

Steel Fabricated Double Shell Jacketed Dryer

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SUMMARY

Double Shell steel fabricated dryers is not new to the industry. It is already in use in paper, pharmaceutical, plastic, printing, rubber and textile industries in abroad, but its use in our country is very rare. Compared to single shell C.I. dryers, it has greater steam efficiency and hence less consumption of fuel. Higher steam velocity minimises scale formation, dead steam and non condensable stray gases. To the contrary greater steam turbulence flushes out air, and guided high velocity steam makes uniform surface temperature possible. Comparatively much higher steam pressure can be made permissible in double shell M.S. dryers. Condensate removal pipes with bucket takes out a definite amount in each revolution. Accumulation of condensate in case of breakdown is much less because of effective condensate removal system and limited space of accumulation. Double shell dryers are much lighter and so economises supporting frames, drive unit, bearings, journals, housing, transportation and power. By reducing number of drying cylinders, floor space may be reduced. Less number of dryers and accessories causes reduction in maintenance cost and downtime M.S. plates distort before rupture thereby increasing safety. To avoid corrosion a brushing roll with suitable speed may be designed. Doctor blades of suitable material may be used. Sizes as large as 18 ft in diameter can be manufactured by a equipped fabrication shop engaged for different types of jobs, for such by single shell dryers highly equipped casting arrangement with heavy pouring facility will be required, which as such is economically unavailable in the country. Presently several Paper and Board plants of capacities ranging between 5 and 30 TPD are being installed. Projected demand of driers/to manufacture C.I. dryers find a big gap. In the country for the purpose and facilities available double-shell M.S. dryer is the right answer to this problem, and can be recommended for M.G./Yankee cylinders and dryers of diameters of 1500 mm and above.

INTRODUCTION

Economical viability of Mini Paper & Board plants are mainly depending upon the initial cost of plant, operational and maintenance expenses and higher production efficiency. In a paper and board industry, drying of paper and board is important consideration for its economic design, operation, maintenance and higher output.

The double shell steel fabricated (Jacketed) type dryers can play a greater role in the industry

for certain types of paper and board and it can be more effective than conventional single shell dryers.

It eliminates stagnancy inherent in low pressure single shell dryers, saves power, reduces weight, requires comparatively thin and strong steel plate, safe with higher steam pressure upto 20 Kg./cm² and more, speeds up heat transmission for higher output.

The schematic diagram illustrates that the steam enters through holes in journal and passes through a number of spoke pipes into the space between two shell plates. Steam travels along the face of double shell dryer heating the outer shell. Two condensate removal pipes with buckets, desi-

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igned and located to remove all the condensate except a very shallow layer in the bottom of the shell, rotates with the dryer. Condensate is blown out of the pipe and passed through the rotary joint twice in each revolution. Air and steam are removed during the balance of revolution. Open ends of the dryer may be covered by thin steel sheet with insulating materials to prevent heat loss from the inner surface.

GREATER STEAM EFFICIENCY

Due to narrow space between the outer and inner shell the steam is guided in a restricted area between the shells across the inner surface of the face of the dryer. Since steam velocity increases as the cross sectional area decreases the steam velocity in double shell dryer is much greater than that in the single shell dryer. The greater steam velocity reduces scale formation; the inner surface gives greater steam turbulence in the dryer and flushes out air. Scale on the inner surface of the dryer shell plate would offer considerable resistance to the heat through the shell. The higher steam velocity also minimises the possibility of dead steam in the dryer. Steam is guided into the jacket through a series of inlet pipes spaced around the dryer in a manner designed to keep all the steam in controlled motion, assuring greater turbulence. Higher steam velocity ensures that air in the entering steam will be flushed out immediately with the exhaust steam and the condensate. Due to its higher steam efficiency it will be much more effective on M.G./Yankee cylinders for higher production rate by increasing the machine speed. Coal and water consumption are reduced considerably compared to the low pressure single shell dryers.

UNIFORM SURFACE TEMPERATURE

The greater velocity of steam and the guiding feature of narrow steam passage maintain a more uniform temperature across the face of double shell dryer. Heat transfer speeds up as steam velocity increases. Even the natural decrease in steam velocity across the face is not detrimental in any way. Due to greater steam velocity the non-condensable stray gases such as hydrogen and oxygen which are mainly responsible for uneven surface temperature resulting in uneven dryness of the paper are driven out.

HIGHER STRENGTH

The higher strength of the rolled steel plates allows the use of lighter gauges of shells and permits safe operation at a pressure of 20 Kg./cm² and higher. Thinner steel sheet substitutes thick cast iron walls and substantially reduces the resistance

to the heat transfer. Normally for 3000 mm ϕ single shell CI dryer, shell thickness will be 50 mm or more whereas the double shell steel fabricated dryer of similar diameter will be reduced to 32 mm thick outer shell,

HIGHER STEAM PRESSURE

Double shell dryer can be manufactured for higher steam pressure than ever before practical on single shell dryer. Use of high pressure of steam resulting in high evaporation rate specially on M.G./Yankee Cylinder may increase in production by speeding up the machine.

BETTER CONDENSATE REMOVAL

Differing from the conventional drying cylinder with its condensate removal pipe (siphon) always maintained in a downward position, the condensate removal pipe with bucket of the double shell dryer revolves with the cylinder. This offers a much more positive method, taking out a definite amount of condensate with every revolution and preventing the risk of inadequate removal which can result from faulty assembly, misalignment and worn out pipe during operation. This method of condensate removal operates with equal efficiency at any speed, providing ready egress of air and reducing to a minimum the amount of entrapped air in the drying cylinder. Due to higher velocity and high pressure on the condensate system, the rotary steam joint and trap system operates smoothly with less amount of leakage. Break-down or non functioning of condensate system in single shell dryer will accumulate the condensate water causing the weight and speed variation of the dryer resulting in uneven drying, breaking of paper and straining of drive. But it will not occur in case of double shell dryer due to effective condensate system and space limited for accumulation of condensate.

WEIGHT SAVING

Small and medium size double shell dryers are lighter than similar single shell dryers and large diameter double shell dryers show outstanding weight saving, reflected immediately in the design of the supporting frames, in the drive unit, bearings and journals. Generally the saving in weight for a standard double shell steel fabricated dryer is about 30-40% with respect to single shell dryers, thereby reducing the cost of materials, labour, handling, transportation, drive, power.

INSTALLATION AND OPERATING ECONOMY

Double shell dryers reduce cost in many ways. For a desired production rate, the double

shell dryer in a new machine may reduce the amount of floor space required by reducing the number of drying cylinders. Accompanying frame and bearing costs are lower because of reduced weight. Reduction of weight and no. of dryers obviously reduces consumption of power and fuel. Due to less number of dryers fitted with a few parts and accessories, the maintenance cost and downtime during the operation of the machine is reduced considerably.

MECHANICAL SAFETY

Double shell dryers are much safer than single shell C.I. dryers—they will not explode. Even if too much pressure is applied for any reason the steel plate would merely distort to noticeable extent before rupture occurs. This reduces the chance of a roll failure that may cause damage of property, personal injury resulting from flying fragments as in the case of single shell C.I. dryer. In addition, no bolt, nut or siphon can work loose when the dryer is an integral piece of welded steel. Internal painting of anticorrosive paint will prevent corrosion and deposition of scales inside the dryer resulting a longer life.

DIMENSIONALLY STABLE

Chance of any deformation may be avoided by observing certain precautions at the time of manufacture. The cylinders are to be machined under the internal pressure deflection under usual operating conditions. Special welding techniques result in a warp resistant drying cylinder, rigid enough to withstand concentrated external loads when necessary.

WIDE RANGE

With the exception of transport restrictions there is practically no limit to the range of sizes possible, which is impracticable in the case of C.I. Single shell dryers due to unavailability of adequate moulding and casting facilities. Sizes as large as 18' (5486 mm) in diameter or larger may be possible to manufacture.

FINISHING AND DOCTORING

The steel plates used to form the outer shell of the double shell dryer provides the soundness required for any type of machine finish. To avoid corrosion a brushing roll with suitable speed is designed to have a clean surface at all the times during operation. Doctor blades of suitable materials can be satisfactorily used. Double shell dryer can be designed with outer shell of solid stainless steel or any suitable non-corrosive mate-

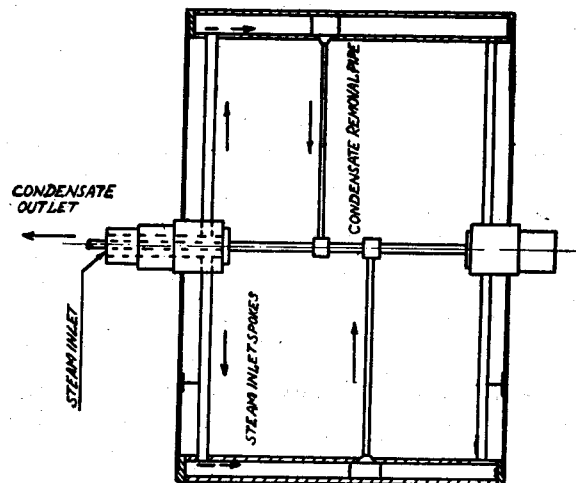
rial clad to avoid corrosion as well as to prevent contamination of the product. Double shell drying cylinders can also be sheathed with Model metal and other non-ferrous metals and alloys.

PRODUCTION FACILITIES AND SPEEDY EXECUTION

The double shell dryers can be fabricated easily in any size in a well equipped fabrication workshop within shortest possible time for which no extra capital investment is required for manufacturing the dryer, whereas to manufacture the C.I. single shell dryers a well equipped modern foundry with good moulding arrangements will be necessary which need initial massive investment. Casting of dryer is comparatively time consuming process and chance of failure are more at any stage of manufacturing.

WIDESPREAD ACCEPTANCE AND ITS USE IN SEVERAL INDUSTRIES

Proof of the value of the double shell dryers is offered in their extensive use in most industries where the principle of drum drying or cooling is used. Applications include—paper making (board, felt, napkins, tissues) linolium, pharmaceuticals, photographic film, plastic film, printing (ink drying), rubber products and textiles.



SCHEMATIC DIAGRAM FOR STEEL FABRICATED DOUBLE SHELL DRYER

CONCLUSION

Presently several Mini Paper & Board Plants are being installed in the country whose capacities are mostly ranging from 5TPD to 30TPD. In comparison to the projected demand of dryers required to be installed in those plants, the facilities of manufacturing C.I. dryers are very much insufficient

and disablanced. Considering the above fact and convenience, capital cost, maintenance and operational expenses, manufacturing facilities, speedy execution, the double shell steel fabricated dryers can be ideal replacement of the same in certain types of Paper and Board Mill. It is again highlighted and recommended to use this dryer for M.G/Yankee Cylinders and the diameters from and above 1500 mm for which no casting facilities are available in this country. Most of the small plants designed for MG/Yankee Cylinders to produce Board, Kraft, Corrugating media & other types of ordinary Packaging Papers can be installed with

double shell steel fabricated dryers ideally to save money and time considerably. In this connection the author invites the detail discussion to develop further and at the end solicits the co-operation from the Engineers and Technologists of this industry.

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