

Control Valves

CONTROL
VALVES



W910 COMPACT
CONTROL VALVE

Control Valves



TA901
I/P TRANSDUCER



TA890
ELECTRONIC
PID CONTROLLER



TA987
AIR FILTER/REGULATOR



ELECTRONIC
TEMPERATURE
SENSOR
RTD or THERMOCOUPLE

CONTROL
VALVES

Control Valves

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W910 Series Compact Control Valve

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The **W910 Series Pneumatic Control Valve** offers high quality at an economical price, incorporating many features found only on more expensive units. Models are available to provide the proper flow response required by the application.

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CONTROL VALVES

W910 Series

Compact Control Valve

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Models	W910A, W910B, W910C, W910TB, W910EPA, W910EPC
Service	Water, Steam, Other Liquids
Sizes	1/2", 3/4", 1", 1 1/4", 1 1/2", 2", 2 1/2", 3", 4"
Connections	Union Ends, 125# Flanged 250# Flanged (optional)
Body Material	1/2" – 2" Bronze 2 1/2" – 4" Cast Iron
Seat Material	Stainless Steel
Max. Inlet Pressure	250 PSIG

DESIGN PRESSURE/TEMPERATURE RATING – PMA/TMA

Union Ends 250 PSIG @ 450° F
125# FLG 125 PSIG @ 450° F



Description

A control valve is a device capable of modulating flow at varying degrees between minimal flow and full capacity in response to a signal from an external control device. The control valve, often referred to as "the final control element," is a critical part of any control loop, as it performs the physical work and is the element that directly affects the process.

Principles of Operation

A control valve is comprised of an actuator mounted to a valve. The valve modulates flow through movement of a valve plug in relation to the port(s) located within the valve body. The valve plug is attached to a valve stem, which, in turn, is connected to the actuator. The actuator, which can be pneumatically or electrically operated, directs the movement of the stem as dictated by the external control device.

Pneumatic/Diaphragm Actuated

Watson McDaniel Pneumatic Actuators are direct acting and utilize an air signal from an external control device to create a modulating control action. The force of the air signal is received into the actuator through a top port and distributed across the full area of the actuator's diaphragm. The diaphragm presses down on the diaphragm plate and spring return assembly, which then moves the valve stem and plug assembly downward to stroke the valve. This actuator will move to a stem-out position in the event of air signal failure. The choice of valve action (stem-In-To-Close or stem-In-To-Open) will determine its signal failure position.

The **W910 Series Pneumatic Control Valve** offers high quality at an economical price, incorporating many features found only on more expensive units. The following Models are available to provide the proper flow response required by the application:

- ▶ The **W910A, W910B & W910C** are used for On/Off control applications, providing a quick-opening flow response when used with single or double seated valves.
- ▶ The **W910TB** is used for proportional or PID control applications, providing a throttling flow response when used with double seated or 3-way valves.
- ▶ The **W910EPA & W910EPC** are used for proportional or PID control applications, providing equal percentage flow response when used with single seated valves.

CONTROL VALVES

W910 Series

Compact Control Valve

Specifications

Actuator Model	Diaphragm Size	Control Action	Input Signal
W910A	7"	On/Off	15 PSIG
W910B	10"	On/Off	15 PSIG
W910C	12"	On/Off	15 PSIG
W910TB	10"	Throttling*	3-15 PSIG
W910EPA	7"	Equal Percentage	3-15 PSIG
W910EPC	12"	Equal Percentage	3-15 PSIG

* Includes 3-Way Valves

Actuator Housing

Die cast aluminum, epoxy powder coated blue finish.

Setting Scale

Integral to housing

Adjustment Screw

Brass

Adjustment Screw Bushing

Lubricant impregnated sintered bronze

Range Adjustment Spring

Cadmium plated

Pressure Plate

Aluminum

Diaphragm

Nylon reinforced EPDM

Air Pressure to Diaphragm

30 PSIG maximum

Air Pressure Connection

1/8" NPT Female

Operating Temperature

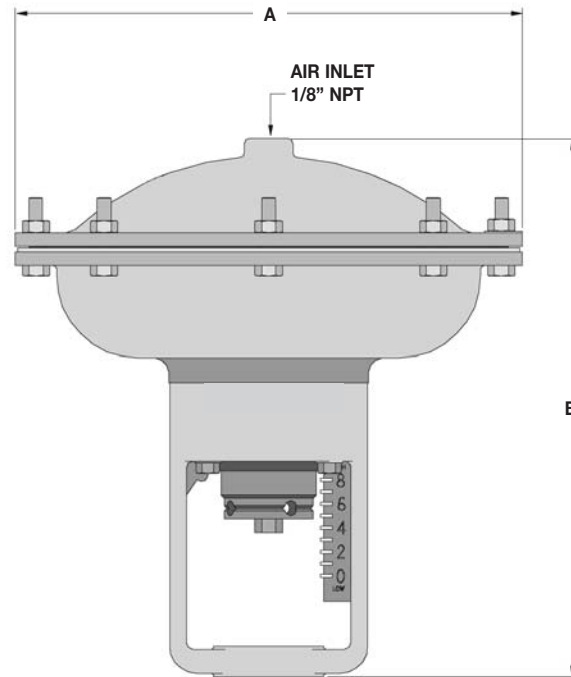
Ambient:

-40°F (-40°C) to 180°F (82°C)

Process Flow:

-40°F (-40°C) to 410°F (210°C)

Units: inches [mm]



Actuator Number	A	B	Approx. Shipping Weight
W910A	7.0 [178]	9.8 [249]	6.6 lbs [2.97 kg]
W910B	9.3 [236]	9.8 [249]	8.5 lbs [3.83 kg]
W910C	11.4 [290]	9.8 [249]	12.0 lbs [5.41 kg]
W910TB	9.3 [236]	9.8 [249]	9.6 lbs [4.32 kg]
W910EPA	7.0 [178]	9.8 [249]	7.6 lbs [3.42 kg]
W910EPC	11.4 [290]	9.8 [249]	13.1 lbs [5.90 kg]

Actuator

- W910 Series Pneumatic Actuators are used in conjunction with the W910 Series Control Valve. Choose the appropriate Actuator model based on the intended service.

HOW TO ORDER

Sample Order Number: **W910TB - A56**

Actuator Model	Control Action	Valve Body Number
W910A W910B W910C	On/Off	Refer to pages 188-190
W910TB	Throttling	Refer to pages 191-193
W910EPA W910EPC	Equal Percentage	Refer to page 188

Procedure:

- Determine the Actuator Model (W910A, W910B, W910C, W910TB, W910EPA or W910EPC) required.

Note: Refer to the maximum close-off pressure columns in the Valve Body Selection tables to determine the Actuator size required by your application.

- Determine the Valve Body Number based on the Valve Size, style and material required by the application.

Note: Consult the Valve Selection tables on the following pages to determine the required Valve Body Number.

CONTROL VALVES

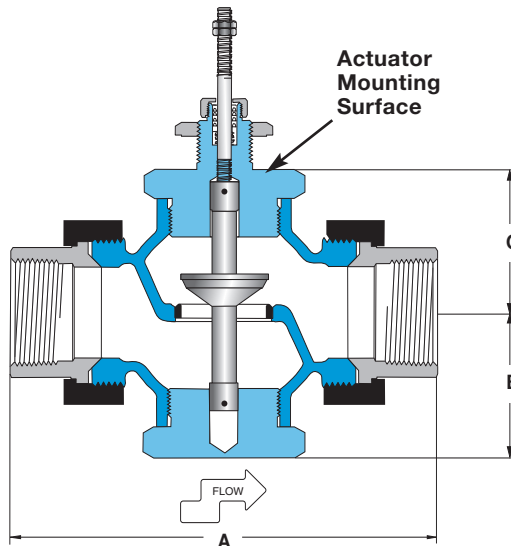
W910 Series

Valve Body for W910A, W910B, W910C, W910EPA & W910EPC

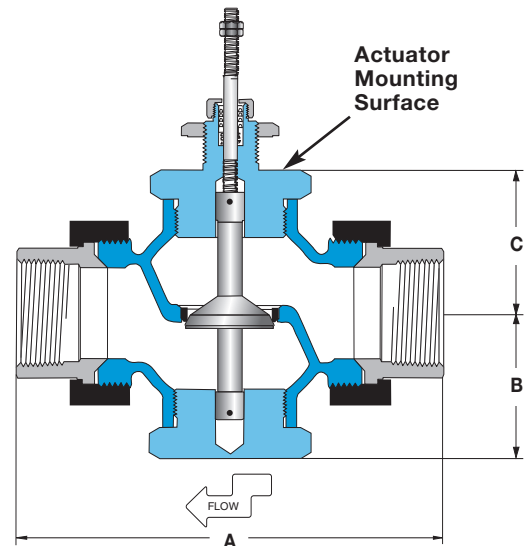
BRONZE

Single Seat • 1/2" – 2"

**Stem In-To-Close
(normally open)**



**Stem In-To-Open
(normally closed)**



Specifications

Body Material	Trim Material	Trim Style	Connection	Pressure & Temperature Rating
Bronze	Stainless Steel	ML or EP	NPT with Malleable Iron Union Ends	250 PSI @ 410°F (210°C)

ML = Modified Linear (On/Off); EP = Equal Percentage

Valve Body Selection

In-To-Close (Normally Open)				Maximum Close-Off Pressure (PSI ΔP)				Dimensions			Approximate Shipping Wt.
Valve Body No. ML	EP	Size Connection (NPT)	C _v	W910A	W910B	W910C	W910EPC	A	B	C	
A14	E14	1/2"	2.8	250	x	x	250	4.8 [122]	1.8 [46]	1.8 [46]	3.0 lbs [1.35 kg]
A19	E19	3/4"	5.6	250	x	x	250	5.6 [142]	2.3 [58]	2.3 [58]	4.9 lbs [2.21 kg]
A26	E26	1"	8.4	200	250	x	200	6.0 [152]	2.3 [58]	2.3 [58]	6.0 lbs [2.70 kg]
A36	E36	1 1/4"	15	100	250	x	150	7.2 [183]	2.6 [66]	2.6 [66]	9.7 lbs [4.37 kg]
A47	E47	1 1/2"	21	50	150	250	100	7.7 [196]	2.6 [66]	2.6 [66]	10.8 lbs [4.86 kg]
A58	E58	2"	33	25	50	250	50	8.6 [218]	3.1 [79]	3.1 [79]	16.3 lbs [7.34 kg]

In-To-Open (Normally Closed)				Maximum Close-Off Pressure (PSI ΔP)				Dimensions			Approximate Shipping Wt.
Valve Body No. ML	EP	Size Connection (NPT)	C _v	W910A	W910B	W910C	W910EPA	A	B	C	
A15	E15	1/2"	2.8	250	x	x	250	4.8 [122]	1.8 [46]	1.8 [46]	3.0 lbs [1.35 kg]
A22	E22	3/4"	5.6	250	x	x	250	5.6 [142]	2.3 [58]	2.3 [58]	4.9 lbs [2.21 kg]
A30	E30	1"	8.4	200	x	x	200	6.0 [152]	2.3 [58]	2.3 [58]	6.0 lbs [2.70 kg]
A41	E41	1 1/4"	15	150	x	x	150	7.2 [183]	2.6 [66]	2.6 [66]	9.7 lbs [4.37 kg]
A52	E52	1 1/2"	21	100	x	x	100	7.7 [196]	2.6 [66]	2.6 [66]	10.8 lbs [4.86 kg]
A63	E63	2"	33	50	x	x	50	8.6 [218]	3.1 [79]	3.1 [79]	16.3 lbs [7.34 kg]

All dimensions are inches [mm].

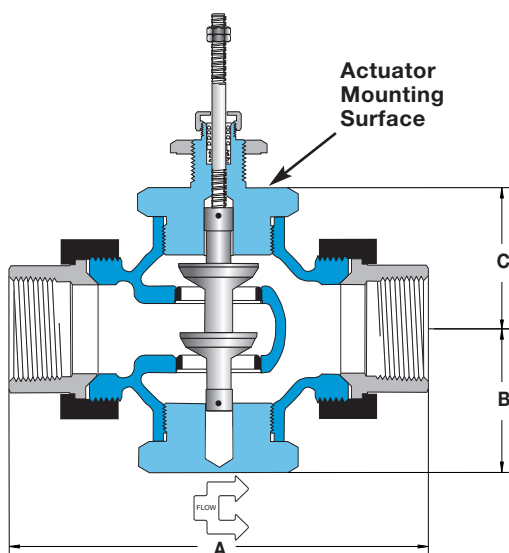
W910 Series

BRONZE

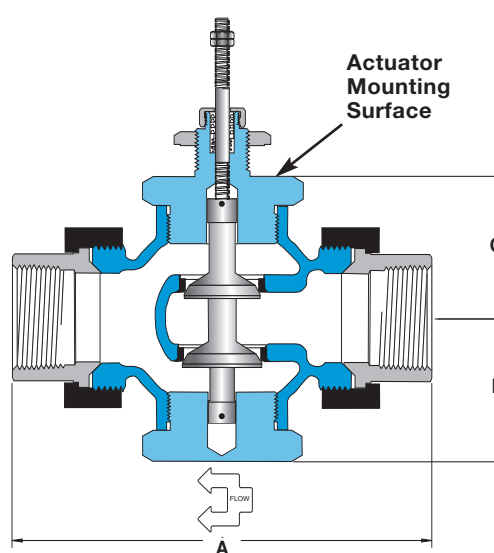
Valve Body for W910A, W910B & W910C

Double Seat • 3/4" – 2"

**Stem In-To-Close
(normally open)**



**Stem In-To-Open
(normally closed)**



CONTROL
VALVES

Specifications

Body Material	Trim Material	Trim Style	Connection	Pressure & Temperature Rating
Bronze	Stainless Steel	Modified Linear	NPT with Malleable Iron Union Ends	250 PSI @ 410°F (210°C)

Valve Body Selection

In-To-Close (Normally Open)				Maximum Close-Off Pressure (PSI ΔP)			Dimensions			Approximate Shipping Wt.
Valve Body Number	Connection (NPT)	Nominal Port	C _v	W910A	W910B	W910C	A	B	C	
A21	3/4"	3/4"	8	250	x	x	5.6 [142]	2.3 [58]	2.3 [58]	5.0 lbs [2.25 kg]
A29	1"	1"	12	250	x	x	6.0 [152]	2.3 [58]	2.3 [58]	6.1 lbs [2.75 kg]
A39	1 1/4"	1 1/4"	21	250	x	x	7.2 [183]	2.6 [66]	2.6 [66]	10.1 lbs [4.55 kg]
A50	1 1/2"	1 1/2"	30	250	x	x	7.7 [196]	2.6 [66]	2.6 [66]	11.1 lbs [5.00 kg]
A61	2"	2"	47	200	x	x	8.6 [218]	3.1 [79]	3.1 [79]	17.0 lbs [7.65 kg]

In-To-Open (Normally Closed)				Maximum Close-Off Pressure (PSI ΔP)			Dimensions			Approximate Shipping Wt.
Valve Body Number	Connection (NPT)	Nominal Port	C _v	W910A	W910B	W910C	A	B	C	
A24	3/4"	3/4"	8	250	x	x	5.6 [142]	2.3 [58]	2.3 [58]	5.0 lbs [2.25 kg]
A33	1"	1"	12	250	x	x	6.0 [152]	2.3 [58]	2.3 [58]	6.1 lbs [2.75 kg]
A44	1 1/4"	1 1/4"	21	250	x	x	7.2 [183]	2.6 [66]	2.6 [66]	10.1 lbs [4.55 kg]
A55	1 1/2"	1 1/2"	30	250	x	x	7.7 [196]	2.6 [66]	2.6 [66]	11.1 lbs [5.00 kg]
A66	2"	2"	47	200	x	x	8.6 [218]	3.1 [79]	3.1 [79]	17.0 lbs [7.65 kg]

All dimensions are inches [mm].

CONTROL VALVES

W910 Series

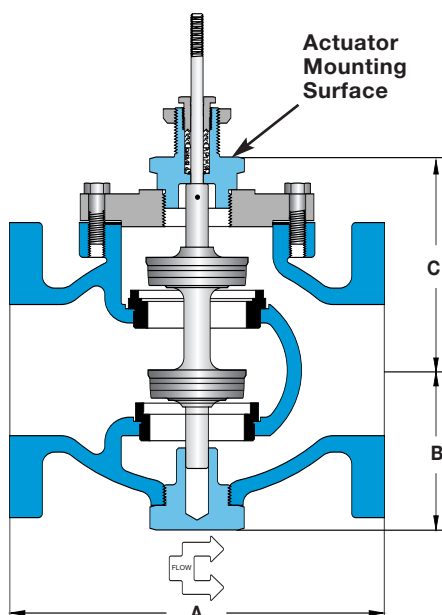
Valve Body for W910A, W910B & W910C

CAST IRON

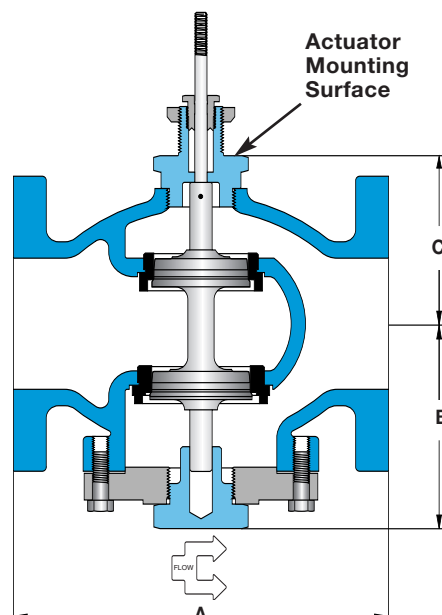
Double Seat • 2½" – 4"

CONTROL VALVES

**Stem In-To-Close
(normally open)**



**Stem In-To-Open
(normally closed)**



Specifications

Body Material	Trim Material	Trim Style	Connection	Pressure & Temperature Rating
Cast Iron	Stainless Steel	Modified Linear	125# Flanged	125 PSI @ 350°F (176°C)

Valve Body Selection

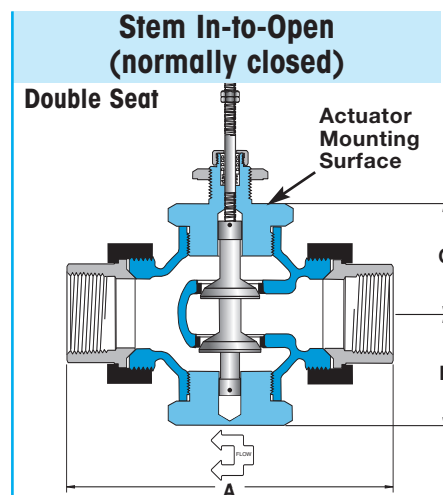
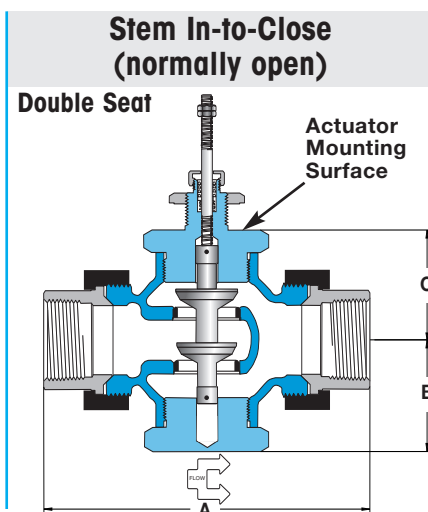
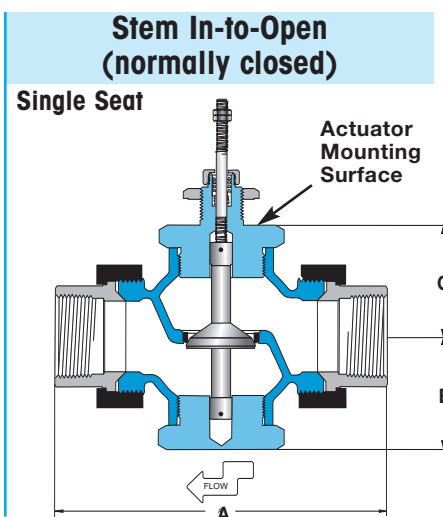
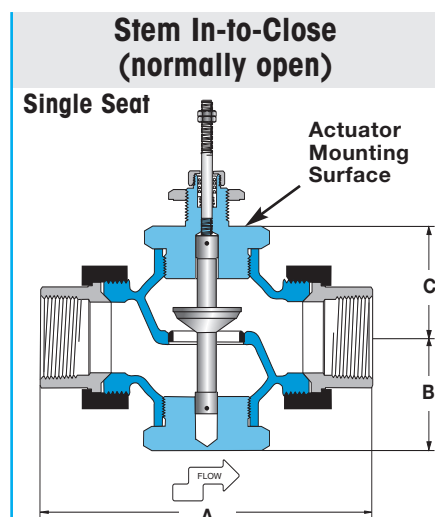
In-To-Close (Normally Open)				Maximum Close-Off Pressure (PSI ΔP)			Dimensions			Approximate Shipping Wt.
Valve Body Number	Connection	Size Nominal Port	C _v	W910A	W910B	W910C	A	B	C	
B73	2½"	2½"	69	125	x	x	7.8 [198]	4.8 [122]	5.4 [137]	45 lbs [20 kg]
B78	3"	3"	90	125	x	x	9.0 [229]	5.0 [127]	5.6 [142]	70 lbs [32 kg]
B83	4"	4"	196	125	x	x	11.4 [290]	6.3 [160]	6.5 [165]	100 lbs [45 kg]

In-To-Open (Normally Closed)				Maximum Close-Off Pressure (PSI ΔP)			Dimensions			Approximate Shipping Wt.
Valve Body Number	Connection	Size Nominal Port	C _v	W910A	W910B	W910C	A	B	C	
B74	2½"	2½"	69	125	x	x	7.8 [198]	4.8 [122]	5.4 [137]	45 lbs [20 kg]
B79	3"	3"	90	125	x	x	9.0 [229]	5.0 [127]	5.6 [142]	70 lbs [32 kg]
B84	4"	4"	196	125	x	x	11.4 [290]	6.3 [160]	6.5 [165]	100 lbs [45 kg]

All dimensions are inches [mm].

BRONZE

Single or Double Seat
1/2" – 2"



CONTROL
VALVES

Specifications

Body Material	Trim Material	Trim Style	Connection	Pressure & Temperature Rating
Bronze	Stainless Steel	Modified Linear	NPT with Malleable Iron Union Ends	250 PSI @ 410°F (210°C)

Valve Body Selection

Valve Body Number	ITC Normally Open	ITO Normally Closed	Size		Number of Seats	C _v	Maximum Close-Off Pressure (PSI ΔP) Actuator W910TB	Dimensions			Approximate Shipping Wt.
			Connection (NPT)	Nominal Port				A	B	C	
A02	A03		1/2"	1/8"	1	0.17	250	4.8 [122]	1.8 [46]	1.8 [46]	3.0 lbs [1.35 kg]
A05	A06		1/2"	3/16"	1	0.35	250	4.8 [122]	1.8 [46]	1.8 [46]	3.0 lbs [1.35 kg]
A08	A09		1/2"	1/4"	1	0.7	250	4.8 [122]	1.8 [46]	1.8 [46]	3.0 lbs [1.35 kg]
A11	A12		1/2"	3/8"	1	1.4	250	4.8 [122]	1.8 [46]	1.8 [46]	3.0 lbs [1.35 kg]
A14	A15		1/2"	1/2"	1	2.8	250	4.8 [122]	1.8 [46]	1.8 [46]	3.0 lbs [1.35 kg]
A21	A24		3/4"	3/4"	2	8	250	5.6 [142]	2.3 [58]	2.3 [58]	5.0 lbs [2.25 kg]
A29	A33		1"	1"	2	12	250	6.0 [152]	2.3 [58]	2.3 [58]	6.1 lbs [2.75 kg]
A39	A44		1 1/4"	1 1/4"	2	21	250	7.2 [183]	2.6 [66]	2.6 [66]	10.1 lbs [4.55 kg]
A50	A55		1 1/2"	1 1/2"	2	30	250	7.7 [196]	2.6 [66]	2.6 [66]	11.1 lbs [5.00 kg]
A61	A66		2"	2"	2	47	250	8.6 [218]	3.1 [79]	3.1 [79]	17.0 lbs [7.65 kg]

All dimensions are inches [mm].

CONTROL VALVES

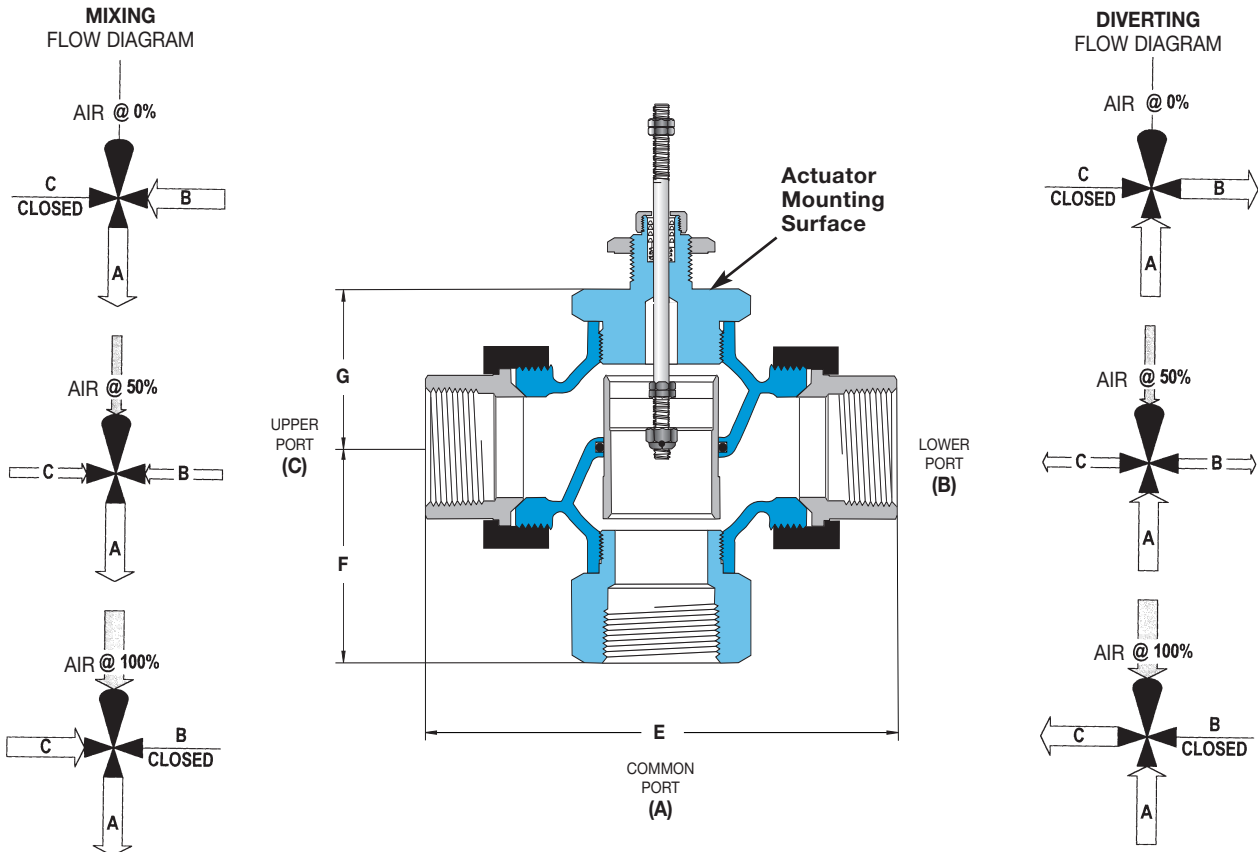
W910 Series

Valve Body for W910TB

BRONZE

3-Way • 1/2" – 2"

for Mixing or Diverting



CAUTION: 3-Way Valves are not designed for use in steam applications.

To properly control the mixing of two flows, inlet pressures at ports B and C should be as equal as possible.

Specifications

Body Material	Trim Material	Trim Style	Connection	Pressure & Temperature Rating
Bronze	Bronze	Modified Linear	NPT with Malleable Iron Union Ends	250 PSI @ 300°F (149°C)

Valve Body Selection

Mixing or Diverting				Maximum Close-Off Pressure (PSI ΔP)					
Valve Body Number	Size		C _v	Actuator W910TB	Dimensions			Approximate Shipping Wt.	
	Connection (NPT)	Nominal Port			E	F	G		
A18	1/2"	1/2"	2.8	250	4.8 [122]	1.8 [46]	1.8 [46]	2.9 lbs [1.31 kg]	
A25	3/4"	3/4"	5.6	250	5.6 [142]	2.3 [58]	2.3 [58]	4.7 lbs [2.12 kg]	
A34	1"	1"	8.4	250	6.0 [152]	2.3 [58]	2.3 [58]	5.7 lbs [2.57 kg]	
A45	1 1/4"	1 1/4"	15	250	7.2 [183]	2.8 [71]	2.6 [66]	9.5 lbs [4.28 kg]	
A56	1 1/2"	1 1/2"	21	250	7.7 [196]	3.5 [89]	2.6 [66]	11.1 lbs [5.00 kg]	
A67	2"	2"	33	250	8.6 [218]	4.1 [104]	3.1 [79]	16.7 lbs [7.55 kg]	

All dimensions are inches [mm].

CAST IRON

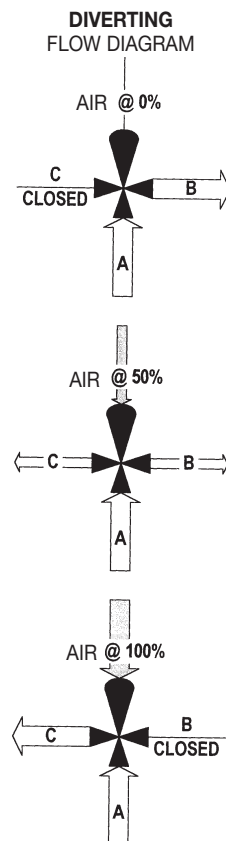
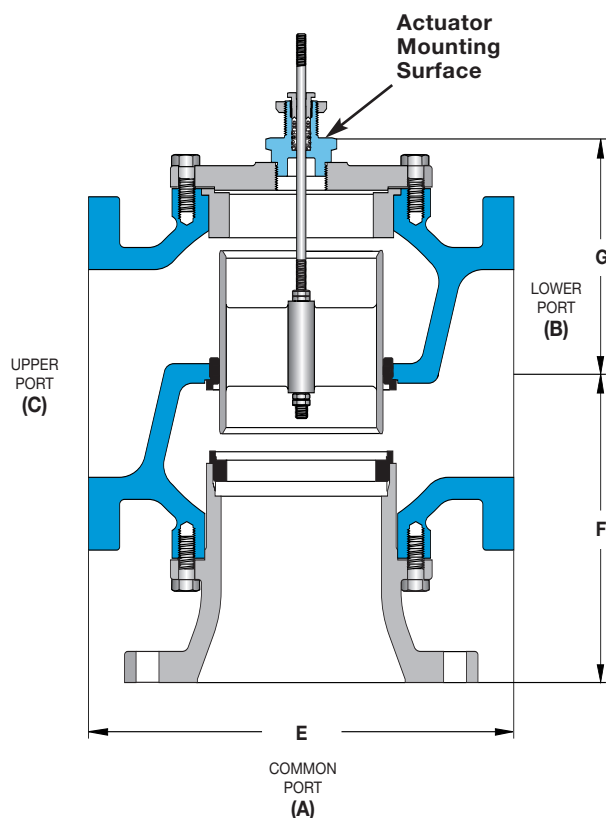
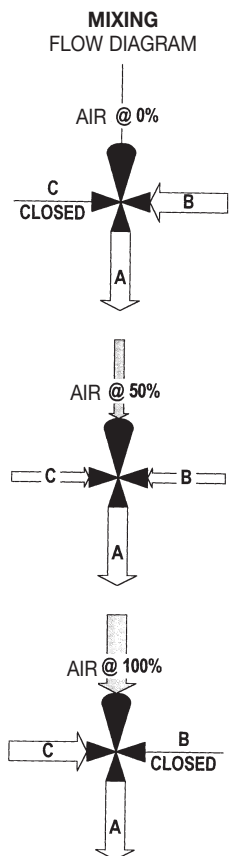
CONTROL VALVES

W910 Series

Valve Body for W910TB

3-Way • 2 1/2" – 4"

for Mixing or Diverting



CONTROL
VALVES

CAUTION: 3-Way Valves are not designed for use in steam applications. To properly control the mixing of two flows, inlet pressures at ports B and C should be as equal as possible.

Specifications

Body Material	Trim Material	Trim Style	Connection	Pressure & Temperature Rating
Cast Iron	Bronze	Modified Linear	125# Flanged	125 PSI @ 300°F (149°C)

Valve Body Selection

Mixing or Diverting			Maximum Close-Off Pressure (PSI ΔP)		Dimensions			Approximate Shipping Wt.
Valve Body Number	Size Connection (NPT)	Nominal Port	C _v	Actuator W910TB	E	F	G	
B75	2 1/2"	2 1/2"	58	125	9.0 [229]	7.1 [180]	5.2 [132]	62 lbs [28 kg]
B80	3"	3"	72	125	10.0 [254]	8.0 [203]	6.0 [152]	80 lbs [36 kg]
B85	4"	4"	102	125	13.0 [330]	10.0 [254]	6.9 [175]	140 lbs [64 kg]

All dimensions are inches [mm].

CONTROL VALVES

W910 Series

Capacity Charts

CAPACITIES – <i>Steam (lbs/hr)</i>				SINGLE SEATED VALVES		
Inlet Pressure (PSIG)	Size, Body Number & Coefficient (Cv)					
	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"
	A14/E14 ITC Cv = 2.8	A19/E19 ITC Cv = 5.6	A26/E26 ITC Cv = 8.4	A36/E36 ITC Cv = 15	A47/E47 ITC Cv = 21	A58/E58 ITC Cv = 33
1	80	160	240	428	599	942
3	90	180	270	483	676	1062
5	100	201	301	537	752	1182
10	126	252	377	674	943	1482
15	151	302	454	810	1134	1782
20	177	353	530	946	1325	2082
25	202	404	606	1083	1516	2382
30	228	455	683	1219	1701	2682
40	279	557	838	1492	2089	3283
50	329	659	988	1765	2471	3883
60	380	761	1141	2038	2853	4483
70	431	863	1294	2310	3235	5083
80	482	964	1447	2583	3617	5683
90	533	1066	1599	2856	3999	6283
100	584	1168	1752	3129	4380	6884
125	711	1423	2134	3811	5335	8384
150	839	1677	2516	4493	6290	9884
175	966	1932	2898	5175	7245	11385
200	1093	2187	3280	5857	8200	12885
250	1348	2696	4044	7221	10109	15886

Note:
Verify that Maximum Close-Off Pressure does not exceed max rating for selected valve body number and actuator. (Refer to Valve Body No. charts for Single Seated Valves.)

Note: All steam capacities based on Critical Drop (Choked Flow).

CAPACITIES – Water (GPM)				SINGLE SEATED VALVES		
Pressure Drop (PSI ΔP)	Size, Body Number & Coefficient (Cv)					
	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"
	A14/E14 ITC A15/E15 ITO Cv = 2.8	A19/E19 ITC A22/E22 ITO Cv = 5.6	A26/E26 ITC A30/E30 ITO Cv = 8.4	A36/E36 ITC A41/E41 ITO Cv = 15	A47/E47 ITC A52/E52 ITO Cv = 21	A58/E58 ITC A63/E63 ITO Cv = 33
1	2.8	5.6	8.4	15	21	33
3	4.8	10	15	26	36	57
5	6.3	13	19	34	47	74
10	8.9	18	27	47	66	104
15	11	22	33	58	81	128
20	13	25	38	67	94	148
25	14	28	42	75	105	165
30	15	31	46	82	115	181
40	18	35	53	95	133	209
50	20	40	59	106	148	233
60	22	43	65	116	163	256
70	23	47	70	125	176	276
80	25	50	75	134	188	295
90	27	53	80	142	199	313
100	28	56	84	150	210	330
125	31	63	94	168	235	369
150	34	69	103	184	257	404
175	37	74	111	198	278	437
175	37	74	111	198	278	437
200	40	79	119	212	297	467
225	42	84	126	225	315	495
250	44	89	133	237	332	522

Note:
Verify that Maximum Close-Off Pressure does not exceed max rating for selected valve body number and actuator. (Refer to Valve Body No. charts for Single Seated Valves.)

ITC = In-to-Close; ITO = In-to-Open

CAPACITIES – Steam (lbs/hr)					DOUBLE SEATED VALVES			
Inlet Pressure (PSIG)	Size, Body Number & Coefficient (Cv)							
	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	4"
	A21 ITC	A29 ITC	A39 ITC	A50 ITC	A61 ITC	B73 ITC	B78 ITC	B83 ITC
	Cv = 8	Cv = 12	Cv = 21	Cv = 30	Cv = 47	Cv = 69	Cv = 90	Cv = 196
1	288	343	599	856	1342	1970	2569	5595
3	257	386	676	965	1513	2221	2896	6308
5	287	430	752	1075	1684	2472	3224	7021
10	359	539	943	1347	2111	3099	4042	8803
15	432	648	1134	1620	2538	3726	4861	10585
20	505	757	1325	1893	2966	4354	5679	12368
25	578	866	1516	2166	3393	4981	6497	14150
30	650	975	1707	2439	3820	5609	7316	15932
40	796	1194	2089	2984	4675	6864	8953	19497
50	941	1412	2471	3530	5530	8119	10589	23080
60	1087	1630	2853	4075	6385	9380	12240	26650
70	1232	1848	3235	4621	7240	10640	13870	30210
80	1378	2067	3617	5167	8094	11890	15510	33780
90	1523	2285	3999	5712	8949	13150	17150	37350
100	1669	2503	4380	6258	9804	14400	18790	40920
125	2032	3049	5335	7622	11941	17540	22880	49830
150	2396	3594	6290	8986	14078			
175	2760	4140	7245	10350	16215			
200	3124	4685	8200	11714	18352			
250	3851	5777	10109	14442	22625			

Note: All steam capacities based on Critical Drop (Choked Flow).

CAPACITIES – Water (GPM)					DOUBLE SEATED VALVES			
Pressure Drop (PSI ΔP)	Size, Body Number & Coefficient (Cv)							
	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	4"
	A21 ITC A24 ITO	A29 ITC A33 ITO	A39 ITC A44 ITO	A50 ITC A55 ITO	A61 ITC A66 ITO	B73 ITC B74 ITO	B78 ITC B79 ITO	B83 ITC B84 ITO
	Cv = 8	Cv = 12	Cv = 21	Cv = 30	Cv = 47	Cv = 69	Cv = 90	Cv = 196
1	8	12	21	30	47	69	90	196
3	14	21	36	52	81	120	156	339
5	18	27	47	67	105	154	201	438
10	25	38	66	95	149	218	285	620
15	31	46	81	116	182	267	349	759
20	36	54	94	134	210	309	402	877
25	40	60	105	150	235	345	450	980
30	44	66	115	164	257	378	493	1074
40	51	76	133	190	297	436	569	1240
50	57	85	148	212	332	488	636	1386
60	62	93	163	232	364	534	697	1518
70	67	100	176	251	393	577	753	1640
80	72	107	188	268	420	617	805	1753
90	76	114	199	285	446	655	854	1859
100	80	120	210	300	470	690	900	1960
125	89	134	235	335	525	771	1006	2191
150	98	147	257	367	576			
175	106	159	278	397	622			
200	113	170	297	424	665			
225	120	180	315	450	705			
250	126	190	332	474	743			

ITC = In-to-Close; ITO = In-to-Open

CONTROL VALVES

W910 Series

Capacity Charts

CAPACITIES – Water (GPM)

3-WAY VALVES

Inlet pressures should be within 5% of each other. Specify if service is for other than water.

Pressure Drop (PSI ΔP)	Size, Body Number & Coefficient (Cv)								
	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	4"
	A18 Cv = 2.8	A25 Cv = 5.6	A34 Cv = 8.4	A45 Cv = 15	A56 Cv = 21	A67 Cv = 33	B75 Cv = 58	B80 Cv = 72	B85 Cv = 102
1	2.8	5.6	8.4	15	21	33	58	72	102
3	4.8	10	15	26	36	57	100	125	177
5	6.3	13	19	34	47	74	130	161	228
10	8.9	18	27	47	66	104	183	228	323
15	11	22	33	58	81	128	225	279	395
20	13	25	38	67	94	148	259	322	456
25	14	28	42	75	105	165	290	360	510
30	15	31	46	82	115	181	318	394	559
40	18	35	53	95	133	209	367	455	645
50	20	40	59	106	148	233	410	509	721
60	22	43	65	116	163	256	449	558	790
70	23	47	70	125	176	276	485	602	853
80	25	50	75	134	188	295	519	644	912
90	27	53	80	142	199	313	550	683	968
100	28	56	84	150	210	330	580	720	1020
125	31	63	94	168	235	369	648	805	1140
150	34	69	103	184	257	404			
175	37	74	111	198	278	437			
200	40	79	119	212	297	467			
225	42	84	126	225	315	495			
250	44	89	133	237	332	522			

Note: Oil service or high temperature service requires special O-ring.

CAPACITIES – Steam (lbs/hr) SINGLE SEATED

Inlet Pressure (PSIG)	Size, Body Number & Coefficient (Cv)			
	1/8"	3/16"	1/4"	3/8"
	Reduced Port A02 ITC Cv = 0.17	Reduced Port A05 ITC Cv = 0.35	Reduced Port A08 ITC Cv = 0.7	Reduced Port A11 ITC Cv = 1.4
1	4.9	10	20	40
3	5.5	11	23	45
5	6.1	13	25	50
10	7.6	16	31	63
15	9.2	19	38	76
20	11	22	44	88
25	12	25	51	101
30	14	28	57	114
40	17	35	70	139
50	20	41	82	165
60	23	48	95	190
70	26	54	108	216
80	29	60	121	241
90	32	67	133	267
100	35	73	146	292
125	43	89	178	356
150	51	105	210	419
175	59	121	241	483
200	66	137	273	547
250	82	168	337	674

Note: All steam capacities based on Critical Drop (Choked Flow).

CAPACITIES – Water (GPM) SINGLE SEATED

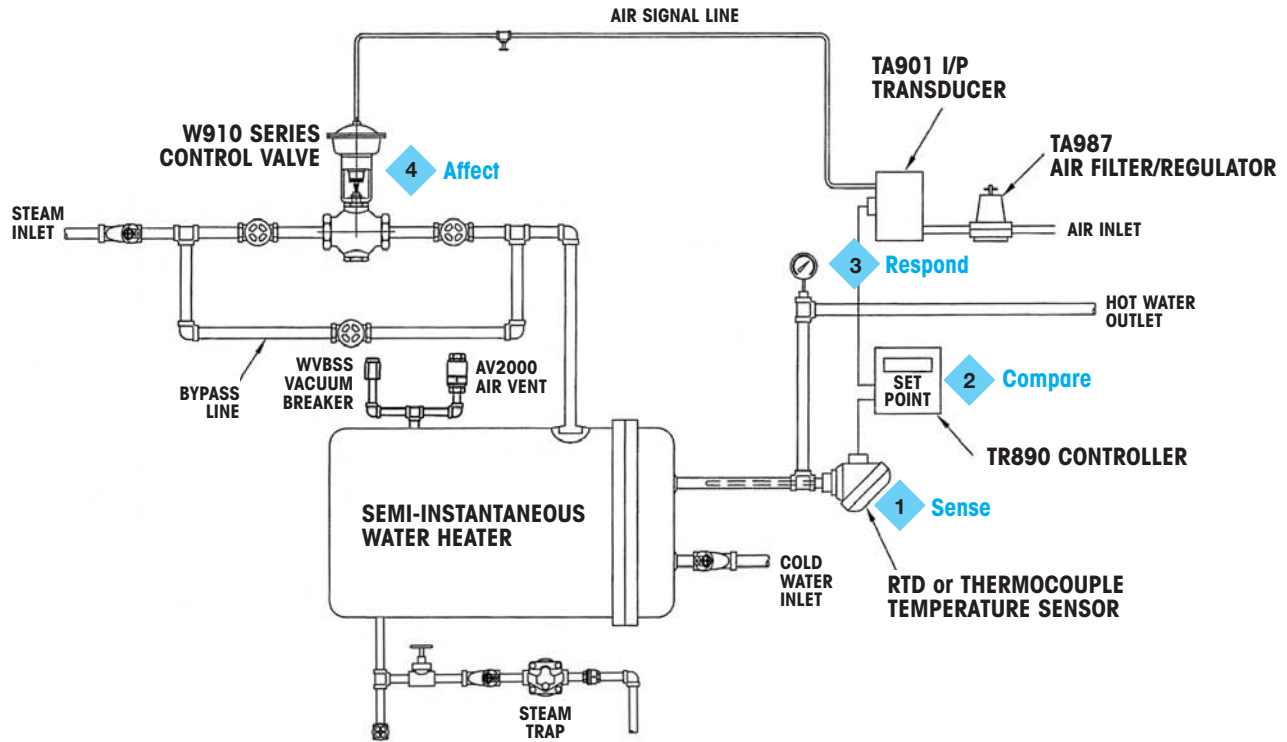
Pressure Drop (PSI ΔP)	Size, Body Number & Coefficient (Cv)			
	1/8"	3/16"	1/4"	3/8"
	Reduced Port A02 ITC A03 ITO Cv = 0.17	Reduced Port A05 ITC A06 ITO Cv = 0.35	Reduced Port A08 ITC A09 ITO Cv = 0.7	Reduced Port A11 ITC A12 ITO Cv = 1.4
1	0.2	0.4	0.7	1.4
3	0.3	0.6	1.2	2.4
5	0.4	0.8	1.6	3.1
10	0.5	1.1	2.2	4.4
15	0.7	1.4	2.7	5.4
20	0.8	1.6	3.1	6.3
25	0.9	1.8	3.5	7.0
30	0.9	1.9	3.8	7.7
40	1.1	2.2	4.4	8.9
50	1.2	2.5	4.9	10
60	1.3	2.7	5.4	11
70	1.4	2.9	5.9	12
80	1.5	3.1	6.3	13
90	1.6	3.3	6.6	13
100	1.7	3.5	7.0	14
125	1.9	3.9	7.8	16
150	2.1	4.3	8.6	17
175	2.2	4.6	9.3	19
200	2.4	4.9	10	20
250	2.7	5.5	11	22

ITC = In-to-Close; ITO = In-to-Open

Control Loop

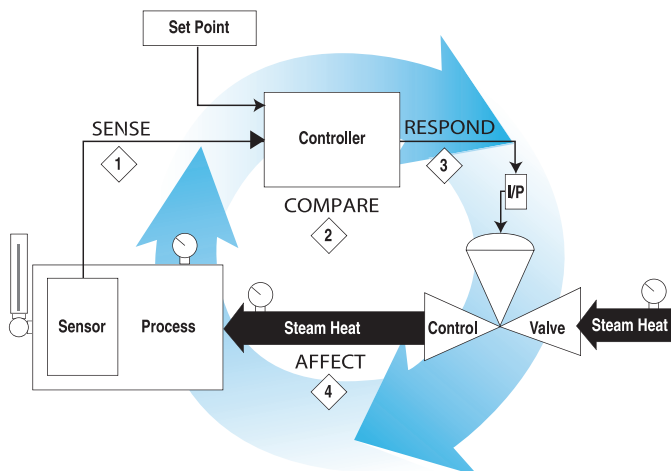
Understanding a Control Loop

SEMI-INSTANTANEOUS WATER HEATER TEMPERATURE CONTROL LOOP



Control Loop

A control loop is a process management system designed to maintain a process variable at a desired set point. Each step in the loop works in conjunction with the others to manage the system. Once the set point has been established, the control loop operates using a four-step process.



1 Sense

Measure the current condition of the process using a sensor, which can be an electronic (thermocouple, RTD or transmitter) or mechanical device (thermal system).

2 Compare

Evaluate the measurement of the current condition against the set point using an electronic or electric contact controller.

3 Respond

React to any error that may exist between the measured value and set point by generating a corrective pneumatic or electric control signal.

4 Affect

Actuate a final control element (valve, heater or other device) that will produce a change in the process variable.

The loop continually cycles through the steps, affecting the process variable in order to maintain the desired set point. Watson McDaniel is unique in its ability to provide all of the necessary components to create a complete control loop.

Controllers

Design & Operation

Description

A controller is a comparative device that receives an input signal from a measured process variable, compares this value with that of a predetermined control point value (set point), and determines the appropriate amount of output signal required by the final control element to provide corrective action within a control loop. Watson McDaniel offers an **Electronic PID Controller**, which uses electrical signals and digital algorithms to perform its receptive, comparative and corrective functions.

Principles of Operation (Electronic PID Controller)

An electronic sensor (thermocouple, RTD or transmitter) installed at the measurement location continuously sends an input signal to the controller. At set intervals, the controller compares this signal to a predefined set point. If the input signal deviates from the set point, the controller sends a corrective electric output signal to the control element. This electric signal must be converted to a pneumatic signal when used with an air operated valve, such as a Watson McDaniel W910 Series Control Valve. The conversion can be made using a Watson McDaniel TA901 I/P Transducer, which converts a 4 to 20 mA electric signal to a 3 to 15 PSI air signal.

Features (Electronic PID Controller)

An electronic controller is best suited for applications where large load changes are encountered and/or fast response changes are required. Watson McDaniel Electronic Controllers have full auto-tuning and PID capabilities, and offer a host of available options, including user selectable inputs and ranges, outputs, setback functions and alarms.

PID Control is a feature of most Watson McDaniel Electronic Controllers. PID combines the proportional, integral and derivative functions into a single unit.

- **Proportional (P)** — Proportional control reacts to the size of the deviation from set point when sending a corrective signal. The size of the corrective signal can be adjusted in relation to the size of the error by changing the width of the proportional band. A narrow proportional band will cause a large corrective action in relation to a given amount of error, while a wider proportional band will cause a smaller corrective action in relation to the same amount of error.
- **Integral (I)** — Integral control reacts to the length of time that the deviation from set point exists when sending a corrective signal. The longer the error exists, the greater the corrective signal.
- **Derivative (D)** — Derivative control reacts to the speed in which the deviation is changing. The corrective signal will be proportional to the rate of change within the process.

Auto-Tuning

Auto-tuning will automatically select the optimum values for **P**, **I** and **D**, thus eliminating the need for the user to calculate and program these values at system startup. This feature can be overridden when so desired. On some models, the control element can be manually operated.

Selecting an Electronic PID Controller

All Watson McDaniel Electronic Controllers are designed to control the temperature or pressure of general industrial equipment and should be carefully selected to meet the demands of the particular application. The information contained within this catalog is offered only as a guide to assist in making the proper selection. Selection of the proper controller is the sole responsibility of the user. Improper application may cause process failure, resulting in possible personal injury or property damage.

Case Size

Case Size selection is determined by both available and designed space, and controller features. Watson McDaniel Electronic Controllers are available in the following panel sizes: 48 x 48 mm ($\frac{1}{16}$ DIN), 72 x 72 mm, 96 x 96 mm ($\frac{1}{4}$ DIN) and 48 x 96 mm ($\frac{1}{8}$ DIN). The depth of the unit varies with the model selected.

Input

The Input is the measurement signal received by the controller from the sensor. A variety of input types are available, including thermocouple, RTD, voltage and current.

Control Output

The Control Output is the corrective signal transmitted from the controller to the control element. Various control output types are available, including contact, voltage, current and solid state relay driver.

Analog Output

The Analog Output is an optional secondary signal that transmits the measurement signal from the controller to a remote data acquisition device, such as a recorder, personal computer or display unit.

Alarms

Most models can be ordered with alarms, event outputs, or heater break alarms, which signal an external device to perform a specific task at a predetermined set point.

Setback Function

This feature, optionally available on some models, is designed to provide energy savings in applications where the process is idled at regular intervals through the connection of an external timer or switch.

CONTROL VALVES

TR890 Series

Electronic PID Controllers • Features PID & Auto-tuning



Multiple Sizes

± 0.3% Accuracy

Keyboard Programmable

Reverse or Direct Acting

Manual Output Override

The **TR890 Series** Electronic PID Controller is designed for use on applications where large load changes are expected, or extreme accuracy and fast response times are needed. With full auto-tune capabilities and a large selection of available inputs, the TR890 Series is ideally suited for use with a Watson McDaniel Control Valve.

Use of a Watson McDaniel No. TA987 Air Filter/Regulator is recommended for filtering and regulating the pressure of plant compressed air, and for delivering clean, dry air at the proper pressure to pneumatic control devices.

Approximate Shipping Weights:

TR891: 0.4 lbs [0.17 kg]

TR892: 0.6 lbs [0.28 kg]

TR893: 0.7 lbs [0.33 kg]

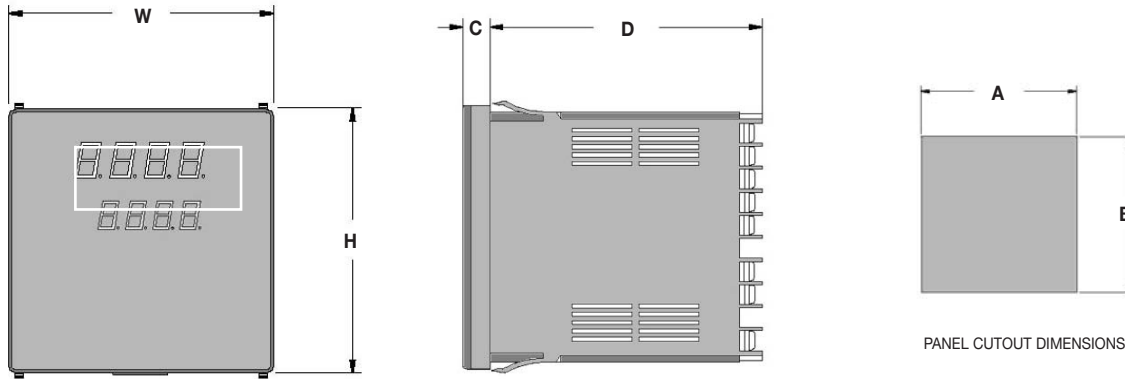
TR894: 0.5 lbs [0.24 kg]

Specifications

Models	TR891: 48 x 48 mm (1/16 DIN) TR892: 72 x 72 mm TR893: 96 x 96 mm (1/4 DIN) TR894: 96 x 48 mm (1/8 DIN)
Control	Control Mode: Auto-Tuning PID Action: Reverse acting (field switchable to direct acting)
Proportional Band	Off, 0.1-999.9% Full Scale Integral Time: Off, 1-6000 sec. Derivative Time: Off, 1-3600 sec.
Accuracy	± 0.3%
Display	Process Value: 4 Digit, 20 mm red LED Set Value: 4 digit, 10.2 mm green LED Sampling Cycle: 0.25 seconds
Inputs	Multi: (switchable between) ▶ Thermocouple: B, R, S, K, E, J, T, N, PL II, WRe5-26 (U,L (DIN 43710) ▶ RTD: Platinum 100 Ω, 3-Wire ▶ mV: (scalable) -10-10, 0-10, 0-20, 0-50, 10-50, 0-100 mV DC Current: (scalable) 4-20, 0-20 mA Voltage: -1-1, 0-1, 0-2, 0-5, 1-5, 0-10 VDC
Control Output	Current: 4-20 mA (load resistance: 600 Ω maximum) Contact: Proportional cycle, 1-120 sec. (capacity: 240 VAC 2 A resistive / 1.2 A inductive) SSR Drive Voltage: Proportional cycle 1-120 sec. (output rating: 12 ± 1.5 VDC / 30 mA maximum) Voltage: 0-10 VDC Load Current 2 mA max
Power Requirements	Supply Voltage: 100-240 VAC, 50/60 Hz or 24 VAC/VDC 50/60 Hz Consumption: 100-240 VAC, 15VA 24 VDC, 8W 24 VAC, 9VA
Data Storage	Nonvolatile EEPROM memory
Case Material	Polyphenylene Oxide (PPO)
Ambient Temp.	14°F (-10°C) to 122°F (50°C)
Humidity	Maximum: 90% RH, non-condensing
Event Outputs	(Contact Capacity: 240 VAC, 1 A/resistive load) Dual Event Outputs (High and/or Low Alarms) Single Event Output + Heater Break Alarm (includes CT30A sensor) Single Event Output + Heater Break Alarm (includes CT50A sensor)
Options:	Analog Output: 0-10 mV DC (output resistance 10 Ω) Analog Output: 4-20 mA DC (load resistance 300 Ω max) Analog Output: 0-10 VDC (load current 2 mA max) Digital Input (switch) including: Setback Function setting range of -1999 - 5000, standby or DA/RA Selection Operated by either non-voltage contact or open collector

TR890 Series

Electronic PID Controllers



HOW TO ORDER

Sample Order Number: **TR893 8 A C 90 1 00**

Model	Input	Control Output	Power Supply	Event Output	Options
TR891	8 Multi	A 4-20 mA	90 100-240 VAC, 50/60 Hz	0 None	00 None
TR892	4 mA	C On/Off Contact	08 24 VAC/VDC, 50/60 Hz	1 Dual Event (high and/or low)	30 Analog Output (0-10 mVDC)
TR893	6 VDC	D SSR Driver		2 Single Event (high or low) and heater break CT30A	40 Analog Output (4-20 mA)
TR894		E 0-10 VDC		3 Single Event (high or low) and heater break CT50A	60 Analog Output (0-10 VDC)

Event Outputs 2 or 3 require Control Outputs C or D

Electronic PID Controller Dimensions – units: inches [mm].

*Not available with Model TR891

Model	A	B	C	D	H	W
TR891	1.77 [45]	1.77 [45]	0.43 [11]	3.94 [100]	1.89 [48]	1.89 [48]
TR892	2.68 [68]	2.68 [68]	0.43 [11]	3.94 [100]	2.83 [72]	2.83 [72]
TR893	3.63 [92]	3.63 [92]	0.43 [11]	3.94 [100]	3.78 [96]	3.78 [96]
TR894	1.77 [45]	3.63 [92]	0.43 [11]	3.94 [100]	3.78 [96]	3.78 [96]

Programmable Ranges

Thermocouple Inputs					RTD Inputs				Current & Voltage Inputs	
T/C Type	Range Code	Fahrenheit Range	Range Code	Celsius Range	Range Code	Fahrenheit Range	Range Code	Celsius Range	Range Code	Range (User-scalable Readout)
B*	15	0° to 3300°F	01	0° to 1800°C	47	-300° to 1100°F	31	-200° to 600°C	71	-10-10 mV
E	21	0° to 1300°F	07	0° to 700°C	48	-150.0° to 200.0°F	32	-100.0° to 100.0°C	72	0-10 mV
J	22	0° to 1100°F	08	0° to 600°C	49	-150° to 600°F	33	-100.0° to 300.0°C	73	0-20 mV
K	18	-150° to 750°F	04	-100.0° to 400.0°C	50	-50.0° to 120.0°F	34	-50.0° to 50.0°C	74	0-50 mV
K	19	0° to 1500°F	05	0° to 800°C	51	0.0° to 120.0°F	35	0.0° to 50.0°C	75	10-50 mV
K	20	0° to 2200°F	06	0° to 1200°C	52	0.0° to 200.0°F	36	0.0° to 100.0°C	76	0-100 mV
L	28	0° to 1100°F	14	0° to 600°C	53	0.0° to 400.0°F	37	0.0° to 200.0°C	81	-1-1 V
N	24	0° to 2300°F	10	0° to 1300°C	54	0° to 1000°F	38	0.0° to 500.0°C	82	0-1 V
PL II	25	0° to 2300°F	11	0° to 1300°C					83	0-2 V
R	16	0° to 3100°F	02	0° to 1700°C					84	0-5 V
S	17	0° to 3100°F	03	0° to 1700°C					85	1-5 V
T	23	-300° to 400°F	09	-199.9° to 200.0°C					86	0-10 V
U	24	-300° to 400°F	13	-199.9° to 200°C					94	0-20 mA
WRe5-26	26	0° to 4200°F	12	0° to 2300°C					95	4-20 mA

Range Codes are not required for ordering, but are used for field programming.

*750°F (400°C) falls below the accuracy range

CONTROL VALVES

TA901 Series

I/P Transducer • Electropneumatic



- ▶ 4 to 20 mA Input
- ▶ 3 to 15 PSI Output
- ▶ Intrinsically Safe
- ▶ Zero and Span Adjustments

The **TA901 Electropneumatic (I/P) Transducer** converts a milliamp current signal to a linearly proportional pneumatic output pressure. This transducer is designed for control applications that require a high degree of reliability and repeatability. The TA901 is used in the control operation of valve actuators and pneumatic valve positioners in the petrochemical, HVAC, energy management, textile, paper, and food & drug industries.

The TA901 I/P Transducer is tested and approved by Factory Mutual as Intrinsically Safe Class I, II and III, Division I, Groups C, D, E, F and G when installed in accordance with the Installation, Operation and Maintenance Instructions. It should be installed in a vertical position in a vibration-free area.

The Watson McDaniel TA987 Air Filter/Regulator is recommended for filtering and regulating the pressure of plant compressed air, and for delivering clean, dry air at the proper pressure to pneumatic control devices.

Specifications

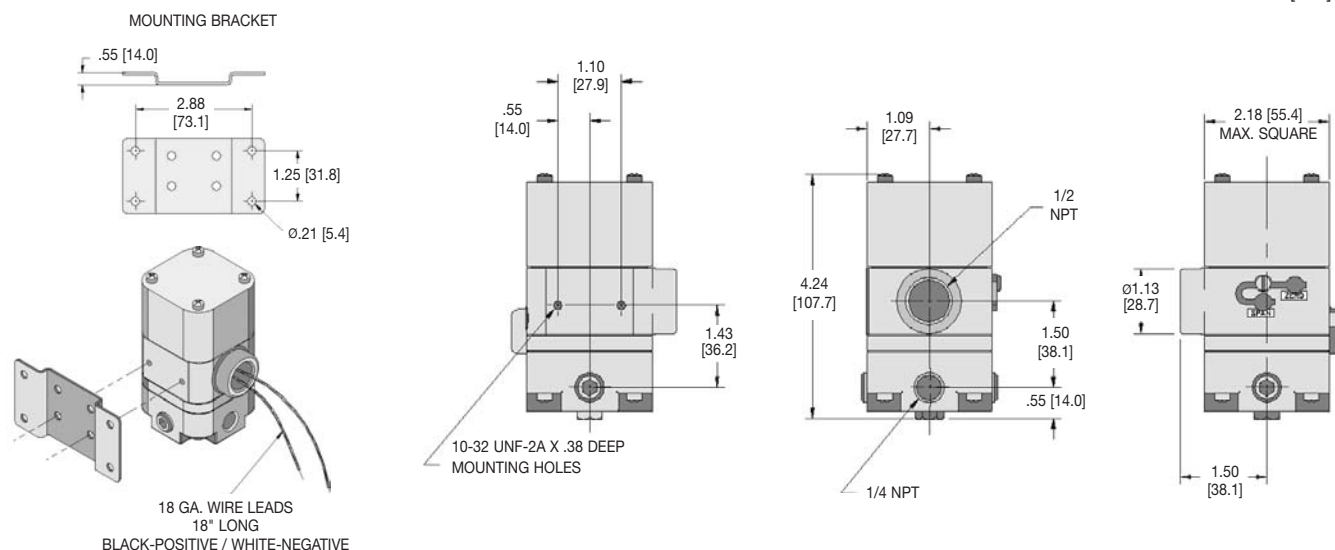
Model TA901	Air Requirements Clean, oil-free, dry air filtered to 40 microns Minimum Supply Pressure: 3 PSIG Maximum Supply Pressure: 100 PSIG Sensitivity: < $\pm 0.1\%$ of span per PSIG Air Consumption: 0.03 SCFH typical Flow Rate: 4.5 SCFM at 25 PSIG supply Relief Capacity: 2.0 SCFM at 5 PSIG above 20 PSIG setpoint	Mounting Pipe, panel or bracket in a vibration-free area. Field adjustment will be required if mounted in a nonvertical position. Adjustment Adjustable zero and span Accuracy Terminal Based Linearity: < $\pm 0.75\%$ of span Repeatability: < 0.5% of span Hysteresis: < 1.0% of span Response Time: < 0.25 sec. @ 3-15 PSIG	Intrinsic Safety Tested and approved by Factory Mutual as Intrinsically Safe Class I, II and III, Division I, Groups C, D, E, F and G when installed in accordance with Installation, Operation and Maintenance Instructions Ambient Temperature -20°F (-30°C) to 140°F (60°C) Approximate Shipping Weight 2.1 lbs [0.94 kg]
Input 4-20 mA			
Output 1-17 PSIG Per ANSI/FCI 87-2 (can be calibrated to provide 1-9 PSIG or 9-17 PSIG)			
Volume Booster Built-in volume booster allows flow capacity up to 20 SCFM			
Connections Pneumatic: 1/4" NPT Electric: 1/2" NPT			

CONTROL VALVES

HOW TO ORDER

Please order using Item Number: **TA901**

Unit: inches [mm].



CONTROL VALVES

TA987

Air Filter/Regulator



- ▶ **Cast Aluminum Housing**
- ▶ **Removable Nylon Mesh Filter**
- ▶ **Low Air Consumption**
- ▶ **Drip Well**

The **TA987 Air Filter/Regulator** is recommended for filtering and regulating the pressure of plant compressed air, and for delivering clean, dry air at the proper pressure to pneumatic control devices. Supply air enters the inlet port, passes through the filtering element, and exits through the reducing valve to the outlet port. The filtering element removes particles as small as 40 microns. A drip well is provided for the accumulation of oil and water and a drain cock is included to allow purging of the unit. The filtering element is readily accessible for cleaning by removal of the drip well bowl.

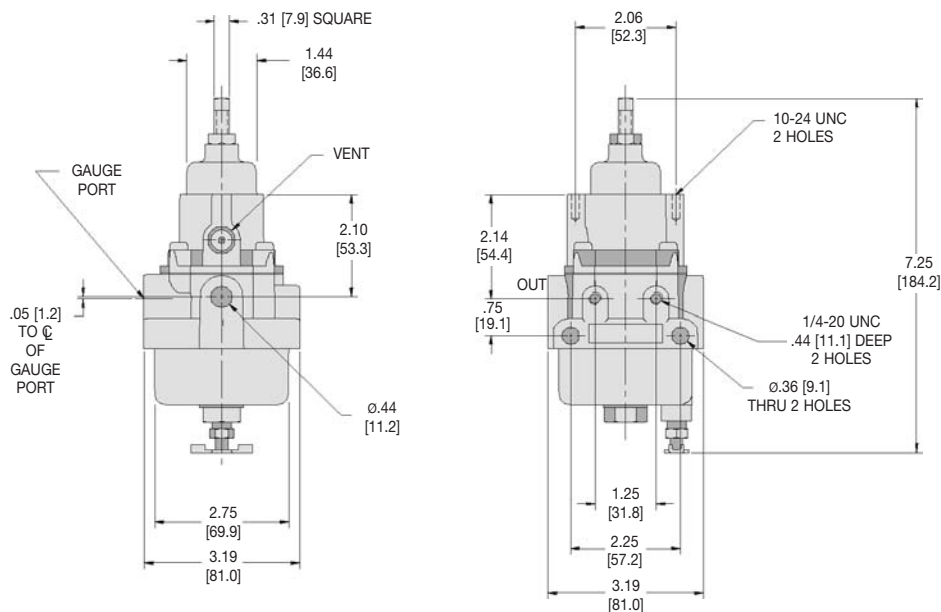
The maximum allowable supply pressure to TA987 Air Filter/Regulator is 250 PSIG. Improper application may cause failure of the regulator, resulting in possible personal injury or property damage.

Specifications

Model TA987	Air Requirements (cont.) Flow Rate: 20 SCFM at 100 PSIG supply/20 PSIG output Relief Capacity: 0.1 SCFM at 5 PSIG above setpoint Effect of Supply Pressure Variation: < 0.2 PSIG for 25 PSIG	Filter Removes particles 40 microns or greater Port Size 1/4" NPT Housing Cast aluminum	Mounting Side, pipe, panel or through body Ambient Temperature -20°F (-30°C) to 160°F (71°C) Approximate Shipping Weight 1.9 lbs [0.86 kg]
Air Requirements Maximum Supply Pressure: 250 PSIG Output Range: 0 to 30 PSIG, adjustable Sensitivity: 0.036 PSIG Air Consumption: < 6 SCFH			

CONTROL VALVES

Units: inches [mm].



CONTROL VALVES

Electronic Temperature Sensors

Connection Head Type • RTD & Thermocouple



- ▶ Thermocouple or RTD
- ▶ Cast Aluminum, Polypropylene or Stainless Steel Head
- ▶ Weather Proof
- ▶ Welded or Spring Loaded Stem

The Watson McDaniel **Connection Head** is available with both Type J and Type K Thermocouples, as well as RTD sensors. The weather proof head provides a conduit connection and is available in cast aluminum (screw cover), polypropylene (flip cover) and stainless steel (screw cover). The stem is either welded directly to the 1/2" NPT threaded connection, or is spring-loaded to provide maximum sensitivity. The spring-loaded stem must always be installed in a thermowell.

Extension wire and transmitter accessories are also available. Please consult factory.

For applications where the process media may be corrosive or contained under pressure, the use of a thermowell is required to prevent damage to the sensor and facilitate its removal from the process. To prevent leakage of the process media, spring loaded sensors must always be installed in a thermowell.

Specifications

Sensors Description

TJD	Type J T/C
TKD	Type K T/C
TDD	100 Ω RTD
TMD	1000 Ω RTD

Hot Junction

T/C: Ungrounded
RTD: Platinum, 3-Wire

Stem 316 stainless steel
1/4" diameter

Insulation Ceramic

Head Cast aluminum, polypropylene or stainless steel

Process Connection

1/2" NPT welded or spring-loaded

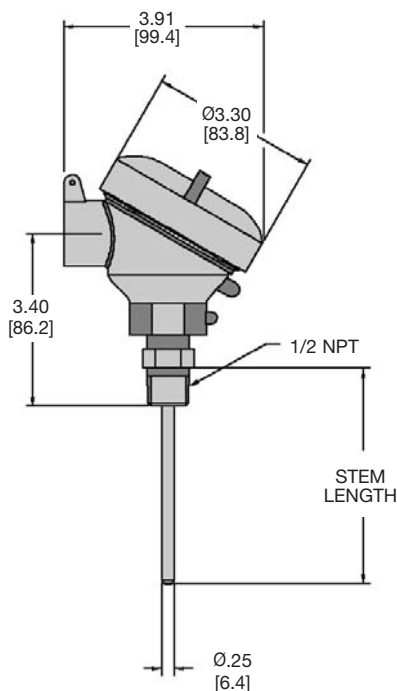
Conduit Connection

3/4" NPT Female

Approximate Shipping Weight

1.1 lbs [0.50 kg]

CONTROL VALVES



Units: inches [mm]

Sensor Specifications

Thermocouple

Type	Color Code	Positive Lead	Negative Lead	Temperature Range
J	Black	Iron* (Fe) [white]	Constantan (Cu-Ni) [red]	32° to 1382°F (0° to 750°C)
K	Yellow	Nickel-Chromium (Ni-Cr) [yellow]	Nickel-Aluminum* (Ni-Al) [red]	32° to 2282°F (0° to 1250°C)

*magnetic lead

RTD

Type	Material	Resistance @ 0°C	Temperature Coefficient	Temperature Range
D	Platinum (Pt)	100 Ω	$\alpha = 0.00385 \text{ } \Omega / \Omega / ^\circ\text{C}$	-50° to 700°F (-45° to 400°C)
M	Platinum (Pt)	1000 Ω	$\alpha = 0.00385 \text{ } \Omega / \Omega / ^\circ\text{C}$	-50° to 700°F (-45° to 400°C)

HOW TO ORDER

Sample Order Number: **TJD Z 04 U W A**

Sensor	Stem Style	Stem Length	Hot Junction	Connection	Head Material
TJD Type J T/C TKD Type K T/C TDD 100 Ω RTD TMD 1000 Ω RTD	Z 316SS, 1/4" O.D.	02 2 1/2" Stem 04 4" Stem 06 6" Stem 09 9" Stem 12 12" Stem	U Ungrounded (T/C) D 3-Wire (RTD)	S Spring Loaded, 1/2" NPT W Welded, 1/2" NPT	A Aluminum P Polypropylene S Stainless Steel

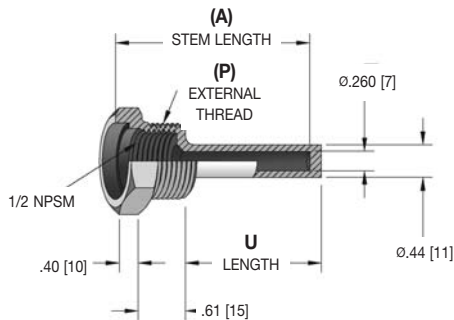
Other sensor styles available. Please consult factory.

Other Lengths: Specify in inches (24" maximum)

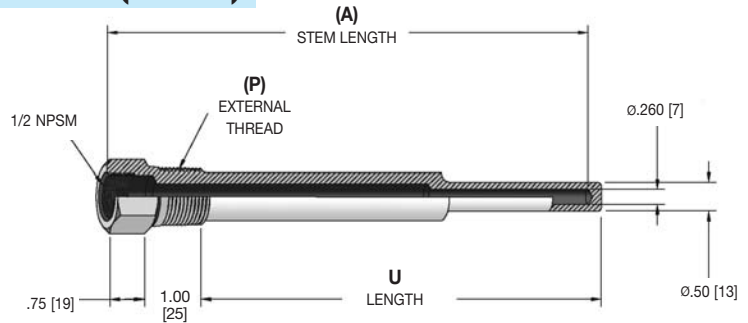
Thermowells

for RTD & Thermocouple Temperature Sensors

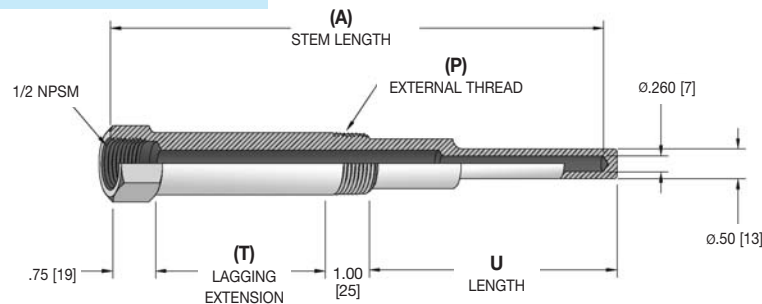
Standard (2 1/2" - 6")



Standard (9" - 24")



with Lagging Extension (4" - 24")



Units inches: [mm]

Lengths

(A) Stem Length	Standard U Length	(T) Lagging Extension	U Length
2 1/2"	1.75 [44]	—	—
4"	2.50 [64]	1.00 [25]	1.50 [38]
6"	4.50 [114]	2.00 [51]	2.50 [64]
9"	7.50 [191]	3.00 [76]	4.50 [114]
12"	10.50 [267]	3.00 [76]	7.50 [191]
15"	13.50 [343]	3.00 [76]	10.50 [267]
18"	16.50 [419]	3.00 [76]	13.50 [343]
24"	22.50 [572]	3.00 [76]	19.50 [495]

Pressure Ratings (PSI)

Material	Operating Temperature					
	70°F	200°F	400°F	600°F	800°F	1000°F
Carbon steel	5000	5000	4800	4600	3500	-
304 stainless steel	6550	6000	4860	4140	3510	3130
316 stainless steel	6540	6400	6000	5270	5180	4660
Monel	5530	4990	4660	4450	4450	-
Brass	3170 PSI @ 150°F, 2930 PSI @ 350°F					

Selection of the proper thermowell is the sole responsibility of the user. Temperature and pressure limitations must be considered. Improper application may cause failure of the thermowell, resulting in possible personal injury or property damage. For correct use and application, please refer to the Thermowells For Thermometers And Electrical Temperature Sensors Standard ASME B40.9.

HOW TO ORDER

Sample Order Number: **76-4J6**

Thermowell Style	(P) External Thread	(A) Stem Length	(T) Lagging Extension	Material
76 - Sensor, Stepped Shank (2 1/2" - 6" Stem Straight Shank)	3 1/2 NPT*	D 2 1/2" Stem	A 1" Extension (4" Stem only)	2 Brass
	4 3/4 NPT	G 4" Stem	C 2" Extension (6" Stem only)	3 Steel
	5 1 NPT*	J 6" Stem	E 3" Extension (9" thru 24" Stem only)	4 Monel
		M 9" Stem	Omit if No Extension	5 304SS
		R 12" Stem		6 316SS
		V 15" Stem		
		Wa 18" Stem		
		Wk 24" Stem		

*Not available with 2 1/2" Stem Length

Other thermowell styles available. Please consult factory.