IFFCO KANDLA PLANT

PROCESS DESCRIPTION FOR

MANUFACTURE OF COMPLEX FERTILISERS

IFFCO Kandla plant comprise of six streams which can manufacture complex fertilizers. The products manufactured are NPK 10:26:26, NPK 12:32:16 and DAP 18:46:00.

The process steps for the manufacture of complex fertilizers consists of ammoniation of phosphoric acid containing 52 to 54% P2O5 upto mole ratio of 1.40 (i.e) ratio of moles of ammonia to moles of phosphoric acid. In the Kandla Phase – I Streams (A, B, C & D Trains), this reaction is carried out in a vertical cylindrical continuous stirred tank reactor of SS 316L construction. A split of about 70% of total acid requirement is added into the reactor and the balance 30% of the acid is sent to scrubbers which finally comes back to the reactor after scrubbing.

In the Kandla Phase - II Streams (E & F Trains) dual pipe reactor technology has been adopted in which the ammoniation of phosphoric acid containing 52 to 54% P2O5 with liquid ammonia at 0 deg. C is carried out in two pipe reactors. The dryer pipe reactor (DPR) is installed inside the rotary dryer where ammoniation upto a mole ratio of 1.05 (ratio of moles of ammonia to moles of H3PO4) and secondly in the granulator pipe reactor (GPR) installed inside the rotary drum granulator upto a mole ratio of 1.40. The discharge from the DPR & GPR falls on the rotating bed of recycle fertiliser material in the corresponding equipment i.e. Granulator & Dryer.

The reaction is exothermic the heat of reaction evaporates water and the boiling slurry at 115 to 120 deg. C comprising ammonium phosphates is sent for granulation. The Chemical Reactions involved are indicated below :

NH_3 + H_3PO_4 ---------- > $NH_4 H_2 PO_4$

(Ammonia) (Phos.acid) (Mono Ammonium Phospahte)

$NH_4H_2PO_4$ + NH_3 --------- > $(NH_4)_2$ H PO_4

(Mono Ammonium Phospahte) (Ammonia) (Di Ammonium Phosphate)

For manufacturing of MAP and other complex fertiliser products as per the Fertiliser (Control) Order 1985, the extent of ammoniation and mole ratio in the reactor is varied as per requirement based on product composition.

Thereafter, the process is common in both the Kandla Phase – I & II Streams. Dry raw materials like Urea, Filler & Muriate of Potash (for NPK grades) are added into the granulator along with recycle material. There is no chemical reaction taking place with Potash, which is physically mixed and incorporated into the fertiliser granules in the granulator.

The fertilizer material in the granulator is further ammoniated upto a mole ratio of 1.80 by sparging liquid ammonia under the bed of fertiliser material in the granulator. The reaction heat aids granulation and granulated fertiliser containing about 2.5% moisture is discharged to the rotary dryer where it is heated with hot air in a co-current flow from a combustion chamber where fuel oil is burnt for hot air.

The fertilizer material is then screened in double deck vibrating screens. The separated oversize material (above 4 mm) is crushed in roll crushers and forms part of the recycle sent to the granulator, the product size material (-4 mm to 1 mm) goes to a rotary cooler as the final product, the fines material (less than 1 mm) along with some product material is also recycled to control the moisture in the granulator at 2.50% which is the optimum for good granulation.

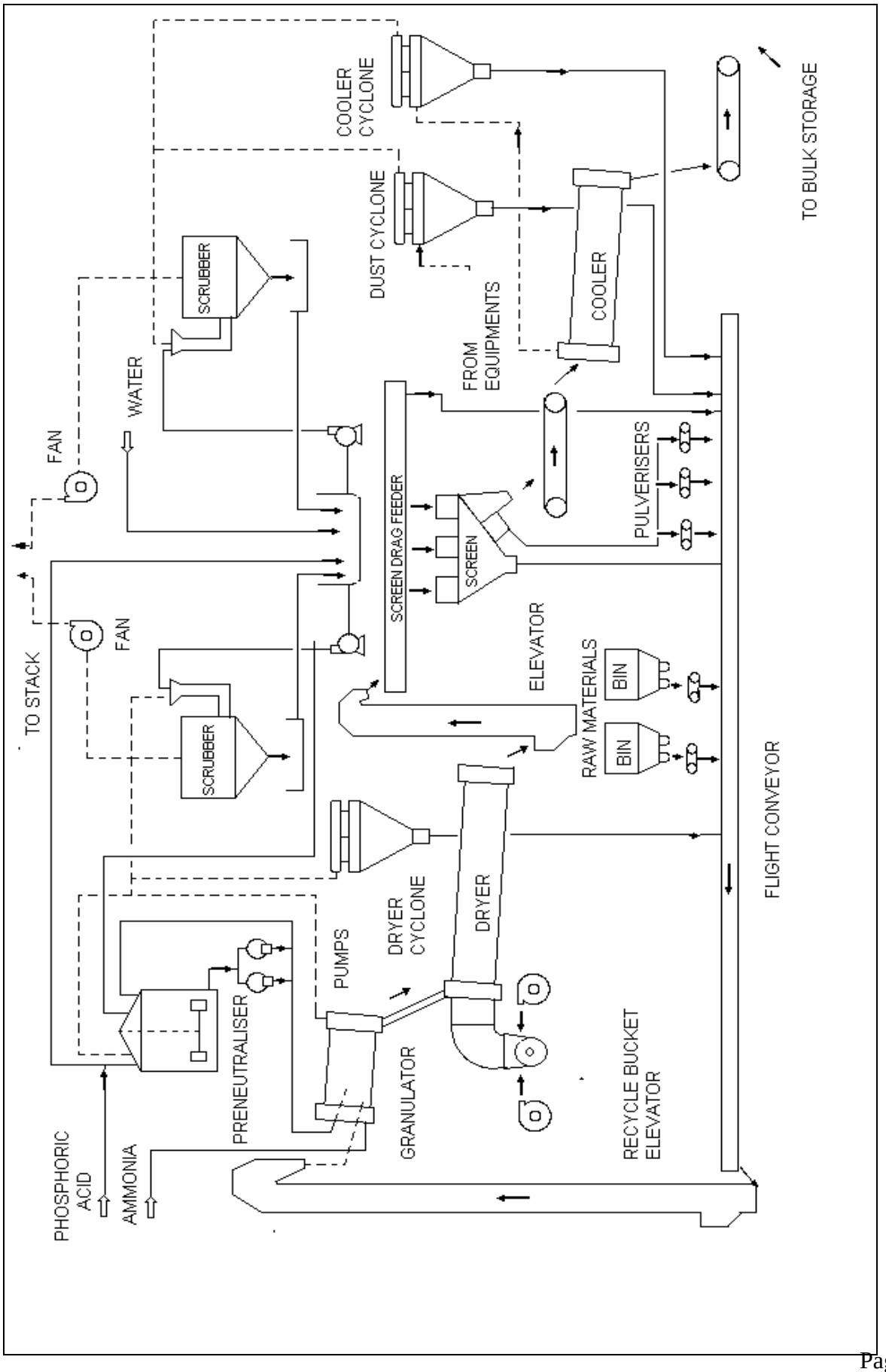
The unreacted ammonia fumes and water vapor from the reactor and granulator in Kandla Phase – I Streams (A, B, C & D Trains) are sucked by fans into venturi type wet gas scrubbers. The gases are scrubbed by scrubber liquor consisting of acidic ammonium phosphate liquor at a mole ratio of 1.20 obtained due to addition of a part of the total acid requirement along with water into the scrubber system. The scrubber liquor absorbs the ammonia from the exhaust gas stream and the liquor is recycled back to the main reactor.

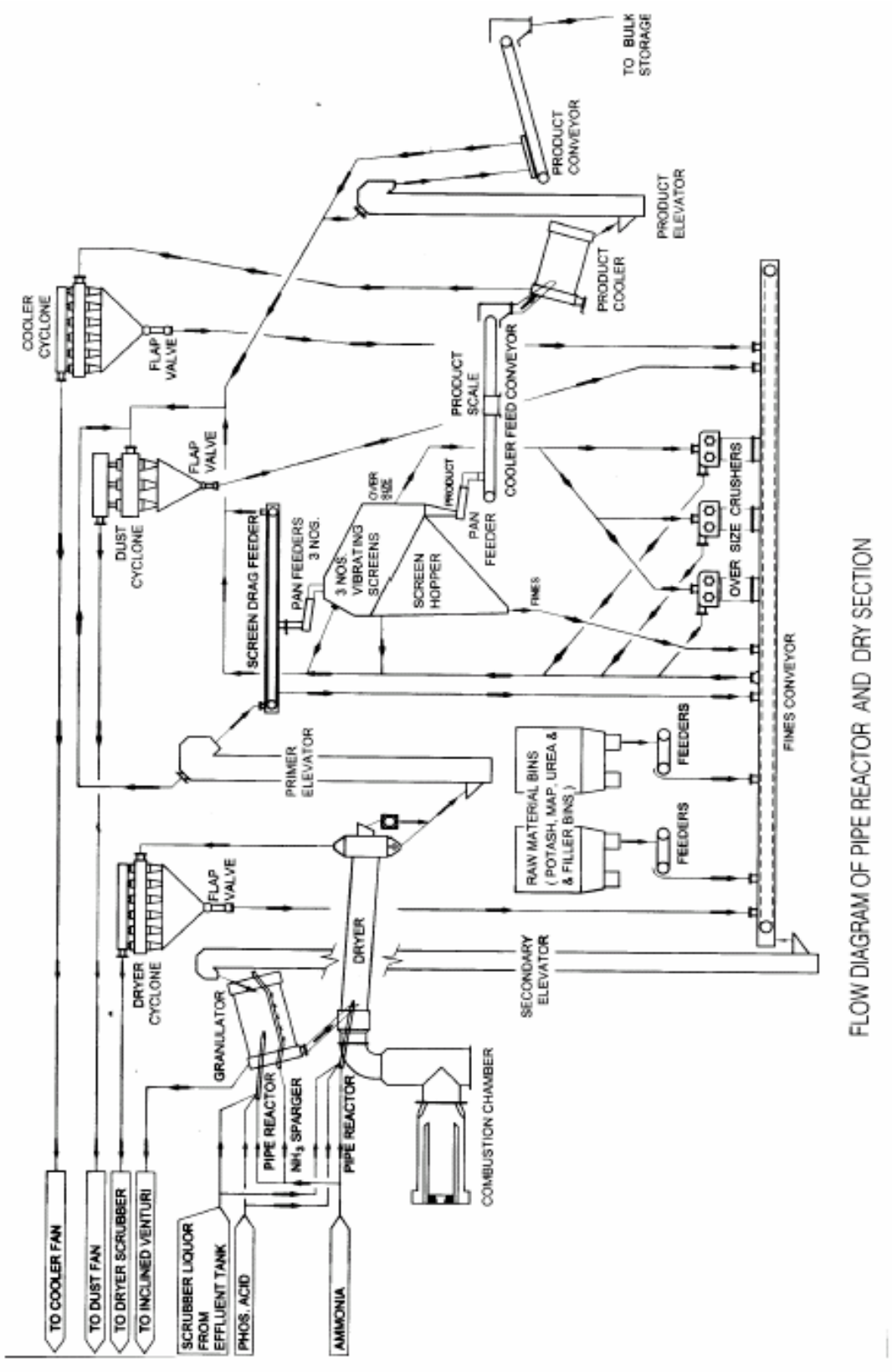
In case of Kandla Phase - II streams (E & F Trains) the off gases from the granulator are first scrubbed in an inclined venturi scrubber followed by a wet venturi type fumes scrubber. The exit gas from the dryer and granulator scrubbers after initial scrubbing are once again passed through a tail gas scrubber for maximum recovery of ammonia and fertiliser dust particles from these gases. The gases are then discharged to atmosphere through the plant stack.

Independent high efficiency wet dust scrubbing system has been provided in all Trains for recovery of dust particles from dust generated at various equipment during conveying and handling of fertiliser material which is collected through the dust collection system, passed through dry cyclones followed by wet ventury scrubbers and spray towers for maximum recovery of nutrients from exhaust gases. This is a total liquid recycle process and there are no effluents generated in the process, the entire quantity of scrubbing liquid is consumed in the process.

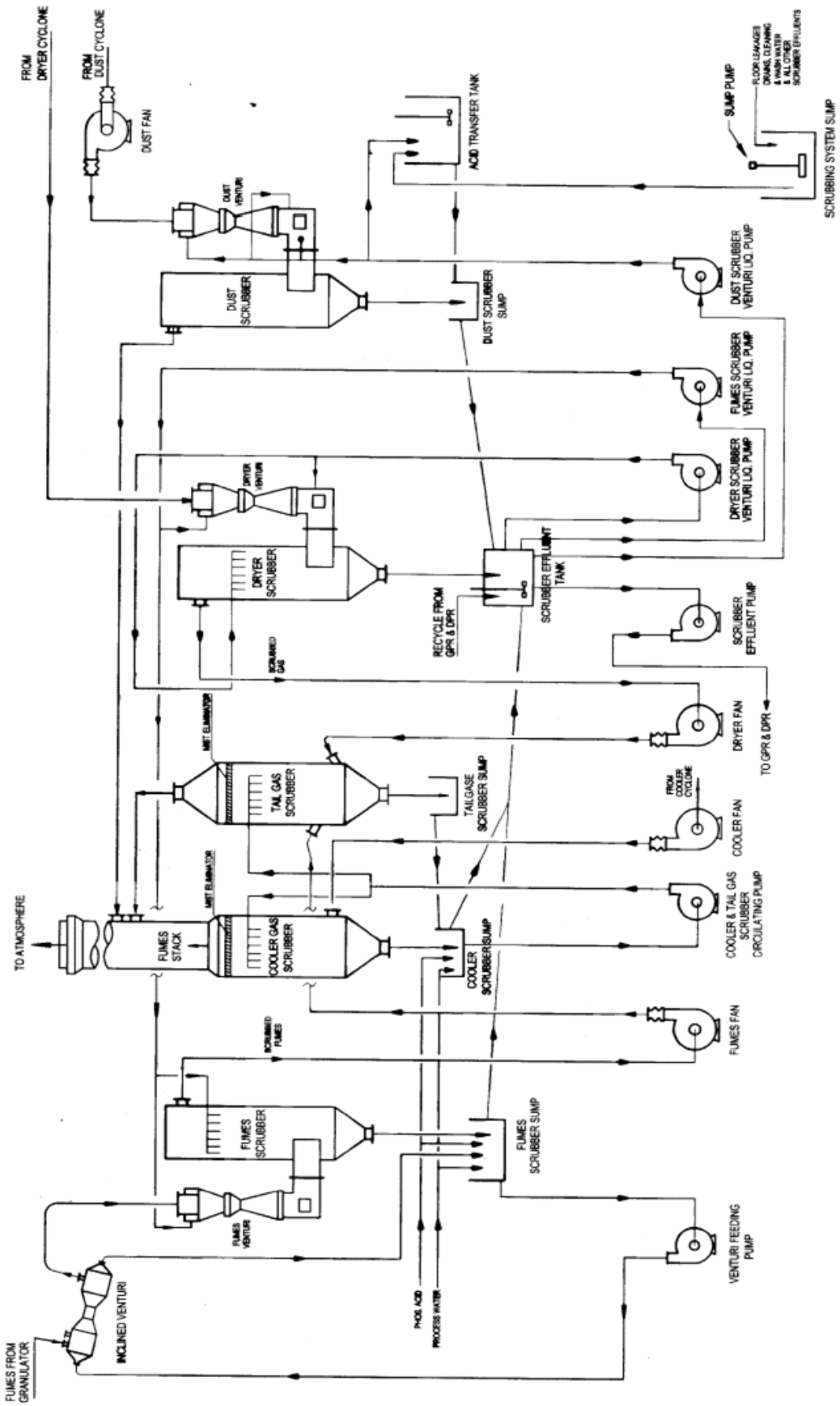
Rotary drum coolers are used for cooling of the final product before it is sent to product storage. The gases from the cooler are passed through an independent scrubbing system comprising cyclones and wet spray tower. The finished product after cooling is sent to the product storage silo or to bagging plant.

Process Flow Diagrams of Kandla Phase – I Streams, Kandla Phase – II Streams and the Scrubbing System respectively are attached below.


COOLER CYCLONE
DUST CYCLONE
TO BULK STORAGE
SCRUBBER
WATER
FAN
FROM EQUIPMENTS
COOLER
SCREEN DRAG FEEDER
SCREEN
PULVERISERS
TO STACK
FAN
ELEVATOR
RAW MATERIALS
BIN
BIN
SCRUBBER
DRYER CYCLONE
DRYER
FLIGHT CONVEYOR
PUMPS
PRENEUTRALISER
GRANULATOR
RECYCLE BUCKET ELEVATOR
PHOSPHORIC ACID
AMMONIA



FLOW DIAGRAM OF PIPE REACTOR AND DRY SECTION



FLOW DIAGRAM OF SCRUBBING SECTION