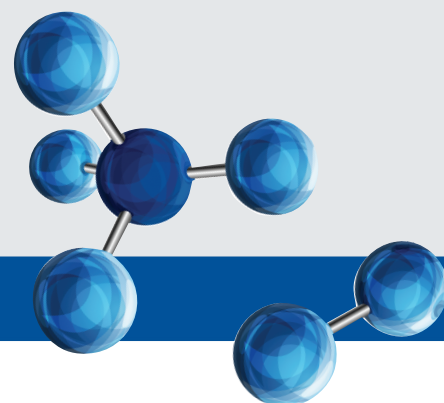


### FREESPIN™ IN-LINE TURBOEXPANDER

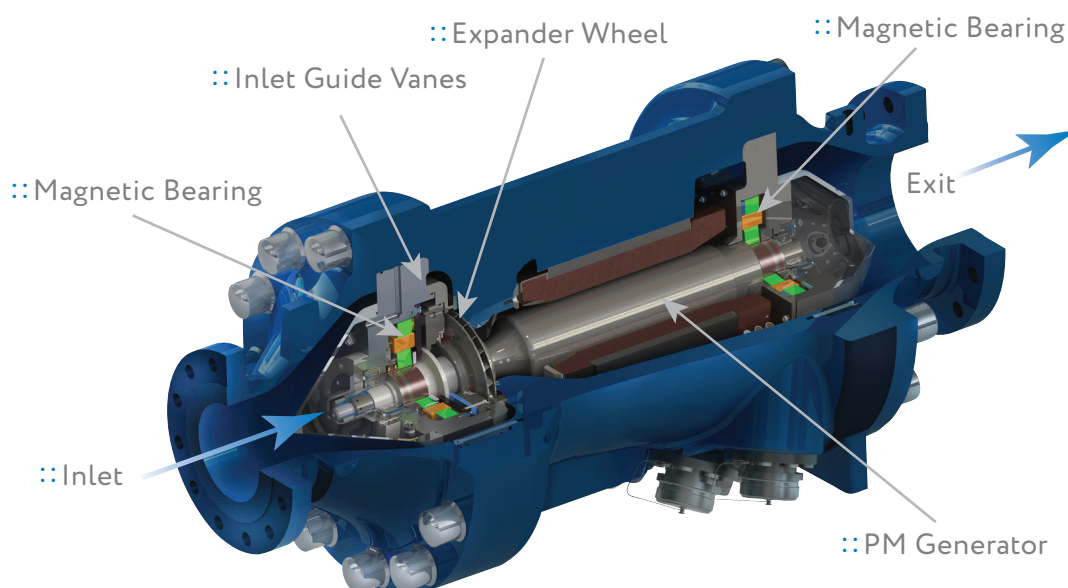
For Natural Gas and Hydrogen Applications



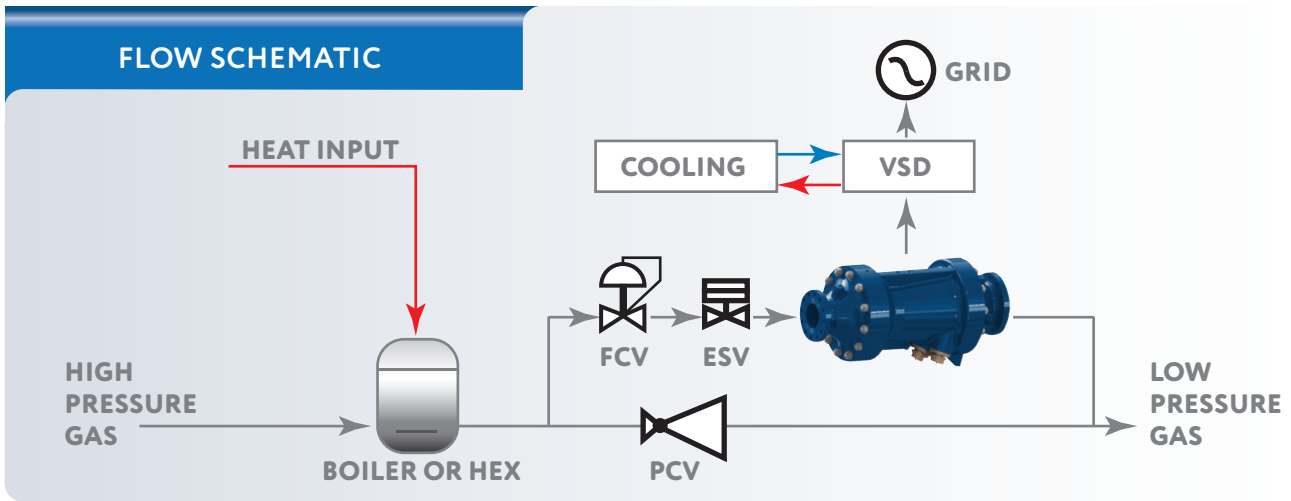
Sapphire Technologies' FreeSpin™ In-line Turboexpander (FIT) provides a way to capture the energy lost in pressure reduction. The FIT generator extracts kinetic energy from the pressure reduction and allows for the generation of electricity with no added pollution.

The FIT consists of a high-performance, high-speed permanent magnet generator with an integrated radial in-flow expansion turbine and low loss active magnetic bearings (AMBs). The FIT is designed to have the process gas flow through the system, which cools the generator section and eliminates the need for auxiliary cooling equipment. The power electronics for FIT combine the Variable Speed Drive (VSD) and Magnetic Bearing Controller (MBC) into one cabinet. The VSD allows for a consistent and clean delivery of generated power from the FIT to the grid.

Cutaway model of FreeSpin™ In-line Turboexpander



## FLOW SCHEMATIC



- Cooling = Cooling Cart for VSD
- ESV = Emergency Shut-off Valve
- FCV = Flow Control Valve
- Heat Input = Energy used for Pre-heating
- PCV = Pressure Control Valve (Joule Thomson Valve)
- VSD = Variable Speed Drive

### Ambient Conditions

- Ingress protection: IP54 and NEMA 4X
- Ambient temperature: -20°C to + 45°C (-4°F to 113°F)
- Relative humidity: 0-90% RH (Non-Condensing)
- Altitude: Sea level to 1000m (3,280 ft.)

## FreeSpin™ In-line Turboexpander Specifications

Parameter	Specification
Power Output	125 kW (168 hp) and 280 kW (375 hp)
Rotor Speed	0 – 30,000 rpm
Normalized Flow**	2,000 – 50,000 Nm <sup>3</sup> /h** (1.8 – 44.8 MMSCFD)
Inlet Pressure	1.9 – 6.0 MPaG (275 – 870 PSI-g)
Exit Pressure	0.8 - 4.0 MPaG (116 – 580 PSI-g)
Gas Temperature Range	-260°C-120°C (-436°F – 248°F)
Hazardous Zone Certification	IECEx Certified Hermetic Explosion Proof
Axial Length	1200 mm (47.2 in.) Flange to Flange
Diameter	600 mm (23.6 in.)
Weight Estimate	1090 kg (2,403 lbs.)

\* Normalized condition is 0°C (32°F), 0.1 MPa (14.5 PSI) \*\* Acceptable flow rate depends on the inlet temperature and pressure

## Variable Speed Drive Specifications

Parameter	FIT 500	FIT 300
Cooling Requirements	Liquid cooled 50 LPM (13 GPM) @ 40°C (104°F) Max, 200 KPA (29 PSI) Max	Liquid cooled 50 LPM (13 GPM) @ 40°C (104°F) Max, 200 KPA (29 PSI) Max
Rated Output	280 kW (168 hp)	125 kW (375 hp)
Output Voltage	380 - 480V AC	380 - 480V AC
Output Current	430 Amps RMS	190 Amps RMS
Output Electrical System	3 Phase 3-wire	3 Phase 3-wire
Rated Frequency	50-60 Hz	50-60 Hz
Grid Harmonics	< 5% THD per IEEE 519	< 5% THD per IEEE 519
Serial Interface	Modbus RTU over RS-485	Modbus RTU over RS-485
Dimensions	2130 mm H x 1380 mm W x 1000 mm D (84 in. H x 54 in. W x 39 in. D)	2130 mm H x 1380 mm W x 1000 mm D (84 in. H x 54 in. W x 39 in. D)

System operation and power generation depend on gas composition and application specific requirements.