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	PLANT	PHASE OUT OF CFCs AT FREEZER PLANT OF XING XING APPLIANCES INDUSTRIAL CO.CHINA
	CUSTOMER CONTRACT N. JOB N.	UNIDO FOR XING XING UNIDO 98/028 PROJECT MP/CPR/97/194 2298220070

**PHASE OUT OF CFCs AT FREEZER
PLANT OF
XING XING APPLIANCES
INDUSTRIAL CO**

FINAL REPORT

D			1		
C					
B					
A	14/12/00	FIST ISSUE	M. BARALE		
Rev.	Dat	Description	Prepared	Controll	Approv.

	PLANT	PHASE OUT OF CFCs AT FREEZER PLANT OF XING XING APPLIANCES INDUSTRIAL CO.CHINA
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1. INTRODUCTION

With the present document The Contractor wants to describe the works performed at the plant site for the conversion of Xing Xing Electric Appliances Industrial Co. to phase out the use of CFC11 in the production of Refrigerators and Freezers.

Here below it is briefly summarised the activities performed under the Contract step by step according to The terms of Reference

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2- VISIT TO THE PROJECT SITE AND LAY OUT OF THE PLANT (STEPS 1, 2 OF THE TERMS OF REFERENCE)

After the award of the order, the Contractor visited the Counterpart between September 5th and 8th 1998 in order to verify the conditions of the site and to identify the best engineering solutions for the conversion of the existing foaming lines.

During the visit, the Contractor discussed and checked with the Counterpart the following main subjects:

A - Technical details regarding the supply of the equipment; in particular The Contractor emphasised the Premix Units, the Polyol and Isocyanate Modules, Safeties of the plant (as i.e.: gas sensors, exhaust system with fan groups), cyclopentane storage tanks and relevant accessories .

B - The suitable site where the new equipment had to be installed and the required modification to the new layout.

Regarding the C5 storage tanks, the Contractor inspected and defined the area where it had to be positioned.

After the visit the Contractor prepared the first progress report(November 1998) including the preliminary lay-out and the Basic requirements and specifications for the site Preparation.

The first progress report covered all the subjects listed during the discussion and gave to the Counterpart, as much as detailed as possible at that phase of the project, a list of all the works and materials to be provided by them.

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3 TECHNICAL SPECIFICATION AND ENGINEERING DESIGN FOR THE PLANT ERECTION- TRAINING ABROAD OF THE COUNTERPART (STEPS 3÷11 OF THE TERMS OF REFERENCE)

In March 1999 the Contractor provided the Final Technical Documentation for the Conversion of the plant.

The above mentioned documentation included the following kind of detailed drawings and specifications:

- civil works for the storage tanks and foaming lines
- grounding of the equipment
- piping arrangements and support details
- piping sketches
- box buildings construction
- ventilation construction
- cable run lay-out
- gas sensor positioning
- electrical drawings
- safety requirements

All the documentation was discussed with the Counterpart and some modifications have been agreed during the next period.

A team of engineers attended the training at Contractor site in May 1999

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4. DELIVERY OF EQUIPMENT, INSTALLATION, COMMISSIONING, TRIAL PRODUCTION OF THE FIRST MODELS, TEST RUN OF PRODUCTION(STEPS 12÷15 OF THE TERMS OF REFERENCE)

In June 1999 all the new equipment have been shipped.

The installation started in September 1999, after the customs clearance of all the equipment.

The Contractor engineers followed the installation phase including the supervision of the job at Counterpart charge.

The Contractor actions basically concerned the following zone of the modified plant:

- Cyclopentane storage tanks areas
- Wet areas
- Process fluid connection piping between wet and dry area
- Cabinets /doors foaming areas
- Safeties of the plants (ventilation system, fire fighting system et cetera)

The installation phase was completed in January 2000

After the installation, the Contractor performed the Commissioning and start-up phase of the modified plant in accordance with the contract.

The commissioning , trial production and test run phases mainly concerned the following operations:

- Pneumatic and Electric circuit check
- Grounding check
- Flushing of the tanks and the piping with nitrogen
- Pressure test
- Check of the operating sequences
- Operating test
- Service simulation test
- Setting start-up parameters
- Foaming quality check
- Performance test

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The training on the job activities has been carried out at the beginning of commissioning phase (January 2000)

In March 2000 the commissioning phase was completed and the Counterpart started the production of the first models of freezers with cyclopentane as blowing agent

The Counterpart signed the final acceptance certificate only in December 2000, that is nine months after the starting up of the plant.(enclosure A)

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5. TRAINING ON THE JOB, SAFETY INSPECTION AND CERTIFICATION, FINAL REPORT, POST CONTRACT MONITORING ACTIVITIES (STEPS 16÷19 OF THE TERMS OF REFERENCE)

The training on the job activities has been carried out at the beginning of commissioning phase (January 2000)

The safety inspection has been performed in July 2000 by TUV ULM ; enclosed please find the TUV final report (enclosure B) .

The post contract monitoring activities have started in March 2000 and will end at the end of December 2000

TUV original certificate is in printing now : it will be send to UNIDO by the end of December .

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6. ENCLOSURES

- A) ACCEPTANCE CERTIFICATE
- B) TUV FINAL REPORT

  SISTEMI	PLANT	PHASE OUT OF CFCs AT FREEZER PLANT OF XING XING APPLIANCES INDUSTRIAL CO.CHINA
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A

验收证书

客户：浙江星星电器工业公司

供应商：意大利 CANNON 集团

项目：UNIDO 项目——MP/CPR/97/194 第 98/028 号

客户在此认可供应商所执行的项目已经基本满意的完成，同时，附录中所列的各项工作供应商保证在二 000 年底之前完成。以上所提项目的保修期自二 000 年十二月三十一日起生效。

浙江星星电器工业公司

CANNON 集团

代表：徐玉书

代表：MAURIZIO MOTTON

徐玉书代

Maurizio Motton

日期：2000.12.3

日期：03-12-2000

备注：

- 1. “附录”作为该验收证书的组成部分，应视为等同有效文本。
- 2. 本验收证书中文、英文各一份，等同有效。

徐玉书

Motton Maurizio

附录:

一、 以下零配件或备件将从 CANNON 集团运往星星电器工业公司, 并在二 000 年底前更换调试完成。

- 1. 发泡机上的温控器, 六个。
- 2. 控制柜上的专用信号灯, 二十个。
- 3. CANNON 集团的聚醚泵连轴外套件, 一件。
- 4. 控制柜总开关把手, 一个。
- 5. 风机的风流开关, 二个。
- 6. 隔离器 (型号: EGE SZA400), 一个。
- 7. 气动阀 (备件号: 384005-4), 一个。
- 8. 消音器 (用于气动阀上), 八个。
- 9. 环戊烷气体探头, 一个。
- 10. 原料流量计 (备件号: Z02776CAO)
- 11. 轴承圈 (用于 CANNON 的 H1V30 泵), 二个。

二、 以下工作由 CANNON 集团的技术人员的帮助指导, 于二 000 年底前完成。

- 1. 更换环戊烷储罐的人孔盖上的法兰垫片。
- 2. 将四台发泡机充分调试运行。
- 3. 更换环戊烷输送泵上的膨涨阀。
- 4. 修改南厂区的报警喇叭, 使之正常作。
- 5. 更换发泡机 (291012) 黑料泵上侧盖。
- 6. 更换并调试其它的已坏备件。
- 7. 对星星公司的相关维修人员进行培训 为期两天。

王浩芳

Marcelo Piroton

ACCEPTANCE CERTIFICATE

**CUSTOMER: ZHEJIANG XINGXING ELECTRICAL EQUIPMENT
INDUSTRIAL COMPANY**

SUPPLIER: CANNON

PROJECT: UNIDO PROJECT NO. MP/CPR/97/194 NO.98/028

The customer herewith acknowledges that the commissioning of project has been satisfactorily completed , at the same time, the supplier guarantee that they have to complete the items mentioned in the Appendix A (enclosed), and the warranty period for the above-mentioned project shall take into effect on 31 Dec., 2000.

XINGXING

CANNON

REPRESENTATING :

REPRESENTATING :

XU YUSHU

MAURIZIO MOTTON

Xu Yushu

Maurizio Motton

DATE: 3 Dec. 2000

DATE: 03/12/2000

REMARK :

- 1. Enclosed on copy of Appendix A if shall be integrated as part of this "Acceptance Certificate".**
- 2. This Certificate has two copies(one in English, one in Chinese), are the same availability.**

Xu Yushu

Maurizio Motton

Appendix A

1. The following parts or accessories will be delivered to Xingxing from Cannon within this year.

- A. No.6 GEFran 400 thermometric displaying meters.
- B. No. 25 bulbs 24 Vdc (for control panel's pilot lamps).
- C. No. pump's housing for premix H1V30 Cannon pump.
- D. No. Panel on-off main switch's handle (machine S/N.291011).
- E. No.2 air flux flow switches.
- F. No.1 barrier (code: EGE SZA400).
- G. No.1 cylinder valve (code: 384005-4).
- H. No.1 cylinder valve (for stream distributor).
- I. No.8silencer Φ 1/4" (for cylinder valve).
- J. No.1 C5 gas sensor.
- K. No.1 flow transducer KRACHT(code:Z02776CAO).
- L. No.2 shaft seals for Cannon H1V30 pump.

2. The following jobs shall be completed with the assistance of one Cannon's technician, the technical intervention period shall be estimated by the end of this year.

- A. Replacement of relevant leaking gaskets for U.S.T flanges in North/South factory.
- B. Put into complete operation of all four units of Penta-Twins.

- C. Replacement of the expansion valve for U.S.T pump.**
- D. To modify the circuit catering 2 bugles 10 alarm sirens.**
- E. Changing and commissioning the faulty parts.**
- F. To replace the pump's shaft seal machine S/N 291012.**
- G. Provide training for Xingxing's maintenance staffs for two days.**

Handwritten signature or initials in the bottom left corner.

Pyawndar = Pwotton

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B

**Final-Report
of the safety Inspection
of the CFC-conversion of XingXing**

Plant Location: Zhejiang XingXing
Electrical Appliance Industrial Company
1 Hong Xi Road Hongxia Jiaojiang
Taizhou Zhejiang, 318050, P.R.China

Plants:

- 3 Plant South
 - C-5 Storage area
 - Pre-mix – Intermediate tank-area
 - Cabinet Line (2X); Door Line
- Plant North
 - C-5 Storage area
 - Pre-mix – Intermediate tank-area
 - Cabinet Line (2X); Door Line

Manufacturer of the plants:

1. Bono Sistemi (Italy) / Cannon Fare East
2. Zhejiang Xing Xing (Local works)

Project: Conversion of the Freezer and Refrigerator Plants
with Pentane as blowing agent

**UNIDO-Project
ORDER No.:** MP/CPR/97/194
200 368 096

TÜV-Experts: Karl-Josef Richardt - TÜV-BB-UL, Dep. NDD
Eberhard Mack - TÜV-BB-UL, Dep. NEG

Dates:

- 29th July 2000 – 3rd August 2000
 - Inspection of the plants at XingXing
- August / September 2000
 - Preparation of Draft-Report
- December 2000
Preparation of Final-Report

Participants:

Mrs. Barale	Bono Sistemi
Mr. Ken Leck	Cannon Fare East
Mr. Alex Tan	Cannon Fare East
Mr. Xu Yushu	XingXing
Mr. Caven Yin	XingXing

**Report is
sended to:** Bono Sistemi Mrs. Barale
UNIDO, Dr. Grof

**Bau und
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TÜV-BB-ULM/Ri-Ma Bon-Xin-
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1. OBJECTIVE AND SCOPE OF THE PLANT EVALUATION

The Xing Xing Company in Teizhou, P.R. China is operating polyurethane plants for the manufacture of refrigerators.

As substitute for the previously used CFC blowing agent R 11, c-pentane (C 5) is used now for the PU foam production. C 5 is a flammable fluid constituting a class A1 hazard. The use of C 5 necessitates fire and explosion protection measures for the C 5 storage and the PU production facilities.

If conjunction with the progressive change-over to combustible blowing agents (C 5) the experts of the Ulm branch of TÜV Süddeutschland have developed German and International safety standards and accumulated a wealth of expert knowledge in this field.

All safety evaluations by the TÜV experts are based on International, European and German standards and the experience gathered with plant inspections, the evaluation of solutions based on measurements and the investigation of accidents since the start of plant conversions in 1993. A special safety strategy was developed for fire and explosion hazards.

Safety evaluations by the TÜV experts basically cover the following tasks:

- Co-ordinate of the safety strategy with fire and explosion protection measures
- Review the feasibility of the proposed safety strategy
- Inspect existing buildings and technical facilities and components
- Functional testing of safety-related equipment at the plants
- Measurements at plant components under fire and explosion protection aspects
- Evaluate existing organisational procedures/requirements
- Review relevant parts of the documentation
- Define the state of the art of safety engineering by a comparison with plants used for similar purposes



2 DOCUMENTS AND INFORMATIONS USED AS A BASIS FOR THIS PLANT EVALUATION

2.1 Inspection

The final inspection took place 29th July to 3rd August 2000.

The results of this inspection are mentioned in this report.

The items were discussed with representatives of Bono and Xing Xing during the mission of TÜV in Taizhou P.R.China.

The most deficiencies and measures, came up during the inspection were solved by technicians of Cannon and Xing Xing. The solved deficiencies were inspected on the last day again.

The deficiencies mentioned in report BON/XIN-PRC/02/00 are solved by Cannon and Xing Xing and this were stated with letter of 23 November 2000 to the signed experts by the project leader Mrs. Barale.

The confirmation was made additional with separate Memorandum of 7-8 November 2000 by XingXing factory Mr. Yin Longfang, Mr. Wang Yanhong, Mr. Li Liangqing and Cannon Fare East Mr. Alex Tan.



2.2 Technical regulations

This plant evaluation is based on International, European and National regulations - in that order - as far as these are available and applicable.

These include the following essential regulations:

- International standards (ISO, IEC)
- Ordinance Regulating Facilities for Storing, Racking and Transporting combustible Liquids - Germany: VbF
- Decree for electrical plants in explosion dangerous areas, Germany: ElexV
- Decree for pressure vessels, Germany DruckbehV
- Law for immissions protection: Germany BImSchG
- Law for water protection: Germany WHG (protection against water-pollution)
- Electrotechnical regulations: International: IEC / European: EN / National: DIN VDE
e.g. IEC 60073, IEC 439-1/A2, IEC 204-1, IEC 1310-2, EN 50054, EN 50013, EN 50020, EN 50081, EN 60529, pr. EN 1050, DIN VDE 0165, EN 349, EN 418, EN 294
- Fundamental safety aspects to be considered for measurement and control equipment: Germany DINV 19250
- Safety requirements for automated manufacturing systems: Germany VDI 2854
- Personal protection regulations / accidents prevention - European: EN..EC / Germany: UVV/ZH
e.g. VBG 1, VBG 5, VBG 61, ZH 1/200, ZH 1/255, ZH 1/8, ZH 1/10
- Technical regulations for combustible liquids and for gases: Germany TRbF / TRG
e.g. TRbF 100, 110 / TRG 280
- Ex-proof / spark-proof for ventilators: Germany VDMA-24169 part 1
- Homologation of technical plant and equipment - European: conformity certificates (e.g. PTB, Cesi, Damko)
- EN 378, Refrigerating systems and heat pumps, Safety and environmental requirements
- pr EN 1612-2 Reaction moulding machines
- EG machine directive (89/392/ESG, revised edition 91/368/EEC)
- CEI/IEG 335-2-24, Safety of household and similar electrical appliances



- IEC 79-10/EN 60079-10/VDE 0165 Part 101: Electrical apparatus for explosive gas atmospheres - classification of hazardous areas.

2.3 Documentation of the PU plants and the peripherals

The complete documentation of Cannon/Bono was delivered in September 2000 to the experts and following was available on site.

- a. Drawings related to Factory north and south Job No.: 229 822 0070
- b. Inspection Book IB 00/103 Rev.0 (Vol. 1 and 2) Revision No. 0: 28/02/2000
- c. Mechanical Manual (MM00/107 Rev.0 (Vol. 1 to 4)
- d. A sys 100 P.T. 291011 and 291012
 - Diagram + Spare parts
 - Use and Maintenance
- e. A sys 40 P.T. No. 271222 and No. 271223
- f. Penta Easy froth 20 + 4 No. 550718 and N. 550689

2.4 Documentation of Xing Xing

- C5-safety regulations for the security guard
- Management Regulations of C5 storage stations (in preparation)
- Instruction of unloading process C5 storage area
- Record about maintenance and mistakes in c-5-area following documentation will be finished
- Operator instruction for production by cfc
- Training regulations of safety production
- Instruments related the behaviour of works during danger situation

3. General definitions of c-pentane-foaming-plants

3.1 C5 safety data

Media	Hazard class	Flash point (°C)	Ignition temp. (°C)	Explosion-group	Temp. class	LEL / HEL (vol. %)	Density (air = 1)	Partially inert max. O ₂ (%)
Cyclo-pentane	Al	< - 30	380	II A	T 3	1.1 / 8.7	2.42	11

3.2 Definition of Zones

The areas of the zones are mentioned in this report are related to the realised safety strategy.

a) Explosion Zones

At the foaming plant which works with c-pentane following explosion zones are existing:

Explosion Zone 0

Explosion Zone 1

Explosion Zone 2

The physical definition of these ex-zones is based on standard 94/9/EG-Atex 100a.

The area definition of the checked foaming plants is based on the standard IEC 79-10.

For the plants which are using pentane a special safety strategy has been developed which contains also other relevant safety zones.



The size of the area of the explosion and safety zones of the particular plants are described under the consideration of the realised safety strategy.

b) „Alarm Zone,,

The alarm zone is a zone which has been defined in relation with the pentane safety strategy by using particular parts of IEC 7910.

The definition is as follow:

Definition of alarm zone:

Defined area in which the development of an explosive atmosphere answering the description of explosion zone 0,1 or 2 is prevented by technical measures in accordance with IEC 79-10 and all potential sources of ignition are switched off automatically before an explosive atmosphere arises.

Technical measures in accordance with IEC 79-10 include:

- Plant sections carrying polyol / C 5 must be technically leak-proof (e.g. special seals, leakage monitoring)
- Technical ventilation dimensioned in accordance with IEC 79-10 to reach a non dangerous zone
- Automatic gas warning system tested and certified in accordance with EN 50054 which automatically switches off of all potential sources of ignition at 40% LEL or lower.
- Only equipment which is absolutely necessary for operating the polyol / C 5 plant must be installed within the alarm zone.

d) Fire danger zone

Around 5 m of the pentane-foaming plant a fire danger zone must be defined.

The installed technical equipment must meet following general requirements:

- The electrical equipment and units must meet the IEC-standards.
- Smoking and using fire is strictly forbidden.
- Special work with the danger of fire like welding and soldering is only allowed with a special permit.
- The flammable materials must be reduced to a minimum.

d) Zone of Nitrogen (N₂) inertisation

This is an area in which through the inertisation of N₂ no explosive atmosphere can be.



4. Results of inspection and evaluation Plant / South Factory

4.1 Parts of TÜV inspection

Following plants and equipment are part of this inspection:

- c-Pentane Tank area
- Pipe to the mixing unit
- Mixing unit and Intermediate tank area
- Cabinet area A and B
- Door plant area C

Not part of this TÜV inspection are:

- Polyol/Isocyanat-Storage areas

4.2 C 5 storage area

4.2.1 Brief description of the plant

Pentane is stored in an underground tank with a capacity of 35.000 liters. This tank will be filled by truck.

The tank is located in a concrete basin inside of sand.

The C 5 pipe to the premix room is aboveground.

The area in which C 5 will be released in the event of leakage during the filling process is designed as a liquid catch basin.

Water gutters are structurally separate from the catch basin.

The sewage system is separated from the C 5 catch basin by a special valve.

The electrical control panels are installed outside the explosion zone of the C 5 storage area.



4.2.2. Explosion zones / fire hazard zone

Based on the above standards, the following explosion zones must to be defined:

- a) Explosion zone 0
 - The interior of the C 5 storage tanks (without controlled inertisation)
 - The interior of C 5 pipes which are not constantly filled with C 5
- b) Explosion zone 1
 - Inside the tank pit
 - The interior of the C 5 catch basin
 - A circle with a radius of 1 m about the end of the C 5 tank exhausting systems
- c) Explosion zone 2
 - The environment of the C 5 tank pit over a distance of 2,0 m up to a height of 0.8 m from the floor additional to the Zone 1.
- d) Fire hazard zone
 - Total C 5 storage area (minimum 5 m around the area)



4.2.3. Measurements / safety functional tests

- Pentane storage area -

Plant/component	Measuring result	Conforming to safety strategy		Remarks
		yes	no	
A) <u>Function tests</u>				
1. Pentane emergency push button				
- pentane emergency push button (1 st level)		x		
- emergency push button (control panel)		x		
2. Alarm signals to guard room		x		
3. C 5 tank				
3.1 leakage monitoring:				
a. Double wall				
- minimum contact		x		
- maximum contact		x		
- flow of the monitoring liquid		x		
3.2 N ₂ -pressurization				
- N ₂ .low (200 mbar)		x		
- N ₂ -min (10 mbar)		x		
3.3 c5-level monitoring				
- maximum level(90 %)		x		
- super max. level (95 %)		x		
- low level (10 %)		x		Requirement of the red jacket pump approval
4. c5-basin				
- function of the sewage valve slope of the basin (test by water)		x		
		x		
5. Pressure testing of pentane pipeline		x		<ul style="list-style-type: none"> - test was done under supervision of Cannon - test record is submitted



Plant/component	Measuring result	Conforming to safety strategy		Remarks
		yes	no	
B) Measurements				
1. Electrical resistance of floor (conductivity)				
– position of tank-truck during unloading	15-20 kohm	x		
– explosion dangerous area around the tank-equipment	20-40 kohm	x		
2. Ground/earth resistance ^a				
– earth resistance				
• earth system	0,7 ohm	x		
• lightning protection	0,7 ohm	x		
– Potential equalisation				
• tank equipment	≤ 0.3 ohm	x		
• truck grounding	0.1 ohm	x		
3. Conductivity				
– racking hoses	1.0 kohm	x		– the metallic couplings were rusty and had to be cleaned
4. Electrical circuits/control panel				
– insulation resistance	≥ 30 mega ohm	x		
– over current protection	adjustments and system o.k.	x		
– over voltage protection		x	confirmed	– over voltage protection device is missing (see chap. 4.2.4)



4.2.4 Detected deficiencies and required actions

- Pentane storage area -

		Responsible BO = Bono/Cannon XI = Xing Xing	
		BO	XI
1.	<p><u>Remark</u></p> <p>The most deficiencies detected at the inspection has been solved by Bono/Cannon and Xing Xing company during the inspection time.</p> <p>The solutions were controlled by the TÜV experts at the last day of the inspection on site.</p> <p>It was stated by Bono and Eletrofrío that the deficiencies mentioned in the draft report are solved.</p> <p>That the deficiencies are solved were confirmed with letter of 23 November 2000.</p>		
2.	<p><u>Electrical control panel</u></p>		
2.1	<p>The protection device against the danger of over voltage (e.g. thunderstorm, main fault) is missing.</p> <p>This device must be installed either in the control panel or in supply circuit of the panel.</p>	confirmed	
2.2	<p>A lamp supplied by a circuit of the back-up generator is necessary in the area of the control panel.</p>	confirmed	
3.	<p><u>Area of c5-tank</u></p>		
3.1	<p>The pits of the earthing-connections must be filled completely by sand.</p>	confirmed	
3.2	<p>The metallic couplings at the pentane-filling-hoses must be stored with a protection against wetness and air-humidity otherwise a dangerous form of rust is possible.</p>	confirmed	

4.3 Pre-mix and Intermediate tank area

4.3.1 Brief description of the plant

The Cannon Pre-mix unit Easy Froth is used. The Easy Froth is inside an enclosure near cabinet line A. Inside the same enclosure an intermediate tank with a capacity of 1000 liters is positioned.

The Pentane feeding pipe is installed over-ground. Before this pipe entered the production hall a automatic valve („Fail safe Valve,“) is mounted.

The pipe is completely welded and designed as a high pressure pipe.

The electrical control panels for the Easy Froth and the Intermediate tank are installed outside the enclosure.

Further details are described in the Bono / Cannon documentation.

4.3.2 Zone Definitions and Dimensions

a) Alarm-zone

- The total enclosure of Easy Froth with intermediate tank.

b) Explosion Zone 2

- The interior of the exhausting system
- A circle with a radius of 2 m about the end of the exhausting system at the open air.

c) Zone of nitrogen inertisation:

- Inside the intermediate tank

d) Fire danger zone

- The surrounding area of 5 m around the enclosure



4.3.3 Measurements/Function tests

- Easy Froth / Intermediate tank area
- c5-safety control panel
- Back-up generator

Plant/component	Measuring result	Function Conforming to safety strategy		Remarks
		yes	no	
A) Function tests				
- Easy Froth/ intermediate tank area				
1. Gas warning system - 15% LEL - 30% LEL - system error		x x x		
2. Emergency push-button - pentane emergency push button (1 st -level) - Emergency push button (control panel)		x x		
3. Alarm signals to guard place		x		
4. Exhausting system - flow sensor • Easy Froth • Room ventilation - test smoke - functions 15 % LEL	o.k.	x x x x		
5. Leakage sensor - Basin buffer tank - Easy Froth Sensor 1 - Easy Froth Sensor 2		x x x		
6. Buffer tank - N ₂ min tank - Super max. level control - Safety Thermostat - Safety relief valve tank		x x x x		- P _{min} =1bar - Stop Easy Froth - Manual reset on control panel - ISPESEL
7. Exit lamps (battery)		x		
8. Fire fighting system - Thermo sticks - Sprinkler system		x x		
9. Leakage control system - c5/polyol feeding pump		x		
10. Door monitoring - doors of Easy Froth - doors of room		x x		
11. Increase of alarm levels				



Plant/component	Measuring result	Function Conforming to safety strategy		Remarks
		yes	no	
<ul style="list-style-type: none"> - increase from 3rd to 2nd level alarm - increase from 2nd to 1st level alarm 		x		
12. P-max. control <ul style="list-style-type: none"> - Easy froth - c5/polyol feeding pipe 		x x		
B) Measurements				
- Easy froth / intermediate tank area				
1. Electric resistance of floor (conductivity) <ul style="list-style-type: none"> - floor in the room 	5 - 10 kohm	x		
2. Ground/earth resistance <ul style="list-style-type: none"> - earth resistance <ul style="list-style-type: none"> • earth system • lightning protection (ventilation system) - Potential equalisation <ul style="list-style-type: none"> • Easy Froth/Buffer tank Tank • plant equipment (pipes, ventilation channels) 	0.7 ohm 0.7 ohm ≤ 0.3 ohm ≤ 0.3 ohm	x x x x		- additional necessities were carried out during inspection
3. Electrostatic field strength <ul style="list-style-type: none"> - enclosure of Easy Froth - windows of the room-enclosure - insulation of tank, pipes etc 	0 kV/m 0 kV/m 0 kV/m	x x x		- grounded bars are mounted on the windows
4. Electrical circuits/control panels <ul style="list-style-type: none"> - Insulation resistance - over current protection 	40 ohm-heating ≥ 30 mega ohm-other adjustment o.k.	confirmed x		- heating buffer tank: the resistance is too low (see chap. 4.3.4) - additional necessities were carried out during inspection (power panel)
5. Exhausting system <ul style="list-style-type: none"> - Fan pre-mix area 	<ul style="list-style-type: none"> - speed 1: 12 m/s - speed 2: 15 m/s 	x x		



Plant/component	Measuring result	Function Conforming to safety strategy		Remarks
		yes	no	
C) c5-safety control panel				
1. Function tests - monitoring of circuit breakers and fuses - push button for testing of signalling - supply by UPS		x x x		- the ground connection to the transformer secondary circuit was missing
2. Presence and adjustment-control - timer relays - over current protection device - over voltage protection device		x x confirmed		- over voltage protection device is missing (see chap. 4.3.4)
3. Measurements - circuits-insulation	≥ 30 mega ohm	x		
D) Back-up Generator				
1. Function tests - running without load - running with load - automatic start in case of power failure		x x x		- at the control panel failures and improvements had to be carried out



4.3.4 Detected deficiencies and required actions

- Easy Froth / intermediate tank area
- c5-safety control panel
- Back-up generator

		Responsible	
		BO = Bono/Cannon XI = Xing Xing	
		BO	XI
1.	<p><u>Remark</u></p> <p>The most deficiencies detected at the inspection has been solved by Bono/Cannon and Xing Xing company during the inspection time.</p> <p>The solutions were controlled by the TÜV experts at the last day of the inspection on site.</p> <p>It was stated by Bono and Eletrofrío that the deficiencies mentioned in the draft report are solved.</p> <p>That the deficiencies are solved were confirmed with letter of 23 November 2000.</p>		
2.	<p><u>Intermediate tank</u></p> <p>The electrical insulation resistance of the tank heating - measured 40 ohm - is too low.</p> <p>The reason therefore could be a long switch off period of the heating i.e. wetness of condensation could be intruded in the heating and reduce the insulation resistance.</p> <p>Following procedure is suggested:</p> <ul style="list-style-type: none"> - Working of the heating for at least some hours (5-6 hours) and measurement of the insulation resistance (phase to ground) after that. The value of the insulation resistance must be at minimum 0.5 mega ohm. - If this value can't be reached an exchange of the heating is necessary. 	confirmed	



3. Pentane safety panel:

3.1 The protection device against the danger of over voltage (e.g. thunderstorm, main fault) is missing.

This device must be installed either in the control panel or in supply circuit of the panel.

3.2 A lamp supplied by a circuit of the back up generator is necessary in the area of the safety panel.

4. Back up generator

4.1 The diesel supply pipe between storage tank and generator must be installed in a professional way.

Responsible	
BO = Bono/Cannon	
XI = Xing Xing	
BO	XI
confirmed	
confirmed	
confirmed	



4.4 Cabinet Line A + B and Door plant

4.4.1 Brief description of the plants

The cabinet line A + B consist at a PU foaming machine Type PM 100 Twin an the door line the type 40 P.T. which are in an enclosure and an carousel with movable jigs.

The machine supplied the mixing heads of the plants.

The jigs are heated in an oven which is supplied by a steam heater.

The pipes are on a pipe bridge. As connection cutting rings are used.

Before the foam injection the cabinet will be filled with nitrogen.

4.4.2 Zone definitions and dimensions

a) Alarm zone

- The interior of the cabin with the wet part
- The interior of the enclosure with the dry part.

b) Explosion zone 2

- The interior of the exhausting system
- A circle with a radius of 2 m about the end of the exhausting systems at the open air

c) Zone of Nitrogen inertisation:

- The interior of the polyol / C 5 tanks
- The interior of the refrigerator cabinets after flushing by nitrogen

d) Fire hazard zone

- A surrounding of 5 m around the wet-part and the dry-part.



4.4.3 Measurements / Function tests

– Cabinet line A + B and Door plant

- 2-foaming machines, Typ 40 P.T. and 100 P.T. (wet parts)
- Cabinet plants A + B and Door plant (dry parts)

Plant/component	Measuring result	Conforming to safety strategy		Remarks
		yes	no	
A) <u>Function tests</u>				
1. Gas warning system				
– 15 % LEL		x		
– 30 % LEL		x		
– system error		x		
2. Emergency push-button				
– pentane emergency push button (1 st level)		x		
– emergency push button (control panel)		x		
3. Alarm signals to guard place		x		
4. Exhausting systems				
– flow sensor				
• Cabinet wet part		x		
• Door wet part		x		
• Door dry part		x		
• Cabinet A Dry part		x		
• Cabinet B Dry part		x		
– test smoke		x		
– functions 15 % LEL		x		
5. Leakage system				
– basis wet part		x		
– pump wet part		x		
– stirrer tank wet part		x		
– stream distributor dry part		x		
6. Polyol / C5 tank				Remarks
– Super max		x		– not function-coupled with Easy Froth because two automatic valves at incoming pipe
– N ₂ -min		x		
– Safety thermostat		x		– door plant: the 70°C-adjustment at the safety thermostat was wrong



Plant/component	Measuring result	Conforming to safety strategy		Remarks
		yes	no	
7. Door monitoring wet part / dry part		x		
8. Fire fighting system - Thermo sticks - Sprinkler system		x x		- a thermo stick was not functioning and had to be repaired (dry part B)
9. Increase of alarm levels - increase from 3 rd to 2 nd level alarm - increase from 2 nd to 1 st level alarm		x x		
10. N ₂ -inertisation of cabinet and doors - N ₂ -pressure monitoring - N ₂ -flow monitoring - Quality of inertisation		x x		
B) Measurements				
1. Electrical resistance of floor (conductivity) - 1.00 m surrounding of foaming machine - dry part	< 1 kohm 5-20 kohm	x x		- the resistance was too high therefore an aluminium plate has to be placed before the wet part-cabin.
2. Ground/earth resistance - earth resistance • earth system • lightning protection (ventilation system) - Potential equalisation • foaming machines • dry part plants • jigs • mixing heads	0,7 ohm 0,7 ohm ≤ 0.3 ohm ≤ 0.3 ohm 0.3 ohm 0.3 ohm	x x x x x x		- grounded bars are mounted on the window
3. Electrostatic field strength - enclosure of foaming machines - window of the dry part - Insulation of tank, pipes etc.	0 kV/m 0 kV/m 0 kV/m	x x x		
4. Electrical circuits / control panels - insulation resistance - over current protection	≥ 30 mega ohm o.k.	x x		



Plant/component	Measuring result	Conforming to safety strategy		Remarks
		yes	no	
5. Exhausting system				
- Fan Cabinet area	- speed 1: 16 m/s - speed 2: 20,5 m/s	x x		
- Fan Door area	- speed 1: 12,1 m/s - speed 2: 15,6 m/s	x x		
6. Inertisation				
- flushing time	- automatic calculated	x		- depend in amount of foam
- O ₂ concentration	- 4,8 % O ₂	x		- < 11,7 % O ₂



4.4.4 Detected deficiencies and required actions

– Cabinet Line A + B and Door plant

- Foaming machines, Typ A 40 P.T. (Door) and A 100 P.T. (Cabinet A + B)
- Cabinet plants A and B (dry parts)
- Door plant

		Responsible	
		BO = Bono/Cannon XI = Xing Xing	
		BO	XI
1.	<u>Remark</u>		
	The most deficiencies detected at the inspection has been solved by Bono/Cannon and Xing Xing company during the inspection time.		
	The solutions were controlled by the TÜV experts at the last day of the inspection on site.		
	It was stated by Bono and Eletrofrío that the deficiencies mentioned in the draft report are solved.		
	That the deficiencies are solved were confirmed with letter of 23 November 2000.		
2.	<u>Dry part line A</u>		
2.1	Door to the area of Easy Froth / intermediate tank:		
	a. For increase the fire protection the existing door should be exchanged for a metal-door..	confirmed	
	b. Regarding the entire safety system at the plant an automatic monitoring of the closed door position is missing.	confirmed	
3.	<u>Door plant</u>		
3.1	For the alarm signalling a siren is necessary in the area of the door plant.	confirmed	
3.2	The attachment of the mixing head isn't completely finished yet.	confirmed	



5. Results of inspection and evaluation North Factory

5.1 Parts of TÜV inspection

Following plants and equipment are part of this inspection:

- c-Pentane Tank area
- Pipe to the mixing unit
- Mixing unit and Intermediate tank area
- Cabinet area A and B
- Door plant area C

Not part of this TÜV inspection are:

- Polyol/Isocyanat-Storage areas

5.2 c5-storage area

5.2.1 Brief description of the plant

The description of the chap. 4.2.1 is valid also here

5.2.1 Explosion zones / fire hazard zone

The definitions and dimensions described in chapter 4.2.2 are valid also here



5.2.3. Measurements / safety functional tests

- Pentane storage area -

Plant/component	Measuring result	Conforming to safety strategy		Remarks
		yes	no	
A) Function tests				
1. Pentane emergency push button				
- pentane emergency push button (1 st level)		x		
- emergency push button (control panel)		x		
2. Alarm signals to guard room		x		
3. C 5 tank				
3.1 leakage monitoring:				
a. double wall				
- minimum contact		x		
- maximum contact		x		
- flow of the monitoring liquid		x		
3.2 N ₂ -pressurization				
- N ₂ -low (200 mbar)		x		
- N ₂ -min (10 mbar)		x		
3.3 c5-level monitoring				
- maximum level(90 %)		x		
- super max. level (95 %)		x		
- low level (10 %)		x		Requirement of the red jacket pump approval
4. c5-basin				
- function of the sewage valve				
- stope of the basin (test by water)				
5. Pressure testing of pentane pipeline				- test was done under supervision of Cannon - test record is submitted



Plant/component	Measuring result	Conforming to safety strategy		Remarks
		yes	no	
B) Measurements				
1. Electrical resistance of floor (conductivity)				
– position of tank-truck during unloading	3 - 10 kohm	x		
– explosion dangerous area around the tank-equipment	3 - 10 kohm	x		
2. Ground/earth resistance				
– earth resistance				
• earth system	0.5 ohm	x		
• lightning protection	0.7 ohm	x		
– Potential equalisation				
• tank equipment	≤ 0.3 ohm	x		
• truck grounding	0.1 ohm	x		
3. Conductivity				
– racking hoses				
• filling hose	0.1 ohm	x		
• gas return hose	0.2 mega ohm	x		
4. Electrical circuits/control panel				
– insulation resistance	≥ 30 mega ohm	x		
– over current protection	adjustments and system	x		
– over voltage protection	o.k.	confirmed		over voltage protection device is missing (see chap. 5.2.4)



5.2.4 Detected deficiencies and required actions

- Pentane storage area -

		Responsible	
		BO = Bono/Cannon	XI = Xing Xing
		BO	XI
1.	<p><u>Remark</u></p> <p>The most deficiencies detected at the inspection has been solved by Bono/Cannon and Xing Xing company during the inspection time.</p> <p>The solutions were controlled by the TÜV experts at the last day of the inspection on site.</p> <p>It was stated by Bono and Eletrofrío that the deficiencies mentioned in the draft report are solved.</p> <p>That the deficiencies are solved were confirmed with letter of 23 November 2000.</p>		
2.	<p><u>Electrical control panel</u></p>		
2.1	<p>The protection device against the danger of over voltage (e.g. thunderstorm, main fault) is missing.</p> <p>This device must be installed either in the control panel or in supply circuit of the panel.</p>	confirmed	

5.3 Pre-mix and Intermediate tank area

5.3.1 Brief description of the plant

The description of chap. 4.3.1 is valid also here

5.3.2 Zone Definitions and Dimensions

The definitions and dimensions described in chapter 4.3.2 are valid also here.

5.3.3. Measurements / safety functional tests

- Easy Froth / Intermediate tank area
- c5-safety control panel
- Back-up generator

Plant/component	Measuring result	Function Conforming to safety strategy		Remarks
		yes	no	
A) Function tests				
- Easy Froth/ intermediate tank area				
1. Gas warning system - 15% LEL - 30% LEL - system error		x x x		
2. Emergency push-button - pentane emergency push button (1 st -level) - Emergency push button (control panel)		x x		
3. Alarm signals to guard place				
4. Exhausting system - flow sensor • Easy Froth • Premix rooom - test smoke - functions 15 % LEL		x x x x		
5. Leakage sensor - Basin buffer tank - Easy Froth Sensor 1 - Easy Froth Sensor 2		x x x		
6. Buffer tank - N ₂ min tank - Super max. level control - Safety Thermostat - Safety relief valve tank		x x x x		- P _{min} = 1bar - Stop Easy Froth
7. Exit lamps (battery)		x		



Plant/component	Measuring result	Function Conforming to safety strategy		Remarks
		yes	no	
8. Fire fighting system – Thermo sticks – Sprinkler system		x x		– must be repaired
9. Leakage control system – c5/polyol feeding pump		x		
10. Door monitoring – doors of Easy Froth – doors of room		x x		
11. Increase of alarm levels – increase from 3rd to 2nd level alarm – increase from 2nd to 1st level alarm		x x		
12. P-max. control – Easy froth – c5/polyol feeding pipe		x x		
B) Measurements – Easy froth / intermediate tank area				
1. Electric resistance of floor (conductivity) – floor in the room	10 - 15 kohm	x		
2. Ground/earth resistance – earth resistance • earth system • lightning protection (ventilation system) – Potential equalisation • Easy Froth/Buffer tank Tank • plant equipment (pipes, ventilation channels)	0.5 ohm 0.5 ohm ≤ 0.3 ohm ≤ 0.3 ohm	x x x x		
3. Electrostatic field strength – enclosure of Easy Froth – windows of the room-enclosure – insulation of tank, pipes etc	0 kv/m 0 kv/m 0 kv/m	x x x		– grounded bars are mounted on the windows
4. Electrical circuits/control panels – Insulation resistance – over current protection	– ≥ 30 mega ohm – adjustment o.k.	x x		– grounded bars are mounted on the windows
5. Exhausting system				



Plant/component	Measuring result	Function Conforming to safety strategy		Remarks
		yes	no	
- Fan Pre-mix area	- speed 1: 11,7 m/s - speed 2: 15,0 m/s	x x		
C) c5-safety control panel				
1. Function tests				
- monitoring of circuit breakers and fuses		x		
- push button for testing of signalling		x		
- supply by UPS		x		
2. Presence and adjustment-control				
- timer relays		x		
- over current				
- protection device		x		
- over voltage protection device		confirmed		- over voltage protection device is missing (see chap. 5.3.4)
3. Measurements				
- circuits-insulation		x		
D) Back-up Generator				
1. Function tests				
- running without load		x		
- running with load		x		
- automatic start in case of power failure		x		- at the control panel and the diesel-supply failures had been corrected and improvements were carried out



5.3.4 Detected deficiencies and required actions

- Easy Froth / Intermediate tank area
- c5-safety control panel
- Back-up generator

		Responsible BO = Bono/Cannon XI = Xing Xing	
		BO	XI
1.	<p><u>Remark</u></p> <p>The most deficiencies detected at the inspection has been solved by Bono/Cannon and Xing Xing company during the inspection time.</p> <p>The solutions were controlled by the TÜV experts at the last day of the inspection on site.</p> <p>It was stated by Bono and Eletrofrío that the deficiencies mentioned in the draft report are solved.</p> <p>That the deficiencies are solved were confirmed with letter of 23 November 2000.</p>		
2.	<p><u>Intermediate tank</u></p> <p>At the 1st level alarm the automatic valve at the outgoing pipe didn't closed because the manual / automatic-adjustment on the valve was wrong.</p> <p>The technicians of Xing Xing company must be educated well in the pentane safety technique.</p>		confirmed
3.	<p><u>Safety control panel</u></p>		
3.1	<p>The protection device against the danger of over voltage (e.g. thunderstorm, main fault) is missing.</p> <p>This device must be installed either in the control panel or in supply circuit of the panel.</p>	confirmed	confirmed
3.2	<p>A lamp supplied by a circuit of the back up generator is necessary in the area of the safety panel.</p>	confirmed	

5.4 Cabinet Line A + B and Door plant

5.4.1 Brief description of the plants

The description of chapter 4.4.1 is valid also here.

5.4.2 Zone Definitions and Dimension

The definitions and dimensions described in chapter 4.4.2 are valid also here.



5.4.3 Measurements / Function tests

- Cabinet line A + B and Door plant
 - 2-foaming machines, Typ 40 P.T. (Door plant) and A 100 P.T. (Cabinet plants)
 - Cabinet plants A + B and Door plant (dry parts)

Plant/component	Measuring result	Conforming to safety strategy		Remarks
		yes	no	
A) <u>Function tests</u>				
1. Gas warning system <ul style="list-style-type: none"> - 15 % LEL - 30 % LEL - System error 		x		see chapter 5.4.4
2. Emergency push-button <ul style="list-style-type: none"> - pentane emergency push button (1st level) - emergency push button (control panel) 		x		
3. Alarm signals to guard place		x		
4. Exhausting systems <ul style="list-style-type: none"> - flow sensor <ul style="list-style-type: none"> • Cabinet part • Door wet part • Door dry part • Cabinet A dry part • Cabinet B dry part - test smoke - functions 15 % LEL 		x		
5. Leakage system <ul style="list-style-type: none"> - basis wet part - pump wet part - stirrer tank wet part - stream distributor dry part 		x		
6. Polyol / C5 tank <ul style="list-style-type: none"> - Super max - N₂-min - safety thermostat 		x		- Remark not function coupled with Easy Froth because two automatic valves at incoming pipe
7. Door monitoring wet part / dry part		x		



Plant/component	Measuring result	Conforming to safety strategy		Remarks
		yes	no	
8. Fire fighting system <ul style="list-style-type: none"> - Thermo sticks - Sprinkler system 		x	x	- see chapter 5.4.4
9. Increase of alarm levels <ul style="list-style-type: none"> - increase from 3rd to 2nd level alarm - increase from 2nd to 1st level alarm 		x		
10. N ₂ -inertisation of cabinet and doors <ul style="list-style-type: none"> - N₂-pressure monitoring - N₂-flow monitoring - quality of inertisation 		x		
B) Measurements				
1. Electrical resistance of floor (conductivity) <ul style="list-style-type: none"> - 1.00 m surrounding of foaming machine - dry part 	<p style="text-align: center;">< 1 kohm</p> <p style="text-align: center;">4 - 15 kohm</p>	x		- the resistance was too high therefore an aluminium plate has to be placed before the wet part-cabin
2. Ground/earth resistance <ul style="list-style-type: none"> - earth resistance <ul style="list-style-type: none"> • earth system • lightning protection (ventilation system) - Potential equalisation <ul style="list-style-type: none"> • foaming machines • dry part plants • jigs • mixing heads 	<p style="text-align: center;">0.5 ohm</p> <p style="text-align: center;">0.5 ohm</p> <p style="text-align: center;">≤ 0.3 ohm</p> <p style="text-align: center;">≤ 0.3 ohm</p> <p style="text-align: center;">0.3 ohm</p> <p style="text-align: center;">0.3 ohm</p>	x		- grounded bars are mounted on the window
3. Electrostatic field strength <ul style="list-style-type: none"> - enclosure of foaming machines - window of the dry part - Insulation of tank, pipes etc. 	<p style="text-align: center;">0 kv/m</p> <p style="text-align: center;">0 kv/m</p> <p style="text-align: center;">0 kv/m</p>	x		
4. Electrical circuits / control panels <ul style="list-style-type: none"> - insulation resistance - over current protection 	<p style="text-align: center;">≥ 30 mega ohm</p> <p style="text-align: center;">o.k.</p>	x		



Plant/component	Measuring result	Conforming to safety strategy		Remarks
		yes	no	
5. Exhausting system				
- Fan cabinet area	- speed 1: 18 m/s	x		
	- speed 2: 24 m/s	x		
- Fan door area	- speed 1: 15 m/s	x		
	- speed 2: 20 m/s	x		
6. Inertisation				
- Flushing time	- automatic calculated	x		- depend in amount of foam
- O ₂ concentration	- 2,9 %	x		- < 11,7 %

5.4.4 Detected deficiencies and required actions

- Cabinet line A + B and Door plant
 - Foaming machine (wet part)
 - Cabinet plants A + B and Door plant (dry part)

	Responsible	
	BO	XI
1. <u>Remark</u>		
<p>The most deficiencies detected at the inspection has been solved by Bono/Cannon and Xing Xing company during the inspection time.</p> <p>The solutions were controlled by the TÜV experts at the last day of the inspection on site.</p> <p>It was stated by Bono and Eletrofrío that the deficiencies mentioned in the draft report are solved.</p> <p>That the deficiencies are solved were confirmed with letter of 23 November 2000.</p>		
2. <u>Cabinet line B - dry part</u>		
2.1 Fire fighting system: The thermostick No. Fx 207 did not function A repair or an exchange is necessary.	confirmed	

		Responsible BO = Bono/Cannon XI = Xing Xing	
		BO	XI
3.	<u>Cabinet line A-dry part</u>		
3.1	Gas monitoring system: The gas sensor No. AE 214 did not function. A repair or an exchange is necessary.	confirmed	
4.	Pipe to A 100 and A 40 According to drawing of Bono the support must be each 3 m, in reality is each 6 m. Bono has to make the calculation again and sent the results to TÜV.	Transmitted x	
5.	Floor behind A 40 The hole in the floor behind the A 40 which leads to the water train system must be closed.	confirmed	
6.	<u>General matters / required measures</u>		
6.1	Safety organisation Following documentation about the organisation of safety related aspects must be available: a) The organisation in case of alarms (1 st / 2 nd / 3 rd): The behaviour of the operators, workers, guards, technicians must be fixed and organised. b) The organisation for regularly safety checks, inspections and training	confirmed confirmed	
6.2	Pentane marking on the refrigerators Refrigerators with pentane in the foam must have a marking where the use of pentane as blowing agent is recognisable.	confirmed	



6. Safety relevant working conditions of the pentane foaming plants

6.1 Organisational requests

To run these plants in safe conditions following safety requirements are essential:

- All parts of the machine documentation and operator instructions must be followed
- The safety checks must be done regularly.

The results of the checks must be recorded.

The management must follow the pending points

- The management, team leader and technicians which are in charge of the plants must be educated regularly by experienced people.

6.2 Change of units of the plant

Before units or parts of the plants related to safety will be changed experienced people must be consulted.

This must be people of the supplier of the machines related to the process and the signed experts related to the safety.

6.3 Regularly inspections

6.3.1 General requirements

According to the safety strategy regularly safety inspections, maintenance and function tests must be done.

The aim is to keep the safety related to water protection, fire and explosions on the highest level and run the plants according to the state of the art.

The work must be done by internal experienced technicians (competent people) and by the signed TÜV experts.

Definitions:

Competent people (CP)

Experienced people must have a special education of the plant and of the safety issues.

The people should get a appointment to this particular work by the management.



Experts

The experts are experienced in this field. They have additional the knowledge of a lot of different plants and also of the accidents who happened. They are independent and have a special approval by the government.

6.3.2 Safety relevant checks, organisation and education

The relevant works, which are listed in the following table must be done:

No	Plant	Kind of check	Qualification	Check time
1	Foam plant complete	Visual check	CP	daily
2	Foam plant complete	technical maintenance	CP	monthly
3	Safety equipment e.g. Pentan control system, ventilation, grounding system, fire detection/fighting system, warning signs	visual check	CP	monthly
4	Safety equipment E.G. gasalarm system, Inertisation, Battery supply	technical inspection	CP	monthly
5	Gasalarm system	calibration of sensors	CP	each 6 month
6	Foamplant complete and relevant surrounding	- visual check - function check	CP	yearly
7	Organisation - Records of check - training of people - Records of changes	check the documents	CP Management	yearly
8	Training	theoretically and practically	CP or Experts	yearly
9	Foamplant complete	check of all safety relevant aspects	Experts	each 3 year
10	Essential changes of the foaming plant or safety parts	check of all safety relevant aspects	Experts	before run the plant again



6.4 Incidents / accidents

In case of special incidents and especially accidents (fire, explosion, human accident) the signed experts must be informed immediately.

6.5 Regularly information's

The carried out inspection is valid maximum till August 2003.

During this time the supervision by the experts will be realised as follow:

- The experts get the yearly record of the internal competent people (CP's) of Xing Xing
- Information about the training of the CP's must be available.
- The experts can visit the factory at any time (e.g. on request of UNIDO)

6.6 Validity of the Certificate

The certificate is only valid in case:

- Xing Xing factory fulfilled all safety requirements.
- Runs the factory on the highest safety level according to the state of the art
- Runs the plants only with the installed safety equipment
- All requests, mentioned in this report are fulfilled.



7. Conclusion

7.1 Safety aspects for the pentane storaging and foaming plants:

b) Handling of the deficiencies

1. The TÜV Süddeutschland, branch Ulm, got a report with the confirmations about the solved deficiencies signed by XingXing and Cannon Fare East and Bono Sistemi.
2. The mentioned list is complete, therefore TÜV-experts issue the certificate.

7.2 Summary of the TÜV inspection

The technical safety requests, regarding the safety strategy for c5-plants are fulfilled.

The signed TÜV-experts have no safety related doubts concerning the process with the pentane-plants.

The safety against danger of fire and explosion because of using c-Pentane has been reduced to a possible minimum.

7.3 Remarks together with the issue of the certificate

The inspection of the installation of the related plants of UNIDO Project took place from 29th July 2000 - 3rd August 2000.

The Xing Xing Company will be allowed to hold a safety certificate for the related plants. The Certificate is only valid if Xing Xing will fulfil all requirements mentioned in this report.

The next regular safety inspection carried out by experts must be done till end of August 2003.

This Certificate will be valid till August 2003.

The experts

signed

K-J Richardt

signed

E. Mack

