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FINAL REPORT

JANUARY 1969

17342

CONTRACT NO. 84/127

between

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION (UNIDO)

and

INSTITUT DE RECHERCHE D'HYDRO-QUÉBEC (IRHQ)

PILOT SYNTHETIC TEST CIRCUIT

in Mexico City

UNIDO PROJECT # DP-MEX-82-011

Activity Code: DP-MEX-31.9

SUMMARY

The contract was signed on July 4, 1985. The work should have been completed within 30 months, i.e. by the end of 1987. By then, all the Contractor's obligations had been met, with one exception: the training of the second IIE test engineer in IREQ's Laboratory, as stipulated in subclause 2.01d of the contract. IIE was urged several times to send the trainee to IREQ but never did so. UNIDO even granted an extension of the performance period to allow IIE more time, but in vain.

It can only be concluded that IIE is either unable to have its second test engineer trained or uninterested.

As there is no longer any specific work to be delivered by the Contractor's personnel, it is suggested the contract be terminated.

1 BACKGROUND

On February 18, 1982, a contract was signed between Instituto de Investigaciones Electrical (IIE) and Institut de recherche d'Hydro-Québec (IREQ) to build a pilot synthetic test circuit in Mexico.

The main purpose of the project was to offer IIE personnel the possibility of familiarizing themselves with synthetic test techniques and learning how to operate the test circuit with a view to building a full-scale circuit for industrial testing in a more distant future.

The IIE representatives specifically requested that the IREQ specialists' role be limited to guidance and supervision only, while the work itself should be done by Mexican personnel. This explains the relatively modest volume of work covered by the contract.

An integral part of the contract was a comprehensive three-part training program for IIE:

- Three compact tutorial courses
- Training of two IIE future test engineers at IREQ
- Laboratory exercises at IIE.

The costs (in 1985 Canadian dollars) were distributed as follows:

Basic project	C\$76,611
Training program	<u>C\$53,490</u>
Total:	C\$130,101

For a few months, work progressed normally. A first invoice for \$18,786.85 was presented and promptly paid by IIE. Later, however, activity slowed down and, when a second invoice was presented for \$26,649, it was never paid. IIE attributed this to Mexico's economical situation.

During the first half of 1985, IIE successfully obtained UNIDO financing and a new contract was signed on July 4, 1985 between UNIDO and IREQ, permitting reactivation of the project.

2 PROGRESS OF THE WORK

Work started immediately under the new contract and progressed according to the initial schedule. This is reported in detail in four quarterly reports, copies of which are attached.

According to the last quarterly report, presented in September 1987, three unfinished items remained: laboratory exercises, correction of a malfunctioning control and training of the second test engineer.

2.1 Laboratory exercises

The exercises were organized by Mr. Ramon de la Rosa from IIE and conducted by Dr. Ryszard Malewski from IREQ with the assistance of a senior technician from IREQ during the two first weeks of December 1987. The first week, a series of measurements was made at IIE headquarters in Cuernavaca, while the second week, measurements were performed in the synthetic test laboratory itself in Salazar.

2.2 Control malfunction

During commissioning, the test circuit as a whole operated correctly but a malfunction of the control circuit was discovered, which was preventing the function from being fully repetitive. A power failure in Salazar made it impossible to identify the problem immediately.

The problem was identified and corrected by Dr. Malewski and his technician during the second week of laboratory exercises and fully repetitive operation was obtained.

2.3 Training of the second test engineer

As may be seen from IREQ's letter to IIE (copy attached), the IIE project leader's attention was drawn to the problem of training for the second test engineer as early as July 1986.

By September 30, 1987, it was already evident that the 6-month training could not be completed within the performance period provided for under the contract and alternative solutions were proposed to IIE, including extension of the performance period. Eventually this extension was granted by UNIDO. However, IIE still did not send a test engineer for training.

Finally, in a letter dated January 18, 1988 (copy attached), the point was raised again. No response was forthcoming.

Since all these interventions have remained unanswered, the only conclusion to be drawn is that IIE is either unable to send the second trainee to IREQ or no longer interested.

CONCLUSION

Under the circumstances described in the present report, and in view of the fact that there is no specific work to be delivered in connection with the operation of the pilot synthetic circuit, IREQ considers that the Contractor's obligation have been fully met and that the contract should be terminated.

It might be noted that if IIE should be interested one day in sending another test engineer for training at IREQ, this could be always considered, albeit in the scope of a separate agreement.

Varenes, January 18, 1988

Mr. Rogelio Covarrubias
INSTITUTO DE INVESTIGACIONES ELECTRICAS
Shakespeare 6-40 Piso
Apartado Postal 5-849
MEXICO 5, D.F.

OBJECT: UNIDO CONTRACT NO. 84/127: PILOT SYNTHETIC TEST CIRCUITS

Dear Mr. Covarrubias:

After completion of the laboratory exercises guided by Mr. Malewski last December and having solved the problem of the control circuit in Salazar, all items of the contract have been fulfilled with the only exception which is the training of the second test engineer in our H.P. Laboratory as stipulated in Cl.2.01 d) and under the conditions of Cl.2.05 of the contract.

The circuit is now fully operational so that the Cl.2.01 a) Basic Project has been met including the testing of the oil recloser according to subclause 4.

The training of IIE personnel in Mexico according to Cl.2.01 b) has also been accomplished; all three tutorial courses have been delivered and, as you know the participation and interest were encouraging.

The laboratory exercises at IIE as per Cl.2.01 c) have been made in the first part of December 1987, as mentioned above. Although the original program of exercises had to be modified to some extent due to the lack of some instrumentation, the whole was a success and the participants learned a lot.

The erection, running in and commissioning of the test circuit in Salazar as specified in Cl.2.01 e) has also been completed. The deficiency of the control circuit, found during my last visit in September and recorded in my fourth quarterly report has been identified and corrected during the last visit of Mr. Malewski.

The only item which remains open now is the training of selected IIE specialists at IREQ laboratories as specified in Cl.2.01 d). Only one of the two trainees, namely Mr. Manuel Garcia passed the training completely. The second trainee, Mr. Ruben Ochoa was with us only two weeks at the end of 1986, but never returned back due to other commitments, to complete the training.

.../2

The problem for us at IREQ is that we would like to close the contract formally, prepare a final report and invoice the remaining payments by UNIDO. Unfortunately sending the trainee to IREQ is out of our control so that finishing the contract without your cooperation is, strictly speaking impossible.

However, considering this point closely, there is no specific work to be delivered by our personnel. The trainee is supposed to take part in routine testing in the laboratory or eventually in some research work associated to it. There is also no working time of our personnel specified for this purpose although sometime will be needed to lead the trainee at the beginning. But, on the other hand, the trainee is supposed to do some useful work for IREQ and this is why IREQ is bound to contribute covering a part of the living expenses of the trainee.

As a conclusion, I would like to suggest to accept the following procedure. The contract would be closed now formally and the remaining training would be made in a sort of "gentlemen's agreement" between IREQ and IIE under the same conditions as stipulated in the contract. This procedure has the advantage that you could send your trainee to IREQ whenever it suits you. Otherwise, if you could not accept this proposal, we would be forced to ask you to give us a date of the arrival of your trainee to IREQ in a binding form, so as we could inform UNIDO about the supplementary time needed to complete the work and also the contract.

Passing now to another problem, Mr. Malewski informed me about your interest to collaborate with IREQ. Specific items mentioned are listed as follows:

1. Development of additional equipment for Salazar to perform dielectric tests, such as impulse generator.
2. Concept of a 800 kV, 100 mA D.C. source for a linear accelerator.
3. Development of pick-ups for the automated control of the distribution network.
4. Development of unconventional measuring systems such as opto-electrical and similar.
5. Assistance in developing shunts and voltage dividers for Salazar.

I would like to inform you that IREQ is prepared to enter into such a collaboration with you, in the scope of a new contract, or a set of contracts, as soon as the necessary funds are available.

Mr. Rogelio Covarrubias

-3-

January 18, 1988

I look forward to hear from you as early as possible and remain,

Yours sincerely,


.....
Vladislav Zajic
Maitre de recherche

cc: Louis Masson
Richard Malewski

IREQ

Institut de recherche
d'Hydro-Québec

July 16, 1986

Mr. Ruben Ochoa Vivanco
Instituto de Investigaciones Electricas
Shakespeare 6-4a Piso
Apartado Postal 5-849
Mexico 5, D.F.

Subject: Pilot Synthetic Circuit - UNIDO Contract No 84/127

Dear Mr. Ochoa:

I would like to draw your attention to the fact that, with respect to the timetable revised in December 85, we have already accumulated considerable delays.

As to the item 2.01 a), we are in contact with Mr. Alfonso Avila R. (Did he take over from Mr. Portillo?) concerning testing of the recloser. It could not be done in August or September as required because the testing time of the HP laboratory has been booked for other clients. The earliest possibility is middle of October. Let's hope this will materialize.

As to Clause 2.01 b) - Courses, the course by Mr. Malewski was a success and I would like to congratulate you and your organization. Mr. Malewski was very pleased and so were the participants, I hope.

I would suggest to prepare in the same way the course on switchgear to be given by myself. According to the timetable, it should be given at the end of September, but to give you more time for preparation, I would suggest end of October or beginning of November. I am tied up by other commitments during the first half of October and therefore this period is not convenient.

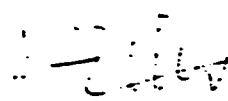
You should also think about the laboratory exercises of item 2.01 c). They were due at the end of May or beginning of June. Could you suggest a new date?

I understand from your last TELEX that the regular test engineer training should start in September. Please let us know as soon as possible about the details: the name, exact date of arrival etc. As to the other trainee, make the decision soon! The time is running quickly and we are responsible to UNIDO as to the fulfillment of the contract, which of course, needs your full cooperation.

At last, I would like to have a note from you about the progress of the assembly of the circuit at Salazar. How far it is and when is the right time to send our test engineer for the checking of the assembly and calibration of the instrumentation as specified in Cl. 2.01 e)?

Please send me your replies as soon as possible in order to give us some space for coordination with other activities of ours.

Looking forward to your message, I remain with best regards,


Vladislav Zajic

/cb

Fourth Quarterly Report
September 1987

CONTRACT NO. 84/127

between

THE UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION (UNIDO)

and

THE INSTITUTE OF RESEARCH OF HYDRO-QUEBEC (IREQ)

PILOT SYNTHETIC TEST CIRCUIT
in Mexico City

UNIDO Project # DP-MEX-82-011
Activity Code: DP-MEX-31.9

REVIEW OF THE WORK ACCOMPLISHED

1. April 1987
Course on synthetic testing.
2. July 1987
Training of test engineer No 1 concluded
3. September 1987
Commissioning of the test circuit.
4. Training of test engineer No 2.
5. Laboratory exercises

1 COURSE ON SYNTHETIC TESTING

During the week of April 6-10, 1987 Mr. Guy St-Jean manager, Electrical Equipment department IREQ delivered a tutorial course, in form of a seminar on synthetic testing methods of switchgear to a group of 12 engineers of IIE, utilities and manufacturers in Salazar, Mexico.

2 TRAINING OF TEST ENGINEER NO 1 AT IREQ

Mr. Manuel Garcia of IIE started his 6 months training period at IREQ's High-Power Laboratory on January 13, 1987 as reported in our third Quarterly Report. His training was concluded to our full satisfaction at the beginning of July 1987 as reported in his "Final Report" annexed to the present Quarterly Report.

3 COMMISSIONING OF THE SYNTHETIC TEST CIRCUIT

The commissioning of this test circuit was made on Sept. 21, 1987 in presence of several persons representing IIE and of Mr. Vladislav Zajic, Project Leader of IREQ. The commissioning took the whole day and consisted in detailed inspection of each element of the test facility, in detailed discussion of the tests made for internal and external clients and examination of the test results and of a demonstration of the function of the test circuit. More detailed description of the commissioning is given in the attached report.

4 TRAINING OF TEST ENGINEER NO 2

The second trainee selected by IIE to be sent to IREQ's laboratories for six months training was Mr. Ruben Ochoa, the project leader for IIE. He presented himself for the training at the beginning of December 1986 and stayed for two weeks. During that period, as agreed between IREQ and IIE he was initiated into the research program "Characterization of secondary arcing faults". It was supposed that after that initiation he would continue to study the problem at home and present himself for another training period-substantially longer, in April 1987 as shown in the timetable, revision of September 1986.

It turned out however, that Mr. R. Ochoa was unable to join us at IREQ, as he was fully involved in the assembly of the test circuit in Salazar until its commissioning which took place Sept. 21, 1987, so that his training is now heavily delayed.

As we can see it from the point of view of the contract conditions we would like to state that the situation was out of our control. We have no possibility of forcing the trainee to come here in time. Now, in order to correct the situation we would suggest to consider the following possibilities:

1. Extension of the contract, until the training is completed, that is until the end of March 1988.
2. Cutting down the duration of the training in such a way that the terms of contract are met. Instead of 6 months duration, only 3 months training would be accepted by IIE.
3. IREQ could accept an "agreement" in the sense that the contract would be closed officially on Dec. 31 1987, while the training of test engineer No 2 would continue until the end of March or so. During the whole training period IREQ would contribute to cover the living expenses of the trainee as stated in Cl. 2.05 of the contract.

5 LABORATORY EXERCISES

These laboratory exercises according to Cl. 2.01C of the contract are now finally scheduled for the first two weeks of December 1987. The necessary instrumentation is being prepared under the responsibility of Mr. Ramon de la Rosa of IIE and the exercises will be made partly in IIE headquarters in Cuernavaca and partly in the laboratory in Salazar.

For IREQ the leader of the exercises will be Dr. Ryszard Malewski, accompanied by a senior technician.

It was planned originally to do the exercises in October 87, but this proved to be impossible due to other commitments of the specialists involved.



Vladislav Zajic

Project leader, IREQ

Sept. 1987

4

Record on commissioning of the pilot synthetic test circuit of I.S at Salazar, Mexico

Date: September 21, 1987

Place: Laboratory of IIE at Salazar

Participants: Ing. Rogelio Covorubias (partly)
Ing. Ruben Ochoa Vivanco
Ing. Daniel Garcia Lucio
Ing. Sabas Lopez Morales IIE, Mexico
Ing. Morais Ireta Alas
Ing. Manuel Gacia Martinez
Ing. Ramon de la Rosa
Vladislav Zajic, project leader, IREQ

Inspection of the test circuit

The pilot synthetic test circuit was inspected element by element by the whole group of participants.

Starting with the incoming bay and step-down transformer, via the back-up circuit breaker, wall bushings into the test bay, the bank of current-limiting reactors of the high current circuit, the auxiliary breaker up to the test bay, the high-current circuit was checked, and it was stated that all elements are properly assembled and connected throughout the circuit.

Similarly, the high-voltage circuit was inspected as well. Starting with the D.C. charging source, via the main capacitor bank and main reactor group of the H.V. circuit, the trigatron, the TRV control capacitor bank and resistances, up to the entrance into the test bay, and including the discharge resistors and safety earthing switches, all elements were found correct and to the satisfaction of the commissioning party.

Experimental shots

After the inspection a few experimental shots were undertaken. It was found that all elements of the main circuit and of the control and measuring circuit worked correctly, except the timing element in the control. It was found that the timing element does not guarantee a stable operation, so that the time sequence was not fully repetitive. Although we suspect that the cause of this flaw lies in improper grounding of the control/measuring system it was impossible to identify readily the immediate source of it as there was a power failure of the incoming H.V. line and the laboratory was left without power.

It is considered that this malfunction of the timing circuit does not present a major problem and would be solved by IIE personel in short time. Should the problem turn out to be more difficult the specialists of IREQ, who will be present in Salazar at the beginning of December because of the laboratory exercises as reported in point 5 of the fourth quarterly report will be able to take care of it.

Review of the tests performed up to now

After that, the commissioning party was invited to look into the results of a number of tests having been performed by the laboratory during the last three months or so for internal and external clients. Six series of tests have been made as shown in a list attached to this report proving that the laboratory is able to perform high-power test in the scope of its parameters, as specified.

Recommendation

In conclusion we would like to stress, that the team of young engineers and technicians of IIE, under the leadership of Mr. Ruben Ochoa, did a commendable work, proposing, assembling and putting into operation a relatively complex test circuit. The testing capacity of that circuit is however,

rather modest, while the space available in the test hall permits installation of a circuit with much higher test capacity. It is therefore recommended to consider an extension of the circuit, increasing both the test voltage and test capacity to better serve the Mexican switchgear industry and research.

Madirou J. J.

Sept. 1987

APPENDIX**TESTS MADE AT SALAZAR LABORATORY****1. Short circuit test of current transformer of the type QDR-245. For:**

Electrotecnica Balteau s.A. de C.V.

Escape No 21

Fracc. Ind. Alce Blanco

Nancalpan Tedo de Mexico 53370

Characteristics of test:

12.5 KAm 2 cycles

2. Short circuit test of prototype reactor made by:

Instituto de Investigaciones Electricas

Cuernavaca, Morelos

Mexico

Characteristics of test:

26 KAm peak, 2 cycles

3. Thermal time constant of prototype reactor made by:

Instituto Investigaciones Electricas

Cuernavaca Morelos

Mexico

Characteristics:

500 Amp

4. Open arc test on Insulator polymeric material, 15 kV for:

Industrias Apaseo S.A.
Apaseo Irapuato
Mexico

Characteristics of the test:

2 KAmper for 75 cycles
1 KAmper for 150 cycles

5. Mechanical characteristics of the recloser type W: 14.4 kV, 560 Amp, 8 KAmper short circuit capability for:

PROLEC S.A. de C.V.
Apartado postal 150
Monterrey N.L.
64000 Mexico

6. Transient function of the voltage divider for supply small load. Connected to 115 kV line for:

Comision Federal de Electricidad
Division Centro sur
Cuernavaca Morelos
Mexico

**FINAL REPORT OF THE TRAINING ON
HIGH POWER DIRECT AND SYNTHETIC TESTING
AT IREQ**

Prepared by: Manuel Garcia

**For: Mr. Vladislav Zajic
Maître de recherche
IREQ**

**c.c. Mr. Jean Lafontaine
Guy Genest
Rogelio Covarrubias**

July 2, 1987

**FINAL REPORT OF THE TRAINING ON HIGH POWER DIRECT AND
SYNTHETIC TESTING AT IREQ**

The activities developed during this six months training were based on the original proposed training program, showed in Annex 1. In order to complete this goal, I have attended and participated in the performance of several test executed in the Medium Voltage, High Voltage and Synthetic Circuits of the High Power IREQ's Laboratory. Such tests are described in Annex 2.

Additionally, in order to clarify some special problems, I held several meetings with the test engineers, and also with specialists in other fields, such as measurement techniques, electronics and installations and Services.

In this way, I think that the most important aims of the program have been fulfilled.

Manuel Garcia Martinez

ANNEX 1

PROPOSED TRAINING PROGRAM AT IREQ

1) High Power Direct Tests

- 1.1 Circuit parameter calculation.
- 1.2 Circuit preparation.
- 1.3 Calibration tests.
- 1.4 Measurements (shielding, instruments, techniques, etc.).
- 1.5 Analysis of the results.
- 1.6 Reports generation (data handling and storage).

2) Synthetic Tests

- 2.1 Test circuit and testing philosophy of the main circuit at IREQ.
- 2.2 Circuit parameter calculation.
- 2.3 Circuit preparation.
- 2.4 Interaction between circuit and test object (Energy, Injection, Current, Gain Factor, etc.).
- 2.5 Triggering methods (laser) (trigatron) (plasma).
- 2.6 Calibration tests.
- 2.7 Selection, application and control of injection current.
- 2.8 Additional circuits (reignition, artificial line, etc.)
- 2.9 Analysis of Results.
- 2.10 Reports generation

3) Operation, maintenance and safety handbooks (Manuals)

- 3.1 Practices
- 3.2 Organization
- 3.3 Procedures

4) Maintenance techniques

ANNEX 2
ACTIVITIES REALIZED DURING THE TRAINING

Starting date	End date	Test or activity
14.01.87	16.01.87	General introduction.
19.01.87	23.01.87	Current impulse test on optical fibres.
26.01.87	10.02.87	Make and break capability test on IIE recloser.
11.02.87	12.02.87	Short-circuit test on a power transformer.
13.02.87	13.02.87	Short-circuit test on a distribution transformer.
16.02.87	23.02.87	Review of the acquired information.
26.02.87	26.02.87	Power arc test on distribution fuses.
27.02.87	06.03.87	Capacitor bank breaking tests on a H.V. circuit-breaker.
09.03.87	09.03.87	Power arc test on a distribution surge arrester.
10.03.87	11.03.87	Preparation of test report of the IIE recloser
12-03-87	13-03-87	Current impulse test on reactors.
16.03.87	17.03.87	Power arc test on a distribution surge arrester.
18.03.87	20.03.87	Short-circuit tests on distribution fuses.
23.03.87	25.03.87	Preparation of test report of the IIE recloser.
26.03.87	03.04.87	Measurement of the TRV-4P of the synthetic circuit.
06.04.87	15.04.87	Line charging current breaking tests on a H.V. SF6 circuit breaker.
21.04.87	01.05.87	Synthetic tests for terminal fault and short-line fault on a H.V. SF6 circuit breaker.
04.05.87	06.05.87	Preparation of a circuit breaker for testing and measurement of the operation times.
07.05.87	15.05.87	Review of the theoretical methods for calculating directly the components of a synthetic circuit.
19.05.87	22.05.87	Synthetic test for terminal fault (test duty no 5 - IEC) on a H.V. SF6 circuit breaker.
25.05.87	30.06.87	Synthetic tests for terminal fault and short-line fault on a H.V. SF6 circuit breaker at -50°C.
02.07.87	03.07.87	Final collection of information, final report preparation and miscellaneous activities.

THIRD QUARTERLY REPORT
February 1987

CONTRACT NO. 84/127

between

THE UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION (UNIDO)

and

THE INSTITUTE OF RESEARCH OF HYDRO-QUEBEC (IRFO)

PILOT SYNTHETIC TEST CIRCUIT
in Mexico City

UNIDO Project # DP-MEX-82-011
Activity Code: DP-MEX-31.9

REVIEW OF THE WORK ACCOMPLISHED

1. December 1986

Initiation of the training of Test Engineer No. 2

2. January 13, 1987

Beginning of 6-month training period of Test Engineer No. 1

3. January 25 - February 11, 1987

Testing of the oil circuit-breaker in High-Power Laboratory of IREQ

1. Test Engineer No. 2

Mr. Ruben Ochoa from IIE arrived at IREQ according to the timetable (revised in September 1986) for a two-week stay at the beginning of December 1986. He was initiated to the research program "Characterization of Secondary Arcing Faults" by the Program Leader, Mr. Bohdan Koch of IREQ and had also the opportunity to participate in a testing program at the High Power Laboratory of IREQ, including synthetic tests. He is now supposed to continue the study of problems associated with the program "at home" and come back for a second training period in April 87, as scheduled.

2. Test Engineer No 1

Mr. Manual Garcia of IIE arrived at IREQ on January 13, 1987 for a training period of 6 months. He is now working in the High-Power laboratory, assisting IREQ's engineers during current testing. He fully participated during a two-week period at the end of January and beginning of February, when the prototype of IIE oil circuit-breaker was tested as reported in the next paragraph.

3. Testing of the prototype of an oil circuit-breaker in the HP Laboratory of IREQ.

Compared to the Timetable (Revised September '86) the testing of the prototype of the oil circuit-breaker has been advanced by a few weeks. In fact, the test were made during a period of 2 1/2 weeks at the end of January and the beginning of February 1987. The tests were made in presence of 3 IIE representatives headed by Mr. Alfonso Avilla. The IIE trainee, Mr. Manual Garcia was also present, assisting the IREQ's test engineer.

A totality of 150 test shots were made, covering completely the test program as scheduled. A detailed test report is now in preparation by the laboratory.

The tests were fully satisfactory. The prototype passed the whole test program without any failure. Only one minor mechanical defect was found during the tests and this was readily corrected.

It can be stated that the breaker is now ready to be used in the synthetic test circuit in Salazar during its commissioning.


Vladislav Zajic
Project Leader
IREQ

SECOND QUARTERLY REPORT
September 1986

CONTRACT NO. 84/127

between

THE UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION (UNIDO)

and

THE INSTITUTE OF RESEARCH OF HYDRO-QUEBEC (IREQ)

PILOT SYNTHETIC TEST CIRCUIT
in Mexico City

UNIDO Project No. DP-MEX-82-011
Activity Code: DP-MEX-31.9

REVIEW OF THE WORK ACCOMPLISHED

1 May 19-24, 1986

Seminar on laboratory measuring methods and techniques given by Dr. Richard Malewski of IREQ in Mexico City.

According to Cl. 2.01 b), Item 2 of contract.

2 September 1-5, 1986

Seminar on High-Voltage Circuit Breakers given by Prof. Vladislav Zajic in IIE Headquarters in Cuernavaca.

According to Cl. 2.01 b), Item 1 of the contract.

3 September 6, 1986

Visit by Prof. Vladislav Zajic of the test installation in Salazer

According to Cl. 2.01 of the contract.

4 September 8-9, 1986

Meeting with Mr. Alfonso Avila and his staff to discuss the status of preparation of the oil circuit recloser to be tested at IREQ.

5 September 9, 1986

Meeting with Mr. Ruben Ochoa, responsible for the project at IIE and preparation of a new timetable.

- 1 The seminar on Laboratory measuring techniques was organized by Mr. Ruben Ochoa of IIE. Out of 28 participants, 15 were from IIE, 8 from CFE and the remaining 5 from other institutions. The speaker, Dr. Richard Malewski is a world-renowned specialist in this field. 20 lecturing hours were covered in 5 days. The seminar was highly appreciated by the participants.
- 2 The seminar on High Voltage Circuit Breakers was also organized by Mr. Ruben Ochoa and was combined with round-table discussions on practical problems with electrical switchgear, introduced by Mr. Rogelio Covarrubias. The speaker was Prof. Vladislav Zajic, leader of this project. He covered 30 hours of the course in 5 days and, with the combination of a two-hour round-table discussions, the participants had a full 8-hour shift every day. Participants: 21, distributed evenly between IIE, CFE and manufacturers.
- 3 The visit of the Salazar installation was made on Saturday. The erection work, although delayed with respect to the timetable of December 1985, is now nearly finished. A few finishing touches shall be made during the second half of September and the first half of October 1986, so that the running-in period could start at the end of the same months. To assist IIE in this work, as foreseen by Cl. 2.01 e), IREQ shall send one test engineer and one senior technician from IREQ's High Power Laboratory to Salazar for two weeks, starting October 20, 1986.
- 4 Meeting with Mr. Alfonso Avila and his collaborators, responsible for the preparation of the oil recloser to be tested at IREQ's Laboratories.

The preparation of the recloser has been affected by several mechanical problems. A total of 7 different problems, causing mechanical malfunctions, have been identified and corrected by IIE successively. However, during recent electrical tests at reduced parameters, the recloser did not work properly and its interrupting chambers plus contact system were heavily damaged. All this was thoroughly discussed, but it was not possible to determine the cause of the last failure immediately. Further analysis is needed, one being the quality of the welding of contact tips on the fingers. A few samples have been obtained for analysis in IREQ's laboratories. Due to these reasons, the tests of the recloser had to be postponed and it is now hoped they will be possible in February or March 1987.

- 5 The closing discussion with Mr. Ruben Ochoa, responsible for the project at IIE, resulted in preparation of a revised timetable, shown in the annexe.

Following are the notes concerning the new timetable:

- a) As for the synthetic test course, the personnel of IIE being tied up by the commissioning of the synthetic circuit in Salazar until the end of the year, it was considered more convenient to delay this course until the beginning of 1987.

- b) The same applies to the laboratory exercises
- c) The training of the test engineer No. 1 will start on November 11, 1986 and will last for 6 months until the middle of May 1987.
- d) As for the training of the test engineer No. 2, it will start on November 11, 1986 as well, But as this trainee should participate in the research program "Characterisation of the secondary arcing faults" it was IREQ's recommendation to split the training period of 6 months on three shorter periods in order to coordinate the training with the anticipated progress of that program.



Vladislav Zajic
Project Leader
IREQ

(months)
(1986 week no) 40 11 50 12 52 1 2 10 3 4 5 20 6 7 30 8 9 10 40 11 12 50 52

	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Cl. 2.01 a) Basic project Item 4. Testing of the circuit-breaker in IREQ's laboratories 1. Testing in the scope of ANSI 2. Finding limits of parameters				X	X									
Cl. 2.01 b) 3. Course on synthetic testing		X												
Cl. 2.01 c) Laboratory exercises at IIE				(XXXX)								(XXXX)		
Cl. 2.01 d) Training of IIE test eng. at IREQ Test engineer No. 1 Test engineer No. 2		XXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXXXXXXXXXX	XXXXXXXXXXXX	(XXXXXXXX)				XXXXXXXXXXXXXXXXXXXX			XXXXXXXXXXXXXXXXXXXX		
Cl. 2.01 e) Erection, running in, comm. 1. One test eng. & one sen. tech. at IIE. Checking of erection instrument calibration 2. One test eng., commisioning		(XX)												

JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC

FIRST QUARTERLY REPORT
December 1985

CONTRACT NO. 84/127
between
THE UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
(UNIDO)
and
THE HYDRO-QUEBEC INSTITUTE OF RESEARCH (IREQ)
to
BUILT A PILOT SYNTHETIC TEST CIRCUIT
in
MEXICO

UNIDO Project no. DP/MEX/82/011
Activity Code: DP/MEX/31.9

Review of the work accomplished

1. July 4, 1985

Meeting in Montreal between the project leader

**Ing. Vladislav Zajic of IREQ and
Mr. Rogelio Covarrubias of IIE**

**Renewal of the contact between IREQ and IIE, general discussion
about the status and further progress of the work.**

**July 4, 1985 is considered to be the start of the performance
period according to Cl. 2.02 of the contract.**

2. November 25-27, 1985

**Visit of the project leader Ing. V. Zajic and Mr. Jacques Aubin
both of IREQ, to Mexico.**

- a. Visit of the synthetic test laboratory at Salazar.
Detailed discussion of the lay-out and equipment.**
- b. Visit of the IIE headquarters at Cuernavaca. Inspection of
the prototypes of the recloser being prepared for tests at
IREQ,s laboratories and detailed discussion of the test
program.**
- c. Discussion of the progress of work and preparation of the
new version of the timetable (Appendix 2)**

A. Visit of the synthetic test laboratory of SALAZAR

On November 26, 1985, two specialists from IREQ, Mr. V. Zajic and Mr. J. Aubin visited the synthetic circuit laboratory at SALAZAR

some 50 km south-west from Mexico City, accompanied by Mr. Ruben Ochoa of IIE. Several other persons took part in the discussion.

It was found that the synthetic circuit building has been finished including the test cells and control room. The main transformer has been delivered and is sitting on its foundation. The capacitor elements have also been delivered. Some of the isolating switches, a vacuum circuit-breaker and a few other elements have also been delivered. All other elements are missing.

Apart from this, the assembly work has hardly started.

A detailed discussion of the lay-out was made on the basis of documentation available. Following are the points raised by IREQ's specialists:

1. It is recommended to change the type of connection between the reactors of the 23 kV system and the test cells. Instead of insulated cables with earth shield, bare bar system should be used, the reason being that the inherent capacitances of a bar system are several orders lower compared to an insulated cable with earth shield, and this will permit to use much higher inherent frequencies (TRV frequencies) for the test. It is always possible to decrease the TRV frequencies by addition of small capacitances while the contrary is impossible.

2. According to the existing lay-out, the two test cells can be used, each of them, either for direct or for synthetic tests. This is considered superfluous requiring a change-over system of isolating switches on the roof of the test cells.

It is recommended to specialize the use of the test cells, one for direct test only, the other for synthetic tests only. This will simplify the circuit diagram and increase the reliability.

3. It is recommended to use standard 23-kV bushings for the entrance of the high-current circuit into the synthetic test hall. Simple insulating plate may cause accumulation of dust and dirt with possible flash-overs to the earth. This is considered dangerous, as dead short-circuit on transformer secondary terminals may result.

4. 23-kV circuit. It is recommended to change-over the positions of resistors and reactors in the test circuit, putting reactors to the test cell side. The reason is the same as according to point 1 here-above.

5. Discharge resistors and earthing switches. Earthing of the capacitor banks via a resistor is not acceptable from the safety point of view. A burned resistor could interrupt the earthing connection. Also the discharge resistors - one for the main bank, the other for the TRV control bank are not necessary. One earthing system should be used, having two branches in parallel. First one earthing switch would discharge both banks in a resistor and than the other switch would connect the capacitor bank terminal directly to the earth.

6. Fire protection. For a small laboratory like this one, manual fire extinguishers should be sufficient. Also face masks with filters against smoke inhalation should be available.

B. Visit of the IIE headquarter at Cuernavaca

On November 27, 1985, two specialists from IREQ, Mr. V. Zajic and Mr. J. Aubin visited the IIE headquarter at Cuernavaca. The main points of the visit were as follows:

1. In company of Mr. Ruben Ochoa and A. Portillo, a detailed inspection of the oil recloser prototype was made. This recloser will serve as a tested circuit breaker according to Clause 2.01, Subclause a) 4, page 4 of the contract.

IIE has built several prototypes of this recloser, two of these are now being prepared for testing at IREQ's laboratories. IIE has performed several tests in scope of parameters available in Mexico.

2. A detailed discussion was then made as to the test program and its timing.

It was agreed to make a first test series at the end of March 1986, the second at the end of June 1986, as also shown in the new edition of Appendix A2.

It was also decided to use the first test period for test series, strictly within the test program according to ANSI/IEEE standards, in order to have, first, an official proof of performance. The second test period would then be used to go over the rated parameters, in terms of current, voltage and TRV values, trying to find the performance limits and safety

margins of the recloser.

C. Discussion of the progress of the work and preparation of the new edition of the timetable (Appendix 2)

During the visits and meetings reported under A and B, several aspects of the progress of work have been discussed. This was finalized during the closing meeting and a new edition of the timetable (bar chart) has been prepared for 1986 as shown hereafter.



Vladislav Zajic
Project Leader
Electrical Equipment
IREQ

December 1985

1986 week no	10	20	30	40	50	52
Cl. 2.01 a) Basic project Item 4. Testing of the circuit-breaker in IREQ's laboratories 1. Testing in the scope of ANSI 2. Finding limits of parameters		(X)	(X)			
Cl. 2.01 b) 1. Course on switchgear 2. Course on measuring techniques 3. Course on synthetic testing		Accomplished (XX)		XX		XX
CL. 2.01 c) Laboratory exercises at IIE			XXX			
Cl. 2.01 d) Training of IIE test eng. at IREQ Test engineer No 1 Test engineer No 2			Postponed XXXXXXXXXXXXXXXXXXXXXXXXXXXX		XXXXXXXXXXXXXXXXXXXXXXXXXXXX	
Cl 2.01 e) Erection, running in, comm. 1. One test eng. & one sen. tech. at IIE. Checking of erection instrument calibration 2. One test eng., commissioning		XX		XX		

APRIL

JULY

OCT

Reported to November

skill building