Specification Guide

For
Selection of Steam Traps, Control Valves, Regulators,
Condensate Pumps,
and
Specialty Equipment.

Prepared For Use By
Consulting Engineers and Specification Writers

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Specification Guide

SECTION 1: STEAM TRAPS & ACCESSORIES

Steam Trap Selection Guide:

Quick-Start Guide for Steam Trap Selection		
Steam trap selection can be overwhelming given the range of applications and trap choices available. Selection criteria for a specific application may include pressure & temperature ratings, capacity, physical size & weight, materials, etc. Therefore, this guide is intended to provide the user with a "starting point" for the selection of Watson McDaniel steam traps. It is in no way intended to be the only possible selection(s) as there may be several appropriate steam trap choices for a specific application. Always consider contacting a qualified Watson McDaniel representative or the factory if any uncertainty exists or additional assistance is required.		
Application	**Recommended Steam Trap**	**Other Watson McDaniel Options**
Drips		
Steam Mains, Valve Protection, and Low Points		
to 30 psig	3/4" WFT-030 Float and Thermostatic	Thermostatic
30 - 600 psig Saturated	1/2" or 3/4" TD600L Thermodynamic	Thermostatic; F&T or Inverted Bucket (to 450 psig)
30 - 600 psig Superheated		Bimetal Thermostatic
600 - 3600 psig	See Thermodynamic Traps	Bimetal Thermostatic
Separators to 250 psig	WFT Series*** Float and Thermostatic	Thermostatic; Inverted Bucket
Heating Processes - Batch & Steady Demand		
Low-to-Medium Capacity Unit Heaters, Storage Tank Coils, Jacketed Vessels, Pipe Coils, Humidifiers	WFT or FTT Series*** Float and Thermostatic	Thermostatic; Inverted Bucket
Storage Tanks - Outdoor	WT3000 Series*** Bellows Thermostatic	Thermodynamic
Radiators to 25 psig	1/2" or 3/4" TA25B Bellows Thermostatic	N / A
Heating Processes - Varying Demand		
High-to-Ultra High Capacity Heat Exchangers, Air Handling Unit Coils, Semi- and Instantaneous Water Heaters	WFT or FTE Series*** Float and Thermostatic	N / A
Industrial Processes - Chemical & Petro-chemical Plants		
Medium-to-High Capacity Heat Exchangers	1/2" to 2" FT600 (Cast Steel) and FT601 (Stainless Steel) Series*** Float and Thermostatic	Thermostatic
High-to-Ultra Capacity Heat Exchangers and Reboilers	FTES or 3" & 4" FT600 (Cast Steel) and FT601 (Stainless Steel) Series*** Float and Thermostatic	N / A
Laundries		
Presses, Irons, & Dryers	IB Series*** Inverted Bucket	Thermodynamic; F&T
Hospital Equipment		
Autoclaves & Sterilizers	WT3000 Series*** Bellows Thermostatic	F&T
Rotating Cylinders & Dryers	FTT Series* Float and Thermostatic	F&T*; Thermostatic*
Clean Steam / Sanitary Applications (CIP / SIP)	FDA Series	N / A
Universal 2-bolt Quick-Change Steam Traps		
Reduced Downtime in Large Populations and Hazardous Locations	UC450 Series Connectors and Modules	N / A

* with steam lock release

*** consult steam trap cut sheet for size, orifice, full model number, etc.

Quick-Start Guide for Steam Trap Sizing

Basic information needed:

1) Inlet Pressure (psi or psig)
The steam pressure at the steam trap inlet connection. For Drip Applications, this will likely be the steam main header pressure and be relatively constant. For Process Applications, this will be the supply pressure to the heating equipment after any pressure drop through a temperature control valve. Unless maximum pressure drop used for control valve sizing is known, consider a 20% pressure loss through any temperature control valve as a rule of thumb.

2) Outlet Pressure (psi or psig + lift height)
The condensate pressure at the outlet of the steam trap, including any line pressure, or static pressure from lift (note: every 2.31 ft. of lift is 1 psi head pressure).

3) Capacity (lb/hr)
The flow of condensate to be discharged by the steam trap (typically in lb/hr). The condensate load may be pre-determined, calculated, or estimated. Safety load factors may be considered when appropriate (see below).

Guidelines for applying Safety Load Factors

Drip Applications: For practical purposes, it is generally not necessary to calculate/estimate condensate loads for drip applications. Experience has shown that ½" or ¾" steam traps will typically satisfy both running and start-up loads for the vast majority of drip applications (when proper installation guidelines are followed by installing traps every 150 – 300 ft.).

Process Applications: Although there are various guidelines to applying Safety Load Factors, a reasonable general guideline is to size the steam trap based on full calculated condensate load at a minimum pressure differential of ½ psi provided the drop leg from the heat transfer device to the inlet of the steam trap is approximately 12" – 14". Assuming gravity drainage (i.e. 0 psig at trap outlet), the minimum trap differential is based on the distance between the heat exchanger drain connection and steam trap inlet. The distance can be equated to head pressure available when the heating is off or when a vacuum breaker opens. (28" = 1 psig head pressure, 14" = ½ psig, consult factory for distances less than 1 ft.). Consult manufacturer for additional guidelines.

The smallest trap suitable for the anticipated condensate loads of a given application should be selected for optimum performance and service life. Selecting larger traps than necessary may result in excessive cycling, reduced service life, and/or steam loss.

Additional Criteria for Selection of Steam Traps

In addition to the Inlet Pressure, Outlet Pressure, and Capacity, below are other considerations for proper selection of Steam Traps:

- Material
- End Connection Type
- Repairability
- Piping & Trap Orientation
- Integral Strainer
- Options
- Cost

Available Pipeline Accessory Equipment to Consider with Steam Traps: Strainers, Check Valves, Separators, Trap Test Valves or Stations, etc.

1.1 THERMODYNAMIC TRAPS

Thermodynamic traps shall have tight shut-off with no steam loss allowed either by bleed or "controlled leak" and shall have an integral seat design with hardened disc and seating surfaces for drip and tracing applications.

A. Thermodynamic Traps for Drip Stations Above 30 psig, Tracer and select Process Applications to 600 Psig.

Model	TD600, TD600L
Sizes	3/8", 1/2", 3/4", 1"
Connections	NPT
Body Material	Stainless Steel 420F
Options	Insulation Cap
PMO Max. Operating Pressure	600 PSIG
TMO Max. Operating Temperature	800°F
PMA Max. Allowable Pressure	600 PSIG up to 800°F
TMA Max. Allowable Temperature	800°F @ 600 PSIG

The steam trap shall be all stainless steel thermodynamic disc type with threaded NPT connections on a common center line. The steam trap shall have an integral seat design with a hardened disc and seating surface, with balanced 3-port discharge for extended service life. Trap will operate with up to 80% back pressure and in any position up to 600 psig @ 800°F.
Option: stainless steel insulation cap for outdoor service.
Watson McDaniel Models: TD600, TD600L

Model	TD600S, TD600LS
Sizes	1/2", 3/4", 1"
Connections	NPT
Body Material	Stainless Steel 420F
Options	Blowdown Valve, Insulation Cap
PMO Max. Operating Pressure	600 PSIG
TMO Max. Operating Temperature	750°F
PMA Max. Allowable Pressure	915 PSIG up to 250°F
TMA Max. Allowable Temperature	610°F @ 750 PSIG

The steam trap shall be all stainless steel thermodynamic disc type with an integral strainer and shall have an integral seat design with a hardened disc and seating surface, with balanced 3-port discharge for extended service life. Trap shall have NPT connections on a common center line, which will operate with up to 80% back pressure and in any position up to 600 psig @ 750°F.
Options include: stainless steel insulation cap for outdoor service and stainless steel strainer blowdown valve.
Watson McDaniel Models: TD600S, TD600SB, TD600LS, TD600LSB

TD700S
Strainer

TD700SB
Strainer &
Blowdown Valve

Model	TD700S, TD700HS
Sizes	1/2", 3/4", 1"
Connections	NPT, SW, FLG
Body Material	Chrome-Moly Alloy Steel
Options	Blowdown Valve, Insulation Cap
PMO Max. Operating Pressure	600 PSIG
TMO Max. Operating Temperature	800°F
PMA Max. Allowable Pressure	600 PSIG up to 800°F
TMA Max. Allowable Temperature	800°F @ 600 PSIG

The steam trap shall be chrome moly with Nickel Electro-Plating coating thermodynamic disc type and shall have a hardened stainless steel disc with balanced 3-port discharge for extended service life. The seat segment will be removable for a complete replacement capsule assembly. Steam trap will have an integral stainless steel strainer. Trap shall have NPT, socket welded or flanged connections on a common center line, which will operate with up to 80% back pressure in any position up to 600 psig @ 800°F.
Option: stainless steel strainer blowdown valve.
Watson McDaniel Models: TD700S, TD700HS, TD700SB

B. <u>Thermodynamic Traps for High Pressure Service to 900 Psig</u>

Model	TD900S, TD900LS
Sizes	1/2", 3/4", 1"
Connections	NPT, SW, 600# FLG
Body Material	Low Carbon Chrome-Moly
Options	Insulation Cap
PMO Max. Operating Pressure	900 PSIG
TMO Max. Operating Temperature	842°F
PMA Max. Allowable Pressure	1500 PSIG @ 100°F
TMA Max. Allowable Temperature	842°F @ 981 PSIG

The steam trap body shall be chrome moly with Nickel Electro-Plating coating thermodynamic disc type and shall have a hardened stainless steel disc with balanced 3-port discharge for extended service life. The steam trap shall include an in-line replaceable, all stainless steel seat and disc assembly and will include an integral stainless steel strainer. Trap shall have NPT, socket welded or flanged connections on a common center line, which will operate with up to 80% back pressure or 50% of the absolute inlet pressure for the TD900LS, and in any position up to 900 psig @ 842°F.
Watson McDaniel Models: TD900S, TD900LS

C. Thermodynamic Traps for High Pressure Service to 3,600 Psig

Model	TD3600
Sizes	1/2", 3/4", 1"
Connections	BW, SW, 600# FLG, 1500# FLG
Body Material	Forged Alloy Steel
PMO Max. Operating Pressure	3600 PSIG
TMO Max. Operating Temperature	975 °F @ 3600 psi 1025 °F @ 2220 psi
PMA Max. Allowable Pressure	2220 PSIG @ 1025 °F 3600 PSIG @ 975 °F
TMA Max. Allowable Temperature	1025 °F @ 2220 PSIG

Note: Connections may limit Pressure & Temperature ratings.

The steam trap body shall be a forged steel thermodynamic disc type and shall have a hardened stainless steel disc and balanced 3-port discharge for extended service life. The steam trap shall include an in-line replaceable, all stainless steel seat and disc assembly and will include an integral stainless steel strainer. Trap shall have butt welded, socket welded or flanged connections on a common center line, which will operate in any position with a backpressure up to 50% of the absolute inlet pressure, to a maximum operating condition of 3,600 psig @ 975^{o}F.

Watson McDaniel Model: TD3600

1.2 THERMOSTATIC TRAPS

Balanced Pressure Thermostatic Traps shall be self-adjusting to operate within 5°F of steam saturation temperature. All elements shall be either multiple plate bellows or capsule-enclosed diaphragm of precision welded stainless steel with hardened stainless steel valve head for drip, tracing and process applications.

A. **Thermostatic Traps for Drip Legs and Tracing to 300 Psig (Non-Repairable)**

Model	WT1000 (Non-Repairable)
Sizes	1/2", 3/4"
Connections	NPT
Body Material	Stainless Steel
PMO Max. Operating Pressure	300 PSIG
TMO Max. Operating Temperature	Saturated Steam Temperature
PMA Max. Allowable Pressure	1032 PSIG @ 100°F
TMA Max. Allowable Temperature	750°F @ 800 PSIG

Trap shall be seal welded and constructed from all stainless steel 304 bar stock with threaded connections on a common center line. The thermal element shall be 300 series stainless steel and of a precision welded design to resist shock from water hammer. The trap will operate in any orientation with a 5°F sub cool below saturated steam temperature to a maximum of 300 psig saturated steam pressure.
Watson McDaniel Model: WT1000

B. **Thermostatic Traps for Sterilizers, Tracing and Drip Legs to 125 Psig (Repairable)**

Model	WT1500 (Repairable)
Sizes	1/2"
Connections	NPT
Body Material	Stainless Steel
PMO Max. Operating Pressure	125 PSIG
TMO Max. Operating Temperature	Saturated Steam Temperature
PMA Max. Allowable Pressure	362 PSIG @ 752°F
TMA Max. Allowable Temperature	752°F @ 362 PSIG

Trap shall be seal welded and constructed from all stainless steel with threaded connections on a common center line. The thermal element shall be 300 series stainless steel and of a precision welded design to resist shock from water hammer. The trap will operate in any orientation with 15°F sub cool below saturated steam temperature to a maximum of 125 psig saturated steam pressure.
Options include: high-capacity versions, discharge temperature options.
Watson McDaniel Model: WT1500

C. **Thermostatic Traps for Drip Legs, Tracing and Process to 650 Psig (Non-Repairable)**

Model	WT2000 (Non-Repairable)
Sizes	1/2", 3/4"
Connections	NPT
Body Material	Stainless Steel
PMO Max. Operating Pressure	650 PSIG
TMO Max. Operating Temperature	Saturated Steam Temp.
PMA Max. Allowable Pressure	1032 PSIG @ 100°F
TMA Max. Allowable Temperature	750°F @ 800 PSIG

Trap shall be seal welded and constructed from cast stainless steel with threaded connections on a common center line. The trap will have an internal strainer screen. The thermal element shall be 300 series stainless steel and of a precision welded design to resist shock from water hammer. Valve plug and seat shall be heat treated for extended service life. The trap will operate in any orientation with a 5°F sub cool below saturated steam temperature to a maximum of 650 psig saturated steam pressure.
Options include: 43°F sub cool bellows and steam lock release (SLR).
Watson McDaniel Model: WT2000 Series

D. **Thermostatic Traps for Drip Legs, Tracing and Process to 250 Psig (Repairable)**

Model	WT2500 (Repairable)
Sizes	1/2", 3/4"
Connections	NPT
Body Material	Cast Iron
PMO Max. Operating Pressure	250 PSIG
TMO Max. Operating Temperature	406°F
PMA Max. Allowable Pressure	250 PSIG up to 450°F
TMA Max. Allowable Temperature	450°F @ 250 PSIG

Trap shall be cast iron with threaded connections on a common center line. The thermal element shall be 300 series stainless steel and of a precision welded design to resist shock from water hammer. Valve plug shall be heat treated 400 series stainless steel. Trap shall be in-line maintainable via a four-bolt cover for access to the replaceable thermal element and hardened orifice seat. Trap will operate in any orientation to a maximum of 250 psig saturated steam pressure.
Options include: 43°F sub cool bellows and steam lock release (SLR).
Watson McDaniel Model: WT2500 Series

E. **Thermostatic Traps for Drip Legs, Tracing and Process to 650 Psig (Repairable)**

Model	WT3000 (Repairable)
Sizes	1/2", 3/4"
Connections	NPT, SW, FLG
Body Material	Stainless Steel
Options	Strainer, Blowdown Valve
PMO Max. Operating Pressure	650 PSIG
TMO Max. Operating Temperature	Saturated Steam Temp.
PMA Max. Allowable Pressure	906 PSIG @ 100°F
TMA Max. Allowable Temperature	750°F @ 725 PSIG

Trap shall be cast from all 316 stainless steel with threaded, socket weld or flanged connections on a common center line. The thermal element shall be 300 series stainless steel and of a precision welded design to resist shock from water hammer. Valve plug shall be heat treated 400 series stainless steel. Trap shall be in-line maintainable via a four-bolt cover for access to the replaceable thermal element and hardened orifice seat. Trap will operate in any orientation with a 5°F sub cool below saturated steam temperature to a maximum of 650 psig saturated steam pressure.
Options include: integral mounted stainless-steel strainer screen, strainer blowdown valve, 43°F sub cool bellows and steam lock release (SLR).
Watson McDaniel Model: WT3000 Series

F. **Thermostatic Traps for Process to 300 Psig (Repairable)**

Model	WT4000 (Repairable)
Sizes	3/4", 1"
Connections	NPT, SW, FLG
Body Material	Stainless Steel
Options	Strainer, Blowdown Valve
PMO Max. Operating Pressure	300 PSIG
TMO Max. Operating Temperature	Saturated Steam Temperature
PMA Max. Allowable Pressure	906 PSIG @ 100°F
TMA Max. Allowable Temperature	750°F @ 725 PSIG

Trap shall be cast from all 316 stainless steel with threaded, socket weld or flanged connections on a common center line. The thermal element shall be 300 series stainless steel and of a precision welded design to resist shock from water hammer. Trap shall be in-line maintainable via a four-bolt cover for access to the replaceable thermal element and hardened orifice seat. Trap will operate in any orientation with a 5°F sub cool below saturated steam temperature to a maximum of 300 psig saturated steam pressure.
Options include: integral mounted stainless-steel strainer screen, strainer blowdown valve, and steam lock release (SLR).
Watson McDaniel Model: WT4000 Series

G. **Thermostatic Bi-Metal Traps for Tracing to 650 Psig with Adjustable Discharge Temperature (Repairable)**

Model	WT5000 (Bi-Metal)
Sizes	3/8", 1/2", 3/4, 1"
Connections	NPT, SW
Body Material	Stainless Steel
PMO Max. Operating Pressure	650 PSIG
TMO Max. Operating Temperature	662°F
PMA Max. Allowable Pressure	900 PSIG
TMA Max. Allowable Temperature	800°F

Trap shall be stainless steel with threaded or socket weld connections on a common center line. The bi-metal thermal element shall be stainless steel and externally adjustable for control of condensate discharge temperature from 120°F to 390°F. Valve plug shall be heat treated 400 series stainless steel. Trap shall be in-line maintainable via a threaded capsule for access to the replaceable thermal element and hardened orifice seat. Trap will operate in any orientation to a maximum of 650 psig steam pressure and suitable for superheated steam to 662°F.

Watson McDaniel Model: WT5000 Series

H. **Thermostatic Traps for HVAC and Air Venting to 125 Psig (Repairable)**

TA Type • Right-Angle Connection

TS Type • Straight-thru Connection

Model	TA25B, TA125, TS25B, TS125
Sizes	1/2", 3/4"
Connections	NPT
Body Material	Brass
PMO Max. Operating Pressure	TA25B, TS25B 25 PSIG TA125, TS125 125 PSIG
TMO Max. Operating Temperature	Saturated Steam Temperature
PMA Max. Allowable Pressure	125 PSIG up to 450°F
TMA Max. Allowable Temperature	450°F @125 PSIG

Trap body shall be forged from all brass with threaded male union inlet connections on either a staggered center line or at 90 Deg right-angle with female threaded outlet connection. The thermal element shall be 300 series stainless steel and of a precision welded design to resist shock from water hammer. Trap shall be in-line maintainable via a threaded cover for access to the replaceable thermal element and orifice seat. Trap will operate in any orientation to a maximum of 125 psig saturated steam pressure. Options include economy version for lower pressures to maximum 25 psig (TA25B / TS25B).

Watson McDaniel Model: TA25B, TS25B, TA125, TS125

1.3 FLOAT & THERMOSTATIC TRAPS

Traps shall be designed with self-adjusting float-operated mechanism to instantaneously remove condensate as its formed from drip and process applications. The trap is to incorporate a thermostatic element for removal of non-condensable gases and to operate within 15°F of steam saturation temperature.

A. **Float & Thermostatic Traps for Drip and Process to 250 Psig (Repairable)**

Model	WFT
Sizes	3/4", 1", 1 1/4", 1 1/2", 2"
Connections	NPT
Body Material	Cast Iron
PMO Max. Operating Pressure	250 PSIG
TMO Max. Operating Temperature	Saturated Steam Temperature
PMA Max. Allowable Pressure	250 PSIG up to 450°F
TMA Max. Allowable Temperature	450°F @ 250 PSIG

Steam trap shall be a cast iron body design with parallel pipe inlet and outlet connections threaded NPT mounted on side or cover plate of trap body. All internals shall be stainless steel with hardened seat area. Float shall actuate the valve via a hinged lever and linkage. Air vent shall be located at the high point of the trap body and of a filled thermal element design with stainless steel, welded, encapsulated bellows capable of discharging air and non-condensable gases continuously within 15°F of saturated temperature. All internal trap components shall have the ability to be replaced with the trap cover (body on smaller sizes) remaining in-line. Trap shall be suitable for a maximum saturated steam operating pressure of 250 Psig.
Options include: live orifice air vent for superheated steam, NPT connection for mounting vacuum breaker, NPT drain connection for mounting freeze protection device, steam lock release (SLR).
Watson McDaniel Model: WFT

B. **Float & Thermostatic Traps for Drip and Process to 300 Psig (Repairable)**

Model	FTT
Sizes	1/2", 3/4", 1", 1 1/2", 2"
Connections	NPT, 150# FLG (1" - 2")
Body Material	Ductile Iron
PMO Max. Operating Pressure	300 PSIG
TMO Max. Operating Temperature	Saturated Steam Temperature
PMA Max. Allowable Pressure	300 PSIG up to 450°F
TMA Max. Allowable Temperature	450°F @ 300 PSIG

1/2" & 3/4" available in NPT only.

Steam trap shall be a ductile iron body or stainless steel design with NPT or flanged pipe inlet and outlet connections (socket welded option for stainless steel body) on a common centerline. All internals shall be stainless steel with hardened seat area. Float shall actuate the valve via a hinged lever and linkage. Air vent shall be located at the high point of the trap body and of a filled thermal element design with stainless steel, welded, encapsulated bellows capable of discharging air and non-condensable gases continuously within 15°F of saturated temperature. All internal trap components shall have the ability to be replaced with the trap cover (body on smaller sizes) remaining in-line. Trap shall be suitable for a maximum saturated steam operating pressure of 300 Psig.
Options include: live orifice air vent for superheated steam, NPT connection for mounting vacuum breaker, NPT drain connection for mounting freeze protection device, steam lock release (SLR)..
Watson McDaniel Model: FTT, FTTS

C. **Float & Thermostatic Traps for High Capacity Process to 200 Psig (Repairable)**

Model	FTE	FTES
Sizes	1 1/2", 2", 2 1/2"	2 1/2"
Connections	NPT	NPT, SW, FLG
Body Material	Ductile Iron	Cast Steel
PMO Max. Operating Pressure	200 PSIG	300 PSIG
TMO Max. Operating Temperature	450°F	450°F
PMA Max. Allowable Pressure	300 PSIG up to 450°F	300 PSIG up to 750°F
TMA Max. Allowable Temperature	450°F @ 300 PSIG	750°F @ 300 PSIG

Steam trap shall be a ductile iron body design with parallel pipe inlet and outlet connections threaded NPT mounted on cover plate of trap body. All internals shall be stainless steel with hardened seat area. Float shall actuate the valve via a hinged lever and linkage. Air vent shall be located at the high point of the trap body and of a filled thermal element design with stainless steel, welded, encapsulated bellows capable of discharging air and non-condensable gases continuously within 15°F of saturated temperature. All internal trap components shall have the ability to be replaced with the trap cover (body on smaller sizes) remaining in-line. Trap shall be suitable for a maximum saturated steam operating pressure of 200 Psig@ 450°F.
Options include live orifice air vent for superheated steam, NPT connection for mounting vacuum breaker, NPT drain connection for mounting freeze protection device, steam lock release (SLR).
Watson McDaniel Model: FTE

D. **Float & Thermostatic Traps for High Capacity Process to 300 Psig (Repairable)**

Steam trap shall be a cast steel body design with parallel pipe inlet and outlet connections threaded NPT, socket weld or flanged, mounted on cover plate of trap body. All internals shall be stainless steel with hardened seat area. Float shall actuate the valve via a hinged lever and linkage. Air vent shall be located at the high point of the trap body and of a filled thermal element design with stainless steel, welded, encapsulated bellows capable of discharging air and non-condensable gases continuously within 15°F of saturated temperature. All internal trap components shall have the ability to be replaced with the trap cover remaining in-line. Trap shall be suitable for a maximum operating pressure of 300 Psig @ 450°F.
Options include: live orifice air vent for superheated steam, NPT connection for mounting vacuum breaker, NPT drain connection for mounting freeze protection device, steam lock release (SLR).
Watson McDaniel Model: FTES

E. **Float & Thermostatic Traps for Process to 450 Psig (Repairable)**

Model	FT600 & FT601*
Sizes	3/4", 1", 1 1/2", 2", 3", 4"
Connections	NPT, SW, FLG
Body Material	Carbon Steel or 316SS
Options	Live Orifice Air Vent
PMO Max. Operating Pressure	450 PSIG
TMO Max. Operating Temperature	750°F
PMA Max. Allowable Pressure	990 PSIG @ 100°F
TMA Max. Allowable Temperature	750°F @ 670 PSIG

** FT601 Body Material is 316 SS*
FT600 Body Material is Carbon Steel

Steam trap shall be a carbon or stainless steel body design with NPT, socket welded or flanged pipe inlet and outlet connections on a common centerline. All internals shall be stainless steel with hardened seat area. Float shall actuate the valve via a hinged lever and linkage. Air vent shall be located at the high point of the trap body and of a filled thermal element design with stainless steel, welded, encapsulated bellows capable of discharging air and non-condensable gases continuously within 15°F of saturated temperature. All internal trap components shall have the ability to be replaced with the trap cover remaining in-line. Trap shall be suitable for a maximum operating pressure of 450 Psig @ 750°F.
Options include: live orifice air vent for superheated steam, NPT connection for mounting vacuum breaker, NPT drain connection for mounting freeze protection device, steam lock release (SLR).
Watson McDaniel Model: FT600, FT601

F. **Float & Thermostatic Traps for Drip and Process to 75 Psig (Repairable)**

Model	FT
Sizes	3/4", 1", 1¼", 1½", 2"
Connections	NPT
Body Material	Cast Iron
PMO Max. Operating Pressure	75 PSIG
TMO Max. Operating Temperature	Saturated Steam Temperature
PMA Max. Allowable Pressure	75 PSIG up to 450°F
TMA Max. Allowable Temperature	450°F @ 75 PSIG

Steam trap shall be cast iron body with an 'H' Pattern design enabling multiple connection options for installation. Connections shall be threaded NPT. All internals shall be stainless steel with 300 series seat area. Float shall actuate the valve via a hinged lever and linkage. Air vent shall be located at the high point of the trap body and of a filled thermal element design with stainless steel, welded, encapsulated bellows capable of discharging air and non-condensable gases continuously within 15°F of saturated temperature. All internal trap components shall have the ability to be replaced with the trap body remaining in-line. Trap shall be suitable for a maximum saturated steam operating pressure of 75 Psig.
Watson McDaniel Model: FT

1.4 INVERTED BUCKET TRAPS

Traps shall be designed with a stainless steel inverted bucket and self-adjusting mechanism to instantaneously remove condensate as its formed from drip, tracing and process applications. The trap valve and seat shall be mounted at the top of the trap to make them less susceptible to failure from dirt and debris.

A. **Inverted Bucket Traps for Drip, Tracing and Process to 250 Psig (Repairable)**

1031/1032
1033/1034
(No Strainer)

1041/1042
1044/1038S
(with Strainer)

Model	1031, 1032, 1033, 1034, 1041, 1042, 1044, 1038S
Sizes	1/2", 3/4", 1", 1¼", 1½"
Connections	NPT
Body Material	Cast Iron
Options	Internal check valve, Thermic vent
PMO Max. Operating Pressure	250 PSIG
TMO Max. Operating Temperature	450°F
PMA Max. Allowable Pressure	250 PSIG up to 450°F
TMA Max. Allowable Temperature	450°F @ 250 PSIG

Steam trap shall be cast iron body with NPT pipe inlet and outlet connections on a common centerline. All internals shall be stainless steel with hardened disc and seat area located at the top of the trap body. Inverted Bucket shall incorporate a fixed air venting bleed and actuate the valve via a hinged lever and linkage. All internal trap components shall have the ability to be replaced with the trap body remaining in-line. Trap shall be suitable for a maximum operating pressure of 250 Psig @ 450^{o}F (150 Psig @ 450^{o}F for models 1031 & 1041).
Options include: integral strainer, strainer blowdown, thermic vent, internal check valve.
Watson McDaniel Model: 1031, 1032, 1033, 1034, 1041, 1042, 1044, 1038S

B. **Inverted Bucket Traps for Drip and Tracing to 450 Psig Saturated Steam**

SIB
Inverted Bucket
Steam Trap

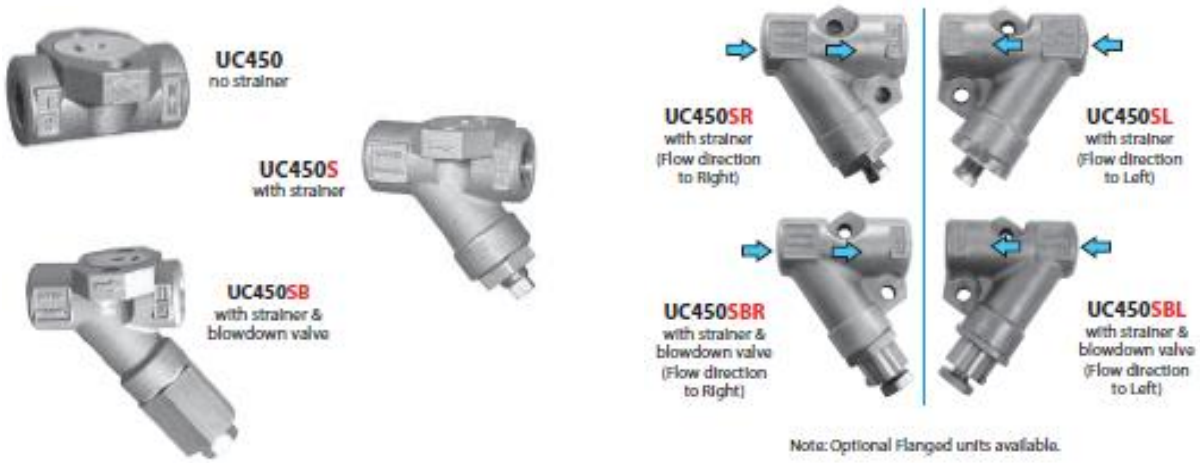
Model	SIB, SIBH
Size	1/2", 3/4"
Connections	NPT, SW
Body Material	Stainless Steel
PMO Max. Operating Pressure	450 PSIG*
TMO Max. Operating Temperature	750°F
PMA Max. Allowable Pressure	720 PSIG @ 100°F
TMA Max. Allowable Temperature	750°F @ 400 PSIG

Steam trap shall be all stainless steel, sealed seam welded body and cover with NPT or socket weld pipe connections on a common centerline. All internals shall be stainless steel with hardened disc and seat area located at the top of the trap body. Inverted Bucket shall incorporate a fixed air venting bleed and actuate the valve via a hinged lever and linkage. Trap shall be suitable for a maximum operating pressure of up 450 psig saturated steam pressure or a maximum operating temperature of 750^{o}F @ 400 psig.
Option: internal check valve.
Watson McDaniel Model: SIB, SIBH

1.5 UNIVERSAL 2-BOLT STEAM TRAPS

Steam trap modules shall be all stainless steel and of an industry standard design with a two bolt quick connection for attaching to an permanent inline universal connector. Traps are able to swivel 360° on the pipeline connector to allow for proper orientation of the trap module. Uses include Drip, Tracing and small Process applications.

A. Universal Trap Swivel Connectors



Note: Optional Flanged units available.

Model	UC450, UC450S, UC450SB UC450SR, UC450SBR, UC450SL, UC450SBL
Sizes	1/2", 3/4", 1"
Connections	NPT, SW, FLG
Body Material	Stainless Steel
PMO Max. Operating Pressure	(trap module dependent)
TMO Max. Operating Temperature	(trap module dependent)
PMA Max. Allowable Pressure	750 PSIG @ 100°F
TMA Max. Allowable Temperature	800°F @ 400 PSIG

Steam Trap Modules that mount to Universal Connectors are shown on the following pages. Trap modules available in: Inverted Bucket, Float & Thermostatic, Thermodynamic, Thermostatic and Bi-metallic type.

Universal steam traps shall be supplied with threaded NPT, socket welded, of flanged connections on a common centerline. Shall be constructed from stainless steel body which, once installed, remains permanently inline. Trap shall be attached to the connector by two bolts to enable simple and rapid installation and replacement. The connector is designed to allow installation on pipework that is vertical, horizontal, or any angle in between. When specified, the connector shall be available with an integral "Y" pattern strainer and optional blowdown valve. The blowdown valve shall be wrench operated to keep operator clear of the blowdown stream. Connectors to have an allowable pressure range up to 400 psig @ 800°F, but operating range may be limited by the trap module selected.

Watson McDaniel Models: UC450, UC450S, UC450SB, UC450SR, UC450SBR, UC450SL, UC450SBL

B. Universal Trap Test Valve Station Connector

Model	UTS600
Sizes	1/2", 3/4", 1"
Connections	NPT, SW, FLG
Body Material	Stainless Steel
PMO Max. Operating Pressure	(trap module dependent)
TMO Max. Operating Temperature	(trap module dependent)
PMA Max. Allowable Pressure	1440 PSIG @ 100°F
TMA Max. Allowable Temperature	800°F @ 845 PSIG

Universal trap test valve station body shall be all stainless steel with threaded NPT, socket weld or flanged connections on a common centerline. Station shall include piston style isolation valves up and down stream of trap module. Station shall include a test valve for visual inspection of trap operation and an integral strainer with blowdown. Station to have an allowable pressure range up to 845 psig @ 800°F, but operating range may be limited by the trap module selected.

Watson McDaniel Model: UTS600

C. Universal Inverted Bucket Trap Module for Drip and Tracing to 450 Psig

Model	USIB450, USIB450H
Connections	Fits UC450 Series Universal Connectors
Body Material	Stainless Steel
PMO Max. Operating Pressure	450 PSIG*
TMO Max. Operating Temperature	800°F
PMA Max. Allowable Pressure	720 PSIG @ 100°F
TMA Max. Allowable Temperature	800°F @ 400 PSIG

*750°F @ operating pressures below 400 PSIG. See installation note regarding using trap in superheated applications.

Trap shall be all stainless steel, sealed seam welded body on a universal two bolt swivel connector for connecting to a variety of universal pipeline connectors. All internals shall be stainless steel with hardened disc and seat area located at the top of the trap body. Inverted Bucket shall incorporate a fixed air venting bleed and actuate the valve via a hinged lever and linkage. Trap shall be suitable for a maximum operating pressure of up 450 psig saturated steam pressure.

Option: internal check valve.

Watson McDaniel Model: USIB450, USIB450H

D. Universal Float & Thermostatic Trap Module for Drip and Small Process to 225 Psig

UFT450
Float & Thermostatic
Steam Trap Module

Model	UFT450
Connections	Fits UC450 Series Universal Connectors
Body Material	Stainless Steel
PMO Max. Operating Pressure	225 PSIG
TMO Max. Operating Temperature	397°F
PMA Max. Allowable Pressure	720 PSIG @ 100°F
TMA Max. Allowable Temperature	800°F @ 400 PSIG

Trap shall be all stainless steel, sealed seam welded body on a universal two bolt swivel connector for connecting to a variety of universal pipeline connectors. All internals shall be stainless steel with hardened seat area. Float shall actuate the valve via a hinged lever and linkage. Air vent shall be located at the high point of the trap body and of a filled thermal element design with stainless steel, welded, encapsulated bellows capable of discharging air and non-condensable gases continuously within 15°F of saturated temperature. Trap shall be suitable for a maximum operating pressure of up 225 psig saturated steam pressure.
Option: steam lock release (SLR).
Watson McDaniel Model: UFT450

E. Universal Thermodynamic Trap Module for Drip Stations Above 30 Psig and Tracing to 450 Psig

UTD450
&
UTD600
Thermodynamic Steam Trap Module
(Side Mount Style)
For vertical or horizontal piping installations.

Model *(Side Mount Style)*	UTD450LSM UTD450SM	UTD600LSM
Connections	Fits UC450 Series Universal Connectors	
Body Material	Stainless Steel	Stainless Steel
PMO Max. Operating Pressure	450 PSIG	600 PSIG
TMO Max. Operating Temperature	750°F	750°F
PMA Max. Allowable Pressure	720 PSIG @ 100°F	720 PSIG @ 100°F
TMA Max. Allowable Temperature	800°F @ 400 PSIG	800°F @ 600 PSIG

Trap body shall be all stainless steel on a universal two bolt swivel connector for connecting to a variety of universal pipeline connectors. The steam trap shall be thermodynamic disc type with hardened disc and seat area. Trap shall operate with up to 80% back pressure up a maximum operating pressure of 450 psig saturated steam pressure.
Watson McDaniel Model: UTD450SM, UTD450LSM

F. Universal Thermodynamic Trap Module for Drip Stations Above 30 Psig and Tracing to 600 Psig

Trap body shall be all stainless steel on a universal two bolt swivel connector for connecting to a variety of universal pipeline connectors. The steam trap shall be thermodynamic disc type with hardened disc and seat area. Trap shall operate with up to 80% back pressure up a maximum operating pressure of 600 psig saturated steam pressure.
Watson McDaniel Model: UTD600LSM

G. Universal Thermodynamic Trap Module for Drip Stations Above 30 Psig and Tracing to 450 Psig

UTD450
Thermodynamic Steam Trap Module
(Top Mount Style)
Recommended for hortzontal piping installations only so that cap can be oriented upwards as shown.

UTD450 Trap Module should be oriented with cap facing Upwards. Therefore it should only be used with Hortzontal Piping, as shown.

Model *(Top Mount Style)*	**UTD450** **UTD450L**
Connections	**Fits UC450 Series Universal Connectors**
Body Material	Stainless Steel
PMO Max. Operating Pressure	**450 PSIG**
TMO Max. Operating Temperature	750°F
PMA Max. Allowable Pressure	720 PSIG @ 100°F
TMA Max. Allowable Temperature	800°F @ 400 PSIG

Trap body shall be all stainless steel on a universal two bolt swivel connector for connecting to the UC450 or UC450S & SB universal pipeline connectors. The steam trap shall be thermodynamic disc type with hardened disc and seat area. Trap shall operate with up to 80% back pressure up a maximum operating pressure of 450 psig saturated steam pressure.
Watson McDaniel Model: UTD450, UTD450L

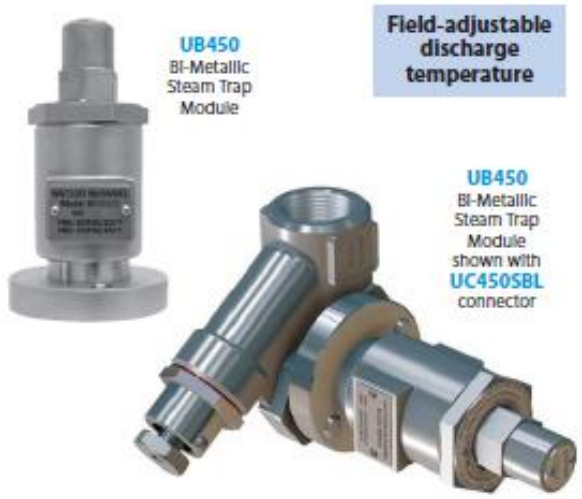
H. Universal Thermostatic Trap Module for Drip, Tracer and Process to 450 Psig

UT450
Thermostatic Steam Trap Module

Model	**UT450**
Connections	**Fits UC450 Series Universal Connectors**
Body Material	Stainless Steel
PMO Max. Operating Pressure	**450 PSIG**
TMO Max. Operating Temperature	Saturated Steam Temp.
PMA Max. Allowable Pressure	720 PSIG @ 100°F
TMA Max. Allowable Temperature	800°F @ 400 PSIG

Trap body shall be all stainless steel, sealed seam welded body on a universal two bolt swivel connector for connecting to a variety of universal pipeline connectors. The thermal element shall be a precision welded design to resist shock from water hammer. Trap will operate in any orientation with a 5°F sub cool below saturated steam temperature to a maximum of 450 psig saturated steam pressure.
Watson McDaniel Model: UT450

I. Universal Bi-Metallic Trap Module for Tracing And Small Process to 450 Psig



Model	UB450
Connections	Fits UC450 Series Universal Connectors
Body Material	Stainless Steel
PMO Max. Operating Pressure	450 PSIG
TMO Max. Operating Temperature	662°F
PMA Max. Allowable Pressure	720 PSIG @ 100°F
TMA Max. Allowable Temperature	800°F @ 400 PSIG

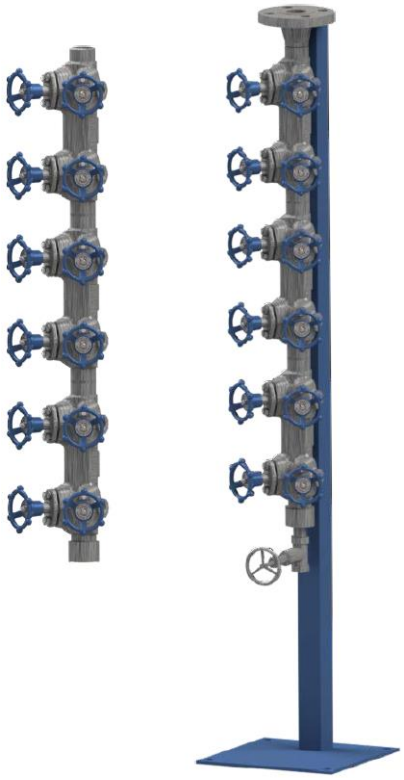
Trap body shall be all stainless steel on a universal two bolt swivel connector for connecting to a variety of universal pipeline connectors. The repairable Bi-Metal element shall be designed such that in-line manual adjustment of the discharge condensate temperature is possible and have an integral strainer screen for preventing debris accumulation on the seating surfaces. Trap will operate in any orientation to a maximum of 450 psig saturated steam pressure.

Watson McDaniel Model: UB450

1.6 TRAP AND CONDENSATE MANIFOLDS

Manifolds are used for steam distribution to the steam tracing system and for condensate collection from the tracing system.

A. Manifold for Steam Supply Tracing to 825 Psig

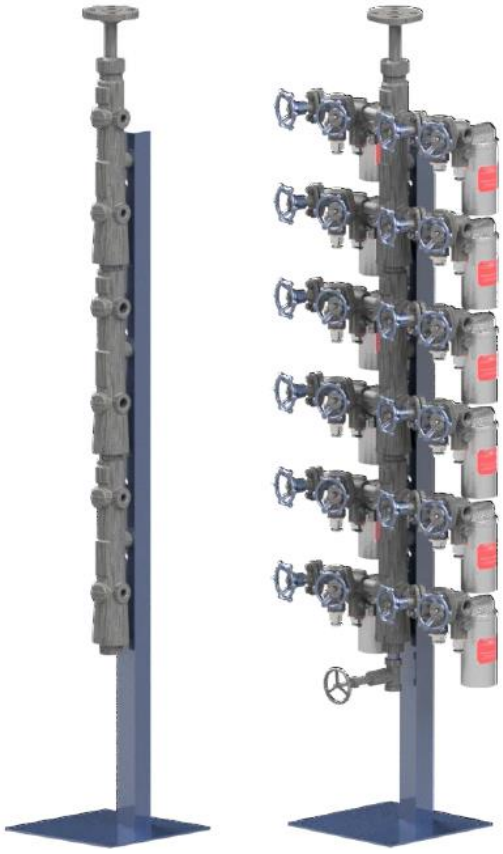


Model	SDM Series
Sizes	1/2", 3/4"
Connections	NPT, SW, Tube Fitting
Body Material	Forged Carbon Steel
PMO Max. Operating Pressure	825 PSIG
Pressure/Temperature Rating	825 PSIG @ 800°F

Manifolds shall be forged from carbon steel with 4, 8, or 12 branch steam outlet connections available with either threaded NPT or socket welded ends. The top steam inlet connection shall be either butt welded or flanged. The bottom condensate outlet connection shall be threaded NPT, socket welded, butt welded, or flanged and available with optional gate valve. The manifold assembly shall be offered separately or with optional frame stand. Manifolds shall operate up to 825 psig @ 800°F.
Options include: gate valve on condensate outlet, frame stand, welded nipples and connectors, insulation jacket, standard designs or custom built.

Watson McDaniel Model: SDM Series

B. <u>Manifold for Condensate Collection to 464 Psig</u>



Model	**CCM Series**
Sizes	**1/2", 3/4"**
Connections	**NPT, SW**
Body Material	**Forged Carbon Steel**
PMO Max. Operating Pressure	**464 PSIG**
Pressure/Temperature Rating	**464 PSIG @ 752°F**

Manifolds shall be forged from carbon steel with 4, 6, 8, 10, or 12 branch condensate inlet connections available with either threaded NPT or socket welded ends. The top condensate outlet connection shall be either threaded NPT, butt welded, or flanged. The bottom drain connection shall be either threaded NPT, socket welded, or flanged. The condensate collection manifold shall be available with a built-in siphon tube to minimize bi-phase flow to reduce water hammer and helps control flash steam. The manifold assembly shall be offered separately or with optional frame stand. Manifolds shall operate up to 464 psig @ 752°F.

Options include: gate valve on drain connection, frame stand, pre-assembled steam trap stations, welded nipples and connectors, insulation jacket, standard designs or custom built.

Watson McDaniel Model: CCM Series

Specification Guide

SECTION 2: CONDENSATE RECOVERY PUMPS

Section 2: CONDENSATE RECOVERY PUMPS

Condensate pumps are devices used to return condensate where steam pressure is insufficient to overcome back pressures created by vertical lift, friction caused by long condensate return lines return and the back pressure created by the deaerator feed tank in the boiler room. Condensate return pumps are either non-electric mechanical pumps that use a motive pressure force to pump the condensate – typically referred to as Pressure Motive Pumps (PMP's) – or electrically-driven centrifugal pumps.

2.1 Non-Electric Pumps

A. PMPC Ductile Iron Pump for Pressures to 200 Psig

Model	PMPC
Body	Ductile Iron
Cover	Ductile Iron
Check Valves	Stainless Steel
PMO Max. Operating Pressure	200 PSIG
TMO Max. Operating Temperature	388°F
PMA Max. Allowable Pressure	200 PSIG @ 650°F
TMA Max. Allowable Temperature	650°F @ 200 PSIG

The pressure powered pump shall be capable of operating with a maximum motive pressure of 200 PSIG and does not require electricity to operate. The pump shall utilize steam, compressed air or inert gas as its motive force. The pump body and cover shall be constructed of cast ductile iron capable of an ASME UM code stamp if requested. The pump mechanism shall be constructed of all stainless steel materials with hardened motive and vent valves and all load bearing points hardened and chromed for extended service life. The pump mechanism shall be float-operated with a patented "Snap-Assure" device and feature dual Inconel springs in compression and mounted such that they remain above the condensate. The pump body shall have NPT connections on a common centerline and be capable of being fitted with a liquid level gauge glass as a standard. The pump mechanism shall be capable of being removed from the top while the pump remains piped in line. The pressure powered pump shall include inlet & outlet check valves with stainless steel body and disc and an Inconel spring. The manufacturer shall warranty the pump mechanism for a period of 3 years against factory defects and workmanship.

Watson McDaniel Model: PMPC

B. **PMPF Fabricated Steel Pump for Pressures to 200 Psig**

Model	PMPF
Body	Carbon Steel
Cover	Carbon Steel
Check Valves	Stainless Steel
PMO Max. Operating Pressure	200 PSIG
TMO Max. Operating Temperature	388°F
PMA Max. Allowable Pressure	250 PSIG @ 650°F

The pressure powered pump shall be capable of operating with a maximum motive pressure of 200 PSIG and does not require electricity to operate. The pump shall utilize steam, compressed air or inert gas as its motive force. The pump body shall be fabricated carbon steel and certified with an ASME UM code stamp. The pump mechanism shall be constructed of all stainless steel materials with hardened motive and vent valves and all load bearing points hardened and chromed for extended service life. The pump mechanism shall be float-operated with a patented "Snap-Assure" device and feature dual Inconel springs in compression and mounted such that they remain above the condensate. The pump body shall have NPT connections on a common centerline and be capable of being fitted with a liquid level gauge glass as a standard. The pump mechanism shall be capable of being removed from the top while the pump remains piped in line. The pressure powered pump shall include inlet & outlet check valves with stainless steel body and disc and an Inconel spring. The manufacturer shall warranty the pump mechanism for a period of 3 years against factory defects and workmanship.

Watson McDaniel Model: PMPF

C. **PMPSS Fabricated Steel Pump for Pressures to 150 Psig**

Model	PMPSS
Body	304L Stainless Steel *
Cover	304L Stainless Steel *
Check Valves	Stainless Steel
PMO Max. Operating Pressure	150 PSIG
TMO Max. Operating Temperature	366 °F
PMA Max. Allowable Pressure	150 PSIG @ 650°F

* For special 316L SS, consult factory.

The pressure powered pump shall be capable of operating with a maximum motive pressure of 150 PSIG and does not require electricity to operate. The pump shall utilize steam, compressed air or inert gas as its motive force. The pump body shall be fabricated stainless steel and certified with an ASME UM code stamp. The pump mechanism shall be constructed of all stainless steel materials with hardened motive and vent valves and all load bearing points hardened and chromed for extended service life. The pump mechanism shall be float-operated with a patented "Snap-Assure" device and feature dual Inconel springs in compression and mounted such that they remain above the condensate. The pump body shall have NPT connections on a common centerline and be capable of being fitted with a liquid level gauge glass as a standard. The pump mechanism shall be capable of being removed from the top while the pump remains piped in line. The pressure powered pump shall include inlet & outlet check valves with stainless steel body and disc and an Inconel spring. The manufacturer shall warranty the pump mechanism for a period of 3 years against factory defects and workmanship.

Watson McDaniel Model: PMPSS

D. **PMPLS Low-Profile Fabricated Steel Pump for Pressures to 150 Psig**

Model	PMPLS
Body	Carbon Steel
Cover	Carbon Steel
Check Valves	Stainless Steel
PMO Max. Operating Pressure	150 PSIG
TMO Max. Operating Temperature	366°F
PMA Max. Allowable Pressure	150 PSIG @ 650°F

Note: Optional 200 PSIG PMA/PMO. Consult Factory.

The non-electric pressure powered pump shall be low-profile design and capable of operating with a maximum motive pressure of 150 PSIG provided by steam, air or other gas supply. The low-profile pump body shall have NPT connections on a common centerline and be fabricated carbon steel, certified with the ASME “UM” code stamp. The pump mechanism shall be constructed of all stainless steel materials with hardened motive and vent valves and all load bearing points hardened and chromed for extended service life. The pump mechanism shall be float-operated with a patented “Snap-Assure” device and feature dual Inconel springs in compression and mounted such that they remain above the condensate. The pump body shall have NPT connections on a common centerline and be capable of being fitted with a liquid level gauge glass as a standard. The pump mechanism shall be capable of being removed from the top while the pump remains piped in line. The pressure powered pump shall include inlet & outlet check valves with stainless steel body and disc and an Inconel spring. The manufacturer shall warranty the pump mechanism for a period of 3 years against factory defects and workmanship.

Watson McDaniel Model: PMPLS

E. **PMPNT Ductile Iron Mini-Pump for Pressures to 125 Psig**

Model	PMPNT	PMPNTS
Body	Ductile Iron	Stainless Steel
Cover	Stainless Steel	Stainless Steel
Sizes	1", 1½" NPT	1½" FLG or NPT
Check Valves	Stainless Steel	Stainless Steel
PMO Max. Operating Pressure	125 PSIG	125 PSIG
TMO Max. Operating Temperature	366°F	366°F
PMA Max. Allowable Pressure	150 PSIG @ 450°F	150 PSIG @ 450°F

The low-profile pressure powered pump shall be capable of operating with a maximum motive pressure of 125 PSIG and does not require electricity to operate. The pump shall utilize steam, compressed air or inert gas as its motive force. The pump body and cover shall be constructed of cast ductile iron. The pump mechanism shall be constructed of all stainless steel materials and all load bearing points hardened and chromed for extended service life. The pump mechanism shall be float operated with a patented "Snap-Assure" device and feature dual Inconel springs and hardened motive and vent valves. The pump body shall have NPT connections on a common centerline and be capable of being fitted with a liquid level gauge glass as a standard. The pump mechanism shall be capable of being removed from the top while the pump remains piped in line. The pressure powered pump shall include inlet & outlet check valves with stainless steel body and disc and an Inconel spring.
Option: all stainless steel body.
Watson McDaniel Model: PMPNT, PMPNTS

F. **PMPBP Carbon Steel High Capacity Pump for Pressures to 150 Psig**

Model	PMPBP
Body	Carbon Steel
Cover	Carbon Steel
Check Valves	Stainless Steel & Steel
PMO Max. Operating Pressure	150 PSIG
TMO Max. Operating Temperature	366°F
PMA Max. Allowable Pressure	150 PSIG @ 470°F

The non-electric pressure powered pump shall be capable of operating with a maximum motive pressure of 150 PSIG provided by steam, air or other gas supply. The pump body shall have flanged connections on a common centerline and be constructed of carbon steel capable of an ASME "UM" code stamp if requested. The pump mechanism shall be float operated constructed of all stainless steel material with all load bearing points hardened for extended service life. The mechanism shall feature quad stainless steel springs used in compression with hardened motive & vent valves.
Watson McDaniel Model: PMPBP

G. **PMPSP Fabricated Steel Sump Pump for Pressures to 150 Psig**

PMPSP

PMPSPL

Model	PMPSP/PMPSPL
Body	Carbon Steel
Cover	Ductile Iron
Check Valves	Stainless Steel
PMO Max. Operating Pressure	150 PSIG
TMO Max. Operating Temperature	366°F
PMA Max. Allowable Pressure	150 PSIG @ 650°F

The non-electric pressure powered pump shall be capable of operating with a maximum motive pressure of 150 PSIG provided by steam, air or other gas supply. The pump body shall be carbon steel. The pump mechanism shall be float operated with a patented “Snap-Assure” feature constructed of all stainless steel materials with all load bearing points hardened for extended service life. The mechanism shall feature dual Inconel springs used in compression with hardened motive & vent valves. Design includes built-in strainer screen and inlet/outlet check valves within the footprint of the pump for installation in pits and sumps.

Watson McDaniel Model: PMPSP

H. **Vented Pressure Power Pump Packages for Pressures to 200 Psig**

Package Model	Simplex, Duplex, Triplex	Simplex, Duplex, Triplex
Pump Model (PMP)	PMPF	PMPC
Pump Body Material	Carbon Steel	Ductile Iron
Receiver Material	Carbon Steel	Carbon Steel
Check Valves	316 Stainless Steel	316 Stainless Steel
PMO Max. Operating Pressure	200 PSIG	200 PSIG
TMO Max. Operating Temperature	388°F	388°F
PMA Max. Allowable Pressure	250 PSIG @ 650°F	200 PSIG @ 650°F
Receiver Pressure Rating	150 PSIG @ 566°F	150 PSIG @ 566°F

Pump package shall be a Watson McDaniel pressure powered pump capable of operating with a maximum motive pressure of 200 PSIG provided by steam, air or other gas supply and is safe for use in hazardous locations. The pre-piped packaged system shall include pressure powered pump(s),ASME vented receiver (with "UM" code stamp available upon request) mounted on a steel base and frame, stainless steel check valves, and interconnecting piping between receiver and pump with isolation valve. The pump mechanism shall be float operated with a patented "Snap-Assure" feature constructed of all stainless steel materials with all load bearing points hardened for extended service life, with no external seals or packing. Typical options are available to assist maintenance, safety, and system diagnosis: gauge glass assemblies, cycle counters, insulation covers, overflow, gauges, pre-piped motive and vent lines, and pressure regulator with steam trap for motive supply line.

Watson McDaniel Model: S-PMPC, D-PMPC, S-PMPF, D-PMPF

2.1.1 Pump-Trap Combination Pumps

A pump-trap is used in place of a steam trap to drain condensate from a process or heating application when the steam pressure is not sufficient to evacuate the condensate from the steam heating space. When steam pressure in a heat exchanger is less than the back pressure on the discharge side of the steam trap, the condensate backs up causing inconsistent heat transfer and potential water hammer. This is commonly known as stall. To prevent condensate back up under stall conditions, a pump trap must be used in place of a stem trap.

I. **Low Profile Ductile Iron Pump-Trap combination to 125 Psig**

Model	PMPT	PMPTS
Body	Ductile Iron	Stainless Steel
Cover	Stainless Steel	Stainless Steel
Sizes	1", 1½" NPT	1½" FLG
Check Valves	Stainless Steel	Stainless Steel
PMO Max. Operating Pressure	125 PSIG	125 PSIG
TMO Max. Operating Temperature	366°F	366°F
PMA Max. Allowable Pressure	150 PSIG @ 450°F	150 PSIG @ 450°F

The low-profile pressure powered pump / trap shall be capable of operating with a maximum steam motive pressure of 125 PSIG and does not require electricity to operate. The pump-trap body and cover shall be constructed of cast ductile iron. The steam trap shall be internal to the pump body and shall be constructed of all stainless steel. The pump mechanism shall be constructed of all stainless steel materials and all load bearing points hardened and chromed for extended service life. The pump mechanism shall be float operated with a patented "Snap-Assure" device and feature dual Inconel springs and hardened motive and vent valves. The pump-trap body shall have NPT connections on a common centerline and be capable of being fitted with a liquid level gauge glass as a standard. The pump mechanism shall be capable of being removed from the top while the pump remains piped in line. The pressure powered pump-trap shall include inlet & outlet check valves with stainless steel body and disc and an Inconel spring.
Option: all stainless steel body.
Watson McDaniel Model: PMPT, PMPTS

J. **<u>Low-profile Fabricated Steel Pump-Trap combination to 150 Psig</u>**

Model	**WPT3**
Size	1-1/2" x 1-1/2"
Connections	NPT
Body Material	
Pump	Carbon Steel
Trap	Ductile Iron
PMO Max. Operating Pressure	**150 PSIG**

The non-electric pressure powered pump-trap combination shall be low-profile design and capable of operating with a maximum motive pressure of 150 PSIG provided by steam, air or other gas supply. The pump shall be fabricated carbon steel, certified with the ASME "UM" code stamp and mounted on a small footprint steel base with interconnecting pipework from the pump outlet to an external float trap. The pump mechanism shall be float operated with a patented "Snap-Assure" feature constructed of all stainless steel materials with all load bearing points hardened for extended service life. The mechanism shall feature dual Inconel springs used in compression with hardened motive & vent valves. The pressure powered pump-trap shall be capable of being fitted with a liquid level gauge glass as a standard and include inlet & outlet check valves with stainless steel body and disc and an Inconel spring.

Watson McDaniel Model: WPT3

K. **High-Capacity Ductile Iron Pump-Trap combination to 200 Psig**

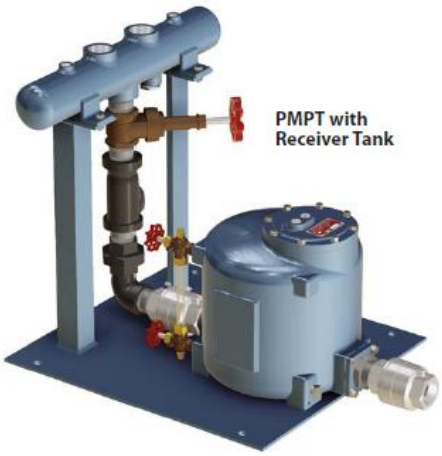
Model	WPT4	WPT5
Size	2" x 2"	3" x 2"
Connections	NPT	NPT
Body Material		
Pump	Ductile Iron	Ductile Iron
Trap	Ductile Iron	Ductile Iron
PMO Max. Operating Pressure	200 PSIG	200 PSIG

The pressure powered pump-trap shall be capable of operating with a maximum motive pressure of 200 psig and does not require electricity to operate. The pump-trap shall utilize steam, compressed air or inert gas as its motive force. The pump body and cover shall be constructed of cast ductile iron capable of an ASME UM code stamp if requested.

The pump mechanism shall be constructed of all stainless steel materials with hardened motive and vent valves and all load bearing points hardened and chromed for extended service life. The pump mechanism shall be float-operated with a patented “Snap-Assure” device and feature dual Inconel springs in compression and mounted such that they remain above the condensate. The pump body shall be mounted on a small footprint steel base with interconnecting pipework from the pump outlet to an external float trap. The pump mechanism shall be capable of being removed from the top while the pump remains piped in line. The pressure powered pump-trap shall be capable of being fitted with a liquid level gauge glass as a standard and include inlet & outlet check valves with stainless steel body and disc and an Inconel spring.

Watson McDaniel Model: WPT4, WPT5

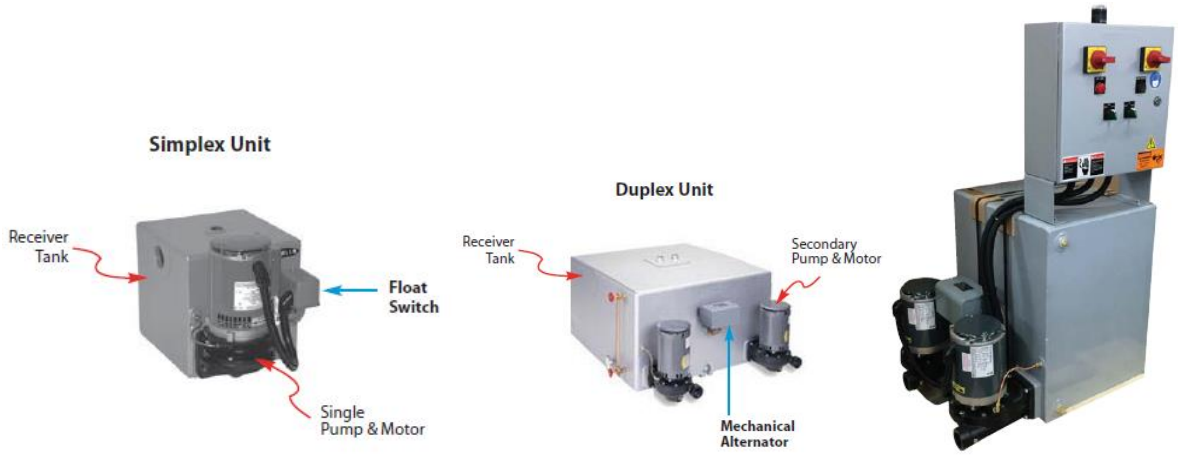
L. **PMPT Pump-Trap Packages for Pressures to 125 Psig**



Model	PMPT	PMPTS
Body	Ductile Iron	Stainless Steel
Cover	Stainless Steel	Stainless Steel
Sizes	1", 1½" NPT	1½" FLG
Check Valves	Stainless Steel	Stainless Steel
PMO Max. Operating Pressure	125 PSIG	125 PSIG
TMO Max. Operating Temperature	366°F	366°F
PMA Max. Allowable Pressure	150 PSIG @ 450°F	150 PSIG @ 450°F

Pump-trap package shall be capable of operating with a maximum motive steam pressure of 125 PSIG and is safe for use in hazardous locations. The pre-piped package will be provided on a small footprint steel base and include a steel condensate reservoir with pre-piped isolation valve, the pressure powered pump-trap, and stainless steel check valves. The pump-trap body and cover shall be constructed of ductile iron and pump mechanism shall be float-operated with a patented "Snap-Assure" device and include dual Inconel springs and hardened motive and vent valves. The steam trap shall be internal to the pump body and be constructed of all stainless steel.
Options include: gauge glass assembly, insulation cover, pre-piped motive and vent lines, and pressure regulator with steam trap for motive supply line.
Watson McDaniel Model: S-PMPT

2.2 Electric Pumps



A. Condensate Return Pump with Fabricated Steel Receiver Tank

Condensate return pump shall have a vented fabricated steel receiver with connections for vent line, condensate return and overflow with options of receiver tank sizes capable of holding up to 95 gallons. The system shall be provided with a float operated switch / alternator to operate close-coupled simplex or duplex, single or three phase electric pumps suitable for discharge pressure up to 50 Psig and flows of 75 GPM.

Watson McDaniel Model: W4100

Notes: (i) For additional pump and receiver options see: **Pump Options Table.**
(ii) For control panel options, see: **Electric Pump Control Panel Selection.**

B. Condensate Return Pump with Cast Iron Receiver Tank

Condensate return pump shall have a vented cast iron receiver with connections for vent line, condensate return and overflow with options of receiver tank sizes capable of holding up to 50 gallons. The system shall be provided with a float-operated switch / alternator to operate close-coupled simplex or duplex, single or three phase electric pumps suitable for discharge pressure up to 50 Psig and flows of 75 GPM.

Watson McDaniel Model: W4200

Notes: (i) For additional pump and receiver options see: **Pump Options Table.**
(ii) For control panel options, see: **Electric Pump Control Panel Selection.**

C. Condensate Return Pump with Stainless Steel Receiver Tank

Condensate return pump shall have a vented fabricated stainless steel receiver with connections for vent line, condensate return and overflow with options of receiver tank sizes capable of holding up to 95 gallons. The system shall be provided with a float-operated switch / alternator to operate close-coupled simplex or duplex, single or three phase electric pumps suitable for discharge pressure up to 50 Psig and flows of 75 GPM.

Watson McDaniel Model: W4300

Notes: (i) For additional pump and receiver options see: **Pump Options Table.**
(ii) For control panel options, see: **Electric Pump Control Panel Selection.**

D. Boiler Feed Pump with Fabricated Steel Receiver Tank

Boiler feed pump shall have a vented fabricated steel receiver with connections for vent line, condensate return and overflow with options of receiver tank sizes capable of holding up to 60 gallons. The system shall be provided with a float-operated switch / alternator to operate close-coupled simplex or duplex, single or three phase electric pumps suitable for discharge pressure up to 50 Psig and flows of 12 GPM.

Watson McDaniel Model: W4100

Notes: (i) For additional pump and receiver options see: **Pump Options Table.**

(ii) For control panel options, see: **Electric Pump Control Panel Selection.**

E. Boiler Feed Pump with Cast Iron Receiver Tank

Boiler feed pump shall have a vented cast iron receiver with connections for vent line, condensate return and overflow with options of receiver tank sizes capable of holding up to 50 gallons. The system shall be provided with a float-operated switch / alternator to operate close-coupled simplex or duplex, single or three phase electric pumps suitable for discharge pressure up to 50 Psig and flows of 12 GPM.

Watson McDaniel Model: W4200

Notes: (i) For additional pump and receiver options see: **Pump Options Table.**

(ii) For control panel options, see: **Electric Pump Control Panel Selection.**

F. Boiler Feed Pump with Stainless Steel Receiver Tank

Condensate return pump shall have a vented fabricated stainless steel receiver with connections for vent line, condensate return and overflow with options of receiver tank sizes capable of holding up to 60 gallons. The system shall be provided with a float-operated switch / alternator to operate close-coupled simplex or duplex, single or three phase electric pumps for discharge pressure up to 50 Psig and flows of 12 GPM.

Watson McDaniel Model: W4300

Notes: (i) For additional pump and receiver options see: **Pump Options Table.**

(ii) For control panel options, see: **Electric Pump Control Panel Selection.**

G. Pump Options Table:

Note: Depending on pump selection, not all options are applicable. Please consult factory for assistance.

- Totally enclosed fan cooled motor.
- Explosion proof motor.
- NEMA 1 or NEMA 4 Mechanical Alternator.
- Explosion proof Mechanical Alternator.
- 2-Level Float Switch.
- High level Auxillary Contacts for Mechanical Alternator.
- Level Gauge glass.
- Pump Isolation valve.
- Dial thermometer.
- Pump discharge pressure gauge.
- Discharge check valve.
- NEMA 4 Float Switch.
- Explosion Proof Float Switch.

Electric Pump Control Panel Selection

H. NEMA 12 Control Panel

The control panel shall be pre-wired to the float switch and pump motor. It shall be mounted to the pump receiver and be of a NEMA 12 enclosure rating. The control panel will include starter motor, Hand-Off-Automatic (HOA) selector switch and motor circuit protector.
Watson McDaniel Model: CPN12-P1-S, CPN12-P2-S, CPN12-P1-D, CPN12-P2-D
Note: (i) For additional NEMA 12 control panel options see: **Control Panel Options Table.**

Control Panel Options Table

Note: Depending on pump selection, not all options are applicable. Please consult factory for assistance.

- UL Certification.
- Power on Pilot Light.
- Test Push Button.
- Electric Alternator.
- Two Level Float Switch
- High level Alarm Horn & Light With Silencing Switch.
- Remote Mount.

I. NEMA 1 Control Panel (Simplex Pump Systems Only)

The control panel shall be for simplex pump systems only and pre-wired to the float switch and pump motor. It shall be mounted to the pump receiver and be a NEMA 1 enclosure rating. The control panel will include starter motor, Hand-Off-Automatic (HOA) selector switch and thermal overload protector.
Option:, Pump operation pilot light.
Watson McDaniel Model: MSN1-1P, MSN1-3P

Specification Guide

SECTION 3: REGULATORS

Section 3: REGULATORS

3.1 Pilot-Operated, Diaphragm-Actuated Pressure Regulators - Complete

Pilot-Operated Regulators consist of two primary components – a main valve which controls the flow of the process fluid and a pilot valve that determines the mode of control (i.e. pressure reducing, back pressure control, differential pressure control, etc.). Main valve shall be diaphragm- or piston-actuated with threaded NPT or ANSI flanged end connections. Pilot valves options are spring-loaded and air-loaded designs and mounting options may include top, side, or remote. Pilot-operated pressure regulators shall provide control accuracy equal to +/- 1 psi.

A. Pilot-Operated Pressure Reducing Regulator – ***Ductile Iron Main Valve and Spring-Loaded Pilot Valve***

HD Valve with Pressure Pilot

Main Valve	**HD-Series**
Sizes	**1/2" – 6"**
Connections	**NPT: 1/2" - 2"** **FLG: 1" - 6"**
Body Material	**Ductile Iron**
PMO Max. Operating Pressure	**300 PSIG**
Design Pressure/ Temperature Ratings TMA/PMA	NPT 450 PSIG @ 650° F 150# FLG 150 PSIG @ 566° F 300# FLG 450 PSIG @ 650° F

The main valve body shall be constructed of ductile iron for steam service and be single-seated, globe-style, packless design, with hardened stainless steel internal trim for a maximum operating pressure of 300 psig. The main valve shall be diaphragm-actuated and self-operated with threaded NPT or ANSI flanged connections and factory tested to Class IV shut-off per ANSI/FCI 70-3. Pilot valve shall be spring-loaded. Pilot shall mount to the main valve for control accuracy of downstream pressure equal to +/- 1 psi and allow for variation in set pressure while in service. The interconnected tubing between pilot mount and main valve shall be internal to the footprint of the main valve and shall be shipped fully assembled. The side-mounted and field-reversible pilot adapter shall have a full port integrated strainer with 60 mesh strainer screen and integral blowdown valve. There shall be no springs in the steam space. The valve shall be repairable in-line and require a pilot for operation.

Watson McDaniel Models: HD Series Main Valve with PP-Series Pilot

B. **<u>Pilot-Operated Pressure Reducing Regulator</u>** – ***Ductile Iron and Diaphragm-Actuated Main Valve and Air-Loaded Pilot Valve***

Pressure Pilot (Air)	**PA**
Pilot Body Material	**Ductile Iron**
Max Inlet Pressure	**300 PSIG**
Reduced Outlet Pressure Range	**3-200 PSIG**
Inlet Pressure Range (when used with **HD** Standard main valve)	**15-300 PSIG**
Inlet Pressure Range (when used with **HD-LP** Low-Pressure main valve)	**5-20 PSIG**

Minimum Differential Pressure:
10 PSI (<u>Standard</u> Main Valve)
3 PSI (<u>Low Pressure</u> Main Valve)

The main valve body shall be constructed of ductile iron for steam service and be single-seated, globe-style, packless design, with hardened stainless steel internal trim for a maximum operating pressure of 300 psig. The main valve shall be diaphragm-actuated and self-operated with threaded NPT or ANSI flanged connections and factory tested to Class IV shut-off per ANSI/FCI 70-3. Pilot valve shall be air-loaded. Pilot shall mount to the main valve for control accuracy of downstream pressure equal to +/- 1 psi and allow for variation in set pressure while in service. The interconnected tubing between pilot mount and main valve shall be internal to the footprint of the main valve and shall be shipped fully assembled. The side-mounted and field-reversible pilot adapter shall have a full port integrated strainer with 60 mesh strainer screen and integral blowdown valve. There shall be no springs in the steam space. The valve shall be repairable in-line and require a pilot for operation.

Watson McDaniel Models: HD Series Main Valve with PA-Series Pilot

C. **<u>Pilot-Operated Back Pressure Regulator</u>** – ***Ductile Iron and Diaphragm-Actuated Main Valve and Spring-Loaded Pilot Valve***

Main Valve	**HD-Series**
Sizes	**1/2" – 6"**
Connections	**NPT: 1/2" - 2"** **FLG: 1" - 6"**
Body Material	**Ductile Iron**
PMO Max. Operating Pressure	**300 PSIG**
Design Pressure/ Temperature Ratings TMA/PMA	NPT 450 PSIG @ 650° F 150# FLG 150 PSIG @ 566° F 300# FLG 450 PSIG @ 650° F

The main valve body shall be constructed of ductile iron for steam service and be single-seated, globe-style, packless design, with hardened stainless steel internal trim for a maximum operating pressure of 300 psig. The main valve shall be diaphragm-actuated and self-operated with threaded NPT or ANSI flanged connections and factory tested to Class IV shut-off per ANSI/FCI 70-3. Pilot valve shall be spring-loaded. Pilot shall mount to the main valve for control accuracy of upstream pressure equal to +/- 1 psi and allow for variation in set pressure while in service. The interconnected tubing between pilot mount and main valve shall be internal to the footprint of the main valve and shall be shipped fully assembled. The side-mounted and field-reversible pilot adapter shall have a full port integrated strainer with 60 mesh strainer screen and integral blowdown valve. There shall be no springs in the steam space. The valve shall be repairable in-line and require a pilot for operation.

Watson McDaniel Models: HD Series Main Valve with PBP-Series Pilot

D. **<u>Pilot-Operated Pressure Reducing Regulator</u>** – ***Carbon Steel Main Valve and Spring-Loaded Pilot Valve***

Model	HSP Series
Sizes	1", 1½", 2", 3", 4"
Connections	150#/300# Flange
Body Material	Cast Steel
PMO Max. Operating Pressure	450 PSIG
TMO Max. Operating Temperature	650°F
PMA Max. Allowable Pressure	550 PSIG @ 650°F
TMA Max. Allowable Temperature	650°F @ 550 PSIG

The main valve body shall be constructed of carbon steel for steam service and be single-seated, globe-style, packless design, with hardened stainless steel internal trim for a maximum operating pressure of 450 psig. The main valve shall be diaphragm-actuated and self-operated with threaded NPT or ANSI flanged connections and factory tested to Class IV shut-off per ANSI/FCI 70-3. Pilot valve shall be spring-loaded. Pilot shall mount to the main valve for control accuracy of downstream pressure equal to +/- 1 psi and allow for variation in set pressure while in service. The interconnected tubing between pilot mount and main valve shall be internal to the footprint of the main valve and shall be shipped fully assembled. The side-mounted and field-reversible pilot adapter shall have a full port integrated strainer with 60 mesh strainer screen and integral blowdown valve. There shall be no springs in the steam space. The valve shall be repairable in-line and require a pilot for operation.

Watson McDaniel Model: HSP

3.2 Pilot-Operated, Diaphragm-Actuated Pressure Regulators - Components

A. HD Series Main Valve

HD Main Valve
Ductile Iron

Main Valve	**HD-Series**
Sizes	**1/2" – 6"**
Connections	**NPT: 1/2" - 2"** **FLG: 1" - 6"**
Body Material	**Ductile Iron**
PMO Max. Operating Pressure	**300 PSIG**
Design Pressure/ Temperature Ratings TMA/PMA	NPT 450 PSIG @ 650° F 150# FLG 150 PSIG @ 566° F 300# FLG 450 PSIG @ 650° F

The main valve body shall be constructed of ductile iron for steam service with hardened stainless steel internal trim to 55 Rockwell C scale for a maximum operating pressure of 300 psig. The main valve shall be diaphragm-actuated and self-operated with threaded NPT or ANSI flanged connections. The valve shall be external pilot type, single-seated, normally closed, packless design and factory tested to Class IV shut-off per ANSI/FCI 70-3. The interconnected tubing between pilot mount and main valve shall be internal to the footprint of the main valve and shall be shipped fully assembled. The side-mounted and field-reversible pilot adapter shall have a full port integrated strainer with 60 mesh strainer screen and integral blowdown valve. There shall be no springs in the steam space. The valve shall be repairable in-line and require a pilot for operation.
Watson McDaniel Models: HD, HDR (reduced port), HD-LP (low pressure)

B. PP-Pilot for Pressure Reducing, Spring-Loaded

Pressure Pilot	(Standard: 1.0 psig accuracy)	PP
	(High-accuracy: 0.5 psig accuracy)	PP5
Pilot Body Material		Cast Steel
Max Inlet Pressure		300 PSIG
Reduced Outlet Pressure Range		3-200 PSIG
Inlet Pressure Range		
(with HD Standard main valve)		15-300 PSIG
(with HD Low-Pressure (LP) main valve)		5-20 PSIG
Minimum Differential Pressure		
(with HD Standard main valve)		10 PSI
(with HD Low-Pressure (LP) main valve)		3 PSI

The pilot shall be separate from the main valve and connected to the pilot adapter with 4 bolts. The pilot shall be normally closed design with packless construction. The pilot shall be interchangeable on all sizes of main valves with a replaceable head and seat assembly. The head and seat assembly shall be a cartridge style design and factory leak tested. The pilot spring shall be enclosed in the pilot body, protecting it from the atmosphere and have one (1) set screw for pressure adjustability. The pilot shall maintain constant downstream pressure within +/- 1 psig and offer consistent control when inlet pressure to the valve fluctuates or required steam flow varies. Pilot diaphragms shall be constructed of phosphorous bronze, solid floating design with no penetration hole for added durability.

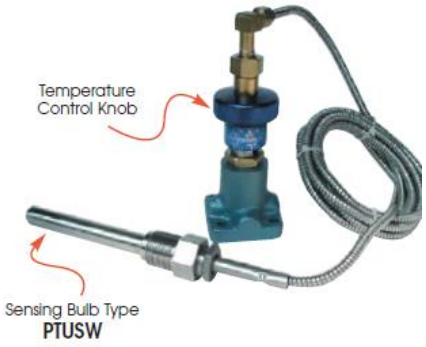
Watson McDaniel Model: PP-Pilot

C. PP5-Pilot for Pressure Reducing, Spring-Loaded

The pilot shall be separate from the main valve and connected to the pilot adapter with 4 bolts. The pilot shall be normally closed design with packless construction. The pilot shall be interchangeable on all sizes of main valves with a replaceable head and seat assembly. The head and seat assembly shall be a cartridge style design and factory leak tested. The pilot spring shall be enclosed in the pilot body, protecting it from the atmosphere and have one (1) set screw for pressure adjustability. The pilot shall maintain constant downstream pressure within +/- 1/2 psig and offer consistent control when inlet pressure to the valve fluctuates or required steam flow varies. Pilot diaphragms shall be constructed of phosphorous bronze, solid floating design with no penetration hole for added durability.

Watson McDaniel Model: PP-5 Pilot

D. PT-Pilot for Temperature Control



Temperature Pilot	PT
Pilot Body Material	Ductile Iron
Max Inlet Pressure	300 PSIG
Temperature Control Range	60-300°F
Steam Inlet Pressure Range (Standard) (when Standard Temperature Pilot is used with **HD** Standard main valve)	15-300 PSIG
Steam Inlet Pressure Range (Low) (when Low-Pressure Temperature Pilot is used with **HD-LP** Low-Pressure main valve)	5-20 PSIG

The pilot shall be separate from the main valve and connected to the pilot adapter with 4 bolts. The pilot shall be normally open design with packless construction. The pilot shall be interchangeable on all sizes of main valves. The thermal system shall be liquid filled bellows type, factory filled and sealed offering 8ft and 15ft capillary lengths with sensing bulbs available in copper or SST. Overheat protection bellows shall be incorporated in sensing bulb offering 200°F overheat protection up to 350°F. The set temperature shall be adjusted to maintain desired process temperature via rotating adjustment knob.

Watson McDaniel Model: PT-Pilot

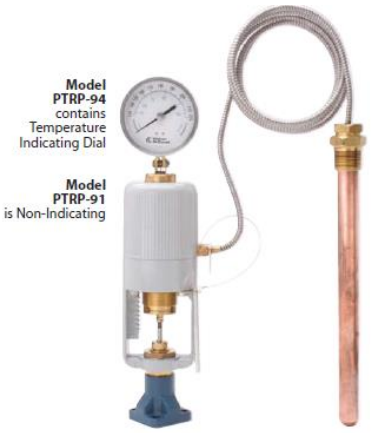
E. PA-Pilot for Pressure or Temperature Control, Air-Loaded

Pressure Pilot (Air)	PA
Pilot Body Material	Ductile Iron
Max Inlet Pressure	300 PSIG
Reduced Outlet Pressure Range	3-200 PSIG
Inlet Pressure Range (when used with **HD** Standard main valve)	15-300 PSIG
Inlet Pressure Range (when used with **HD-LP** Low-Pressure main valve)	5-20 PSIG

The pilot shall be separate from the main valve and connected to the pilot adapter with 4 bolts. The pilot shall be normally closed design with packless construction. The pilot shall be interchangeable on all sizes of main valves with a replaceable head and seat assembly. The head and seat assembly shall be a cartridge style design and factory leak tested. The control chamber shall be air loaded offering delivery to control pressure ratios of 1:1, 4:1 or 6:1. The pilot shall maintain constant downstream pressure within +/- 1 psig and offer consistent control when inlet pressure to the valve fluctuates or required steam flow varies. Pilot diaphragms shall be constructed of phosphorous bronze, solid floating design with no penetration hole for added durability.

Watson McDaniel Model: PA-Pilot

F. PTRP-Pilot for Temperature Control



Model	PTRP
Pilot Body Material	Cast Steel
Max Inlet Pressure	300 PSIG
Temperature Control Range	20-440˚ F
Steam Inlet Pressure Range (when Standard Temperature Pilot is used with **HD** Standard main valve)	15-300 PSIG
Steam Inlet Pressure Range (when Low-Pressure Temperature Pilot is used with **HD-LP** Low-Pressure main valve)	5-20 PSIG

The pilot shall be separate from the main valve and connected to the pilot adapter with 4 bolts. The pilot shall be normally open design and shall be interchangeable on all sizes of main valves. The thermal system shall be vapor tension type, factory filled and sealed offering various capillary lengths with sensing bulbs in copper or SST. The pilot stem shall be sealed with live-loaded Teflon V-Ring packing rated for saturated steam service up to 300 psig. Actuator bellows shall be constructed of high pressure brass with corrosion resistant tin-plated finish and provide 100°F over-temperature protection.

Watson McDaniel Model: PTRP-Pilot

G. PBP-Pilot for Back Pressure Control

Back Pressure Pilot	PBP
Pilot Body Material	Ductile Iron
Max Inlet Pressure	300 PSIG
Reduced Outlet Pressure Range	10-200 PSIG
Inlet Pressure Range (when used with **HD** Standard main valve)	15-300 PSIG
Inlet Pressure Range (when used with **HD-LP** Low-Pressure main valve)	5-20 PSIG

The pilot shall be separate from the main valve and connected to the pilot adapter with 4 bolts. The pilot shall be normally open design with packless construction. The pilot shall be interchangeable on all sizes of main valves with a replaceable head and seat assembly. The head and seat assembly shall be a cartridge style design and factory leak tested. The pilot spring shall be enclosed in the pilot body, protecting it from the atmosphere and have one (1) set screw for pressure adjustability. The pilot shall maintain constant upstream pressure within +/- 1 psig and offer consistent control when inlet pressure to the valve fluctuates or required steam flow varies. Pilot diaphragms shall be constructed of phosphorous bronze, solid floating design with no penetration hole for added durability.

Watson McDaniel Model: PBP-Pilot

H. PDP-Pilot for Differential Pressure Control

Differential Pressure Pilot	PDP
Body Material	Ductile Iron
Max Inlet Pressure	300 PSIG
Reduced Outlet Pressure Range	3-200 PSIG
Inlet Pressure Range	
(with **HD** Standard main valve)	15-300 PSIG
(with **HD-LP** Low-Pressure main valve)	5-20 PSIG
Minimum Differential Pressure	
(with **HD** Standard main valve)	10 PSI
(with **HD-LP** Low-Pressure main valve)	3 PSI

The pilot shall be separate from the main valve and connected to the pilot adapter with 4 bolts. The pilot shall be normally open design with packless construction. The pilot shall be interchangeable on all sizes of main valves with a replaceable head and seat assembly. The head and seat assembly shall be a cartridge style design and factory leak tested. The pilot spring shall be enclosed in the pilot body, protecting it from the atmosphere and have one (1) set screw for pressure adjustability. The pilot shall maintain a set differential pressure above the loading pressure and within +/- 2 psig of set point. Pilot diaphragms shall be constructed of phosphorous bronze, solid floating design with no penetration hole for added durability.

Watson McDaniel Model: PDP-Pilot

I. HSP Series Pilot-Operated Steam Pressure Reducing Regulator

Model	HSP Series
Sizes	1", 1½", 2", 3", 4"
Connections	150#/300# Flange
Body Material	Cast Steel
PMO Max. Operating Pressure	450 PSIG
TMO Max. Operating Temperature	650°F
PMA Max. Allowable Pressure	550 PSIG @ 650°F
TMA Max. Allowable Temperature	650°F @ 550 PSIG

The valve shall be self-operated, external pilot type, single-seated, metal diaphragm-actuated, normally closed, packless design. The main valve and pilot bodies shall be constructed of carbon steel for steam service with a maximum operating pressure of 450 psig. Internal parts including seat, disc and stem shall be constructed of hardened stainless steel. Main valve and pilot diaphragms shall be constructed of phosphorous bronze, solid floating design with no penetration hole for added durability. The main valve shall be available with ANSI flanged end connections. The interconnected tubing between pilot mount and main valve shall be shipped fully assembled. The pilot adapter shall have a full port integrated pilot strainer with 60 mesh strainer screen and integral blowdown valve. Pilot shall be side-mounted and field reversible. Pilot shall provide downstream pressure control within +/- 1 psig of set point. There shall be no springs in the steam space. The valve and pilot shall be repairable in-line.

Watson McDaniel Models: HSP

3.3 Pilot-Operated, Piston-Actuated Pressure Regulators

A. 403 Series Pressure Reducing Regulator

Threaded

Flanged

Model	**403 Series**
Service	**Steam & Air**
Sizes	1/2" – 4"
Connections	NPT, 150# FLG, 300# FLG
Body Material	Ductile Iron
Seat & Disc	Hardened 420 Stainless Steel (55 Rc)
Max Inlet Pressure	**450 PSIG**
Min Inlet Pressure	20 PSIG
Max Differential Pressure	250 PSI
Min Differential Pressure	15% of Inlet Pressure (10 PSI min)

The valve shall be self-operated, single-seated, piston-actuated, and normally closed. The spring-loaded pilot shall be integral to the main body. The main valve body shall be constructed of ductile iron with a maximum operating pressure of 450 psig and threaded NPT or ANSI flanged end connections. Internal components shall be constructed of stainless steel, with hardened main seat and disc. Piston rings shall be constructed of polyether ether ketone or similar material to promote free movement and extended service life. Regulator shall be suitable for steam or air service. Valve shall be offered with external or internal sensing options.

Watson McDaniel Model: 403 Series

3.4 Direct-Operated Pressure Regulators

Direct-operated Regulators are self-operated diaphragm- or bellows-actuated. Bodies shall be constructed of bronze, iron, steel, or stainless steel. Pressure setting shall be adjustable while valve is in service. Regulator end connections shall be threaded NPT or ANSI flanged. Diaphragms shall be constructed of phosphorous bronze, stainless steel, or various elastomeric materials. Pressure sensing is typically internal to the valve, but some models offer external sensing for increased control accuracy.

A. O Series – *for Pressure Reducing*

Model	**O-Series**
Service	**Steam, Air, Water & Other Liquids**
Sizes	3/8", 1/2", 3/4", 1", 1¼", 1½", 2"
Connections	NPT
Body Material	Cast Iron
Seat & Disc	Hardened 420 Stainless Steel
Diaphragm (for Steam)	**Phosphor Bronze** - Steam
Diaphragm (for Liquid or Air)	**Viton** - Water, Air & Oil (300°F max)
Max Inlet Pressure	**250 PSIG**
Min Inlet Pressure	15 PSIG
Max Differential Pressure	125 PSI
Min Differential Pressure	15 PSI

Regulator shall be suitable for steam, air, water or other gas or liquid service. The valve shall be repairable, direct-operated, single-seated, and offer various control spring ranges. The valve body shall be constructed of Cast Iron with a maximum inlet pressure of 250 psig at 450 ^{o}F and threaded NPT end connections. Internal parts shall be constructed of stainless steel, with hardened stainless steel seat and disc. The control spring shall be enclosed, protecting it from the atmosphere and have one (1) set screw for pressure adjustability. Diaphragms for steam service shall be of quantity two (2) constructed of Phosphor Bronze and for maximum of 300 ^{o}F. Water, air or oil service diaphragm shall be Viton or similar suitable elastomer.
Option: all stainless steel body, sizes ½" – 1-1/4" (OSS Series).
Watson McDaniel Model: O Series, OSS Series

B. <u>B Series</u> – *for Pressure Reducing*

Model	B-Series
Service	Water, Air, Oil, Other Gases & Liquids
Sizes	1/2", 3/4", 1", 1¼", 1½", 2", 2½", 3", 4"
Connections	NPT, 125# FLG, 250# FLG
Body Material	1/2"– 2½" Bronze 3"& 4" Cast Iron
Disc & Diaphragm	Viton - 300°F max
Max Inlet Pressure	250 PSIG
Min Inlet Pressure	10 PSIG
Max Differential Pressure	125 PSI
Min Differential Pressure	20% of Inlet Pressure

Regulator shall be suitable for water, air, or other gas/liquid service. The valve shall be repairable, direct-operated, have a balanced trim rated for Class V shut-off. The main valve body shall be constructed of Bronze or Cast Iron with a maximum operating pressure of 250 psig and threaded NPT or ANSI flanged end connections. Disc and Diaphragm shall be constructed of Viton or similar material. The control spring shall be enclosed, protecting it from the atmosphere and have one (1) set screw for pressure adjustability.

Watson McDaniel Model: B Series

C. <u>455 Series</u> – *for Pressure Reducing*

Model	455 Series
Service	Steam, Air & Other Gases
Sizes	1/2", 3/4", 1", 1¼", 1½", 2", 2½", 3", 4"
Connections	NPT, 125# FLG, 250# FLG
Body Material	1/2"– 1½" SS Body/Brass Stuffing Box 2"– 4" Cast Iron
Seat & Disc	Stainless Steel
Diaphragm	Neoprene/Nylon
Max Inlet Pressure	250 PSIG
Min Inlet Pressure	5 PSIG
Max Differential Pressure	125 PSI
Min Differential Pressure	20% of Inlet Pressure

Regulator shall be suitable for steam, air or other gas service. The valve shall be direct-operated with external sensing line connection and have a balanced trim. The main valve body shall be constructed of Stainless Steel with a Brass Stuffing Box for sizes ½" through 1-1/2" and Cast Iron for sizes 2" through 4" with a maximum operating pressure of 250 psig at 450°F and threaded NPT or ANSI flanged end connections. Minimum inlet pressure shall be 5 psig. Internals shall be constructed of Stainless Steel. Diaphragm shall be constructed of Neoprene/Nylon, EPDM, Viton, or similar material. The control spring shall have one (1) adjustment knob for pressure adjustment.

Watson McDaniel Model: 455 Series

D. **R Series** – ***for Back Pressure Relief***

Model	R Series	10691 Series*
Service	Liquids	Liquids
Sizes	1/2" – 3"	1/2", 3/4", 1"
Connections	NPT	NPT
Body	Bronze	Bronze
Seat Material	Bronze	Bronze
Disc Material	Stainless Steel (1/2" – 1 1/2") Bronze (2" – 3")	EPDM* Optional Viton or Teflon
Max Inlet Pressure	300 PSIG	300 PSIG

* **10691-Series** Relief Valves use a soft elastomeric disc for tight shut-off. Available in 1/2", 3/4" & 1" sizes only.

Design Pressure/Temperature Rating – PMA/TMA

NPT 300 PSIG @ 180°F

Regulator shall be suitable for relief and/or back pressure for water, oil or other liquid service. The valve shall be direct-operated, single-seated, normally closed, with threaded NPT angled end connections up to 3". The main valve body shall be constructed of bronze with a maximum operating pressure of 300 psig at 180°F. The control spring shall be enclosed, protecting it from the atmosphere and have one (1) set screw for pressure adjustability.

Watson McDaniel Model: R Series

E. **10691 Series** – ***for Back Pressure Relief***

Regulator shall be suitable for relief and/or back pressure for water, oil or other liquid service. The valve shall be direct-operated, single-seated, normally closed, with threaded NPT angled end connections up to 1". The main valve body shall be constructed of bronze with a maximum operating pressure of 300 psig at 180°F. Disc shall be constructed of EPDM for Class VI bubble-tight shut-off with options for Viton or Teflon. The control spring shall be enclosed, protecting it from the atmosphere and have one (1) set screw for pressure adjustability.

Watson McDaniel Model: 10691 Series

F. **<u>3040 Series</u>** – ***for Back Pressure Relief***

Model	3040 Series
Service	Water, Oil, other Liquids, Air
Sizes	1/2", 3/4", 1", 1¼", 1½", 2"
Connections	NPT, 125# FLG, 250# FLG
Body Material	• 1/2"– 1½" NPT, SS Body, Bronze Diaphragm Chamber
	• 2" NPT, Cast Iron Body
	• 2" FLG, Cast Iron Body
Seat Material	Stainless Steel
Disc Material	Viton - 300°F max
Diaphragm	Viton - 300°F max
Max Inlet Pressure	**250 PSIG**

Design Pressure/Temperature Rating – PMA/TMA		
NPT	300 PSIG	@ 200°F
125# FLG	125 PSIG	@ 200°F
250# FLG	250 PSIG	@ 200°F

Regulator shall be suitable for relief and/or back pressure for water, oil or other liquid service. The valve shall be direct-operated, single-seated, normally closed, with threaded NPT or ANSI flanged in-line end connections. The main valve body shall be constructed of bronze or cast iron with a maximum operating pressure of 300 psig at 200°F or 250 psig at 200°F, respectively. Disc shall be constructed of Viton for tight shut-off. The control spring shall be enclosed, protecting it from the atmosphere and have one (1) set screw for pressure adjustability.

Watson McDaniel Model: 3040 Series

3.5 Direct-Operated (Self-Operated) Temperature Regulators

Direct-Operated Temperature Regulators are self-operated devices for temperature control in heating, cooling, or mixing/diverting applications. Temperature regulators shall consist of a valve body to control or direct the process fluid and an actuator connected by capillary to a temperature sensing probe (bulb). Temperature probe material options are typically copper for increased heat transfer or stainless steel for corrosion resistance. Options include thermowells and various capillary lengths and bulb sizes.

A. W91 Series (Non-Indicating)

Model	W91 (No Indicating Dial) W94 (Temperature Indicating Dial)	
Service	Water, Steam, Other Liquids	
Sizes	1/2"– 4"	
Connections	Threaded, Union Ends, 125# FLG 250# FLG (optional)	
Body Material	1/2" – 1 1/2"	Bronze/Stainless Steel
	2"	Cast Iron (Direct-acting)
	2"	Bronze (Reverse-acting)
	2 1/2" – 4"	Cast Iron
Seat Material	Stainless Steel	
Max Inlet Pressure	250 PSIG	

Regulators shall be self-operating, bellows-actuated, requiring no external power for operation, and include a separable actuator and valve assembly. Actuator housing shall be of die cast aluminum with a corrosion resistant finish. Bellows shall be of high pressure brass, with a corrosion resistant finish. Adjustment screw shall be of brass, and include a lubricant impregnated, sintered bronze bushing. Actuator shall include over-range protection to allow the sensing bulb to be heated 100° Fahrenheit above the control point. Valve body shall be of bronze, stainless steel or cast iron construction. Bronze two-way valves shall include malleable iron union ends for ease of installation and be a field reversible design with a top and bottom guided valve plug, which will prolong life of the valve. Stainless steel two-way valves shall have threaded NPT end connections. Valve trim shall be stainless steel. Bronze 3-way valves shall have bronze trim. Iron valves shall have ANSI flanged end connections.

Watson McDaniel Model: W91 Series

B. W94 Series (Indicating)

Regulators shall be self-operating, bellows-actuated, requiring no external power for operation, and include a separable actuator and valve assembly. Actuator housing shall be of die cast aluminum with a corrosion resistant finish and include a 3½" dial temperature indicator. Indicator shall have a stainless steel case and be capable of 340 degree rotation and 90 degree adjustment to be positioned for easy readability. Bellows shall be of high pressure brass, with a corrosion resistant finish. Adjustment screw shall be of brass, and include a lubricant-impregnated, sintered bronze bushing. Actuator shall include over-range protection to allow the sensing bulb to be heated 100° Fahrenheit above the control point. Valve body shall be of bronze, stainless steel or cast iron construction. Bronze two-way valves shall include malleable iron union ends for ease of installation and be a field reversible design with a top and bottom guided valve plug, which will prolong life of the valve. Stainless steel two valves shall have threaded NPT end connections. Valve trim shall be stainless steel. Bronze 3-way valves shall have bronze trim. Iron valves shall have ANSI flanged end connections.

Watson McDaniel Model: W94 Series

Specification Guide

SECTION 4: CONTROL VALVES, CONTROLLERS, SENSORS & HOT WATER PACKAGES

Control Valve Sizing and Selection Guidelines

Valve Sizing

Control Valves are sized based on the flow required through the valve (capacity) at a given pressure drop. When using control valves for Pressure Reducing applications, sizing is easy and based on the Inlet Pressure, Desired Outlet Pressure, and the Flow Capacity.

However, when sizing control valves for Temperature Control applications such as using steam to heat water in a heat exchanger, the outlet pressure will vary depending on the amount of steam required as the water flow rate varies. Therefore, if the differential pressure is not defined, then it is appropriate to make reasonable assumptions for sizing purposes.

Helpful guidelines: Sizing for higher differential pressures will allow use of a smaller control valve. Sizing based on lower differential pressures may improve control and extend valve service life in certain applications.

For example, if supply steam pressure (inlet) to the control valve is 40 psig, sizing based on 25 psi differential pressure (15 psig Outlet Pressure) at design maximum flow requirements will size a smaller control valve than if a differential pressure of 5 psi (35 psig Outlet Pressure) were selected.

Actuation Considerations

After selecting the appropriate valve size for the application, next is to consider how to modulate (control) the valve open and closed. The two most popular methods are either electric or pneumatically actuated.

When selecting an actuator, consult valve specifications to make certain the valve close-off pressure of the size selected meets or exceeds the maximum inlet pressure to the valve. Actuator sizes and spring range options or positioners may be considered to increase valve close-off pressures.

Pneumatic Actuators

Pneumatic actuators utilize compressed air as the source of power to drive the valve.
The actuators most commonly used are the piston or diaphragm style.

- Diaphragm style actuators are usually designed to accept air to one side of the diaphragm and are known as single acting actuators. They rely on another force on the opposite side of the diaphragm to drive the valve in the opposite direction. This alternative force is provided by a set of compression springs. Depending on the position of the springs will dictate the valve fail mode. Spring to close or spring to open.

- The piston style actuators are generally used where high compression forces are need that would make the diaphragm style actuator unrealistically large for the valve or where the stroke of the valve is longer than a diaphragm valve could provide. Piston actuators can be either single or double acting and are able to accept higher motive air pressures.

Valve Positioners:

Valve positioners are an additional device to improve valve sensitivity and accuracy. The positioner will also act as a booster of the force required to help maintain valve position irrespective of the flowing forces through the valve.

Positioners are commonly used on pneumatic actuators for the ability of receiving an electrical control signal input (usually 4/20mA). By using this style of control ensures when the input signal is sent, for example, to close the valve, the positioner will fully exhaust the actuator (spring to close), ensuring the full spring force is used to keep the valve fully closed.

Valve positioners should be considered for the following:

1) *When accurate valve positioning is required.*
2) *Where fast response is required to quickly changing process conditions. Valve positioners utilize a higher pressure source and allow greater air flow to adjust the positioner than if it were a 3-15 psig signal directly.*
3) *Where varying differential pressures exist within the fluid flow that would cause the valve plug position to vary.*
4) *When controlling over a wide turndown.*
5) *Where an electronic control signal is required (4/20mA)*

Electric Actuators

Electric actuators are motor driven units that receive a power supply to either side of the motor windings to drive the valve open or closed. For globe style valves, the motor rotation is converted via gearing to transition rotational movement to linear. The actuators are able to accept analog (4/20mA) or 2-10 VDC signal input.

Although pneumatic actuators have typically been selected because of advantages in speed of actuation and fail-safe modes, the continuous advancement of electrical actuators have allowed them to greatly close the gap. Electric actuators now include options of spring reserve or “fail safe” capacitors to drive the valves to a fail-safe position. New high-speed electric actuators now provide positional speeds similar to that of their pneumatic counterparts.

SECTION 4: CONTROL VALVES, CONTROLLERS, SENSORS & HOT WATER PACKAGES

4.1 CONTROL VALVES

Control valves are two or three port devices used in control loops for controlling flow, pressure and temperature of various media. Actuation of the control valve is typically pneumatic or electric.

A. Valve, Pneumatic (HB)

Models	HB Series
Service	Steam, Air, Water
Sizes	1/2", 3/4", 1", 1 1/2", 2", 2 1/2"
Connections	NPT, 150# FLG, 300# FLG
Body Material	316 Stainless Steel
Plug and Seat Material	Stainless Steel
PMA Max. Operating Pressure	720 PSIG @ 100°F
TMA Max. Operating Temperature	450°F @ 497 PSIG
Min Operating Temperature	-20°F
Max Air Supply Pressure	40 PSIG
Max Ambient Temperature	280°F
Min Ambient Temperature	-20°F

DESIGN PRESSURE/TEMPERATURE RATING – PMA/TMA	
NPT	300 PSIG @ 450°F
150# FLG	150 PSIG @ 450°F
300# FLG	300 PSIG @ 450°F

Control valve shall be ½" to 2-1/2" stainless steel construction and shall be two-port with all stainless-steel seat, plug and stem assembly with equal percentage or linear flow characteristics. Valve stem shall be double guided and stem seals shall be self-adjusting chevron style PTFE and factory tested to Class IV shut off per ANSI/FCI 70-3. Valves shall have NPT or ANSI flanged connections on a common centerline and be coupled to an ATC or ATO pneumatic series actuator.
Options include, reduced port trim
WATSON McDANIEL MODEL: HB

B. Valve, Pneumatic (CV)

CV Series with Pneumatic Actuator	
Material Specification	
Body	Cast Steel
Plug & Seat	Stainless Steel
Technical Specification	
Sizes (in.)	3" - 4"
Connection	150# FLG, 300# FLG
Max Operating Pressure	up to **217 PSIG**
Max Air Supply Pressure	**50 PSIG**

Control Valve shall be 3" to 4" cast steel construction and shall be two-port with all stainless-steel seat, plug and stem assembly with equal percentage or linear flow characteristics. Valve stem shall be double guided and stem seals shall be self-adjusting chevron style PTFE and factory tested to Class IV shut off per ANSI/FCI 70-3. Valves to be ANSI flanged 150 / 300 connections on a common centerline and be coupled to an ATC or ATO pneumatic series actuator.
Option: reduced port trim.
WATSON McDANIEL MODEL: CV

C. Actuator, Pneumatic

Actuator shall incorporate low profile multi springs and a fully guided rolling diaphragm designed to handle air pressures up to 50 psig. Actuators to be designed to allow for on-site conversion from fail closed to fail open position.
Options include 3-15psi or 3-21psi spring range, air to open or air to close.
WATSON McDANIEL MODEL: PA1, PA2, PB1, PB2

D. Positioner, Pneumatic To Pneumatic

Positioner shall be provided with close coupled valve mounting hardware, encapsulated in a die cast aluminum case with epoxy finish, rated to Nema 4X. Capable of tuning for full signal span, split signal input and signal inversion. Integral gauge block with porting arrangements for connection of gauges to monitor supply, signal and outlet air pressures rated to a maximum pressure of 145 psig. Standard Pillar or NAMUR mounting arrangement.
Option: dome indicator.
WATSON McDANIEL MODEL: CA2000

E. **Positioner, Electro-Pneumatic**

Positioner shall be provided with close coupled valve mounting hardware, encapsulated in a die cast aluminum case with epoxy finish, Intrinsically safe or explosion proof. Capable of tuning for 4/20mA electro-pneumatic signal conversion for full signal span, split signal input and signal inversion. Integral gauge block with porting arrangements for connection of gauges to monitor supply and outlet air pressures rated to a maximum pressure of 145 psig. Standard Pillar or NAMUR mounting arrangement.

Options include explosion proof, dome indicator.

WATSON McDANIEL MODEL: CA2010, CA2020

F. **Valve, Electric (HB)**

HB Series with Electric Actuator

Material Specification	
Body	316 Stainless Steel
Plug & Seat	Stainless Steel

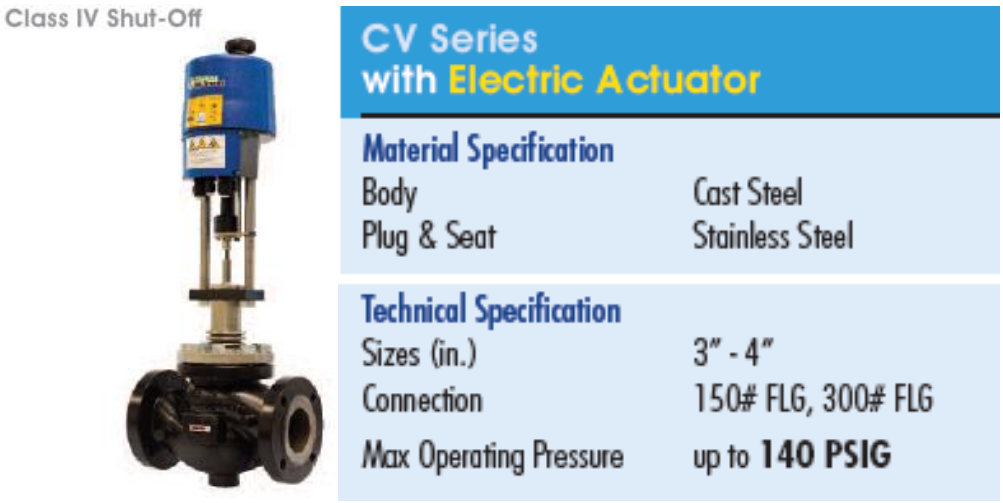
Technical Specification	
Sizes (in.)	1/2" - 2 1/2"
Connection	NPT, 150# FLG, 300# FLG
Max Operating Pressure	up to **300 PSIG**

Control valve shall be ½" to 2-1/2" stainless steel construction and shall be two port with all stainless-steel seat, plug and stem assembly with equal percentage or linear flow characteristics. Valve stem shall be double guided and stem seals shall be self-adjusting chevron style PTFE and factory tested to Class IV shut off per ANSI/FCI 70-3. Valves shall have NPT or ANSI flanged connections on a common centerline and be coupled to an ETC or ETO electric series actuator.

Option: reduced port trim.

WATSON McDANIEL MODEL: HB

G. Valve, Electric (CV)



Control valve shall be 3" to 4" cast steel construction and shall be two port with all stainless-steel seat, plug and stem assembly with equal percentage or linear flow characteristics. Valve stem shall be double guided and stem seals shall be self-adjusting chevron style PTFE and factory tested to Class IV shut off per ANSI/FCI 70-3. Valves to be ANSI flanged 150 / 300 connections on a common centerline and be coupled to an ETC or ETO Electric series actuator. Option: reduced port trim.

WATSON McDANIEL MODEL: CV

H. Actuator, Electric (EC)

Actuator shall operate with 110VAC or 24 VAC/DC power supply, to include super capacitors for fail safe motor drive under power loss conditions and shall accept either a 4/20mA or 2-10VDC control signals with position feedback. Actuator to include a hand wheel for manual operation of valve position. Enclosure rating shall be IP65 or higher. Actuator shall be configurable via an onboard ethernet communication port for valve travel, failure position, control signal span and split range settings.

WATSON McDANIEL MODEL: ECA, ECB

I. Actuator, Electric (ES)

Actuator shall operate with 110VAC or 24 VAC/DC power supply, to include spring reserve for fail safe motor drive under power loss conditions and shall accept either a 4/20mA or 2-10VDC control signals with position feedback. Enclosure rating shall be IP65. Actuator shall be configurable via two onboard push buttons and dip switches for valve travel, failure position, and control signal span settings.

WATSON McDANIEL MODEL: ESA, ESB

J. W910TB 3-Way Valve – Pneumatically-Actuated

for MIXING & DIVERTING • Water & Other Liquids

Models	W910TB
Service	Water, Other Liquids
Sizes	1/2", 3/4", 1", 1¼", 1½", 2", 2½", 3", 4"
Connections	Union Ends, 125# Flanged 250# Flanged (optional)
Body Material	1/2" – 2" Bronze 2½" – 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

NOT FOR USE WITH STEAM

Valve body shall be constructed from bronze material for connection sizes ½" to 2" union NPT on a common centerline and be suitable for a maximum pressure of 250 psig. For valve connection sizes 2-1/2" to 4" body material shall be cast iron, flanged on a common center line and be suitable for a maximum close off pressure of 250 psig for valve sizes ½" – 2" and 125 psig for valve sizes 2-1/2" – 4". Control of the valve will be via a pneumatic actuator constructed from die cast aluminum and epoxy powder coated, suitable for a maximum air supply pressure of 30 psig. Valve shall be designed and configured for mixing or diverting of liquids.

WATSON McDANIEL MODEL: W910TB

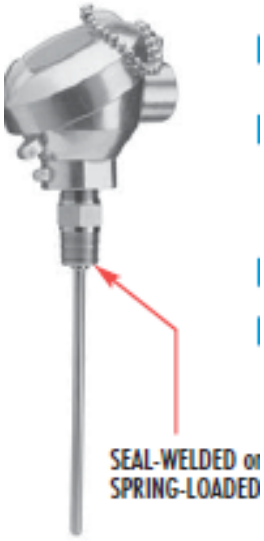
K. W910E 3-Way Valve – Electrically-Actuated

Valve body shall be constructed from bronze material for connection sizes ½" to 2" union NPT on a common centerline and be suitable for a maximum pressure of 250 psig. For valve connection sizes 2-1/2" to 4" body material shall be cast iron, flanged on a common center line and be suitable for a maximum close off pressure of 250 psig for valve sizes ½" – 2" and 125 psig for valve sizes 2-1/2" – 4". Control of the valve will be via a pillar mounted electric actuator with 110VAC or 24VAC/DC power supply. Control input signal shall include options of 4-20mA, 0-20mA, 0-10V and 2-10V. Valve shall be designed and configured for mixing or diverting of liquids.

WATSON McDANIEL MODEL: W910E

4.2 CONTROL LOOP ACCESSORIES

A. Temperature Sensor (Thermocouple)



Specifications

Sensors	Description
TJD	Type J (Thermocouple)
TKD	Type K (Thermocouple)
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]

Temperature sensor shall be a thermocouple type with either a J or K sensor. Sensing stem constructed of ¼" O.D 316 stainless steel, with stem length options of 2.1/2", 4", 6", 9", & 12". Piping connection to be ½" MNPT. Electronic housing material options of Cast Aluminum, Polypropylene or stainless steel with ¾" FNPT conduit connection.
Options include spring loaded or welded stem and thermowells.
WATSON McDANIEL MODEL: TJD, TKD

B. Temperature Sensor (RTD)

Temperature sensor shall be a platinum resistance type with either a 100 Ω or 1000 Ω sensor. Sensing stem constructed of ¼" O.D 316 stainless steel, with stem length options of 2.1/2", 4", 6", 9", & 12". Piping connection to be ½" MNPT. Electronic housing material options of Cast Aluminum, Polypropylene or stainless steel with ¾" FNPT conduit connection.
Options include spring loaded or welded stem and thermowells.
WATSON McDANIEL MODEL: TDD, TMD

C. TR890 Series PID Controller

- Multiple Sizes
- ±0.3% Accuracy
- Keyboard Programmable
- Reverse or Direct Acting
- Manual Output Override

Controller shall be a panel mounted unit with 3 term and auto-tune capability. Programming and configuration of controller via four push button key pad on front panel. Display will indicate process variable and target selected set point. Controller selection options to include universal input of RTD, Thermocouple and mV with options of current (4/20 mA) and voltage DC.
Selectable options of control output: 4/20 mA, on/off contact, SSR driver, and 0-10VDC.
Power supply availability of 100-240VAC or 24VAC/DC. Event output option of single or dual events. Selectable retransmission options to include: mVDC, 4-20mA, 0-10VDC and digital input switch options. Unit shall be suitable for ambient temperatures of 14°F to 122°F. Panel cut out options of 1/16, 1/4 and 1/8 DIN mounting.
WATSON McDANIEL MODEL: TR891, TR892, TR893, TR894

D. TA901 Series I/P Transducer

Model
TA901

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

TA901 series transducer shall be intrinsically safe to Class I, II and III, groups C, D, E, F and G. Transducer shall accept a 4/20 mA input and is capable of outputs of 3-15, 3-21 & 3-27 psig with adjustment capabilities of zero and span. Unit shall have an integral volume booster to allow flow capacity up to 20 SCFM. Repeatability of the transducer shall be < +/- 0.5% of span and Hysteresis < 1.0% of span. Typical air consumption shall be 0.03 SCFH. Transducer shall be capable of pipe, panel, bracket or valve mounted. Pneumatic air supply connection shall be ¼" FNPT and supplied with a pressure of no greater than 100 psig. Electrical conduit connection of ½"FNPT. Transducer shall be suitable for ambient temperatures of -20°F to 140°F.
WATSON McDANIEL MODEL: TA901, TA902, TA903

E. <u>TA987 Air Filter Regulator</u>

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

Shall be constructed from cast Aluminum with removable nylon mesh filter element. Element shall remove particulates down to 40 microns. An integral drip well shall collect liquids and be drained via a purge drain cock. Inlet and outlet air connections to be 1/4" FNPT on a common center line. Maximum air supply not to exceed 250 psig and have regulated air output adjustable between 0-30 psig. Typical air consumption will be < 6 SCFH. Mounting options to include pipe, panel and direct valve mounting.
WATSON McDANIEL MODEL: TA987

4.3 CONTROL PACKAGED SYSTEMS

A. Heat Miser Instantaneous Steam-to-Water Heating Packages

1P 2P 3P

Model	WATER		STEAM			Footprint Dimensions (in)		
	Inlet & Outlet	GPM	Steam Inlet	Condensate Outlet	Steam Load (lbs/hr) @ 100˚F Temp Rise	Length	Width	Height
1P10	3"	20	1 1/2"	1 1/2"	1,030	46	30	67
1P20	3"	40	2"	1 1/2"	2,061	46	30	67
2P28	3"	60	2 1/2"	2"	3,091	46	30	73
3P20	3"	80	3"	2"	4,122	54	34	92
3P28	3"	100	3"	2"	5,152	54	34	92

Heat Miser shall be an instantaneous steam to water factory assembled, skid mounted heat exchanger for the generation and supply of potable hot water for domestic and process applications. The gasketed plate-and-frame heat exchanger shall provide efficient heat transfer within a small footprint. Heat exchanger plates shall be 316L as standard with EPDM gaskets rated to 320F at 150 psig. Package shall be factory assembled and pressure tested, complete with integral factory wired NEMA 4X control panel, electronic PID controller, on/off selector switches, pneumatic or electric actuated control valves, heat exchanger, interconnecting piping, steam trap for condensate removal, small re-circulating pump for continuous flow across the temperature sensor and all required specialties. Accurate temperature control is achieved with programmable PID controller and temperature sensors to provide a modulated control signal to the steam control valve.
Sample Options: Pump-trap for lifting condensate, titanium plates, high-limit steam isolation package including dedicated sensor and actuated ball valve to protect and prevent excessive hot water temperature, various PID options (data logging, communication protocols, etc.), custom built packages, etc.
WATSON McDANIEL MODEL: HEAT MISER 1P10, 1P20, 2P28, 3P20, 3P28

Specification Guide

SECTION 5: LIQUID DRAIN TRAPS

Section 5: LIQUID DRAIN TRAPS

Liquid Drain Traps are primarily used to remove condensation from tanks or pipes containing air or other pressurized gases. The proper liquid drain trap should be selected on pressure limitation, material compatibility, and volume and specific gravity of the liquid to be drained.

5.1 Float-Operated Liquid Drain Traps

A. **Float-Operated** – ***Parallel Pipe Connections***

WLD1900
3/4" & 1"

WLD1900
2"

Model	WLD1900
Sizes	3/4", 1", 1¼", 1½", 2"
Connections	NPT
Body Material	Cast Iron
PMO Max. Operating Pressure	250 PSIG
TMO Max. Operating Temperature	450°F
PMA Max. Allowable Pressure	250 PSIG up to 450°F
TMA Max. Allowable Temperature	450°F @ 250 PSIG

The Liquid Drain Trap shall be float-operated with a cast iron body, all stainless steel internals and a hardened valve seat. Inlet and outlet connections shall be parallel, top/bottom arrangement and available in threaded NPT for maximum operating pressure up to 250 psig. The unit shall be in-line repairable and equipped with a FNPT threaded connection for the use of a balance line.
WATSON McDANIEL MODEL: WLD1900 Series

B. **Float-Operated** – ***In-Line Pipe Connections***

Model	WLD1400
Sizes	1/2", 3/4", 1", 1½", 2"
Connections	NPT
Body Material	Ductile Iron
PMO Max. Operating Pressure	300 PSIG
TMO Max. Operating Temperature	450°F
PMA Max. Allowable Pressure	300 PSIG up to 450°F
TMA Max. Allowable Temperature	450°F @ 300 PSIG

The Liquid Drain Trap shall be float-operated with a ductile iron body, all stainless steel internals and a hardened valve seat. Inlet and outlet connections shall be on a common centerline (in-line) and available in threaded NPT for a maximum operating pressure up to 300 psig. The unit shall be in-line repairable and equipped with a FNPT threaded connection for the use of a balance line in sizes 1" and above.
WATSON McDANIEL MODEL: WLD1400 Series

C. **Float-Operated** – ***High-Capacity, Parallel Pipe Connections***

Model	WLDE	WLDES
Sizes	1½", 2", 2½"	2½"
Connections	NPT	NPT, SW, Flanged
Body Material	Ductile Iron	Cast Steel
PMO Max. Operating Pressure	200 PSIG	300 PSIG
TMO Max. Operating Temperature	450°F	450°F
PMA Max. Allowable Pressure	300 PSIG up to 450°F	300 PSIG up to 750°F
TMA Max. Allowable Temperature	450°F @ 300 PSIG	750°F @ 300 PSIG

The Liquid Drain Trap shall be float-operated with a ductile iron body for operating pressure up to 200 psig or cast steel body for operation up to 300 psig. Internals shall be all stainless steel with a hardened valve seat. Inlet and outlet connections shall be parallel, top/bottom arrangement and available in threaded NPT for ductile iron body and threaded NPT, socket welded, or ANSI flanged for cast steel body. The unit shall be in-line repairable and equipped with a FNPT threaded connection for the use of a balance line.

WATSON McDANIEL MODEL: WLDE Series (ductile iron), WLDES Series (carbon steel)

D. **Float-Operated** – ***Industrial Processes, In-Line Pipe Connections***

Model	WLD600 & WLD601
Sizes	3/4", 1", 1½", 2", 3", 4"
Connections	NPT, SW, Flanged
Body Material WLD600	Carbon Steel
Body Material WLD601	316 Stainless Steel
PMO Max. Operating Pressure	450 PSIG
TMO Max. Operating Temperature	750°F
PMA Max. Allowable Pressure	*990 PSIG @ 100°F
TMA Max. Allowable Temperature	*750°F @ 670 PSIG

The Liquid Drain Trap shall be float-operated with a cast steel or stainless steel body, all stainless steel internals and a hardened valve seat. Inlet and outlet connections shall be on a common centerline (in-line) and available in threaded NPT, socket welded, or ANSI flanged for a maximum operating pressure up to 450 psig. The unit shall be in-line repairable and equipped with a FNPT threaded connection for the use of a balance line.

WATSON McDANIEL MODEL: WLD600 Series (carbon steel), WLD601 Series (stainless steel)

E. **Float-Operated** – ***Top In / Bottom Out Connections for Vertical Piping***

WLD1800
(Non-Repairable)

WLD1800R
(Repairable)

Model	**WLD1800** Non-repairable **WLD1800R** Repairable
Sizes	1/2", 3/4"
Connections	NPT
Body Material	Stainless Steel
PMO Max. Operating Pressure	**400 PSIG**
TMO Max. Operating Temperature	500°F
PMA Max. Allowable Pressure	400 PSIG @ 500°F
TMA Max. Allowable Temperature	500°F @ 400 PSIG

The Liquid Drain Trap shall have a guided-float operation with a tamper-proof seal-welded stainless steel body and all stainless steel internals. Inlet and outlet connections shall be on a common centerline (in-line) for vertical piping and available in threaded NPT for a maximum operating pressure up to 400 psig.
Option: Repairable version with Grafoil gasket.
WATSON McDANIEL MODEL: WLD1800 Series, WLD1800R Series

5.2 Inverted Bucket Liquid Drain Traps

A. **Inverted Bucket Type**

WLD1521/1522/1524
with Strainer

Model	WLD1501, WLD1502, WLD1504, WLD1521, WLD1522, WLD1524
Sizes	3/4", 1"
Connections	NPT
Body Material	Cast Iron
PMO Max. Operating Pressure	200 PSIG
TMO Max. Operating Temperature	450°F
PMA Max. Allowable Pressure	250 PSIG up to 450°F
TMA Max. Allowable Temperature	450°F @ 250 PSIG

The Liquid Drain Trap shall be an inverted bucket trap design with cast iron body, all stainless steel internals, hardened valve & seat, plus a scrubber wire. Inlet and outlet connections shall be on a common centerline (in-line) for horizontal piping and available in threaded NPT for a maximum operating pressure up to 200 psig. The unit shall be in-line repairable.
WATSON McDANIEL MODEL: WLD1500 Series

5.3 Disc-Type Liquid Drain Traps

A. **Disc-Type**

WLD1703SB
with Strainer &
Blowdown
Valve

Model	WLD1703S
Sizes	1/2"
Connections	NPT
Body Material	Stainless Steel
Options	Blowdown Valve
PMO Max. Operating Pressure	250 PSIG
TMO Max. Operating Temperature	750°F
PMA Max. Allowable Pressure	915 PSIG up to 250°F
TMA Max. Allowable Temperature	610°F @ 750 PSIG

The Liquid Drain Trap shall be a disc-type with all stainless steel construction. Body shall have a built-in strainer with optional blowdown valve. Integral seat design and disc to be hardened for extended service life. Inlet and outlet connections shall be on a common centerline (in-line) and available in threaded NPT for a maximum operating pressure up to 250 psig. Unit shall be capable of installation in any orientation and self-draining when mounted vertically with flow direction downwards.
WATSON McDANIEL MODEL: WLD1703S

Specification Guide

SECTION 6: CLEAN & SANITARY STEAM PRODUCTS

Section 6: CLEAN & SANITARY STEAM PRODUCTS

6.1 CLEAN STEAM & SANITARY STEAM TRAPS

Sanitary steam traps are designed to offer free flow through the internal passages by incorporating very smooth internal finishes. The internal electro-polish finish on a sanitary steam trap must be between 20-25 RA, while the external finish is usually between 25-32 RA. Because the system must be periodically passivated to provide sterilization, these traps offer sanitary tri-clamp connections on the body to allow for removal of the thermal element. Removal of the element allows unobstructed flow through the trap during passivation.

Clean Steam traps are designed for the same functionality as the sanitary traps, but do not offer the same level of RA surface finish. Therefore, clean steam traps cannot be used when a sanitary specified application is required.

A. Sanitary Thermostatic Steam Trap Process and CIP/SIP to 90 Psig (Repairable)

Model	FDA300
Sizes	1 1/2"
Connections	Tri-Clamp
Body Material	Stainless Steel
PMO Max. Operating Pressure	90 PSIG
TMO Max. Operating Temperature	Saturated Steam Temperature
PMA Max. Allowable Pressure	145 PSIG up to 338°F
TMA Max. Allowable Temperature	350°F @ 132 PSIG

Thermostatic steam trap wetted parts shall be all 316L stainless steel with body internally electro-polished to 20-25 microinches RA and externally finished to 25-32 RA. The thermal element shall be precision welded design to resist shock from water hammer and operate near to saturated steam temperature. Trap shall have a split body, sanitary tri-clamp design on a common center line for easy maintenance and be completey self draining when installed in a vertical orientation and operate up to 90 psig saturated steam pressure.

Watson McDaniel Model: FDA300

B. Sanitary Thermostatic Steam Trap For Drip, Process and CIP/SIP to 90 Psig (Repairable)

Model	FDA401, FDA402, FDA403
Sizes	1/2", 3/4"
Connections	Tri-clamp
Body Material	Stainless Steel
PMO Max. Operating Pressure	90 PSIG
TMO Max. Operating Temperature	Saturated Steam Temperature
PMA Max. Allowable Pressure	145 PSIG up to 338°F
TMA Max. Allowable Temperature	350°F @ 132 PSIG

Thermostatic steam trap wetted parts shall be all 316L stainless steel with body internally electro-polished to 20-25 microinches RA and externally finished to 25-32 RA. The thermal element shall be precision welded design to resist shock from water hammer and operate near to saturated steam temperature. Trap shall have a split body, sanitary tri-clamp design for easy maintenance and be completey self draining when installed in a vertical orientation. Inlet, outlet or both connections must contain a 90° swivel arrangement capable of 360° orientation. Trap design to operate up to 90 psig saturated steam pressure.
Watson McDaniel Model: FDA401, FDA402, FDA 403, FDA411, FDA412, FDA413

C. Sanitary Thermostatic Steam Trap For Drip, Process and CIP/SIP to 90 Psig (Repairable)

Model	FDA500, FDA510
Sizes	1/2", 3/4", 1", 1½"
Connections	Tri-clamp, NPT, Tube Weld
Body Material	Stainless Steel
PMO Max. Operating Pressure	90 PSIG
TMO Max. Operating Temperature	Saturated Steam Temperature
PMA Max. Allowable Pressure	145 PSIG up to 338°F
TMA Max. Allowable Temperature	350°F @ 132 PSIG

Thermostatic steam trap wetted parts shall be all 316L stainless steel with body internally electro-polished to 20-25 microinches RA and externally finished to 25-32 RA. The thermal element shall be precision welded design to resist shock from water hammer and operate near to saturated steam temperature. Trap shall have a split body, sanitary tri-clamp design on a common centerline for easy maintenance and be completey self draining when installed in a vertical orientation. Trap design to operate up to 90 psig saturated steam pressure.
Options include: 15RA internal electro-polish, Tri-clamp x NPT connection, NPT x NPT connection and Tube weld x Tube weld connection.
Watson McDaniel Model: FDA500, FDA501

D. Clean Steam Thermostatic Steam Trap for Drip, Process and CIP/SIP to 110 Psig (Repairable)

Model	FDA600
Sizes	1/2", 3/4", 1"
Connections	Tri-clamp, NPT, Tube Weld
Body Material	Stainless Steel
PMO Max. Operating Pressure	110 PSIG
TMO Max. Operating Temperature	Saturated Steam Temperature
PMA Max. Allowable Pressure	145 PSIG up to 338°F
TMA Max. Allowable Temperature	350°F @ 132 PSIG

Thermostatic steam trap wetted parts shall be all 316L stainless steel. The thermal element shall be precision welded design to resist shock from water hammer and operate near to saturated steam temperature. Trap shall have a split body design for easy maintenance and tri-clamp, NPT, Tri-clamp x NPT or tube weld connections on a common centerline. Trap shall be be completey self draining when installed in a vertical orientation and designed to operate up to 110 psig saturated steam pressure.
Watson McDaniel Model: FDA600

E. Clean Steam Thermodynamic Steam Trap for Drip, Process and CIP/SIP to 150 Psig


NPT


Tri-Clamp

Model	FDA800
Sizes	1/2"
Connections	Tri-Clamp, NPT, Tube Weld
Body Material	Stainless Steel
PMO Max. Operating Pressure	150 PSIG
TMO Max. Operating Temperature	500°F
PMA Max. Allowable Pressure	230 PSIG @ 850°F
TMA Max. Allowable Temperature	850°F @ 230 PSIG

Thermodynamic steam trap wetted parts shall be all 316L stainless steel with hardened disc and seat area. Trap shall have tri-clamp, NPT, or tube weld connections on a common centerline and operate with up to 80% back pressure up a maximum operating pressure of 150 psig saturated steam pressure. Trap shall be self-draining when installed in a vertical orientation.
Watson McDaniel Model: FDA800

Specification Guide

SECTION 7: PIPELINE ACCESSORIES

Section 7: PIPELINE ACCESSORIES

A. Spring / Disc Check Valves

Model	WSSCV
Sizes	1/2", 3/4", 1", 1¼", 1½", 2", 3"
Connections	NPT, SW
Body Material	316 Stainless Steel
PMO Max. Operating Pressure	500 PSIG
PMA Max. Allowable Pressure	750°F PSIG @ 100°F
TMA Max. Allowable Temperature	850°F @ 420 PSIG

Note: WSSCV with 1/4 PSI cracking pressure is required for all mechanical pump applications. The 5 PSIG cracking pressure version is also available. See model code chart.

The check valve shall be a spring/disc design with all stainless steel body and disc for steam, gas, or liquid service up to 500 psig. The spring shall be made from Inconel X-750 for extended service life in harsh environments. The check valve shall be offered in threaded NPT or socket welded connections in sizes up to 3". Check valve body shall be seal-welded together to eliminate need for O-ring or gasket. Check valve shall be offered with standard and low cracking pressure variations.

Watson McDaniel Model: WSSCV Series

B. Safety Valves – *Bronze*

Model	SVB
Sizes	1/2", 3/4", 1", 1¼", 1½", 2", 2½"
Connections	NPT
Body Material	Bronze
PMO Max. Operating Pressure	250 PSIG (steam)
TMO Max. Operating Temperature	406 °F

Safety valves shall be provided for over-pressure protection up to 250 psig on unfired pressure vessels in saturated steam systems. The valve body shall be cast bronze with various flow orifice options to meet application capacity requirements. End connections shall be angled design with threaded NPT inlet and outlet. Internal components shall include stainless steel springs, Teflon-PFA seats and stainless steel stems. Units shall be factory tested and qualified to the ASME Boiler Code, Section VIII. Rated relief capacities shall be published based on 90% or actual capacity.

Watson McDaniel Model: SVB Series

C. Safety Valves – *Cast Iron*

Model	SVI
Sizes	1 1/2", 2", 2 1/2", 3", 4", 6"
Connections	NPT, FLG
Body Material	Cast Iron
PMO Max. Operating Pressure	250 PSIG (Steam)
TMO Max. Operating Temperature	422° F

Safety valves shall be provided for high-capacity over-pressure protection up to 250 psig on unfired pressure vessels in saturated steam systems. The valve body shall be cast iron with various flow orifice options to meet application capacity requirements. End connections shall be angled design with ANSI flanged inlet and NPT or flanged outlet. Internal components shall include rust-proof stainless steel stems, springs, washers, and lapped metal-to-metal seats. Units shall be factory tested and qualified to the ASME Boiler Code, Section VIII. Rated relief capacities shall be published based on 90% or actual capacity.

Watson McDaniel Model: SVI Series

D. Drip Pan Elbow

Model	DPL
Sizes	3/4" through 8"
Connections	NPT, FLG
Body Material	Cast Iron
PMO Max. Operating Pressure	250 PSIG

DPL
Flanged

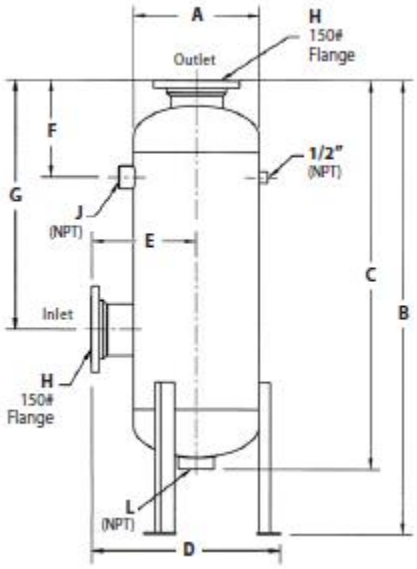
Drip Pan Elbows for use with safety relief valves shall be cast iron, and be of the same size as the safety valve outlet or larger. The Drip Pan Elbow shall have a pan to collect condensate from the steam riser pipe and a drain to pipe away. Steam riser pipe shall be externally supported so as not to bear any weight on the Drip Pan Elbow.

Watson McDaniel Model: DPL Series

E. Flash Steam Recovery Vessel

Model	WFLV
Sizes	6", 8", 12", 16"
Connections	150# RF
Body Material	Carbon Steel
PMO Max. Operating Pressure	150 PSIG
TMO Max. Operating Temperature	366°F
PMA Max. Allowable Pressure	150 PSIG @ 562°F

Note: 250 PSIG unit available. Consult factory.

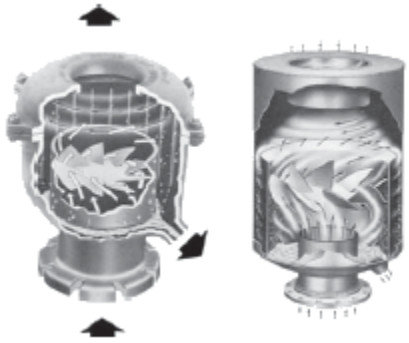


Flash Tanks shall be suitable for steam on condensate return systems. The vessel shall be constructed of carbon steel with a maximum operating pressure of 150 psig with 250 psig maximum operating pressure available upon request. All vessels are supplied with ASME section VIII code stamp.

Watson McDaniel Model: SVI Series

F. Vent / Exhaust Head

Model	EHC	EHF	EHFSS
Sizes	1", 1 1/2", 2", 2 1/2", 3", 4", 5", 6", 8", 10"	2, 2 1/2", 3", 4", 5", 6", 8", 10"	
Connections	NPT, 125# FLG	150# FLG	
Body Material	Cast Iron	Carbon Steel	Stainless Steel

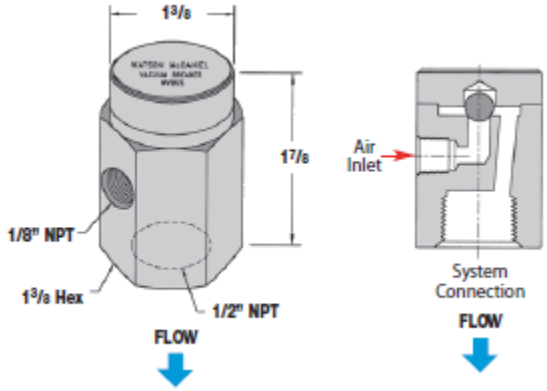


Exhaust Head shall be suitable for removal of moisture from flash steam venting to atmosphere. Exhaust Head body material shall be constructed of cast iron EHC rated at 125 psig maximum operating pressure, carbon steel EHF and stainless steel EHFSS, rated at 150 psig maximum operating pressure. End connections shall be threaded NPT or ANSI flanged. Exhaust heads will remove 99% of all entrained liquid or particulate matter 10 micron in size or larger when properly installed. Exhaust head will be designed so that there will be no required maintenance and have a Vortex Containment Plate to prevent the re-entrainment of separated material. Exhaust head shall have a drain connection to pipe away condensate and rain water that is collected.

Watson McDaniel Model: EHC, EHF, EHFSS

G. Vacuum Breaker

Model Code	WVBSS-12-N
Sizes	1/2"
Connections	NPT
Body Material	Stainless Steel
PMO Max. Operating Pressure	300 PSIG
TMO Max. Operating Temperature	752°F
PMA Max. Allowable Pressure	300 PSIG up to 752°F
TMA Max. Allowable Temperature	752°F @ 300 PSIG



Vacuum Breaker shall be suitable for steam, water and air service. The valve shall be self-operating. The main valve body shall be constructed of 300 series stainless steel, with internal ball constructed of hardened stainless steel. Vacuum Breaker has a maximum operating pressure of 300 psig.

Watson McDaniel Model: WVBSS

H. Air Vents – *Saturated Steam Systems*

Air Vents are used for Removing Air from Steam Systems

Model	AVT125
Sizes	1/2", 3/4"
Connections	NPT
Body Material	Forged Brass
PMO Max. Operating Pressure	125 PSIG
TMO Max. Operating Temperature	353°F
PMA Max. Allowable Pressure	125 PSIG up to 450°F
TMA Max. Allowable Temperature	450°F @ 125 PSIG

Model	AV2000 Series
Sizes	1/2", 3/4"
Connections	NPT
Body Material	Stainless Steel
PMO Max. Operating Pressure	650 PSIG
TMO Max. Operating Temperature	Saturated Steam Temp.
PMA Max. Allowable Pressure	1032 PSIG @ 100°F
TMA Max. Allowable Temperature	750°F @ 800 PSIG

Air Vent shall be suitable for steam. The valve shall be self-operating, thermostatically controlled. The main valve body of the AVT125 shall be constructed of forged brass and contains welded stainless steel thermal element. Maximum operating pressure 125 psig. The main valve body of the AV2000 shall be constructed of stainless steel, valve and seat hardened stainless steel and a welded stainless steel thermal element. Maximum operating pressure 650 psig.

Watson McDaniel Model: AVT125, AV2000 Series

I. Y-Type Strainer – Cast Iron

Model	CIY
Sizes	1/2", 3/4", 1", 1¼", 1½", 2", 2½", 3", 4"
Connections	NPT, FLG
Body Material	Cast Iron

PRESSURE/TEMPERATURE RATINGS		
NPT	250 PSIG @ 406°F	- Steam
NPT	400 PSIG @ 150°F	- WOG
125# FLG	125 PSIG @ 450°F	- Steam
125# FLG	200 PSIG @ 150°F	- WOG
250# FLG	250 PSIG @ 450°F	- Steam
250# FLG	500 PSIG @ 150°F	- WOG

Note: WOG = Water, Oil or Gas.

Strainer shall be Y-type with body constructed of cast iron material and rated at 400 psi CWP and Class 250 service. Inlet and outlet connections shall be threaded NPT or ANSI flanged. Cap shall be straight threaded into the body, machined with an NPT blow off opening and furnished with a plug. Gasket seating area shall include a recessed seat to prevent gasket blowout. Standard gasket shall be flat graphite with metal insert. Standard screen material shall be stainless steel. Strainer screen shall be #20 wire mesh, 0.0625" perforated sheet, or as needed for specific application.
Watson McDaniel Model: CIY

J. Y-Type Strainer – Carbon Steel

Model	CSY, SSY
Sizes	1/2", 3/4", 1", 1½", 2"
Connections	NPT, SW
Body Material	Carbon Steel (CSY) Stainless Steel (SSY)

PRESSURE/TEMPERATURE RATINGS		
Carbon Steel	NPT	600 PSIG @ 489°F
Stainless Steel	NPT	600 PSIG @ 489°F

Strainer shall be Y-type with body constructed of carbon steel material and rated for Class 600 service. Inlet and outlet connections shall be threaded NPT or socket welded. Up to 2" size, cap shall be straight threaded into the body, machined with an NPT blow off opening and furnished with a plug. For 2" and larger sizes, cover shall be installed on the strainer body using threaded fasteners, machined with an NPT blow off opening and furnished with a plug. Gasket seating area shall include a recessed seat to prevent gasket blowout. Standard gasket shall be flat graphite with metal insert. Standard screen material shall be stainless steel. Strainer screen shall be #20 wire mesh, 0.0625" perforated sheet, or as needed for specific application.
Watson McDaniel Model: CSY

K. <u>Y-Type Strainer</u> – Stainless Steel

Strainer shall be Y-type with body constructed of stainless steel material and rated for Class 600 service. Inlet and outlet connections shall be threaded NPT or socket welded. Up to 2" size, cap shall be straight threaded into the body, machined with an NPT blow off opening and furnished with a plug. For 2" and larger sizes, cover shall be installed on the strainer body using threaded fasteners, machined with an NPT blow off opening and furnished with a plug. Gasket seating area shall include a recessed seat to prevent gasket blowout. Standard gasket shall be flat graphite with metal insert. Standard screen material shall be stainless steel. Strainer screen shall be #20 wire mesh, 0.0625" perforated sheet, or as needed for specific application.

Watson McDaniel Model: SSY

L. <u>Suction / Mixing Tee</u>

Model	Suction Tee	
Sizes	1/2", 3/4", 1", 1¼", 1½", 2", 2½", 3"	
Connections	NPT	
Body Material	Cast Iron	125# & 250#
	Bronze	250#
	Stainless Steel	300#

PRESSURE/TEMPERATURE RATINGS		
Cast Iron	NPT	250 PSIG @ 406°F
Bronze	NPT	300 PSIG @ 422°F
Stainless Steel	NPT	450 PSIG @ 400°F

The Suction / Mixing Tee shall be a specialized pipe fitting with no moving parts used for blending, agitation, recirculation, mixing, aeration, and heating using steam or water. Body shall be available in cast iron, bronze, or stainless steel and have 3 separate connections for motive fluid, secondary fluid, and discharge of fluid mixture. The Suction / Mixing Tee shall have an internal nozzle that uses high pressure steam or water to induce an internal pressure drop for mixing with a secondary fluid. Body shall be available with threaded NPT connections up to 3" for a maximum rated pressure to 250 psig.

Watson McDaniel Model: SUCT

M. Ejectors

Model **EJECT** can be used with Steam or Water as the Motive Inlet

EJECT-ELL

Motive Fluid is LIQUID

EJECT-LM

Motive Fluid is LIQUID

Model	EJECT EJECT-ELL EJECT-LM
Sizes	1/2" – 2"
Connections	NPT
Body Material	Bronze (1/2" - 1 1/2") Cast Iron (2")
PMO Max. Operating Pressure	100 PSIG
TMO Max. Operating Temperature	130°F
PMA Max. Allowable Pressure	250 PSIG up to 450°F
TMA Max. Allowable Temperature	450°F @ 250 PSIG

Note: Minimum Operating Pressure for EJECT-ELL & EJECT-LM is 20 PSIG.

Ejectors use high pressure steam or water for pumping, mixing, and exhausting a secondary fluid such as steam, water, or air. Body shall be available in cast iron or bronze and have 3 separate connections for motive fluid, secondary fluid, and discharge of fluid mixture. Ejectors shall have an internal nozzle that uses high pressure steam or water to induce an internal pressure drop to pump or mix with a secondary fluid. Body shall be available with threaded NPT connections for a maximum rated pressure to 250 psig.

Watson McDaniel Model: EJECT, ELL, LM

N. Air Eliminator – Cast Iron

Model Code	AV813-13-N *
Sizes	3/4"
Connections	NPT
Body Material	Cast Iron
PMO Max. Operating Pressure	150 PSIG
TMO Max. Operating Temperature	300°F
PMA Max. Allowable Pressure	150 PSIG up to 350°F
TMA Max. Allowable Temperature	353°F @ 150 PSIG

* With Viton seat, use Model Code AV813V-13-N

Air Eliminator shall be used for removal of air and other gases from vessels or piping systems without allowing the contained liquid to escape. Body shall be cast iron with stainless steel float-type internals and soft EPDM seat for tight shut-off.

Option: Viton seat material for elevated temperatures.

Watson McDaniel Model: AV813

O. <u>Air Eliminator</u> – Stainless Steel

AE1800
(Non-Repairable)

AE1800R
(Repairable)

Model	AE1800, AE1800R
Sizes	1/2", 3/4"
Connections	NPT
Body Material	Stainless Steel
PMO Max. Operating Pressure	400 PSIG
TMO Max. Operating Temperature	500°F
PMA Max. Allowable Pressure	400 PSIG up to 500°F
TMA Max. Allowable Temperature	500°F @ 400 PSIG

Air Eliminator shall be used for removal of air and other gases from vessels or piping systems without allowing the contained liquid to escape. The Liquid Drain Trap shall have a guided-float operation with a tamper-proof seal-welded stainless steel body. Air Eliminator shall have stainless steel internals and be factory tested to ensure tight shut-off of metal seating components. Option: Repairable version with Grafoil gasket.

Watson McDaniel Model: AE1800, AE1800R Series

P. <u>Separator</u> – Cyclonic T-Type

WDS
Carbon Steel
(Flanged)

WDS
Cast Iron
(NPT)

Model	WDS	
Body Material	Cast Iron	Carbon Steel
Sizes	3/4" thru 4"	1" thru 12"
Connections	NPT, 125# Flanged	NPT, SW, 150# & 300# Flanged
PMO Max. Operating Pressure	250 PSIG	300 PSIG (NPT & SW)
Pressure/ Temperature Rating	NPT: 250 PSIG @ 450°F 125# FLG: 150 PSIG @ 450°F	NPT, SW: 1000 PSIG @ 650°F 150# FLG:150 PSIG @ 450°F 300# FLG: 500 PSIG @ 650°F

Moisture Separators shall be T-type for horizontal piping installations and designed for in-line removal of liquid from gas (steam, air, similar) streams. Separator bodies shall be constructed of iron, carbon steel or stainless steel with threaded NPT, ANSI flanged, or socket welded connections. Construction shall be cast or fabricated depending on size. Separators will use cyclonic motion to generate centrifugal force and remove 99% of entrained liquid or particulate matter 10 micron in size or larger when properly installed. Re-entrainment of separated material will be prevented by a Vortex Containment Plate. A threaded bottom drain shall be provided for the installation of a trap to discharge any accumulated liquid.

Watson McDaniel Model: WDS

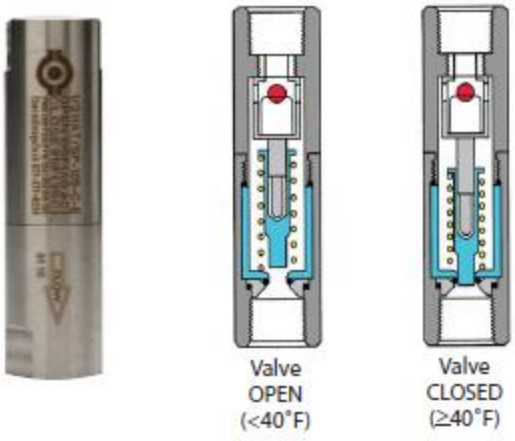
Q. <u>Separator</u> – Baffle-Type

Model	WCIS1	WCIS3
Sizes	3/4" – 2"	2½" – 4"
Connections	NPT	ANSI 150#/300#
Body Material	Cast Iron	Cast Iron
PMO Max. Operating Pressure	360 PSIG	360 PSIG
TMO Max. Operating Temperature	662°F	662°F
PMA Max. Allowable Pressure	232 PSIG @ 248°F 160 PSIG @ 572°F	232 PSIG @ 248°F 188 PSIG @ 428°F
TMA Max. Allowable Temperature	572°F @ 160 PSIG	428°F @ 188 PSIG

Moisture Separator shall be of the high-efficiency impingement type having a pressure drop that does not exceed an equivalent length of pipe. Body shall be iron with threaded NPT or ANSI flanged end connections. A threaded bottom drain shall be provided for the installation of a trap to discharge any accumulated liquid.

Watson McDaniel Model: WCIS Series

R. <u>Freeze Protection Valve</u>

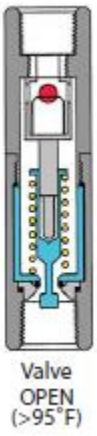


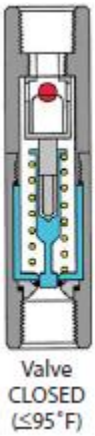
Model Code	WFPV-12-N
Sizes	1/2"
Connections	NPT
Body Material	Stainless Steel
PMO Max. Operating Pressure	200 PSIG
TMO Max. Operating Temperature	300°F

The Freeze Protection Valve shall protect pipes, valves, pumps, safety showers, and freeze-sensitive equipment. The valve shall have a stainless steel body available with ½" threaded NPT end connections for a maximum operating pressure of 150 psig. The unit shall be actuated by a thermostatic element that senses water temperature and opens when temperature falls below 35°F and feature a ram-type plug for tight and reliable shut-off.

Watson McDaniel Model: WFPV

S. Scald Protection Valve



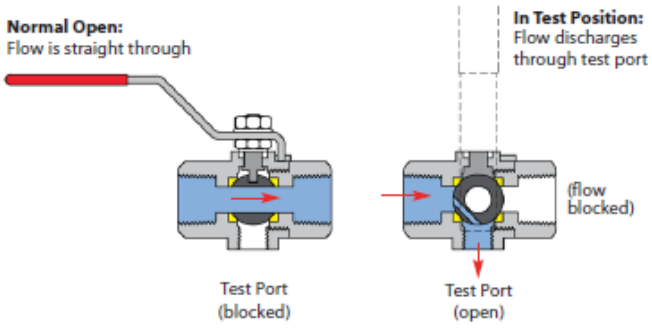


Model Code	1/2"	WSPV-12-N
	3/4"	WSPV-13-N
Sizes		1/2", 3/4"
Connections		NPT
Body Material		Stainless Steel
PMO Max. Operating Pressure		200 PSIG
TMO Max. Operating Temperature		300°F

The Scald Protection Valve shall protect personnel from accidental scalding by over-heated water or other liquids. The valve shall have a stainless steel body available with ½" or ¾" threaded NPT end connections for a maximum operating pressure of 150 psig. The unit shall be actuated by a thermostatic element that senses water temperature and opens when temperature rises above 95°F and feature a ram-type plug for tight and reliable shut-off.

Watson McDaniel Model: WSPV

T. Steam Trap Test Valve



Model	WSTTV	Stainless Steel
Sizes & Model Code	1/2"	WSTTV-12-N-SS
	3/4"	WSTTV-13-N-SS
	1"	WSTTV-14-N-SS
Connections	NPT	
Body Material		Stainless Steel
Pressure Ratings		150 PSIG WSP

WSP = Working Steam Pressure

The Steam Trap Test Valve shall provide visible diagnosis of any steam trap by manually directing flow through a test port. Valve body shall be stainless steel with threaded NPT connections for operation to 150 psig. The ball-type internals shall be stainless steel with soft steam-rated seats for tight shut-off. Main flow ports shall be full ported so as not to create any additional back pressure on the trap discharge. Trap testing shall be operated by a quarter-turn handle to divert flow from steam trap discharge to the test port. Test valve shall be NACE MR-01-75 compliant. Test valve shall not be an isolation or stop valve.

Watson McDaniel Model: WSTTV

U. Direct Steam Injection Humidifiers

Series "**WSI**" Steam Injection Humidifiers

Series "**WIP**" INSTY-PAC Steam Injection Humidifiers

The humidifier shall be a duct-mounted direct steam injector type with all stainless steel injectors. Humidifier shall be equipped with a stainless steel steam moisture separator and electrically-actuated modulating control valve for controlling air duct humidity. Option includes single or multiple injectors.

Watson McDaniel Model: WSI, WIP

V. Steam Heat Exchanger Humidifiers

Steam heat exchanger shall be constructed from stainless steel with side-entry heat exchanger for easy cleanout access. Unit shall be supplied with pneumatically-actuated heat exchanger modulating control valve, supply steam strainer, heat exchanger steam trap and water level control probe system. Unit shall have a user-adjustable automatic drain system and surface water flush control.

Options include: INTAC microprocessor control, electric modulating control valve, factory-mounted control panel, seasonal end-of-use drain system, interlock safety switch, factory-insulated reservoir, blower pack for area humidification, variable air volume (VAV) control, outdoor air temperature sensing, outdoor enclosure.

Watson McDaniel Model: WSX