

Turbo-Inductor White Paper

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Pressure discharge truck and railcar tankers are a common method of transportation for dry bulk materials that can be off-loaded by pneumatic conveying. The truck tankers typically have a 4" discharge line (railcars use a 5-inch discharge), which is suitable for discharge over short distances. Often, the tankers are unloaded adjacent to a storage silo. What happens when plant layout or traffic flow patterns won't allow truck access next to the silo and the discharge distance needs to be double or tripled? What if plant production rates require shorter discharge times to keep pace with demands? Cyclonaire's Turbo-Inductor® can solve both of these problems.

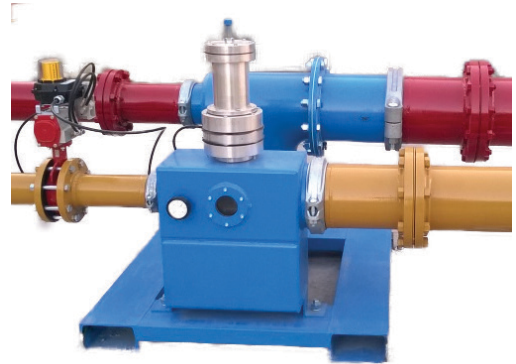
How It Works

Discharge rates for positive discharge trucks are determined by: 1) line diameter, 2) convey distance and routing, 3) convey pressure, 4) airflow, and 5) material characteristics.

A typical pressure discharge truck has a 4-inch discharge outlet with a blower sized to supply the proper airflow to maintain optimal convey line velocities. A simple way to increase the discharge rate of a pressure discharge truck would be to increase the discharge line diameter on the truck while proportionally increasing the airflow in order to maintain proper line velocity. This is an expensive and not very practical change to make to a fleet of trucks that may not be owned or dedicated to your plant. A system that utilizes existing standard truck plumbing configurations yet increase rates is what is needed. The Cyclonaire Turbo-Inductor solves the problem without modification to the trucks.

The Turbo-Inductor allows for transition to a larger convey line while maintaining proper convey line velocities. This is done by providing a transition for the discharge line from 4-inch to 6-inch, 8-inch or even 10-inch. For the sake of this discussion we will assume a step to an 8-inch convey line.

With the Turbo-Inductor, conveying is effectively a two-stage continuous operation. The first stage uses the standard truck discharge hose, (usually limiting it to 10 to 15 feet), feeding from the tanker material outlet to the Turbo-Inductor inlet. The Turbo-Inductor is at an intermediate pressure between the tank and atmospheric pressure. The second stage is the larger line, running from the Turbo-Inductor discharge to the destination silo that is at atmospheric pressure.



Since the larger convey line from the Turbo-Inductor to the silo requires higher airflows, the system requires a larger convey air blower than what is typically provided on a pressure discharge truck (1300 scfm for our 8-inch example). The output from the larger blower is connected to the Turbo-Inductor convey air inlet. At that point, the air is automatically proportioned, with the exact portion of the air diverted to the truck and the remainder of the air directed to a specially designed mixing chamber in the Turbo-Inductor. The airflow is split because the plumbing on the truck is too small to efficiently handle the entire airflow from the larger blower. The Turbo-Inductor monitors the pressure in the air supply line going to the truck and modulates to maintain that pressure just under 15 psig. The airflow that is diverted to the truck is equivalent to the airflow supplied by a typical truck blower. The remainder of the airflow is directed to the mixing chamber where it joins the material and air being discharged from the truck. The 4-inch discharge line from the truck is stepped up to an 8-inch convey line at the outlet of the mixing chamber. The air entering the convey line at the mixing chamber is the appropriate airflow for the 8-inch convey line section that runs from the Turbo-Inductor to the destination.

As an example of the performance enhancements gained by using a Turbo- Inductor, take a truck unloading system that requires a 200 foot convey distance. By stepping the convey line to an 8-inch pipe, it is expected that the discharge rates would be double of that for a similar 4-inch convey line at that distance.

Operational Benefits

The most obvious operational benefit is higher discharge rates which yield shorter unload times. This equates to quicker turnaround times for truck drivers and fewer demurrage charges. Trucks are more valuable when they are moving!

An equal benefit is the ability to convey longer distances. Given the space constraints at some facilities, truck unloading stations may need to be positioned a few hundred feet from the destination silo instead of adjacent to the silo. With standard 4-inch systems this can result in a significant reduction in discharge rates. Conversely, the Turbo-Inductor may give Plant Managers the flexibility to relocate their truck or rail unload stations further from their storage facilities without sacrificing discharge times. The Turbo-Inductor can be sized to maintain or improve discharge rates even if the convey distance is increased.

Traffic flow is streamlined since the truck unload stations can be located in more suitable locations and with faster unload times, trucks are not lined up waiting at the unloading stations for as long.

From a labor perspective, the operator effort is the same. The operation of the Turbo-Inductor is transparent to the driver. In addition, if a plant operator is required to oversee the truck delivery, there is an additional savings of not requiring an operator to monitor the discharge for as long as a typical truck discharge operation.

Facility Benefits

Since the blower capacity, air pressure in the lines, and dust collection are all balanced, there is an overall increase in conveying efficiency and a reduction in the risk of plugged lines or accidental dust discharge. The system utilizes an external blower thereby saving fuel and wear and tear on the delivery vehicles. The blower and/or the Turbo-Inductor can be self-contained, mounted on a modular skid for mobility. Given that trucks do not have to be positioned at the base of silos but can be staged for unloading varying distances and at multiple locations, traffic congestion is reduced. The package also accommodates underground convey line routing thus further reducing congestion and equipment interference in the unloading areas.

Cyclonaire's Turbo-Inductor is an efficient, practical solution to the challenge of unloading of pneumatic discharge trucks and railcars further and faster.