



**Cryogenic Pump
Variable Pitch and Hub
Helical Inducer**

■ BACKGROUND

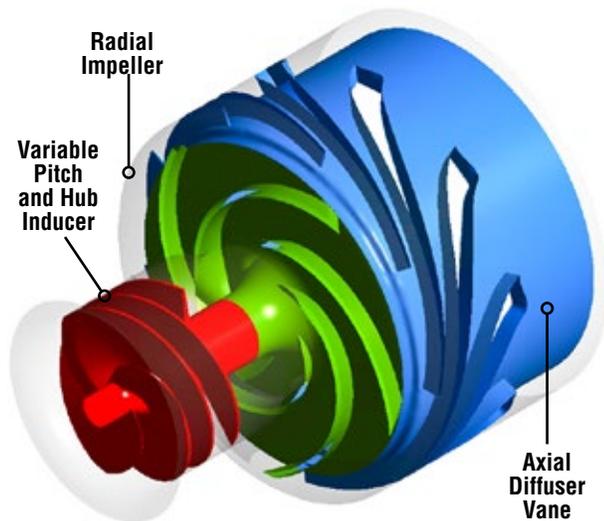
Inducer technology is used in industrial pump applications where the suction performance needs enhancement for safe operation. The cavitation behavior of centrifugal pumps is an important performance criterion to meet and exceed safe operating requirements in the event of lack of suction pressure. Centrifugal pumps often use an inducer to delay cavitation, which can be detrimental to pump internal components, or to improve the suction performance by reducing the required net positive suction head (NPSHr).

One of the most common application areas for inducers is liquefied natural gas (LNG) in-tank pump applications where NPSH determines the non-useable height of the liquid inside a storage tank. Storage tanks cannot be pressurized due to their size and construction, which limits the available suction pressure to the pump.

It is possible to delay cavitation and enhance suction power of a new or existing cryogenic pump via inducer technology where suction pressure is less than ideal. Cryodynamics® variable pitch and hub helical inducers achieve a suction specific speed, ranging from 55,000 to 75,000 US units, while maintaining high flow-out capabilities.

■ INDUCER DESCRIPTION

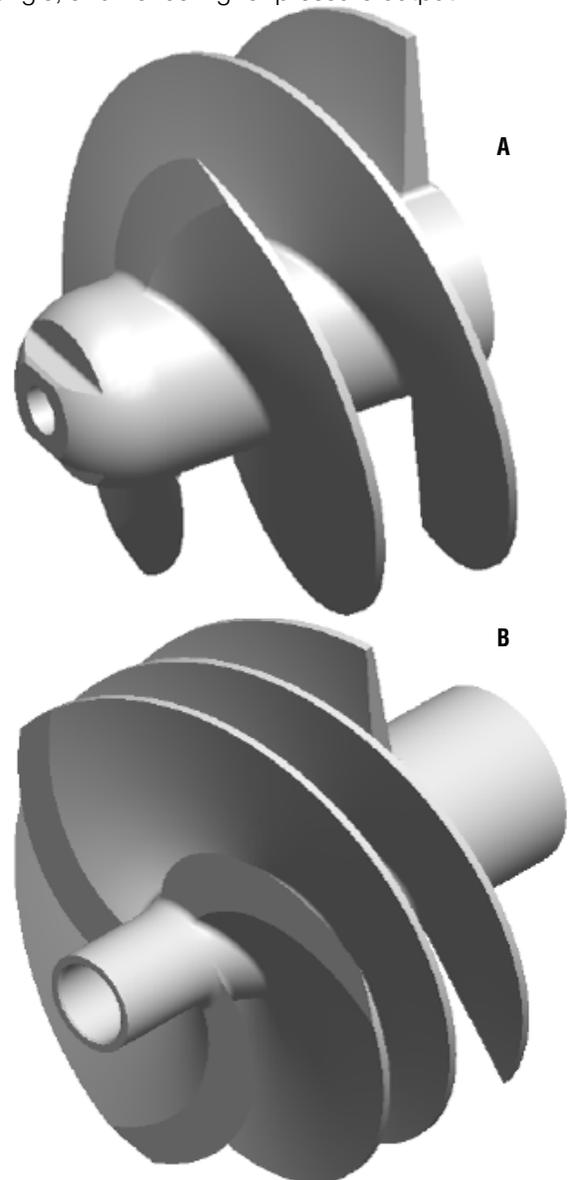
An inducer is fundamentally an axial impeller with two to four long blades downstream of the impeller that produce little inlet blockage. It increases the pressure at the inlet of the actual impeller to the extent that the impeller operates without a cavitation induced head drop. An inducer typically allows a reduction in the value of the NPSHr of a pump to half of the NPSHr value without an inducer.



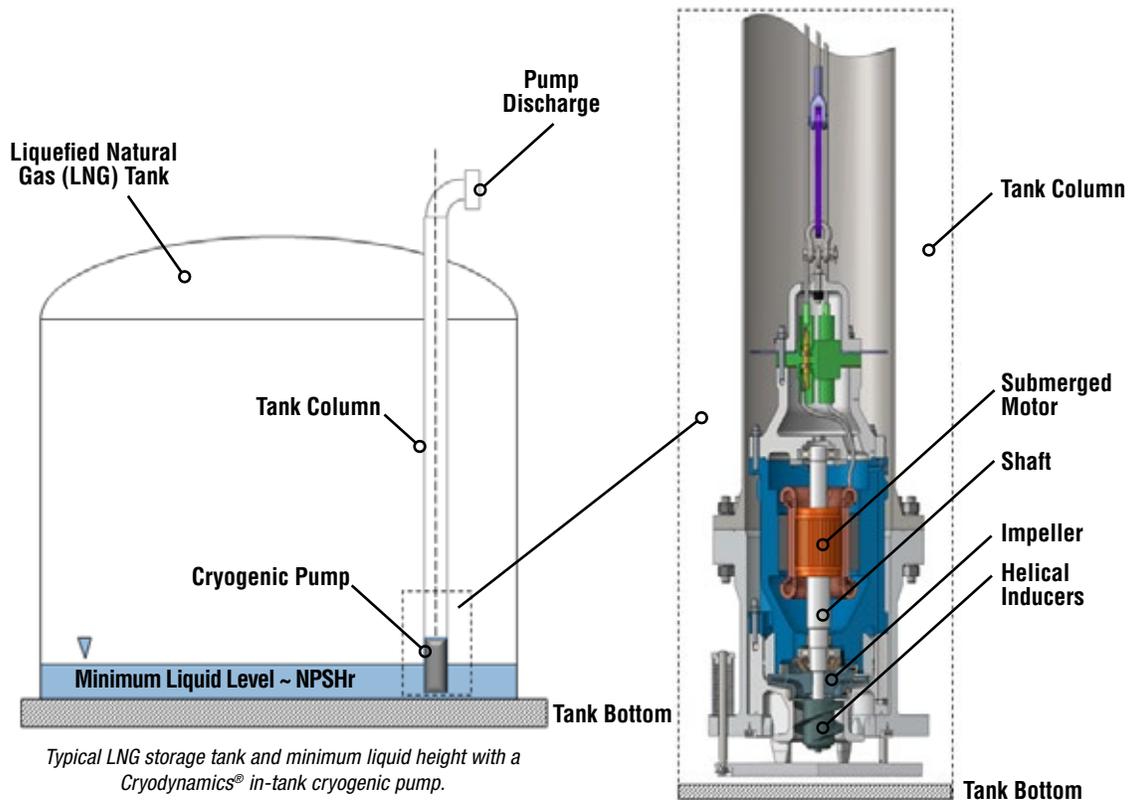
Cryogenic in-tank pump hydraulic components (impeller shroud removed for clarity).

■ VARIABLE PITCH AND HUB INDUCER

Typical Cryodynamics pump hydraulic components consist of an inducer, an impeller, and a diffuser vane. Each variable pitch and hub inducer is custom designed by considering the impeller eye (inlet) geometry to achieve maximum cavitation performance, and gets a matching impeller to meet the application requirements. A Cryodynamics variable pitch and hub inducer further increases head via a change in blade angle from suction to discharge. With an increase in blade angle at discharge, the inducer produces more head with an increase in absolute velocity. More importantly, with the variation in blade angle from suction to discharge, shockless entry at the design flow can be obtained. A change in hub diameter from suction to discharge allows for more drastic changes in blade angle, and hence higher pressure output.



Traditional constant pitch inducer (A) and new variable pitch-hub inducer (B).



■ BENEFITS

- ◆ Improves NPSHr performance by at least 40% over a traditional inducer
- ◆ Minimal to no impact to existing pump normal operating performance
- ◆ Shockless entry at the design flow enables smooth operation
- ◆ Custom designed to meet application requirements to obtain the best suction performance
- ◆ Can be retrofitted to existing pump applications without major component modifications

■ TECHNICAL SPECIFICATIONS

Traditional constant pitch inducer vs. new variable pitch and hub inducer

	Constant Pitch Inducer (Traditional)	Variable Pitch and Hub Inducer (New)
Rotational Speed:	50 Hz to 60 Hz, 2 to 4 Pole (1500 RPM to 3600 RPM) and Variable Speed Applications	50 Hz to 60 Hz, 2 to 4 Pole (1500 RPM to 3600 RPM) and Variable Speed Applications
Rated Volumetric Flow:	Up to 3000 m ³ /hr	Up to 3000 m ³ /hr
Blade Count:	2	2 to 3 (Depending on Pump Duty)
Tip Diameter:	Constant	Constant
Hub Diameter:	Constant	10-Degree to 15-Degree Hub Angle
Blade Angle:	Constant from Suction to Discharge	Variable
Pitch:	Constant/360-Degree Rotation	Variable Pitch/360-Degree Rotation
Suction Specific Speed (N_{ss}):	<45k US Units	55k to 75k US Units



Elliott Group is a global leader in the design, manufacture, and service of technically advanced centrifugal compressors, steam turbines, power recovery expanders, cryogenic pumps and expanders, and axial compressors used in the petrochemical, refining, oil & gas, liquefied gas, and process industries, as well as in power applications.

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T H E W O R L D T U R N S T O E L L I O T T



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