JAEGER

TOWER PACKINGS · TRAYS · COLUMN INTERNALS

Jaeger Tri-Packs®

Product Bulletin 600

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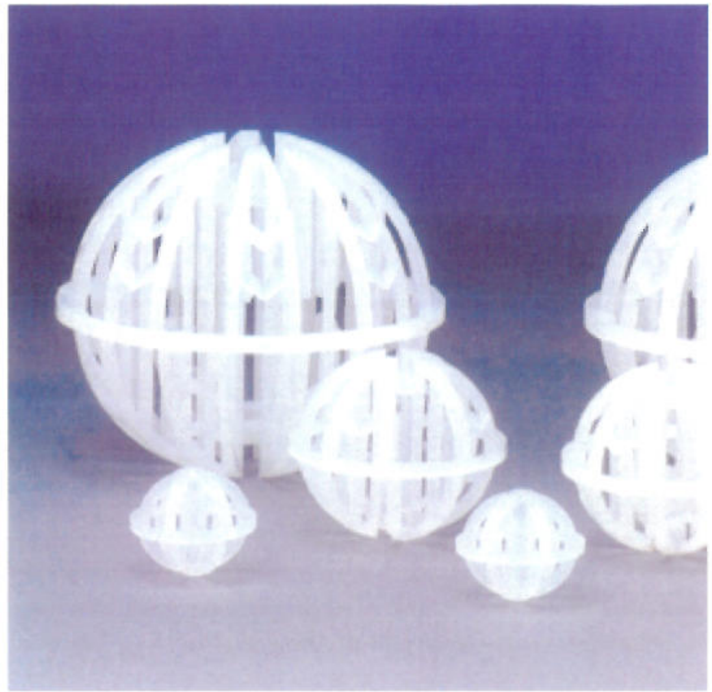

Superior performance by design™

JAEGER PRODUCTS, iNC.®

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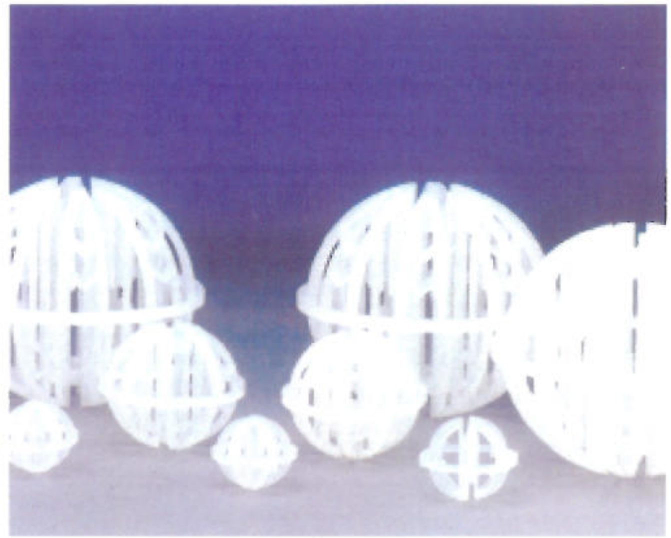

Jaeger Tri-Packs®

Features

- Jaeger Tri-Packs® are hollow, spherical packings made of injection molded plastic, available in four diameters: 1", 1 ¼", 2", and 3 ½".
- Symmetrical geometry made from a unique network of ribs, struts, and drip rods.
- High active surface areas.
- Extremely low pressure drops.
- Extremely high operating capacities.

Benefits

- High mass and heat transfer rates.
- Excellent gas and liquid dispersion characteristics.
- Resist nesting, making removal easy.
- Installs to packed position - no settling.
- Available in a wide variety of plastics.
- Predictable performance.

Jaeger Tri-Packs®-PP are NSF Certified to ANSI/NSF Standard 61 when made in polypropylene.

Specifications & Physical Properties

Materials.

Twelve standard, injection moldable plastics are available:

Polypropylene (PP)	TopEx® (LCP)
Polyethylene (PE)	Kynar® (PVDF)
Polypropylene Glass-Filled (PPG)	Halar® (ECTFE)
Noryl® (PPO)	Teflon® (PFA)
Polyvinylchloride (PVC)	Tefzel® (ETFE)
Corzan™ (CPVC)	Tefzel® Glass-Filled (ETFE-G)

Other plastics are available on request.

IMPORTANT NOTE:
Design data presented in this bulletin are for preliminary calculations only. Contact Jaeger before finalizing calculations.

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Properties Table

Size (in.)	1	1 1/4	2	3 1/2
Geometric Surface Area (ft^2/ft^3)	85	70	48	38
Packing Factor (1/ft)	28	25	16	12
Void Space (%)	90	92	93.5	95
Bulk Density (lb/ft^3) (PP)	6.2	5.6	4.2	3.3

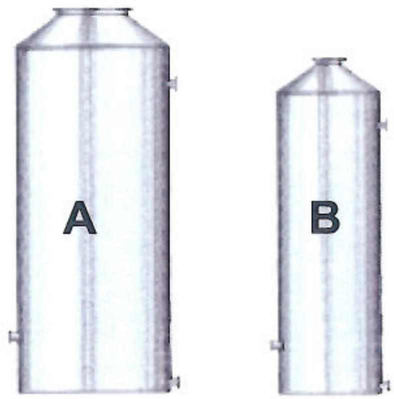
Maximum Operating Temperatures for Plastic Jaeger Tri-Packs®

Jaeger Tri-Packs® are available in a variety of injection-molded plastics for different applications. The maximum operating temperatures for these different resins vary from material to material and are also affected by specific process variables. The data presented below correspond to maximum continuous operating temperatures at atmospheric pressure and systems that are essentially air and water. The presence of solvents, acids, free radicals, and oxidants needs to be considered. Furthermore, these temperatures correspond to the maximum recommended bed depth for each packing size and material. These maximum bed depths are different depending on the application. Consult with Jaeger in respect to the maximum bed depth for your particular application.

Material	**Maximum Temperature (Deg. F) (1 atm, air/water, at max. recommended depth)**	**Bulk Density Factor**
Polyvinyl Chloride (PVC)	140	1.50
Polyethylene (PE)	160	1.02
Polypropylene (PP)	180	1.00
Corzan™ (CPVC)	230	1.74
Chlorinated Polyvinyl Chloride (CPVC)	210	1.74
Polypropylene - Glass-Filled (10-30%) (PP-G)	210-230*	1.17-1.38*
Noryl® (PPO)	230	1.24
Kynar® (PVDF)	280	1.98
Halar® (ECTFE)	290	1.86
Tefzel® (ETFE)	350	1.93
Teflon® (PFA)	400	2.45
Tefzel® - Glass Filled (25% Glass) (ETFE-G)	410	2.2

*Depending on glass content.

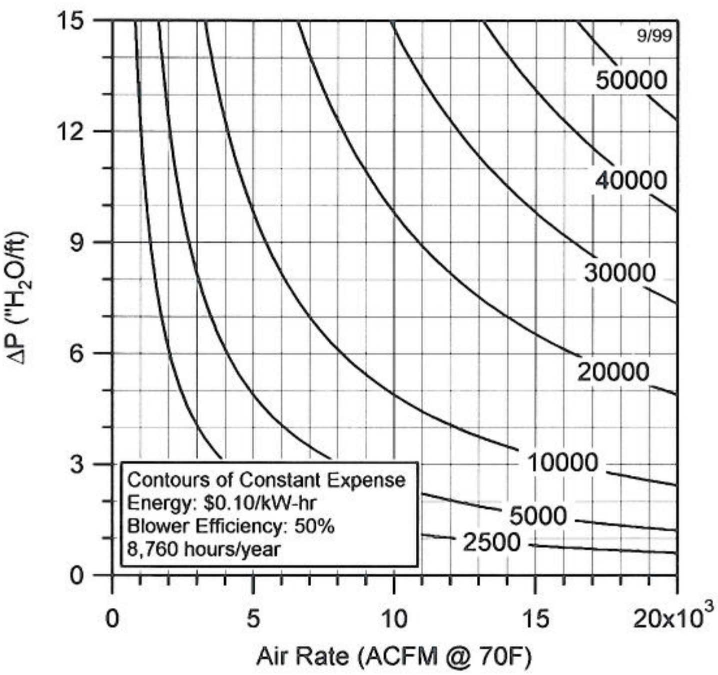
Superior Performance by Design



Question: Which column design is less expensive?

Answer: Column **A**

Which design is less expensive? If you chose column **B**, then you might be in for a surprise.



The price you pay for pollution abatement is composed of two parts. First, there's the direct capital cost for the scrubber or stripper. This includes the up-front money you are charged for the column, the packing and the internals. But there's also an ongoing energy expense that you must pay for gas compression and for liquid pumping. The capital cost is usually carefully monitored and controlled because it is oftentimes a large lump sum payment charged before abatement even begins.

By contrast, energy is paid for on an ongoing basis. It is a cost not often considered in the evaluation of designs submitted by different vendors because it is presumed that this cost should be about the same for all designs. It then follows that the cost for abatement is minimized by minimizing the capital expense. But this reasoning can be seriously flawed. Energy costs are extremely sensitive to design choices like column diameter, packed depth, gas loading per square foot of column cross section, and materials of construction. The only proper way to choose a design is to balance capital expenses against operating expenses. The annual abatement cost is the sum of the depreciated capital cost and the annual energy cost. The proper choices of column diameter, packed depth, and gas loading per unit cross section are those that minimize this annual abatement cost. When the capital depreciation time is relatively long, the column diameter increases in order to bring the pressure drop down and thus lower energy costs. Conversely, when capital is depreciated more quickly, the column size shrinks (at the expense of higher pressure drop) in order to lower the up front expense. In short, then, a smaller column can be more expensive to operate than a larger one when all cost factors are taken into account.

Jaeger Products can work closely with your organization to develop cost models for your project and we can optimize a design based on these models to meet your financial objectives. Contact us about your design needs.

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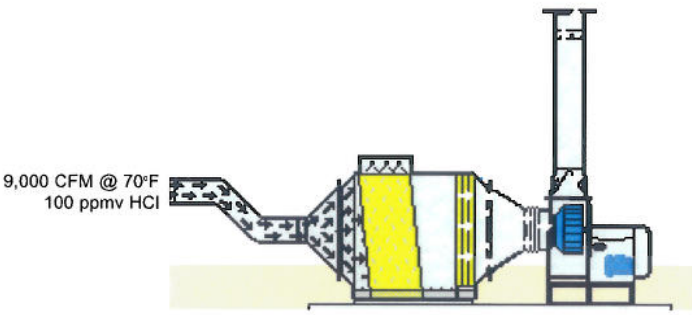
Performance Comparison

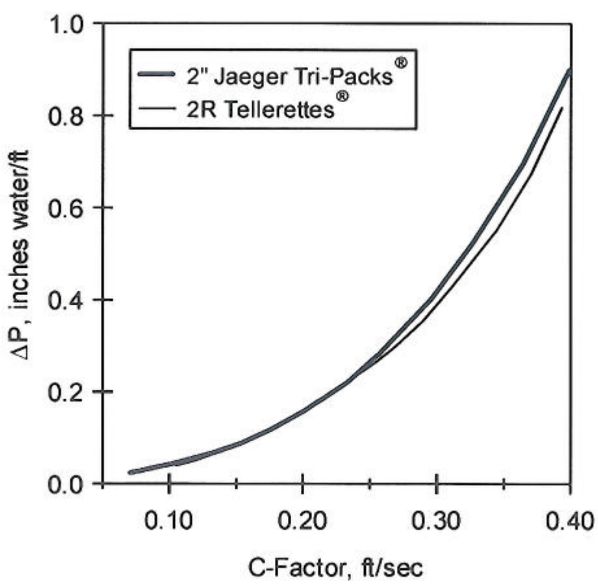
2R Tellerettes® vs 2" Tri-Packs®

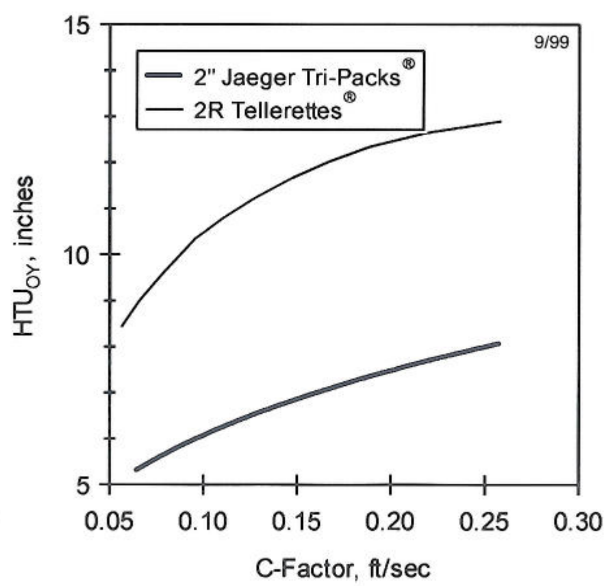
HCl/Caustic Scrubbing @ 70°F, 1 atm, 100 ppm_V Inlet



ppm_V Out	Removal Effcy. %	Δp/H "H_2O/ft	
17.5	82.5	0.11	2" Pall Rings
3.8	96.2	0.065	2R Tellerettes®
3.8	96.2	0.042	3 1/2" Tri-Packs®
0.5	99.5	0.086	2" Tri-Packs®

- 2" Tri-Packs® give a 97% improvement in outlet HCl concentration compared to 2" Pall Rings
- 2" Tri-Packs® outperform 2R Tellerettes® by 87%
- 3 1/2" Tri-Packs® give a 78% improvement when compared to 2" Pall Rings
- **3 1/2" Tri-Packs® equal 2R Tellerettes® performance with 35% lower pressure drop.**





Tellerettes® HTU data from Ceilcote catalog 12-10.60; Δp data from 12-10.11
Tri-Packs® HTU curves are simulations based on available HTU data from other systems.

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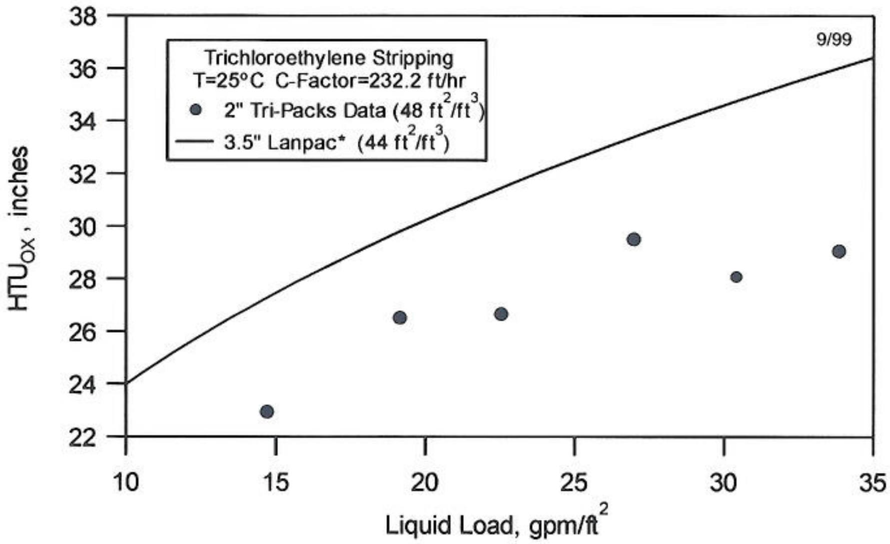
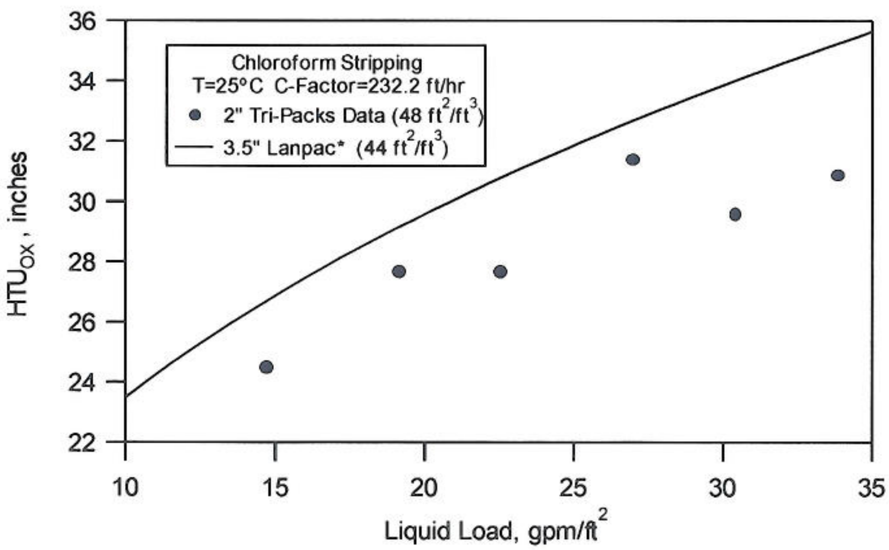
Jaeger Tri-Packs® Outperform Lanpac®

Verified by Independent Tests

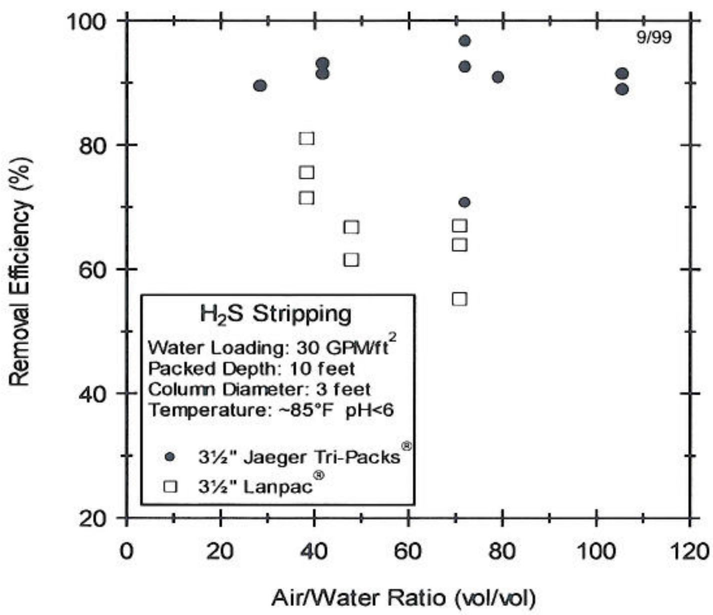


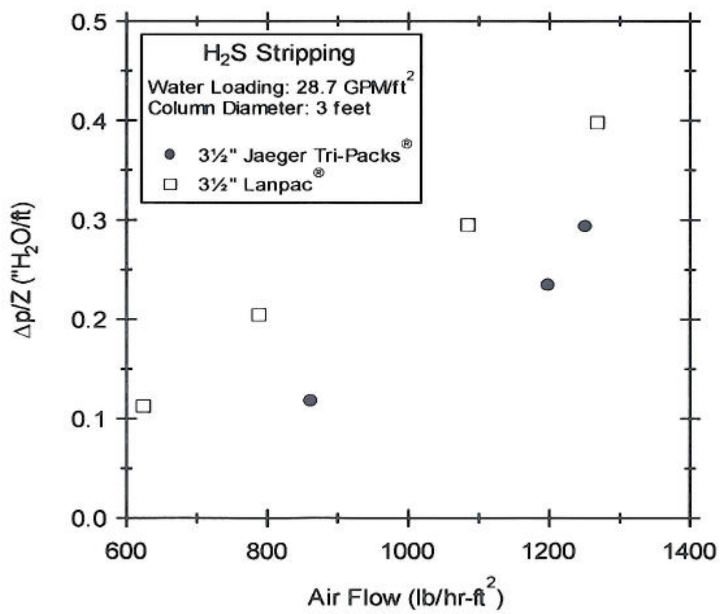


*HTU values for 3.5" Lanpac® calculated from Lanpac HTU correlation reported in Lantec Technical Bulletin TL-901.
2" Jaeger Tri-Packs® performance data taken from U.S. Department of Commerce document AD-A158 811 June 1985.

Again & Again!!

Jaeger Tri-Packs® Out Distance Lanpac® in Stripping and Pressure Drop Tests





When Manatee County, Florida required H_2S stripping towers for water treatment in 1992, they were concerned about long-term energy cost. The OEM Manufacturer retained by the county conducted tests on different packings to assure that their client received the most efficient packing and system. The partial results shown in the two graphs at the left show why they picked 3 1/2" Jaeger Tri-Packs® over 3 1/2" Lanpac® as the most efficient and affordable packing available.

When these two products - of comparable size - are used for identical purposes with identical conditions, the 3 1/2" Jaeger Tri-Packs® overwhelmingly outperform the 3 1/2" Lanpac®. Stripping efficiencies for 3 1/2" Jaeger Tri-Packs® averaged 36.5% better than those for 3 1/2" Lanpac®. These results are illustrated by the graph at the top left.

The same trend is evident in the pressure drop, as illustrated by the graph on the lower left. The data shows the advantage in energy savings that 3 1/2" Jaeger Tri-Packs® offers over the 3 1/2" Lanpac®.

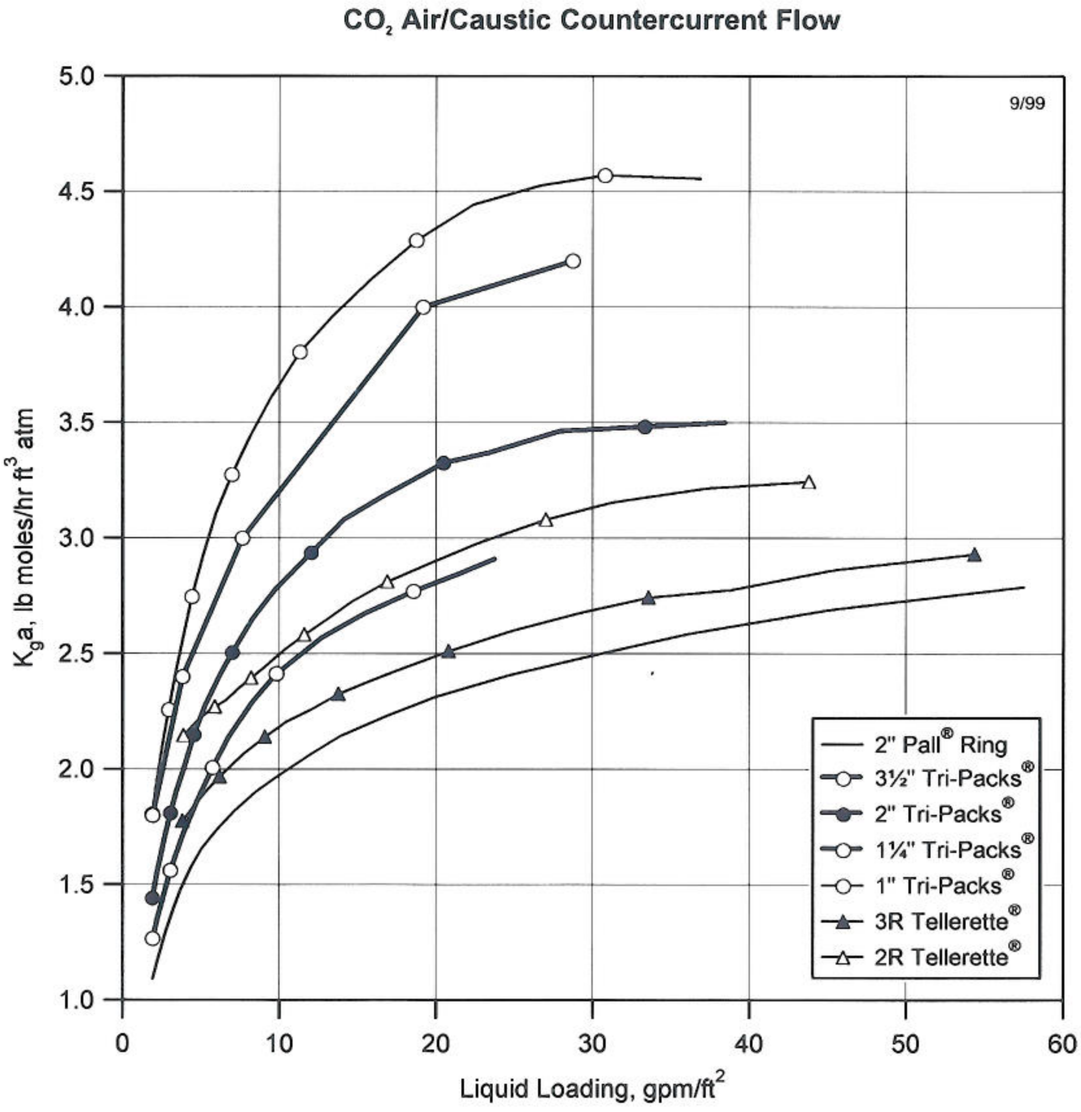
3 1/2" Jaeger Tri-Packs® were recommended and installed because they outperformed 3 1/2" Lanpac® in both mass transfer efficiency and pressure drop. The 3 1/2" Jaeger Tri-Packs® are still in service and will continue to provide the energy savings and value originally desired by Manatee County.

Give us a call. Jaeger can provide the products and services to get you the most out of your packing or mass transfer device.

Data from test performed in 1992 by Duall Division, Metpro Corporation, Owosso, Michigan.

Packing Comparison

Kga vs. Liquid Loading

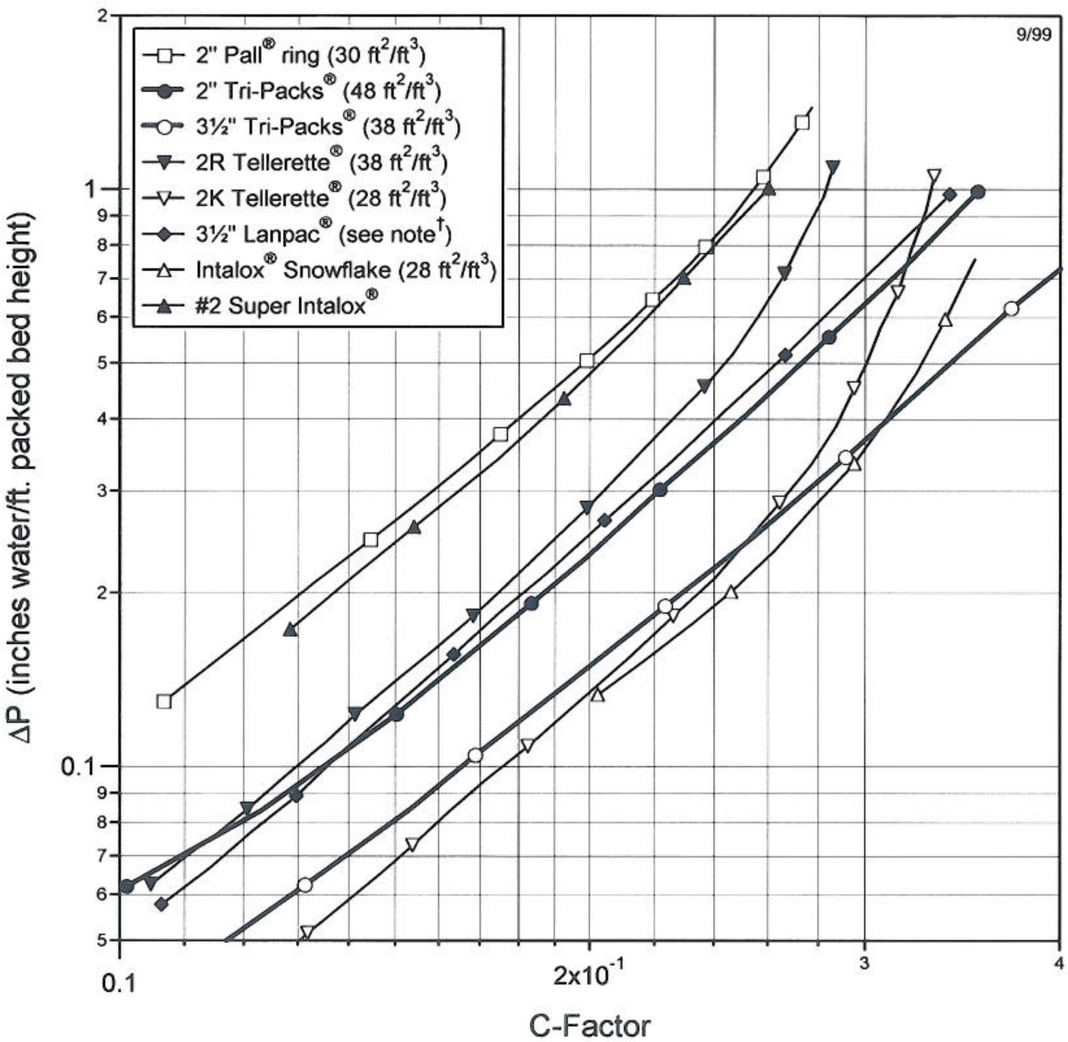


Tellerettes® data from Ceilcote Technical Bulletin 12-10.60.
Column diameters and packed depths varied among the tests reported here.

Pressure Drop Comparison

Plastic Packing

Ambient Air/Water (70°F, 1 atm) at 20 gpm/ft²



C-Factor = $V_s[(\rho_V)/(\rho_L - \rho_V)]^{1/2}$ where

V_s = Superficial Vapor Velocity in ft/sec

ρ_L and ρ_V = Density of Liquid and Vapor in lb/ft^3

†44, 45, 48, 68 ft²/ft³ reported in Lantec Literature.
Lanpac data from Lantec Technical Bulletin TL-905.
2K & 2R Tellerettes data from Ceilcote Catalog 12-10.11 and 12-10.13.
Pall ring data from Jaeger Catalog 700-pd705.
Snowflake data from Norton Bulletin ISPP-1.
Super Intalox saddle data from Norton Bulletin DC-11.

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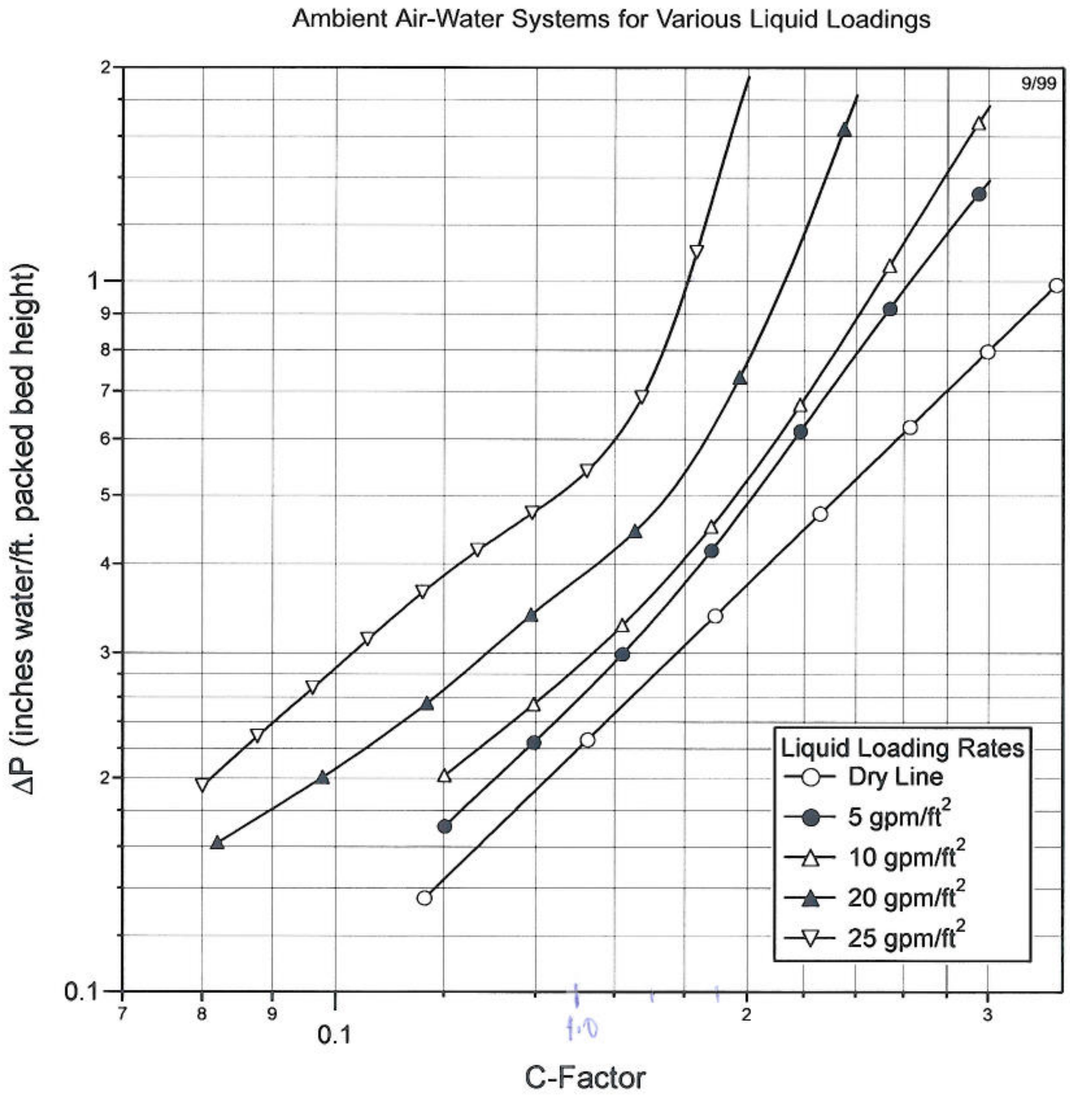
Pressure Drop vs. C-Factor

1" Plastic Jaeger Tri-Packs®



C-Factor = $V_s[(\rho_V)/(\rho_L - \rho_V)]^{1/2}$ where

V_s = Superficial Vapor Velocity in ft/sec

ρ_L and ρ_V = Density of Liquid and Vapor in lb/ft³

For Air/Water systems at 70°F & 1 atm: C-Factor x 7776.2 = lb/hr-ft²; gpm/ft² x 499.7 = lb/hr-ft²

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