

Vinasse Incinerator - a consolidated technology arriving to Brazil

By Fives Cail KCP

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INITIAL PROBLEMS

INITIAL PROBLEMS WITH INCINERATION TECHNOLOGY FOR FEW DECADES WERE

- IMPROPER / INCOMPLETE COMBUSTION
- CORROSION OF BOILER INTERNALS
- ASH ACCUMULATION, CLOGGING, CHOCKING
- CLINCKER FORMATION
- DROP OF PERFORMANCE AFTER 15 DAYS OF OPERATION
- CLEANING THE BOILER BY MECHANICAL CHIPPING / HAMMERING

Spent wash

VINASSE CHARACTERISTICS (AS EFFLUENT)



Characteristics of distillery effluent	
Brix	11.5 to 12.5
Colour	Reddish Brown
PH	4.0 to 4.8
Smell	Caramel Smell
Temperature	80o C
Chemical Oxygen demand PPM	88,000 TO 124,000
Biological Oxygen Demand PPM	30,000 TO 45,000
Total Nitrogen PPM	12,000 TO 15,000
Ammonical Nitrogen PPM	70
Phosphate PPM	250 - 370
Potash (K20) – PPM	8,000 – 10,000
Total Solids – PPM	1, 03,000 – 1, 10,000
Volatile solids PPM	65,000
Ash PPM	34,000 to 40,000

VINASSE CHARACTERISTICS (AS FUEL)

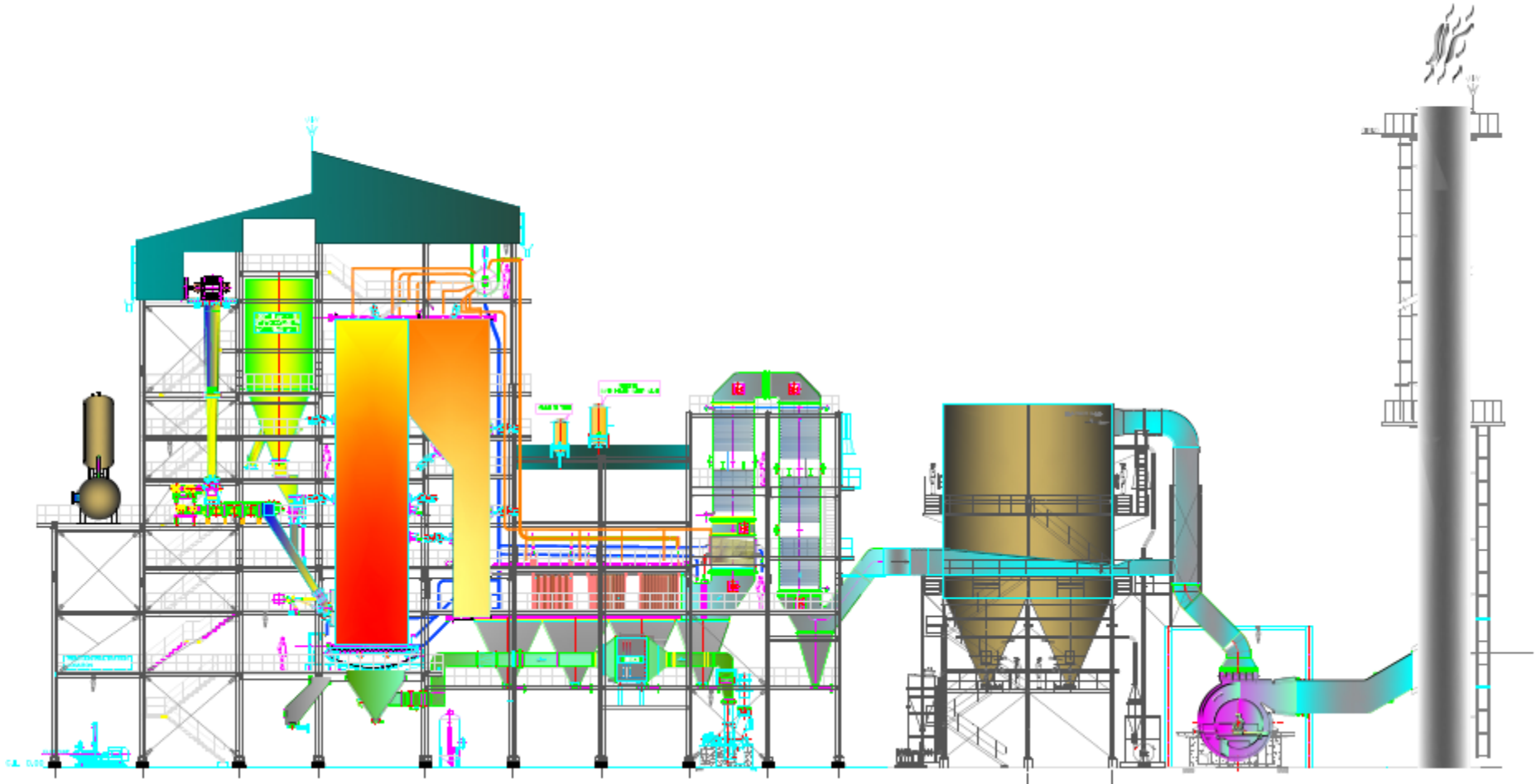


Ultimate analysis of Spentwash @ 60° Brix	
Carbon	22.22 %
Hydrogen	21.15 %
Oxygen	14.5 %
Nitrogen	1.85 %
Sulphur	0.62 %
Moisture	40 %
Ash	18.66 %
Gross Calorific Value (GCV)	1750 kCal/kg

FIVES CAIL-KCP BRAND VINASSE INCINERATOR



Model representation of Spent wash Incinerator



FIVES CAIL KCP BRAND VINASSE INCINERATOR

Salient features

Salient features of Fives Cail KCP brand vinasse Incinerator

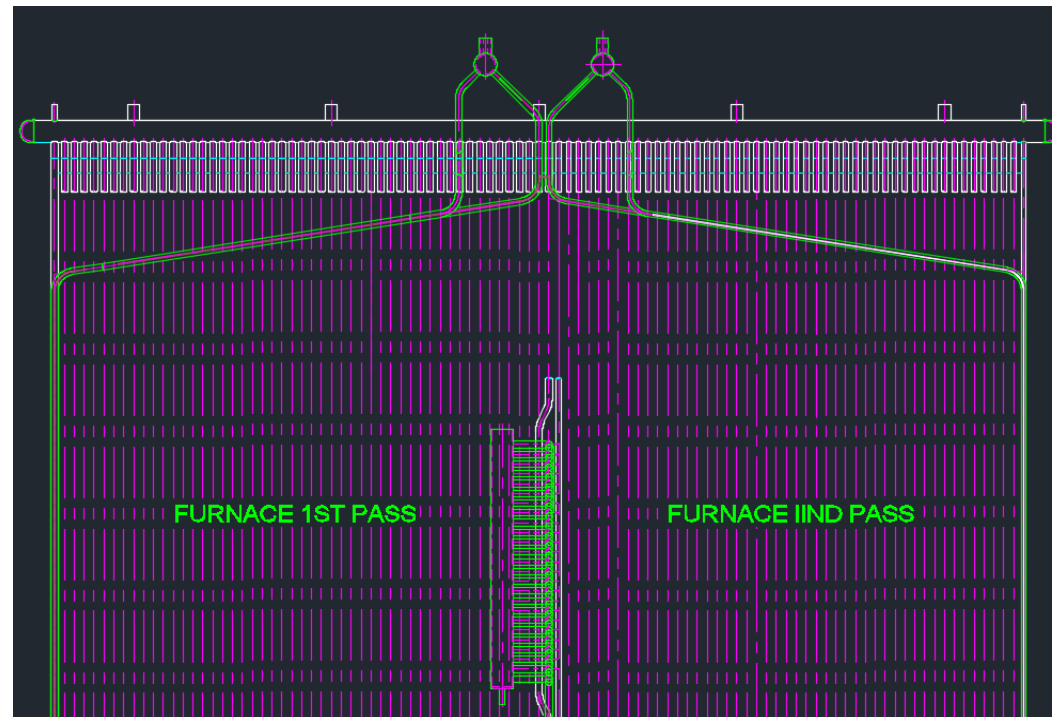


- Fives Cail-KCP make spent wash incinerator are designed for multi fuel firing option.
 - Vinasse + Coal
 - Vinasse + Bagasse
 - Vinasse + Bagasse / Biomass
 - Vinasse + Rice Husk
 - 100% Coal
 - 100% Bagasse
 - 100 % Rice Husk

Salient features of Fives Cail KCP brand vinasse Incinerator



- Three pass boiler design with tall furnace
- High residence time (> 10 seconds) before reaching super heater.
- No screen tubes at the furnace exit.
- Low flue gas temperature at convection zone, well below initial ash deformation temperature, prevents fouling of alkalis.



Salient features of Fives Cail KCP brand vinasse Incinerator

Travelling Grate:

- Most suitable and most successful technology in spent wash incineration
- Smooth and trouble free operation.
- Continuous convey of the ash into the ash tray
- Driven by variable speed hydraulic drive with self-lubricated type graphite bearings.



Travelling Grate

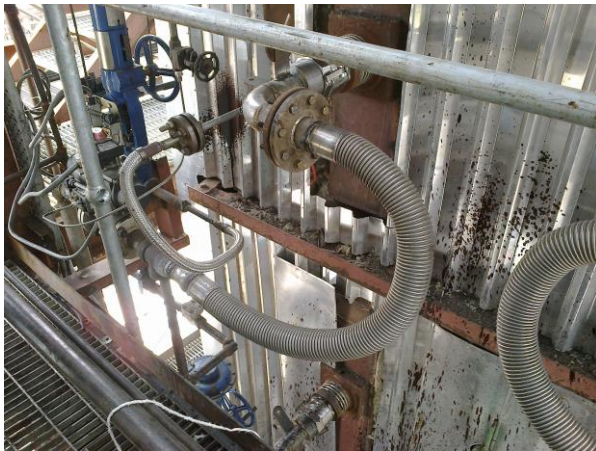


Travelling Grate shop assembled

Salient features of Fives Cail KCP brand vinasse Incinerator



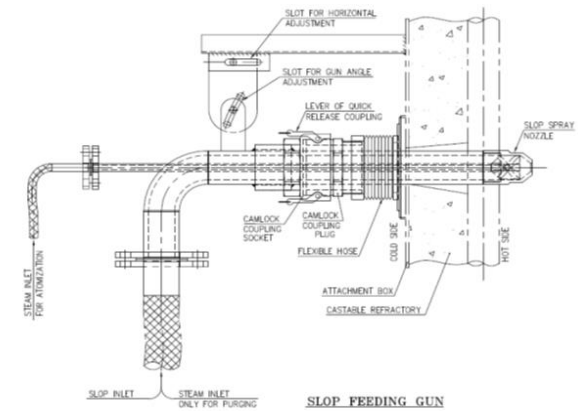
- Two stage super heater with attemperator in horizontal third pass of boiler gives consistent steam temperature.
- Specially designed slop gun. Flexible to adjust its angle and clean during operation.



Spent wash feeding arrangement



Spent wash spraying gun



Spent wash spraying gun drawing

Salient features of Fives Cail KCP brand vinasse Incinerator



Soot Blowers:

- Wall type soot blowers on water wall panels ensuring the FOT below 550°C.
- Retractable soot blowers in the super heater zones
- Rotary soot blowers in Evaporators and Economizers.



Wall Blower



Retractable Blower

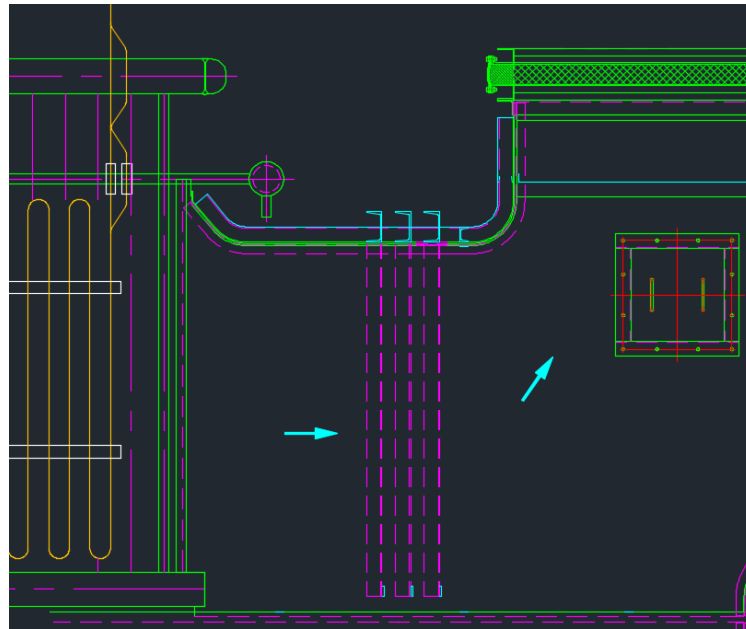


Rotary Blower

Salient features of Fives Cail KCP brand vinasse Incinerator



- Refractory lined hoppers in super heaters zone
- Grit Catcher:



Grit Catcher

Salient features of Fives Cail KCP brand vinasse Incinerator

Steam Coil Air Pre Heater:

- SCAPH (Steam Coil Air Preheater) is provided at the delivery of FD and Sa fan
- Avoid cold end corrosion.
- Finned type SCAPH is widely used to increase the air temperature from ambient to requisite level using steam as heating medium.



Steam Coil Air Pre Heater (SCAPH)

Salient features of Fives Cail KCP brand vinasse Incinerator

Filtration:

- Bag filters specially designed to retain 20 microns particle size (80% of the quantity).
- The air to cloth ratio is limited to less than $0.5\text{m}^3/\text{m}^2/\text{min}$
- Dust concentration $< 50\text{ mg / Nm}^3$.



Bag Filter



Bag Filter - Inside



Bag Filter

References

List of Vinasse Incinerator

References

Customer Name	Capacity t/h	Fuel fired	Commissioning
Rajshree Sugars & Chemicals, Tamil Nadu, India	30	Bagasse / Coal	2012
Jamkhandi Sugars, Karnataka, India	22	Bagasse / Coal	July 2017
Dhanalakshmi Srinivasan Sugars Pvt., Tamil Nadu, India	23	Bagasse / Coal	2017
United Spirits, Uttar Pradesh, India	20	Blended rice husk	2016
Gem Sugars, Karnataka, India	24	Coal	Sept. 2017
Mankapur Chini Mills, Uttar Pradesh, India	45	Bagasse	2016
Balrampur Chini Mills (Babhnan Unit), Uttar Pradesh, India	45	Bagasse	2016
KM Sugar Mills , Uttar Pradesh, India	16	Bagasse / Coal	Oct. 2017
Swaraj India Argro, Maharastra, India	35	Bagasse / Coal	Mar. 2018
Dhampur Sugar Mills (Dhampur Unit), Uttar Pradesh, India	75	Bagasse / Coal / Rice Husk	Nov. 2017
Dhampur Sugar Mills (Asmoli Unit), Uttar Pradesh, India	35	Bagasse / Coal / Rice Husk	Sept. 2017
Bhalkeshwar sugar, Kamataka, India	25	Bagasse / Coal	Feb. 2018
LH Sugars, Uttar Pradesh, India	23	Bagasse / Coal	Mar. 2018
Molindo Raya Industrial, Indonesia	56	Coal	. Sept 2018

Technology leap forward in distillery industry

Zero effluent discharge: 2 examples of successful installation

Successful installation: Ginge

Rajshree sugars and chemicals, GINGEE



Successful installation: Ginge

Basic design parameters

Ginge	
Distillery Capacity	80
Incinerator Capacity	30
Boiler pressure	45
Steam temperature	400
Supporting Fuel	Coal
STG capacity	3 MW
Feed water temperature	150°C
Flue Gas Emission	50 mg/Ncum
Exit Flue gas temperature	180°C

Successful installation: Ginge

Performance Highlight

Performances reached in Ginge	
Supporting Fuel	20% Coal
Dust concentration of flue gas	50 mg/Ncum
Continuous operation on full load of slop firing, without any issues and RSCL is confident on that.	65 days
Max Slop burnt in a day	287 tons

Successful installation: Ginge

Ash analysis

Ash Analysis Report – Chemical composition					
	Bottom ash (%)	llnd pass (%)	Eva & Eco (%)	Bag filter (%)	Total (%)
Alumina	5.11	3.23	2.41	3.09	3.62
Iron	3.00	3.63	2.79	3.92	3.43
Calcium	14.91	11.28	11.17	7.52	10.85
Magnesium	9.54	14.30	14.26	3.80	8.67
Potassium	6.63	13.69	15.89	20.85	14.77
sodium	2.42	4.01	4.26	5.06	3.99
silica	54.29	34.18	34.80	27.29	37.55
Titanium	0.28	0.15	0.11	0.15	0.18
Phosphorous	0.48	1.51	1.45	0.87	0.94
Sulphur	3.14	13.82	12.66	22.65	13.97
Un burnt Carbon	0.2	10.21	7.82	7.36	5.71
Oil	-	-	-	-	-



Fly Ash



Grate Ash

Successful installation: MANKAPUR

Mankapur Chini Mills, MANKAPUR



Successful installation: Mankapur

Basic design parameters

Mankapur	
Distillery Capacity	120
Incinerator Capacity	45
Boiler pressure	45
Steam temperature	400
Supporting Fuel	Bagasse
STG capacity	6.7 MW
Feed water temperature	150°C
Flue Gas Emission	50 mg/Ncum
Exit Flue gas temperature	180°C

Successful installation: Mankapur

Performance Highlight



Performances reached in Mankapur

Average Slop quantity burnt	370 to 390 tons
Dust concentration of flue gas	50 mg/Ncum
Continuous operation on full load of slop firing, without any issues and RSCL is confident on that.	65 days
Max Slop burnt in a day	397 tons

No Stoppage on account of Ash Accumulation, Chocking or Clinker formation

Successful installation: MANKAPUR

Ash analysis

Ash Analysis Report – Chemical composition					
	Ind pass (%)	Eva & Eco (%)	Bag Filter 1&2	Bag Filter 3&4	Bag Filter 5&6
Unburnt Carbon	6.78%	7.00%	8.02%	7.08%	4.59%
Loss on Ignition as LOI	6.98%	7.40%	10.67%	8.69%	7.01%
Silica as SiO ₂	9.62%	28.21%	10.73%	9.34%	9.26%
Alumina as Al ₂ O ₃	0.46%	1.06%	0.18%	0.08%	0.09%
Iron Oxide as Fe ₂ O ₃	0.02%	0.01%	0.02%	0.01%	0.01%
Calcium Oxide as CaO	25.43%	22.95%	26.54%	16.70%	15.49%
Magnesium Oxide as MgO	11.80%	11.78%	9.62%	7.06%	9.23%
Manganese Oxide as MnO	Nil	Nil	Nil	Nil	Nil
Titanium Oxide as TiO ₂	Traces	Traces	Traces	Traces	Traces
Sodium Oxide as Na ₂ O	0.44%	0.45%	0.38%	0.56%	0.40%
Potassium Oxide as K ₂ O	25.56%	16.97%	28.07%	32.06%	30.16%
Potassium as K	21.21%	14.08%	23.30%	26.61%	25.03%
Phosphorous as P	0.03%	0.03%	0.02%	0.02%	0.02%
Sulphur Tri Oxide as SO ₃	26.36%	18.16%	24.15%	34.02%	35.14%



Fly Ash



Grate Ash

Latest news

World's biggest vinasse fired boiler under execution

World's Biggest Vinasse Incinerator: Dhampur

Basic design parameters

Mankapur	
Distillery Capacity	200
Incinerator Capacity	75
Boiler pressure	45
Steam temperature	400
Supporting Fuel	Bagasse / Coal / Rice husk
Feed water temperature	150°C
Flue Gas Emission	50 mg/Ncum
Exit Flue gas temperature	180°C

World's biggest vinasse fired boiler under execution

Dhampur Sugar Mills (Dhampur Unit), Uttar Pradesh



Learnings with Experience

Learnings

Learnings with Experience

Air Ingressment

➤ Observations:

Sticky Ash

Ash grows big by attracting other ash particles.

➤ Solution:

Therefore, Air ingressment should be avoided.

Learnings with Experience

Periodic soot blowing

➤ Observations:

Ash accumulation

Ash Deposits on heating surface

➤ Solution:

Therefore, Soot blowing once in a shift

Learnings with Experience

Ash Handling System

➤ Observations:

Ash accumulation hoppers

Blockage in flue path

Burning of bags (once)

Damaging of Dome seal by ash with high temperature

➤ Solution:

Introducing Screw Conveyor to ensure continuous withdrawal of ash

Avoiding air leakages through Ash Handling System

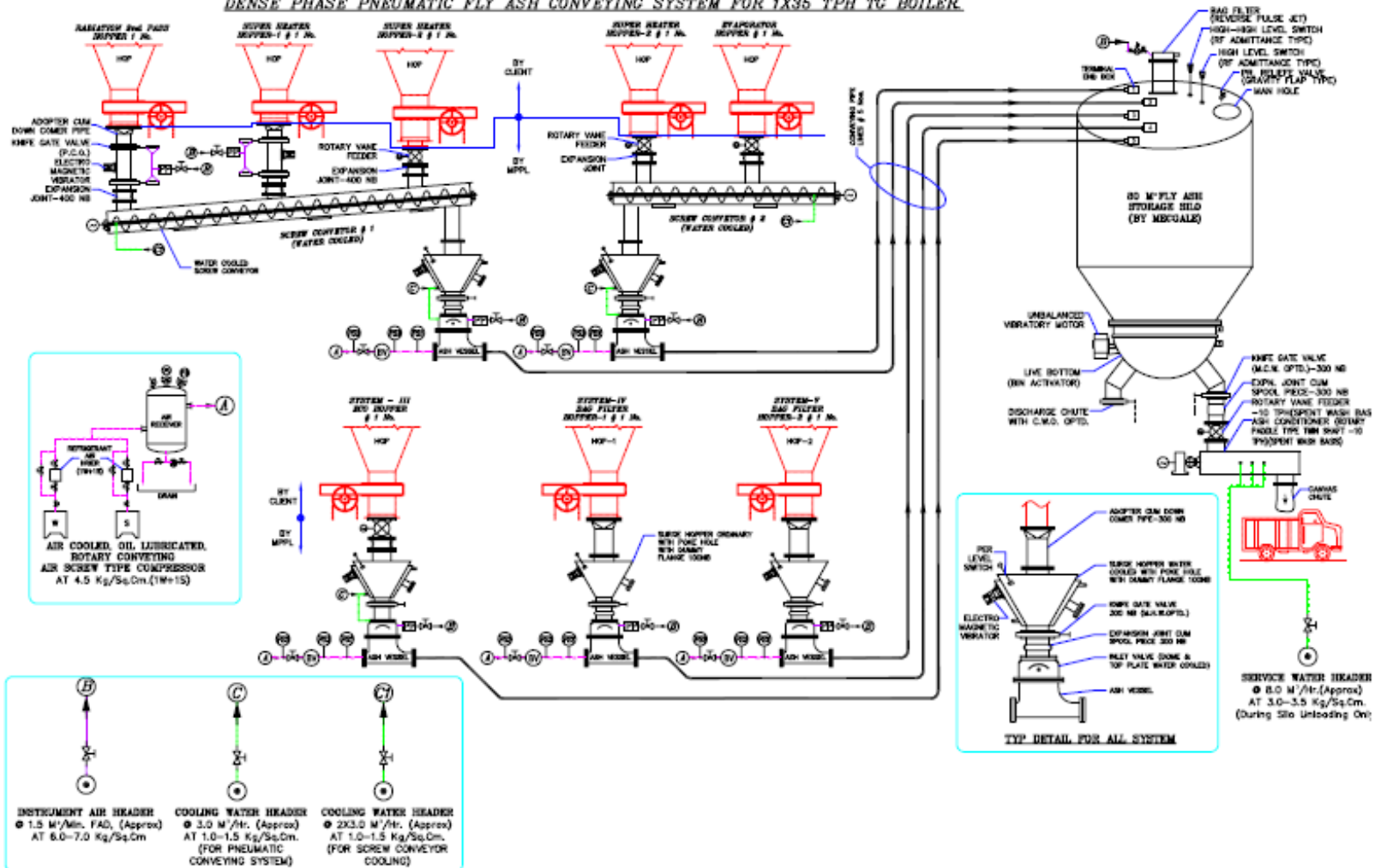
Learnings with Experience

Ash Handling System



fives

DENSE PHASE PNEUMATIC FLY ASH CONVEYING SYSTEM FOR 1X35 TPH TG BOILER.



Learnings with Experience

Vinasse Analysis

➤ Observations:

Lower actual Oxygen content than predicted in vinasse.

Inadequacy of Fan sizes

➤ Solution:

Vinasse analysis with reasonable accuracy

Learnings with Experience

Adequacy of Support Fuel

➤ Observations:

Instability of furnace flame.

Draft fluctuation.

➤ Solution:

To maintain adequate quantity of support fuel

Economics

Economics of Vinasse Incinerator

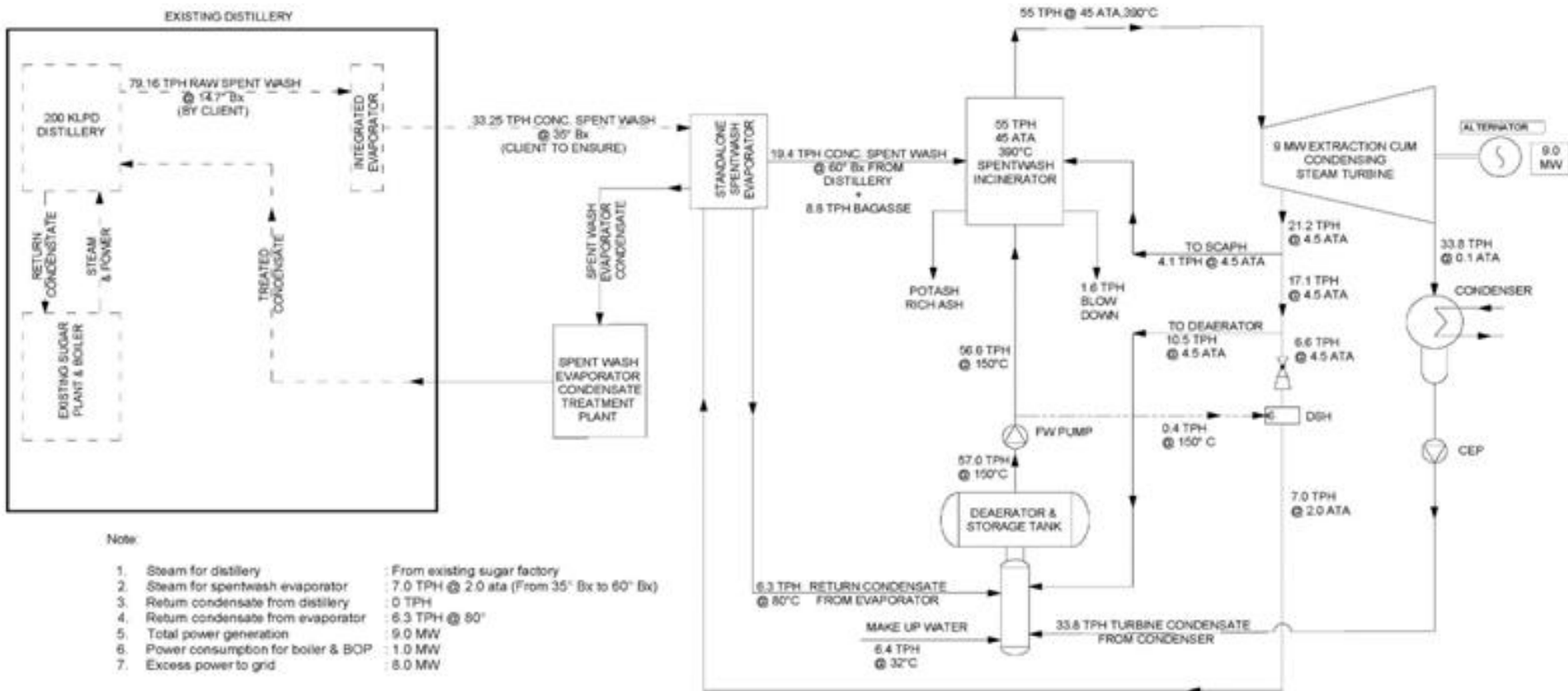
Typical Case n°1

Sugar production + Distillery with Integrated Concentrator: Vinasse @ 35% solids

TYPICAL 200 KLPD DISTILLERY	
DISTILLERY CAPACITY	200 KLPD (ATTACHED WITH SUGAR FACTORY)
Sugar production	YES
EXISTING BOILER AND TURBINE	SUITABLE TO SUGAR FACTORY
EXISTING INTEGRATED EVAPORATED SYSTEM	YES
CONCENTRATION OF VINASSE AT OUTLET	35 % SOLIDS
NEW VINASSE CONCENTRATOR	From concentration of 35% solids to 60 % SOLIDS
NEW VINASSE FIRED BOILER	55 TPH
NEW STEAM TURBINE	9 MW EXTRACTION CUM CONDENSING
SUITABLE PROCESS CONDENSATE TREATMENT PLANT	YES

Typical Case n°1

Sugar production + Distillery with Integrated Concentrator: Vinasse @ 35% solids



Typical Case n°1

Sugar production + Distillery with Integethered Concentrator: Vinasse @ 35% solids

SUMMARY		
1	CAPITAL INVESTMENT	M\$US
a	Boiler	21,00
b	Concentrator	Incl.
c	Turbine	Incl.
d	Conveyors	Incl.
e	Structure + civil basis	Incl.
f	Erection & installation	Incl.
g	Others necessary for operating such installation	Incl.
	TOTAL CAPITAL	21,00
2	ANNUAL OPERATION COST inclusive of 90 days of additional operation (WITH BAGASSE)	
a	FUEL COST	-0,80
b	MANPOWER & OTHER CONSUMABLES	-0,34
	TOTAL OPEX (BAGASSE)	-1,14
3	ANNUAL REVENUE inclusive of 90 days of additional operation	
a	POWER EXPORT / IMPORT	6,31
b	SALE OF COMPOST / ASH	0,28
	TOTAL REVENUE	6.59
4	TOTAL PROFIT (2) + (3)	5.45
A	ANNUAL RETURN / CAPEX (4) / (1)	0,26
B	PAYBACK PERIOD (YEARS) (1) / (4)	3,33
C	ANNUAL RETURN / OPEX (4) / (-2)	4.80

Recirculation of Process Condensate is additional benefit

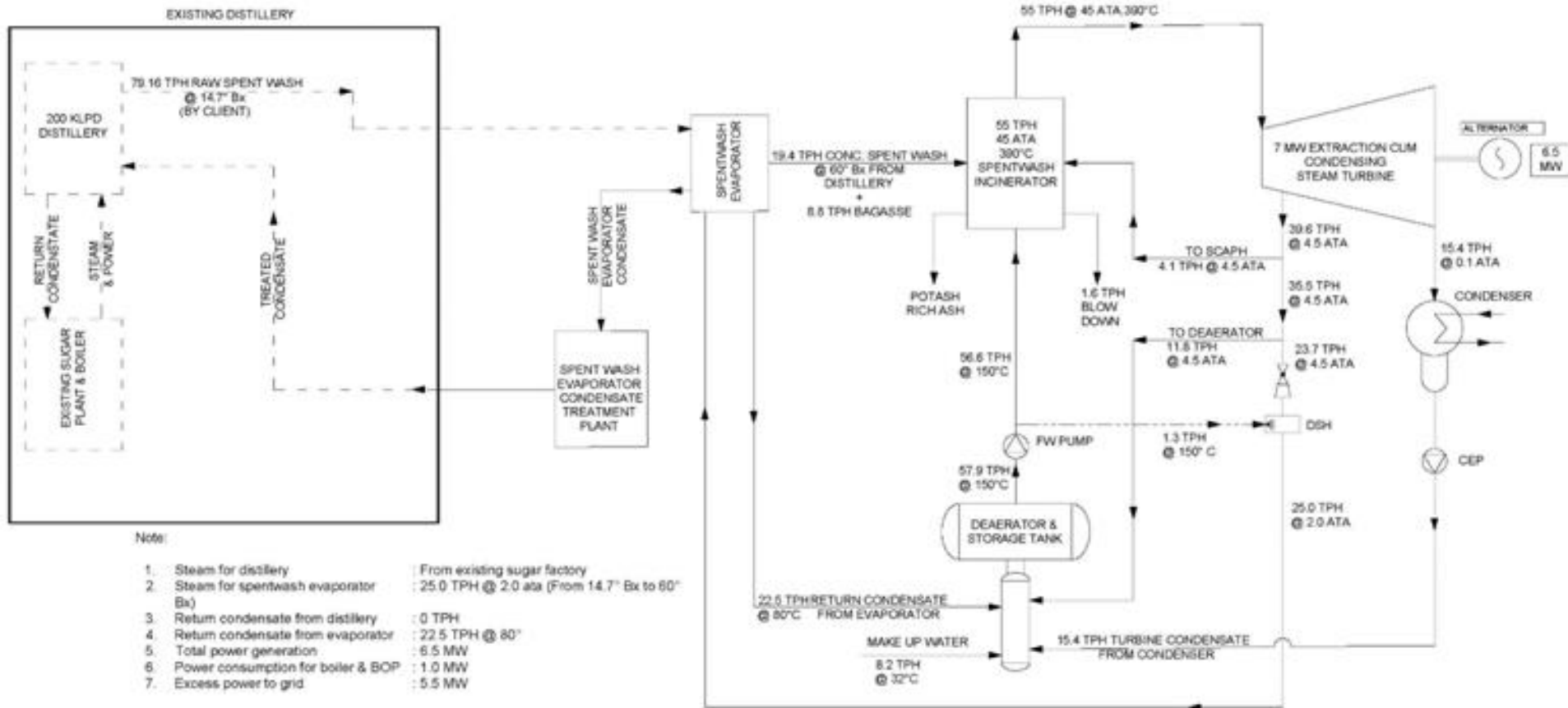
Typical Case n°2

Sugar production + Distillery Vinasse @ 14.7 % solids

TYPICAL 200 KLPD DISTILLERY	
DISTILLERY CAPACITY	200 kIDP
Sugar production	YES
EXISTING BOILER AND TURBINE	SUITABLE TO SUGAR FACTORY
EXISTING INTEGRATED EVAPORATED SYSTEM	NO
CONCENTRATION OF VINASSE AT OUTLET	14,70%
NEW VINASSE CONCENTRATOR	From concentration of 14,7% solids to 60 % SOLIDS
NEW VINASSE FIRED BOILER	55 TPH
NEW STEAM TURBINE	7 MW EXTRACTION CUM CONDENSING
SUITABLE PROCESS CONDENSATE TREATMENT PLANT	YES

Typical Case n°2

Sugar production + Distillery Vinasse @ 14.7 % solids



Typical Case n°2

Sugar production + Distillery Vinasse @ 14.7 % solids

SUMMARY		
1	CAPITAL INVESTMENT	M\$US
a	Boiler	27,00
b	Concentrator	Incl.
c	Turbine	Incl.
d	Conveyors	Incl.
e	Structure + civil basis	Incl.
f	Erection & installation	Incl.
g	Others necessary for operating such installation	Incl.
	TOTAL CAPITAL	27,00
2	ANNUAL OPERATION COST inclusive of 90 days of additional operation (WITH BAGASSE)	
a	FUEL COST	-0,80
b	MANPOWER & OTHER CONSUMABLES	-0,34
	TOTAL OPEX (BAGASSE)	-1,14
3	ANNUAL REVENUE inclusive of 90 days of additional operation	
a	POWER EXPORT / IMPORT	4,34
b	SALE OF COMPOST / ASH	0,28
	TOTAL REVENUE	4.62
4	TOTAL PROFIT (2) + (3)	3.48
A	ANNUAL RETURN / CAPEX (4) / (1)	0,13
B	PAYBACK PERIOD (YEARS) (1) / (4)	7.75
C	ANNUAL RETURN / OPEX (4) / (-2)	3.07

Recirculation of Process Condensate is additional benefit

Overall Economics

- Operation friendly with minimum manpower.
- Operable round the year irrespective of monsoon.
- Easy cleaning method.
- Reduced maintenance cost.
- Distillery Effluent is converted into potash rich manure.
- Safety to environment.
- Bagasse to slop ratio is guaranteed for 35:65 based on heat value.
- Coal to slop is guaranteed for 30:70 based on heat value.
- Coal (GCV - 5500 kcals/kg) to slop is guaranteed at a ratio of 18:82 by weight.

Performance guarantees

PERFORMANCE GUARANTEES

- Steam Generation (MCR).
- Complete firing of spent wash generated.
- Maximum number of days of operation between cleanings.
- Auxiliary Power Consumption.
- Supporting Fuel Consumption.

Photographs

Photograph of Fives Cail-KCP Spent wash
Incinerator

SPENTWASH INCINERATOR AT RSCL, GINGEE, INDIA - 30 TPH



30 TPH Vinasse Incinerator at Rajashree Sugars and Chemicals Limited (During firing Vinasse with Coal)



45 TPH Vinasse Incinerator at M/s Mankapur Chini Mills Limited











35 TPH Vinasse Incinerator at M/s Dhampur (Asmoli Unit) Sugar Mills Limited



24 TPH Vinasse Incinerator at Gem Sugars Limited



SPENTWASH INCINERATOR AT RSCL - 30 TPH, 45 ATA, 400°C



FUTURE VINASSE FIRED BOILERS

➤ CONCEPT

To burn concentrated vinasse without any supporting fuel.

➤ ADVANTAGE

Incidental Steam and Power Generation.

Slop is converted into potash rich manure. Expected potassium content is 35 % and above.

➤ LIMITATION

Incidental Steam and Power Generation will not enough to meet total steam and power demand of a distillery.



fives ultimate machines
ultimate factory

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