

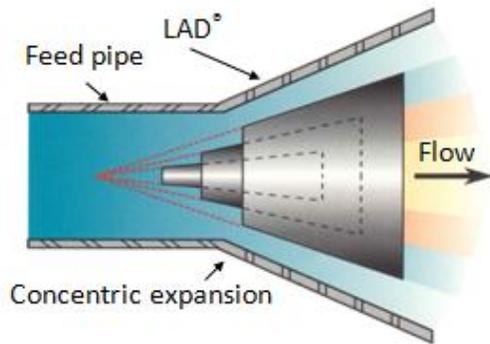
CHENG FLUID SYSTEMS, INC.

The LAD[®] Large Angle Diffuser is used in conjunction with conical expansions and reductions associated with reactors, heat exchangers and other process equipment. It consists of a series of overlapping truncated cones with a common focal point located within the expansion/reduction. Despite the change in diameter, the LAD[®] produces a flat velocity profile which results in an even distribution of process fluid in the cross-section during the concentric expansion or reduction.

Point Source "Large Angle Diffuser" (LAD[®])

The Large Angle Diffuser (LAD[®]) is located inside a standard concentric diffuser and protrudes a small distance inside the small diameter piping section.

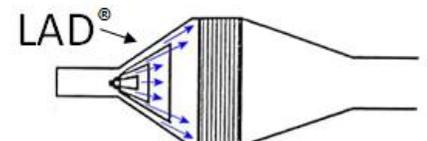
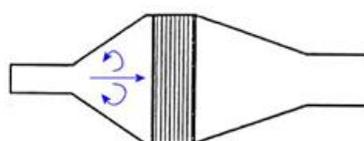
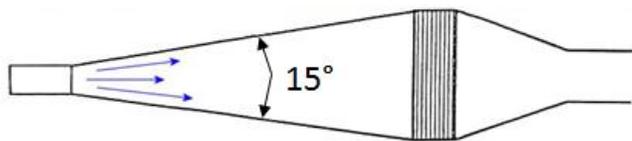
The LAD[®] consists of a series of overlapping, truncated cones, all with a common focal point, which is located within the expansion



The maximum angle of expansion you can have without causing backflow is 15°, which results in a very long piece of equipment.

Without a LAD[®] there is turbulence and backflow.

With a LAD[®] there is smooth laminar flow, and a more compact piece of equipment.

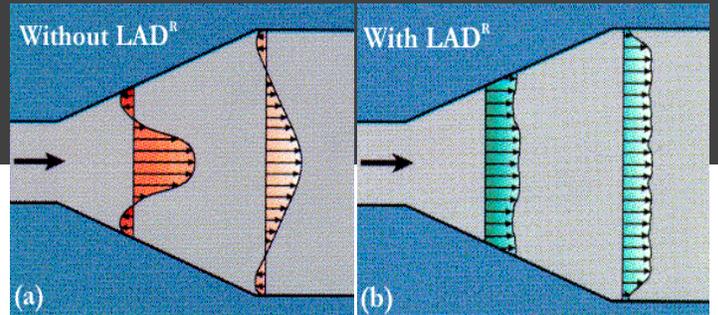


LAD[®] Large Angle Diffuser



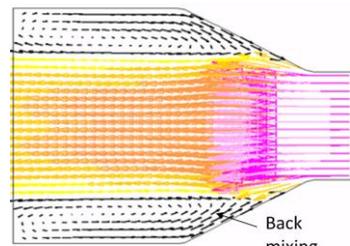
Effects of "Large Angle Diffuser" (LAD[®])

Fluids will obey trajectories of the point source and will then be distributed uniformly in the expansion as if from a singular point.



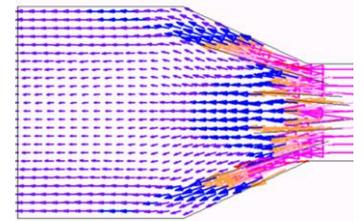
An LAD[®] creates a uniform exit flow profile and eliminates back mixing of the fluids.

Velocity profile at mid plane of expansion



Velocity Profile at Exit of Bayer Geometry Without LAD
Black Represents Back Flow in the Z Direction

No LAD[®]



Uniform Exit Velocity Profile Created by Using LAD
This LAD was used at Bayer Corporation

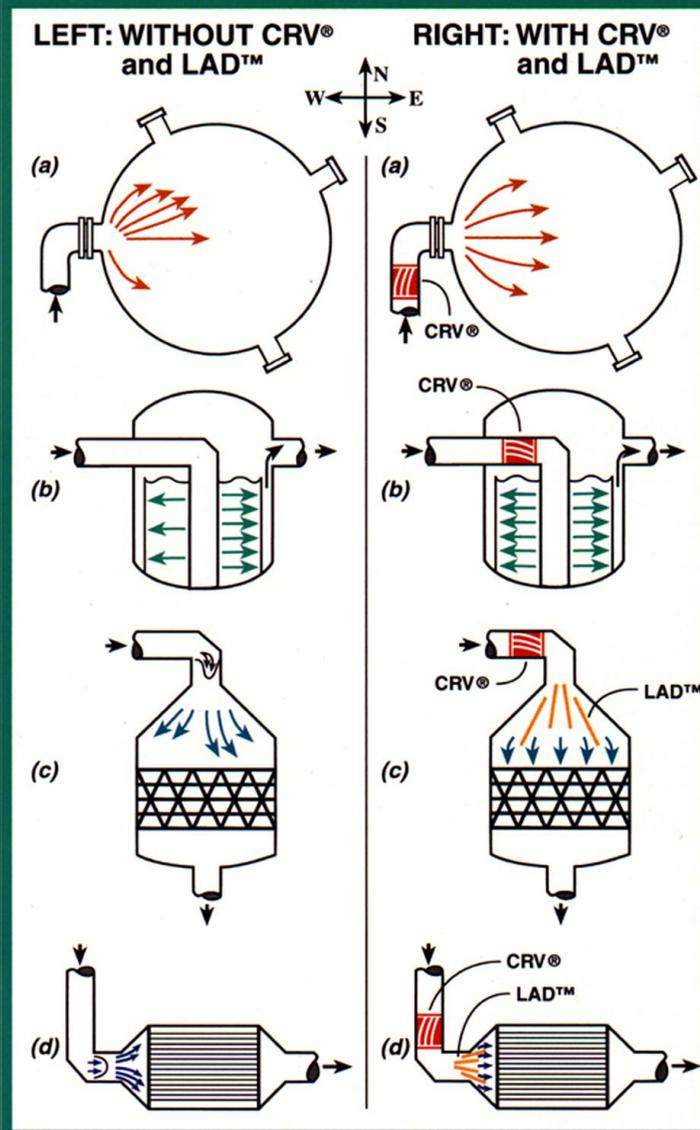
With LAD[®]

LAD[®] Benefits:

- Diffuser is More Compact
- Less Loss of Head
- Maximum Pressure Head Recovery

Process Equipment Improves with LAD® & CRV® Technology

Experimental Results showing how LAD® can eliminate flow separation in an expansion.

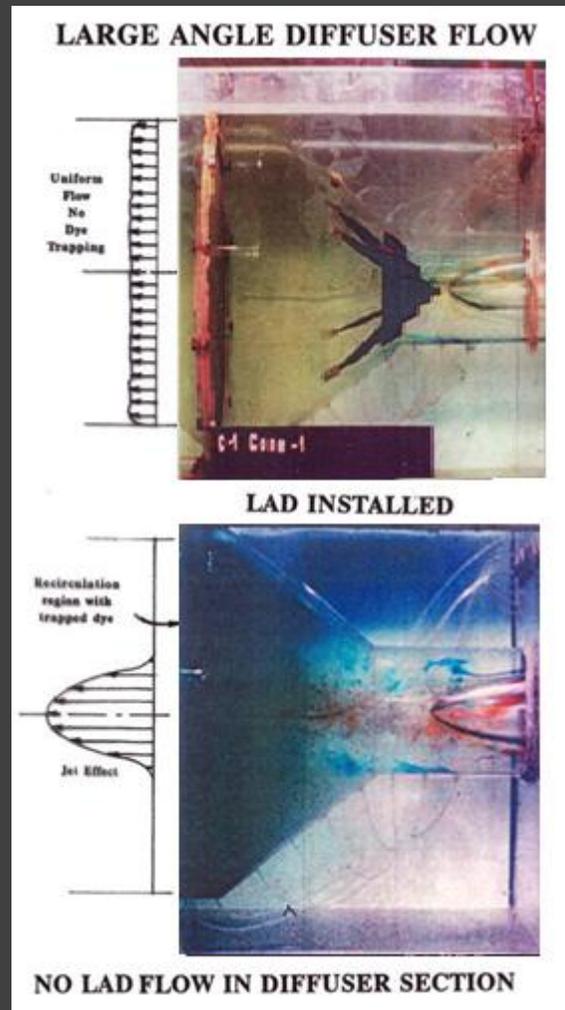


If the diffuser is at a larger angle than 15°, pressure recovery occurs, separating the fluid flow from the wall which causes back-mixing of the fluid. In a chemical reacting fluid, this may create a quality control problem due to unpredictable residence time of a small percentage of the trapped fluid in the separated flow region. The LAD® is a set of concentric cones which were developed for a similar large angle (60°) diffuser situation. It was tested in a scaled test demonstration shown below. The flow was made visible by injecting colored dyes from orifices in a strut spanning the entering stream. The flow separates from the wall immediately upon entering the expansion section and follows the wall. Flow velocity measurements were plotted and the high velocity central core flow is seen to be replaced by a more uniform flow across the expanding channel when the LAD® unit is installed.

The principles of the LAD® diverter design are fully applicable to the design of equally effective expansion sections for rectangular flow channels, such as are experienced in heating and ventilating ducts, for example. The principles also form a basis for the development of efficient and effective expansion sections in pipe or ducting of irregular shapes.

Information needed to fit application

- Location where LAD® is needed (i.e. Condenser, Sudden Expansion, etc.)
 - Describe Flow Conditions
 - Piping Diameter/Schedule, Piping Material
 - Piping Geometry Isometric
 - LAD® Fits any size concentric expansion or reduction
- Based on Above Information, CFS will provide a quote for the correct Large Angle Diffuser Design, which can be welded into the expansion.



Solved over 3,000 cases of Piping & Flow Problems for many Leading Fortune 500 Companies.

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