A COMPUTER SYSTEM FOR THE DRAFTING OF OFFSHORE PLATFORM

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SUMMARY

One of the main contributions of the CAD/CAE equipment is the automatization and electronic production of engineering drafts. In the case of offshore platforms, the utilization of such techniques is particularly effective, due to large number of drafts involved and the rigid time constraints for construction.

GEDEP, implemented by Petrobrás S.A., is a computational system for electronic drafting of platform technical drafts, adjusting automatically fabrication details according to specific codes, and assisting the engineer in the rapid preparation of design technical documentation. CAD/CAE techniques applied to a data base common with other systems, is a fundamental approach to achieve a large degree of integration in the design process.

GEDEP has also the capability of generating drafts for production facilities, including process flowcharts, engineering flowcharts, electric diagrams, equipment layouts, and area classification drafts.

This paper presents a summary of the available GEDEP capabilities, commenting on the experience collected in its practical application at Petrobrás S.A.

INTRODUCTION

GEDEP is a computational system for the generation of fabrication drafts, which operates on a CAD/CAE

unit with the configuration shown in Figure 1.

GEDEP operates in conjuction with several other computational systems for offshore engineering. These include the ADEP and INPLA systems, the first for analysis and design of offshore structures, and the second for analysis of installation processes, as the main systems for the application of numerical procedures. In the case of ADEP three support systems, including GADEP, for data generation of structural models, GEMAT, for generation of finite element meshes, and POSADEP, for result post-processing, materialize the connection with the data base. In the case of INPLA that connection is done through the support systems GINPLA, for data generation, and POSINPLA, for result post-processing. As shown in Figure 2 GEDEP operates from both data bases for the production of drafts.

The initial operation is to generate the data of the analysis model. This performed by GADEP, which stores that data in the data base, and passes it also to ADEP , which operates on IBM and CDC computers for processing. The results from the structural analysis, applied using ADEP, are treated by POSADEP, which produces result diagrams and stores the result information in the data base as well. Once completed, GEDEP takes the information required from that data base and produces the drafts.

The generation of technical drafts corresponding to offshore platforms is made in two steps. In the first step geometrical adjustments for excentricities are introduced in the structures, while the second step performs the actual draft generation. In the case of production facilities the drafts are produced in just one step. These operations are described in the following sections emphasizing the methodological aspects and including illustrative examples.

STEP I: GEOMETRICAL ADJUSTMENT

Having the definition of the model for structural analysis, such as shown in Figure 3, it is necessary to introduce adjustments in some members in order to attend the code recommendations, particularly regarding the connection of the members at a joint. These excentricity adjustments are automatically introduced in the secondary members at the connection with a main member, as shown in Figure

4. It is performed in the tridimensional model, in an interactive operation, where the engineer selects on the scope the set of members which will undergo alterations. The related geometrical properties are automatically updated in the data base.

A especial verification of the existence of interferences between secondary tubes is also performed.

STEP II: OFFSHORE PLATFORM DRAFTING

Working with the structural model, and with the information stored in the data base, after the geometry adjustment are completed, it is possible to proceed to the production of the final drafts. This operation is performed by means of "user-friendly" menus displayed on the scope, such as the one shown in Figure 5, which permit the daftman to direct the drafting process, introducing alterations and additions as needed.

Once the basic draft is ready, welding details and dimensions are added, the final lettering is completed, and a bill of materials is automatically generated.

PRODUCTION FACILITIES DRAFTS

The generation of technical drafts for production facilities is performed using a cell base connected to a graphic file, again employing "user-friendly" menus on the scope, producing the type of drafts illustrated in Figure 6.

ILLUSTRATIVE EXAMPLE

As an example of the application of GEDEP, let us consider the case of a horizontal bracing of the offshore structure indicated in Figure 3. That part of the stucture is isolated from the remaining components and, in the first step, the excentricity adjustments are performed, as indicated in Figure 7. The spacial verification of the existance of interferences between secondary tubes is also performed using the planification of the members. Next the dimensions are generated, as indicated in Figure 8 and, finally, the lettering and the bill of materials are drafted as shown in Figure 9, to complete the drafting process.

CONCLUSIONS

Some observations can be made regarding the utilization of "user-friendly" menus on the scope in the generation of drafts. It is postulated that in terms of man-machine communication the menu permits a better integration, because it is possible to show what must be done, and what information must be specified, in a graphic way, making easier for technical draftsman to operate with the graphic station, in substitution to manual methods.

The easy understanding of the menus, and the power of the CAD/CAE techniques employed, contribute to speed up considerably the technical drafting, which becomes from 3 to 40 times faster than by manual methods. The electronic drafting is also more reliable and portable, since the drafts can be stored in magnetic tapes, saving space, and making extremely easier their recovery for production of new originals.

In that respect, it can be mentioned that the design the templates of the platforms for the North-East area of the Campos Basin, offshore Rio de Janeiro, was stimated to represent 1100 man/hours for each template. In the first application of GEDEP it was possible to perform the design for one template in just three weeks, using one designer and a graphic station, comprising a total of 160 man/hours. This means that the technical drafts were ready 7 times faster with regard to the initial estimate.

It is also relevant to mention that the production of the preliminary drafts, without bill of materials, for the Pargo Central Platform, for a water depth of 110 meters, was performed in 24 hours of machine utilization.

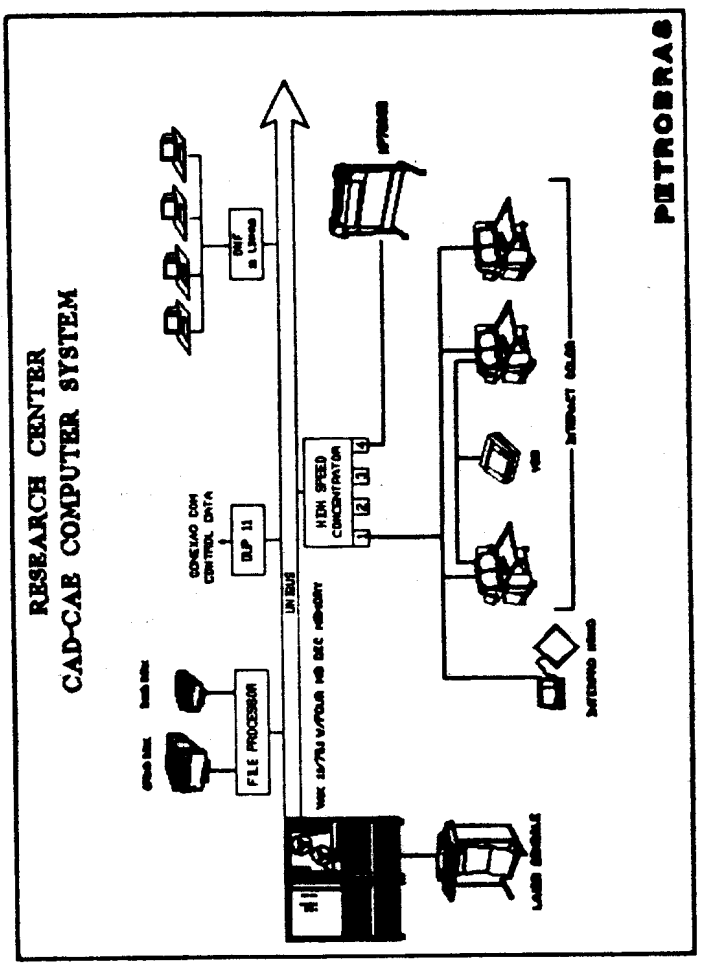
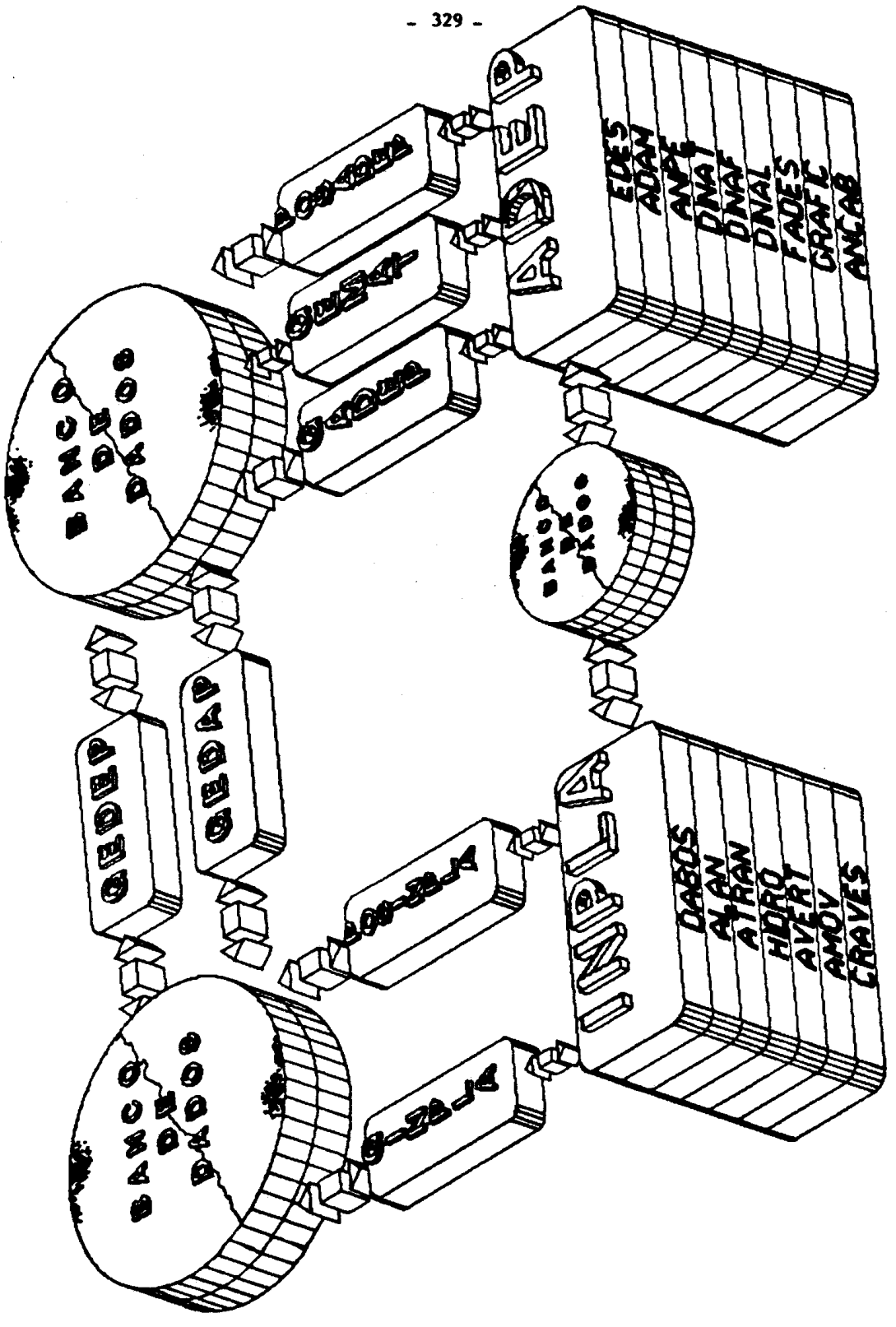

RESEARCH CENTER
CAD-CAB COMPUTER SYSTEM
PETROBRAS
FILE PROCESSOR
DLP 11
HIGH SPEED CONCENTRATOR
1
2
3
4

Figure 1


EDES
ADAM
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FADES
GRAFT
ANCAB
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ARAN
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AVERT
AMOV
CRAVES

Figure 2

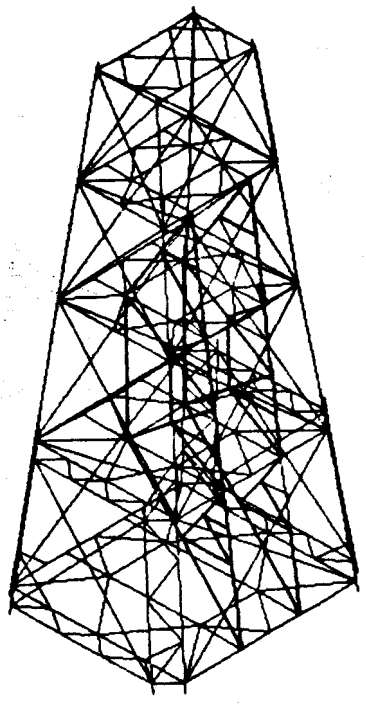


Figure 3

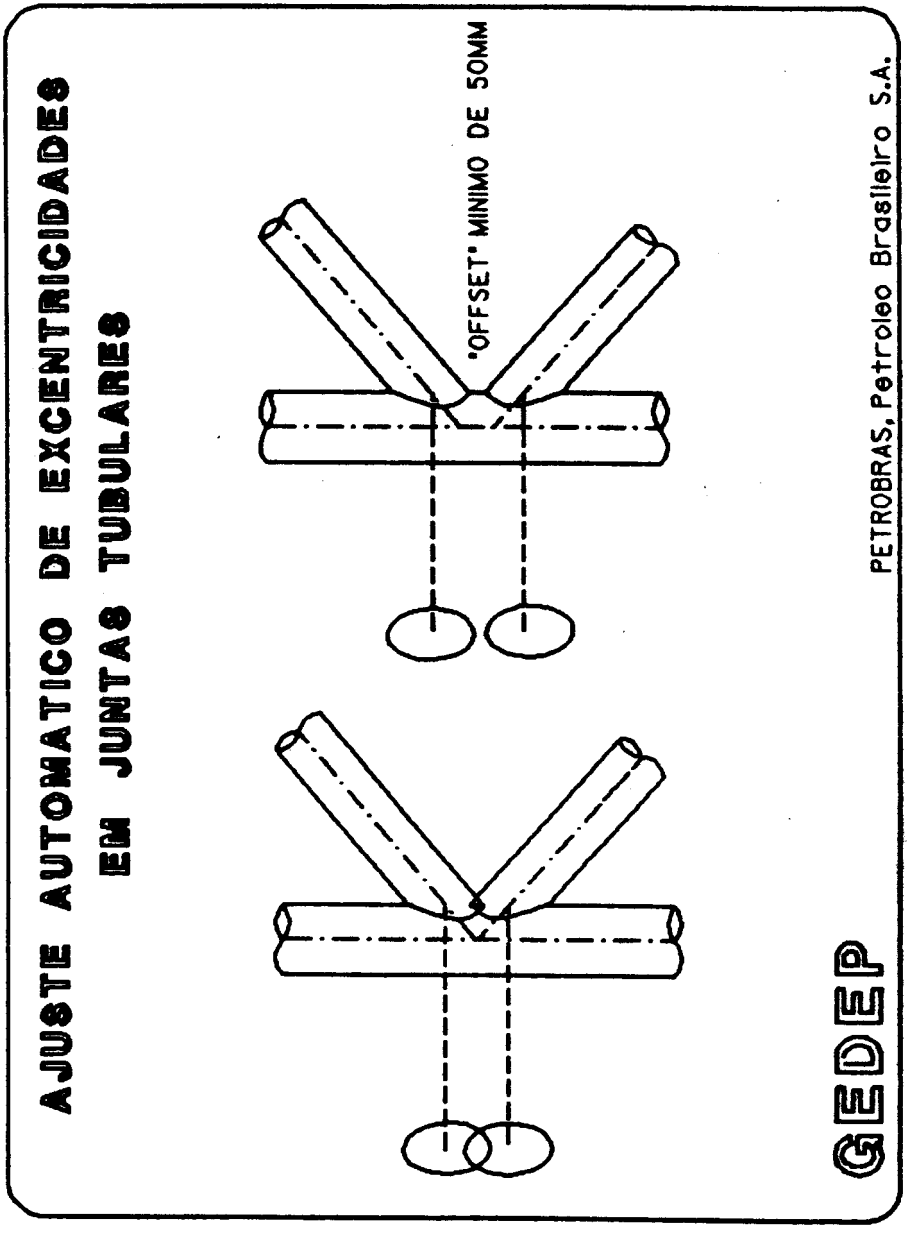

AJUSTE AUTOMATICO DE EXCENTRICIDADES
EM JUNTAS TUBULARES
'OFFSET' MINIMO DE 50MM
GEDEP
PETROBRAS, Petroleo Brasileiro S.A.

Figure 4

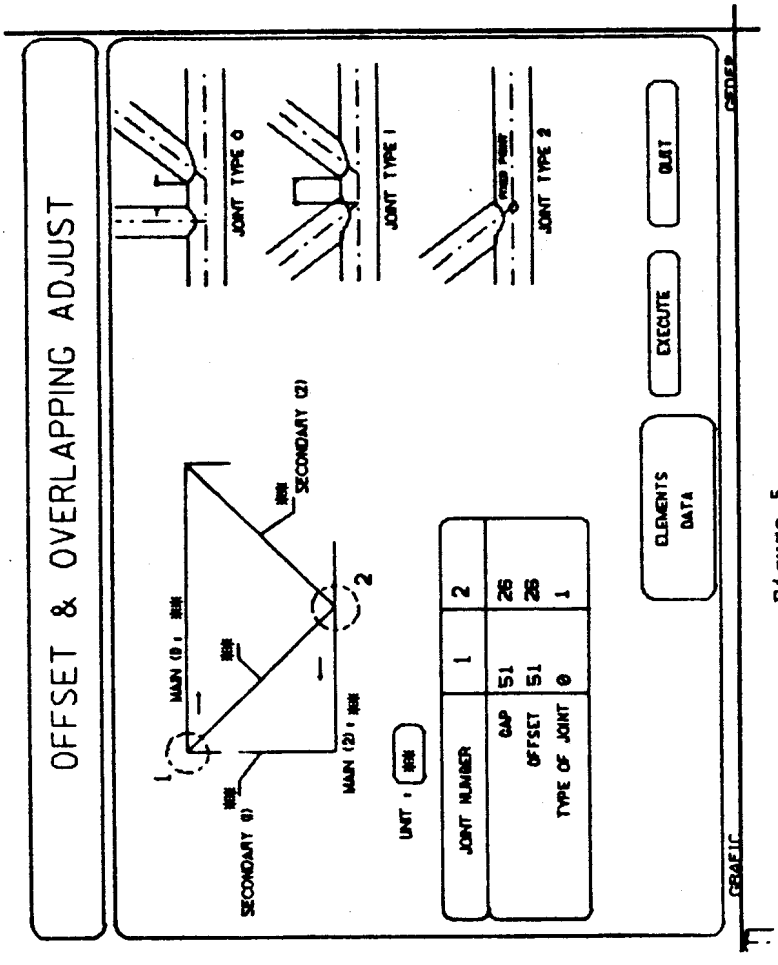

OFFSET & OVERLAPPING ADJUST
JOINT TYPE 0
JOINT TYPE 1
JOINT TYPE 2
SECONDARY (2)
SECONDARY (1)
MAIN (1)
MAIN (2)
UNIT :
JOINT NUMBER
GAP
OFFSET
TYPE OF JOINT
1
2
51
51
0
26
26
1
ELEMENTS DATA
EXECUTE
QUIT
GRAFIC
ORDER

Figure 5

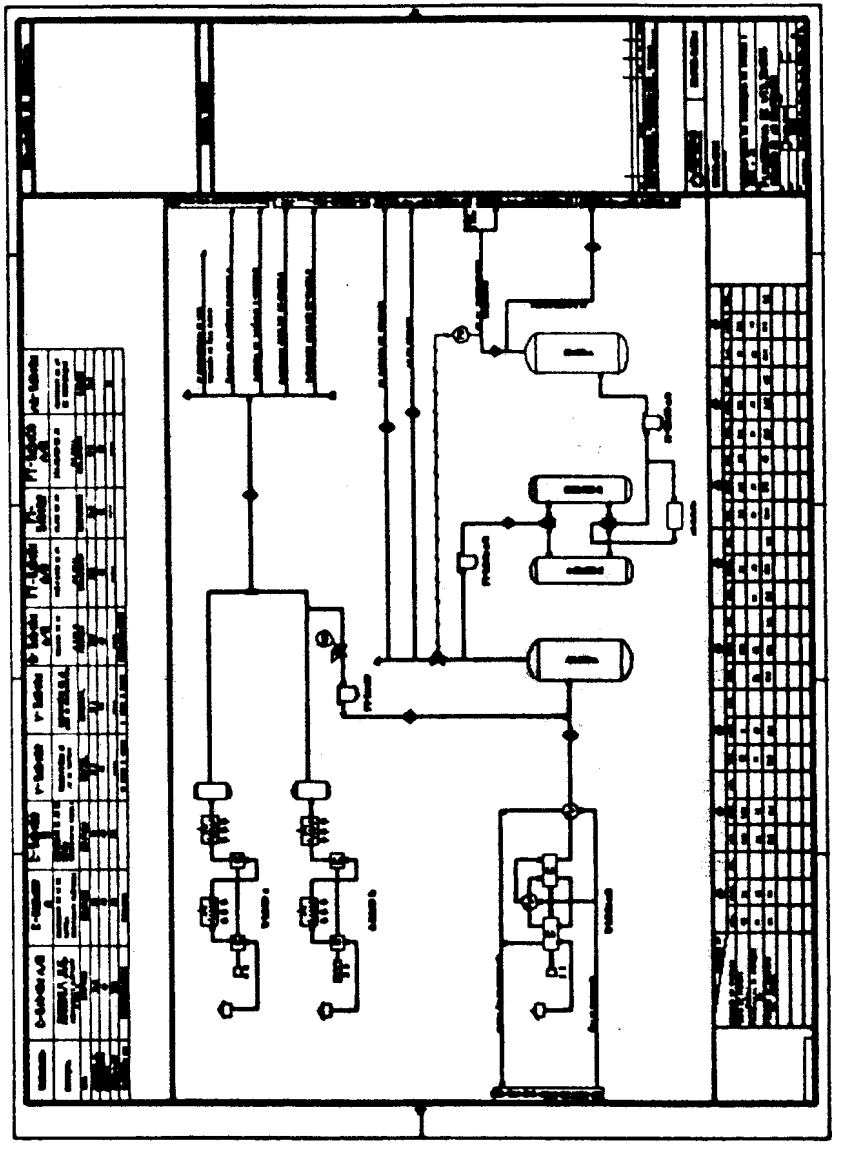


Figure 6

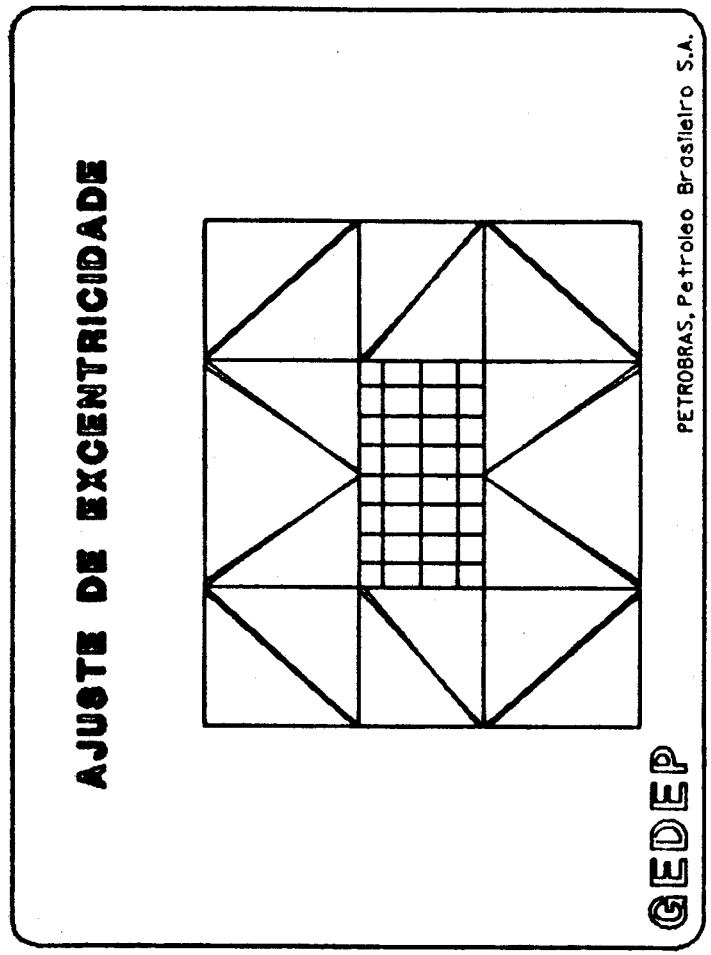
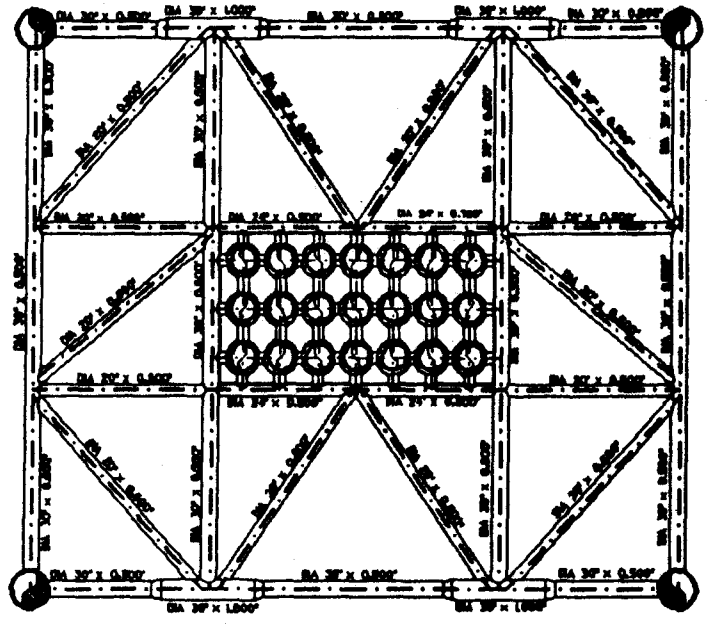

AJUSTE DE EXCENTRICIDADE
GEDEP
PETROBRAS, Petroleo Brasileiro S.A.

Figure 7

SUPER-FENCE

GERACAO AUTOMATICA DO DESENHO DE FABRICACAO A PARTIR DO BANCO DE DADOS



GEDEP

PETROBRAS, Petroleo Brasileiro S.A.

Figure 8

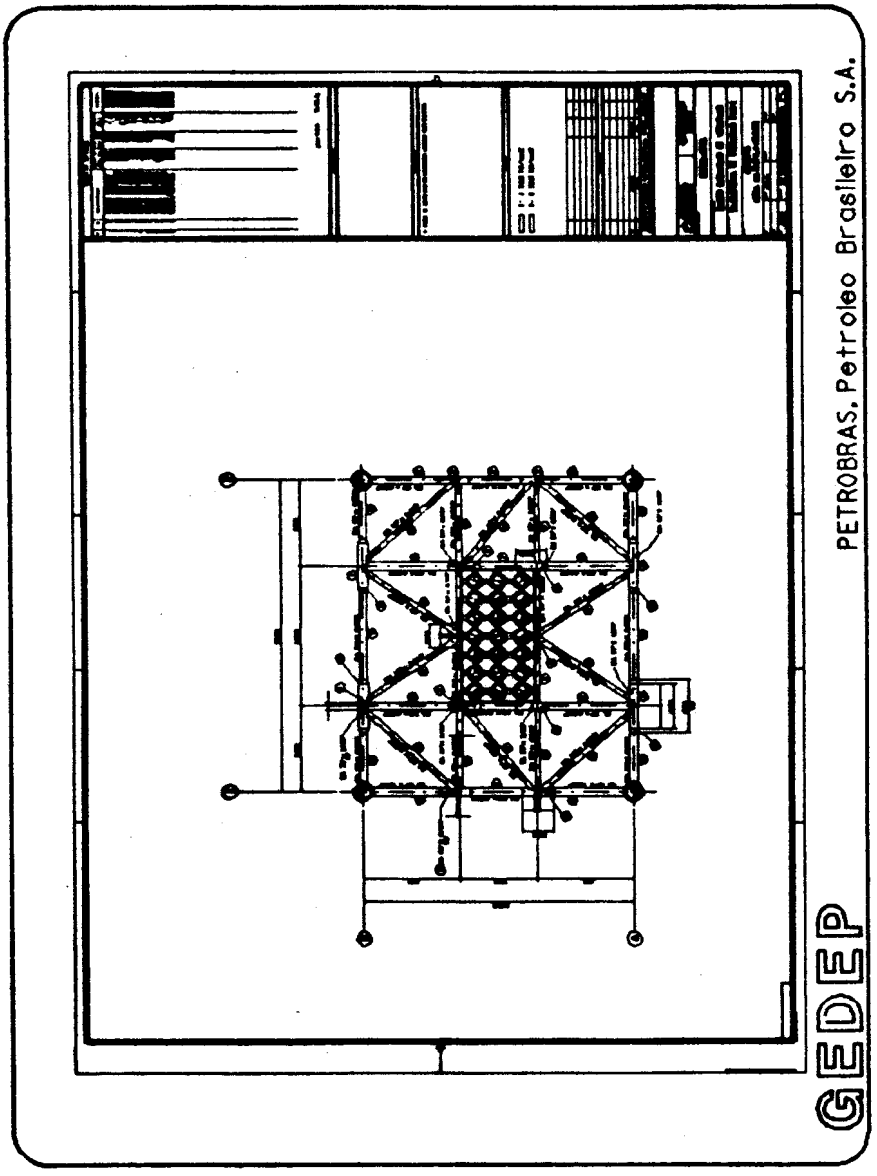


Figure 9