M-CLASS

THE TOUGHEST APPLICATIONS HAVE MET THEIR MATCH

KEYSTONE

M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

KEYS TO SUCCESS:

SYNERGY

FLEXIBILITY

ENGINEERING

RESPONSE

M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

Place the toughest valves in the toughest applications

KEYS TO SUCCESS:

SYNERGY

FLEXIBILITY

ENGINEERING

RESPONSE

M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

Find customized solutions for unique requirements

KEYS TO SUCCESS:

SYNERGY

FLEXIBILITY

ENGINEERING

RESPONSE

M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

Specialize in the most complex and abrasive applications

KEYS TO SUCCESS:

SYNERGY

FLEXIBILITY

ENGINEERING

RESPONSE

M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

KEYS TO SUCCESS:

Fast response to designs and delivery

SYNERGY

FLEXIBILITY

ENGINEERING

RESPONSE

M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

KEYS TO SUCCESS:

SYNERGY

FLEXIBILITY

ENGINEERING

RESPONSE

M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

M-CLASS BALL VALVES

M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

M-CLASS BALL VALVES

Custom metal seated valves

M-CLASS
METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

M-CLASS BALL VALVES

Custom metal seated valves

½” to 16” full port

M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

M-CLASS BALL VALVES

Custom metal seated valves

½” to 16” full port

Up to 4500# class

M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

M-CLASS BALL VALVES

Custom metal seated valves

½” to 16” full port

Up to 4500# class

-328 °F/-200 °C to 1600 °F/871 °C

M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

M-CLASS BALL VALVES

Custom metal seated valves

½” to 16” full port

Up to 4500# class

-328 °F/-200 °C to 1600 °F/871 °C

8-10 week standard delivery

M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

M-CLASS BALL VALVES

Custom metal seated valves

½” to 16” full port

Up to 4500# class

-328 °F/-200 °C to 1600 °F/871 °C

8-10 week standard delivery

Most extreme applications

M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

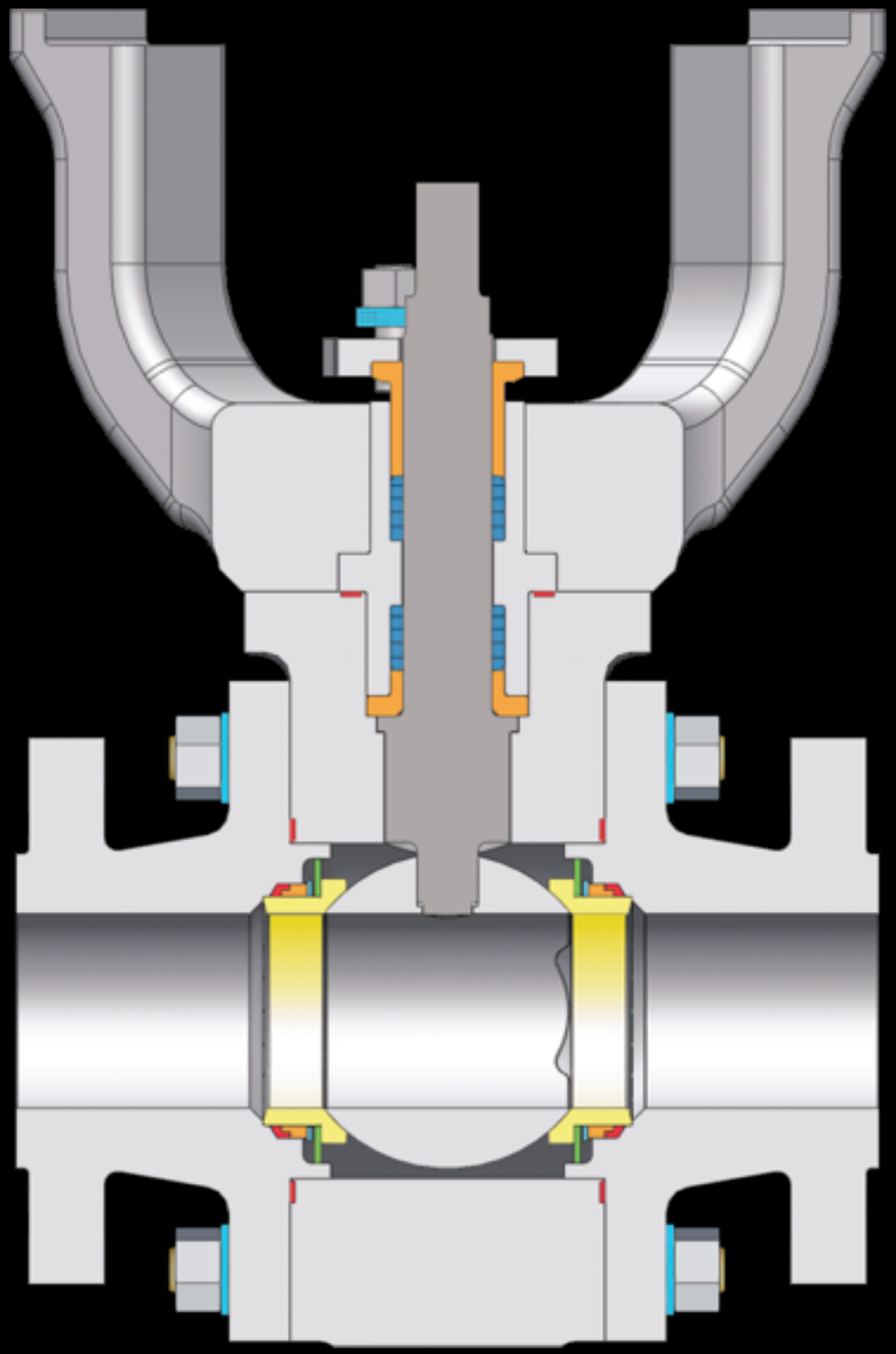
KEYSTONE

M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE



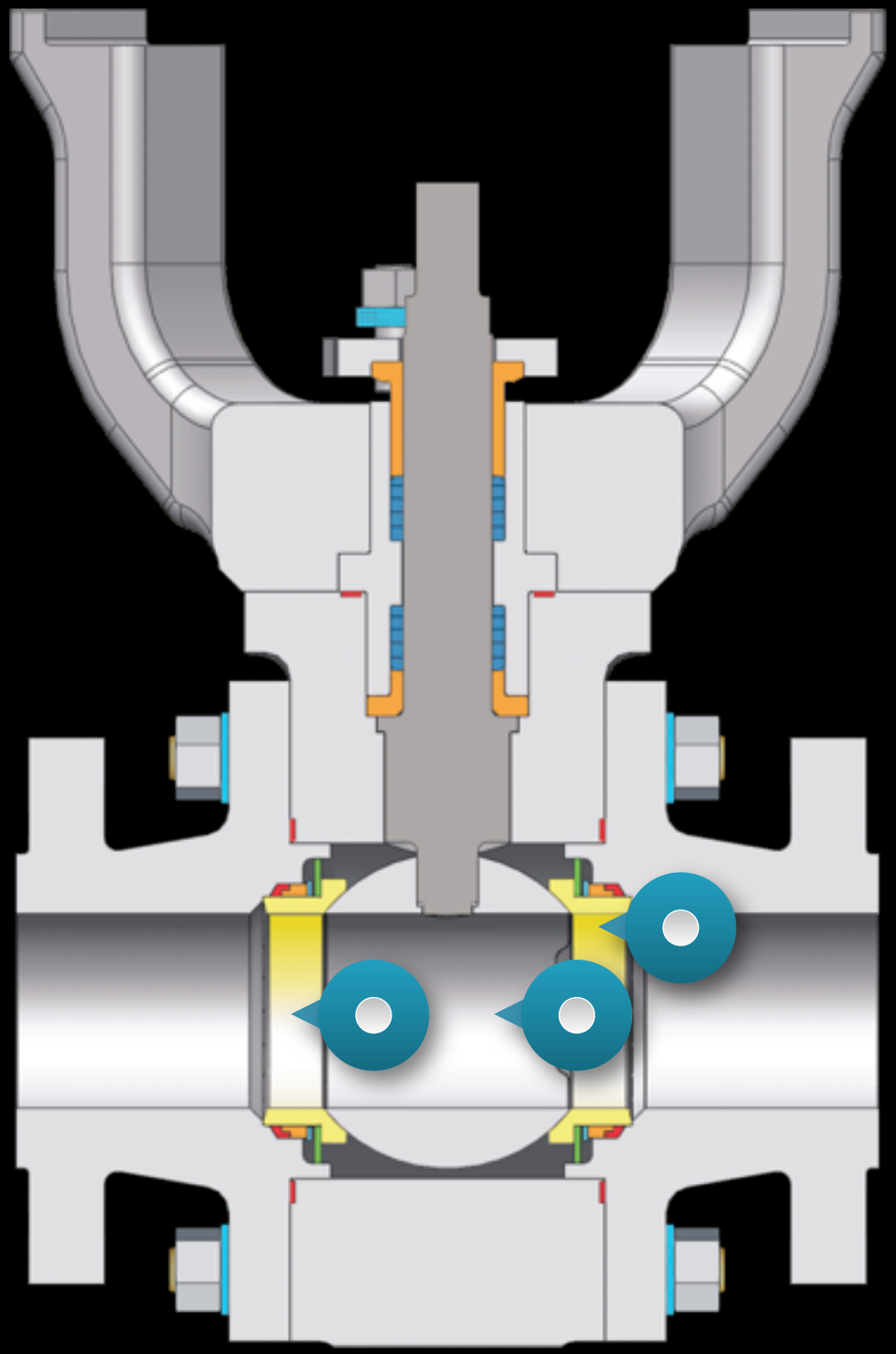
M-CLASS FEATURES

M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE



M-CLASS FEATURES

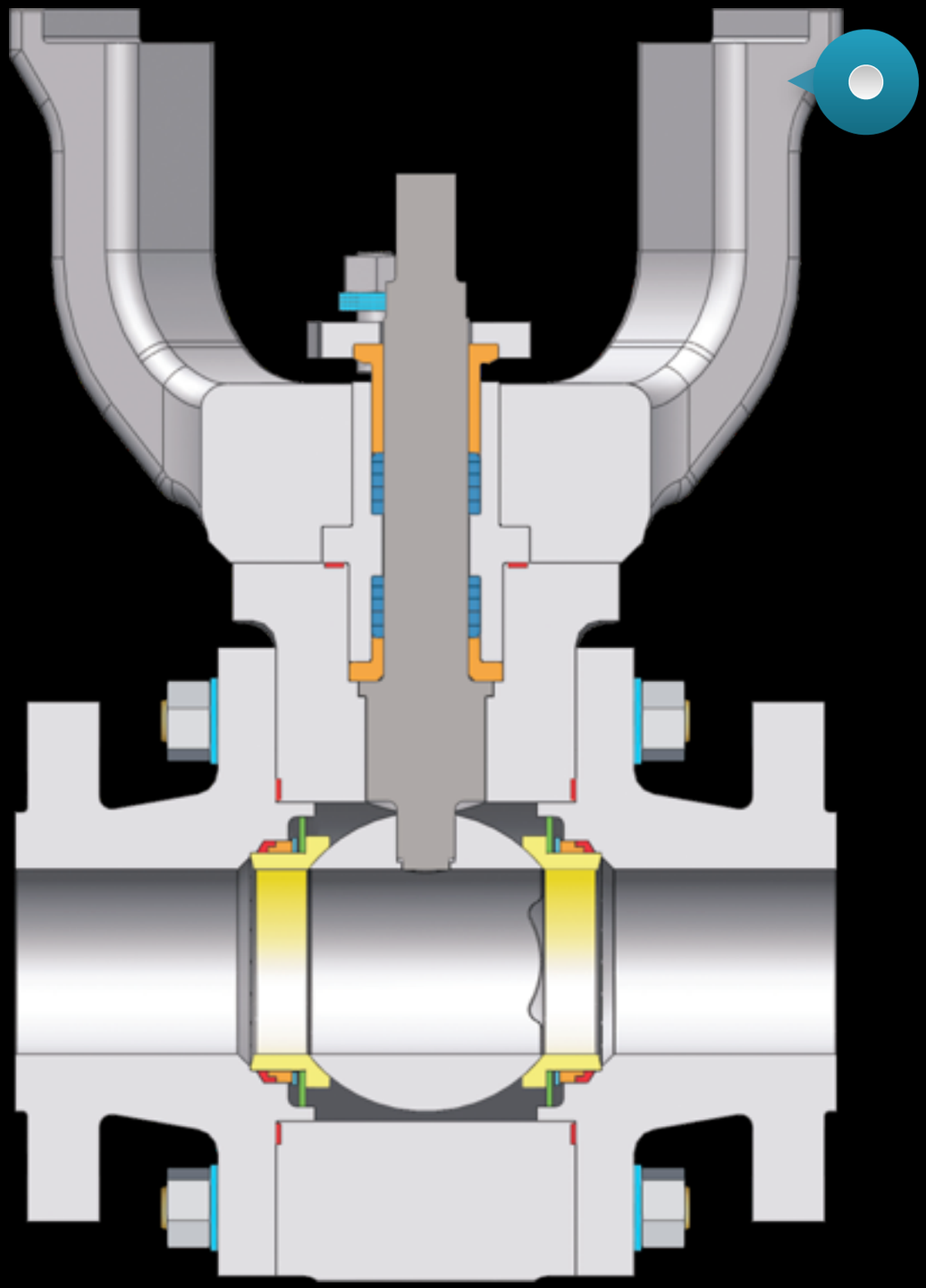
Superior trim hardening

M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE



M-CLASS FEATURES

Superior trim hardening

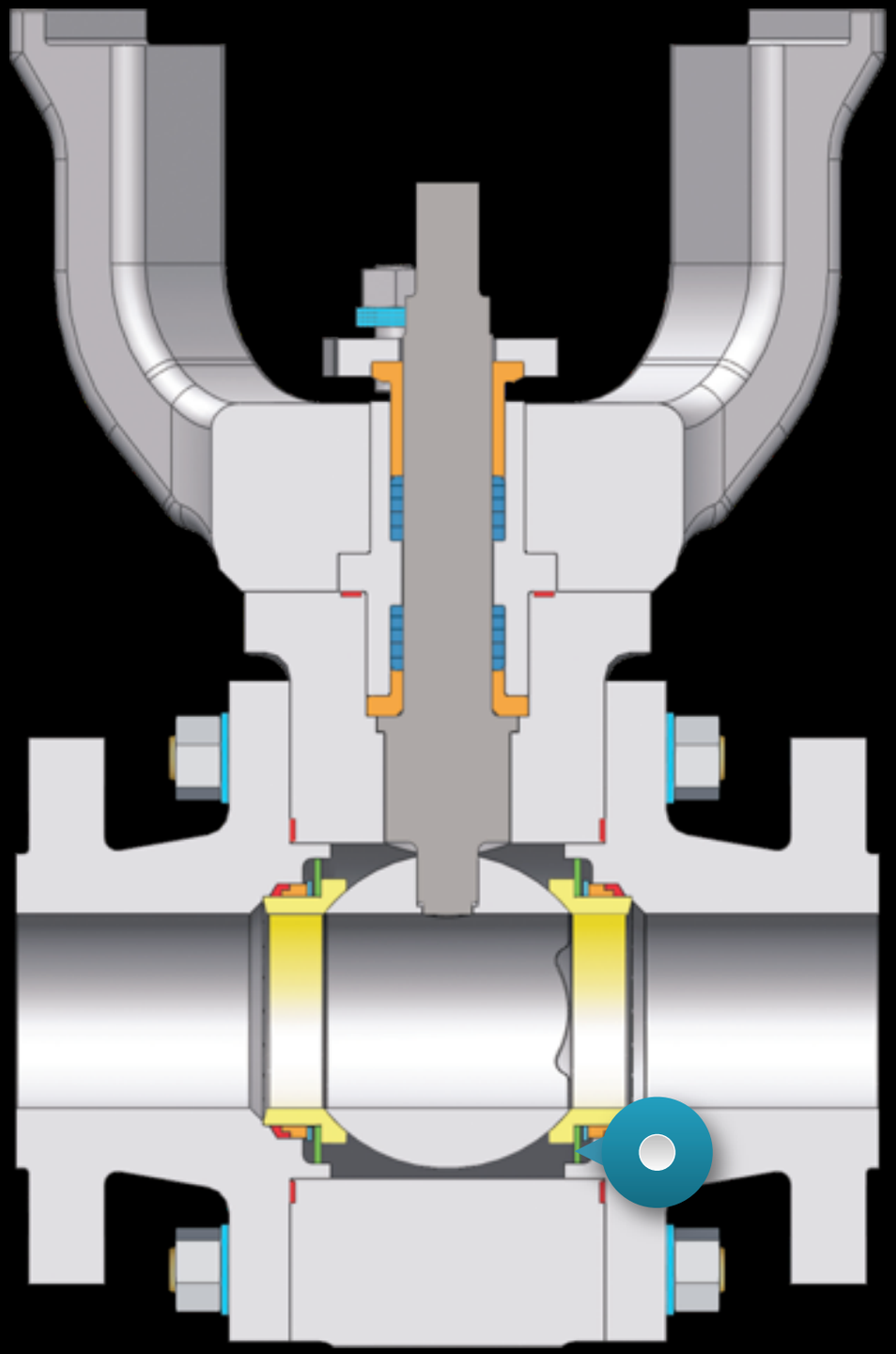
Tripod mounting bracket

M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE



M-CLASS FEATURES

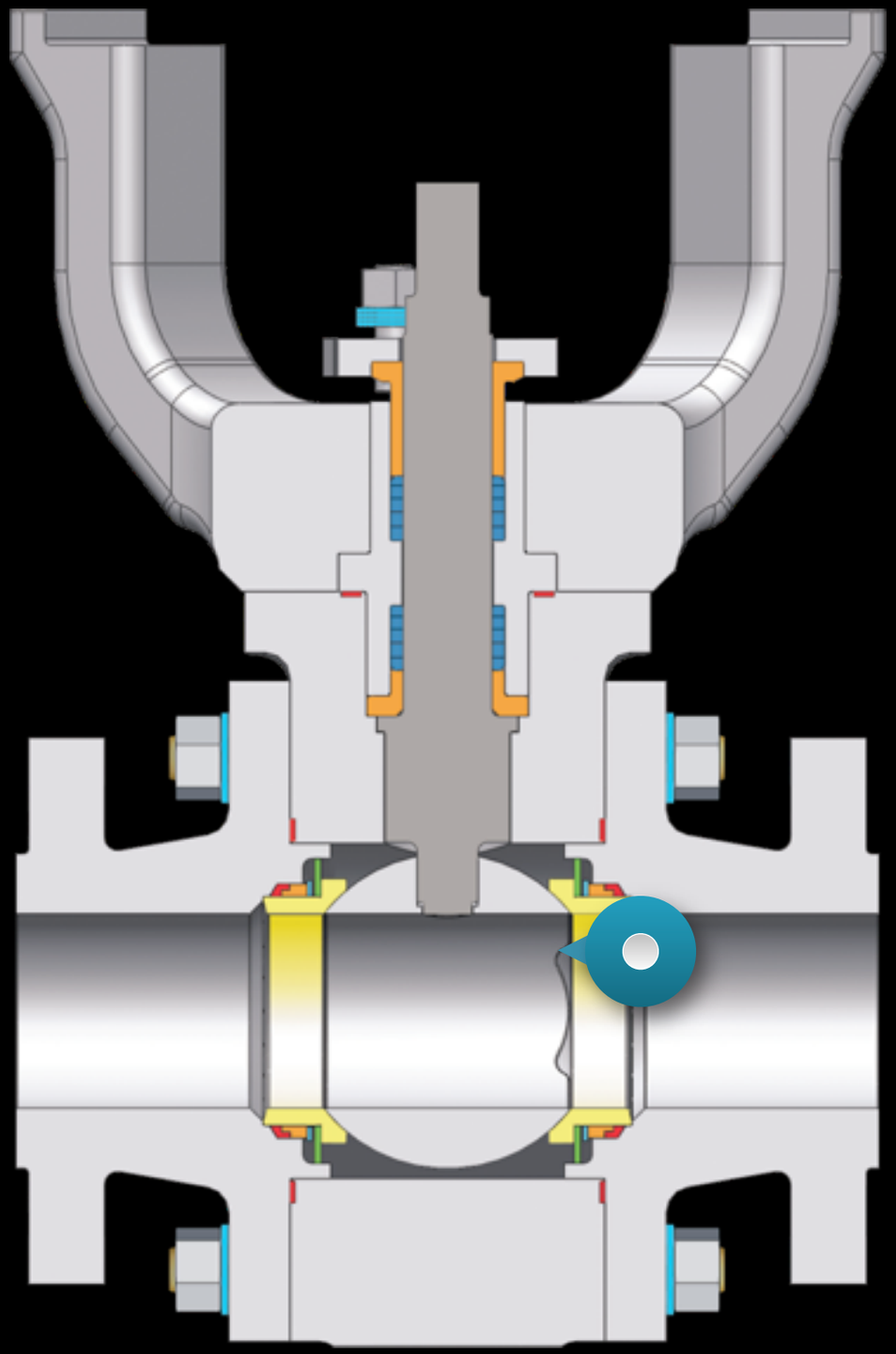
Superior trim hardening

Tripod mounting bracket

Scalloped rings / seats

832-261-2400
tycovalves.com

KEYSTONE



M-CLASS FEATURES

Superior trim hardening

Tripod mounting bracket

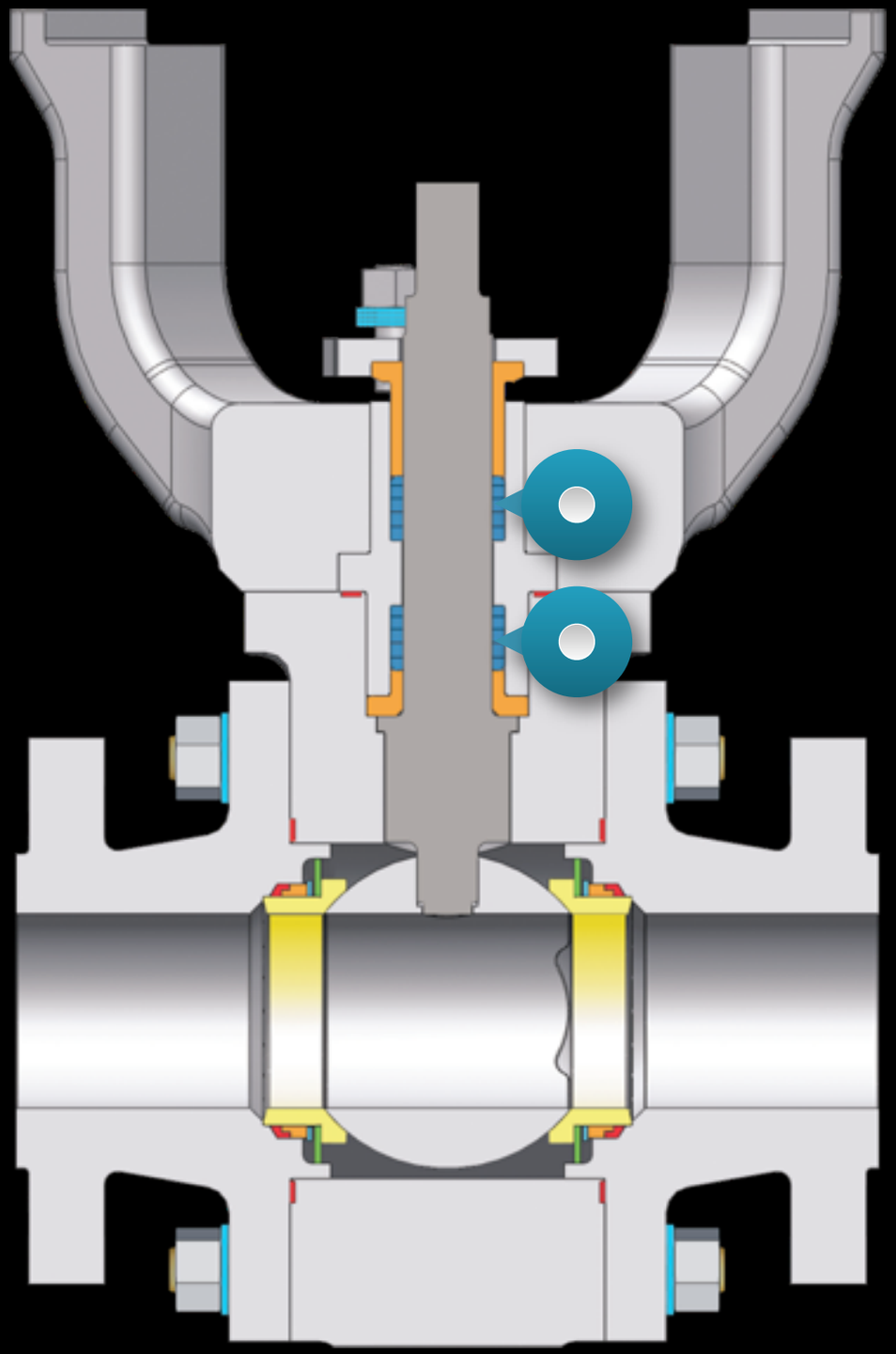
Scalloped rings / seats

Arcuate cut ball

M-CLASS
METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE



M-CLASS FEATURES

Superior trim hardening

Tripod mounting bracket

Scalloped rings / seats

Arcuate cut ball

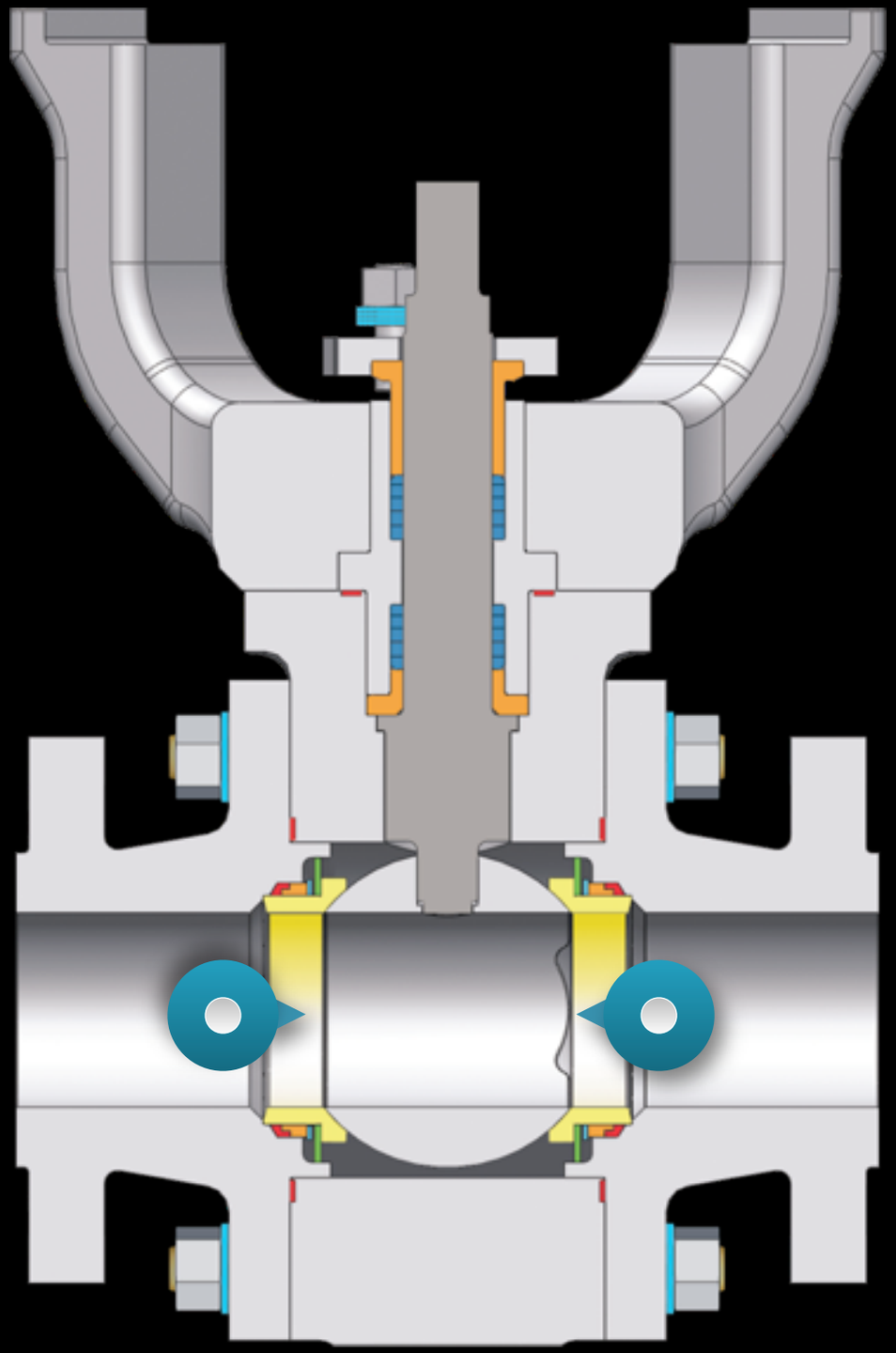
Patented dual stem sealing

M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE



M-CLASS FEATURES

- Superior trim hardening
- Tripod mounting bracket
- Scalloped rings / seats
- Arcuate cut ball
- Patented dual stem sealing
- Bi-directional sealing

M-CLASS
METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

Why do Keystone M-Class valves last?

M-CLASS
METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

COMPETITION VS. M-CLASS

M-CLASS
METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

COMPETITION VS. M-CLASS

TRIM HARDENING

M-CLASS
METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

COMPETITION VS. M-CLASS

TRIM HARDENING

ACTUATOR MOUNTING

M-CLASS
METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

COMPETITION VS. M-CLASS

TRIM HARDENING

ACTUATOR MOUNTING

SEAT DESIGN

832-261-2400
tycovalves.com

KEYSTONE

COMPETITION VS. M-CLASS

TRIM HARDENING

ACTUATOR MOUNTING

SEAT DESIGN

BALL DESIGN

M-CLASS
METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

COMPETITION VS. M-CLASS

TRIM HARDENING

ACTUATOR MOUNTING

SEAT DESIGN

BALL DESIGN

STEM SEALING

M-CLASS
METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

COMPETITION VS. M-CLASS

TRIM HARDENING

ACTUATOR MOUNTING

SEAT DESIGN

BALL DESIGN

STEM SEALING

EXOTIC ALLOYS

M-CLASS
METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

COMPETITION VS. M-CLASS

TRIM HARDENING

ACTUATOR MOUNTING

SEAT DESIGN

BALL DESIGN

STEM SEALING

EXOTIC ALLOYS

BALL/SEAT SEALING

M-CLASS
METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

COMPETITION VS. M-CLASS

TRIM HARDENING

ACTUATOR MOUNTING

SEAT DESIGN

BALL DESIGN

STEM SEALING

EXOTIC ALLOYS

BALL/SEAT SEALING

LEAD TIMES

M-CLASS
METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

COMPETITION VS. M-CLASS

TRIM HARDENING
ACTUATOR MOUNTING
SEAT DESIGN
BALL DESIGN
STEM SEALING
EXOTIC ALLOYS
BALL/SEAT SEALING
LEAD TIMES

832-261-2400
tycovalves.com

COMPETITION VS. M-CLASS

TRIM HARDENING	HVOF	Boronizing
ACTUATOR MOUNTING		
SEAT DESIGN		
BALL DESIGN		
STEM SEALING		
EXOTIC ALLOYS		
BALL/SEAT SEALING		
LEAD TIMES		

M-CLASS
METAL-SEATED VALVES

832-261-2400
tycovalves.com

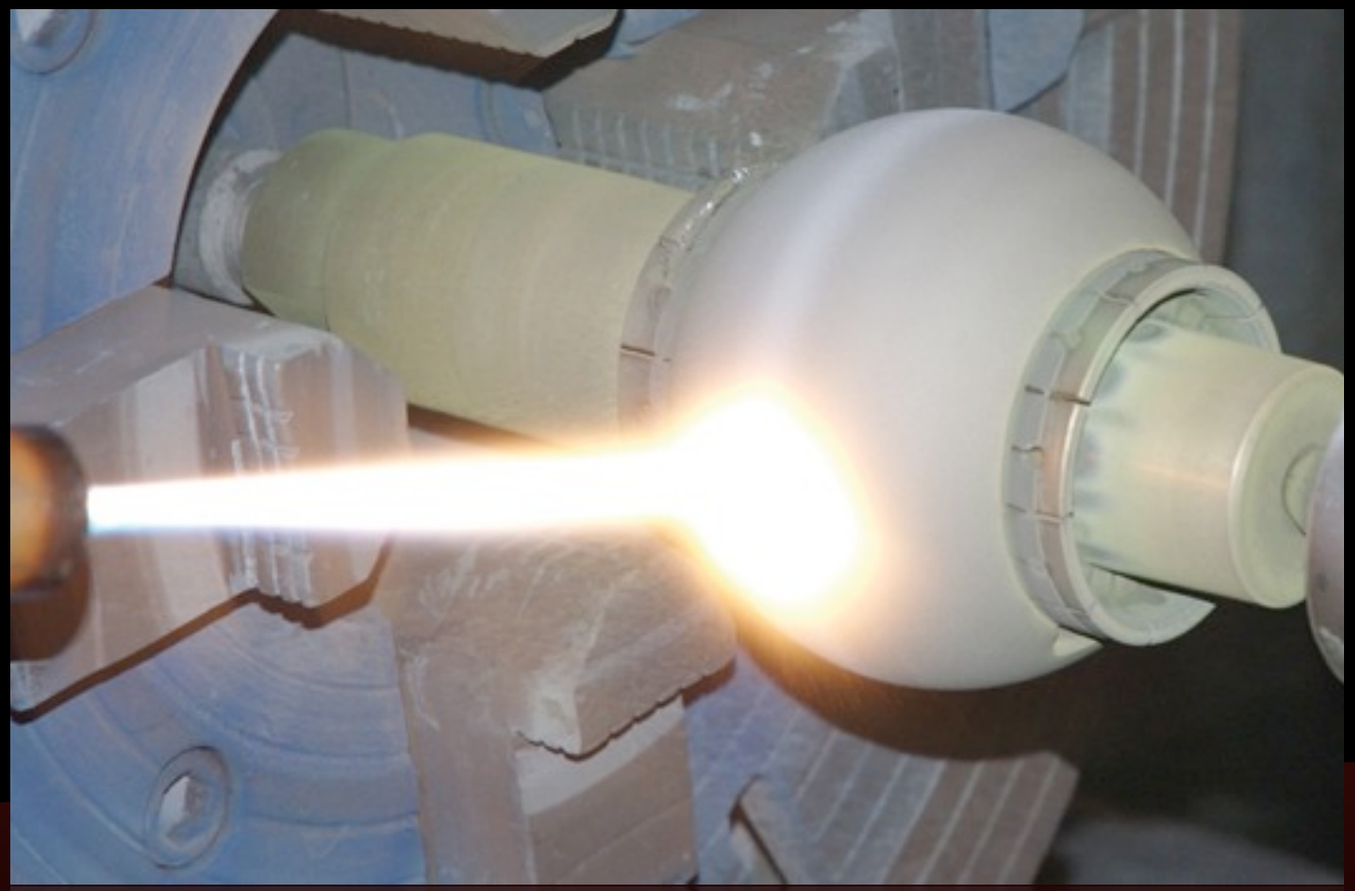
KEYSTONE

M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

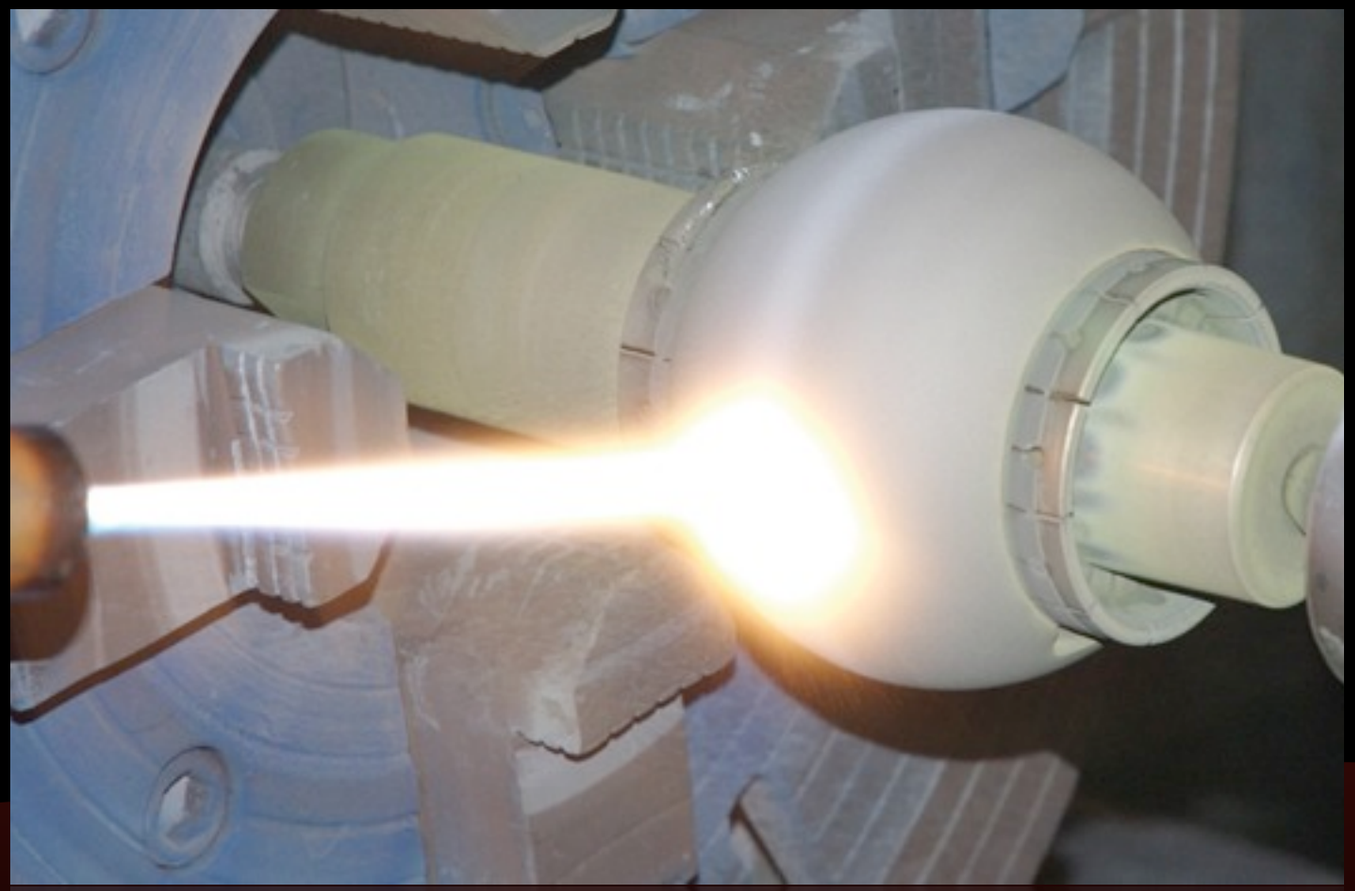


HVOF

M-CLASS
METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

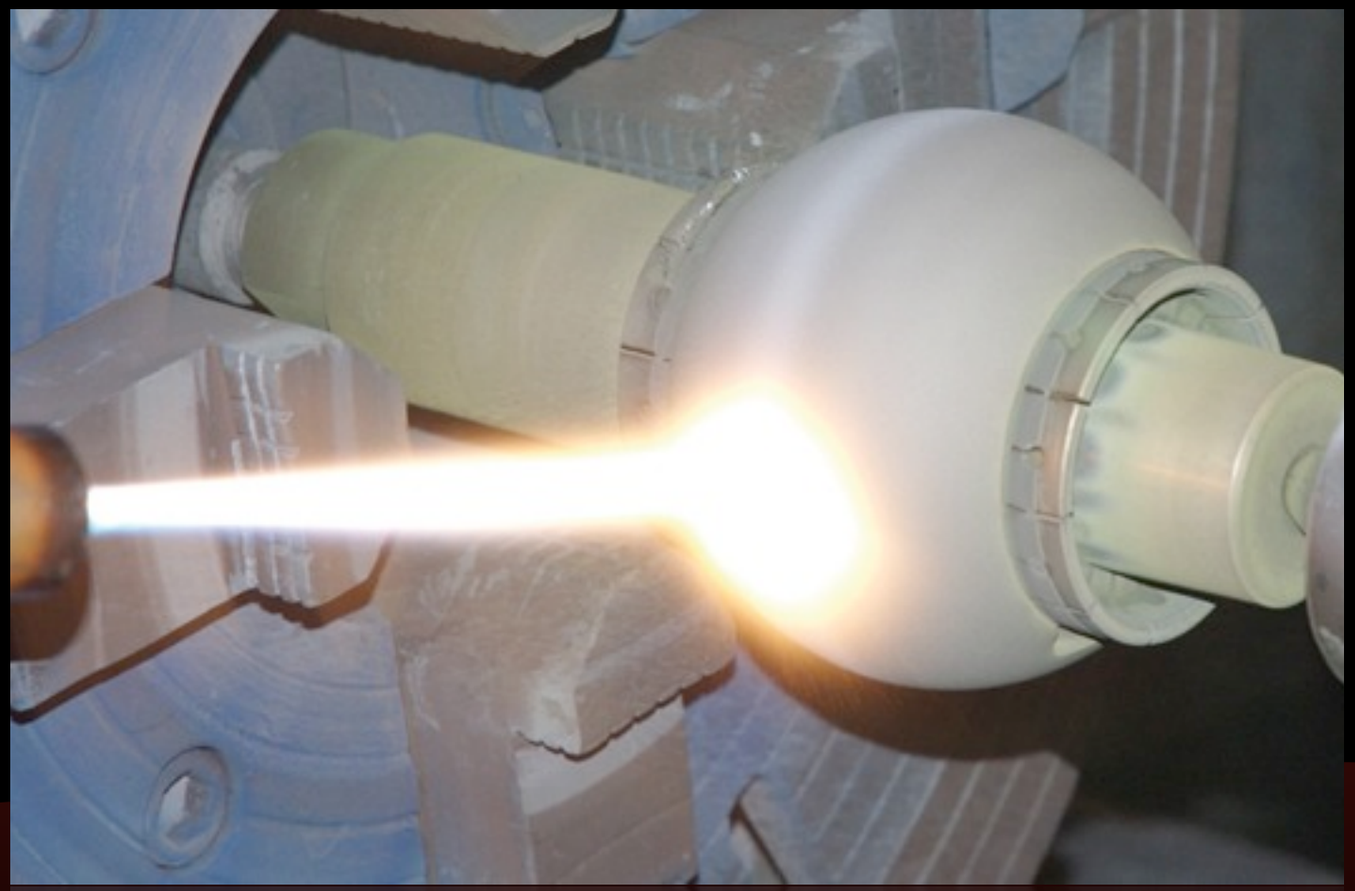


HVOF

Cheap

832-261-2400
tycovalves.com

KEYSTONE

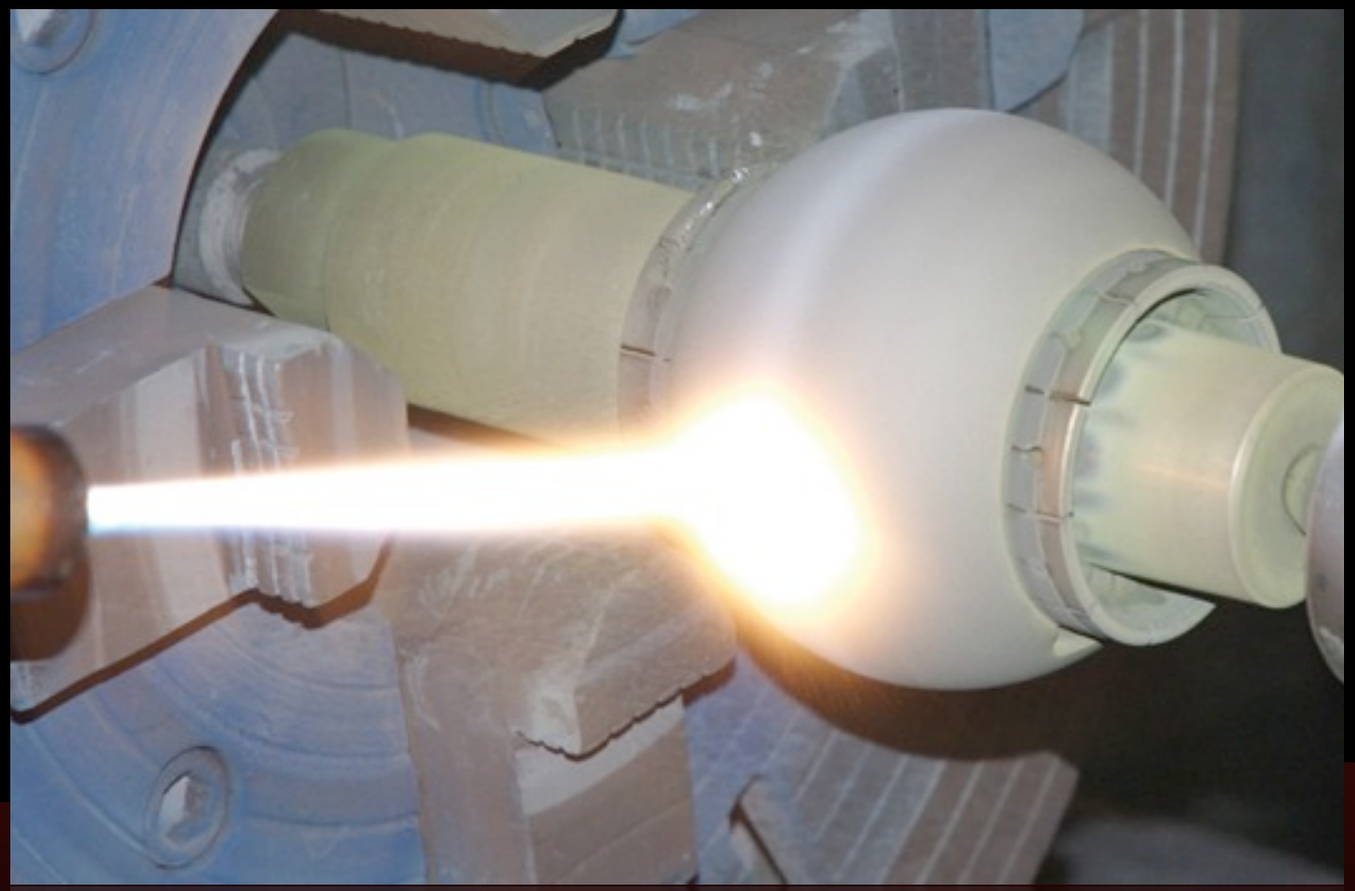


HVOF

Cheap

Cracks / Spalls

832-261-2400
tycovalves.com



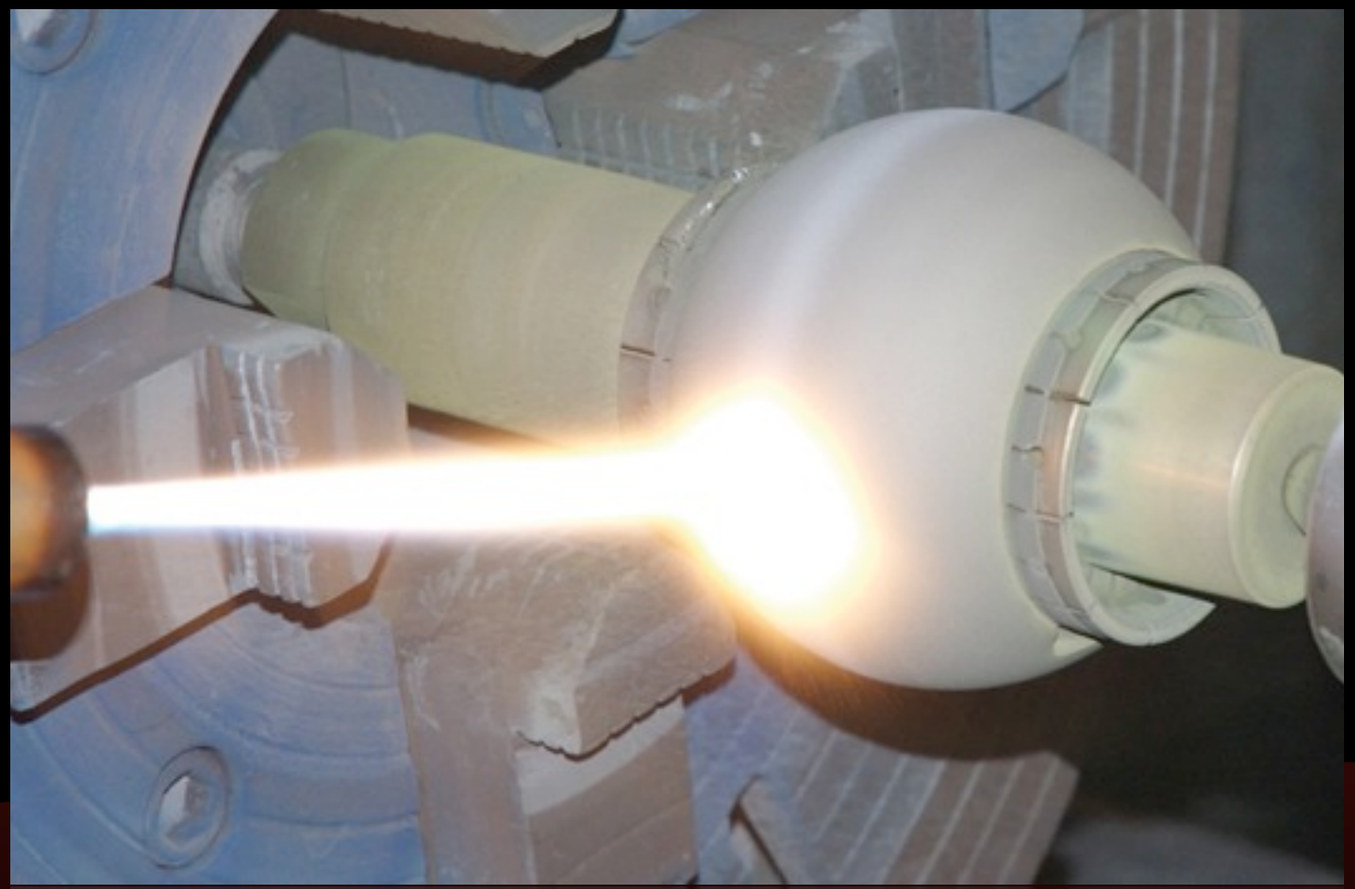
HVOF

Cheap

Cracks / Spalls

Uneven coating

832-261-2400
tycovalves.com



HVOF

Cheap

Cracks / Spalls

Uneven coating

No penetration of base metal

832-261-2400
tycovalves.com

KEYSTONE

M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

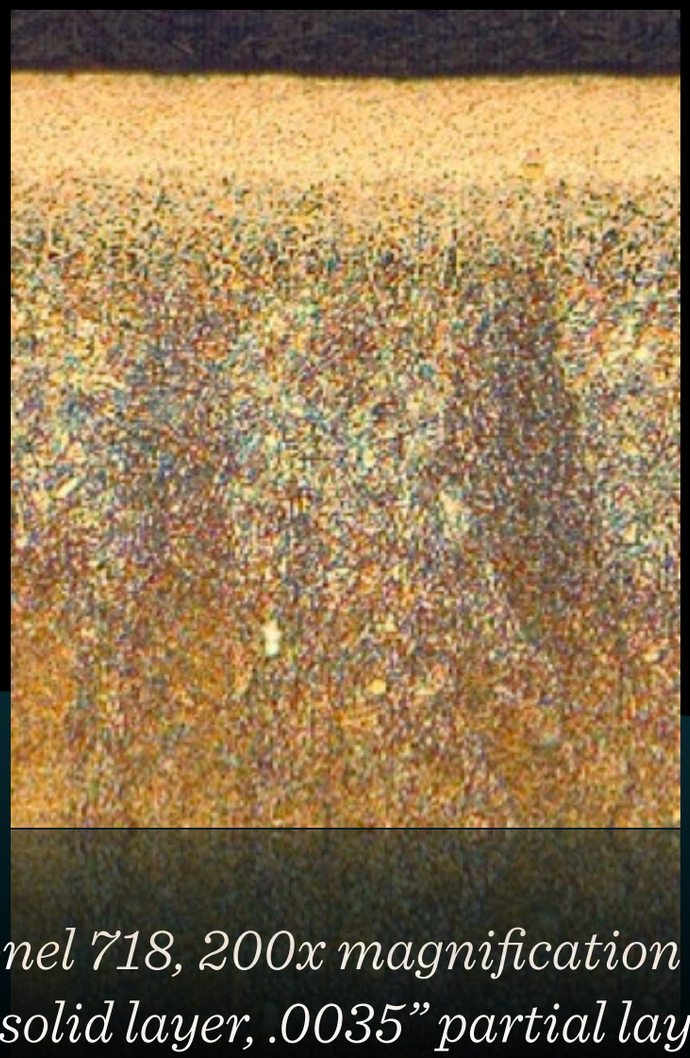
BORONIZING

M-CLASS
METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

BORONIZING

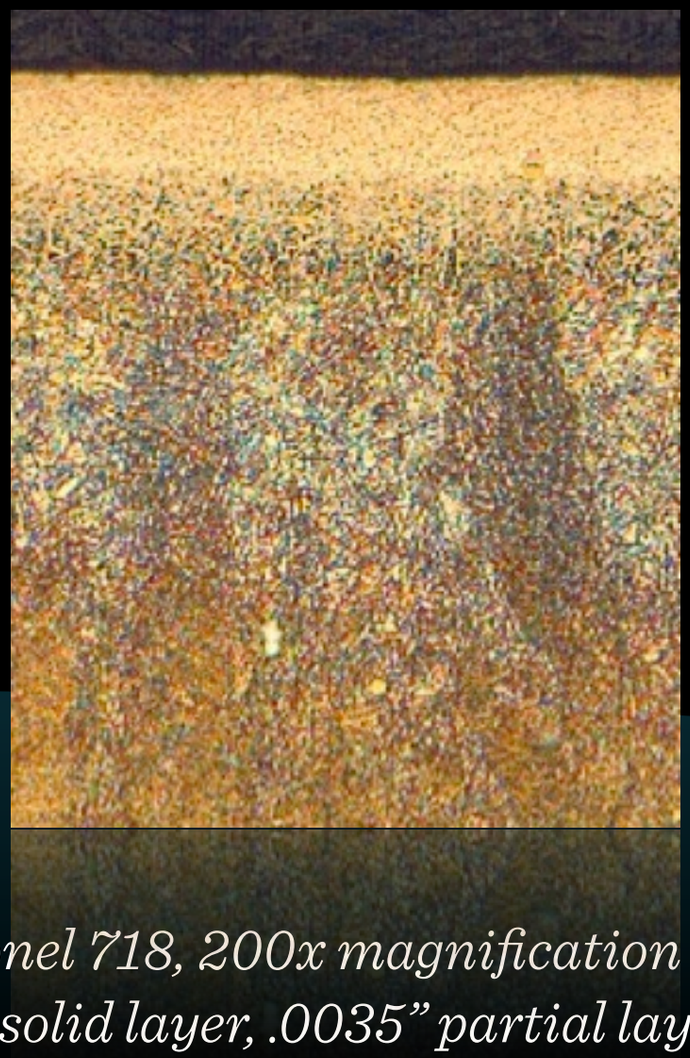


Inconel 718, 200x magnification
.0017” solid layer, .0035” partial layer

832-261-2400
tycovalves.com

BORONIZING

Thermo-chemical surface hardening process



Inconel 718, 200x magnification
.0017” solid layer, .0035” partial layer

M-CLASS
METAL-SEATED VALVES

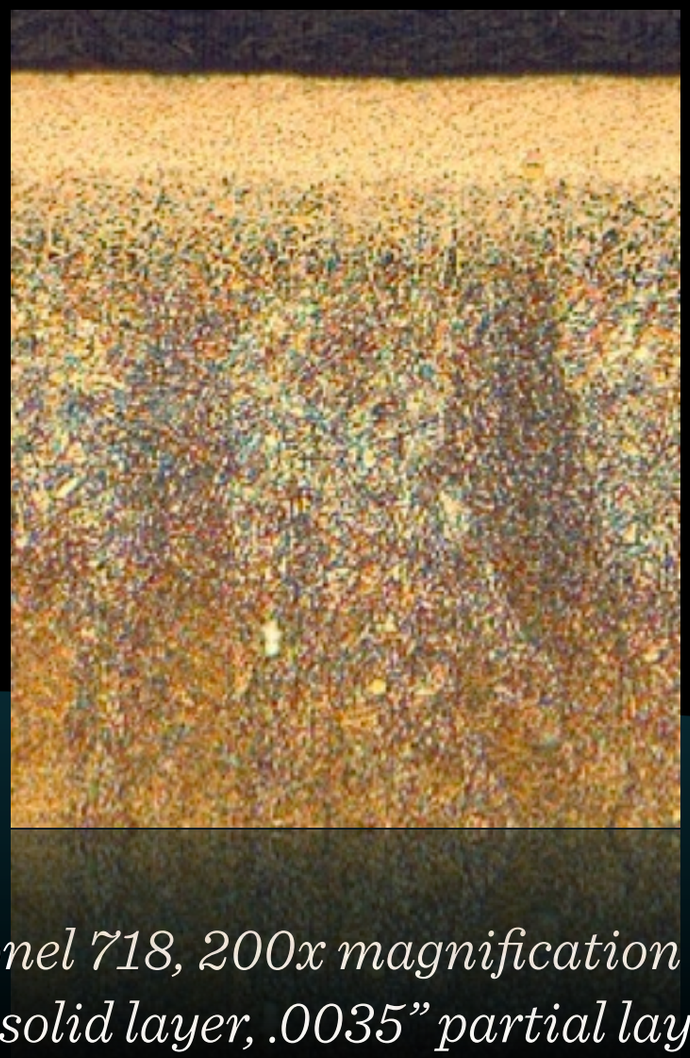
832-261-2400
tycovalves.com

KEYSTONE

BORONIZING

Thermo-chemical surface hardening process

Boron atoms are diffused into surface



Inconel 718, 200x magnification
.0017” solid layer, .0035” partial layer

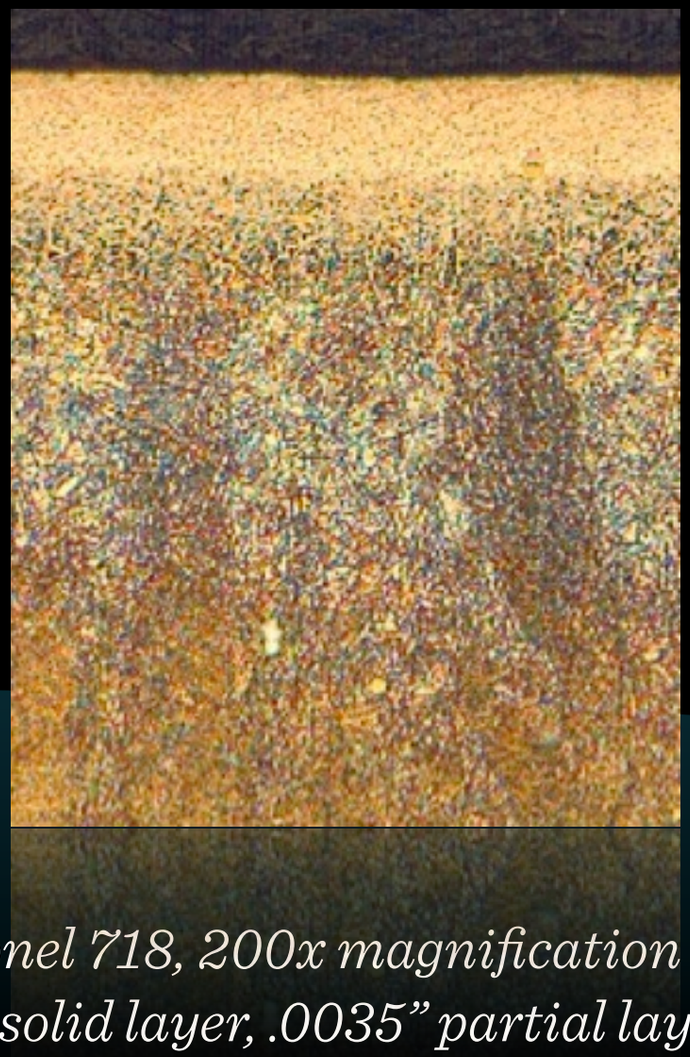
832-261-2400
tycovalves.com

BORONIZING

Thermo-chemical surface hardening process

Boron atoms are diffused into surface

Results in a case layer that is hard, slippery, and capable of performing at higher temperatures



Inconel 718, 200x magnification
.0017" solid layer, .0035" partial layer

M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

BORONIZING VS. HVOF

Comparison of trim set surface after 1 year in high temperature application

M-CLASS
METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

BORONIZING VS. HVOF

Comparison of trim set surface after 1 year in high temperature application

BORONIZING

832-261-2400
tycovalves.com

KEYSTONE

BORONIZING VS. HVOF

Comparison of trim set surface after 1 year in high temperature application

BORONIZING

HVOF

M-CLASS
METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

BORONIZING VS. HVOF

Comparison of trim set surface after 1 year in high temperature application

BORONIZING

HVOF

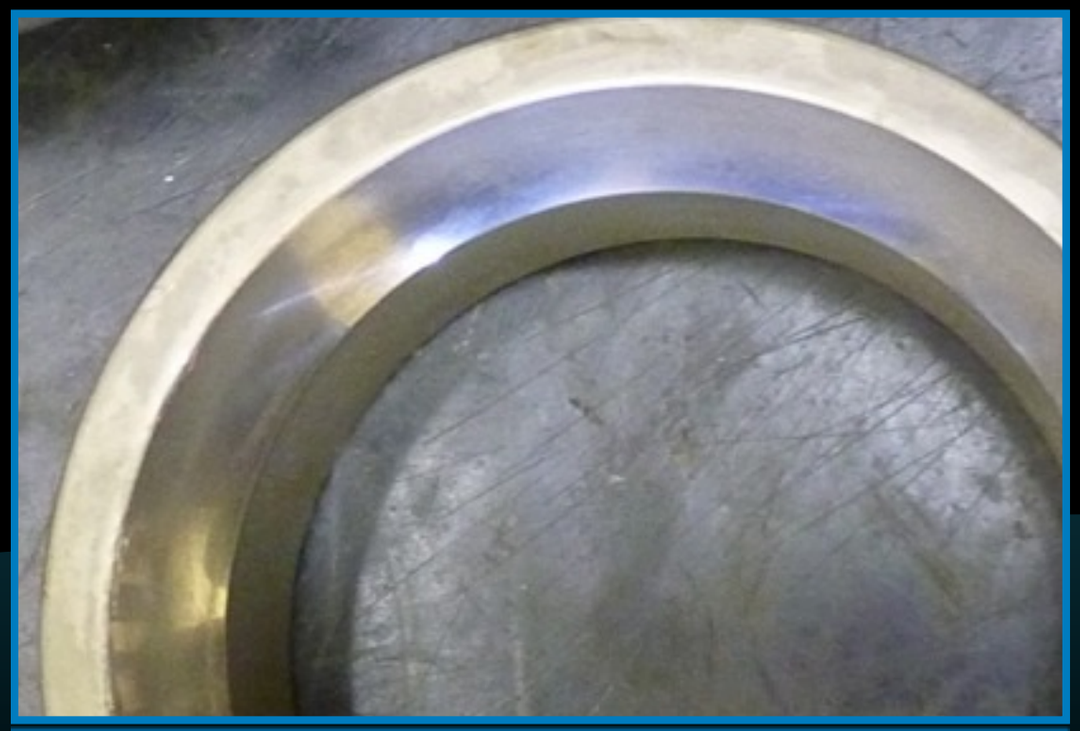
M-CLASS
METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

BORONIZING VS. HVOF

Comparison of trim set surface after 1 year in high temperature application



BORONIZING

HVOF

M-CLASS
METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

APPLICATION NOTE ON COATINGS

Common Coatings

Method of Application	HVOF		Fusion	Plasma	Diffused		Patented
Material	Chromium Carbide	Tungsten Carbide	Chromium Carbide	Chromuim Oxide	Nitride	Boride	Nano Titanium Dioxide
Uses	General Severe Service, Power, Slurry Mining, Chemical	Specialized Severe Service, Mining, Food Processing, Corrosive Chemical	Specialized Severe Service, Power, Thermal Shock, Extreme Temperature	Corrosive Service, Gold Mining	General Service, Bearings, Hot Gas	Specialized Severe Service, Power Corrosive Services, Thermal Shock	Corrosive Service, Gold Mining, Nickel Mining, High Pressure Acid Leach
Base Metals	Any	Any	300 Series Stainless Nickel Alloys	Any, Duplex SS & Ti Typical	Iron-Based Alloys	Nickel-Based Alloys	Any, Duplex SS & Ti Typical
Advantages	High Strain to Fracture, Erosion-Resistant, Extreme Temperature	Erosion-Resistant, Wear-Resistant	Erosion-Resistant, Non-Porous, Thermal Shock, Metallurgical Bond, Corrosion Resistant	Very Corrosion Resistant at lower temperatures	Inexpensive Metallurgical Bond	Extremely Hard, Metallurgical Bond, Non-Porous, Corrosion Resistant	Very Corrosion Resistant at low and high temperatures, superior wear to conventional ceramic coatings
Disadvantages	Some Porosity, Mechanical Bond	Some Porosity, Mechanical Bond, Thermal Cycling Can Produce Cracking	Not Suitable on 410 SS 17-4PH Carbon Steel, Expensive	Poor Thermal Shock, Poor Bond Strength, Porosity, & Cracking are Typical	Reduces Corrosion Resistance, Lower Abrasion & Wear Resistance than HVOF Coatings	Very Thin .001" Finished, Bore Size Limit 1.5"	Ceramic coatings are not as tough as HVOF cermets

832-261-2400
tycovalves.com

CUSTOMER ON COATINGS:

APPLICATION NOTE ON COATINGS

Common Coatings

Method of Application	HVOF		Fusion	Plasma	Diffused		Patented
Material	Chromium Carbide	Tungsten Carbide	Chromium Carbide	Chromuim Oxide	Nitride	Boride	Nano Titanium Dioxide
Uses	General Severe Service, Power, Slurry Mining, Chemical	Specialized Severe Service, Mining, Food Processing, Corrosive Chemical	Specialized Severe Service, Power, Thermal Shock, Extreme Temperature	Corrosive Service, Gold Mining	General Service, Bearings, Hot Gas	Specialized Severe Service, Power Corrosive Services, Thermal Shock	Corrosive Service, Gold Mining, Nickel Mining, High Pressure Acid Leach
Base Metals	Any	Any	300 Series Stainless Nickel Alloys	Any, Duplex SS & Ti Typical	Iron-Based Alloys	Nickel-Based Alloys	Any, Duplex SS & Ti Typical
Advantages	High Strain to Fracture, Erosion-Resistant, Extreme Temperature	Erosion-Resistant, Wear-Resistant	Erosion-Resistant, Non-Porous, Thermal Shock, Metallurgical Bond, Corrosion Resistant	Very Corrosion Resistant at lower temperatures	Inexpensive Metallurgical Bond	Extremely Hard, Metallurgical Bond, Non-Porous, Corrosion Resistant	Very Corrosion Resistant at low and high temperatures, superior wear to conventional ceramic coatings
Disadvantages	Some Porosity, Mechanical Bond	Some Porosity, Mechanical Bond, Thermal Cycling Can Produce Cracking	Not Suitable on 410 SS 17-4PH Carbon Steel, Expensive	Poor Thermal Shock, Poor Bond Strength, Porosity, & Cracking are Typical	Reduces Corrosion Resistance, Lower Abrasion & Wear Resistance than HVOF Coatings	Very Thin .001" Finished, Bore Size Limit 1.5"	Ceramic coatings are not as tough as HVOF cermets

832-261-2400
tycovalves.com

CUSTOMER ON COATINGS:

Method of Application	HVOF	
Material	Chromium Carbide	Tungsten Carbide
Uses	General Severe Service, Power, Slurry Mining, Chemical	Specialized Severe Service, Mining, Food Processing, Corrosive Chemical
Base Metals	Any	Any
Advantages	High Strain to Fracture, Erosion-Resistant, Extreme Temperature	Erosion-Resistant, Wear-Resistant
Disadvantages	Some Porosity, Mechanical Bond	Some Porosity, Mechanical Bond, Thermal Cycling Can Produce Cracking

	Diffused		Patented
m Oxide	Nitride	Boride	Nano Titanium Dioxide
e Gold	General Service, Bearings, Hot Gas	Specialized Severe Service, Power Corrosive Services, Thermal Shock	Corrosive Service, Gold Mining, Nickel Mining, High Pressure Acid Leach
lex SS cal	Iron-Based Alloys	Nickel-Based Alloys	Any, Duplex SS & Ti Typical
rosion tures	Inexpensive Metallurgical Bond	Extremely Hard, Metallurgical Bond, Non-Porous, Corrosion Resistant	Very Corrosion Resistant at low and high temperatures, superior wear to conventional ceramic coatings
rmal oor ength, & are	Reduces Corrosion Resistance, Lower Abrasion & Wear Resistance than HVOF Coatings	Very Thin .001" Finished, Bore Size Limit 1.5"	Ceramic coatings are not as tough as HVOF cermets

M-CLASS
METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

CUSTOMER ON COATINGS:

Method of Application	HVOF	
Material	Chromium Carbide	Tungsten Carbide
Uses	General Severe Service, Power, Slurry Mining, Chemical	Specialized Severe Service, Mining, Food Processing, Corrosive Chemical
Base Metals	Any	Any
Advantages	High Strain to Fracture, Erosion-Resistant, Extreme Temperature	Erosion-Resistant, Wear-Resistant
Disadvantages	Some Porosity, Mechanical Bond	Some Porosity, Mechanical Bond, Thermal Cycling Can Produce Cracking

	Diffused		Patented
m Oxide	Nitride	Boride	Nano Titanium Dioxide
e Gold	General Service, Bearings, Hot Gas	Specialized Severe Service, Power Corrosive Services, Thermal Shock	Corrosive Service, Gold Mining, Nickel Mining, High Pressure Acid Leach
lex SS cal	Iron-Based Alloys	Nickel-Based Alloys	Any, Duplex SS & Ti Typical
rosion t tures	Inexpensive Metallurgical Bond	Extremely Hard, Metallurgical Bond, Non-Porous, Corrosion Resistant	Very Corrosion Resistant at low and high temperatures, superior wear to conventional ceramic coatings
rmal oor ength, & are	Reduces Corrosion Resistance, Lower Abrasion & Wear Resistance than HVOF Coatings	Very Thin .001" Finished, Bore Size Limit 1.5"	Ceramic coatings are not as tough as HVOF cermets

M-CLASS
METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

CUSTOMER ON COATINGS:

Method of Application	HVOF		Diffused		Patented
Material	Chromium Carbide	Tungsten Carbide	m Oxide	Nitride	Boride	Nano Titanium Dioxide
Uses	General Severe Service, Power, Slurry Mining, Chemical	Specialized Severe Service, Mining, Food Processing, Corrosive Chemical	e Gold	General Service, Bearings, Hot Gas	Specialized Severe Service, Power Corrosive Services, Thermal Shock	Corrosive Service, Gold Mining, Nickel Mining, High Pressure Acid Leach
Base Metals	Any	Any	plex SS cal	Iron-Based Alloys	Nickel-Based Alloys	Any, Duplex SS & Ti Typical
Advantages	High Strain to Fracture, Erosion-Resistant, Extreme Temperature	Erosion-Resistant, Wear-Resistant	rosion t tures	Inexpensive Metallurgical Bond	Extremely Hard, Metallurgical Bond, Non-Porous, Corrosion Resistant	Very Corrosion Resistant at low and high temperatures, superior wear to conventional ceramic coatings
Disadvantages	Some Porosity, Mechanical Bond	Some Porosity, Mechanical Bond, Thermal Cycling Can Produce Cracking	rmal oor ength, & are	Reduces Corrosion Resistance, Lower Abrasion & Wear Resistance than HVOF Coatings	Very Thin .001" Finished, Bore Size Limit 1.5"	Ceramic coatings are not as tough as HVOF cermets

M-CLASS
METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

CUSTOMER ON COATINGS:

Method of Application	HVOF	
Material	Chromium Carbide	Tungsten Carbide
Uses	General Severe Service, Power, Slurry Mining, Chemical	Specialized Severe Service, Mining, Food Processing, Corrosive Chemical
Base Metals	Any	Any
Advantages	High Strain to Fracture, Erosion-Resistant, Extreme Temperature	Erosion-Resistant, Wear-Resistant
Disadvantages	Some Porosity, Mechanical Bond	Some Porosity, Mechanical Bond, Thermal Cycling Can Produce Cracking

	Diffused		Patented
m Oxide	Nitride	Boride	Nano Titanium Dioxide
e Gold	General Service, Bearings, Hot Gas	Specialized Severe Service, Power Corrosive Services, Thermal Shock	Corrosive Service, Gold Mining, Nickel Mining, High Pressure Acid Leach
lex SS cal	Iron-Based Alloys	Nickel-Based Alloys	Any, Duplex SS & Ti Typical
rosion tures	Inexpensive Metallurgical Bond	Extremely Hard, Metallurgical Bond, Non-Porous, Corrosion Resistant	Very Corrosion Resistant at low and high temperatures, superior wear to conventional ceramic coatings
rmal oor ength, & are	Reduces Corrosion Resistance, Lower Abrasion & Wear Resistance than HVOF Coatings	Very Thin .001" Finished, Bore Size Limit 1.5"	Ceramic coatings are not as tough as HVOF cermets

832-261-2400
tycovalves.com

CUSTOMER ON COATINGS:

APPLICATION NOTE ON COATINGS

Common Coatings

Method of Application	HVOF		Fusion	Plasma	Diffused		Patented
Material	Chromium Carbide	Tungsten Carbide	Chromium Carbide	Chromuim Oxide	Nitride	Boride	Nano Titanium Dioxide
Uses	General Severe Service, Power, Slurry Mining, Chemical	Specialized Severe Service, Mining, Food Processing, Corrosive Chemical	Specialized Severe Service, Power, Thermal Shock, Extreme Temperature	Corrosive Service, Gold Mining	General Service, Bearings, Hot Gas	Specialized Severe Service, Power Corrosive Services, Thermal Shock	Corrosive Service, Gold Mining, Nickel Mining, High Pressure Acid Leach
Base Metals	Any	Any	300 Series Stainless Nickel Alloys	Any, Duplex SS & Ti Typical	Iron-Based Alloys	Nickel-Based Alloys	Any, Duplex SS & Ti Typical
Advantages	High Strain to Fracture, Erosion-Resistant, Extreme Temperature	Erosion-Resistant, Wear-Resistant	Erosion-Resistant, Non-Porous, Thermal Shock, Metallurgical Bond, Corrosion Resistant	Very Corrosion Resistant at lower temperatures	Inexpensive Metallurgical Bond	Extremely Hard, Metallurgical Bond, Non-Porous, Corrosion Resistant	Very Corrosion Resistant at low and high temperatures, superior wear to conventional ceramic coatings
Disadvantages	Some Porosity, Mechanical Bond	Some Porosity, Mechanical Bond, Thermal Cycling Can Produce Cracking	Not Suitable on 410 SS 17-4PH Carbon Steel, Expensive	Poor Thermal Shock, Poor Bond Strength, Porosity, & Cracking are Typical	Reduces Corrosion Resistance, Lower Abrasion & Wear Resistance than HVOF Coatings	Very Thin .001" Finished, Bore Size Limit 1.5"	Ceramic coatings are not as tough as HVOF cermets

832-261-2400
tycovalves.com

CUSTOMER ON COATINGS:

APPLICATION NOTE ON COATINGS

Common Coatings

Method of Application	HVOF		Fusion
Material	Chromium Carbide	Tungsten Carbide	Chromi Carbide
Uses	General Severe Service, Power, Slurry Mining, Chemical	Specialized Severe Service, Mining, Food Processing, Corrosive Chemical	Speciali Severe Power, Shock, Temper
Base Metals	Any	Any	300 Ser Stainles Alloys
Advantages	High Strain to Fracture, Erosion-Resistant, Extreme Temperature	Erosion-Resistant, Wear-Resistant	Erosion Resistar Non-Po Therma Metallu Bond, C Resistar
Disadvantages	Some Porosity, Mechanical Bond	Some Porosity, Mechanical Bond, Thermal Cycling Can Produce Cracking	Not Sui 410 SS Carbon Expensi

Method of Application	Diffused	
Material	Nitride	Boride
Uses	General Service, Bearings, Hot Gas	Specialized Severe Service, Power Corrosive Services, Thermal Shock
Base Metals	Iron-Based Alloys	Nickel-Based Alloys
Advantages	Inexpensive Metallurgical Bond	Extremely Hard, Metallurgical Bond, Non-Porous, Corrosion Resistant
Disadvantages	Reduces Corrosion Resistance, Lower Abrasion & Wear Resistance than HVOF Coatings	Very Thin .001" Finished, Bore Size Limit 1.5"

M-CLASS
METAL-SEATED VALVES

tycovalves.com

KEYSTONE

CUSTOMER ON COATINGS:

APPLICATION NOTE ON COATINGS

Common Coatings

Method of Application	HVOF		Fusion
Material	Chromium Carbide	Tungsten Carbide	Chromi Carbide
Uses	General Severe Service, Power, Slurry Mining, Chemical	Specialized Severe Service, Mining, Food Processing, Corrosive Chemical	Speciali Severe Power, Shock, Temper
Base Metals	Any	Any	300 Ser Stainles Alloys
Advantages	High Strain to Fracture, Erosion-Resistant, Extreme Temperature	Erosion-Resistant, Wear-Resistant	Erosion Resistar Non-Po Therma Metallu Bond, C Resistar
Disadvantages	Some Porosity, Mechanical Bond	Some Porosity, Mechanical Bond, Thermal Cycling Can Produce Cracking	Not Sui 410 SS Carbon Expensi

Method of Application	Diffused	
Material	Nitride	Boride
Uses	General Servi e, Bearings, Ho Gas	Specialized Severe Service, Power Corrosive Services, Thermal Shock
Base Metals	Iron-Based Alloys	Nickel-Based Alloys
Advantages	Inexpensive Metallurgical Bond	Extremely Hard, Metallurgical Bond, Non-Porous, Corrosion Resistant
Disadvantages	Reduces Corrosion Resistance, Lower Abrasion & Wear Resistance than HVOF Coatings	Very Thin .001" Finished, Bore Size Limit 1.5"

M-CLASS
METAL-SEATED VALVES

tycovalves.com

KEYSTONE

CUSTOMER ON COATINGS:

APPLICATION NOTE ON COATINGS

Common Coatings

Method of Application	HVOF		Fusion
Material	Chromium Carbide	Tungsten Carbide	Chromi Carbide
Uses	General Severe Service, Power, Slurry Mining, Chemical	Specialized Severe Service, Mining, Food Processing, Corrosive Chemical	Speciali Severe Power, Shock, Temper
Base Metals	Any	Any	300 Ser Stainles Alloys
Advantages	High Strain to Fracture, Erosion-Resistant, Extreme Temperature	Erosion-Resistant, Wear-Resistant	Erosion Resistar Non-Po Therma Metallu Bond, C Resistar
Disadvantages	Some Porosity, Mechanical Bond	Some Porosity, Mechanical Bond, Thermal Cycling Can Produce Cracking	Not Sui 410 SS Carbon Expensi

Method of Application	Diffused	
Material	Nitride	Boride
Uses	General Service, Bearings, Hot Gas	Specialized Severe Service, Power Corrosive Services, Thermal Shock
Base Metals	Iron-Based Alloys	Nickel-Based Alloys
Advantages	Inexpensive Metallurgica Bond	Extremely Hard, Metallurgical Bond, Non-Porous, Corrosion Resistant
Disadvantages	Reduces Corrosion Resistance, Lower Abrasion & Wear Resistance than HVOF Coatings	Very Thin .001" Finished, Bore Size Limit 1.5"

M-CLASS
METAL-SEATED VALVES

tycovalves.com

KEYSTONE

CUSTOMER ON COATINGS:

APPLICATION NOTE ON COATINGS

Common Coatings

Method of Application	HVOF		Fusion
Material	Chromium Carbide	Tungsten Carbide	Chromi Carbide
Uses	General Severe Service, Power, Slurry Mining, Chemical	Specialized Severe Service, Mining, Food Processing, Corrosive Chemical	Speciali Severe Power, Shock, Temper
Base Metals	Any	Any	300 Ser Stainles Alloys
Advantages	High Strain to Fracture, Erosion-Resistant, Extreme Temperature	Erosion-Resistant, Wear-Resistant	Erosion Resistar Non-Po Therma Metallu Bond, C Resistar
Disadvantages	Some Porosity, Mechanical Bond	Some Porosity, Mechanical Bond, Thermal Cycling Can Produce Cracking	Not Sui 410 SS Carbon Expensi

Method of Application	Diffused	
Material	Nitride	Boride
Uses	General Service, Bearings, Hot Gas	Specialized Severe Service, Power Corrosive Services, Thermal Shock
Base Metals	Iron-Based Alloys	Nickel-Based Alloys
Advantages	Inexpensive Metallurgical Bond	Extremely Hard, Metallurgical Bond, Non-Porous, Corrosion Resistant
Disadvantages	Reduces Corrosion Resistance, Lower Abrasion & Wear Resistance than HVOF Coatings	Very Thin .001" Finished, Bore Size Limit 1.5"

M-CLASS
METAL-SEATED VALVES

tycovalves.com

KEYSTONE

M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

PROPRIETARY BORONIZING PROCESS

M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

PROPRIETARY BORONIZING PROCESS

0.005” to 0.008” depth

M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

PROPRIETARY BORONIZING PROCESS

0.005” to 0.008” depth

No size limit

M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

COMPETITION VS. M-CLASS

TRIM HARDENING	HVOF	Boronizing
ACTUATOR MOUNTING		
SEAT DESIGN		
BALL DESIGN		
STEM SEALING		
EXOTIC ALLOYS		
BALL/SEAT SEALING		
LEAD TIMES		

832-261-2400
tycovalves.com

COMPETITION VS. M-CLASS

TRIM HARDENING	HVOF	Boronizing
ACTUATOR MOUNTING		
SEAT DESIGN		
BALL DESIGN		
STEM SEALING		
EXOTIC ALLOYS		
BALL/SEAT SEALING		
LEAD TIMES		

832-261-2400
tycovalves.com

COMPETITION VS. M-CLASS

TRIM HARDENING	HVOF	Boronizing
ACTUATOR MOUNTING	Bent Bracket	Tripod Mount
SEAT DESIGN		
BALL DESIGN		
STEM SEALING		
EXOTIC ALLOYS		
BALL/SEAT SEALING		
LEAD TIMES		

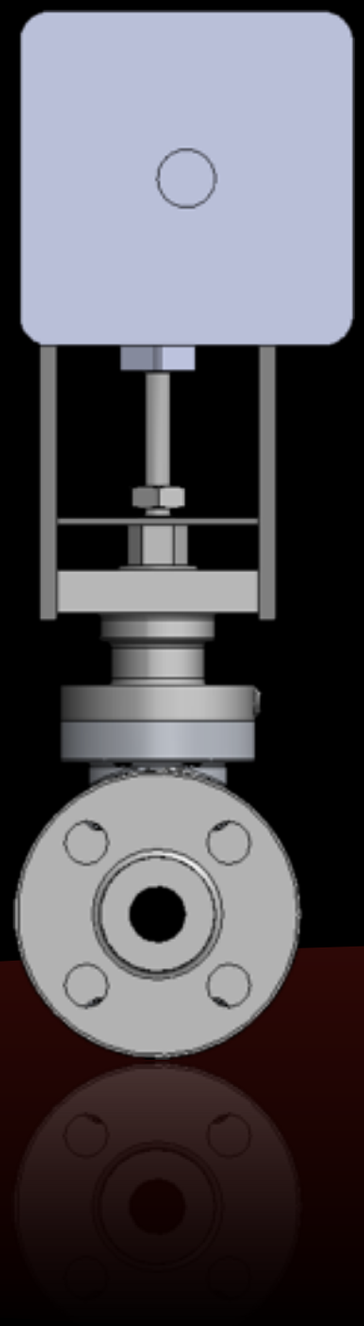
832-261-2400
tycovalves.com

M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE



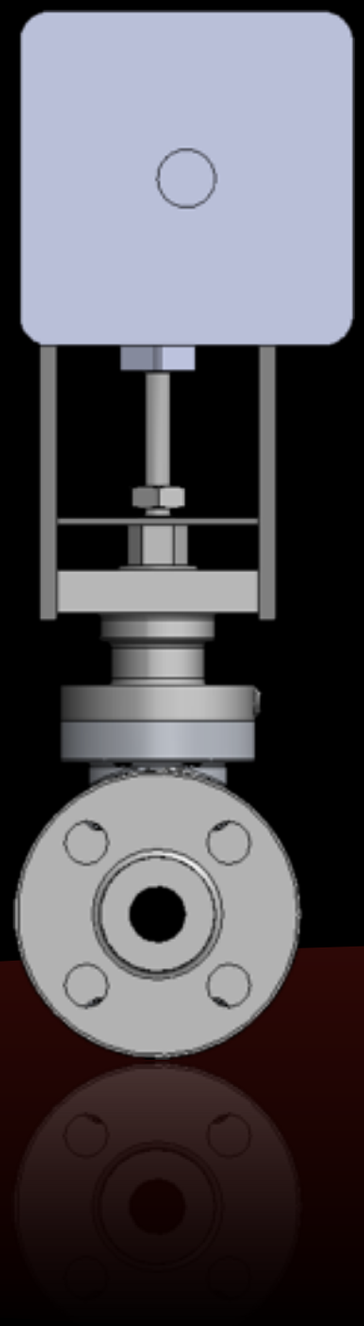
BENT BRACKET

M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

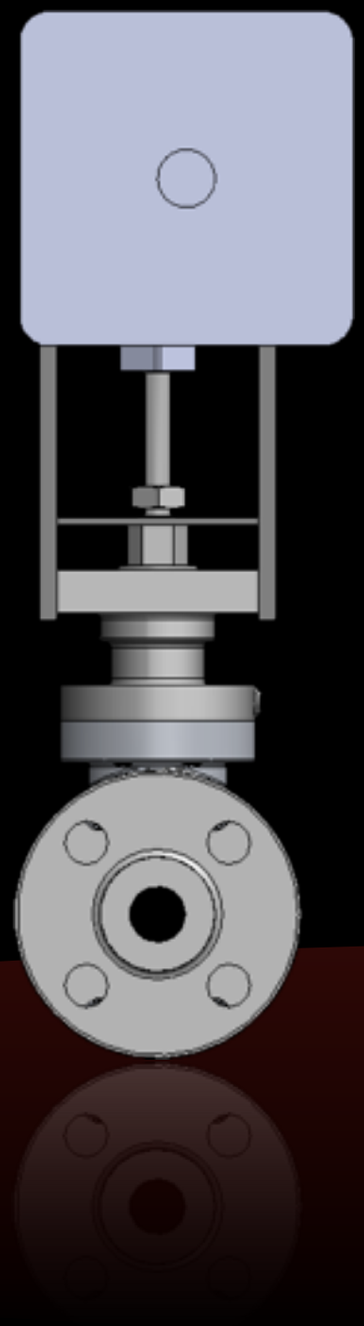


BENT BRACKET

Not accurate

832-261-2400
tycovalves.com

KEYSTONE



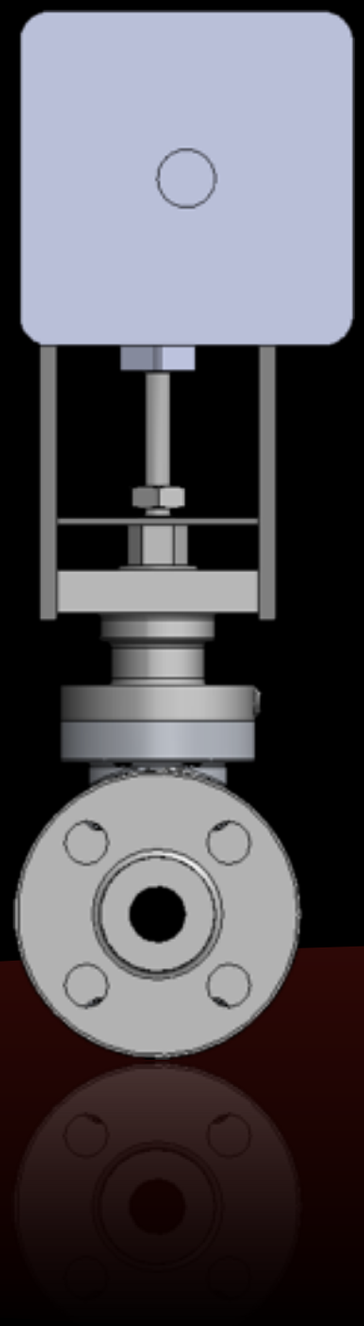
BENT BRACKET

Not accurate

Access to packing adjustments is limited

832-261-2400
tycovalves.com

KEYSTONE



BENT BRACKET

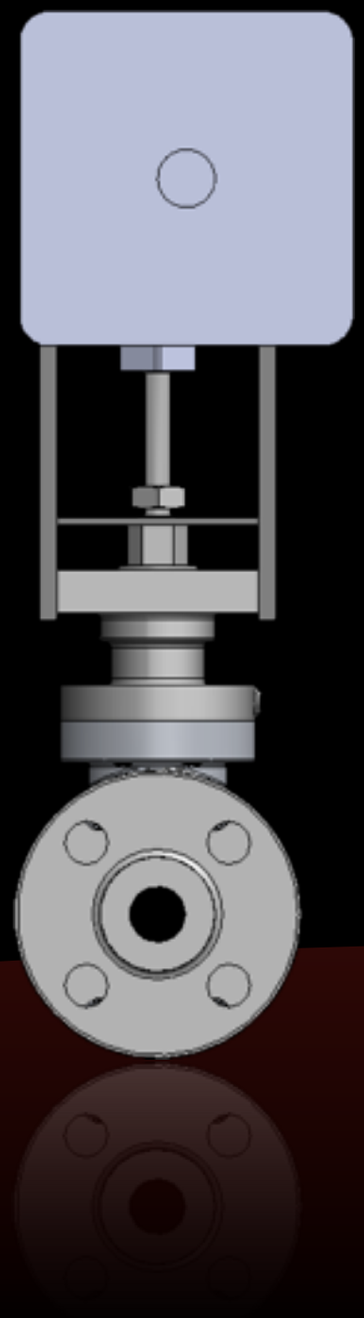
Not accurate

Access to packing adjustments is limited

No ISO 5211 mounting pad

832-261-2400
tycovalves.com

KEYSTONE



BENT BRACKET

Not accurate

Access to packing adjustments is limited

No ISO 5211 mounting pad

Bracket is weak in certain orientations

832-261-2400
tycovalves.com

KEYSTONE

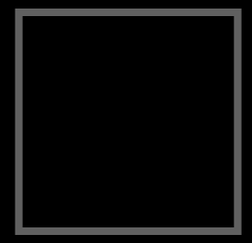
M-CLASS

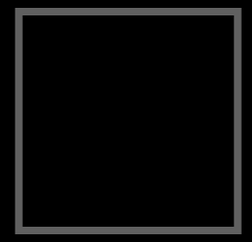
METAL-SEATED VALVES

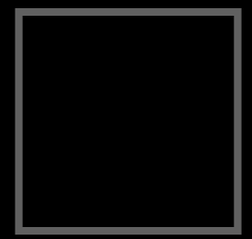
832-261-2400
tycovalves.com

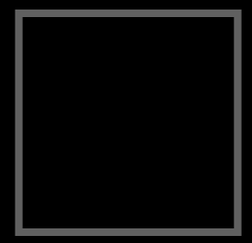
KEYSTONE

BRACKET







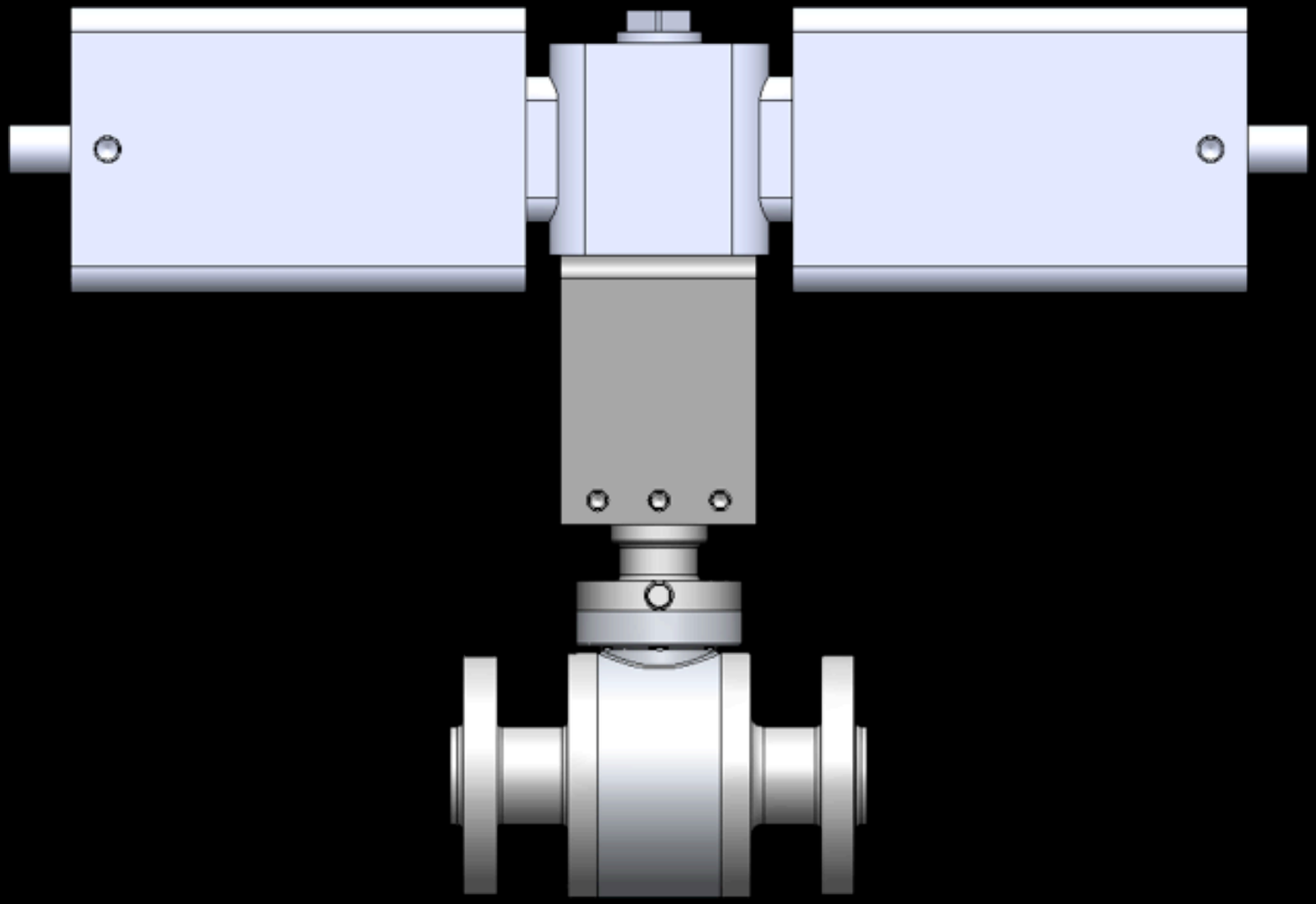


M-CLASS
METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

BRACKET

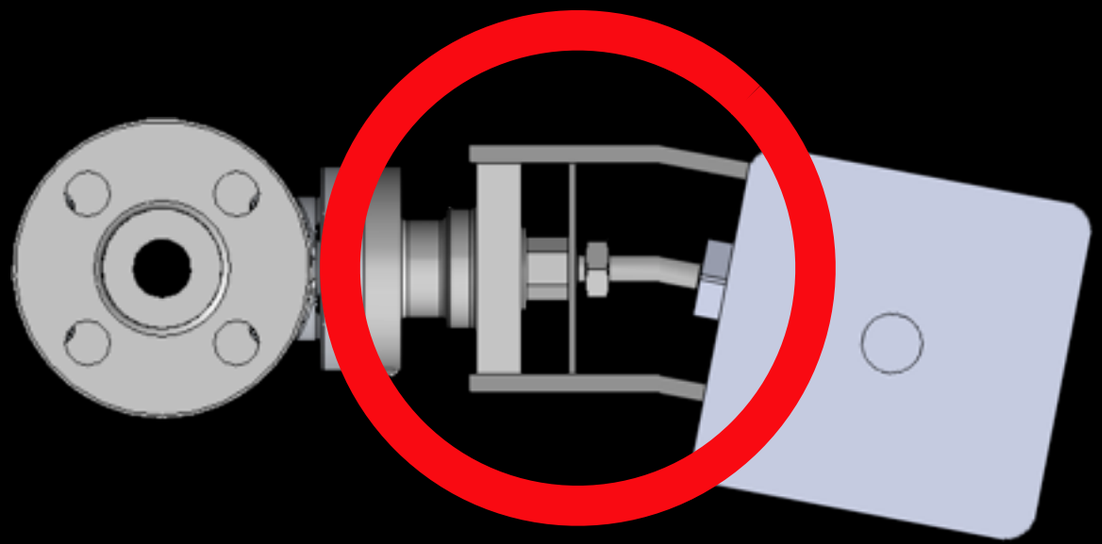


M-CLASS
METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

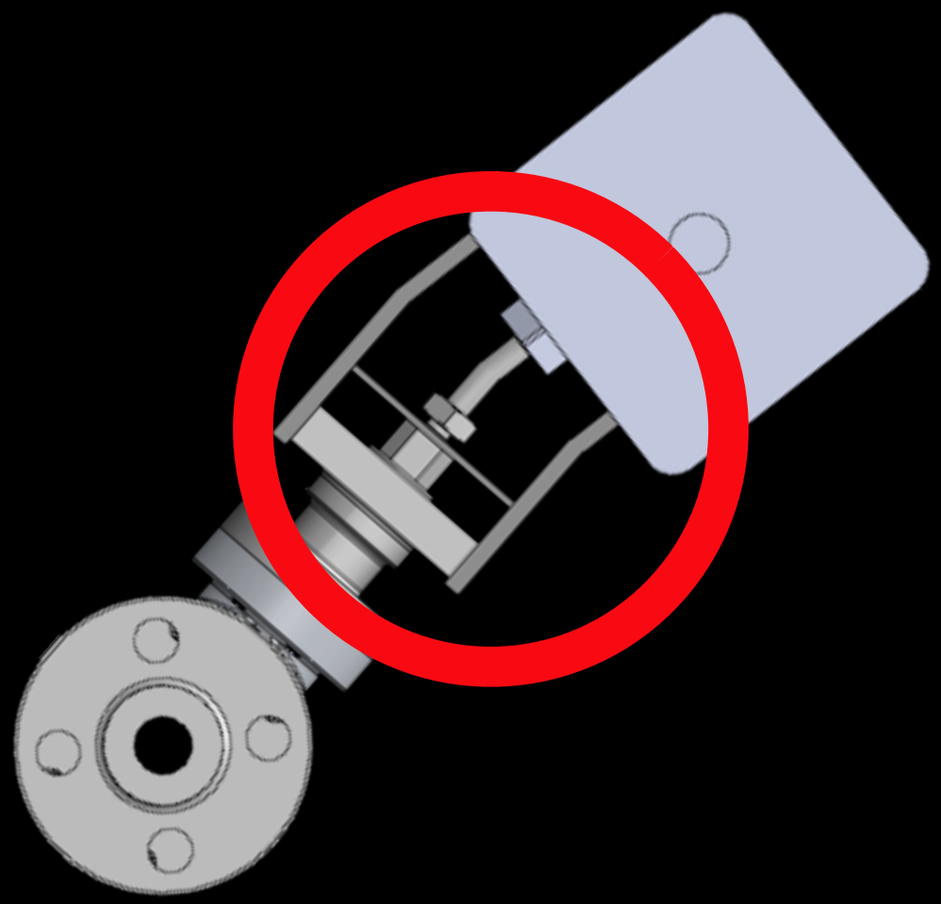
BRACKET

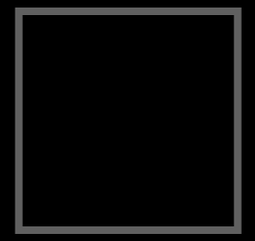


832-261-2400
tycovalves.com

KEYSTONE

BRACKET



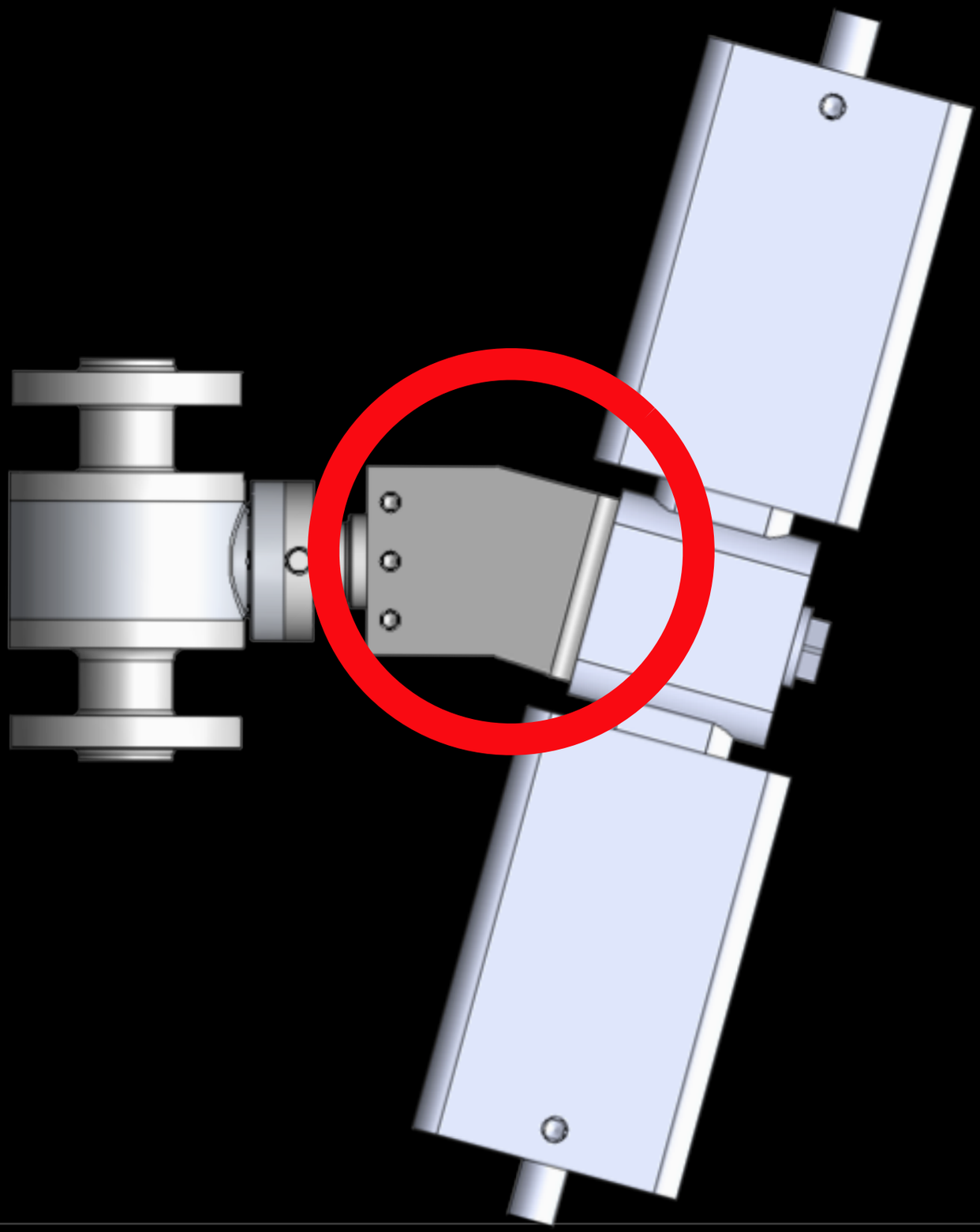


M-CLASS
METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

BRACKET



M-CLASS
METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

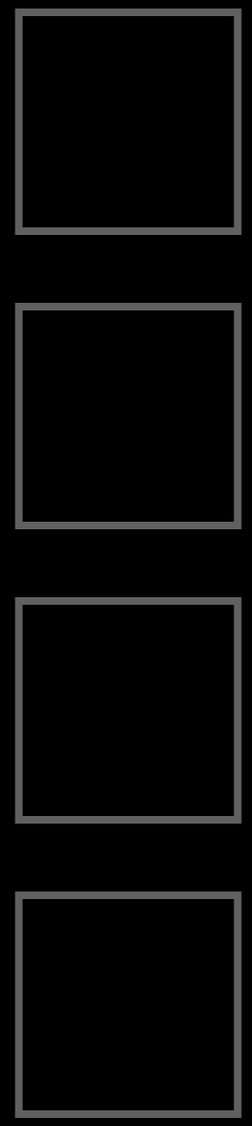
M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

TRIPOD MOUNT

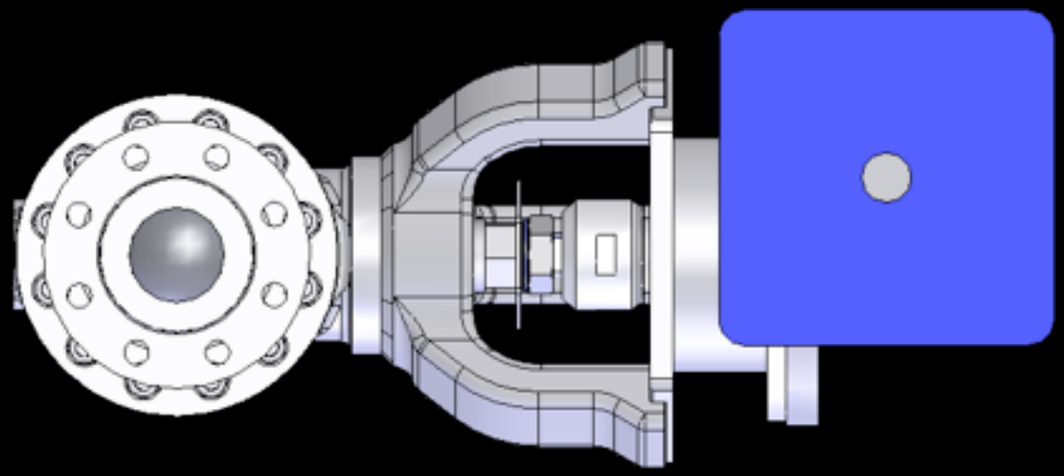


M-CLASS
METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

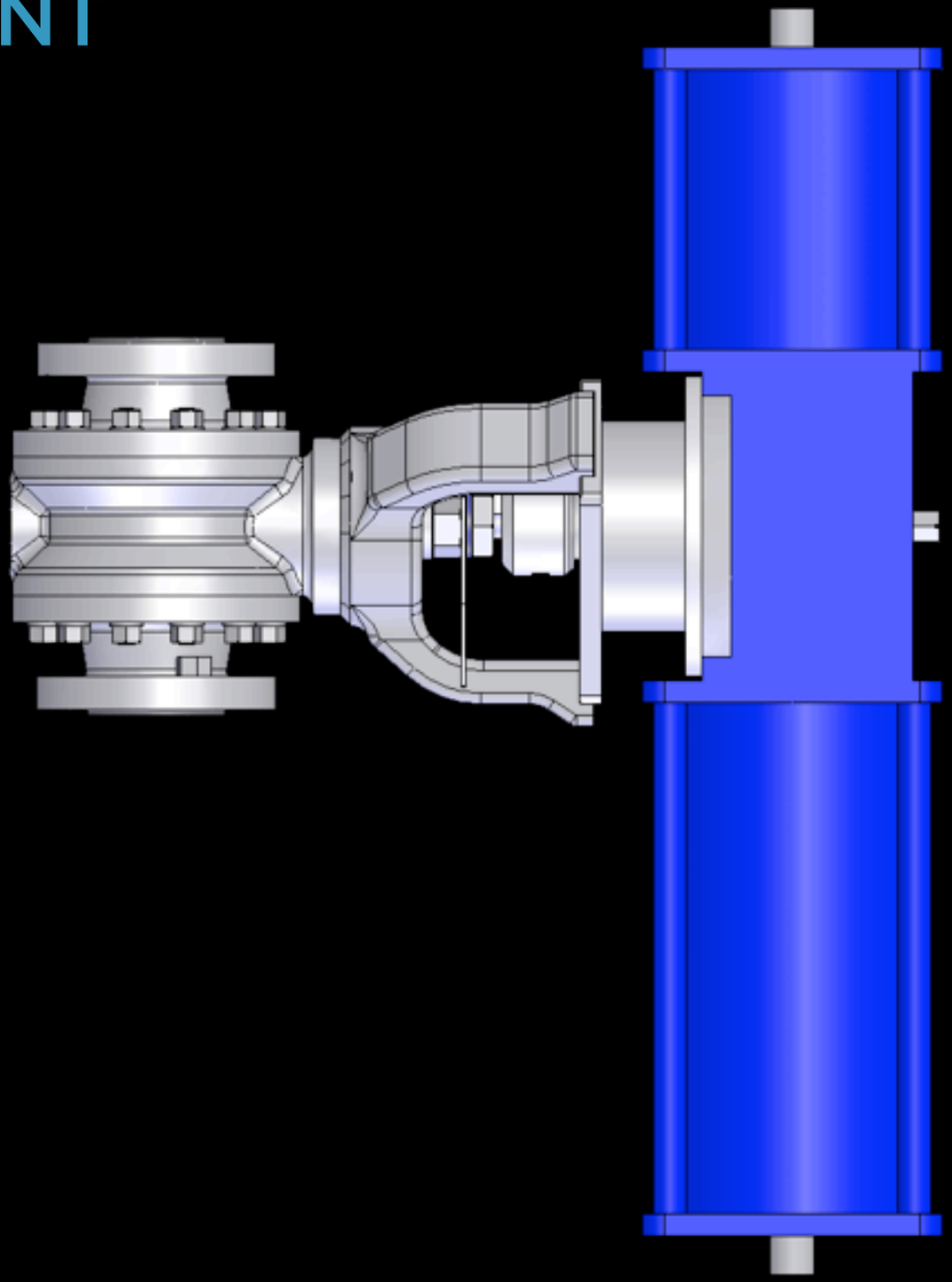
TRIPOD MOUNT

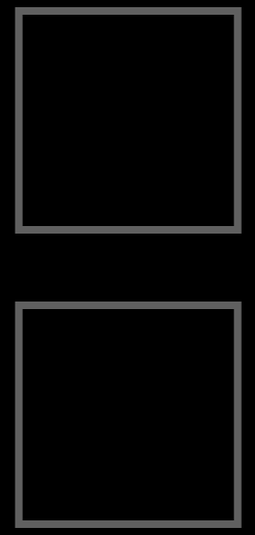


832-261-2400
tycovalves.com

KEYSTONE

TRIPOD MOUNT



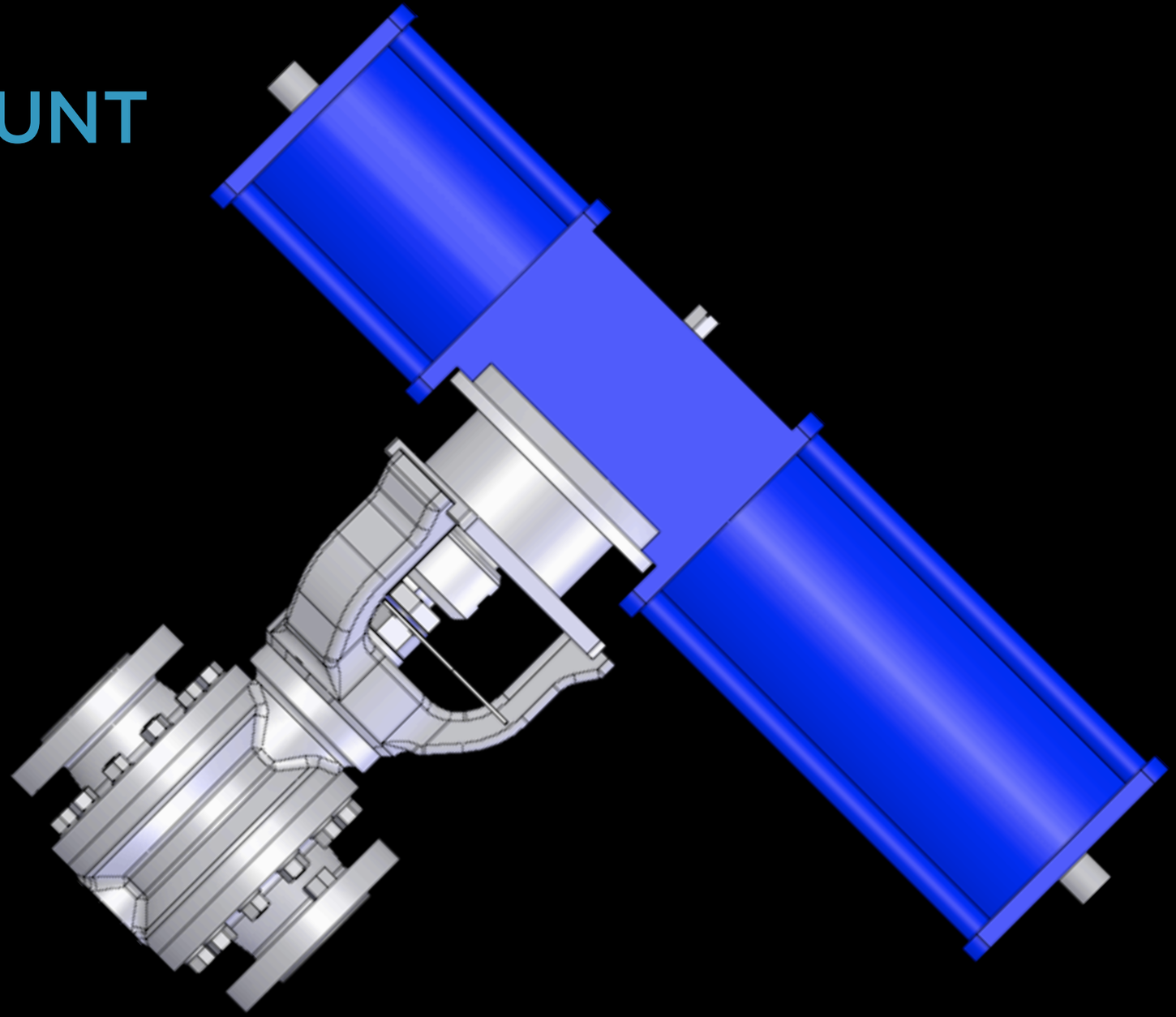


M-CLASS
METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

TRIPOD MOUNT

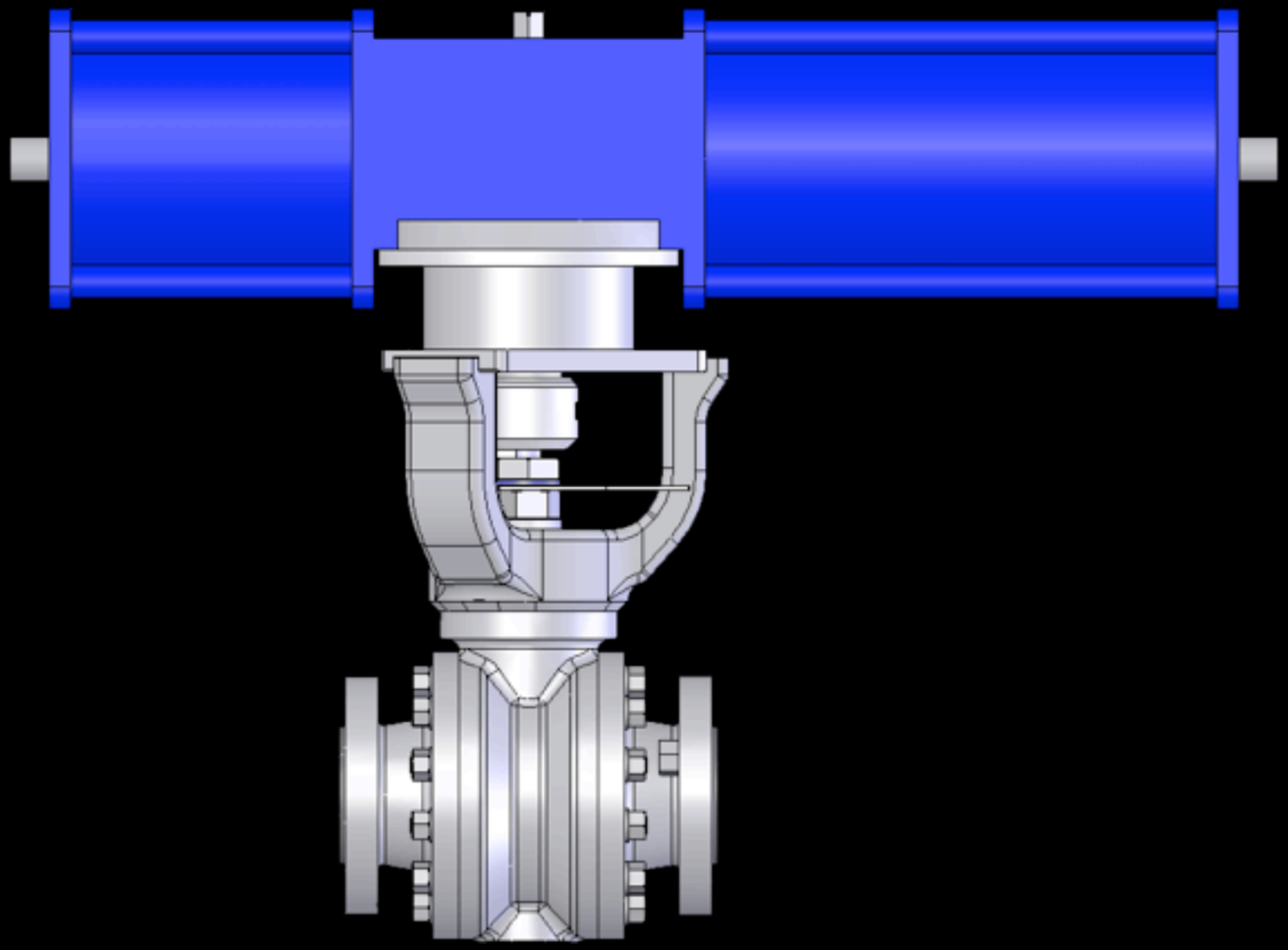


- [x]
- [x]
- [x]
- [ ]

832-261-2400
tycovalves.com

KEYSTONE

TRIPOD MOUNT



832-261-2400
tycovalves.com

KEYSTONE

TRIPOD MOUNT

832-261-2400
tycovalves.com

KEYSTONE

M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

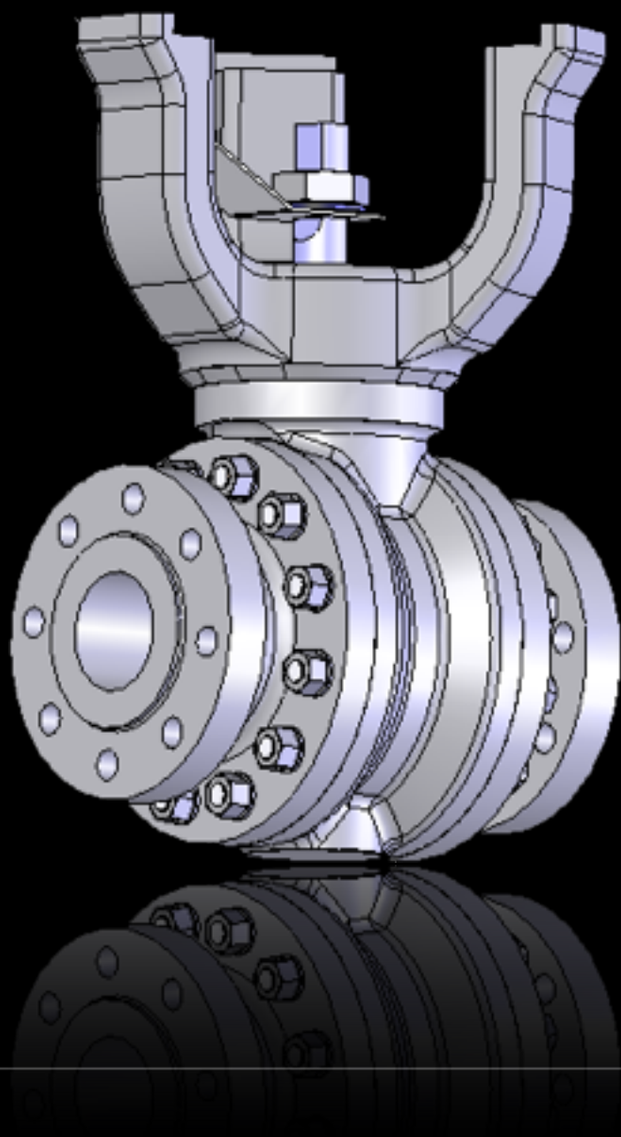
TRIPOD MOUNT

M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE



TRIPOD MOUNT

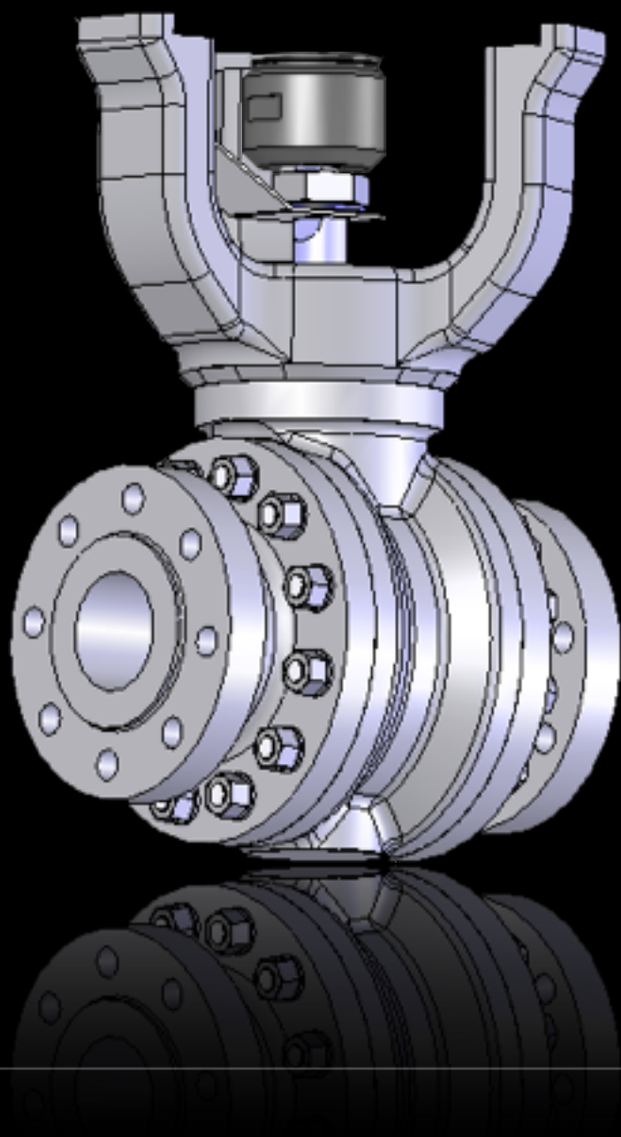
Easy to assemble

M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE



TRIPOD MOUNT

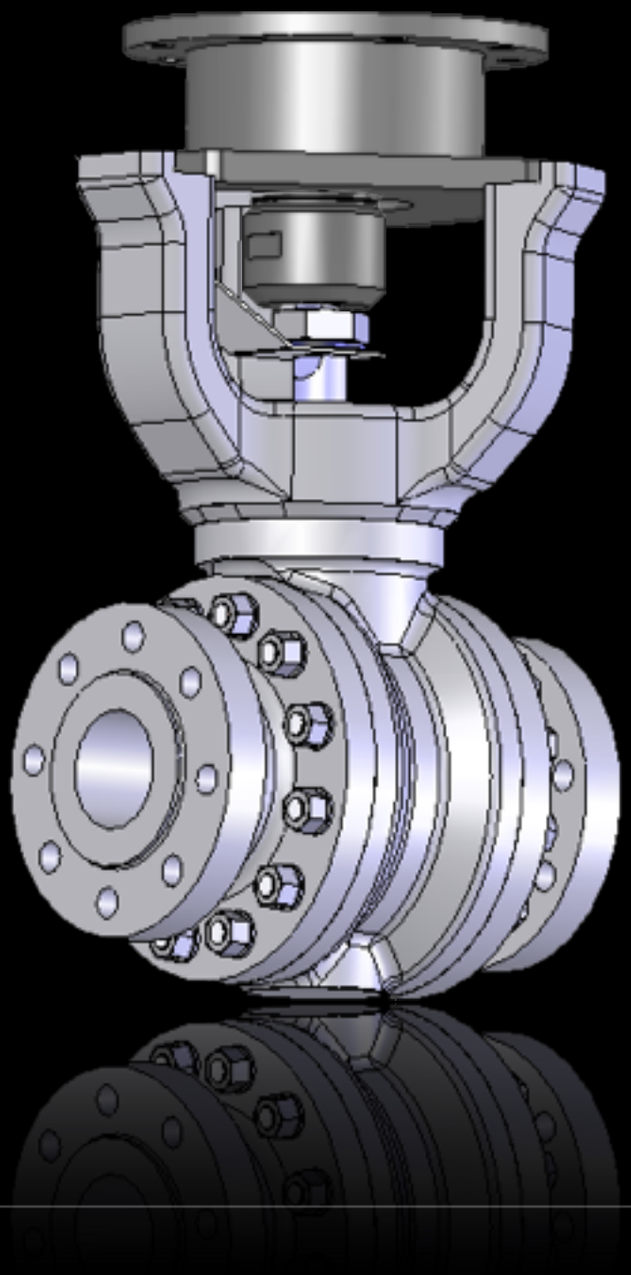
Easy to assemble

M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE



TRIPOD MOUNT

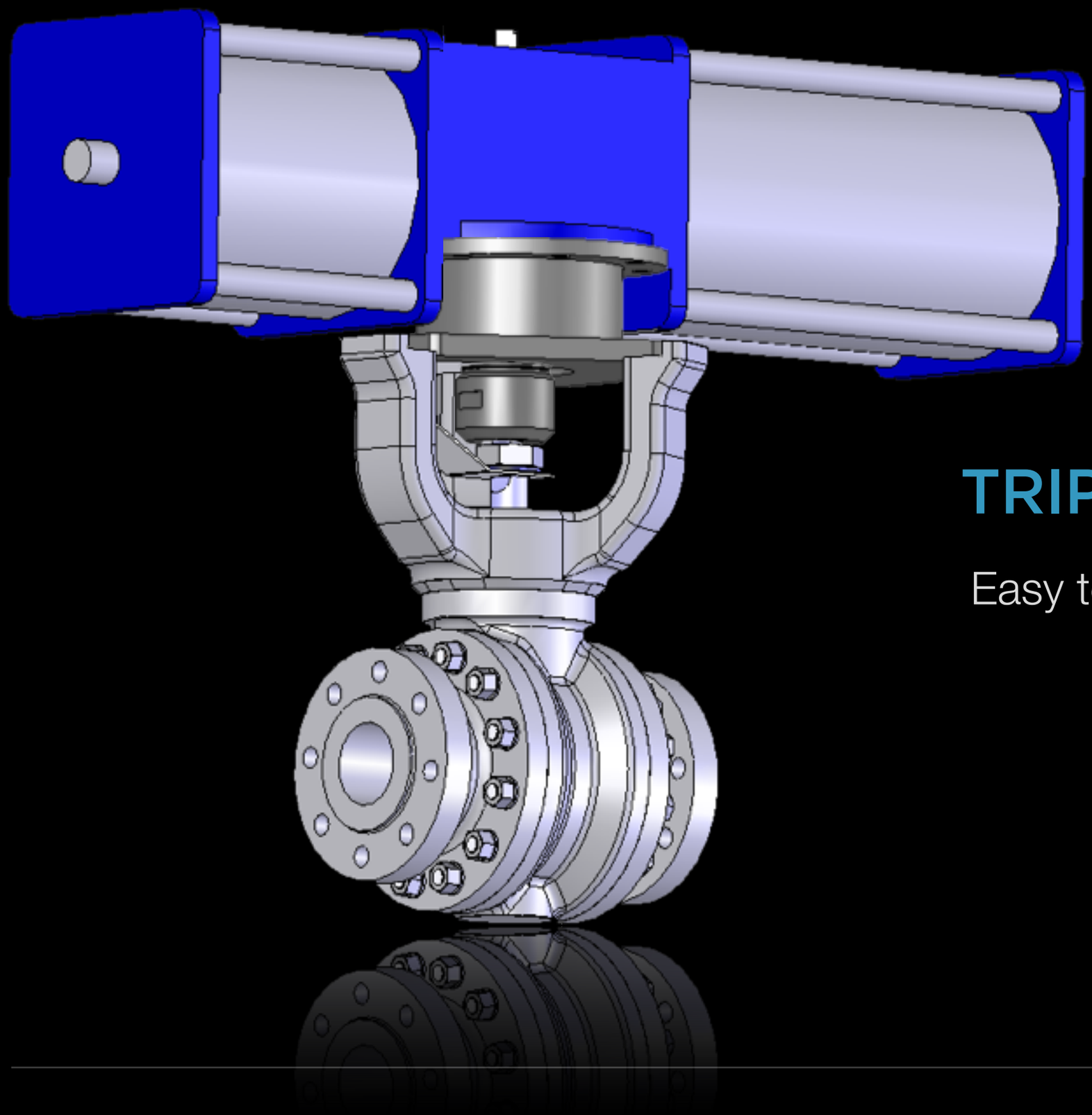
Easy to assemble

M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE



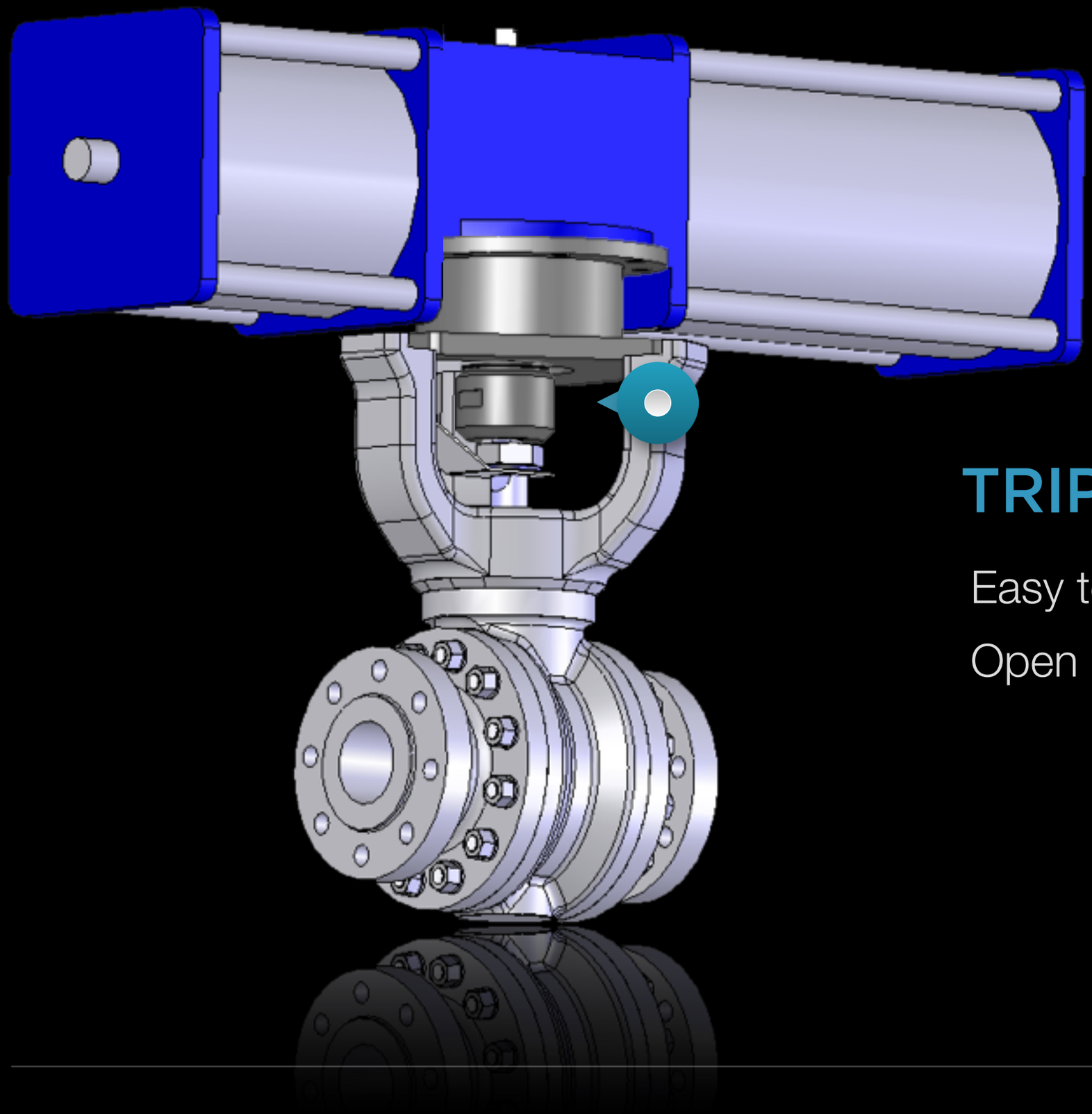
TRIPOD MOUNT

Easy to assemble

M-CLASS
METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE



TRIPOD MOUNT

Easy to assemble

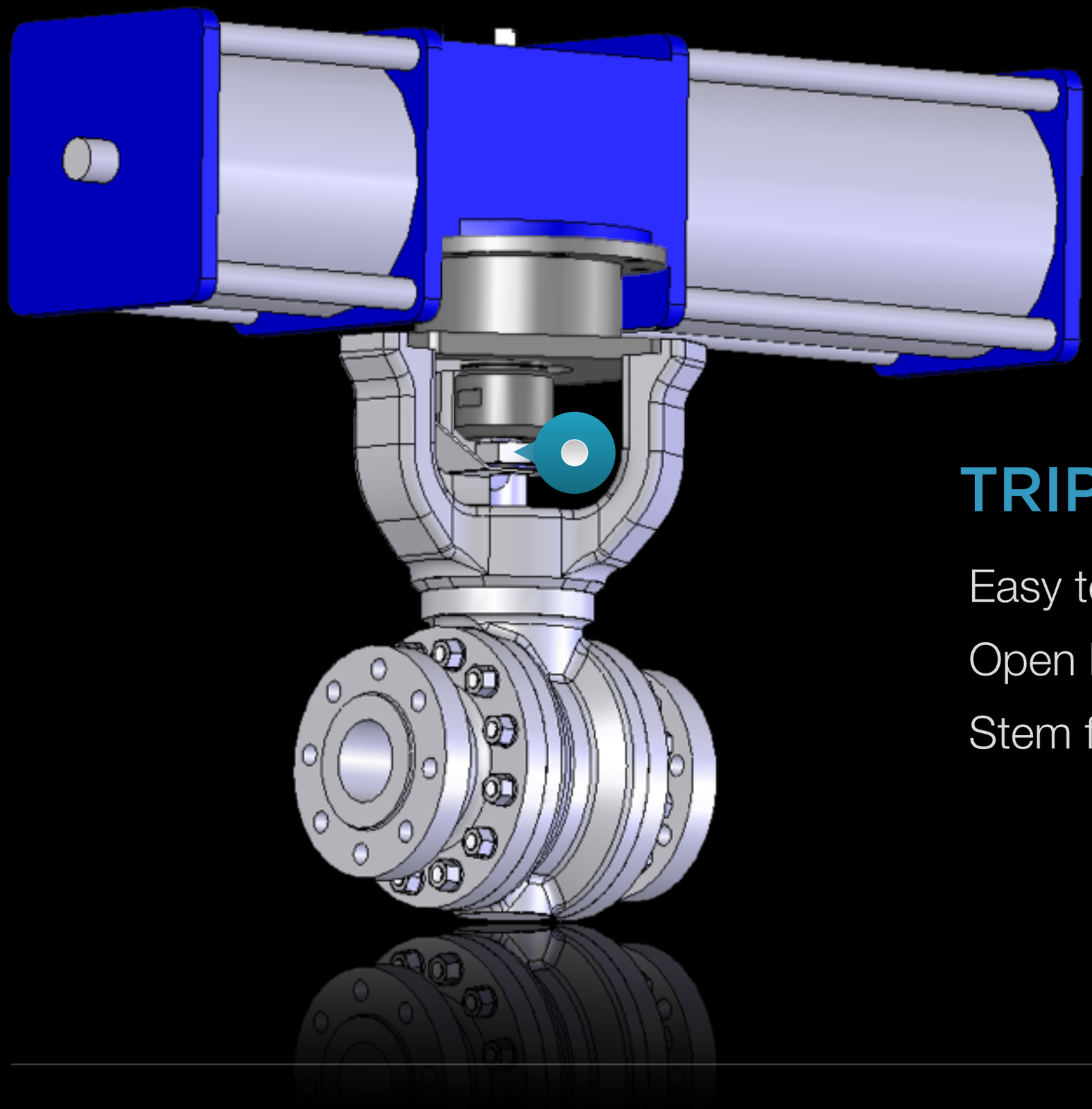
Open between the prongs

M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE



TRIPOD MOUNT

Easy to assemble

Open between the prongs

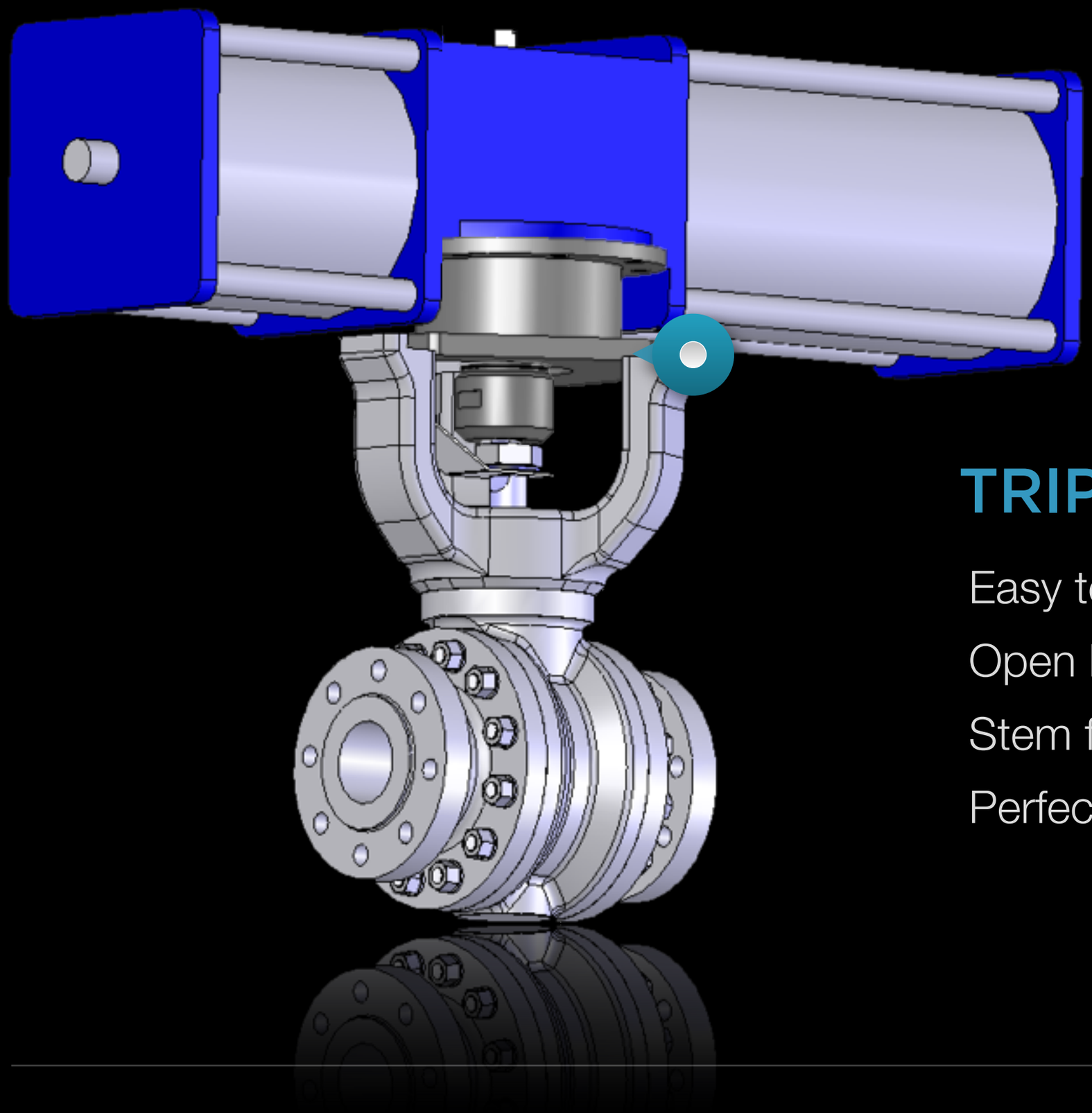
Stem flats fully visible

M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE



TRIPOD MOUNT

Easy to assemble

Open between the prongs

Stem flats fully visible

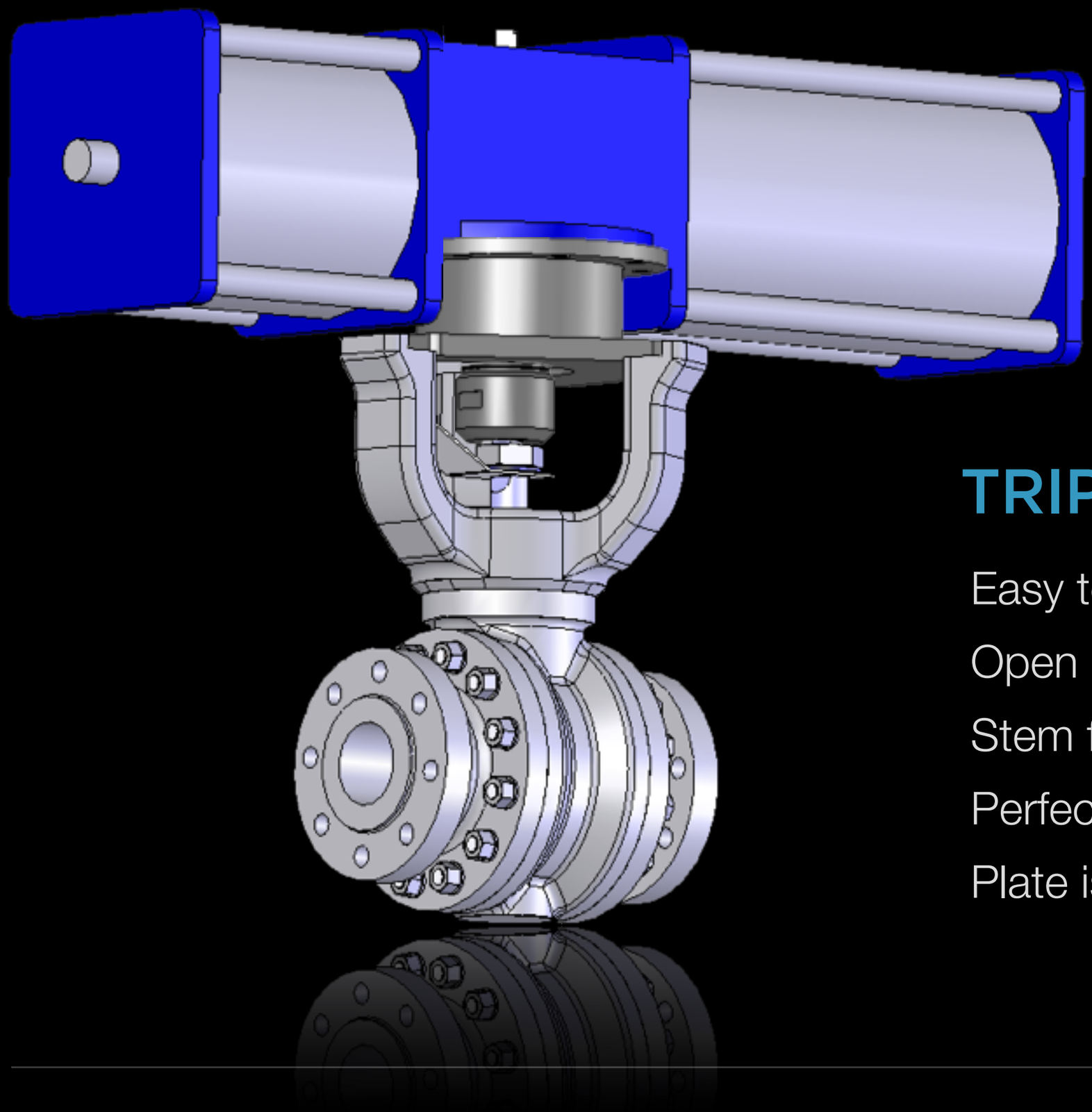
Perfectly flat - will not rock

M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE



TRIPOD MOUNT

Easy to assemble

Open between the prongs

Stem flats fully visible

Perfectly flat - will not rock

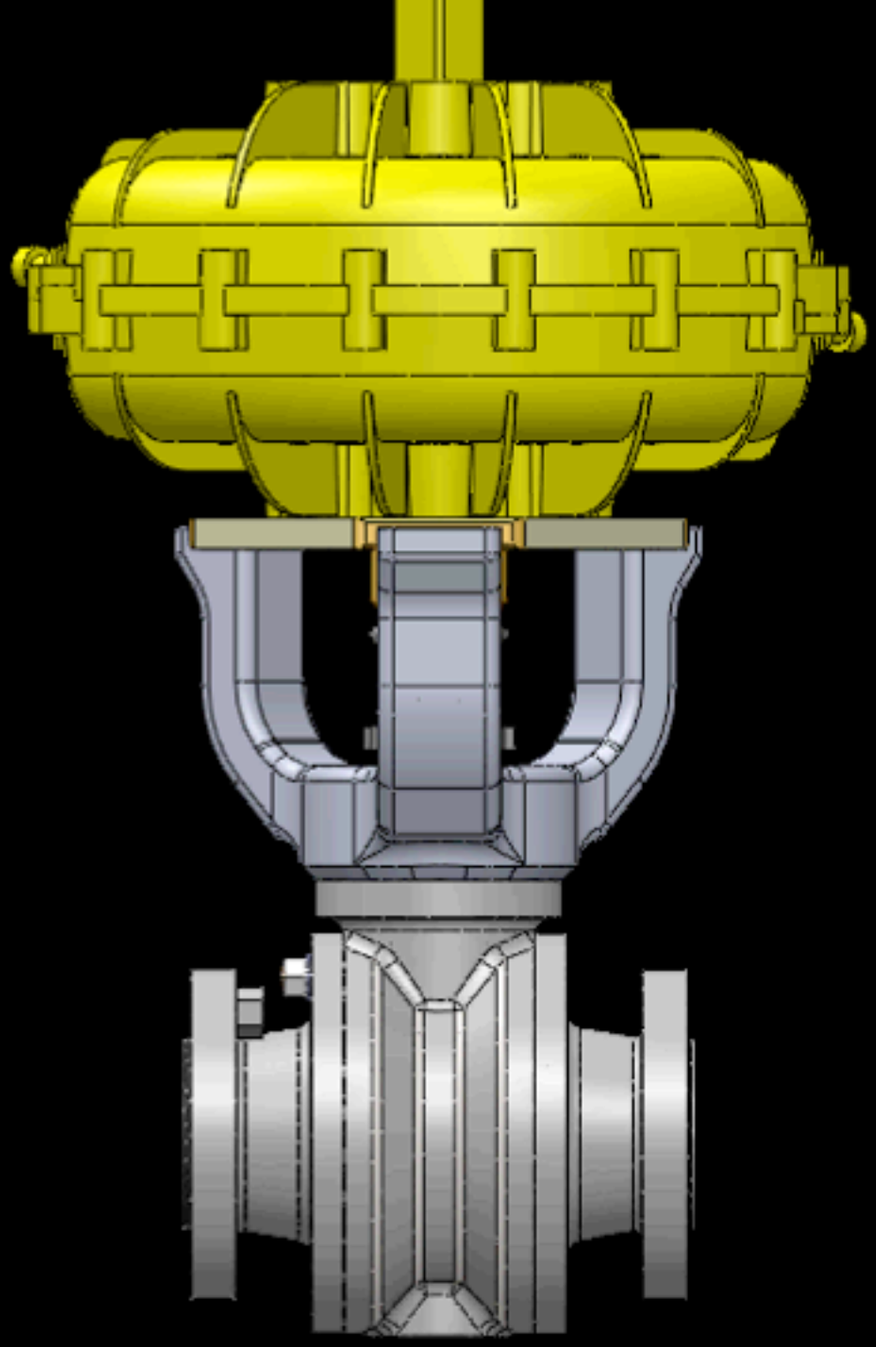
Plate is centered between prongs

M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

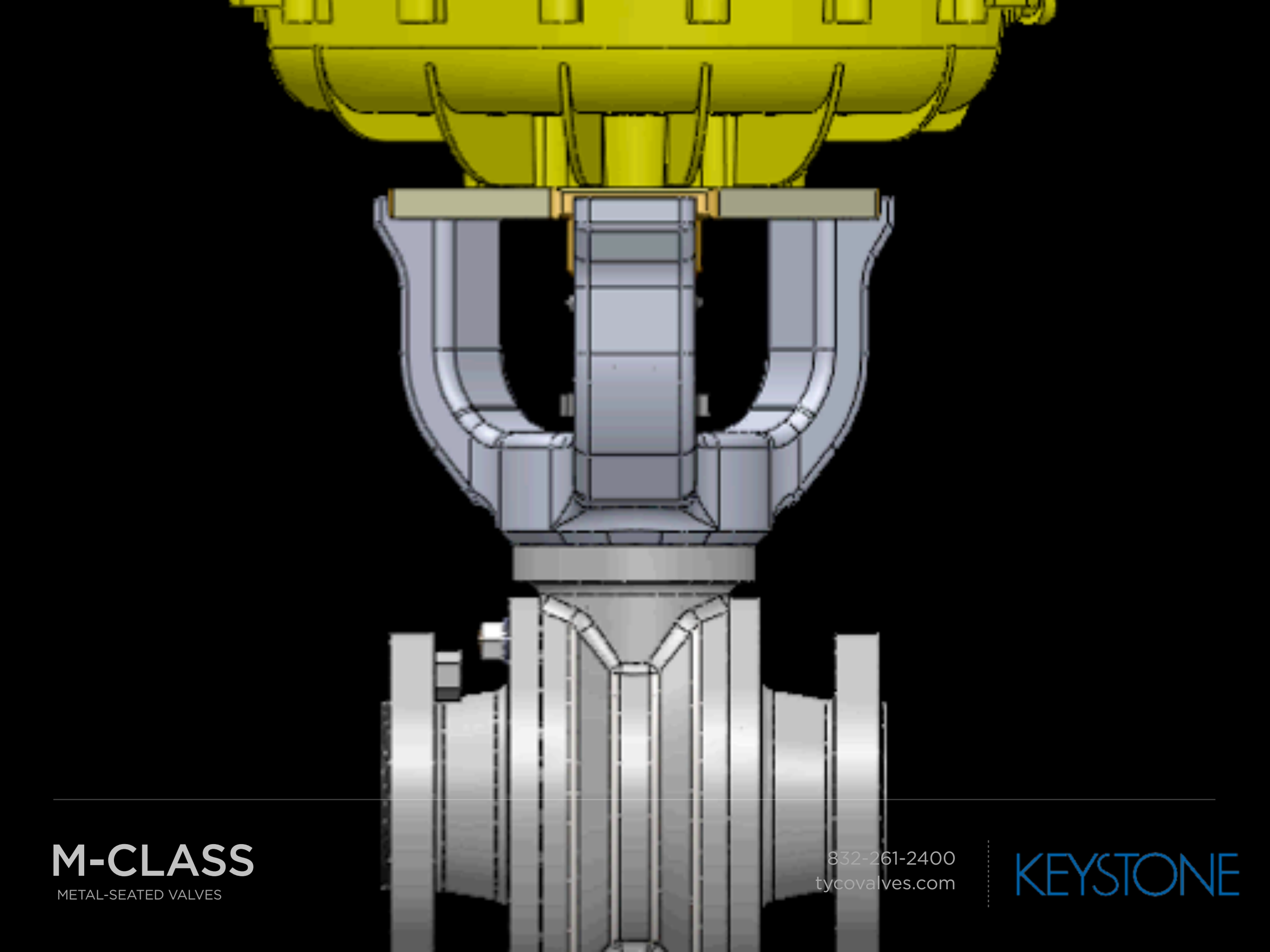


M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

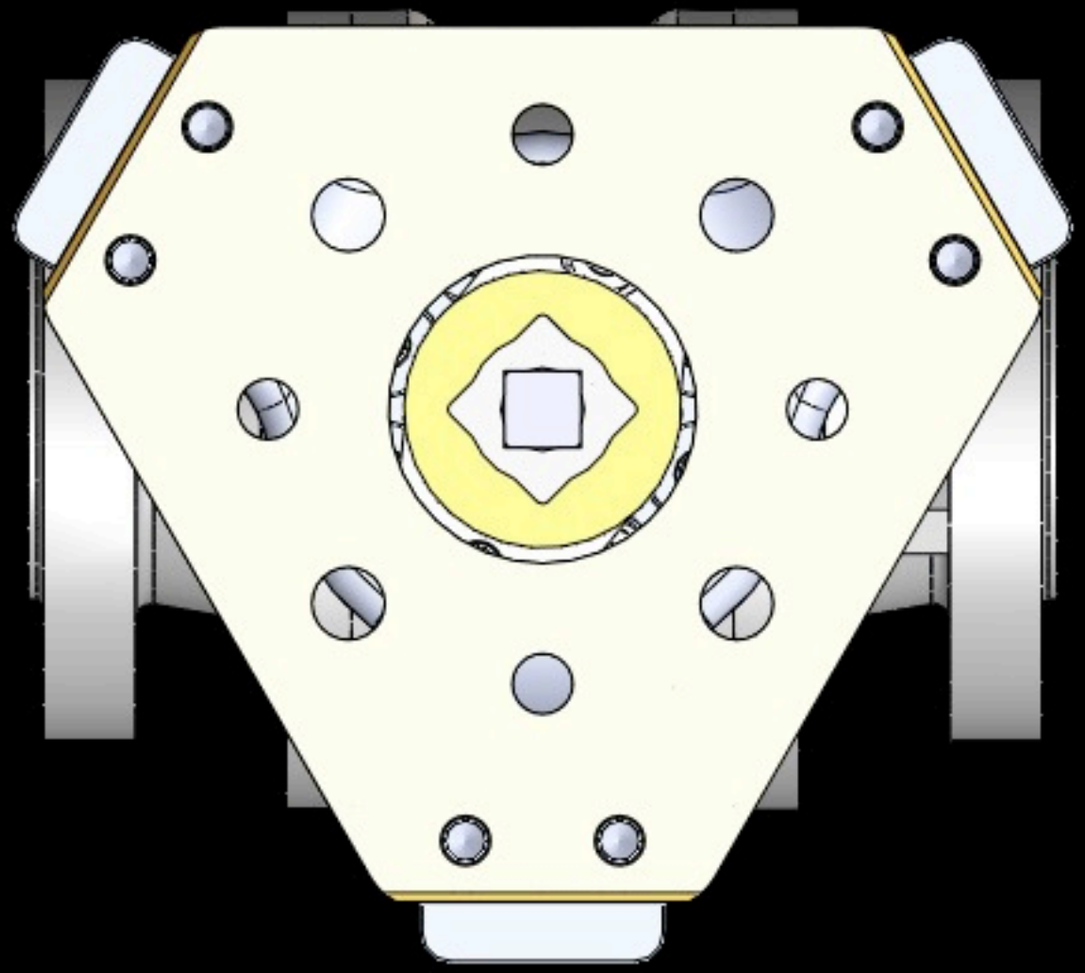


M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE



M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

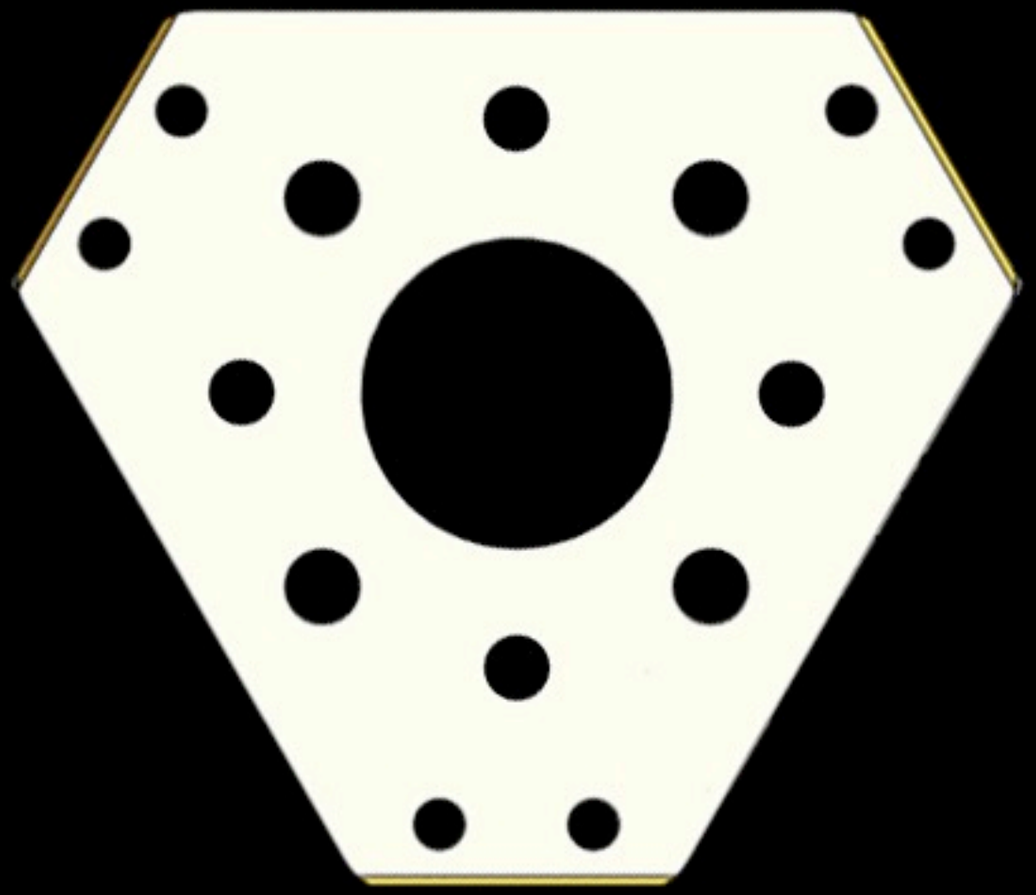
KEYSTONE

M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

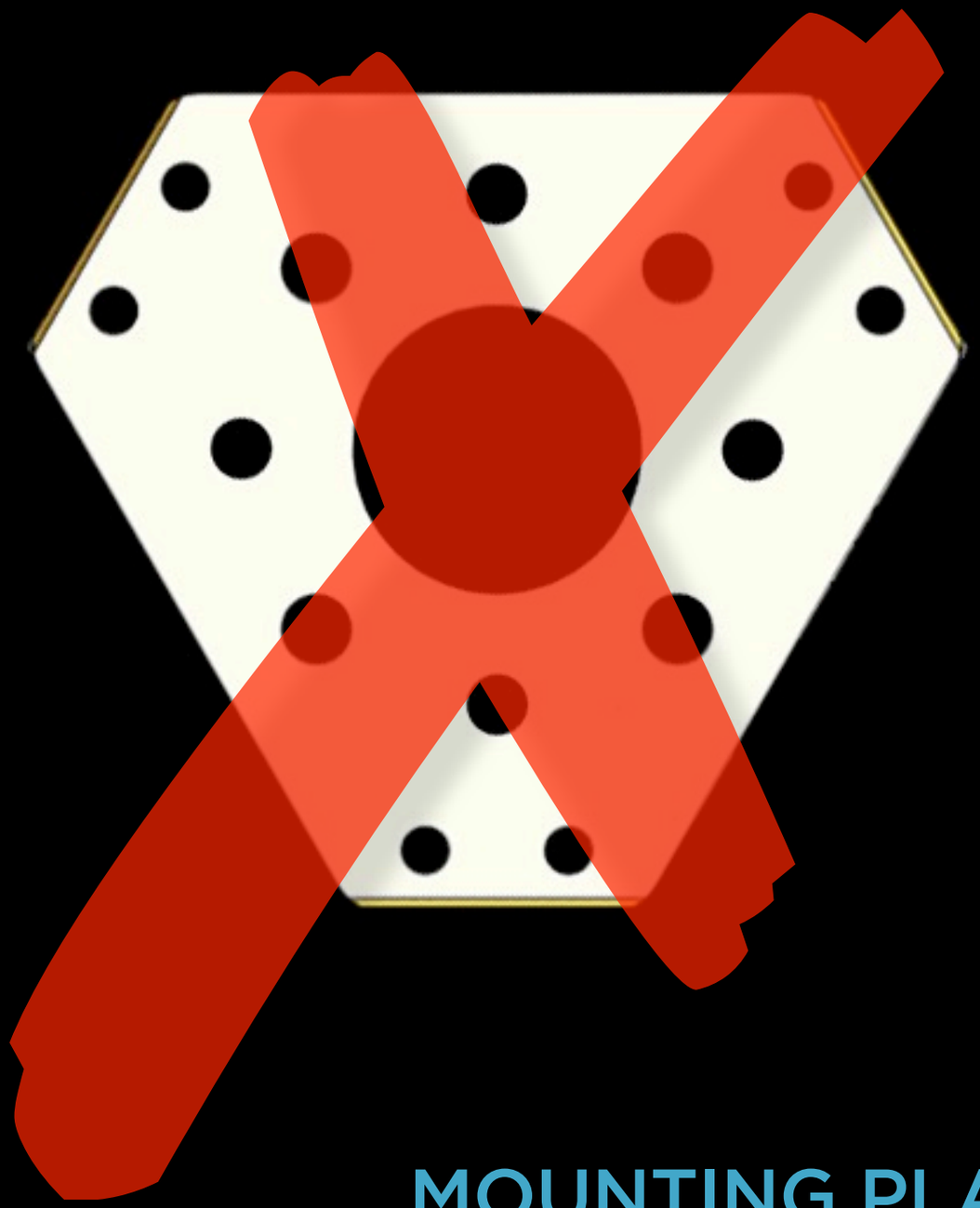


M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

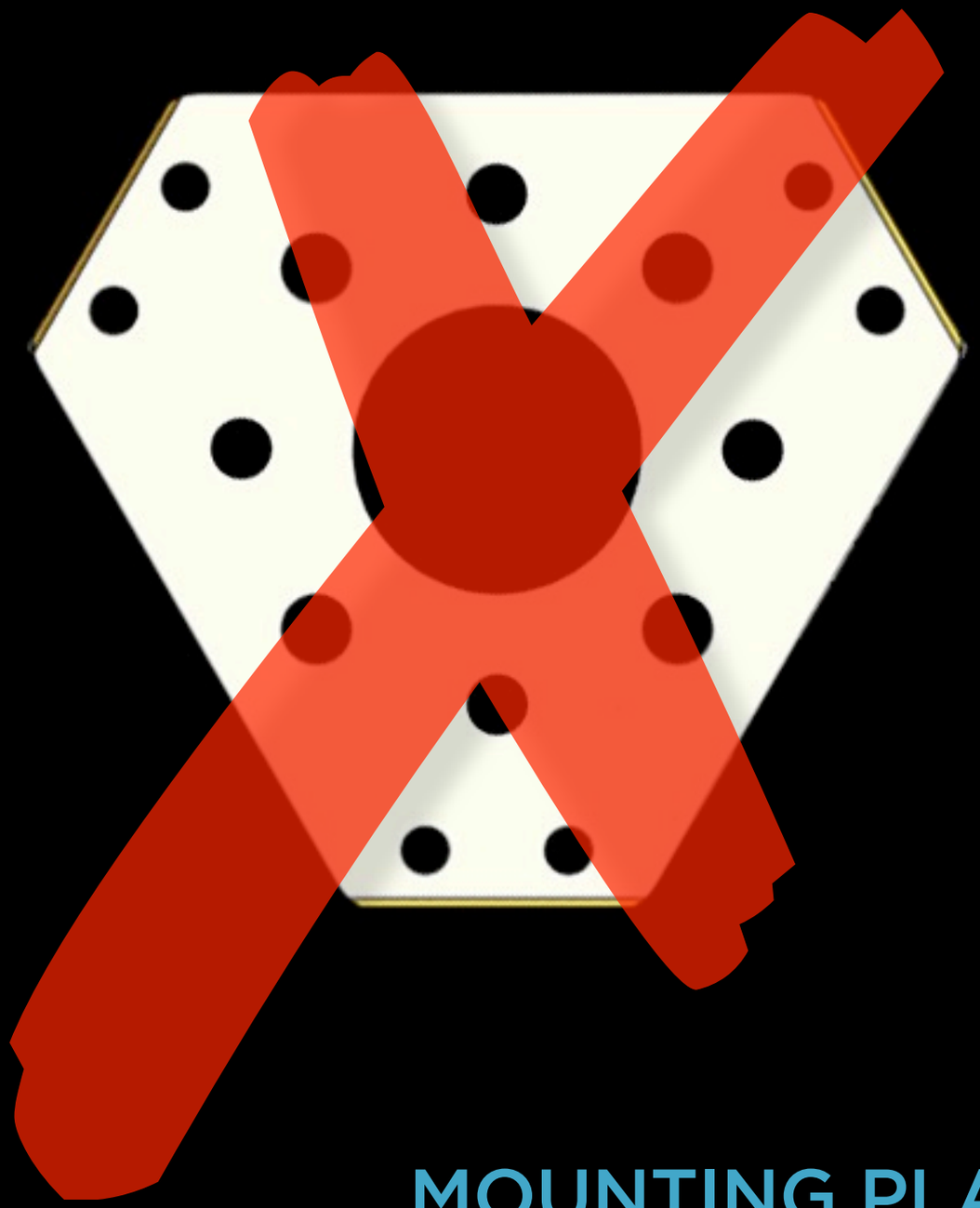


MOUNTING PLATE ALIGNMENT

M-CLASS
METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

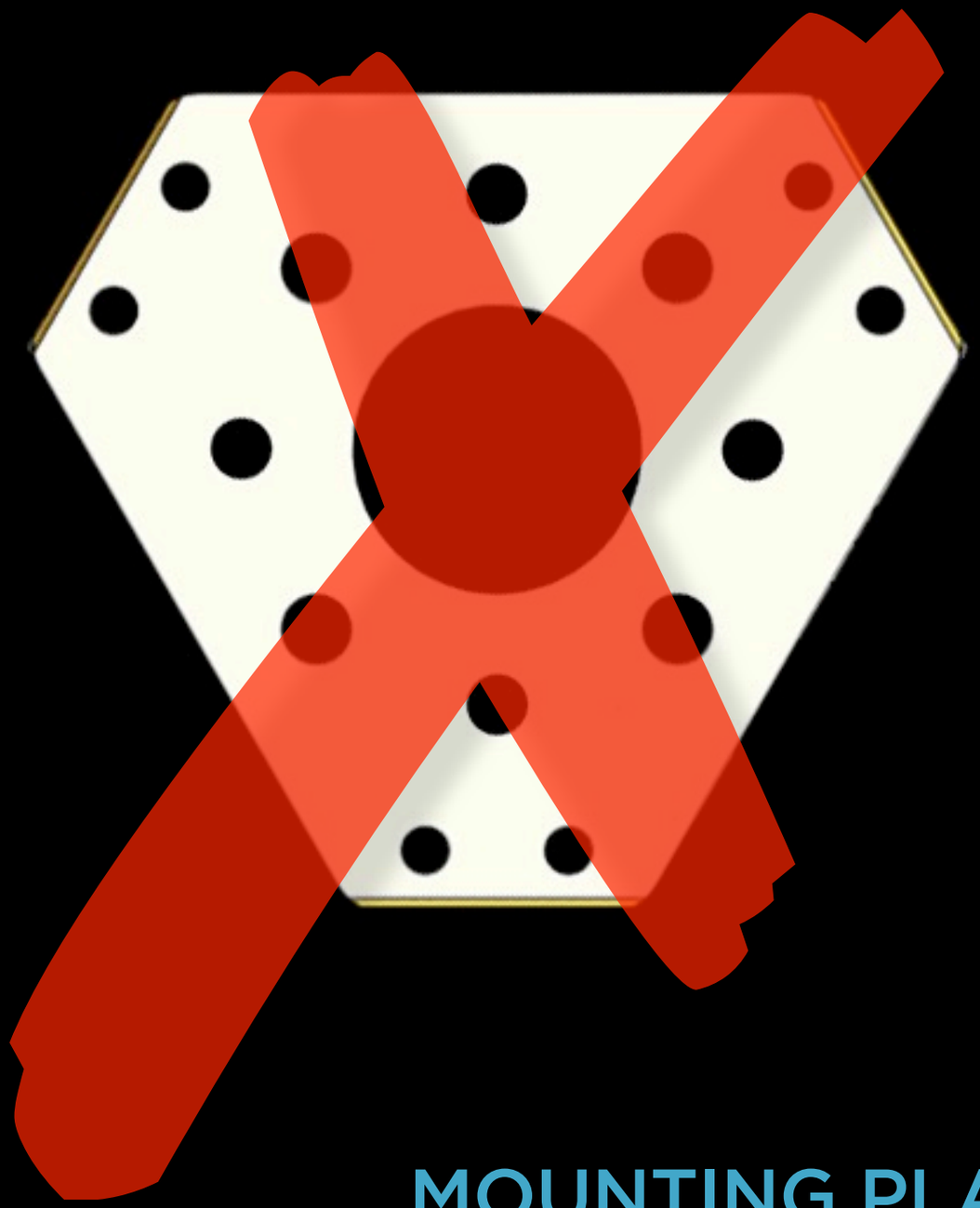


MOUNTING PLATE ALIGNMENT

M-CLASS
METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE



MOUNTING PLATE ALIGNMENT

M-CLASS
METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

COMPETITION VS. M-CLASS

TRIM HARDENING
ACTUATOR MOUNTING
SEAT DESIGN
BALL DESIGN
STEM SEALING
EXOTIC ALLOYS
BALL/SEAT SEALING
LEAD TIMES

832-261-2400
tycovalves.com

COMPETITION VS. M-CLASS

TRIM HARDENING	HVOF	Boronizing
ACTUATOR MOUNTING	Bent Bracket	Tripod Mount
SEAT DESIGN		
BALL DESIGN		
STEM SEALING		
EXOTIC ALLOYS		
BALL/SEAT SEALING		
LEAD TIMES		

832-261-2400
tycovalves.com

COMPETITION VS. M-CLASS

TRIM HARDENING	HVOF	Boronizing
ACTUATOR MOUNTING	Bent Bracket	Tripod Mount
SEAT DESIGN	Standard Seats	Scalloped Seats
BALL DESIGN		
STEM SEALING		
EXOTIC ALLOYS		
BALL/SEAT SEALING		
LEAD TIMES		

832-261-2400
tycovalves.com

M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

STANDARD SEATS

M-CLASS
METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

STANDARD SEATS

Material builds up between the seats and the spring

M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

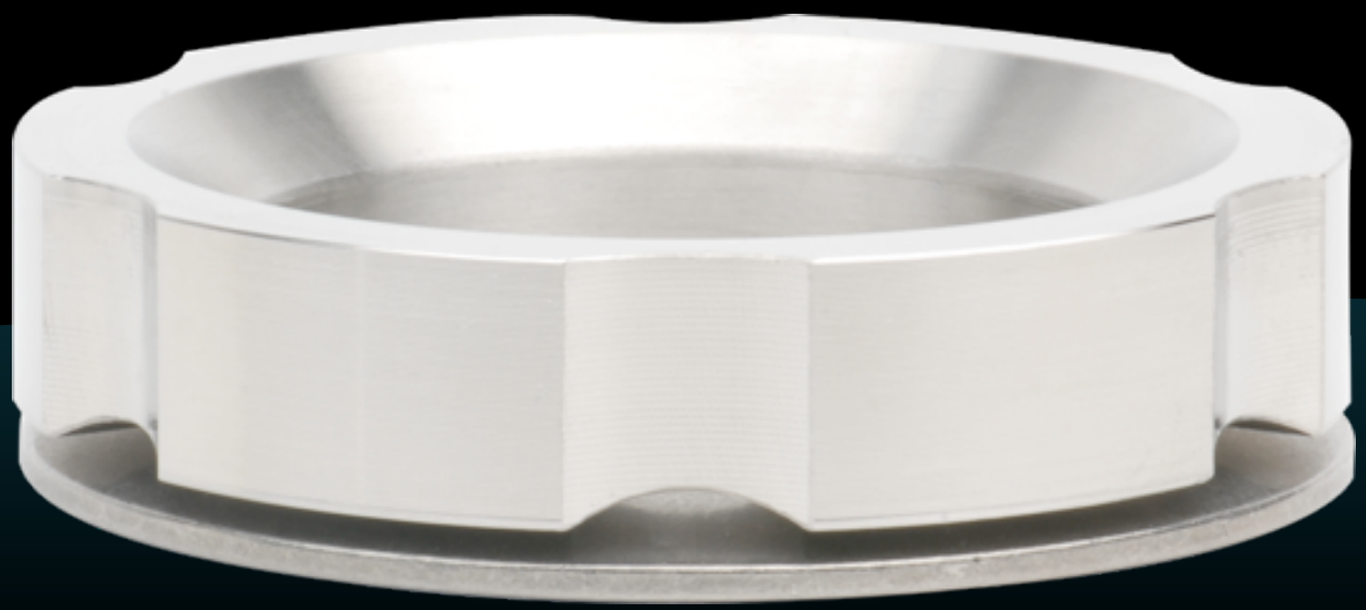
M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

SCALLOPED SEATS



M-CLASS
METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

SCALLOPED SEATS

M-CLASS
METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

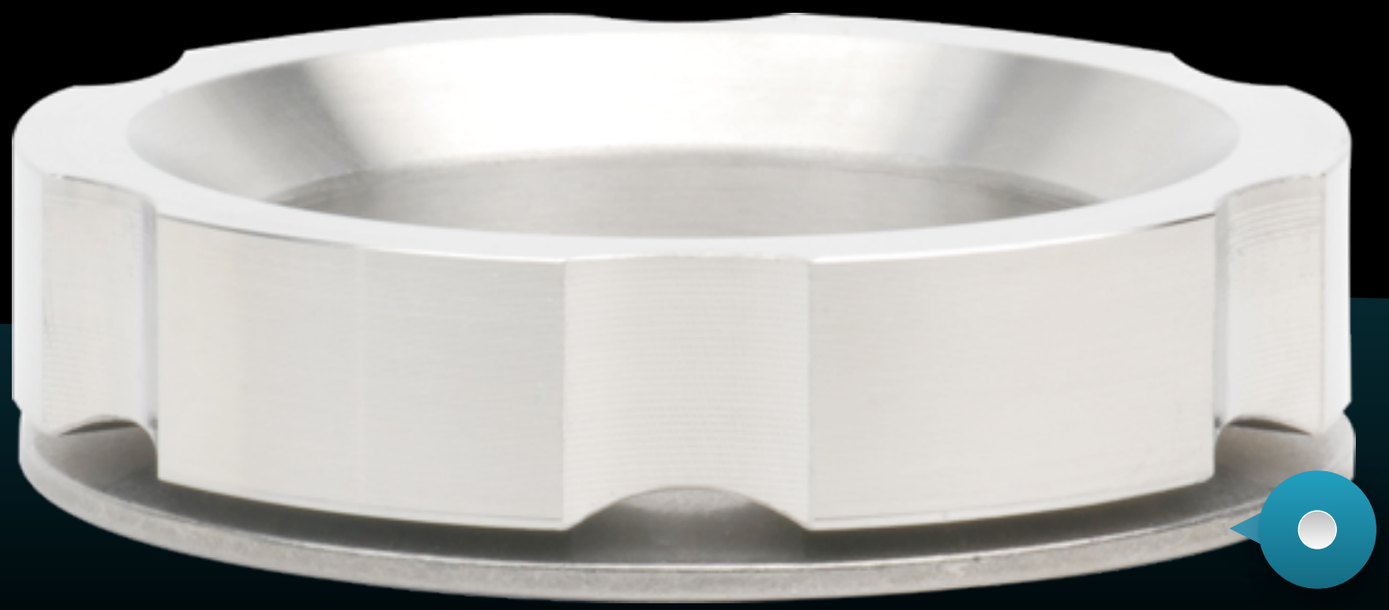
SCALLOPED SEATS

M-CLASS
METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

SCALLOPED SEATS



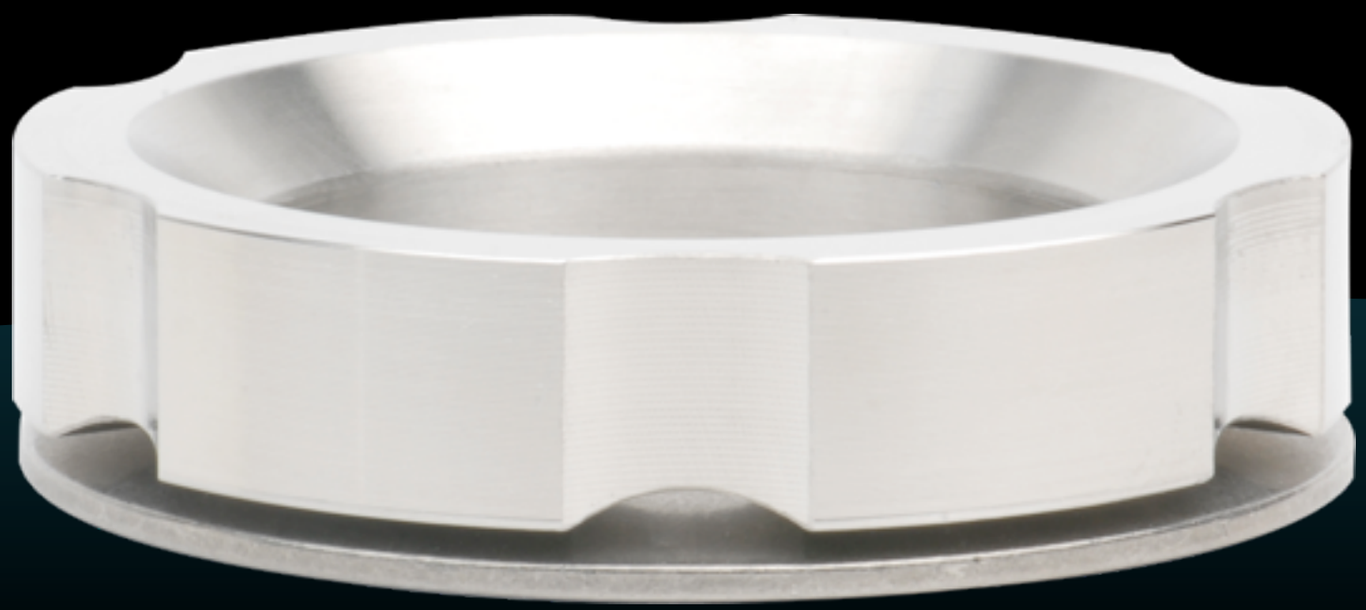
Spring

M-CLASS
METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

SCALLOPED SEATS



Prevents build up of material behind the seat

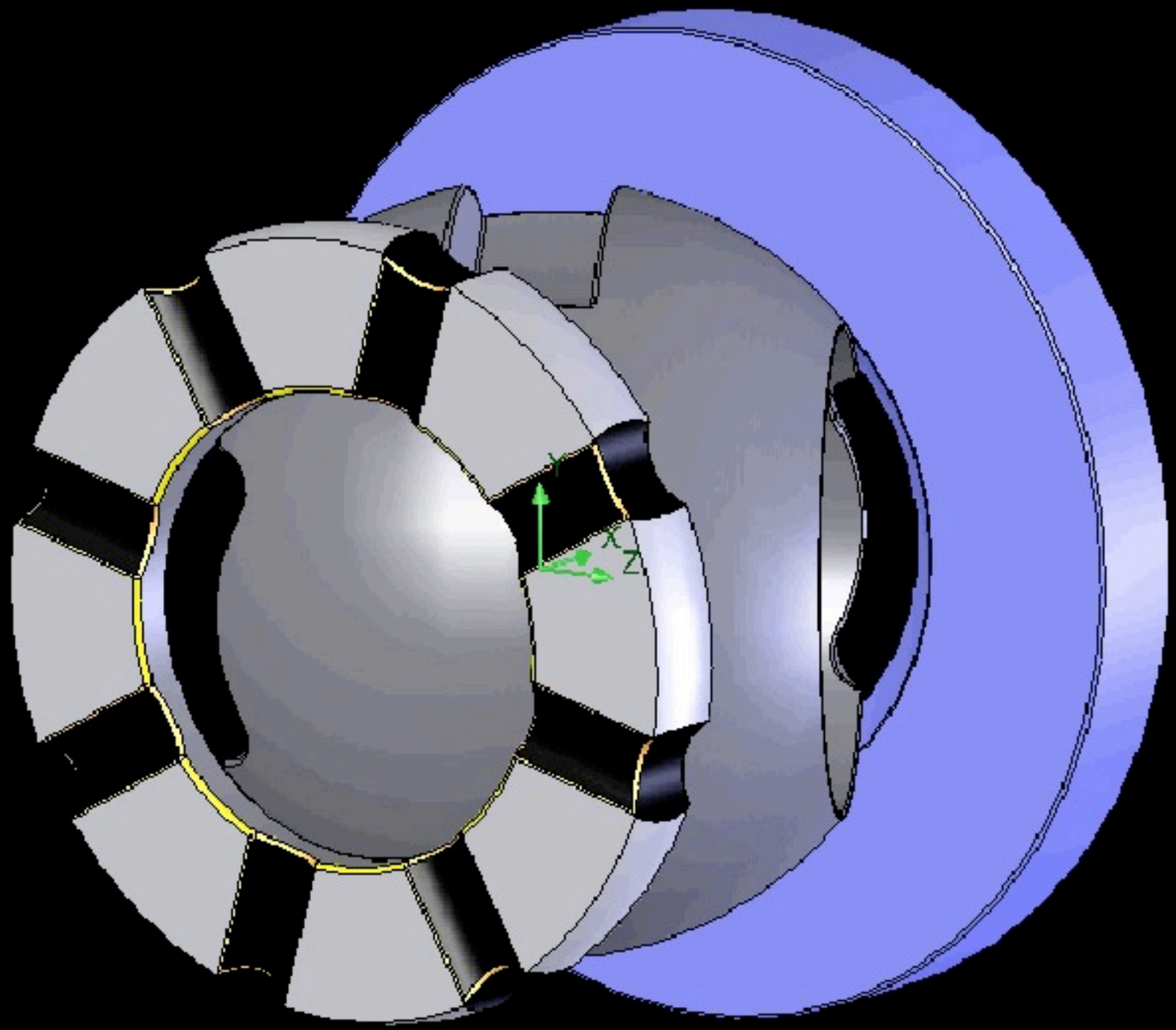
bi-directional scalloped seats also available.

M-CLASS

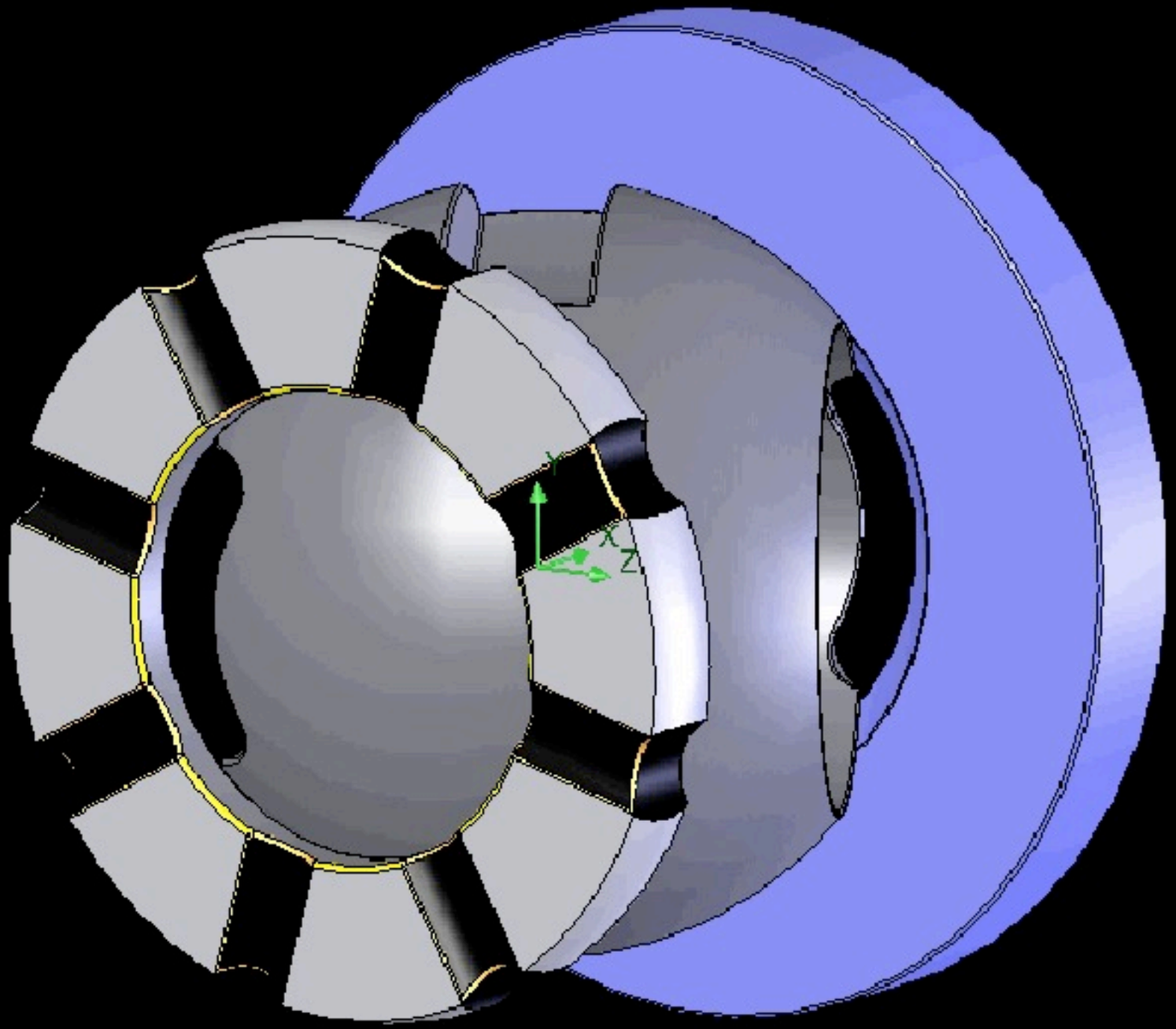
METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

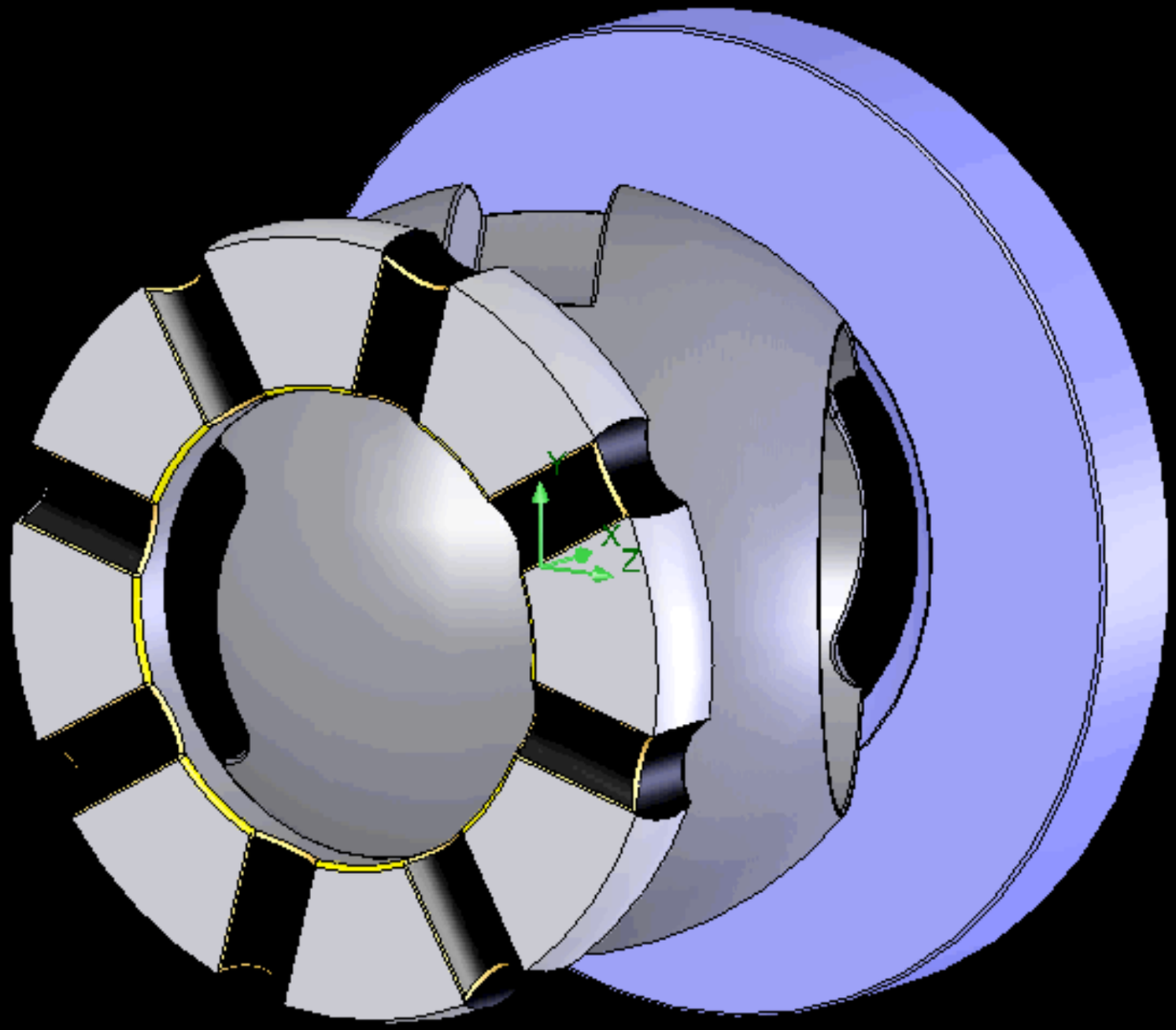

Y
X
Z

COMPUTATIONAL FLUID DYNAMICS ANALYSIS (CFD)



bi-directional scalloped seats also available.

COMPUTATIONAL FLUID DYNAMICS ANALYSIS (CFD)



bi-directional scalloped seats also available.

COMPETITION VS. M-CLASS

TRIM HARDENING
ACTUATOR MOUNTING
SEAT DESIGN
BALL DESIGN
STEM SEALING
EXOTIC ALLOYS
BALL/SEAT SEALING
LEAD TIMES

832-261-2400
tycovalves.com

COMPETITION VS. M-CLASS

TRIM HARDENING	HVOF	Boronizing
ACTUATOR MOUNTING	Bent Bracket	Tripod Mount
SEAT DESIGN	Standard Seats	Scalloped Seats
BALL DESIGN		
STEM SEALING		
EXOTIC ALLOYS		
BALL/SEAT SEALING		
LEAD TIMES		

832-261-2400
tycovalves.com

COMPETITION VS. M-CLASS

TRIM HARDENING	HVOF	Boronizing
ACTUATOR MOUNTING	Bent Bracket	Tripod Mount
SEAT DESIGN	Standard Seats	Scalloped Seats
BALL DESIGN	Standard Ball	Arcuate Cut & Vari-V Ball
STEM SEALING		
EXOTIC ALLOYS		
BALL/SEAT SEALING		
LEAD TIMES		

M-CLASS
METAL-SEATED VALVES

832-261-2400
tycovalves.com

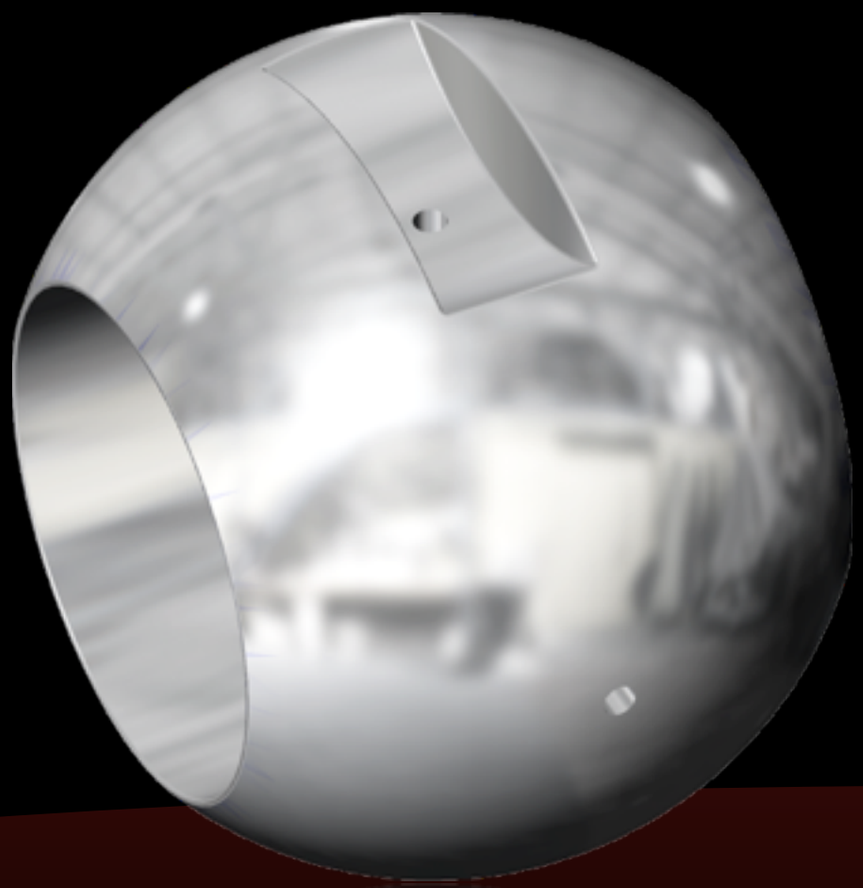
KEYSTONE

M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE



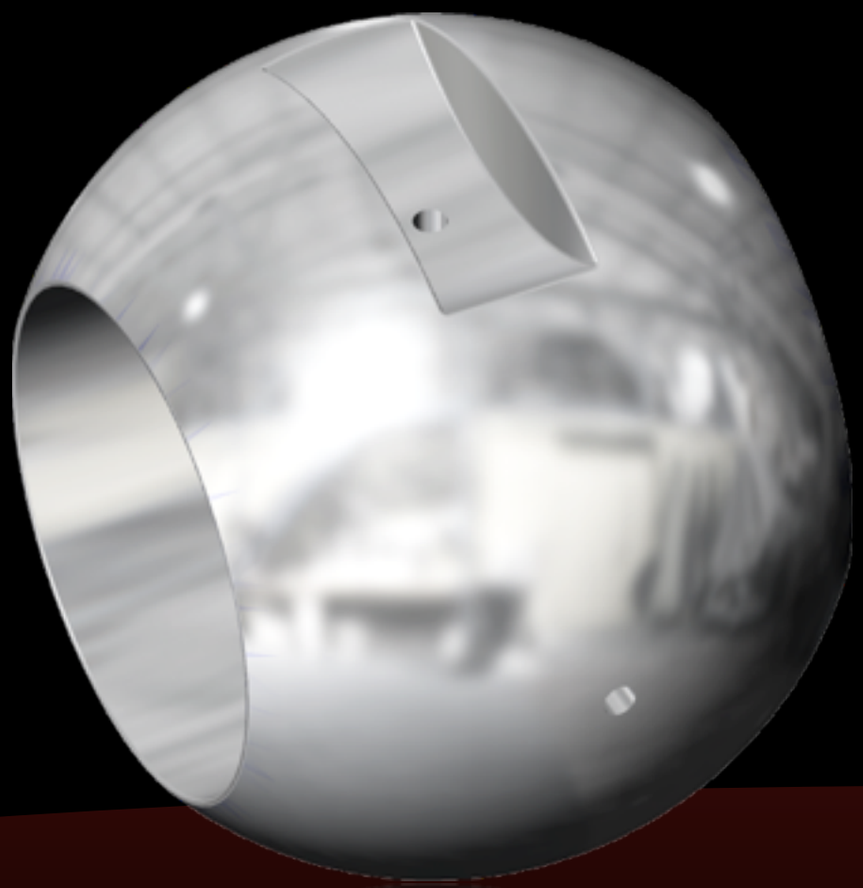
STANDARD BALL

M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE



STANDARD BALL

High velocities occur when valve is opened, causing erosion

832-261-2400
tycovalves.com

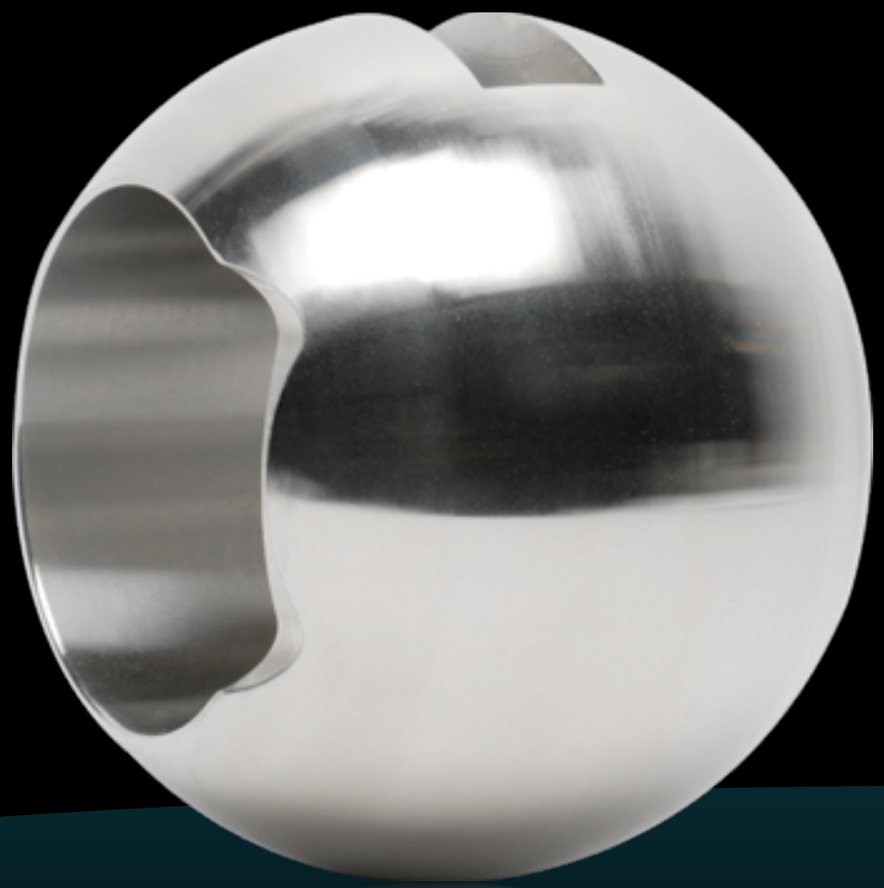
KEYSTONE

M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE



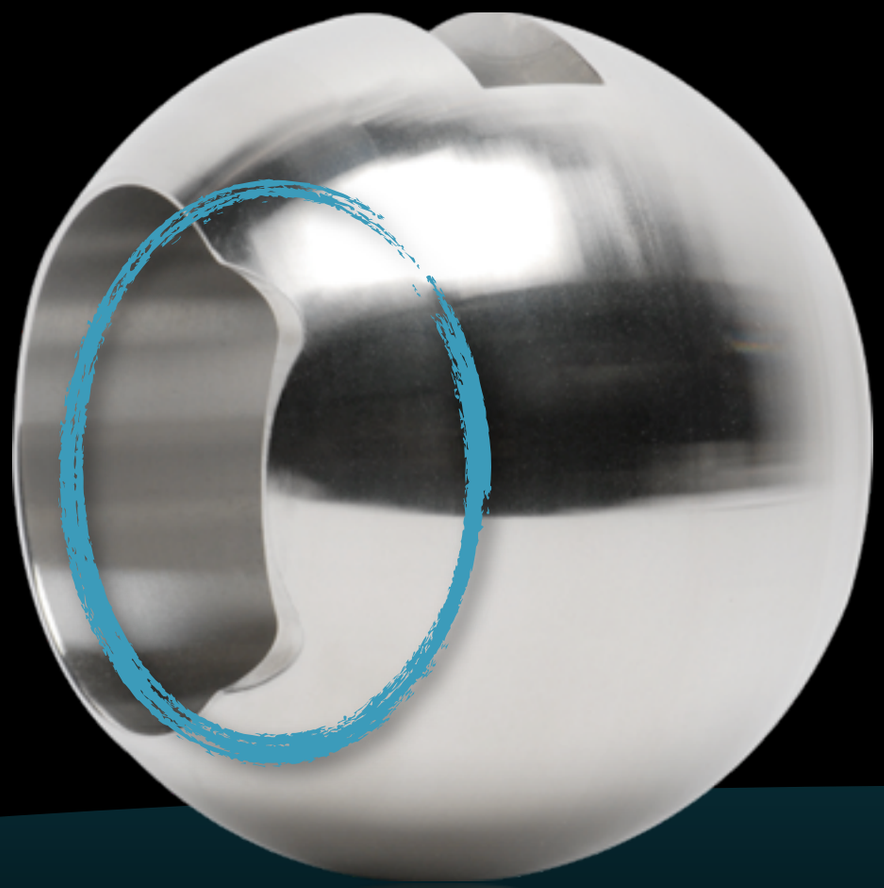
ARCUATE CUT BALL

M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE



ARCUATE CUT BALL

Specific profile is cut on the ball
to reduce velocities

M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

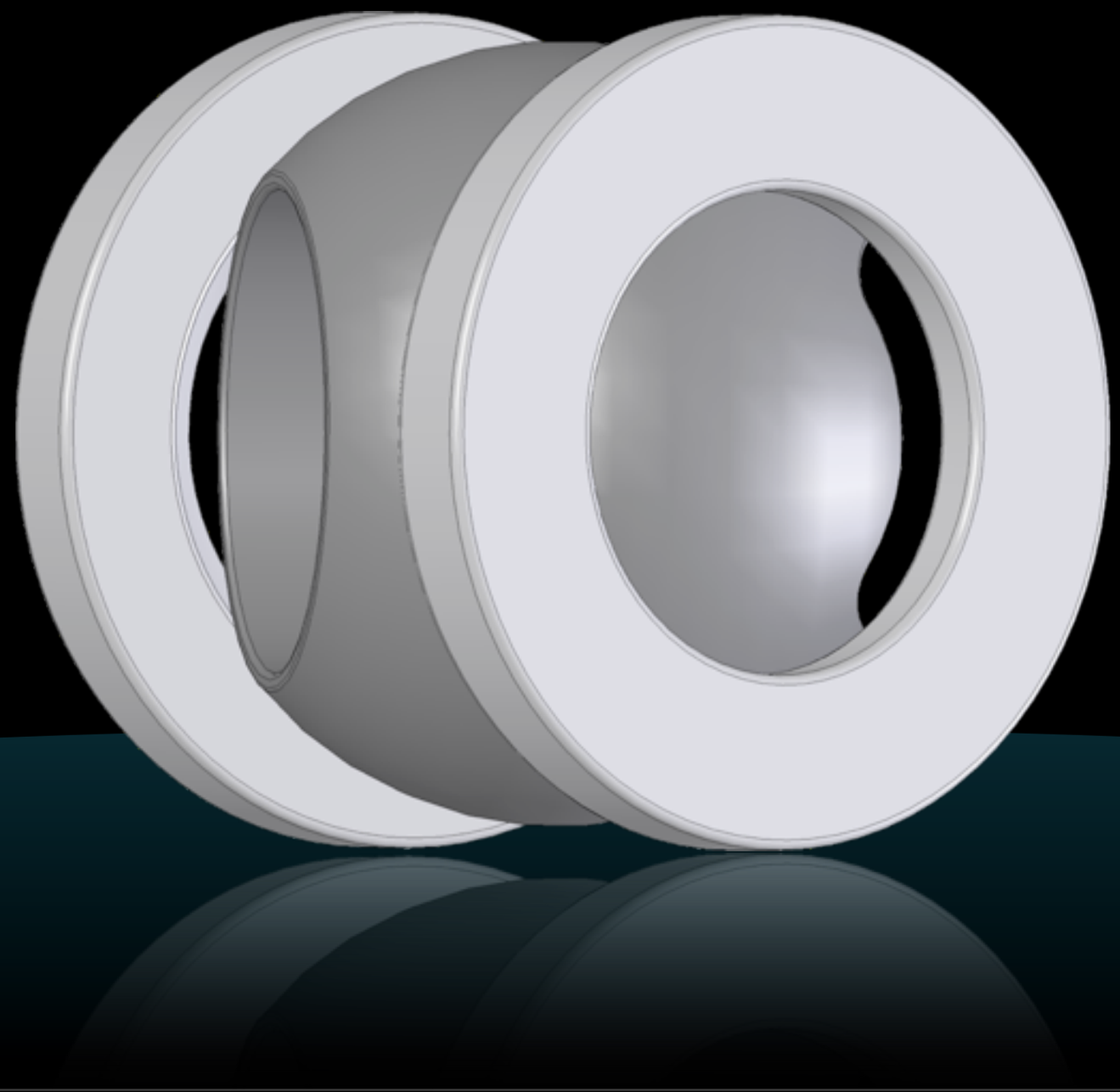
M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

STANDARD BALL VS. ARCUATE CUT



M-CLASS
METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

STANDARD BALL VS. ARCUATE CUT

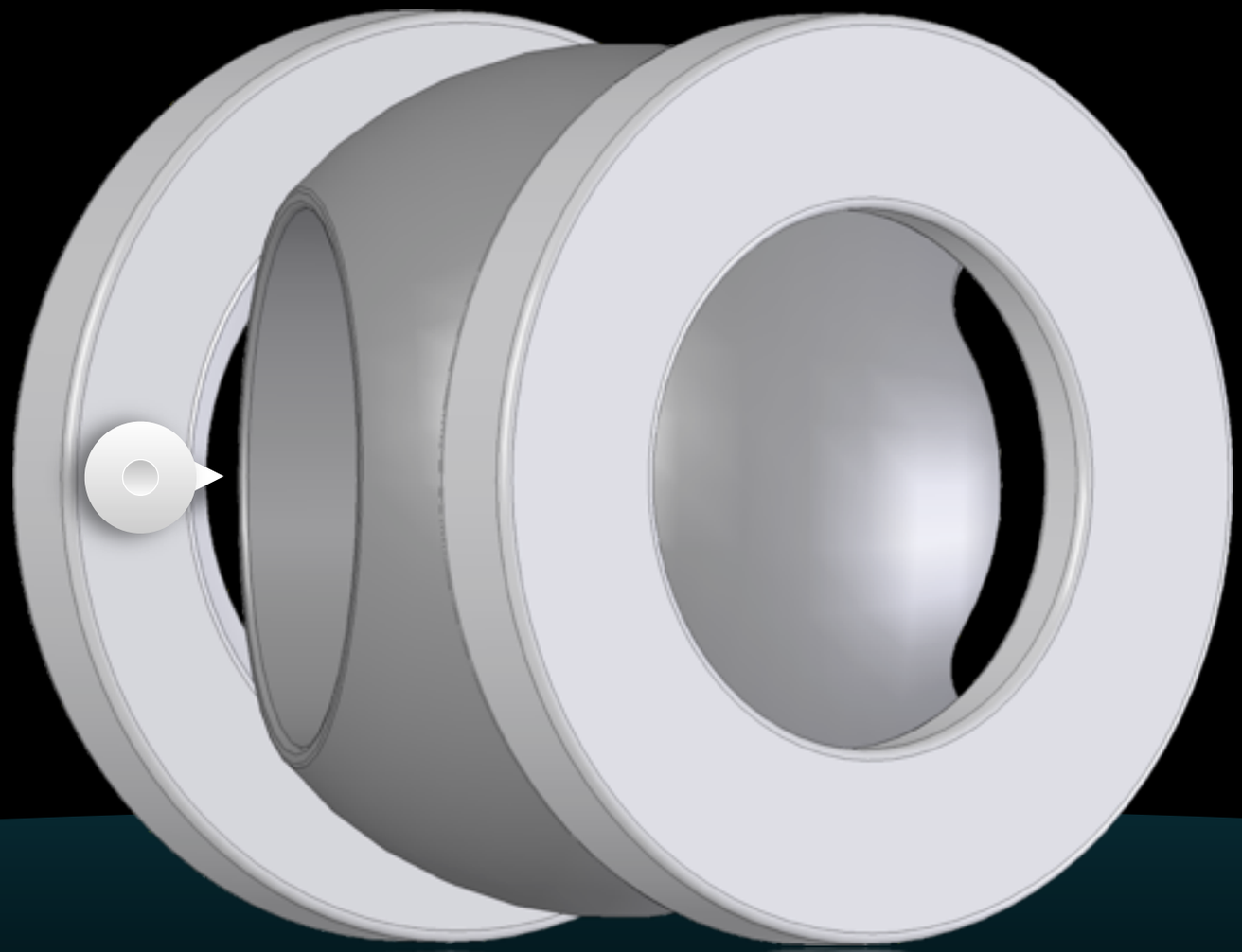
STANDARD

Elliptical opening

Sharp corners

High velocities

Trim damage



M-CLASS
METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

STANDARD BALL VS. ARCUATE CUT

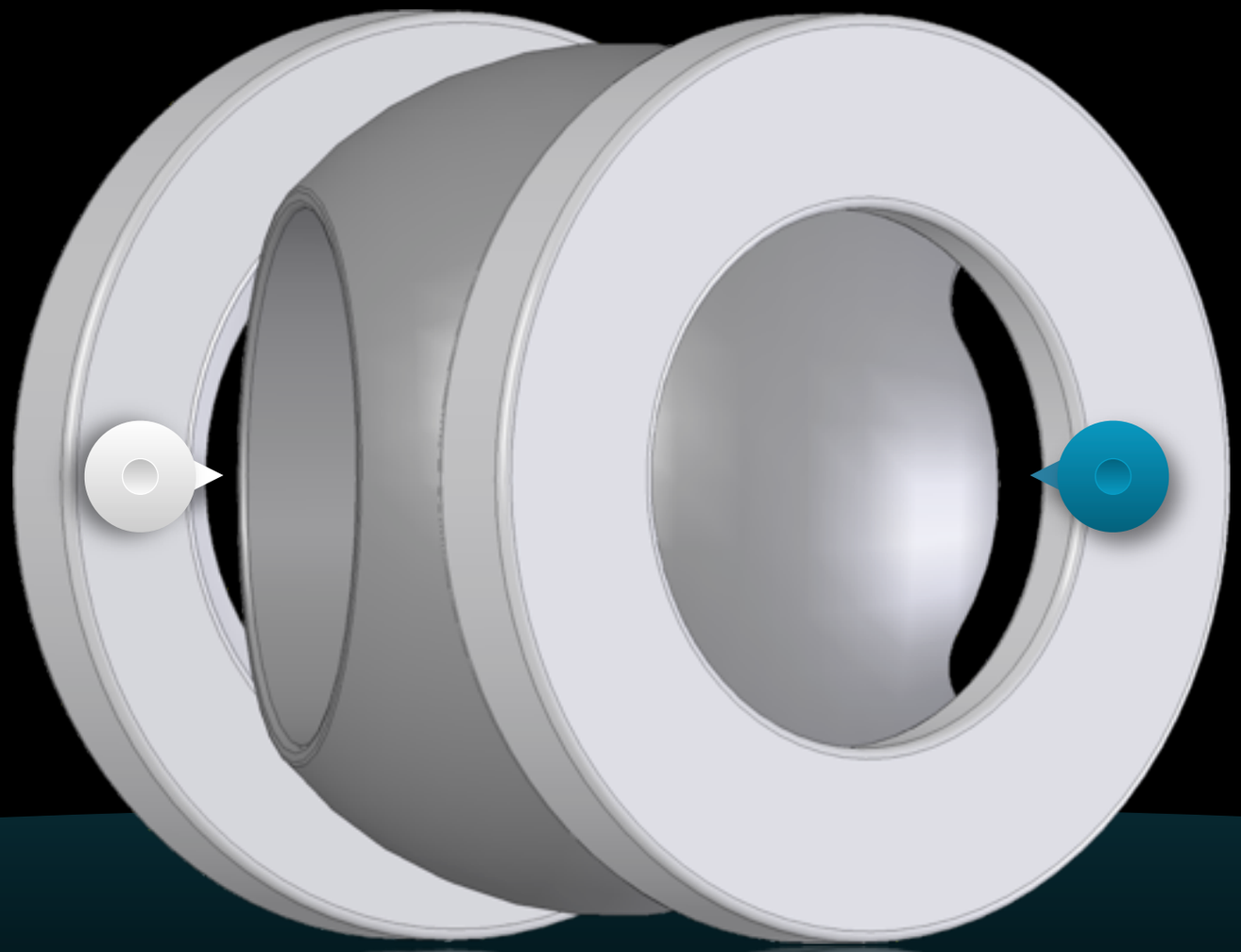
STANDARD

Elliptical opening

Sharp corners

High velocities

Trim damage



ARCUATE

Increased opening

No sharp corners

Flow is spread out

Less damage

M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

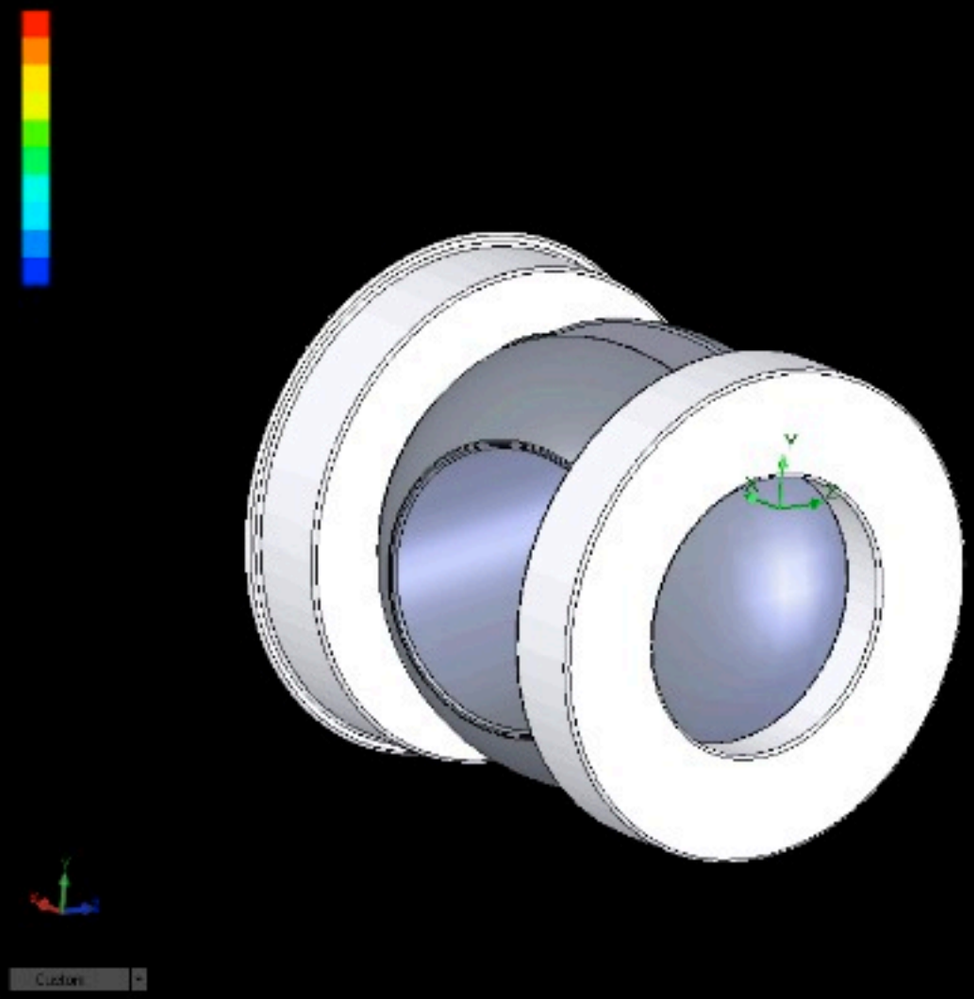
M-CLASS

METAL-SEATED VALVES

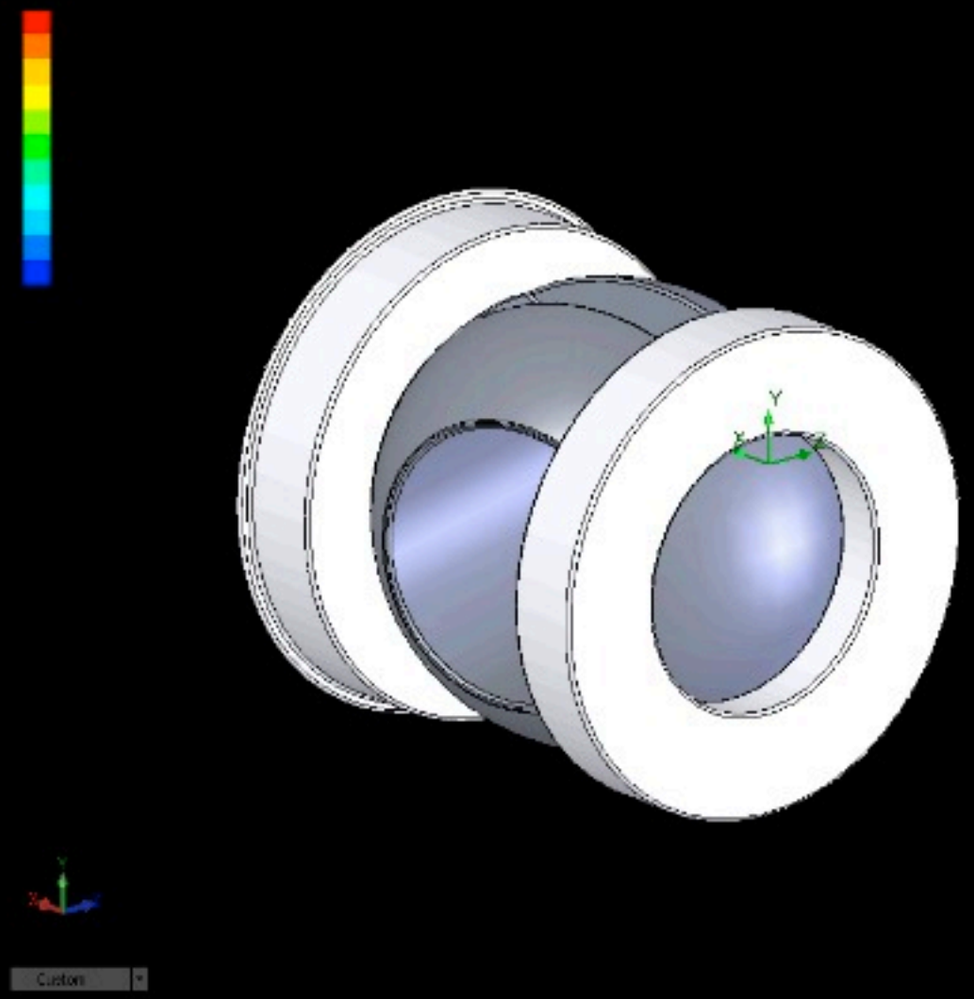
832-261-2400
tycovalves.com

KEYSTONE

COMPUTATIONAL FLUID DYNAMICS ANALYSIS (CFD)



REGULAR BALL



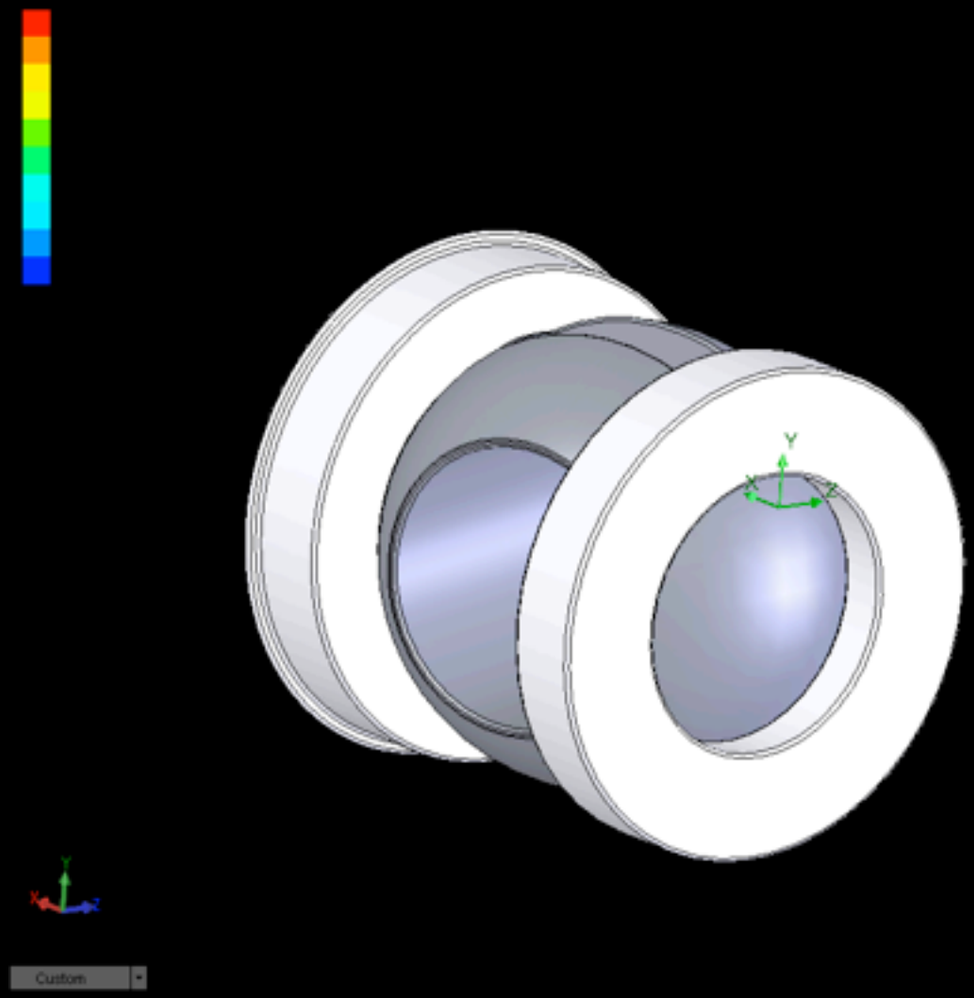
ARCUATE CUT

M-CLASS
METAL-SEATED VALVES

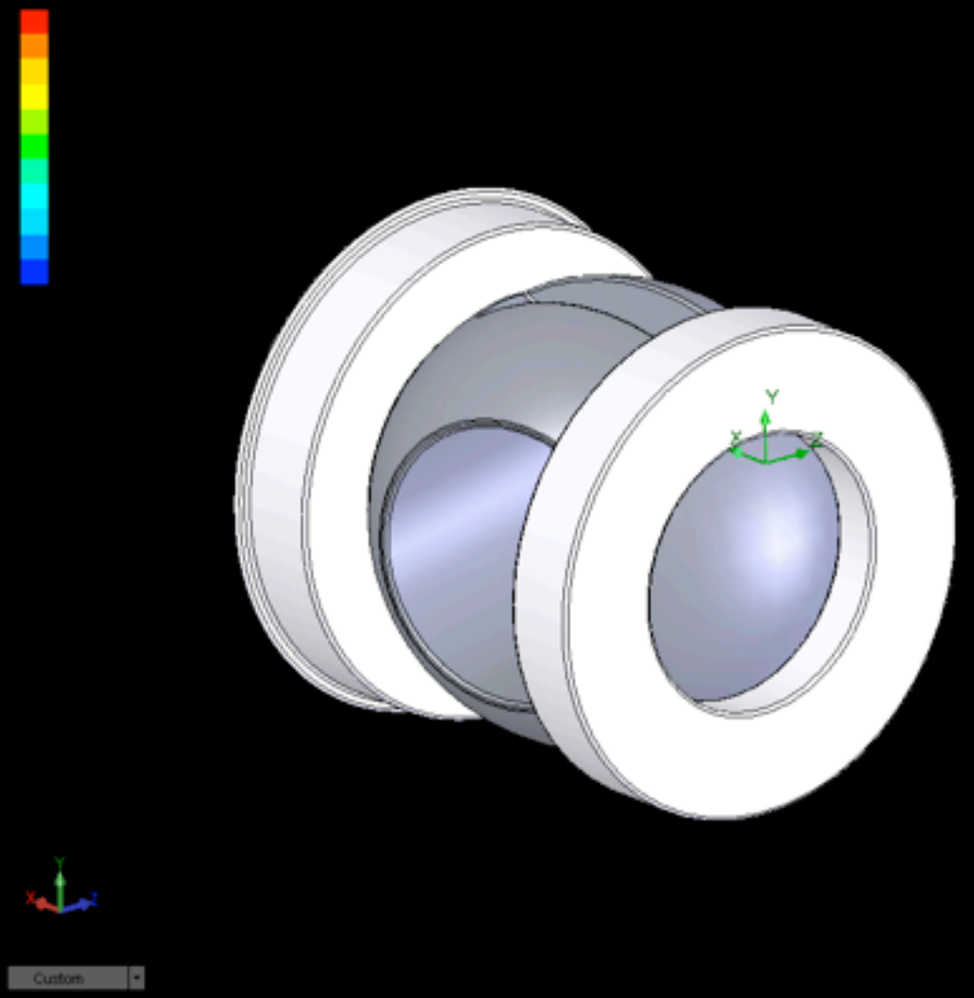
832-261-2400
tycovalves.com

KEYSTONE

COMPUTATIONAL FLUID DYNAMICS ANALYSIS (CFD)



REGULAR BALL



ARCUATE CUT

M-CLASS
METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

COMPETITION VS. M-CLASS

TRIM HARDENING
ACTUATOR MOUNTING
SEAT DESIGN
BALL DESIGN
STEM SEALING
EXOTIC ALLOYS
BALL/SEAT SEALING
LEAD TIMES

832-261-2400
tycovalves.com

COMPETITION VS. M-CLASS

TRIM HARDENING	HVOF	Boronizing
ACTUATOR MOUNTING	Bent Bracket	Tripod Mount
SEAT DESIGN	Standard Seats	Scalloped Seats
BALL DESIGN	Standard Ball	Arcuate Cut & Vari-V Ball
STEM SEALING		
EXOTIC ALLOYS		
BALL/SEAT SEALING		
LEAD TIMES		

832-261-2400
tycovalves.com

COMPETITION VS. M-CLASS

TRIM HARDENING	HVOF	Boronizing
ACTUATOR MOUNTING	Bent Bracket	Tripod Mount
SEAT DESIGN	Standard Seats	Scalloped Seats
BALL DESIGN	Standard Ball	Arcuate Cut & Vari-V Ball
STEM SEALING	Single Packing	Dual Packing
EXOTIC ALLOYS		
BALL/SEAT SEALING		
LEAD TIMES		

M-CLASS
METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

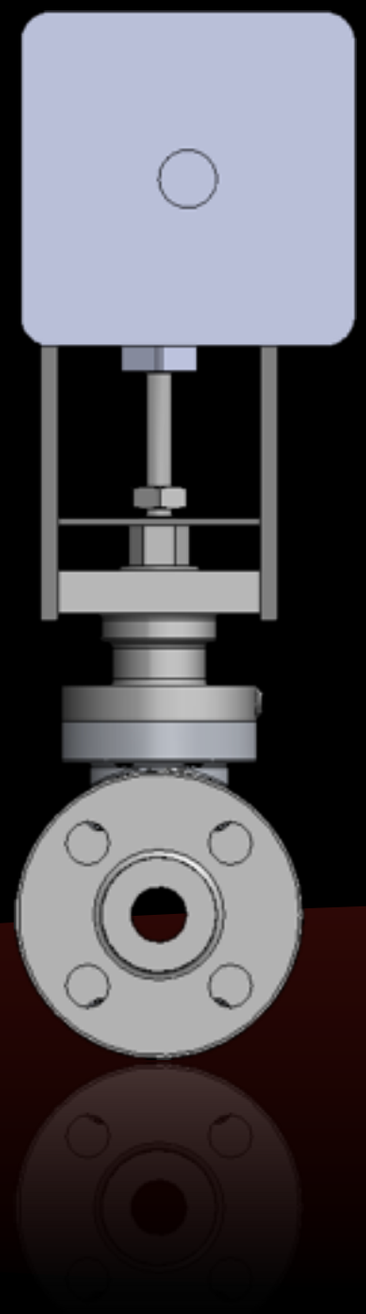
SINGLE PACKING

M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE



SINGLE PACKING

When packing leaks, there is risk of downtime, expense and injury

M-CLASS
METAL-SEATED VALVES

832-261-2400
tycovalves.com

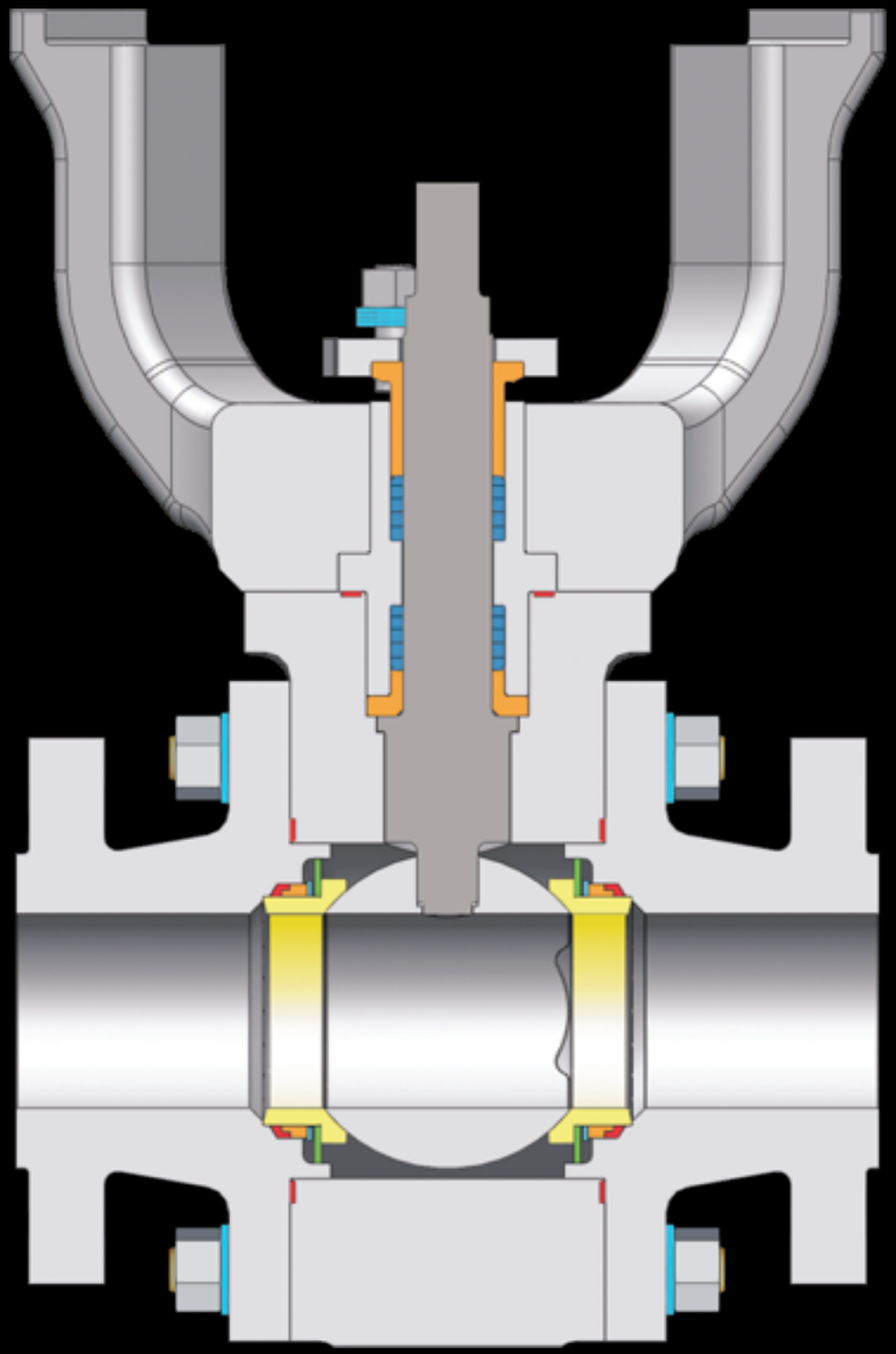
KEYSTONE

M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE



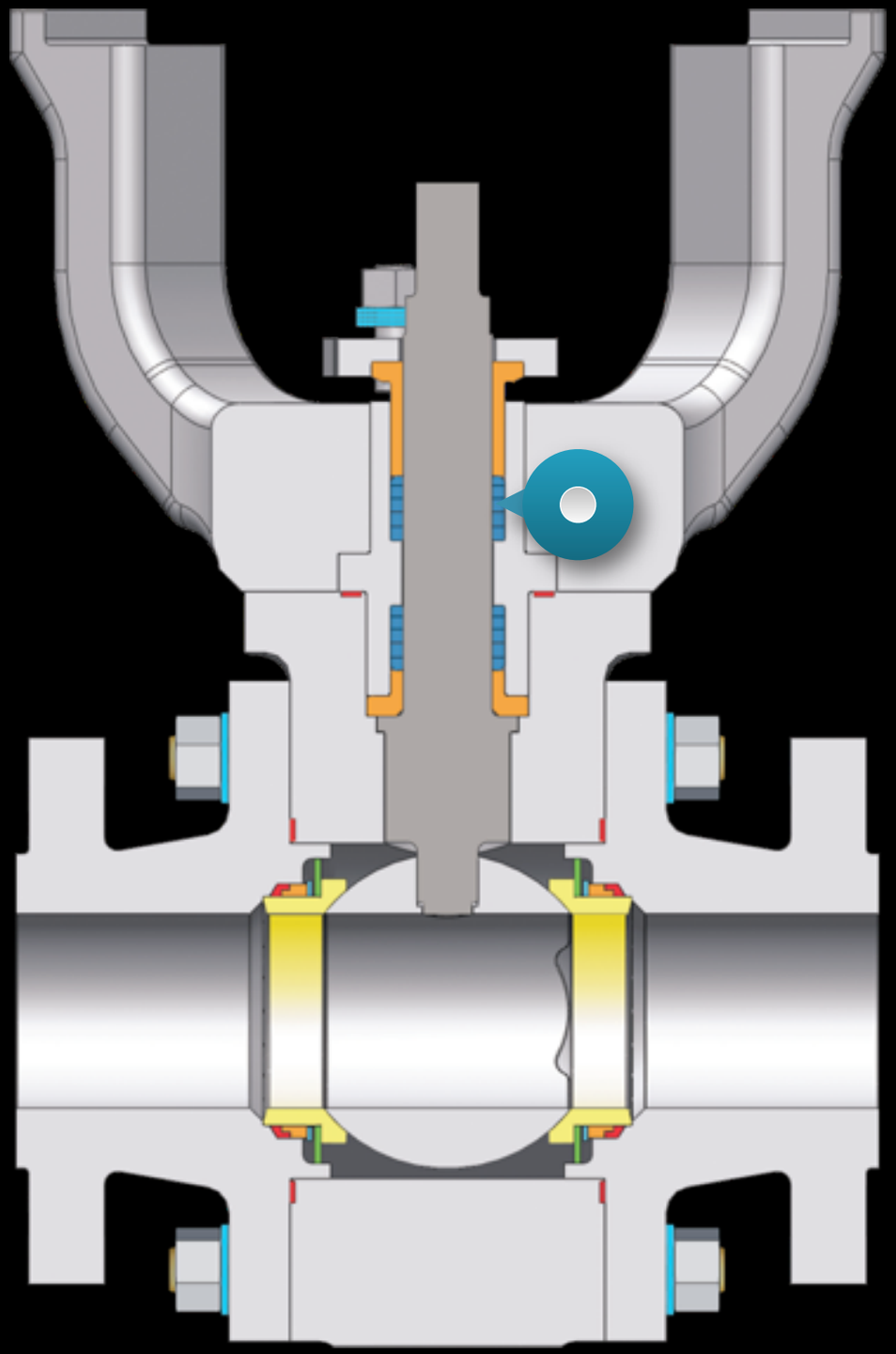
DUAL PACKING

M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

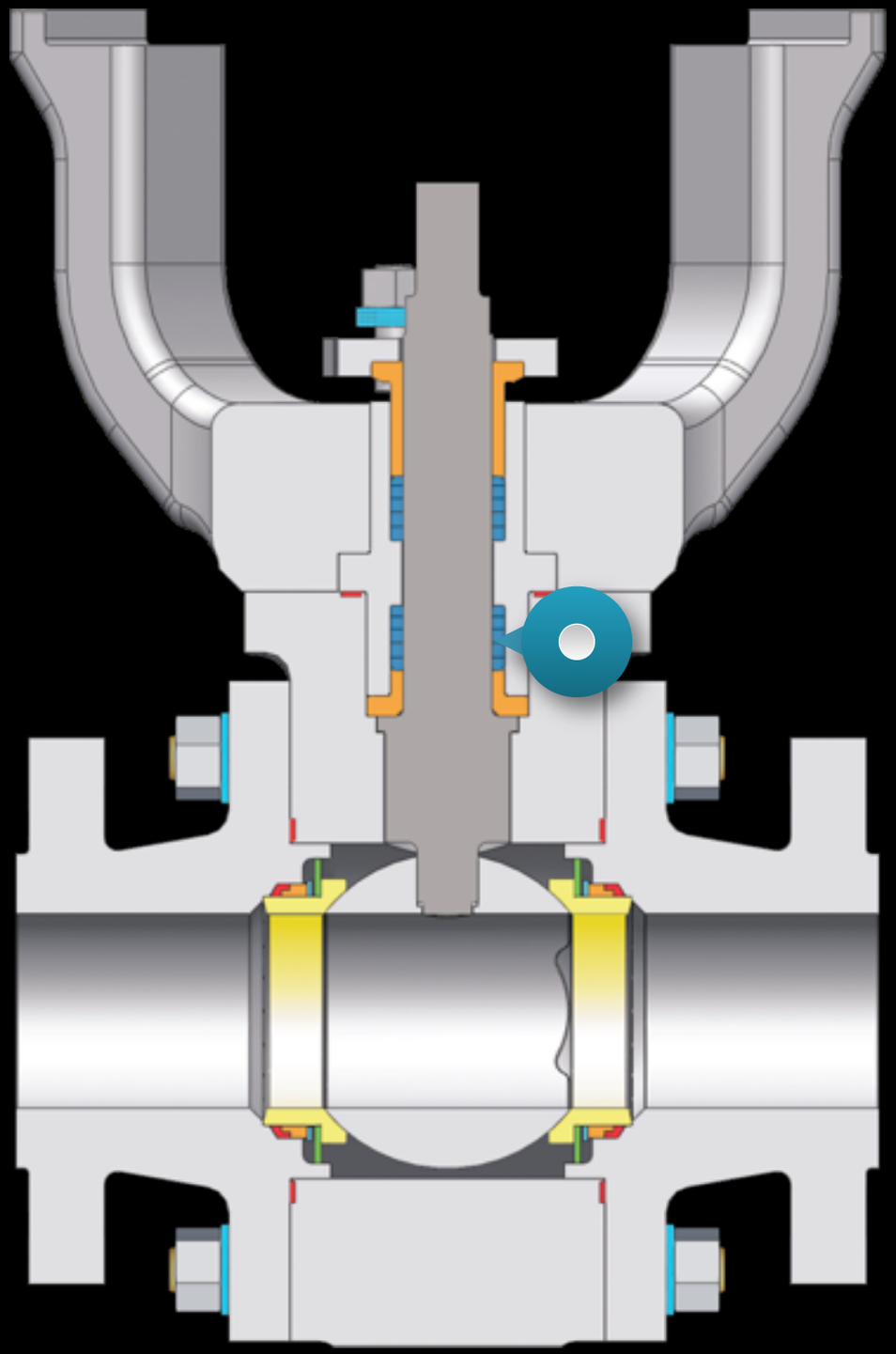


DUAL PACKING

Live loaded upper packing

832-261-2400
tycovalves.com

KEYSTONE



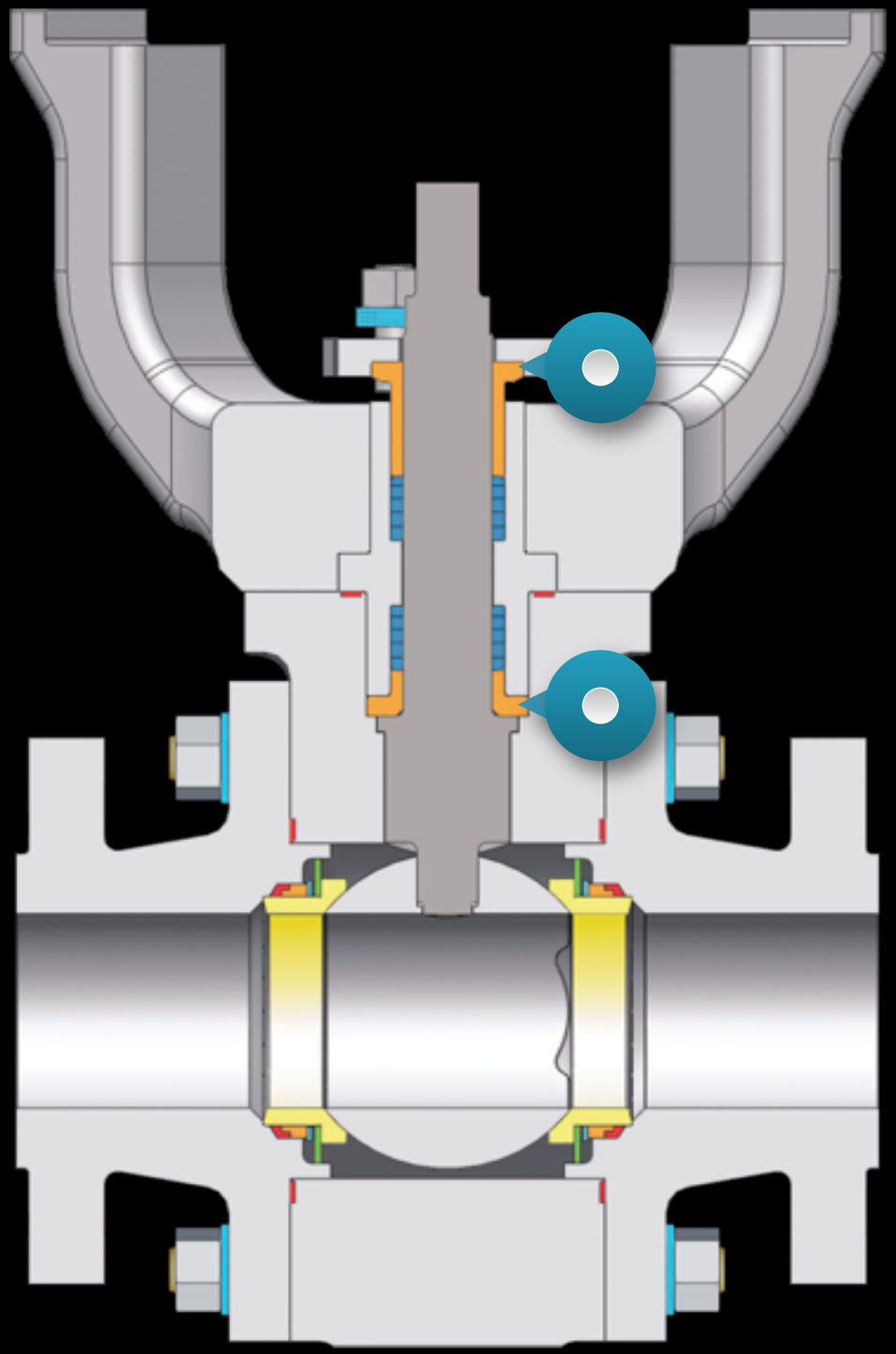
DUAL PACKING

Live loaded upper packing

SmartPak™ lower packing

832-261-2400
tycovalves.com

KEYSTONE



DUAL PACKING

Live loaded upper packing

SmartPak™ lower packing

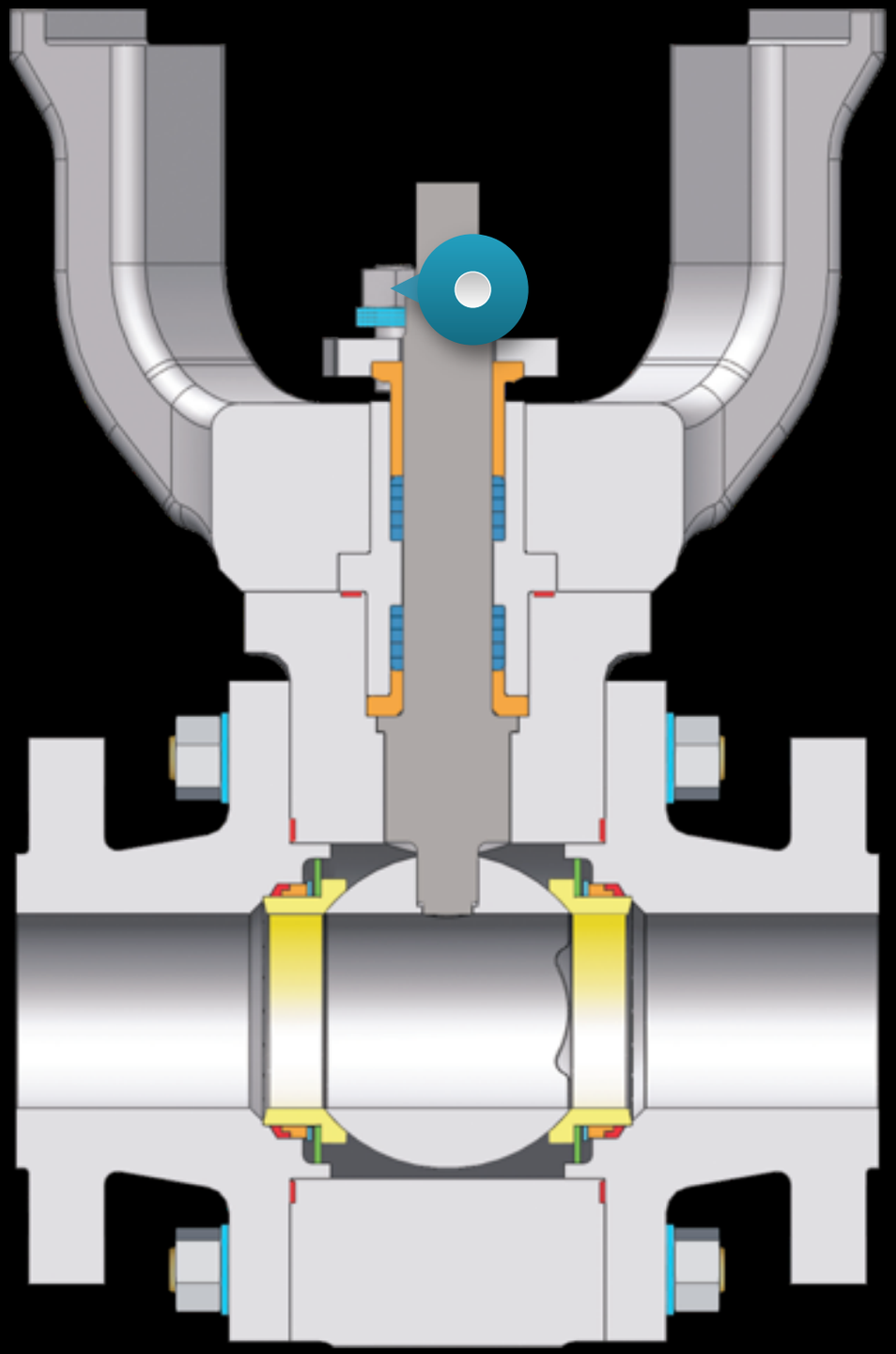
Dual stem guides

M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE



DUAL PACKING

Live loaded upper packing

SmartPak™ lower packing

Dual stem guides

Proprietary packing adjustment

M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

COMPETITION VS. M-CLASS

TRIM HARDENING
ACTUATOR MOUNTING
SEAT DESIGN
BALL DESIGN
STEM SEALING
EXOTIC ALLOYS
BALL/SEAT SEALING
LEAD TIMES

832-261-2400
tycovalves.com

COMPETITION VS. M-CLASS

TRIM HARDENING	HVOF	Boronizing
ACTUATOR MOUNTING	Bent Bracket	Tripod Mount
SEAT DESIGN	Standard Seats	Scalloped Seats
BALL DESIGN	Standard Ball	Arcuate Cut & Vari-V Ball
STEM SEALING	Single Packing	Dual Packing
EXOTIC ALLOYS		
BALL/SEAT SEALING		
LEAD TIMES		

M-CLASS
METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

COMPETITION VS. M-CLASS

TRIM HARDENING	HVOF	Boronizing
ACTUATOR MOUNTING	Bent Bracket	Tripod Mount
SEAT DESIGN	Standard Seats	Scalloped Seats
BALL DESIGN	Standard Ball	Arcuate Cut & Vari-V Ball
STEM SEALING	Single Packing	Dual Packing
EXOTIC ALLOYS	Limited	Any available
BALL/SEAT SEALING		
LEAD TIMES		

M-CLASS
METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

ALLOY OPTIONS

M-CLASS
METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

Hastelloy

INCONEL

Alloy 20

Ceramic

Titanium

MONEL

Incoloy

Super Duplex

DUPLEX

Zirconium

Tantalum

Customer specified

ALLOY OPTIONS

M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

COMPETITION VS. M-CLASS

TRIM HARDENING
ACTUATOR MOUNTING
SEAT DESIGN
BALL DESIGN
STEM SEALING
EXOTIC ALLOYS
BALL/SEAT SEALING
LEAD TIMES

832-261-2400
tycovalves.com

COMPETITION VS. M-CLASS

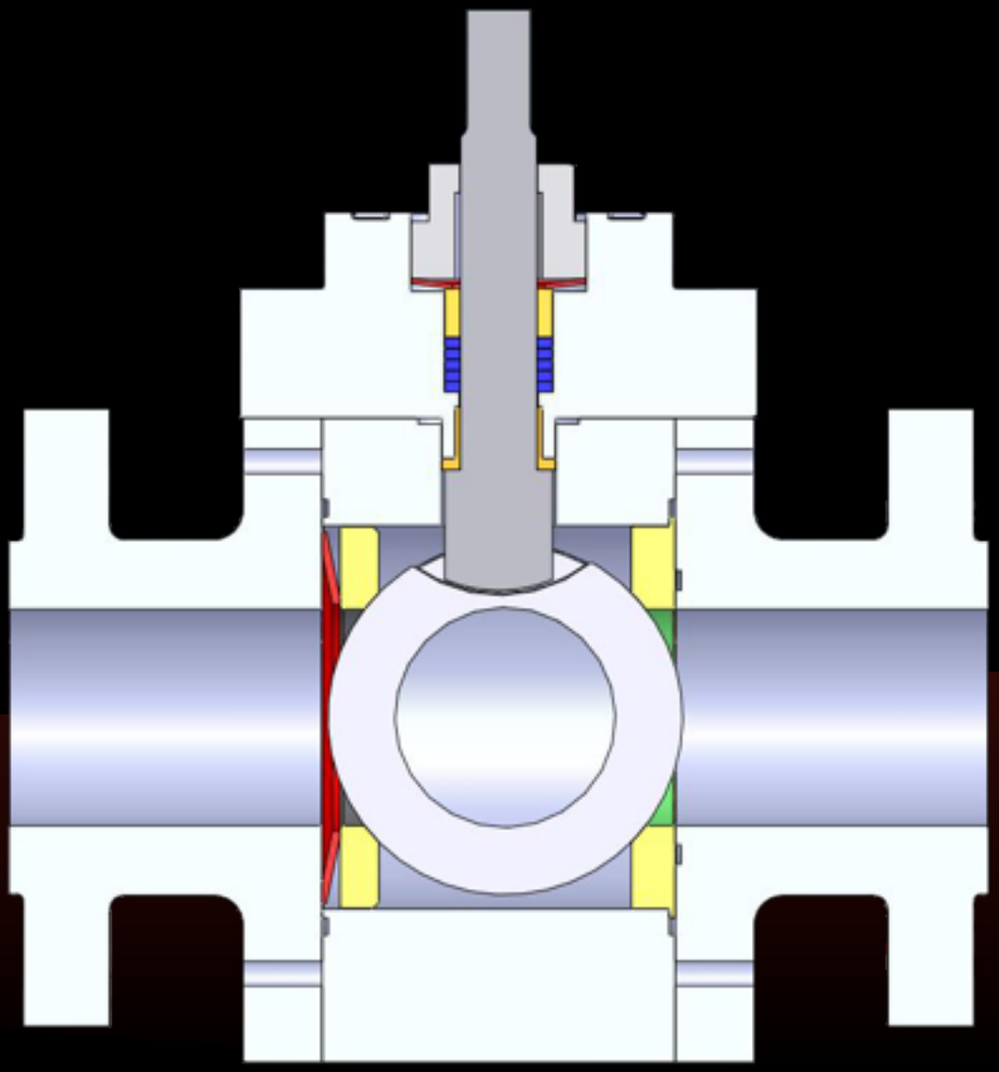
TRIM HARDENING	HVOF	Boronizing
ACTUATOR MOUNTING	Bent Bracket	Tripod Mount
SEAT DESIGN	Standard Seats	Scalloped Seats
BALL DESIGN	Standard Ball	Arcuate Cut & Vari-V Ball
STEM SEALING	Single Packing	Dual Packing
EXOTIC ALLOYS	Limited	Any available
BALL/SEAT SEALING		
LEAD TIMES		

832-261-2400
tycovalves.com

COMPETITION VS. M-CLASS

TRIM HARDENING	HVOF	Boronizing
ACTUATOR MOUNTING	Bent Bracket	Tripod Mount
SEAT DESIGN	Standard Seats	Scalloped Seats
BALL DESIGN	Standard Ball	Arcuate Cut & Vari-V Ball
STEM SEALING	Single Packing	Dual Packing
EXOTIC ALLOYS	Limited	Any available
BALL/SEAT SEALING	Uni-directional	Bi-directional
LEAD TIMES		

832-261-2400
tycovalves.com



M-CLASS

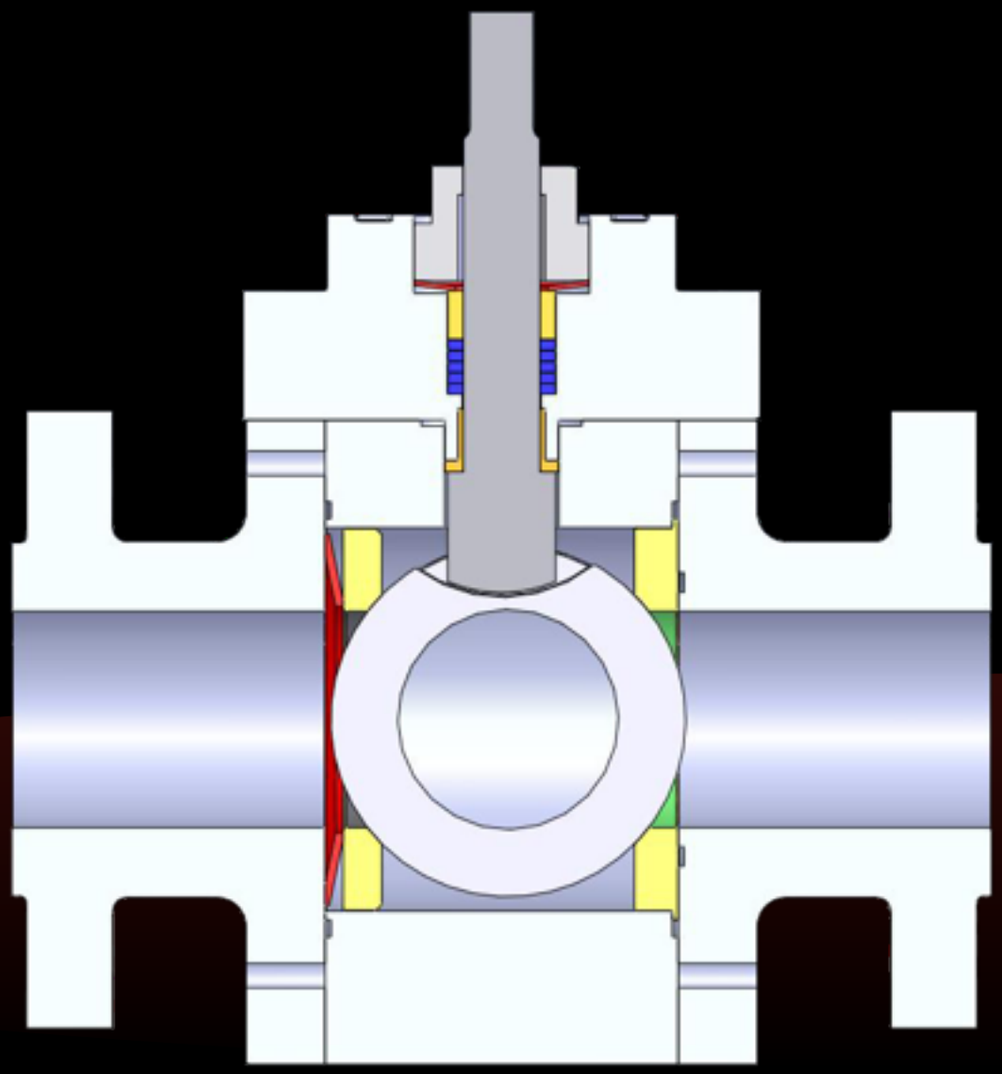
METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

UNI-DIRECTIONAL SEALING

With upstream flow



M-CLASS

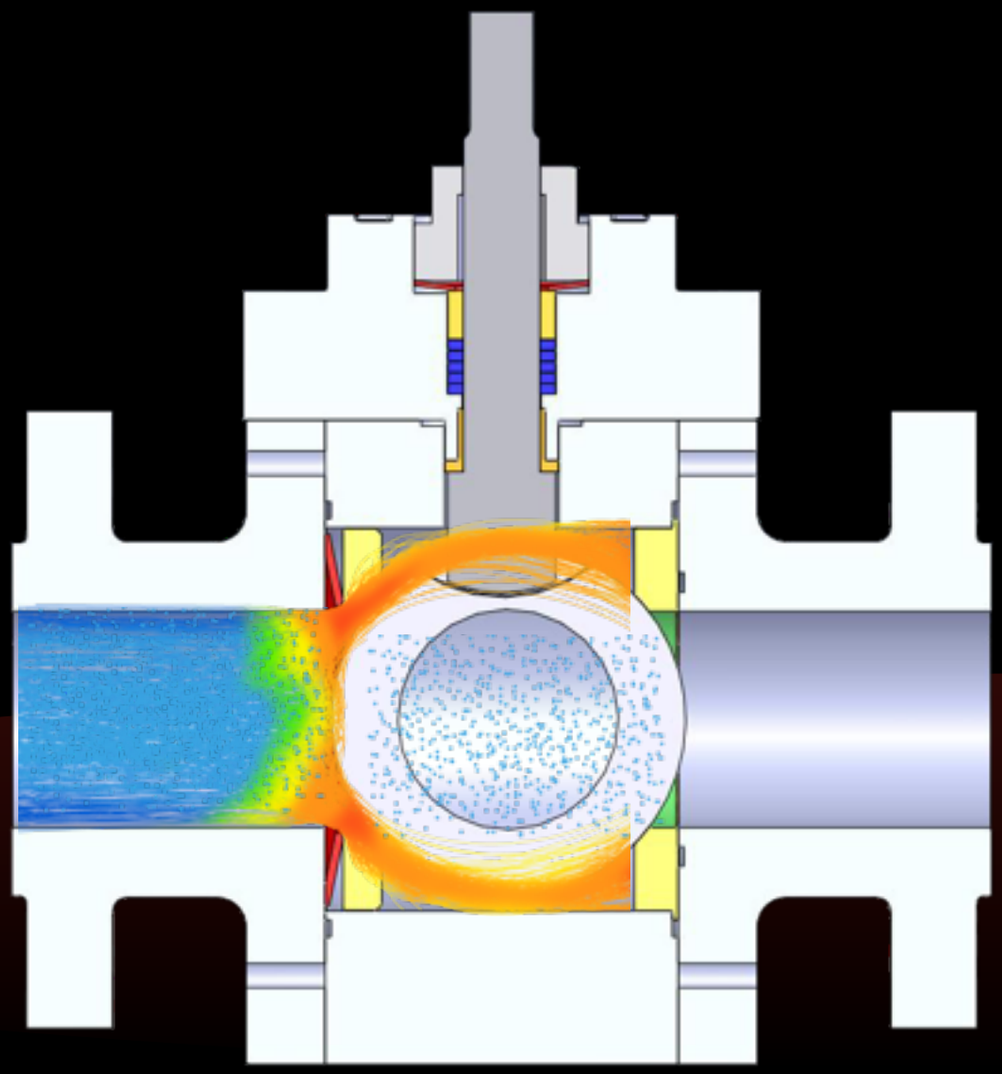
METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

UNI-DIRECTIONAL SEALING

With upstream flow

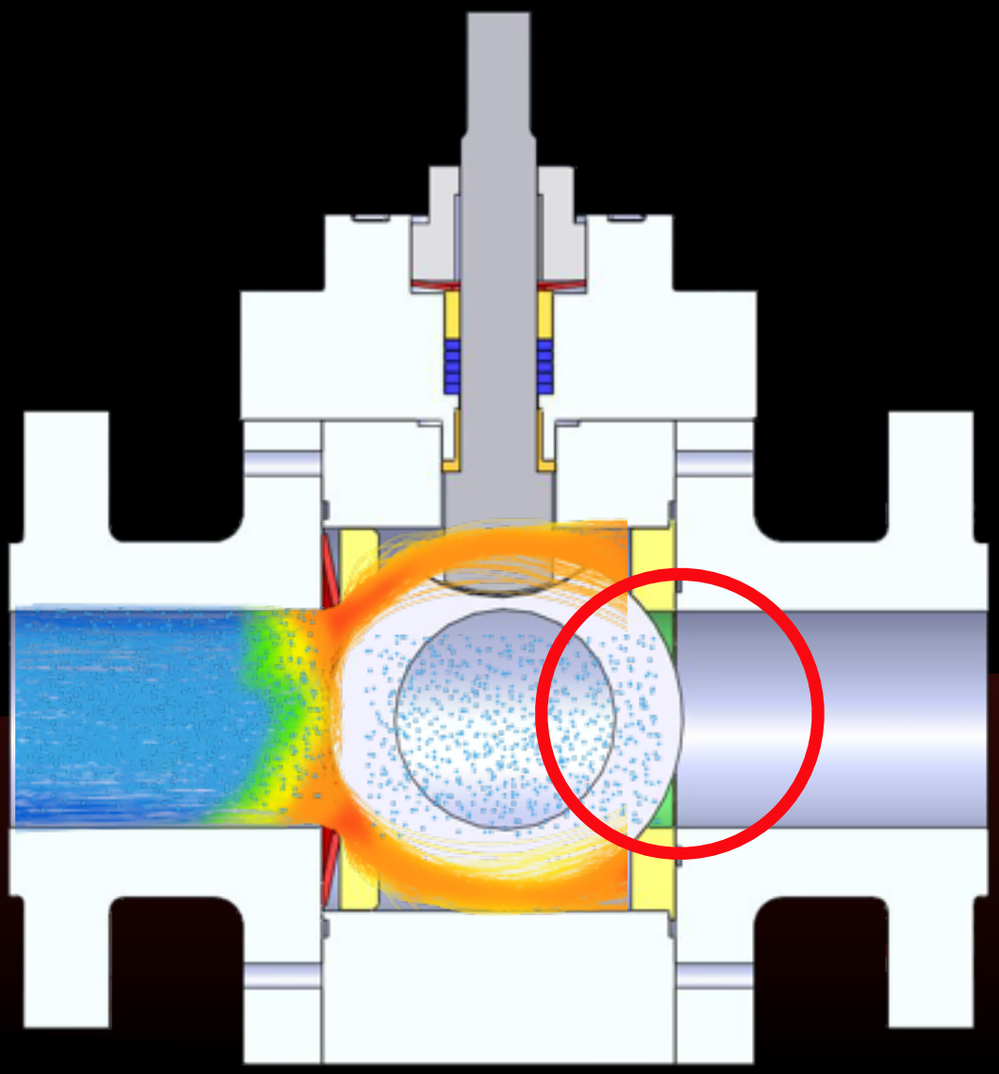


M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE



UNI-DIRECTIONAL SEALING

With upstream flow

Seal between the downstream seat

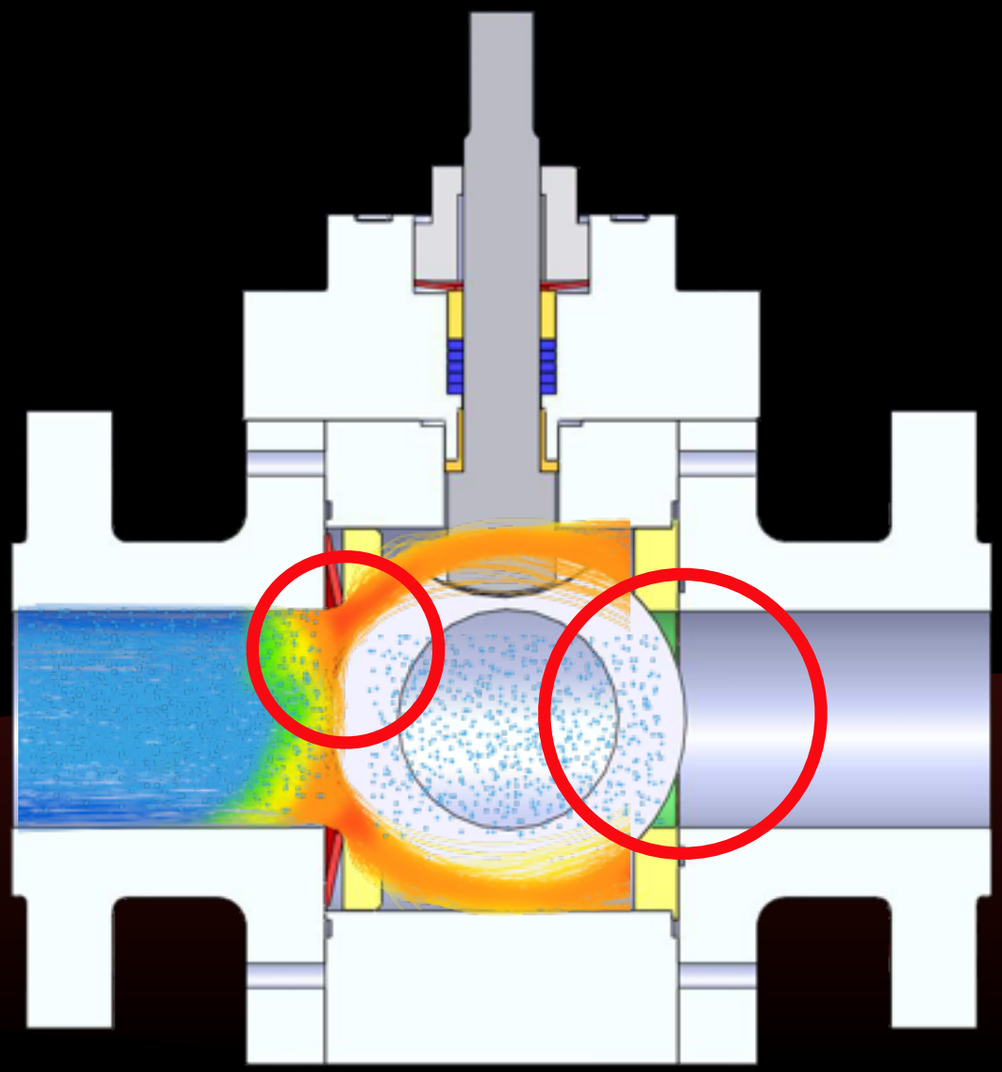
and ball is intact

M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE



UNI-DIRECTIONAL SEALING

With upstream flow

Seal between the downstream seat

and ball is intact

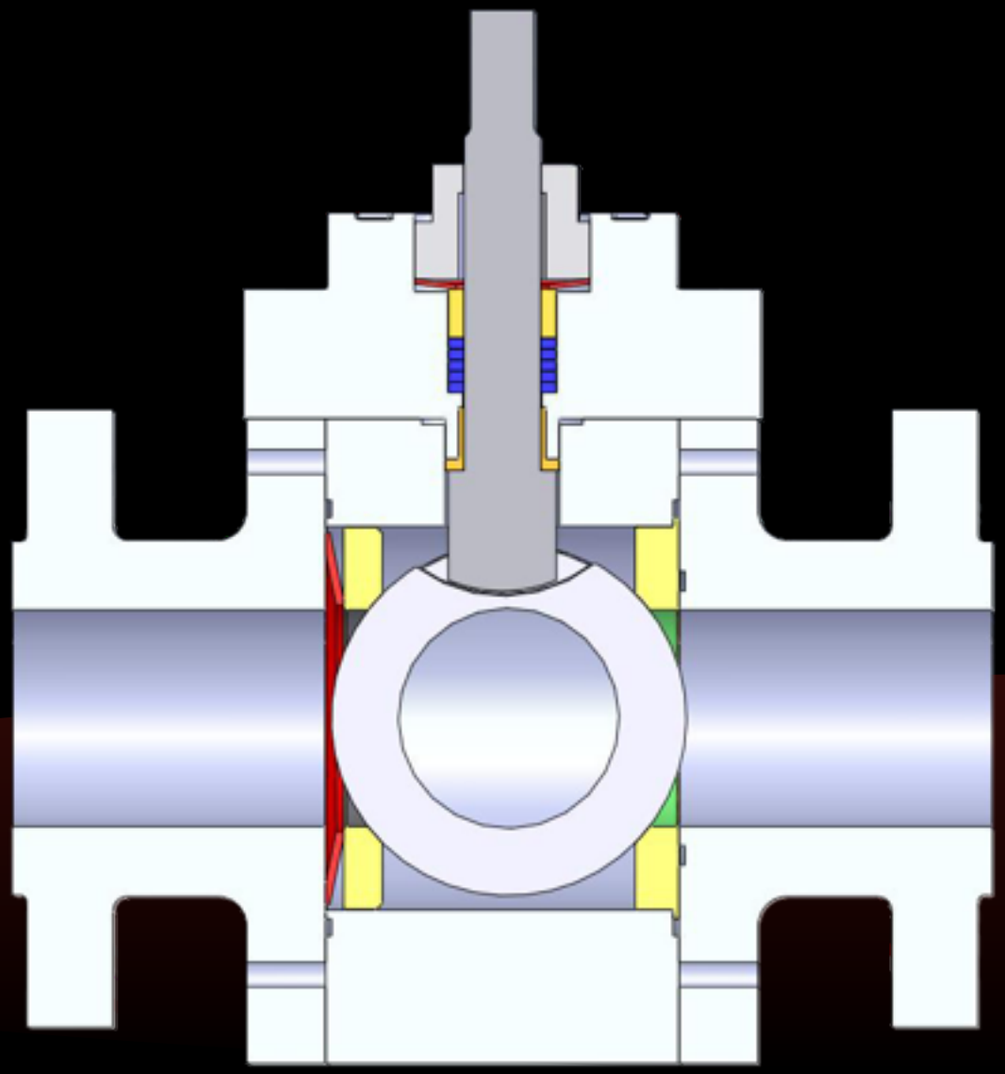
Spring is not compressed

832-261-2400

tycovalves.com

KEYSTONE

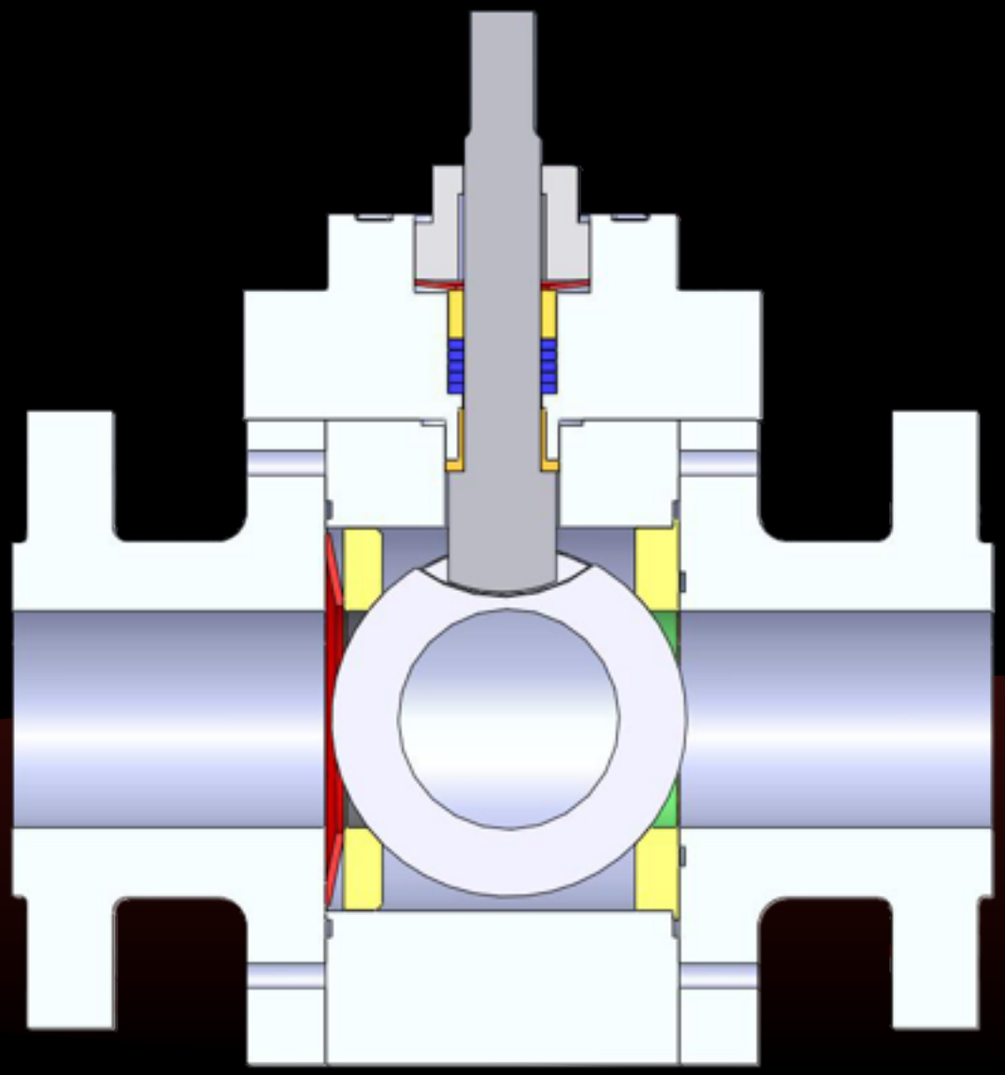
UNI-DIRECTIONAL SEALING



M-CLASS
METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE



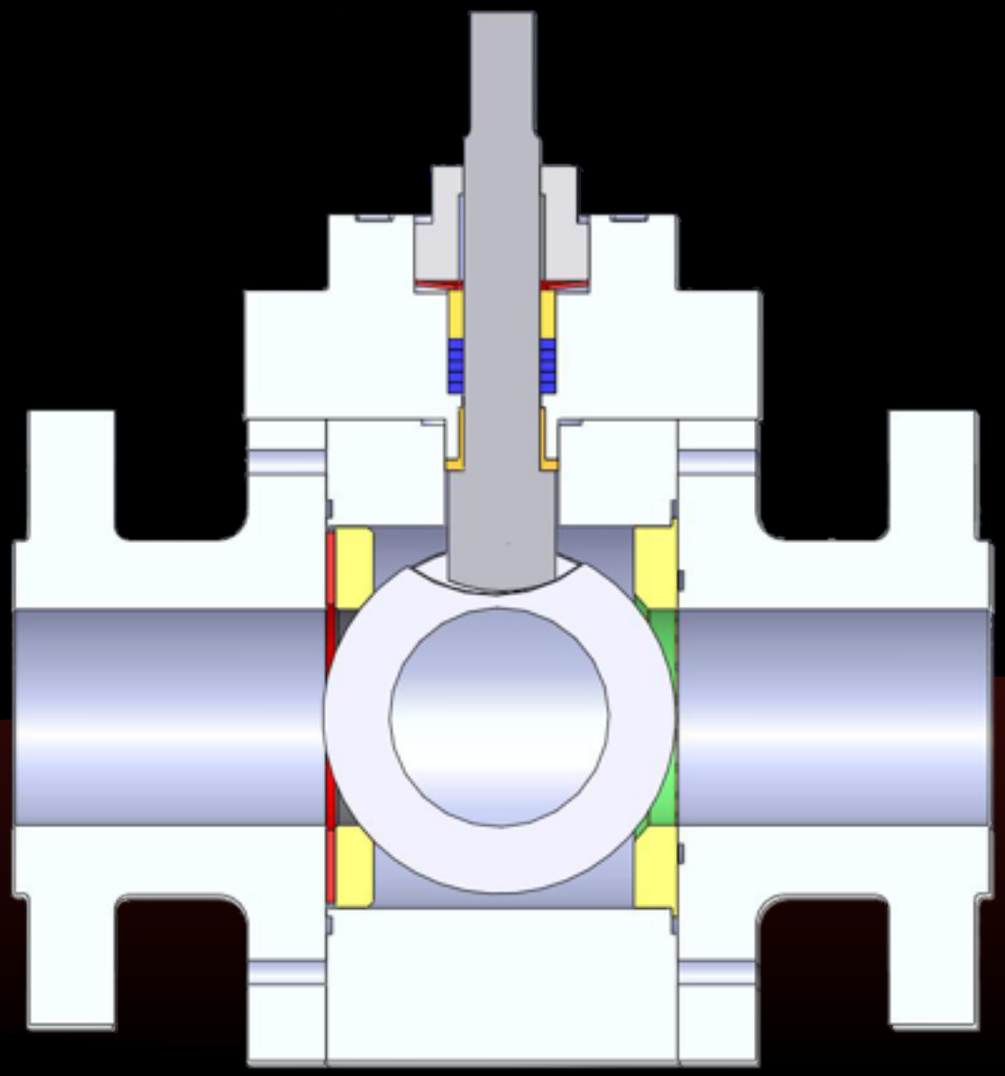
UNI-DIRECTIONAL SEALING

However, with any sort of back-pressure or reverse flow, the valve fails

M-CLASS
METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE



UNI-DIRECTIONAL SEALING

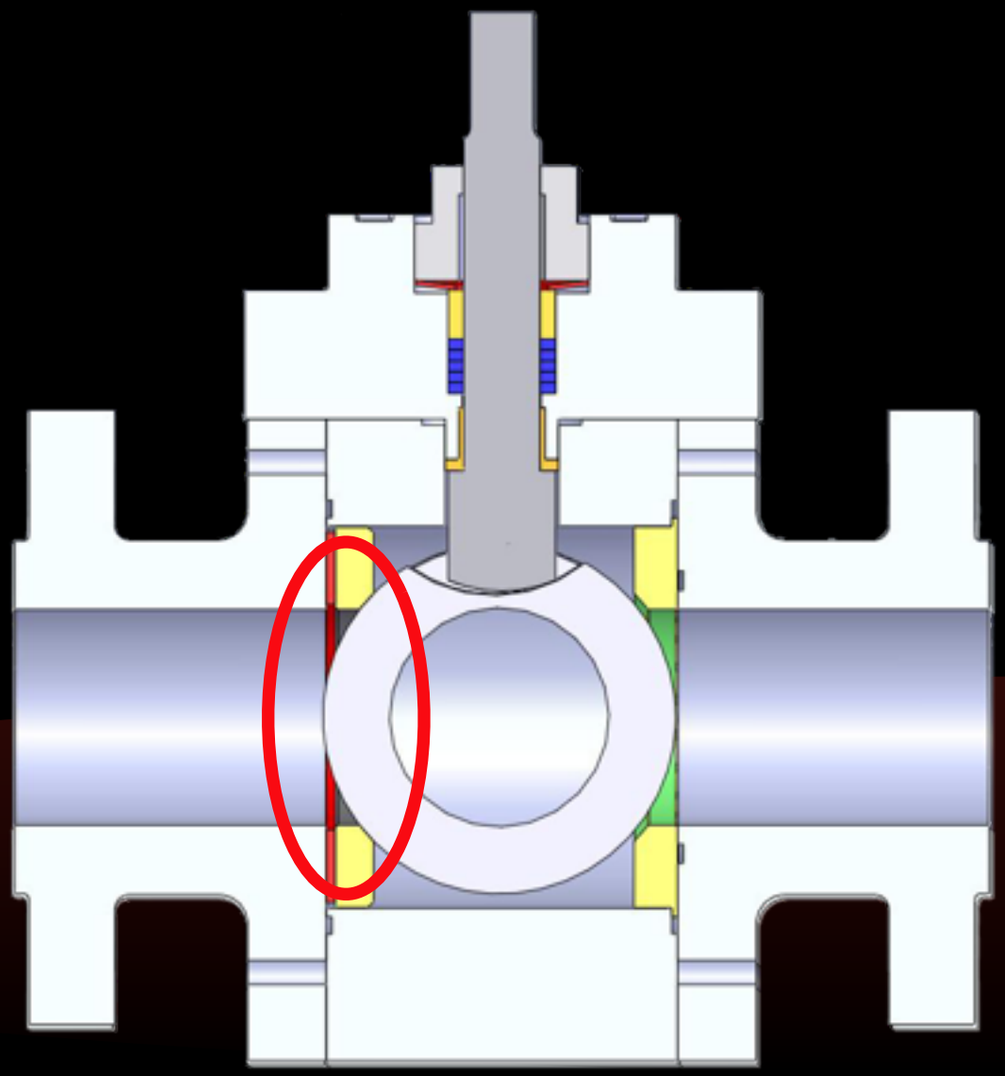
However, with any sort of back-pressure or reverse flow, the valve fails

M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE



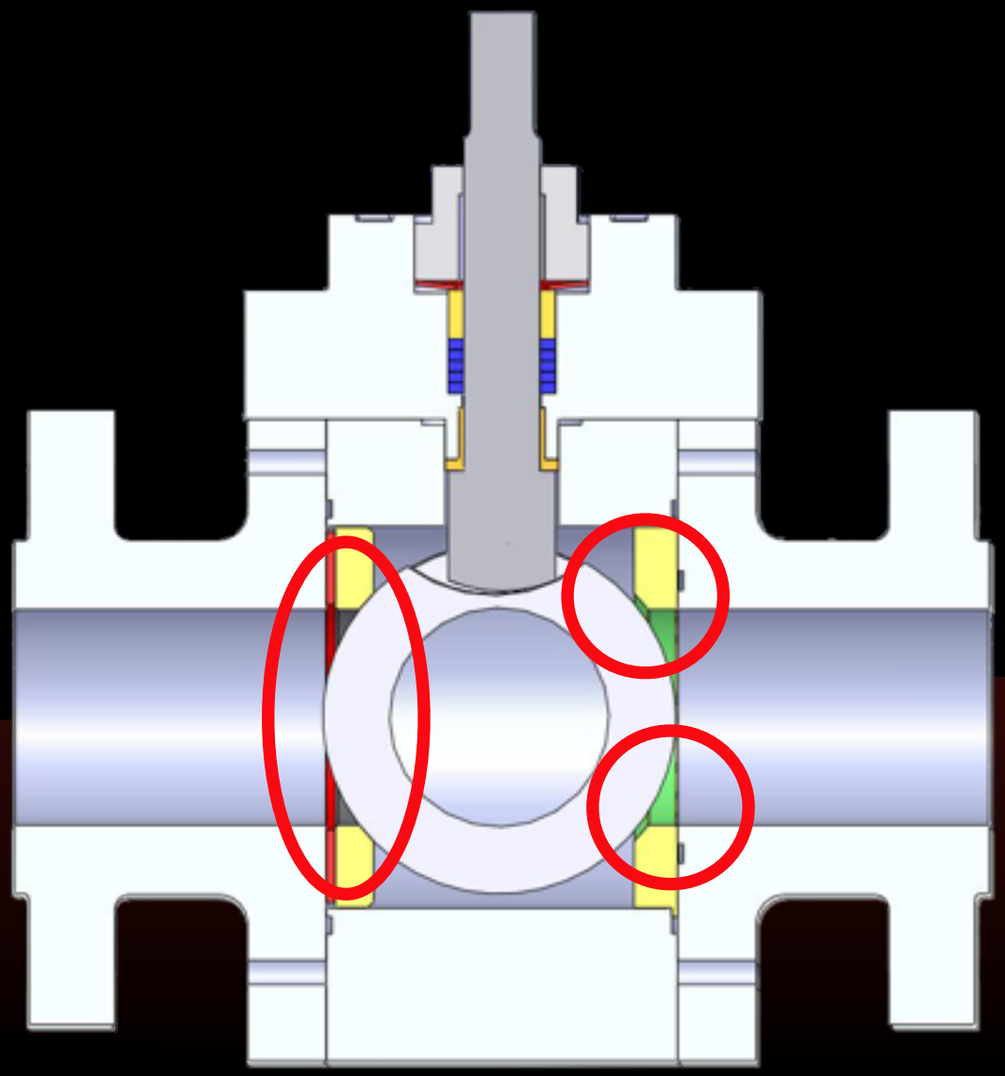
UNI-DIRECTIONAL SEALING

However, with any sort of back-pressure or reverse flow, the valve fails

Ball collapses the spring

832-261-2400
tycovalves.com

KEYSTONE



UNI-DIRECTIONAL SEALING

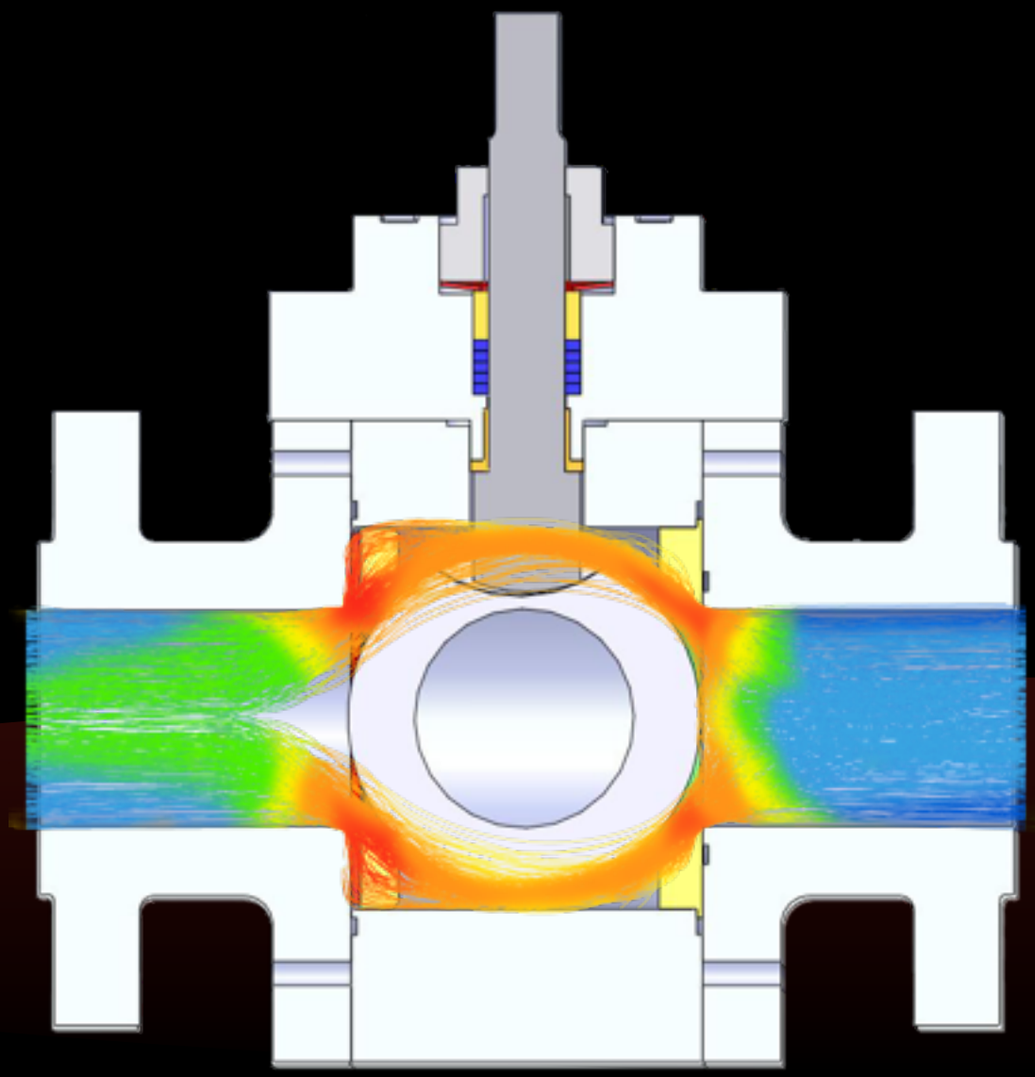
However, with any sort of back-pressure or reverse flow, the valve fails

Ball collapses the spring

Gaps between downstream seat and ball cause leakage

832-261-2400
tycovalves.com

KEYSTONE



UNI-DIRECTIONAL SEALING

However, with any sort of back-pressure or reverse flow, the valve fails

Ball collapses the spring

Gaps between downstream seat and ball cause leakage

M-CLASS
METAL-SEATED VALVES

832-261-2400
tycovalves.com

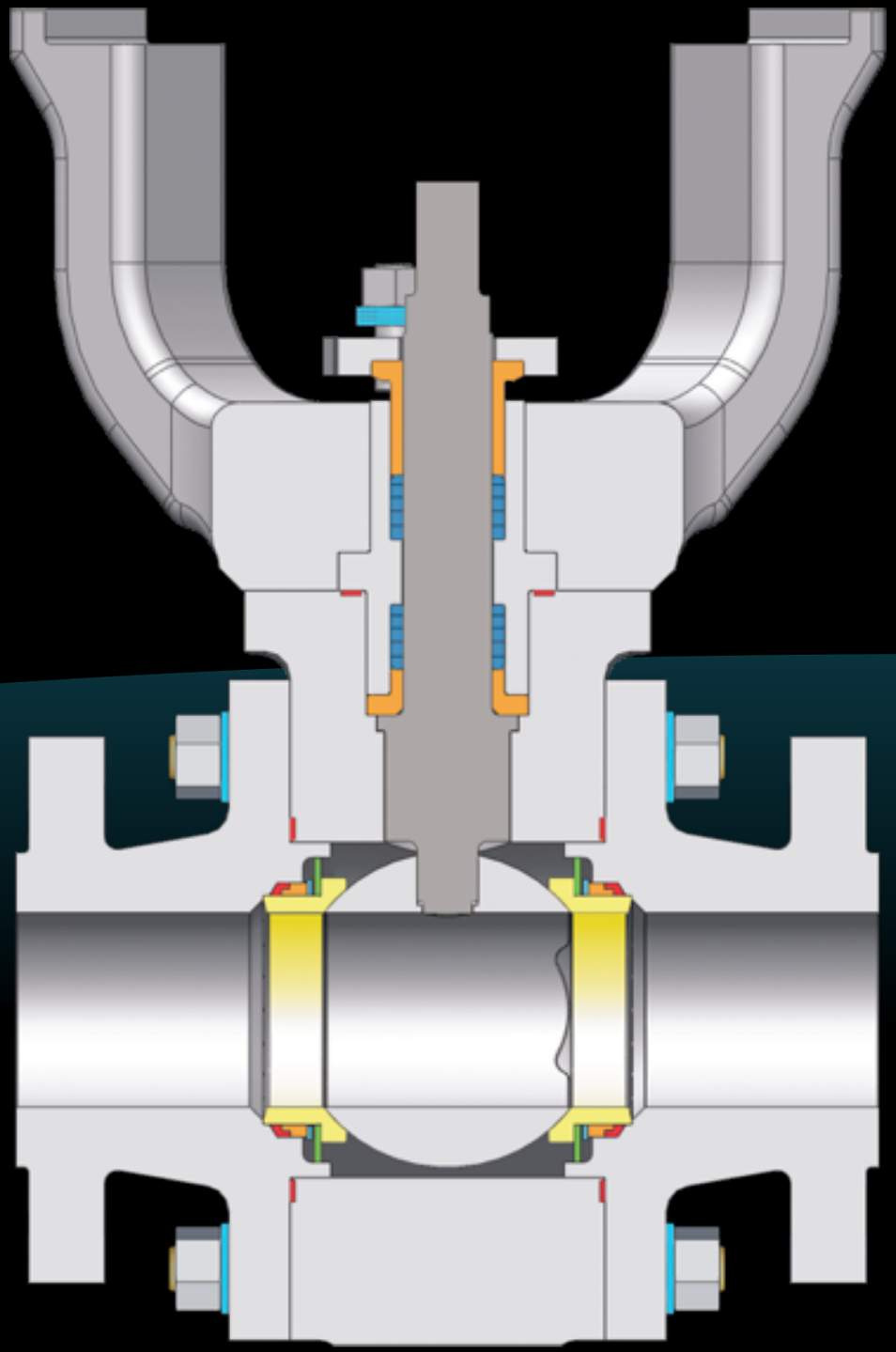
KEYSTONE

M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE



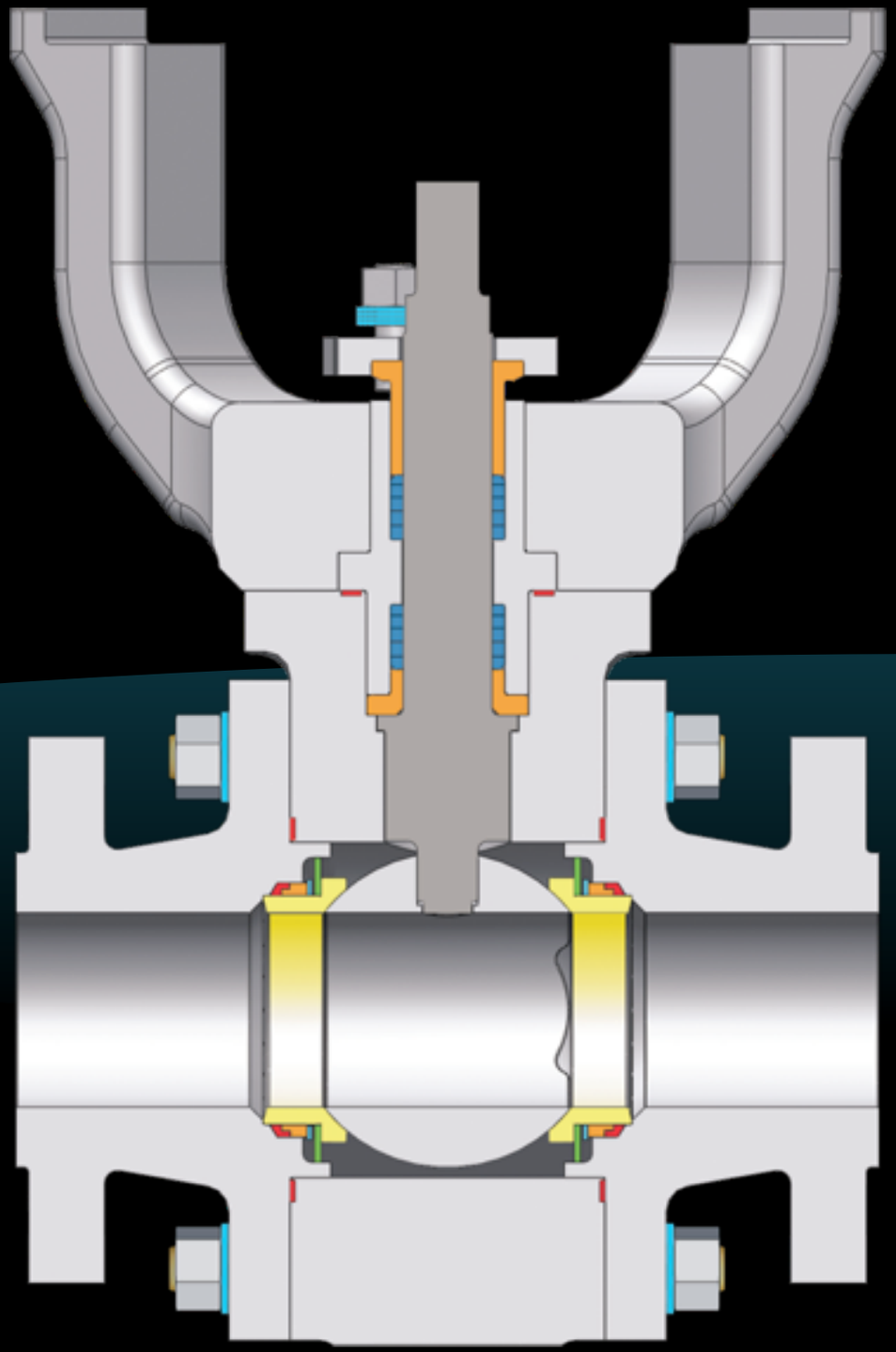
BI-DIRECTIONAL SEALING

M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE



BI-DIRECTIONAL SEALING

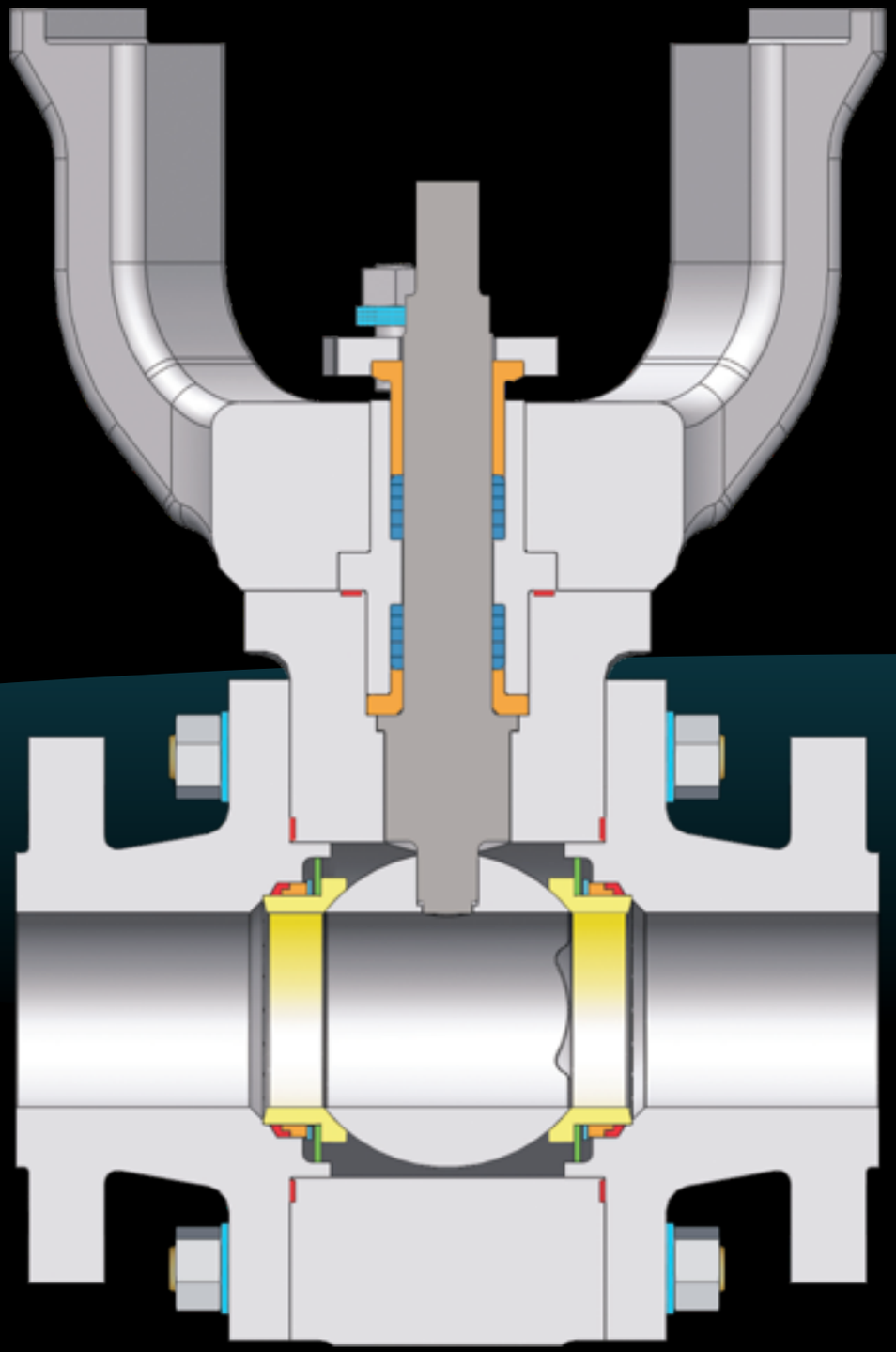
Valve can withstand pressure from upstream or downstream

M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE



BI-DIRECTIONAL SEALING

Valve can withstand pressure from upstream or downstream

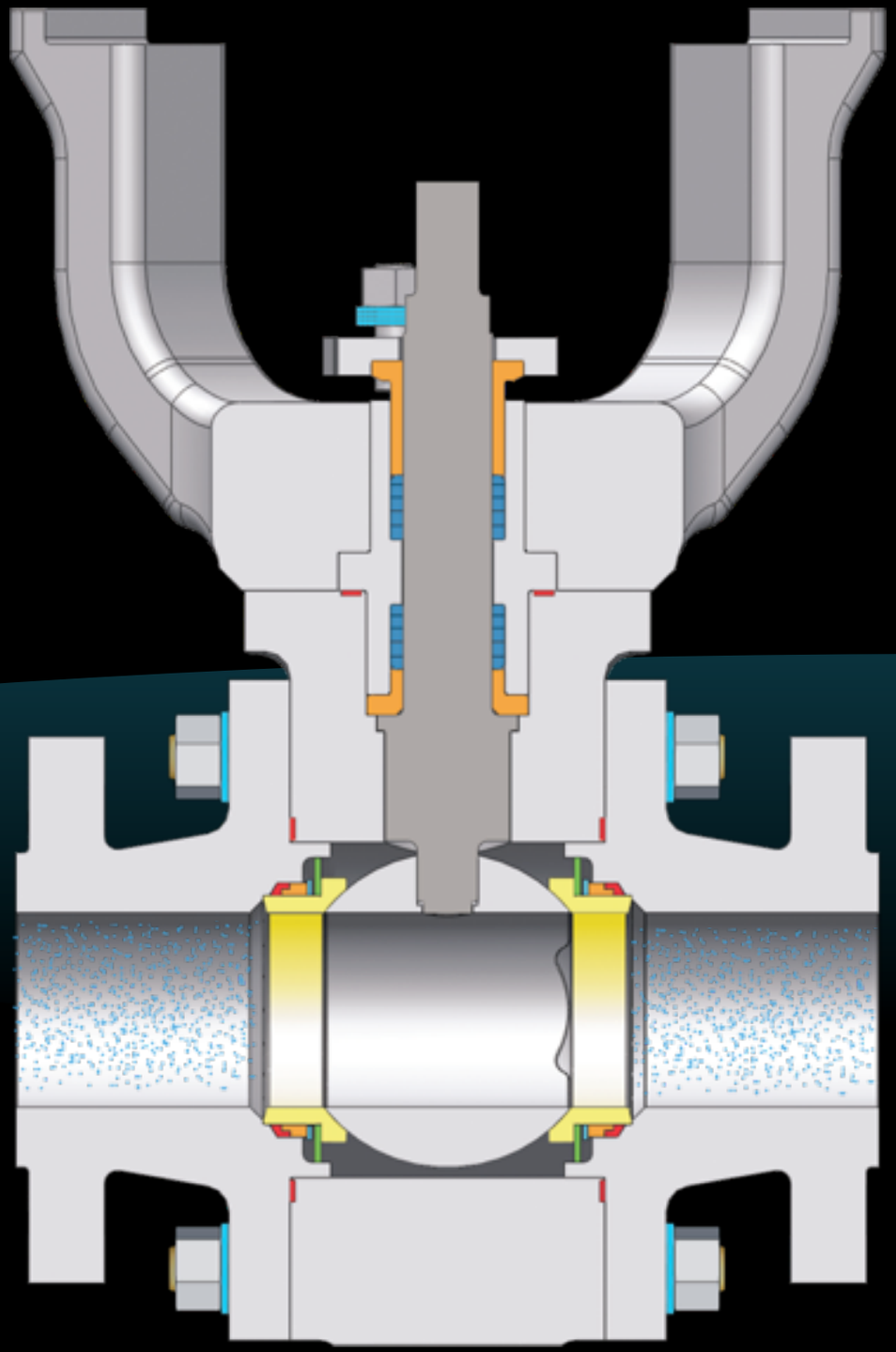
Both seals remain intact

M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE



BI-DIRECTIONAL SEALING

Valve can withstand pressure from upstream or downstream

Both seals remain intact

M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

COMPETITION VS. M-CLASS

TRIM HARDENING	HVOF	Boronizing
ACTUATOR MOUNTING	Bent Bracket	Tripod Mount
SEAT DESIGN	Standard Seats	Scalloped Seats
BALL DESIGN	Standard Ball	Arcuate Cut & Vari-V Ball
STEM SEALING	Single Packing	Dual Packing
EXOTIC ALLOYS	Limited	Any available
BALL/SEAT SEALING	Uni-directional	Bi-directional
LEAD TIMES		

M-CLASS
METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

COMPETITION VS. M-CLASS

TRIM HARDENING	HVOF	Boronizing
ACTUATOR MOUNTING	Bent Bracket	Tripod Mount
SEAT DESIGN	Standard Seats	Scalloped Seats
BALL DESIGN	Standard Ball	Arcuate Cut & Vari-V Ball
STEM SEALING	Single Packing	Dual Packing
EXOTIC ALLOYS	Limited	Any available
BALL/SEAT SEALING	Uni-directional	Bi-directional
LEAD TIMES		

M-CLASS
METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

COMPETITION VS. M-CLASS

TRIM HARDENING	HVOF	Boronizing
ACTUATOR MOUNTING	Bent Bracket	Tripod Mount
SEAT DESIGN	Standard Seats	Scalloped Seats
BALL DESIGN	Standard Ball	Arcuate Cut & Vari-V Ball
STEM SEALING	Single Packing	Dual Packing
EXOTIC ALLOYS	Limited	Any available
BALL/SEAT SEALING	Uni-directional	Bi-directional
LEAD TIMES	Up to 52 Weeks	8-10 Weeks

M-CLASS
METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

FAST TRACK

M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

FAST TRACK

Expedited machining/assembly/shipping

M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

FAST TRACK

Expedited machining/assembly/shipping

Fee is based on costs incurred

M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

FAST TRACK

Expedited machining/assembly/shipping

Fee is based on costs incurred

Not on time? No Fast Track charge.

M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

SATISFIED GOSCO CUSTOMERS

SATISFIED GOSCO CUSTOMERS

SATISFIED GOSCO CUSTOMERS

EXXON

中国石化
SINOPEC

SATISFIED GOSCO CUSTOMERS

EXXON

Chevron Phillips Chemical Company

中国石化 SINOPEC

SATISFIED GOSCO CUSTOMERS

EXXON

Chevron Phillips Chemical Company

SINOPEC 中国石化

DUPONT®

The miracles of science™

SATISFIED GOSCO CUSTOMERS

EXXON

Chevron Phillips Chemical Company

DU PONT®

The miracles of science™

ConocoPhillips

SINOPEC 中国石化

SATISFIED GOSCO CUSTOMERS

OPTI CANADA INC.

nexen

EXXON

Chevron Phillips Chemical Company

SINOPEC 中国石化

DUPONT®

The miracles of science™

ConocoPhillips

SATISFIED GOSCO CUSTOMERS

SUNCOR ENERGY

OPTI CANADA INC.

nexen

EXXON

Chevron Phillips Chemical Company

SINOPEC 中国石化

DUPONT®

The miracles of science™

ConocoPhillips

SATISFIED GOSCO CUSTOMERS

SUNCOR ENERGY

ConocoPhillips

SUNCOR ENERGY

M-CLASS

CUSTOM METAL SEATED

832-261-2400
tycovalves.com

KEYSTONE

SUNCOR ENERGY

M-CLASS

CUSTOM METAL SEATED

832-261-2400
tycovalves.com

KEYSTONE

8” Quenched Desand Water to Desand Tank severe service valve

M-CLASS
CUSTOM METAL SEATED

832-261-2400
tycovalves.com

KEYSTONE

8” Quenched Desand Water to Desand Tank severe service valve

Part of the Suncor Firebag III project

M-CLASS

CUSTOM METAL SEATED

832-261-2400
tycovalves.com

KEYSTONE

8” Quenched Desand Water to Desand Tank severe service valve

Part of the Suncor Firebag III project

Exposure to high level of solids at high velocity

M-CLASS

CUSTOM METAL SEATED

832-261-2400
tycovalves.com

KEYSTONE

8” Quenched Desand Water to Desand Tank severe service valve

Part of the Suncor Firebag III project

Exposure to high level of solids at high velocity

WHY A KEYSTONE M-CLASS?

M-CLASS
CUSTOM METAL SEATED

832-261-2400
tycovalves.com

KEYSTONE

8” Quenched Desand Water to Desand Tank severe service valve

Part of the Suncor Firebag III project

Exposure to high level of solids at high velocity

WHY A KEYSTONE M-CLASS?

Expertise and experience with metal-seated vales

M-CLASS
CUSTOM METAL SEATED

832-261-2400
tycovalves.com

KEYSTONE

SUNCOR ENERGY

8” Quenched Desand Water to Desand Tank severe service valve

Part of the Suncor Firebag III project

Exposure to high level of solids at high velocity

WHY A KEYSTONE M-CLASS?

Expertise and experience with metal-seated vales

Reputation for high performance in tough applications

M-CLASS
CUSTOM METAL SEATED

832-261-2400
tycovalves.com

KEYSTONE

SUNCOR ENERGY

8” Quenched Desand Water to Desand Tank severe service valve

Part of the Suncor Firebag III project

Exposure to high level of solids at high velocity

WHY A KEYSTONE M-CLASS?

Expertise and experience with metal-seated vales

Reputation for high performance in tough applications

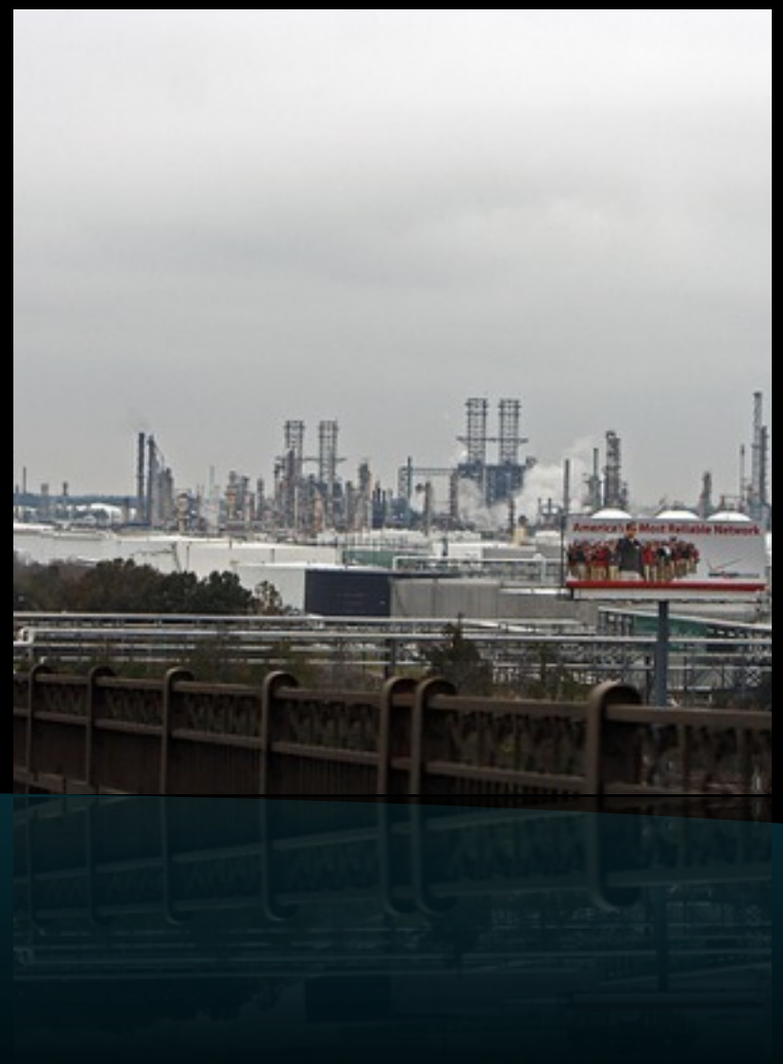
Proprietary ball and seat designs

M-CLASS
CUSTOM METAL SEATED

832-261-2400
tycovalves.com

KEYSTONE

ConocoPhillips



M-CLASS

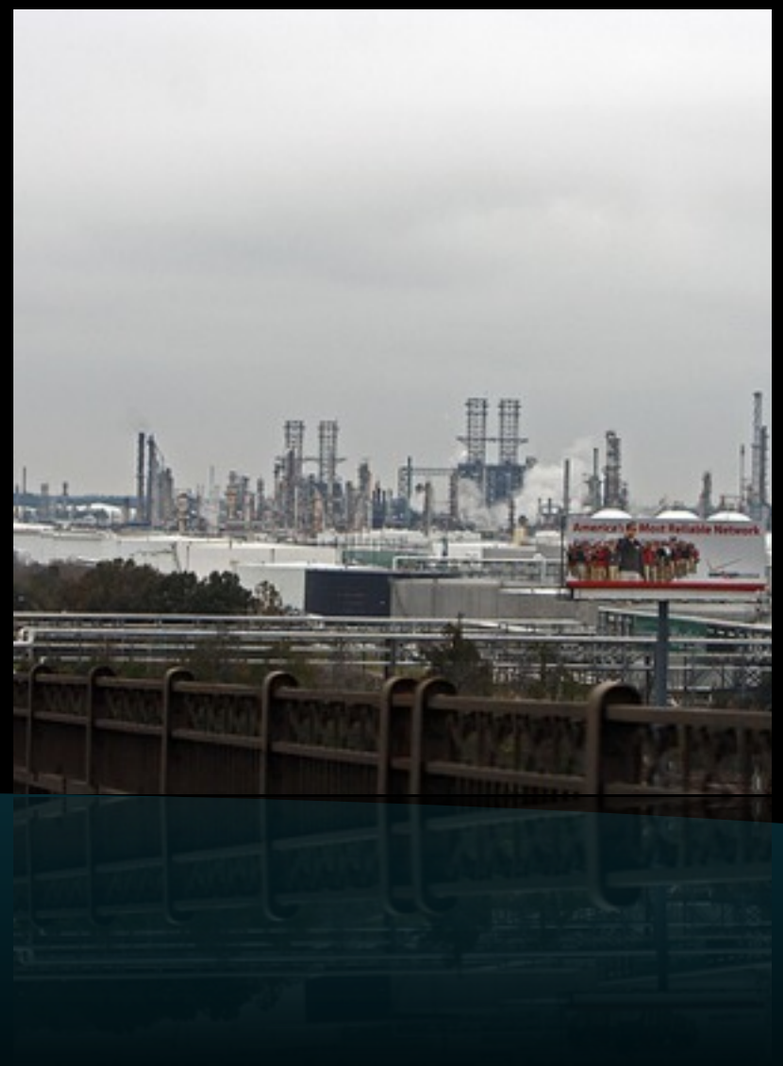
CUSTOM METAL SEATED

832-261-2400
tycovalves.com

KEYSTONE

ConocoPhillips

ConocoPhilips started up their “SZorb” unit in 2005



M-CLASS

CUSTOM METAL SEATED

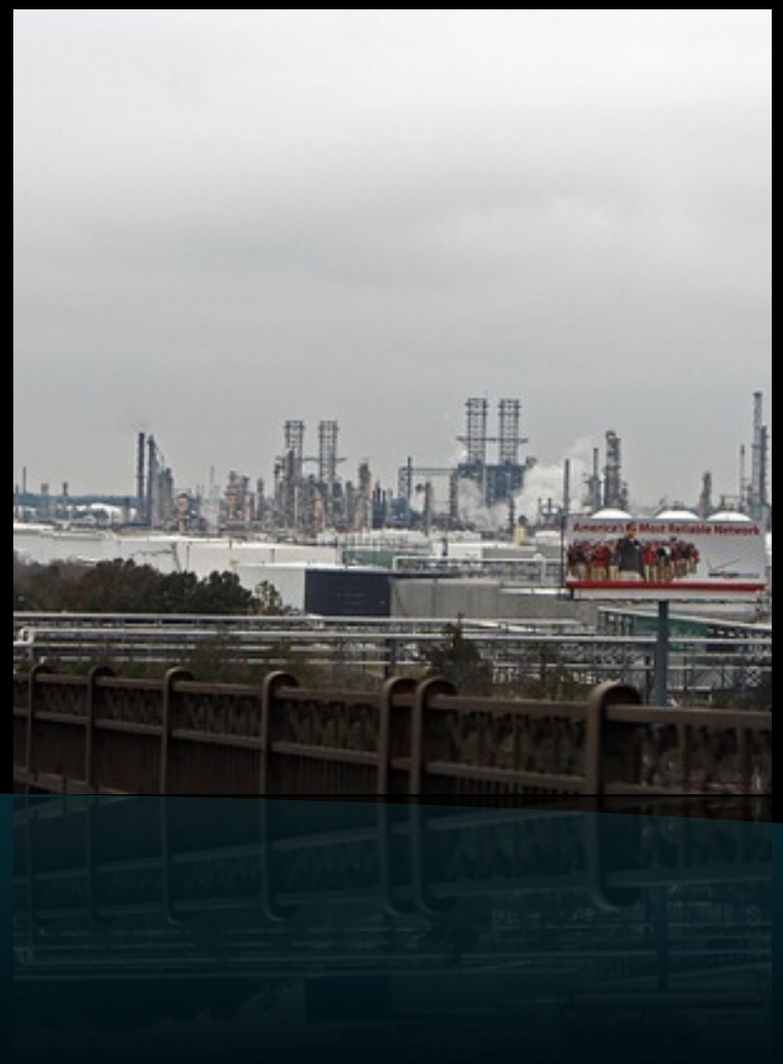
832-261-2400
tycovalves.com

KEYSTONE

ConocoPhillips

ConocoPhilips started up their “SZorb” unit in 2005

A sorption-based technology that removed sulfur from FCC gasoline with minimal octane loss



M-CLASS
CUSTOM METAL SEATED

832-261-2400
tycovalves.com

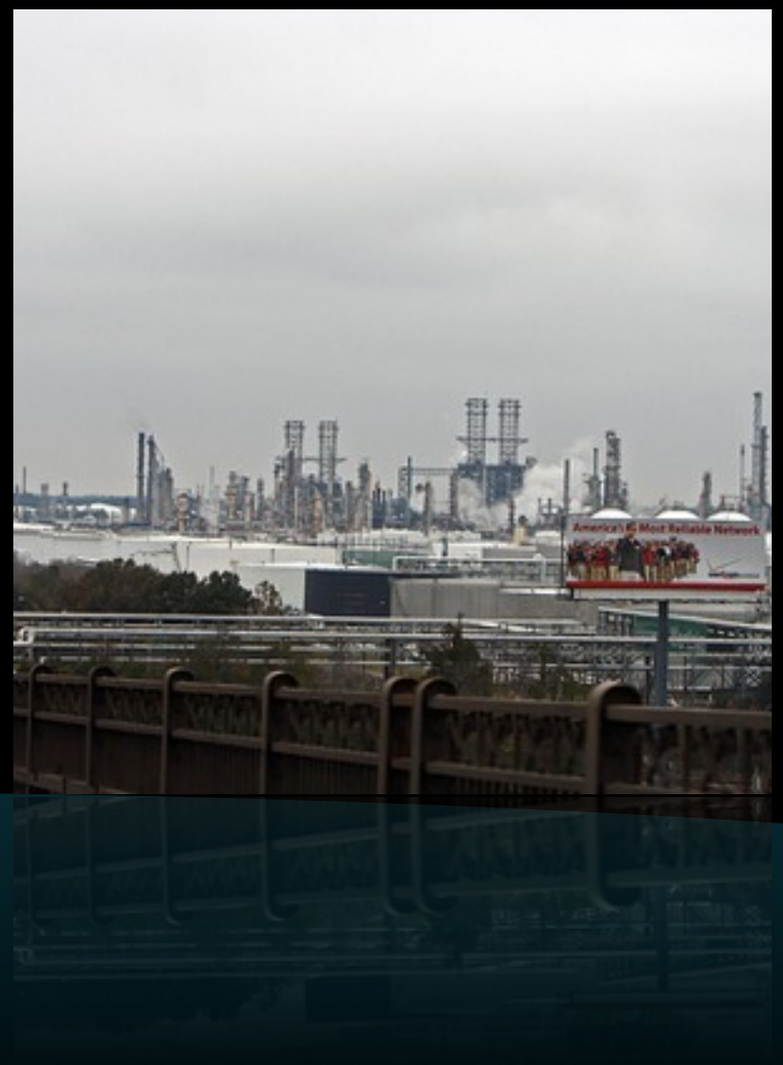
KEYSTONE

ConocoPhillips

ConocoPhilips started up their “SZorb” unit in 2005

A sorption-based technology that removed sulfur from FCC gasoline with minimal octane loss

Mogas valves were installed on every sorbent position



M-CLASS
CUSTOM METAL SEATED

832-261-2400
tycovalves.com

KEYSTONE

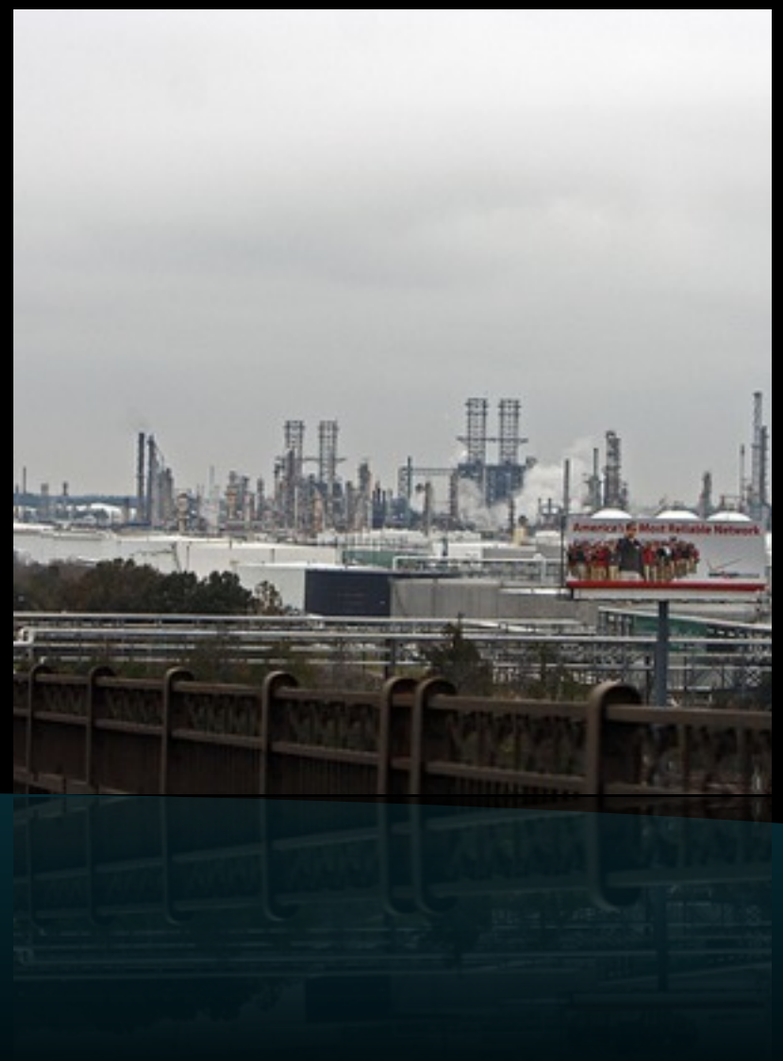
ConocoPhillips

ConocoPhilips started up their “SZorb” unit in 2005

A sorption-based technology that removed sulfur from FCC gasoline with minimal octane loss

Mogas valves were installed on every sorbent position

Last year, ConocoPhilips replaced every single Mogas valve with a Keystone valve



M-CLASS
CUSTOM METAL SEATED

832-261-2400
tycovalves.com

KEYSTONE

ConocoPhillips

"Because of the reliability and availability of the Keystone valves, we have now replaced every Mogas valve with a Keystone, and will continue to use them in other areas of the plant.

We are working very closely with Tyco to extend the life of the current valves (3 year goal). Previous attempts to achieve any sort of information exchange with Mogas regarding failures and recommendations have gone ignored leading to an inability to improve valve reliability.

The management and engineering team are much easier to deal with, and have a commitment to continue improving an already superior valve. These reasons are why I have chosen to purchase Keystone valves."

Dustin Willis
Reliability Engineer, ConocoPhilips

ConocoPhillips

"Because of the reliability and availability of the Keystone valves, we have now replaced every Mogas valve with a Keystone, and will continue to use them in other areas of the plant.

We are working very closely with Tyco to extend the life of the current valves (3 year goal). Previous attempts to achieve any s
r
¡ **"Because of the reliability and availability of the Keystone valves, we have now replaced every Mogas valve with a Keystone, and will continue to use them in other areas of the plant."**

The management and engineering team are much easier to deal with, and have a commitment to continue improving an already superior valve. These reasons are why I have chosen to purchase Keystone valves."

Dustin Willis
Reliability Engineer, ConocoPhilips

ConocoPhillips

ConocoPhillips

"Four of us spent many weeks consulting experts, troubleshooting valve failures, identifying important valve design considerations and comparing various valve manufacturers. One important objective was to identify a valve that would last one million cycles.

Our conclusion was that the Keystone valve was the "A" rated valve for this service, and the Argus valve was rated "B". KTM was also rated "B", Mogas was rated "C", VTI was rated "F" and Velan was not graded because they were not able to provide a proposal for our evaluation. We looked at several other manufacturers but they were all similar to Argus, Velan and VTI and we concluded further evaluation would not add anything to our knowledge.

I recommend Keystone valves not as a matter of brand preference but as the end result of a thorough engineering evaluation."

William Gerrie
Chief Instrument and Control Engineer

ConocoPhillips

"Four of us spent many weeks consulting experts, troubleshooting valve failures, identifying important valve design considerations and comparing various valve manufacturers. One important objective was to identify a valve that would last one million cycles.

Our conclusion was that the Keystone valve was the "A" rated valve for this service, and the Argus valve was rated "B". KTM was also rated "B"

"Our conclusion was that the Keystone valve was the "A" rated valve for this service."

looked at several other manufacturers but they were all similar to Argus, Velan and VTI and we concluded further evaluation would not add anything to our knowledge.

I recommend Keystone valves not as a matter of brand preference but as the end result of a thorough engineering evaluation."

William Gerrie
Chief Instrument and Control Engineer

ConocoPhillips


MARATHON

"Keystone valves were first considered because the approved manufacturer of the specific valve we needed could not deliever the required valve in time for unit start up. Keystone responded by sending their Chief Engineer who met with specialists from Marathon and UOP to design a valve for the application that would not only meet all the requirements of the specified valve, but also offer some unique options that could be delivered before start up.

Through basic concept, design, manufacture and delivery, the required valve was completed and installed on the platform within three weeks. This was a remarkable feat and it exemplified the type of creativity, service and manufacturing capability that Keystone valves has.

I recommend Gosco Valves as they can provide robust, precise, high quality valves for a variety of services and processes."

Soni O. Oyekan, Ph.D.
Marathon Petroleum Company
Catalyst Fines Application

"Keystone valves were first considered because the approved manufacturer of the specific valve we needed could not deliever the required valve in time for unit start up. Keystone responded by sending their Chief Engineer who met with specialists from Marathon and UOP to design a valve for the application that would not only meet all the requirements of the specified valve, but also offer some unique options that could be delivered before start up.

"This was a remarkable feat and it exemplified the type of creativity, service and manufacturing capability that Keystone valves has."

and manufacturing capability that Keystone valves has.

I recommend Gosco Valves as they can provide robust, precise, high quality valves for a variety of services and processes."

Soni O. Oyekan, Ph.D.
Marathon Petroleum Company
Catalyst Fines Application

M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

M-CLASS VALVES

M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

M-CLASS VALVES

Made-to-order metal seated valves

M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

M-CLASS VALVES

Made-to-order metal seated valves

½” to 16” full port, Up to 4500# class

M-CLASS

METAL-SEATED VALVES

832-261-2400

tycovalves.com

KEYSTONE

M-CLASS VALVES

Made-to-order metal seated valves

½” to 16” full port, Up to 4500# class

-328 °F/-200 °C to 1600 °F/871 °C

M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

M-CLASS VALVES

Made-to-order metal seated valves

½” to 16” full port, Up to 4500# class

-328 °F/-200 °C to 1600 °F/871 °C

Shortest lead times in the industry

M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

M-CLASS VALVES

Made-to-order metal seated valves

½” to 16” full port, Up to 4500# class

-328 °F/-200 °C to 1600 °F/871 °C

Shortest lead times in the industry

Most extreme applications

M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

M-CLASS

METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

M-CLASS CONFIGURATIONS

M-CLASS
METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

M-CLASS CONFIGURATIONS

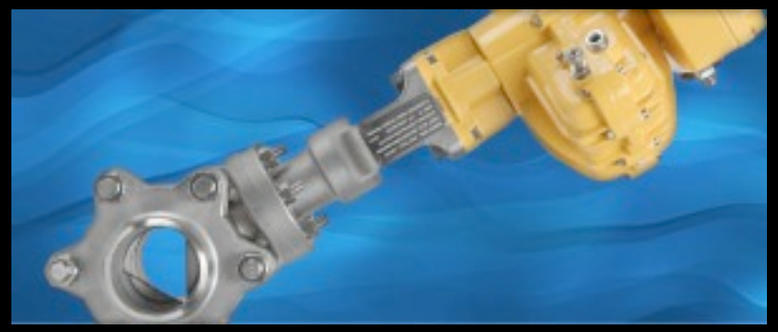
ON/OFF

832-261-2400
tycovalves.com

KEYSTONE

M-CLASS CONFIGURATIONS

ON/OFF



VARI-V CONTROL

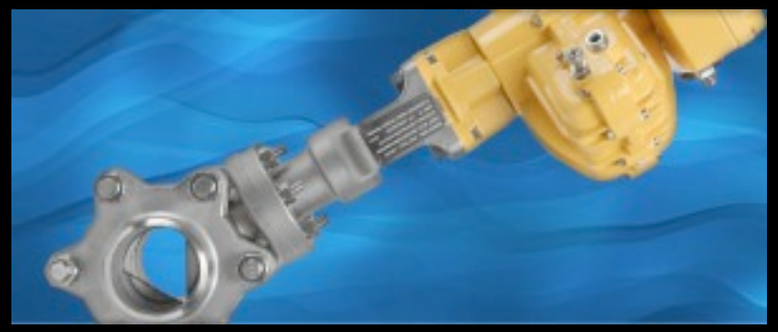
M-CLASS
METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

M-CLASS CONFIGURATIONS

ON/OFF



VARI-V CONTROL

CRYOGENIC

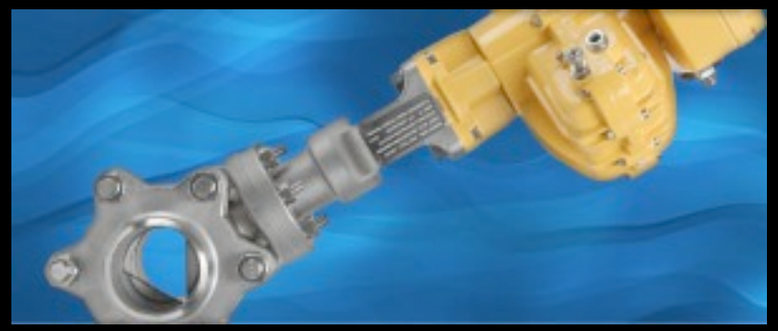
M-CLASS
METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

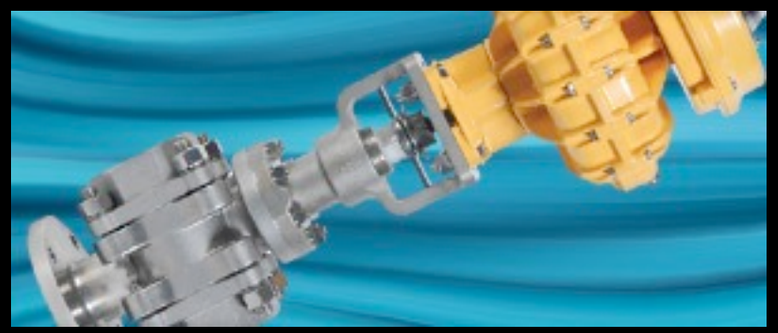
M-CLASS CONFIGURATIONS

ON/OFF



VARI-V CONTROL

CRYOGENIC



3-WAY DIVERTER

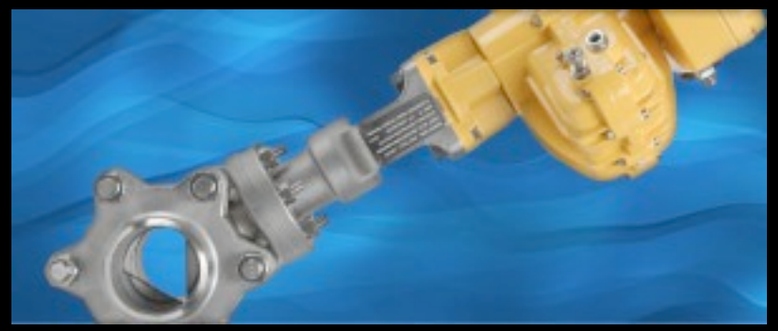
M-CLASS
METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

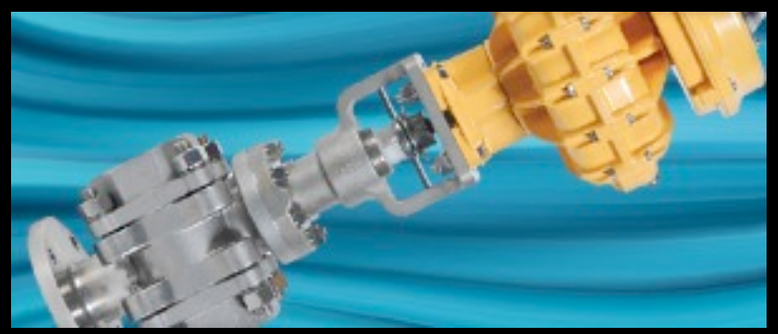
M-CLASS CONFIGURATIONS

ON/OFF



VARI-V CONTROL

CRYOGENIC



3-WAY DIVERTER

BLOCK & BLEED

M-CLASS
METAL-SEATED VALVES

832-261-2400
tycovalves.com

KEYSTONE

M-CLASS

THE TOUGHEST APPLICATIONS HAVE MET THEIR MATCH

TOM GOSLING I MARCH 2011

KEYSTONE