



do more
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live longer

Nanomilling Overview

LOCATION : CENTRAL MILLING BUILDING GSK Cork



Typical Process Flow

- Prepare liquid suspension
- Mill liquid suspension
- Collect milled suspension
- Spray Dry Milled Suspension
- Discharge Spray Dried Granule.

Main Process Equipment

- **Batch Make-Up Vessel**
- **8 Wet Bead Mills**
- **2 off Suspension Vessels**
 - **Waste Receiver Vessel for off grade suspension.**
- **Spray Dryer Unit ,complete with rotary atomiser, gas recirculation system(nitrogen) closed loop, product collection cyclone and filter, heater,and condenser and condensate collection system.**
- **Product Discharge System.**

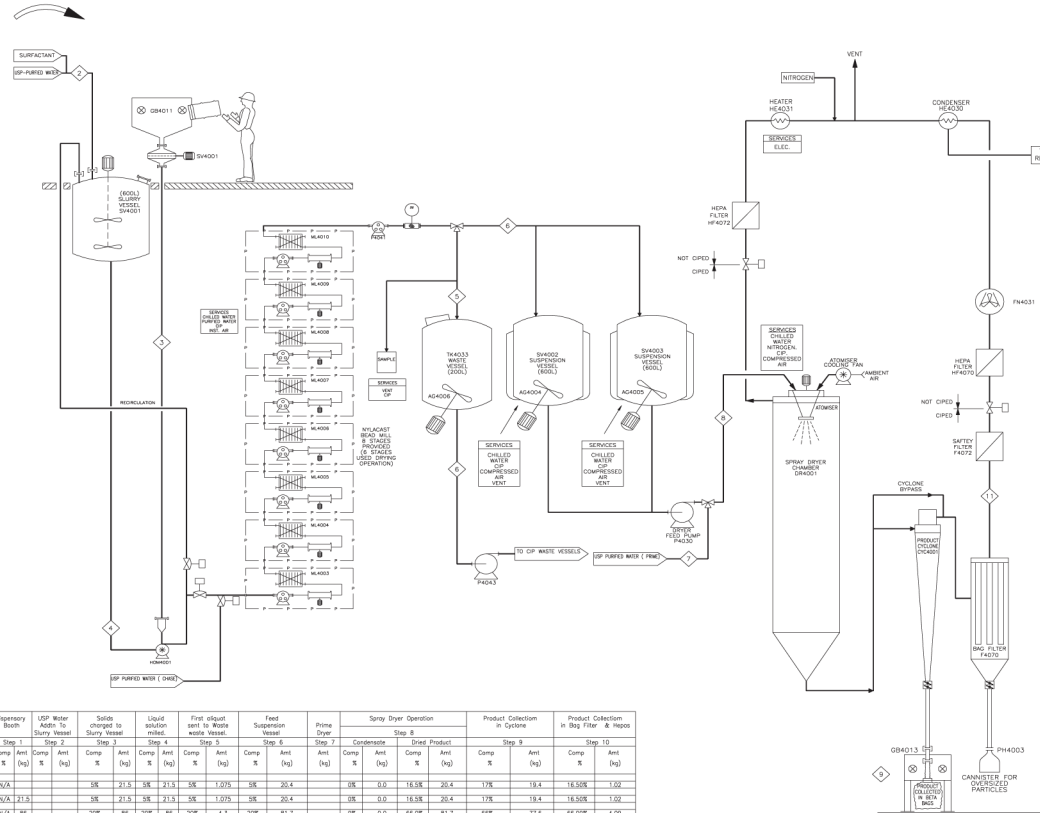
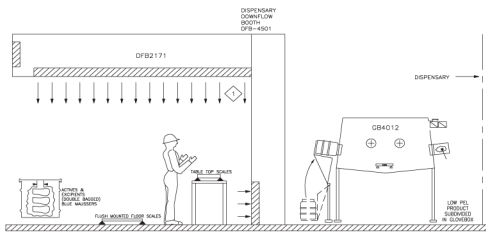
Process Engineering

- **Glovebox technology to accommodate the complete range of OHC-3 compounds.**
- **Dedicated Purified water distribution loop within the facility.**
- **Dedicated dispensary within the facility, (to cater for OHC-3 compounds). This can operate in either a serial or batch mode for dispensing.**
- **Contained Solids charging to Batch Make-Up vessel using in-line high shear homogeniser.**
- **Batch Size Range within the facility 100-600 litres**

Process Engineering

- Process areas clean room finishes, ISO 8.
- Dedicated HVAC extract, shared HVAC supply with core area .HEPA filtration on supply and extract.
- Design is based for Aqueous based products only. (No Solvents.)
- CIP skid and distribution for cleaning of complete installation. Dedicated sanitisation vessel.
- System Controlled by Delta V.
 - Data capture system for process parameters.

Process Flow Diagram



Components	Dispensary Booth		Step 1		Step 2		Step 3		Step 4		Step 5		Step 6		Step 7		Step 8		Step 9		Step 10	
	Comp	Ant	Comp	Ant	Comp	Ant	Comp	Ant	Comp	Ant	Comp	Ant	Comp	Ant	Comp	Ant	Comp	Ant	Comp	Ant	Comp	Ant
	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)
Surfactant	N/A		3K	21.5	3K	21.5	3K	21.5	3K	21.5	3K	21.5	3K	21.5	3K	21.5	3K	21.5	3K	21.5	3K	21.5
Surfactant/Polymers	N/A	21.5	3K	21.5	3K	21.5	3K	21.5	3K	21.5	3K	21.5	3K	21.5	3K	21.5	3K	21.5	3K	21.5	3K	21.5
Process Solids (W)	N/A	3K	21.5	3K	21.5	3K	21.5	3K	21.5	3K	21.5	3K	21.5	3K	21.5	3K	21.5	3K	21.5	3K	21.5	3K
Surfact. Water		301	70K	301	70K	301	70K	301	70K	301	70K	301	70K	301	70K	301	70K	301	70K	301	70K	301
Air Silt (Spr. Dryer)																						
Total	138	301	100K	430	100K	430	100K	430	100K	430	100K	430	100K	430	100K	430	100K	430	100K	430	100K	430
Intermediate Calculations:			22.0	70K																		
Spray Dryer Cycle Time																						
Dryer Spray Feed Rate																						

PROCESS STEPS

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1.0 Batch Size (Kg Mill of wet slurry) 430 kg @ 100%
Target Batch (of Dried powder) 117.6 kg @ 100%

Components KG @ 100% Assay (E) K2(Na) 1.0
Surfactant 21.5 TBC TBC
Surfact/Polymers 21.5 TBC TBC
Solids 3K TBC TBC
Water 301 TBC TBC

2.0 Batch Yields
Batch Size (Kg Mill of wet slurry) 430 kg
Product Assay 100 %
Batch Size in Kg at 100% 430 kg
Optimum Theoretical Batch of Dried powder at 100 % 117.6 kg
Yield (Target batch @100%/Optimum Theoretical Batch @ 100%) 91.2 %

3.0 Cycle Times & Cycle Times
Batch Time 28.4 hrs
Cycle Time 1st Batch 28.4 hrs
2nd & Subsequent Batches 24.7 hrs

Vessel/Equipment Number Volume (Litres) Cycle Time (Hours) Maximum Occupancy %

Dispensary Booth DF8401 N/A 1.0 N/A
Cleaning Booth DF8402 N/A 2.0 N/A
Slurry Vessel S4001 600 4.9 65.2
Wash Vessel W4001 200 18.0 TBC
Suspension Vessel A S4002 600 28.5 61.9
Suspension Vessel B S4003 600 28.5 61.9
Spray Dryer DR4001 N/A 28.4 N/A
Product Cyclone C10001 N/A 28.4 N/A
Bag Filter F4070 N/A 28.6 N/A

4.0 Capacity
Theoretical Max Annual Operating Hours /Year 24 hrs/day
Theoretical Max Annual Operating Days /Year 6 Days/Week
Theoretical Max Annual Operating Hours /Year 1488 hrs/year
Operating Downtime for Inter batch Cleaning 24 hrs/Week
Total yearly Downtime for inter batch cleaning 1248 hrs/year
Operating Downtime for CP between campaigns
Time allowed for each CP 72 hrs
Number of CP Cycles per Year 2
Total yearly Downtime for CP between campaigns 360 hrs/year
Downtime for Maintenance/Maintenance (% of Annual Hrs) 10 %
Yearly Downtime for Maintenance/Maintenance 148.8 hrs/year

Available Production Processing Time 5131 hrs/year
Batch Cycle Time 24.7 hrs
Water Conversion Rate to 1.0 kg/kg
Batch Throughput Rate (Spray Dryer) 18.6 kg/hr
Spray Dryer Cycle Time 27.0 hrs
Number of Batch Cycles Per Year 2078 cycles/yr
Product Released at Cycle Per Cycle 257.8 kg/cycle
Annual Storage (Pharmaceutical Product) 25.7 ton
Annual Storage (Active Pharmaceutical Ingredient) 17.2 ton

Nano Milling & Spray Drying Facility Process Steps

Step No	Description	Vessel/Equipment	Hours
1.0	Actives/Excipients Weighed in Dispensary Booth	DF8-4501	1
2.0	Add Purified Water& Surfactant to Slurry Vessel	S4001	0.5
3.0	Actives/Excipients Charged to Slurry Vessel via Doublehead Homogenizer	DF8402	0.5
4.0	Wash/homogenization in Slurry Vessel	S4001	1
5.0	Mill Run For Sampling & to Waste Vessel	W4003/04/05/06/07/08/09/10	0.5
6.0	Mill Run For Sampling & to Waste Vessel	W4003/04/05/06/07/08/09/10	2.4
7.0	Prime Spray Dryer with Aqueous Solution	DR4001	0.3
8.0	Transfer milled product to Spray Dryer & drying	DR4001	22.0
9.0	Final Product Discharge from Cyclone(End of batch the final output)	C104001	0.2
10.0	Bag Filter discharge (at end of batch run)	F4070	0.2
11.0	Bag Filter Weighing	N/A	0.2
Total Batch Time			28.6

Step No	Description	Vessel/Equipment	Hours
1.0	Actives/Excipients Weighed in Dispensary Booth	DF8-4501	1
2.0	Add Purified Water& Surfactant to Slurry Vessel	S4001	0.5
3.0	Actives/Excipients Charged to Slurry Vessel via Doublehead Homogenizer	DF8402	0.5
4.0	Wash/homogenization in Slurry Vessel	S4001	1
5.0	Mill Run For Sampling & to Waste Vessel	W4003/04/05/06/07/08/09/10	0.5
6.0	Mill Run For Sampling & to Waste Vessel	W4003/04/05/06/07/08/09/10	2.4
7.0	Prime Spray Dryer with Aqueous Solution	DR4001	0.3
8.0	Transfer milled product to Spray Dryer & drying	DR4001	22.0
9.0	Final Product Discharge from Cyclone(End of batch the final output)	C104001	0.2
10.0	Bag Filter discharge (at end of batch run)	F4070	0.2
11.0	Bag Filter Weighing	N/A	0.2
Total Batch Time			28.6

17.06.03	D	ISSUE FOR DESIGN		
18.05.03	C	ISSUE FOR HAZOP	CB	PF
06.05.03	B	HAZOP ISSUE	P.F.	C.B.
20.04.03	A	INITIAL ISSUE	C.B.	P.F.
DATE	REV.	DESCRIPTION	APPROD.	BY

DPS Drawing No.-13108-PD-3693
SB SmithKline Beecham
 (Corp.) Limited,
 Carrigrohilly, Carrigtime,
 Co. Cork, Ireland

Equip. No.	Project Title	Drawing Title
40	NANO MILLING & SPRAY DRYING FACILITY	PROCESS FLOW SCHEMATIC FOR NANO MILLING & SPRAY DRYING FACILITY
40	Prop. No.	Project No.
555/03	Design By	Drawn By
	P.F.	G.S.
File Name	Drawing No.	Shr. No.
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	N.T.S.	Date
		18.03.03
		Rev
		D

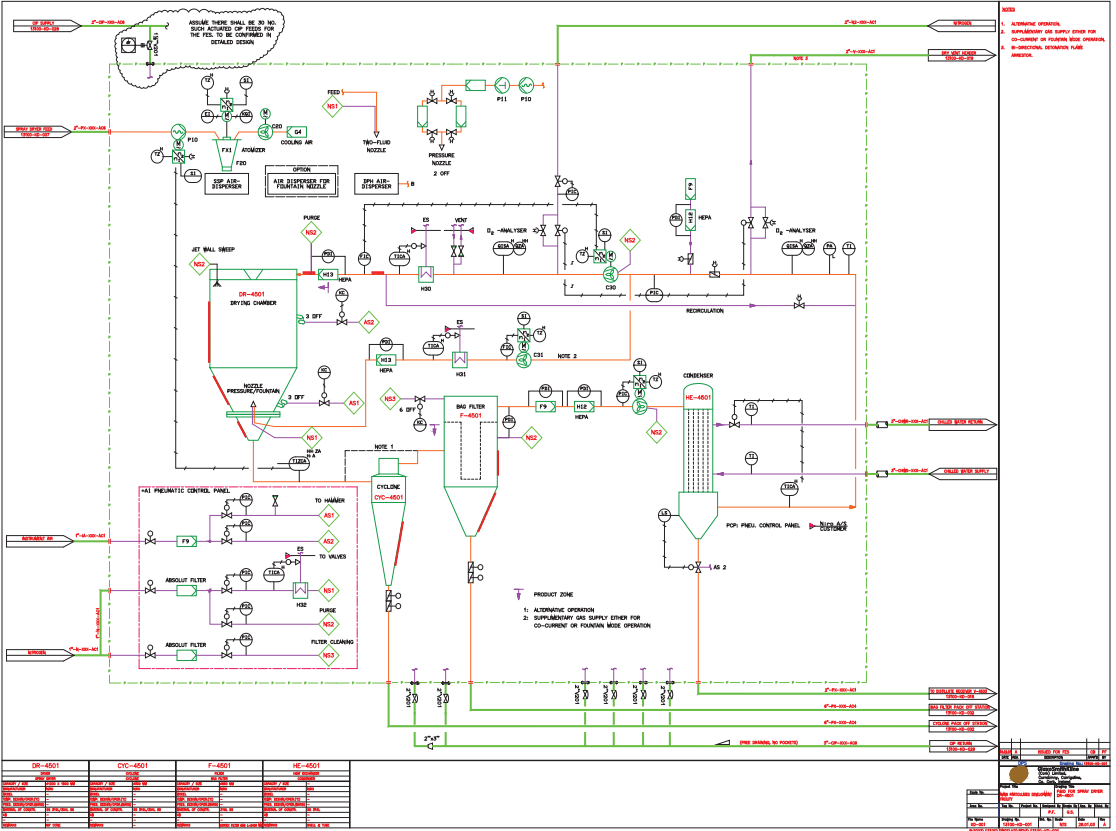
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Spray Dryer

Details:

1. PSD 3 Unit from Niro
2. Droplet Formation Type: Rotary Atomiser
3. Gas Recirculation Loop-nitrogen or air
4. Evaporative Capacity: 13kgs/hr of water.
5. Product separation: cyclone and dust filter.
6. Co-current flow in drying chamber
7. Chilled water supply to condenser.
8. Two feed vessels,..... each vessel 600 litre capacity.

NIRO SPRAY DRYER : PSD-3-R-CC



Facility and Equipment Photographs

Dispensing GloveBox



Suspension
Feed Tank to
Spray Dryer.



Spray Drying Chamber

Inlet Gas HEPA
Filter

Drying Chamber



Drying Chamber Outlet, Cyclone Separator, Dust Filter

Drying Chamber



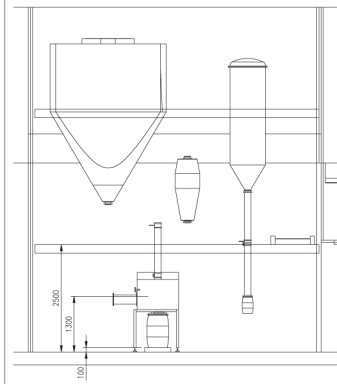
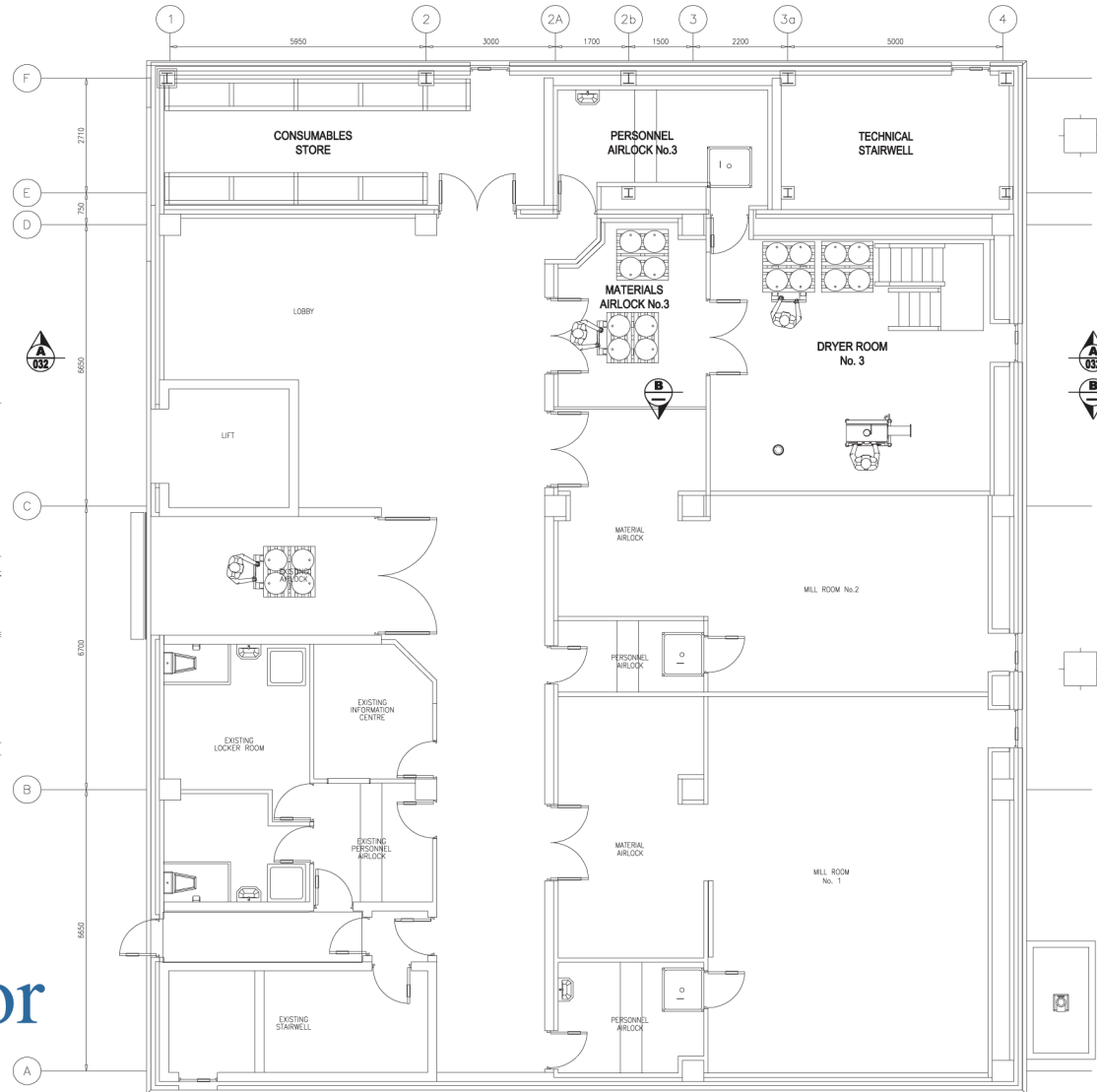
Dust Filter

Cyclone

Discharge Glove Box



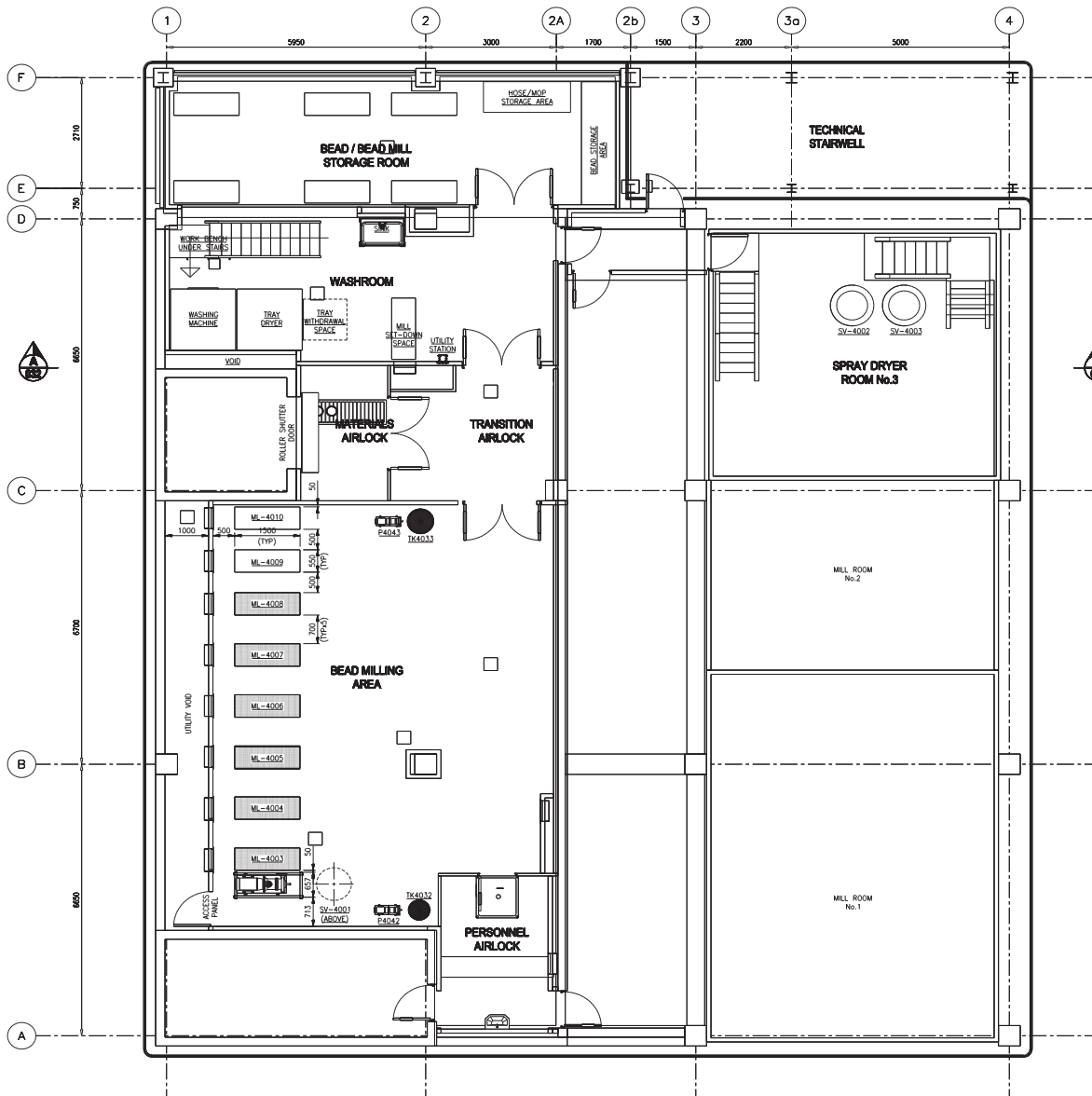
Floor Layouts



SECTION B-B

30.07.03	J	ISSUED FOR TENDER			
27.06.03	H	ISSUED FOR #10E ESTIMATE			WKG
13.06.03	C	RE-ISSUED FOR DESIGN			WKG
02.05.03	F	NRG EQUIP / DRYER ROOM ACCESS ADDED			WKG
17.04.03	E	ISSUE FOR DESIGN			WKG
10.04.03	D	SPRAY DRYER AVAILABLE FOOTPRINT ADDED			WKG
18.03.03	C	RE-ISSUE FOR COMMENT			WKG
12.03.03	B	ISSUE FOR COMMENT			WKG
10.03.03	A	ISSUE FOR REVIEW			WKG
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Project Title			Drawing No. MSR-001		
NANO MILLING & SPRAY DRYING FACILITY			GROUND FLOOR EQUIP. LAYOUT		
Equip. No.	Top No.	Project No.	Designed By	Drawn By	Chkd. By
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Ground Floor



1st Floor

NOTES:

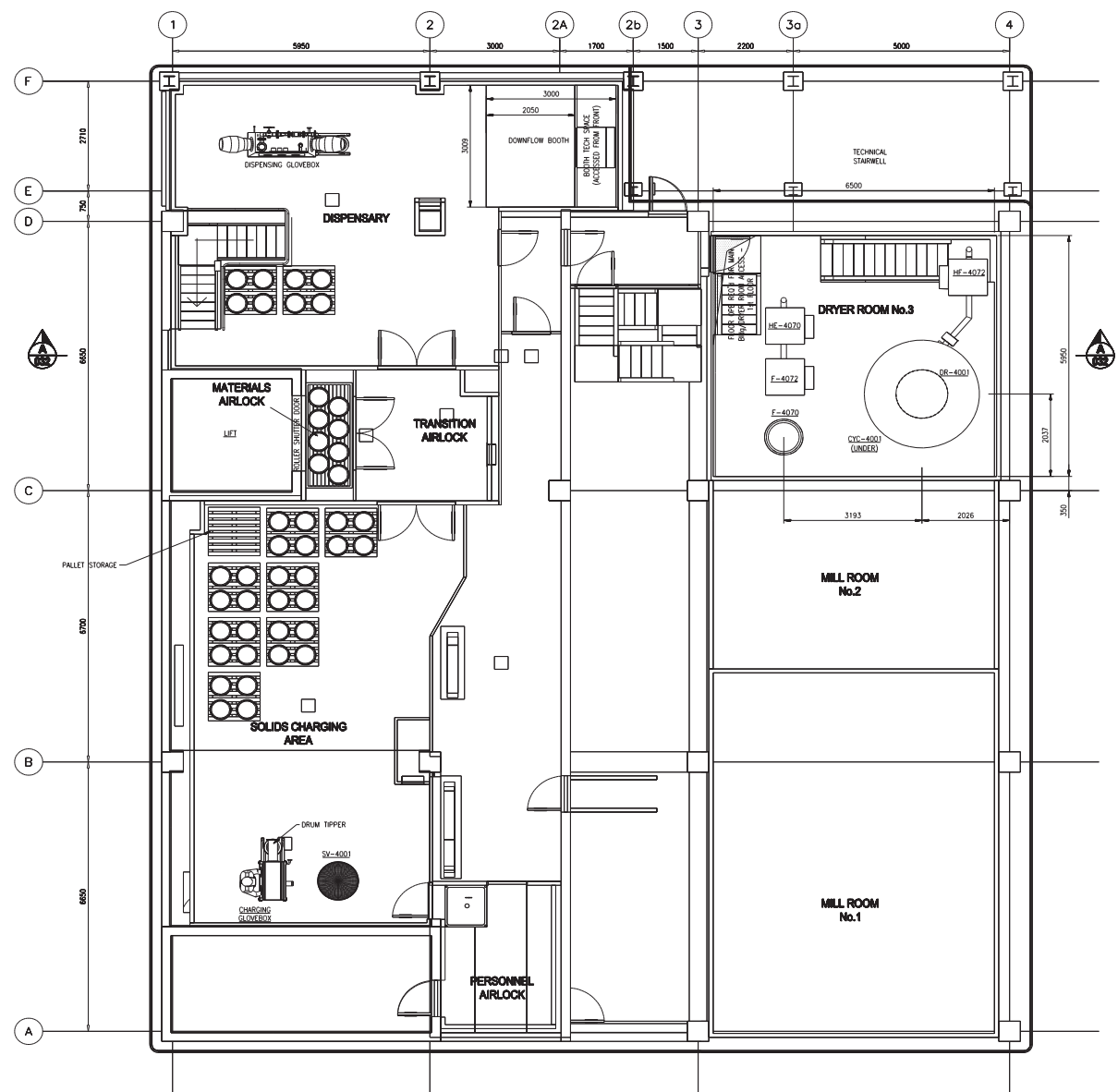
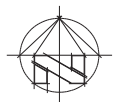
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28.05.03	K	BUILDING EXTENDED		WKG
22.05.03	J	HARD EQUIP / DRYER ROOM ACCESS ADDED		WKG
17.04.03	H	ISSUE FOR DESIGN		WKG
10.04.03	G	SPRAY DRYER AVAILABLE FOOTPRINT ADDED		WKG
03.04.03	F	WASHROOM / SPRAY DRYER LINK CORRIDOR ADDED		WKG
01.04.03	E	OPERATOR ACCESS CHANGED		WKG
19.03.03	D	WASHROOM AIRLOCKS ADDED		WKG
16.03.03	C	RE-ISSUE FOR COMMENT		WKG
12.03.03	B	ISSUE FOR COMMENT		WKG
10.03.03	A	ISSUE FOR REVIEW		WKG

DPS
SB SmithKline Beecham
 (Cork) Limited,
 Carrigrohilly, Carrigrohilly,
 Co. Cork, Ireland

Equip. No.	Project Title	Project No.	Designated By	Drawn By	App. By	Chkd. By
	HARD MILLING & SPRAY DRYING FACILITY	555/03	WKG	WKG		

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1st Floor Mezzanine

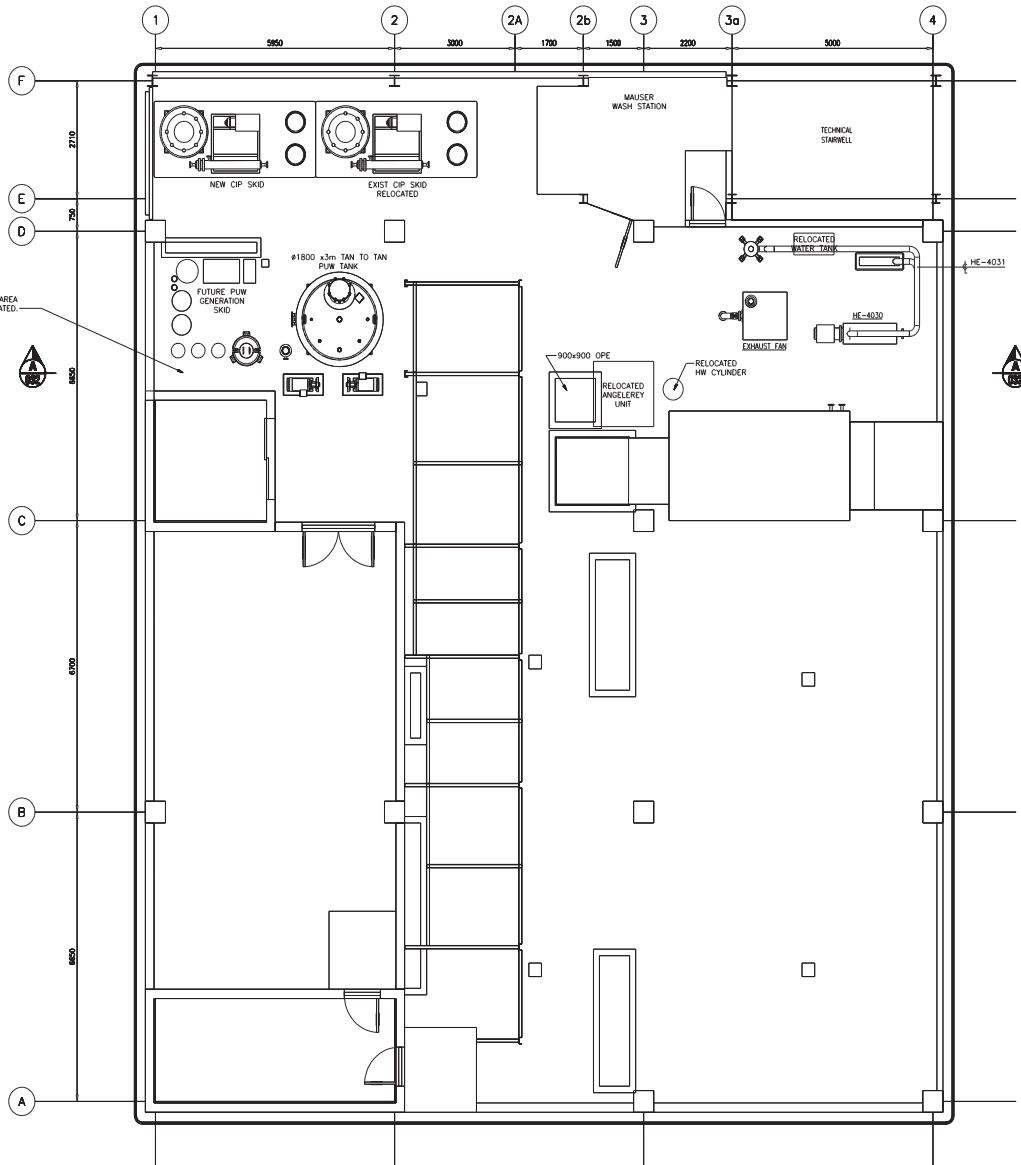
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13.06.03	J	RE-ISSUED FOR DESIGN		WKG
28.05.03	H	BUILDING EXTENDED		WKG
02.05.03	G	NIRO EQUIP / DRYER ROOM ACCESS ADDED		WKG
17.04.03	F	ISSUE FOR DESIGN		WKG
10.04.03	E	SPRAY DRYER AVAILABLE FOOTPRINT ADDED		WKG
01.04.03	D	RE-ISSUE FOR COMMENT		WKG
19.03.03	C	RE-ISSUE FOR COMMENT		WKG
12.03.03	B	ISSUE FOR COMMENT		WKG
10.03.03	A	ISSUE FOR REVIEW		WKG
DATE	REV.	DESCRIPTION	APPRO'D	BY

DPS Drawing No.: MSK-003
SB SmithKline Beecham
 (Cork) Limited,
 Carrigrohilly, Carrigrohilly,
 Co. Cork, Ireland

Equip. No.	Project Title	Drawing Title
	HAND MILLING & SPRAY DRYING FACILITY	FIRST FLOOR, MEZZ, EQUIP. LAYOUT
Area No.	Tag No.	Project No.
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	Rev	

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2nd Floor

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27.06.03	F	ISSUED FOR 415E ESTIMATE		W/C
16.06.03	C	RE-ISSUED FOR DESIGN		W/C
03.05.03	D	HWB EQUIP / DRIVER ROOM ACCESS ADDED		W/C
22.04.03	C	ISSUE FOR DESIGN		W/C
10.04.03	B	DRIVER EQUIP AVAILABLE FOOTPRINT ADDED		W/C
18.03.03	A	ISSUE FOR COMMENT		W/C
DATE	REV	DESCRIPTION	APPROV	BY

OPS Drawing No.: MSK-004
SB SmithKline Beecham
 (Cork) Limited,
 Carrigrohilly, Carrigrohilly,
 Co. Cork, Ireland

Project Title		Drawing Title				
HAND MILLING & SPRAY DRYING FACILITY		2nd FLOOR				
Equip. No.	Tag No.	Project No.	Designed By	Drawn By	App. By	Check By
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