PN. AB2-166
91600

TRIP REPORT

BASICS

A

TECHNICAL ASSISTANCE FOR STRENGTHENING EPI IN MOLDOVA

MOLDOVA
COMMONWEALTH OF INDEPENDENT STATES

February 24-March 10 and May 11-22, 1996

SØREN SPANNER

BASICS Technical Directive No: 000-MD-01-037
USAID Contract No: HRN-6006-C-00-3031-00

B

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ACKNOWLEDGMENTS

The activities described in this report were undertaken in close cooperation with staff from the Ministry of Health, Government of Moldova, especially those at the Republican Sanitary and Epidemiological Station Headquarters, in the city of Chisinau.

Particular mention should be made of the invaluable guidance given by Dr. Magdei Mircea Vassilievich, Deputy Minister of Health Care, Kishinev Republic of Moldova, and the daily support and assistance of Dr. Oleg Benes, Chief Epidemiologist of the Republican Sanitary and Epidemiological Station and Dr. A. Melnic, Chief Doctor of the Republican Sanitary and Epidemiological Station.

Special thanks are also extended to my excellent interpreter in Moldova, Ms. Marina Kryazheva, whose skill and patience throughout contributed greatly to the success of the mission.

ACRONYMS

BCG	Bacillus Calmette Guerin
CCM	Cold Chain Monitor
CFC	Chloride Fluorine Carbon
CIS	Commonwealth of Independent States
CLM	Commodities and Logistics Management
DPT	Diphtheria, Pertussis, Tetanus
EPI	Expanded Programme on Immunisation
FAP	Feldsher Obstetrician (Health) Post
FOF	Front Opening Freezer
FSU	Former Soviet Union
GPV	Global Programme for Vaccination
ILR	Ice-Lined Refrigerator
IPF	Ice-Pack Freezer
KRF	Kishinev Refrigerator Factory
MCH	Maternal and Child Health Services
MoH	Ministry of Health
MSH	Management Sciences for Health
NIS	Newly Independent States
OPV	Oral Polio Vaccine
PC	Polyclinic
PIS	Product Information Sheets; WHO/UNICEF Publication
R12	Refrigerant 12 (Banned in the developed world as per 01.01.96)
R134a	Refrigerant 134a
REACH	Resources for Child Health
RSES	Republican SES
SES	Sanitary and Epidemiology Station
SUB	Rural Outpatient Clinic
SVA	Rural Hospital
TTM	Time Temperature Monitor
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
WHO	World Health Organisation

EXECUTIVE SUMMARY

BASICS consultant Søren Spanner made two technical assistance visits to Moldova in February/March and May 1996, to continue training for vaccine stock control, to develop vaccine stock control forms for improving inventory tracking at central and district level, and to continue discussions with representatives of the Kishinev Refrigerator Factory (KRF) on the potential production of a freezer for vaccine storage.

During a visit to the Republican SES, tests were conducted on the recently received incinerator boxes which have been the subject of several communications. The tests were not favourable: burning two of the boxes resulted in molten plastic flowing out of the box and needles were not satisfactorily destroyed. RSES staff predict another potential problem with the boxes–for health workers in the field with low salaries, the boxes appear too expensive to burn.

RSES stock control was reviewed during both visits. The new storekeeper maintains good order in the stores, cold room, and freezers. Problems encountered during the first visit with reading of temperatures, incorrect use of cold chain monitors, and irregularities with the chart recorder of the cold room were corrected by the time of the second visit. To ensure continuity, a new stock of recording charts will need to be ordered.

During the consultant's first visit, four stock control forms were developed for use at all levels of the health system. The forms for the RSES level are being used satisfactorily. Use of forms at the SUB, SVA, and FAP levels should follow now that requested adjustments to reduce the total number of forms have been made.

A primary purpose of both consultant trips to Moldova was to visit the Kishinev Refrigerator Factory and discuss the possibility of manufacturing EPI cold chain equipment at this factory. During both visits, the factory was not operating due to lack of orders and the high cost of heating the factory. Samples of factory-produced freezers and cold boxes were inspected and the potential production of a combined IPF/OPV freezer discussed. Documentation for testing chest freezers to meet WHO specifications was discussed with the Chief Engineer. Following testing in Moldova, planned for June-July 1996, independent outside testing will need to be arranged by WHO/GPV in Geneva.

The consultant met with the new manager of the KRF; the manager had recently returned from Romania with an agreement for the factory to produce 7000 refrigerator/freezer units per month. Under the terms of the agreement, which still must be signed by the Prime Minister of Moldova, Romania will supply the raw materials for the units to be produced.

Between trips to Moldova, the consultant met with UNICEF representatives in Copenhagen and with WHO/GPV in Geneva. UNICEF is interested in buying equipment that is produced in less developed countries and WHO would bear the cost of testing the equipment. Since less

developed countries such as Moldova are not covered by the ban on CFCs, KRF could produce and sell equipment using R12 refrigerant.

In anticipation of US$ 136,000 assistance from the Japanese Government for the purchase of cold chain equipment, the MoH solicited the consultant's advice on the selection of specific equipment. Suggestions and price quotes were passed to Dr. Benes for his consideration.

In March, the consultant visited the Grigoropol SES and Children's Polyclinic in Trans-Dnestr. He inspected the cold chain and discussed findings with the staff. Vaccine found damaged was discarded. The staff was trained and the consultant helped them to fit the ice-lining in the MK-302, an important precaution in case of power cuts.

In summary, there exists a good inventory system which can, and will, be used at all levels of the immunization system in Moldova. The new system should be allowed a trial period of three months, after which it should be reviewed. The KRF will produce and test the 130 litre IP/OPV freezer beginning in June 1996, to be followed by independent testing through WHO. The MoH has received guidelines for the quantity and type of cold chain equipment that might be purchased with Japanese assistance.

I. PURPOSE OF THE VISIT

BASICS consultant Søren Spanner made two technical assistance visits to Moldova in February/March and May 1996. The purpose of these visits was to (1) continue previous work in training the staff of the Republican SES and the Ministry of Health in vaccine stock control; (2) develop vaccine stock control forms for improving inventory tracking at central and district level; and (3) continue discussions with representatives of the Kishinev Refrigerator Factory (KRF) on the potential production of a freezer for vaccine storage, including further explanation of the WHO specifications and testing of the combined ice-pack and polio vaccine freezer. (See Scopes of Work, Appendix A.) For previous work carried out under the REACH and BASICS projects, please refer to previous reports by the author.

II. BACKGROUND

The Republic of Moldova covers an area of 33,700 km^2 and has a population of 4.35 million persons (including 66,000 infants). Of the total population, almost two-thirds are Moldovans, and the remainder is comprised of Ukrainians, Russians, Gagauzi (a Turkic people), Jews, Gypsies and Bulgarians.

Moldova has a higher average population density than any of the NIS republics. The urban population rose as a result of industrialization in the 1980s; more than a third of the people live in towns. Moreover, Moldovan villages are large and typically have more than 1000 inhabitants. All are supplied with electricity.

III. TRIP ACTIVITIES

A. Visit to the RSES and Review of the Stock Control System

1. Incinerator boxes

At the RSES, we tested two incinerator boxes as follow-up to substantial e-mail and fax traffic since their delivery. The boxes burned well, in about 40 minutes as expected. However, the molten plastic does not stay in the bottom of the box, as shown in the picture in the users manual (which is written in neither Russian nor Romanian). The molten plastic flows "all over the place" and leaves the needles in the bottom of the box. The second box we tried to place on a level surface, but the results were the same; this box even had a needle in a plastic cover that had not melted. (See picture series in Appendix B1.)

The RSES staff are not happy about the boxes, but will distribute the boxes when they next distribute needles and syringes. They think that the box is awkward, impractical and expensive. At Republican SES level they do not believe that these will be used as incinerator boxes at field

level simply because "the boxes are too nice to burn". In fact, this may pose a serious problem, since to health workers with very low salary, the boxes do look too expensive to just burn.

2. Stock control

There was also time during the visit for a look at the stores. The new storekeeper, Mr. Marin Melnic, maintains good order in the stores, cold room and freezers. The temperature records are filled in daily, except on weekends and holidays. It was found, however, that some of the temperature records are merely checked off. The actual temperature was never read. The understanding is that if the freezer has been opened and "you can see that it is cold", there is no need to look at the thermometer. The importance of actually reading the temperature was explained and understood.

The consultant observed that the cold chain monitors (CCMs) were still not being used correctly. An attempt was made to explain the importance and usefulness of CCMs to the new storekeeper. At a later look in the stores it was found that both problems had been corrected: the CCMs were in use and the temperatures were being read and correctly recorded.

There have also been irregularities with the chart recorder of the cold room. (See picture in Appendix B2.) This has now been rectified with the appointment of the new storekeeper. The charts are changed on a weekly basis and are marked with dates (in and out). There are only 57 recording charts left for the recorder (one year's use) and new charts should be ordered. The charts can be ordered from:

Huurre Group OY
Head Office
P.O. Box 127
FIN-33101 Tampere
Finland
Fax: +358 31 349 4360 att.: Mr. H.E. Nyström. Ref. Moldova Cold-Room .

One of the time temperature monitors (TTMs) was found in the Central Cold Room.

The current stock control system at RSES level is based on forms introduced in February 1996. See Appendices C-I.

B. Development and Implementation of Stock Control Forms

During the first of the consultant's two visits, stock control forms were developed for use at all levels of the health system. The forms were developed in such a way that it will be easier to introduce the CLM software at a later stage.

As of the writing of this report, the system has been operating satisfactorily for two months at the RSES level. The forms developed for SUB, SVA and FAP levels have not yet been put into use. It was agreed in February that the forms would be implemented as soon as possible, but Dr. Benes had second thoughts and decided not to introduce the forms until we had a chance to discuss the forms once more. With the laudable goal of reducing the total number of forms, Dr. Benes would like the proposed forms to include the number of vaccines to be ordered monthly by SUB, SVA and FAP from the Rayon SES. This suggestion has been incorporated, reducing the number of forms by one. A text box on how to use the forms at lower levels has also been introduced.

A total of four forms will be used, as follows:

1. Form for stock control at RSES and SES (*Fisa De Evidenta Stocului*)
2. Form for monthly reporting to SES, ordering of commodities and temperature recording at SUB, SVA, FAP and Polyclinics (*Fisa De Raportare Si Comanda Lunara A Stocului)*
3. Form for stock control at SUB, SVA, FAP and Polyclinics (*Fisa De Evidenta Stocului*)
4. Temperature recording sheet for RSES and SES (*Foaia Regimului de Temperatura;* same format as for SUB, SVA, etc.)

The new forms appear in Moldovan and English in Appendices C-I.

C. Visit to the Kishinev Refrigerator Factory

The other main purpose of these trips was to visit the Kishinev Refrigerator Factory (KRF) and discuss the possibilities of manufacturing EPI cold chain equipment at this factory in Moldova. We were specifically interested in the possibility of manufacturing an ice-lined refrigerator (ILR) and, subsequently, a combined ice-pack and OPV chest/front opening freezer, operating on R12.

At the time of the visits to the factory, both in February and in May, the factory was closed down. Lack of orders and the very high cost of heating the factory were cited as reasons for the shutdown.

The factory was scheduled to reopen on March 18, but by May 19 it had still not reopened. The factory workers were sent home on the minimum salary of 15 Lei (≈$3.50) per month.

The factory is, by European standards, very old fashioned. The machinery is very old, part of it of Hungarian origin and part of it of Russian origin. (See pictures in Appendix J). Nevertheless, the factory has been producing front opening freezers of acceptable standard. (See Appendix K)

There have been attempts to manufacture chest freezers and cold boxes; samples of both were seen and inspected. The samples clearly show that they are made by hand (see Appendix K). The samples are made from a standard front opening freezer (FOF), which is turned 90° and fitted with a kind of external evaporator (i.e., it is inside the storage room of the freezer). The compressor is located at the same place as in the FOF, also turned 90°, and capped by a simple

cover with sharp edges. The condenser (also external) is in the bottom, which could add excessive heat to the freezer. This could, however, work well for ice-pack freezers (IPFs), for which excessively cold temperatures in the bottom pose a problem.

There is a clear advantage to having external condensers and evaporators in a low income country such as Moldova, where it is always preferable to attempt repairs on a broken unit rather than discard it and buy a new one. Easy access to the parts makes it possible to change/repair both, and low salaries combined with the high cost of new equipment justify time spent for repairs.

The only products, at present, that are suitable for use in EPI are the FOF freezers (130 litre and 170 litre). The top opening freezer cannot be mass produced as the necessary tooling, moulds, etc., do not exist and the financial situation does not leave room for investment in new tools. Front opening freezers, on the other hand, can be used as combined IPF and OPV freezer after slight modifications which the factory is willing and able to make. The 130 l is the first to be tested. (See appendices L and M.)

All the necessary (WHO) documentation for testing of chest freezers was translated, discussed and handed over to the Chief Engineer, Mr. Karnaukhov. (See Appendices N-P.) Actual testing will start on June 3, 1996 and is expected to last for one and a half months. This consultant will be kept informed of the results/problems via the Moldova Country Coordinator, Vladimir Kolteniuk. Part of the test, the 43°/15°C test, will take place in Beltsy where they have an environmental chamber capable of managing the 43°/15°C test.

A meeting with the new manager, Mr. Usatiay, was held on May 20, 1996. Mr. Usatiay had just returned from Romania, where he had had negotiations with a Romanian refrigerator company. He brought news that an agreement had been signed that KRF will receive raw materials from Romania to produce 7000 refrigerator/freezer units per month. The only signature missing on the contract is the signature of the Prime Minister of Moldova; the manager did not foresee problems in getting the signature as the agreement will benefit the country.

According to Mr. Usatiay, production is due to resume in late June. He also informed us that negotiations were ongoing with American investors who are Moldovan emigrants.

D. Potential Donor Funding of Cold Chain Equipment

After the visit to the factory in February, the consultant met with both UNICEF/Copenhagen and WHO/GPV/Geneva. (See Appendix Q.) They both maintain their interest in an inexpensive freezer produced in a less developed country. At the meeting with WHO/GPV, the idea of having a combined ice-pack/polio vaccine freezer developed. A combined freezer would be much more versatile than just an ice-pack freezer. The possible market share would also be much bigger.

UNICEF has shown interest in buying equipment that is produced in less developed countries and WHO would bear the cost of testing the equipment. (See Appendix R, e-mail from UNICEF and WHO.) UNICEF sees no problem in purchasing and selling R12 equipment as long as it is within the geographical area that is **not** covered by the CFC ban, i.e., the developing world. (Eastern Europe and several developing countries may continue to produce CFCs until 2005; see Appendix S.)

It is likely that MoH will receive some US$136,000 from the Japanese Government for the purchase of cold chain equipment. Some work was done, with Feilden and Benes, on the selection of cold chain equipment. It is deemed necessary to have one more cold room of the same size as the present (15.7 m^3).

The supplier, Huurre, has been contacted and a quotation has been received. The total cost of a room equivalent to the existing one, but operating on R134a, including spare-parts and R134a, is approximately US$16,047. The prices for Vestfrost MK 142 and MK/MF 4010 are approximately US$484 and US$673, respectively. These price quotations from Huurre have been transmitted to Oleg Benes.

With the use of the existing data base we have come to the following suggestion, which is meant only as a guideline, as discussed with Dr. Benes. (See also Appendix T.) As the number of aging refrigerators is increasing, it is recommended to purchase as many refrigerators as possible with the money made available, bearing in mind that ice-packs are needed in some of the facilities.

TABLE NO. 1

TYPE OF REFRIGERATOR	*ESTIMATED COST*	*NUMBER*	*COST IN US$*
MK 142	483	112	54,208
MK/MF 4010	673	46	30,958
SPARE PARTS 10%[1]			8,517
COLD ROOM	16,047	1	16,047
SUB TOTAL			109,729
FREIGHT 10%			10,972
TOTAL			**120,701**

[1] Spare parts for R134a

E. Visit to Grigoropol SES and Children's Polyclinic

A trip was made to Trans-Dnestr in March to visit the Grigoropol SES and Children's Polyclinic. The cold chain was inspected, with the following findings:

- The MK-302 (ice-lined refrigerator) had never had the ice-packs that form the ice-lining installed. As a result, the ILR did not have any protection in case of power cuts. (In the new generation of MK-302s, they will be pre-installed.)

- Hepatitis B vaccine was stored in the bottom of the ILR, which is the coldest place; the vaccine was not damaged.

- The SB-300 (freezer) was not used for EPI, but for reagents in the laboratory. It was agreed that it be moved to the EPI section and used for vaccines.

- The MK-142 (ILR) was also not used for EPI. It contained various specimens and no ice-lining.

- The 4010 at the polyclinic had never worked, though this was never reported to the RSES. The compressor was faulty at delivery. This has now been rectified.

- There was an old front opening refrigerator at the polyclinic. Hepatitis B vaccine stored on the top shelf was checked and found to have been frozen and was therefore discarded.

The staff were trained and helped fit the ice-packs (ice-lining).

IV. RESULTS AND CONCLUSIONS

It is now felt that there is a good inventory system which can, and will, be used at all levels of the immunization system. Stock, inventory and temperature recording sheets will be printed on lightweight poster paper. The system is designed in such a way that it will be easier to eventually introduce CLM. The new system should be allowed a trial period of three months, after which it should be reviewed.

The KRF will start the test of the 130 litre IP/OPV freezer beginning in June 1996. The results will continuously be transmitted to me and I will follow up as needed. Once the test is finished and the results are satisfactory, i.e., the WHO criteria are met, contact must be made with Michel Zaffran, WHO/GPV Cold Chain Officer, in order to have the freezer sent for independent testing.

Guidelines for ordering equipment (quantity and type) have been discussed with Dr. Benes.

V. FOLLOW-UP and RECOMMENDATIONS

- **If possible a short visit to the KRF should be made in August.**
- **A follow up visit on stock and inventory control should be paid late September or early October.**
- **The cold chain engineer, Mr. Alexandru N. Jitaras, must be kept informed as to the "CFC free" training course in Mombasa in September.**
- **Every effort should be made to ensure that Viorika Ghimpu, Logistics Officer, can join Dr. Benes for the WHO/EPI training course in Geneva.**
- **Upon completion of KRF testing of the IP/OPV freezer, Michel Zaffran at WHO/EPI should be contacted to arrange for independent testing.**

APPENDICES

APPENDIX A

BASICS
SCOPE OF WORK DESCRIPTION

A) Name:	Soren Spanner
B) Account Code:	000 MD 01 037/ 000 MD 01 042 (50/50)
C) Destination:	Chisinau, Moldova
D) Dates:	February 24 - March 9, 1996
E) Fee days:	15 days

F) Scope of Work:

BASICS Consultant Soren Spanner will travel to Chisinau, Moldova on or about January 23 - February 7, 1996 to work on development of a refrigerator for vaccine storage and on vaccine stock management control. Specifically during his visit, he will carry out the following:

- meet with officials at the Chisinau Refrigerator Factory in response to their request for technical assistance for local production of a refrigerator for vaccine storage. Review the various refrigerator models produced and assess factory production capacity;

- compare findings to vaccine refrigerator specifications from WHO and determine modifications which would be necessary to produce an Ice-Lined Refrigerator used for vaccine storage;

- meet with assignment counterpart Steve Brooke, who will prepare a market analysis and business plan for local refrigerator production, and provide him with an orientation and debriefing on the status of this assignment;

- assess progress on the vaccine stock management control at national level and outline action to be taken to achieve a well-working stock management system by year end, at national and raion levels;

- meet and debrief USAID Representative at US Embassy.

BASICS
SCOPE OF WORK DESCRIPTION

A) Name:	Soren Spanner	Rachel Feilden
B) Account Code	000 MD 01 119; 000 MD 01 116	000 MD 01 039
C) Destination:	Chisinau, Moldova	Chisinau, Moldova
D) Dates:	May 6 - May 20	May 8 - May 22
E) Fee days:	16 fee days	16 fee days

F) Scope of Work:

1) BASICS Consultant Soren Spanner will carry out the following:

- continue discussions with Chisinau Refrigerator Factory representatives on the manufacture of a freezer used for immunization programs;

- work with Factory representatives to explain use of the freezer (ice-packs and polio vaccine) and freezer model specifications;

- continue work on vaccine stock cards for improving inventory tracking at central and district levels, and other aspects related to vaccine logistics;

- work with MOH counterparts on aspects of syringe safety boxes (use, delivery, storage, distribution);

- brief and debrief USAID representatives in Moldova;

- submit a trip report with findings, recommendations and action to be taken.

2) BASICS Consultant Rachel Feilden will carry out the following:

- work with MOH counterparts on the cost-effectiveness analysis of the national vaccination program;

- prepare, field test and have translated the data collection formats for use in gathering data;

- identify and select local two teams of two (one epidemiologist and one pediatrician) to collect information from health facilities on vaccines, needles and syringes, equipment, fuel costs, staff time and other cost-related data;

- work with MOH counterparts and resident coordinator on logistic arrangements of the research and analysis;

- brief and debrief USAID representatives in Moldova;

- submit a trip report with findings, recommendations and action to be taken.

TO: ACTION OFFICE NIS 03
CC: HEAL 04
PLEASE PASS TO BASICS
BASICS CONSULTANT SOREN SPANNER WAS NOT ABLE TO BRIEF USAID/US EMBASSY ON THE FINDINGS OF HIS MISSION TO MOLDOVA FROM 11 MAY TO 22 MAY 1996. USAID OFFICER POUL MORRIS WAS ON LEAVE.
CONSULTANT SPANNER'S ACTIVITIES INCLUDED MEETING WITH MANAGEMENT STAFF OF THE KISHINEV REFRIGERATOR FACTORY (KRF) TO FOLLOW UP ON HIS VISIT IN FEB/MARCH 1996, INFORM ABOUT THE CRITERIA SET BY WHO/UNICEF ON ICEPACK FREEZERS/ORAL POLIO VACCINE (OPV) FREEZERS, AND ASSESS KRF'S CURRENT CAPABILITIES IN PRODUCING A COMBINED ICEPACK FREEZER/OPV FREEZER.
THE MISSION ALSO INCLUDED FURTHER DEVELOPMENT OF VACCINE STOCK AND INVENTORY SYSTEM FOR IMPROVED MANAGEMENT.
SPANNER'S FINDINGS FOLLOW:
1) A CONTRACT HAS BEEN SIGNED BY KRF WITH A ROMANIAN REFRIGERATOR FACTORY STIPULATING THAT KER DURING THE NEXT 3 MONTHS WILL PRODUCE REFRIGERATORS TO THE ROMANIAN FACTORY (7000 PER MONTH) AND THE ROMANIAN FACTORY WILL SUPPLY THE RAW MATERIALS. THE CONTRACT IS AWAITING THE SIGNATURE OF THE PRIME MINISTER IN MOLDOVA.
2) KER IS ALSO NEGOTIATING WITH AMERICAN INVESTORS (MOLDOVAN EMIGRANTS).
3) FOLLOWING UP ON HIS LAST VISIT, SPANNER HAD MEETINGS WITH WHO/UNICEF IN WHICH IT WAS DETERMINED THAT, SINCE KER WAS UNABLE TO PRODUCE AN ICE-LINED FREEZER, THE BEST PRODUCT FOR KER TO PRODUCE IS A COMBINED ICE-PACK/OPV FREEZER.
4) THE CRITERIA SET BY WHO/UNICEF WAS THOROUGHLY DISCUSSED, TRANSLATED INTO RUSSIAN AND EXPLAINED TO THE PRODUCTION ENGINEERS. THE TESTING FACILITIES AT KER WERE INSPECTED AND

FOUND SATISFACTORY FOR MOST OF THE TESTS, ALTHOUGH ONE TEST WILL NEED TO BE CARRIED OUT IN BELTSY WHERE TEST FACILITIES ARE BETTER.

5) THE TESTS WILL START 3 JUNE AND IS EXPECTED TO CONCLUDE IN AUGUST 1996.

6) WHEN THIS LOCAL TESTS HAVE BEEN PASSED SUCCESSFULLY, THE FREEZER WILL BE SHIPPED TO AN INDEPENDENT LAB (AT WHO EXPENSE) FOR FINAL TESTING AND APPROVAL.

7. THE STOCK CONTROL FORM DEVELOPED (FOR RSES AND SES) WAS IN USE AT THE RSES AND PROVED TO BE WORKING WELL.

8. FORMS TO BE USED AT EACH OF THE LOWER LEVELS (PC, SUB, SVA, FAP) ENSURING A BETTER STOCK CONTROL SYSTEM HAVE BEEN IMPROVED, APPROVED AND WILL BE PRINTED AND INTRODUCED. THE NEW STOCK CONTROL SYSTEM WILL PERMIT BETTER TRACKING AND MORE EFFICIENT USE OF NATIONAL AND DONATED COMMODITIES.

EMBASSY REQUESTS RETURN VISIT BY BASICS CONSULTANT SOREN SPANNER TO PROVIDE ADDITIONAL TA SUPPORT FOR THE MINISTRY OF HEALTH'S EFFORTS TO STIMULATE LOCAL PRODUCTION OF COLD CHAIN EQUIPMENT AND FOLLOW UP ON STOCK CONTROL FOR IMPROVED MANAGEMENT OF IMMUNIZATION PROGRAM.

APPENDIX B

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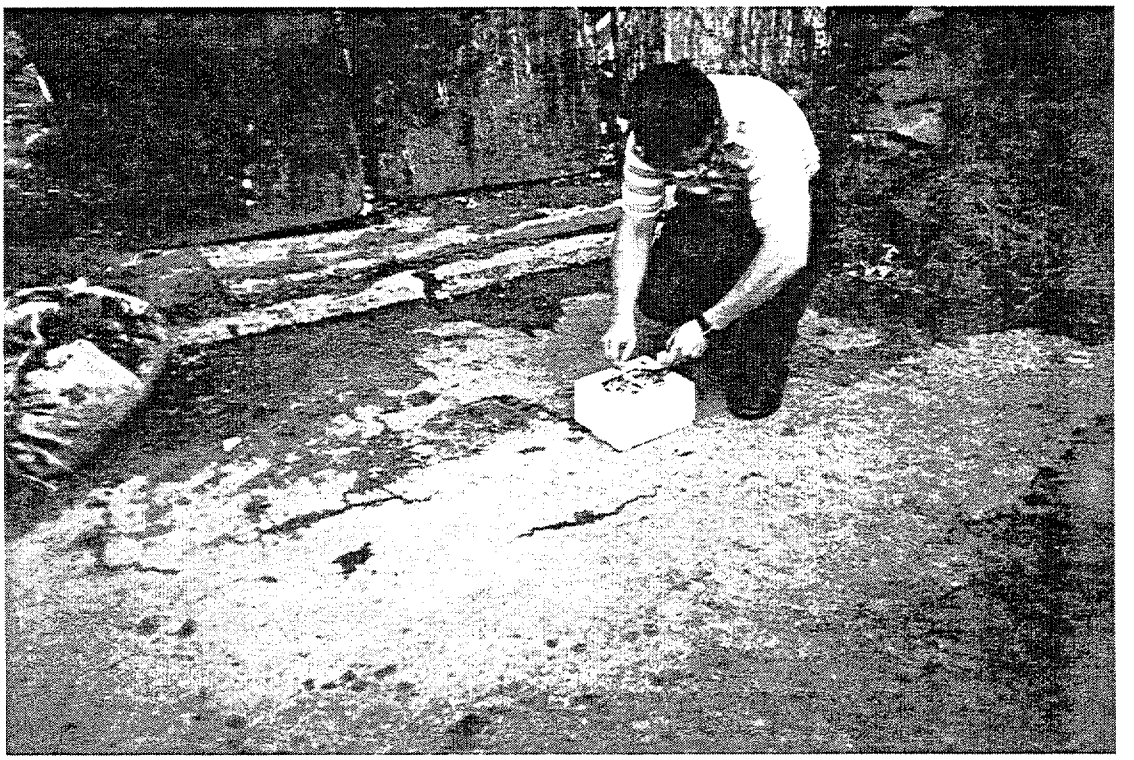
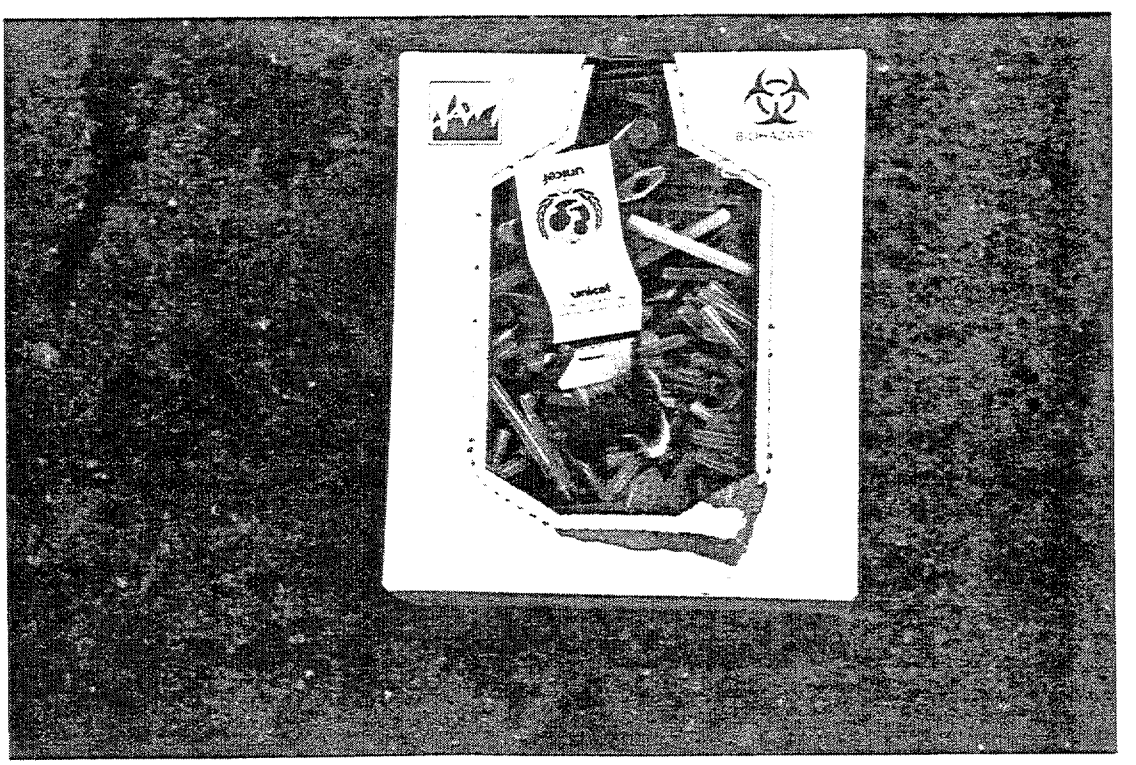
Lighting up the box





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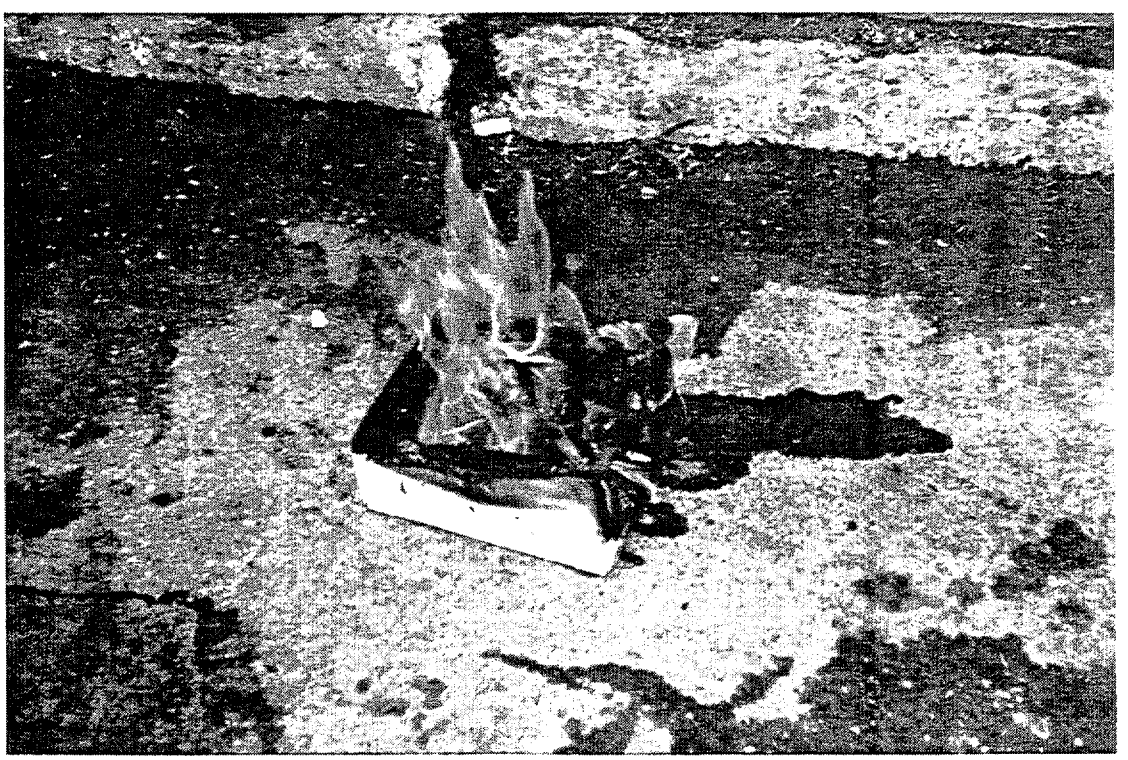
The box and syringes starts burning



The molten plastic starts running out of the box!

18

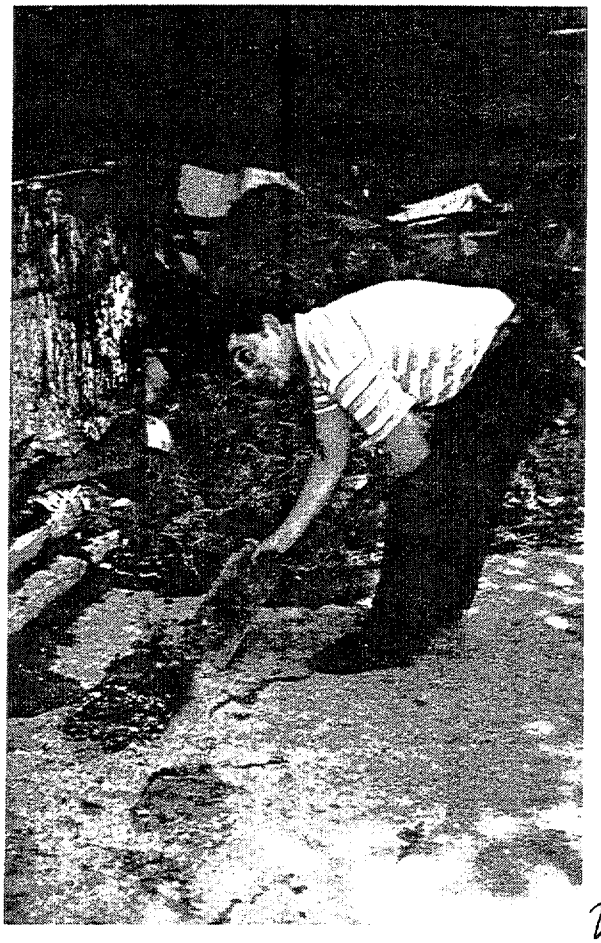
The fire dies

BEST AVAILABLE COPY

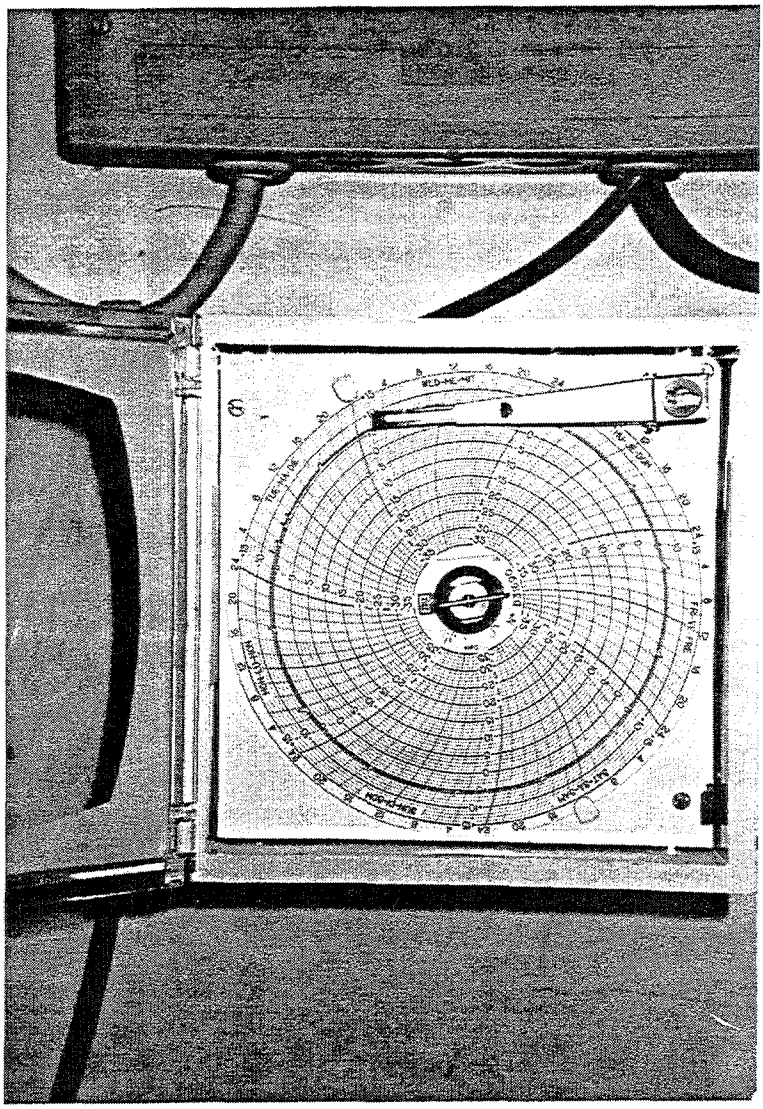
And the molten plastic disappears !

THE INCINERATOR BOX

The fire is dead, syringes and ash remains



Temperature Recorder for the cold-room at RSES, the temperature is constant. The small peaks are the defrosting periods.



APPENDIX C

FIŞA DE EVIDENŢĂ STOCULUI

RAION			DENUMIREA		PRET / 1 DOZA:	
LOCALITATEA			AMBALAJUL		STOC MINIM.:	
UNIT. MEDICALĂ			UNITATEA		STOC MAXIM.:	
LOCUL			SERIA LOTULUI		NR. FIŞEI:	
			DATA EXPIRĂRII			
DATA	S-A PRIMIT DE LA S-A DISTRIBUIT	NUMĂRUL FACTURII	CANTITATEA PRIMITĂ	CANTITATEA DISTRIBUITĂ	RĂMĂŞITA	SEMNĂTURA ADNOTARE

ANNEX c 23

DATA	S-A PRIMIT DE LA S-A DISTRIBUIT	NUMĂRUL FACTURII	CANTITATEA PRIMITĂ	CANTITATEA DISTRIBUITĂ	RĂMĂŞITA	SEMNĂTURA ADNOTARE

APPENDIX D

STOCK CONTROL CARD

RAYON			NAME		PRICE PER DOSE	
LOCALITY			PRESENTATION		MIN. STOCK	
FACILITY			UNIT		MAX. STOCK	
PLACE			LOT NUMBER		CARD NO.:	
			EXPIRY DATE			
DATE	OBTAINED FROM/ DISTRIBUTED TO	INVOICE NUMBER	AMOUNT OBTAINED	AMOUNT DISTRIBUTED	REMAINDER	SIGNATURE NOTES

DATE	OBTAINED FROM/ DISTRIBUTED TO	INVOICE NUMBER	AMOUNT OBTAINED	AMOUNT DISTRIBUTED	REMAINDER	SIGNATURE NOTES

APPENDIX E

FIŞA DE RAPORTARE ŞI COMANDA LUNARĂ A STOCULUI

RAION	
LOCALITATEA	
UNIT. MEDICALĂ	
DATA/SEMNATURA	

1. Notati pe parcursul lunii pe verso temperatura din frigider
2. La sfirsitul lunii:
   - inscrieti in tabel restul de vaccinuri
   - determinati si inscrieti numarul de copii care vor fi imunizati luna viitoare cu fiecare tip de vaccin
   - prezentati fisa la CIE (AMR,CMR) pentru a primi vaccin

DENUMIREA	RĂMĂŞITA	SERIA LOTULUI	DATA EXPIRĂRII	AMBALAJUL	NR. DE COPII CE VOR FI VACCINAŢI	CANTITATEA DE VACCIN ELIBERATA
BCG					Vaccinati:	
					Revaccinati:	
Hep B						
VPO						
DTP						
Vaccin Rujeolic						
Vaccin Parotidic						
DT pentru copii						
Td						
AT						
Seringi BCG						
Seringi 0,5-2,0ml						
Seringi 5,0ml						

FOAIA REGIMULUI DE TEMPERATURA

RAION:.....LUNA/ANUL:.....

DENUMIREA INSTITUTIEI:.....

TIPUL SI NUMARUL DE EVIDENTA A FRIGIDERULUI/CONGELATORULUI:.....

DATA / TEMP	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
	D S	D S	D S	D S	D S	D S	D S	D S	D S	D S	D S	D S	D S	D S	D S	D S	D S	D S	D S	D S	D S	D S	D S	D S	D S	D S	D S	D S	D S	D S	D S
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IN PFM, AMR SI SCR VACCINURILE SE PASTREAZA IN FRIGIDER LA TEMP. 0° PANA LA 8 °C

TEMPERATURA RECOMANDATA PENTRU CONGELATOR (-15 PANA LA -25 °C.)

A CONTROLA TEMPERATURA DIMINEATA SI SARA (D&S) (9&16) SI A O SEMNA PRIN PUNCTE

A SEMNA LUNAR STAREA DE ERUPTIE A MONITORULUI DE CONGELARE - CIAS

DA ◯ NU ◯

SE INTERZICE INGHETAREA DTP, DT, Td, AT, AD, Hep B.

NU UITATI SA ASIGURATI REGIMUL TEHNIC, DE CURATIRE SI DEZGHETARE

IN CAS DE LIPSA A ENERGIEI ELECTRICE NU DESCHIDETI FRIGIDERUL/CONGELATORUL

A SEMNA LUNAR INDEXUL INDICATORULUI "LANTULUI RECE"

A ◯ B ◯ C ◯ D ◯

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APPENDIX F

TO BE USED AT FAP-SVA-SUB-POLYCLINICS ANNEX F

MONTHLY STOCK REPORT AND ORDERING CARD

RAYON	
LOCALITY	
FACILITY	
DATE/SIGNATURE	

1. Note the temperature of the fridge on the reverse daily.
2. At the end of the month:
   - note the remaining amount of vaccines;
   - determine and note the number of children to be vaccinated next month with each type of vaccine;
   - submit the card to SES (SUB, SVA) to collect vaccines

NAME	REMAINDER	LOT NUMBER	EXPIRY DATE	PRESENTATION	NO OF CHILDREN TO BE VACCINATED	QUANTITY OF VACCINES TO BE ISSUED
BCG					Vaccinations:	
					Boosters:	
Hep B						
Polio						
DPT						
Measles Vaccine						
Mumps Vaccine						
DT for infants						
Td?						
AT						
BCG Syringes						
Syringes 0.5-2.0 ml						
Syringes 5.0 ml						

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FOAIA REGIMULUI DE TEMPERATURA

RAION:.....LUNA/ANUL:.....

DENUMIREA INSTITUTIEI:.....

TIPUL SI NUMARUL DE EVIDENTA A FRIGIDERULUI/CONGELATORULUI:.....

DATA / TEMP	1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		21		22		23		24		25		26		27		28		29		30		31	
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IN PFM, AMR SI SCR VACCINURILE SE PASTREAZA IN FRIGIDER LA TEMP. 0° PANA LA 8 °C

TEMPERATURA RECOMANDATA PENTRU CONGELATOR (-15 PANA LA -25 °C.)

A CONTROLA TEMPERATURA DIMINEATA SI SARA (D&S) (9&16) SI A O SEMNA PRIN PUNCTE

A SEMNA LUNAR STAREA DE ERUPTIE A MONITORULUI DE CONGELARE - CIAS

DA ◯ NU ◯

SE INTERZICE INGHETAREA DTP, DT, Td, AT, AD, Hep B.

NU UITATI SA ASIGURATI REGIMUL TEHNIC, DE CURATIRE SI DEZGHETARE

IN CAS DE LIPSA A ENERGIEI ELECTRICE NU DESCHIDETI FRIGIDERUL/CONGELATORUL

A SEMNA LUNAR INDEXUL INDICATORULUI "LANTULUI RECE"

A ◯ B ◯ C ◯ D ◯

APPENDIX G

FIŞA DE EVIDENŢĂ A STOCULUI

RAION		1. Completati fisa in fiece institutie medicala, unde se fac vaccinari. 2. Folositi fise aparte pentru evidenta fiecarui tip de vaccin. (Exemplu: o fisa pentru DTP, alta pentru VPO etc.) 3. Pastrati fisele intr-o mapa aparte 4. Indicati restul de vaccin la sfirsitul fiecarei luni 5. Utilizati fisa pe parcursul unui an.	DENUMIREA:
LOCALITATEA			STOC MINIM.:
UNIT. MEDICALĂ			STOC MAXIM.:
LOCUL			NR. FIŞEI:

DATA	S-A PRIMIT DE LA S-A DISTRIBUIT	SERIA LOTULUI	DATA EXPIRĂRII	AMBALAJUL	UNITATEA	CANTITATEA PRIMITĂ	CANTITATEA DISTRIBUITĂ	RĂMĂŞITA	SEMNĂTURA ADNOTARE

EVIDENTA IN PFM-AMR-CMR-POLICLINICA

DATA	S-A PRIMIT DE LA S-A DISTRIBUIT	SERIA LOTULUI	DATA EXPIRĂRII	AMBALAJUL	UNITATEA	CANTITATEA PRIMITĂ	CANTITATEA DISTRIBUITĂ	RĂMĂŞITA	SEMNĂTURA ADNOTARE

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APPENDIX H

TO BE USED AT FAP-SVA-SUB-POLYCLINICS

ANNEX H

STOCK CONTROL CARD

RAYON	
LOCALITY	
FACILITY	
PLACE	

1. This card must be filled in at every immunizing facility.
2. A separate card must be used for each type of vaccine. (Example: one card for DPT, another card for Polio, etc.)
3. Stock control cards must be kept in a separate file.
4. At the end of each month the remaining amount of each vaccine must be recorded.
5. Each stock control card should be used for one year.

NAME	
MIN. STOCK	
MAX. STOCK	
CARD NO.:	

DATE	OBTAINED FROM/ DISTRIBUTED TO	LOT NUMBER	EXPIRY DATE	PRESENTATION	UNIT	AMOUNT OBTAINED	AMOUNT DISTRIBUTED	REMAINDER	SEMNĂTURA ADNOTARE

TO BE USED AT FAP-SVA-SUB-POLYCLINICS

DATE	OBTAINED FROM/ DISTRIBUTED TO	LOT NUMBER	EXPIRY DATE	PRESENTATION	UNIT	AMOUNT OBTAINED	AMOUNT DISTRIBUTED	REMAINDER	SIGNATURE COMMENTS

APPENDIX I

ANNEX I

FOAIA REGIMULUI DE TEMPERATURA

RAION:.....LUNA/ANUL:.....

DENUMIREA INSTITUTIEI:.....

TIPUL SI NUMARUL DE EVIDENTA A FRIGIDERULUI/CONGELATORULUI:.....

DATA / TEMP	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
	D S	D S	D S	D S	D S	D S	D S	D S	D S	D S	D S	D S	D S	D S	D S	D S	D S	D S	D S	D S	D S	D S	D S	D S	D S	D S	D S	D S	D S	D S	D S
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IN PFM, AMR SI SCR VACCINURILE SE PASTREAZA IN FRIGIDER LA TEMP. 0° PANA LA 8 °C

TEMPERATURA RECOMANDATA PENTRU CONGELATOR (-15 PANA LA -25 °C.)

A CONTROLA TEMPERATURA DIMINEATA SI SARA (D&S) (9&16) SI A O SEMNA PRIN PUNCTE

A SEMNA LUNAR STAREA DE ERUPTIE A MONITORULUI DE CONGELARE - CIAS

DA ◯ NU ◯

SE INTERZICE INGHETAREA DTP, DT, Td, AT, AD, Hep B.

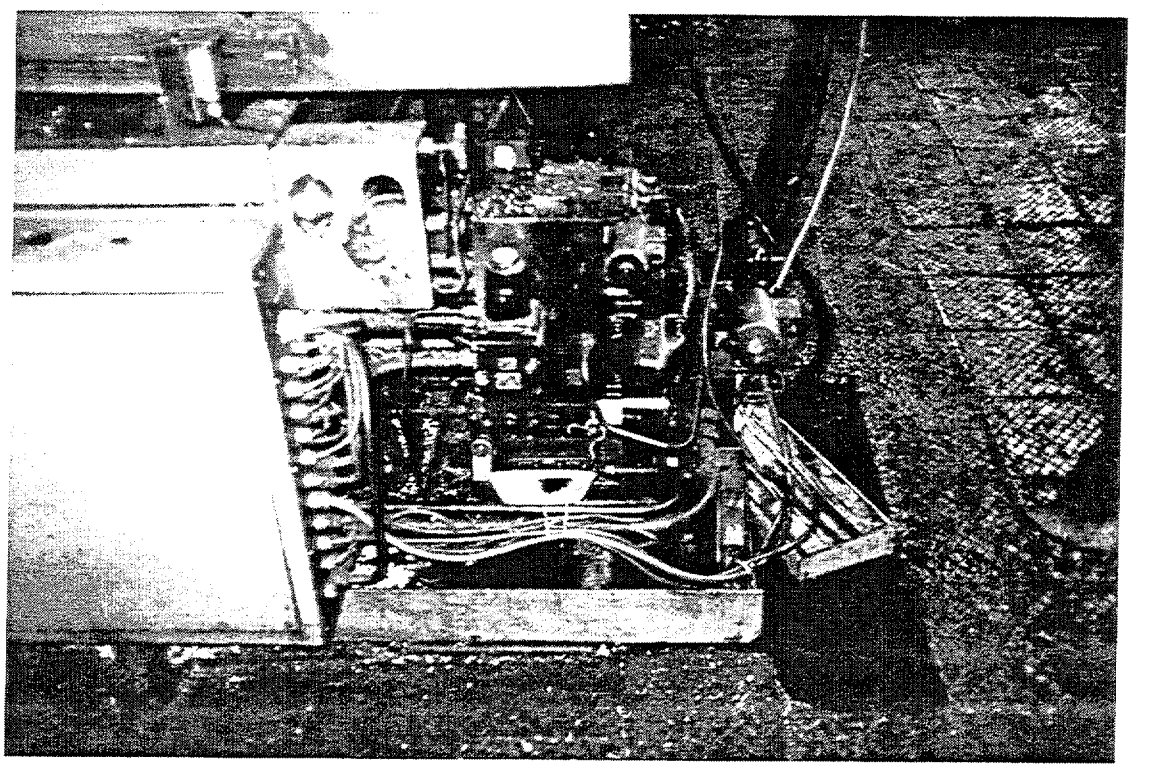
NU UITATI SA ASIGURATI REGIMUL TEHNIC, DE CURATIRE SI DEZGHETARE

IN CAS DE LIPSA A ENERGIEI ELECTRICE NU DESCHIDETI FRIGIDERUL/CONGELATORUL

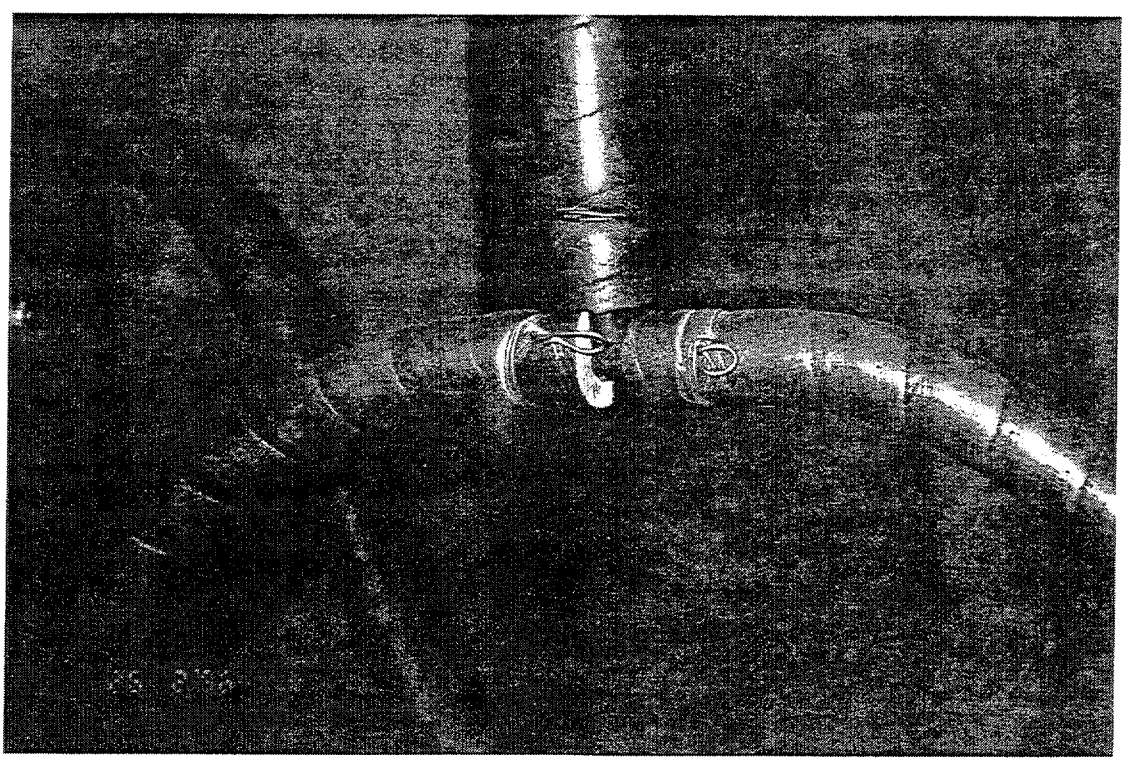
A SEMNA LUNAR INDEXUL INDICATORULUI "LANTULUI RECE"

A ◯ B ◯ C ◯ D ◯

APPENDIX J

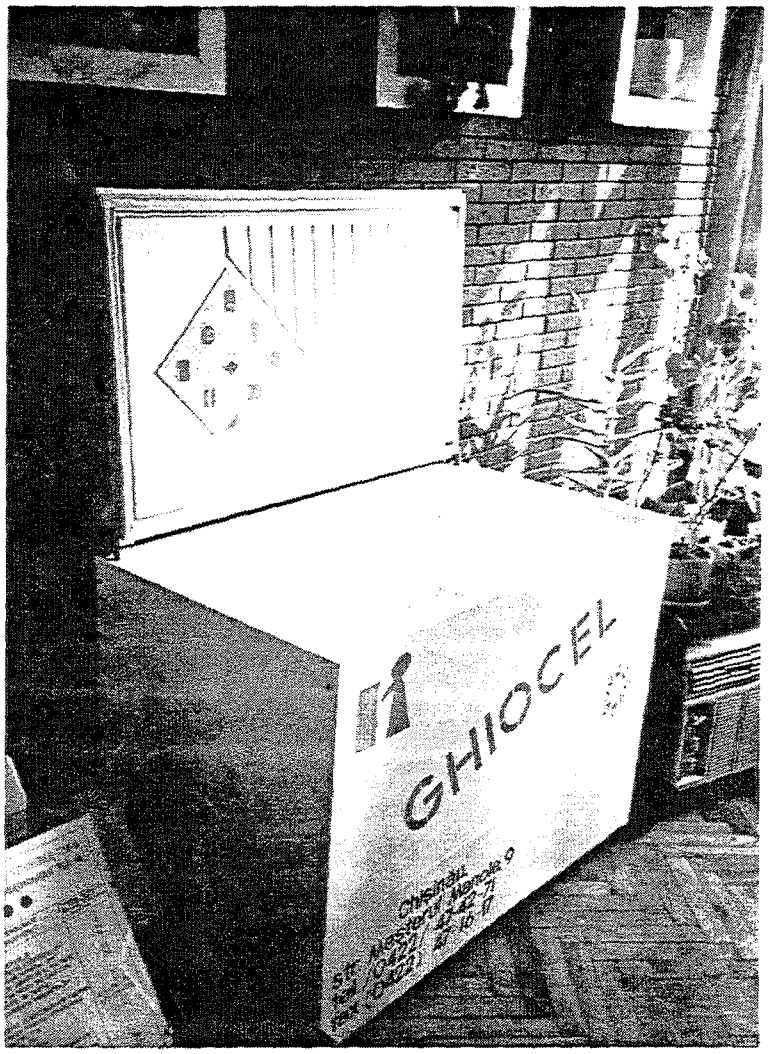


Old moulding machine leaking oil and "covers off"

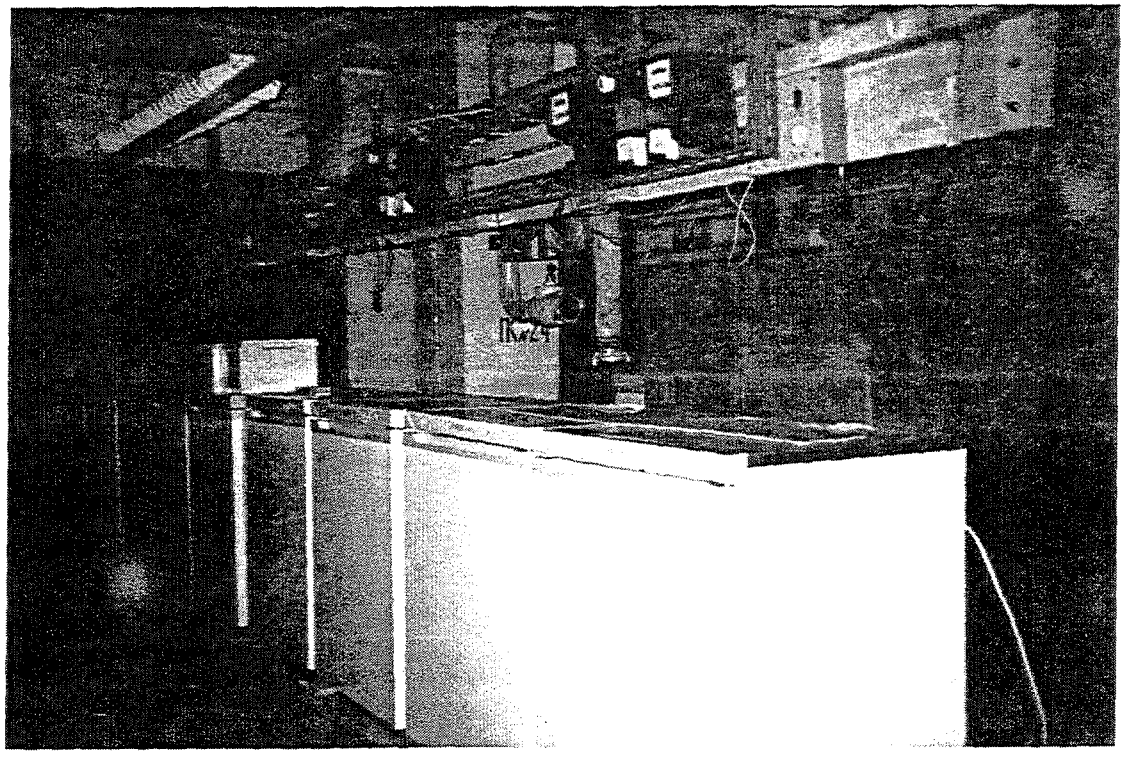


Vacuum hose "hose clips are short in supply"

APPENDIX K



Hand made chest freezer, it is a front opening freezer that has been turned 90°. (photo: *Steve Brooke*)



The testing line (front opening freezers)

THE KISHINEV REFIGERATOR FACTORY

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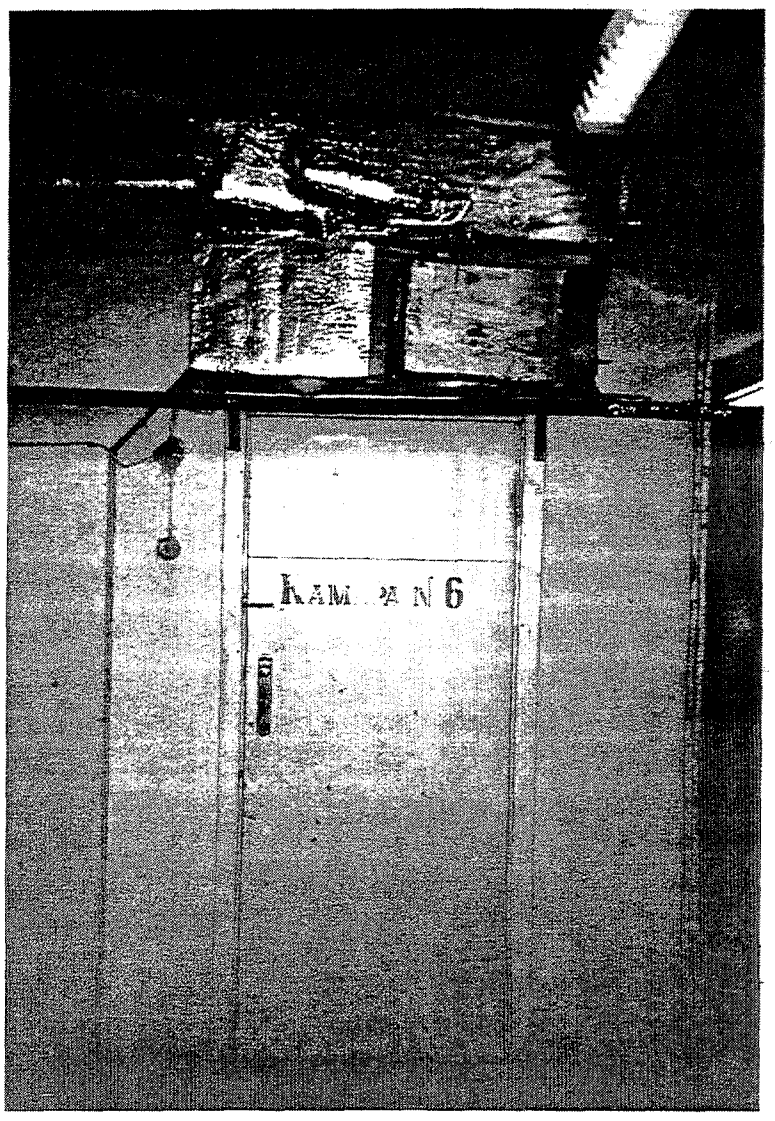
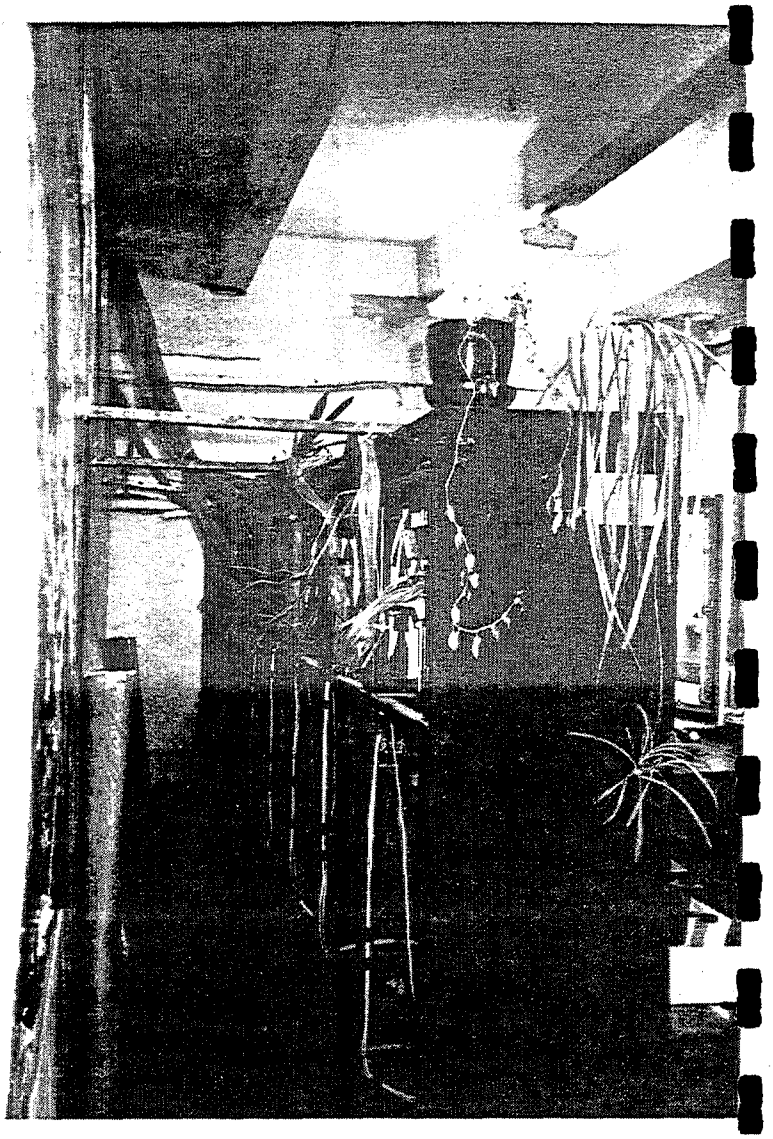
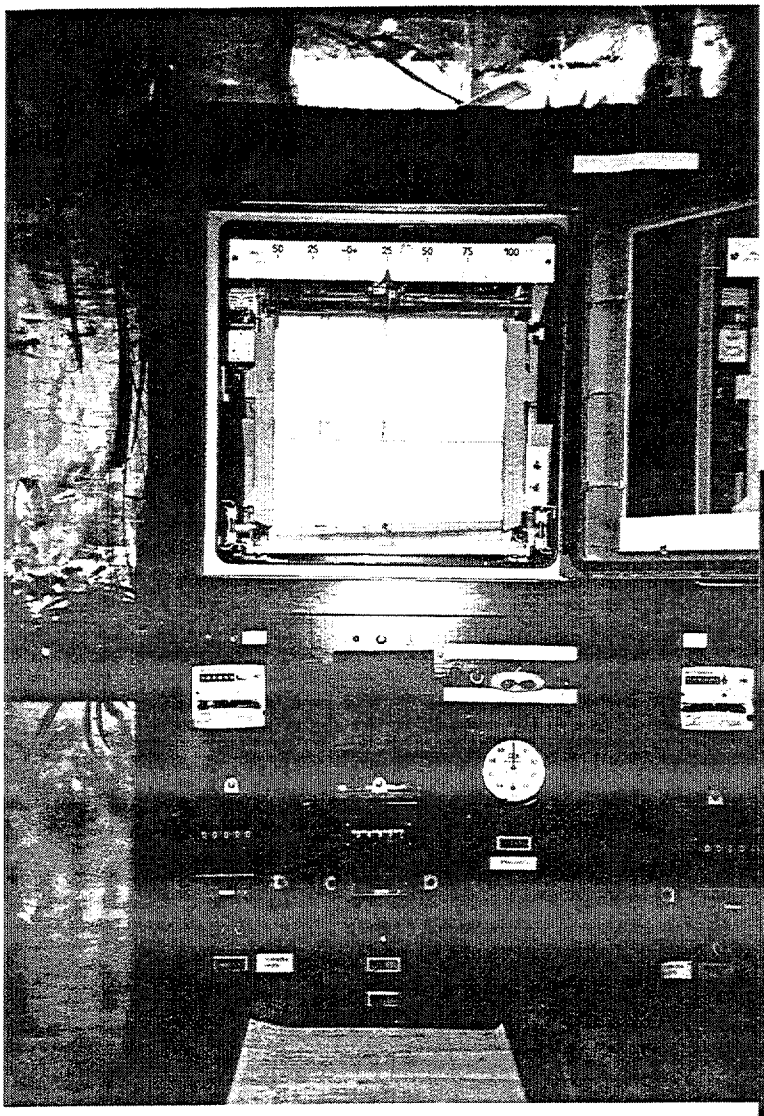


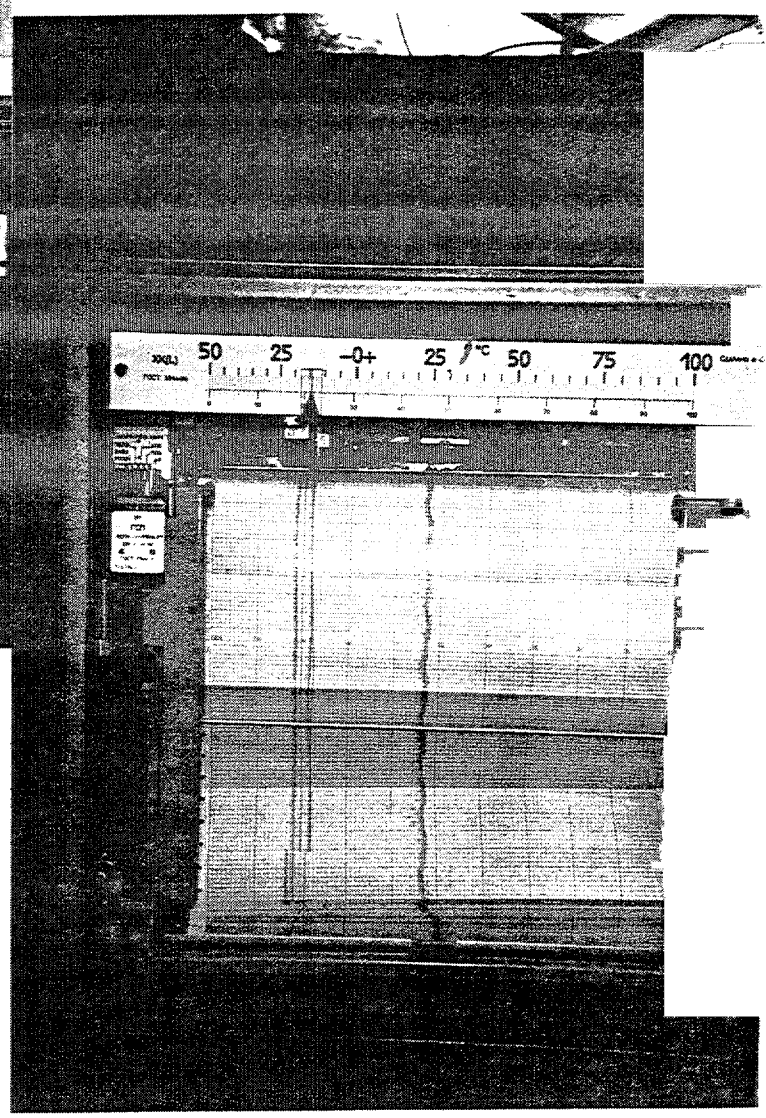
Control panel for environmetal chambers.



Environmental Chamber number 6.



Old fashioned, but functional temperature recorder



Temperature recorder, Amp-meter, kWh-meter and runtime-meter for Chamber no.: 6

APPENDIX L

Congelatoare «Ghiocel»
Морозильники «Гиочел»
Freezers «Giochel»

CONGELATOARE

Congelatorul «Ghiocel» este o realizare perfectă la ideea păstrării indelungate a produselor înghețate fără a-și pierde calitățile gustative și nutritive în orice anotimp al anului!

Desăvîrșit prin construcție și dizain, echilibrat ca proporții, congelatorul completează firesc interiorul bucătăriei moderne. Executat în forma unui dulăpior cu rafturi, el poate fi utilizat concomitent și ca măsuță de servit.

Coșurile metalice mobile amplasate în camera de congelare permit repartizarea și păstrarea îndelungată a produselor.

În partea superioară a congelatorului este plasat panoul de comandă dotat cu semnalizare luminiscentă a regimului de funcționare.

Funcționînd în regim «congelare» în camera de congelare se menține temperatura maximă de -24 °C. În regim «păstrare» temperatura maxima este de -18 °C.

МОРОЗИЛЬНИКИ

Морозильники марки «Гиочел» блестяще реализуют идею длительного хранения замороженных продуктов, без потери ими вкусовых и питательных качеств – круглый год!

Оптимальные размеры, красивый внешний вид морозильников дополняют интерьер современной кухни.

Конструктивно они выполнены в виде напольных шкафов, верхняя плоскость которых может использоваться в качестве сервировочных столов.

В камере охлаждения выдвижные металлические корзины служат для распределения и длительного хранения продуктов.

В верхней части морозильников расположен пульт управления со световой сигнализацией режимов работы. При работе в режиме «замораживание» в камере охлаждения поддерживается температура не выше минус 24 °С, а в режиме «хранения» не выше минус 18 °С.

FREEZERS

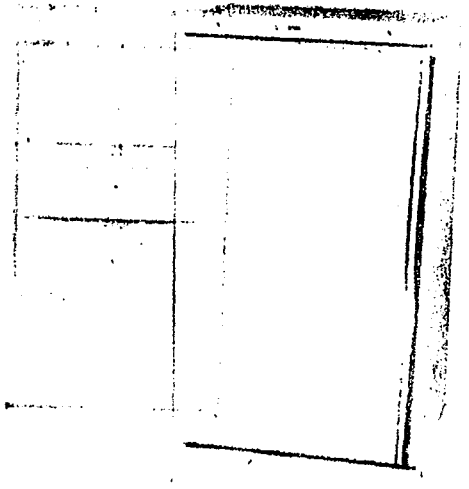
The name «Giochel» stands for the perfect embodiment of the idea of frozen foods year-long storage with full preservation of original taste and nutritive properties.

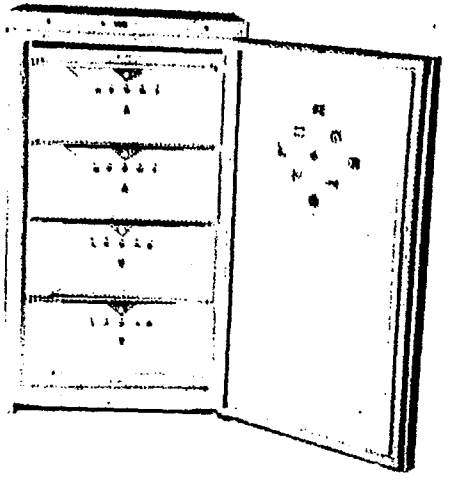
Freezer optimum dimensions and general attractive appearance contribute to the modern interior of your kitchen. The freezers are made in the shape of floor cabinets having a flat top which can be used as a serving table.

The freezer chamber accommodates pull-out metal baskets for food long-term storage.

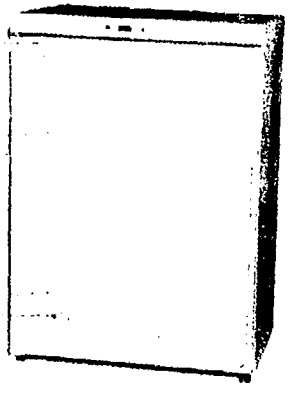
The control panel located in the upper part of the cabinet comprises the pilot lamps which indicate freezer working mode. The temperature of foods freezing is not higher than minus 24 ° C, while frozen foods storage temperature does not rise above minus 18 ° C.

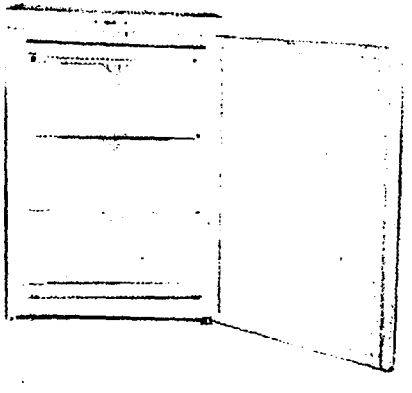
Ghiocel-108
MKS-170





Ghiocel-107
MKS-130





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APPENDIX M

CONGELATOARE «GHIOCEL»
МОРОЗИЛЬНИКИ «ГИОЧЕЛ»
FREEZERS «GIOCHEL»

PARAMETRII ŞI DIMENSIUNILE	Ghiocel-108 MKŞ-170	Ghiocel-107 MKŞ-130
Volumul general al congelatorului, dm^3	170	130
Temperatura în congelator, C^0, cel mult:		
în regimul «Păstrare»	-18	-18
în regimul «Îngheţare»	-24	-24
Consumul de energie electrică în 24 ore la temperatura aerului ambiant 25^0 C, kW.h, cel mult	1,16	1,04
Capacitatea de congelare kg/24 ore, cel puţin	12	10,5
Tensiunea curentului alternativ, V	220	220
Frecvenţa curentului, Hz	50	50
Dimensiunile de gabarit, mm:		
înălţimea	1050	850
lăţimea	600	600
adîncimea	600	600
Masa împreună cu piesele de completare, kg	53,5	44
Productivitatea fabricării gheţei alimentare, $kg/oră^{-1}$, nu mai mică	0,04	0.04

ПАРАМЕТРЫ И РАЗМЕРЫ	Гиочел 108 МКШ — 170	Гиочел 107 МКШ — 130
Общий объем морозильника, дм3	170	130
Температура в морозильнике, ^{0} C, не выше:		
в режиме «Хранение»	-18	-18
в режиме «Замораживание»	-24	-24
Суточный расход электроэнергии при температуре окружающего воздуха 25 ^{0} C, кВт.ч, не более	1,16	1,04
Напряжение переменного тока, В	220	220
Частота тока, Гц	50	50
Мощность замораживания, кг/сут, не менее	12	10,5
Габаритные размеры, мм:		
высота	1050	850
ширина	600	600
глубина	600	600
Масса с комплектующими, кг	53,5	44
Производительность получения пищевого льда кг.час $^{-1}$ не менее	0,04	0.04

MAIN DATA	Giochel-108 MKШ-170	Ghiochel-107 MKШ-130
Total internal volume, dm3.	170	130
Temperature in the freezer, o C not more than:		
in the regime of cold storage	- 18	- 18
in the regime of freezing	- 24	- 24
Electric power consumption, at temperature t 25^0 C, kW.h.day	1,16	1,04
Voltage, V	220	220
Frequency, Hz	50	50
Freezing capacity, kg/day	12	10,5
Overall dimensions, mm:		
height	1050	850
width	600	600
depth	600	600
Massa, kg	53,5	44
Productivity of the edible ice, $kg.hour^{-1}$, not less than	0,04	0.04

FRIGIDERE «GHIOCEL»
ХОЛОД ИЛЬНИКИ «ГИОЧЕЛ»
FREEZERS «GIOCHEL»

CARACTERISTICI TEHNICE:	"Ghiocel 411" KC - 160/20	"Ghiocel 412" KШ - 200/30
Volumul camerei frigorifice, dm^3	160	200
Volumul compartimentului temperatură joasă, dm3	20	30
Dimensiunile generale, mm:		
înălţimea	850	1050
lăţimea	600	600
adîncimea (fără miner)	600	600
Masa (fără ambalaj), kg	39	45
Tensiunea nominală la o frecvenţa a curentului de 50 Hz, V	220	220
Consumul de energie electrică la temperatura aerului inconjurător de 25^0 C, la temperatura medie în interiorul frigiderului de 5^0 C şi la temperatura în evaporator de minus 12^0C, kWt O/zi, nu mai mult de	0,84	0,87

ТЕХНИЧЕСКИЕ ДАННЫЕ:	"Гиочел 411" КС — 160/20	"Гиочел 412" КШ — 200/30
Объем холодильной камеры, $дм^3$	160	200
Объем низко температурного отделения, $дм^3$	20	30
Габаритные размеры, мм:		
высота	850	1050
ширина	600	600
глубина (без ручки)	600	600
Масса (без упаковки), кг	39	45
Номинальное напряжение при частоте тока 50 Гц, В	220	220
Расход электроэнергии при температуре окружающего воздуха 25^0 C, средней температуре в холодильном шкафу 5^0 C и температуре в испарителе минус 12^0 C, кВт.ч/сут, не более	0,84	0,87

SPECIFICATIONS:	"Giochel 411" KC — 160/20	"Giochel 412" KШ — 200/30
Freezing chamber capacity, dm^3	160	200
Low temperature section capacity, dm^3	20	30
Overall dimensions, mm		
Height	850	1050
Width	600	600
(without handle) Depth	600	600
Mass (without packaging), kg	39	45
Rated voltage at 50 Hz, V	220	220
Power consumption at ambient air temperature of 25^0 C, average in freezing cabinet 5^0 C and in evaporator minus 12^0 C, kw.h/24 hrs, not more than	0,84	0,87

APPENDIX N

STANDARD TEST PROCEDURES
FOR REFRIGERATORS AND FREEZERS
GENERAL TEST CONDITIONS

1. TESTING CONDITIONS

Tests must be carried out in a room for which both temperature and humidity are capable of being controlled within an accuracy of + or -1ºC. Stable temperature of +32ºC and +43ºC are required within the room with relative humidity (RH) in the range of 45% to 75%. Temperatures within the appliance must be capable of being continuously monitored to within an accuracy of ± 0.5ºC without the sensors used influencing the test in any way. Thermocouples which are sealed within the appliance are most commonly used.

Up to 15 simultaneous temperature measurements may be required for a single appliance. The ambient temperatures at which equipment is tested must remain within a tolerance of ± 1ºC, unless otherwise stated.

It is essential that appliances are level and that air flow around the appliance is not restricted in any way.

2. STABILIZATION TIMES

Before measuring the performance of a refrigerator or freezer under normal running conditions, conditions must be stable. This is normally assumed to exist when either:

(a) the thermostat has been cycling for 24 hours, or

(b) the temperature at each point in the appliance varies by less than 2ºC over 24 hours.

3. LOADING

Appliances are tested in both empty and loaded conditions. Tests which call for a vaccine load specifically require:

Cardboard boxes 100 x 100 x 100 mm and 100 x 100 x 50 mm containing empty glass vials or bottles so that the gross weight of the load is equivalent to 0.35 to 0.45 kg per litre volume of boxes. Standard boxes and vials for this load are available ✓ from the Consumer Research Laboratories (UK) (see Annex 1, Appendix 1).

This load is packed in the following manner:

Freezers: No air spaces are left between the boxes or between the boxes and the walls. The loading should respect any maximum loading lines recommended by the manufacturer. The load is not placed in the fast freeze compartments of freezers.

Refrigerators: The load is packed in refrigerators with air spaces of 15 mm between each column of packets and between the packets and any adjoining walls of the refrigerator.

The total volume of vaccine which can be stored in this way is taken as the net storage volume used for testing. The volume and distribution of the vaccine load should be recorded in all cases.

Tests which call for a load of icepacks specifically require:

Chest freezers:	0.6 litre icepacks conforming to Specification E5/IP1.
Solar PV refrigerators:	0.6 litre icepacks conforming to Specification E5/IP1.

4. RECORDED TEMPERATURES

Temperatures are recorded at various points within an appliance to monitor the temperature of the load, or the internal temperatures of the appliance when empty. In general, the temperatures at centre of the vaccine load or empty cabinet are recorded together with any positions which are likely to have extremes of temperature. Such positions might be near door seals, or where air circulation is restricted by the appliance design. Other positions are also monitored so that an overall picture of the temperature distribution can be obtained. Suggested positions of sensors for all refrigeration equipment are given in the figures at the end of this procedure.

Where appropriate, the following points should also be monitored:

- surface temperature of evaporator plates,
- the flue temperature; and,
- the condenser fins or outer skin temperatures.

Positions of sensors should never be altered during the stable running tests. Special care should be taken in reporting and analyzing data for temperature distribution in refrigerators with separate vegetable compartments in the bottom; these compartments usually have much higher temperatures than the rest of the refrigerator and are not normally used for storing vaccine. So that the values obtained for the vegetable

compartment do not distort those of the main compartment, they should be reported and analyzed separately.

5. FUEL SOURCES

If equipment can be operated by more than one fuel source (particularly absorption refrigerators) and the order of the test has not been already determined, then the tests should start on electrical power before moving to another option.

For equipment which can be run as a freezer or as a refrigerator, the first set of tests should test the refrigerator function and the second should test the freezer function.

Multi-fuel, multi-function equipment will be lengthy and costly to test, so a decision should be made by WHO which options should be tested.

6. GENERAL INSPECTION

On receipt, all refrigerators and freezers should be carefully examined to ensure that no serious damage or defects are present. Before testing commences, each appliance should be run for at least 48 hours to run in and to check that it is operating correctly.

The initial inspection report is sent to WHO as soon as possible. It should be as complete as possible, particularly regarding:

- any damage or faults observed,
- the action taken to remedy these,
- any problems which make it difficult or impossible to test the appliance,
- any recommendations for manufacturer's action.

External measurements of appliance.

Internal volumes of refrigerator and freezer

Projected vaccine load

Maximum icepacks load

Vaccine load distribution

Icepacks distribution

Projected test cycle

The test laboratory of tests should include in its initial report to WHO the schedule of the tests to be carried out. If a previous version of the same appliance was tested, the physical and procedural differences between the appliances and their respective test cycles should be mentioned.

Photographs should be taken showing a 3/4 view of the appliance with the door open. Borderless black and white prints l00 x 70 mm should be provided for attachment to the Product Information Sheet.

7. ELECTRICAL SAFETY

Manufacturer should provide evidence of conformity with one of the following standards: VDE, BEAB. If no evidence is provided, an inspection should be made including the following points: (*** To be completed)

8. CORROSION

Manufacturer should provide evidence of conformity with DIN 8985. If no evidence is provided, a visual inspection should be made and a written report provided.

9. REPORTING

Reports should be to a fixed format. If more than one piece of equipment is being tested, then one report per manufacturer should be prepared including the test results of all equipment belonging to the same manufacturer. Appliances should be referred to by code to avoid confusion of names. A list of these codes and the corresponding names, models and country of origin should be as a separate fold-out table at the back of the report.

The report should be in four sections as given below:

(1) Introduction: This gives a brief description of the purpose of the tests and the samples used.

(2) Testing Procedure: Contains a copy of the standard testing procedure and a description of the test apparatus used.

(3) Results: The results of test on each product are described individually. For each product, the following are provided:

(a) A copy of the initial inspection report.

(b) A description and interpretation of the test results, with a table summarizing performance results, with a comparison with previous versions of the same appliance if applicable.

(c) Graphs showing all test results and diagrams showing distribution of internal temperatures with distinct marks for the thermocouples measuring vaccines, icepacks, freezers and evaporator temperatures.

(4) **Performance summary Reports are prepared and submitted to WHO as follows:**

- **Initial inspection report, on arrival of equipment.**
- **Interim performance report, at end of +32ºC tests.**
- **Final report on completion of all testing.**

GLOSSARY

Gross storage volume

This is taken as the manufacturer's stated gross volume and, for purposes of comparison, the internal free volume, including the space occupied by the freezing compartment, and the volume occupied by shelves, door storage space, etc.

Icepacks

Flat plastic bottles filled with water which conform to Specifications E5/IP1 and E5/IP2.

Net vaccine storage capacity

The volume of the maximum number of boxes (100 x 100 x 100 mm or 100 x 100 x 50 mm) which can be stored in the refrigerator when space (15 mm), for free air circulation between piles of boxes and between boxes and interior walls of refrigerator, is still maintained. For freezers, no air spaces are left between boxes and between boxes and the walls. The loading should respect the maximum loading lines recommended by the manufactures. No load is placed in the fast freezing compartment of the freezer.

Freezing compartment

As defined by the manufacturer and, for purposes of comparison, the internal free volume measured in litres ± 5%.

Safe freezing capacity

Maximum weight of icepacks which can be frozen, in one batch, during a 24 hour freezing cycle without causing temperatures of vaccine storage to exceed the limits: 0 to +8ºC (refrigerators) and below -15ºC (freezers)

Holdover time

The time between switching off the appliance and when the warmest internal temperature reaches +10ºC for refrigerators and freezers at a given ambient temperature.

Autonomy (Icelined refrigerators)

The time, for the warmest internal vaccine temperature to reach 10°C, when, at the end of the intermittent energy supply test the appliance is switched off, before energy supply is resumed

Areas not suitable for vaccine storage

Certain areas of an otherwise acceptable appliance which are too warm, and should be excluded from use (e.g. vegetable drawer, door shelves).

STANDARD TEST PROCEDURES
FOR REFRIGERATORS AND FREEZERS

COMPRESSION VACCINE/ICEPACK CHEST FREEZER

Procedure reference: E3/PROC/1
Applies to: Specification E3/FR1

1. STABILIZATION (appliance empty)

Test condition: **+43ºC.**

Objectives *:*

To determine how it takes the appliance to stabilize and at which temperature this is achieved, with the thermostat on its maximum setting.

- To determine the energy consumption and the compressor duty cycle during the appliance start.

Procedure:

The test room should be set to +43ºC with the appliance empty, the door open and the power supply switched off for a period of 48 hours. The lid of the freezer should then be closed, the appliance switched on and left to stabilize, with the thermostat/fast freeze switch on its maximum setting. Temperatures should be recorded every 15 minutes during 24 hours. During this period the energy consumption should be measured and the compressor duty cycle determined. The duty cycle is measured by timing from the end of one cycle to the end of a corresponding cycle approximately 24 hours later. The percentage "on" time over this period is then calculated. Consumption is measured over the same time scale.

Test criteria for qualification:

Stabilized internal temperatures below -15ºC.

2. STABLE RUNNING TESTS AND CONSUMPTION (appliance loaded)

Test condition:

+43ºC.

Objectives *:*

To determine the capacity of the appliance to keep the vaccine below -15ºC and what is the optimum thermostat setting to achieve this.

- To determine the energy consumption and the compressor duty cycle.

Procedure:

With the thermostat adjusted on its maximum setting, the appliance should then be fully loaded and allowed to stabilize as above. Internal temperatures, energy consumption and compressor duty cycle are recorded. If the internal temperatures are not correct, the thermostat should be adjusted if possible and the test repeated. This new setting is referred to as the revised optimum. Note all thermostat settings.

Test criteria for qualification :

Stabilized internal temperatures below -15ºC.
Power consumption to be less than 1 KWh per 24 hours per 100 litres gross volume, fully loaded with vaccine only.

3. SAFE ICEPACK FREEZING LOAD

Test condition:

+43ºC

Objectives :

To determine the maximum quantity of Icepacks which the appliance can freeze keeping the vaccine temperature below - 5ºC.

Procedure:

The ability of the fast freeze compartment of the freezer to freeze icepacks without affecting vaccine storage is then measured. Ice-making capability is measured in kg per freezing cycle. All icepacks to form part of the freezing load should be pre-conditioned at +43ºC. Fast freeze switches on freezers should be switched on at the start of this test, but thermostats should not be adjusted.

After the appliance has stabilized, place two packs of water (1,2 kg) at 43ºC, if possible in a row and with the edges perpendicular to the evaporator surface. The temperature of the icepacks and of the vaccines must be recorded every 15 minutes during the following 24 hours. If the ice load is frozen (below -3ºC) and the vaccine load stays below - 5ºC, the icepacks are taken away and the procedure is repeated every 24 hours increasing by 2 the number of packs each time. This is the way to proceed every 24 hours until the maximum ice load which can be safely frozen in 24 hours is found, while the vaccine stays in the adequate temperature range.

Available thermocouples must be distributed as uniformly as possible in the packs which are loaded each time.

Care must be taken in freezing icepacks in freezers, as placing too large a number in the fast freeze compartment may cause the temperature in the main compartment to rise above the - 5ºC mark, which is undesirable for the long term safe keeping of vaccines. For this reason, a maximum safe freezing load for which temperatures in the main compartment do not rise above -5ºC must be established.

Test criteria for qualification:

More than 7 kg ice frozen in icepacks per 24 hours at +43ºC while maintaining vaccine storage temperatures below -5ºC.

4. HOLDOVER TIME (TEMPERATURE RISE TEST)

Test condition:

+43ºC. fully loaded with vaccine but no icepacks, and with fast freeze compartment empty.

Procedure:

After completion of the freezing tests, all icepacks are removed and a full load of vaccine is added. The freezer is then allowed to stabilize for 48 hours, loaded with vaccine but without icepacks. The electricity supply is then switched off at the moment that the thermostat switches off the compressor. Internal temperatures are monitored every 15 minutes. The time recorded for the warmest point to exceed +10ºC is reported

Test criteria for qualification:

Not less than six hours, and more than six hours per 100 litres gross capacity,

5. DAY/NIGHT TESTS

Test condition:

+43ºC and +15ºC.

Objectives :

To determine the temperature range maintained in the freezer while ambient temperatures are varying during a day/night cycle.

Procedure:

Before the test, the appliance should be stabilized fully loaded with vaccine at an ambient temperature of +43ºC, but without icepacks, and allowed to run for a further 24 hours. The ambient temperature is then varied to simulate day/night temperatures. Over a 2 hour period the temperature is reduced to +15ºC and held at this temperature for 9 hours before being raised to +43ºC over a 3 hour period. It is held at 43ºC for a further 9 hours before being reduced to +15ºC again over a further 3 hour period. Five such day/night cycles are undertaken. During this time the internal Temperatures should be recorded every 15 minutes From the results the temperature range of the warmest and coldest recorded temperatures should be found.

Test criteria for qualification:

Stabilized internal temperatures below -15ºC.

6. MAXIMUM ICEPACK FREEZING LOAD

Test condition: +43ºC.

Objective :

to measure the quantity of icepacks that can be frozen without a vaccine load.. Ice-making capability is measured in kg per freezing cycle

Procedure:

All icepacks to form part of the freezing load should be pre-conditioned at +43ºC. Fast freeze switches on freezers should be switched on at the time of loading, but thermostats should not be adjusted.

The icepack load should occupy one third of the internal gross volume as stated by the manufacturer, and the whole of the fast freeze area included in this volume. Temperatures inside the icepacks (as distributed in Figure for E3/FR1 under General Test Conditions (E3), points 7 to 10 and 5 in the centre of the load) are monitored every 15 minutes and the load is assumed to be completely frozen when the temperature of the warmest icepack reaches -3ºC. Internal temperatures should be monitored throughout this test.

The maximum icepack freezing load is then reported as the weight of icepacks (less the weight of the containers) which has been completely frozen in 24 hours.

Test criteria for qualification:

No standard set.

7. COMPRESSOR STARTING TESTS (freezer empty)

Test condition:

+43ºC.

Objective :

To determine the minimum starting voltages of the appliance from cold and hot starts.

Procedure:

A minimum starting voltage, at which the appliance starts successfully in 10 out of 10 attempts, should be established. The voltage is reduced in 2% steps from a starting voltage 20% lower than the nominal voltage of the compressor. At each voltage the freezer should be started ten times from cold (compressor at ambient) and ten times hot (compressor at normal operating temperatures).
If the appliance presents starting problems, the reason for these should be established, if possible, and included in the final report.

Test criteria for qualification:

Ten out of ten starts successful in both cold start and hot start tests at a minimum of 22% below the manufacturers nominal voltage.

8. ELECTRICAL SAFETY TESTING

Test condition:

Procedure: Pending.

Test criteria for qualification:

Only rating 4 and 5 on the scale of electrical safety standards (see Annex 2).

9. CORROSION RESISTANCE

Test condition:
Procedure: According to DIN 8985.
Test criteria for qualification: Meet DIN 8985.

APPENDIX O

ТИПОВАЯ ПРОЦЕДУРА ИСПЫТАНИЙ ДЛЯ ХОЛОДИЛЬНИКОВ И МОРОЗИЛЬНИКОВ (Е3)

ОБЩИЕ УСЛОВИЯ ИСПЫТАНИЙ (Е3)

1. Условия испытаний

Испытания должны проводиться в помещении с контролируемыми температурой и влажностью с точностью до плюс/минус 1 °С. В помещении необходимо поддержание стабильной температуры в +32°С и +43 °С при относительной влажности в диапазоне от 45% до 75%. Температура внутри шкафа должна постоянно регистрироваться с точностью до 0,5 °С без использования датчиков, которые могли бы как-то сказаться на результатах испытания. Чаще всего используются термопары, запечатанные внутри шкафа.

Для одного шкафа может потребоваться одновременное снятие температуры не менее чем с 15 точек.

Необходимо, чтобы шкаф стоял ровно, а циркуляция воздуха вокруг него ничем не преграждалась.

2. Время стабилизации

Перед испытанием производительности холодильника или морозильника в нормальных условиях эксплуатации эти условия требуется стабилизировать. Обычно считается, что стабилизация произошла:

(а) если термостат проработал 24 часа;

(б) колебание температур в различных точках внутри шкафа составляет менее 2 С на протяжении 24 часов.

Необходимо, чтобы температура контролировалась постоянно с точностью до 0,5 °С без использования датчиков, которые могут сказаться на точности полученных результатов. Чаще всего используются термопары, запечатанные внутри шкафа.

3. Загрузка

Шкафы испытываются пустыми и загруженными. Для испытаний с загрузкой вакцинами конкретно требуются:

Картонные коробки 100 x 100 x 100 мм и 100 x 100 x 50 мм с пустыми стеклянными ампулами или бутылочками, чтобы общий вес груза составлял 0,5 кг на литр объема коробок.

Груз укладывается следующим образом:

Для морозильников: Между коробками либо между коробками и стенками не должно оставаться воздушных зазоров. При загрузке необходимо учитывать заводские метки уровня максимальной загрузки, рекомендованной производителем, если таковые имеются внутри шкафа. Камеры ускоренного замораживания в морозильниках не загружаются.

Для холодильников: Груз распределяется внутри холодильника с воздушным зазором в 15 мм между рядами коробок и между коробками и стенками холодильной камеры.

Общий объем вакцины, которая может храниться таким образом, принимается за используемый при испытаниях чистый (нетто) полезный объем. ***При всех испытаниях необходимо регистрировать объем и распределение груза внутри шкафа.***

Для испытаний с загрузкой холодовыми пакетами конкретно требуются:

Для морозильников-ларей: холодовые пакеты на 0,6 л согласно ТУ (Спецификации) E5/IP1.

Для холодильников PV с подпиткой солнечной энергией: холодовые пакеты на 0,6 л согласно ТУ E5/IP1.

4. Измеренная температура

Температура измеряется в различных точках внутри шкафа для контроля за температурой груза либо за температурой внутри пустого шкафа. В целом температура регистрируется по центру загрузки вакцинами либо пустого шкафа, а также во всех тех точках, где могут возникать экстремальные значения температур. Такие точки могут находится вблизи изоляции дверцы и в тех местах, где циркуляция воздуха понижена в силу конструктивных особенностей шкафа. Температура регистрируется и в других точках для получения общей картины распределения температур. Предлагаемые точки размещения датчиков для всех типов холодильного оборудования показаны на рисунках в конце настоящего описания.

По необходимости следует также регистрировать температуру в следующих точках:

- на поверхности пластин испарителя;
- в теплоотводной трубке;
- на лопастях либо на корпусе конденсатора.

В ходе испытаний на стабильность в эксплуатации расположение датчиков нельзя менять. Особое внимание следует проявлять при регистрации и анализе данных по распределению температур в холодильниках с раздельными отделениями для овощей в нижней части; обычно температура в таких отделениях гораздо выше, чем в остальных частях холодильника, поэтому их, как правило, не используют для хранения вакцин. Чтобы данные, полученные для овощных ящиков, не искажали результатов по общей камере, их нужно регистрировать и анализировать отдельно.

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7. *Электрическая безопасность*

Классы электрической безопасности указаны в приложении 2. Процедура испытаний разрабатывается.

8. *Коррозионная устойчивость*

Коррозионная устойчивость по стандарту DIN 8985.

9. *Регистрация результатов*

Регистрация результатов должна производиться на бланках по установленной форме. Если испытывается более одного объекта, то каждый из испытываемых объектов должен получать соответствующий код во избежание путаницы по названиям. Список с такими кодами и указанием производителя, названия, модели и страны происхождения прилагается в конце к отчету об испытаниях в виде отдельной раскладной таблицы.

Отчет об испытаниях должен состоять из следующих четырех частей:

(1) Вступления: В нем дается краткое описание задач испытания и испытываемых образцов;

(2) Описания процедуры испытания: В этой части содержится выдержка из описания стандартной процедуры испытаний и описание использованного испытательного оборудования;

(3) Результатов: Результаты, полученные в ходе испытаний каждого вида продукции, описываются отдельно. По каждому виду продукции прилагается следующее:

(а) Копия отчета о предварительной проверке,

(б) Описание и интерпретация результатов испытания с таблицей, где приведены сводные рабочие результаты, показанные объектом,

(в) Графиков, где показаны все результаты испытаний, и диаграмм распределения температур внутри шкафа.

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ГЛОССАРИЙ

Это список пояснений к использованным в описании прцедуры испытаний для холодильников и морозильников терминам и величинам.

Общий полезный объем	Это общий объем, указанный производителем, и для сравнения - внутренний свободный объем, включая место, занимаемое морозильным отделением, и объем: который занимают полки, области хранения в дверце и пр.
Холодовые пакеты	Плоские пластиковые емкости, заполненные водой, которые отвечают требованиям ТУ E5/IP1 либо E5/IP2.
Чистый полезный объем	Объем максимального числа коробок (100 x 100 x 100 мм либо 100 x 100 x 50 мм), которые можно разместить в холодильнике при сохранении воздушного зазора в 15 мм между рядами коробок и между коробками и внутренними стенками холодильного шкафа. Для морозильников воздушного зазора между коробками и между коробками и стенками не остается. При загрузке необходимо учитывать метки максимального уровня загрузки, сделанные изготовителем. Отделение ускоренного замораживания морозильников не загружается.
Морозильное отделение	Согласно указаниям изготовителя, а для сравнения - внутренний свободный объем в литрах плюс/минус 5%.
Безопасный объем замораживания	Максимальный вес холодовых пакетов, который можно заморозить за сутки без превышения диапазона температур хранения вакцин от 0 С до +8 С и от -15 С до -25 С.
Время выдержки	Промежуток времени от выключения шкафа до регистрации в самой его теплой внутренней точке температуры +10 С для холодильников и морозильников при данной температуре окружающей среды.
Области, непригодные для хранения вакцины	Определенные слишком теплые области приемлемого во всех остальных отношениях шкафа, которыми нельзя пользоваться (например, ящик для хранения овощей, полки в дверце).

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ПРИЛОЖЕНИЕ 2

КЛАССЫ ЭЛЕКТРИЧЕСКОЙ БЕЗОПАСНОСТИ

	Класс
Опасный При обычной эксплуатации изделия существует риск серьезного поражения электрическим током либо электрошока.	***1***
Потенциально опасный При эксплуатации изделия после проявления одного дефекта либо в случае последующего случайного включения, неразумных действий или поломки существует риск серьезного поражения электрическим током либо электрошока.	***2***
Неудовлетворительный После проявления двух взаимосвязанных дефектов либо нескольких несвязанных между собой дефектов существует риск серьезного поражения электрическим током либо электрошока.	***3***
Удовлетворительный В рамках проведенных испытаний в изделии не выявлено недостатков либо выявлены незначительные недостатки, не представляющие опасности; шок или поражение электротоком возможны только в результате непредвиденных неразумных действий эксплуатанта; существующая опасность невелика.	***4***
Полностью удовлетворительный При полных испытаниях на соответствие определенному стандарту недостатков не выявлено.	***5***

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APPENDIX P

E3/FR.1

VACCINE/ICEPACK CHEST FREEZER

[Test according to: Standard Test Procedure E3/PROC/1]

Type/features:

Compression cycle; low energy.

CFC Free units : R134a refrigerant only

Note: R12 refrigerant is only acceptable within the geographic limitations and deadlines set by the Montreal Protocol on the ban of CFC gases. **THIS APPLIES FOR MOLDOVA**

Thermal insulation

Any gas complying with the geographic limitations and deadlines set by the Montreal Protocol on the ban of CFC gases can be used as thermal insulation foaming agent. **R 11 MAY BE USED IN MOLDOVA**

Temperature control:

The vaccine load must remain below -15°C during +43°C continuous external temperature; +43°C/+15°C day/night cycling temperature. While freezing maximum safe icepack freeze load, the temperature of the full load of vaccines must remain below -5 °C.

Safe freezing capacity:

If there is a fast freeze compartment, more than 7 kg ice to be frozen in icepacks per 24 hours at +43°C while maintaining above temperature control. **THERE IS NO FAST FREEZE COMPARTMENT IN THE GHIOCHEL**

Power consumption:

Less than 1 KWh per 24 hours, per 100 litres gross volume stable running, fully loaded with vaccine only, at +43°C ambient temperature.

Holdover time:

6 hours minimum, and more than 6 hours per 100 litres gross capacity, at +43°C ambient temperature, fully loaded with vaccine but no icepacks, and with fast-freeze compartment empty. **THIS DOES NOT APPLY, BUT THE HOLDOVER TIME MUST BE MEASURED.**

Compressor starting voltage:

At 22% below manufacturers stated voltage, 10 out of 10 cold starts and 10 out of 10 hot starts all successful.

Electrical safety rating:

Only ratings 4 and 5 are acceptable (see Annex 1).

Corrosion resistance:

Internal and external cabinet, lid and frame protected against corrosion to DIN 8985.

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VACCINE/ICEPACK CHEST FREEZER

Markings, accessories and fittings:

External reading thermometer; doorlock with key. **THIS IS NOT NECESSARY**

Compressors operating on R134a refrigerant should be marked with a blue disk painted or otherwise securely attached on their visible side. The disk should have a minimum diameter of 100 mm (see Annex ***)

Instructions:

Users instructions in English, French, Spanish , Russian and Arabic available and provided upon request.

PERFORMANCE SPECIFICATION

E3/FR.2

ICEPACK FREEZER

[Test according to: Standard Test Procedure E3/PROC/2]

Type/features:

Compression cycle

CFC Free units : R134a refrigerant only

Note: R12 refrigerant is only acceptable within the geographic limitations and deadlines set by the Montreal Protocol on the ban of CFC gases.

Evaporator configuration: Evaporator set in shelves; minimum clearance between shelves 130 mm.

Thermal insulation

Any gas complying with the geographic limitations and deadlines set by the Montreal Protocol on the ban of CFC gases can be used as thermal insulation foaming agent.

Icepack freezing capacity:

More than 15 kg of icepacks frozen in 0.6 litre capacity icepacks (type E5/IP.1) per 24 hours per 100 litres gross volume at +43°C ambient temperature.

Power consumption:

Less than 1 KWh per 24 hours per 10 kg ice frozen at +43°C ambient temperature.

Compressor starting voltage:

At 22% below manufacturers stated voltage, 10 out of 10 cold starts and 10 out of 10 hot starts all successful.

Electrical safety rating:

Only ratings 4 and 5 are acceptable (see Annex 1).

Corrosion resistance:

Internal and external cabinet, lid and frame protected against corrosion to DIN 8985.

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VACCINE/ICEPACK CHEST FREEZER

Marking, accessories and fittings:

External reading thermometer; doorlock with key.

Compressors operating on R134a refrigerant should be marked with a blue disk painted or otherwise securely attached on their visible side. The disk should have a minimum diameter of 100 mm (see Annex ***)

Instructions:

Users instructions in English, French, Spanish, Russian and Arabic available and provided upon request.

APPENDIX Q

BASICS
SCOPE OF WORK DESCRIPTION

A) Name: Soren Spanner

B) Account Code 000 MD 01 119

C) Destination: Copenhagen, Denmark and Geneva, Switzerland

D) Dates: March 25 March 26

E) Fee days: 4 fee days

F) Scope of Work:

Spanner will visit WHO Geneva and UNICEF Copenhagen to follow up on his work with a Refrigerator Manufacturer in Chisinau, Moldova, to carry out the following:

-meet with WHO GPV Cold Chain officers and UNICEF logistics and supply officers to discuss the use of freezer units produced in Moldova to support the cold chain system of national immunization programs;

-provide background on the refrigerator factory, including its current production line,production capacity and what is proposed for development;

-further discuss with WHO, funding the testing of the units developed, and with UNICEF, the purchase of units which are developed for use in Moldova and for export for use in other national immunization programs.

APPENDIX R

To: basics@basics2.moldova.su, zaffranm@who.ch
From: "" <mikko.lainejoki@supply.unicef.dk>
Date: Wed, 28 Feb 96 11:08:06 cet
Subject: Re[2]: moldovan ref/frz

Soren,

Thks for your message. UNICEF is interested in finding new sources for cold chain equipment, especially from less developed countries outside of Europe. Currently we have only one low cost chest freezer manufacturer. A couple of other sources using standard models would be perfect (India, South Africa, Moldova?).

We can purchase/supply R12 units from/to countries not having the R12 ban. However, Michel may well be right pointing out that the market for R12 units is diminishing. Our aim is to serve our customers the best way we can bearing in mind WHO's recommendations and national policies. If the demand is there and we have a tested and WHO recommended product, then I do not see any reason why not use R12 units.

Rgds Mikko

PS. As a matter of fact last week one Technet member expressed his wish to purchase only R12 units in the future (due to poor R134a test results).

To: basics@basics2.moldova.su, mikko.lainejoki@supply.unicef.dk
From: "" <zaffranm@who.ch>
Date: Wed, 28 Feb 96 15:24:19 CET
Subject: Re[3]: moldovan ref/frz

Soren,

given Mikko's position, please go ahead and identify a couple of suitable freezers for independent testing. we will bear expenses.

Regards Michel

APPENDIX S

NOTE ON CFCs

A booming black market in smuggled chlorofluorocarbon products is hindering the shift away from ozone-depleting chemicals, government and industry officials say. The amount of illegal CFC imports is not known, but EPA officials acknowledged Oct. 25 that increasingly large amounts of CFC-12, used for automobile air conditioners and other cooling, are being sold on a thriving black market at cut-rate prices. The chlorofluorocarbon family of chemicals has been blamed for deterioration of the stratospheric ozone layer that protects the Earth from harmful ultraviolet (UVB...) radiation. A national and international consensus exists that certain manmade halocarbons, including chlorofluorocarbons, halons, carbon tetrachloride and methylchloroform, must be restricted because of the risk to the ozone layer. The United States and the international community have adopted increasingly stringent policies regarding the manufacture and use of ozone-depleting substances. In September 1987, the United States and 22 other countries signed the Montreal Protocol on Substances that Deplete the Ozone Layer. At the Second Meeting of the Protocol Parties, held in June 1990, the parties responded to new evidence by tightening the restrictions placed on these chemicals. The parties passed amendments and adjustments which called for a full phase out of the already regulated CFCs and halons by 2000 and a phase out of carbon tetrachloride and"other CFCs" by 2000. EPA announced a final rule Nov. 30, 1993, that will fully phase out U.S. production and import of chlorofluorocarbons and six other substances that deplete the ozone. Halons will be phased out by Jan.1, 1994, and CFCs, carbon tetrachloride and methyl chloroform by Jan.1, 1996. In an attempt to speed up the transition, Congress levied an excise tax on the sale of CFCs. The tax is operated as a complement to EPA's regulations limiting production and consumption by increasing the cost of using virgin controlled substances. By raising the cost of virgin controlled substances, the tax is an additional incentive for industry to shift out of these substances, increase recycling activities and to encourage the development of a market for alternative chemicals and processes. Substitute products are being developed. Some refrigerator manufacturers in Europe have begun to use hydrocarbon mixtures as coolants to replace chlorofluorocarbons. Manufacturers in the UnitedStates have held off because of questions regarding performance and flammability. As part of its ongoing research into CFC alternatives, EPA's Office of Research and Development has found that two mixtures of isobutane and propane in refrigerators cooled just as well as CFC-12 and consumed three percent less energy. The next step for ORD scientists is to determine if flame-suppressing fluoroiodocarbons can be added to the mixtures without reducing performance. EPA announced its first list of acceptable and unacceptable substitutes for CFCs and other ozone destroyers Feb. 16, 1994, plus a process for ongoing review of substitutes as they are developed. The program will assess alternative use in eight major industrial categories: refrigeration and air conditioning, solvents, foamblowing, fire and explosion suppression, sterilants, aerosols,

adhesives, coatings, inks and tobacco treatment. During the transition to substitute products, millions of pounds of CFCs will continue to be needed to supply equipment still in use, including air conditioners in the approximately 140 million cars still on the road. Industry officials say these products are being undercut by the illegal imports that avoid the $4.35 excise tax on CFCs. The primary chemical on the market is CFC-12. The availability of cheap black market CFC-12 for refrigeration is"substantially discouraging the shift to new materials or practices that can reduce the emission of these compounds," said Kevin Fay, executive director of the Alliance

for Responsible Atmospheric Policy. Fay, whose group represents makers of CFCs and their substitutes, said the illegal imports may total as much as 20 million pounds a year,costing the government $100 million a year in lost excise taxes alone. Representatives of EPA, the U.S. Customs Service and the Internal Revenue Service said recently that the agencies planned to step up cooperative efforts to stem the illegal imports. Fay said the black market in CFC refrigerant "is reminiscent of the Prohibition Era in the 1920s" and extremely lucrative because CFC-12can be produced for less than 50 cents a pound. Because sellers on the black market can avoid the tax, they frequently offer CFC-12 for as little as $2 and $3 a pound, far less than the tax itself, undercutting legitimate suppliers and slowing the shift to CFC substitutes, industry officials said. Stephen Seidel, acting director of the EPA stratospheric protection division, said the problem "is still growing" and likely will become more widespread once production is banned in the United States and other industrial countries after next year. Seidel conceded that the EPA and other U.S. agencies can only guess how much CFCs currently are being smuggled into the country. In four years, the EPA has discovered only 12 cases, resulting in$225,000 in civil penalties for illegal transport of CFCs into the country. Recently a Los Angeles man was convicted of illegally bringing 200 containers of Freon (a trade name for CFC refrigerant) in from Mexico. But these cases only scratch the surface, said George White, a U.S.Customs agent in Miami, which is suspected of being a major port of entry for illegal CFCs. "There are a thousand and one ways to bend the system," said White.He said containers are falsely labelled as propane or some other gas of a weight similar to CFC-12, illegal virgin CFC is disguised as recycled CFC, which can be legally imported, or CFC-12 cylinders are hidden amid thousands of containers of legal products such as a CFC substitute. Much of the black market supplies of CFC-12 are believed to come from Russia, but other likely sources include India, China, eastern Europe and several developing countries that under international treaty may continue to produce CFCs until 2005. For more information, contact Evelyn Baskin, ORD Air and Energy Engineering Research Laboratory, (919)541-2429, Seidel, (202)233-9161 or EPA's Stratospheric Ozone Hotline, (800)296-1996.

APPENDIX T

APPENDIX T

Summary of EPI-INFO database for SUBs and SVAs without working equipment

There are 51 SUBs (SCs or CMR in the file) with no working fridge.
(Note that Ciniseuti SUB in Rezina has a second fridge that works.)

There are 96 SVAs (Ambulatorios or AMR in the file) with no working fridge.

Some of these definitely do not need to supply icepacks because they do not support, supply or supervise any peripheral facilities. Others supply vaccine to FAPs, some of which have no working fridge. The table below summarizes the situation.

SUBs and SVAs with no working fridge

Category	SUB	SVA	
1. No FAP in the sector, so no need to supply ice-packs	15	54	MK 142
2. Has 1 or more FAPs, all supplied direct from Raion SES	13	15	MK 142
3. Supplies vaccine to FAPs, all of whose fridges are working now	8	16	
1 FAP 4 SUBs and 10 SVAs			MK 142
2 FAPs 3 SUBs and 3 SVAs			MK4010
3 FAPs 3 SVAs			MK4010
5 FAPs 1 SUB			MK4010
4. Supplies vaccine to FAPs; 1 or more has no working fridge	15	11	MK4010
5. Has a second fridge which is working (Ciniseuti, Rezina)	1		none
Total	52	96	

Recommendation:

Line 4: Buy at least 15 + 11 refrigerators with freezer compartment (MK4010).

Also buy this model for 4 SUBs and 6 SVAs which supply more than 1 FAP even though all the FAP refrigerators are working now (see Line 3).

Buy MK 142s for the remaining 4 SUBs and 10 SVAs which supply only one FAP (see Line 3).

Buy MK 142s for all SUBs and SVAs on lines 1 and 2.

Note on Facilities with small numbers of children

Of the 15 SUBs with no fridge and no FAP in their sector, 2 had very small numbers of newborns (11 in Gertop, Grigoriopol and 18 in Pirjola, Riscani. It would take these SUBs at least two months to finish one 10-dose vial of DPT or OPV. They do not need a fridge for vaccines.

Of the 54 SVAs with no fridge and no FAP in their sector, 4 of these SVAs had fewer than 8 newborns registered in 1994. They could be served by outreach.

FAPs

Major threats to the quality of immunization are:

(a) vaccine getting frozen during the winter in a domestic refrigerator in an unheated FAP; this is a risk wherever domestic refrigerators are in use.

(b) health worker's technique for looking after the vaccine; the risk of inadequate vaccine handling may be greater at the smaller FAPs, that is those with fewer children.

Suggested criteria for deciding which FAPs should have a vaccine refrigerator:

1. Those with at least 24 children registered per year (COPII_94 >= 24).
Smaller FAPs give so few doses that they will be keeping opened vials of multi-dose vaccines (DPT, OPV, HepB, DT) for several weeks before giving enough doses to finish the vial. The vaccine would be at less risk of being compromised if it is brought fresh by the paediatrician.
Out of 1014 FAPs, 75% had fewer than 24 children under 1 registered in 1994.
There are several FAPs which have more COPII_94 than SUBs or SVAs (see FREQ COPII_94).

2. Those with a fridge more than 10 years old (ANULPROD < 1986)
Among the 254 FAPs with 24 or more COPII_94, only 37 fridges are definitely 10 years old or younger; one of these is not working. The rest were made before 1986 (n=194) or the data are missing (n=23).

Table 1
Number of FAPs with:COPII_94 >= 24

	STAREA			
ANULPROD	Missing (.)	No (0)	Yes (1)	Total
Missing (.)	15	3	5	23
<1986	0	40	154	194
1986-1996	0	1	36	37
Total	15	44	195	254

3. Those that collect their vaccine from a SUB or a SVA (SURSAVAC<>"CIE")
These FAPs are definitely not in the Sector of the Policlinic, and may be further away from the Raion CIE. Among the 254 FAPs with 24 or more COPII_94, 143 FAPs collect from the SUB or SVA for their Sector.
Of these 143, 37 fridges are 10 years old or younger but one of these is not working. In the rest of the 117 FAPs, their fridges were made before 1986 (n=91) or the data are missing (n=16).

Table 2
Number of FAPs with COPII_94 >= 24 and SURSAVAC <> "CIE"

	STAREA			
ANULPROD	Missing (.)	No (0)	Yes (1)	Total
Missing (.)	12	1	3	16
<1986	0	24	77	91
1986-1996	0	1	25	26
Total	12	26	105	143

Here is another way of looking at the question of COPII_94.

You could choose the following criteria:

If the FAP cannot use a 10-dose vial of DPT in one week, then it is risky to keep the opened vial longer. That FAP should not have a vaccine fridge because of the risk of keeping opened vials too long.

We will assume that it is possible to give 9 injections from a 10-dose vial. At present immunizations are provided every two weeks. Counting first plus second plus third dose, on average a FAP with 3 or more under-1s registered per two weeks can use up a 10-dose vial within a week of opening the vial. This translates into 3 x 26 = 78 under-1s registered per year.

Under the present policy of immunization every 2 weeks, the illustration in the tables, using COPII_94 >= 24, is already inviting the risk of holding opened vials for too long in the middle-sized FAPS (COPII_94 >= 24 but < 78).

If the policy changes to offering immunization once per month (12 times per year), then a FAP with COPII_94 >= 36 will (on average) be able to use an opened vial within its monthly session.

APPENDIX U

SPECIFICATIONS FOR S-K SERIES COMPRESSORS

Compressor	S-K 100N5	S-K 120N5	S-K 140N5	S-K 160N5	S-K 175N5	S-K 200N5
Boiling temperature range of refrigerant	-10 C to -35 C					
Refrigerant	Refrigerant R12					
Throttle	Capillary pipe					
Cooling	Natural convection			Combined, with oil bath cooling		
Thermal Power Parameters						
Energy Consumption, Watts	105	140	140	155	170	195
Specific Cooling Power, Wt/Wt	1.05	1.07	1.18	1.19	1.18	1.23
Cooling Power, Watts	110	150	165	185	200	240
Refrigerant boiling point, °C	-20					
Refrigerant vapors dew point, °C	55					
Refrigerant supercooling point, °C	32					
Refrigerant vapors superheating point, °C	32					
Ambient temperature	32					
Compression Parameters						
Design	Hermetic, crank and slot gear, vertical pivot					
Volume, m^3	4.5	5.54	6.08	6.79	7.24	8.14
Volume of oil, m^3	300	300	370	370	370	370
Weight, kgs	7.4	7.7	7.9	8.2	8.5	8.6
Specifications for Built-in Electric Engine						
Type	One phase, bipolar, asynchronous, with working condenser					
Condenser: capacity,mcF voltage, Vs	3 400	4 400	4 400	5 400	5 400	5 400
Safety relay	RKT-1	RKT-2	RKT-2	RKT-2	RKT-2	RKT-3
- Responce temperature	130+/-10	130+/-10	130+/-10	130+/-10	130+/-10	130+/-10
- Return temperature	65+10/-5	65+10/-5	65+10/-5	65+10/-5	65+10/-5	65+10/-5
- Responce current, A (at T=80 ±2 °C)	1.5	1.8	1.8	1.8	1.8	2.5
- Maximum responce current, A	5	6.3	6.3	6.3	6.3	8
- Responce time, sec.	6-15	6-15	6-15	6-15	6-15	6-15
Starting relay	RT					
Resistance, Ω at 25 ±1.5 °C	22+6/-7					
Maximum voltage, V	350					