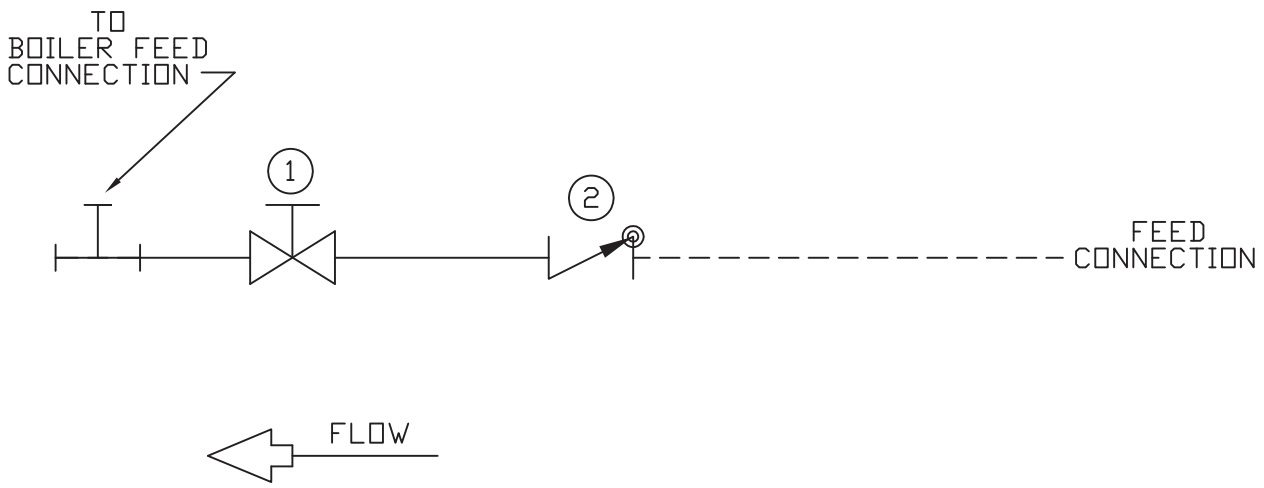


NOTE:
PIPING IS TO RUN
OPPOSITE OF TUBE PULL

ITEM	QTY	DESCRIPTION
①	1	(1-1/2") 125S STOP VALVE
②	1	(1-1/2") #62 CHECK VALVE

BRYAN STEAM
783 North Chili Avenue Peru, IN 46970

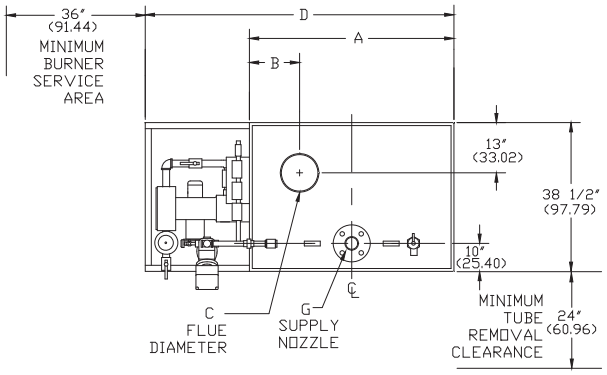
DWG. TITLE: RECOMMENDED PIPING DIAGRAM FOR STOP AND CHECK VALVE FEEDWATER PIPING

DRAWN BY	APPROVED BY			
RWJ				
REVISION NO.	EFFECTIVE DATE:	REF#	DISK:	DWG. NO.:
0	9/5/14		FS	A20797-5140273FW

AB SERIES FORCED DRAFT 15# STEAM BOILER

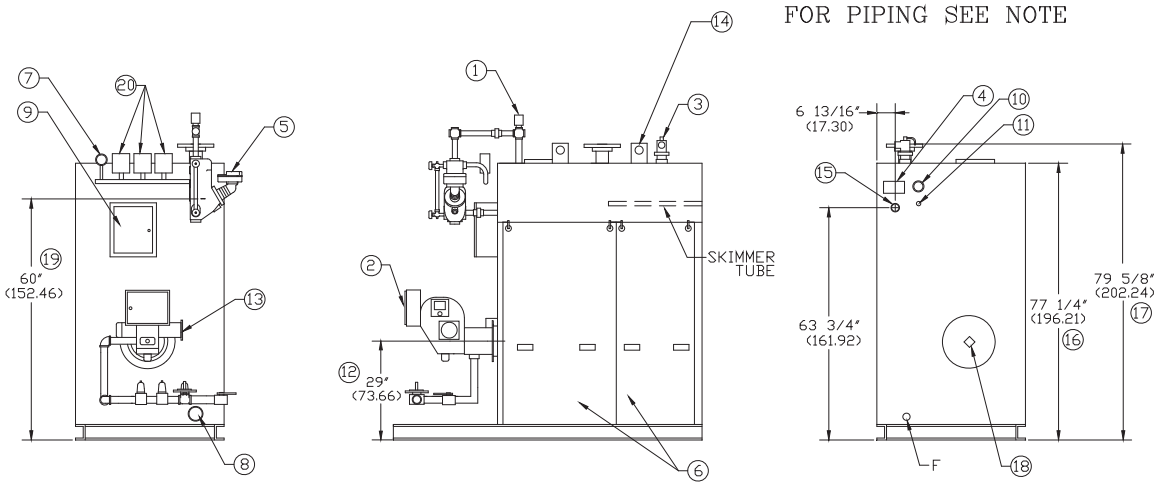
NOTES:

1. ALL DIMENSIONS ARE IN INCHES. THOSE IN PARENTHESES ARE CENTIMETERS.
2. LOCATION DIMENSIONS ARE ALL +/- 1/2".
3. GAS TRAIN, CONTROL AND BURNER CONFIGURATION WILL VARY DEPENDING ON JOB SPECIFICATIONS & CONDITIONS.
4. DIMENSIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE. CONSULT FACTORY FOR CERTIFIED DIMENSIONS.
5. ALL FLANGES ARE 150# CLASS UNLESS OTHERWISE NOTED.
6. FOR AUTO SURFACE BLOWDOWN PIPING SEE DWG# A20526-5140273ASB.
7. FOR BOTTOM BLOWDOWN PIPING SEE DWG# A20527-5140273BD.
8. FOR FEEDWATER PIPING SEE DWG# A20797-5140273FW.



TOP VIEW

FOR PIPING SEE NOTE



LEFT END VIEW | FRONT VIEW | RIGHT END VIEW

1. PROBE TYPE AUX L.W.C.O.	6. JACKET ACCESS PANELS	11. SURFACE BLOWDOWN - 1" NPT	16. HEIGHT OVER JACKET
2. FORCED DRAFT BURNER	7. PRESSURE GAUGE	12. BURNER CENTER LINE	17. HEIGHT OVER SUPPLY NOZZLE
3. RELIEF VALVE(S) LOCATION	8. CLNOUT./INSP. OPNG.-1 1/2"NPT	13. FLANGED AIR INLET	18. FLAME OBSERVATION PORT
4. ASME NAMEPLATE	9. ELEC. ENCLOSURE	14. LIFTING LUGS	19. MINIMUM SAFE WATER LEVEL
5. LWCO/PUMP CONTROL	10. CLNOUT/INSP OPNG - 2" NPT	15. 1-1/2" (3.81) FEED CONN	20. PRESSURE CONTROLS

AB120-S-15-FDG-RC	INCHES	CENTIMETERS	TYPE
A-LENGTH OVER JACKET	54.1875	137.64	
B-FLUE LOCATION	12	30.48	
C-FLUE DIAMETER	10	25.4	
D-LENGTH OVER BASE	85.375	216.85	
F-DRAIN/BLOWDOWN SIZE	1.25	3.18	
G-SUPPLY NOZZLE SIZE	4	10.16	FLG.
H-BURNER EXTENSION	29	73.66	

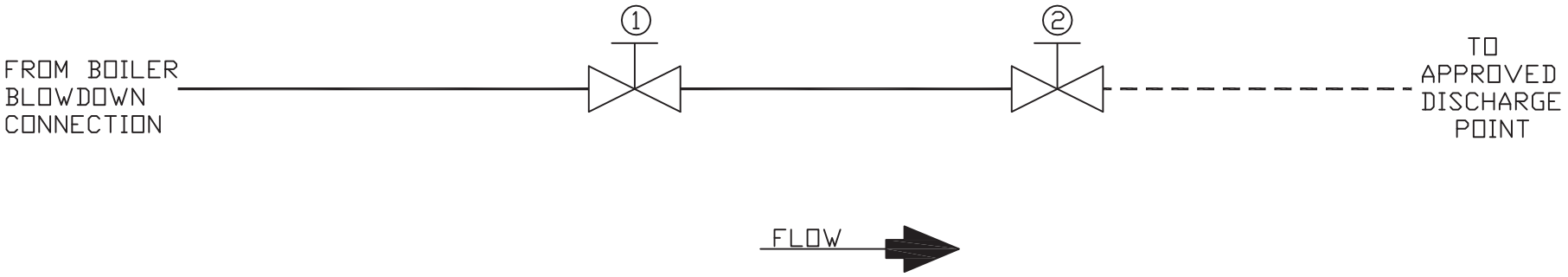
BRYAN STEAM LLC
783 NORTH CHILI AVE
PERU, INDIANA 46970

Order Number:	5140273D
Revision Number:	0
Drawn By:	Bob Jones

Order #: 5140273
Job Name: UNIV. OF MISSOURI SCIENCE & TECHNOLOGY, SCHRENK HALL
Agent: Blackmore And Glunt #4070

AB SERIES FORCED DRAFT 15# STEAM BOILER

BOILER MODEL	AB120-S-15-FDG-RC	
INPUT	MBH	1200
	(KW)	351.6
OUTPUT	MBH	960
	(KW)	281.3
BOILER HORSE POWER	HP	29
	(KW)	284.2
TUBE DIAMETER	INCHES	1
	(CM)	2.54
NUMBER OF TUBES		35
PRESSURE VESSEL VOLUME	GAL	49
	LITERS	185.5
HEATING SURFACE	SQ FT	148
	(SQ M)	13.8
STEAM OUTPUT	LBS/HR	990
	KG/HR	449.1
OPERATING WEIGHT	LBS	3350
	(KG)	1519.6
SHIPPING WEIGHT	LBS	2950
	(KG)	1338.1



NOTE: WHEN SUPPLIED BY BRYAN UNIONS OTHER THAN SHOWN MAY BE USED WHERE NEEDED TO ALLOW REMOVAL OF PREPIPED ASSEMBLY FOR SHIPMENT.

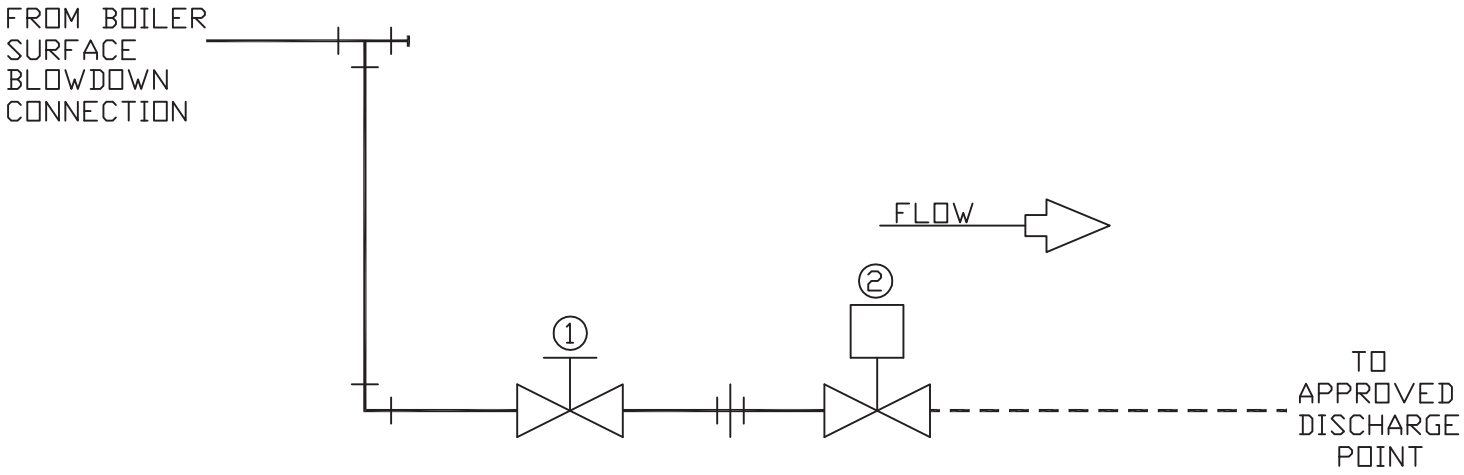
ITEM	QTY	DESCRIPTION
①	1	QUICK-OPENING VALVE (1 1/4" T585)
②	1	SLOW-OPENING VALVE (1 1/4" 125S)

BRYAN BOILERS
P.O. BOX 27 PERU, INDIANA 46970

DWG. TITLE:

RECOMMENDED PIPING DIAGRAM FOR AB,CL,D,F,K,RV,SERIES MANUAL BOTTOM BOILER BLOWDOWN

REVISION NO.	EFFECTIVE DATE:	REF#	DISK:	DWG. NO.:
1	9/5/14		FS	A20527-5140273BD



NOTE: WHEN SUPPLIED BY BRYAN UNIONS OTHER THAN SHOWN MAY BE USED WHERE NEEDED TO ALLOW REMOVAL OF PREPIPED ASSEMBLY FOR SHIPMENT.

ITEM	QTY	DESCRIPTION
①	1	1/2" 125S VALVE
②	1	1/2" 4446 VALVE

BRYAN STEAM LLC
783 North Chili Avenue Peru, IN 46970

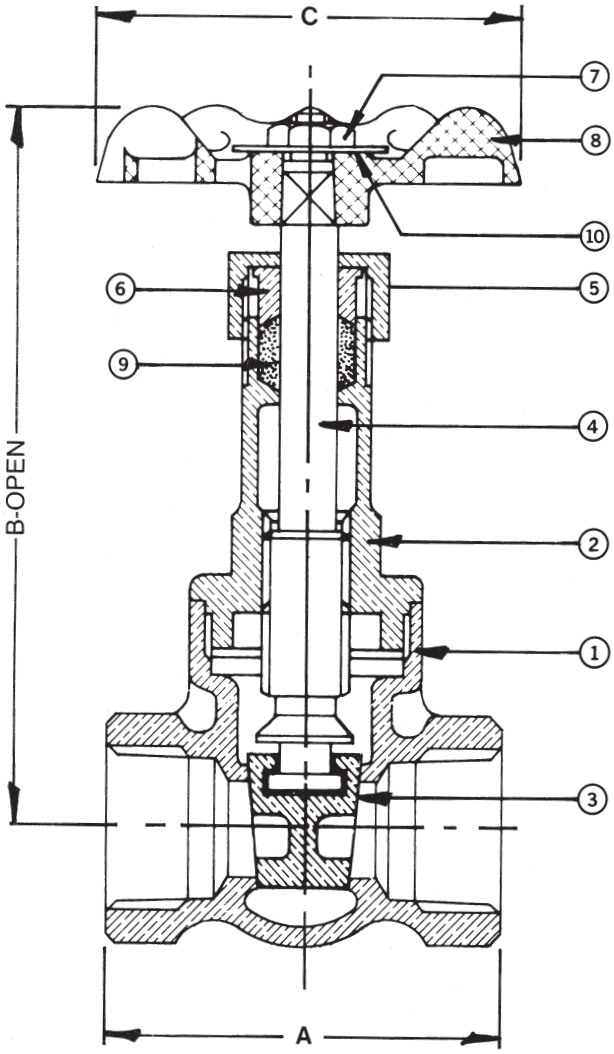
DWG. TITLE:

RECOMMENDED PIPING DIAGRAM FOR

AUTOMATIC SURFACE BOILER BLOWDOWN SYSTEM

REVISION NO.	EFFECTIVE DATE:	SCALE:	DISK:	DWG. NO.:
0	9/5/14	NONE	FS	A20526-5140273ASB

GATE 148
BRONZE
125 lb. SWP-200 lb. WOG† • General Service
Solid Wedge Disc • Rising Stem
Threaded Bonnet • Gland Packed • Threaded Ends



4" size has split wedge and bolted bonnet. It is not covered in MSS SP-80.

SPECIFICATIONS

148	Conforms to: MSS SP-80. Type 2, Class 125, Threaded Ends.

MATERIAL LIST

NO.	PART	MATERIAL	SPECIFICATION
1	Body	Bronze	ASTM B 62
2	Bonnet	Bronze	ASTM B 62
3	Wedge	Bronze	ASTM B 62
4	Stem	Bronze	ASTM B 62
5	Stuff Nut	Rod Br.	CA 360
6 [1]	Gland	Rod Br.	CA 360
7	Wheel Nut	Brass	Commercial
8	Handwheel	Mall. Iron	Commercial
9	Packing	Non-Asbestos	
10	Name Plate	Sh. Alum.	Commercial

[1] Not used on 1/2" and smaller.

DIMENSIONS - INCHES / MILIMETERS				
Units	**Size**	**A**	**B**	**C**
Inches	**1/4**	1 3/4	4 3/8	2
MM	**6.35**	44.45	111.13	50.80
Inches	**3/8**	1 13/16	4 3/8	2
MM	**9.53**	46.05	111.13	50.80
Inches	**1/2**	2	4 3/8	2
MM	**12.70**	50.80	111.13	50.80
Inches	**3/4**	2 1/8	5 27/32	2 1/2
MM	**19.05**	53.98	148.44	63.50
Inches	**1**	2 9/16	7 1/16	2 3/4
MM	**25.40**	65.10	179.40	69.85
Inches	**1 1/4**	2 25/32	8 25/32	3 1/8
MM	**31.75**	70.64	223.04	79.38
Inches	**1 1/2**	2 13/16	9 1/2	3 1/2
MM	**38.10**	71.45	241.30	88.90
Inches	**2**	3 5/16	11 1/2	3 3/4
MM	**50.80**	84.15	292.10	95.25
Inches	**2 1/2**	4 3/16	14 5/16	4 3/4
MM	**63.50**	106.38	363.55	120.65
Inches	**3**	4 5/8	16 5/8	5 1/4
MM	**76.20**	117.48	422.28	133.35
Inches	**4**	5 1/2	15 1/2	5 1/4
MM	**101.60**	139.70	393.70	133.35

† Non-Shock

INNOVATION IN EVERY VALVE

MILWAUKEE VALVE

www.milwaukeevalve.com

3/03 Printed on recycled paper with soy ink.

Electronic Timer
Minuterie électronique
Elektronisches Zeitrelais
Temporizzatore elettronico
Temporizador electronico
Temporizador eletrônico

(Cat 700-HRC12_ _, 700-HRM12_ _)

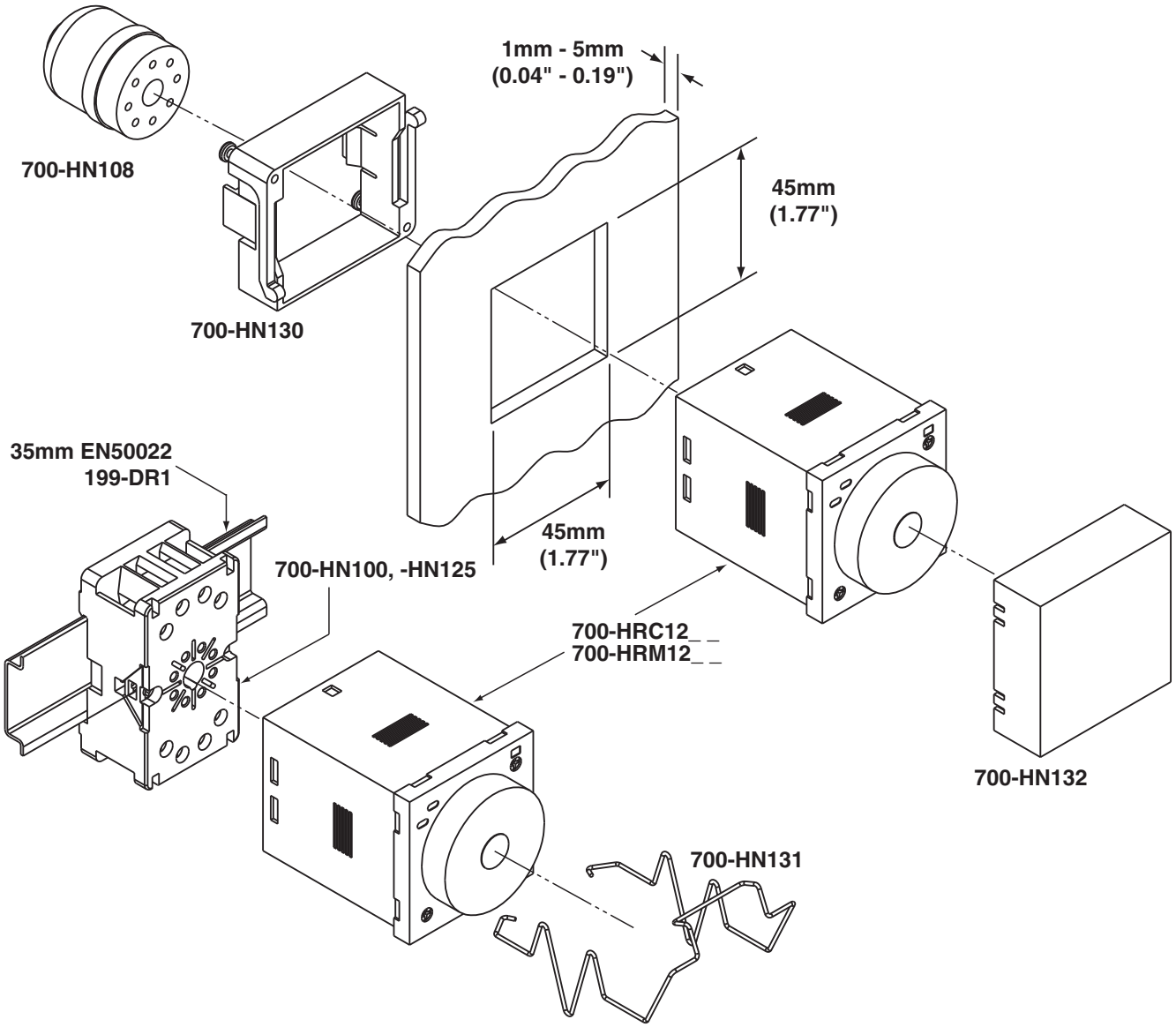
Attention: To prevent electrical shock, disconnect from power source before installing or servicing. Do not open the apparatus.

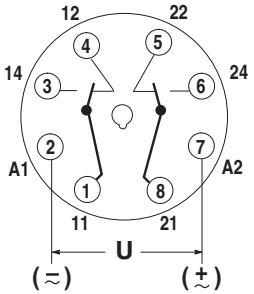
Attention: Avant le montage et la mise en service, couper l'alimentation secteur afin d'éviter tout accident. Ne pas ouvrir l'appareil.

Achtung: Um Unfälle zu vermeiden, Installations- oder Servicearbeiten nur im spannungsfreien Zustand. Gehäuse niemals öffnen.

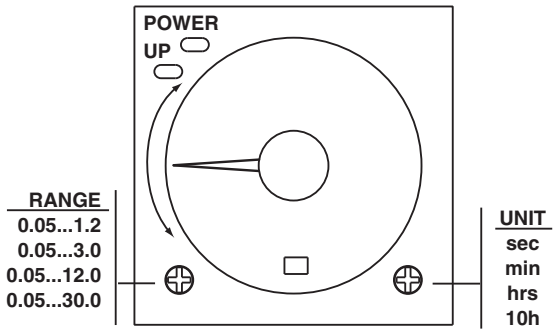
Attenzione: Per prevenire infortuni, togliere tensione prima dell'installazione o manutenzione. Non aprire l'apparecchio.

Atención: Desconectar la alimentación eléctrica antes de realizar el montaje y la puesta en servicio, con el objeto de evitar accidentes. No abrir el aparato.

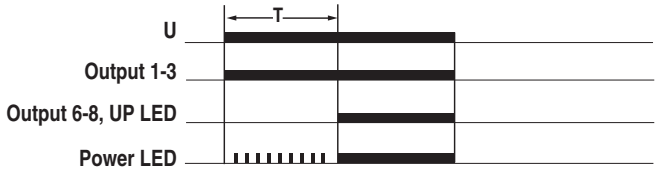




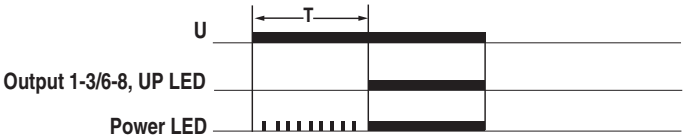
Output:
N.C. (1-4), (5-8)
N.O. (1-3), (6-8)



700-HRC12_ _

Function Fonktion Funktion Funzione Função Función	Trigger Déclencheur Auslöser Trigger Disparador Disparador	Timing diagrams Séquences Funktionsablauf Schema funzionale Diagramas Diagrama
On-Delay Début de temporisation Einschaltverzögerung Ritardo all'eccitazione Retardo de conexión Retardado	Power-On Tension Einschalter In corrente Conexión Alimentação - ligado	

700-HRM12_ _

Function Fonktion Funktion Funzione Função Función	Trigger Déclencheur Auslöser Trigger Disparador Disparador	Timing diagrams Séquences Funktionsablauf Schema funzionale Diagramas Diagrama
On-Delay Début de temporisation Einschaltverzögerung Ritardo all'eccitazione Retardo de conexión Retardado	Power-On Tension Einschalter In corrente Conexión Alimentação - ligado	

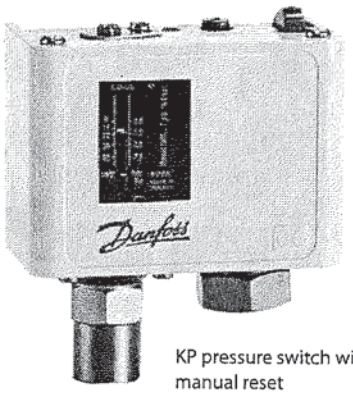
41063-210-01 (1)
1618578-1A
Printed in Japan
http://www.ab.com/manuals/

Rockwell Automation

Data sheet

Pressure and temperature switches, type KP

Features



KP pressure switch with manual reset

- Wide regulating range
- Small dimensions
  Space-saving, easy to install in panels
- Shock and impact resistant
- Ultra-short bounce time.
  Limits wear to an absolute minimum and increases reliability
- Snap action electrical contacts minimize chatter, bounce, and wear, and ensure long term electrical and mechanical reliability
- Electrical connection from front of the unit.
  Makes rack mounting easier and also saves space
- Suitable for alternating current and direct current
- Manual trip allows electrical function test without tools
- Versions with automatic and manual reset available

Contents

Data sheet **Pressure switches type KP34, KP35, KP36 and KP37**

Description

Danfoss KP switches are used for regulating, monitoring and alarm systems in the industry. They provide automatic limit protection or manual reset limit protection for pressure systems. Can be used with steam, air, gaseous and liquid media.

The pressure switches are fitted with single-pole changeover switch (SPDT). The position of the switch depends on the setting of the pressure switch and the pressure in the connector.

Approvals

UL listed for USA and Canada according to UL 353 and UL 873.

CE marked in accordance to EN 60947-4/05 .

Ordering

Pressure switches, type KP

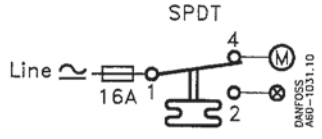
Type	Range [psig]	Differential [psi]	Reset	Pressure connection	Max. operating pressure [psig]	Min. burst pressure [psig]	Code nos
KP 34	2....15	2....6	Autmatic	¼" 18 NPT	58	435	**060-214966**
KP 34	2....15	3 fixed	Manual		58	435	**060-214866**
KP 35	6....50	6....32	Automatic		145	1015	**060-215166**
KP 35	6....50	7 fixed	Manual		145	900	**060-215066**
KP 36	15....150	10....58	Automatic		245	1015	**060-214466**
KP 36	15...150	10 fixed	Manual		245	1015	**060-214566**
KP 37	58....300	26....45	Automatic		405	1450	**060-214666**
KP 37	58....300	43 fixed	Manual		405	1450	**060-214766**

Technical data

Ambient temperature
-40 to 150 °F (175 °F for short period of time)
Media temperature
-40 to 212 °F
Parts in contact with medium:
Bellows: stainless steel
Pressure connection: free-cutting steel, nickel plated
Enclosure
NEMA 1
Wire dimension
12 AWG max

Contact system
Single pole changeover switch (SPDT)
Contact material AgCdO
Contac load
Alternating current
FLA = 16 A @ 120 Vac
8 A @ 240 Vac
LRA = 96 A @ 120 Vac
48 A @ 240 Vac
Direct current
240 VDC: 12W pilot duty
Cable entry
Integral ½ in. female NPSM swivel cable connector, allows direct attachenments of ½ in. male pipe thread connector

Contact system and application

Switch type - single pole double throw	Switch action	Application
	1. Terminals 1 - 4 close high and open low Terminals 1 - 2 can be used as low pressure alarm 2. Terminals 1 - 2 open high and close low Terminals 1 - 4 can be used as high pressure alarm	1. Low pressure cut-out 2. High pressure cut-out

Setting

Cut-in and cut-out pressures of the system should always be checked with an accurate pressure gauge.

Pressure setting for switches with automatic reset.

Set the cut-out pressure on RANGE scale and differential on DIFF scale.
Note:
Restart pressure is equal to cut-out pressure minus differential value.

Pressure switches with manual reset

Set the cut-out pressure on the RANGE scale. Pressure limiters can be manually reset by pressing reset button when the pressure is equal to the cut-out pressure minus fixed value of the differential.

Terminology

Set point
A predetermined value to which a switch is adjusted and at which it performs its intended function.

Reset
1. Manual reset
A unit with manual reset can only be restored to operational mode by activation of the external reset button.
2. Automatic reset
A unit with automatic reset is restored to operational mode automatically.

Maximum working pressure
The maximum permissible pressure for safe functioning of a heating system or any of its part.

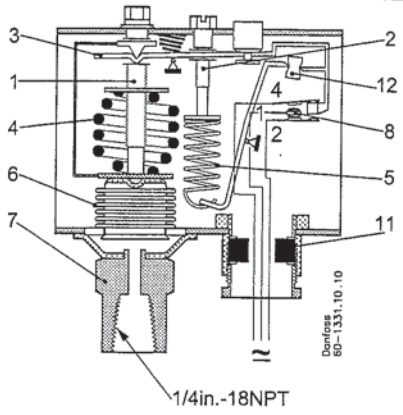
Snap function
A specific contact force is maintained until snap is initiated. The time over which contact force reaches zero is a few milliseconds; therefore, contact bounce cannot occur as a result, for example, of slight vibrations before cut-out.
The snap-action contact system will continue to function even when micro-welds are created between the contacts during cut-in.
The force created to separate the contacts is strong, and instantly shears off all contact surface welds that have been created as the result of cut-in action.
These design features ensure that the cut-out point of the KP switch remains very accurate and completely independent of the magnitude of the current load.

FLA -Motor Full Load Amperes
The current rating, in amperes, of the motor when a full load is applied to it for work being done.

LRA - Locked Rotor Amperes
The current drawn, in amperes, by an electric motor with the shaft or rotor stopped and locked in position.

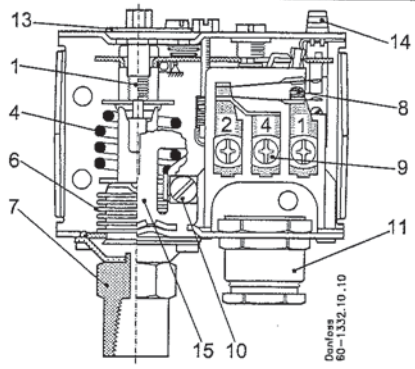
Design and function

1. Range setting spindle
2. Differential setting spindle
3. Main arm
4. Main spring
5. Differential spring
6. Bellows
7. Pressure connector
8. Contact system
9. Switch terminals
10. Ground terminal
11. Cable entry: ½ in. female cable gland
12. Tumbler
13. Locking screw
14. Manual reset
15. Distance plate



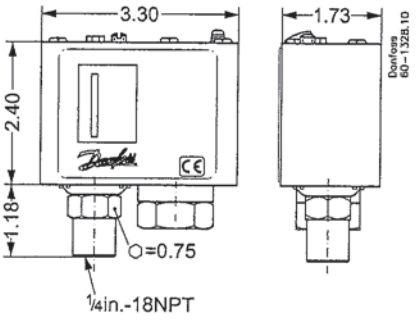
Key sketch of KP pressure switch

The contact system of KP switches has a snap-action function and the bellows moves only when cut-in or cut-out set point is reached.
The design has the following advantages:
- higher contact load
- ultra short bounce time
- long mechanical and electrical lifetime
- high resistance to vibrations and pulsations

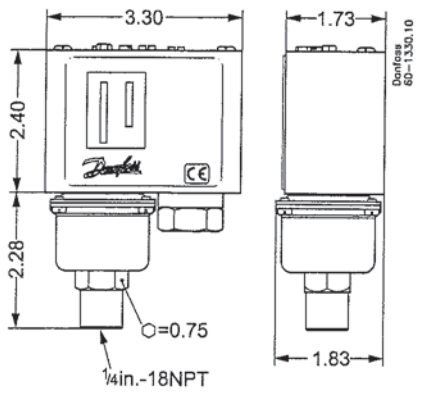


Simplified drawing of KP pressure switch without front cover and scale. Version with manual reset.

Dimensions and weight



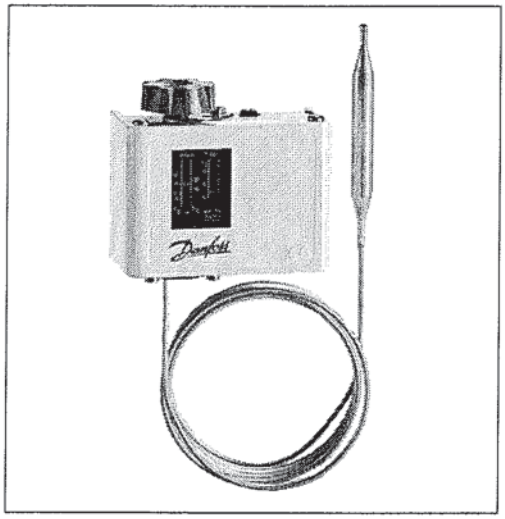
KP 35, KP 36 and KP37
(all dimensions in inches)
Approximate weight: 0.83 lb



KP 34 pressure switch
(all dimensions in inches)
Approximate weight: 0.9 lb

Data sheet **Temperature switches type KP79 and KP 81**

Features



- Wide regulating range
- Small dimensions
  Space saving, easy to install in panels
- Shock and impact resistant
- Ultra-short bounce time
- Snap action electrical contacts minimize chatter, bounce, and wear, and ensure long term electrical and mechanical reliability
- Electrical connection at front of the unit. Makes rack mounting easier and save space.
- Suitable for both alternating and direct current
- Screwed wiring, makes rewiring easy
- Manual trip allows electrical function test without the tools
- Version with automatic and manual reset available

Description

Danfoss KP temperature switches are used for regulating, monitoring and alarm systems in industry.
KP thermostats are temperature-operated electric circuit breakers. The thermostats are fitted with single-pole changeover switch (SPDT).

The position of the switch depends on the thermostat setting and sensor temperature.
A KP thermostat can be connected and switch to single-phase alternating current motors of up to 2 kW.

Approvals

UL listed for USA and Canada according to UL 353 and UL 873.

CE marked in accordance to EN 60947-4/-5 .

Ordering

Temperature switches, type KP

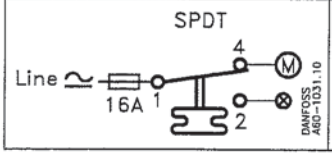
Type	Setting range [°F]	Differential [°F]	Reset function	Capillary tube length [in]	Max. sensor temperature [°F]	Code number
KP 79	122 to 210	9 to 27	Auto	80	300	**060L223866**
KP 79	122 to 210	10 fixed	Manual		300	**060L223966**
KP 79	140 to 240	9 to 27	Auto		300	**060L224266**
KP 79	140 to 240	10 fixed	Manual		300	**060L224366**
KP 81	176 to 240	9 to 45	Auto		480	**060L224066**
KP 81	176 to 240	16 fixed	Manual		480	**060L224166**

Technical data

Ambient temperature
-40°F to 150 °F (for short periods up to 175 °F)
Sensor material
Tinned copper Cu/Sn5
Contac system
SPDT – single pole double throw
Contact load
Alternating current
FLA = 16A @120 Vac
LRA = 96A @ 120 Vac
Direct current
240 Vdc: 12 W pilot duty

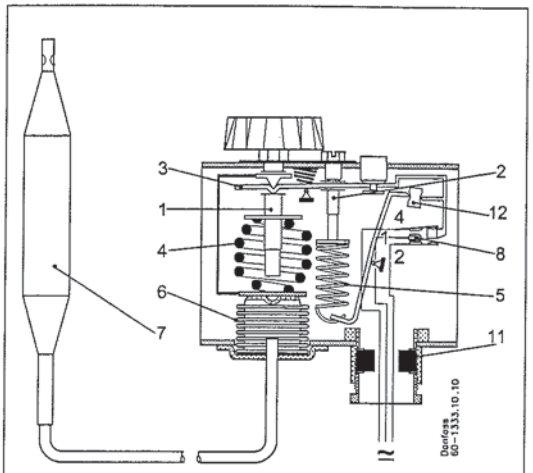
Cable entry
Integral ½ in. female NPSM swivel cable connector, allows direct attachenments of ½ in. male pipe thread connector
Wire dimension
12 AWG max
Enclosure
NEMA 1

Contact system and application

Switch type - single pole	Switch action	Application
SPDT 	1. Terminals 1 - 4 close high and open low Terminals 1 - 2 can be used as low temperature alarm 2. Terminals 1 - 2 open high and close low Terminals 1 - 4 can be used as high temperature alarm	1. Low temperature cut-out 2. High temperature cut-out

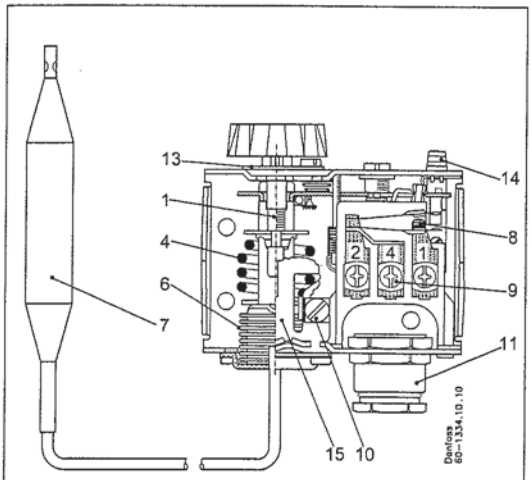
Design and function

1. Temperature setting spindle
2. differential setting spindle
3. Main arm
4. Main spring
5. Differential spring
6. Bellows
7. Temperature sensor
8. Contact system
9. Terminals
10. Ground terminal
11. Cable entry: ½ in. female cable gland
12. Tumbler
13. Locking screw
14. Manual reset
15. Distance plate



Key sketch of KP79, KP81 temperature switches

The contact system of KP switches has a snap-action function and the bellows moves only when cut-in or cut-out set point is reached. The design has the following advantages:
- higher contact load
- ultra short bounce time
- long mechanical and electrical lifetime
- high resistance to vibrations and pulsations



Simplified drawing of KP temperature switch without front cover and scale.
Version with manual reset.

Setting

Temperature switches with automatic reset

Set the cut-out temperature on the RANGE scale and differential on the DIFF scale.
Restart temperature is equal to the cut-out temperature minus differential value.

Please note that the differential scale is only a reference. The exact value of distances on the scale depends on where in its range the switch cut-in is set. Use the differential scale as a guide, and if precise function is required, establish the differential setting by comparing function with an accurate thermometer in the controlled zone.

Temperature switches with manual max. reset

Set the cut-out temperature on the range scale.
The differential is fixed.

Restart the system by pressing the reset button after the temperature of the sensor falls to a value equal to the range scale setting minus the fixed differential.

Terminology

Differential
The differential is the difference between the cut-in and cut-out temperatures.
The differential is necessary for satisfactory automatic operation of the controlled system.
Mechanical differential (intrinsic differential).
The mechanical differential is the differential set by the differential spindle.

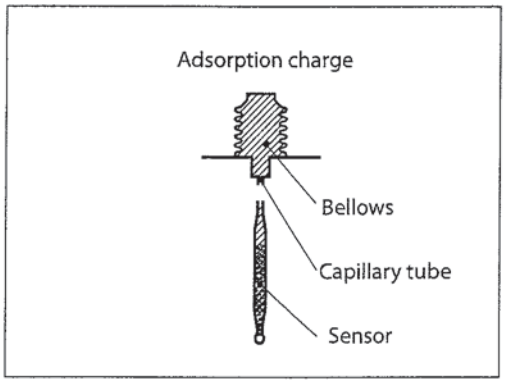
Snap function
A specific contact force is maintained until snap is initiated. The time over which contact force reaches zero is a few milliseconds; therefore, contact bounce due to vibration, for example, cannot occur at cut-out.
The snap-action contact system will continue to function even when micro-welds are created between the contacts during cut-in. The force created to separate the contacts is strong enough to instantly shear off all contact surface welds that may have been created by cut-in action.

Reset
1. Manual reset:
   units with manual reset can only be restarted after activation of the reset button. On max. reset units the set value is equal to cut-out value for rising temperature.
2. Automatic reset:
   These units are automatically reset after operational stop.

FLA - Motor Full Load Amperes
FLA is the largest current that a motor or other device is designed to carry at rated voltage and other specific conditions. Also often called current at rated conditions.

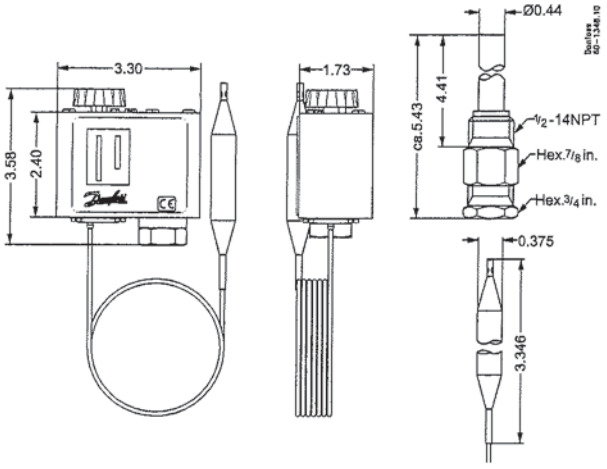
LRA - Locked Rotor Amperes
LRA is the current in amperes drawn by an electric motor with the shaft or rotor immobilized.

Charge



Sensors with adsorption charges contain a superheated gas together with a solid having a large adsorption surface. The sensor can be placed in zones that are warmer or colder than the switch housing and capillary tube, but variations of more than +70°F may influence scale accuracy.

Dimensions and weights

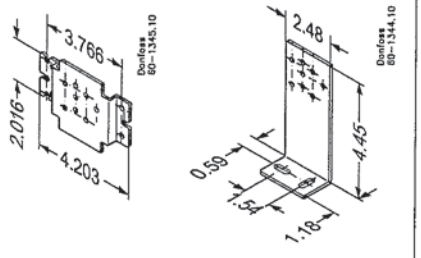
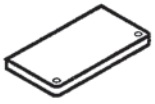
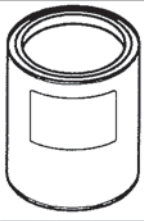


KP 79 and KP 81 temperature switches (all dimensions are in inches)
Approximate weight: 1.0lb

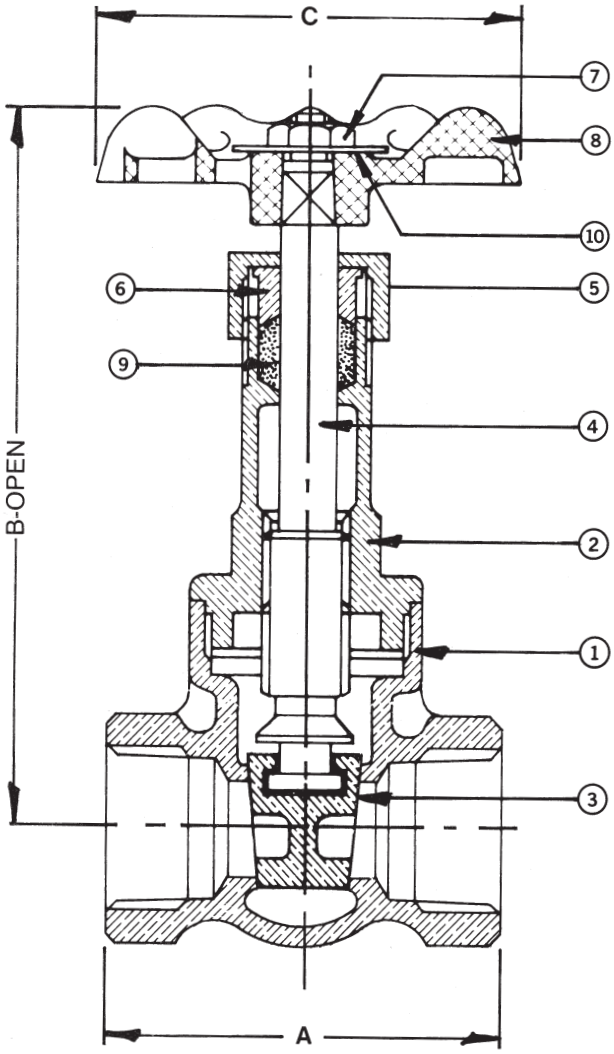
Sensor pocket for KP79/ KP81,
code no.: 017-437866

Sensor of KP79/ KP 81,
Material: tinned copper CuSn5

Accessories for KP pressure and temperature switches

Part	Symbol	Description	Code no.
Brackets with mounting screws and washers for pressure and temperature switches		Wall bracket Angle bracket 4 screws 10-32 UNC + 4 washers	**060-105266** **060-105366** **060-105166**
Top cover for pressure and temperature switches		When the bracket is mounted on the back plate of the housing, the grade of enclosure of the KP switch is IP 44. Top cover covers the setting spindles.	**060-109766**
Brass made sensor pocket for KP temperature switch		Sensor pocket, gasket and union nut to screw into ½ in. connector welded onto tubes, containers etc.	**017-437866**
Knob for KP temperature switch			**060-106366**
Heat conductive compound for KP temperature switches	Tube  Tin 	For temperature switches with sensor mounted in sensor pocket. Temperature range: –5F° to 300 F°: 1. 5g tube 2. 750 g tin	**041E0110** **041E0111**

GATE 148
BRONZE
125 lb. SWP-200 lb. WOG† • General Service
Solid Wedge Disc • Rising Stem
Threaded Bonnet • Gland Packed • Threaded Ends



4" size has split wedge and bolted bonnet. It is not covered in MSS SP-80.

SPECIFICATIONS

148	Conforms to: MSS SP-80. Type 2, Class 125, Threaded Ends.

MATERIAL LIST

NO.	PART	MATERIAL	SPECIFICATION
1	Body	Bronze	ASTM B 62
2	Bonnet	Bronze	ASTM B 62
3	Wedge	Bronze	ASTM B 62
4	Stem	Bronze	ASTM B 62
5	Stuff Nut	Rod Br.	CA 360
6 [1]	Gland	Rod Br.	CA 360
7	Wheel Nut	Brass	Commercial
8	Handwheel	Mall. Iron	Commercial
9	Packing	Non-Asbestos	
10	Name Plate	Sh. Alum.	Commercial

[1] Not used on 1/2" and smaller.

DIMENSIONS - INCHES / MILIMETERS				
Units	**Size**	**A**	**B**	**C**
Inches	**1/4**	1 3/4	4 3/8	2
MM	**6.35**	44.45	111.13	50.80
Inches	**3/8**	1 13/16	4 3/8	2
MM	**9.53**	46.05	111.13	50.80
Inches	**1/2**	2	4 3/8	2
MM	**12.70**	50.80	111.13	50.80
Inches	**3/4**	2 1/8	5 27/32	2 1/2
MM	**19.05**	53.98	148.44	63.50
Inches	**1**	2 9/16	7 1/16	2 3/4
MM	**25.40**	65.10	179.40	69.85
Inches	**1 1/4**	2 25/32	8 25/32	3 1/8
MM	**31.75**	70.64	223.04	79.38
Inches	**1 1/2**	2 13/16	9 1/2	3 1/2
MM	**38.10**	71.45	241.30	88.90
Inches	**2**	3 5/16	11 1/2	3 3/4
MM	**50.80**	84.15	292.10	95.25
Inches	**2 1/2**	4 3/16	14 5/16	4 3/4
MM	**63.50**	106.38	363.55	120.65
Inches	**3**	4 5/8	16 5/8	5 1/4
MM	**76.20**	117.48	422.28	133.35
Inches	**4**	5 1/2	15 1/2	5 1/4
MM	**101.60**	139.70	393.70	133.35

† Non-Shock

INNOVATION IN EVERY VALVE

MILWAUKEE VALVE

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UNITED BRASS WORKS, INC.

714 S. Main St., Randleman, NC 27317

Tel: 800-334-3035 Fax: 800-498-4696 www.ubw.com

Model 62 Swing Check Valve

Complies with MSS-SP-80-97

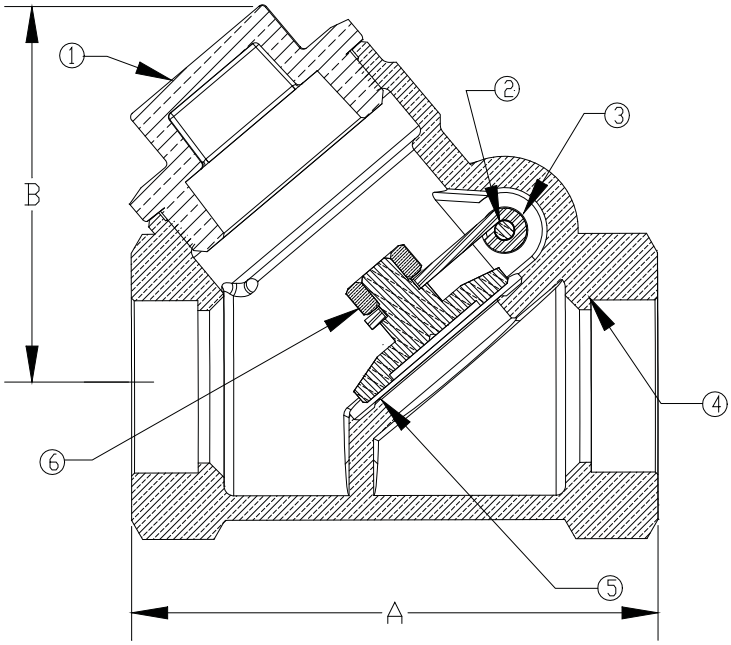
200WSP @ 406° Max
400 WOG
100% Pressure Tested
Threaded Ends

Install in horizontal position with cap in upright position. Not recommended for pulsating or vibrating service.

When used on Boiler feed line it is recommended that a #50T spring loaded check valve be used in conjunction with #62 with the #62 located nearest to the boiler and the #50T located nearest to the pump.

MATERIAL LIST

NO.	DESCRIPTION	MATERIAL
1	Cap (¼" – ¾") Cap (1" – 3")	Brass Bronze
2	Hinge Pin	Brass
3	Hinge	Stainless Steel
4	Body	Bronze
5	Disc	Bronze
6	Disc Nut	Brass



Size	¼"	3/8"	½"	¾"	1"	1 ¼"	1 ½"	2"	3"
A	2.38	2.53	2.66	3.09	3.53	5.13	5.13	5.56	9.13
B	1.53	1.53	1.53	1.88	2.09	3.63	3.63	4.56	5.58
Ship Wgt. (lbs.)	0.75	0.81	0.76	1.19	1.73	5.75	5.75	10.00	29.00
Qty. Per Ctn.	12	12	12	12	6	2	2	1	1

Water Gauges & Accessories

20-100 & 20-150 Series

Standard Pattern Bronze Water Gauges

Use for all types of liquid level verification; available with 3/8" or 1/2" NPT male pipe connections. Aluminum or plastic composition hand wheels; EPDM gauge glass gaskets standard. Other glass gaskets available.

- Ball checks standard on **20-150** models
- Equipped with two copper guard rods
- Standard 1/4" needle drain valve in lower arm
- Rated: 125 psig @ 350°F, 300 psig @ 100°F (See note!)
- CRN Registered

Model Number	Pipe Size (in.)	Glass O.D. & Length	Wt./100 (lbs.)	Wheel Type
20-101	3/8	5/8 x 10	145	ALUMINUM
20-102	3/8	5/8 x 10	145	COMPOSITION
20-104	1/2	5/8 x 12	160	ALUMINUM
20-105	1/2	5/8 x 12	160	COMPOSITION
20-150	1/2	5/8 x 12	160	ALUMINUM
20-151	1/2	5/8 x 12	160	COMPOSITION

Note: Service ratings are subject to pressure/temperature ratings of gauge glass and glass gaskets.

20-200, 20-250 & 25-200 Series

Heavy Pattern Bronze Water Gauges

All standard 20 Series features but with a heavier valve body pattern for higher service ratings.

- Available with 3/8", 1/2" and 3/4" MNPT fittings
- Ball checks standard on **20-250** models
- Polished finish on **25-200** valves
- Rated: 200 psig @ 400°F, 400 psig @ 100°F (See note!)
- CRN Registered

Model Number	Pipe Size (in.)	Glass O.D. & Length	Wt./100 (lbs.)	Wheel Type
20-201	3/8	5/8 x 10	185	ALUMINUM
20-202	3/8	5/8 x 10	189	COMPOSITION
20-204	1/2	5/8 x 12	205	ALUMINUM
20-205	1/2	5/8 x 12	205	COMPOSITION
20-207	3/4	3/4 x 16	270	ALUMINUM
20-208	3/4	3/4 x 16	270	COMPOSITION
20-250	1/2	5/8 x 12	195	ALUMINUM
20-251	1/2	5/8 x 12	200	COMPOSITION
20-253	3/4	3/4 x 16	355	ALUMINUM
20-254	3/4	3/4 x 16	360	COMPOSITION
25-201	3/8	5/8 x 10	180	ALUMINUM
25-202	3/8	5/8 x 10	185	COMPOSITION
25-204	1/2	5/8 x 12	190	ALUMINUM
25-205	1/2	5/8 x 12	190	COMPOSITION
25-207	3/4	3/4 x 16	290	ALUMINUM
25-208	3/4	3/4 x 16	295	COMPOSITION

Note: Service ratings are subject to pressure/temperature ratings of gauge glass and glass gaskets.

21 SERIES: ROUGH BRONZE WATER GAUGES WITH EXTENDED SHANK

OVERVIEW

Available with 3/8" or 1/2" MNPT connections; EPDM gauge glass gaskets and 1/4" needle drain valve in lower arm are both standard.

FEATURES

- 1-3/4" standard shank length
- **21-100** rated 125 psig @ 350°F, 300 psig @ 100°F
- **21-200** rated 200 psig @ 400°F, 400 psig @ 100°F (See note!)
- CRN Registered
- Equipped with two copper-plated steel guard rods

Part Number	Pipe Size (in.)	Glass O.D. & Length	Wt./100 (lbs.)	Wheel Type
21-104	1/2	5/8 x 12	185	ALUMINUM
21-105	1/2	5/8 x 12	197	COMPOSITION
21-150*	1/2	5/8 x 12	195	ALUMINUM
21-151*	1/2	5/8 x 12	207	COMPOSITION
21-204	1/2	5/8 x 12	215	ALUMINUM
21-205	1/2	5/8 x 12	219	COMPOSITION
21-250*	1/2	5/8 x 12	215	ALUMINUM
21-251*	1/2	5/8 x 12	215	COMPOSITION

** Automatic Model*
Note: Service ratings are subject to pressure/temperature ratings of gauge glass and glass gaskets.

OPTIONS

Suffix Number	Specification
-00	Standard gauge w/ standard glass & rod
-01	Top only
-02	Bottom only
-03	Standard gauge less glass & rod
-10	For special gauges w/ non-standard glass and rod lengths

WATER GAUGE & GAUGE GLASS INSTALLATION INSTRUCTIONS

INSTALLATION

Only properly trained personnel should install and maintain water gauge glass and connections. Remember to wear safety gloves and glasses during installation. Before installing, make sure all parts are free of chips and debris.

1. Apply thread sealant or tape to pipe threads. Install top gauge fitting (fitting without a drain valve) into the uppermost tapping. Wrench tighten the fitting until it is snug and the glass outlet is pointing at five o'clock (about 1/8 turn from its final downward vertical position).

2. Install the bottom gauge fitting (the fitting with a drain valve) until it is snug and the glass outlet is pointing directly upward.

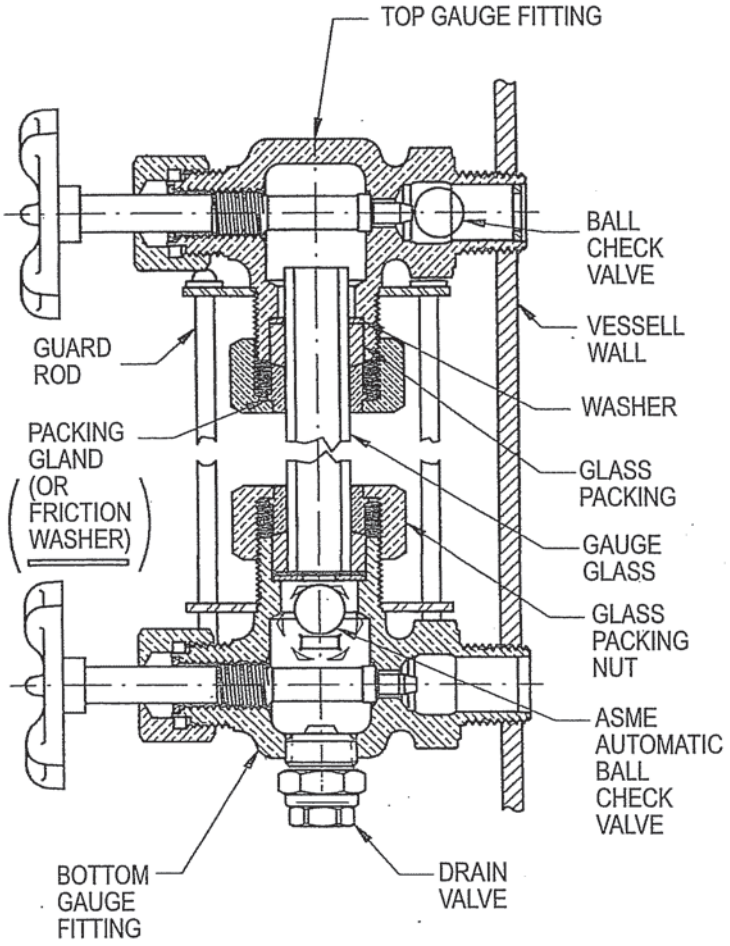
3. Remove glass packing nut, friction washer (or packing gland, depending on the model), and glass packing from each gauge fitting. Slide the packing nut, then friction washer or packing gland, then and glass packing onto each end of glass.

4. Gently inset one end of the glass into the top gauge fitting. Keeping the glass inside the top fitting, gently rotate the top gauge fitting clockwise until vertically aligned with the bottom gauge fitting, then insert glass into bottom fitting until glass bottoms out on the shoulder inside the bottom fitting.

5. Carefully raise glass about 1/16" and slide lower glass packing down until the glass packing contacts the lower gauge fitting. DO NOT allow the glass to remain in contact with any metal!

6. Carefully slide upper glass packing up as far as possible.

7. Hand tighten both glass packing nuts, then tighten 1/2 turn more by wrench. Tighten only enough to prevent leakage. DO NOT OVER TIGHTEN! If any leakage should occur, tighten slightly, a quarter turn at a time, checking for leakage after each turn.



24-350 SERIES

NOTE: NOT ALL WATER GAUGES ARE EQUIPPED WITH BALL CHECK VALVES

WARNING!

VALVE MUST BE USED IN THE FULLY OPEN POSITION FOR PROPER OPERATION OF BALL CHECK. FAILURE TO DO SO COULD RESULT IN BODILY INJURY AND/OR PROPERTY DAMAGE.

WARNING! This product contains chemicals known to the State of California to cause cancer and birth defects or other reproductive harm. (California law requires that this warning be given to the consumers in the State of California.).
For more information visit www.apollovalves.com.

THIS PRODUCT MEETS THE REQUIREMENTS OF THE EPA SAFE DRINKING WATER ACT.

WATER GAUGE GLASS

NOTICE: READ ALL WARNINGS AND INSTRUCTIONS BEFORE PERFORMING INSTALLATION OR MAINTENANCE.

WARNING!

SAFETY GLASSES AND GLOVES SHOULD BE WORN AT ALL TIMES WHEN WORKING WITH OR EXAMINING WATER GAUGE GLASS AND CONNECTIONS.

IMPROPER INSTALLATION OR MAINTENANCE OF GAUGE GLASS AND CONNECTIONS CAN CAUSE IMMEDIATE OR DELAYED BREAKAGE RESULTING IN BODILY INJURY AND/ OR PROPERTY DAMAGE.

USE AND CARE

DO NOT's

DO NOT use the glass if it contains any chips, or any other visible signs of damage.

DO NOT reuse any tubular glass or glass packings.

DO NOT subject gauge glass to bending or torsional stresses.

DO NOT over tighten glass packing nuts.

DO NOT allow glass to touch any metal parts.

DO NOT exceed the recommended pressure of the gauge or gauge glass.

DO NOT clean the gauge or gauge glass while pressurized or in operation.

"Apollo" Valves

Made In The USA

Manufactured by Conbraco Industries, Inc.
1418 S. PEARL ST.
PAGELAND, SC 29728
TELEPHONE (704) 841-6000
www.apollovalves.com

WATER GAUGE GLASS

DO's

DO verify proper gauge has been supplied.

DO examine gauge glass and packings carefully for damage before installation.

DO install protective guards and utilize automatic ball checks where necessary to help prevent injury in case of glass breakage.

DO inspect the gauge glass daily, keep maintenance records, and conduct routine replacements.

DO protect glass from sudden changes in temperatures such as drafts, water spray, etc.

MAINTENANCE

Examine the gauge glass regularly for any signs of clouding, scratching, erosion, or corrosion. The glass should be inspected daily until the need for replacement becomes apparent. This will help establish the routine inspection and routine replacement schedules.

CLEANING

Use commercial non-abrasive glass cleaners to keep the glass clean. Use diluted acids such as Hydrochloric (muriatic) acid when regular cleaners do not seem to work. Do not use wire brushes or any other abrasive materials which could scratch the glass.

INSPECTION

Examine the surface of the glass for scratches, corrosion, chips, cracks, surface flaws, or nicks. To do this, shine a very bright concentrated light at an angle of about 45 degrees. A defective glass will glisten as the light strikes imperfections. Glass which appears cloudy or roughened, and will not respond to cleaning, should be replaced.

STORING

Keep gauge glass in original packaging until ready to install.

Electronic Timer
Minuterie électronique
Elektronisches Zeitrelais
Temporizzatore elettronico
Temporizador electronico
Temporizador eletrônico

(Cat 700-HR52_ _, 700-HRT6_ _)

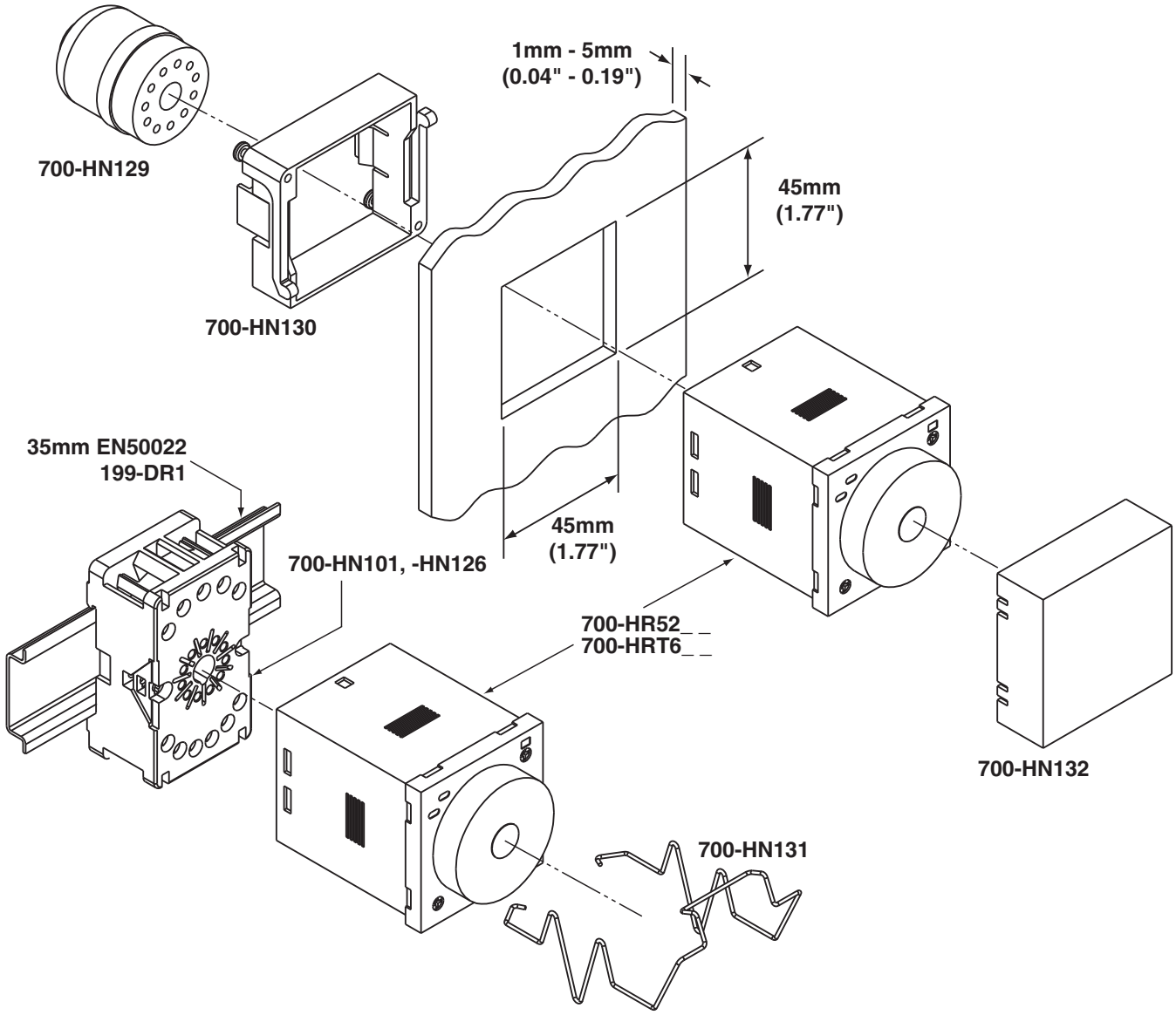
Attention: To prevent electrical shock, disconnect from power source before installing or servicing. Do not open the apparatus.

Attention: Avant le montage et la mise en service, couper l'alimentation secteur afin d'éviter tout accident. Ne pas ouvrir l'appareil.

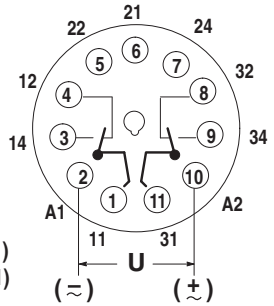
Achtung: Um Unfälle zu vermeiden, Installations- oder Servicearbeiten nur im spannungsfreien Zustand. Gehäuse niemals öffnen.

Attenzione: Per prevenire infortuni, togliere tensione prima dell'installazione o manutenzione. Non aprire l'apparecchio.

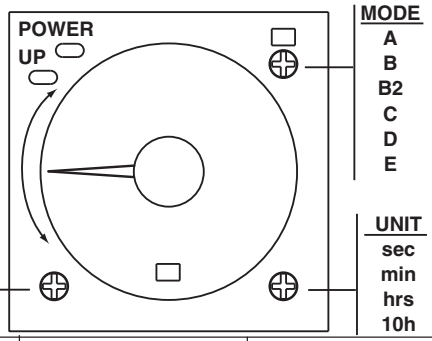
Atención: Desconectar la alimentación eléctrica antes de realizar el montaje y la puesta en servicio, con el objeto de evitar accidentes. No abrir el aparato.



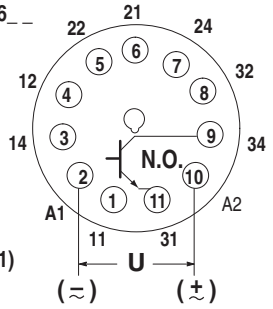
700-HR52_ _



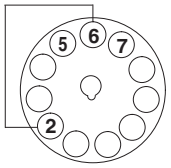
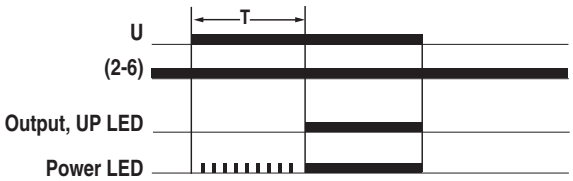
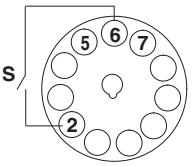
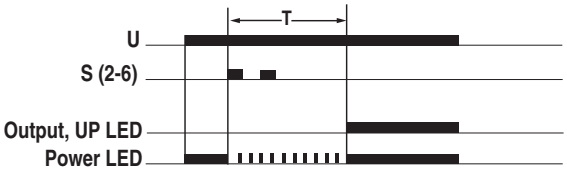
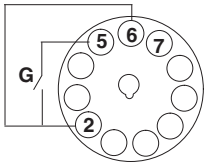
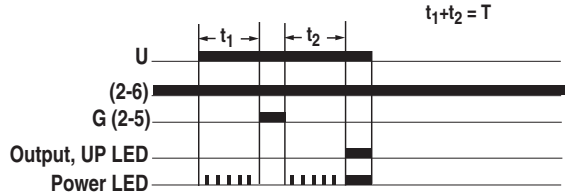
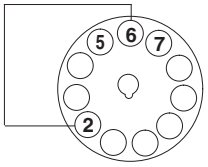
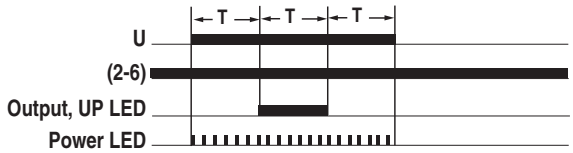
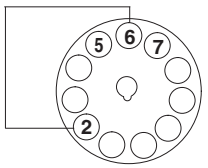
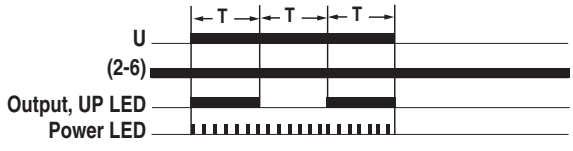
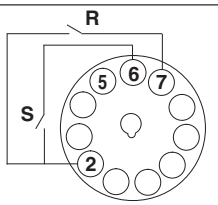
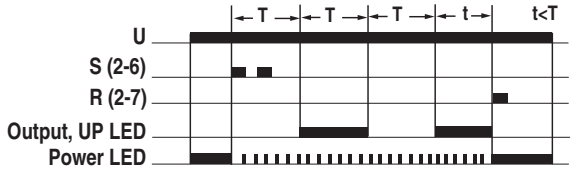
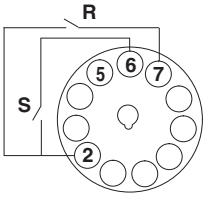
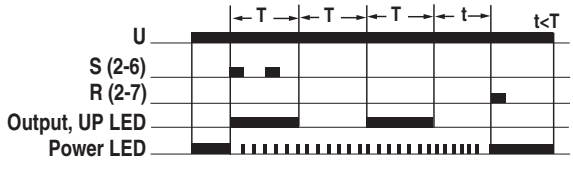
Output:
N.C. (1-4), (8-11)
N.O. (1-3), (9-11)



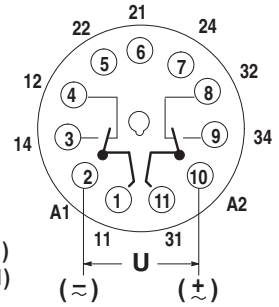
700-HRT6_ _



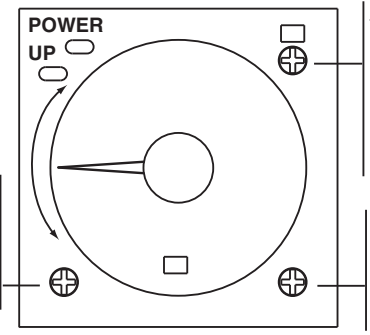
Output:
N.O. (9-11)

	Function Fonktion Funktion Funzione Função Función	Trigger Déclencheur Auslöser Trigger Disparador Disparador	0 Volt Signal Signal 0 Volt 0-Volt-Signal Segnale da 0 Volt Señal de 0 voltio Sinal de 0 Volt	Timing diagrams Séquences Funktionsablauf Schema funzionale Diagramas Diagrama
MODE A	On-Delay Début de temporisation Einschaltverzögerung Ritardo all'eccitazione Retardo de conexión Retardado	Power-On Tension Einschalter In corrente Conexión Ligado		
MODE A	On-Delay Début de temporisation Einschaltverzögerung Ritardo all'eccitazione Retardo de conexión Retardado	Signal-On Signal de début Signal ein Segnale attivo Señal encendida Sinal - ligado		
MODE A	On-Delay with Pause Début de temporisation avec pause Ausschaltverzögerung mit Unterbrechung Ritardo all'eccitazione con intermittenza Retardo de conexión con pausa Retardado com pausa	Signal-Off Signal d'arrêt Signal aus Segnale inattivo Señal apagada Sinal - desligado		
MODE B	Repeat Cycle, Off Start Répéter cycle, A l'arrêt Zyklus wiederholen, Aus/Ein Ripetizione ciclo di accensione Repetir ciclo, Inicio apagado Repetir Ciclo, Início Desligado	Power-On Tension Einschalter In corrente Conexión Ligado		
MODE B2	Repeat Cycle, On Start Répéter cycle, Au début Zyklus wiederholen, Ein/Aus Ripetizione ciclo di spegnimento Repetir ciclo, Inicio encendido Repetir Ciclo, Início Ligado	Power-On Tension Einschalter In corrente Conexión Ligado		
MODE B	Repeat Cycle, Off Start Répéter cycle, A l'arrêt Zyklus wiederholen, Aus/Ein Ripetizione ciclo di accensione Repetir ciclo, Inicio apagado Repetir Ciclo, Início Desligado	Signal-On Signal de début Signal ein Segnale attivo Señal encendida Sinal - ligado		
MODE B2	Repeat Cycle, On Start Répéter cycle, Au début Zyklus wiederholen, Ein/Aus Ripetizione ciclo di spegnimento Repetir ciclo, Inicio encendido Repetir Ciclo, Início Ligado	Signal-On Signal de début Signal ein Segnale attivo Señal encendida Sinal - ligado		

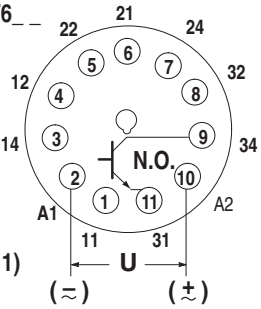
700-HR52_ _



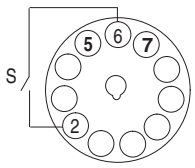
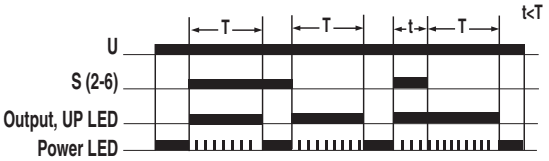
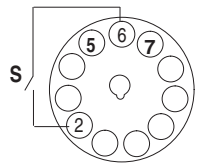
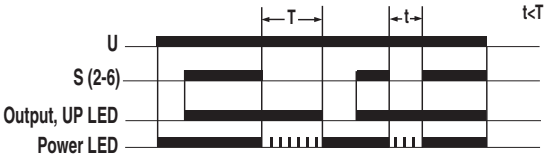
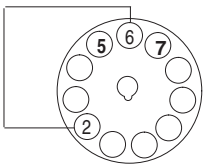
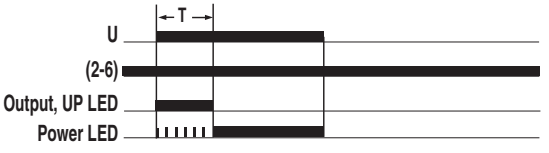
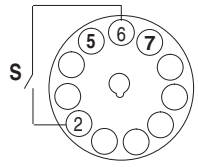
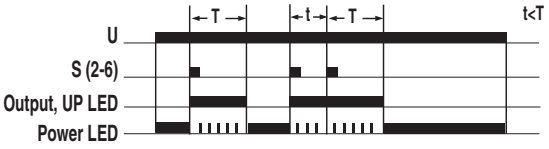
Output:
N.C. (1-4), (8-11)
N.O. (1-3), (9-11)



700-HRT6_ _

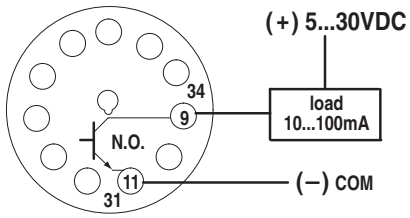


Output:
N.O. (9-11)

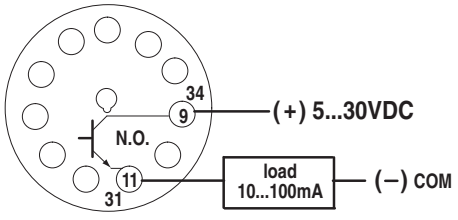
	Function Fonktion Funktion Funzione Função Función	Trigger Déclencheur Auslöser Trigger Disparador Disparador	0 Volt Signal Signal 0 Volt 0-Volt-Signal Segnale da 0 Volt Señal de 0 voltio Sinal de 0 Volt	Timing diagrams Séquences Funktionsablauf Schema funzionale Diagramas Diagrama
MODE C	Watchdog Monitor Surveillance Funktionsüberwachung Monitor di controllo Monitor de control Monitor do Controle de impulso à conexão	Signal-On/Off Signal Début/Arrêt Signal ein/aus Segnale attivo/inattivo Señal encendida/apagada Sinal - ligado/desligado		
MODE D	Off-Delay Arrêt de temporisation Ausschaltverzögerung Ritardo inattivo Retardo apagado Desligado - Retardo	Signal-Off Signal d'arrêt Signal aus Segnale inattivo Señal apagada Sinal - desligado		
MODE E	One-Shot Un coup Einzelimpuls Colpo singolo Un golpe Impulso à conexão	Power-On Tension Einschalter In corrente Conexión Alimentação - ligado		
MODE E	One-Shot Un coup Einzelimpuls Colpo singolo Un golpe Impulso à conexão	Signal-On Signal de début Signal ein Segnale attivo Señal encendida Sinal - ligado		

Cat 700-HRT6_ _
Transistor Output Connection
Connexion de sortie du transistor
Transistorausgangsanschluss
Connessione di uscita transistor
Conexión de salida de transistor
Connessione di uscita transistor

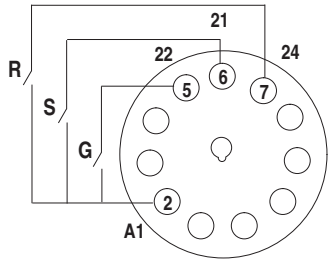
700-HRT6_ _ (Sinking)



700-HRT6_ _ (Sourcing)



Trigger Connection
Connexion du déclencheur
Auslöseranschluss
Connessione trigger
Conexión de disparador
Conexão do disparador



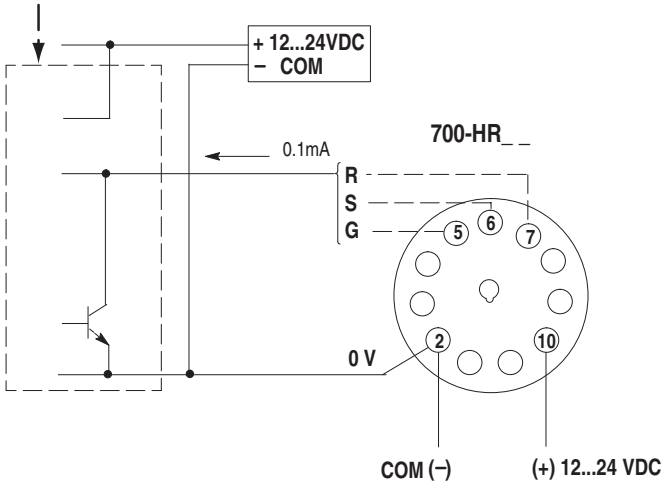
S - Starts timing cycle.
S - Lance le temps de transition
S - startet Taktgebungszyklus
S: avvia il ciclo di temporizzazione
S - Inicia ciclo de intervalos
S - Inicia o ciclo do temporizador

G (optional) - Gate provides a pause in timing cycle.
G (optionnel) - Crée une pause dans le temps de transition.
G (optional) - unterbricht den Taktgebungszyklus
G (facoltativo): determina una pausa nel ciclo di temporizzazione.
G (opcional) - Proporciona una pausa en el ciclo de intervalos.
G (opcional) - Proporciona uma pausa no ciclo do temporizador.

R (optional) - Resets timing cycle and returns output to shelf state / overrides S and G signal.
R (optionnel) - Réinitialise le temps de transition et fait passer la sortie à l'état de stockage / surcharge les signaux S et G.
R (optional) - setzt Taktgebungszyklus zurück und deaktiviert Ausgang / übersteuert Signal S und G
R (opzionale): azzera il ciclo di temporizzazione e riporta l'uscita allo stato dormiente/annulla i segnali S e G.
R (opcional) - Reinicia el ciclo de intervalos y devuelve la salida a al estado de almacenamiento / sobrecarga la señal S y G.
R (opcional) - Redefine o ciclo do temporizador e retorna a saída para estado de repouso / sobrecarrega o sinal S e G.

Solid-state Signal Inputs (R, S, G): Proximity switch, photoelectric switch, etc.
Entrées de Signaux à Semi-conducteurs (R, S, G): Commutatuer de proximit é commutatuer photo é lectrique etc.
Halbleiter-Signal-Eingänge (R, S, G): Näherungsschalter, photoelektrischer schalter, etc.
Entradas de Se ñal Transistorizadas (R, S, G): Conmutador de proximidad, conmutador fotoelectrico, etc.
Entradas de Sinal Transistorizados (R, S, G): Tomada de proximidade, tomada foto électrica, etc.
Entradas de estado sólido (R, S, G): Chave de proximidade, chave fotoelétrica etc.

NPN Wiring Diagram + 700-HR_ _ VDC supply



41063-204-01 (1)
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Rockwell Automation

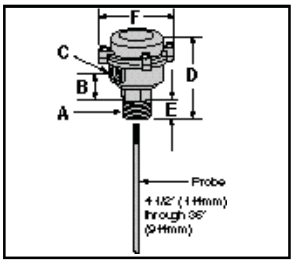
Series RS – High Pressure Sensors & Probes For Conductance Actuated Controls

Series RS Sensors

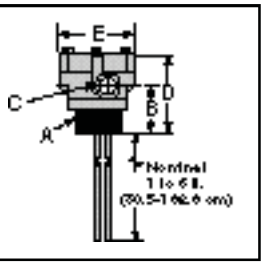
Series-RS-X-BR-1:

- NEMA 4X Enclosure
- For sophisticated multi-level control in tanks, boilers and hydronic systems
- Remote sensors, which thread into the top of the boiler or tank, are available with 1, 2, 3, 4 or 5 probes of varying lengths that can easily be cut to desired set points
- Probe lengths 12 - 72" (2.5 - 183cm) in 12" (2.5cm) increments (purchased separately)
- Control, remote sensor and probe(s) must be ordered separately. Order Spacer S-4 when 2 or more probes greater than 36" (914mm) will be used
- No blow down required
- Maximum Temperature 406°F (208°C)
- Maximum Pressure 250 psig (17.6 kg/cm)

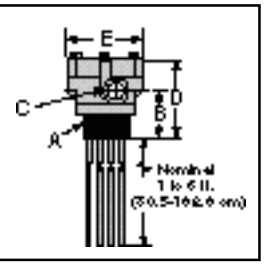
High Pressure Remote Sensor Model RS-1-BR-1



High Pressure Remote Sensor Model RS-2-BR-1 Model RS-3-BR-1



High Pressure Remote Sensor Model RS-4-BR-1 Model RS-5-BR-1



High Pressure Remote Sensors and Probes

Model Number	Part Number	Description	Weight lbs. (kg)
RS-1-BR-1	179524	Remote Sensor; 1 level	1.7 (.8)
RS-2-BR-1	179525	Remote Sensor; 2 levels	3.3 (1.5)
RS-3-BR-1	179526	Remote Sensor; 3 levels	3.3 (1.5)
RS-4-BR-1	179527	Remote Sensor; 4 levels	4.0 (1.8)
RS-5-BR-1	179528	Remote Sensor; 4 levels for non-metallic tanks	4.3 (1.95)

See page 73 for probe rods.

Dimensions, in. (mm)

Remote Sensor	A	B	C
1 Probe	1 NPT	$1\frac{11}{16}$ (43)	½ NPT
2 or 3 Probes	2 NPT	$2\frac{11}{32}$ (59.5)	½ NPT
4 or 5 Probes	2½ NPT	$2\frac{15}{32}$ (63)	½ NPT

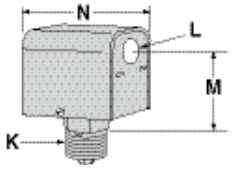
Remote Sensor	D	E	F
1 Probe	$4\frac{9}{16}$ (116)	$1\frac{1}{4}$ (32)	$3\frac{1}{4}$ (83)
2 or 3 Probes	$3\frac{7}{8}$ (98)	4 (102)	–
4 or 5 Probes	4 (102)	4 (102)	–

RS-1-HP

Series-RS High Pressure Remote Sensor:

- NEMA 1 Enclosure
- Maximum Temperature 406°F (208°C)
- Maximum Pressure 250 psig (17.6 kg/cm)
- For single sensor applications with high-pressure environments. Requires additional probe rod. See page 73.

Remote Sensor Model RS-1-HP



Ordering Information

Model Number	Part Number	Description	Weight lbs. (kg)
RS-1-HP	176199	High pressure remote sensor	0.5 (.23)

Dimensions, in. (mm)

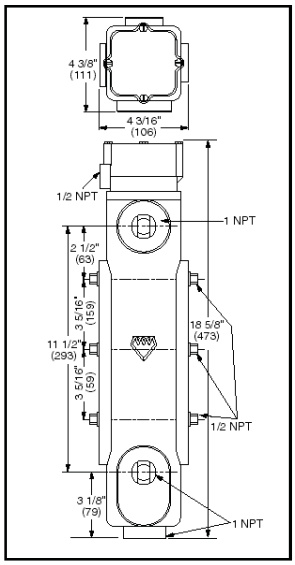
Model	K	L	M	N
RS-1-HP Remote Sensor	⅜ NPT	⅞ (22)	3 (80)	$3\frac{3}{8}$ (86)

Sensors – High Pressure

Series 750B-C3 Chamber
with 3 Probes

Series 750B-C4 Chamber
with 4 Probes

Remote Chamber



Specifications Chamber

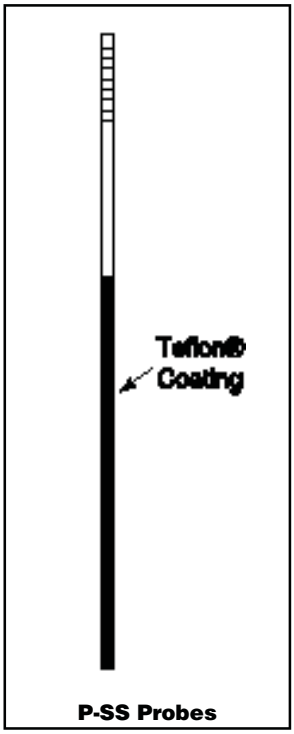
- NEMA 4X chamber enclosure and listed
- Maximum steam pressure 250 psig (17.6 kg/cm²)
- Designed for use with the Series 750B remote mount control module to make a complete system for level control in a boiler or other vessel. See page 78.

Ordering Information

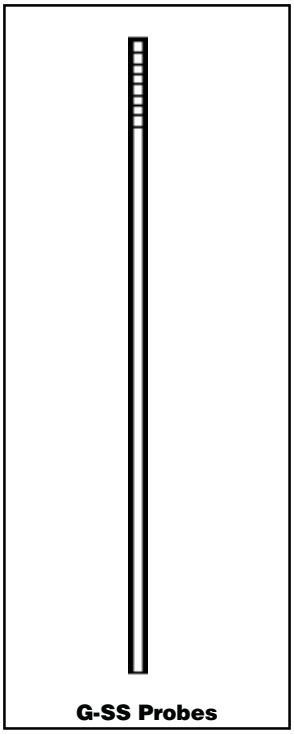
Model Number	Part Number	Description	Weight lbs. (kg)
750B-C3	176316	Cast iron chamber w/3 probes	26 (11.8)
750B-C4	176317	Cast iron chamber w/4 probes	26 (11.8)

Probe Rods

- Stainless steel - Series 316 material
- Teflon® coated probe ends provide protection from false signals [available on 24-72" (610 - 1829mm) probes]
- For use with RS sensors



P-SS Probes



G-SS Probes

Ordering Information

Model Number	Part Number	Description	Weight lbs. (kg)
G-2-SS	179156	24" (610mm) Ground Probe	1.0 (.5)
G-3-SS	179157	36" (914mm) Ground Probe	1.5 (.7)
G-4-SS	179158	48" (1219mm) Ground Probe	2.0 (.9)
G-5-SS	179159	60" (1524mm) Ground Probe	2.5 (1.1)
G-6-SS	179160	72" (1829mm) Ground Probe	3.0 (1.4)
P-⅓ SS	176208	4½" (114mm) Probe	0.5 (.23)
P-1-SS	179530	12" (305mm) Probe	0.5 (.23)
P-2-SS	179535	24" (610mm) Probe w/Teflon®	1.0 (.5)
P-3-SS	179540	36" (914mm) Probe w/Teflon®	1.5 (.7)
P-4-SS	179545	48" (1219mm) Probe w/Teflon®	2.0 (.9)
P-5-SS	179550	60" (1524mm) Probe w/Teflon®	2.5 (1.1)
P-6-SS	179555	72" (1829mm) Probe w/Teflon®	3.0 (1.4)

Selecting control according to anticipated use, the sensor should be selected according to the number of probes required. The probe rods are ordered separately according to length needed. The control, sensor and each probe rod must be specified separately, using the appropriate model and part numbers.

ProtoDesign Inc.

50495 Corporate Dr. Suite 106 Utica MI. 48315
Phone: 586-739-4340 Fax: 586-739-4341

INSTALLATION & OPERATING INSTRUCTIONS FOR THE FW CONTROL

Trained personnel should use this document as a guide to installing the ProtoDesign feed water control. Follow necessary wiring practices as defined by the national electric code (NEC). Installation or selection of equipment should always be accompanied by trained technical personnel. Reset and probe wires runs should be separated from high voltage wire runs.

SPECIFICATIONS:

Ambient Operation Temp: 0 to 150 degree F.
UL Approval: UL353 – File# MH46954
Supply Voltage: 120/240 VAC 50/60 Hz. plus/minus 10% line variation.
Contact Ratings: SPDT, 10A, 1/3H.P. 120/240VAC. Rated 5 million cycles no load and 100,000 cycles rated load.
Power Consumption: 1.5VA
Wiring Terminals: Octal socket, all connections are #6-32 screws with pressure clamps. Open board design ¼" quick connects on high voltage and 3/16" quick connects on low voltage.
Probe wire distances: 7,500 feet maximum using MTW or THHN #14 or #16 AWG wire.

FEATURES:

Sensitivity: 4.7K ohms up to 1M optional. (26K ohms standard)
Falling level time delay: 0 to 60 seconds in 1 second increments.
Rising level time delay: 0 to 60 seconds in 1 second increments.
Relay energized indicator: LED indicates that the relay is energized.

OPERATION

Single Level Service - Direct Mode: When the liquid rises to the electrode on terminal **TB3**, the control energizes (LED will be lit). The control remains energizes until the liquid leaves the electrode de-energizing the load contacts (LED will not be lit).

Single Level Service - Inverse Mode: Same as "Direct Mode" except that when the liquid contacts the electrode, the contacts de-energize (LED will not be lit). When the liquid leaves the electrode the control energizes (LED will be lit).

Differential Service – Direct Mode: When the liquid rises to the high electrode on terminal **TB3**, the control energizes (LED will be lit). The control remains energizes until the liquid leaves the low electrode on terminal **TB4** de-energizing the load contacts (LED will not be lit).

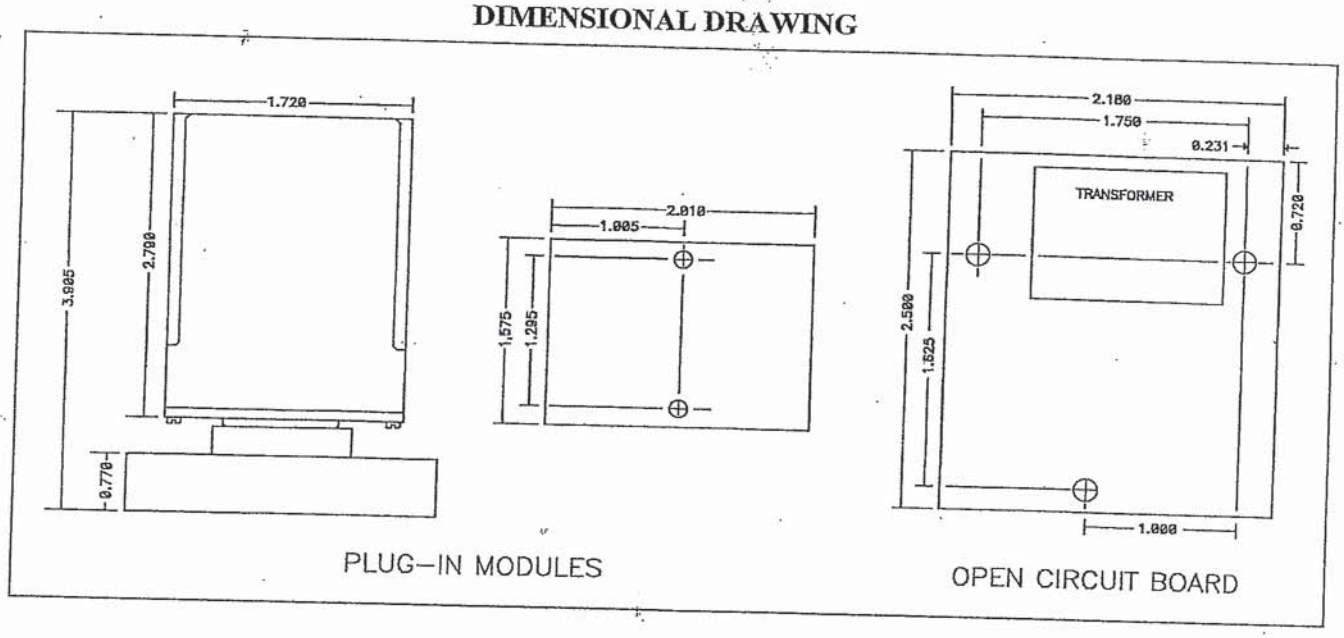
Differential Service – Inverse Mode: Same as "Direct Mode" except that when the liquid contacts the high electrode, the contacts de-energizes (LED will not be lit). When the liquid leaves the low electrode the control energizes (LED will be lit).

Time Delays: Rising level time delays begin upon liquid level contacting the high probe. Falling level time delays begin upon leaving the low probe. Terminals **TB3** & **TB4** must be jumpered together to achieve time delays on both increasing and decreasing levels and just decreasing level.

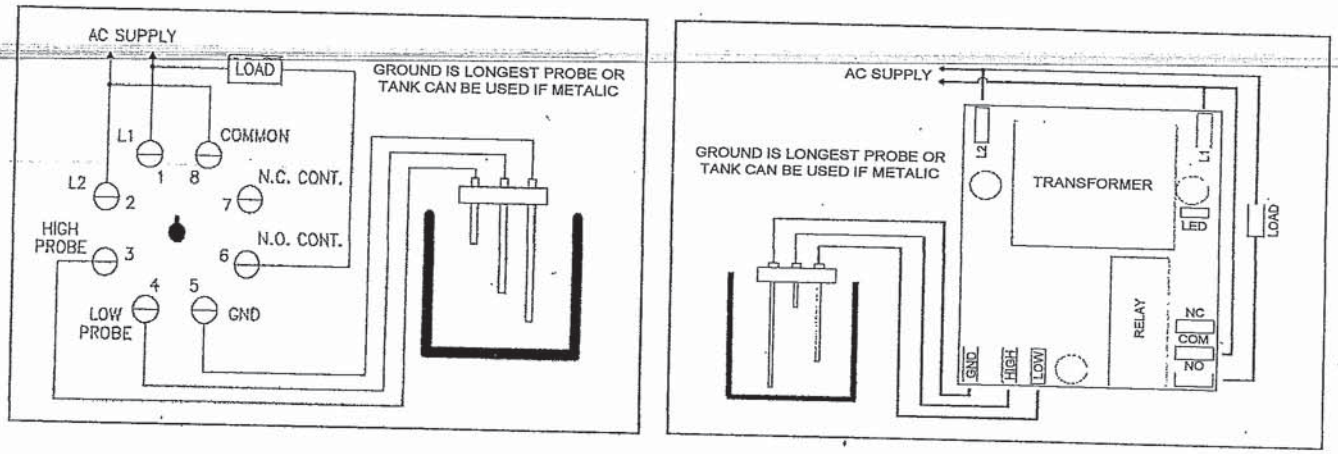
Maintenance Schedule

- Inspect probe annually for scale build-up and clean if necessary. Make certain there is no scale or build-up on the probe or its white insulator.
- Replace probe every 10 years. More frequent replacement of the probe is required if it is used in locales where significant water treatment is required, where more frequent cleaning is necessary, or in applications with high make- up water requirements.
- Replace the feed water control every 15 years.

DIMENSIONAL DRAWING



TYPICAL WIRING DIAGRAM



MODEL NUMBER DESIGNATION

FW – X – X – X – X – XX – XX

FALLING LEVEL DELAY
(00 – 60 SECONDS)

RISING LEVEL DELAY
(00 – 60 SECONDS)

MODE
A = DIRECT B = INVERSE

SUPPLY VOLTAGE
1 = 120VAC 2 = 240VAC

SENSITIVITY
A = 4.7K B = 10K C = 26K D = 50K
E = 100K F = 470K G = 1M

PACKAGE
1 = 8 PIN MODULE
2 = OPEN BOARD WITH STANDOFFS FOR 1/8" PANEL
3 = OPEN BOARD WITH STANDOFFS FOR 1/16" PANEL

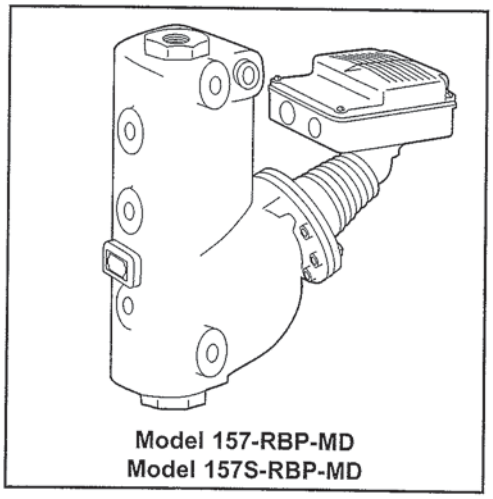
MODULE SOCKET: LCS – 8 = (FW SOCKET)

McDonnell & Miller

Model 157-RBP-MD
(Mercury Switch)

Model 157S-RBP-MD
(Snap Switch)

Low Water Cut-Off/Pump Controller

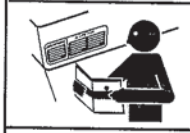


Model 157-RBP-MD
Model 157S-RBP-MD

Applications:

For bi-level pump control applications such as multiple boiler level operation.

⚠ WARNING



- Before using this product read and understand instructions.
- Save these instructions for future reference
- All work must be performed by qualified personnel trained in the proper application, installation, and maintenance of plumbing, steam, and electrical equipment and/or systems in accordance with all applicable codes and ordinances.
- To prevent serious burns, the boiler must be cooled to 80˚F (27˚C) and the pressure must be 0 psi (0 bar) before servicing.
- To prevent electrical shock, turn off the electrical power before making electrical connections.
- This low water cut-off must be installed in series with all other limit and operating controls installed on the boiler. After installation, check for proper operation of all of the limit and operating controls before leaving the site.
- We recommend that secondary (redundant) Low Water Cut-Off controls be installed on all steam boilers with heat input greater than 400,000 BTU/hour or operating above 15 psi of steam pressure. At least two controls should be connected in series with the burner control circuit to provide safety redundancy protection should the boiler experience a low water condition. Moreover, at each annual outage, the low water cut-offs should be dismantled, inspected, cleaned, and checked for proper calibration and performance.
- To prevent serious personal injury from steam blow down, connect a drain pipe to the control opening to avoid exposure to steam discharge.
- To prevent a fire, do not use this low water cut-off to switch currents over 7.4A, 1/3 Hp at 120 VAC or 3.7A, 1/3 Hp at 240 VAC, unless a starter or relay is used in conjunction with it.

Failure to follow this warning could cause property damage, personal injury or death.

OPERATION

Maximum Pressure: 150 psi (10.5 kg/cm^2)

Electrical Ratings
Float Control

Voltage	Pump or Motorized Valve Circuit Rating (Amperes)		Pilot Duty
	Full Load	Locked Rotor	
120 VAC	7.4	44.4	345 VA at 120 or 240 VAC
240 VAC	3.7	22.2	

Alarm Circuit Rating	
Voltage	Amps
120 VAC	1
240 VAC	1/2

Motor Horsepower	
Voltage	Amps
120 VAC	1/3
240 VAC	1/3

Probe Control (750BM-P-120-CI)

Voltage	Pump or Motorized Valve Circuit Rating (Amperes)	
	Full Load	Locked Rotor
120 VAC	7.2	43.2
240 VAC	3.75	21.6

Probe Sensitivity:
- 26,000 ohms

Probe Input Power
- 120 volts

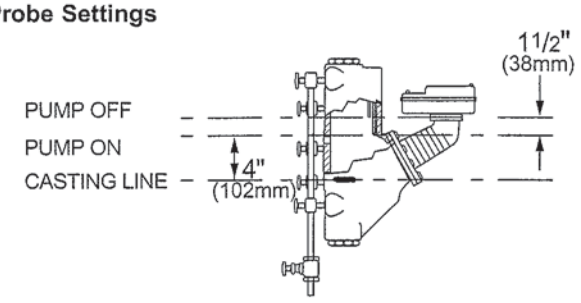
Settings and Differential Pressures:

* Values are ± 1/8" (3.2mm).

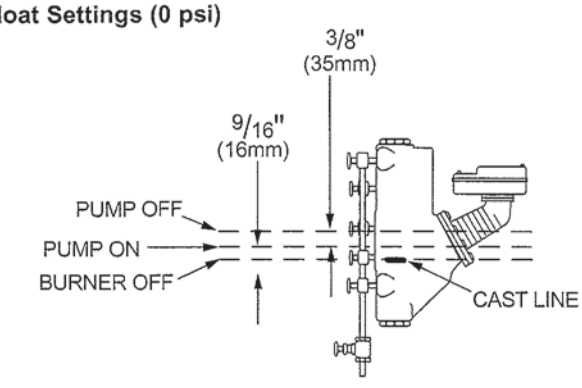
157-RBP-MD/157S-RBP-MD

Pressure	Setting	Approximate Distance Above Cast Line In. (mm)	Differential In. (mm)
Probes Any Pressure	Pump Off	5 1/2 (140)	1 1/2 (38)
	Pump On	4 (102)	
Float 0 psi (0 kg/cm^2)	Pump Off	15/16 (24)	3/8 (16)
	Pump On	9/16 (14)	
	Burner Off	0	N/A
Float 150 psi (10.5 kg/cm^2)	Pump Off	1 7/16 (37)	3/4 (19)
	Pump On	11/16 (17)	
	Burner Off	-3/8 (-16)	N/A

Probe Settings



Float Settings (0 psi)



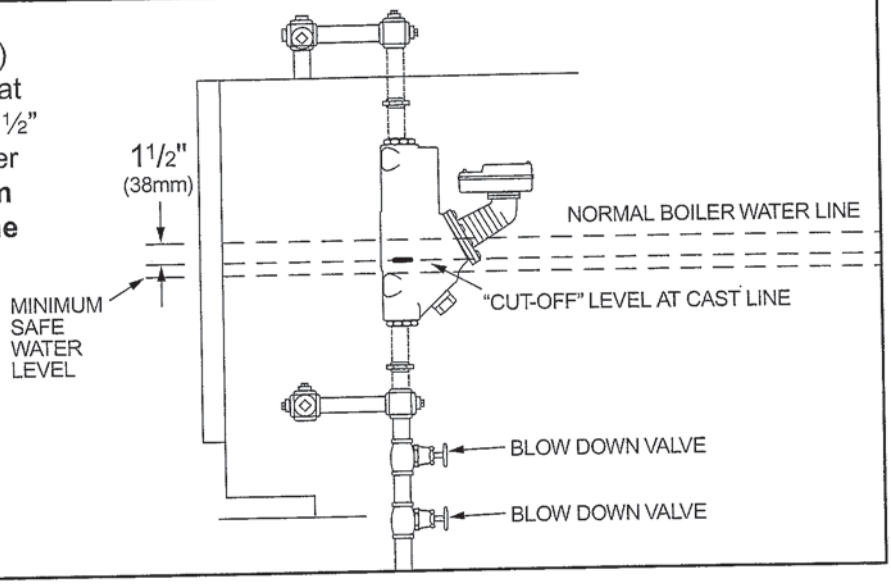
INSTALLATION –

TOOLS NEEDED:
Two (2) pipe wrenches, one (1) flathead screw driver, and pipe sealing compound.

IMPORTANT: Follow the boiler manufacturer's instructions along with all applicable codes and ordinances for piping, blow down valve and water gauge glass requirements.

STEP 1 - Determine the Elevation at Which the Low Water Cut-Off/Pump Controller Must be Installed

Size the steam (top) and water (bottom) horizontal equalizing pipe lengths so that the horizontal cast line on the body is 1½" (38mm) **below** the boiler's **normal** water level, **but not lower than the minimum safe water level, as determined by the boiler manufacturer.**



STEP 2 - Installing the Low Water Cut-Off

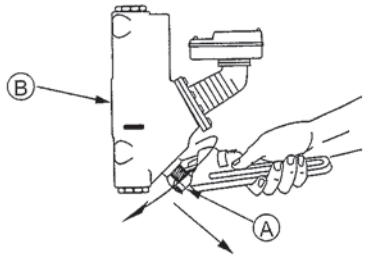
a. Using a pipe wrench, unscrew the plastic float blocking plug (A) from the float block tapping of the low water cut-off body (B).

Install pipe plug (provided) to seal port.

⚠ CAUTION

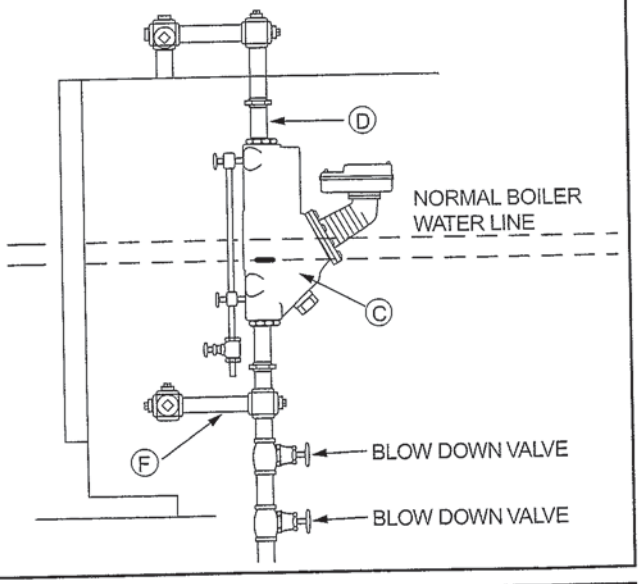
The plug must be reinstalled before control is shipped installed on the boiler, and removed when boiler is installed after shipment.

Failure to follow this caution may damage float and operating mechanism



b. Mount and pipe the low water cut-off (C) on a vertical equalizing pipe (D) at the required elevation level, as determined in Step 1.

Install full ported blow down valves directly below the lower cross of the water equalizing pipe (F).



STEP 3 - Electrical Wiring

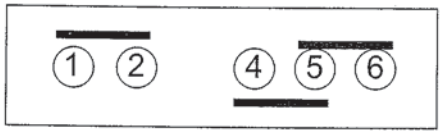
⚠ WARNING

- To prevent electrical shock, turn off the electrical power before making electrical connections.
- This low water cut-off must be installed in series with all other limit and operating controls installed on the boiler. After installation, check for proper operation of all of the limit and operating controls, before leaving the site.
- Modification of the switch assembly before or after installation could cause damage to the boiler and/or boiler system.
- Boiler manufacturer schematics should always be followed. In the event that the boiler manufacturer's schematic does not exist, or is not available from the boiler manufacturer, refer to the schematics provided in this document.

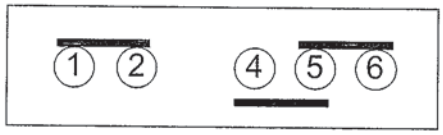
Failure to follow this warning could cause electrical shock, an explosion and/or a fire, which could result in property damage, personal injury or death.

Switch Operation - Float Control

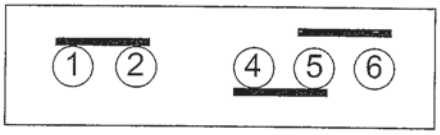
Boiler feed pump off, burner on, alarm off.



Boiler feed pump on, burner on, alarm off.

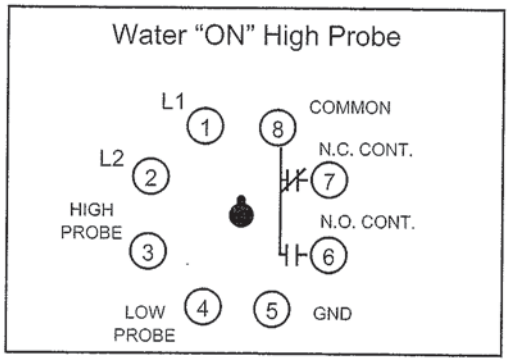


Boiler feed pump on, burner off, alarm on.

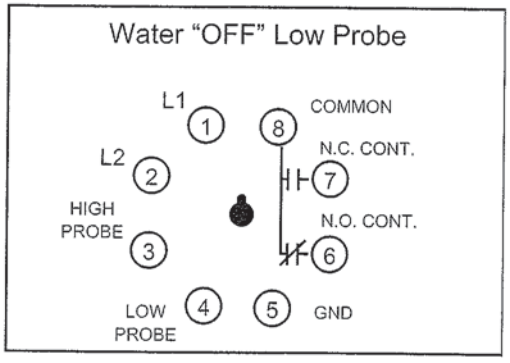


Switch Operation - Probe Control

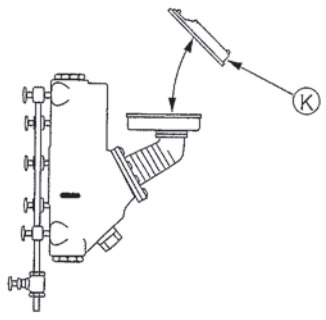
Water "ON" High Probe



Water "OFF" Low Probe



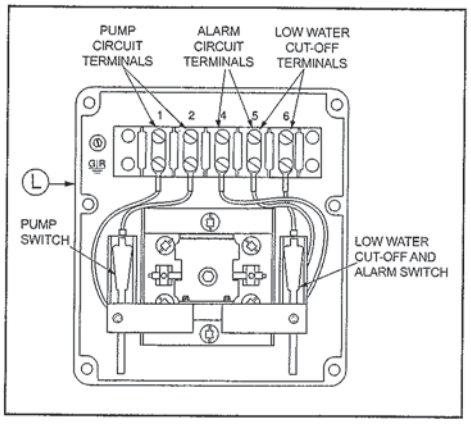
a. Using a flathead screwdriver, remove the junction box cover (K) by unscrewing the four (4) cover screws.



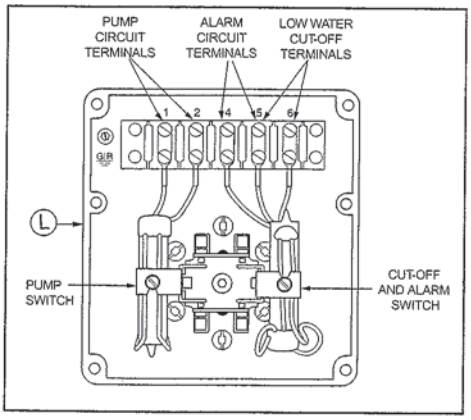
b. Following the appropriate wiring diagram, (refer to page 6) based on your application requirements, and using BX armored cable or Thinwall electrical metal tubing connector fittings, make electrical connections to the junction box (L).

IMPORTANT: There must be a minimum space of 1/2" (13mm) between connector fittings and electrical live metal parts.

Snap Switches (Series 150S)



Mercury Switches (Series 150)



Installation of 750BM-P-120-CI

- Mount 750BM module using 8 pin socket base (supplied by others) in **Boiler Electrical Panel**.

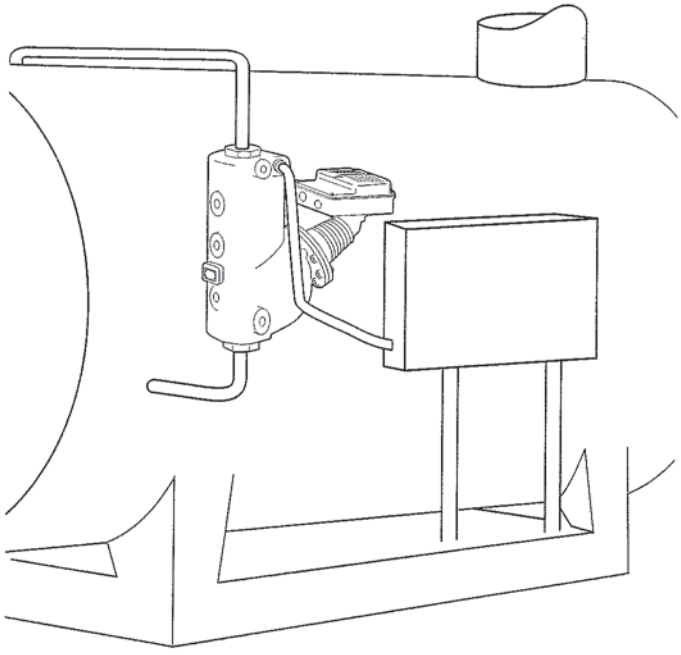
NOTE
Boiler sight glass must be visible from location of Control Box and must be within 25 feet of Control Body.

- Install electrical conduit between **Probe Housing** and **Boiler Electrical Panel.**

NOTE
Wire must be 18 AWG stranded with glass braided silicone jacket (UL 3071) suitable for high temperature (200˚C) service.

NOTE
Refer to and follow local codes and standards when selecting conduit and electrical fittings. Probe wires must be in their own conduit. If they are run in conduit with other wires, there may be interference that can affect the performance of the control.

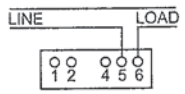
- Pull three (3) wires through conduit.



WIRING DIAGRAMS

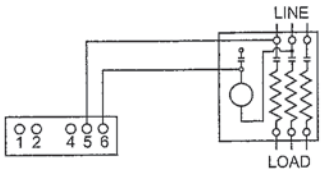
Low Water Cut-Off Only

1. Main Line Switch - For burner circuits within the switch's electrical rating.



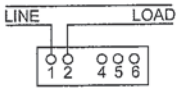
OR

2. Pilot Switch - To holding coil of a starter when the burner circuit exceeds the switch's electrical rating.



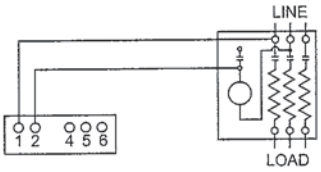
Pump Control Only

1. Main Line Switch - For pump motors within the switch's electrical rating.



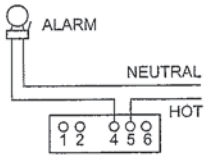
OR

2. Pilot Switch-To holding coil of a starter when the pump circuit exceeds the switch's electrical rating.



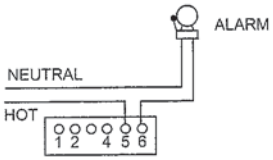
Alarm Circuit Only

1. Low Water Alarm



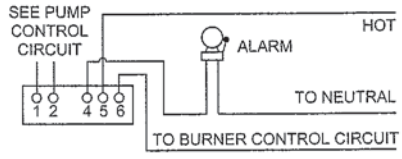
OR

2. High Water Alarm



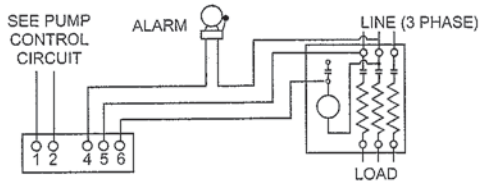
Combination Pump Control, Low Water Cut-Off and Alarm

1. Main Line Switch - For burner circuits within the switch's electrical rating.

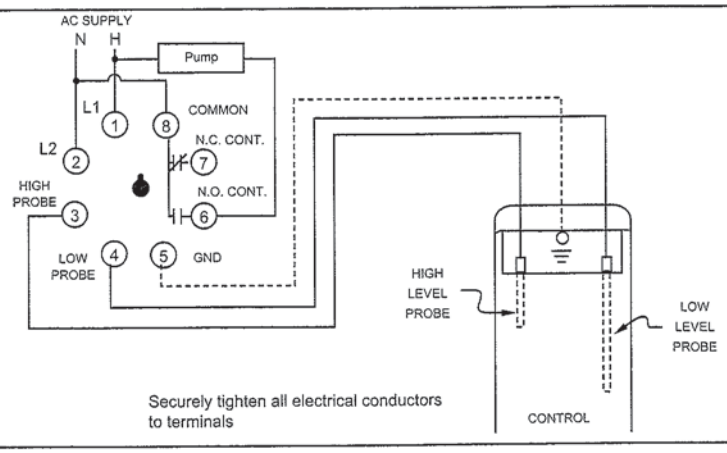


OR

2. Pilot Switch-To holding coil of a starter when the burner circuit exceeds the switch's electrical rating.



ELECTRONIC PROBES:



Securely tighten all electrical conductors to terminals

STEP 4 - Testing

This control is factory calibrated for specific level settings as shown on page 2 in the "Operation" section. The following testing procedure is only meant to serve as a verification of proper operating sequence.

IMPORTANT: Follow the boiler manufacturer's start-up and operating instructions along with all applicable codes and ordinances.

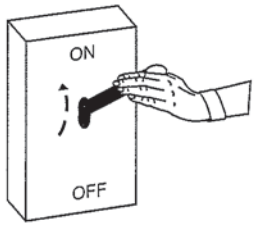
Standby Range Operation:

a. Turn on the electric power to the boiler. The pump should go on and the burner must remain off.

⚠ WARNING

If the burner comes on, immediately turn the boiler off and make the necessary corrections.

Failure to follow this warning could cause an explosion or fire and result in property damage, personal injury or death.

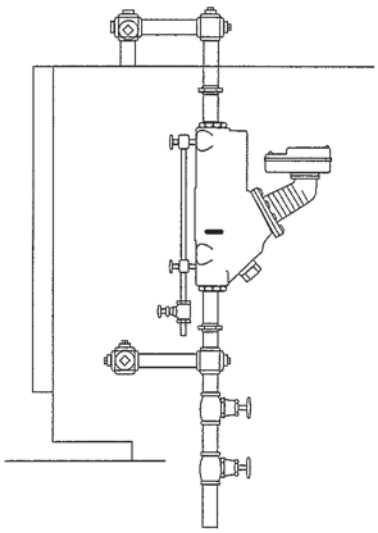


b. The boiler should begin to fill with water. As the water level rises in the sight glass, the burner should turn on and then the pump should turn off.
If the burner does not turn on or pump turn off at appropriate levels, immediately turn off the boiler and make the necessary corrections.

⚠ CAUTION

To prevent serious personal injury from steam pipe blow down, connect a drain pipe to the control opening to avoid exposure to steam discharge.

Failure to follow this caution could cause personal injury.



c. Blow down the control when the water in the boiler is at its normal level and the burner is on. **Slowly** open the upper then the lower blow-down valves and observe the water level fall in the sight glass. Close the valves (lower first then upper) after verifying that the pump contacts have closed and the burner shuts off. If this does not happen, immediately shut off the boiler, correct the problem and retest.

INSTALLATION COMPLETE

MAINTENANCE

SCHEDULE:

Blow down control as follows when boiler is in operation.

- **Daily if operating pressure is above 15 psi.**
- **Weekly if operating pressure is below 15 psi.**

NOTE
More frequent blow-down may be necessary due to dirty boiler water and/or local codes.

Disassemble and inspect annually.

- **Remove sediment or debris from float chamber.**
- **Inspect and clean probes.** Use a non-abrasive cloth to clean probes.

NOTE
The probes may need to be inspected and cleaned more frequently on systems with high raw water make-up. This includes systems with no condensate return or untreated boiler water.

Replace head mechanism every 5 years. More frequent replacement may be required when severe conditions exist such as rapid switch cycling, surging water levels and use of water treatment chemicals.

Replacement parts are available from your local authorized McDonnell & Miller Distributor. The use of parts or components other than those manufactured by McDonnell & Miller will void all warranties and may affect the units compliance with listing or regulating agencies.

BLOW DOWN PROCEDURE:

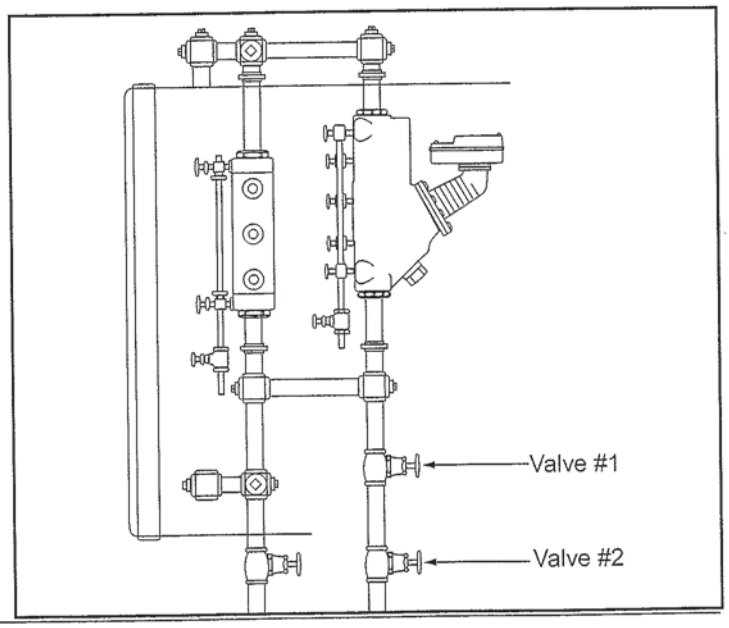
⚠ CAUTION
 **To prevent serious personal injury from steam pipe blow down, connect a drain pipe to the control opening to avoid exposure to steam discharge.** **Failure to follow this caution could cause personal injury.**

Blow down the control when the water in the boiler is at its normal level and the burner is on.

NOTE: Refer to page 2 for switch operating points.

- Open upper valve (#1).
- Slowly open the lower valve (#2).
- Water level in the sight glass should lower.
- As the water level in the sight glass lowers, the pump should turn on.
- As water continues to lower in the sight glass, the burner should turn off.
- Slowly close the lower valve (#2).
- Close the upper valve (#1).
- The water level in the sight glass should rise, first turning on the burner and then turning off the pump.

NOTE: On manual reset models, the reset button will need to be pressed after the water level has been restored before the burner will operate.



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BRYAN BOILERS

Bi-Level Pump Control Circuit
Sequence of Operation

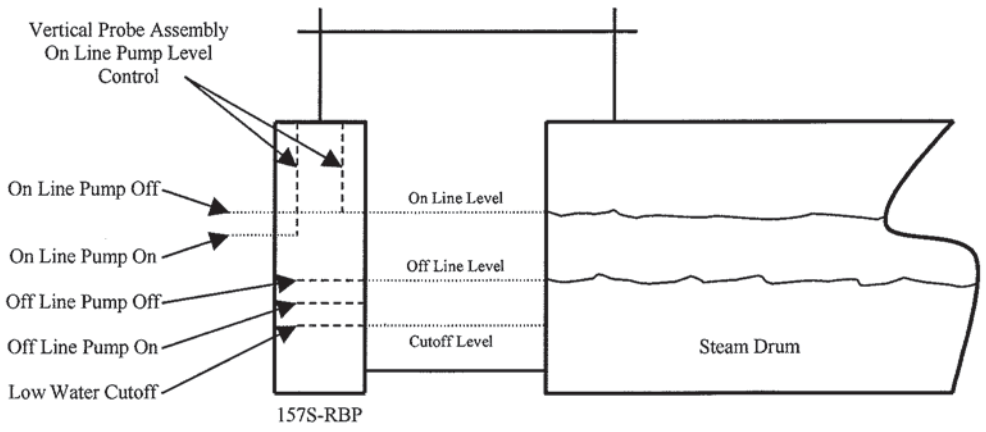
1. Description:

1.1. The Bryan Bi-Level Pump Control consists of:

1.1.1. A float type combination pump control and low water cutoff; plus

1.1.2. An additional vertically mounted probe type control assembly for on-line control of the boiler feed pump at a higher level.

1.1.3. All this is accomplished in the McDonnell Miller 157S-RBP controller which houses both float & probe control assemblies in the same body.



Water Level Detail

2. Purpose:

2.1. This special circuit design provides for control of the water level at two different points:

2.1.1. A low level fill point (as defined by the position of the combination pump control /low water cut-off for fill only during off cycles).

2.1.2. An operating (on-line) control level is from 4 to 5½ inches (dependent on boiler series) above the casting mark on the 157S-RBP. The position of the two vertically mounted probe rod lengths in the 157S-RBP casting define this control level.

2.1.3. Because the on-line level is widely separated from the low water cut-off level, there is no concern of nuisance shutdowns due to close differentials, excessive feed pump rates, or low feed water temperatures which halts the steam formation.

2.1.4. The boiler will always assume an immediate stand-by ready mode when the burner is shutdown by a limit or operating control. The level drop caused by shutdown does not result in a temporary low water condition often experienced on many water tube or other types of low water volume content boilers.

3. Sequence of Operation:

3.1. Operating Control Satisfied (Boiler Off)

3.1.1. The feed pump is controlled through the pump switch of the combination low water cutoff pump control. This fills the boiler to a level from 2 to 4 inches deep in the upper header.

3.2. Call for Heat (Boiler On)

3.2.1. A time delay relay is activated and begins timing when the operating control calls for steam. This allows sufficient time for the boiler to begin steaming and the associated rise in the water level due to the thermal expansion.

3.2.2. When the time delay relay has timed out, the on-line level controller (vertically mounted probes in the 157S-RBP) is introduced into the feed pump control circuit. This then causes the water level to be controlled at the higher (operating) level.

3.3. Boiler Shutdown

3.3.1. If the operating control or any limit control, or other control switch shuts down the boiler, the time delay relay is deactivated. This then restores feed pump control to the lower level control portion of the 157S-RBP.

ITT

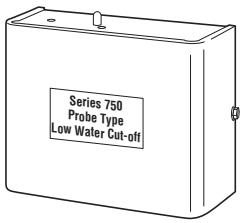
McDonnell & Miller

Installation & Maintenance Instructions
MM-213(F)

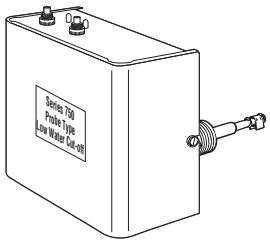
GUARDDOG®

U.S. Pat. No. 6,571,625

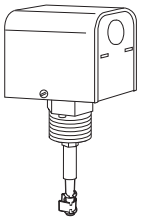
Series 750 Probe Type Low Water Cut-Offs with Remote Sensors



Series 750 Control Unit



Series 750P-MT Control Unit



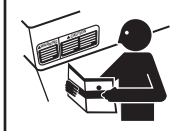
Remote Sensor Model RS-1-LP

Remote Sensor Model RS-1-BR-1

Applications:

- **Primary conductance type control for commercial or industrial hot water boilers with remote or integral sensing provisions.**
- **Secondary control for commercial or industrial steam boilers.**

⚠ WARNING

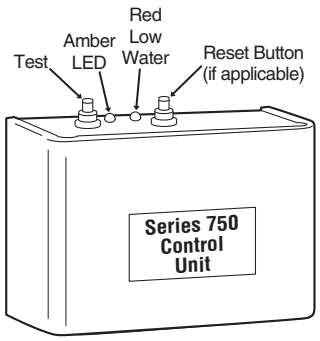


- **Before using product, read and understand instructions.**
- **Save these instructions for future reference.**
- **All work must be performed by qualified personnel trained in the proper application, installation, and maintenance of plumbing and electrical equipment and/or systems in accordance with all applicable codes and ordinances.**
- **Boiler manufacturer schematics should always be followed. In the event that the boiler manufacturer's schematic does not exist, or is not available from the boiler manufacturer, refer to the schematics provided in this document.**
- **To prevent serious burns, allow the control and surrounding equipment to cool to 80˚F (27˚C) and allow pressure to release to 0 psi (0 bar) before servicing.**
- **To prevent an electrical fire or equipment damage, electrical wiring insulation must have a rating of 167˚F (75˚C) if the liquid's temperature exceeds 180˚F (82˚C).**
- **This low water cut-off must be installed in series with all other limit and operating controls installed on the boiler. After installation, check for proper operation of all the limit and operating controls, before leaving the site.**
- **We recommend that secondary (redundant) Low Water Cut-Off controls be installed on all steam boilers with heat input greater than 400,000 BTU/hour or operating above 15 psi of steam pressure. At least two controls should be connected in series with the burner control circuit to provide safety redundancy protection should the boiler experience a low water condition. Moreover, at each annual outage, the low water cut-offs should be dismantled, inspected, cleaned, and checked for proper calibration and performance.**
- **When using mixed voltages, do not jumper from terminal 1 to terminal 3.**
- **To prevent electrocution, when the electrical power is connected to the control, do not touch the terminals, or electrical wires.**
- **To prevent electrical shock, turn off the electrical power before making electrical connections.**

Failure to follow this warning could cause property damage, personal injury or death.

SPECIFICATIONS

The Series 750 controls provide continuous protection against low water conditions for commercial and industrial applications. Newer models feature user-friendly diagnostic LEDs and increased probe sensitivity to prevent nuisance shut-downs.



Previous Models

Control Unit

Temperature Ratings:

Storage: -40˚F to 135˚F (-40˚C to 57˚C)
Ambient: 32˚F to 135˚F (0˚C to 57˚C)

Humidity: 85% (non-condensing)

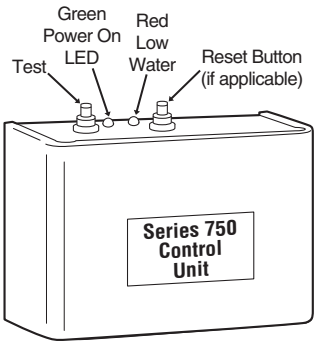
Electrical Enclosure Rating: NEMA 1 General Purpose

RS-1-BR1 Remote Sensor

Maximum Steam Pressure: 250 psi (17.6 kg/cm^2)
Maximum Water Pressure: 250 psi (17.6 kg/cm^2)
Maximum Water Temperature: 406˚F (208˚C)
Electrical Enclosure Rating: NEMA 1 General Purpose
Connection Size: 1” NPT

RS-1-LP

Maximum Steam Pressure: 15 psi (1.0 kg/cm^2)
Maximum Water Pressure: 160 psi (11.2 kg/cm^2)
Maximum Water Temperature: 250˚F (121˚C)
Electrical Enclosure Rating: NEMA 1 General Purpose
Connection Size: 3/4” NPT



Newer Models

PA-800 Probe (included with 750P-MT-120)
PA-800-U Probe (included with 750P-MT-U-120)
Maximum Steam Pressure: 15 psi (1.0 kg/cm^2)
Maximum Water Pressure: 160 psi (11.2 kg/cm^2)
Maximum Water Temperature: 250˚F (121˚C)
Connection Size: 3/4” NPT

Electrical Specifications

Model	Voltage	Motor Switch Rating (Amperes)		Pilot Duty
		Full Load	Locked Rotor	
120 VAC	120 VAC	7.2	43.2	125 VA at 120 or 240 VAC 50 or 60 Hz
	240 VAC	3.6	21.6	

Control Voltage: 120 VAC
Hz: 50/60
Control Power Consumption: 3 VA (max.)
Probe Sensitivity: 20,000 ohm

Automatic Reset Models

Whenever water is below the level of the probe, the control will go into a low water condition. When the water level has been restored, the control will automatically return to a run condition.

Manual Reset Models

If a low water condition occurs (water off probe), the manual reset button must be pressed once the water level is restored to a level above the probe.

CSD-1 Code Compliance

On Manual Reset units, if the control is in a low water condition (water off probe) when there is an interruption of power, the control will remain in a low water condition when power is restored. The reset button will need to be pressed when the water level is restored to a level above the probe.

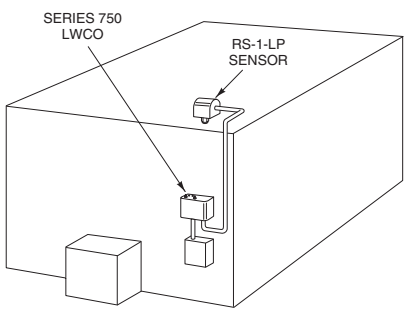
STEP 1 - Where to Install the Remote Sensors

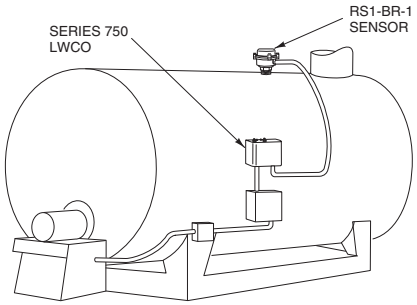
Determine where to install the remote sensor based on the following requirements:

a. The tip of the probe or extension **must be installed above the minimum safe water level,** as determined by the boiler manufacturer.

b. Probes must be installed vertically if they are more than 5" (127mm) long.

c. There must be a minimum 1/4" (6.4mm) clearance between the probe and any grounding surface inside the boiler.

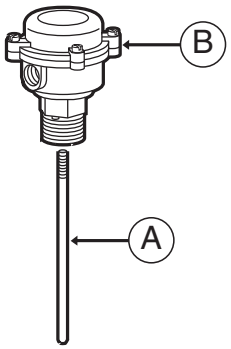




STEP 2 - Installing the Remote Sensor

For the Model RS-1-BR-1 sensors, only:

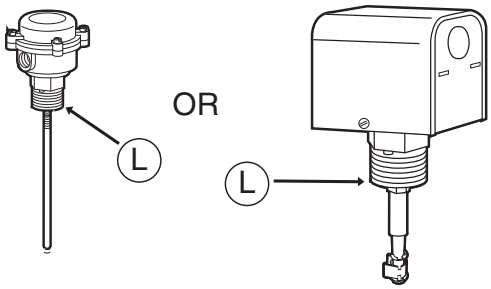
a. Cut the probe to desired length. Screw, clockwise, the threaded stainless steel probe extension (A) into the remote sensor (B). Carefully tighten the locking nut to approximately 1 ft•lb (1.7 N•m). Do not cut the clear plastic protective tube.



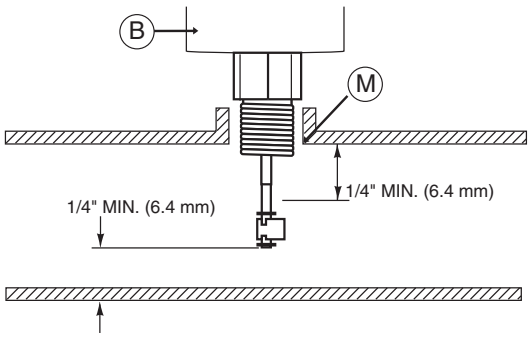
For All Remote Sensors

b. Apply a small amount of pipe dope to the first threads (L) of the remote sensor.

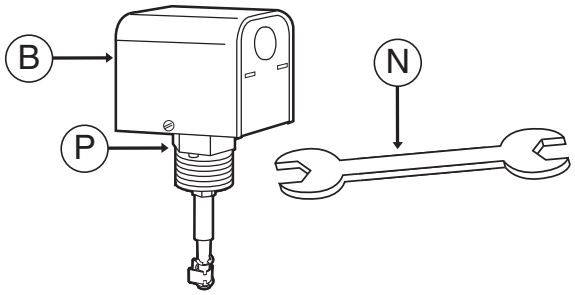
IMPORTANT: Do not use Teflon® tape or thread sealant.



c. Insert the remote sensor (B) into the boiler tapping (M) as determined in Step 1.

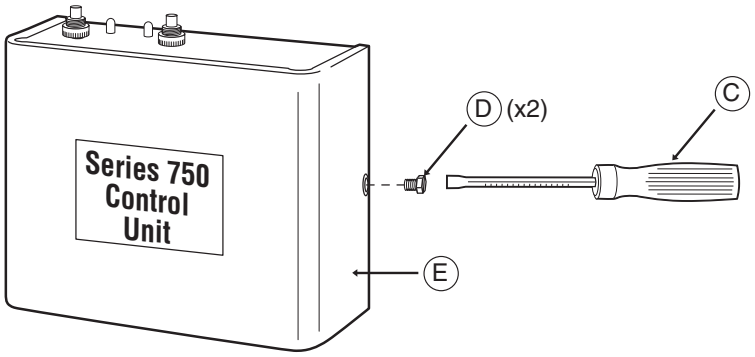


d. Using a wrench (N), tighten the brass hex adapter (P) on the remote sensor (B) to approximately 63 ft•lb (85 N•m). DO NOT TIGHTEN BY TURNING THE SENSOR HOUSING.



STEP 3 - Installing the Control Box

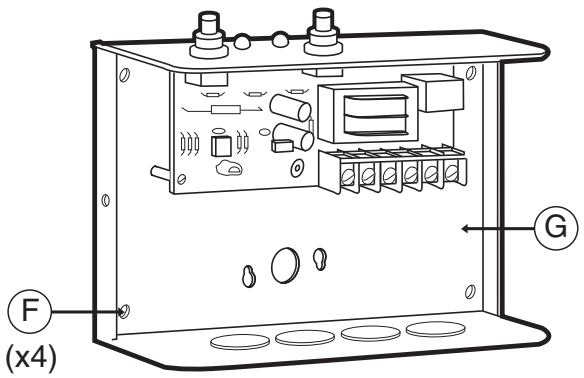
a. Using the flatblade screwdriver or nut driver (C), loosen the two (2) screws (D) and remove cover (E).



IMPORTANT: To protect control from damage caused by liquid or debris, mount as shown with buttons on top.

b. Using the four (4) 3/16" (4.8mm) mounting holes (F), attach the control (G) to the boiler jacket, entry plate, or other suitable location.

NOTE: Mounting hardware is not included.



STEP 4 - Locating and Installing the 750P-MT (Unimount)

a. Based on the following criteria locate a suitable position for the probe (A):

For all Applications:

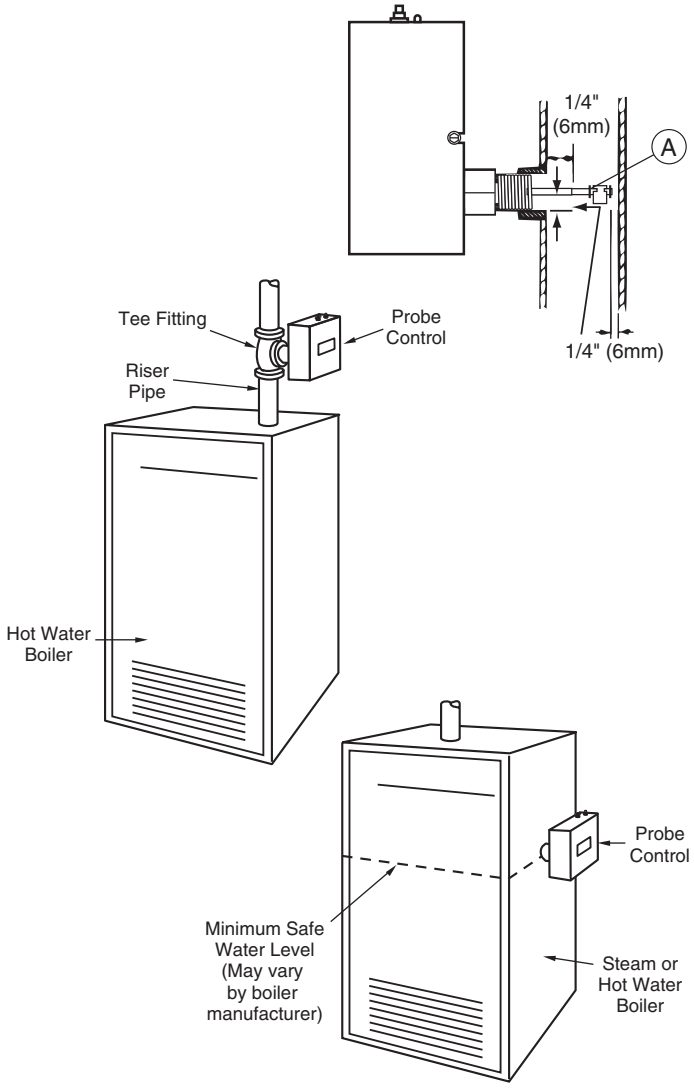
1. Make sure probe is installed above minimum safe water line as determined by the boiler manufacturer.
2. Make sure that ends and sides of the probe are at least 1/4” (6.4mm) from all internal metal surfaces.
3. Make sure the probe is positioned to shut off the boiler before the water level falls below the lowest visible part of the gauge glass.

For Steam Boilers:

1. Refer to boiler manufacturers instructions to determine suitable tapping for the probe.

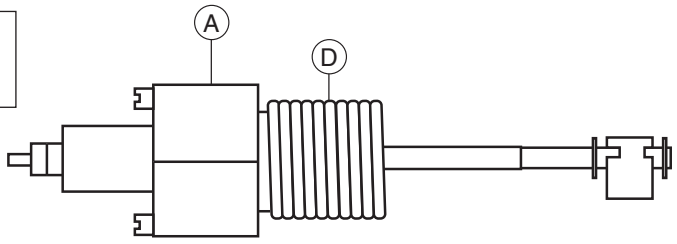
For Hot Water Boilers:

1. Refer to boiler manufacturers instructions to determine suitable tapping for the probe.
2. Locate probe in supply piping using a tee fitting.

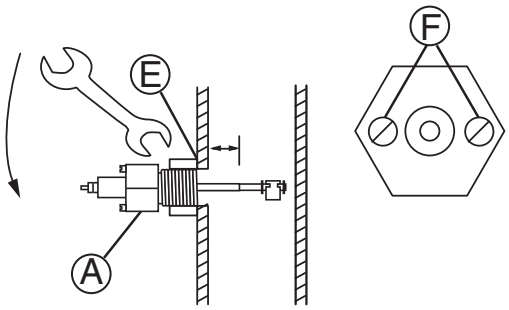


b. Apply a small amount of pipe dope to the first external threads (D) of the probe (A).

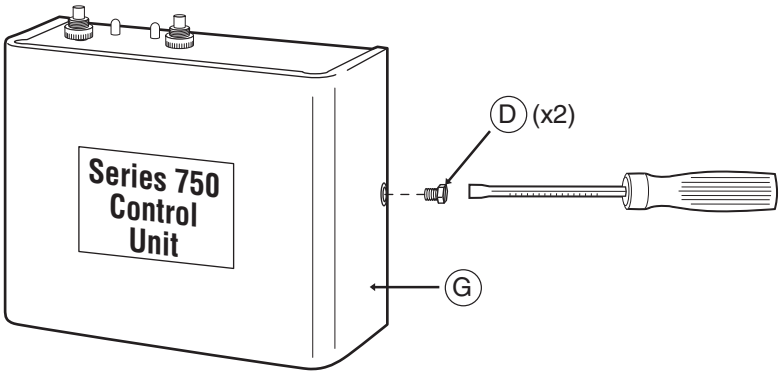
IMPORTANT: Do not use Teflon® tape or thread sealant.



c. Using a wrench, tighten the probe (A) into the tapped connection (E) that was determined in Step 1 of these instructions. Tighten to 47 ft•lb (64 N•m).
NOTE: Be sure to align the probe so that the mounting screws (F) are in a horizontal position.



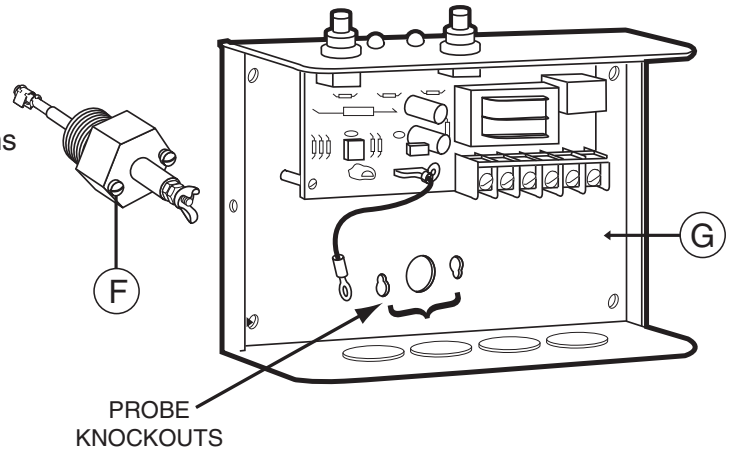
d. Using the flatblade screwdriver, loosen the two (2) screws that secure the cover (G) to the control about 1-1/2 turns and remove cover.



Direct Mounting - Unimount Models

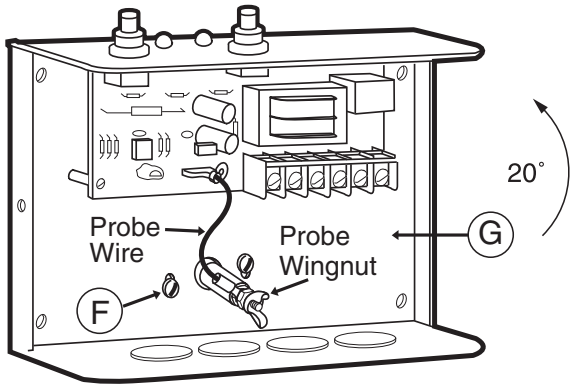
a. Push out the probe knockouts and remove completely from the control housing.

b. Using a flatblade screwdriver, loosen the probe mounting screws (F) 1/8" (3mm) about 1-1/2 turns and slip the control housing (G) over these two screws at a 20˚ angle.



c. Rotate the control housing (G) 20˚ counterclockwise so that the slots in the control base are firmly under the screw heads. Tighten the mounting screws (F) to approximately 2 ft•lb (2.6 N•m).

d. Remove wingnut from probe and position ring terminal of probe wire on threaded probe rod. Secure with wingnut.



STEP 5 - Electrical Wiring

IMPORTANT

Boiler manufacturer schematics should always be followed. In the event that the boiler manufacturer's schematic does not exist, or is not available from the boiler manufacturer, refer to the schematics provided in this document.

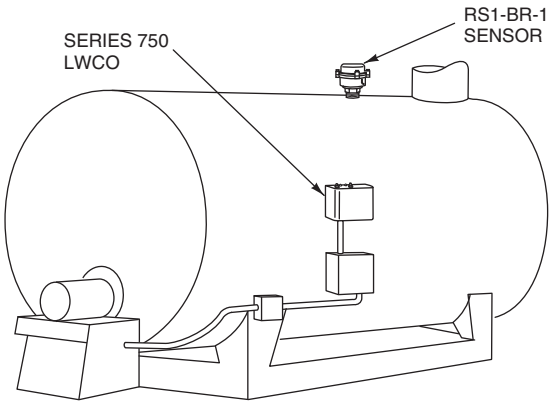
WARNING

To prevent an electrical fire or equipment damage, electrical wiring must have a rating of 167˚F (75˚C) if the liquid's temperature exceeds 180˚F (82˚C).
Failure to follow this warning could cause property damage, personal injury or death.

- Mount **Control Box** in a suitable location near the boiler's main electrical panel.

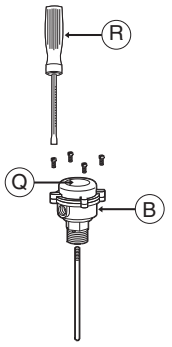
NOTE

Boiler sight glass must be visible from location of Control Box and must be within 25 feet of Control Body.

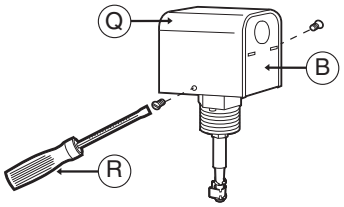


a. Remove the sensor housing cover (Q).

1. ***For Model RS-1-BR-1,*** using a flathead screwdriver (R), remove the four (4) screws and separate the housing cover (Q) from the sensor (B).
2. ***For Model RS-1-LP,*** using a flathead screwdriver or nut driver (R), loosen the two (2) screws and separate the housing cover (Q) from the sensor (B).



Model RS-1-BR-1



Model RS-1-LP

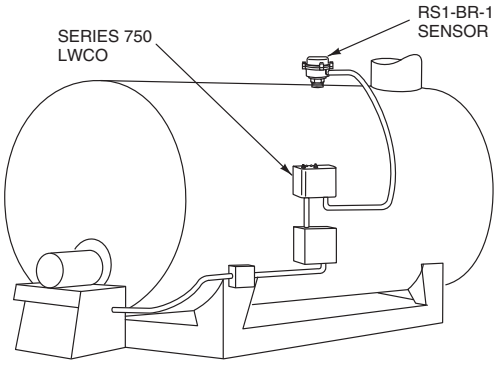
- Install electrical conduit between **Probe Housing** and **Control Box.**

NOTE

Wire must be 18 AWG stranded with glass braided silicone jacket (UL 3071) suitable for high temperature (200˚C) service.

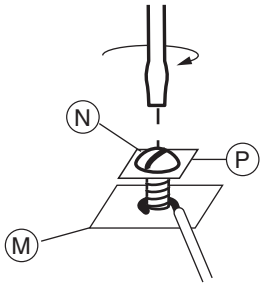
NOTE

Refer to and follow local codes and standards when selecting conduit and electrical fittings. Wires from Probe Housing and Control Box must be in their own conduit. If they are run in conduit with other wires, there may be interference that can affect the performance of the control.



b. For all wire connections to the terminal block (M).

1. Strip about 1/3" (8.5 mm) of insulation from the wire.
2. Loosen the terminal screw (N), DO NOT REMOVE, and move the wire clamping plate (P) back until the plate touches the back side of the screw head.
3. Insert the stripped end of the wire under the wire clamping plate (P) and securely tighten the terminal screw (N).



Wiring Diagram Legends

1. Bold lines indicate action to be taken in Step shown.
2. Dotted black lines indicate internal wiring.

Remote Sensor Wiring:

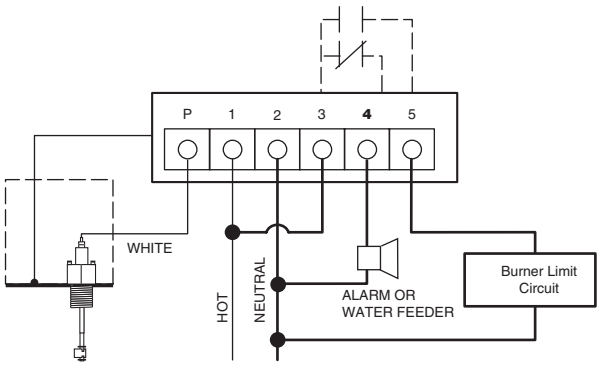
- Connect wire from probe end to Terminal 'P'
- Connect wire from remote sensor green ground screw to chassis green ground screw

Unimount Sensor Wiring:

- Connect ring terminal of wire to probe end
- Slide female spade connection of wire onto male spade connection on terminal board

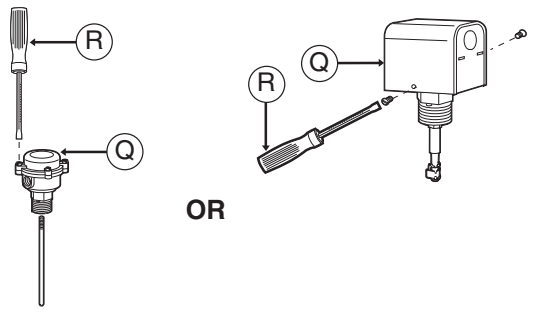
Control Wiring:

- Connect 120V hot wire to terminal 1
- Connect 120V neutral wire to terminal 2
- Connect jumper wire from Terminal 1 to Terminal 3
- Connect wire from beginning of Burner circuit (thermostat, gas valve, limits, etc.) to terminal 5
- Connect wire from end of Burner circuit to terminal 2



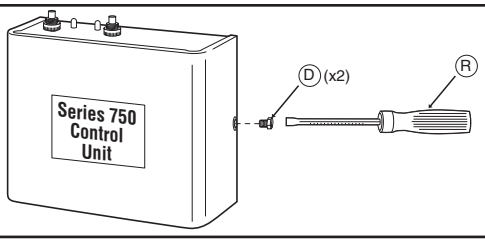
c. Secure the sensor housing cover (Q).

1. ***For model RS-1-BR-1,*** using the flatblade screwdriver (R), tighten the four (4) screws into the housing (Q) to approximately 3 ft•lb (4 N•m).
2. ***For model RS-1-LP,*** using the flatblade screwdriver or nut driver (R), tighten the two (2) screws into the housing (Q) to approximately 2 ft•lb (2.6 N•m).



Model RS-1-BR-1 **Model RS-1-LP**

d. Secure the control housing cover by using the flatblade screwdriver or nut driver (R) to tighten the two (2) screws (D) to approximately 2 ft•lb (2.6 N•m).



STEP 6 -Testing and Diagnostic Procedures

Series 750 LWCO with Green Power On LED and Red Low Water LED

Start-Up

a. Before filling the system, turn on the electric power to the boiler.

1. Upon initial power up, the Green and Red lights will flash simultaneously 4 times.

2. The Green and Red lights will turn "ON".

3. The burner will never turn "ON" during power up, if water is off the probe.

b. Now fill the boiler with water.
(auto reset units only)

1. When water touches the probe, the Green light will remain "ON".

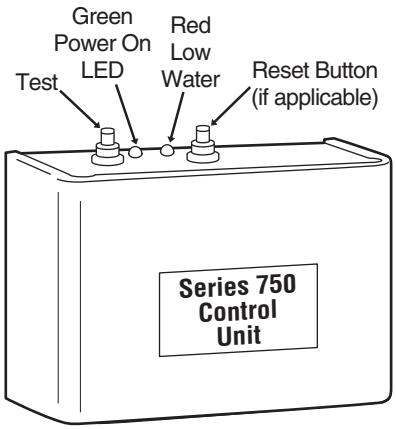
2. The Red light will turn "OFF" and the burner will turn “ON” as long as there is water on the probe.

(manual reset units only)
(When water returns to the probe, nothing will happen until the manual reset button is depressed.)

1. After depressing manual reset button, the Green and Red lights will flash simultaneously 4 times.

2. Then the Green light will turn "ON" and the Red light will turn “OFF”.

4. The burner will turn "ON" as long as there is water on the probe.



Newer Models

Manually Testing Control

c. Slowly drain the boiler of water.
(both auto and manual reset units)

1. When water drops off the probe, the Green light will remain "ON".

2. The Red light will turn “ON” and the burner will turn “OFF”, if water is off the probe.

Testing Control Using "Test Button"

d. Depressing test button with "water on probe" (auto reset units only):
(Must depress and hold the test button to activate test cycle.)

1. When test cycle is activated the Red and Green lights will flash simultaneously 3 times.

2. The Red light will turn “ON”.

3. Burner will turn "OFF".

4. The Green light will continue flashing as long as test button is depressed.

(Release test button, if water is still on probe)

5. The Green light will stop flashing and turn "ON".

6. The Red light will turn "OFF".

7. Burner will turn "ON" as long as there is water on the probe.

e. Depressing test button with "water on probe" (manual reset units only):
(Must depress and hold test button to activate test cycle.)

1. When test cycle is activated the Red and Green lights will flash simultaneously 3 times.

2. The Red light will turn "ON".

3. Burner will turn "OFF".

4. The Green light will continue flashing as long as test button is depressed.

(Release test button. You must depress the manual reset button to unlock the low water cut-off.)

5. After depressing manual reset button, the Green and Red lights will flash simultaneously 4 times.

6. Then the Green light will turn "ON" and the Red light will turn "OFF".

7. The burner will turn "ON" as long as there is water on the probe.

f. Depressing test button with "water off probe" (both auto and manual reset units):
Since control is in "low water" the Green light will flash and the Red light will remain “ON”. The burner will remain “OFF”.

CSD-1 Compliance
On Manual Reset units, if the control is in a low water condition (water off probe) when there is an interruption of power, the control will remain in a low water condition when power is restored. The reset button will need to be pressed when the water level is restored to a level above the probe.

Series 750 LWCO with Amber LED and Red Low Water LED

For Control Unit Models with a Test Switch

a. Hold the test switch down while noting the amber LED on top of the control housing.

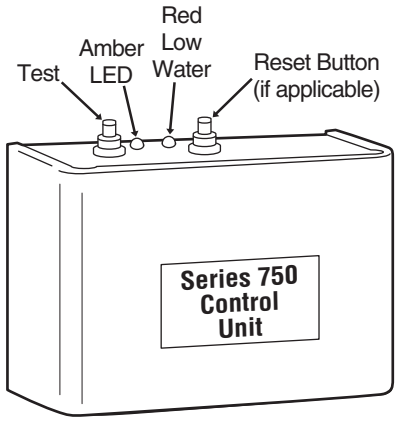
1. **If the amber LED glows dimly,** the water level is above the probe.
2. **If the amber LED is off,** the water level may be below the probe or the water is too pure and may require the addition of boiler water treatment.
3. **If the amber LED glows brightly,** it could indicate a grounded (non-operable) probe. If this is the case, proceed to "Troubleshooting" on page 12.

b. Test for correct burner circuit wiring.

1. Hold down the test switch while the burner is running.
2. If the burner shuts off while the test switch is depressed, the burner circuit is wired correctly.
3. ***For automatic reset models -*** release the test switch and the burner should resume firing provided that the boiler water is in contact with the probes.
4. ***For manual reset models -*** the burner will not return to normal operation until the reset switch is depressed.

If you believe the probe to be grounded, perform the following steps for control with test switch.

1. Make sure that the liquid level is below the probe.
2. Depress the test switch. If the amber LED turns “ON” the probe may indeed be grounded. If so, check the probe to make sure that it is the proper length, or replace the grounded probe.



Older Models

If control fails to operate as required, perform the following diagnostic checks:

1. Check to be sure that the water level in the boiler is at or above the level of the probe.
2. Re-check all wiring to ensure proper connections as specified in boiler manufacturer's wiring diagrams or these instructions.
3. Check to ensure that Teflon® tape has not been used on the threaded connection of the electrode to the boiler.
4. Re-check the electrical ground connection for the remote sensor and control unit.
5. Check the quality of the boiler water to ensure adequate conductance.

MAINTENANCE

SCHEDULE:

- **Test the low water cut-off annually or more frequently.**
- **Remove and inspect the self-cleaning probe every 5 years.**

⚠ CAUTION

Replace Probe if:
- **Teflon® insulator is cracked or worn.**
- **Probe is loose.**

Failure to follow this caution could cause property damage, personal injury or death.

- **Replace probe every 10 years.**
- **Replace the low water cut-off every 15 years.**

NOTE

Clean probe by wiping with non-abrasive cloth and rinsing with clean water. DO NOT use sharp instruments to remove any accumulations of rust or scale.

McDonnell & Miller
8200 N. Austin Ave.
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Printed in U.S.A. 11-06 210210

BULLETIN BV_MS_EN_10.2006
Replaced MS2042

Manual Ball Valves

for gas and other applications

Model BV602: 3/8", 1/2", 3/4" NPT

Model BV250: 1/4", 3/8", 1/2", 3/4", 1", 1¼", 1½", 2", 2½", 3", 4" NPT

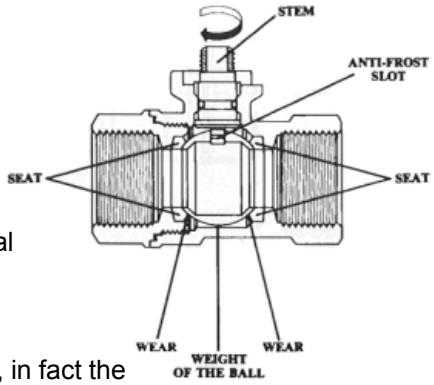
BV602 shown, see reverse for model BV250

Ball valves from Maxitrol for gas, water, oil, steam and other applications have a strong body of forged brass, female NPT inlet and outlet, hard chrome plated ball, and anticorrosion Dacromet treated handle.

BV602 models contain seats of Buna N, and are of one-piece construction. BV250 models contain seats of PTFE (Teflon®), and are of two-piece construction. Each of the two standard models is equipped with a different lever style handle (see reverse).

A Self Locking Nut improves reliability between the stem and lever by providing additional stability against vibrations. In addition to the seal created by the O-Ring, a PTFE anti-thrust washer seals against the shoulder of the valve.

The valves also feature innovative designs of the ball and seat.

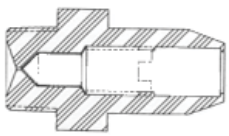


The hollow ball design is based on R&D lab work and years of field experience. Manufacture of the hollow ball requires a technical level not found in most substitutes. Heavier is not necessarily better, in fact the lighter ball decreases wear associated with on-off turning action. Typically the greatest friction loss takes place at the point of highest gravitational force. The lighter hollow ball increases the life of the valve seats from 10% to 20% more than with a solid ball.

The valves are manufactured with a unique new seat shape to reduce friction during opening and closing. Compared with other seat shapes the maneuver torque is reduced 20% to 40%.

S-model valves have side pressure taps (602S-44 shown).

Pressure Tap Connector Available



Certifications for BV602 models (one-piece body)

- (1/2" and 3/4") UL Listed 757X (water)
- (1/2" and 3/4") Complies with CSA requirement 3.88 for 2 psig
- CSA Certified in compliance with Z21.15

Certifications for BV250 models (two-piece body)

- CSA Certified Tamper Resistant construction
- CSA Verified for ambient temperature range from -40° to 300°F
- (2 1/2" and 3") CSA Certified in compliance with Z21.15
- (1/2", 3/4", 1", 1 1/4", 1 1/2", 2") CSA certified to requirement 3.88 for 2 and 5 psig
- (1/2", 3/4", 1") CSA Certified under Certificate 633-3A, following Standard ANSI B.16.33-1981 for gas at 125 psi
- (1/4", 3/8", 1/2", 3/4", 1", 1 1/4", 1 1/2", 2") NFPA 58-UL 250 psi
- (1/2", 3/4", 1", 1 1/4", 1 1/2", 2") UL 258 for 175 psi
- (1/4", 3/8", 1/2", 3/4", 1", 1 1/4", 1 1/2", 2") UL Listed LP gas shut-off valves - Standard YSTD under Listing 44R8 for 400 psig
- UL Listed:
  - Gas shut-off valves (UL Standard YRPV)
  - Compressed gas shut-off valves (UL Standard YQNZ)
  - Manual valves (UL Standard MHKZ)

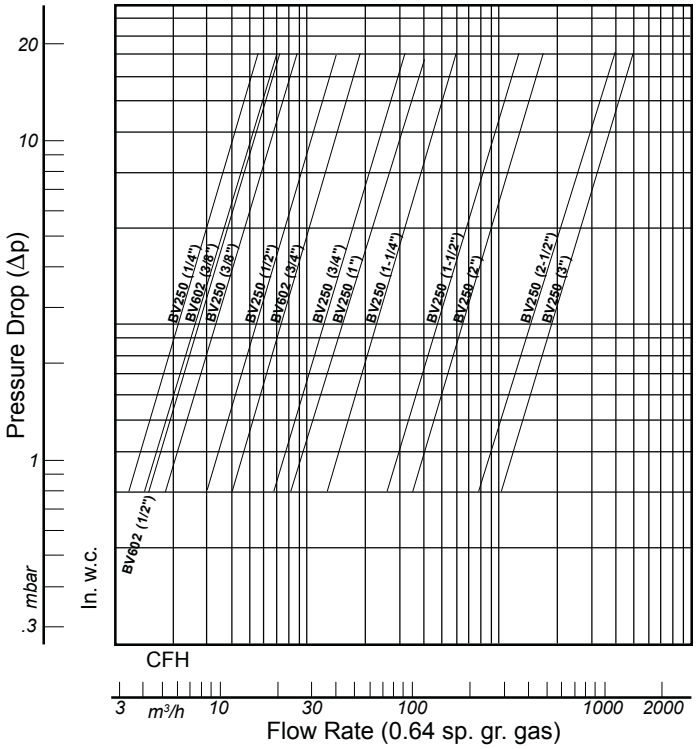
  for the following fluid service:
  - -natural and manufactured gas
  - -fuel oil No.1-6 (260°F)
  - -air
  - -acetylene
  - -nitrogen
  - -carbon dioxide
  - -inert gases
- (1/2", 3/4", 1", 1 1/4", 1 1/2", 2") FM approved for sprinkler systems (Approval No. J.I. ON7A5.AH)
- (3/8", 1/2", 3/4", 1") CSA approved
- (All sizes) Rating of 150 WSP
  - (1/4", 3/8", 1/2", 3/4",) 600 WOG
  - (1", 1 1/4", 1 1/2", 2") 500 WOG
  - (2 1/2", 3", 4") 400 WOG
- Other international approvals include WRC in the U.K., VA in Denmark, IAA in Korea, KFT in Hungary, SVGW in Switzerland, and conformity to the new proposed European standard prEN 331
- S Model Side tap is 1/8" NPT

No. PF10 - Pressure tap connector installed as part of the control. It is a hose fitting incorporating a captured sealing means for testing inlet and outlet pressures. This eliminates the need for a special barb fitting.

Capacity, Pressure Drop

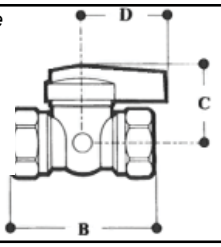
Model	Size	Capacity CFH (m3/h) 0.64 sp. gr. gas ΔP .3" w.c.	ΔP 1" w.c.
BV250T-22	1/4"	117 (3.31)	214 (6.06)
BV250-33	3/8"	183.5 (5.20)	335 (9.49)
BV602-33	3/8"	136 (3.85)	249 (7.05)
BV250-44	1/2"	296.5 (8.40)	541.3 (15.33)
BV602-44 ** or S-44	1/2"	151 (4.28)	275 (7.79)
BV250-66	3/4"	682.4 (19.32)	1245.9 (35.28)
BV602-66 ** or S-66	3/4"	405 (11.47)	740 (20.95)
BV250-88 ** or 602S-88	1"	834 (23.62)	1523 (43.13)
BV250-1010	1 1/4"	1278 (36.19)	2334 (66.09)
BV250-1212	1 1/2"	2605 (73.77)	4756 (134.68)
BV250-1616	2"	3562 (100.87)	6503.7 (184.17)
BV250-2020	2 1/2"	7947 (225.04)	14508.7 (410.85)
BV250-2424	3"	10296 (291.56)	18797.5 (532.30)
BV250-2424	4"		

Cv factor is flow rate in GPM when DR is 1 psi, Cv = GPM / ÖDR
(GPM = gallons [US] per minute, DR = pressure drop [psi])



Dimensions, Port Size, Cv Factor

Dimensions, Port Size in inches (mm)

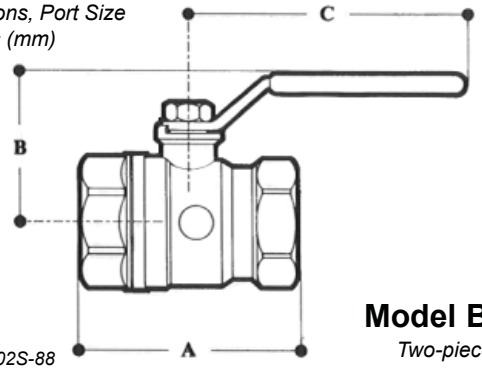


Model BV602
One-piece body

Model	Size	Port	Cv	B	C	B
BV602-33	3/8"	0.4" (10)	5.95	2.02" (51.3)	1.69" (42.9)	1.41" (35.8)
BV602-44 **or S-44	1/2"	0.4" (10)	6.26	2.35" (59.7)	1.69" (42.9)	1.41" (35.8)
BV602-66 **or S-66	3/8"	0.6" (15)	14.1	2.59" (65.8)	1.69" (42.9)	1.41" (35.8)

*** S-models have side pressure taps (602S-44 shown)*
Widths: 602S-44 = 1.57", 602S-66 = 1.78", 602S-88 = 2.09"

Dimensions, Port Size in inches (mm)



Includes 602S-88

Model BV250
Two-piece body

Model	Size	Port	Cv	A	B	C
BV250T-22*	1/4"	0.3" (8)	7.68	1.61" (40.89)	0.99" (25.15)	*
BV250-33	3/8"	0.4" (10)	7.79	1.77" (44.96)	1.28" (32.51)	3.07" (77.98)
BV250-44	1/2"	0.5" (13)	11.9	2.08" (52.83)	1.42" (36.07)	3.07" (77.98)
BV250-66	3/4"	0.7" (18)	21.4	2.35" (59.69)	1.87" (47.50)	3.78" (96.01)
BV250-88 ** or 602S-88	1"	0.9" (22)	42.2	2.91" (73.91)	2.02" (51.31)	3.78" (96.01)
BV250-1010	1-1/4"	1.1" (28)	85.5	3.28" (83.31)	2.22" (56.39)	3.78" (96.01)
BV250-1212	1-1/2"	1.4" (35)	122.2	3.72" (94.49)	2.78" (70.61)	5.43" (137.92)
BV250-1616	2"	1.8" (45)	184	4.28" (108.71)	3.09" (78.49)	4.43" (112.52)
BV250-2020	2-1/2"	2.3" (58)	279.3	5.63" (143.00)	3.98" (101.09)	6.97" (177.04)
BV250-2424	3"	2.7" (68)	313.1	6.30" (160.02)	4.29" (108.97)	6.77" (171.96)
BV250-3232	4"	2.7" (68)	537	7.99" (202.95)	4.13" (104.90)	8.00" (203.20)

**Model BV250T-22 equipped with T-handle*

MAXITROL

Maxitrol Company
23555 Telegraph Rd., P.O. Box 2230
Southfield, MI 48037-2230 U.S.A.
248.356.1400 • Fax 248.356.0829
www.maxitrol.com

12-200 Series
Low Pressure Steam Heating Boiler Safety Valves

Section IV
Heating Boilers

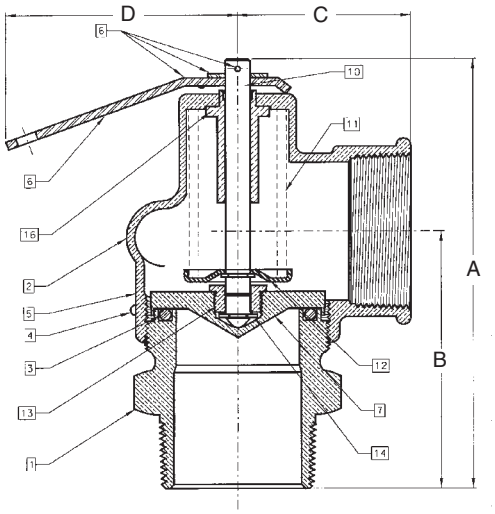
Medium capacity safety valves protect ASME Section IV low pressure steam heating boilers. Cast bronze, full nozzle design features PTFE faced elastomer soft seating for dependable operation.

ASME Section IV
Sizes 2, 2-1/2" and 3"
Set pressures 5-15 psi

Applications: Medium and large commercial and industrial steam heating and processing boilers.

Features

- All bronze construction
- PTFE-coated O-ring seat seal
- 3/8" NPT side tapping for drain
- Rust-proofed steel spring
- Top guided, high capacity design
- Registered in all Canadian provinces and territories, CRN #0G8547.5C
- National Board certified at 15 psig



Dimensions and Weights

Model Number	Size (in./*mm.*) Inlet NPT	Outlet NPT	Wt./100 (lbs./*kg.*)	Dimensions (in./*mm.*) A	B	C	D
12-205	2M	2F	514	6.00	3.75	2.62	4.00
	50	*50*	*233.6*	*152*	*95*	*67*	*102*
12-206	2-1/2M	2-1/2F	835	8.50	5.25	3.06	4.00
	65	*65*	*379.5*	*216*	*133*	*78*	*102*
12-208	3M	3F	1162	9.50	6.00	3.75	4.00
	80	*80*	*528.2*	*241*	*152*	*95*	*102*

NOTE: See Capacities page 15

Materials

Item	Component	Material
1	NOZZLE	BRONZE ASTM B584
2	BODY	BRONZE ASTM B584
3	O-RING	TEFLON COATED EPDM
4	DRIVE SCREW	AISI 1010 PLATED CR STEEL
5	NAMEPLATE	ALUMINUM
6	HANDLE ASSEMBLY	STEEL, PLATED
7	DISC	BRASS ASTM B-16
10	STEM	BRASS ASTM B-16
11	SPRING	STAINLESS STEEL
12	SPR. WASHER	AISI 1010 PLATED CR STEEL
13	STEM NUT	BRASS ASTM B-16
14	RETAINER RING	BRASS ASTM B-16
15	GUIDE	BRASS ASTM B-16

P/N Suffix Key

Set Pressure psig	Suffix
5	-03
6	-04
8	-05
10	-06
12	-07
15	-08

ORDERING CODE:

Use two-digit suffix number to indicate set pressure and body finish.

EXAMPLE:

12-205-08 = 2" 12 Series set 15 psig

13 Series
ASME Section IV Low Pressure Steam Heating Boiler Safety Valves

Section IV Heating Boilers

ASME Section IV bronze safety valves protect small to medium low pressure steam heating boilers. Three design configurations feature top guiding and raised seating area for extended service life. Available top and side discharge models.

ASME Section IV
Sizes 3/4"-1-1/2"
Set pressure 5 to 15 psi

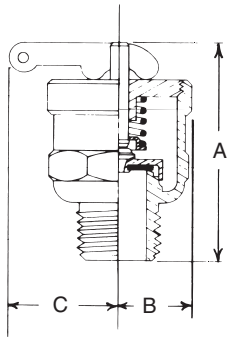
Applications: Low pressure steam heating and supply boilers.

Features

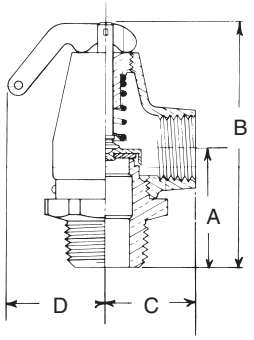
- Flat seat, PTFE faced disc for positive seal
- Standard set pressure of 15 psig
- Positive drainage of condensate from seat area
- No. **13-101** is top outlet discharge
- Registered in all Canadian provinces and territories, CRN #0G8547.5C
- National Board certified at 15 psig

Options

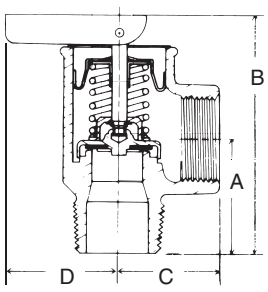
- Plain, satin or polished chrome finish



13-101



13-200



13-511

Dimensions and Weights

Model Number	Size (in./*mm.*) Inlet NPT	Outlet NPT	Wt./100 (lbs./kg.)	Dimensions (in./*mm.*) A	B	C	D
13-101	3/4 M	Top	64	2.87	0.94	1.25	–
	20		*29.0*	*73*	*23*	*31*	–
13-211	3/4 M	3/4 F	107	1.81	3.69	1.44	1.41
	20	*20*	*48.5*	*46*	*93*	*36*	*35*
13-202	1 M	1 F	110	2.06	3.87	1.22	1.41
	25	*25*	*49.9*	*52*	*98*	*30*	*35*
13-213	1-1/4 M	1-1/2 F	218	2.53	4.50	1.87	1.50
	32	*40*	*98.9*	*64*	*114*	*47*	*38*
13-214	1-1/2 M	2 F	320	3	5.25	2.19	1.81
	40	*50*	*145.1*	*76*	*133*	*55*	*46*
13-511	3/4 M	3/4 F	62	1.69	3.25	1.19	1.25
	20	*20*	*28.1*	*42*	*82*	*30*	*31*
13-512	3/4 F	3/4 F	59	1.19	2.75	1.19	1.25
	20	*20*	*26.8*	*30*	*69*	*30*	*31*

NOTE: See Capacities page 15

P/N Suffix Key

Set Pressure psig	EXTERIOR FINISH Plain Brass	Satin Chrome	Polished Chrome
5	-03	-35	-43
6	-04	-36	-44
8	-05	-37	-45
10	-06	-38	-46
12	-07	-39	-47
15	-08	-40	-48

ORDERING CODE:

Use two-digit suffix number to indicate set pressure and body finish.

EXAMPLE:

13-511-08 = 3/4" 13-511 set 15 psig

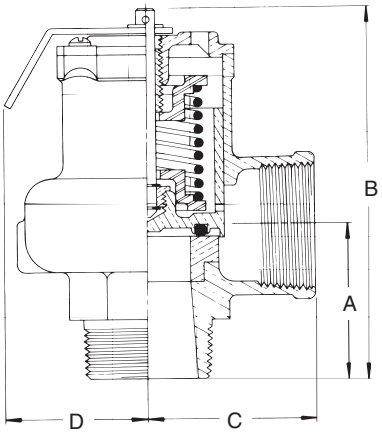
14-200 Series
Low Pressure Steam Boiler Safety Valves

Section IV
Heating Boilers

ASME Section IV
Set pressures from 5 to 15 psig.
Sizes 2", 2-1/2" and 3".

Applications:
The 14 Series is an ASME Section IV high capacity steam safety valve for use with medium and large size commercial and industrial heating boilers.

Features
- One piece body, all bronze construction
- Rust proofed steel spring
- Chrome plated seat, PTFE coated disc
- PTFE coated EPDM O-ring for positive seal
- 3/8" NPT side tapping for drain connection
- Valves are capacity certified by the National Board at 15 psig only, in accordance with ASME Boiler and Pressure Vessel Code Section IV
- Registered in all Canadian provinces and territories, CRN #0G8547.5C



Options
- Test gag available to prevent the valve from opening during hydrostatic testing of the boiler. To specify gag option, add "G" to suffix.

Dimensions and Weights

Model Number	Size (in./*mm.*) Inlet	Outlet	Dimensions (in./*mm.*) A	B	C	D	Wt./Each (lbs./*kg.*)
14-205	2M	2F	3.00	7.12	3.12	4.00	8.4
	50M	*50F*	*76*	*181*	*79*	*101*	*3.8*
14-206	2-1/2M	2-1/2F	3.50	8.25	3.50	4.00	13.0
	65M	*65F*	*88*	*209*	*88*	*101*	*5.9*
14-207	3M	3F	4.12	9.37	3.87	4.00	17.0
	80M	*80F*	*104*	*238*	*98*	*101*	*7.7*

NOTE: See Capacities page 15

P/N Suffix Key

Set Pressure psig	Suffix
5	-03
6	-04
8	-05
10	-06
12	-07
15	-08

NOTE:
- ASME IV and NB certified capacities at 15 psi only
- Valves may be set for any pressure between 5 and 15 psi. Consult factory for set pressures not listed.
- To specify test gag option add "G" to suffix.

ORDERING CODE:
Use model number and two digit suffix number to indicate size and set pressure.

EXAMPLE:
14-206-08: 2-1/2" valve set at 15 psi

12, 13 and 14-200 Series
Capacities

ASME Section IV Steam
POUNDS PER HOUR (KILOGRAMS PER HOUR) SATURATED STEAM AT 33-1/3% OVERPRESSURE. NATIONAL BOARD CERTIFIED. RATINGS ARE 90% OF ACTUAL.

U.S. Customary Units lbs./hr.						
Model No.	**12-205 2 x 2**	**12-206 2-1/2 x 2-1/2**	**12-208 3 x 3**	**13-101 3/4**	**13-202 1 x 1**	**13-211 3/4 x 3/4**
Set Pressure psig						
5*	1,439	2,043	2,855	333	374	290
10*	1,969	2,786	3,478	372	509	383
15	2,500	3,529	4,100	410	643	475
Model No.	**13-213 1-1/4 x 1-1/2**	**13-214 1-1/2 x 2**	**13-511 13-512 3/4 x 3/4**	**14-205 2 x 2**	**14-206 2-1/2 x 2-1/2**	**14-207 3 x 3**
Set Pressure psig						
5*	699	1,106	213	1,815	2,695	3,944
10*	950	1,503	310	2,483	3,686	5,394
15	1,200	1,900	407	3,150	4,676	6,843

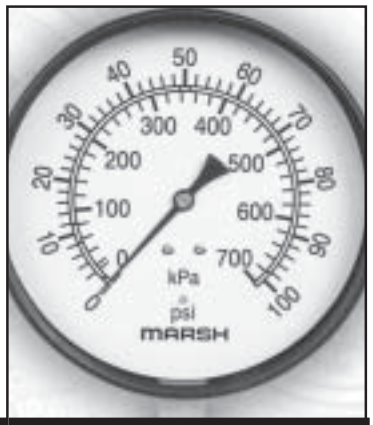
Metric Units kg./hr.						
Model No.	**12-205 2 x 2**	**12-206 2-1/2 x 2-1/2**	**12-208 3 x 3**	**13-101 3/4**	**13-202 1 x 1**	**13-211 3/4 x 3/4**
Set Pressure barg						
0.34	653	927	1,295	151	170	131
0.69	893	1,264	1,577	169	231	174
1.03	1,134	1,601	1,860	186	292	215
Model No.	**13-213 1-1/4 x 1-1/2**	**13-214 1-1/2 x 2**	**13-511 13-512 3/4 - 3/4**	**14-205 2 x 2**	**14-206 2-1/2 x 2-1/2**	**14-207 3 x 3**
Set Pressure barg						
0.34	317	502	97	823	1,222	1,789
0.69	431	682	141	1,126	1,672	2,447
1.03	544	862	185	1,429	2,121	3,103

ASME Section IV and NB certified capacities at 15 psi only.

Valves may be set for any pressure between 5 and 15 psi. Consult factory for set pressures not listed.

- Dial Sizes: 1½", 2", 2½", 3½" & 4½"
- Superb Quality, Economical Price
- Pressure Ranges to 5000 psi

Marsh Instruments GENERAL SERVICE STEEL CASE GAUGES are an economical, general purpose gauge for pressure measurement from vacuum/compound through 5,000 psi. Suited for use with water, oil, air, gas, or other non-corrosive media. Typical applications include FRLs, compressors, pumps, boilers, regulators, dryers as well as commercial and industrial equipment.



STANDARD RANGES & PART NUMBERS

TYPE	GENERAL SERVICE (SERIES "J") STEEL CASE GAUGE						
Internals	Copper Alloy						
Case Material	Steel						
Dual Scale Standard	psi/kPa						
Size	1½"			2"			
Mounting / Case Style	LM	UC	CB	LM	LM	CB	CB
Connection (NPT)	⅛"	⅛"	⅛"	⅛"	¼"	⅛"	¼"
0 to 30" Hg VAC	J0405	J0505	J0605	J1105	J1405	J1805	J2005
30" Hg VAC to 15psi							
30" Hg VAC to 30psi					J1412		
30" Hg VAC to 60psi					J1414		
30" Hg VAC to 100psi							
30" Hg VAC to 150psi	J0418	J0518	J0618	J1118	J1418	J1818	J2018
30" Hg VAC to 200psi	J0420	J0520	J0620	J1120	J1420	J1820	J2020
30" Hg VAC to 300psi	J0424	J0524	J0624	J1124	J1424	J1824	J2024
30" Hg VAC to 400psi				J1126	J1426	J1826	J2026
0 to 15psi	J0440	J0540	J0640	J1140	J1440	J1840	J2040
0 to 30psi	J0442	J0542	J0642	J1142	J1442	J1842	J2042
0 to 60psi	J0446	J0546	J0646	J1146	J1446	J1846	J2046
0 to 100psi	J0448	J0548	J0648	J1148	J1448	J1848	J2048
0 to 160psi	J0452	J0552	J0652	J1152	J1452	J1852	J2052
0 to 200psi	J0454	J0554	J0654	J1154	J1454	J1854	J2054
0 to 300psi	J0458	J0558	J0658	J1158	J1458	J1858	J2058
0 to 400psi				J1160	J1460	J1860	J2060
0 to 600psi					J1464	J1864	
0 to 1,000psi							
0 to 1,500psi							
0 to 2,000psi							
0 to 3,000psi					J1478	J1878	J2078
0 to 5,000psi					J1482		

NOTE: Items are available on special order. However, minimums and lead times apply. Consult factory.

SERIES "J" STEEL CASE

SPECIFICATIONS

ACCURACY
ASME Grade B–±3/2/3% (±2% of range across middle half of scale)

CASE SIZES
1½", 2", 2½", 3½", 4½" diameter

CASE MATERIAL
Drawn steel, pretreated for rust resistance and black enamel finish

CASE STYLE
LM – Lower Mount
UC – U-Clamp Mount
CB – Center Back Mount
See option tables for Front Flange

TUBE & SOCKET
Copper alloy tube & socket

MOVEMENT
Brass sector and pinion

CONNECTION
⅛" & ¼" NPT

RANGES
0 to 30" Hg VAC; Compound 30" Hg vac to 400 psi; 15 to 5,000 psi

DIAL STANDARD
Dual scale psi and kPa

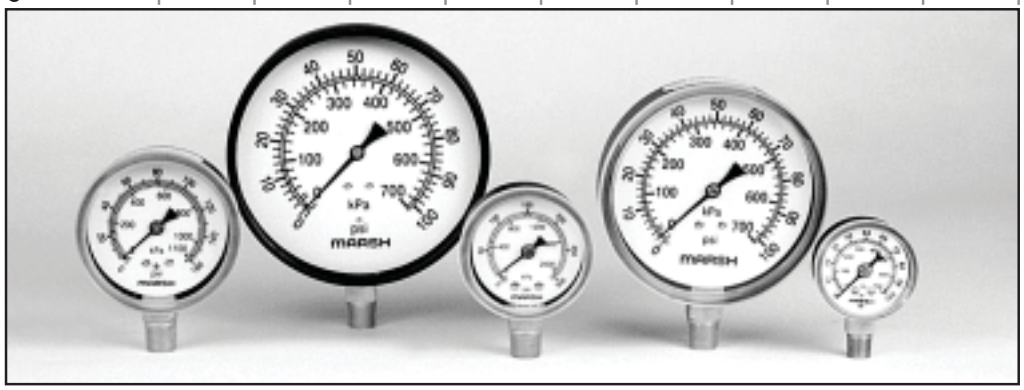
DIAL COLOR
Black markings on white

POINTER
Aluminum, black painted

WINDOW
1½", 2", 2½", 3½": flat, twist-in Clearlok 4½": flat glass window with steel friction ring

RESTRICTOR
Standard for ranges 1,000 psi and above

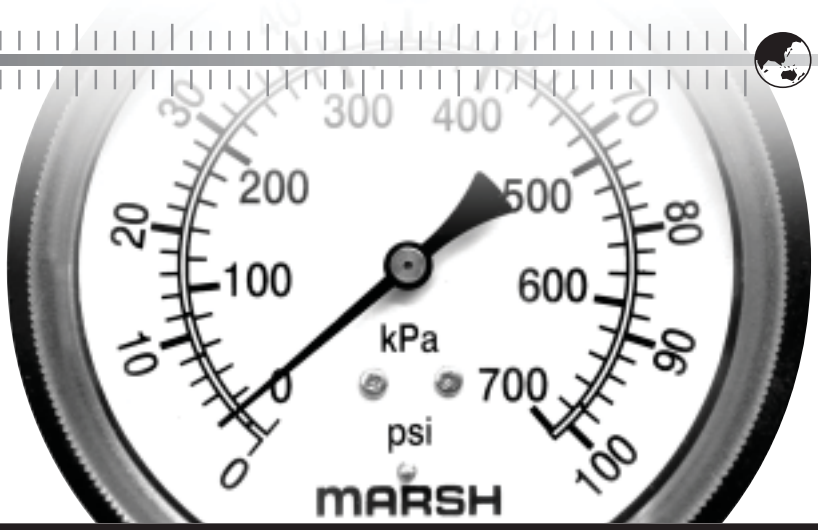
General Service Gauges



STANDARD RANGES & PART NUMBERS

TYPE	GENERAL SERVICE (SERIES "J")											
Internals	Copper Alloy											
Case Material	Steel											
Dual Scale Standard	psi/kPa											
Size	2"		2½"						3½"			4½"
Mounting / Case Style	UC	UC	LM	LM	CB	CB	UC	UC	LM	CB	UC	LM
Connection (NPT)	⅛"	¼"	⅛"	¼"	⅛"	¼"	⅛"	¼"	¼"	¼"	¼"	¼"
0 to 30" Hg VAC	J2405	J2605	J4005	J4605	J5005	J5405	J6005	J6205	J8005	J8605	J8805	J9005
30" Hg VAC to 15psi												
30" Hg VAC to 30psi				J4612					J8012			
30" Hg VAC to 60psi				J4614					J8014			J9014
30" Hg VAC to 100psi												
30" Hg VAC to 150psi	J2418	J2618	J4018	J4618	J5018	J5418	J6018	J6218	J8018	J8618	J8818	J9018
30" Hg VAC to 200psi	J2420	J2620	J4020	J4620	J5020	J5420	J6020	J6220	J8020	J8620	J8820	J9020
30" Hg VAC to 300psi	J2424	J2624	J4024	J4624	J5024	J5424	J6024	J6224	J8024	J8624	J8824	J9024
30" Hg VAC to 400psi	J2426	J2626	J4026	J4626	J5026	J5426	J6026	J6226	J8026	J8626	J8826	J9026
0 to 15psi	J2440	J2640	J4040	J4640		J5440		J6240	J8040	J8640	J8840	J9040
0 to 30psi	J2442	J2642	J4042	J4642	J5042	J5442	J6042	J6242	J8042	J8642	J8842	J9042
0 to 60psi	J2446	J2646	J4046	J4646	J5046	J5446	J6046	J6246	J8046	J8646	J8846	J9046
0 to 100psi	J2448	J2648	J4048	J4648	J5048	J5448	J6048	J6248	J8048	J8648	J8848	J9048
0 to 160psi	J2452	J2652	J4052	J4652	J5052	J5452	J6052	J6252	J8052	J8652	J8852	J9052
0 to 200psi	J2454	J2654	J4054	J4654	J5054	J5454	J6054	J6254	J8054	J8654	J8854	J9054
0 to 300psi	J2458	J2658	J4058	J4658	J5058	J5458	J6058	J6258	J8058	J8658	J8858	J9058
0 to 400psi	J2460	J2660	J4060	J4660	J5060	J5460	J6060	J6260	J8060	J8660	J8860	J9060
0 to 600psi				J4664					J8064	J8664	J8864	J9064
0 to 1,000psi			J4072	J4672		J5472		J6272		J8672	J8872	J9072
0 to 1,500psi				J4674					J8074			
0 to 2,000psi				J4676		J5476		J6276				J9076
0 to 3,000psi	J2478	J2678		J4678	J5078	J5478	J6078	J6278				
0 to 5,000psi				J4682						J8682	J8882	J9082

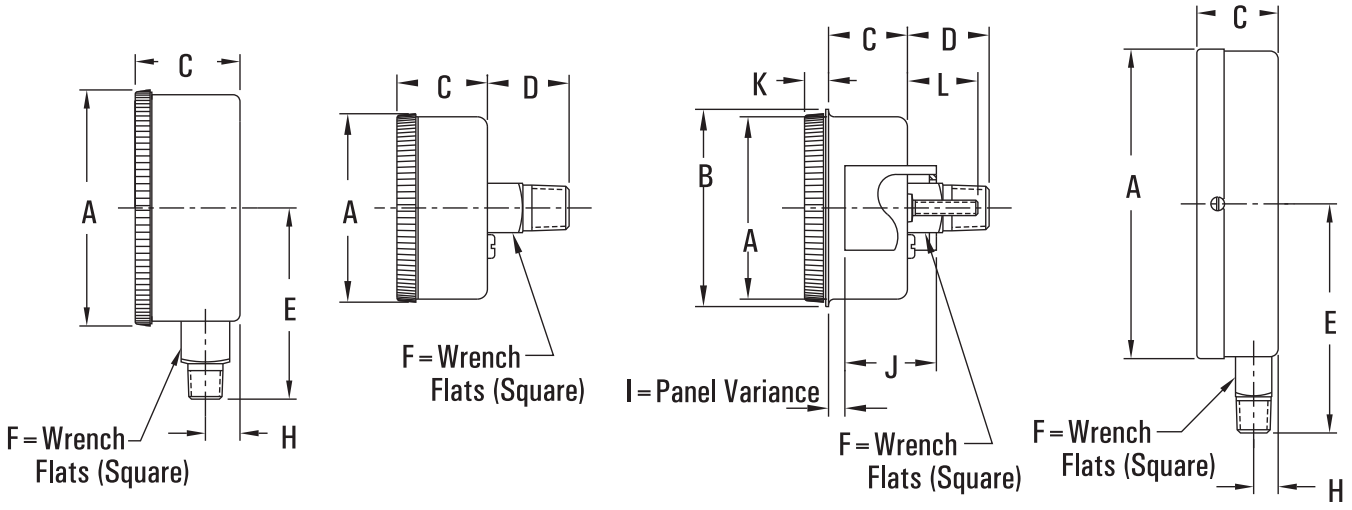
NOTE: Items are available on special order. However, minimums and lead times apply. Consult factory.



GENERAL SERVICE GAUGE OPTIONS

OPTION	TYPE	SUFFIX	AVAILABLE ON MODELS
Restrictors	Add restrictor	H	All models – Consult factory for other sizes
Catalog Dials	psi only	E	See Marsh Price List for minimums
	bar only	L1	
	kg/cm^2 only	L2	
	kPa only	L3	
	psi & bar	W1	
	psi & kg/cm^2	W2	
	psi & MPa	W4	
Custom Dials	Custom face	M	See Marsh Price List for minimums
Window	Instrument glass w/ring (GS)	F1	1½"- 3½" Consult factory for availability
	Acrylic	F2	4½" Consult factory for availability
Pointer	Adjustable (slotted) pointer (AD)	Z1	2"- 4½" Consult factory for availability
	Max. Hand Assembly (MX)	Z2	2"- 4½" Consult factory for availability
Increased	Accuracy Grade A: (2/1/2%)	B	All models - 10 piece minimum order
Cases	3 hole front flange (FF)		1½" - 3½" See below for part number
	[Part Numbers: 1½"x ⅛" (J07XX), 2"x ⅛" (J25XX), 2"x ¼" (J29XX), 2½" x ⅛" (J61XX), 2½"x ¼" (J63XX), 3½"x ⅛" (J85XX), 3½"x ¼" (J89XX)]. Consult factory for availability.		
	Stainless steel (SS)	J1	Consult factory for availability
	Brass (BR)	J2	
Rings	Friction ring (external), (FC) Polished Stainless Steel	A1	1½" to 3½" CB or LM only
	Friction ring (external), black (FB)	A2	1½" to 3½" CB or LM only
	Press ring, black (PB)	A3	2" to 3½" [Panel mount]
	Press ring, chrome (PC)	A4	2" to 3½" [Panel mount]
Special Connections			Consult Factory for availability

Dial Divisions	General Service Series "J" 3/2/3% of Span	
Ranges	Figure Intervals	Minor Graduations
Vacuum	5	1
COMPOUND		
30" Hg VAC to 15 psi	10	5	2	1
30" Hg VAC to 30 psi	10	10	2	1
30" Hg VAC to 60 psi	10	10	2	2
30" Hg VAC to 150 psi	30	30	5	5
30" Hg VAC to 300 psi	30	50	–	10
PRESSURE		
0 to 15 psi	3	0.2
0 to 30 psi	5	1
0 to 60 psi	10	1
0 to 100 psi	10	2
0 to 160 psi	20	2
0 to 200 psi	50	4
0 to 300 psi	50	5
0 to 400 psi	50	5
0 to 600 psi	50	10
HIGH PRESSURE		
0 to 1,000 psi	200	20
0 to 1,500 psi	300	20
0 to 2,000 psi	400	40
0 to 3,000 psi	500	100
0 to 4,000 psi	1,000	100
0 to 5,000 psi	1,000	100



SERIES "J" STEEL CASE DIMENSIONS

Part#	Dial Size	Mount	A	B	C	D	E	F	H	I	J	K	L
J04xx	1½	⅛" LM	1.67		.90		1.50	7/16"	.26				
J05xx	1½	⅛" UC	1.60	1.75	.71	.72		7/16"		.06-.37	.81	.19	.63
J06xx	1½	⅛" CB	1.67		.90	.72		7/16"					
J11xx	2.0	⅛" LM	2.20		1.22		1.82	9/16"	.40				
J14xx	2.0	¼" LM	2.20		1.22		1.82	9/16"	.40				
J18xx	2.0	⅛" CB	2.20		1.22	.82		9/16"					
J20xx	2.0	¼" CB	2.20		1.22	.82		9/16"					
J24xx	2.0	⅛" UC	2.06	2.25	.94	.88		9/16"		0-0.43	1.22	.20	.92
J26xx	2.0	¼" UC	2.06	2.25	.94	.88		9/16"		0-0.43	1.22	.20	.92
J40xx	2½	⅛" LM	2.73		1.22		2.10	9/16"	.40				
J46xx	2½	¼" LM	2.73		1.22		2.10	9/16"	.40				
J50xx	2½	⅛" CB	2.73		1.23	.82		9/16"					
J54xx	2½	¼" CB	2.73		1.23	.82		9/16"					
J60xx	2½	⅛" UC	2.58	2.81	.94	.88		9/16"		0-0.43	1.22	.20	.92
J62xx	2½	¼" UC	2.58	2.81	.94	.88		9/16"		0-0.43	1.22	.20	.92
J80xx	3½	¼" LM	3.71		1.22		2.77	9/16"	.40				
J86xx	3½	¼" CB	3.71		1.15	.80		9/16"					
J88xx	3½	¼" UC	3.65	3.98	.91	.87		9/16"		0-0.49	1.10	.24	.92
J90xx	4½	¼" LM	4.53		1.22		3.16	9/16"	.40				

General Purpose Toggle Switches — AC Rated

DESCRIPTION

These ac rated toggle switches offer the widest selection of features and the design flexibility to meet a variety of applications.

Combi-Term Option

This is an extension of our ac rated General Purpose Toggle Switch. The "Combi-Term" design allows the user the option of Screw Terminals, .250″ Quick Connects or Solder Termination all on the same switch. The special clips and screws are provided in a poly bag with the switch.

SPECIFICATIONS

Rating:

See selection table.

Circuits:

1PST, 1PDT, 2PST, 2PDT, 3PST, 3PDT, 4PST & 4PDT.

Maintained and momentary.

Contact Mechanism:

Slow-make/Slow-brake butt contact.

Terminal Types:

Screw Terminals — Brass designed to accept #6-32 x 3/16 binding head **(Cat. No. 811-2)** screws. Furnished unassembled.

Solder Lug Terminals — Tintillate plated brass.

Spade Terminals — Brass.

Combi-Term — Brass.

STANDARD AC RATED TOGGLES SELECTION TABLE

(**BOLD** FACE TYPE INDICATES ITEMS NORMALLY IN DISTRIBUTOR STOCK)

Rating	Poles and Throw	Circuit with Toggle in: UP Position	CENTER Position	DOWN Position (Keyway)	BASE CIRCUIT SEE PAGE 4.28	Bushing Length A mm (inches)	Lever Length B mm (inches)	CATALOG NUMBERS: Solder Lugs	Screw Terminals	.250″ Spade Terminals	Combi-Term
ONE POLE								**ONE POLE**			
6A, 125V ac 3A, 250V ac	1 P.S.T.	ON	NONE	OFF	A	8.74 (.344) 11.91 (.469)	14.30 (.563) 14.30 (.563)	**7580K7** **7580K6**	7580K5 **7580K4**	**7580K9** **7580K8**	N/A
	1 P.D.T.	ON	OFF	ON	B	11.91 (.469)	14.30 (.563)	7581K6	**7581K4**	7581K8	
	1 P.D.T.	ON	NONE	ON	B	11.91 (.469)	14.30 (.563)	**7582K6**	**7582K4**	7582K8	
	1 P.D.T.	ON ON*	NONE OFF	ON* ON*	B	11.91 (.469)	14.30 (.563)	7585K6 7587K6	7585K4 7587K4	7585K8 7587K8	
10A, 250V ac 1/2 Hp, 250V ac	1 P.S.T.	OFF	NONE	ON*	A	11.91 (.469)	14.30 (.563)	7506K3	**7506K4**	7506K6	
	1 P.S.T.	OFF	NONE	ON*	A	11.91 (.469)	17.48 (.688)	7506K38	7506K36	7506K40	
	1 P.D.T.	ON* ON	OFF NONE	ON* ON*	B	11.91 (.469)	14.30 (.563)	7509K4 7510K6	**7509K5** 7510K7	7509K7 7510K9	
	1 P.D.T.	ON ON*	OFF OFF	ON* ON*	B	11.91 (.469)	17.48 (.688)	7508K38 7509K38	7508K36 7509K36	7508K40 7509K40	
15A, 125V ac 10A, 250V ac 3/4 Hp, 250V ac 1/2 Hp, 125V-250V ac	1 P.S.T.	ON	NONE	OFF	A	8.74 (.344) 11.91 (.469)	14.30 (.563) 14.30 (.563)	7501K12 **7501K13**	7500K13 ❷ **7500K14** ❷	7501K14 **7501K15**	
15A, 125V ac 10A, 250V ac 1/2 Hp, 125V ac 3/4 Hp, 250V ac	1 P.D.T.	ON	OFF	ON	B	11.91 (.469)	14.30 (.563)	**7503K13** ❷	**7502K13**	**7503K15**	
	1 P.D.T.	ON	NONE	ON	B	11.91 (.469)	14.30 (.563)	**7505K4**	**7504K4** ❷	**7505K6**	
20A, 125V ac 10A, 250V ac 1/2 Hp, 125V ac 3/4 Hp, 250V ac	1 P.S.T.	ON	NONE	OFF	A	11.91 (.469)	17.48 (.688)	7546K38	7546K36	7546K40	
20A, 125V AC 10A, 250V AC 1 Hp, 120-240V ac	1 P.S.T.	ON	NONE	OFF	A	11.89 (.468)	17.45 (.687)	**7802K11**	**7802K31**	**7802K21** ❸	**7802K41**
	1 P.D.T.	ON ON ON*	OFF NONE OFF	ON ON ON*	B	11.89 (.468)	17.04 (.671)	**7802K12** **7802K13** 7802K17 ❹	**7802K32** **7802K33** **7802K37** ❹	7802K22 7802K23 ❸ 7802K27 ❹	7802K42 7802K43 7802K47 ❹
30A, 125V ac 25A, 250V ac ❶	1 P.S.T.	ON	NONE	OFF	A	8.74 (.344)	14.30 (.563)	—	**7576K2**	—	N/A

Selection Table continues on page 2.4.

* Momentary Contact.
❶ Single pole switch in 2-pole base.
❷ Also 4.2A L @ 125V ac Rating.
❸ Also 7.5A @ 277V ac, 3/4 Hp @ 120, 240 and 277V ac.
❹ Not CSA Certified.

Panel mounted fuse holders for ¼" x 1¼" fuses

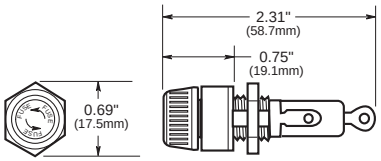
HKP, HKP-L, HKP-W

Specifications
Description: Standard fuse holders.
Dimensions: See Dimensions illustration.
Ratings:
Volts: — 250V
Amps: — 30A

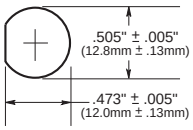
Catalog Numbers

Catalog Numbers	Fuse Description
HKP	—
HKP-L	HKP w/ 2250V stand-off barrier
HKP-W	HKP w/ drip-proof knob

Dimensions



Punched Mounting Hole



Data Sheet: 2106

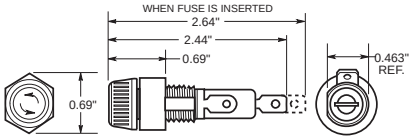
HKP-BBHH, HKP-HH and HKP-LW-HH

Specifications
Description: Fuse holders with ¼" quick-connects.
Dimensions: See Dimensions illustration.
Ratings:
Volts: — 250V
Amps: — 15A

Catalog Numbers

Catalog Numbers	Fuse Description
HKP-BBHH	HKP w/ ¼" quick-connects,nut and washer assembled.
HKP-HH	HKP w/ ¼" quick-connect.
HKP-LW-HH	HKP w/ drip-proof knob, 2250V stand-off barrier and quick-connects.

Dimensions



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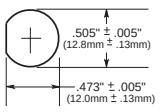
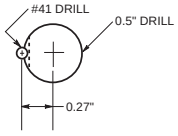


Drilled Mounting Hole



Data Sheet: 2106

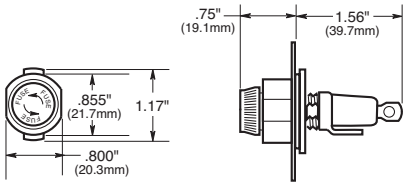
HKP-OO

Specifications
Description: Snap-lock fuse holders.
Dimensions: See Dimensions illustration.
Ratings:
Volts: — 250V
Amps: — 30A

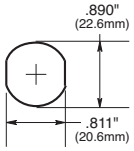
Catalog Numbers

Catalog Number	Fuse Description
HKP-OO	HKP with snap-lock

Dimensions



Punched Mounting Hole



Data Sheet: 2106

Specifications

Terminals: Bayonet-type knob.
Vibration resistant.
For panels up to 5/16" (7.9mm) thick.

Agency Information: CE, UL Recognized — Guide IZLT2, File E14853, CSA Certified — Class 6225-01, File 47235

Replacement Parts: Knob: 9435-1/2"
Plastic Nut: BK/1A4287
Metal Nut: BK/1A4806-2
Washer: 9732