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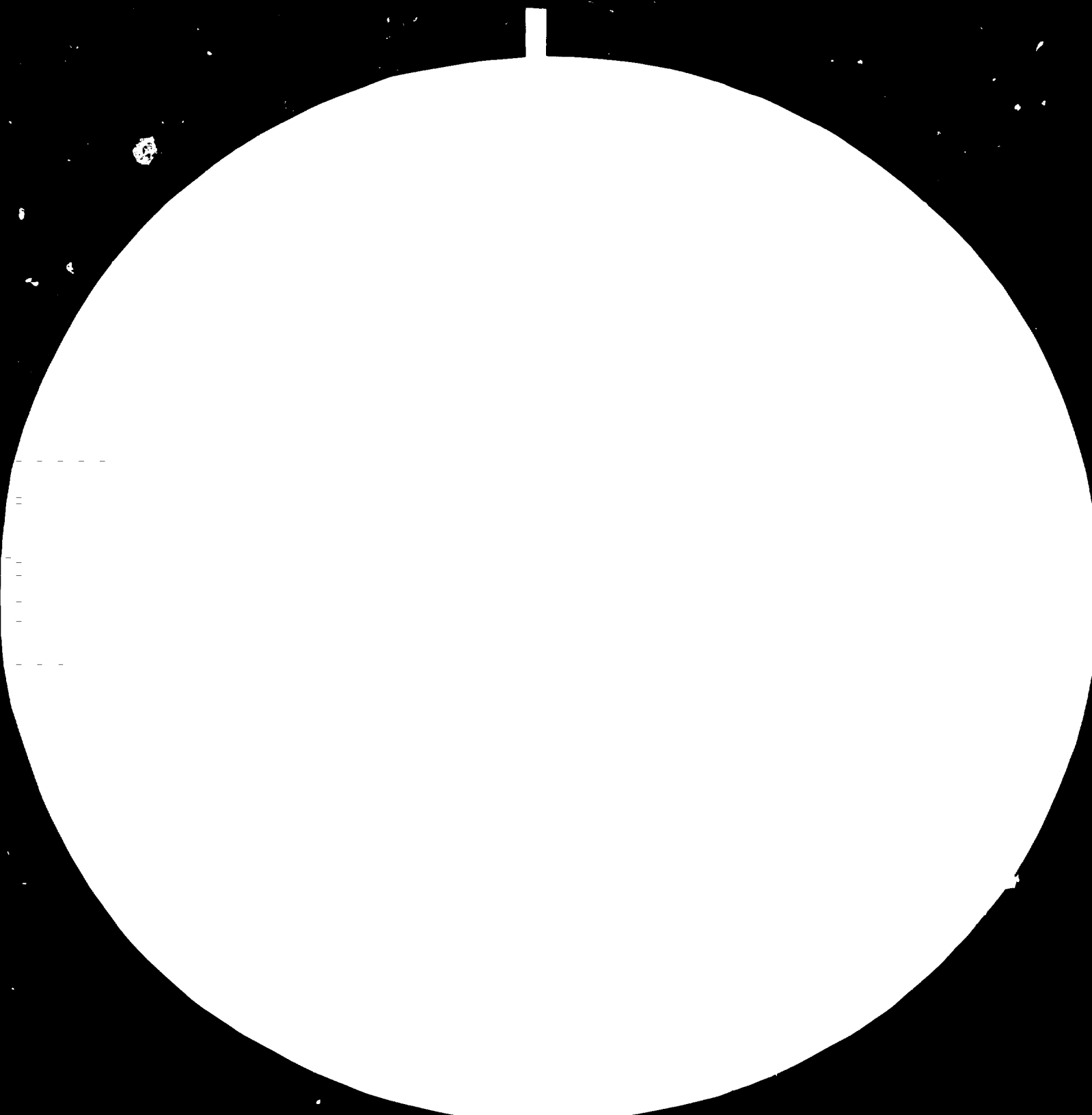

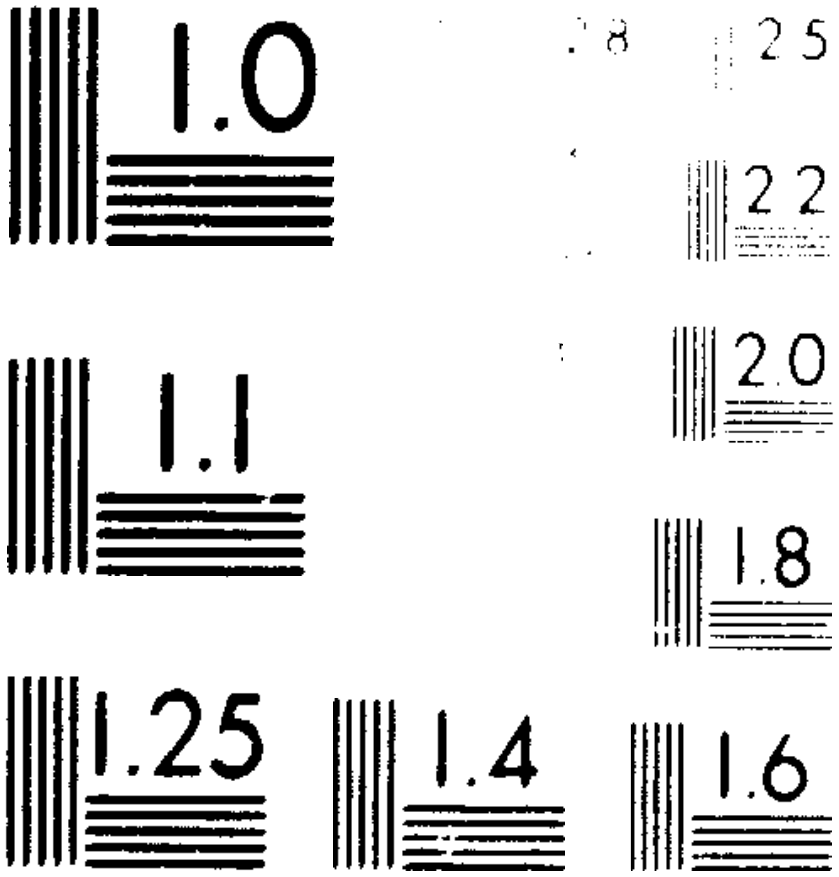
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Syria. BOILERS AND HEAT PRODUCING SYSTEMS
FINDINGS, ACTIVITIES AND RECOMMENDATIONS
DP/SYR/77/004/11-08A/REV.1/31.3.1
SYRIAN ARAB REPUBLIC

Final Report

Prepared for the Government of Syrian Arab Republic
by the United Nations Industrial Development Organization
Executing Agency for the United Nations Development Programme

Based on the work of D. N. Trivic
Consultant in Boilers and Heat Producing Systems

United Nations Industrial Development Organization
Vienna

This report has not been cleared with the United Nations Industrial Development Organization which does not, therefore, necessarily share the views presented.

EXPLANATORY NOTES

The unfamiliar and local capital letter abbreviations and the unusual technical abbreviations are as follows:

ITRDC	The Industrial Testing, Research and Development Centre, Damascus
GOEI	The General Organization for Engineering Industries, Damascus
METALCO	Metallic Construction and Mechanical Industries Company, Adra
ANCC	Associazione Nacionale Controllo Combustione, Italian Standard
OI	Operating Instructions
MI	Maintenance Instructions
IF	Inspection File
IO	Inspection Organization

ABSTRACT

The post title is Consultant in Boilers and Heat Producing Systems. The job number is DP/SYR/77/004/11-08A/Rev.1/31/3.J. The duration of the job is one month and the purpose is the improvement of steam boilers productivity and quality. The objectives are to identify the problems in the Boilers' manufacturing and inspection and to give conceptional solutions. The main recommendations are:

a) To write and accept the national standard for construction of steam boilers

b) To establish an Inspection Organization and to organize its work

c) To improve the organization and accomplishment of boilers' manufacturing.

The main conclusion is that all detailed given recommendations and detailed developed plan of action for implementation of the recommendations should be carried out.

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RECOMMENDATIONS

The following recommendations are addressed to ITRDC:

1. To establish Syrian National Standard for boilers, that is rules for construction of boilers.

2. To establish Inspection Organization for boilers within ITRDC according to the standard.

3. To define, according to the standard, duties and responsibilities of internal quality control service in Boiler factory and Inspection Organization as well as the relationship between them.

4. To organize the work of Inspection Organization.

The steps which should be taken to consolidate, develop and utilize the results are as follows:

To establish National Standard for Boiler means to write it down, to discuss it, to modify it according to discussion and to accept it. All parties interested in like manufactureres of boilers, boilers' users and ITRDC should take part in each of mentioned activities.

The duties and responsibilities as well as relationship numbered 3 above are given in this report. It is very important to carry them out. The author of this report has written and given, together with very detailed explanations, to ITRDC engineers the following papers:

a) Inspection requirements for pressure vessels, heat exchangers, steam boilers, steam superheaters and economizers.

b) Inspection check sheet for fired heaters.

c) Inspection check sheet for furnace tubes and heater coils.

d) Inspection check sheet for welding fittings and flanges.

These papers should be used by Inspection Organization. They are together with this report, the guides for how the work of inspection organization should be organized. It is very important to follow these papers.

The following recommendations are addressed to Boiler factory METALCO:

1. To collect operating and maintenance instructions (OI and MI) for every manufacturing facility, machine and quality control equipment.

2. If some of these manuals are lost, to write to the firms producers of this equipment asking for the OI and MI and giving in the letters information on type, year of production, number of machine and so on.

3. To translate every OI and MI into Arabic.

4. To instruct the operators and maintenance personnel according to OI and MI where it is necessary.

5. To check the operators from time to time to ensure that they operate in the proper way according to the OI.

6. To check the maintenance personnel from time to time to ensure that they use maintenance facilities in the proper way given in MI.

7. To obtain additional training abroad for the crews of very sophisticated equipment and where it is necessary.

8. To write and to supply to every user OI and MI for every manufacturing steam Boiler. It is unacceptable to deliver the steam Boiler to user without OI,MI,Inspection File or without any of drawings of any of technical papers.

9. To repair existing equipment for ultrasonic examinations and to obtain the training for at least two operators (technicians).

10. If the above-mentioned repair is not possible, then to buy new ultrasonic examinations equipment only on condition that the firm-supplier, together with the equipment, renders the training for the operators.

11. To carry out completely all recommendations and instructions given in the chapter "Detailed Plan of Action for METALCO factory" of this report.

The steps which should be taken to consolidate, develop and utilize the results are as follows:

By the implementation of the given recommendation, it is very important to deal very carefully with the workers trying to increase their motivation. Every activity should be completed step by step, little by little and not very fast. It is necessary to take into account industrial experience, technical level and background of every operator and maintenance worker.

I. EXISTING SITUATION IN METALCO FACTORY-IDENTIFICATION OF PROBLEMS

METALCO manufactures the fire-tube steam boilers according to the licence of Italian firm CALDAIE CARIMATI, S.P.A., Milano, following Italian standard ANCC. The production programme consists of eight boiler types, capacities of 1 t/h, 3 t/h, 4 t/h and 8 t/h and each of them for the pressures 9 Bar and 14 Bar.

The equipment for ultrasonic examinations are out of order. There are not also qualified operators to use this equipment. METALCO does not do ultrasonic examinations and has solved this problem in such a way that the basic material bought from abroad, always must be fully ultrasonically examined. It is more expensive.

METALCO does radiographic X-ray, penetration and hydrostatic pressure tests.

The questions which should be solved institutionally, by organization are as follows:

Does the accepted Syrian National Offical Standard for boilers' construction exist, and is it presented to METALCO as well as the order to use it?
Does the internal quality control service of boiler factory carry out all by standard required activities, for every manufactured Boilers and in the proper way?
Does the Inspection Organization check the Internal Quality Control Service and give the certificate for every boiler according to the standard, to make sure that the materials, design, construction and testing of the boiler conform in all respects to the requirements of the rules?

The manufacturing facilities and machines in METALCO are very good and modern. Some of them are bigger, stronger and with higher capacity than is necessary for the existing production programme. It is possible to increase existing production of boilers (20 boilers per year) three to five times, only by proper and full usage of the existing manufacturing facilities in one shift (for eight hours per day). This is the first, fast and very rough estimation. The right answer on this question can be obtained by the procedure given in the chapter "Detailed plan of action for METALCO Factory" under the heading "Manufacture Preparation Section."

II. DETAILED PLAN OF ACTION FOR METALCO FACTORY-ORGANIZATION DRAFT

It is necessary to establish at least four engineering sections (departments) each of them like a distinct service. For each of these sections should be written the duties and responsibilities as well as interdependences and relationship between them. These sections are as follows:

A. Design Section

B. Manufacturing Preparation Section

C. Manufacturing Section

D. Quality Control Section

A. Design Section

The duties of this section are as follows:
Present existing duties (for now)

1. To prepare documents, drawings and calculations for every manufactured Boiler for Inspection File (See Annex No. 1). Now, in the very beginning, it is simple copying of the existing foreign (Italian) drawings and calculations according to the licence. The following documents for Inspection File (Annex No. 1) are required from the Design Section:

1.1 From Item No. 1 to Item No. 4 (including items 1 and 4)

1.2 Item No. 14

1.3 Parts of Item No. 15 which are the safety valve description and drawing.

1.4 Item No. 16

2. To investigate possibility and to approve the change of material and the change of design if these changes are necessary or are required by the other sections.

3. To carry out the changes of design on the drawings and to check calculations and to do new calculations if the changes are necessary and accepted (See Annex No. 2, The reasons producing the changes of original design). The new drawings and calculations are now valued and their copies should be attached to the Inspection File.

4. To do, copy and send workshop and detailed drawings to the other sections (B,C and D).

5. In the future the design section should do its own original designs for steam Boilers of different capacities and pressures. It means, the design section will do:

5.1 Drawings

5.2 Thermal Calculations

5.3 Pressure drops calculations

5.4 Mechanical calculations should be done by usage of the existing experience obtained from the implementation of the above-mentioned points 2 and 3, and from existing licenses.

B. Manufacturing Preparation Section

This section should obtain the written procedure and forms for every manufacturing operation and every Boiler item (part).

Manufacturing preparation section should plan and describe the motion of materials and the motion of documents. This section should issue necessary forms and documents. For every boiler item should be written number and title of operation. For every operation should be written:

1. Description of operation.

2. Required Manpower.
3. Required time.
4. Required facilities and machines
5. Other specific requirements or necessary notes

For example, Boiler shell manufacturing needs the following operations:

1. Material (sheets) transport
2. Marking out, then sketching the sheets in required dimensions
3. Cutting
4. Edges preparation for welding
5. Bending
6. Welding, and so on.

This detailed example of the operation description is given in Annex No. 3, sheets transport.

Going from a boiler item to another, from an operation to another and from a machine to another, it is possible to define very precisely required time, manpower and machines for every item, every boiler and every machine. If we add all required values of time, of manpower and of machine for production of some quantity of boilers, and compare them with available values of the same features, we can find very precisely the existing available resources of the factory.

In such a way, it is possible to put under control the usage of time, manpower and machines and to improve productivity and efficiency.

The Manufacturing Preparation Section will define the flow of documents starting from Design Section to the other sections. It should be written in this section which of the drawings and bills of materials will be sent from section A to section B and which of manufacturing preparations lists and forms will travel from section B to section C and to section D and so on.

C. Manufacturing Section

This section should strictly follow and commit the procedure given by the manufacturing preparation section. It means manufacturing section will consider the manufacturing preparation lists and forms like the working orders.

Maintenance Division

It is necessary to establish in manufacturing section one division for maintenance. This division will take care of OI and MI and spare parts lists. It is necessary, in the very beginning, to identify the condition and the usage of every facility and every machine. It means to check, from machine to another, if the usage is proper or not, if the operators are sufficiently qualified or not, and so on. It is very important to find out, for every machine, if something is missing, if something is wrong and if something should be done in advance like the precautions for its trusty operation (necessary spare part, lubricants and so on).

D Quality Control Section

The duties and responsibilities of this section are as follows:

1. To carry out all radiographic (X-ray), ultrasonic, penetration, pressure (Hydrostatic) and other tests required by the accepted standard.

2. To obtain the following documents for Inspection File (Annex No. 1):

2.1 From Item No. 5 to Item No. 13 (including items 5 and 13)

2.2 Part of Item No. 15 which is safety valve certificate in accordance with accepted standard.

3. To co-operate with ITRDC, to complete Inspection File for every boiler and to submit IF to Inspection Organization.

4. To fulfil requirements asked by ITRDC which could be Certifying Authority (Inspection Organization) for steam boilers.

5. To develop and to improve its own testing procedures according to accepted standard.

E. Additional Divisions

It should be necessary, besides the four engineering sections, to establish two additional non-engineering divisions under guidance of general management. These two divisions should be:

1. Commercial Division dealing with contracts for boilers delivery.

2. Material Supply Division which should take care to obtain the necessary material for boilers manufacturing.

III. ACTIVITIES

The author of this report has undertaken the following activities during the technical assistance:

1. He has written the papers mentioned in recommendations addressed to ITRDC.

2. He has given very detailed explanations and instructions to ITRDC engineers (see Annex No. 4) specially to junior staff how to use these papers and how to organize to deal with inspection service.

3. He has visited 7 (seven) times, with the junior ITRDC staff, the METALCO factory and undertaken with them informal on-the-job training in the field of inspection and quality control of steam boilers.

4. He has had detailed discussions with Dr. Abdul Satar about feed and boiler water quality and treatment, specially on SIO_2 removal. He has given to Dr. Satar instructions, adivce and final operating and defined papers which present the solution of this problem.

5. He has visited workshop of METALCO factory several times and had detailed discussions with the METALCO senior staff (See Annex No. 4) about the existing manufacturing facilities and quality control. This has helped the author of this report to be familiar with the situation in METALCO.

6. The author of this report has never met anyone from GOEI. He has accomplished his job with ITRDC and METALCO.

IV. TRAINING PROGRAMMES FOR KEY PERSONNEL IN METALCO FACTORY

It is necessary to realize the training for 4 (four) graduated mechanical engineers for the following activities:

1 (one)	for A.	Design section	duration 3 (three) months
1 (one)	for B.	Manufacturing Preparation Section	duration 3 (three) months
1 (one)	for C.	Manufacturing Section	duration 3 (three) months
1 (one)	for D.	Quality Control Section	duration 3 (three) months

Each of them should be head of the corresponding section.

Descriptions and scopes of activities as well as training programmes are presented in chapter II, "Detailed plan of action in METALCO Factory." It means, the training should assist the engineers to establish and carry out Organization Draft given in Chapter II of this report.

The place of training should be boiler factories in industrialized countries.

CONCLUSIONS

The findings, recommendations and the detailed plan of action given in this report should be considered as first aid and first step for long-term persistent, systematic and hard work.

The activities as to write and accept the standard, to establish inspection organization and to organize its work, to train the engineers in usage the standard and inspection file, to carry out organization draft in METALCO and all recommendations given by this report in order to increase existing production three times and to manufacture the good quality boilers which should be safety operated, not very expensive and ready for export, with all required documents, need at least three foreign experts for a minimum one and a half years for each of them.

The would cover the following fields:

I. Standards, Inspection, Design, Calculations and Drawings
II. Manufacturing preparation and manufacture
III. Quality Control

The real success could be reach only by serious, tenacious and long-term work. This work should be done by mutual efforts of foreign experts as well as domestic personnel.

ANNEX NO. 1

Inspection File

Certificate and technical documents

All the following required documents, after being checked by an inspector, shall be sent to the buyer as stated in paragraph .... of the standard.

1. Certificate of the boiler company according to the standard.
2. Outline dimension drawing of the boiler, vessel or heat exchanger.
3. Manufacturer's standard construction sheet.
4. Corresponding Manufacturer's data reports per standard.
5. Base and filler metal and other used material specification.
6. Mill tes reports.
7. Welding Rod certificates.
8. Pressure test certificates (hydrostatic and/or pneumatic).
9. Heat treatment chart.
10. Radiographic test reports.
11. Welding procedure used in construction of boiler, vessel or heat exchanger.
12. Record of welding procedure qualification test per standard.
13. Welder qualification certificates per standard.
14. Design check calculations.
15. Safety valve description, drawing and certificate, in accordance with requirements given by standards.
16. Fascimile of name plate.

ANNEX NO. 2

The reasons producing the changes of original design

The reasons producing the changes of original boiler designs are as follows:

1. Material for the shell could be different than the material required by the original design. It is necessary, in this case, to calculate the new shell thickness. The change of shell thickness will produce the changes on other dimensions on the drawings which should be carried out. The same could be done for heads and tube sheets.

2. The tube-tube sheet connection is predicted, in its original design, to be done by tubes expansion. This connection could be done by welding. It is necessary, in this case, to carry out control mechanical calculation for welding seams and to carry out these changes on the drawings.

These are only two examples, but there are many reasons producing the changes or original boiler design.

ANNEX NO. 3

Sheets Transport

This sheets transport is an example of the operation description.

Sample

Name of item: Boiler shell

No. of item:

Title of operation: Sheets transport

Transfer the plates from warehouse-depot (let us say) No. 3 to workshop No. 7-B

Quantity of plates: 6 (six)

Plate material:

Code of material:

Dimensions of plates: 5400 mm X 1800 mm X 12mm

1. Use the mobile crane No. 11 in warehouse No. 3 to load the plates in the care No. 37-A
2. Use the care No. 37-A to transfer the plates from warehouse workshop.
3. Use the overhead travelling crane to handle the plates from the car to the place No. 47 in workshop No. 7-b.

Required time:

Loading in car:	20 minutes
Transport by car:	5 minutes
Handling in workshop:	20 minutes
Duration of entire Operation:	45 minutes

Required Manpower

1	(one)	car driver	5 minutes
1	(one)	mobile crane operator	20 minutes
1	(one)	overhead travelling crane operator	20 minutes
3	(three)	workers	45 minutes

ANNEX NO. 4

Senior counterpart staff in ITRDC:

1. Mr. Hisham Sharafli, General Director of ITRDC
2. Mr. Kamal Sunbuli
3. Mr. Yassin Thaljah

Senior counterpart staff in METALCO:

1. Mr. Salem Ghiboor, General Director of Boiler Manufacture
2. Mr. Rekni Romhen
3. Mrs. Maria Francis