technical datasheet

Parallel Downflow Deaerators

Advanced Technology for Optimum Deaeration of Boiler Feed Water

The parallel downflow deaerator design is best suited in many applications. One can expect superior performance from a **COCHRANE® by newterra** parallel downflow deaerator for the following reasons:

1. In parallel downflow, steam flow through the trays will not impede the water flow under any operating condition within the unit's design capacity. This allows **COCHRANE® by newterra** to utilize a tray section based on optimum water loading rates, providing maximum turndown capability for both water and steam flows.
2. Since the steam flow aids, rather than opposes water flow through the trays in the parallel downflow deaerator, high internal steam velocities are permitted. High internal steam velocity promotes turbulence and mixing in the steam flow, an important factor in efficient gas-liquid contact and stripping of dissolved gases. High steam velocities also assist in the development of thin water films which present the lowest resistance to dissolved gas release.

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613.498.1876
1.800.420.4056
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3. The high steam velocities allowed by parallel flow operation reduce the amount of "open volume" needed in the tray stack. As a result, more tray stack volume can be used for metal surface which provides the spilling edges and contact area needed for complete deaeration. No competing deaerator tray design matches the amount of spilling edge and metal surface available in a **COCHRANE® by newterra** parallel downflow tray.

   (Since spilling edge controls the ultimate thickness of the liquid films, threads, and droplets produced in the tray stack maximizing this variable produces optimum conditions for release of dissolved gases. High metal surface area in the tray stack is important since it is this metal which permits the liquid falling from each tray to be intercepted and mixed (agitated) on the tray immediately below. A maximum metal surface to open area in tray design provides high resistance to channeling and short circuiting of water and steam flow in the tray stack.)

4. Since steam pressure in the parallel downflow tray stack decreases in the direction of water flow, the water in the trays is brought to a saturated state, a condition needed for 'zero' oxygen performance. In counterflow deaerators, steam pressure increases in the direction of water flow and it is impossible to reach a 100% saturated state.

5. A parallel downflow deaerator can be successfully operated with a temperature rise as low as 15° F whereas counterflow designs require a minimum temperature rise of 30° F to insure proper steam distribution and scrubbing action in the deaerator. (Temperature rise can be calculated by subtracting the average temperature of the incoming feedwater from the operating temperature of the deaerator. The temperature rise determines the amount of steam flow through the deaerator.)

   The minimum temperature rise (steam flow) that a deaerator can tolerate is a function of the open area of the trays. A low ratio of tray open area to tray surface allows the steam velocity needed for efficient stripping to be maintained at reduced steam flows which can be caused by reduced deaerator load or high inlet water temperatures. **COCHRANE® by newterra**'s tray open area/surface ratio of 0.2 is 40% to 60% less than offered by our competitors.

6. Due to the lower steam velocities and retention times of typical counterflow deaerating tray designs, counterflow units often suffer a loss in gas removal efficiency when treating make-up water that has been pre-heated to a high degree prior to entering the deaerator. Many counterflow deaerator manufacturers will recommend the installation of an 'air separation tank' upstream of the deaerator to effect a release of any air liberated by preheating and will not guarantee operation if any such "free air" is found in the incoming water.

   The performance of a paralle l downflow deaerator does not suffer when handling pre-heated make-up water.

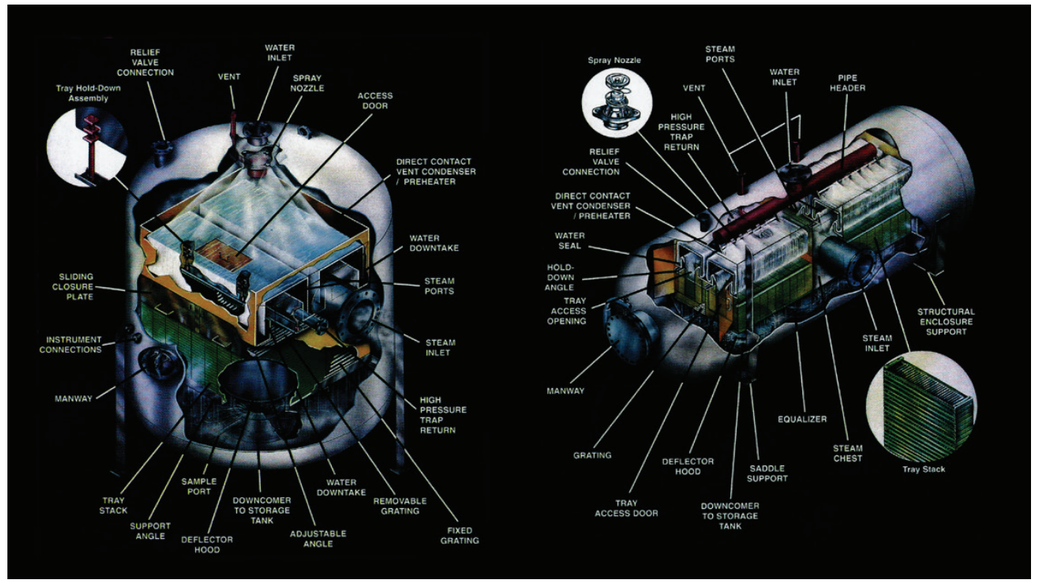
7. The use of a water seal between the spray and tray areas in the parallel downflow design provides a pause time in the mixing and gas release stage that is not present in a counterflow deaerator. Water delivered from the spray area to the trays is at a uniform temperature and low dissolved gas level. Cold spots and stagnant areas are eliminated, proper water distribution onto the trays is assured at all loads.

8. The water seal isolates the preheating (spray) area from the tray section. Gases released in the spray area (about 95% of the initial concentration) cannot enter the tray area under any operating condition.

9. In the parallel downflow deaerator, the spray valves are relieved of any duty to distribute water over the trays (this is accomplished by the water seal). As a result, the spray valves can be arranged in a close pattern that allows the sprays to overlap, forcing steam to flow through the water sheets to the vent(s) without short circuits. Heating and gas removal efficiencies are enhanced and water is delivered to the tray stack closer to saturation temperature and with a lower oxygen concentration than might be expected in a counterflow design.

10. The **COCHRANE® by newterra** internal vent condenser is designed so that released gases are driven to a central location for venting. Outer areas of the deaerator's vent condensing section are blanketed by near pure steam (less than 0.003% 02 present).

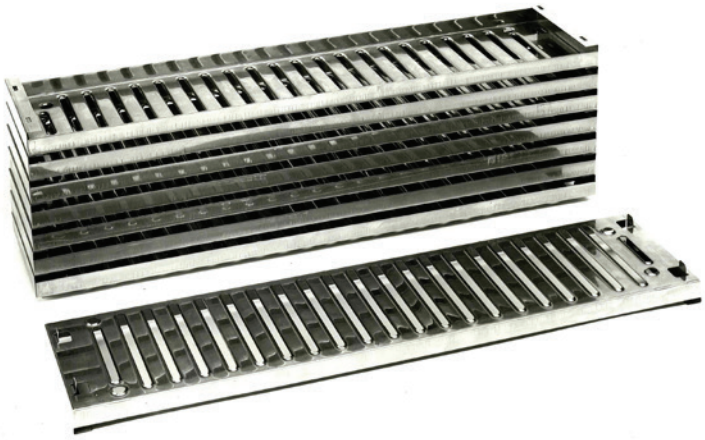
11. Fewer spray valves are required in the parallel downflow design since the spray valves do not have to assume the burden for distribution of water over the tray stack. The spray valves are thus allowed to operate at higher average flow rates which promote superior spray formation over the widest range of flows. Since fewer spray valves are required in a parallel downflow deaerator, maintenance effort and expense are reduced.



The Parallel Difference

12. **COCHRANE® by newterra** parallel downflow trays are one piece formed stampings of either 16 or 22 gauge stainless steel. No rivets, welds, or highly stressed twisted metal tabs are allowed in the construction of **COCHRANE® by newterra** parallel downflow trays. The box type structure (full sides) of the **COCHRANE® by newterra** tray insures that the uniform water distribution afforded by the water seal/distributor is maintained throughout the tray stack.
13. **COCHRANE® by newterra**uses 24 layers of trays in our parallel downflow design. This means that the steam and water flows are positively intercepted, mixed, and redistributed 24 times in the tray stack. Most competitive, counter flow designs use 19 or fewer tray layers.
14. **COCHRANE® by newterra's** water distributor design eliminates the need for alloy water box liner plates found on some older designs still being offered today. The lack of reliability of water box liner plates has been a source of much user dissatisfaction in the past.
15. **COCHRANE® by newterra's** "Accu-Spray" spray valve used in our current deaerator design is the product of many years of operating experience and product improvement. The Accu-Spray valve features a non-binding teflon guide which prevents sideways deflection of the valve disc by hydraulic forces transmitted from the water box or spray header; poor spray development and premature wear of valve parts due to these unwanted sideways forces is thereby eliminated. The Accu-Spray nozzle also utilizes a special deep drawn, conical guide (deflector) which enhances the spray cone pattern over a wider range of flows than shallow spherical guides seen in many competing designs.

COCHRANE® by newterra
Accu-Spray Nozzle



Parallel Downflow Trays

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