M3 – INDUSTRY – PRECISION - ENGINEERED HOMES

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Content

Part I Report for 5stargreen Building Technolgies (BTT) HML Trust

Part II Annexes

Part III Drawings

Whole Plant

System	Drawing Number	Subsystem
General-	000 00 - 001	GENERAL FLOW SHEET
Information	000 - 00 - 101	GENERAL LAYOUT
	000 - 00 - 102	PERSONNEL & RELAY ROOMS
	000 - 00 - 103	SAFETY CONCEPT
	000 - 00 - 104	OUTSIDE LINES
	000 - 00 - 201	ROOF TOP VIEW
	000 - 00 - 301	LONGITUDINAL SECTION BUILDING A
	000 - 00 - 302	LONGITUDINAL SECTION BUILDING B
	000 - 00 - 303	CROSS SECTION BUILDING B, C, D & E
	000 - 00 - 304	LONGITUDINAL SECTION BUILDING C
	000 - 00 - 305	LONGITUDINAL SECTION BUILDING E

Building A

System	Drawing Number	Subsystem
Building-	000 - A0 - 401	ELEVATIONS
Drawings	000 - A1 - 101	PLAN AT LEVEL ± 0,00
	000 - A1 - 102	PLAN AT LEVEL + 4,60
	000 - A1 - 301	SECTIONS 1-1,2-2,3-3,4-4 AND 5-5
	000 - A2 - 101	PLAN AT LEVEL ± 0,00
	000 - A2 - 102	PLAN AT LEVEL + 4,60
	000 - A2 - 103	PLAN AT LEVEL + 9,00, 14,00 AND + 20,00
	000 - A2 - 301	SECTIONS 1-1,2-2,3-3, 4-4 AND 5-5
Waste Water	040 - A0 - 001	CLARIFICATION PLAN-FLOW SHEET
	040 - A1 - 101	PLAN AT LEVEL ± 0,00
	040 - A1 - 102	PLAN AT LEVEL + 4,60
	040 - A2 - 101	PLAN AT LEVEL ± 0,00
	040 - A2 - 102	PLAN AT LEVEL + 4,60

Building A

System	Drawing Number	Subsystem
Potable Water	050 - A0 - 000	FLOW SHEET
Water	050 - A1 - 101	PLAN AT LEVEL ± 0,00
	050 - A1 - 102	PLAN AT LEVEL + 4,60
	050 - A2 - 101	PLAN AT LEVEL ± 0,00
	050 - A2 - 102	PLAN AT LEVEL + 4,60
	050 - A2 - 103	PLAN AT LEVEL + 9,00 AND +14,00
Industrial Water	051 - A0 - 000	FLOW SHEET
Fire Fighting	052 - A0 - 000	FLOW SHEET
Ventilation	060 - A0 - 001	IS0 - CHART
	060 - A1 - 102	PLAN AT LEVEL + 4,60
	060 - A1 - 301	SECTION 1-1, 2-2, 3-3, 4-4, AND 5-5
	060 - A2 - 102	PLAN AT LEVEL + 4,60
	060 - A2 - 103	PLAN AT LEVEL + 9,00 AND + 14,00
	060 - A2 - 301	SECTION 1-1, 2-2, 3-3, 4-4, AND 5-5
Compressed Air	070 - A0 - 000	FLOW SHEET
	070 - A1 - 101	PLAN AT LEVEL ± 0,00
	070 - A1 - 102	PLAN AT LEVEL + 4,60
	070 - A2 - 101	PLAN AT LEVEL ± 0,00
	070 - A2 - 102	PLAN AT LEVEL + 4,60
	070 - A2 - 103	PLAN AT LEVEL + 9,00 AND + 14,00

BUILDING B

System	Drawing Number	Subsystem
Building-Drawings	000 - B0 - 401	ELEVATIONS
	000 - B1 - 101	PLAN BASEMENT
	000 - B1 - 102	PLAN AT LEVEL ± 0,00
	000 - B1 - 103	PLAN AT LEVEL + 8,00
	000 - B1 - 301	SECTIONS 1-1,2-2 AND 3-3,
	000 - B2 - 101	PLAN BASEMENT
	000 - B2 - 102	PLAN AT LEVEL ± 0,00
	000 - B2 - 103	PLAN AT LEVEL + 6,00
	000 - B2 - 104	HORIZONTAL SECTION AT LEVEL + 12,00, + 16,00, + 19,00 AND + 30,00
	000 - B2 - 301	SECTIONS 1-1,2-2 AND 3-3
Waste Water	040 - B1 - 101	PLAN BASEMENT
	040 - B1 - 102	PLAN AT LEVEL ± 0,00
	040 - B1 - 103	PLAN AT LEVEL + 8,00
	040 - B2 - 102	PLAN AT LEVEL ± 0,00
	040 - B2 - 103	PLAN AT LEVEL + 6,00
	040 - B2 - 104	HORIZONTAL SECTION AT LEVEL +12,00, +16,00, + 19,00 AND + 30,00
Potable Water Water	050 - B0 - 000	FLOW SHEET
	050 - B1 - 101	PLAN BASEMENT
	050 - B1 - 102	PLAN AT LEVEL ± 0,00
	050 - B1 - 103	PLAN AT LEVEL + 8,00
	050 - B2 - 102	PLAN AT LEVEL ± 0,00
	050 - B2 - 103	PLAN AT LEVEL + 6,00
	050 - B2 - 104	HORIZONTAL SECTION AT LEVEL +12,00, +16,00, + 19,00 AND + 30,00
Industrial Water	051 - B0 - 000	FLOW SHEET
Fire Fighting	052 - B0 - 000	FLOW SHEET

BUILDING B

System	Drawing Number	Subsystem
Cooling & Heating Fluids	054 - B0 - 001	FLOW SHEET
	054 - B0 – 002	FLOW SHEET
	054 - B1 - 101	PLAN BASEMENT
	054 - B1 - 103	PLAN AT LEVEL + 8,00
	054 - B2 - 103	PLAN AT LEVEL + 6,00
	054 - B2 - 104	HORIZONTAL SECTION AT LEVEL +12,00, +16,00, + 19,00 AND + 30,00
Ventilation	060 - B1 - 001	FLOW SHEET
	060 - B1 - 103	PLAN AT LEVEL + 8,00
	060 - B1 - 301	SECTION 1-1, 2-2
	060 - B2 - 001	FLOW SHEET
	060 - B2 - 104	PLAN AT LEVEL + 12,00, +16,00, +19,00, +30,00
	060 - B2 - 301	SECTION 1-1, 2-2, 3-3
Compressed Air	070 - B0 - 000	FLOW SHEET
	070 - B1 - 101	PLAN BASEMENT
	070 - B1 - 102	PLAN AT LEVEL ± 0,00
	070 - B1 - 103	PLAN AT LEVEL + 8,00
	070 - B2 - 102	PLAN AT LEVEL ± 0,00
	070 - B2 - 103	PLAN AT LEVEL + 6,00
	070 - B2 - 104	HORIZONTAL SECTION AT LEVEL +12,00, +16,00, + 19,00 AND + 30,00
Methocell	095 - B2 - 001	PROCESS FLOW DIAGRAM
	095 - B2 - 104	HORIZONTAL SECTION AT LEVEL +12,00, +16,00, + 19,00 AND + 30,00

BUILDING C & D

System	Drawing Number	Subsystem
Building-Drawings	000 - CD - 401	ELEVATIONS
	000 - C1 - 101	PLAN BASEMENT
	000 - C1 - 102	PLAN AT LEVEL ± 0,00
	000 - C1 - 103	PLAN AT LEVEL + 5,50
	000 - C1 - 104	PLAN AT LEVEL + 8,00, +12,00 AND 17,50
	000 - C1 - 301	SECTIONS 1-1 AND 2-2
	000 - C2 - 101	PLAN AT LEVEL ± 0,00
	000 - C2 - 102	PLAN AT LEVEL + 3,50
	000 - C2 - 301	SECTIONS 1-1 AND 2-2
Waste Water	040 - C1 - 101	PLAN BASEMENT
	040 - C1 - 102	PLAN AT LEVEL ± 0,00
	040 - C1 - 103	PLAN AT LEVEL + 5,50
	040 - C1 - 104	HORIZONTAL SECTION AT LEVEL +8,00, +12,00 AND + 17,50
	040 - C2 - 101	PLAN AT LEVEL ± 0,00
Peroxide	090 - 00 - 001	PROCESS FLOW DIAGRAM
	090 - 00 - 101	HORIZONTAL SECTION AT LEVEL ± 0,00 AND SECTION 1-1, 2-2

BUILDING E

System	Drawing Number	Subsystem
Building-Drawings	000 - E0 - 401	ELEVATIONS
	000 - E1 - 101	PLAN AT LEVEL ± 0,00
	000 - E1 - 102	PLAN AT LEVEL + 3,50
	000 - E1 - 103	PLAN AT LEVEL + 8,00, +12,00 AND +17,50
	000 - E1 - 301	SECTION 1-1, 2-2
	000 - E2 - 101	PLAN AT LEVEL ± 0,00
Waste Water	040 - E1 - 101	PLAN AT LEVEL ± 0,00
	040 - E1 - 102	PLAN AT LEVEL + 3,50
	040 - E1 - 103	HORIZONTAL SECTION AT LEVEL +8,00, +12,00 AND + 17,50
	040 - E2 - 101	PLAN AT LEVEL ± 0,00

Pilot Plant

System	Drawing Number	Subsystem
Building-Drawings	000 - PP - 001	GENERAL LAYOUT, ALTERNATIV 1
	000 - PP - 002	GENERAL LAYOUT, ALTERNATIV 1
	000 - PP - 101	
	000 - PP - 102	

0. Foreword

0.1 Fundamental Idea

When people burn down materials or do them on a dump without any worth then one must state that the possibilities of materials use are not adequately exhausted. Usually the unsorted domestic waste is wet, thus for inflammation energy must be invested, and the energy output from the heating process is relatively low. The storing in the earth on a dump results in a loss of the benefits possibly to gain from that material.

The HML process is designed to reduce waste to its basic components and then to re-use these basic raw materials to manufacture a product entirely different in form from the original products from which they were sourced i.e. structural panels.

The idea is to use this material as a voluminous filler in building panels. For the realization of this idea a production process and a production technology have been thought and this Basic Design is for the production plant.

The attraction for HML is that they are paid to take the waste into the plant and the cost of manufacturing the product is accordingly subsidized from inception.

0.2 Drawings

For presentation of a comprehensive overview we attached general arrangement drawings to this Basic Design Report in scale 1 : 500. These drawings shall show the various systems in scale and in connection to the whole factory and the flow charts. The same scale is also used for the five (5) section drawings. We decided to use the same scale in contradiction to usual practice but to give a better understanding for the relations when seeing the enormous dimensions of these plant parts.

0.3 Report

The DBI -5stargreen BTT report shall show the attempts to prepare the first-stage documentation for the HML Plant. This is the first time when all disciplines of technology, process engineering, mechanical and electrical engineering, civil engineering and architectural design are working together for one goal: to prepare a coordinated design framework for the factory under consideration of the most important features as there are the technological process, the fulfillment of the production demand, the physical and technical arrangements, the technical and safety regulations, the environmental duties, and influence onto costs.

0.4 Missing Input

It is normal that a basic design cannot be complete and correct in all parts otherwise one must not plan and design further in the next stages. But the complementation of those important parts still missing will have remarkable influence on some plant parts. A letter fax was sent to HML Technology Ltd. dated 11.12……. and is attached as Annex 0 – 1.

0.5 Location

As this project has not yet been located onto a building place but is only a basic design for the Generic Plant, showing the necessities and possibilities of the arrangements, we will name the directions as the usual practice is according to the winds. So we name the upper side of the drawings to be the north side.

1. Overview

1.1 Production and General Flow

1.1.1 Reference Drawings

General Flowchart	000 – 00 – 001
General Layout	000 – 00 – 101
Longitudinal Section Building A	000 – 00 – 301
Longitudinal Section Building B	000 – 00 – 302
Cross Section Buildings B, C, D & E	000 – 00 – 303
Longitudinal Section Building C	000 – 00 – 304
Longitudinal Section Building E	000 – 00 – 305

1.1.2 Process Brief

Bulk waste is delivered to the plant, either by rail and also by road transport. After sorting out into several fractions shredders and hammer mills then reduce the discarded material to an adequate grain size. Parallel the material will be dried and sterilized.

Waste material is then combined with a ………. binder, a specially formulated proprietary chemical formula and water to produce integrated mortar which is extruded continuous processing belt and quick dried to produce a lightweight building modules.

This panel is then passed through a coating process to produce the end product – a lightweight but structurally strong building material with a decorative polymer coating suitable for exterior and interior building purposes.

For dispatch it is planned to pack and strap the panels to packages and loaded into containers. The low cost house laid to ground for this Basic Design bases on a system of …….. different panels, but in general it is possible to change the use of the products according to the demand.

1.2 Nominal Basic Data

Input of waste material is app. 750.000 to/year This will provide sufficient raw material to build around 70,000 houses per annum, which will have to be removed by container each house in 5 containers. This will necessitate the use of more than 350,000 containers.

1.2.1 For the house panels production:

Total quantity of binder is	app. 950.000 to/year
Total output is	app. 23,2 Mio sqm panels/year of 7,5 cm thickness average
according to	app. 1,74 Mio cbm/year

1.2.2 For the Kitchen board production:

Total quantity of paper derived from the a.m. waste stream in a moist condition is app. 45.000 to/year

Total quantity of …….. app. 220.000 to/year

Total output of board panels is appr. 230.000 cbm/year,

according to app. 23 Mio sqm/year with a thickness, average of 10 mm.

1.2.3 For the HML Plant

The total area of the factory site is in minimum 825 m x 450 m = 370.000 sqm.

1.3 Main Plant Parts

Following the flow, the HML plant consists of the production halls

A Waste delivery and sorting out

B Storage, mixing, extrusion and drying

C Machining, coating, and packing

D Dispatch

E Kitchen board factory

F Engineering workshop & spare parts store

and the auxiliary buildings, as there are e.g.

- Administration and other offices
- Weighbridges
- Suppliers' on-site spare parts storage facilities
- Container hardstand area
- Site utilities building
- Power substations
- Rail spurs and station
- In the vicinity could/should be erected
- Virgin materials manufacturing plants
- Power plant (where necessary)

1.4 Production in Building A

1.4.1 Waste Delivery and Pre -sorting

The upper edge of drawing -101 helps to understand how the delivery of the relatively great material amounts will be realized and how the finished products will be dispatched. Rail Transportation will be necessary due to the volumes of input and output that are anticipated. The 750,000 tons of waste per annum expected to be processed averages to 80 tons per hour and would require around 5 to 10 trucks per hour.

In case of greater distances between waste production and waste use a system delivery by railway makes sense. That's the reason for the railway station arrangement for waste delivery. The transport could be performed by using bulk freight wagons or – when finally developed – by waste bulk containers. Both the possibilities are shown, but for the site adaptation those versions will be deleted which are not appropriate for the site in question. Remark: Within the plant, there will be some more locations available to permit the selection of the right mode of production.

With all probability the waste will not come pre-sorted, like in central European countries where the waste is now being pre-treated in such a manner. Assumingly waste is delivered without any prior treatment or sorting, containing minor or major fully mixed portions.

The processing of this department is predominantly designed by the firm B. The material is dumped into hoppers feeding material onto an underground apron steel belt conveyor which is transporting it to Building A to the „safety station" where hazardous materials and large items will be removed mechanically near the hall´s entrance prior to being sorted by workers. Oversized material is fed to a bulk waste separator from which material is removed manually using small helping means. The bulk waste rotator separator screens and cuts material to a handable size. Some materials are foreseen to be directly delivered to the area of pre-disintegration, like green wood, dry wooden parts (old meubles a.s.o.), tyres, concrete rubble.

Delivery of waste just in the form of domestic waste will – for this mixture and receipt - be insufficient to meet the demand. Therefore additional materials will have to be received like other waste types from industrial use like old tyres, wood waste, green or dried, or construction waste, in particular concrete rubble. Special in-feed containers have been provided for these four waste types and methods elaborated for the processing of the same.

The following waste sorting lines are proposed as outlined hereinafter:

- Green wood
- dry wood
- ferrous metals
- glass
- paper
- card panel
- soft plastic
- hard plastic
- mixed man-made materials (textiles such as floor coverings, rugs, clothing, etc.)
- textiles
- Furniture
- non-ferrous metals
- concrete rubble.

Metals will be collected and handled differently; they shall be sold, for example. Materials not listed here separately are composed of domestic waste and will be hauled off to a dump.

1.4.2 Waste Sorting

As a general rule, materials are sorted in two separate areas of building A. One area will receive the waste and is handling it, while the second area does not handle any waste but will be cleaned. This will be done alternately to prevent the transmission of diseases, dangerous germs, bacteria, or spores. It will not be possible to withdraw just by mechanical means the useful materials out of unsorted waste. On the contrary, this work must be done manually. In order to protect the personnel carrying out this work from health problems the air stream must necessarily keep the persons free of any injuries to health which may be contained in the waste. Great attention has been paid to the air stream to ensure the protection of persons from such dangers. To allow for a good air stream it will be necessary to keep the flow in an undisturbed manner. Therefore the sorting area has been enclosed with a structure in accordance with German regulations. This is shown in drawing -303.

Correct sized material is transferred from the bulk separator onto dual apron feeders which separately convey it into the upper floor by horizontal conveyors and from there to the nine carousels for further handish separation. Different types of waste are fed through holes in the floor by the sorters and fall onto conveyor belts, which cater for different sorts of materials. At the end of these conveyors pre-disintegration units according to the kind of the material like shredders are installed. Thus the materials has grain size that allows the transport via air ducts into the drying department.

Tyres will be handled separately in a special room and they will be disintegrated utilizing a special technique.

1.4.3 Drying and Sterilization

The materials sorted out have according to their properties different moisture content and have therefore more or less spores and moulds, or bacteria and germs. To prevent against odour in the final product and to prevent against self-inflammation it is necessary to sterilize them and to dry the materials to an acceptable content (industrial standard grade) of water and sterilize them. This system was studied by Professor T of the Royal M Institute of Technology RMIT by order of 5stargreen. Further development of this generic design is presently effected by the firms B.-BSH and their partner M. Elektronik. Design in detail will be dependent on the conditions of the material, thus requiring individual designs for the various materials.

Generally, this task will be performed using hot air in combination with microwaving and the specially developed drum dryers. To allow for microwaving the precipitation of all ferrous metals is unavoidable to prevent against overheating of those parts and following inflammation of the light weight materials. Magnetic separators will be installed throughout to avoid such a problem.

1.4.4 Concrete Rubble and Glass Milling

This department is situated in the south-west corner of the building A and is to be installed by Krupp. A remarkable quantity of concrete rubble material of app. 130.000 to/year is expected, which has to be disintegrated by heavy crawler hammers, then crushed, hammermilled and milled down to powder of 60 microns or less. This material will be stored in silos and sent by air ducts to the mixing towers.

Glass sorted out has to be milled down to 150 microns or less and then be stored and transported as the concrete powder.

1.4.5 Raw Materials Transport and Storage

After drying, despite precautions, some materials parts might be hot and create problems due to the flammable nature of some of the materials. Heat detection sensors will monitor for any hot-spots and will actuate for flow stop for separation of any hot items. A power sub-station will be installed near the drying area to provide the significant amounts of energy that will be required for the sterilization process.

A treatment plant called 'liquid waste treatment' is located east to building A. Originally, the purpose of this treatment plant was only to accommodate and treat the sorting area cleansing waters. As a result of thorough deliberations, the cleaning in building A, however, will be effected without the use of any detergents only by the use of hot water and/or steam. In that case, the treatment of such water can be done in a relatively simple manner. For this reason, we propose to also treat the sanitary sewage from the other areas so that there will be a regular treatment plant, in particular due to the fact that about 1.200 persons will work at the plant. If it were only for that purpose alone, such a treatment plant would be worth it.

1.5 Productions in Building B

1.5.1 Transport and Storage

Crushed materials from building A are hauled over a bridge above the road into building B where they are stored in large silos. Thus one can divide the building A to be the unclean side and building B the clean side. The storage volume is designed for a 24-hour production. Yet, twice as many silos as necessary will be provided to allow for the emptying of a container at regular intervals to de-gasify the same for the extinction of any germs and bacteria which might still exist. Some of the silos are huge in their dimensions as shown in section drawing -303. This is due to the fact that the individual material fractions have to be crushed down to such an extent that they can be reasonably absorbed by the mortar. Yet, very highly crushed materials like textile fibers or fine wood chips have a very low weight by volume, that is with loose density they have a very great volume. These silos do not store paper and cardboard materials which are used and processed in building E, in the K. board factory. The silos are positioned on a solid mezzanine with top on about 6m level. They are open air structures without containment. They will drain on their bottom sides underneath the mezzanine into adequate conveying systems. From there the materials will be distributed to five silo dosing units using bucket elevators and horizontal distribution elements. One dosing unit each will be allocated to two mixing towers.

1.5.2 Dosing Facilities

The dosing facilities consist each of 6 individual silos of differing volumes roughly corresponding to the share of the mixed material compounds in the overall amount. From these dosing facilities, material for one mixture is delivered via a dosing belt to the mixing tower. SW will handle this process of transportation and dosing including all storing activities.

1.5.3 Mixing Towers

Several smaller silos are situated in the mixing tower (which is shown in drawing -303) atop the actual mixing facilities. Other dry materials are stored in these silos, namely fine ground glass, fine concrete powder, reclaimed and recycled materials, binder silos requiring continuous filling, and one silo for aluminum sulfate. The mixture itself will be prepared dry in a large compulsory mixer from where it will be delivered batch-wise in an interim storage container. Materials are continuously delivered out of this container into a continuous operation mixer (conti mixer) allowing for continuous processing from this point onward. In addition to the dry materials, all liquids are added to this second mixer which are necessary for mortar production. The extrusion feeding towers for the panels are filled from here. The mixing process and the mixing tower with all its devices will be manufactured by the firm Eh.

1.5.4 Extrusion Lines

The filling to feed the extrussion processes are of a somewhat more complicated nature because it will not be possible just to fill the materials into the hopers moreover, it will be necessary to keep the foamed material in shape, that is it must be ensured that the panel thickness of 75mm format will be reached also at its final stage of production. The panels are produced as twin panels in ten lines, that is 20 individual panels are produced within a 22 to 30 second cycle. The mc. compound, however, needs a specific process, time for curing and hardening. According to tests carried out, it will take about 5 minutes before a panel can be actually handled. This is the time the panel has to stay on the supporting frame or conveyers and be conveyed on ongoing belts. At the end, the panels are taken of the conveyers by robots by suction device and transported further on rolling belts. This process called 'extrusion' has been fully developed and built by EM in cooperation with the firm B. and H. who started development for and behalf of 5stargreen.

1.5.5 Quality Testing and Reclaiming

Following the removal of the panels it has to be checked whether they meet the required quality standard. That is, it has to be checked whether they are broken, whether some of the edges are missing, or any other deficiencies prevail. It is planned to automate this quality control process. In the case of a deficient panel, this panel is to be reclaimed. For this purpose a flap will be installed in the rolling belt to be activated in the event of a deficient panel which will then be dropped onto a crossing belt underneath. Such reclaimed material will be crushed down to first-size in a shredder manufactured by the firm Krupp and will then return eastward to the storage facility where it will be dried, crushed, and ground before it can be re-introduced into the mixing process again.

1.5.6 Transportation Means

The 'good' panels are then turned by 90 degrees by Robots with the use of suction type lifting mechanisms and stored in plastic cassettes. Each of these cassettes can accommodate 56 individual panels. According to the size of the drying units to follow, the cassettes are placed temporarily on assembly tracks. The cassettes are of special design and production owing to the fact that they must be absolutely metal and water-free to meet the requirements in the drying units. Though at the present time, information about the materials is available, clarification on their structural design has not been completed yet. This part of the plant is under the responsibility of the R.

1.5.7 RFV Dryers

The panels placed in these cassettes are jointly moved into the dryers. The RFV (radio frequency and vacuum) dryers were developed by the firm H. W., and further in Germany in cooperation by the firm L.Dornier. The size of these dryers varies according to the required numbers of individual panel types. The dryers are of the modular interior and exterior design, that is one module always consists of one piece accommodating three cassettes each.

These dryers have to fulfill two tasks:

1. The panels are to be heated again up to 95 to 98 degrees Centigrade where any germs or bacteria that might still exist will be eliminated to ensure that the panels will never emit any hazardous vapors and substances.

2. As about half of the water poured into the mix is not chemically bound it has to be removed again, that is dried. The technologists have minimized the amount of water in the panels already. Yet, the drying process is the most energy-consuming one of the entire plant. The process starts out from the assumption that electric fields are generated by radio frequency (microwaves) where water molecules are heated up with energy to such an extent that they get hot, thus heating up the materials, and then being emitted as vapors. By this method, complete heating of the panels cores is obtained up to the desired temperature so that the bacteria, spores and germs are killed and the water is extracted in vaporous form. For this purpose, however, the dryer must be subjected to vacuum pressure. The vacuum thus generated is about 97 percent which corresponds to an internal pressure of about 30mbar. At this pressure, water evaporates at a temperature of 25 degrees Centigrade already. That maximum panel temperature is required because the coating material to be applied to the panels later will not allow for higher temperatures.

   Section –303 shows the arrangement of the dryers with their associated cooling facilities. The re cooling process is rather complicated requiring condensers, deep ducts, water basins for warm water, cold water, and chilled water, as well as the necessary cooling towers. The installation of which will be very expensive given the required high performance levels. The high energy demand for the radio frequency facility of 500kVA per cassette corresponds to a total connected load of 64.5MW and will require the provision of separate transformers for every single drying facility. The associated switching systems are located in separate switch rooms on the mezzanine level floor above the dryers. The switching systems are longer than the dryers themselves!

   Note: Some time ago a standard type dryer was offered by a renowned firm producing dryers for ceramic plants. Probably, such dryers would have had volumes and energy demand as huge and high as for these dryers, but nobody would have been able to assume warranty for the 'ceramics dryer'!

   Further note: Of course, it will not be necessary to provide the total connected load of nearly 70MW during the whole drying process because of the loading phases and phases of a lower heat or cooling demand in-between.

1.5.8 Dried Panels Transport

As soon as the panels have reached the required drying level the dryer will be deactivated, the vacuum balanced by opening of the valves, and only then can the cassettes containing the panels be moved out and the dryer be loaded again from the other side. The dried panels cassettes are placed on tracks and from there moved by a crane (always 3 cassettes at one time) to a mezzanine above the road between buildings B and C. Please refer to the section drawing -303. From there another crane takes the panels and hauls them into building C where they are removed from the cassette again. This somewhat complicated process is due to the fact that one crane alone will not be able to make the long distance from the southern tracks in building B and the northern tracks in building C within the required time frame. Therefore, a total of 4 cranes will be provided. Unloading of the cassettes will be effected in analogy and reverse to the loading of the cassettes, that is reliable suction-type Robotic lifting mechanisms are used to move the panels in horizontal position and place them onto the roller conveyors. Then the empty cassettes will be returned under floor level through a long channel up to the loading points. Please refer to section drawing -304 - spec return and also in section drawing –302 this channel is shown in the center of the drawing. All the transportation equipment is subsumed under R. B.

1.6 Productions in Building C

1.6.1 Machining

Finishing and packing of the finished products will be carried out in building C. For this purpose, first of all individual processing steps will have to be taken in the machining department like: so far it had not been possible in form the upper chamfers in the panels which are now to be obtained by milling in this department. Furthermore, it is assumed that during the casting process minor unevenness, roughness, peaks will appear on the upper side of the panels caused by some binder sluice collected by the vibration during the compaction process. It will therefore be necessary to remove such roughness by some grinding in the machining department and then to remove the dust from the surface by vacuum cleaning and brushing.

The transportation facilities from behind the dryer up to the machining department are part of 'R. B', the machining part is the 'R. C' part.

1.6.2 Coating Department

The coating area following then covers a rather large section; its technology is known, yet it is still undefined in its technical design. The coating area comprises three major sections.

1. Pre-coating

   Here all panel surfaces are to receive a p. s. coat of a specific penetration depth to make the surfaces resistant to powdering.

2. Final Coating

   The actual coating is carried out using newly developed material to be applied in single layers of rather great thickness. Since reactive resin compounds are involved the great layer thickness is a quite modern application system and the technique has therefore to be designed. The porous surfaces of the panels provide for extremely good anchoring. The coating system were developed by EM and CP.

3. Sanding

   According to the program, four different panel types will be produced. One of these types is of higher density and of greater strength than the others and shall be used as floor panels. Of course, these floor panels must also be protected from skidding, that is by scattering in quartzite sand of a specific grain size into the coating, the surface will become rough enough to prevent accidents from happening.

The entire coating area will be covered by a solid mezzanine on which the mixing facilities for the coating materials are to be located. These are the pre-coating and the coating mixing facilities requiring specific provisions for safety, fire protection, etc.

The pre-coating and coating facilities underneath the ceiling will be designed by the firm E.M., the mixing facilities above the ceiling have been designed by K.N.

Delivery of the synthetic resin compound for final coating will require special provisions; that is why a separate lane has been considered in the delivery road.

The overspray resulting from the coating process will be collected and recycled in a dry process.

The drying time of approximately 20 seconds for the two-component material is extremely low. That is why the coating system can be designed as a very compact unit. Yet, as the cycle times of the panel of 20 to 30 seconds are very small as well, it has to be ensured that the coatings might not stick to each other when stacked. For this reason, the first coating will be followed by a thin interim polyethylene layer of a certain thickness or similar so that sticking of the individual panels to each other can be excluded. The panels are then transported further via roller conveyors to the packaging stations where 5, 6 or 7 panels are joined, enclosed with plastic strappings for dispatch according to the respective panel types. Ideally, the packs are directly loaded into the containers. The production rates and capacities have been coordinated analogously.

However, minor disturbances or delays somewhere in the process will unavoidably cause disturbance of the continuous stream of the various panel types. For this reason, specific interim storage facilities prior to the dispatch must be provided. Accordingly, for every single panel type a rack system will be constructed to accommodate a 48-hour production of one line of the respective type. This will ensure that all available containers can be filled even if there is a stoppage somewhere in the production process up to two days.

1.7 Activities in Building D

Building D houses the container loading facility. It is planned to ship the finished products in 20 ft containers. A loading pattern is proposed for this purpose so that every single container can accommodate the materials for two houses. Since it is presently started out from an hourly production of about …… houses, the loading time for a container is limited to app. …. minutes. During this time the loading equipment have to store 54 packages into the container. This is foreseen by using four loading cranes with suction cups for taking off. 70 000 Homes produced during 280 days of production in 2 times 10 hour shifts per every 24 hours.

Two major risks are involved in the production:

1.7.1 Risk No.1

Waste is to be delivered and storage of mixed solid waste to be minimum quantity of …… Containers to be the feedstock for minimum 7 – 12 days of production. Finished product must be dispatched at all times... That is why we proposed a container storage area to take this amount. Section drawing

–304 shows the stacked up containers with the associated loading tracks. Since trains are not available for the dispatch (and this is the risk we are discussing) it must be possible to stack up the empty containers as well as the loaded containers. It is, thus, planned to take one container from the stack of empty containers, to place this on a 'rail transportation' unit, to haul it for loading, load and then place onto a stack of loaded containers. Since the time needed for this process is higher than the actual loading time, it will be necessary to have 3 rail transportation units available. These units will be placed on a separate small railroad track section and activated as needed.

1.7.2 Risk No.2

. If no waste is received due to a strike or any other circumstance preventing the delivery of waste, contractual requirements entered will still have to be complied with. A ship, for example, must be loaded because of the limited staying time available. It is therefore proposed to establish a facility where a 7 days full production can be stored. This will be the facility which will be used to cope with any failure in production at any of the various stations of production. At the right end of building C are shown the four high storage racks into which strapped packages ready for shipment will be stacked.

1.8 K. board Factory (Building E)

This factory will be constructed by the firm S. to process the paper, timber, plastic material unwanted in the normal panel production. About 40 to 45.000 tons/per year of paper are contained in the overall waste stream for which there was no use in the normal panel production process. K. board production can use these papers to reinforce the K. materials providing for the manufacture of a high quality panel product. The complete factory will be constructed by S. except for the packing/dispatch department, as the panels will be transported by Container to a Container Hardstand, to be dispatch to Kitchen fabrication area as need by quantities.. To date, no final decision could been made on this department because clarification on the distribution of the K. boards could not yet been obtained as it is a matter of application which must be adopted to the circumstances at the production site area. For the painting the same system was taken as for the building panels from building. C with the change of thickness of coating. Though it is realizable in principle and has already been done in various combinations. Packaging and dispatch will have also to be adapted to the selected painting material and the use of the finished product. Therefore, this area has only been identified as white area.

As part of the K. board production there are quite some cuttings which can be returned to the production process though in reconditioned form which will take place in the c. plant. Here hardened panels are returned to its original condition and back to production. This c. plant can – in accordance with the site conditions – produce again powder for the KFF, when it is of sense to transport the raw materials to the site. Other possibilities may be discussed.

1.9 Other Buildings

1.9.1 P. Storage Facility

The p. storage facility is situated between buildings D and A. The facility provides for interim storage in the form of insulated ISO-containers. The contents of which will be pumped into three vertical tanks out of which supply of the mixing towers will be realized. Three units are used because, on the supplier's advice, one container each shall be empty to take the next delivery, one container shall feed the mixing towers, and the third one will be filled and checked including its contents.

This facility has also been designed to allow for the delivery of the ISO-tanks not via railroad but via trucks, if this were necessary.

1.9.2 Binder Unloading Station

A one-year production of panels will require binding material in the amount of roughly 1mio tons. Transportation of these amounts on the road would be fully impractical. An adequate unloading station should therefore be constructed directly along the railroad tracks and the materials be conveyed over a bridge to the two main silos on the 6 m floor. It will be worthwhile considering that 150 tons of binder per hour will be needed and will be stored at designated Container hardstand.

1.9.3 Workshop and Spare Parts Store (Building F)

According to the overall plant philosophy disturbance times should be kept as low as possible. Continuous day and night production is therefore planned with maintenance and repair to be carried out on one day of the week. Minor repairs which will come up quite naturally, for example the repair of a conveyor belt drive engine or similar things, will have to be effected during the production time requiring extremely quick action. Certainly there will be quite some parts which will fail more often than others. These parts should be kept available as spare as close as possible to their needed locations. And that is why we have provided a small workshop and spare parts store for every single department to allow for expedient reaction. In addition, there will be major parts which are not kept available in greater numbers but shall be stored in the big spare parts store. It is planned for import restriction reasons in the various countries to keep a relatively great number of spare parts available in order to prevent longer production failure at any rate. It is also proposed to fit a workshop building with the best facilities possible so that any non-existing spare parts can be produced at the plant itself.

1.9.4 Car Wash

A truck wash rack is proposed as an annex to building A where highly soiled waste delivery trucks can be cleaned.

1.9.5 Substations

The considerable power demand for the overall plant must be coped within a reasonable manner. The bottom left of drawing -101 shows a reminder informing that the installation of an overhead line for overall plant supply would be a practical measure. The overall connected load will amount to about 110MW. Probably, such an overhead line will be used to supply high tension as interim tension at the plant itself. It is planned to operate the plant with 20kV and then to install substations near the load centers. The final substation locations and sizes have drawn on the plan and named.

In substations # 1, 2, and 7 emergency power sets to be installed which are necessary

a) for keeping the production facilities continuously working which otherwise would be congested with mortar or panels.

b) for keeping the safety on the plant site, which is necessary for the staff as well as for the means.

1.9.6 Compressed Air Stations

Compressed air will be needed in major amounts at several locations for maintenance purposes, for production and for transportation of bulky goods. In the last days we got information about huge demand for coating and for compounding the coating material. The wide extension of the plant will require a system in network form with a central compressed air station which will be able to supply adequate amounts in to the ring running also to the end points of the plant. With reference to the experts opinion the pressure drop can be accepted and get a cost effective system. The high amount of compressed air for the coating plants require a specially tailored system with water cooled screw compressors, big storage tanks at the ends and big pipes for reduction of velocity and pressure loss. For this reason it is planned to feed the compressed air system at two locations. The piping will be designed as 'large' storage tank to ensure safe supply for the compressed air operated plant components with relatively low speed and low pressure loss. Those will include all suction type panel unloading units in which vacuum conditions for the lifting devices are generated.

1.9.7 Auxiliary Buildings

Three buildings are joined in one building complex on the western side of the plant named de-ionized water plant, water station, and site utilities. At the present time it has not been clearly defined whether these buildings in their current dimensions and as drawn will be actually needed. To date they have been provided as alternative solutions and they are dependent on the actual conditions on site, whether for example, large-scale water treatment will be necessary. The demand of water for the plant is rather high. Just taking mortar production alone, the demand per hour will be 55 cbm of which less than half will be recycled by the panel drying process. These amounts will be supplemented by the sewage to be partly drained, though we try to recover industrial sewage to the maximum extent possible.

It will possibly be necessary to install a forklift loading station also at that location as we have start out from the requirement that major maintenance services and other transportation efforts have to be carried out by electrically driven forklift units. The other one can be found in buildg. A.

Further need may be the compressed air station and a garage.

1.9.8 Social Facilities

The social facilities have been situated inside the individual production buildings commensurate with the personnel working in those areas. They will be equipped accordingly.

The work load will be as follows:

		1 shift	3 shifts
Building	A	188	564
	B	47	141
	C + D	25	75
	E	33	99
	F	23	69
Technical support		19	57
Production personnel		335	1005
w/o headquarters		(70)	(140)

In addition, a canteen building may have to be added in dependence of the specific locations. Drawing -101 shows such a facility close to the headquarters. Whether such a facility will be realized or not will depend on the specific locations.

Providing a central facility for the personnel has been discussed in detail but rejected in consideration of the large distances to the individual production areas involved.

1.9.9 Headquarters

This term will comprise the general administration building, the overall operations control facilities, as well as some part which might be assigned to research and development. At any rate, a central administration area will be required close to the entrance area, also a central production control facility. According to the technical state of the art, one central control system is proposed for the plant on the whole and for its individual components. This system will be connected to the central operations center using an optic fiber network where all data necessary for the control of the system are joined and controlled. Analysis of all data is easily obtained using standard applications.

This overall system will be designed and installed by the firm Schneider Australia. The individual departments will be equipped with control devices by the associated firms themselves. The interfaces, however, will be coordinated to be compatible with each other.

2. General Arrangements

2.1 Production Halls

As a general rule, premises with 1:1 or 1:2 side ratios should be given preference so that the distances between the individual production departments are not too big. In the present case the side ratio is 1:1.8; thus providing for adequate dimensions. Though this is not an absolute requirement, the existing building width along with the width of the roads to be located in between, however, will determine the shape and the size of the premises.

The building widths are as follows:

Building A 129 m plus annexes on the eastern side

building B 107 m

building C 83 m

These are rather big dimensions which will require the designer to pay great attention to the safety of the persons and of the facilities and equipment in the case of a fire or any mis -function. Therefore bridges have to be constructed over and above the production lines from where access to the space between the lines and also to the roads is possible in an emergency case as well as for maintenance and repair. See in this regard also 4.4.

2.2 Traffic

Deliveries to the individual production departments will have to be carried out at the production site. Persons working at the plant must be able to reach their job places without being endangered by other external traffic. And also the finished products must be dispatched. Sound separation of these traffic streams should therefore be strived at.

Building A has three lanes running from north to south and vice versa for the delivery and/or hauling off of materials for the sorting plant.

2.2.1 Railway Connection

The generic plant shows the solution as described below:

Four tracks are planned for the delivery of bulk materials, another two tracks for the shipping of the finished products. The railroad company will have to decide whether these tracks will be joined later. Drawing -101 shows the end of the railroad tracks at the eastern boundaries of the site which is not commensurate with the real conditions. It will be necessary to continue these tracks to the east to allow for the shunting of the rail wagons including the moving forward and backward.

The following major materials can be delivered by rail:

- the waste stream

- the binder materials

- other supplies – goods for Building 2

All other materials may be delivered by rail or by truck:

The G- Binder materials are a big quantity and should be handled as bulky material. The coating material is also a candidate for rail delivery.

2.2.2 Road System

In the present case connection to the road is shown on the eastern side. Of course, it may also be effected on the southern or on the western side. Here the shown arrangement is considered practical because there is space available for the parking lots, for the administration building, for the canteen and also for the spare parts store etc. In general we have started out from the assumption that the employees, if arriving by car, will park their cars at the central lot close to the entrance and then reach their work places by foot (the car park is usually outside the fence). Decision on these circumstances has to be made for every single project site. The vehicular access has two weighing bridges to allow for the weight control and settlement of any type of special deliveries.

Two roads will run in east-western direction from where maintenance and repair work as well as fire fighting could be carried out.. In consideration of the adjacent buildings the selected total width of these road spaces will range between 30 m and 40 m, with street width of 20 m. Where dangerous liquids are delivered by trucks or tank trucks to the production areas and unloaded, special provisions for the hardstands and their safety are taken, in particular for the hardstand in front of buildings C and E where the resin compounds, the hardener and the cleaning solvents for the coating materials have to be reloaded.

As the traffic code will apply in general also to sites of such dimensions this means that distinction may have to be made between right or left traffic in dependence of the country where the plant will be constructed. This may result in the necessity to modify details of the traffic routings. (The drawing shows the solution for left-hand traffic as for Australia).

2.3 Environmental Basics

The environmental protection requirements of the country in which the plant will be constructed shall apply. The respective laws valid in Germany have been taken as basis for the design. These primarily include regulations to keep waste gas clean, noise protection measures, groundwater hazards in particular in the case that fire fighting water has to be collected after a fire, or the catchment of any substances detrimental to the groundwater. The requirements also refer to the treatment of cleansing water from the sorting area.

These regulations, as we see it, will also include the necessity to carefully handle the water. For this reason we plan to recycle as much waste water as possible. Obviously, this plan can be put into reality.

2.4 Base Material Productions

It is generally planned to manufacture the pre-products in an area close to the plant. These will include the production of the binder material, the production of a. g. compounds and possibly also the production of synthetic resin pre-products for the manufacture of the coating materials. According to mutual agreement, the manufacture of these pre-products will have to take place outside the actual production plant. Only then will it be roughly possible to obtain a separation for warranty purposes concerning quality, processes and economic success. The location of premises for the construction of such pre-product plants might also effect the piping and transportation lines to the areas of consumption or storage at the HML site.

2.5 Outside Facilities, Trees, Areas

In general, all these items are dependent on the local conditions, the local modes of construction, and the shape of the premises. The present section will have to summarize statements on the functions, on the parking lots, the special delivery area, truck wash areas, storage areas, connections to the finished product shipping areas, connection to the railroad tracks, and similar. Statements on the individual sections above must be made concerning the manufacturability, use of materials, dimensions, and similar. As a statement at the present stage of planning, all the proposed functions can be realized.

3. Buildings and Structures Systems

3.1 General

The selection of the structural systems and of the materials for the construction of the buildings will depend on the local conditions. Definition on the individual structures has not yet been done in consideration of the availability of materials, availability of associated facilities for the processing of those materials, for constructions to comply with the local requirements, and in consideration of the external loads, including the seismic loads.

The structural system and the selection of the materials will be determined in cooperation with the contractor as part of the next phase.

3.2 Loads and Weights

In the stages of a standard planning at hand, the static-constructive pre-planning of constructions does not make much sense, as those details on the local parameters which are still missing are of decisive dimensions for this planning. Alongside the weight resulting from the production engineering and the dead weight of the building components, following important influential dimensions are to be taken into consideration:

- Wind / typhoon
- Snow / ice
- Earthquakes
- Bedrock structure / ground water / subsidence sensitivity / bearing capacity
- Local availability of materials
- Local experience of fitters

Therefore, only general application references can be given from the size (of the possible screens), which are to be checked during the adaptation.

3.3 Choice of material

Basic criteria for the choice of building materials are:

Assurance against stress and strain caused by static weights, if necessary also by mounting or operational weights, is generally required for all standard materials. Usually, it is only a question of dimensioning.

Important for the workability of the constructions are their distortion under various weights. These criteria must also be seen in conjunction with the forming of the bearing parts. This is especially true of the manufacture of flat roofs, where a large degree of bending on too low roof slope results in damage to the roof covering. As a matter of cost, however, slim constructions from higher grade steel are to be assessed positively if they have no other constructive defects apart from their relatively high degree of distortion.

Fire protection is not assured to the same degree in all materials, to some extent special instructions must be observed.

Protection against corrosion is an influential factor on the durability of a product, which also affects the productivity. The susceptibility to corrosion depends on climatic conditions.

One must precisely calculate protection against vibrations from rotating machinery; some materials have definite advantages over others in certain circumstances.

3.4 Static systems

Static systems are frequently the result of pre-planning where the columns positioning is pre-adjusted. In this respect, the pre-planning is of utmost importance.

In the static system, not only the dead loads and operational loads are to be taken into consideration, but also the assembly weights, which have enormous significance in today's frequently-used prefabrication construction method.

Local restrictions can occur in the choice of span, if the assembly or transport possibilities are limited.

Mat foundations are improbable for medium-sized to large spans; single foundations are better suited to this. The size and depth are dependent on the bedrock.

An important point is the frost depth and the distortion of the bedrock resulting from it in unfavourable conditions.

3.5 Exterior walls

Today, simple, light wall constructions from profiled sheet metal with an interior-insulating layer to protect against heat loss in the winter or for the deflection of summer temperatures, are frequently used. The protection against impact and against the loosening of the insulation material require an interior cover, e.g. a further sheet metal casing.

At 2-3 metres, the height of the plinth made from solid materials to protect against impact and destruction by vehicles, is standard.

3.6 Roofs

For operational reasons, flat roofs have been suggested for this schematic planning, in order to have practically the same lighting and heat protection conditions from above via the dome lights in all locations. The manufacture of shed roofs would be somewhat more complicated as a result of the not quite uniform support positioning. Shed roofs must always be aligned according to the geographic area (in particular according to the parallel). The plot of land must therefore allow a certain building arrangement, so that the planning of shed roofs can be considered.

The dome lights are combined with air vents, which also serve as smoke and heat vents; they also have an important function in fire protection by reducing build up of heat and of the smoke vent.

According to the climate, the skylights may have to be glazed with heat absorbing glass.

The roof surfaces must be accessible, so that the skylights can be cleaned from time to time. Moreover, there are a series of pipeline bridges which must be installed, inspected and maintained.

4. Production Means

4.1 Purpose and Functions

4.1.1 Exterior waste delivery area

Reference drawings:

Plan views	000 – A1 - 101
	- 102
Sections	000 – A1 - 301

Waste shall be unloaded free of any rain or direct sunlight action. That is why a roofing structure is to be placed above.

Delivery by rail can be effected using bulk material rail wagons which, for accounting purposes, will be weighed on the weigh bridges. Also waste containers may be delivered by rail and unloaded by cranes. For the time being, this solution shall be left aside because design of the waste containers has not yet been complete. Delivery may also be effected by trucks to unload backwardly into the waste pits. These pits will be dug into the ground for 3m in depth. The pits should not be deeper in order to prevent the compaction of the waste and long storage times are not desired because of germ growth hazards. Accordingly, all delivered materials will require sorting directly after the delivery. To allow for the crossing of the delivery streams with the aboveground truck traffic, the waste transportation lines shall be routed underfloor as tunnels in building A. The principle of the storage, transportation, and sorting of waste on the left or the right side selectively shall also apply to the delivered materials. Accordingly, they will also be subjected to cleaning at regular intervals.

Therefore all parts which may get into contact with the waste material shall be coated such that they can be cleaned properly by automated means. Hot water or steam are to be given preference for such purposes. Waste cleansing water in the deeper parts will be collected in even deeper wells and then pumped to the treatment plant.

4.1.2 Building A

Reference Drawings:

Plan views and sections with numbering	000 – A1 - ......
	000 – A1 - ......

The cross section –302 shows that building A has three major areas, namely the elevated western area attached to the building, the central main building and the eastern annex portion.

The central main building is approximately 98m wide and 163m long, its floor is even. Three roads permitting truck traffic are routed through the building in north-south direction. Waste transportation vehicles may deliver special materials and/or other vehicles may haul off recyclable materials. For this reason, roof mounted ventilation fans may have to extract excessive truck gases.

Normal domestic waste will be hauled on the external roads to the northern side of the building. The two waste pits located in that area are basically identical in construction with that of the rail wagon waste pits, they are also connected to the transportation line leading up to the sorting plant. Each of the two sorting areas has at its ground floor level a pre-sorting, a pre-crushing and then a rising transportation belt leading to the upper floor with its roughly 30 individual sorting stations. The single fractions are sorted on the upper floor and then dropped downward into the ground floor containers from where they are transported to the crushing units.

The sorting stations of the upper floor are enclosed by cabins. This measure is required to prevent whirling of the air at the work places which might endanger the persons working at those stations. Moreover, the persons working there are prevented from inhaling the germ and bacteria loaded air. For this reason, the slab of the upper floor in itself represents a closed surface only interrupted by the drop chutes through which the sorted materials are dropped downward. The ventilation systems only operating with fresh air supply are located above these cabins.

The cabins shall be fitted such that cleaning with spray and cleansing water as well as high pressure steam units will be possible easily and that water can be collected without disturbing or affecting the work process of the other sorting line.

The central control and switch room for building A is located between the cabins and at a somewhat higher level than the waste delivery area.

The western annexes accommodate the workshop with spare parts store for the systems of building A, the tyres disintegration shop, the dryers and sterilisers, the concrete rubble and glass milling stations, as well as a substation. Besides this a forklift battery loading station can be arranged. The covered area is 30 x 163m = 4,900m² and in part extends over several floors. In particular the substation seems bigger than necessary and can accommodate other individual areas from the eastern annexes, if needed. Accordingly, the eastern annexes may be deleted in part.

The external crushing facility of the firm Krupp will be located in the south-western corner of the building for the disintegration of the delivered concrete rubble. For this purpose, only a canopy will be provided above some parts of the facility in order to prevent excessive rain water load (where necessary and in dependence of local conditions).

The southern side of the central building will also have a canopy constructed in the loading area of the materials to be hauled off.

To haul the individual pre-crushed fractions from the sorting areas into the sterilisers, air-operated conveying systems are proposed. This will require adequate separators or de-dusters to be installed in the area of the sterilisers and to the exterior walls to reduce explosion hazards. Therefore a specific arrangement is needed. Together with the building for the transportation lines leading to the main silos in building B these are the forced points on the western side of building A.

The eastern annex presently accommodates some parts which could not be moved to the western side this is at any rate, the car wash facility as well as some part of the personnel facilities (for the people in the eastern part of the sorting facility) and the associated offices and the first aid facilities.

4.1.3 Building B

Reference drawings:

Plan views with numbering	000 - B1 - 1.....
	000 - B2 - 1.....
Sections	000 - B1 - 301
	000 - B2 - 301

Building B is composed of the following four major components:

Raw material containers	31.0 m in length
mixing towers and dosing units	28.0 m
main building for extrusion lines incl. interim product buffer	185.5 m
dryers and hauling to machining	137.5 m
Total	382.0 m

With a width of 107m, the built-up area will be 40,900 m².

a. Raw material silos

Raw material silos will be placed on a solid mezzanine of 6m height. All transportation facilities and the containers themselves are of the weather-resistant type. The mezzanine has a defined storm water drain. Maintenance platforms and maintenance ways are located above the silos to allow for the control of the individual material distribution systems. The light materials to be stored in the silos may be subject to dust explosion or the like followed by a smoldering or even by an open fire in the silos. Regulations exist for these systems describing the necessary measures to be taken. According to these regulations, the silos must be equipped for fire extinction with water and designed for an adequate internal hydraulic pressure, while also explosion relief measures have to be obtained by the provision of a flap in the silos covers. In the case of extinction with water, fire fighting water must be collected and drained in a defined manner for environmental protection reasons. If a smoldering or an open fire occurs in a plastics containing silo the fire fighting water would certainly be contaminated. A silo in which a fire was extinguished with water will generally require complete discharge. For this purpose the materials must be hauled via an emergency conveyor belt to trucks for transportation to a special intermediate storage area.

The silo discharge devices and the closed transportation facilities are situated underneath the platform which will further convey the materials into the dosing containers. This entire room must be kept dry by natural ventilation. With a room depth of 31 m the ground floor will require artificial illumination.

b. Mixing towers

This building is nearly 40 m high and completely enclosed. The ground floor houses a truck passage way for the supply of the mixed exhaust facilities, the mixing facilities, and of the casting equipment. The actual mixing towers are nearly identical, also the five dosing silo groups which are located above the passage way. The northern and/or the southern marginal area elevated water towers are proposed for the highest possible points so that also in the case water pumps are out of operation, a minimum pressure of 3.5 bar will be maintained in the domestic and/or drinking water net.

An additional level is proposed between the passageway and the dosing silos for the central control and switch room for approx. 40 major components of the core technology as well as of the technical support. Two workshops with spare parts store are arranged in the northern and/or the southern corner of this level. Deliberations will be required on any joining of these rooms.

Various maintenance platforms and maintenance ways will be located at different levels, for example above and below the silos. The mixing facilities shall receive eleven dry materials and three liquids. All dosing systems will require monitoring and controls. Special attention has to be paid to the transportation and dosing facilities for the light weight materials because of the large volumes involved.

A natural ventilation system will, of course, be provided for the entire building except for the control and switch room is air conditioning is foreseen. The need is especially for drying the facilities when cleansed.

Natural illumination will be realized by the use of, for example, translucent cladding but is to decide at any location with respect of heat radiation.

c. Main building for the extrusion lines

This very long building directly adjoins the mixing tower. The ten casting lines will always take their start in the mixing tower, the associated return lines will terminate in the mixing tower.

A lot of noise is generated at the beginning of the casting lines because of the proposed vibration systems for the distribution and regular spreading of the mortar in the forms. Noise protection hoods should be provided. Whether the lines can be fully enclosed by the hoods or not will be decided in the detail design stage. The undersides of the conti mixers as well as the distribution and filling units for the casting lines will require jet water cleaning at regular intervals. Proper catchment and discharge of the waste water must be guaranteed. In particular, sedimentation or adhesion of the binding agent must be prevented.

The casting lines with their racks are placed on the ground floor, also the associated return lines. Separate cabins are proposed for the cleaning, returning or spraying stations (to spray parting agents on) contained therein. The floor will thus remain dry.

Maintenance overhead gang ways crossing these lines are positioned at two locations. Furthermore, pedestrian access from one mixing tower to the other is possible to approach the casting lines.

The cleaning facilities for the forms generate waste water which will be treated in the northern part of the building. Treated water as well as the waste water can be routed either under floor level or overhead. Deliberation by EM to do. Personnel facilities, workshop for the casting line with spare parts store are also planned beside the treatment plant at the northern building edge.

At the end of the curing line access to the space between the lines is open for small loaders up to approx. 3,0 m.

Quality control is obtained by inspection of the panels when taken out of the forms via video cameras and personal control - as an alternative, automatic error recognition by laser jet scanning or similar could be realized and should be subject to further investigations. At any rate, two central control rooms are required to ensure 24 hour occupancy, also in the case that a person at one of the extrusion lines has a personal problem or will take a time out. (Only one centralized control room requires very more cable length from the cameras to the monitoring stations and this counts seriously).

Crossing the hall in the middle in transversal direction, standing on the floor the heavy conveyor for transportation of the rejected panels in a channel of 1,5 m height limits the movability on both sides.
The access on the west of this reclaimer belt is app. 20 m away and gives way to the equipment of unloading and buffering.

The unloading equipment (to take the horizontal panels and place them vertically into the cassettes) is placed at ground level. The underfloor channel for cassette return is situated directly beside. Loaded cassettes are transported via transfer sections and belts up to in front of the drying units.

The building has a flat pitched roof with domes for ventilation, smoke and heat exhaust, as well as for natural illumination.

d. Dryers with transportation

Underground water basins are located at right angle cross with the building underneath the conveyors in front of the drying units; in the roof area cooling towers for the re-cooling of the cooling water which is used for drying and cooling of the products and of the switching facilities. This area also contains walk-in utility channels routed alongside and cross with the building.

On ground floor level between the drying units, vacuum ring water pumps are installed consuming most of the space of the area of the existing clearance between the drying units. Therefore the transportation along the vacuum pumps are impossible. However, approach up to the pumps from both sides will be possible. Transportation for mounting purposes can be realized from the western side.

A solid mezzanine is located above the vacuum drying chambers with open spaces in between to allow for heat exhaust from the lower parts. This platform is 81.5m long and extends over the entire width of the building. The transformers, the low voltage main distribution cubicles, switch rooms, the heat exchangers for the switch rooms and switching facilities, the chiller units for cold water generation, and the vacuum condensers are located on that mezzanine. The parts have been shown on the drawings. At this point it should be considered that the ten drying units with their associated facilities will consume energy in the amount of about 70MW. The switching devices must be cooled with fully desalinated water (!); the switch cabinets are 1.2m deep and are kept cold internally by the use of defined cooled and filtered air. The technical requirements for this area naturally cause quite some technical solutions which will have to be complied with by the technical support.

A control room # 4 to join and accommodate the central controls for the parts R 'A', L-Dornier, and R 'B' are also be located on the mezzanine. Stairs are provided at various locations on the platform to allow for escape and/or access for the operating personnel.

The mounting aids for the components placed above and also placed below the platform still require clarification with the firms involved. Lifting mechanisms have to be installed. Maintenance and mounting aids shall at least include an industrial elevator to be located in the north western corner of the mezzanine.

When dried, the cassettes are moved to the interim storage area from where they are hauled in a pack of three each toward building C. This entire area is flat.

According to a proposal by the firm R two central switch rooms for all electrical services of the area are located in the center above the buffer storage sections before an after the dryers.

Because of the line routings, the associated ventilation systems, and the crane transportation lifting height this building part is higher than the main building. Roughly estimated the height is 17 or 18m, while that of the main building is about 12m.

The hauling in of machines or repair accessibility to the single transportation facilities is obtained by the provision of adequately sized openings in the western gable wall through which major parts can be moved into the building.

A bridge is located between building B and building C where the cassettes are placed for future transportation into building C by a crane as before, taking each three cassettes and be capable of carrying 25 tons. The clear height under this bridge must allow for vehicular passage, that is it must be min. 4.5m. Adequate expansion space in north-south direction have to be taken into consideration accordingly.

4.1.4 Building C

Reference drawings:

Plan views with numbering	000 - C1 - 1....
	- C2 - 1....
Sections with numbering	- C1 - 301
	- C2 - 301

The total area of this building is 336 x 83 = 27.890 sqm. It is in the middle part more-storey and contains five zones:

a. Transportation and unloading area

There the cassettes will be transferred from the bridge onto those lines which are belonging to the panel type on the cassette. The panels will then be unloaded by a Robots with suction dishes. Underfloor transportation will return the cassettes to the starting point in building B on two parallel return lines due to the necessity for two different cassette sizes. Three maintenance ways are foreseen along the crane runways and across the unloading stations for quick reach of the machines. A control and switch room will be installed in the middle of the lines but elevated allowing overview and short cabling.

b. Machining department

The panels will be smoothed on the top side and vacuum will take off the dust. As no chamfers are on the top side these shall be milled at this stage. There is need for a cyclone and some dust separators. For maintenance a gangway along those installations is planned to access quickly the areas between the lines. At the end a shortest possible connection to the tool store is prepared.

As all these procedures are very costly and need some machinery for separation of cuttings, de dusting, and preparation of tools, it was under discussion to replace this department to chamfer and smooth the panels at a certain stage during travelling through the casting line. This process is not usable because the cured mortar is unable to be form-pressed without loss of strength.

c. Coating

As well in the machining department as in the coating section twenty (20) panels on ten (10) double lines are produced. The pre-coating as well as the final coating will be done in a massive structure because on top of the concrete roof the mixing plants for the coating materials are located. For safety reasons, the ceiling must be fire proof and the arrangement of the equipment for storage, dosing, mixing and distribution will be governed by the relevant safety codes.

Ten double lines with a width of 85m are foreseen, and for maintenance, material feeding, installation of fresh air and waste air ducts, low tension and control cabling some intermediate bridges are to be installed. The control room together with the switch room is proposed to be installed on the “roof”. A substation is to erect directly besides on the ground floor for the relative high power consumption.

For three lines is foreseen to sand the floor panels to prevent slip of the users. EM is to design this coating part.

d. Compounding

The mixing installations require a closed building of 16 m height on the ceiling +8,0m with two intermediate floors. This is to be built over the total width of the building, and at the ends two stairs are installed as access and escape route.

Fluid materials will be truck-delivered and pumped resp. small quantities will be brought in barrels which then must be lifted onto the 8m floor using an industrial elevator. This is also foreseen for the bag-packed additives. Bigger quantities will be silo-stored in the bulk storage western of bldg. C and then pumped through air transport pipes. These installations need a pipe supporting bridge between the compounding area and the bulk storage area in the west. This is shown on 000-00-201.

e. Packing

The panels will be stacked to packages of 5, 6, or 7 each according to the numbers of panels per type per house. These packs will be strapped and then be conveyed to the loading facilities in building D. In case of more production than the finished packs will be stored by finger cars into the 9-level “emergency stores”. The strapping machines need continuously feeding with strapping band, thus a bridge with lifting devices and connection to the store is foreseen from which personnel can have also access to the space between the lines. Besides that the control and switch room is planned in the center of the ‘R D’ installations.

4.1.5 Building D

Reference drawings for bldg. C:

Plan views	000 - C1 - 1....
	- C2 - 1....
Sections	- C1 - 301
	- C2 - 301

This building is for storage and weather protected loading of the finished products into container on railway platform wagons for dispatch. It is to arrange directly besides the building C, only separated by a fire rated wall. Where the packs will be transported through it, fire rated flaps have to be installed and shall be directed by an automatic fire alarm system.

This hall contains app. 300 containers for in-feed of the 36 hours production. These containers must not in all cases stand under the roof. But the loading area itself must be dry to save the material against water in the container. The arrangement of the tracks must be carefully detailed to comply with the loads of the wagon which is app. 60 to total. This load must be accelerated and exactly stopped at the point of loading for allowance of automatic loading.

This area R D is not yet pre-designed and needs further efforts to find best solutions compatible to the equipment already chosen by R. But they haven't offered their package up to now.

4.2 Personnel

4.2.1 Reference Drawings

General Layout	000 – 00 – 101
Personnel & Relay Rooms	000 – 00 – 102

4.2.2 Production Personnel

Under full operation of the plant approx. 480 person per shift are working. Approx. 270 persons thereof are unskilled labourers employed for sorting the raw materials. The others should be skilled workers. Preferably they should participate in the construction or erection of the factory, in order to get to know „their" plant intensively.

Those figures are estimations based on the assumption of work productivity as per standards of Middle European workers plus a general mark up of approx. 10% to 20% as an average value for all departments. Generally it is assumed that during each shift and for each department a group of workers for maintenance and small repair works must be available. A standard group consists of 1 foreman, 1 mechanics, 1 electrician and one helper. Certain groups may require additional helpers or an electronics specialist. For certain departments the groups can be combined together.

The central workshop with the spare parts store requires highly qualified staff because here the responsibility and management of the spare parts are located. Special parts which are not or no more available in the store eventually need to be fabricated in the central workshop.

4.2.3 Foremen and Engineers

To assume that the plant can be operated without intensive care and control “at the machine” by well experienced and highly qualified specialists would be fatal. Even well trained craftsmen within the department-groups require guidance by engineers and foremen. Those engineers and foremen must not sit in the administration offices only. This is important to the success of this investment.

The raw material will change from season to season and even during a day variations occur. This requires immediate reactions at the mixing towers and all following production sections. An adequate structure and organisation of the information flow, the responsibilities and the instruction privileges and levels must be established from the beginning.

4.2.4 Quality Control

The mixing and extrusion lines are the core technology of the plant. Errors made in this area cannot be corrected and thus their detection is necessary. The errors will – so it is assumed- mainly result in panels which show after the curing process either incorrect shape or incorrect surface or cracks or even broken panels. Those faults are relatively easy to detect and the faulty panels must be sorted out. The testing for those faults has to be done 24 hours a day because panels continuously pass the inspection station. This requires selected personal for execution of the inspection at the monitors. The inspection personal need to be alternated often. Therefore the team for 10 lines requires 20 persons plus two supervisors per shift.

4.2.5 Cleaning Personnel

For the wet cleaning in building A the need is to wear special clothes because of the very high temperatures of the cleansing medium. The original idea to use automatic cleaning equipment was dropped because an automatic cleaning-installation would not be able to detect all or special dirty areas.

4.2.6 Administration and Others

Within the administration building there are three zones equipped with different staff. Within the R&D area technology specialists are to be employed. They are responsible for product development, production development and (new) applications development. The staff is to be selected under consideration of local conditions and business strategy of the plant. This has to be considered already in the building design.

The inspection at the receipt of goods is part of the operations, but as this requires personal with knowledge of chemicals could be affiliated with the R&D department.

The section operations will handle the centralised control of the production of the plant by means of an external control systems. This includes the registration and control of all accessory materials, spare parts, wear parts, consumables, maintenance and repair activities .from the input to the output including of all intermediate steps. Where required influence is taken.

The size of the plant and the requirement to react immediately on all disturbances or problems of the materials, the material flow and the production equipment demands that this central control area is permanently operating with excellent staff for permanent evaluation and correction of steering. At present the staff numbers can only be estimated and depends on distribution of the works. It is possible to operate as follows: receipt of goods + shipment of products, spare part management, maintenance of stock and supplies, maintenance and repair organised according to buildings, consumables, security devices and controls, overall data. During the main shift the staff should consist of approx. 10 persons and can be reduced during the night times.

The administration includes the management with all departments of a company and plant: purchase, selling, accounts, personal, medical care, facility management, transport and vehicles, headquarter management c/w its departments e.g. marketing. Depending on the efficiency of the managers and their subordinates the total numbers of staff will be between 40 and 60 persons.

4.3 Auxiliary Buildings

4.3.1 Building F – Engineering Workshop & Spare Parts Store

This building is required for the central storage of spare parts placed there by the delivery firms. Usually, the quantities are enough for two years' operations. The suppliers are experienced in this, which they partially assess and which has some influence in the calculation of the surfaces. The storage equipment is diverse; small parts are stored in boxes or medium-sized units, engines, for example, are stacked in shelves, and larger parts are stored on the floor surface.

With regards to access to the individual stored parts and clarity, an EDP storekeeping and monitoring system with search system is absolutely vital, as the speed of the acquisition of spare parts will have a direct influence on production. At 60 x 40 m, one can easily keep an overview of the store-room. The total surface is divided into smaller surfaces by accessible transport lanes which can then be supplied directly by forklift trucks from the doors in front of them in the outer wall.

The small workshops in the departments and their spare parts stores are under the control of the main storeroom. Only those spare parts which presumably need to be changed more frequently are kept in the small workshops, which of course has to be carried out as quickly as possible.

The engineering workshop is equipped for all manner of repairs or manufacturing of parts which are not in stock or which cannot be quickly acquired. That however requires a high-quality, well-equipped workshop and well-trained craftsmen. Without establishing the details of how the workshop is equipped, the size has been applied from comparable plants. The following functions must be met:

- Gas and electro welding
- Section sawing
- Turning and milling
- Autogenous cutting / plasma cutting
- Plate cutting
- Sheet metal folds
- Drilling
- Grinding
- Sandblasting
- Sifting / hardening
- Brazing
- Injection galvanising / coating
- Processing of plastic, rubber and wooden parts
- Loading and unloading of heavy parts

Further functions will also be detailed. In this case, one should put one's trust in the experience of the specialists of the companies of fitters.

4.3.2 Administration Building

This building is divided functionally into three main parts, as already indicated in the description in 4.1.2. Those functions described there i.e.

- Laboratory work and technical development
- Monitoring and control of the production and of the means of production
- Administration of the staff and the work plants

must be suitable for the premises. Lighting and air conditions are particularly important criteria for orderly successful work. The height of the premises plays an important role here, and good lighting is vital in today's world of work places with computers.

With regards to the design, any kind of local adaptation is possible. Further technical equipment regarding electrical, communications and sanitary facilities for the successful support of the staff whilst working goes without saying.

4.3.3 Central Personnel Facilities

Due to the relatively great distances, we have gone without a combined unit of public facilities. Instead, a public unit is to be set up close to every department with toilets, changing room, washroom and restroom. It is probably advantageous if smaller units are used and looked after by the users themselves.

It is up to the operators to supply a canteen, arranged on the ground plan next to the administration building. Appropriate connections from the supply network are planned. A more detailed definition of the size, equipment and throughput is only possible at the adjustment planning stages.

Close by there is a somewhat larger car park, which probably will not be used to its full capacity in the current stages, but which may be required in a few years'. The surface should be retained, the current expansion could however be less.

4.4 SAFETY CONCEPTS

4.4.1 Reference Drawings

General Layout - Safety Concepts 000 – 00 – 103

4.4.2 Intended Use

A production plant with 1200 workers and employees and a material turnover of 1.7 million tons per year has great responsibility towards their own staff, the country and the insurance company. Those responsibility must be considered and fulfilled by the builder and operator of the plant.

It is important that in case of fire or other emergencies, those risks can never be completely eliminated, no humans are effected, and the loss of real assets (like buildings and plants) as well as the environmental impacts are minimised.

This is achieved by following four preventive measures

4.4.3 Passive Fire Protection

is achieved by dividing the buildings into a number of separate “fire-sections” and into smaller “fire-fighting-sections” .

4.4.3.1 Fire sections

Are the subdivision of buildings by means of constructional arrangements. The aim of fire sections is to reduce the extension or spreading out of fires to the defined limits. Those constructional arrangements and equipment must prohibit the possibility of fire flashover..

Here the buildings A, B, C, D, E, and F1 and F2 itself are the fire sections.. Towards the neighbouring fire sections they divided by fire resistant construction elements. In the drawing the boundaries of each section are colour marked.

The boundary elements are streets, walls, slabs and roof areas. For example: the slabs above the coating plants are fire section boundaries and subject to fire attack from burning coating materials and therefore are to be executed with 30 cm reinforced concrete.

Also smaller units with higher risk potential like control rooms, switchboard rooms, intermediate storage areas for consumables, packing materials, or surplus material are separated with fire resistant materials.

4.4.3.2 Fire fighting sections

Are separated areas within the fire sections. They depend on the fire-load, the type and quality of the fire fighting systems and personal and from the time the fire brigade needs to get to the place of fire. The determination of the fire fighting sections usually follows the local regulations under consideration of the buildings and above mentioned criteria.

Fire fighting sections require less construction measures but mainly call for technical equipment and their control equipment, e.g. activating alarm systems – control of smoke exhausting systems – switch-on of dry rising mains- of sprinkler systems and so on.

Fire fighting sections are required in industrial buildings where small fire sections usually are not possible. Hall B with a length of 380 m and a width of 107 m is too large for a fire-section and should be subdivided. A division into smaller fire-sections. But this would certainly disturb the production.

Therefore one tries to contain the fire to small areas by other means. The fire area must be kept free of smoke (smoke extraction openings or system required) as good as possible to allow the fire brigade to reach the fire closely. This includes special doors which serve as escape routes and must allow the fire fighters to open them from the outside and thus allow the fire extinguishing attack.

The plan drawing shows one possibility to arrange the fire fighting sections. This is indicative and does not replace the final solution to be determined in co-operation with local fire department and local authorities.

4.4.4 Active Fire Protection

The fire extinguishing must consider the type of fire load (which is the material which can burn). In industrial projects and here these are following materials

- Flammable materials from the raw material deliveries e.g.. Unsorted waste wood chips, paper clippings, rubber, plastics, each of them with or without coatings
- Construction elements which may burn- this can be minimised by careful selection of materials- at minimum all structurally required elements should be fireproof and should be covered adequately. Those covers must be (nearly) inflammable and fire-retardant.
- Various elements of the technical equipment like cables or sealing can be made of non- or hardly inflammable materials, at considerably increased cost. There are various materials to substitute PVC which when burning produces toxic smoke.

  The transformers used in this project are not counted as fire-load because they are enclosed cast-resin transformers.
- Spare parts and consumables like lubricants, hydraulic oil, fuel from vehicles
- Packing materials and palettes from delivered accessory materials

- Oxygen gas from P is very fire conducive.

In principle – for reasons of economy- each fire or material which can be attacked and extinguished with water should be extinguished with water. Therefore the plant is quipped with a separate net for the water used for this purpose. The water is stored in cisterns to ensure immediate availability . From the cisterns and the fire fighting-water-net the street and wall hydrants within the halls are supplied. The inner hydrants are located next to the maintenance catwalks to secure easy and quick access.

For areas of high potential of risk special equipment is to be provided, e.g.

- After the sterilisation of the raw material using the microwave system material could due to excessive heating of certain parts start to smoulder. Therefore detectors are used to find those materials and to allow for automatic sorting out. The material can then be extinguished or burn down in a separate open tank.
- The light material silos will be equipped with automatic fire extinguishing nozzles at their upper edge and with hand extinguishing equipment at the lower discharger.
- The sorting plant is a high risk area but permanently there is staff working and available to fight fires immediately with simple powder type fire extinguishers.
- the compounding plants for the coating materials receives specially – adapted to the fire load- fire extinguishing materials and equipment with automatic release system. The same accounts for the coating plants itself.
- All switchboards and control rooms can be extinguished with powder extinguishers. Gas-flood-equipment like CO_2 or Halon are purposely not used because they pose also danger to human personal.

4.4.5 Escape Routes

The drawings show the escape routes. There are always two escape routes which simultaneously secures that there are two fire attack directions. Within large halls those routes are naturally used for repair-maintenance or exchange ways.

The arrangement of escape routes is in accordance with the maintenance walkways located above the production lines.

The doors and gates can be used for ventilation purposes also..

Secondary rooms only have one (escape) door but there is a possibility to leave those rooms via the windows (workshops, spare parts store, personnel facilities).

Control rooms are located centrally to allow good overview in case of emergencies. The sorting cabins in building A have somehow slightly reduced escape possibilities. This must be improved in the further design stages.

Also in the silo areas a pair of escape routes (here: stairs) exists.

The escape routes from the coating plants should be designed according to German standards. This is not shown on drawings yet..

4.4.6 Protection of environment

with regard to protection of environment following four items are of relevance :

a) Exhaust gas which contains solvents which eventually have harmful or dangerous effects should be collected whenever possible in a way to allow burning without residues. The technology to be used by EM is available for this report. There will be no danger of explosions or pollution of the air.

b) From the coating plants there will be presumably no lacquer-mud which cannot be treated, because the overspray is not collected in a water bath but will be dried after collection. The aim is to treat those dried coating materials and return them to the production process (= recycling)..

c) Water used for extinguishing of burning light weight materials can be contaminated. Therefore it must be collected and controlled disposed to the water treatment plant. There it can be analysed and neutralised if necessary. Adequate dishes are to be provided below the silos and their discharge equipment and also with the separation cabins in order to avoid toxic water to infiltrate into the ground water.

d) Within the area of the compounding plant rainwater and eventually water which was used for fire fighting will not be disposed immediately, but first collected in order to allow for testing and treatment if required.

6 Technical Support

6.1 Water

6.1.1 Potable Water

6.1.1.1 Reference Drawings

General Layout	000 - 00 - 101
All schemes with numbering	050 - .....
All plan views with numbering	050 - .....

6.1.1.2 Intended Use

In one shift more than 350 people will work in the complete factory during full operation; therefore the appropriate sanitary requirements must be met. An emergency supply system must be provided.

6.1.1.3 Requirements

The numbers of employees are listed in 6.1.1-1. These figures should be re-determined depending on the location. The current constant hourly requirement = 8,0 m³/h, maximum value according to Annex 6.1.1-2 approx. 145 m³/h for a duration of approx. 15 min.

Assumptions and Requirements:

The consumption value per person and shift is set at 80 l. The value is purposely selected to be somewhat less than in Germany (120 l).

A constant supply network pressure between 5.0 and 6.0 bar must be present. Any pressure fluctuations should remain between the range of 1.0 bar.

Normal continuous water quality is present in the public supply system.

The low-pressure units must be kept frost-free and the building shut-off devices are in a shaft with a depth of 1.5 m.

Stop valves or shut-off valves equipped with a post-fitted no-return valve as well as dirt filters.

A central and other water meters should be provided at the building supply areas.

6.1.1.4 Main system

See Annex 6.1.1-3 and General Layout.

Total water content of the supply network is approximately 16 m³ which in normal operation should be replaced within 5 hours. Total length approx. 2,950 m with DN 25 – DN 150.

The supply network pressure is set at 6.5 bar which is created by pumping. Control of the complete external drink water supply takes place dependant on pressure

If the pump fails, a minimum pressure of 2.7 bar is maintained by the water tower. It contains a reserve of 55 m³ , according to the consumption during a shift.

The system is a ring system with accessibility via drain and ventilation shafts.

The supply network feed takes place depending on consumption through the float control in the water tower, resulting in the minimal pressure. In cases of questionable external supply, it is possible to set up a basin and, if necessary, a treatment processing in the water station (optional).

6.1.1.5 Installation

The ventilation and de-ventilation of the ground-covered pipe supply system outside of local supply networks should be designed so that it is possible that air separated from the water can escape via independently functioning de-ventilation valves at the high points planned for this purpose. Properly dimensioned ventilation and de-ventilation pipes should be provided at these high points in the supply network which are integrated into separate shafts.

The shafts must also be equipped with ventilation and de-ventilation capacity.

The shut-off devices must be freely accessible at all times.

Uninhibited access to the shafts installed (low points and high points) must be ensured in each case.

Addition installations in the external network are ground-covered shut-off devices in the form of slide gates with rods and a valve box made of cast iron.

All lines of the potable water supply network in the buildings should be laid with a gradient to the distributor.

The distribution station should be installed in a frost-protected room.

Because complete draining must take place in the individual line segments for maintenance and repair purposes, water sacks should be avoided in maintaining the lines. If this is not possible, drainage fittings should be integrated into the supply network component at these points. All resulting drainage water is drained via ground canals.

The pipe systems should be installed in such a way that sufficient ventilation and de-ventilation is ensured via the highest supply or extraction valves. Commercially available pipe ventilators and de-ventilators should be provided for this purpose at all planned high points in the network.

When the potable water supply network is filled for the first time for pressure tests for test operation must occur with processed water from the public supply network using tankers because the processing plant cannot presently feed into the potable water supply network.
Required labelling indicating **"POTABLE WATER"** should be supplied. Additional labelling should be provided according to existing local regulations.

6.1.1.6 Details

High-level tank in Building B

Tank as an open container with cover (atmospheric connection) made of steel, internal lining with polyethylene material, safe in terms of foodstuff safety laws, with all required connections, fittings, and signal transmitters.

- Approximate measurement: diameter of approx. 4.00 m, total height of 5.50 m
- completely heat-insulated and with condensation water insulation on all water-conducting components.
- Inflow via flow valve with killed flow via a supply pipe,
- Alarm in cases of insufficient water (such as an error function of the float valve installed),
- Upper entry hole approx., min. 0.80 m inner width for inspection and maintenance purposes,
- maximum water level to overflow at approx. 4.40 m,
- 1 additional ventilation pipe (atmospheric connection),
- Extraction pumps (=Pressure increase pumps) including float control.

Warm Water

Warm water processors as electrical boilers or with solar plants in buildings A, B, C, E and F and r & d/operations/admin., canteen.

Warm water small-size devices as sub-table devices or wall boilers

in the sewage treatment building, water station/site utilities, guardhouse, weigh houses.

6.1.1.7 Materials

All components for potable water plants must be kept at a permissible pressure of 10 bar if a higher operational pressure does not apply.

Any pressure reducers or additional filters are included in the product machine delivery content (warranty reasons).

6.1.1.8 Insulation

The insulation of all water supply lines in the buildings have non-flammable mineral fibre shells in accordance with DIN 4102, laminated on aluminium foil with a vapour-sealing effect. All contact surfaces are glued with non-flammable, vapour sealant adhesive. The insulation has a protective coating made of aluminium plates to protect against mechanical damage in work areas, equipment rooms, and in the upper area of open hall areas.

These cold water supply lines have this insulation + insulation protecting against the formation of condensation water (DIN 1998, Part 2) and heat loss in periods of low ambient temperatures and against warming at high air temperatures for hygienic reasons.

The fittings have the appropriate insulation caps.

In the case of factories endangered by frost, all water-conducting pipelines within the unheated hall areas should include an accompanying self-regulating heating unit.

6.1.2 Industrial Water & Fire Fighting Water

6.1.2.1 Reference Drawings

General Layout	000 – 00 - 101
Safety Concept on General Layout	000 – 00 - 103
All schemes with numbering	051 - .....
All schemes with numbering	052 - .....
All plan views with numbering	050 - .....

6.1.2.2 Intended Use

The production needs water for

- mortar preparation for panels
- preparation of de-salinated water for coating and make-up water of cooling circuits
- cleansing of areas with waste material
- wetting of the K board material
- wetting of storage tanks

Water is kept available for fighting fires.

6.1.2.3 Requirements

The production technology requires water of a certain quality and quantity.

- For mortar production: essentially chemically neutral and germ-free; with a minimum pressure of 1-2 bar on the warm water processors of the mixing unit, turbidity limited
- For the creation of de-salinated water: germ-free, cool, turbidity limited in co-ordination with the processing plants.
- Cleansing water has to be softened to such an extent that no calcium precipitation occurs during heating, germ-free.
- Moisture water for GFF as for mortar production.
- For fire-fighting no requirements that go beyond this.

Peak demand limit from annex 6.1.2-1 is

- for production 157.7 m³/h
- for extinguishing water only with production stoppage 3 x 36 = 108.0 m³/h (in accordance with regulations)
- for the case of continuing production and additional fire-fighting, most unfavourable in building E =

  157.7 + 3 x 36.0 – 7.5 = 258.2 m³/h

6.1.2.4 Main System

See annexes 6.1.2-2 and -3 as well as general layout.

Total length approximately 5,150 m at DN 65...DN 150

Network pressure provided 6.5 bar in average, created by pumping

Control of the entire waste water or water extinguisher external networks

occurs dependant on pressure.

If a pump fails, a minimum pressure of approx. 2.7 bar is maintained by the water tower. It contains a reserve of 110 m³, corresponding to the extinguishing water for a period of extinguishing of 1 hour (= 3 x 36 m³/h). The feed to the water tower takes place dependant on pressure and is controlled by the float.

a) from the industrial usage water basin of the sewage treatment plant and

b) in emergencies from the public potable water network per precipitation incident.

c) from the rain water lines from the roofes of building A....F into the 8 rain water distribution reservoirs.

The system is a ring system with accessibility through drainage and ventilation shafts.

These distribution reservoirs can provide water for the intended purposes, however, the fire reserves always remain. The total storage capacity of these tanks should be 300 m³ in each case, the fire reserve is 108 m³, i.e. in fully filled cisterns a total of 8 x (300-108)= 1536 m³ is available for production (approx. 10 day supply).

After a fire, the water is refilled by rainwater. If this is not possible naturally, it can be done either with tankers or by a hose.

The water from the sewage treatment plant is degermed.

Additionally at least 2 membrane pressure tanks must be installed in building A and in the room next to substation 7 western of C as a buffer in the network.

6.1.2.5 Installations

The ventilation and de-ventilation of the ground-covered pipe supply system outside of local supply networks should be designed so that it is possible that air separated from the water can escape via independently functioning de-ventilation valves at the high points planned for this purpose.

Properly dimensioned ventilation and de-ventilation pipes should be provided at these high points in the supply network which are integrated into separate shafts. The shafts must also be equipped with ventilation and de-ventilation capacity.

The shut-off devices must be freely accessible at all times.

Uninhibited access to the installed hydrants must be ensured in all cases. Hydrants as the conventional design according to local availability with two visible, not individually lockable connects DN 80. Service takes place using a six-edged head or a perforated ring in the cap top. Additional service types in coordination with the local fire department.

The planned fire hydrants should also be equipped with a break-off point as a by-pass protection mechanism. This prevents the loss of pressure water in the case of damage.

Hydrants with independent drainage as protection against frost danger

The colour is “red” in accordance with international norms.

Addition installations in the external network are ground-covered shut-off devices in the form of slide gates with rods and a valve box made of cast iron.

All lines of the water extinguisher network should be laid with a gradient to the filling and drainage station.

The distribution of the required water quantities for the consumers in the individual buildings takes place directly after entry to each building from the utility distribution room, primarily in two main branches:

- Waste water supply for regular consumers for production, cleaning etc.
- Water extinguisher supply of the connection type “wet/dry” with filling and drainage station.

The filling and drainage station should always be installed in a frost-free room.

Because complete draining must take place in the individual line segments for maintenance and repair purposes, water sacks should be avoided in maintaining the lines. All resulting drainage water is drained via ground canals.

The drainage of the pipe system should be measured in such a way that extinguishing water is available at the most unfavourably laid hose connection valve no more than 60 seconds after activating water extinguishing. “Fast pipe ventilators and de-ventilator should be provided on all highpoints in the network.

In normal cases, the extinguishing water supply in the buildings takes place with wall hydrants in the workrooms and corridors (emergency escape routes). Uninhibited access to the wall hydrant cabinets must be ensured.
The wall hydrant cabinets with hose drums are equipped with manual fire alarms and connected to the external control system.

The required labelling indicating **“no potable water”** on wastewater must be supplied. Additional labelling is to be according to local regulations.

6.1.2.6 Details

High-level tank in Building B

Tank as an open container with cover (atmospheric connection) made of steel, internal lining with polyethylene material, safe in terms of foodstuff safety laws, with all required connections, fittings, and signal transmitters.

- Approximate measurement: diameter of approx. 5.50 m, total height of 5.60 m
- completely heat-insulated and with condensation water insulation on all water-conducting components.
- Inflow via flow valve with killed flow via a supply pipe,
- Alarm in cases of insufficient water (such as an error function of the float valve installed),
- Upper entry hole approx., min. 0.80 m inner width for inspection and maintenance purposes,
- maximum water level to overflow at approx. 4.65 m,
- 1 additional ventilation pipe (atmospheric connection),
- Extraction pumps (=Pressure increase pumps) including

  float control.

6.1.2.7 Materials

All components for industrial res. fire fighting water plants must be kept at a permissible pressure of 10 bar if a higher operational pressure does not apply.

Any pressure reducers or additional filters are included in the product machine delivery content (warranty reasons).

6.1.2.8 Insulation

The insulation of all water supply lines in the buildings have non-flammable mineral fibre shells in accordance with DIN 4102, laminated on aluminium foil with a vapour-sealing effect. All contact surfaces are glued with non-flammable, vapour sealant adhesive. The insulation has a protective coating made of aluminium plates to protect against mechanical damage in work areas, equipment rooms, and in the upper area of open hall areas.

These cold water supply lines have this insulation + insulation protecting against the formation of condensation water (DIN 1998, Part 2) and heat loss in periods of low ambient temperatures and against warming at high air temperatures for hygienic reasons.

The fittings have the appropriate insulation caps.

In the case of factories endangered by frost, all water-conducting pipelines within the unheated hall areas should include an accompanying self-regulating heating

6.1.3 De-Salinated Water

6.1.3.1 Reference Drawings

Water - plan view - basement	050 - B1 - 101
Water - plan view - mezzanine	050 - B1 - 103
Flow sheet - cooling fluids	054 - B0 - 002

6.1.3.2 Intended Use

In certain areas, processed water is required:

a) Fully de-salinated water for make-up of electrical cooling circuits (HeatWave/ Lindauer Dornier)

b) Fully de-salinated water to prepare the precoating materials (Klausen)

c) Softened water for make-up of the cooling circuits of the RFV dryers.

6.1.3.3 Requirements

Corresponding to the supplier guidelines:

a) HW has requirements for electrical circuits-water cooling and L Dornier provides the units.

b) C has requirements for pre-coating material preparation and K provides the units.

c) L Dornier has requirements for cooling circuits approx. 15 m³/h softened water to prevent the formation of incrustation in the cooling circuits.

6.1.3.4 Softening

Regarding point (c) above, a pendulum device is suggested for the full required capacity with control dependant on consumption from the 26°- basin (B1). During low temperature periods the activation period is reduced. The nominal capacity must be adapted to local climate data.

The units are to be set up in building B in the basement next to the 26°-basin in the pump basement.

Backwash water is directed to the sewage treatment plant via industrial wastewater by a lifting device.

6.1.3.5 Consumables

Commercial cooking salt NaCl is used for the chemical bonding of the harmful calcium deposit in the water. It is delivered in sacks and stored in the basement, directly next to the unit.

6.1.4 Cooling & Heating Fluids in Building B

6.1.4.1 Reference Drawings

Plan views	054 - B1 - 101
	054 - B1 - 103
	054 - B2 - 102
	054 - B2 - 103
Flow sheets	054 - B0 - 001
	054 - B0 - 002

6.1.4.2 Intended Use

From the dissipation of the RF control cabinets, 1/5 is siphoned out of the cabinets by air. These cooling machines are cooled down via the cooling towers.

The rooms themselves absorb heat from the cabinets and the ventilation cools / partially heats the rooms in the winter.

For the conditioning of the air, the ventilation equipment receives connections from heating and / or cooling systems.

6.1.4.3 Heating

Individual equipment has to be heated in the winter. As the accompanying ventilation systems require fresh air, there is the danger of the suction equipment freezing. That is why the heating is supplied with an anti-freeze glycol-water combination which is heated by means of a heat exchanger. The heat comes from the 33° basin (B2) in the cellar of building B, the return flow enters basin B1 at 26°.

For the design of the equipment, the determining winter temperatures must be applied. The intake air to be heated (fresh air rate) lies between 0.9 and 1.84 m^3/s and is shown in the flow; the given rates of the outside temperature of – 20° and a room temperature of at least + 15° are taken as the basis.

The heat exchanger and the water-glycol container are both on the north side of the mezzanine next to the refrigerators.

6.1.4.4 Cooling

As a rule, the control rooms and the control cabinets need to be cooled. Two separate cooling systems are planned for this. Both of them however will be cooled down with cold water from the 15° tank, the return flow enters the B2 basin with temperature between 26°C and 33°C.

The temperature range in summer is:

- for the room ventilation 40°C outside / 26°C interior cooled intake air
- for the control cabinet ventilation 40°C outside / 18°C / 30°C max interior temperature

That results in a cold water temperature of 15°C / 26°C, for which the refrigerators are equipped, i.e. the same values as those for the cooling of the RFV Dryer. The capacities of the refrigerators are also the same.

6.1.4.5 Other control and switch rooms

The control rooms and the workshop B4 on the mezzanine plus the control room on the mixing station shall all be supplied with room ventilation, i.e. with heated intake air (with glycol) and cooled circulating air from the 15° basin. As the control facilities usually produce heat, heat re-extraction is planned for the winter for these two rooms, whereby heat from the extracted air is pumped to the intake air’s heater via heat exchanger.

For the three other, smaller control rooms, it is planned that they will be cooled and ventilated via wall-mounted equipment. In case of local hot climate conditions, these rooms will also be connected to the cooling units.

6.2 Waste Water

6.2.1 Domestic Waste Water

6.2.1.1 Reference Drawings

Roof Top View (General Layout)	000 - 00 – 201
All plan views with numbering	040 - ....

6.2.1.2 Intended Use

Collection and channelling of effluents from the staff facilities to the sewage plant.

Wherever water is delivered to it must be eventually be channelled away again as waste. This means that all points with water connections will also require adequate wastewater connections.

6.2.1.3 Requirements

Drainage of the building will be carried out using a split system.

Domestic wastewater must be collected in septic tanks and pumped to the treatment plant.

Water containing industrial effluents must also be treated.

The minimum slope for free surface flow lines is 2%.

Minimum cover for the top of the pipes dependent upon the depth of frost and traffic and cover loading.

6.2.1.4 Systems

For safety reasons, all septic tanks contain connection supports for cleaning out by sewage vehicles.

The cleaning out connection is to be verified by the public waste disposal authority.

The wastewater collection lines will be extended beyond roof level for top ventilation above the highest connection point. These ventilation lines are usually installed in front of the façade and underneath the eaves to prevent any unnecessary penetration through the cladding.

Clean-out sections will be provided in front of the apertures of the vertical DN 100 pipelines. Cleaning out can also be conducted via the new floor drains.

Because of the very great area of the whole factory space and the consequent large civil works, free surface flow lines for sewage disposal are very cost intensive. (Additional interim true sewage siphons would in any case be required, at least in front of the sewage plant).

Building A and Sewage Treatment Plant Building

Because of the position of both buildings right next to the sewage plant, a direct connection of the effluent drain to the free surface flow lines lope is possible. This also applies to the covered washing area next to Building A. Falling washing water from the cleaning process is directed via a floor drain to the petrol separator and from there it is diverted on to the sewage treatment plant collection drain.

Peroxide open-air stores

The sumps of the non-covered peroxide open-air stores are connected to the planned ground pipe network for Building A by pressure pipes and submersible pumps.

Dimensioning is done in accordance with the eventuality of rain and/or extinguishing in the event of a fire.

Buildings B, C, D and E

Waste inside the building is collected in a septic tank and taken to its own sewage treatment plant using submersible wastewater pumps.

The buried wastewater drains for the tank are intended to be free surface flow lines.

The septic tanks are to be dimensioned according to their load values. (Appendix 6.2.1).

6.2.1.5 Materials

The waste water collection lines for the fixtures and floor drains etc. in the buildings will be laid underneath the floor slabs, joined and connected to the new exterior waste water network with septic tanks. Back-up level = street level at connection to the building.

The individual pipe dimensions are shown in the drawings.

A maximum operating pressure of 10 bar must be withstood for all pressure pipe plant parts including those within the buildings, where no higher operating pressures are to be observed.

It is advisable for the underground pressure pipes to be constructed from UPVC material, produced with sleeve connections.
The necessary blocking instruments must be accessible on either side.

Installation of buried pressure piping must be 1.00 m underneath the ground.

<u>Instructions for the septic tank with a pump</u>

- Concrete basin with wastewater resistant covering and capacity of approximately 30 m^3.
- Installation up to circa 6.00m underground, covered with approximately 2.00m of earth.
- Pump drain with mudguard and additional suction pipe drain sump
- 1 additional ventilation pipe above the roof.
- Aperture = c 1.50/1.00 m with lid and without ventilation openings above the pump drain, for maintenance purposes, with cad ladder or tension bars for the submersible waste water pumps.
- Easier flow via a flow pipe.
- Underground waste water pipes including float regulation with levels for the pump.
- Warning of over-filling in case of failure of the submersible wastewater pumps with connection to the external control system.

6.2.2 Industrial Waste Water and Cleansing

6.2.2.1 Reference Drawings

all plan views with numbering 040 - ..... - .....

6.2.2.2 Intended Use

All loads of water carrying harmful substances, even those which may be carrying them, from production, leakage and precipitation, must be collected and directed to a cleaning plant.

6.2.2.3 Requirements

All transfer areas for chemicals, all open air storages and retention basins for ultimately contaminated extinguishing and cleaning water are to be connected to the system, if necessary using an emergency basin.

An additional suction pipe connection for disposal by an on-site sewage vehicle is to be arranged with the operator on site.

6.2.2.4 Systems

The buildings are essentially connected to collection pits with free surface flow, which travel to the sewage plant via pressure pipes.

Underground areas (such as, for example, basin pits) which generally remain dry, do not contain pump drains and which can be pumped out in an emergency with mobile pumps.

Revision shafts up to a maximum of 50m distance are also inside due to the extensive dimensions of the buildings.

<u>Building A</u>

Cleaning water and possibly also extinguishing water from the following general areas:

- Floor gutters at all entrances for cleaning purposes and/or the retention of extinguishing water in the event of accidents or fire.
- Floor gutters in the area of rubber storage and rubber disintegration as above.
- Floor gutters the length of the inside, at +- 0.0 m, for cleaning purposes
- Side gutters the length of the platforms, at + 4.0 m, for cleaning purposes
- Floor drainage channels at +- 0.0 m principally along the side areas, for cleaning of the area, drainage from fire protection equipment for emptying and other wastewater disposal.
- Floor drainage channels from the drying area at +- 0.0 m for removal of extinguishing water
- Floor drainage channels from the concrete rubble milling area at +- 0.0 m

- 6 sewage pumps for the pits in the rubbish delivery area and cleaning of the pit using flat jets
- A separate pump shaft with running channel is envisaged next to the delivery pit.

Building B

Cleaning water and possibly also extinguishing water from the following general areas:

- Floor gutters at all entrances for cleaning purposes and/or the retention of extinguishing water in the event of accidents or fire.
- Floor drainage channels at +- 0.0 m for cleaning moulds
- Floor drainage channels at +- 0.0 m principally along the side areas for cleaning the area, drainage from fire protection equipment for emptying and other wastewater disposal.

- Floor gutters at +- 0.0 m underneath the mixing tower for the disposal of contaminated waste in the event of an accident or fire

- Floor drainage channels on the platform at +8.0 m for cleaning purposes
- Floor drainage channels on the platforms +10.0 m, +13.15 m, +15.0m and +19.0 (Methocell preparation)
- Floor basin underneath the raw material silos at -0.30 m for interim storage of contaminated waste in the event of fire / quick-closing silo with 900 m^3 storage space
- Flat roof basin at +6.0 m directly underneath the silo (= base of the silo). In the event of a fire or emergency its rainwater connection pipes will be selectively closed automatically by motor sensors on the fire alarm equipment so that the contaminated extinguishing water flows underneath the floor basin described via overflows.
- Basin construction above the switching room under the dosing silos as above
- Basin construction under the mixer in the mixing towers for cleaning of the mixer and filling stations by rotation
- Overflow and emptying of the potable water and industrial water tanks at +27.0 m with connections to the ground pipes
- Floor drainage channels on the platform at + 27.0 m for emptying
- Overflow and emptying of the basins from the 11 cooling towers at +15.50 m with connections to the ground pipes
- Floor gutters in the cellar at -5.85 m for cleaning and drainage of leakage
- Floor drainage channels in the cellar at -5.85 m for rinsing water from the de-salinated water equipment.
- Floor drainage channels from the cassette return channel at -3.80 m for cleaning
- Floor drainage channels in the assembly shaft in front of the outside façade of the cellar at -6,0 m for diversion of the falling rainwater

- 2 Wastewater pump-shafts in the cellar of the building for overflow and emptying of the 3 basins for vacuum cooling.

Buildings C, D and E as well as neighbouring sub buildings

- Transfer areas with floor drains
- Floor drainage at all entrances
- Workshops
- Final emptying points for the coating equipment
- Final emptying points for the compounding equipment
- Floor drainage channels at +- o inside the side areas for cleaning the area and waste from emptying of fire protection equipment
- Pump in the cassette return channel

6.2.2.5 Materials

Pump shafts:

- Concrete shaft with waste water resistant covering and capacity of circa 1.0 m3
- Dimensions of around 1.0 x 1.0 m per chamber, inner wall with overflow
- Distance underneath the inside floor variable
- Pump drain with mudguard and an additional suction pipe drain per chamber
- Covered by circa 0.30 m concrete, with an additional ventilation pipe above the roof when the drain is sealed off completely watertight from the building.
- Entrance d = 1.00 m, with Begu cover and without ventilation apertures above the pump drain (for maintenance) with ladder or draught grilles for the underground waste water pumps in each chamber
- Simplified entry via an entry pipe in each chamber
- Underground waste water pipes, about 3 l/s per chamber including separate flow regulator with level for the pumps in each room
- Over-fill warning via failure of the installed underground wastewater pumps connected to the external control system.

Revision shafts:

- Revision shafts made of concrete with waste water resistant covering of gutters
- Minimum clear diameter 1.00 m, with conical narrowing entrances
- Entrance d = 0.625 m, with Begu cover and no ventilation apertures
- Depth of circa 1.30 m underneath the building floor

Collection pits for interim storage:

- Concrete basin with waste-water resistant covering and a capacity of circa 65 m³, as before, but with the following differences,

  Dimensions in the order of L x B circa 5.00 x 5.00 m,

  Depth of around 5.7 m below ground level of which around 2.00 m is covered in soil,

  1 Underground wastewater pump 15 l/s in normal conditions,

2 Underground waste water pumps 30 l/s for additional waste water from emptying processes, e.g. basins, including separate flow regulation with levels for the existing pumps.

6.2.4 WASTE WATER TREATMENT

6.2.4.1 Reference Drawings

Flow sheet 040 - A0 - 001
Plan at Level ± 0.00 m 040 - A1 - 101

6.2.4.2 Intended Use

The intended use of this planned purification plant is the purification of domestic and industrial wastewater from the whole operation with the intension of re-using it.

The consumption rate is composed as follows:

1. Domestic wastewater
   - Sanitary and public areas from building A -- free drainage -
   - Sanitary and public areas from buildings B, C+E including outbuildings -- delivery pipes -
2. Industrial wastewater
   - Washing and surface cleaning from building A and the car wash -- free drainage -

- Other buildings -- delivery pipes -

6.2.4.3 Requirements

The treatment of the wastewater is to use “biological” cleaning techniques. This planned biological purification plant is to have an effectiveness of at least 98%. After the processing process (including sterilising with H_2O_2), part of the purified water will be fed back into the industrial water network.

6.2.4.4 Quantities data

E = abbreviation for a figure showing the consumption quantity compared with that of a person.

- *Amount of wastewater*

Personnel ⇒ 1200 E x 150 l/d

Washing and cleaning

processes ⇒ 800 E x 150 l/d

Total wastewater ⇒ 2000 E x 150 l/d ⇒ 300 m³/d ⇒ 3.5 l/s

The maximum drainage from the structural conditions is:

⇒ 3.5 l/s x 2.5 = 8.75 l/s

- *Organic load*

  BSB_5 (5-day, biological oxygen

  requirements) ⇒ 300 kg/m³ O_2 ⇒ 2.63 kg/sO_2
- *Air requirements*

  The air requirements

  resulting from it ⇒ 300 kg/m³ O_2 ⇒ 2.63 kg/sO_2
- *Accrued amount of sludge* ⇒ 1 l/E/d ⇒ 2000 l/d ⇒ 2,0 m³/d

6.2.4.5 Dimensions

- The compact plant “Raking+Sand Filtering+Grease Filtering” is designed for 8.75 l/s

  Intake DN 150
  Outlet DN 150
- Combined neutralising with a mixing device and component dosing

  Size of the tank V = 150 m³
- Distributor construction for a homogenous wastewater dosage to the activated-sludge basin
- Two purifying units – each consisting of one activated-sludge basin (B) and one secondary purification basin (N):
  V_B = 350 m³
  F_N = 32 m²
- The input of air into the activated-sludge basin is a result of fan units with a capacity of V = 0.96 Nm³/s (1 unit as reserve)
- One backwashed sludge pump per secondary purification basin with a capacity of V = 8 l/s
- Sludge silo with V = 120 m³ with a sludge output device
- Drainage sampling with pumps to the water supply tanks
- Sterilising plant (H_2O_2), designed for an input of 3.5 l/s water
- Water supply tank V = 500 m³
- Collecting tank V = 500 m³ (Average!)

6.2.4.6 Description of the plant

The economically viable working of a purification plant requires continuous operation. It is for this purpose that the plant was designed from two separate purification lanes. Both systems work identically to each other.

The wastewater to be purified is mainly obtained from an operation which has a high turnover of various waste. There exists, therefore, the probability of unforeseen or wastewater-relevant emissions (damage).

As a safety design, it is planned that, before the first intake shaft, the industrial intake and the domestic intake are fed into different pipes. The domestic wastewater can flow unrestricted for further processing.

In case of an abnormal occurrence, the industrial wastewater will be fed to a collecting container via a slide valve (in the first inlet shaft). The appropriate emergency switch is in building A and is activated manually. After undergoing quality control in the collecting container, the wastewater is pumped into the neutralising vessel for further treatment.

The purified wastewater is fed to the water supply network after sterilisation; the excess is forwarded to the receiving water.

The resulting sludge (ca. 2 m^3/d) continues for further treatment.

Further treatment and the ultimate destination of the sludge to be arranged with the local authorities.

6.2.3 Rainwater

6.2.3.1 Reference Drawings

The standard planning does not allow any reasonable representation of outside plant as the topographical data can only be fictitious. Thus there is no reference drawing.

6.2.3.2 Intended Use

Roof areas require the draining off of rain in order to prevent water running uncontrollably into the eaves and forming icicles in winter. Uncontrolled downfall leads to damage to the outer areas of the building. Rainwater should sometimes be used in production or for general use.

6.2.3.3 Requirements

Amounts of rainwater are not definitive in the standard planning, that is, the dimensions of pipes and drains, etc. must be adapted.

The width of buildings sometimes demands internal drainage.

The roof surfaces must be equipped with straight slopes to the low-lying roof gullies to avoid damage to the surfaces.

Gullies to be heated ultimately according to the climatic zone.

Roof guttering for buildings up to a maximum of 50m total width.

6.2.3.4 Systems

External building drainage

Due to large amounts of water from large roof areas, large gutter cross-sections are required. Therefore, box gutters with corresponding supports are recommended. Drainage via open slopes using down spouts and drainage pipes.

Internal building drainage

Pressure drainage to be used with rain water pipes without slopes that operate when full, underneath the planned roof construction, according to the plans.

The filling up of the pipe system and its subsequent self-emptying will thereby be achieved by the build-up of underpressure. The energy to create the underpressure is generated by the height difference between the roof water outlet and the passage to the free surface flow drainage.

Advantages

- fewer ground pipes, drainage connections and earthworks
- smaller pipe dimensions; approximately half the nominal value compared to conventional systems
- no pipe elevations necessary in the buildings and therefore better options for the organisation of pipes
- better use of internal space due to considerably fewer down pipes
- better self-cleaning of pipes due to the higher speed of flow
- complete systems offer appropriate connections that do not require increased safety input in order to operate an underpressure system

Storage

In order to effect the use of collected rainwater, it can be directed into the underground fire fighting water stores.

The stores are laid out at the minimum for the required amount of extinguishing water and the operation of the extinguishing water external network with the necessary open-air hydrants.

Pressure water pipes terminate as collection pipes that are designed as normal free surface flow pipes. The water flows in front of the reservoirs through the necessary pre-set filter system and forms the first cleaning stage for the use of rainwater. Should the reservoirs be full, then the rainwater goes into the recipient. It contains

- Buffers for the required and additional amounts of water for the production make-up water
- Buffers for irrigation and spraying within the factory areas
- Buffers for cleaning within the factory areas (delivery and storage areas)
- Reserve amounts (compensation of peak efflue)
- Extinguishing water reserves

Two cisterns are envisaged for each building, generally arranged diagonally. The remaining neighbouring buildings will, as far as possible, be integrated into this rain water system.

6.2.3.5 Operation

Through the correct and regular maintenance of the roof and the roof water drains, enduring safety and optimum drainage will be guaranteed. Contamination, such as, for example, leaves or, ultimately, any growth on the roof area, must be removed. This cleaning must be carried out according to the environmental requirements.

Essentially, the layout of the plant is to be observed in such a way as to require little maintenance and so that no damage occurs if it is not done.

The storage plant is to be completely checked over periodically.

6.2.3.6 Details

External roof drainage according to local availability with non-corroding materials.

Pressure drainage must have pressure-tight connections and allow as large a range as possible. (e.g. cast pipes or special composite plastic pipes).

Pipework to the reservoir must be equipped with non-corroding, self-cleaning filters, specially constructed with an overflow into the drainage network.

Instructions for the planned storage basin (suggestions)

- Basin made from concrete, segment construction, capacity 300 m³, dimensions: circular, approx. 12.0 m in diameter,
- Maximum water depth 3.40 m, total depth, approx. 4.60 m below ground-level, of which approx. 0.60 m earth coverage.
- Pump drain with mud filter and additional emptying drain.
- 2 ventilation and air extraction pipes to/from the basin to approx. 1.0 m above ground level,
- Simple access via an access platform or appropriate front shaft.
- Entrance D = 1.00 m, with well-shaft cover above the pump drain and ladder (for maintenance purposes),
- Two additional extinguishing water pipe connections for removal of extinguishing water by the fire services.
- Entrance d = 0.625 m, with Begu-cover above the overflow drain and ladder (for maintenance purposes).
- Overflow drain and siphon construction (including active rat protection) to the drainage network or front pools for seepage or evaporation.
- The evacuation pump is proportioned for the necessary amount of extinguishing water as well as the additional amounts of water for production purposes or for cleaning and spraying purposes.
- Includes pipework from the pumps to the network connections and additional evacuation of the network into the basin as required.

The rapid and simple emptying of extinguishing water when needed, is ensured by the fixed construction and corresponding structure of the area around the extinguishing water pipe connections.

6.3 VENTILATION SYSTEMS

6.3.1 Building A

6.3.1.1 Reference Drawings

ISO-Chart	060 - A0 - 001
Plan at Level +4.60 m	060 - A1 - 102
Sections 1-1, 2-2, 3-3, 4-4, 5-5	060 - A1 - 301
Plan at Level +4.60 m	060 - A2 - 102
Plan at Level +9.00 m + 14.00 m	060 - A2 - 103
Sections 1-1, 2-2, 3-3, 4-4, 5-5	060 - A2 - 301

6.3.1.2 Intended Use

A ventilation system is necessary for the air conditioning in the sorting areas.

The sorting is done manually, and therefore appropriate working conditions must be maintained for the personnel, i.e. the air stream should prevent the workers from inhaling swirled up pollutants. This is guaranteed with this planned ventilation system.

6.3.1.3 Requirements

The outside air is to be introduced via a sand separator and a high-quality category F7pocket-type filter.

This assures a sand and dust free atmosphere of at least 98% if the filter is properly maintained. Automatic filters are not used as they are prone to defects.

The circulating air within the room is 10x/h.

In the winter, the air heating will keep the room temperature at a minimum +15°C.

Cooling will not be carried out in the summer, unless required.

6.3.1.4 Function & Systems

The sorting of waste takes place in a hall which is divided into four work areas (partitioned rooms).

Two partitioned rooms are one sorting unit (conveyor belt).

One sorting line consists of one belt conveyor line sorting work followed by one carousel sorting work.

The ventilation ducts are positioned in the immediate vicinity of the conveyor belts.

Each partitioned room has its own independently-operating ventilation system (street).

The systems employed to fulfil the various demands are constructed as a simple central solution which guarantees a high level of supply whilst requiring low levels of maintenance and upkeep.

The method of operation of all four ventilation ducts are the same.

a) Intake air

The outside air is siphoned in by an intake air ventilator, fed into the dust chamber, it then goes through a filter, a heat exchanger (air heater), a sound absorber and arrives in the working area via intake air pipes and inlets.

The amount of intake air for the rooms is:

- Carousel sorting work 8 m³/s
- Conveyor line sorting work 4 m³/s

b) Extracted air

The air is extracted from the working areas via suction caps with the aid of ventilators. The amount of extracted air in the rooms is:

- Carousel sorting work 7.5 m³/s
- Conveyor line sorting work 3.6 m³/s

The differences between the siphoned amount of intake air and the amount of extracted air result in slight excess pressure in the sorting areas.

This is a desired effect and is explained as follows:

6.3.1.5 Exchange of air

The sorting rooms are situated in an enclosed hall, intended for the handling of materials (loading and unloading of lorries).

The ensuing car emissions are extracted via 8 ceiling ventilators with a capacity of 5 m³/s each. The ceiling ventilators are activated according to requirements and their high capacity has a quick effect.

The previously mentioned excess pressure prevents the car emissions from the heavy traffic in the main hall from entering the sorting rooms.

6.3.2 Ventilation of the Central Control Rooms of the RFV Dryer

6.3.2.1 Reference Drawings

Flow sheet	060 - B0 - 001
Plan at Level +8.00 m	060 - B1 - 103
Sections 1-1, 2-2	060 - B1 - 301

6.3.2.2 Intended Use

A high-frequency vacuum drying plant is used to dry the product. Its regulatory and controlling elements are in six different central control rooms. The operation of this plant gives rises to huge amounts of heat. In order to maintain the plant's permitted temperature, a water cooler and an air cooling system is used. The air-cooling system consists of two components:

- Room air-cooling
- Air-cooling of the electrical machinery

6.3.2.3 Requirements

- Room air-cooling

The cooling system guarantees a six-fold exchange of air and is equipped for use in both summer and winter.

The air temperature will not exceed 30°C in the summer and the air will be heated to at least 15°C during the winter.

- Air-cooling of the electrical machinery

The cooling system employed here is a "closed system". The resulting remaining heat of 30 kW per element is removed from the electric cubicles via the compulsory cooling air.

The air temperature may not exceed 30°C. The heat is discharged via cold water. Compare the cool water diagram in this case.

6.3.2.4 Function

- Room air-cooling

The air is siphoned off at the gable ends, flows under a dust separator, a suspended particle filter (EU 13) and continues through a heat exchanger + sound absorber, where it arrives at the central control room via a ceiling air vent. In the air ducts there is an air-cooler which is only used in the summer.

There is high-capacity electrical machinery in the central control rooms. It must be noted that there is a possibility of fire.

In this case, a fire protection flap has been installed in front of the ceiling air vent which will stop the intake of fresh air in an emergency.

Room air balance

The siphoned intake air in the six central control rooms is as follows:

1) 0.9 m^3/s	4) 1.84 m^3/s
2) 1.5 m^3/s	5) 1.84 m^3/s
3) 1.84 m^3/s	6) 0.9 m^3/s

The extracted air escapes via air outlets mounted at the ends of the rooms.

- Cooling the electrical machinery

The proposed cooling air system is a closed, circulating system.

The air is fed from below via a stationary filter into the control / regulatory cabinets where the cooling is effected. After removing the heat, a ventilator transfers the air to a heat exchanger via a filter (EU 13), where the cooled air is ultimately fed back into the circulating system.

By passing through the electrical machinery, the circulatory air may become polluted by small particles. The inbuilt air filter (at least category EU 13) prevents this and guarantees the required purity of the air-cooling system.

6.3.2.5 Summary

In the six central control rooms, there are between 9 and 30 control elements in each room, which give off heat. In order to keep below the prescribed 30°C, a circulatory air of 6000 m^3/h per control element is required. The aforementioned air-cooling systems guarantee the cooling of such a large volume of air.

6.4 COMPRESSED AIR SYSTEMS

6.4.1 Reference Drawings

General Layout	000-00-101
All drawings with numbering	070-..........
All flow charts with numbering	070-..........

6.4.2 Intended Use

a) Preparation of vacuum for handling with suction devices

b) Industrial purposes, i.e. wool drives, control drives

c) Cleaning of tools, machine parts, filters

d) Driving motors in ex-areas

e) Transport of bulk materials through air transportation pipes

f) Possibly driving motors of doors and flaps

g) Spraying of coating material

6.4.3 Requirements

The properties required for production are:
- oil free
- dry
- minimum pressure 8 bar
- dew point +3°C, at normal ambient temperature
- filter quality max. 10 μm (class 3)

6.4.4 Quantities and Capacities

see Annex 6.4-1 Quantity Summary for Station 1
see Annex 6.4-2 Quantity Summary for Station 2
Accordingly, the overall consumption as determinable to date is

Station 1	approx. 5.000 m³/h
Station 2	approx. 16.000 m³/h

The uniformity factor to be applied to the main consumers is 1.0.

6.4.5 System of Arrangement

For economic reasons, generation and treatment of compressed air will usually be realised at one centralised location since the splitting into the two production areas would result in higher costs due to a doubling of the system. But the quantities and distances are large enough that a central unit cannot perform this function in a proper way.

Therefore, ring mains supply for the general parts of the factory is suggested, this is the system 1, with a pressure of 8 bar.

Station 1 is located on the island between A and C. Station 2 is organised next to the coating material storage area. The systems differ in terms of capacities, and derived from this fact the machine types are different too, the bigger machines are water cooled.

System 2 contains three stub pipes not connected to the ring which almost exclusively provide the compound and coating materials including bulk transport. Pressure level 8 bar. As this system is directly woven with the bulk storage outside the coating area but this should be as nearby as possible this system will be unchanged also in the adaptations.

6.4.6 Ring & Station 1

Because of the high demand and for safety reasons it will be a practical economic solution to distribute the required overall capacity to four generators.

Each generator should have a capacity of at least 1600 m³/h at 8 bar with one each as spare. The aggregates are air cooled.

For sizing of the network, the respective maximum value of each pipe can be applied, namely about 2500 m³/h. The required pipe cross section for the highest velocity in the pipe of 15 m/s will be between DN 100 and DN 150. This cross-section could be reduced because larger buffer tanks are provided at the “end points“ (4 x 10 m³ ■ approx. 40 % of the minute capacity).

6.4.7 System & Station 2

For station 2 which is no ring system each generator should have a capacity of at least 4.500 m³/h (!) at 7 - 8 bar with also one each as spare.

Pipeline DN 300 to DN 350. Buffer tanks to the main consumption points 3 x 20 m³.

6.4.8 Service Plants

The overall compressed air amount needed for production will be produced by 3 air-cooled screw-type compressors. One generator shall be as reserve unit for stoppage times due to regular maintenance work and/or for times of unusual machine failures.

The compressor sets will be activated alternately by means of a fully automatic control and regulation system such that the running times and/or idle hours of the units will be roughly identical within a one-year period.

The first automatic condensate separation will be effected by centrifugal type separators positioned directly behind the compressor.

The proposed vertical compressed air storage tank with a 10,0 / 20,0 cbm volume will be used for interim storage and to regulate the network pressure.

Owing to the fact that the highly-tempered compressed air will cool down even more in the tank, another automatic condensate separation must take place downstream of the tank. Treatment of compressed air (de-oiling and drying) under normal operations is done by a cold dryer.

Furthermore, an absorptive dryer will be available for production which, however, may again result in condensation in the piping during times of relatively low ambient and/or fresh air temperatures. This dryer will very well comply with the quality standard required for compressed air. Any necessary switchover of the dryers will be done via a fully automatic regulation system with pneumatic fitting drives controlled in a temperature sensitive manner by thermostats/exterior sensors. The absorptive dryer shall also be used to cope with any peak demand and shall be used as reserve unit (with standby function) for stoppage times during regular maintenance services and/or in the case of unusual machine failures.

Both dryers are also equipped with an automatic condensate separation system. Condensate will be cleaned in an automatic separation unit after which the residual oil content will be less than 20 mg/litre and the pH value will range between 6 and 9. The water thus cleaned can then be discharged into the sewerage causing no harm.

After the dryers, compressed air for production will be filtered.

Supply and exhaust of air for the compressor rooms will be affected as follows: Supply air for normal operations from the exterior via controllable flap regulation. Exhaust air for normal operations to the exterior via proposed air duct connections.

Supply air for times of relatively low ambient air temperatures to be taken from the room by switching exhaust air in the warm air distributor to the unit.

6.4.9 Piping

The piping will consist of black steel pipes of mild steel.

Pipe connections up to a nominal width of DN 50 will have fittings, pipes of greater dimensions will be flanged. Armatures up to a nominal width of DN 50 will be connected by sleeves, armatures of greater dimensions will also be flanged.

For corrosion protection reasons, the piping for the condensate collection lines within the compressed air station of DN 15 to DN 32 will consist of galvanized threaded pipes up to the automatic oil water separators.

All rising and fixture connection lines will be laid exposed on the wall or fixed freely in the air to pertinent supporting constructions. The feeders for the machines will be laid in horizontal direction at a height of more than 3,5m above floor level, connection lines usually run in vertical direction. The connection sizes depend on the sizing of the feeder lines and/or will be as recommended by the manufacturer of the machines.

Adapters for reduced or extended connections will be furnished and mounted by the manufacturers of the machines

Silver-grey colour-coating for all pipelines will be applied in accordance with DIN 2403.

The tap points in the halls will be equipped as follows: shutoff fitting, pressure controller and/or pressure reducing valve. Connection unions with flexible PVC hose, about 5 m long. At the free hose end fitted with coupling union for connection of compressed air tools (like air guns, etc.).

6.5 Heating Gases

6.5.1 Reference Drawing

General Layout 000 – 00 – 101

6.5.2 General Statement

This medium will be used where it is available. But then it is necessary to install the net as well as the installation of the armatures in conformity with the locally valid regulations. These are dependant on the nature and quality of the natural gas. Therefore, further planning will take place in the adaptation phase.

6.6 Fuels

6.6.1 Reference Drawings

General Layout	000 – 00 – 101

6.6.2 General Statement

Fuels are needed for the emergency power generators which are located in three power stations, namely #1, #2, and #7.

In the moment it is assumed to use as energy provider the natural gas line. But it might happen that at any location no gas is available and then it is necessary to look for an alternative. This could be liquid gas as propane, or the Diesel fuel.

Latest in the adaptation phase this theme will be handled.

6.7. Electrical installations

- **High & Medium Voltage Network**

- **Reference Drawings**

Outside Lines	000 – 00 - 104
Single Line Diagram	080 – 00 - 001

- **Intended use**

The high and medium voltage network has to supply the factory site. For this purpose, oil cooled transformers (2x63MVA) for outdoor installation will be foreseen for the 110kV-feeding station, cast-resin transformers will be foreseen for the 20kV-network.

See annex 1: Trihal Transformer Page 1 to 4

- **Requirements**

The electric supply company should provide loop supply with two systems to ensure adequate power supply if one section should fail. There are several MV-substations to feed in load centres (dryers) or substations.

- **Quantities and Capacities**

The total factory demand is about 112MVA. This demand is covered by two transformers 63MVA (110/20kV) and nine substations (20/0,4kV). There are two loops planned for the load centre in Building B (Dryer). One loop connects substation 1-8 and one loop in spare.

The demand on which the design of the different sizes of transformers is based is shown in the annex and single line diagram.

See annex 2 :	MCSET Technical Specification	Page 1 to 14
See annex 3:	SM 6 Range Technical Specification	Page 1 to 6

- **System of Arrangement**

The supply routes for the MV lines (20kV) within the site will run in underground pipes at 0.8m depth with the required channels, building entries and road crossings.

The buildings are supplied by an extensive cable system. It consists of a network of cable trenches, cable trays and bus bars which is designed as a 3-level system. Medium voltage, low voltage and communication. The main medium voltage station is

located next to the high voltage station. From the main station four power supplying loops are planned.

Because of the different loops to the substations it is necessary to protect the medium voltage installation:

- Installation of digital distance protection relays.
- Installation of digital overcurrent time protection relays.

- Installation of digital cable differential protection relays.

- **Cabling**

The medium voltage distribution cabling between 20kV switchboards and from 20kV switchboard to the transformers shall be single core cables. All cables shall have a voltage level of 24kV. The stranded copper conductors with XLPE insulation, a concentric screen/armour and a red PVC sheet, cable type N2XSY is required. The cable manufacturer´s recommended sealing ends shall be used.

- **Low Voltage Supply**

- **Intended use**

The low voltage supply system will provide electric power for the entire site, namely 400V/230V, 50Hz. All electric consumers will be connected to this system.

- **Requirements**

Transformers will transform the 20kV into the low voltage system. A 400V TN-S network in accordance with VDE 0100 will be built up. The short circuit current , voltage drop and selectivity measuring´s must meet the requirements.

The TN-S system has to have a seperate ground, this means a

5 wire system.

A combined neutral and ground should not be allowed.

- **Inspection of the electrical installations**

The following measurements must be made and recorded by the electrical inspection:

Continuity of the protection conductor and the equipotential bonding conductor, insulation resistance of the electrical equipment, protection by means of automatic disconnection of the power supply (Coil resistance/cut off current, contact voltage and RCD-resolution/earthing resistance), voltage polarity and the uniform distribution of the power consumption across the individual phases

- **Power Factor Correction Equipment**

- **Intended use**

To improve the power factor in each substation, controlled power factor correction equipment should be installed.

The corrected power factor should meet the requirements of the

power supply company.

- **Requirements**

The power correction equipment shall be built into the low voltage switchgear assembly. The rating and the number of stages will be specified in the detail engineering. All power factor correction equipment shall be designed for operation on the nominal voltage and frequency specified in the chapter Low Voltage Supply and shall be capable of operation within the voltage and variations specified. The number and capacitance of the capacitor units incorporated in each correction bank shall be such that the capacitance can be switched into and out of circuit in steps.

The connection of the capacitor units shall be via conductors. This process shall be controlled by multi-stage, kVAr sensitive, solid state relay which cycles the capacitor stages so, that each is called into service in sequence and advances so that each capacitor is used equally.

Capacitors shall be dry type of a proven design. All capacitors shall be self-healing. Capacitors shall be low loss type. Losses shall be less than 0.5W/kVar.

The 20/0,4 KV transformers should be equipped with a fixed compensation bank to compensate the transformer beside the system installed in the substation.

See annex 4: Detuned Fixed Compensation Bank Page 1 of 1

- **Emergency Power Supply System**

- **Intended use**

With the emergency power supply all important devices or systems can be operated which have to remain in operation to continue or finish production process in case of power failure.

Also the fire fighting stations should be supplied in case of a

Power failure.

The uninterrupted power supply system (UPS) for emergency lighting enables people to leave the building safely, and should be

In accordance with VDE 0108.

- **Requirements, Capacities**

The generator of the emergency power system will supply electric power after about 15s of power failure. For the production lines in Building B it is necessary,that one of four generator systems in SUB 1 should provide power immediately. The system is designed for a rated voltage of 400V.

- **Service plant**

  The generating power sets with its necessary equipment like cooler, switchgear assembly and day tank are planned in Substation 1 (4x1,5MVA), Substation 2 (1x400kVA) and Substation 7 (1x400kVA). The generating sets should either run with diesel or natural gas.

  The day tanks will hold the amount of fuel consumed in 1.5 day with full load. The tanks will be of the double walled type with leakage control located on the floor slab.

- **Cabling**

  The electric cable installations of required safety devices must be made in such a way that these safety devices do not fail in case of fire.

  The cable installation must withstand a fire according to DIN 4102. To be considered as cable installations are power cables , isolated power lines, installation cables incl. the necessary connection elements, carrying devices and mounts. Important are also the fire protection proved accessories like dowels and screws.

  The cables have to withstand a fire of minimum 30 minutes for:

  - security lighting and alternative lighting located in the same fire section

  90 minutes for:

  - pressure step up pumps for supply of extinguishing water,
  - ventilating systems for smoke and heat in case of fire,
  - fire brigade elevators and other safety installations, except for line installations which are located within the technique or engine rooms,
  - lifting installations for evacuation, except for line installations which are located within the technique or engine rooms

- **UPS system**

  The UPS as part of the MV- and LV-Substations is required to ensure safe functioning of the MV- and LV-Substations.

  There will also be an additional UPS or battery pack for the emergency lighting. This UPS is located in each substation. The planned back-up time should not be less than 15 minutes.

- **Artificial lighting**

- **Intended use**

Basically there are two different types of lighting:

- General lighting which lights the factory area surface.
- Workplace lighting which lights individual workplaces or production processes and which increases the lower level of general lighting.

The lighting equipment consists of the respective circuit distributors and cable network including laying systems and lights and bulbs

- **General and work site lighting**

Reflector lights for high inner rooms **(Production area, Waste separating area, etc.)**, compensated, equipped with a high-pressure discharge lamp, the ballast is integrated in the light housing. The lights should be fed via a busbar. In addition to the main luminaire suspension, a welded link safety chain shall be fixed between the light and the structure and be of a suitable type to be able to support the weight of the light in the event of failure of the fitting suspension.

To support general lighting fluorescent lamps T26 for ratings 36W or 58W single-flame or dual-flame at the production line and the workshop areas should be installed where necessary.

Basis for the illumination of the **offices** is DIN 5035 part 2. Fluorescent lighting is suggested for illuminating the office spaces. The lights must be suitable for workplaces with computer monitors

where required.

The lights for office spaces must meet to the local conditions (inlaid lights, hanging type lights, mounted lights). The choice of lights can be selected from ratings 18 W to 58 W fluorescent lamps, but must conform to the specifications and requirements of the customer.

Auxiliary rooms include kitchens, canteens, storage rooms, restrooms, sanitary rooms and locker rooms. As far as possible ceiling mounted lights should be used in these rooms. The selection of the luminairs and cover (prism cap, opal cap, screen) should be adjusted and matched according to the usage of the

room and it´s size. In kitchens and showers, lights with the

minimum degree of protection IP54 should be used. In some areas additional specifications with respect to the design could be necessary.

The corridors in the Administration building or office areas with public traffic inbuilt, wide-reflecting lights should be used. They should be equipped with TC-D lamps. If there is no suspended ceiling, the corridor is to be illuminated by direct and indirect reflecting wall mounted lights.

- **Street lighting and outside illumination**

  As far as street and outside lighting are concerned, there are basically two lighting types:

  - The purpose of the lighting system is an adequate and well-aimed illumination of open areas and streets
  - Street lights for traffic routes only

  The lighting plant consists of respective distributors, cable network and installation systems and lamp with masts and lights. For outside illumination mast or wall lights are planned with mercury discharge lamp 80/125W depending on luminary height.

- **Emergency lighting**

  Emergency Lighting is a lighting that works if power fails. It maintains safety at locations where people may be in danger without light. There are two different types of emergency lighting:

  - Safety lighting at workplaces with particular endangering, where safe termination of necessary actions or leaving a workplace are required.
  - Safety lighting for escape ways are illuminating escape routes for a necessary time with minimum of brightness to make it possible to leave a room or plant safely (min. 2 LX).

  Illumination of emergency exits and escape ways must be built according to the regional building regulations, the DIN VDE 0108, the DIN 5035 and DIN 4844. Working places with special endangering must be treated according to the DIN 5035 part 5. A special escape way layout is necessary to position the emergency exit signs and emergency lighting with a lighting level of min. 2 LX

  Indications of the client must especially be considered.

  Each emergency light and rescue sign must be equipped with an electronic module that indicates a fault of the light to the circuit supervision in the substation. The module must be provided with title block. The Power supply (UPS and battery pack) for the emergency lighting is located in the substation.

  The battery installation in the substations must be a standard distributor, steel sheet housing IP40. The installation has to meet the VDE 0108 regulations.

  Control panel for indication of operational status of the battery installation is required according to VDE 0108. The indications must be signalled optically and acoustically. For permanent information indication about current operation statuses of the entire installation, a central monitoring and supervision system is planned and located in the administration building.

- **Cabling**

  The cabling to the light feeding busbars inside the building will run on / in cable tray systems. Outside the buildings they will be laid in cable trenches at 0.8m depth. The NYY type cables will generally be used.

  Where required the cables have to withstand a fire according to

DIN 4102 for 30 minutes. See also 6.7.4.4.

- **Service installations**

- **Intended use**

In the complete production area next to the production lines and in the workshop areas special CEE power outlets have to be installed. They can be used for general maintenance and repair.

- **Requirements**

Number of CEE-combinations has to make sure, that a CEE-combination can be reached from any point within a maximum distance of 20 meters. These CEE-combinations to be divided in 16A (230 V) and 32A (400 V) in a relation of 3:1 (at least one 32A combination).

For the office area, auxiliary rooms and the administration building switch material has to be suitable for the intended purpose (refer to DIN VDE 0100 part 537 and 550) Shape and colour has to be proven or determined together with the management of works with samples.

- **Communication**

- **PABX System**

The PABX system shall comprise a fully functional digital PABX offering both voice and fax communication and EURO-ISDN services.

The system shall include

PABX processor

Maintenance terminals

Associated cabling

Operator terminals and system

Administration consoles

Analogue and digital handsets

The system shall be of a high standard and comply with all local standards and all statutory requirements in the country of installation.

The system shall meet all appropiate standards in particularEN 41003.

- **Fire alarm system**

Fire alarm systems protect life and objects. A fire warning system therefore has to include all required components.

By implementing the most modern technologies the fire alarm system needs to be able to identify a fire in its initial stages and report the information to an aid station in order to limit the damage as much as possible by activating fire security and signal devices or to control or extinguish the fire by activating an automatic sprinkler system. A fire alarm system must consist of the following components:

- Automatic and non-automatic fire alarms
- transponders
- couplers
- visual and acoustic alarm systems
- transmission network
- Main and Sub Fire Control Unit

Depending on the individual system-specific conditions the installation of the fire alarm system including its components and equipment must comply with the current VDE regulations, DIN standards and all local authorities´regulations. The link between the fire alarm system and external safety installations with production processes which have to be stopped or interrupted in case of a fire has to be considered.

Signalling should be with horns or bells and, in areas of higher noise levels additionally with flashing lights. Alarm signals and error messages must be switched to the General Control System, and any interface with floating contacts necessary to the GCS is to be provided. Horns or bells are to be spread in the production buildings such as a noise level of 95dB(A) or 10dB(A) more than machine noise. To be proven by on-site measurements. Flushing lights are to be installed in addition to horns or bells in areas in which ear protectors have to be used during work. Push-button alarms are to be installed near emergency exit doors and at a max distance of 70m apart on walk ways, the distance to the nearest push-button alarm may not exceed 35m. Automatic detectors are to be used in the administration building, canteen, offices , control rooms and production facilities if required.

Cabling (feeds to transponders which supply horns) must be of the fire withstanding type(E30 cabling) according to DIN 4102. The cables from transponder to the horns or bells are to be plastic cable type NYY-J. Loop lines are to be planned in fire alarm cable JY(St)Y 2x2x0,8 RED). The lines have to be protected.

The Main Fire Control Unit and its monitoring system is located in the Administration building operations departement or fire fighting station.

Sub Fire Control Units should be installed for each building.

- **Public address system**

The public address system should cover all normally occupied and normally accessible areas.

The primary function shall be to provide secure and failsafe emergency speech broadcast to all areas.

Terminology, characteristics and measurement techniques shall be in accordance with the appropriate sections of

IEC 268 (Sound system equipment) and applicable local and national standards.

- **UHF Radio Communication System**

A private mobile radio system should be installed to enable radio communication to all site locations, including all buildings.

The radio system shall be flexible in operation and able to adapt to future changes such as change of the location of the main antenna.

The on site mobile communication system should provide basic features:

- Good quality simplex voice communication from anywhere on site.
- At least four separate, simultaneous communication channels.
- Facility for handset – handset communication.

- **Master Clock System**

The site should in general be served by a master clock system, which will synchronize the different slave clocks.

Additional to the master clock there should be some battery clocks serving some of the remote areas on site.

The system should consist of:

- Master clock with battery back up.
- Interface with public address system
- Slave clocks.
- Battery clocks.
- Necessary wiring for the distribution to all slave clocks and interconnection back to the master clock.

- **Bonding System**

- **Intended use**

Bonding system to eliminate potential differences between all conductive housing, conduits and building parts.

- **Requirements**

Bonding system lines shall be laid in metal pipes on cable platforms or in channels. Minimum cross section shall not fall less than 6 sqmm. The lines shall be marked continuously in green-yellow. The line shall be laid in a way that no mechanical, thermal or chemical damage can occur because of their position or wrapping. The conductive structure parts implemented into the bonding system can not be used as bonding line. The lines shall be laid continously without terminal blocks directly from the connection point to the bonding busbar.

- **Systems of Arrangement**

The scope of the bonding system starts at the free connection point of the connection angle, which is provided by the builder of the grounding device facing the unit. For the office area each one potential bonding busbar should be provided in a technical room per floor. It has to be connected to the grounding system of the building.

The bonding system shall be implemented interconnectedly. The following structure parts shall be implemented: connection angle of the grounding device, cable channel, metal cable platforms, cable jackets, cable busbars, racks and housings for electrical facilities, high power voltage ground, ground for PE-conductors, pipe lines for water, heater and gas, lightning protection ground, and ground terminal blocks for overvoltage protection devices.

An additional local bonding shall be conducted in areas with uncontrolled stray or equalization current (explosion-proof areas). Therefore admissible and conductive constructions have to be connected to each other and the grounding device in explosion risk areas.

- **Lightning protection, grounding**

- **Intended use**

The lightning and grounding systems are intended for long-term protection of electrical parts, structural parts and people against overvoltage from lightning and fault currents in systems from different potentials.

- **Requirements**

A defined grounding resistance is required for the technical facilities like main distributors (HV,MV,LV), transformers and electronic equipment of the production lines. The grounding system may consist of foundation grounds, ring grounds, mesh grounds and individual grounds. It shall be approx. 1 Ohm for electronic devices. For the high voltage system the resistance value will be indicated by the power supply company. The required resistance factor should not be exceeded.

The system shall be protected to the maximum possible taking into consideration also the cost factor. With the measures outlined the requirement can be complied with for the external lightning protection and rough overall protection without major expenses.

- **Systems of Arrangement**

All building will have a foundation grounding linked with the grounding lines of the external cable runs at potential equalization busbar.

A huge net is formed by the linking of the foundation grounds via the grounding lines above the cable runs. Its resistance should remain within the required limits. Measurements could be necessary in longer periods of heat to avoid a rising resistance.

The grounding must be fully functional without using metal water pipes, other pipes and grounded cables of the existing electrical machinery. The mesh opening width for the grounding system should not exceed 20mx20m.

The transformer and the high and medium voltage distribution panel will have separate open ring grounds at which several grounding points exist for short circuit of active conductors disconnected during maintenance and repair work.

The network size of the lightning protection for all the arrester and the number-checking points should be designed according to the

lightning protection class of the VDE V 0185 part 100. The lightning protection class is usually given in the construction certificate. The network size should be selected according to the risk class of the building.

- **Materials**

Hot galvanized steel should be used as the material. Minimum core 100 sqmm. By the selected type of construction of the buildings with their steel supporting sections and sectional steel roofs, a lightning protection system is in required which is in accordance with the requirements. Additional arresters and down conductors will have to be furnished for different constructions.

- **Overvoltage protection**

The electric installations inside the buildings will be fitted with lightning current arresters at the low voltage distribution panels and with overvoltage protection modules at the other distribution panels. Damage to the equipment caused by overvoltage will be avoided. All centralised technical systems shall be protected adequately. Suppliers of the electronic equipment will have to provide additional protection.

  - **External / Overall control**

6.8 P Storage & Distribution

6.8.1 Reference Drawings

Flow Chart	090 – 00 – 001
Plan view	090 – 00 – 101

6.8.2 Intended Use

P with a concentration of 50 % will be used for mixing in for foaming the mortar.

6.8.3 Requirements

The transport and storage of p is governed by technical rules prepared and distributed by authorities of those countries where it is used and / or produced.

The most important thing is to use for tanks and pipes only absolute clean materials of special type, e.g. an austenit steel of the type (18Cr 12Ni 2Mo) = 1.4435 (DIN), or 1.4404, or in a non-aggressive atmosphere 1.4306 (w/o molybdanium).

The inside surface should be treated with fluoride compound and polished.

The quantity used is app. 70 to/day, i.e. 20.000 to/year. Therefore delivery per railway and per truck should be considered.

6.8.4 System

The delivery will usually be performed using ISO tanks which can be transported and handled like a container. They have a useful volume of 17,5 cbm acc. to app. 20 to each.

For delivery by train one can assume the normal length of a train. A one week delivery needs app. 6 x 70 = 420 to, this is a train with 20 tanks which will be unloaded by a gantry crane taking each move a full tank onto a free place in the tank farm and replace an empty one from the neighbouring place onto the empty wagon a.s.o. The tanks can be double high stored. Special gangways with swiveling arms are foreseen for the persons connecting the pipes to the tanks.

For provision of storage capacity the peroxide will be transferred into three bulk storage tanks of 300 cbm each. From there it will be pumpeed to the 28 m levelled 2,0 cbm intermediate storage tank from which the distribution to the 10 mixing installations will be performed. Thus at each dosing pump the same pre-pressure exists. The dosing pumps with all measuring and dosing equipment is part of the mixing station delivery.

6.8.5 Safety Measures

To avoid overheat during summer time the bulk tanks as well as the ISO tank farm can be watered for cooling purpose.

All breather lines are led through outlet filters. The bulk tanks stand in a catch water basin with the holding capacity of one tank volume. The rain water must be drained by pumping.

6.9 MC Storage & Mixing

6.9.1 Reference Drawings

Flow Diagram	095 – B2 – 001
Plan view	095 – B2 – 101

6.9.2 Intended Use

For the mixing certain portion of mc A4M is required which has to be in a liquid form allowing pumping and controlled spraying into the c-mixer.

6.9.3 Requirements

The total quantity of dry powdery mc is app. 518 to/year, according to 75 kg/h, which has to be provided for the mixing stations for panel types 1,2, and 4 as a 1% solution.

6.9.4 Process

The material will be delivered in bags which will be brought up to the +19 m floor for opening and storing the powder in a 2 cbm silo from which it will be dosed to the first process reactor. There, the methocell will be mixed with 90°C hot water and stirred for an uniform distribution of the powder pearls in the water. The mixing time is app. 1 hour. After this step, in the second reactor the temperature will be lowered to a mixing temperature of 20°C by adding 5 °C cold water, cooling also down the reactors double wall mantle with this chilled water. This step will cause the solution of the methocell.

This fluid flows into a storage vessel of 150 % capacity = 10 cbm from which the small holding vessels at the mixers will be fed.

Because of cleaning needs the processing equipment is doubled so that one line can be cleaned whilst the other is in operation.

6.9.5 Equipment

According to the material flow:

-- Bag transportation and emptying

-- Powder silo 2 cbm with two discharge connections

-- Two mc powder dosing container 100 l

-- Two mixing process reactors, 1,6 cbm for 90°C

-- Two mixing process reactors, 6,3 cbm for 20°C

-- Holding vessel of 10 cbm

-- Hot water boiler 140 kW

-- Chiller set with two cooling machines of 150 kW each, one 10 cbm cold water tank, and an air recooling condenser unit

-- Water + compressed air cleansing system

Piping system between the top floor +19,0 m down to the 7,5 m level of the intermediate tanks in front of the mixers.

6.9.6 Arrangement

As shown on the drawing, the system will be installed in the northern part of the mixing building on the floors +19,5, +15,65, +13,15, and +10,0 m.

For transportation of the bags the industrial elevator in that area can be used.

7. PILOT PLANT

7.1 Reference Drawings

General Layout - Alternative 1	000 – PP - 001
General Layout - Alternative 2	000 – PP - 002

7.2 Basic Idea

Since first steps of the suppliers into new technology with some improvements of the technique, they wish to prove their systems in a to-scale trial system. Especially the extrusion lines need some time for checking the correctness of the single equipment parts.

Also the continuous filling of the mixers, the unloading with suction dishes, the cassettes and the strapping.

Therefore one can install one line and have to remove the products as rubbish, or one can produce all four panel types with the aim to have in case of success finished products ready for use and selling.

This was the decision of HML after discussion. To start as soon as possible it would make sense to reduce for the first step also some other parts not directly under development but one can save some money for interest.

7.3 System of Erection

It was agreed upon the basis to build at any rate the whole structure and to install the process technique in two steps.

7.3.1 First Step

must include

in building A:

-- waste delivery and sorting

-- light weight materials preparation and storage for min. 50 %

In building B:

-- additional materials and binder delivery and storage

-- dosing silos and belts for the four lines

-- four mixing towers

-- four casting lines for the four types referenced

-- quality control rooms and QS installation for four lines

-- reclaimed material conveyor, shredder, and preparation

-- unloading of panels into cassettes

-- cassettes transfer installation and buffer tracks in front of the dryers

-- one to three dryers. This number depends on the throughput in the casting lines. As type 2 needs only 1/3 of the capacity, it may be not necessary to have an "own" dryer for this line.

-- buffer tracks after the installed dryers

-- one transportation line with two cranes.

In building C:

-- two cassette buffer lines and the transfer installation

-- four cassette unloading devices

-- four double lines for machining (single lines are not enough to show how to manage the operation of them)

-- four double coating lines

-- four stacking and packing installations

-- the four emergency stores with finger cars

-- the four transportation lanes with the loading cranes

In all:

-- the total spectrum of technical support

7.3.2 The Second Step

must then bring all the missing installations to the final status. Whilst these installation will be erected the pilot plant production is going on. But it will be stopped for that time when the new equipment will be connected to the networks of water, waste water, compressed air, power, and control.

7.4 Alternative Solutions

This discussion shall show the problems and or solutions caused by different arrangements in the first step assembly.

How can be the raw material infeed to the mixing stations put together, this means, on which way can the raw material be fed to the mixers via the dosing silo groups?

Which lines can be installed after without great disturbance of the first step production? And what problems can occur when the erection of the second step equipment will be performed especially under consideration of the materials transport?

Which dryers are necessary and which ones are probable for different throughput ?

What is the outcome of the reduced waste stream to the GFF?

7.4.1 Alternative 1

7.4.1.1 Reference drawing:

Alternative 1 000 – PP – 001

On the drawing the second step installations are colored.

7.4.1.2 Building A

The air transportation overhead lines for the second step should be installed with connections to the ongoing system components without causing any problems. The work and cleaning in one sorting line can be done intermittently, because of the greater capacity in the sorting process.

7.4.1.3 Building B

For installation of the raw material distribution lines above the dosing silos, it is necessary to install some bridges each from one silo group to the other one. Therefore it deems us to be of sense to install at first three dosing groups in minimum.

The space between the extrusion lines are wide enough to assemble the production equipment, beginning in the middle of the hall and proceeding in the east direction. After the extrusion lines of that space has been finished one can start with the erection and installation of the mixing towers belonging to these lines.

The gangways crossing the lines will be shortened and arranged only over the existing production lines of step 1.

For the dryers the biggest ones have been selected to have enough capacity in any case. Therefore it would make sense to consider a solution to start with one big dryer for the normal panels and the one for floor panels type 3 and add the next ones step by step as the productivity rises of the casting lines. The same is possible the cooling towers where one can start in the middle of the hall.

7.4.1.4 Buildings C + D

It is not yet clear if in the coating section this system will simply function because of the several air ducts and channels crossing transversal the coating lines. Anyway, this arrangement can be designed in detail to satisfy the demand.

7.4.1.5 Technical Support

Some reductions could be realized, e.g. the compressed air supply aggregates can be delivered and installed in the 2nd step, or some pumps of the water systems, and emergency power sets. The after installation of such aggregates bears some difficulties and costs some more time and money on the one side, on the other side one can save some interest rates for the duration of some months. This chapter should be discussed and evaluated together with all involved in the next step.

7.4.2 Alternative 2

Reference drawing

Alternative 2 000 – PP – 002

On this drawing also the second step installations are colored. Statements for the buildings A and E as for the alternative 1.

In building B:

This system starts from the assumption to install in the 2nd step only on two areas against the solution of alternative 1 with three areas with after installation. For the second step installation the wide area for the assembling seems advantageous on the first glance but with respect to the longer time to wait for start of mounting the mixing towers it is not the best way.

Other features:

For the dosing silo groups feeding lines one must build up one group more.

The dryer installations can be as before.

The machining and coating installations can be as before.

The technical support can be as before.

7.4.3 Discussion and Recommendation

The critical points are the after installation in the extrusion lines and mixing towers because of the limited entrance space, and the dryers usage because also this system must be prototyped. In the extrusion lines for the 1st step installation the alternative 2 with three lanes is not so favorable because of not so quick reach of all equipment by cars and forklifts as in the other alternative. In the alternative 1 the installation of only one portion with two lines have to be performed between running production facilities, the 4 other lines can be mounted from the "outside". All other features are not so far away from the others.

With regard of the both systems discussed before we recommend to go onward with the alternative 1, i.e. installation of 3 x 2 lines of equal width in the 2nd step.