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*for a sustainable future*

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**TOGETHER**  
*for a sustainable future*

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
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tables

<b>Cannon</b> polyuretane technology	DOC N.	CR98/103
	Object	Phasing out of CFC's at MEE
	Contract	UNIDO N. 97/097

## COMMISSIONING REPORT

### RETROFITTING OF THE REFRIGERATOR CABINET AND DOOR FOAMING PLANTS FOR THE REPLACEMENT OF CFC WITH CYCLOPENTANE AS BLOWING AGENT

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C					
B					
A	04/12/98	FIRST ISSUE	M. BARALE		
Rev.	Date	Description	Prepared	Controll	Approv.

<b>Cannon</b> polyuretane technology	DOC N.	CR98/103
	Object	Phasing out of CFC's at MEE
	Contract	UNIDO N. 97/097

## 1. INTRODUCTION

After the installation phase ,completed in July 1998 and after the TUV inspections, carried out in July and October, the Contractor has performed the Commissioning, Start-up , Test run and Training on the job phases of the modified plant in accordance with the contract n. 97/097 .

On November 28th all the above mentioned phases have been completed

Here below it is briefly summarised the work performed under the Contract up to the Commissioning completion.

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

- **Cyclopentane storage tank area**
- **Wet area**
- **Process fluid connection piping between wet and dry area**
- **Cabinets /doors foaming area**

<b>Cannon</b> polyuretane technology	DOC N.	CR98/103
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## 2. CYCLOPENTANE STORAGE TANK AREA

- Installation of the C5 storage tank, assembly of the accessory parts and connection of the electrical / pneumatic parts
- Assembly of the C5 piping between C5 storage tank and the the wet area
- Pneumatic and Electric circuit check
- Grounding check
- Flushing of the tank and the piping with nitrogen
- Pressure test of the C5 piping
- Check of the operating sequences ( blank test on work/filling/depressurization cycles)
- Filling the tank with cyclopentane
- Tank pressurization

<b>Cannon</b> polyuretane technology	DOC N.	CR98/103
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### 3 WET AREA

- Installation of the cyclopentane/polyol premix and dosing unit.
- Installation of the fan over the box of the premix / dosing unit.
- Installation of the gas sensors.
- Installation of the isocyanate dosing unit
- Assembly of the accessory parts and connection of the electrical and pneumatic part.
- Connection of the machines with the mixing heads (see point n.4).
- Pneumatic and electric circuit check.
- Hydraulic circuit check
- Grounding check.
- Settings of start-up parameters ( temperature, pressure etc.)
- Operating test : blank test on machine and safeties
- Filling the tanks
- Service simulation test ( dry cycle)
- Pumps adjusting and checking
- Turning on the machine

<b>Cannon</b> polyuretane technology	DOC N.	CR98/103
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#### 4. PROCESS FLUID CONNECTION PIPING BETWEEN WET AND DRY AREA

- Installation of the poliol/isocyanate/oil /nitrogen piping
- Flushing of the piping with nitrogen
- Pressure test of the piping
- Operating test

<b>Cannon</b> polyuretane technology	DOC N.	CR98/103
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## 5. CABINET/DOOR FOAMING AREA

- Installation of the foaming heads, assembly of the accessory parts and connection of the electrical / pneumatic parts
- Installation of the fans
- Installation of the gas sensors
- Pneumatic, electric and hydraulic circuit check
- Grounding check
- Ventilation circuit check
- Gas detection circuit check
- Setting of start-up parameters
- Operating test: blank test on heads, foaming fixtures and safeties
- Preparation for the start-up
- Pouring preparation of the machine
- Foam quality check (realised by positioning a bag under the outlets of the mixing heads): cream time , gel time, touch time and free density check
- Performance tests: Pouring cycle, cabinet and doors production, quality check of the foamed cabinet/door.

<b>Cannon</b> polyuretane technology	DOC N.	CR98/103
	Object	Phasing out of CFC's at MEE
	Contract	UNIDO N. 97/097

## 6. RESULTS

**The commissioning and performance tests have been successful and have met the requirements of the Contract and of the Counterpart**



# CANNON

polyurethane technology

**GROUP**

energy & ecology

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DATE: 28/11/98

COMMISSIONING ACCEPTANCE OF UNIDO PROJECT NO:97/097

SUPPLIER: CANNON BONO SISTEMI S.P.A.

BY THIS DOCUMENT MEE ACKNOWLEDGE THAT CANNON BONO SISTEMI S.P.A. HAS SATISFACTORILY COMPLETED THE COMMISSIONING CONCERNING MEETERING UNIT AND SAFETY DIVICES. FOR TOTAL ACCEPTANCE OF THE PROJECT NO:97/097 BY MEE, MUST BE SOLVED THE FOLLOWING POINTS:-

- 1\* NYTROGEN GENERATOR FAILURE (DEVOTRA SUPLIES)
- 2\* EMERGENCY POWER GENERATOR HAS TO BE INSTALLED AND RUN BY MEE. (ALREBY DONE ON 28TH NOVEMBER)

NOTE:- CANNON HAS TO SUPPLY ONE SUITABLE PNEUMATIC PUMP FOR CYCLOPENTANE AND ONE INFRARED GAS SENSOR DAMAGED DURING START UP.

MEE

CANNON BONO SISTEMI

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## Jordan Projects NRC and MEC

Dear Mr. Malayeri,

attached I send to your information the Final Commission-lists

- NRC-JO/03/98 Revision 2 and

- MEC-JO/03/98 Revision 2

from our inspections made for Cannon Afros/Bono Sistemi.

The X for the responsibilities are mostly agreed during our inspections with both parties. Some pending points could not be agreed with both parties because the reports were not finish during the inspection. So take this only as a help or suggest but it is not our business to fix this finally.

Cannon Afros / Bono Sistemi has done a good job, that stands for the plant and for the documentation and therefore in our opinion an additional inspection to test the last pending points is not necessary.

To close these matters finally the last pending points in the Commission lists must be realised as soon as possible and confirmed by Bone Sistemi in agreement with the companies.

After we got that confirmation we will issue one certificate for each factory.

Thank you very much for your cooperation.

With kind regards

K-J Richardt

### Final Commission-List on Technical Plant Inspections and Evaluations

#### Middle East Electrical Industries, Jordan

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Ulm, 16.12.1998

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File No. MEC-JO/03/98

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**Plant Location:** Middle East Complex  
Amman Industrial City  
JORDAN

**Responsible / Experts:** Richardt, Karl-Josef TÜV-AW  
Berger, Hans-Joachim TÜV-BT-E  
Companygroup TÜV Süddeutschland

**Project** UNIDO Contract No. 97 / 097 with BONO SISTEMI  
Order No.: 98 024 3220-2 and 98 025 3126

**Dates:** July 1998  
- Plant inspections and evaluations on location  
Oktober 1998  
- Final Plant inspections and evaluations on location  
August 1998  
- Preparation of commission list  
- Meeting on Bono Sistemi  
October 1998  
- Preparation of final commission list

**Participants on location:** - Mrs. Barale - Bono Sistemi  
- Mr. Pulici - Cannon Afros  
- Mr. Guerra - Cannon Afros  
- Mr. Khalili - MEC  
- Mr. Thabbat - MEC  
- Mr. Ghandour - MEC

	Responsible		Remark (October 1998)
	Bon	MEC	
<p><b>0 Preliminary Remarks</b></p> <p>Following commission list is the result of the inspection of July 1998 and has been updated after the final inspection of October 1998</p>			
<p><b>1.1 Unloading station / pentane storage tank</b></p>			
<p><b>1.1 Unloading station</b></p>			
<p><b>1.1.1 Basin</b></p> <p>The place where the drums will be unloaded must be constructed as follows:</p>			
<p>a) The place must be designed as a basin with a capacity of min 0.2 m<sup>3</sup>.</p>	-	- x	<p>Has been done          The metal grill will be putted in a frame of steel profile.          So the basin can be cleaned at any time.</p>
<p>b) The floor must be tight against pentane (concrete), cracks must be less than 0,1 mm wide.</p>		x	<p>little cracks in the corner of the basin must be sealed.</p>
<p>c) Drain trays for rain water are not existing inside the basin.</p>	-	-	

	Responsible		Remark (October 1998)
	Bon	MEC	
<b>1.1.2 Filling Pump</b>			
a) The existing pump needs a suitable connection to the drum		X	MEC got a drawing from Bono must be done
b) The pump must be included in the switch-off-system of max. and supermax level	-	-	Has been done
c) The clamp for earthing the drums is still missing. The existing clamp is only suitable with the particular drum	-	-	Has been done
d) The flexible filling pipe and gas return line are still missing		X	the filling line is suitable but the flexible gas return line is not suitable A new gas return line is needed and must be accepted by TÜV
e) The connection from the filling pipe and the gas return line must be different.	-	-	Has been done
<b>1.2 Pentane storage tanks</b>			
<b>1.2.1 Basin</b>			
a) The cables of the earthing system must be fixed finally.	-	-	Has been done
<b>1.2.2. Tank</b>			
a) The tank must be fixed on the floor	-	-	Has been done
b) The correct tank plate is still missing		X	was shipped by Bono Must be fixed by MEC

	Responsible		Remark (October 1998)
	Bon	MEC	
<b>1.2.3 Pipe</b>			
a) - the valve (automatic fire safe valve) in the pipe before the building is a return spring valve. It must be fail safe.	-	-	Has been done
- The valve should be protected against high temperature of sunshine	-	-	Has been done
- For a final evaluation concerning leakage proof the specification is necessary	-	-	Has been done
- The pressure test and test of tightness must be confirmed	X		must be done
b) The c-5 line must be protected against rust		X	must be done
c) The valve in the c-5 line to empty the pipe, must be installed over the basin.		X	Has been done but the pipe must be closed by a blind screw
<b>1.2.4 Roof</b>			
a) The roof for the c-5 tank and for the control panel must be in that way that the tank and the panel are protected against the direct sunshine.	-	-	Has been done for the control panel
		X	must be done for the tank (in east direction)
<b>1.2.5 a) 5 m around the tank no flammable material must be stored</b>		X	must be done
<b>1.2.5 Labels:</b>			
All electrical and mechanical devices must be marked according to the drawing.	-	-	Has been done The area will be marked

**1.2.6 Control panel**

- a) The current supply for the control panel should come from the alarm panel, otherwise a over-voltage protection for this panel is necessary.
- b) The electrical devices must be identified in accordance with the plans.
- c) The hand-/ automatic-switches of the pneumatic valves must be secured against unauthorised handling. The switch must be covered additional and a following label is necessary:  
 „Attention, safety equipment. Changes are only allowed by authorised persons.
- d) lamp test

**1.2.7 Emergency switch**

The emergency switch must be installed inside the C-5 area.

Responsible		Remark (October 1998)
Bon	MEC	
-	-	An overvoltage protection has been installed
-	-	Has been done
-	-	an special cover has been installed
X		A system to check the signal lamps will be installed
X		An electrical system using an EEx-i-barriere must be installed Functions will be the same as for all emergency switches (1 <sup>st</sup> level) Signal will go to safety panel and from there to remote panel

	Responsible		Remark (October 1998)
	Bon	MEC	
<b>1.3 Fire fighting / detection system</b>			
a) A new pump for the water supply system will be installed		X	The installation was not ready The pump and system in general are suitable but must be checked by MEC finally
b) The deliver pump will get a connection with the backup generator.		X	
c) The pump of the sprinkler system will be tested each week.		x	must be done
d) For water supply the existing watertank will be used.	-	-	
f) Signal transmission The signal of the fire detection system must be transmitted to the safety control panel and to the remote panel in the guard room (presently not existing) All necessary safety related functions must be connected.	x		The remote panel has been installed. After the installation of the fire detection system the signal must be transmitted to the safety panel and from there to the remote panel.
<b>1.4. Organisation</b>			
a) The operator instruction of the unloading process is missing		x	must be done
b) The warning signs(Ex-area, no smoking, inflammable liquid, c-5-safety datasheet)		x	must be done
c) The operator instructions of the handling for the empty drums is missing		x	must be done
<b>1.5 Grounding system</b>			
a) The cables of the earthing system must be fixed finally.	-	-	has been done
b) The c-5 pipe must be earthed each 20 m	-	-	has been done



**2 Wet-part for door and cabinet**

**2.1 Equipment**

a) High pressure pump

Following proof according to high pressure is necessary:

How much is the max. pressure of the pump?

The pump hasn't inside a overflow valve to limit the pressure?

Remark: The pressure gauge after the high pressure pump is adjustable till 400 bar. The system is designed for max 300 bar.

b) Pipe

The valve in the c-5 line in front of the wetpart enclosure must be removed.

c) Control panel

The wires and clamps of the EEx-i electric circuits are not installed separately from the other wires.

The wire will be installed in a separate channel or protection pipe which are marked

d) Thermostat

The thermostat of the tank-heater must get a safety label with hte set point.

e) Penta twin

The valve in the outgoing pipe of the daytank must be fail safe.( presently it is used for both direction by air)

Responsible		
Bon	MEC	Remark (October 1998)
		The pressure gauge is only adjustable till 300 bar (inside a stoppage has been installed)
x		A label with the setpoint will be fixed during the start up.
	X	The operator will get instructions about the system
-	-	has been done
X		must be done
X		The setpoint will marked
-	-	has been done

**2.2 Enclosure**

b) Electrostatic

The transparent plastic material can get a too high electrostatic charge (plain window: 350KV/m; ripped window: >3000 KV/m)

Suggest: On the inner side of the windows should be mounted a grounded metal screen.

c) Remark

Hight of enclosure

The uper parts of the devices are bad accessible to maintenance and regularly checks.

**2.3 Pentan emergency push button**

In the wet part area should be installed a pentan emergency push button.

**2.4** On the junction box outside the enclosure the number according the drawing is missing.

Responsible		
Bon	MEC	Remark (October 1998)
-	-	Has been done
-	-	Is acceptable but must be changed for further projects
-	-	has been done
X		

	Responsible		Remark (October 1998)
	Bon	MEC	
<b>3. Dry Part</b>			
<b>3.1 General</b>			
a) Electrical resistance of the floor	-	-	The results of the measurements are > 10 <sup>9</sup> Ohm
b) Enclosure The transparent plasticmaterial can get a too high electrostatic charge (window: >2000 KV/m;)			
Suggest: On the inner side of the windows should be mounted a grounded metal screen or it must divided in little parts	-	-	has been done
c) Junction boxes On the junction boxes the numbers according the drawing are missing.	X		must be done
<b>3.2. Heating system</b> Has not been installed		X	is installed but: The first thermostat is adjustable till 400°C . It must be blocked below 100°C (working temperatur). The second thermostat must be a safety thermostat (In case of a function the system must be reseted). The system must be switch off the heating system when the temperatur reded 100 °C. The safety thermostat must switch off the heating system direct via the main switch of the heating system. The installation must be done in a professional way.

**4. Safety panel**

- a) Type plate  
 The typplate of the panelmaker is missing
- b) Overvoltage  
 No overvoltage protection has been provided.
- c) Batterie  
 The capacity of the batterie is dimentioned approximately for 10 min.  
 This is only possible when the normal power supply for the safety panel is interrupt und in this case the backup generator starts automatically.  
 The type plate of the battery is missing.  
 (Capacity, data of first charging, type)  
 The battery charging device presently isn't in function.
- e) The electrical drawing must be brought up to date.
- f) Transformer T 40 and 24-DC  
 The minus-wire of the secondary circuit is not grounded.
- g) Gasmonitoring  
 The center of the gasalarm system has not been labeled concerning the sensor position.
- h) Pilz safety relais  
 On the clamp with the ground sign has no ground wire connected. (Final evaluation after documentation is available)

Responsible		
Bon	MEC	Remark (October 1998)
X		is available but must be fasten
-	-	has been done
	X	The designed system is correct, but the backup generator was not installed because the electrical panel was not available.
-	-	is available
X		must be done, latest direct after the start up
-	-	has been done
-	-	has be done
-	-	DC has been used according to the documentation the installation is correct

	Responsible		Remark (October 1998)
	Bon	MEC	
i) <b>Timer relais</b> The setpoints of the relais of alarmlevel increasing must be documented and marked.	X		All time relais must be marked during the start up.
j) <b>Alarm defination</b> The color and the sound of the different alarm-levels have to be defined and marked on a board near the safety panel.	X		Must been done
k) For some connections clams the numers according the drawing are missing.	-	-	has been done
l) For the acoustic alarm signal (sirene, horn) should have a possibility for reset.	-	-	has been done

**5. Ventilation**

a) Flow sensor

The different pressure for all flowswitches must be measured. According to the result the right spring must be installed and the system has to be adjusted. The result must be documented. All flow switches must be marked according the electrical diagram.

b) Earthing

The ducts must get a ground connections to the metal construction of the building near the roof (lighthing protection).

c) Compensators

The compensators between the ducts must be bringed with wires.

d) The flow switches must get a number according the drawing.

e) The short flexible pipes between ducts and flow switch must be removed

	Responsible		Remark (October 1998)
	Bon	MEC	
a) Flow sensor The different pressure for all flowswitches must be measured. According to the result the right spring must be installed and the system has to be adjusted. The result must be documented. All flow switches must be marked according the electrical diagram.	-	-	has been done
b) Earthing The ducts must get a ground connections to the metal construction of the building near the roof (lighthing protection).	-	-	has been done
c) Compensators The compensators between the ducts must be bringed with wires.		X	must be done
d) The flow switches must get a number according the drawing.	-	-	has been marked
e) The short flexible pipes between ducts and flow switch must be removed	X		The pipes must be in an way that the operator and maintenance people can use the way behind the enclosure without the danger to destroy the pipes.

**6. Inertisation**

- a) Remark: The Nitrogen generator is not functioning.
- b) After the system is finished the O<sub>2</sub>-concentration should be measured inside the cabinets.
- c) The position control sensor has not been installed.
- d) The system must be calibrated regularly. For that reason suitable plastic bags must be available.
- e) The amount of N<sub>2</sub> can be changed via the PLC

Responsible		
Bon	MEC	Remark (October 1998)
-	-	The generator was in function. The working pressure was 6 bar.
-	-	The O <sub>2</sub> concentration was during the test 3.6 %. The system can be optimised if the N <sub>2</sub> amount must be reduced.
	X	Not installed
	X	This must be done regularly.
	X	Only a special educated maintenance worker is it allowed to charge the system. A special password will be necessary.

	Responsible		Remark (October 1998)
	Bon	MEC	
<b>7. General</b>			
<b>7.1 Pentane emergency push buttons</b>			
a) The housing of the pushbuttons should not be red (according to the international standards this color will be used for fire alarm push buttons) Housings in yellow color and additional marking „Pentane Emergency“ is recommended.	-	-	has been changed to yellow
<b>7.2 EEx-i cables</b>			
a) Cables of EEx-i and not EEx-i-circuits are used with blue color. A differentiation is therefore not possible. Following solutions can be recommended:  - Using of blue cables only for EEx-i circuits - Using of normal cables inside a particular cable tray. This cable tray must be marked (EEx-i) along the whole way.	X		This will be done
<b>7.3 Back up-generator</b>			
a) The generator is not available.		X	The electrical panel of the generator is not available
b) A signal of a defect of the generator plant must be transmitted to the remote panel inside the security room. (presently not available)			
c) The safety panel will be connected direct to the generator and the generator connected to the company line.  This interjection line will get separate fuses.		X	This must be finish before the start up.



**7.4 N2-Generator**

The Generator wasn't in good function.

**7.5 Fire fighting system**

In the areas of the wetpart and drypart automatic  
 smokesensors will be installed.  
 Sprinklersystem in the c-5 storage area.

Responsible		Remark (October 1998)
Bon	MEC	
-	X	<p>The generator was in good function but it reached only 9 bar. The safety valves of the pressure vessels for the air and for the N<sub>2</sub> must relief the vessel according to the designed pressure of the vessel.</p> <p>The relief valve opened if the pressure reached 19 bar instead of 16 bar.</p> <p>The N<sub>2</sub>-vessel has not been tested because the pressure of 11 bar are not reached by the N2-Generator.</p> <p>The setpoints of the relief valves must be marked and regularly tested.</p>
	X	<p>It will be checked whether it is possible to make a connection between the existing fire detection system and the safety panel. In case this connection is not possible the new fire detection system will be connected direct to the safety panel and produce a 1<sup>st</sup> level Alarm.</p> <p>In the existing situation also thermosensors can be used which are explosion proof. Inside the control panel a contact is available for this function.</p>

**7.6 Marking / Covering**

a) Pipes

The pipes must be marked according to the materials which are inside (Color, flow direction)

b) Pressure Gauges

The min and max setpoints must be marked

c) Timer relais

The setpoints must be marked.

d) Pressure air valve

The manuell switch to change the position must be covered and marked.

e) Thermostat

The setpoint must be marked

**7.7 Remote panel in security room**

a) is presently not available

**7.8 Signs on the plant**

Following signs should be available:

- Emergency exit
- Fire- and Explosions danger
- Safety data sheets of the Pentan, Polyol and Isocyanate must be available on the plant.

**7.9 Refrigerator**

The refrigerator must be signed an the back with „pentane“.

Responsible		Remark (October 1998)
Bon	MEC	
	X	work must be done complete
X		will be during start up
X		will be done during start up
X		Has been done
X		Must be done
-	-	it is realised
	X	Must be done
	X	Must be done

	Responsible		Remark (October 1998)
	Bon	MEC	
<b>7.10 Earthing system</b>			
Connections with large metal structures (e.g. gas lines, water lines, building structures) are required for a good potential equalisation it's recommended to use bars to the connection of these cables.		X	This is valid for all parts of the plants, also for the compressors and nitrogen generator
<b>8. Documentation</b>			
<b>8.1 Inertisation</b>			
a) The certificate about the safety relief valve on the vessel is missing.	-	-	is available
b) The specification of the position control system of the mixing head (maker : Elobau) has to be available.	-	-	is available
<b>8.4 Gasalarmssystem</b>			
a) Calibration report for the gas sensors has to be submitted	-	-	is available calibration must be done continuously
<b>8.5 Measurements and Protocols</b>			
a) Test and measuring reports for the electrical equipment in accordance with IEC 204-1	X	-	Must be confirmed

**8.6 Safety-related organization**

a) The operators and the personnel responsible for maintenance must be well trained in the plant technology of Bono Sistemi, proof of regular training must be provided.

b) An instruction manual must be provided for the operator and the maintenance personnel; maintenance equipment (e.g. antistatic clothes, tools, personal safety equipment) must be suitable for pentane.

c) A safety function matrix must be prepared; all safety-relevant functions must be tested and documented by well and regularly trained personnel (at least once a year) in accordance with this checklist.

d) A coordination between the company and the official authorities (fire brigade, civil defense) is necessary; the results must be documented.

e) For emergencies, an alarm plan must exist which has been coordinated with the fire brigade and the civil defense authority.

Function matrix of all safety-related functions and report showing that all functional tests have been performed

Responsible		
Bon	MEC	Remark (October 1998)
X	X	Will be done during start up
X	X	At last till start up
X	X	During start up
-	-	according to MEC no special demands are required
	X	The plan is also important for the guard in case he get a signal on the remote panel

**9. General**

a) The following documents must still be finalized:  
 Wiring diagrams must be updated

**10. Conclusion**

The facilities for pentane operation had not yet been completed at the time of the TÜV audits. Overall, the safety concept agrees with the TÜV safety strategy.

A complete audit of all safety-related aspects (such as inerting, ventilation after completion of the enclosures) was not yet possible.

In the opinion of the TÜV experts, it would be safe to start trial operation with pentane after completion of the various measures stipulated in this Commission List and all work still to be completed on the facilities.

Pentane trial operation means that in the 1st phase the plant may only be operated under the supervision of experts and that in the 2nd phase operation must be constantly monitored by specially trained personnel.

Responsible		Remark (October 1998)
Bon	MEC	
X	X	Must be done
X	X	<p>The most important safety equipment has been installed and tested.</p> <p>All mentioned demands in this report must be fulfilled till the start up.</p> <p>After the start up the completion of all demands of this report has to be confirmed by Bono and MEC in a written letter to TÜV.</p> <p>In case all demands are fulfilled a certificate can be issued.</p>

The TÜV experts

  
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