Book 1), and accepted 24.11.83 by Ponticelli and EAN inspectors.

To find the WPS (No. 25 P) it should be located in Volume 2 Section 3 Chapter 3.6 Welding.

(Ch.3.6.7) In Volume 2 Section 3 Book 3 Chapter 3.6 can be found, and the covering qualification test (IN-MA-72) can be found from the summary sheets in the beginning of the chapter.

APPENDIX 6

APPENDIX 6

Project Procedures

- General Correspondence
- EAN Site Team Internal Procedure
- Request for Modification/Engineering
- Onshore Issued Task/Change Order
- Offshore Issued Task/Change Order
- Site Instruction/Change Order
- Material Handling Procedure
- Task Sheet Approval
- Non-Conformance Reporting
- Corrective Action
- Commissioning System

1.1. Introduction

The purpose of this procedure is to give a detailed description of the documentation routing for "General correspondence" received from Haugesund De Groot Project team and the Offshore Site team.

By "General Correspondence" we refer to all documents, letters, Minutes of Meetings, telexes etc. for which no special routing procedure have been written.

1.2. Identification of correspondance

Letters from Contractor to EAN

These letters are to be identified by an LHE reference plus a number, for example LHE 001, LHE 002, etc. (letter Haugesund De Groot to Elf Aquitaine)

Letters from EAN to Contractor

These letters are to be identified by an LEH reference plus a number, for example LEH 001, LEH 002 etc. (letter Elf Aquitaine to Haugesund De Groot).

Telexes from Contractor to EAN

These telexes should be identified by a THE plus a number, f.ex. THE 001 (telex Haugesund De Groot to EAN).

Telexes from EAN to Contractor

These telexes should be identified by a TEH plus a number, f.ex. TEH 001 (telex EAN to Haugesund De Groot).

Minutes of Meeting from Contractor to EAN

These documents should be identified by MHE plus a number, f.ex. MHE 001, MHE 002.

Minutes of Meeting from EAN to Contractor

These documents should be identified by MEH plus a number, f.ex. MEH 001, MEH 002.

Memos from Contractor to EAN

These documents are given an HEM identification plus a number, HEM 001, HEM 002.

Memos from EAN to Contractor

These documents are given an EHM reference plus a number, EHM 001, EHM 002.

1.2. Principles

The distribution follows the below listed principles;

1. Secretary dispatch according to stamp (resp, info.)
2. CT identifies others for review.
3. Resp. start evaluation.
4. Others give comments to resp.
5. Resp. prepare answer.
6. CT and resp. sign.
7. Secretary dispatch according to list.

All documents from HDG will carry the following heading;

Subject: "Verbal Description"
Code : Responsible (discipline)

Responsible:

General - CT
Hook-up - JB
Commissioning - MØ/JMK
Engineering - JF
Procurement - LT
Cost - KM
Planning - KM
Quality Assurance - LK
Welding - FD
(QA - Quality Assurance, Certification, Safety, Authority)

Information:

Proj. Mgr. - MH
Engineering - JF
Quality Assurance - LK
Site - PS/GB
Discipline - TH, EH, BÅG, RJ, AL

2.3. Detailed routing description

Project secretary & filing clerk will register all received correspondence in the log book. They are responsible for the identification of the correspondance and the initiation of the distribution. Prior to the distribution project secretary will insert the Chronoligical file number on the special distribution stamp attached to or stamped directly on the "Documents" for distribution.

Project secretary will give the "Document" to the Construction Manager who is responsible for indicating the distribution sequence on R-line only, name, due dates and technical filing key on the special distribution stamp. The document is then to be returned to the project secretary.

Project secretary will transfer information given by Construction manager on the special distribution front page to all copies being distributed.

Documents being distributed are separated in the two main lines, I-information line and R-Responsible line.

In the absence of Construction manager his deputy will be responsible for distribution in order to avoid delay.

R-Responsible line

Construction Manager will normally receive two copies.
It is the responsibility of the Construction Manager to ensure that other specialists (specialists in case of interdiscipline document), operational responsible, QA/QC or cost and planning are on the loop in correct sequence, if required.

On the special stamp or front page the QA/QC, Operational responsible supervisors, Procurement and cost and planning will give their comments if requested by Construction Manager.

Based upon the comments given during the review, Construction Manager will prepare an answer to Haugesund De Groot if required.

When the document has obtained the final approval and is signed by all persons indicated on the R-loop, a copy of the "front page" with specialists comments will be forwarded to the QA/QC, who will verify that the procedure is followed and comments incorporated or initiate adequate action if not.

Transmittal letter is to be signed both by Construction Manager and discipline section leader, and registered by the project secretary before transmittal to Haugesund De Groot.

Copy of transmittal letter is forewarded to Project Manager, QA/QC Manager, Engineering Manager, Site and involved discipline specialists.

The routing above describes the formal principles of the R-responsible line.

However, in order to save time the secretaries will issue a copy of the document according to the code key indicated by HDG directly to the engineer in charge. (Ref. listing page, chapter 1.2. Principles).

I-Information-line

Project manager, Engineering Manager, Quality Assurance Manager, Site Manager and when applicable the discipline leader will each receive one copy of the document as indicated on fig. no. .. (or be on a special loop indicated by th Construction manager).

If there are special comments they will be reported to the Construction manager.

It is the responsibility of the Engineering manager to update all drawings and technical specifications.

Note

Telexes and mail to Project Team in Stavanger shall bear the following reference:

Telexes should be addressed

Elf Aquitaine Norge A/S

TCP-2 Extension Department

Att : NAME
Action: Section or Discipline Responsible
Copy : Construction Manager

Letters should be addressed

Elf Aquitaine Norge A/S

TCP-2 Extension Department

Postbox 168

4000 STAVANGER, Norway

Att : Name
Action: Section or Discipline Responsible
Copy : Construction Manager

Telexes and mail to offshore Site Team shall bear the following reference:

Telexes should be addressed

Tlx.no.:0058926180
Treasure Supporter
TCP-2 Extension Project

Att: Site Manager

Eventually: Action: Discipline Responsible

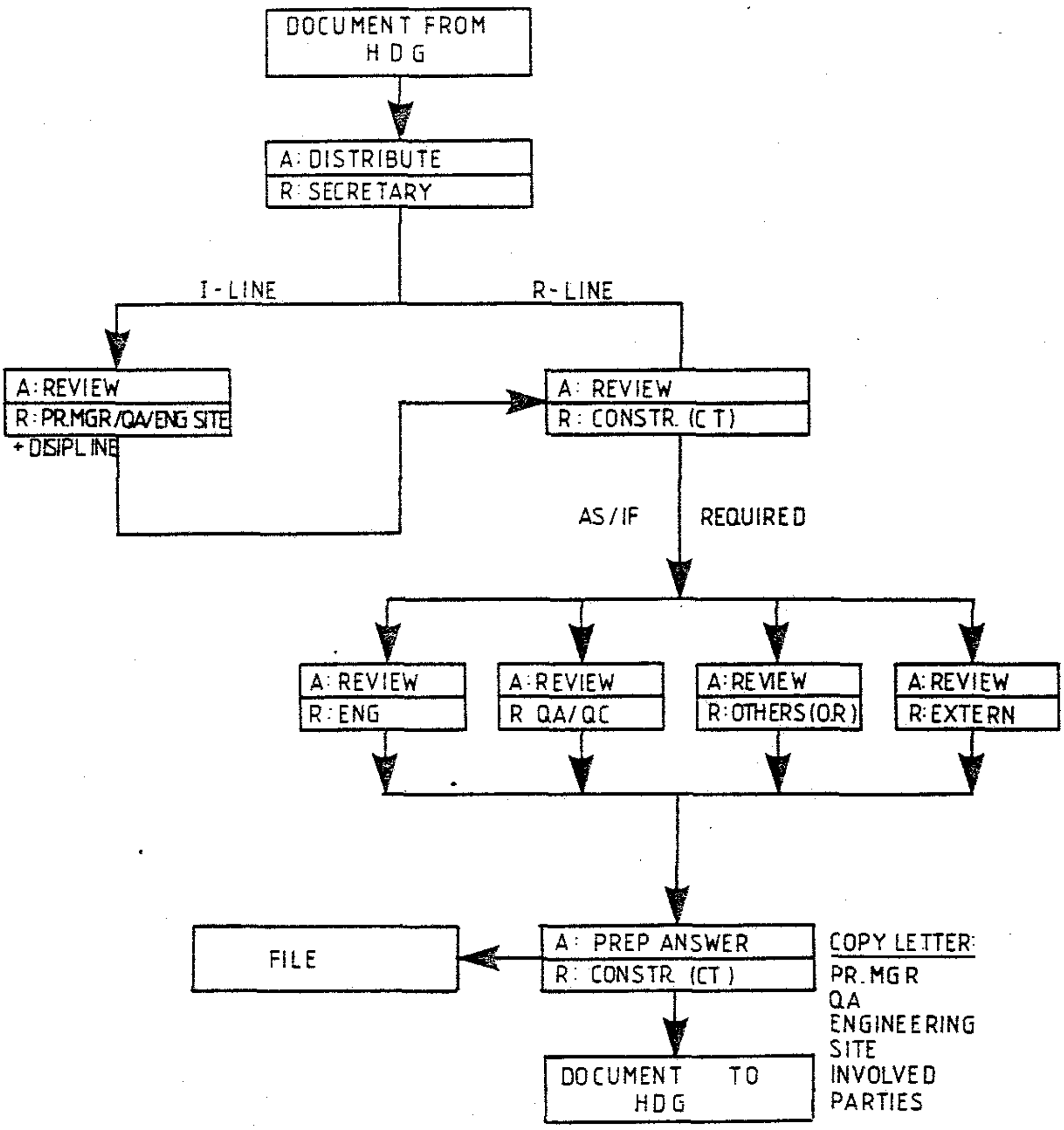
Telex to be signed by one of the following (in addition to originator):
Proj.Mgr., Eng.Mgr., Constr.Mgr., QA Mgr., Mat.Mgr., Adm.Mgr.

Letters should be addressed

Elf Aquitaine Norge A/S
TCP-2 Extension Offshore Team
Treasure Supporter
Postbox 168
4001 STAVANGER

Att: Site Manager

GENERAL CORRESPONDENCE/DOCUMENTATION ROUTING



TCP-2 EXTENSION DOCUMENT REVIEW	Recived:	
	File.	Chrono:
		Techn:

ACTIVITY :
CONTRACTOR :
SUBJECT :
TRANSMITTAL REF. :
DUE DATE :

	REVIEW		INFO.		COMMENTS :
	DC	LOOP	DC	LOOP	
C. TREMON					
K. MADSEN					
L. THORSEN					
L. KREFTING					
F. DUESSO					
J. FOSEN					
D. ESPLANDIU / E.H					
B.Å. GJERDE					
T. HÖINES					
A. LUNDSGAARD					
R. JEFFS					
O. LINGA					
M. HAUG					
J. BRYSON					

APPROVALS / COMMENTS :

CONSTR. MGR.	ENG MGR	QA / QC MGR.
DATE :	DATE :	DATE :

INTERNAL DOCUMENT DISTRIBUTION

EAN-SITE-TEAM

A	CORRESPONDANCE FROM SITE TO HDG (SERIE 500 AND ABOVE)	LEH
B	CORRESPONDANCE FROM HDG TO SITE	LHE
C	LETTERS FROM SITE TO EAN STAVANGER	
D	LETTERS FROM EAN STAVANGER TO SITE	LES
E	TELEX FROM SITE TO EAN STAVANGER	TSE
F	TELEX FROM EAN STAVANGER TO SITE	TES
G	TRANSMITTALS (SITE INSTRUCTIONS) FROM HDG TO SITE	HEM
H	INTERNAL CORRESPONDANCE	

A. Letters from Site to HDG (LEH)

The letters are identified by chronological increasing LEH numbers.

The secretary fills in the record registrating LEH crononumber, heading/subject, date and signature.

After being checked and signed by responsible Engineer and Site Manager, the letters are transmitted to HDG with eventual enclosures.

Copy 1 is filed by secretary in the LEH-file.

Copy 2 is given to the Site Manager.

Copy 3 is eventually given to hook-up or commissioning superintendent/and/or specialist

Copy 4 is sent to Stavanger when required.

B. Letters from HDG to Site (LHE)

The letters are identified with chronological increasing LHE numbers. The LHE are registrated by the secretary with respect to LHE Nos., heading/subject and date. The letters are given a circulation stamp by the secretary and directly given to the Site Manager.

He will indicate the number of direct copies (DC) for design review and action to the responsible engineer in the circulation stamp field, and the secretary will directly take the necessary copies and distribute.

The secretary files the original letter in the LHE-file.

C. Letters from Site to EAN Stavanger

The letters are identified by chrono numbers. The same procedure as noted in A shall be followed.

D. Letters from EAN Stavanger to Site (LES)

The letters are identified by chronological increasing LES numbers. The same procedure as noted in B shall be followed.

E. Telex from EAN Stavanger to Site

Telexes shall be registrated by the secretary and the same procedure as noted in B should apply.

G. Transmittal (Site instructions) received from HDG (HEM)

This document is marked by a two digit identification and signed by HDG construction superintendent. The transmittal are registrated by the secretary with respect to transmittal Nos., designation, date and signature. The transmittal are given circulation stamp by the secretary and directly given to the Site Manager.

He will indicate the number of direct copies (DC) for design review and action to the responsible engineer in the circulation stamp field, and the secretary will directly take the necessary copies and distribute.

The secretary files the original letter in the transmittal file.

H. Internal correspondance (IM, Notes etc.)

All internal IM's, notes etc. within Site Team to be cronological filed by tech. secretary.

1. Introduction

The purpose with this procedure is to give a detailed description of the documentation routing for "Request for Modification" when approved for execution by the "Approval Committee".

The work covered by this procedure are defined as:

- New task (raised onshore or offshore)
- Cancellation of task (raised onshore or offshore)
- Revision of task (onshore only)

When "Request for Modification" has been approved by the Approval Committee a technical review under the responsibility of the Engineering Manager will take place.

The technical review will follow the same principles as under DRP no. 1. Procedure, however, with the exeption that it is now the Engineering Manager who will indicate the engineers (disciplines), sequence, due dates and technical filing key to be on the loop on the special distribution stamp. When the tecnical evaluation is completed the necessary instructions (with enclosed documents if applicable) will be given to HDG and site via the construction manager.
All members of the Evaluation Committee shall be copies on transmittal letter to HDG/Site.

It is essential to evaluate if the change of work (tasks) or delition of work (tasks) have any impact of our committments towards NPD or if we are obliged to inform DnV.
DnV is "Certifying Authority" on the British sector of Frigg Field and existing Frigg System.

In addition we are obliged to inform DnV on all modificatons that we are doing on the Norwegian sector of Frigg Field.

The request for modification will follow the following principles;

1. Originator forward the modification request to Engineering Manager.

2. Engineering Manager ensures a preliminary accept to start engineering from the "Approval Committee"

3. Engineering Manager initiate the technical evaluation.

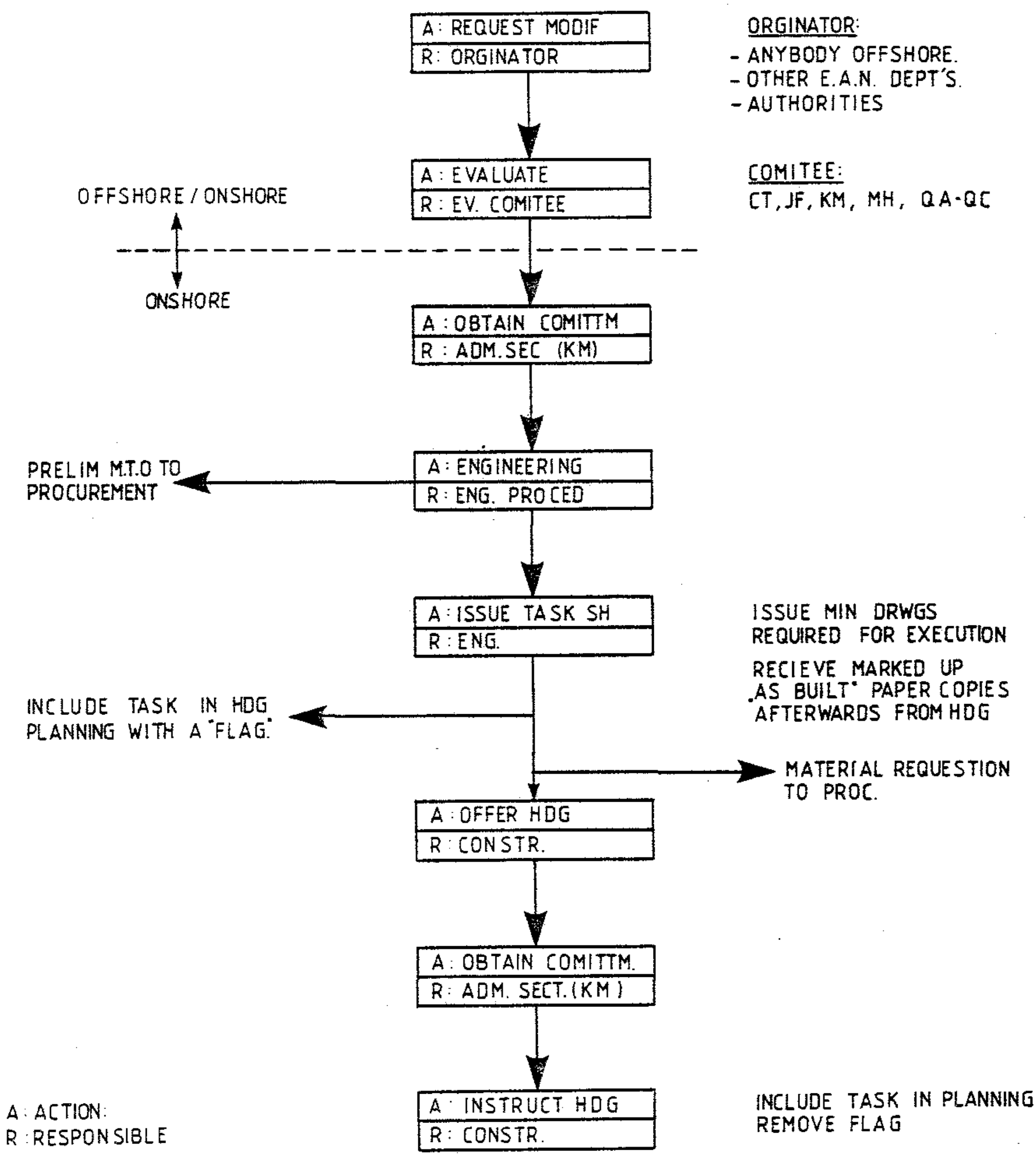
4. Engineering Manager ensures comments from the involved engineers, operational responsible, QA/QC etc. and prepare a final technical dossier

5. The "Approval Committee" will accept or reject the technical dossier.

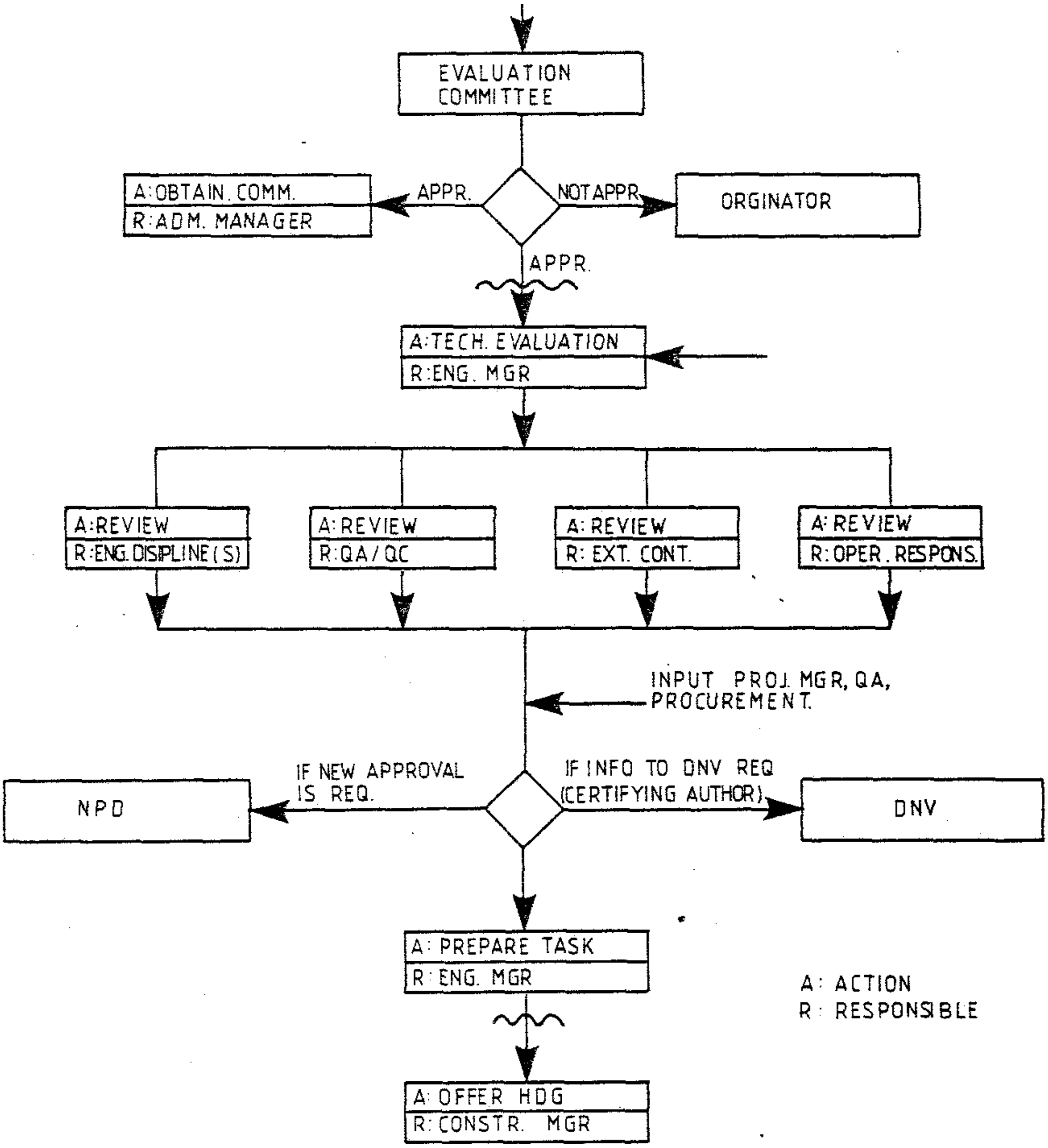
6. If approved the Engineering Manager will prepare a new task and submit the task to the Construction Manager.

7. Construction Manager will initiate step 4. in procedure no. 19.4 - Onshore issued task/Change order.

REQUEST FOR MODIFICATION



ENGINEERING EVALUATION OF MODIFICATION (S)



Request for a New Task Raised Onshore

This is the preferred method of handling workscope increases offshore. It is intended to cover new work or alterations to current work that cannot be covered by an existing task. Due to the nature of this procedure, it is not meant to be used to cover minor changes to existing tasks.

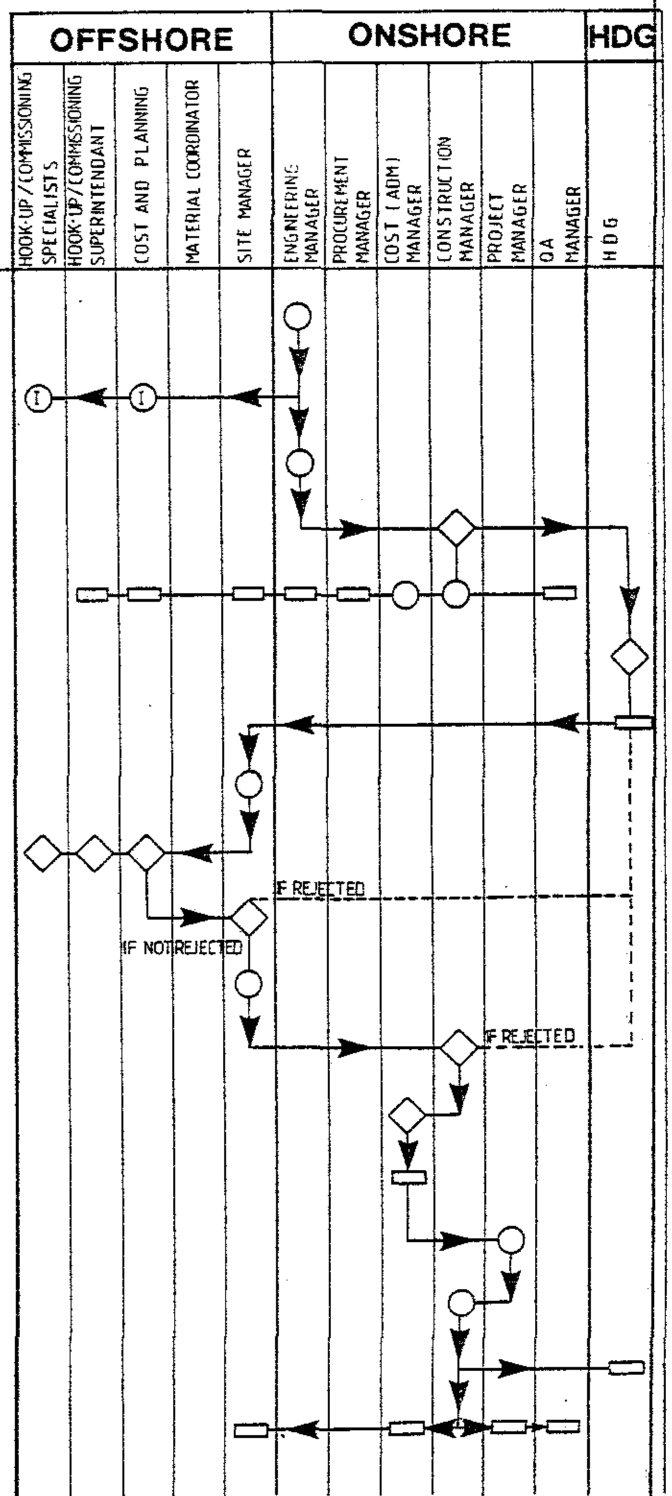
New tasks can be requested by preparing and submitting an Offshore issued Modification Request (Attachment no. 1). The request is to be filled-in with all appropriate information and references. Before submittal the request will be reviewed by the Hook-up and Commissioning Superintendents and approved by the Site Manager. Distribution of the approved document will be as indicated thereon. Hook-up Superintendent to maintain a register of MR's.

Due to the time involved in implementing this procedure, a considerable lead time is required for it to function correctly.

ONSHORE ISSUED TASK/CHANGE ORDER

(I) = Information
○ = Operation
◇ = Check/review
▭ = Document
△ = File

Seq	Description
1	ISSUE TASK SHEET, REQUIRED DOCUMENTS CODIFICATION AND TRANSMITTAL LETTER (unsign)
2	INFORMATION COPIES
3	PUNCH INFO ON COMPUTER/TYPWRITE
4	REVIEW/SIGN ON TRANSMITTAL LETTER
5	ISSUE TRANSMITTAL LETTER W/INFO
6	HDG MAKES REVIEW
7	HDG ISSUE CHANGE ORDER REQUEST
8	TRANSMIT DOCUMENT
9	TRANSMIT DOCUMENT FOR REVIEW
10	CHECK AND SIGN
11	TRANSMIT ONSHORE
12	CHECK AND TRANSMIT
13	CHECK
14	ISSUE CHANGE ORDER
15	TRANSMIT PROJ.MGR. FOR SIGNATURE
16	WORK OUT TRANSMITTAL LETTER
17	SEND DOCUMENT TO HDG
18	DOCUMENT COPY TO PROJECT



311E TCP2 EXT 83/5029/SE/ej

ATTACHMENT NR 1

Form: MR1
No. :

EAN - TCP-2 EXTENSION

OFFSHORE ISSUED MODIFICATION REQUEST

FROM	Originator	Name (sign)	Date
CHECKED BY	HU Superintendent	Name	Date
	Commissioning Superintendent	Name	Date
	Site manager	Name	Date
ACTION	Engineering	J. Fosen	
	Info.	C. Tremon L. Krefting K. Madsen B. Weill (Start-up)	

DESCRIPTION:

ATTACHED DOCUMENTS

PRIORITY TO BE GIVEN

Issue of a New Task Offshore

In accordance with current policy, offshore raised tasks are only to be issued related to urgent works.

New tasks are to be written by the Discipline Engineers, filling in all appropriate information on the task sheet. Completed task sheets are to be reviewed with the Hook-up Superintendent who will discuss them with the Commissioning Superintendent and the Site Manager.

If agreed urgent and correct, the task sheet will be issued by the Site Manager to HDG, with information copies according to flow chart page 2/2.

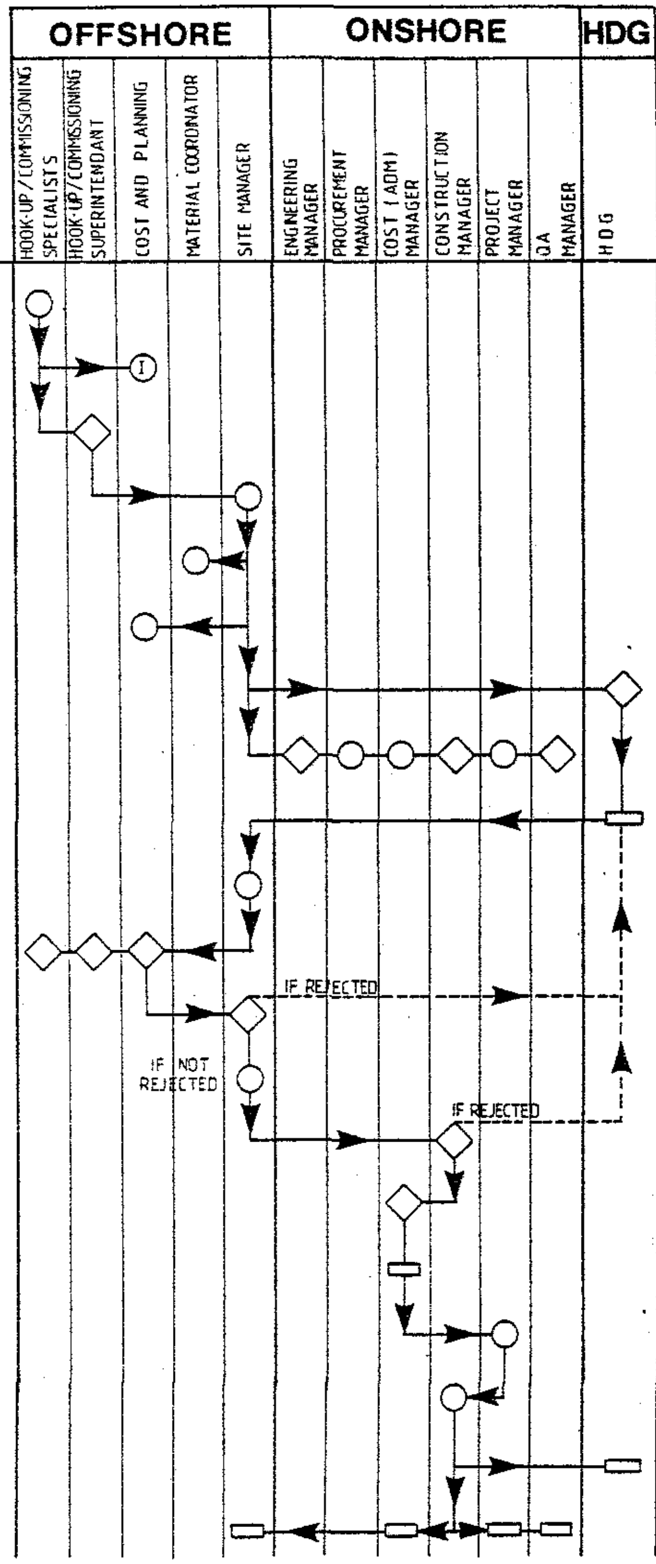
HDG shall, upon receipt of an offshore-issued task, submit a Change Order Request offshore. Each task is enforced as soon as it has been issued, even if the price is not settled.

Material Coordinator must be informed about all new tasks issued.

OFFSHORE ISSUED TASK/CHANGE ORDER

(I) = Information
○ = Operation
◇ = Check/review
▭ = Document
△ = File

Seq	Description
1	ISSUE TASK SHEET (REQUIRED DOCUMENT)
2	INFO AND PLANNING
3	CHECKED BY SUPERINT.
4	APPROVE
5	REQUEST MATERIAL
6	IMPLEMENT ON COMP. SYSTEM
7	SUBMIT HDG
8	CHECK AND INFO
9	HDG ISSUE COR.
10	TRANSMIT FOR REVIEW
11	CHECK AND RETURN TO SITE MGR.
12	CHECK AND SIGN
13	TRANSMIT ONSHORE
14	CHECK AND TRANSMIT
15	CHECK
16	ISSUE CHANGE ORDER
17	TRANSMIT P.M FOR SIGNATURE
18	WORK OUT TRANSMITTAL LETTER
19	SEND DOCUMENT TO HDG
20	COPY OF DOCUMENT WITHIN PROJECT



Alteration of an Existing Task

The preferred method of marking minor changes to the workscope is by modifying an existing task to incorporate the changes.

The method available for modifying an existing task sheet are via a Site Instruction.

A. A Site Instruction (Attachment no. 2) is issued by HDG when they discover a problem or discrepancy related to the work. The Site Instruction is intended to present a situation and propose a solution on a technical basis only. However, the possibility of any cost or schedule implications will be indicated on the form.

The original of the Site Instruction will be given directly to the appropriate Discipline Engineer, with a copy to the Site Manager.

The Discipline Engineer will make his comments to the HDG statement, sign the form, and submit it to the Hook-up Superintendent for review. After considering inter-discipline implications and discussing with the Commissioning Superintendent (if appropriate), the Hook-up Superintendent initials the form and returns it to HDG.

The Discipline Engineers are responsible for maintaining accurate records regarding Site Instruction Reports.

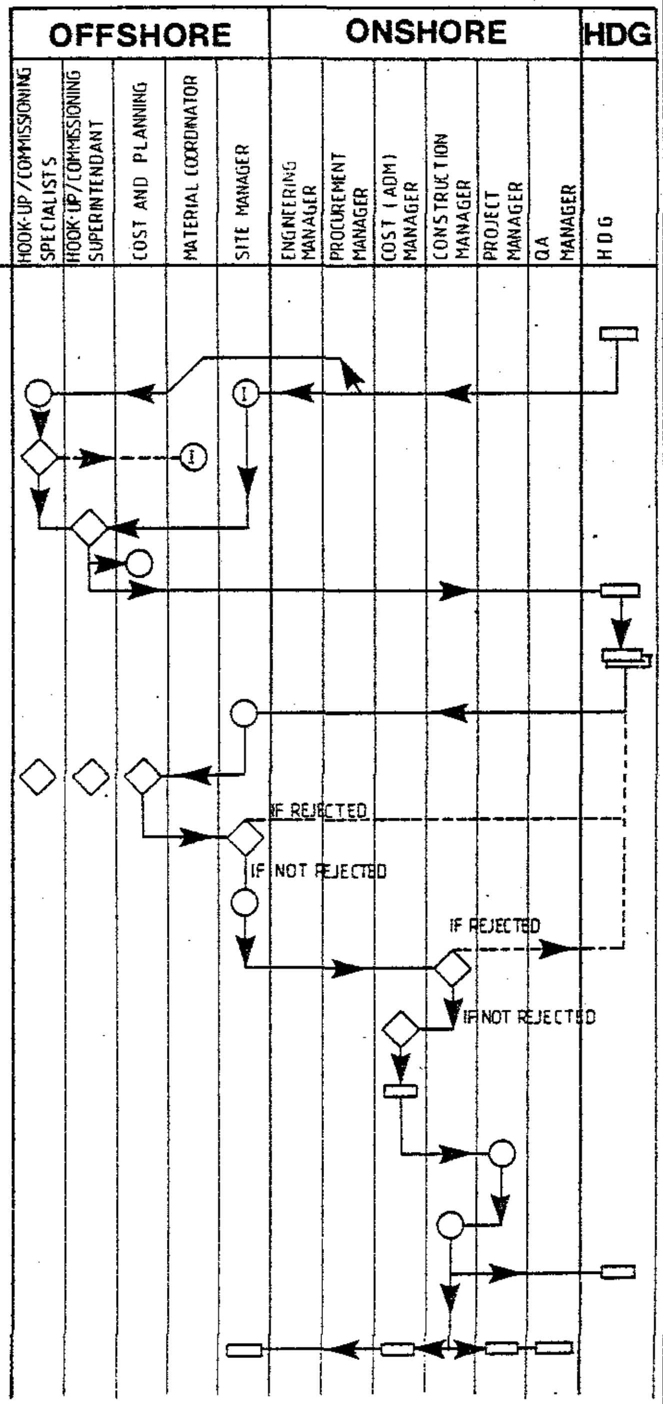
Before the Site instruction is returned to HDG, the Hook-up Superintendent notifies the Planning Department who "flag" the task on the computer. Copies of all completed Site Instruction Reports are maintained by the Hook-up Superintendent.

The Site Instruction is followed by a Change Order Request from HDG.

SITE INSTRUCTION/CHANGE ORDER

(I) = Information
○ = Operation
◇ = Check/review
▭ = Document
△ = File

Seq	Description
1	HDG ISSUE SITE INSTRUCTION (2 COPIES)
2	DISTRIBUTES TWO COPIES
3	DICIPLINE SPECIALIST REVIEWS
4	INTERDICIPLINE/SYSTEM CHECK COST & PLANNING "FLAG" IF COST CONSEQ.
5	TO BE TRANSMITTED HDG (WORK STARTS)
6	HDG ISSUES CHANGE ORDER REQUEST
7	C.O.R. TO BE SENT SITE MGR.
8	TO BE REVIEWED
9	SITE MGR. EVALUATES
10	TO BE SENT ONSHORE
11	CONSTRUCTION EVALUATES
12	COST AND PL. EVALUATES
13	COST AND PL. EVALUATE "AND PREPARE" C.O.
14	PROJECT MGR SIGNS
15	CONSTR.MGR ISSUE TRANSMITTAL LETTER
16	TRANSMIT TO HDG
17	COPIES TO PROJECT



This is the way written communication [illegible] letters HSC → site

HAUGESUND — DE GROOT OFFSHORE A/S & CO
P.O. Box 729 - N 4001 Stavanger - Norway - Telephone (04) 52 85 95 - Telex 40116

Job N°: F.142	MEMORANDUM	Client: E.A.N
Date: 21-6-83	Job Location: TCP-2	Sheet of

MEMO N°: H.EM -54
TO: G.Bachoue
FROM: E.HANDÅ
SUBJECT: site instructions

Please find enclosed the site instructions.

No. 2/012 – 2/013

21 JUNI 1983

EHandå.

PB → Estp:
Are these new or have they been revised?

Estp =
They [illegible]
receive
commen[illegible]
signed
return[illegible]

TCP2 EXT. HOOK – UP			
LOG NR:			
DIST	ACTION	INFO	ATT
X SITE MGR			
HU SUP			
MATERIALS			
COST/PLAN			
COMMISS.			
PIPING	X		
STRUCT			
INST			
ELECT			
QA/QC			
ONSHORE MGR			

[redacted] Passages/links to site mgr.
Civ. staying EAN secretary
[redacted] Response to [redacted]
HDG constr. supervisor

Client

MATERIAL HANDLING PROCEDURE

○ = OPERATION

◇ = CHECK/INSPECTION

1 MATERIAL COORDINATOR ONSHORE TCP 2 EXT PROCURES MATERIAL TO THE PROJECT

2 ELF WAREHOUSE RECEIVING INSPECTION INSP: THE MATERIALS FOR COMPLIANCE

3 MATERIALS TO BE SENT TO TCP 2 EXT WAREHOUSE/STORING

4 HDG REQUESTS MATERIALS

5 TCP 2 EXT (PLANNER, MATERIALCOORD, DICIPL. ENGINEER)

REVIEW THE REQUEST FROM HDG

6A IF NOT OK - REQUEST BACK TO HDG MAT.COORD.

6B IF OK - REQUEST TO BE SENT TO MATERIAL COORD. LT VIA ARTEMIS

7 MATERIAL REQUEST TO PUNCHED BY TCP 2 ONSHORE

ON COMPUTER TO TCP 2 EXT WAREHOUSE

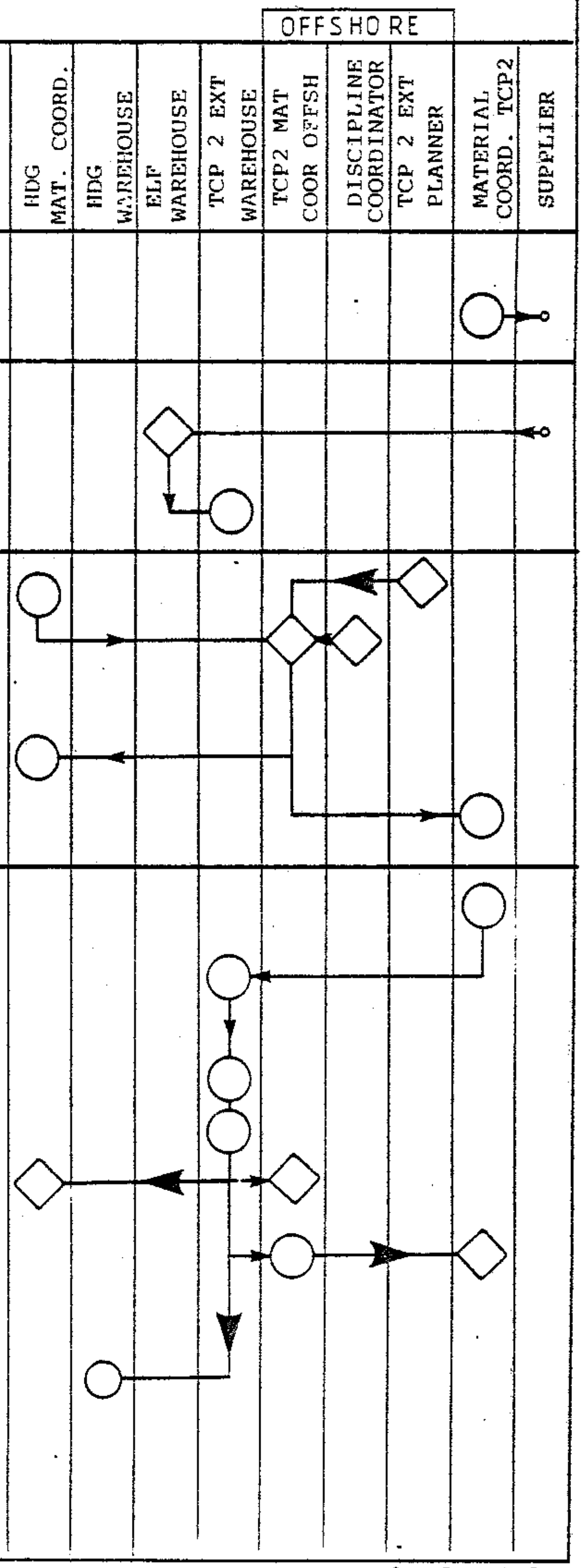
8 MATERIALS TO BE PACKED PR TASK FOR SHIPPING SUPPLY BOAT/HELICOPTER

9 PACKING LIST TO BE FILLED IN

10 MATERIALS TO BE INSPECTED OFFSHORE WHEN RECIVED. HDG/EAN MATERIAL CORR. ACTION·

11 IF NOT O.K - MESSAGE TO MATERIAL COORDIN - ATOR ONSHORE

12 MATERIALS TO BE STORED OR USED IF O.K.



REQUEST FOR MATERIAL 0069-1

(COPY VERSION)

RAISED ON: 20-MAY-83 FOR TASK NO: 2001 SCHEDULED FOR: 15-JUN-83

ITEM NO	MATERIAL CODE	DESCRIPTION	QUANTITY REQUIRED	QUANTITY FOUND	QUANTITY MISSING	CERTIFICATION INCLUDED
1	9365075	STUDBOLTS/NUTS M76X730 MM3227	16	16		Y
2	9360061	GASKETS RTJ R75 KS3227	2	2		N
3	9322012	SPRING BOX SUPPORT 50SSP45	2		2	
4	9320010	20" SUPPORT TYPE BBR 50BBR65	1	1		N
5	9320011	20" SUPPORT TYPE BBR 50BBR66	1	1		N
6	9338112	C2000 EFS 20" P SPOOL A	1	1		N
7	9338113	C2000 EFS 20" P SPOOL B	1	1		N
8	9338114	C2000 EFS 20" P SPOOL B1	1	1		N
9	9338115	C2000 EFS 20" P SPOOL B2	1	1		N
10	9338116	C2000 EFS 20" P SSPOOL B3	1	1		N
11	9338117	C2000 EFS 20" P SPOOL C	1	1		N

SHIPPING DATE: (PLANNED): (ACTUAL):31-MAY-83

VESSEL : PRINCESS SUPPLIER
MANIFEST: 6155 CONTAINER: PACKING LIST:

COMMENTS:

IN CONT 207 AND 328

REPORT SHM01
PRINTED 26-MAY-83

TASK SHEET MATERIAL DETAILS

TASK NUMBER	ITEM	MATERIAL CODE	DESCRIPTION	AMOUNT		WEIGHT KG	MARKING	COMMENTS
4237	3	4903939	P/I CONVERTER FOXBORO E92	1	PI	0	ZY M210 1C	
4237	4	4903930	P/I CONVERTER FOXBORO E92	1	PI	0	ZY M210 1D	
4237	5	4903931	POWER SUPPLY FOXBORO E 4	4	PI	0		
4238	1	5800074	CABLE RHUH 12X2X1.5 750V GREY CAT 1.3	15	ME	0	C1162	
4238	2	5800074	CABLE RHUH 12X2X1.5 750V GREY CAT 1.3	15	ME	0	C1164	
4239	1	5800005	CABLE RH 4X2X1.5 BLACK 250V CAT 1.4	15	ME	0	C1235	
4239	2	5800005	CABLE RH 4X2X1.5 BLACK 250V CAT 1.4	15	ME	0	C1243	
4240	1	4910040	TEMP SWITCH SOR BETA	1	PI	0	TSHL203-5	
4240	2	4910040	TEMP SWITCH SOR BETA	1	PI	0	TSHE211-5	
4240	3	4910076	THERMOWELL TWE 205.5	1	PI	0	TWL203-5	
4240	4	4910077	THERMOWELL TWE 211.5	1	PI	0	TWE211-5	
4241	1	9350017	TUBING 9/16" AUTOCLAVE	3	ME	0		
4241	2	9353320	ADAPTER COUPLING 1/2" NPTX 9/16" OD AUTOCLAVE 6M69M6	4	PI	0		
4242	1	9350017	TUBING 9/16" AUTOCLAVE	3	ME	0		
4242	2	9353320	ADAPTER COUPLING 1/2" NPTX 9/16" OD AUTOCLAVE 6M69M6	4	PI	0		
4243	1	5800005	CABLE RH 4X2X1.5 BLACK 250V CAT 1.4	25	ME	0		

TASK NUMBER | ITEM | MATERIAL CODE | DESCRIPTION | AMOUNT | WEIGHT KG | MARKING | COMMENTS

REPORT SMM15
PRINTED 4-MAY-83

MATERIALS RECONCILIATION REPORT

MATERIAL REFERENCE		TOTAL QUANTITY			TOTAL QUANTITY			MATERIAL SHORTFALL		
CODE	DESCRIPTION	REQUIRED	ORDERED	RECEIVED	REQUESTED	SHIPPED	PADSTOCK	REQUIRED NOT ORDERED	REQUESTED NOT RECEIVED	REQUI NOT SI
CHECK VALVES										
9802015	CHECK VALVE 2" 600LBS RTJ D1A5JW	..*..	1...	1...	... ..*..	... .	... .	... ..*..	... .	... .
9802024	CHECK VALVE 10" 600LBS RTJ ECX5JW	..*..	1...	1...	... ..*..	... .	... .	... ..*..	... .	... .
BUTTERFLY VALVES										
9803006	4" 150LBS BUTTEFLY VALVE 4" EA 7RW	..*..	3...	1...	... ..*..	... .	... .	... ..*..	2...	... .
9806										
9806015		..*..	1...	... .	... ..*..	... .	... .	... ..*..	1...	... .
9900										
9900410	FILTER FA 106 A/B	..*..	1...	... .	... ..*..	... .	... .	... ..*..	1...	... .

CODE	DESCRIPTION	REQUIRED	ORDERED	RECEIVED	REQUESTED	SHIPPED	PADSTOCK	REQUIRED NOT ORDERED	REQUESTED NOT RECEIVED	REQUI NOT SI
MATERIAL REFERENCE		TOTAL QUANTITY			TOTAL QUANTITY			MATERIAL SHORTFALL		

REPORT SMM04
PRINTED 26-MAY-83

MATERIAL CODING CATALOGUE

MATERIAL CODE	DESCRIPTION	UNITS	COMMENTS
PRESSURE VALVES			
4725010	PRESS REGULATOR	EA	
4725035	FILTER REGULATOR NORGREN	PI	
4725060	PRESS VALVE AMOT 4023 E140A QD-U/A	EA	
4725061	PRESS VALVE AMOT 4023 E140A QD-O/A	EA	
4725062	PRESS VALVE AMOT 4023 E140A QD-N/A	EA	
4725070	PRESS VALVE AMOT 4023 E140A(SPARE)	EA	
4725080	PILOT VALVE	PI	
PRESSURE GAUGES			
4900008	PRESS GAUGE 0-1 BAR 6" DIA 1/2" BOTT 316 SS	EA	
4900012	PRESS GAUGE 0-4 BAR 6" DIA 1/2" BOTT 316 SS	EA	
4900014	PRESS GAUGE 0-6 BAR 6" DIA 1/2" BOTT 316 SS	EA	
4900017	PRESS GAUGE 0-8 BAR 6" DIA 1/2" BOTT 316 SS	EA	
4900023	PRESS GAUGE 0-16 BAR 6" DIA 1/2" BOTT 316 SS	EA	
4900030	PRESS GAUGE 0-30 BAR 6" DIA 1/2" BOTT 316 SS	EA	
4900080	PRESS GAUGE 0-200 BAR 6" DIA 1/2" BOTT 316 SS	EA	
4903			
4903010	PRESS CONTROLLER FOXBORO 40MN PIC 260	EA	
4903020	PRESS TRANSMITTER FOXBORO 13HA HS2 PDT 258	EA	
4903030	P/I CONVERTER FOXBORO E92	PI	
4903031	POWER SUPPLY FOXBORO E 4	PI	
TEMPERATURE INDICATORS			
[illegible]	[illegible]	EA	

REPORT SMM02
PRINTED 30-MAY-83

PURCHASE ORDER DETAILS

PURCHASE ORDER	ITEM	MATERIAL CODE	DESCRIPTION	QUANTITY ORDERED	QUANTITY RECEIVED	ESTIMATED DELIVERY	CONFIRMED DELIVERY	DATE RECEIVED	SUPPLIER	COMMENTS
1160002	1	4700005	CONTROL VALVE 2" PCV260	1	1			15-FEB-83		
1160002	2	4700010	CONTROL VALVE 2" 1500 RTJ ESDV M 201 2	1	0	15-MAY-83				
1160002	3	4700012	CONTROL VALVE 2" 1500 RTJ ESDV V 1A6	1	1			15-FEB-83		
1160002	4	4700030	CONTROL VALVE 6" 1500 RTJ LCV V1A5	1	1			15-FEB-83		
1160015	1	4903010	PRESS CONTROLLER FOXBORO 40MN PIC 260	1	1			15-FEB-83		
1160024	1	4710010	HYDRAULIC CONTROL BOX TYPE B FOR ESDV P12 1	1	1	15-MAY-83		27-MAY-83		
1160024	2	4710011	HYDRAULIC CONTROL BOX TYPE B FOR ESDV M210 1	1	1	15-MAY-83		27-MAY-83		
1160024	3	4710012	HYDRAULIC CONTROL BOX TYPE B FOR ESDV M 201 1	1	1	15-MAY-83		27-MAY-83		
1160024	4	4710020	HYDRAULIC CONTROL BOX TYPE B1 FOR NEF SEALINE DEPR	1	1	15-MAY-83		27-MAY-83		
1160027	1	4701010	CHOKE VALVE MANUAL 3" X 4" 1500 RTJ CSP V1A1	1	1	22-FEB-83		27-MAY-83		
1160030	1	4920020	LEVEL SWITCH MAGNETROL J30-1V3X KA LSLL-V23.5	1	1					
1160030	2	4920030	LEVEL SWITCH MAGNETROL J30-1V3X 0KU LSH-V17A.3	1	1					
1160030	3	4920031	LEVEL SWITCH MAGNETROL J30-1V3X 0KU LSH-V17B.3	1	1					
1160030	4	4920032	LEVEL SWITCH MAGNETROL J30-1V3X 0KU LSH-V17C.3	1	1					
1160031	1	7401031		4	4			15-FEB-83		
1160033	1	5810933	SPLICE CONNECTOR STRAIGHT P/N 61104	270	270			15-FEB-83		
1160033	2	5810951	FIXING CLAMP P/N 61122	500	500			15-FEB-83		
1160033	3	5810507	CABLE LADDER STRAIGHT 450 MM WIDE P/N 60933	200	200			15-FEB-83		
1160033	4	5810506	CABLE LADDER STRAIGHT 300 MM WIDE P/N 60932	160	160			15-FEB-83		
1160033	5	5810505	CABLE LADDER STRAIGHT 150 MM WIDE P/N 63687	36	36			15-FEB-83		
1160033	6	5810513	CABLE LADDER ELBOW 90 DEG 300 MM WIDE P/N 60937	17	17			15-FEB-83		
1160033	7	5810542	CABLE LADDER TEE 450 X 450 X 450 MM WIDE P/N 60962	7	7			15-FEB-83		
1160033	8	5810586	CABLE LADDER REDUCED RIGHT 450X300 60994	5	5			15-FEB-83		
1160033	9	5810585	CABLE LADDER REDUCER RIGHT 300X150 63707	4	4			15-FEB-83		
1160033	10	5810608	CABLE LADDER INS RISER 90 DEG 450 R=L P/N 61008	11	11			15-FEB-83		
1160033	11	5810620	CABLE LADDER OUT RISER 90 DEG 450 R=L P/N 61018	11	11			15-FEB-83		
1160033	12	5810956	EXITPLATE 450 MM P/N 61126	9	9			15-FEB-83		
1160033	13	5810514	CABLE LADDER ELBOW 90 DEG 750 MM WIDE P/N 60938	30	30			15-FEB-83		
1160033	14	5810601	CABLE LADDER INS RISER 90 DEG 300 R=S P/N 61002	4	4			15-FEB-83		
1160033	15	5810613	CABLE LADDER OUT RISER 90 DEG 300 R=S P/N 61012	4	4			15-FEB-83		
1160033	16	5810991	HINGE VERTICAL P/N 61190	34	34			15-FEB-83		
1160033	17	5810541	CABLE LADDER TEE 450 X 300 X 450 MM WIDE P/N 60961	4	4			15-FEB-83		
1160033	18	5810939	BRACKET 150 MM WIDE FOR HEAVY LADDER P/N 64102	15	15			15-FEB-83		
1160033	19	5810537	CABLE LADDER TEE 300 X 300 X 300 MM WIDE P/N 60957	2	2			15-FEB-83		
1160033	20	5810915	ANGLE BRACKET/IRON WIDE P/N 61097	15	15			15-FEB-83		
1160033	21	5810949	BRACKET 525 MM TRAVERS P/N 62554	33	33			15-FEB-83		

Task sheets for approval are submitted by HDG to the EAN Site Manager in three (3) copies. Each copy is to have complete back-up attached (i.e: Check Lists, Precommissioning sheets, As-Built Sketches, and applicable Site Instructions, Change Order Requests, or Alteration Notes etc.).

All three copies are forwarded to the Hook-up Superintendent, who will obtain the necessary reviews.

One copy - complete with all back-up - is sent through an "Approval Distribution". The remaining two task packages are held in a pending file for further action.

The "Approval Distribution" consists of the sequence: Discipline Supervisor - NDT Supervisor - Commissioning Superintendent.

The discipline supervisor reviews the documentation and inspects the work. The task package is then forwarded to the NDT Supervisor either signed as approved or with an attached explanation of the rejection. All tasks are to be submitted to the NDT Supervisor - even if this is not appropriate to the task.

The NDT Supervisor forwards the task to the Commissioning Superintendent, either approved or with comments.

The Commissioning Superintendent reviews the task package and returns it to the Hook-up Superintendent either approved or with comments.

No task package is considered complete unless all applicable instructions covered by Site Instructions have been completed.

When the circulated "Approval" task package is returned to the Hook-up Superintendent, action is taken as follows:

Accepted Tasks: When a task package has been accepted by all the responsible EAN parties, the remaining two originals are stamped "EAN Site Accepted" and signed by the Hook-up Superintendent.

Rejected Tasks: When a task package has been rejected by any of the responsible EAN parties, the two packages in the pending file will be retrieved and a cover note drafted explaining the rejection.

All three complete task packages are then sent to Cost/Planning, where relevant information is logged and records updated.

For approved tasks, the "Approval" package is filed in the Planning office as part of the offshore filing system. If the task has been "flagged", Planning will ensure that an Alteration Note is attached to the package.

The Planner then prepares a transmittal for the packages to be returned to HDG. Transmittals for rejected tasks will contain a appropriate explanation for the rejection (or an attached punch list). The transmittals and task packages will be forwarded to the Site Manager for signature. The Materials' Coordinator and appropriate Discipline Supervisor will be copied on all transmittals.

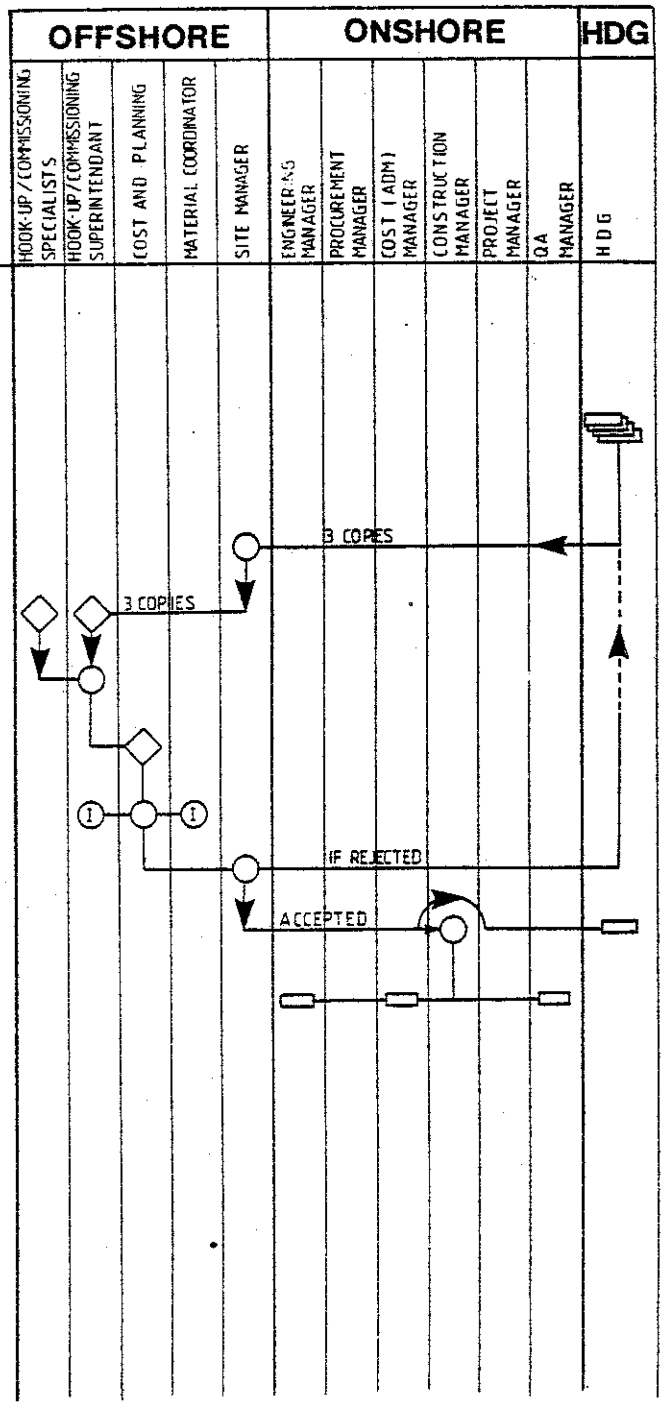
This entire process is to be completed in 24 hours or less.

The attached flow chart depicts documentation flow.

Note:
Loop test tasks and related precommissioning check sheets are to be approved by the Commissioning Systems Coordinators.

TASK SHEET APPROVAL

Ⓘ = Information
○ = Operation
◇ = Check/review
▭ = Document
△ = File

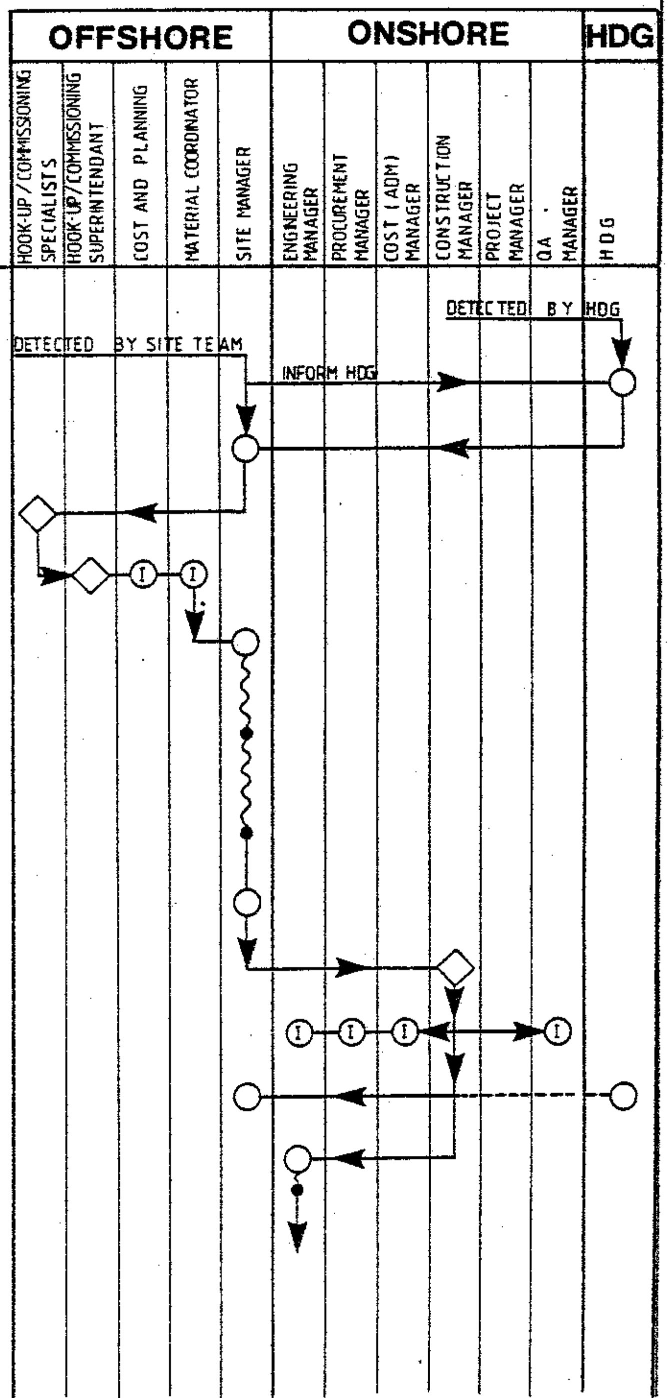


Seq	Description
1	HDG ISSUES 3 COPIES OF: TASK SHEET PRE. COMM SHEET AS BUILT DRWNGS SITE INSTRUCTIONS CHANGE ORDER REQUEST NDE
2	SITE MGR RECEIVES 3 COPIES FROM HDG
3	DISTRIBUTE 3 COPIES FOR REVIEW
4	TASK SHEET TO BE SIGNED - IF APPROVED
5	REVIEW
6	PREPARE TRANSMITTAL LETTER ACCEPTED OR REJECTED
7	DISTRIBUTE 2(3) COPIES TO SITE MGR
8	DISTRIBUTE TO HDG AND CONST. MGR
9	DISTRIBUTE TO COST AND PLANNING, CONSTRUCTION AND QA COST AND PLANNING: ORIGINAL SITE INSTRUCTION C.OR QA : TASK SHEET AS BULIT INFORMATION ENGINEERING : TASK SHEET AS BUILT INFORMATION

NON CONFORMANCE REPORTING

(I) = Information
○ = Operation
◇ = Check/review
▭ = Document
△ = File

Seq	Description
1	NON CONFORMANCE DETECTED AND TREATED WITHIN HDG'S ORGANIZATION ACCORDING TO PROCEDURE, OR DETECTED BY SITE TEAM
2	REPORT THE NON CONFORMANCE
3	DISCIPLINE SPECIALIST EVALUATES
4	SUPERINTENDANT EVALUATE INFO CP/MC
5	REPORT TO SITE MANAGER
6	IF MINOR MODIFICATION WITHIN A TASK, PROCEED AS PER "SITE INSTRUCTION"
7	IF MINOR MODIFICATION/NEW WORK, PROCEED AS PER "OFFSHORE ISSUED TASK"
8	IF MAJOR MODIFICATION, REPORT ONSHORE
9	EVALUATION
10	INFORMATION
11	IF REJECTED
12	IF ACCEPTED, PROCEED AS "ONSHORE ISSUED TASK"

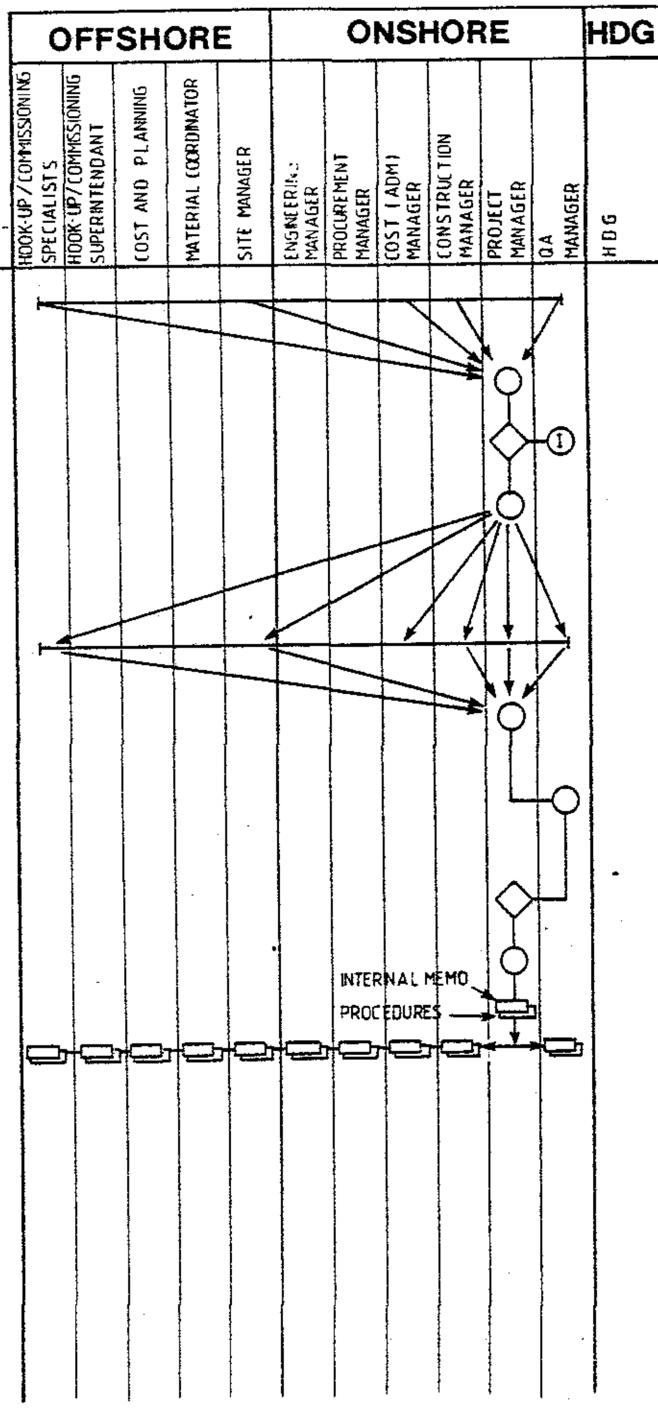


elf	QUALITY MANAGEMENT MANUAL TCP-2 EXTENSION PROJECT HOOK-UP & COMMISSIONING	Ref. No. Date effective : Revision No. : Date revised : Page 1/1

CORRECTIVE ACTION
(corrective actions to be taken caused by a non conformance of repetitve nature)

- (I) = Information
- ○ = Operation
- ◇ = Check/review
- ▭ = Document
- △ = File

Seq	Description
1	COMMITY ANALYZING A NON CONFORMANCE
2	RESULT TO BE SUBMITTED PROJECT MGR
3	PROJECT MGR EVALUATE (INFO QA DEPT)
4	PROJECT MGR PREPARE DRAFT FOR DISCUSSION IN THE WEEKLY MEETING
5	DRAFT PRESENTED AND DISCUSSED IN WEEKLY MEETING
6	PROJECT MGR MAKES DECISSION BASED UPON RESPONSE FROM WEEKLY MEETING
7	QA WORKS OUT NECESSARY PROCEDURES/REVICE EXISTING PROCEDURES
8	PROCEDURES TO BE CHECKED BY P.M
9	P.M WORKS OUT "INTERNAL MEMO" WHICH ARE DISTRIBUTED TOGETHER WITH THE PROCEDURES TO ALL PROJECT/INVOLVED PERSONS



1. Commissioning phase:

1.1. Commissioning phase starts after "ready for commissioning certificate".

1.2. Systems during commissioning phase are under the commissioning team responsibility.

1.3. Work permit is required for any work; to be issued by system coordinator.

1.4. Hook-up task procedure has to be followed for any hook-up assistance work. Management remains the commissioning responsibility.

1.5. Contractor commissioning teams will be managed by Elf commissioning team specialists.

1.6. Tests phases will be scheduled by Commissioning team (working document: General start-up schedule, weekly program..)

1.7. Commissioning sheets to be signed by

- Contractor and/or Vendor
- System Coordinator and (where necessary) specialist.

11. System acceptance certificate

11.1 Purpose: To be issued after completion of performance tests. To relieve Contractor and/or Vendor of his responsibility as fas as safekeeping, protection and performance tests are concerned with the exception of outstanding works as per "exception report", attached, if any.

- To release the system to Elf * Production/Maintenance for further operation and maintenance.

- This certificate gives to the Maintenance department the responsibility to maintain the equipment and to provide spare parts.

- This certificate can be issued for a subsystem

III. Provisional acceptance certificate

III.1. Same purposes as SYSTEM ACCEPTANCE CERTIFICATE, but is applied on a part of system and7or when performance tests are delayed.

III.2. Outstanding works to be described in "Commissioning Exception Report" and will be managed by the Commissioning System Coordinators.

IV. Clearance certificate

IV.1. Purpose: To be issued after completion of outstanding works as described in "Commissioning Exception Report".

IV.2. Elf * Production/Maintenance takes the complete responsibility of the system and no claim, for further outstanding works, could be issued to commissioning.

* Delete as required

COMMISSIONING	SYSTEM ACCEPTANCE CERTIFICATE
ELF AQUITAINE NORGE A/S elf	PROJECT **TCP 2 EXTENSION**

This certificate concerns the system:
subsystem:
equipment:

The commissioning will be completed

Year: Month: Day: Hour:

This certificate:

- relieves contractor or vendor of his responsibility as far as safekeeping, protection and performance tests are concerned with the exception of outstanding works as per "commissioning exception report" attached, if any.
- releases the system, subsystem or equipment from E.A.N. Commissioning responsibility and transfers to E.A.N. * Production/Maintenance the the responsibility of operation and maintenance.

	Commissioning	* Production/Maintenance
Name: Sign: Date:		

Documents attached:

* Delete as required

COMMISSIONING	CLEARANCE CERTIFICATE
ELF AQUITAINE NORGE A/S elf	PROJECT **TCP 2 EXTENSION**

The certificate concerns the system :
subsystem :
equipment

This certificate releases the system, subsystem or equipment from commissioning responsibility and transfers to E.A.N. * Production/ Maintenance the responsibility of operation and maintenance with no possible claim on Commissioning for further outstanding works.

	COMMISSIONING	* PRODUCTION/MAINTENANCE
Name: Sign: Date:		

* Delete as required

COMMISSIONING	PROVISIONAL ACCEPTANCE CERTIFICATE
ELF AQUITAINE NORGE A/S elf	PROJECT **TCP 2 EXTENSION**

This certificate concerns the system:
subsystem:
equipment:

The commissioning will be completed

Year: Month: Day: Hour:

The performance tests are delayed:

This certificate:

- relieves contractor or vendor of his responsibility as far as safekeeping, protection and performance tests are concerned with the exception of outstanding works as per "commissioning exception report" attached, if any.
- releases the system, subsystem or equipment from E.A.N. Commissioning responsibility and transfers to E.A.N. * Production/Maintenance the the responsibility of operation and maintenance.

	Commissioning	* Production/Maintenance
Name: Sign: Date:		

Document attached:

* Delete as required

COMMISSIONING	COMMISSIONING EXCEPTION REPORT
ELF AQUITAINE NORGE A/S	PROJECT: **TCP - 2 EXTENSION**

SYSTEM: ATTACHED TO: PROVISIONAL ACCEPTANCE *
SYSTEM ACCEPTANCE

Item	Description	Comments / Action

OBSERV.: * Cross out inapplicable item	Revision				
	Date				

APPENDIX 7

Appendix 7

Det norske Veritas
Industrial and Offshore Division

POSTAL ADDRESS: P.O.BOX 300, 1322 HØVIK, NORWAY
TELEPHONE: +47(02) 12 99 55
CABLE ADDRESS: VERITAS, OSLO
TELEX: 76 192 VERIT N

TECHNICAL REPORT

VERITAS Report No.:	Subject Group:
Date: 29. August 1983	
Department: IOD/089	Project No.: 871018
Title of Report: Audit Report Audit of Haugesund De Groot 17 - 19 August 1983	Approved by: P.A. Syrrist
Client/Sponsor of project: Elf TCP 2 - Extention	Client/Sponsor ref.: L. Krefting
Work carried out by: Dag Molvig	Reporters sign.: D Molvig

<u>INDEX:</u>

1. PREPHASE

The audit described in this report was instituted and supported by ELF TCP2-Ext. project management.

The audit was carried out during the period 17-19 August 1983.

The main basis for the audit were the Haugesund De Groot's manuals Part I and Part II and the ELF TCP2-Ext. Quality Management Manual (QMM).

2. THE AUDIT PLAN

2.1 The audit plan described in this report was worked out in close cooperation with TCP2-Extention's QA-Manager and was agreed upon before Audit start up.

2.2 The main objective of this scheduled audit was to:

- Provide objective evidence to what extent the prescribed procedural requirements were adhered to.
- Evaluate the adequacy of the prescribed procedural requirements.
- Reveal the Haugesund De Groot personnel experiences on significant areas.

3. AUDIT PLANNING

3.1 Selection of activities and areas to be audited:

- Basic QA-Manual's 14 requirements.
- Quality Control Manual procedures. Special attention were paid to recording, documentation and traceability.

3.2 The audit-team consists of:

Dag Molvig, Dnv
L. Krefting, Elf TCP2-Ext.

3.3 Questions were asked to HDG's Site Manager and HDG's QA-Manager. However, HDG's dicipline specialists were also involved when necessary. The questions were asked in accordance with the plan and check lists.

3.4 A short Pre-Audit meeting was held.
Following participated:
Mr. E. Handå, HDG Site Manager
Mr. G. Bradshaw, HDG QA-Manager.
Mr. L. Krefting, Elf TCP2-Ext., Stavanger.
Mr. P. Solhaug, Elf TCP2-Ext., Site Manager.
Mr. D. Molvig, DnV, Høvik.

4. THE EXECUTION

The audit was executed in accordance with plan and check lists.
The plan and check lists are enclosed.

5. FINDINGS

I Distribution list in the manuals were missing.

II The submitted manuals were not numbered, and the status "controlled" or "uncontrolled" were not indicated in the manuals.

III "The Quality Plan" was not worked out as described in the manual.

IV Records which should indicate renewal dates for the welders were not available at HDG's Site office.

V The Quality Audit Plan according to contract requirement were not followed. The contract states that 3 audits are to be performed during the Hook up and Commissioning.
No audit reports from the "offshore periode" were available.

VI Revisions to the QA-Manual were not performed during the offshore periode. However, Mr. Smith HDG's project manager in Stavanger informed me about a third revision before the audit started, but the 2nd revision should be used during this audit as the third was not yet distributed.

6. CONCLUSION

All the above mentioned findings could easily have been detected by HDG's Quality Assurance department if the contract requirement regarding the internal audits was full-filled.

However, it seems to the audit-team that the work HDG's project organization has performed is of good quality.

7. APPENDICES

Appendix 1: Audit Plan

Appendix 2: Check Lists

23.08.83
D. Molvig

L. Krefting

AUDIT PLAN TCO-2 Extention

Hook up and commissioning

1. Pre audit meeting — Onsdag 17.08.
2. Visit the facilities — Onsdag 17.08.
3. Audit performance — Thuesday 18.08.
4. Post audit meeting
5. Reporting

1. Pre audit meeting

- Welcome the participants
- Inform about the audit intention
- Inform about areas to eb audited
- Arrange with key person in respective areas

2. Visit in the TCP2 Ext. areas to be familiar with the installations

3. Audit Performance

- QA-Manual
- QC-Plan
- Status Reports
- Documentation and Changes
- Subcontractors and Supplies
- Storage
- Identification, marking etc.
- Measuring and Testing Equipment
- Production Control
- Hook and Installations
- Inspection Status
- Records
- Non-Confirming
- Corrective Action
- Quality Audits

NDT audit by Odd Møller, DnV, will be submitted TCP2-Ext. separate.

4. Post Audit Meeting (See comments)

5. Reporting

DET NORSKE VERITAS

AUDIT CHECKLIST

Audit No./Date	Page 12 of 22
Client	ELF
Project	TCP2-Ext

Location/Organizational unit: Haugesund De Groot

Subject/Element: QUALITY AUDITS

Reg. No.:

No.	Checkpoint description	Document references External	Document references Internal	Yes	No	Comment*	Not applic.	Not checked
16.11	Are written audit procedures sufficiently comprehensive to provide objective evidence of the system's effectiveness?			X				
16.12	Are these audits covering: -Quality Assurance Systems -Processes and working methods -Products and services			X				

*Finding/Observation to be described in the audit rep.

Diskette reference	Date/Sign. of auditor
IOD/89-C24	

DET NORSKE VERITAS	AUDIT CHECKLIST	Audit No./Date	Page 21 of 22
		Client ELF	
		Project TCP 2-Ext	

Location/Organizational unit: Haugesund De Groot

Subject/Element: QUALITY AUDITS

Reg. No.:

No.	Checkpoint description	Document references: External	Document references: Internal	Yes	No	Comments*	Not applic.	Not checked
16.1	Is a system for quality audits established?			X				
16.2	Are audits planned and carried out on a scheduled basis?	See audit report.			X			
16.3	Are procedures for audit documented?			X				
16.4	Are audits carried out by qualified personnel?	No audit reports available			X	X		
16.5	Are the audit team members independent of the activity beeing audited?	— // —						
16.6	Are audit results documented?				X			
16.7	Are corrective actions initiated?				X			
16.8	Are effective corrective actions taken when revealed as necessary by the audit findings	See abovementioned comments			X			
16.9	Is sufficient training provided for audit personnel?	— // —						
16.10	Is the quality audit system including subcontractor's quality assurance?	In the manual it is described		X				

*Finding/Observation to be described in the audit report

Diskette reference	Date/Sign. of auditor
IOD/89-C24	

DET NORSKE VERITAS

AUDIT CHECKLIST

Client: ELF

Project: TCP 2 Ext

Location/Organizational unit: Haugesund De Groot

Subject/Element: FINAL INSPECTION

Reg. No.:

No.	Checkpoint description	Document references External	Document references Internal	Yes	No	Comments*	Not applic.	Not checked
15.1	Is a system for final inspection established?			X				
15.2	Are completed items given a final inspection which indicates overall quality?			X				
15.3	Does the system include re-inspection of corrected, repaired or modified products?			X				
15.4	Are all final inspection results reported?			X				
15.5	Are inspection problems or deficiencies promptly reported to appropriate authority?	To ELF TCP 2 Ext site team		X				

*Finding/Observation to be described in the audit re[port]

Diskette reference	Date/Sign. of auditor
IOD/89-C24	

DET NORSKE VERITAS

AUDIT CHECKLIST

Client	ELF
Project	TCP2 - Ext

Location/Organizational unit: Haugesund De Groot

Subject/Element: CORRECTIVE ACTION

Reg. No.:

No.	Checkpoint description	Document references: External	Document references: Internal	Yes	No	Comments*	Not applic.	Not checked
14.1	Are products designed to detect and correct any condition which causes or may cause nonconformance?							
14.2	Do these procedures include analysis of nonconforming products, services and documents and processes and operations in order to detect the cause of the nonconformance?							
14.3	Are procedures prepared which ensure that corrective actions are accomplished, documented and checked?							
14.4	Are adequate actions taken to correct the causes of defects in products and facilities?							
14.5	Are analysis made to identify trends towards product deficiencies?							
14.6	Does corrective action extend to sub-contractors' products?							
14.7	Is corrective action taken to arrest unfavourable trends before deficiencies occur?							

*Finding/Observation to be described in the audit re[...]

Diskette reference	Date/Sign. of auditor
IOD/89-C24	

DET NORSKE VERITAS

AUDIT CHECKLIST

Client: *ELF*

Project: *TCP 2-Ext*

Location/Organizational unit: *Haugesund De Groot*

Subject/Element: NONCONFORMANCE

Reg. No.:

No.	Checkpoint description	Document references: External	Document references: Internal	Yes	No	Comments*	Not applic.	Not checked
13.1	Does the contractor have a satisfactory system for control and treatment of nonconforming products and documents?	*Only one report was issued (Non conformance report)*		X		X		
13.2	Are nonconforming products and documents identified and marked and if found necessary segregated from other products and documents?			X				
13.3	Does the system define responsibility and authority to decide disposition of nonconforming products and documents?			X				
13.4	Does the system include types and extent of inspection or testing after repair, rework, correction etc.?			X				
13.5	Are results of nonconformance treatment recorded?	*The only report issued was also closed.*		X				
13.6	Are holding areas adequate for the detention and storage of nonconforming products?	*No specific holding areas due to components dimentions and shape. No serial production*						

*Finding/Observation to be described in the audit rep[ort]

Diskette reference	Date/Sign. of auditor
IOD/89-C24	

DET NORSKE VERITAS	AUDIT CHECKLIST	Audit No./Date:	Page 17 of 22
		Client: ELF	
		Project: TCP 2-Ext	

Location/Organizational unit: Haugesund De Groot

Subject/Element: RECORDS

Reg. No.:

No.	Checkpoint description	Document references: External	Document references: Internal	Evaluation: Yes	No	Comments*	Not applic.	Not checked
12.1	Are there records of essential quality assurance activities?			X				
12.2	Are there effective means for assuring the currency, completeness and accuracy of records?			X				
12.3	Do inspection records contain all essential data?			X				
12.4	In instances of rejection, do records show resulting action?			X				
12.5	Are records analyzed and used for the purpose of management action?			X				
12.6	Are there satisfactory arrangements for the storage and rtrieval of records?			X				
12.7	Are records from subcontractors part of the documentation?	Certificates documents etc		X				
12.8	Are data obtained analysed and used for maintenance and improvement of the fabrication process?	only for welders qualification as this is the most important activity				X	X	

*Finding/Observation to be described in the audit rep

Diskette reference	Date/Sign. of auditor
IOD/89-C24	

DET NORSKE VERITAS

AUDIT CHECKLIST

Client: ELF

Project: TCP2-Ext

Location/Organizational unit: Haugesund De Groot

Subject/Element: INSPECTION STATUS

Reg. No.:

No.	Checkpoint description	Document references: External	Document references: Internal	Yes	No	Comments*	Not applic.	Not checked
11.1	Does the contractor employ an effective system for indicating the inspection status of materiel?			X				
11.2	Is the inspection status of materiel readily apparent?			X				
11.3	Is batch or lot identity maintained throughout the manufacturing process where necessary?							
11.4	If stamps are used for identification, are there then records of stam holders?						X	

*Finding/Observation to be described in the audit repo

Diskette reference: IOD/89-C24

Date/Sign. of auditor:

DET NORSKE VERITAS

AUDIT CHECKLIST

Client: ELF
Project: TCP2-Ext

Location/Organizational unit: Haugesund De Groot

Subject/Element: PRODUCTION

Rep. No.:

No.	Checkpoint description	Document references: External	Document references: Internal	Yes	No	Comment*	Not applic.	Not checked
10.17	Do any of the supplier's manufacturing or inspection processes fall into the category of special processes?			X				
10.18	Does the quality system ensure that appropriate and detailed work, inspection and test instructions are provided and used for any highly specialized or complex processes?			X				
10.19	Is equipment used in special processes suitable?			X				
10.20	Are personnel performing work on special processes adequately trained and qualified?	Two welders were sent onshore due to qualifications		X		X		

*Finding/Observation to be described in the audit rep[ort]

Diskette reference	Date/Sign. of auditor
IOD/89-C24	

DET NORSKE VERITAS

AUDIT CHECKLIST

17

Client: *ELF*

Project: *TCP 2-Ext*

Location/Organizational unit: *Haugesund De Groot*

Subject/Element: PRODUCTION

Reg. No.:

No.	Checkpoint description	Document references: External	Document references: Internal	Evaluation: Yes	Evaluation: No	Evaluation: Comments*	Evaluation: Not applic.	Evaluation: Not checked
10.9	Are unsuitable inspection or monitoring methods corrected promptly?			X				
10.10	Is conformance to documented inspection methods complete and continuous and are corrective measures taken wen non-compliance occurs?			X				
10.11	Is a system for preventive maintenance established?			X				
10.12	Are acceptance and rejection criteria provided for all inspection and monitoring actions?			X				
10.13	Is accepted and rejected materiel properly identified?			X				
10.14	Does the quality system assure provision of the proper processing equipment as well as the necessary degree of certification, inspection, authorization and monitoring for specified and complex processes?			X				
10.15	Do established standards of workmanship and acceptance and rejection criteria provide an objective basis for decisions on acceptibility?	*codes and standards*		X				
10.16	Can work be released without the agreement of the authority responsible?				X			

*Finding/Observation to be described in the audit report

Diskette reference	Date/Sign. of auditor
IOD/89-C24	

DET NORSKE VERITAS

AUDIT CHECKLIST

Audit No./Date

Client: ELF

Project: TCP2-Ext

Location/Organizational unit: Haugesund De Groot

Subject/Element: PRODUCTION

Reg. No.

No.	Checkpoint description	Document references External	Document references Internal	Yes	No	Comments*	Not applic.	Not checked
10.1	Are all production processes accomplished under controlled conditions?			X				
10.2	Does control include necessary documented work instructions, adequate production equipment and appropriate working environments?			X				
10.3	Do necessary work instructions provide criteria for determining whether production, processing and fabrication work is acceptable or unacceptable?			X				
10.4	Does the quality system provide for monitoring both the issue of necessary work instructions and compliance with them?			X				
10.5	Are physical examination, measurements or tests of materiels provided for each work operation where appropriate?			X				
10.6	When direct inspection is not practicable, does the system provide for indirect control by monitoring of processes?	When NDT is required		X		X		
10.7	Are both physical inspection and process monitoring used when either alone would be inadequate, or when required by the contract?	NDT		X				
10.8	Is inspection and process monitoring accomplished systematically and are records kept?			X				

*Finding/Observation to be described in the audit rep

Diskette reference	Date/Sign. of auditor
IOD/89-C24	

DET NORSKE VERITAS	AUDIT CHECKLIST	Client: *ELF* Project: *TCP2-Ext*

Location/Organizational unit: *Haugesund De Groot*

Subject/Element | Reg. No.

No.	Checkpoint description	Document references: External	Document references: Internal	Yes	No	Comments*	Not applic.	Not checked
9.10	Is the vendor maintaining calibration records?	*Only NDT Equipm.* (bracketing 9.10–9.17)						
9.11	Do the calibration records appear adequate and in order?							
9.12	Is all equipment labelled, coded or otherwise identified to indicate the calibration status?							
9.13	Does the calibration system also include special equipment used for inspection purposes, as rigs and fixtures?							
9.14	Is equipment possessed or used by subcontractors subject to the same requirements as apply to the contractor's requirements?							
9.15	Is calibration of equipment traceable to national or international standards?							
9.16	Are certified measurement standards available and used?							
9.17	Do calibration certificates and reports include a statement of environmental conditions?							
9.18	Is all tooling which is used as inspection equipment proved for accurency prior to use?							

*Finding/Observation to be described in the audit re[port]

Diskette reference	Date/Sign. of auditor
DD/89-C24	

DET NORSKE VERITAS

AUDIT CHECKLIST

Client: ELF

Project: TCP 2 - Ext

Location/Organizational unit: Haugesund De Groot

Subject/Element: MEASURING AND TESTING EQUIPMENT

Reg. No.:

No.	Checkpoint description	Document references: External	Document references: Internal	Evaluation: Yes	No	Comments*	Not applic.	Not checked
9.1	Is a system established which ensures that satisfactory measuring and testing equipment is required?	In procedures it is well described but measuring and testing equipment are limited		X				
9.2	Does this system cover all necessary equipment for inspecting, testing and verifying that products and services are in accordance with the specification?			X				
9.3	Has all equipment been assigned a ~~unique~~ unique identification?							
9.4	Does the vendor maintain a list of all measuring and testing equipment?				X			
9.5	Is all equipment stored under proper conditions?			X				
9.6	Is all equipment used as intended by qualified personnel?							
9.7	Are training provided for users of this equipment?	Except for NDT Equipment		X			X	
9.8	Has the vendor established the frequency of calibration for all equipment?			X				
9.9	Is all equipment calibrated at established intervals?	For the limited job. NDE equipment yes		X			X	

*Finding/Observation to be described in the audit rep

Diskette reference	Date/Sign. of auditor
IOD/89-C24	

DET NORSKE VERITAS

AUDIT CHECKLIST

Client: ELF

Project: TCP 2 - Ext

Location/Organizational unit: Haugesund De Groot

Subject/Element:

Reg. No.:

No.	Checkpoint description	Document references: External	Document references: Internal	Evaluation: Yes	No	Comments*	Not applic.	Not checked
8.7	Are special crates, boxes, containers, trucks or other transportation vehicles provided for handling materiel?			X				
8.8	Are handling devices periodically inspected for cleanliness and suitability for use?			X				
8.9	Is material suitability protected when passing through or held in areas that may contain harmful contaminants?							X
8.10	Are there procedures and regular schedules for the inspection of products in storage and are these procedures adequate to prevent deterioration or damage?	This project is time limited						
8.11	Is there a procedure to assure that items that can corrode or otherwise deteriorate during manufacture or interim storage are properly cleaned and preserved?			X				
8.12	Are all required critical environments maintained during storage?			X				
8.13	Is all materiel to be stored or shipped properly identified and labelled?			X				
8.14	Are all shipments prepared and transported in conformance to specified requirements and applicable carrier regulations?			X				

*Finding/Observation to be described in the audit rep

Diskette reference: OD/89-C24

Date/Sign. of auditor:

DET NORSKE VERITAS

AUDIT CHECKLIST

Client: *ELF*

Project: *TCP 2 - Ext*

Location/Organizational unit: *Haugesund De Groot*

Subject/Element: IDENTIFICATION, MARKING, HANDLING, STORING AND SHIPPING

Reg. No.:

No.	Checkpoint description	Document references: External	Document references: Internal	Evaluation: Yes	Evaluation: No	Evaluation: Comments*	Evaluation: Not applic.	Evaluation: Not checked
8.1	Is a system established which ensures that the following activities are taken care of for raw material and products: -Identification -Marking -Handling -Segregation -Preservation -Storing -Skipping			X				
8.2	Does this system cover: the materials or products supplied or produced -By the manufacturer himself -Sub-contractors? -Customers?			X				
8.3	Does.. the system provide for the identification, as necessary, of the materiel from the time of receipt until the contractor's responsibility ceases?			X				
8.4	Are adequate work and inspection instructions prepared and implemented for the handling, storage and delivery of materiel?			X				
8.5	Are handling, storage and delivery procedures and methods monitored as part of the quality system review?			X				
8.6	Has the contractor instructions or procedures, where necessary, to control handling and transport operations?			X				

*Finding/Observation to be described in the audit r

Diskette reference	Date/Sign. of auditor
IOD/89-C24	

DET NORSKE VERITAS

AUDIT CHECKLIST

Client: ELF

Project: TCP 2-Ext

Location/Organizational unit: Haugesund De Groot

Subject/Element: SUBCONTRACTS

Reg. No.:

No.	Checkpoint description	Document references: External	Document references: Internal	Yes	No	Comments*	Not applic.
7.15	Does the contractor's system provide for the immediate recall and replacement of materiel released for production prior to completion incoming inspection and subsequently found to be non-conforming?	Through ELF TCP 2 Ext Stavanger		X			
7.16	Is a procedure for treatment of nonconformance established for incoming inspection?	Yes for all stages		X			

*Finding/Observation to be described in the audit re[port]

Diskette reference: IOD/89-C24

Date/Sign. of auditor:

DET NORSKE VERITAS	AUDIT CHECKLIST	7 . 12 Client: ELF Project: TCP2-Ext

Location/Organizational unit: Haugesund De Groot		Document references		Evaluation				
Subject/Element: SUBCONTRACTS	**Reg. No.**	**External**	**Internal**	**Yes**	**No**	**Comments***	**Not applic.**	**Not checked**
No.	**Checkpoint description**							
	Incoming inspection							
7.8	Does the contractor inspect incoming materiel to the extent necessary upon receipt?	Most of the materials are Elf supplies and will only be inspected for quantity and transportation damages						
7.9	Does the contractor adjust the extent of receiving inspection on the basis of objective data?							
7.10	Does the contractor assure that materiel conforms to the applicable physical, chemical and other technical requirements, using laboratory analysis as necessary?							
7.11	Is tested, approved materiel identified and carefully segregated from that not tested or approved?							
7.12	Does the contractor have effective controls for preventing the use of non-conforming incoming materiel?							
7.13	Are there adequate procedures for providing sub-contractors with appropriate data regarding unsatisfactory quality?							
7.14	Has the contractor adequate controls for assuring correction of sub-contracted non-conforming materiel?							

*Finding/Observation to be described in the audit re[port]

Diskette reference	Date/Sign. of auditor
IOD/89-C24	

DET NORSKE VERITAS

AUDIT CHECKLIST

Client: ELF
Project: TCP2 - Ext

Location/Organizational/unit: Haugesund De Groot

Subject/Element: SUBCONTRACTS

Reg. No.:

No.	Checkpoint description	Document references: External	Document references: Internal	Yes	No	Comments*	Not applic.	Not checked
7.1	Is a system established to assure that materiel and services supplied by sub-contractors meet contract requriements?	by approtation of all subcontracting from Elf TCP 2 Ext		X				
7.2	Does the system provide for the selection of sub-contractors on the basis of their quality capability?						X	
7.3	Does the contractor review his sub-contractor's performance at intervals consistent with the complexity and quality of the product?						X	
7.4	Do contractor records provide evidence that the supplier's control, and those of his sub-contractors, are adequate to assure the quality of purchased materiel and services?	Yes, the manual indicates Not applicable for this job						
	Purchasing documents							
7.5	Do the contractor's purchasing documents clearly describe requirements?						X	
7.6	Do the purchasing documents contain a clear description of the products or services ordered?						X	
7.7	Do the purchasing documents include a clear identification of relevant edition of specifications, drawings etc.?						X	

*Finding/Observation to be described in the audit re[port]

Diskette reference: IOD/89-C24

Date/Sign. of auditor:

DET NORSKE VERITAS

AUDIT CHECKLIST

Client: ELF
Project: TCP 2 - Ext

Location/Organizational unit: Haugesund De Groot

Subject/Element: DOCUMENTATION AND CHANGES

Reg. No.:

No.	Checkpoint description	Document references: External	Document references: Internal	Yes	No	Comments*	Not applic.	Not checked
5.1	Is a system for documentation and change control established?			X				
5.2	Does the system provide for clear and precise stipulation of responsibilities in documentation issue and change control?			X				
5.3	Are changes made in writing?			X				
5.4	Is the system of recording changes satisfactory?			X				
5.5	Are obsolete documents promptly removed from all points of issue or use?			X				
5.6	Are changes in documentation verified and approved by the same authority which approved the original documentation?	All changes are subject to review by both ELF and HDG		X		X		

*Finding/Observation to be described in the audit re[port]

Diskette reference	Date/Sign. of auditor
IOD/89-C24	

DET NORSKE VERITAS

AUDIT CHECKLIST

Client: ELF

Project: TCP 2 - Ext

Location/Organizational unit		Document references		Evaluation				
Haugesund De Groot		External	Internal					
Subject/Element: JOB INSTRUCTIONS AND PROCEDURES	Reg. No.							
No.	Checkpoint description			Yes	No	Comments*	Not applic.	Not checked
4.1	Are documented instructions and procedures available for work operations where lack of those would adversely affect work performance?			X				
4.2	Are such work instructions and procedures clear and complete?			X				
4.3	Are these stating by whom and in what way the work shall be carried out?			X				
4.4	Do they establish acceptable quality standards for the work operations covered?			X				
4.5	Are they compatible with associated inspection and testing?			X				
4.6	Is proper use made of the work instructions and procedures?			X				
4.7	Are the work instructions and procedures systematically reviewed?						X	
4.8	Are these consuming correct understanding and performance of the task?			X				
4.9	Are those instructions and procedures good enough to give satisfactory continuity in the work, even if the personnel changes?			X				

*Finding/Observation to be described in the audit re

Diskette reference	Date/Sign. of auditor
IOD/89-C24	

DET NORSKE VERITAS

AUDIT CHECKLIST

Client: ELF

Project: TCP2-Ext

Location/Organizational unit: Haugesund De Groot

Subject/Element: PLANNING

Reg. No.:

No.	Checkpoint description	Document references: External	Document references: Internal	Evaluation: Yes	Evaluation: No	Evaluation: Comments*	Evaluation: Not applic.
3.1	Has the contractor obtained all the information needed to execute the contract?			X			
3.2	Has the contractor conducted a complete review of his contract to identify and provide for special or unusual contract requirements?	This audit shows that internal audits were missing				X	
3.3	Has the contractor initiated quality planning prior to starting work?	Yes, it is indicated in the manual. Actual plan is missing				X	
3.4	Is the need for measuring and testing equipment evaluated and the equipment procured at the right time?						
3.5	Does quality planning provide for inclusion of quality requirements, as stated in the contract, in the purchasing and production documents?	As the different jobs are devided into tasks each task contains all requirements for each job.					
3.6	Is sufficient time for inspection reserved in the manufacturing plans?						
3.7	Are possible subcontractors evaluated?			X			
3.8	Are checks of compatibility between production procedures, inspection procedures and applicable technical documentation carried out before start of manufacturing?	They are approved by HDG				X	
3.9	Are personnel required, their qualification requirements and training programmes evaluated?			X			
3.10	Are training records maintained?			X			

*Finding/Observation to be described in the audit r

Diskette reference	Date/Sign. of auditor
IOD/89-C24	

DET NORSKE VERITAS

AUDIT CHECKLIST

Client: *ELF*

Project: *TCP 2 Ext*

Location/Organizational unit: *Haugesund De Groot*

Subject/Element: ORGANIZATION

Reg. No.:

No.	Checkpoint description	Document references: External	Document references: Internal	Yes	No	Comments*	Not applic.	Not checked
2.1	Is the contractor's organization documented?			X				
2.2	Does these documents show how the contractor's different tasks are distributed between departments?			X				
2.3	Has the contractor identified and assigned responsibility and authority for the functions and activities directly affecting quality?			X				
2.4	Are there any gaps?				X			
2.5	Is there overlapping or conflict of responsibilities?				X			
2.6	Are job descriptions beeing prepared?			X				
2.7	Has the quality manager an independant position in the organization with direct responsibility to the top management?			X				
2.8	Has the quality manager sufficiently defined responsibility, authority, resources and organizational freedom to perform the following tasks: -planm and maintain the contractor's quality assurance program -verify that specified requirements are met -implement the measures or soketions necessary to cusure quality -plan and perform quality audits	*Remark: The project Mgr in Stavanger prepare the revision of the QA program. However, most of the QAM's chapters are prepared by the QA Manager Mr. G. Bradshaw.*						
2.9	Is verification of quality requirements carried out by personnel other then those who have performed the work?			X				

*Finding/Observation to be described in the audit report

Diskette reference	Date/Sign. of auditor
IOD/89-C24	

DET NORSKE VERITAS

AUDIT CHECKLIST

Client: ELF

Project: TCP 2-Ext

Location/Organizational unit: Haugesund (De Groot)

Subject/Element: GENERAL REQUIREMENTS

Reg. No.:

No.	Checkpoint description	Document references: External	Document references: Internal	Yes	No	Comments*	Not applic.	Not checked
1.1	Has the contractor established and documented a formal system of quality assurance?	NS 5802	QAS					
1.2	Is the description of the quality assurance summarized in a quality assurance manual?			X				
1.3	Does the quality assurance manual contain the contractor's quality objective, endorced by the contractor's top management?			X				
1.4	Is a description given of how the requirements in NS 5802 are met?			X				
1.5	Does the quality assurance manual give a survey of the quality assurance documentation? -composition x -content x -distribution x -updating x			X				
1.6	Is a description given on how quality assurance on contracts, products or services in question shall be prepared?			X				
1.7	Are qualification and background requirements specified for personnel carrying out work of significance for the quality?			X				

*Finding/Observation to be described in the audit re...

Diskette reference: IDD/89-C24

Date/Sign. of auditor:

APPENDIX 8

ELF AQUITAINE NORGE RIGG TCP2 EXTENTION

PRODUCED BY HAUGESUND - DE GROOT

ID:50 PROJECT: TCP2

PAGE : 1

SCHEDULE : LEVEL 2

REPORT NUMBER : BARL2

RUN DATE 12-SEP-83

SORTED BY PLANNED START

DATASET : LEVEL2

LOCATION	SYSTEM	DESCRIPTION	% COM	1 JUN 83 … 28 SEP 83 (weekly: 1, 8, 15, 22, 29 JUN; 6, 13, 20, 27 JUL; 3, 10, 17, 24, 31 AUG; 7, 14, 21, 28 SEP)	REMARKS
DP2 (DRILLING PLATFORM NO.2)					
03	01	AIR SYSTEM	100	I I I I #...................................C I I I I I T I I I I	SYSTEM ACCEPTED
03	53	CONTROL ROOM EQUIPMENT	100	I I I I I I I ##########################...............I T I I I I	SYSTEM ACCEPTED
03	54	METHANOLATED WATER DISPOSAL	100	I I ##...............CCC T I I I I	SYSTEM ACCEPTED
05					
05	12	ODIN GAS TREATMENT LINE	0	I I I I I I I XXXXXXXXXXXXXXXXXXXXXXXXXX. I I I T I I I I	"SYSTEM ACCEPTED" PC2=100
05	14	ODIN GAS SUPPLY LINE	0	I I I I I I I XXXXXXXXXXXXXXXXXXXXXXXXXX. I I I T I I I I	"SYSTEM ACCEPTED" PC2=100
TCP2 (COMPRESSION)					
07	20	POWER GENERATION 5.5 KV	100	## I I CCCCCCCCCCCCCCCCCCCCCCCCC I I T I I I I	
07	28	EMERGENCY SHUTDOWN(HYDAULIC &	100	I I #................ I I I I I I I I I T I I I I	SYSTEM ACCEPTED
TCP2 EXTENSION					
08	01A	INSTRUMENT AIR DISTRIBUTION	100	I I I ##################.........................CCI I I I I T I I I I	SYSTEM ACCEPTED
08	01B	SERVICE AIR DISTRIBUTION	100	####################################.........................CCI I I I I T I I I I	SYSTEM ACCEPTED
08	02	FUEL GAS	100	I I ##......CCC I I T I I I I	SYSTEM ACCEPTED
08	03A	CABLE TRAYS	100	##########.... I I I I I CC I I I I I T I I I I	SYSTEM ACCEPTED
08	03B	380V POWER DISTRIBUTION	100	I I ##.......................CCCCCCC I I T I I I I	SYSTEM ACCEPTED
08	03C	NORMAL LIGHTING	100	#########...... I I I I I ICC I I I I I T I I I I	SYSTEM ACCEPTED
08	03D	EMERGENCY LIGHTING	100	#########..... I I I I ICC I I I I I I T I I I I	SYSTEM ACCEPTED
08	03E	EMERGENCY POWER (220V NO BREAK)	100	I I ##................ I I I CCCCC I I I I I T I I I I	SYSTEM ACCEPTED

LEVEL 2 BARCHART

KEY: T=TIMENOW #=PROGRESS X=DURATION .=FLOAT C=COMMISSIONING

Columns (weeks): 1 JUN 83, 8 JUN 83, 15 JUN 83, 22 JUN 83, 29 JUN 83, 6 JUL 83, 13 JUL 83, 20 JUL 83, 27 JUL 83, 3 AUG 83, 10 AUG 83, 17 AUG 83, 24 AUG 83, 31 AUG 83, 7 SEP 83, 14 SEP 83, 21 SEP 83, 28 SEP 83

LOCATION	SYSTEM	DESCRIPTION	% COM	BAR (1 JUN 83 – 28 SEP 83)	REMARKS
88	03F	24V DC	100	I I ########.......................CCCCC I I T I I I I	SYSTEM ACCEPTED
88	03G	GROUNDING	100	I I I I I I ################################ I I I T I I I I	SYSTEM ACCEPTED
88	03H	TRACE HEATING	100	I I ####################################..................CCCCCCCCCC I T I I I I	
88	03J	GENERAL (NO COMM. INVOLVED)	100	I I ##T#####... I I I	
88	04A	HIGH PRESSURE RELIEF TO CV 24	100	##..................CCC I I T I I I I	SYSTEM ACCEPTED
88	04B	LOW TEMPERATURE RELIEF	99	I I I I I ##############################....CCC I I T I I I I	
88	05	LOW PRESSURE RELIEF	100	I I I I I I I I I ########.......CC I I T I I I I	SYSTEM ACCEPTED
88	06A	PUBLIC ADDRESS AND PUBLIC ALARM	100	##...........................T.....CC I I I	SYSTEM ACCEPTED
88	06B	GAS DETECTION	100	I##################...................................CCCCCCCCCCI I I I T I I I I	SYSTEM ACCEPTED
88	06C	FIRE DETECTION	100	##################...................................CCCCCCCCCCI I I I T I I I I	
88	08	HYDRAULIC & SHUTDOWN SYSTEMS	95	I ###XXX..............CCCCCCCTCCCCCCI I I I	
88	09A	HIGH PRESSURE METHANOL	100	I #.. I I I T I I I I	SYSTEM ACCEPTED
88	09B	METHANOL INJECTION TO NEF	100	I I I ######################################..........CCCC I T I I I I	SYSTEM ACCEPTED
88	10A	OPEN DRAINAGE	100	I I I ##############################..C I I I I I T I I I I	SYSTEM ACCEPTED
88	10B	CLOSED DRAINAGE	100	###..CCC I I T I I I I	
88	10C	METHANOLATED WATER	100	I I ##.....CCCC I T I I I I	
88	11	CONDENSATE	99	I###...CCCCCCCCCCCCCCCCC T I I I I	
88	12A	NEF TREATMENT LINE	98	I I I I I #################.........................CCCCCCCCCCCCCCCCCCCCCCCTCCCCCCCCCCCC I I I	
88	12B	ODIN GAS TREATMENT LINE	98	I ##...CCCCCCCCCCCCCCCCCCCCCCTCCCCCCCCCCCC I I I	
88	14A	NORTH EAST FRIGG GAS SUPPLY LI	98	I I I I ####################################..................CCCCCC T I I I I	
88	14B	ODIN GAS SUPPLY LINE	99	I I I ##,,,CCCCCC I I T I I I I	
88	16	GLYCOL HEATING MEDIUM	100	##....CCCCC I I T I I I I	
88	17A	FIRE WATER	100	I########################## I CC I I I I I I I T I I I I	SYSTEM ACCEPTED

LEVEL 2 BARCHART

KEY: T=TIMENOW #=PROGRESS X=DURATION .=FLOAT C=COMMISSIONING

LOCA TION	SYS TEM	DESCRIPTION	% COM	1 JUN 83 … 28 SEP 83 (weekly: 1, 8, 15, 22, 29 JUN; 6, 13, 20, 27 JUL; 3, 10, 17, 24, 31 AUG; 7, 14, 21, 28 SEP 83)	REMARKS
88	17B	DELUGE WATER	58	I I I I I I I I ############XXXXXXXX..............CCCCCT I I I I	
88	17C	EXTINGUISHING SYSTEM	100	##..........CC I I I I I T I I I I	SYSTEM ACCEPTED
88	18	WASHDOWN	100	I ##......................CC I I T I I I I	SYSTEM ACCEPTED
88	22	MISCELLANEOUS	97	I ##TXX...... I I I	
88	25A	STRUCTURE	97	I ##XX.........T........ I I I	
88	25B	ACCESS & ESCAPE WAYS	97	##X.........................T........ I I I	
88	33	UTILITY WATER	100	I I ##.................CI I I T I I I I	SYSTEM ACCEPTED

P (QUARTERS PLATFORM)

LOCA TION	SYS TEM	DESCRIPTION	% COM	1 JUN 83 … 28 SEP 83	REMARKS
96	11	TELECOMMUNICATIONS, TELEMETRY	100	I ##....................CCCCCCCCCCCCCC T I I I I	
96	14	CONTROL ROOM	91	I I I ###XXX.................. I I T I I I I	
96	17	ELECTRICAL	100	I I ###############... I I T I I I I	SYSTEM ACCEPTED

LEVEL 2 BARCHART

KEY: T=TIMENOW #=PROGRESS X=DURATION .=FLOAT C=COMMISSIONING

END OF REPORT

Timeline columns (week starting): 1 JUN 83, 8 JUN 83, 15 JUN 83, 22 JUN 83, 29 JUN 83, 6 JUL 83, 13 JUL 83, 20 JUL 83, 27 JUL 83, 3 AUG 83, 10 AUG 83, 17 AUG 83, 24 AUG 83, 31 AUG 83, 7 SEP 83, 14 SEP 83, 21 SEP 83, 28 SEP 83

TASK	DESCRIPTION	PHYS AREA	D I S	EARLY START	EARLY FINISH	DUR	1 JUN – 28 SEP 83
3242	PULLING AND FASTENING ELECTRICAL CABLES FROM DB32 TO DIFFERENT DISTRIBUTION BOARDS AND INSTR CABINETS	85	E	12-JUN-83	12-JUN-83	1	I I X..I......I......I I I I I I I I I I I I I I I
3126	TERMINATION OF CABLE IN TELEMETRY CABINET INTERFACE ROOM P13	85	E	13-JUN-83	13-JUN-83	1	I I X.I......I......I. I I I I I I I I I I I I I I
3127	TERMINATION OF CABINET IN ZENER BARRIER RACK INTERFACE ROOM P13	85	E	13-JUN-83	13-JUN-83	1	I I X.I......I......I. I I I I I I I I I I I I I I
3134	TERMINATION OF ELECTRICAL CABLE 323 P08	85	E	13-JUN-83	13-JUN-83	1	I I X.I......I......I. I I I I I I I I I I I I I I
3228	GLANDING OF CABLES IN FIRE DETECTION CABINET INTERFACE ROOM P13	85	E	13-JUN-83	13-JUN-83	1	I I X.I......I......I. I I I I I I I I I I I I I I
3230	GLANDING OF CABLES IN FIRE DETECTION CABINET INTERFACE ROOM P13	85	E	13-JUN-83	13-JUN-83	1	I I X.I......I......I. I I I I I I I I I I I I I I

TCP2 EXTENSION SYSTEM : 88 03F

TASK	DESCRIPTION	PHYS AREA	D I S	EARLY START	EARLY FINISH	DUR	1 JUN – 28 SEP 83
3243	PULLING AND FASTENING ELECTRICAL CABLES FROM DB324 TO DIFFERENT DISTRIBUTION BOARDS AND INSTR CABINETS	85	E	20-JUN-83	20-JUN-83	1	I I I X.I......I......I......I......I......I......I......I.... I I I I I I I I
3217	PULLING AND FASTENING ELECTRICAL CABLES FROM S 52,32,2,2&3 (MCC "A" & "B") TO MARSHELLING CABINET INTERF ROOM P13	8587	E	30-JUN-83	30-JUN-83	1	I I I I IX.....I......I......I......I......I......I......I.... I I I I I I I I
3128	TERMINATION OF CABLES IN ESD CABINET NO. 2 INTERFACE ROOM P13	85	E	1-JUL-83	1-JUL-83	1	I I I I I X....I......I......I......I......I......I..... I I I I I I I I
3135	TERMINATION OF ELECTRICAL CABLE IN DB 324 P08	85	E	1-JUL-83	1-JUL-83	1	I I I I I X....I......I......I......I......I......I..... I I I I I I I I
3229	GLANDING OF CABLES IN FIRE DETECTION CABINET INTERFACE ROOM P13	85	E	1-JUL-83	1-JUL-83	1	I I I I I X....I......I......I......I......I......I..... I I I I I I I I
3231	GLANDING OF CABLES IN FIRE DETECTION CABINET INTERFACE ROOM P13	85	E	2-JUL-83	2-JUL-83	1	I I I I I X...I......I......I......I......I......I..... I I I I I I I I
3241	TERMINATION OF ELECTRICAL CABLES IN MCC "A" EXTENSION S 52,32,2,2 -M32-TCP-2C	87	E	2-JUL-83	2-JUL-83	1	I I I I I X...I......I......I......I......I......I..... I I I I I I I I

TCP2 EXTENSION SYSTEM : 88 03G

TASK	DESCRIPTION	PHYS AREA	D I S	EARLY START	EARLY FINISH	DUR	1 JUN – 28 SEP 83
3050	TIE-IN/EARTH CONNECTION M-50 TO EXISTING LOOP	50	E	27-JUN-83	27-JUN-83	1	I I I I X.I......I.... I I I I I I I I I I I I I I
3051	TIE-IN/EARTH CONNECTION P-53 TO EXISTING LOOP	53	E	27-JUN-83	27-JUN-83	1	I I I I X.I......I.... I I I I I I I I I I I I I I

TCP2 EXTENSION SYSTEM : 88 03H

TASK	DESCRIPTION	PHYS AREA	D I S	EARLY START	EARLY FINISH	DUR	1 JUN – 28 SEP 83
3047	INSTALLATION OF J.B. & TRACE HEATING CABLES FOR CV1A-M02	85	E	14-JUN-83	14-JUN-83	1	I I XI......I......I......I......I......I......I......I......I.... I I I I I I I I
3048	INSTALLATION OF J.B. & TRACE HEATING CABLES IN COLUMN 5	85	E	16-JUN-83	16-JUN-83	1	I I IX.....I......I......I......I......I......I......I......I.... I I I I I I I I
3026A	CLEANING OF CIRCUIT BREAKER FOR HEAT TRACING CIRCUIT BREAKER NO. 22,23,26 & 30	85	E	19-JUN-83	19-JUN-83	1	I I I X..I......I......I......I......I......I......I......I.... I I I I I I I I

ISSUED FOR CONSTRUCTION

APPENDIX 9