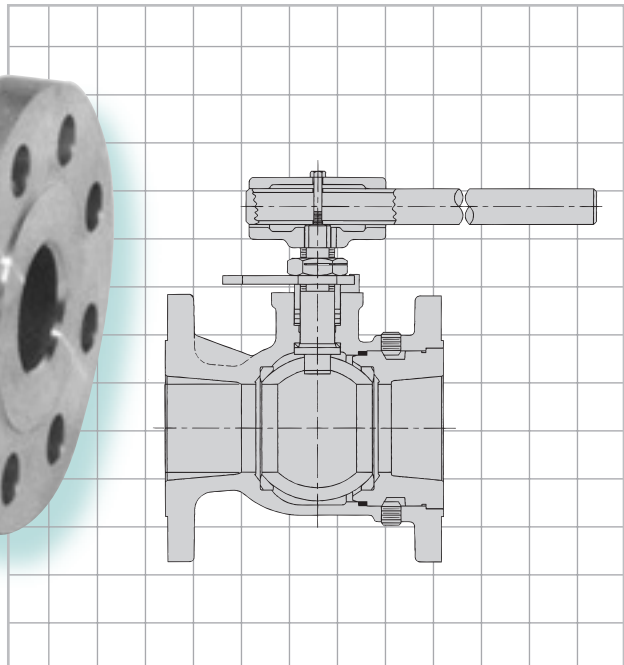


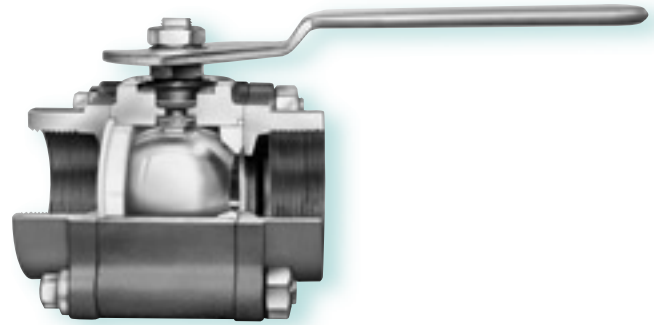
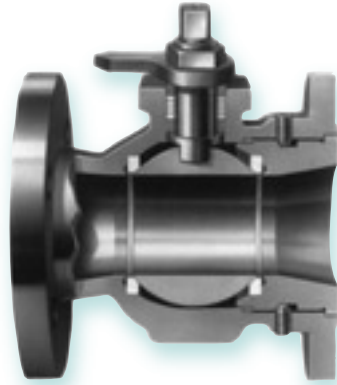
AN ISO 9001 REGISTERED COMPANY



Fire-Rated Ball Valves

*Meet EXES 3-14-1-2A, API 607 Edition 3 and 4,
Factory Mutual FM 7440 and British Standards*

Worcester Fire-Rated Valves Assure Operational Integrity Before, During and After a Fire



In recent years, many factors have contributed to an increased demand for fire-safe valves. Engineers and plant managers have faced the rising cost of insurance for liability and property damage. There has been an across-the-board tightening of environmental and safety regulations. Also, the cost of replacing damaged property and the expense of after-fire clean-ups have skyrocketed.

Worcester Controls has the quality solution for tough valve applications where operational integrity must be maintained before, during and after a fire. The solution is Worcester's Fire-Rated Valves that assure tight shutoff and prevent external leakage in the tremendous heat of an industrial fire.

Heavy-duty body bolts and pipe ends add a great margin of safety to Worcester Fire-Safe Valves. Normal service performance is maintained with bubble-tight bidirectional sealing and three rugged seating materials - TFE, Reinforced TFE and Polyfill®. All fire-rated products can be ordered to meet NACE MR-01-75.

Fire-Rated Valves for All Standards

Worcester Controls Fire-Rated Valves meet the requirements of all major fire-safe standards including EXES 3-14-1-2A, API 607 Edition 4, Factory Mutual FM-7440 and British Standards BS5146 APP.B, BS 5351 Anti-Static and BS 6755-PT2. (See page 3).

Tight Shutoff

The ball in Worcester's fire-rated valves moves downstream to create a metal-to-metal seal when the resilient seat has been totally sublimated in a fire (see illustrations on page 3).

Anti-Static

All Worcester fire valves feature a thrust bearing or stem seal of carbon-filled TFE. This material has excellent bearing characteristics, seals well, and positively grounds the stem to the valve body under all

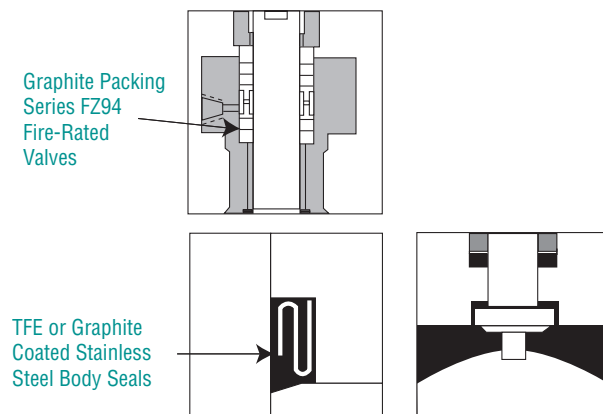
operating conditions. Valve sizes three inches and larger with 316 stainless steel stems feature positive ball grounding through the stem (IAW BS 5351).

No External Leakage

Process fluids are contained within the valves in a fire situation. The standard thrust bearing is carbon-filled TFE. If heat from the fire sublimates the thrust bearing, the blowout-proof stem forms a metal-to-metal seal with the valve body. TFE or graphite-coated stainless steel body seals (shown below) provide maximum fire safety. If a fire does occur, the 316 stainless steel "S" gasket provides a spring action to maintain the body seal throughout drastic temperature fluctuations. Larger valves utilize graphite body seals.

Standard Service vs High Cycle

All Worcester Fire Safe Valves provide excellent performance as manually operated or automated valves. For high-cycle operation, specify Series FZ94 three-piece or flanged valves. For cryogenic applications, specify the Series 94 cryogenic valve through the Custom Products Department.



Valve Model Identification

Three basic valve model identification letter groups are presented in this brochure, AF, FZ and FM. The letters are applied to a number of valve lines according to the standard the valve meets. AF valves meet API607. FZ valves meet EXES 3-14-1-2A (as well as API 607). FM valves meet FM 7440. Refer to the table below.

The Standards

EXES 3-14-1-2A (Fire-Safe)

This fire test is a recognized standard in the industry. It includes a test for sealing at low pressures to reduce the risk of gravity fed liquids fueling a fire. It also includes a rapid quench of the valve after the burn, to simulate the abrupt cooling that occurs in an actual fire fighting situation.

API 607, Edition 4

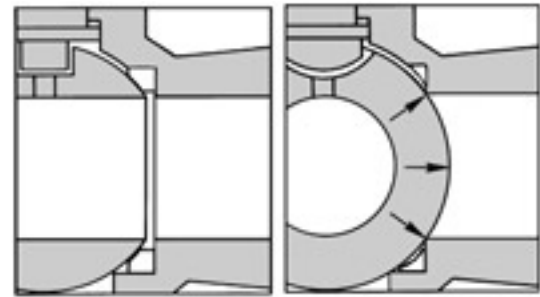
This is a fire test for soft seated valves, developed by the Refinery Division of the American Petroleum Institute (API). This standard measures the ability of a ball valve to retard fire propagation. Valves meeting API 607 are designed to inhibit fires that are fueled by volatile fluids.

BS-5351

This British anti-static standard is the only national standard for grounding of valves. This standard requires a grounded stem on ball valves. AF44 and FZ44 valves meet this standard through the use of carbon-filled thrust bearing. On sizes 3" - 10", anti-static devices grounding the ball to the body via the stem are also mandatory and accomplished with a spring loaded plunger on the stem tang. Available on the Series AF51/52, AF 818/828, EAF 818/828 and 3" - 6" FZ 51 with 316 stainless steel stem.

Optional, All-Metal, Fire-Rated Valves

Special versions of Worcester's Series PT 44 and 94 valves incorporate abrasion resistant "Metal G" seats of graphite impregnated sintered stainless steel. Request Worcester brochures PB HP and PB 94.



Worcester's Fire Lip in Normal Service

Worcester's Fire Lip in a Fire

Automation

Worcester offers a complete line of pneumatic and electric automation packages for the FZ, FM* and AF Series valves. Both electric and pneumatic packages are offered for on/off or proportional control. Available options include:

For Pneumatic

- Failsafe operation
- End and top mounted limit switches
- Proximity switches
- Single- and double-acting and electropneumatic positioner

For Electric

- TYPE 1,4,7 and 9 enclosures
- Remote positions indication
- Single-loop, set-point control
- Computer interfaces
- Many more options for today's computer control applications



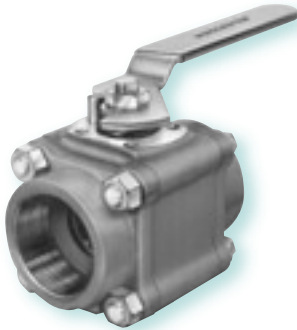
For more information, request Bulletins PB-302 and PB-730.

**For pneumatic operation only.*

Worcester Fire-Rated Valves									
Fire-Safe Standard	AF44 AF59 Three-piece	FZ44 Three-piece	FZ94 Three-piece	AF51/52 Flanged	FZ51/52 Flanged	AF94 Flanged	FZ94 Flanged	FM51/52 Flanged	AF818/828 EAF818/828 AF82/83 Full Port Flanged
EXES 3-14-1-2A		Approved	Approved		Approved		Approved		
American Petroleum Institute API 607, Edition 4	Approved	Approved	Approved	Approved	Approved	Approved	Approved	Approved	Approved
British and Standard BS 6755-PT2 (same as API 607, Edition 3)				Approved	Approved	Approved	Approved	Approved	Approved
Factory Mutual FM-7440								Approved	

Specifications

Series AF44, Series FZ44, Three-Piece Valves, Series AF59 Full-Port, Three-Piece Valves



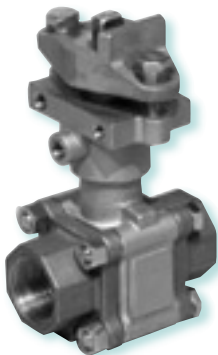
Variations (V-Numbers)

- V14 - Handleless Valves (2" AF59)
- V32 - Oval Handle
- V38 - Assemble without lubrication
- V48 - Extended Lever Handle
- V59 - Extended Oval Handle
- V60 - OSHA Lockout
- V67 - Weld-as-is

For other variations, see bottom of page 5.

Sizes	AF44 ¼" and ¾" only FZ44 - ½", ¾", 1", 1½", 2" AF59 - 2"
Pipe Ends	Screw Ends, Socket Weld, Butt Weld
Body and End Material	Carbon Steel or 316 Stainless Steel
Stem	One-piece, bottom-entry, 316 Stainless Steel, Monel®, Hastelloy C®
Stem Seal	Flexible Graphite
Follower	316 Stainless Steel
Thrust Bearing	Carbon-filled TFE (Conductive)
Seats	TFE, Reinforced TFE, Polyfill, Metal "G"
Body Seals	316 Stainless Steel "S" gasket (TFE or Graphite coated). Graphite on 2" AF59
Ball	316 Stainless Steel, Monel, Hastelloy C
Body Bolts*	Stainless Steel ASTM A193 Grade B8 through bolts maintain strength even during the high temperatures of a fire.
Body Nuts	Stainless Steel ASTM A194 Grade 8
Operation	Valves are supplied with a handle. A locking or spring-return handle and complete complement of pneumatic and electric automation packages are also available.

Series FZ94, Three-Piece Valves



Variations (V-Numbers)

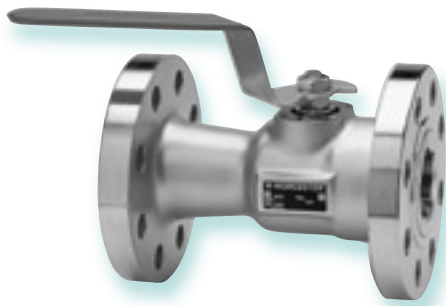
- V38 - Assemble without Lurication
- V57 - Corrosion Resistant Hardware
- V67 - Weld-as-is

For other variations, see bottom of page 5.

Sizes	½", ¾", 1", 1½", 2
Pipe Ends	Screw Ends, Socket Weld, Butt Weld
Body and End Material	Carbon Steel, Stainless Steel
Stem	316 Stainless Steel, one-piece extended length construction with increased stem support for high cycling.
Stem Seal	Grafoil®
Seats	TFE, Reinforced TFE, Polyfill®, Metal "G"
Body Seals	316 Stainless Steel "S" gasket (TFE or Graphite coated).
Ball	316 Stainless Steel
Body Bolts*	Stainless Steel ASTM A193 Grade B8 through bolts maintain strength even during the high temperatures of a fire.
Body Nuts	Stainless Steel ASTM A194 Grade 8
Port	One sensing port drilled and tapped to ½" NPT standard. Optional second port for purging.
Operation	Optional lever handle, pneumatic or electric automation (on/off or proportional control).

*Alloy 20® bolts and nuts available for Chloride environments.

Series AF51 and AF52, Series FZ51 & FZ52, One-Piece Flanged Valves



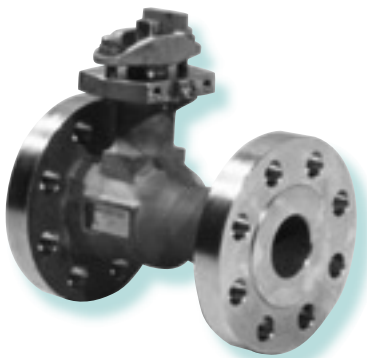
Variations (V-Numbers)

- V14 - Handleless Valves (3" - 10")
- V17 - Grounding Thrust Bearing
- V32 - Oval Handle (1/2" - 2")
- V34 - Threaded End Plug (3" - 10")
- V39 - API - 6D Approved
- V48 - Extended Lever Handle (1/2" - 2")
- V59 - Extended Oval Handle (1/2" - 2")

For other variations, see below.

Sizes	AF51/52 - 1/2", 3/4", 1", 1 1/2", 2", 3", 4", 6", 8", 10" FZ51/52 - 1/2", 3/4", 1", 1 1/2", 2", 3", 4", 6"
Flanges	Series AF51 - ANSI 150#, Series AF52 - ANSI 300# Series FZ51 - ANSI 150#, Series FZ52 - ANSI 300#
Body Material	Carbon Steel ASTM A216 Grade WCB Stainless Steel ASTM A351 Grade CF8M
Stem	One-piece, bottom-entry, 316 Stainless Steel, Monel, Hastelloy C
Thrust Bearing	Carbon-filled TFE (conductive)
Stem Seal	Flexible Graphite
Follower	316 Stainless Steel
Seats	TFE, Reinforced TFE, Polyfill, Metal "G"
Body Seal	316 Stainless Steel "S" gasket (TFE or Graphite coated) (1/2" - 2") Graphite (3" - 8")
Ball	316 Stainless Steel, Monel, Hastelloy C
End Plug	Retention Bolt Style (except 1/2" - 2" threaded style) Carbon Steel or 316 Stainless Steel.
Operation	Valves are supplied with a lever or T-handle. Gear operators as well as pneumatic and electric automation packages are also available.

Series AF94 and FZ94, One-Piece Flanged Valves



Variations (V-Numbers)

- V38 - Assemble without Lubrication (1/2" - 2")
- V57 - Corrosion Resistant Hardware

For other variations, see below.

Sizes	FZ94 - 1/2", 3/4", 1", 1 1/2", 2", 3", 4", 6" AF94 - 4", 6"
Flanges	AF94; FZ94-150 (ANSI 150# raised face) AF94; FZ94-300 (ANSI 300# raised face)
Body Material	Carbon Steel ASTM A216 Grade WCB Stainless Steel ASTM A351 Grade CF8M
Stem	316 Stainless Steel, one-piece extended length construction with increased stem support for high cycling.
Stem Seal	Grafoil
Seats	TFE, Reinforced TFE, Polyfill, Metal "G"
Body Seal	316 Stainless Steel "S" gasket (TFE or Graphite-coated), Graphite (3" - 6")
Ball	316 Stainless Steel
End Plug	Retention Bolt Style (except 1/2" - 2" threaded style) Carbon Steel or 316 Stainless Steel
Port	One sensing port drilled and tapped to 1/8" NPT standard. Optional second port for purging.
Operation	Optional lever or T-handle, pneumatic or electric automation (on/off or proportional control).

Other Available Variations (V-Numbers)

- V3 - Upstream Relief Hole, V5 - Hydrostatic Testing, V6 - Source Inspection, V20 - Oxygen Service, V33 - Oxygen Service without Source Inspection, V36 - Certificate of Compliance, V37 - Certificate of Compliance & Hydro Testing, V46 - Silicon Free Lubricant, V58 - B16.34 Compliance, V66 - Certificate of Compliance - European Valve Orders/Contracts.

All products designed to ANSI B16.34. *Requires metal G seats.

Series AF82 and AF83, AF/FZ818 and AF/FZ828, EAF818 and EAF828, Full Port Flanged Valves



Sizes	AF82/83 - 1/2", 3/4", 1", 1 1/2", 2 1/2", 10" AF/FZ 818/828 - 2", and EAF 818/828 - 2", 3", 4", 6", 8"
Flanges	AF 82, AF/FZ 818, EAF818 (ANSI 150# raised face) AF 83, AF/FZ 828, EAF828 (ANSI 300# raised face)
Body Material	Carbon Steel ASTM A216 Grade WCB Stainless Steel ASTM A351 Grade CF8M
End Connector	Carbon Steel ASTM A216 Grade WCB Stainless Steel ASTM A351 Grade CF8M
Stem	One-piece, bottom-entry, 316 Stainless Steel
Stem Seals	Flexible Graphite
Thrust Bearing	AF82/83 - Carbon-filled TFE (Conductive) AF/FZ 818/828, EAF818/828 - Graphite
Body Seal	1/2" - 1 1/2" Stainless Steel (TFE or Graphite coated) 2" - 10" Graphite
Ball	16 Stainless Steel
Operation	Supplied with lever or T-handles (1/2" - 6" only). Handles optional on EAF 818/828 Valves. Gear Operators as well as electric and pneumatic automation packages are also available.

Variations (V-Numbers)

- V14 - Handleless Valves (2 1/2")
- V17 - Grounding Thrust Bearing
- V32 - Oval Handle (1/2" - 1 1/2")
- V39 - API-6D Approved (2" - 10")
- V48 - Extended Lever Handle (1/2" - 1 1/2")
- V59 - Extended Oval Handle (1/2" - 1 1/2")

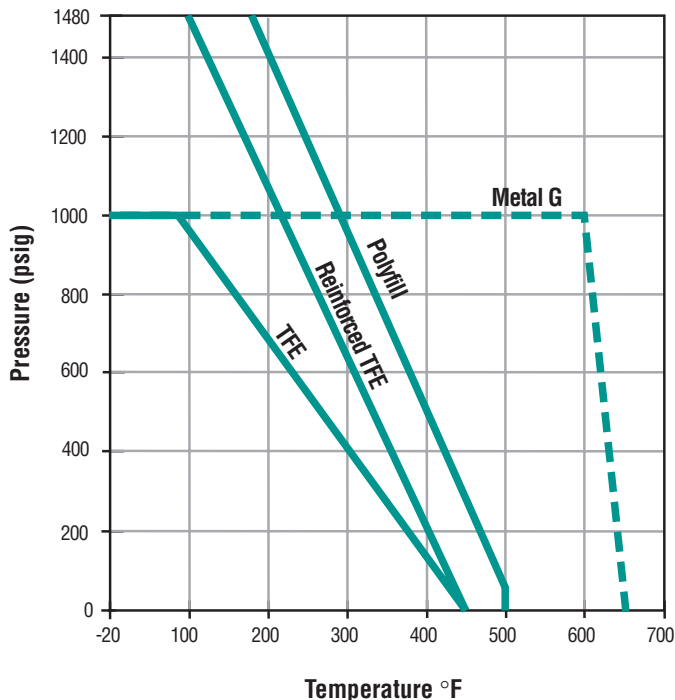
For other variations, see bottom of page 5.

Dimensions

For dimensions, refer to dimensional sheets EVD - 1, 2 and 4. For Fire-Safe Series 94 valves, refer to Brochure PB-94.

Specifications (AF/FZ Valves)

Pressure Temperature Ratings



Flow Coefficient (Cv)

	Valve Size	Max. Cv	Equivalent Length of Pipe in Feet
Three-Piece Ball Valves	1/4", 3/8"	8	0.9
	1/2"	8	3.1
	3/4"	12	6.3
	1"	32	3.1
	1 1/2"	82	4.3
	2"	120	7.5
	2" AF 59	600	2.1
Flanged Ball Valves	1/2"	8	3.9
	3/4"	12	8.7
	1"	32	3.6
	1 1/2"	82	3.7
	2"	120	6.5
	3"	350	7.1
	4"	720	6.9
	6" 8"	1020 1800	20.4 37.7
Full-Port Flanged Ball Valves	1/2"	32	
	3/4"	54	
	1"	105	
	1 1/2"	275	
	2"	460	
	2 1/2"	780	
	3"	1330	
	4"	2420	
	6"	5400	
	8" 10"	10000 18500	

Note: Standard Worcester valves are assembled with silicon based break-in. For other options consult your distributor or Flowserve.

Series FM and AFM 51/52 Flanged Valves

Factory Mutual Approved Valves for Flammable Liquid Service

Worcester Controls Series FM 51/52 valves are a line of rugged flanged ball valves designed specifically to meet requirements of the FM 7440 Standards, flammable liquid service. The valve performance features are the same as AF 51/52 and FZ 51/52 Worcester Fire-Safe valves.

The approved AFM valves have specific seat and body seal materials, actuator sizes and solenoid valve types (see specifications below). When a Series 39 pneumatic actuator is used for on-off or throttling service, a fusible plug with splash guard is installed in the air line to the actuator. At a predetermined temperature, the plug melts, exhausting air to close the valve well before the actuator is threatened by fire exposure.

AFM 51/52 valves are available in sizes 1/2" - 4", with Series 39 pneumatic actuators with solenoid valves (on-off operation) and PM-15 positioners (throttling operation). FM 51/52 valves are manual valves also available in sizes 1/2" - 4". For an outline of FM testing programs, refer to Worcester Controls' Technical Paper TP-2D-1.

*AFM designates "Actuated Factory Mutual" and is a separate product from the AF Series, which is appropriate to API and British Standards.



On/Off Operation, shown with Fusible Plug on Solenoid - Failsafe



Throttling Operation, Shown with Fuseable Plug in Positioner Line - Failsafe

Specifications (FM/AFM Valves)

Valve Series and Size	Series FM51, Class 150 Flanged 1/2" - 4" Series FM52, Class 300 Flanged 1/2" - 4"
Materials	All Stainless Steel Carbon Steel with Stainless Steel ball and stem
Valve End Connections	ANSI Class 150 flanged ANSI Class 300 flanged
Seats	Polyfill
Body Seal	TFE 316 Stainless Steel "S" Gasket (TFE or Graphite coated) (1/2" - 2") Graphite (3", 4")
Stem Seals	Grafoil
Pressure Rating	125 psig maximum, flammable liquid
Temperature Rating	500°F maximum. Refer to published pressure/temperature curves
Operation	Manual lever handle or fail closed air actuated
Actuator Series Minimum Sizes	1039S (1/2" - 3/4") 1539S (1") 2039S (1 1/2") 2539S (2") 3339S (3") 3539S (4")
Actuator Pressure Rating	60 to 120 psi
Solenoid/NEMA Rating	TYPE 7 Class 1, Groups C&D
Solenoid Voltage	24, 120, 240 VAC; 6, 12, 24 VDC
Limit Switch Rating	ELK39, End Mounted Indication Device TYPE 4, 7, 9
Positioner	PM15D, double acting pneumatic PM15S, single acting pneumatic
Positioner Input	3 to 15 psi, 3 to 9 psi, 9 to 15 psi
Positioner Mode	Direct or reverse acting

How to Order

Three-Piece Valves

Size	Options	Styles	Series	Body Pipe Ends	Ball and Stem	Seats	Body Seals	Pipe Ends	Variations
1/4" 3/8"	V - Vacuum X - Oxygen (Specify Service)	AF	44	4 - Carbon steel 6 - Stainless steel	6 - Stainless steel 7 - Monel (44/59 only) C - Hastelloy	T - TFE R - RTFE P - Polyfill G - Metal "G"	G - Graphite coated stainless steel "S" gasket M - TFE-coated stainless steel "S" gasket Note: FZ valves with "G" seats use G seals only	SE - Screw ends SW - Socket weld BW1 - Butt weld sch. 10 (S.S. FZ44 and FZ only) BW4 - Butt weld sch. 40 (C.S. or S.S. FZ44 and FZ94 only)	L20 - Alloy 20 [®] body bolts and nuts See pages 4 and 5 for available variations.
1/2" 3/4" 1" 1 1/2" 2"		FZ	44						
2"		AF	59						
1/2" 3/4" 1" 1 1/2" 2"		FZ	94						

Full-Port Flanged Valves

Size	Options	Styles	Series	Body Pipe Ends	Ball and Stem	Seats	Body Seals	Pipe Ends	Variations
1/2" 3/4" 1" 1 1/2" 2 1/2" 10"		AF	82/83	4 - Carbon steel 6 - Stainless steel	6 - Stainless steel	T - TFE R - RTFE P - Polyfill	1/2" - 1 1/2" M - TFE coated S.S. "S" gasket 2" - 10" Z - Graphite	150 - ANSI Class 150 flanges 300 - ANSI Class 300 2" - 10" flanges	See pages 5 and 6 for available variations.
2" 4" 6" 8"	V - Vacuum X - Oxygen (Specify Service)	AF	818/828						
		FZ (2" only)							
		AF	E818/828						

How to Order

One-Piece Flanged Valves

Size	Options	Styles	Series	Body Pipe Ends	Ball and Stem	Seats	Body Seals	End Connections	Variations
1/2" 3/4" 1" 1 1/2" 2" 3" 4" 6" 8" 10"	V - Vacuum X - Oxygen (Specify Service)	AF	51/52	4 - Carbon steel 6 - Stainless steel	6 - Stainless steel 7 - Monel (51/52 only) C - Hastelloy C	T - TFE R - RTFE P - Polyfill G - Metal "G" (FZ only) Note: 4" and 6" FZ94 and FZ51/52 use "G" seats only	M - TFE coated G - Graphite coated stainless steel "S" gasket (1/2" - 2") Z - Graphite (3" - 10") Note: 1/2" - 2" FZ94 valves with "G" seats use "G" seals only.	150 - ANSI Class 150 flanges 300 - ANSI Class 300 flanges	S-7 - Complete S.S. externals <div style="border: 1px solid black; padding: 5px; text-align: center;"> <i>See page 5 for available variations.</i> </div>
1/2" 3/4" 1" 1 1/2" 2" 3" 4" 6"		FZ	51/52						
1/2" 3/4" 1" 2" 3" 4" 6"		FZ AF (4", 6" only)	94						
1/2" 3/4" 1" 1 1/2" 3" 4"	A - Automated V - Vacuum X - Oxygen Blank - Manual (Specify Service)	FM*	51/52	6 - Stainless steel	P - Polyfill	G or M - TFE (1/2" - 2") Z - Graphite (3" - 4")		See Page 7 for FM Approved manual and pneumatic actuators	

*FM 51/52 Valves available through Custom Products, Consult Factory.



Worcester ... All The Right Valves In All The Right Places

CAUTION: Ball valves can retain pressurized media in the body cavity when closed. Use care when disassembling. Always open valve to relieve pressure prior to disassembly. Due to continuous development of our product range, we reserve the right to alter the dimensions and information contained in this leaflet as required.

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Monel® is a registered trademark of Inco Alloys.

Polyfill® is a registered trademark of Flowserve Corporation.

Grafoil® is a registered trademark of Union Carbide Corporation.

Alloy 20® is a registered trademark of CRS Holdings, Inc.

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For more information about Flowserve Corporation, contact www.flowserve.com or call USA 1-800-225-6989.

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