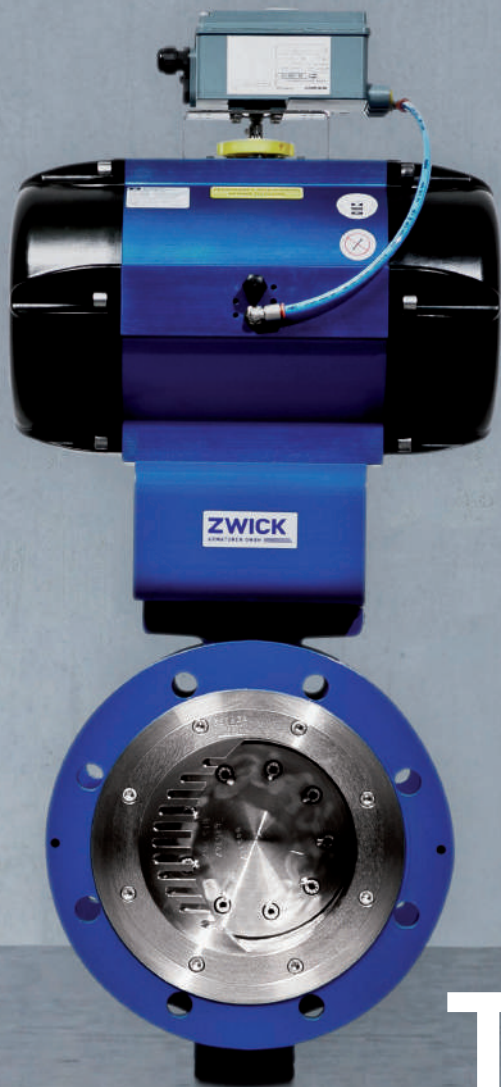


ZWICK
ARMATUREN GMBH 



TRI-SHARK

100 % CONTROL VALVE 100% TIGHT

TRI-SHARK Control Valves

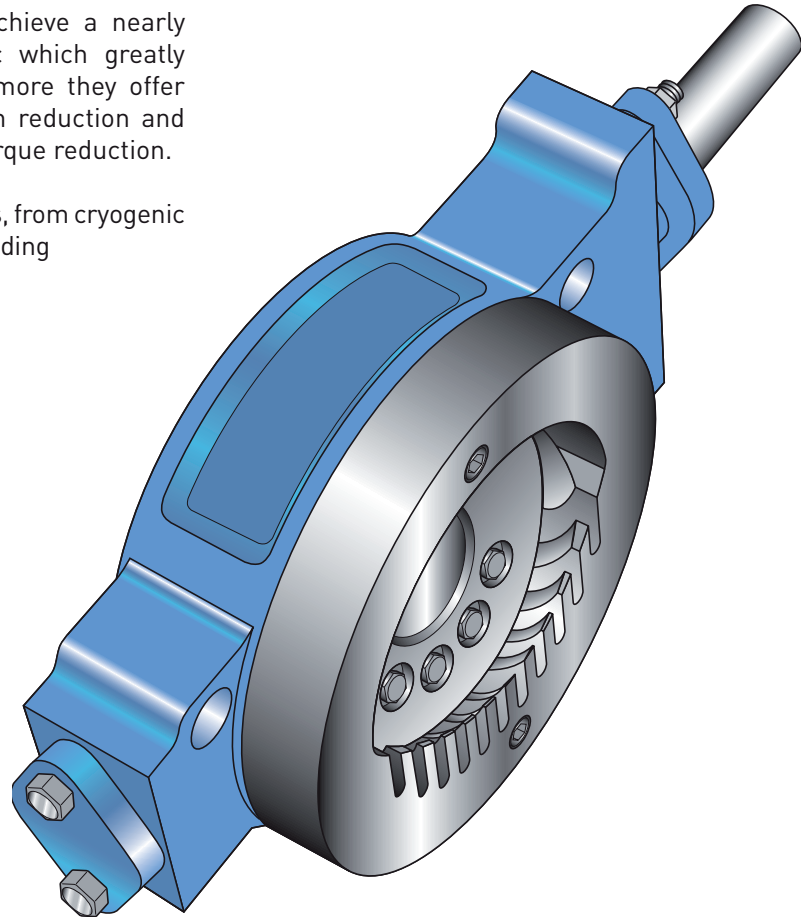
TRI-SHARK control valves are able to achieve a nearly equal percentage inherent characteristic which greatly extends the control rangeability. Furthermore they offer great advantages in the field of cavitation reduction and noise attenuation, as well as in dynamic torque reduction.

They are suitable for a wide range of services, from cryogenic temperatures till -196°C up to $+815^{\circ}\text{C}$, including liquids, gases and steam.

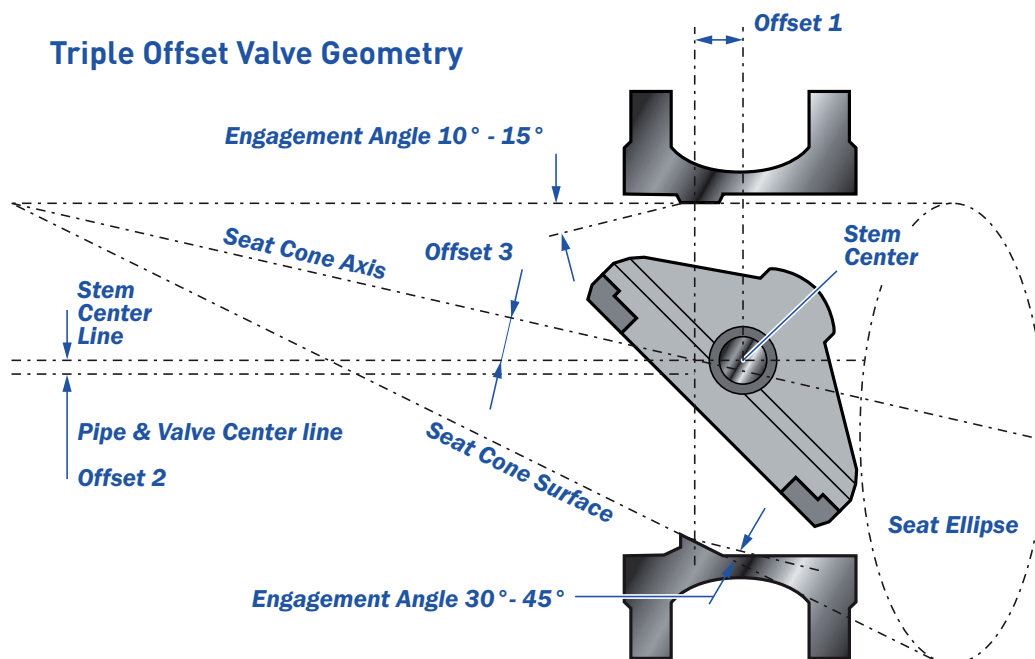
Performance Benefits

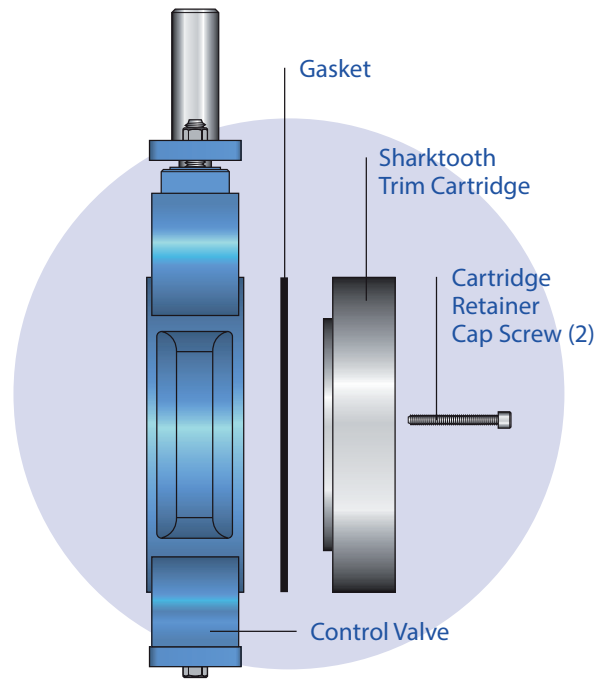
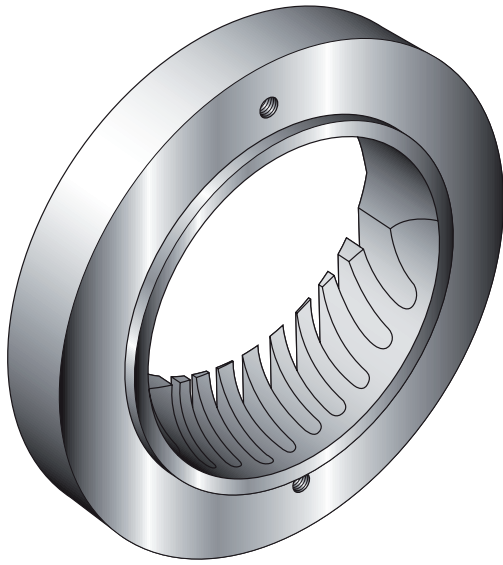
- DN 80 - DN 900, 3" - 36"*
- Class: 150 thru 900
- Compactness
- Metal-to-Metal Seating
- Cryogenic to 815°C .
- Zero Leakage
- Firesafe to API 607
- Low Running Torques
- Stable Control
- Light Weight
- Low Cost of Ownership
- Field Replaceable Trim Cartridges
- Carbon Steel, Stainless Steel, & Exotic Alloys
- Severe Service Capability

* = Larger sizes available



Triple Offset Valve Geometry





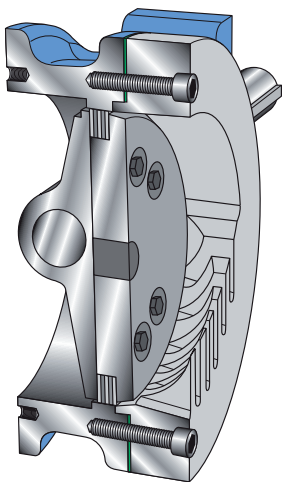
TRI-SHARK Throttling Trim Cartridge

The Sharktooth "Throttling Trim Cartridge" is used to turn our Triple-Off-Set Butterfly Valves into excellent throttling control valves. Now, just one style of valve can be used for both on-off, and control applications.

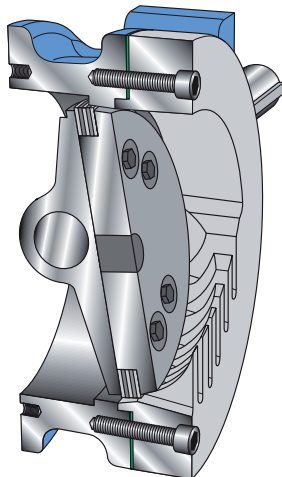
EXCEPTIONAL PERFORMANCE, SIMPLICITY, AND ECONOMY!

TRI-SHARK - controlling at every angle!

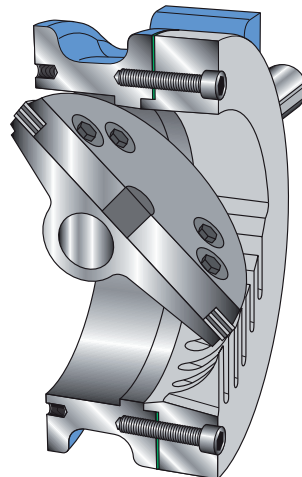
Tight Shut-off



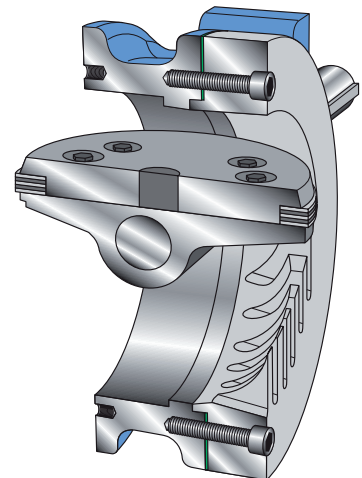
Low Flow



Medium Flow



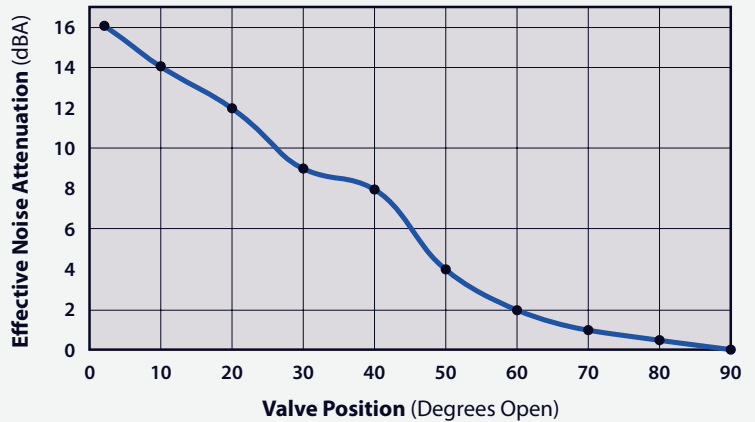
Maximum Flow



Reduces Aerodynamic Noise Up to 15 dBA

As the vane turns within the Sharktooth Throttling Trim Cartridge, multiple, optimized, throttling slots are gradually exposed to flow. Then, at higher flows, when the vane has cleared the contoured slotted portion of the control cartridge, the resultant lower pressure drop will alleviate any further noise problems.

Noise Attenuation

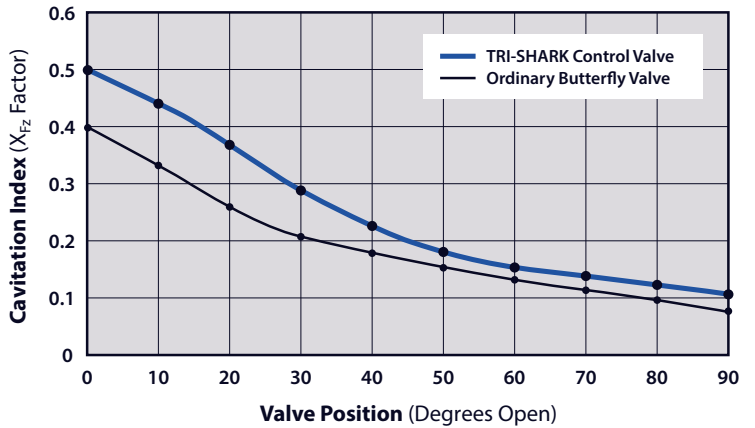


Anti-Cavitation Properties

TRI-SHARKs twenty-five percent higher incipient cavitation index allows for higher pressure drops than ordinary butterfly valves, while exhibiting much less noise, cavitation, and damage.

Even if cavitation does occur in higher pressure drop situations, the shorter vapor jets produced by the slots will avoid the damaging effects caused by large vapor jets, referred to as "super cavitation".

Cavitation Reduction

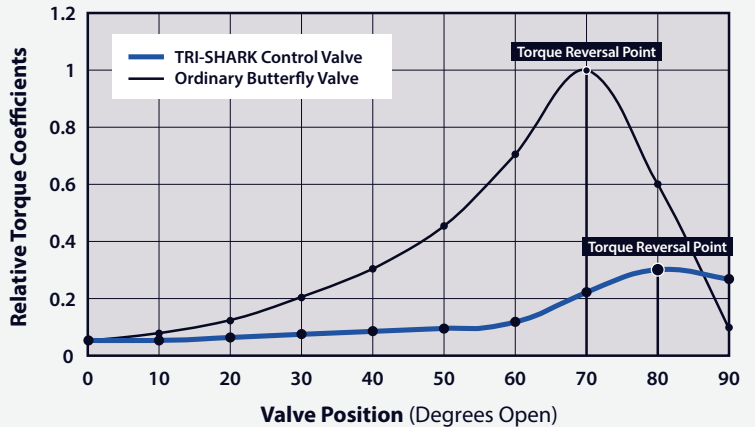


More Control with Less Torque

TRI-SHARKs dynamic torque requirements are 60 percent less than ordinary butterfly valves, even at high-end Cv's, thereby providing exceptional stability throughout its control range.

TRI-SHARKs Triple Eccentric Metal-to-Metal Seating requires lower breakaway torques than either butterfly or rotary plug control valves and, its extended torque reversal point allows for an expanded range of control.

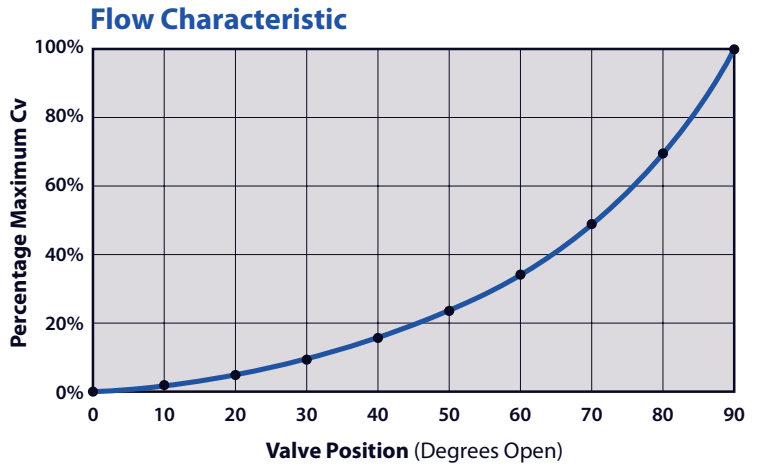
Dynamic Torque Reduction



Excellent Control Range

TRI-SHARK Control Valves have an effective control range that extends from 1 percent at 5 degrees of travel to 100 percent at 90 degrees of travel.

Its equal percentage flow characteristic fits the vast majority of control loop requirements.



Low to High Flow Capability

The Sharktooth Throttling Trim Cartridge eliminates the low angle instability inherent in most quarter-turn control valves. For instance, ordinary butterfly valves exhibit poor control at angles of opening that are less than 30 degrees.

Sharktooth technology greatly extends the control rangeability of our quarter-turn valves to as low as 3 degrees of valve opening while also providing noise attenuation and anti-cavitation benefits.

Notes:

- 1) Min CV= Minimum Controllable CV
- 2) Rangeability
 - 3" to 6" = 100 : 1
 - 8" to 10" = 75 : 1
 - 12" to 16" = 50 : 1
 - 18" to 24" = 30 : 1

Zwick Cv Comparison With & Without Sharktooth

Size		ANSI 150 & 300				ANSI 600			
		Standard Zwick Valve		Zwick TRI-SHARK		Standard Zwick Valve		Zwick TRI-SHARK	
Inch	DN	CV 20°	Max CV	Min CV	Max CV	CV 20°	Max CV	Min CV	Max CV
3	80	14	120	1,1	101	14	120	1,1	101
4	100	27	230	1,9	199	26	215	1,9	186
6	150	77	660	7,6	575	77	660	7,6	575
8	200	176	1500	18	1325	158	1350	16	1192
10	250	280	2400	30	2148	242	2064	25	1847
12	300	421	3600	64	3245	356	3043	55	2742
14	350	643	5500	98	4915	533	4550	81	4066
16	400	890	7600	136	6813	751	6416	115	5751
18	450	1205	10300	309	9290	1003	8576	258	7735
20	500	1521	13000	388	11667	1265	10808	323	9699
24	600	2364	20200	598	17967	1967	16814	498	14955

Empirically Tested and Proven For:

- Flow Capacity (Cv)
- Rangeability
- Dynamic Torque
- Seating Torque
- Incipient Cavitation
- Noise Attenuation
- Proof of Design



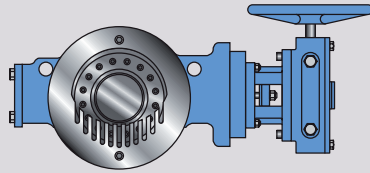
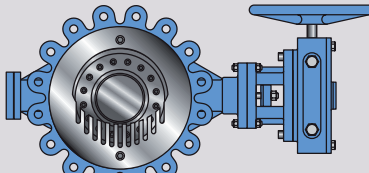
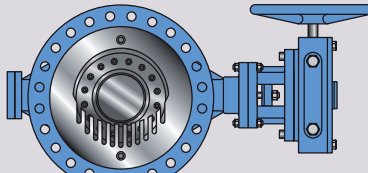
Valve Sizing Coefficients

Valve Opening	F _L	X _{Fz}	X _T
10°	0.97	0.45	0.58
20°	0.96	0.38	0.57
30°	0.93	0.28	0.56
40°	0.90	0.23	0.55
50°	0.88	0.19	0.54
60°	0.84	0.17	0.53
70°	0.78	0.15	0.51
80°	0.69	0.13	0.48
90°	0.58	0.11	0.44

Note: The above data was substantiated at the Utah State University Water Research Laboratory, Summer 2008.

Standard Product Range

Size		Wafer Type			Lug Type			Raised Face Flanged		
Inch	DN	ANSI 150	ANSI 300	ANSI 600	ANSI 150	ANSI 300	ANSI 600	ANSI 150	ANSI 300	ANSI 600
3	80	•	•		•	•		•	•	
4	100	•	•	•	•	•	•	•	•	•
6	150	•	•	•	•	•	•	•	•	•
8	200	•	•	•	•	•	•	•	•	•
10	250	•	•	•	•	•	•	•	•	•
12	300	•	•	•	•	•	•	•	•	•
14	350	•	•		•	•	•	•	•	•
16	400	•	•		•	•	•	•	•	•
18	450	•	•		•	•	•	•	•	•
20	500	•	•		•	•	•	•	•	•
24	600	•	•		•	•	•	•	•	•

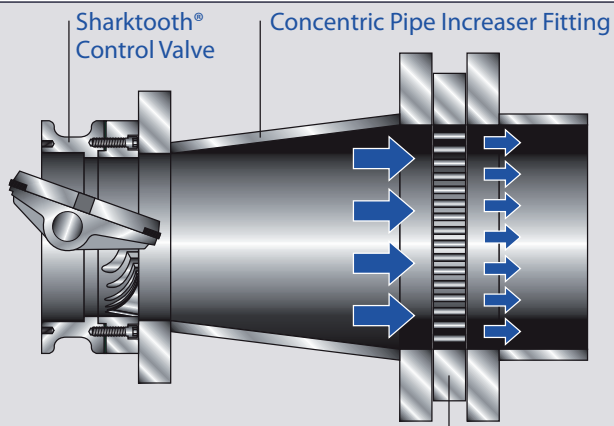
Body Styles			
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Note: Other styles and larger sizes upon request.

Optional Resistance Plates for More Attenuation

When the control valve exit velocity (UV) for gases exceeds 250 ft/sec, the installation of a Resistance Plate to reduce the aerodynamic noise is recommended. Similar use of such plates is advised for high pressure liquids to reduce excessive hydrodynamic noise, or cavitation.

Note: Contact Zwick Armaturen GmbH for additional information and assistance.



Sharktooth® Resistance Plate

$$U_V = 1120 \times \left[0.02 \times P_1 \times C_V \times \frac{F_L}{D_2^2 \times P_2} \right] \text{ ft/sec}$$

*Where: P1 = upstream pressure in psia, P2 = downstream pressure in psia.
D2 = valve size, inch. For example: an 8" valve, P1 = 114.5 psia; P2 = 34.5 psia,
Cv = 405, FL = 0.9, has an outlet velocity of 421 ft/sec. A resistance plate is required.*

Automation and Control Systems

Zwick & Yeary Controls offers a complete array of control valve actuators, control instrumentation, and engineered systems to ensure an optimized configuration for your control valve applications.

Our engineering team offers guaranteed solutions that will facilitate implementation of Sharktooth and other Yeary Controls products.

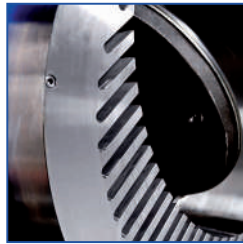
Energy absorbing Flow Pattern

Flow Laboratory tests verified how individual water jets impinge upon each other at approximately one pipe diameter downstream from the Sharktooth Control Element, thereby converting kinetic energy in the fluid prior to contacting the pipe wall.



Some Typical Installations

Industry	Application
Steel Mill	12" - 150 Shark + 14" Diffuser, Pump Discharge Flow Control, Water
CoGen Plant	12" - 600 Shark Steam Flow Control
Geothermal Power Gen	12" - 300 Shark w/Electric Actuator Flow Control, Geothermal Water
Steel Mill	14" - 150 Shark, Manual Flow Control Water
Gas Pipeline Station	10" - 600 Shark, Flow Control Natural Gas
Geothermal Power Gen	12" - 300 Shark + 16" Diffuser, Freon, Turbo Expander Bypass + Startup
Oil Pipeline	8" - 150 Shark w/ Electro-hydraulic Actuator, Flow Control
Geothermal Heat Transfer	8" - 300 Shark, Flow Control, Freon, Turbo Expander Vent & Bypass
Steel Mill	8" - 150 Shark, Flow Control, Dirty Water to Sump
Major HVAC OEM	3" - 150 Shark, Successful Flow Test Program
Geothermal	8" - 300 Shark w/ Electric Actuator, Flow Control, Geothermal Water
Salt Cavern Storage	10" - 300 Shark + 12" Diffuser, Flow Control, Brine Well Injection
Snow Making	8" - 300 Shark, Pump Inlet Flow Control - 700 psi Water
Geothermal Power Gen	12" - 150 Shark Steam, Flow Control, Turbine By-Pass
Oilfield Production	6" - 300 Shark, Waste Water Flow Control
Heat Exchanger	12" - 300 Shark, Steam Pressure Control
Paper Mill	10" - 300 Shark, Steam Flow Control
Marine	24" - 150 Shark, Ballast Water Flow Control
Corn Products	8" - 150 Shark, Water Flow Control



ZWICK & Sharktooth - Control Valves are Ideal for Most Applications

By combining the Sharktooth Throttling Control Cartridge with our Triple Eccentric Butterfly Valves, just one style of valve can be used for both on-off, and control applications. It's the smart choice for today's control systems engineer.

- Oil & Gas Production
- Refining Storage/Transmission
- Electric Power Generation
- Chemicals & Petrochemical
- Textiles
- Pulp & Paper
- Mining & Metals
- Micro-Electronics
- Pharmaceutical & Biotech
- Water Pumping & Transport
- Office Buildings & Hotels
- Water Treatment
- Aircraft, Aerospace, & Military
- Ship Building & Marine

Typical Standard Services

- Pump By-pass Control
- Pressure Reducing
- Back Pressure Control
- Compressor Surge Control
- Flow Control & Balancing
- Ballast Water Flow Control
- Overboard Discharge
- Fire Water Ring Control
- Brine Blowdown
- Jetty Loading Control
- Sea-Water Re-Circulation & Drain
- Cooling Tower Bypass
- Brine Well Injection
- Steam Condensor Inlet
- Steam Venting
- Natural Gas Pressure Control

Typical Severe and Special Services

- Cavitating Liquids
- Noise Reduction in Gas, Steam, & Vapor
- Two Phase Fluids
- Cryogenic Liquids & Gasses
- Fire Safe Shut-off plus Control
- Metal to Metal Tight Shut-off plus Control

ZWICK

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