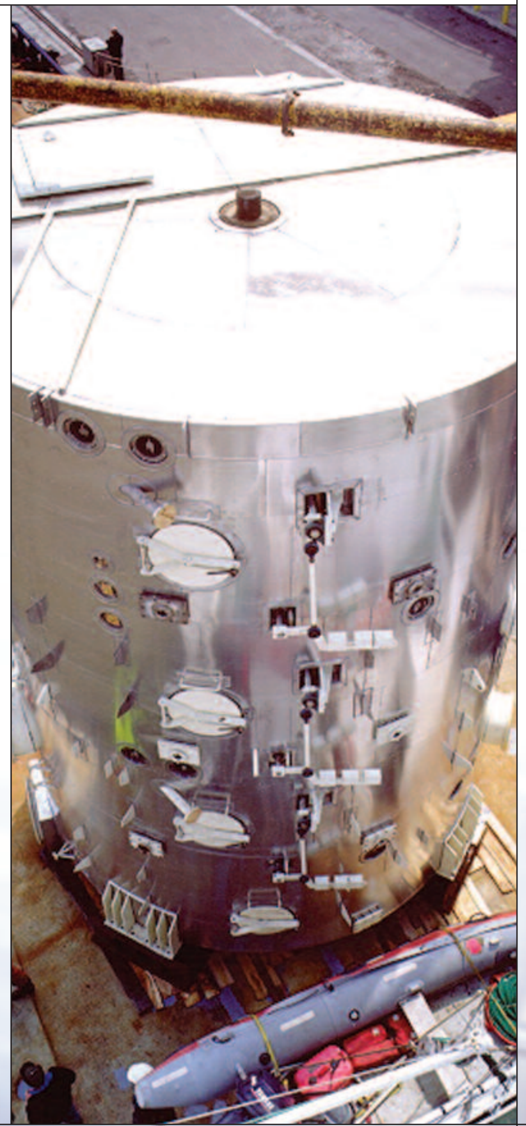
ENERGY CONSUMPTION FOR VARIOUS DTDC OPTIONS

Performance may vary due to many variables. The major variables for this calculation: 1500 short tons per day of soybeans, dehulled flakes at 10 percent moisture to the extractor, 31 percent solvent to DT, 12.5 percent finished meal. 145 psi steam, 70° F ambient air.

OPTION	DT + ROTARY DC	DT + DC	SDT + DC	SDTDC + VRS + HR
Dome (°F)	175	175	156	154
Meal (°F-H_2O)	222-19.6	222-19.6	228-17.9	215-17.2
DT lb/hr	17,354	17,354	13,976	13,344
DC lb/hr	5,163	4,048	902	0
Total Steam	22,517	21,402	14,878	13,344
lb/ton	360	342	238	214
ppm hexane	600	600	226	185
Steam saved*	$0	$59,140	$405,173	$486,536
Hexane saved*	$0	$0	$138,816	$154,034

*Steam at $0.0065/lb, hexane at $2.50/gallon, 340 days per year.

DT + Rotary DC means a non-counterflow DT, rotary steam tube dryer and rotary cooler (or similar efficiency system). SDTDC + VRS + HR means a Crown/Schumacher DTDC with VRS tray and Heat Recovery on the DC.



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7/2013

Desolventizer-Toaster-Dryer-Cooler

Crown Iron Works Company

A CPM Company

CROWN EST. 1878

The Crown DTDC designed to meet your production requirements

THE CROWN DESIGN

In 1976 Crown became the first and only United States Company to obtain a license from Heinz Schumacher for the Desolventizer-Toaster-Dryer-Cooler (DTDC). Crown has continually modified and improved the design, offering the most efficient DTDC built. Today it is known as the Crown/Schumacher design.

FEATURES AND ADVANTAGES

- The Crown DTDC uses a significantly lower amount of steam, and leads to distinctly lower solvent losses. Reduced solvent losses can be attributed to the unique, counter-current flow as well as improvements to meal and vapor flow throughout the vessel.
- A greater degree of safety is obtained by stabilizing meal temperatures in the lower trays of the DTDC. Operational errors can create a drop in meal temperature in the top tray. Because the major flow of steam passes through all the major meal beds, temperature drop errors can be recovered more easily in the second or succeeding trays.
- Automatic level controls and special chutes or variable speed rotary valves provide for smooth and efficient operation. This frees operators to focus attention in other areas of the plant so as to improve overall efficiency.
- Low horsepower per ton requirements.
- Using heavy duty steam chests and robust computer designed sweep arms virtually eliminates sweep arm breakage and bending.
- Low capital costs and space requirements.
- Pre-desolventizing meal with steam-heated trays reduces sparge steam requirements and meal moisture, resulting in reduced meal dryer steam usage.
- The pre-desolventizing trays are basket type, suspended in the dome. The main steam flow passes by these trays during startup, effectively purging them of solvent vapors in the usual startup sequence for greater safety than would be expected in a separate pre-DT vessel.
- The large and carefully designed dome of the DT reduces the amount of fine dust carried out of the DT with vapors
- The Vapor Recovery System or VRS (patented) provides for even less steam use and lower consumption of solvent.
- Recent innovations to interior design of the DT have led to the successful introduction of single units with capacities of over 9,000 metric tons per day of soybeans.

CROWN DESOLVENTIZER-TOASTER OPERATION

After all the oil has been removed from the oilseed flakes or cake, they leave the Crown Extractor with approximately 30 percent solvent (hexane) content. The Crown/Schumacher DT is the newest innovation in removing the hexane from the flakes and completing the toasting operation.

The solvent laden flakes enter the top of the DT, and land on the steam heated predesolventizing tray(s) where they are evenly distributed by a sweep arm. The meal flows from one tray to the next through tray openings. These top trays are called pre-desolventizing trays because they use indirect heat from a hot tray surface to "flash" the vapor hexane from the white flakes without adding moisture.

The main (middle) trays are designed to provide both indirect heating and direct steam contact to remove the bulk of the solvent from the meal, and to add the correct amount of moisture for cooking of the meal. The combination of slightly elevated moisture and temperature provide the desired nutritional characteristics of the meal. Each of these trays have hollow stay bolts for venting vapors from one tray to the next. The quantity and position of these openings are carefully designed to allow near-optimum contact between vapors and meal. These vapors travel counter-current to the direction of meal travel. Meal levels in these trays are controlled by chutes, which convey the material down through the unit.

The bottom DT tray is called the Sparge Tray. The Sparge Tray contains a specially designed variable speed rotary valve to maintain a level in the unit. This bottom tray is perforated for direct sparge steam injection, which strips the final solvent from the meal and vents up through all the hollow staybolt trays and all the main meal beds above.

The quantity of trays and their positions are carefully designed to allow maximum contact between vapors and meal, and the proper meal moisture at each stage of the process. Counter-current desolventization is achieved, previously unavailable in DTs. The result is a uniquely low solvent content in desolventized meal, and significantly reduced solvent losses.

For certain light and dusty products such as cottonseed, other special features may be added or substituted. For example, venting may be obtained by a specially designed side vent which draws the water vapors from above the meal beds and vents them to the atmosphere. In special types of DTs, sparge steam is often added through a specially designed sweep arm in the top tray.

THE CROWN DRYER-COOLER

From the desolventizer toaster the flakes are either conveyed to a Dryer-Cooler (DC) or in the case of a Crown DTDC, they pass through the rotary valve and directly into the drying section of the dryer cooler. The drying and cooling are accomplished by blowing heated air in the drying section (dryer trays) and using ambient air to cool the meal in the cooling section (cooling tray).

Air leaves the DC via ducting and DC cyclones. An optional dust filter can be supplied in addition to, or in place of the cyclones. The desolventized, dried, and cooled meal leaves the DTDC via the DTDC discharge conveyor.

The DC, when used with the DT, will dry and cool most any solvent extracted, vegetable oil bearing meal. The drying and cooling is accomplished by injecting heated air in the drying section, and using ambient temperature air to cool the meal in the cooling section. The evenly distributed flow of hot air and cool air in a true counter-current system results in extremely high efficiency and reduces energy costs. This produces a meal with the desired characteristics for sale and storage.

The DC unit works equally well when combined with a DT or used as a separate unit, depending upon customer preference.

VAPOR RECOVERY SYSTEM

The Vapor Recovery System (VRS) is a patented system designed to reduce steam use, solvent consumption, and hexane emissions in a solvent extraction plant. The VRS was designed to be added to a modern counter flow (or Schumacher-type) desolventizer toaster. Plants using a VRS are capable of recovering almost all of any sparge steam leakage, and efficiently using it to provide desolventizing energy and recover trace amounts of hexane.

The VRS consists of an added tray below the sparge tray, preferably with a second rotary valve. This chamber is maintained just above ambient pressure to virtually eliminate leakage or flashing of steam from the outlet of the final rotary valve.

An important advantage of using a VRS is the recovery of almost all the vapors, even in the case of a slightly worn rotary valve. Means to directly measure the effect a VRS has on solvent loss have not yet been devised. However, recent calculations show for a typical new system, the VRS is estimated to reduce total plant solvent consumption by about 10 percent. The VRS is a simple, logical way to directly improve efficiency and emissions with almost no side effects on other systems.

Typical Crown/Schumacher Counterflow DTDC