Bray Technology Provides Reliable Performance in Turboexpander Applications

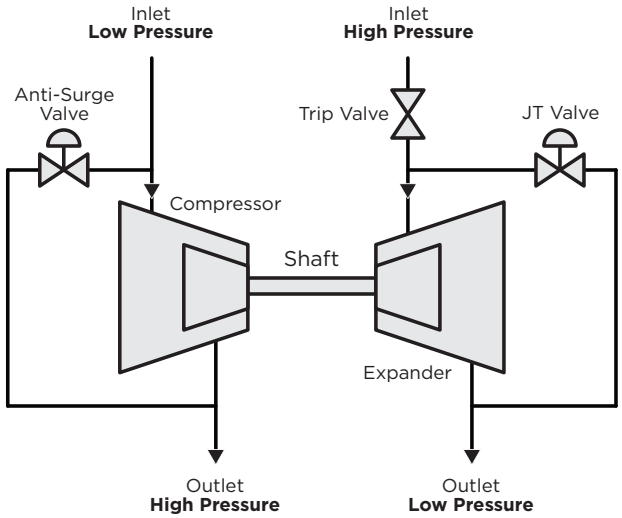
TURBOEXPANDER OVERVIEW

A **turboexpander** is a mechanical device made up of a gas turbine, a compressor, and a connecting shaft. These devices are used in gas processing facilities to simultaneously expand one fluid while compressing another. These concurrent processes increases the energy efficiency in the facility by reducing the amount of energy lost in the depressurization process.

A turboexpander works by decompressing a high-pressure gas that enters the turbine so that it exits at a lower pressure. The energy generated from this process is used to rotate the compressor, which takes a lower pressure gas and compresses it so that it leaves the compressor at a higher pressure.

Trip valves, **anti-surge valves**, and **JT valves** are critical in turboexpanders. These valves maintain the safety and longevity of both the turboexpander and its down stream components. Without these safety systems, the turboexpander risks catastrophic failure.

TYPICAL TURBOEXPANDER DIAGRAM



EXPANDER | TRIP VALVES

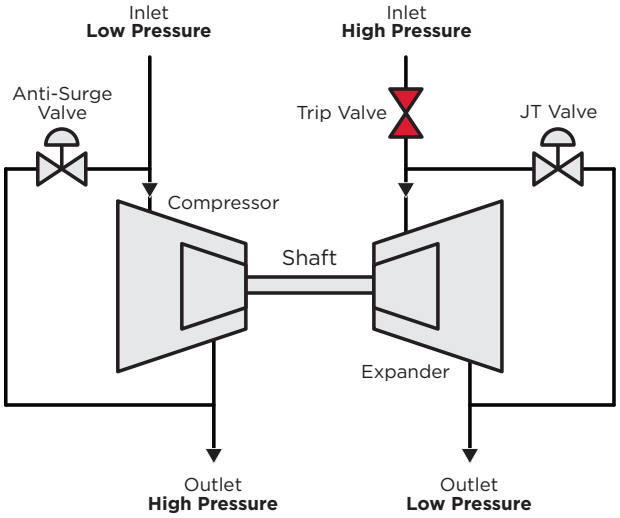
Turbines extract energy from high pressure fluids by rotating a drive shaft to create mechanical work. The inlet energy directly correlates with the turbine's rotations per min (RPM). This means RPMs are not limited, and could increase to dangerous levels (otherwise known as turbine runaway). Fast-acting **trip valves** are installed at the inlet and outlet to prevent runaway, quickly closing to choke the turbine.

SIZING CONSIDERATIONS

When sizing the expander trip valves, the following variables are needed:

- Full Open Cv – When the valve is open, minimum flow impact to the turbine is required.
- Close Speed – Turbine runaway can occur in just a few seconds, so quick closing is required (0.3 to 3 seconds).
- Media Temperatures – Turbo expanders are used in many gas applications, which range from cryogenic temperatures to super-heated fluids.

TYPICAL TURBOEXPANDER DIAGRAM



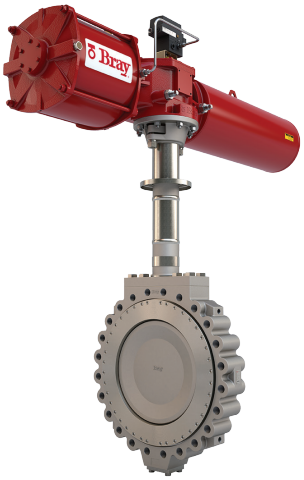
AUTOMATED SOLUTIONS | TRIP VALVE

Trip valve packages typically include Bray's double offset or triple offset butterfly valve coupled with our scotch yoke pneumatic actuator and control accessories, designed to meet the application's fast-acting and SIL 2 or SIL 3 ratings requirements.

MCCANNALOK HIGH PERFORMANCE BUTTERFLY VALVE

The standard choice for trip valves, due to its superior Cv values and versatile temperature range. Models are designed to handle temperatures as low as -320°F | -196°C or as high as +500°F | +260°C.

- Flow Cv – Max flow is critical to ensure the compressor does not choke.
- Fail Close – The required closing speed typically ranges from **0.3 to 3 seconds.**
- Fail State – Activation will be loss of 4-20mA signal or discreet fail signal.
- Controllability – Tight deadband in the range of 1% is required.
- Use in cryogenic temperatures, when higher flowrates are required.



High Performance Butterly Valve

TRI LOK® TRIPLE OFFSET BUTTERFLY VALVE

Used in applications with elevated temperatures and pressures. Also specified when ZERO bidirectional leakage and firesafe design is required.

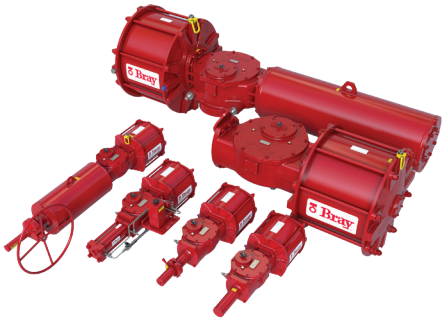
- Suitable for higher temperature and pressure applications, including steam service.
- Field repairable design simplifies maintenance and onsite repairs.
- Live loaded packing certified to API 641, ISO 15848-1, and TA-Luft VDI 2440 for fugitive emissions.
- Firesafe according to API 641 and ISO 10497.

Triple Offset Butterfly Valve

SERIES 98 SCOTCH YOKE PNEUMATIC ACTUATOR

The premiere actuator designed for fast-acting, high-cycle applications.

- Tested and validated to 1 million+ cycles.
- Customizable automation accessories (such as quick exhausts, volume boosters, pilot and solenoid valves) to meet demanding operating speeds with maximum reliability and system redundancy.
- Standard maximum air port diameter (avaliable at no added cost) and optional dual porting to increase actuator Cv.
- Engineered hydraulic dampener available to protect valve sealing elements and actuator components from damage during fast closures.

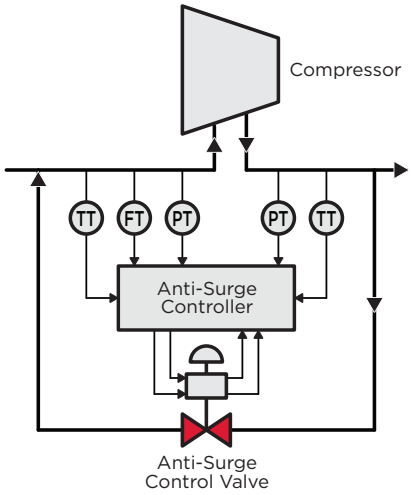


Scotch Yoke Pneumatic Actuator

COMPRESSOR | ANTI-SURGE VALVES

Compressors increase the pressure of a fluid by converting mechanical energy from a drive shaft to drive a compressor wheel. The performance of a compressor depends heavily on balancing the inlet volume to the output volume.

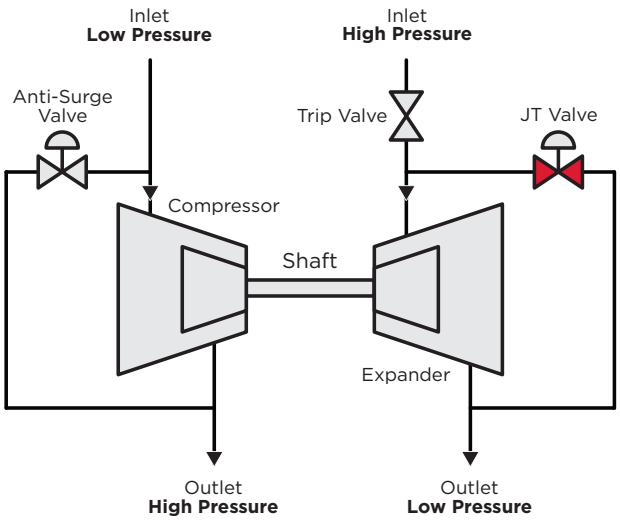
Some process scenarios such as upstream demand and start up can cause the downstream pressure to be higher than the compressor output, which causes back flow. This effect is known as compressor surge, and it can lead to system failure. **Anti-surge valves** are used to reroute the compressor output back to the inlet to artificially increase the compressor input. These control valves are critical to ensuring the compressor is protected.



EXPANDER | JT VALVES

Another common valve on the expander side is the **JT valve**, which is used to bypass the expander if the turbine malfunctions. The JT valve was the original technology used to create large drops in temperature before the invention of the turboexpander. The JT valve creates a large temperature drop by inducing a large pressure drop across the valve.

TYPICAL TURBOEXPANDER DIAGRAM



SIZING CONSIDERATIONS

When sizing anti-surge and JT valves, the following variables are needed:

- Flow Cv – Max flow is critical for rapid anti-surge protection.
- Fail Open – The required opening speed typically ranges from **0.3 to 3 seconds.**
- Fail State – Activation will be loss of 4-20mA signal or discrete fail signal.
- Controllability – Tight deadband in the range of 1% is required.

AUTOMATED SOLUTIONS | ANTI-SURGE AND JT VALVE

Anti-surge valve packages feature a segmented ball valve with a compact scotch yoke pneumatic actuator. Other accessories, such as a positioner, are included to provide reliable system feedback on valve position.

SERIES 19 SEGMENTED BALL VALVE

The Series 19 segmented control valve has the following features suitable for optimal surge prevention:

- Maximum rangeability (300:1)
- High Cv – Max flow is critical to ensure the compressor does not choke.
- Quick Fail Open – The default safe state can open in **0.3 to 3 seconds**.
- Fail State – Activation will be loss of 4-20mA control signal or discrete fail signal.
- Precise Controllability – Tight range of 1% is required.
- Splined Stem to Segment Connection – Provides efficient torque transmission and precise control, with minimal hysteresis and reduced deadband.

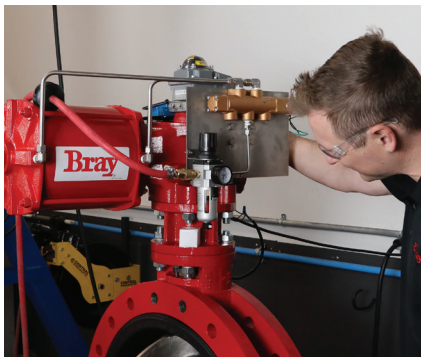
Segmented Ball Valve

In the same way that an anti-surge valve protects the compressor, a JT valve is a control valve that is used to bypass the expander. JT valves are key components in turboexpander machinery, since they protect the expander in the event it malfunctions. Globe valves are historically used in this application, but Bray's Series 19 segmented ball valve is increasingly providing an **alternative solution** that utilizes newer technology to solve an age-old problem.

Automation packages for anti-surge and JT valves typically include Bray's compact scotch yoke pneumatic actuator, the Series 98C, and the Series 6A smart electro-pneumatic positioner.

ADDING VALUE

VALVE AUTOMATION CENTER



Bray's global Valve Automation Centers (VAC) offer turnkey solutions for your complex automation challenges. Consider the benefits of working with a trusted and experienced single source provider:

- Single point of contact simplifies decisions, saving time and money.
- Fully integrated and tested controls packages using high performance Bray products or fully-qualified complementary products.
- Stringent processes and quality standards, with full traceability of documentation.
- Application engineers available to provide immediate technical expertise, including valve and actuator sizing recommendations.
- Full customer support, including start-up commissioning and field service.
- All Bray products are backed by our three year warranty and worldwide support.

CLEANROOM SERVICES

Bray's cleanroom facilities offer a single source for precision cleaned valves, from automated packages to assemblies and spare parts. With global cleaning capabilities from **ISO Class 9 through ISO Class 6**, multiple service levels are available to meet a variety of international certifications and standards.

- Factory direct cleaned valve & automation packages.
- Reduced logisitical risk provides faster delivery.
- Trained and experienced technicians provide consistent product cleanliness.
- Cleaning procedures validated by third party labs.

CERTIFICATIONS & STANDARDS	
EIGA 33/18	Cleaning of Equipment for Oxygen Service
ISO 14644-1	Certification of Air Cleanliness
MSS-SP-140	Preparation of Valves and Fittings for Silicone-Free Service
VDMA 24364	Testing for Paint Wetting Impairment Substances (LABS-Conformity)

GLOBAL COMPANY. REGIONAL FOCUS. LOCAL PRESENCE.

- Our diversified headquarters develop and maintain standard processes across six continents to ensure consistent product quality and reliability.
- Our research & development, engineering, and manufacturing facilities are strategically located to provide customized solutions with short delivery times.
- Our factory certified sales and distribution networks span more than 40 countries to serve you locally.