NOTE: TILE BY OTHERS - SOME FEATURES OMITTED FOR CLARITY

Item Description	Experience Shower
Structural	Stainless Steel Specifications
Finishes	Tile Finish
Controls	Touch Screen Temperature Sensor
Plumbing	Hansgrohe Raindance AIR Imperial Showerhead Hansgrohe Body Jets Mister Mist Heads Plumbing Manifold Solenoid Valves
Lighting	Starscape LED Bullet Lights
Audio	SoSound Sound Hearts

Experience Shower - Overview & Description:

A unique variety of multi-temperature water features combined with relaxing chromatherapy lighting, soothing acoustics and rejuvenating aromatherapy creates a delightful experience.

A simple to use, yet elegant interface presents the bather with a choice of 5 shower experiences and the owner/operator all the necessary functions to control the system. Networked capabilities allow "online" technical diagnostics and easy downloads of new experiences.

Standard Items:

- Custom configurations - sizes, shapes, functions
- Watertight, structural stainless steel shell
- Tile Finish per designer specs
- 24" Overhead Rain Imperial Shower Head complete with 5 spray modes
- 6 body massagers
- Misters overhead
- Full color, multi-function touch screen menu
- Full color changing, ultra bright LED lightsystem; overhead
- Light color and display sequenced in harmony with water and audio features
- Tranducer audio speaker system emits sound through the floor and walls of shower
- Integral floor drain
- Aroma injection system

Leadership in Energy & Environmental Design:

ENVIRONMENTALLY SOUND PRODUCTS FOR THE GREEN 21ST CENTURY

Bradford Products, LLC, has been a world-leader in the design and fabrication of stainless steel aquatic vessels for the last 25 years. We remain "ahead of the curve" by using and manufacturing environmentally friendly products that are both recycled and recyclable.

Bradford has pioneered the use of stainless steel—itself made 65% – 80% from recycled steel—in the manufacture of all manner of aquatic vessels and water features. Bradford's aquatic vessels not only will out-last comparable aquatic vessels formed of polymerized petrochemicals which employ increasingly scarce and high-cost raw material but are superior to concrete shells as well.

Bradford utilizes closed-loop filtration systems that recycle and sanitize water, conserving and reusing that resource. A stainless steel vessel, properly maintained, has a comparatively extended life expectancy which, assuming proper maintenance and care, is far beyond any other material.

Recycling and recyclablility is one of the many factors that would permit LEED certification of a project. Stainless steel is recognized as a "green" material and its use, as a feature of the overall design, can be a factor in earning LEED points.

Allegheny Ludlum
An Allegheny Technologies Company

Technical Data BLUE SHEET

Allegheny Ludlum Corporation ◆ Pittsburgh, PA

Stainless Steels

Chromium-Nickel

Types 302 (S30200), 304 (S30400), 304L (S30403), 305 (S30500)

GENERAL PROPERTIES

Allegheny Ludlum Types 302 (S30200), 304 (S30400), 304L (S30403), and 305 (S30500) stainless steels are variations of the 18 percent chromium – 8 percent nickel austenitic alloy, the most familiar and most frequently used alloy in the stainless steel family. These alloys may be considered for a wide variety of applications where one or more of the following properties are important:

1. Resistance to corrosion
2. Prevention of product contamination
3. Resistance to oxidation
4. Ease of fabrication
5. Excellent formability
6. Beauty of appearance
7. Ease of cleaning
8. High strength with low weight
9. Good strength and toughness at cryogenic temperatures
10. Ready availability of a wide range of product forms

Each alloy represents an excellent combination of corrosion resistance and fabricability. This combination of properties is the reason for the extensive use of these alloys which represent nearly one half of the total U.S. stainless steel production. Type 304 represents the largest volume followed by Type 304L. Types 302 and 305 are used in smaller quantities. The 18-8 stainless steels, principally Types 304 and 304L, are available in a wide range of product forms including sheet, strip, foil and plate from Allegheny Ludlum. The alloys are covered by a variety of specifications and codes relating to, or regulating, construction or use of equipment manufactured from these alloys for specific conditions. Food and beverage, sanitary, cryogenic, and pressure-containing applications are examples.

Past users of Type 302 are generally now using Type 304 since AOD technology has made lower carbon levels more easily attainable and economical. There are instances, such as in temper rolled products, when Type 302 is preferred over Type 304 since the higher carbon permits meeting of yield and tensile strength requirements while maintaining a higher level of ductility (elongation) versus that of the lower carbon T304. Type 304L is used for welded products which might be exposed to conditions which could cause intergranular corrosion in service. Type 305 is used for applications requiring a low rate of work hardening during severe cold forming operations such as deep drawing.

Other less frequently specified 18-8 stainless steel grades, such as Type 304N (S30451) and Type 304LN (S30453) are also available from Allegheny Ludlum.

CHEMICAL COMPOSITION

Chemistries per ASTM A240 and ASME SA-240:

Element	Percentage by Weight Maximum Unless Range is Specified			
	302	304	304L	305
Carbon	0.15	0.08	0.030	0.12
Manganese	2.00	2.00	2.00	2.00
Phosphorus	0.045	0.045	0.045	0.045
Sulfur	0.030	0.030	0.030	0.030
Silicon	0.75	0.75	0.75	0.75
Chromium	17.00 – 19.00	18.00 – 20.00	18.00 – 20.00	17.00 – 19.00
Nickel	8.00 – 10.00	8.00 – 10.50	8.00 – 12.00	10.50 – 13.00
Nitrogen	0.10	0.10	0.10	--

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RESISTANCE TO CORROSION

General Corrosion

The Types 302, 304, 304L and 305 austenitic stainless steels provide useful resistance to corrosion on a wide range of moderately oxidizing to moderately reducing environments. The alloys are used widely in equipment and utensils for processing and handling of food, beverages and dairy products. Heat exchangers, piping, tanks and other process equipment in contact with fresh water also utilize these alloys. Building facades and other architectural and structural applications exposed to non-marine atmospheres also heavily utilize the 18-8 alloys. In addition, a large variety of applications involve household and industrial chemicals.

The 18 to 19 percent of chromium which these alloys contain provides resistance to oxidizing environments such as dilute nitric acid, as illustrated by data for Type 304 below.

% Nitric Acid	Temperature °F (°C)	Corrosion Rate Mils/Yr (mm/a)
10	300 (149)	5.0 (0.13)
20	300 (149)	10.1 (0.25)
30	300 (149)	17.0 (0.43)

Other laboratory data for Types 304 and 304L in the table below illustrate that these alloys are also resistant to moderately aggressive organic acids such as acetic, and reducing acids such as phosphoric. The 9 to 11 percent of nickel contained by these 18-8 alloys assists in providing resistance to moderately reducing environments. The more highly reducing environments such as boiling dilute hydrochloric and sulfuric acids are shown to be too aggressive for these materials. Boiling 50 percent caustic is likewise too aggressive.

General Corrosion in Boiling Chemicals

Boiling Environment		Corrosion Rate, Mils/Yr (mm/a)			
		Type 304**		Type 304L	
20% Acetic Acid,	Base Metal	0.1	(<0.01)	0.1	(<0.01)
	Welded*	1.0	(0.03)	0.1	(<0.01)
45% Formic Acid,	Base Metal	55	(1.4)	15	(0.4)
	Welded*	52	(1.3)	19	(0.5)
10% Sulfamic Acid,	Base Metal	144	(3.7)	50	(1.3)
	Welded*	144	(3.7)	57	(1.4)
1% Hydrochloric,	Base Metal	98	(2.5)	85	(2.2)
	Welded	112	(2.8)	143	(3.6)
20% Phosphoric Acid,	Base Metal	<1.0	(<0.03)	--	--
	Welded	<1.0	(<0.03)	--	--
65% Nitric Acid,	Base Metal	9.2	(0.2)	8.9	(0.2)
	Welded	9.4	(0.2)	7.4	(0.2)
10% Sulfuric Acid,	Base Metal	445	(11.3)	662	(16.8)
	Welded	494	(12.5)	879	(22.3)
50% Sodium Hydroxide,	Base Metal	118	(3.0)	71	(1.8)
	Welded	130	(3.3)	87	(2.2)

*Autogenous weld on base metal sample.
**Types 302 and 305 exhibit similar performance.

Data are typical and should not be construed as maximum or minimum values for specification or for final design. Data on any particular piece of material may vary from those shown herein.

In some cases, the low carbon Type 304L alloy may show a lower corrosion rate than the higher carbon Type 304 alloy. The data for formic acid, sulfamic acid and sodium hydroxide illustrate this. Otherwise, the Types 302, 304, 304L and 305 alloys may be considered to perform equally in most corrosive environments. A notable exception is in environments sufficiently corrosive to cause intergranular corrosion of welds and heat-affected zones on susceptible alloys. The Type 304L alloy is preferred for use in such media in the welded condition since the low carbon level enhances resistance to intergranular corrosion.

Intergranular Corrosion

Exposure of the 18-8 austenitic stainless steels to temperatures in the 800°F to 1500°F (427°C to 816°C) range may cause precipitation of chromium carbides in grain boundaries. Such steels are “sensitized” and subject to intergranular corrosion when exposed to aggressive environments. The carbon content of Types 302, 304, and 305 may allow sensitization to occur from thermal conditions experienced by autogenous welds and heat-affected zones of welds. For this reason, the low carbon Type 304L alloy is preferred for applications in which the material is put into service in the as-welded condition. Low carbon content extends the time necessary to precipitate a harmful level of chromium carbides, but does not eliminate the precipitation reaction for material held for long times in the precipitation temperature range.

Intergranular Corrosion Tests		
ASTM A 262 Evaluation Test	**Corrosion Rate, Mils/Yr (mm/a)**	
	302, 304, 305	304L
Practice B Base Metal Welded	20 (0.5) 23 (0.6) Intergranular Corrosion	20 (0.5) 20 (0.5)
Practice E Base Metal Welded	No Fissures on Bend Some Fissures on Weld (unacceptable)	No Fissures No Fissures
Practice A Base Metal Welded	Step Structure Ditched (unacceptable)	Step Structure Step Structure

Stress Corrosion Cracking

The Type 302, 304, 304L and 305 alloys are the most susceptible of the austenitic stainless steels to stress corrosion cracking (SCC) in halides because of their relatively low nickel content. Conditions which cause SCC are: (1) presence of halide ions (generally chloride), (2) residual tensile stresses, and (3) temperatures in excess of about 120°F (49°C). Stresses may result from cold deformation of the alloy during forming, or by roller expanding tubes into tubesheets, or by welding operations which produce stresses from the thermal cycles used. Stress levels may be reduced by annealing or stress relieving heat treatments following cold deformation, thereby reducing sensitivity to halide SCC. The low carbon Type 304L material is the better choice for service in the stress relieved condition in environments which might cause intergranular corrosion.

Halide (Chloride) Stress Corrosion Tests		
Test	**U-Bend (Highly Stressed) Samples**	
	302, 304, 304L, 305	
42% Magnesium Chloride, Boiling	Base Metal Welded	Cracked, 1 to 20 hours Cracked, ½ to 21 hours
33% Lithium Chloride, Boiling	Base Metal Welded	Cracked, 24 to 96 hours Cracked, 18 to 90 hours
26% Sodium Chloride, Boiling	Base Metal Welded	Cracked, 142 to 1004 hours Cracked, 300 to 500 hours
40% Calcium Chloride, Boiling	Base Metal	Cracked, 144 Hours --
Ambient Temperature Seacoast Exposure	Base Metal Welded	No Cracking No Cracking

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The above data illustrate that various hot chloride solutions may cause failure after differing lengths of time. The important thing to note is that failure eventually occurs under these conditions of chloride presence, high stresses and elevated temperatures.

Pitting/Crevice Corrosion

The 18-8 alloys have been used very successfully in fresh waters containing low levels of chloride ion. Although Type 304 tubing has been used in power plant surface condenser cooling water with as much as 1000 ppm chloride, this performance can only result from careful cleaning of the tubes during use and care to avoid stagnant waters from remaining in contact with the tube. Generally, 100 ppm chloride is considered to be the limit for the 18-8 alloys, particularly if crevices are present. Higher levels of chloride might cause crevice corrosion and pitting. For the more severe conditions of higher chloride levels, lower pH and/or higher temperatures, alloys with higher molybdenum content such as Type 316 or AL-6XN® alloy should be considered. Interestingly, Types 304 and 304L stainless steels pass the 100 hour, 5 percent neutral salt spray test (ASTM B117) with no rusting or staining of samples. However, Type 304 building exteriors exposed to salt mists from the ocean are prone to pitting and crevice corrosion accompanied by severe discoloration. The 18-8 alloys are not recommended for exposure to marine environments.

The reader is invited to consult the Allegheny Ludlum Technical Center with questions concerning the suitability of the 18-8 alloys for specific environments.

PHYSICAL PROPERTIES

Density:

0.285 lb/in^3 (7.90 g/cm^3)

Modulus of Elasticity in Tension:

29 x 10^6 psi (200 GPa)

Linear Coefficient of Thermal Expansion:

Temperature Range		Coefficients	
°F	°C	in/in/°F	cm/cm/°C
68 - 212	20 - 100	9.2 x 10^{-6}	16.6 x 10^{-6}
68 - 1600	20 - 870	11.0 x 10^{-6}	19.8 x 10^{-6}

Thermal Conductivity:

Temperature Range		Btu/hr•ft•°F	W/m•K
°F	°C		
212	100	9.4	16.3
932	500	12.4	21.4

The overall heat transfer coefficient of metals is determined by factors in addition to the thermal conductivity of the metal. The ability of the 18-8 stainless grades to maintain clean surfaces often allows better heat transfer than other metals having higher thermal conductivity. Consult the Allegheny Ludlum Technical Center (724-226-6300) for further information.

Specific Heat:

°F	°C	Btu/lb/°F	J/kg•K
32 - 212	0 - 100	0.12	500

Magnetic Permeability

The 18-8 alloys are generally non-magnetic in the annealed condition with magnetic permeability values typically less than 1.02 at 200H. As illustrated below, permeability values will vary with composition and will increase with cold work. Type 305 with the highest nickel content is the most stable of these austenitic alloys and will have the lowest permeability when cold worked. The following data are illustrative:

Percent Cold Work	Magnetic Permeability			
	302	304	304L	305
0	1.004	1.005	1.015	1.002
10	1.039	1.009	1.064	1.003
30	1.414	1.163	3.235	1.004
50	3.214	2.291	8.480	1.008

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Melting Range

°F	°C
2,550 - 2,590	1,399 - 1,421

Electrical Resistivity

Temperature °F	Temperature °C	Microhm-in	Microhm-cm
68	20	28.3	72
212	100	30.7	78
392	200	33.8	86
752	400	39.4	100
1112	600	43.7	111
1472	800	47.6	121
1652	900	49.6	126

MECHANICAL PROPERTIES

Room Temperature Mechanical Properties

Minimum mechanical properties for annealed Types 302, 304, 304L and 305 austenitic stainless steel plate, sheet and strip as required by ASTM specifications A 240 and ASME specification SA-240 are shown below.

Property	Minimum Mechanical Properties Required by ASTM A 240, and ASME SA-240		
	302, 304	304L	305
0.2% Offset Yield Strength, psi MPa	30,000 205	25,000 170	30,000 205
Ultimate Tensile Strength, psi MPa	75,000 515	70,000 485	75,000 515
Percent Elongation in 2 in. or 51 mm	40.0	40.0	40.0
Hardness, Max., Brinell R_B	201 92	201 92	183 88

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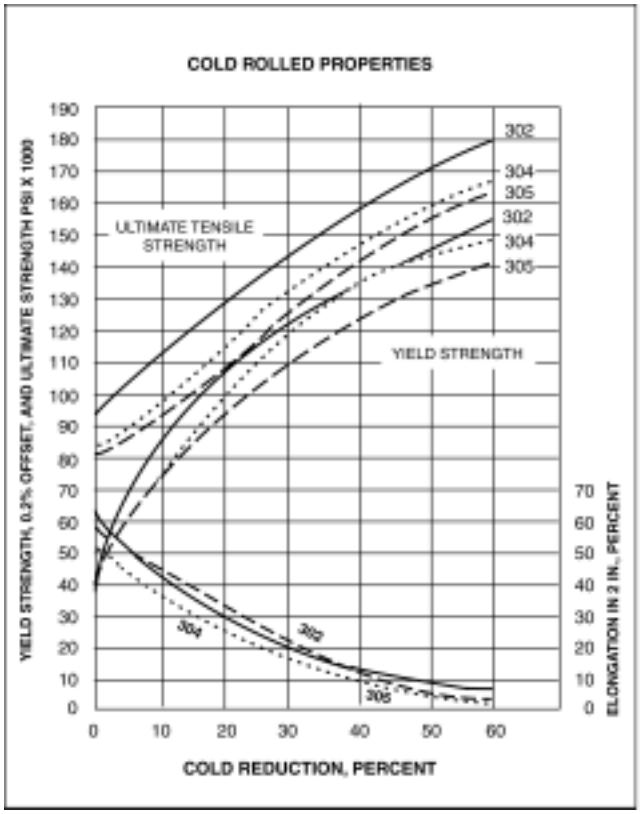
Effect of Cold Work

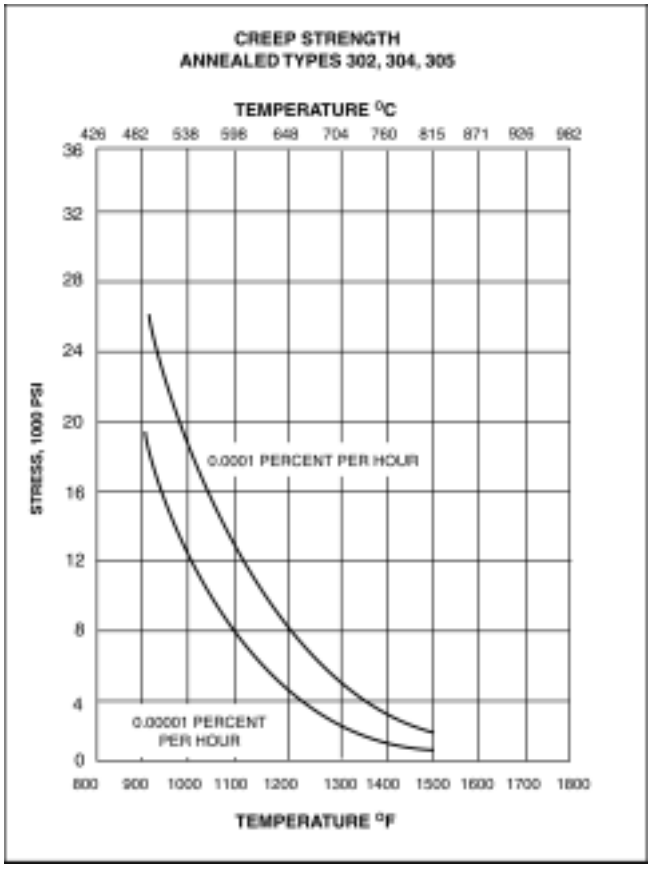
Deformation of the 18-8 alloys at room or slightly elevated temperatures produces an increase in strength accompanied by a decrease in elongation value. A portion of this increase in strength is caused by partial transformation of austenite to martensite during deformation. As shown by the permeability data, the Type 302, 304 and 304L alloys are more prone to martensite formation than the Type 305 alloy. Strengthening during deformation is, therefore, more pronounced in the leaner compositions. Among the 18-8 alloys, Type 305 alloy with highest nickel content exhibits the least amount of work hardening. Typical data are shown below.



Low and Elevated Temperature Properties

Typical short time tensile property data for low and elevated temperatures are shown below. At temperatures of 1000°F (538°C) or higher, creep and stress rupture become considerations. Typical creep and stress rupture data are also shown below.

Test Temperature		0.2% Yield Strength		Tensile Strength		Elongation
°F	°C	psi	(MPa)	psi	(MPa)	Percent in 2" or 51 mm
-423	-253	100,000	690	250,000	1725	25
-320	-196	70,000	485	230,000	1585	35
-100	-79	50,000	345	150,000	1035	50
70	21	35,000	240	90,000	620	60
400	205	23,000	160	70,000	485	50
800	427	19,000	130	66,000	455	43
1200	650	15,500	105	48,000	330	34
1500	815	13,000	90	23,000	160	46



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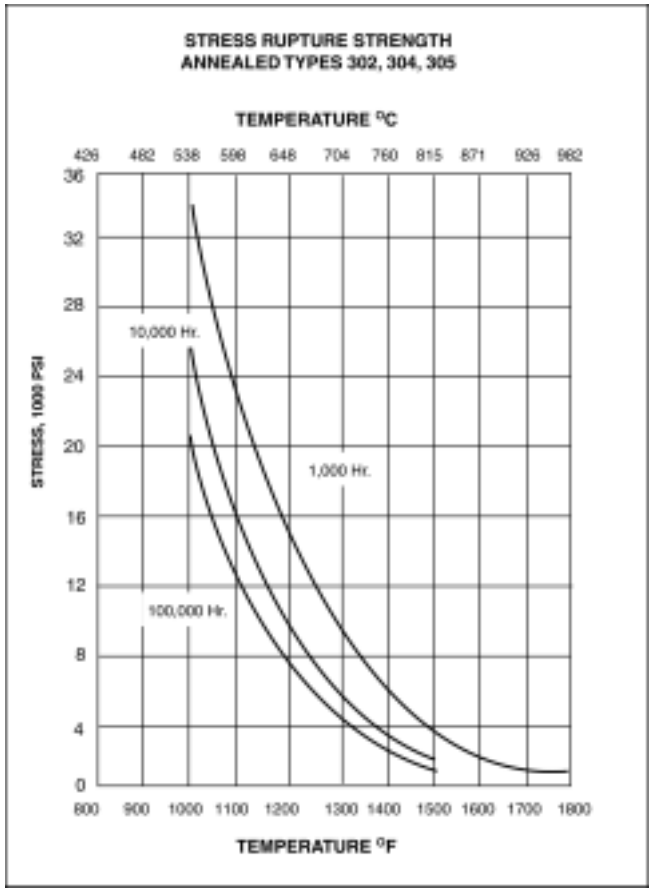

Impact Resistance

The annealed austenitic stainless steels maintain high impact resistance even at cryogenic temperatures, a property which, in combination with their low temperature strength and fabricability, has led to their use in handling liquified natural gas and other cryogenic environments. Typical Charpy V-notch impact data are shown below.

Temperature		Charpy V-Notch Energy Absorbed	
°F	°C	Foot - pounds	Joules
75	23	150	200
-320	-196	85	115
-425	-254	85	115

Fatigue Strength

The fatigue strength or endurance limit is the maximum stress below which material is unlikely to fail in 10 million cycles in air environment. The fatigue strength for austenitic stainless steels, as a group, is typically about 35 percent of the tensile strength. Substantial variability in service results is experienced since additional variables influence fatigue strength. As examples – increased smoothness of surface improves strength, increased corrosivity of service environment decreases strength.

WELDING

The austenitic stainless steels are considered to be the most weldable of the high-alloy steels and can be welded by all fusion and resistance welding processes. The Types 302, 304, 304L and 305 alloys are typical of the austenitic stainless steels.

Two important considerations in producing weld joints in the austenitic stainless steels are: 1) preservation of corrosion resistance, and 2) avoidance of cracking.

A temperature gradient is produced in the material being welded which ranges from above the melting temperature in the molten pool to ambient temperature at some distance from the weld. The higher the carbon level of the material being welded, the greater the likelihood that the welding thermal cycle will result in the chromium carbide precipitation which is detrimental to corrosion resistance. To provide material at the best level of corrosion resistance, low carbon material (Type 304L) should be used for material put in service in the welded condition. Alternately, full annealing dissolves the chromium carbide and restores a high level of corrosion resistance to the standard carbon content materials.

Weld metal with a fully austenitic structure is more susceptible to cracking during the welding operation. For this reason, Types 302, 304, and 304L alloys are designed to resolidify with a small amount of ferrite to minimize cracking susceptibility. Type 305, however, contains virtually no ferrite on solidification and is more sensitive to hot cracking upon welding than the other alloys.

If filler metal is required, Type 308 (20% Cr-11% Ni) is generally used. This enriched composition avoids martensite which might otherwise form in multipass welds. Chemistry is controlled to allow a small amount of ferrite in the deposit to limit hot cracking tendency.

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Type 309 (23% Cr – 13.5% Ni) or nickel-base filler metals are used in joining the 18-8 austenitic alloys to carbon steel.

HEAT TREATMENT

The austenitic stainless steels are heat treated to remove the effects of cold forming or to dissolve precipitated chromium carbides. The surest heat treatment to accomplish both requirements is the solution anneal which is conducted in the 1850°F to 2050°F range (1010°C to 1121°C). Cooling from the anneal temperature should be at sufficiently high rates through 1500-800°F (816°C – 427°C) to avoid reprecipitation of chromium carbides.

These materials cannot be hardened by heat treatment.

CLEANING

Despite their corrosion resistance, stainless steels need care in fabrication and use to maintain their surface appearance even under normal conditions of service.

In welding, inert gas processes are used. Scale or slag that forms from welding processes is removed with a stainless steel wire brush. Normal carbon steel wire brushes will leave carbon steel particles in the surface which will eventually produce surface rusting. For more severe applications, welded areas should be treated with a descaling solution such as a mixture of nitric and hydrofluoric acids and these should be subsequently washed off.

For material exposed in inland, light industrial or milder service, minimum maintenance is required. Only sheltered areas need occasional washing with a stream of pressurized water. In heavy industrial areas, frequent washing is advisable to remove dirt deposits which might eventually cause corrosion and impair the surface appearance of the stainless steel.

Stubborn spots and deposits like burned-on food can be removed by scrubbing with a nonabrasive cleaner and fiber brush, a sponge or pad of stainless steel wool. The stainless steel wool will leave a permanent mark on smooth stainless steel surfaces.

Many of the uses of stainless steel involve cleaning or sterilizing on a regular basis. Equipment is cleaned with specially designed caustic soda, organic solvent or acid solutions such as phosphoric or sulfamic acid (strongly reducing acids such as hydrofluoric or hydrochloric may be harmful to these stainless steels).

Cleaning solutions need to be drained and stainless steel surfaces rinsed thoroughly with fresh water.

Design can aid cleanability. Equipment with rounded corners, fillets and absence of crevices facilitates cleaning as do smooth ground welds and polished surfaces.

SURFACE FINISHES

A range of surface finishes is available. These are designated by a series of numbers.

Number 1 Finish – is hot rolled annealed and descaled. It is available in plate and sheet and is used for functional applications where a smooth decorative finish is not important.

Number 2D Finish – is a dull finish produced by cold rolling, annealing and descaling. This finish is favorable for the retention of lubricants in drawing or forming operations and is preferred for deep drawn and formed parts.

Number 2B Finish – is a brighter finish than 2D. It is produced much like the 2D finish except that the final cold rolling is done with smooth polished rolls. This is a general purpose finish used for all but severe cold forming. Because it is smoother as produced, it is more readily polished than 1 or 2D finishes.

Number 2BA Finish – is a very smooth finish produced by cold rolling and bright annealing. A light pass using highly polished rolls produces a glossy finish. A 2BA finish may be used for lightly formed applications where a glossy finish is desired in the as formed part.

Polished finishes – a variety of ground finishes is available.

Because special equipment or processes are used to develop these finishes, not all finishes are available in the range of products produced by Allegheny Ludlum. Surface finish requirements should be discussed with Allegheny Ludlum mill representatives.

SPECIFICATION COVERAGE

Because of the extensive use of these austenitic stainless steels, and their broad specification coverage, the following list of specifications is representative, but not complete.

Product Form	Specification	
	ASTM	ASME
Plate, Sheet and Strip	A 240	SA-240
Seamless and/or Welded Tubing	A 249/A 249M (304, 304L, 305 only), A 269/ A269M (304, 304L only), A554	SA-249/SA-249M (304, 304L only)
Seamless and/or Welded Pipe	A 312/A 312M, A 409/A 409M (304, 304L only)	SA-312/SA-312M, SA-409/SA-409M (304, 304L only)
Bar, Wire	A 276, A 478, A 479/A 479M (302, 304, 304L only)	SA-479/SA-479M (302, 304, 304L only)
Billet, Forgings	A 314, A 473	
Flanges, Fittings	A 182/A 182M, A 403/A 403M (304, 304L only)	SA-182/SA-182M, SA-403/SA-403M (304, 304L only)

In Section II, Part D of the ASME Boiler and Pressure Vessel Code, Type 304 is assigned allowable stresses for a variety of product forms to maximum use temperatures of 1500°F (816°C). Type 304L coverage includes fewer product forms with lower allowable stresses to maximum use temperature of 800°F (426°C) while Types 302 and 305 have very limited coverage.

All of the grades are accepted for use in food preparation and storage by the National Sanitation Foundation and for contact with dairy products by the Dairy and Food Industries Supply Association – Sanitary Standards Committee and are standard materials used in each industry. Similarly, Types 304 and 304L are standard materials of construction in the brewery industry.

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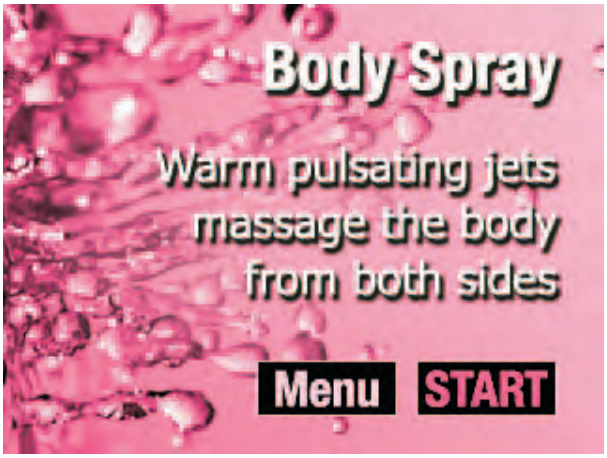
Controls - Touchscreen:

A simple to use, yet elegant interface presents the bather with a choice of 5 shower experiences and the owner/operator with all the functions necessary to control the overall system. Networked capabilities allow "online" technical diagnostics and easy downloads of new experiences.

Controls - Touchscreen functions:

Arctic Mist
Body Spray
Tropical Rain
Island Storm
Full Experience



Controls - Temperature Sensor:

Resistance temperature detectors (**RTD**) accurately sense temperature with an excellent degree of repeatability and interchangeability of elements. The RTD is composed of certain metallic elements whose change in resistance is a function of temperature.

In operation, a small excitation current is passed across the element, and the voltage, which is proportional to resistance, is then measured and converted to units of temperature calibration. The RTD element is manufactured by winding a wire (wire wound elements) or plating a film (thin film elements) on a ceramic or glass core and sealing the element within a ceramic or glass capsule. Since most RTDs have a low initial resistance, often 100 ohms, and have a small change in resistance per unit of temperature range, the resistance of the lead wire is often compensated for with a three or four wire bridge configuration built into the measuring devices. By selecting the proper elements and protective sheathing, RTDs can operate in a temperature range of (-200 to 650) °C [-328 to 1202] °F.

Specific Sensor:

0.25-inch diameter x 4-inch long, with 0.5-inch NPT compression fitting, 100 ohm, 3-wire, with 36-inch leads and plug/jack.

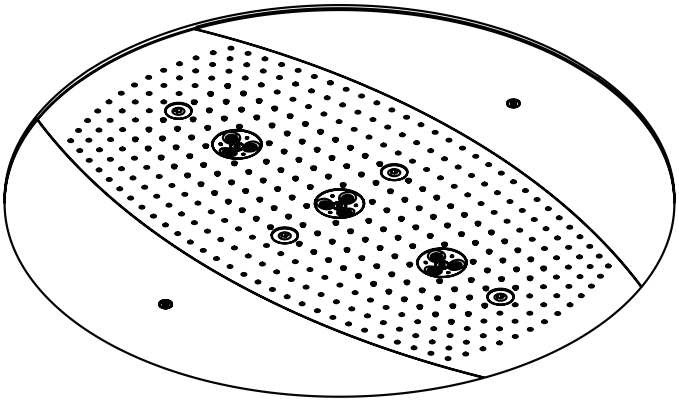
Plumbing - Requirements / Flow Rates

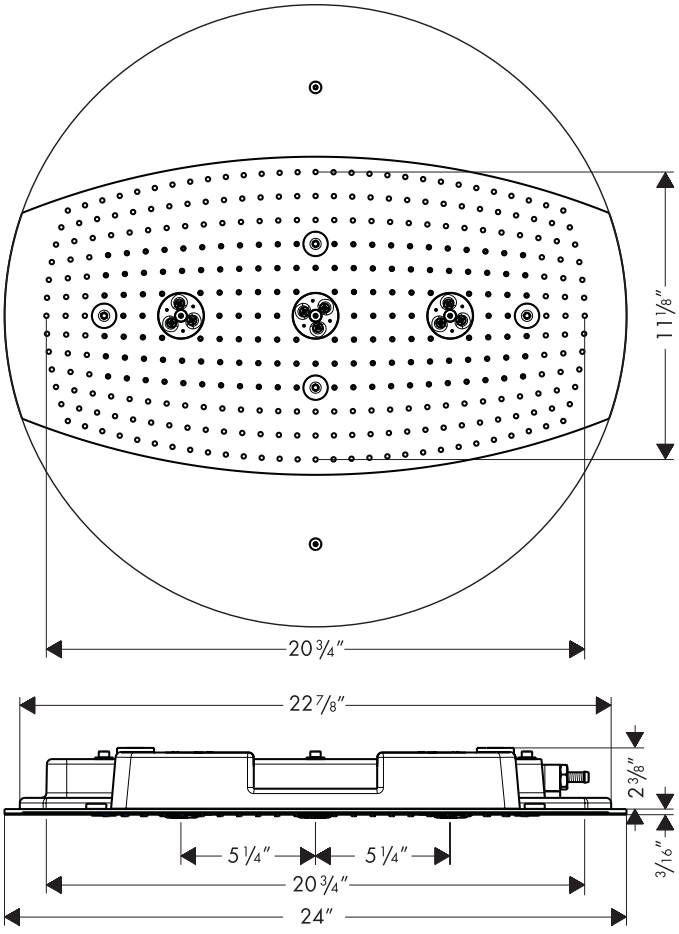
Plumbing Requirements DETAIL	**GPM per unit**	**Qty.**	**Total**
24" Raindance Imperial	7.5 gpm MAX	1	**7.5 gpm**
Body Jets	less than 1 gpm	6	**6 gpm**
Misters	0.5 gpm	2	**1 gpm**

*with 40 psi water pressure.

Raindance Imperial 600 AIR Showerhead

28403001





Product Features

- 24″ Spray face
- Ceiling flush mount
- Rubit™ cleaning system
- 358 no-clog spray channels
- Three spray modes: 12″ rain, dual rain, triple massage
- 2.5 gpm per spray mode

Code Compliance

This unit meets or exceeds the following:

- ASME A112.18.1
- CSA B125.1
- Listed by IAPMO
- Approved for use in Massachusetts

Available Finishes

Chrome	28403001

Required Accessories

Rainidance Imperial basic set	28412181
Ecostat/EcoMax rough	15374181
Volume control rough	13975181
Quattro diverter rough	13932181

Trim kits for all three roughs – many Axor styles available

The measurements shown are for reference only.

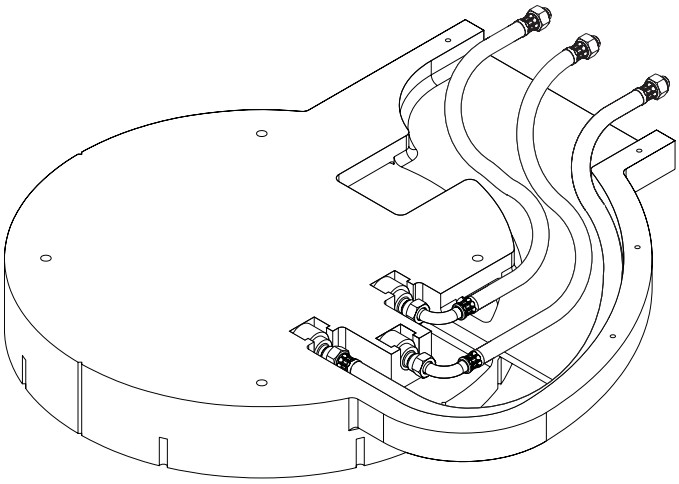
Products and specifications shown are subject to change without notice.

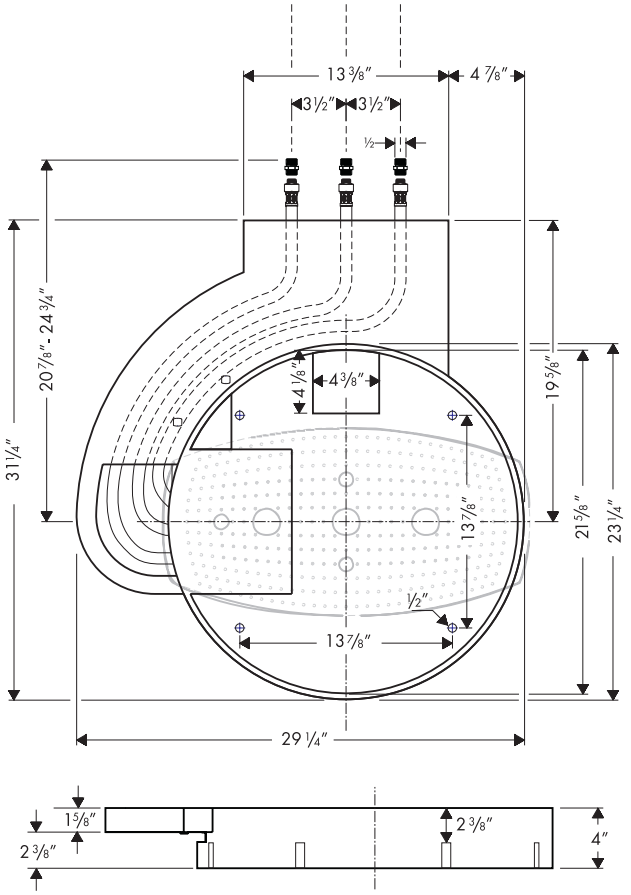
Specification sheet revised 1/2008

hansgrohe

Raindance Imperial Basic Set

28412181





Product Features

- Required for Raindance Imperial
- Three flexible hose connections 1/2" NPT male inlets

Code Compliance

This unit meets or exceeds the following:

- ASME A112.18.1
- CSA B125.1
- Listed by IAPMO
- Approved for use in Massachusetts

Required Accessories

Raindance Imperial 600 AIR showerhead	28403001
Ecostat / EcoMax rough	15374181
Volume control rough	13975181
Quattro diverter rough	13932181

Trim kits for all three roughs – many Axor styles available

The measurements shown are for reference only.

Products and specifications shown are subject to change without notice.

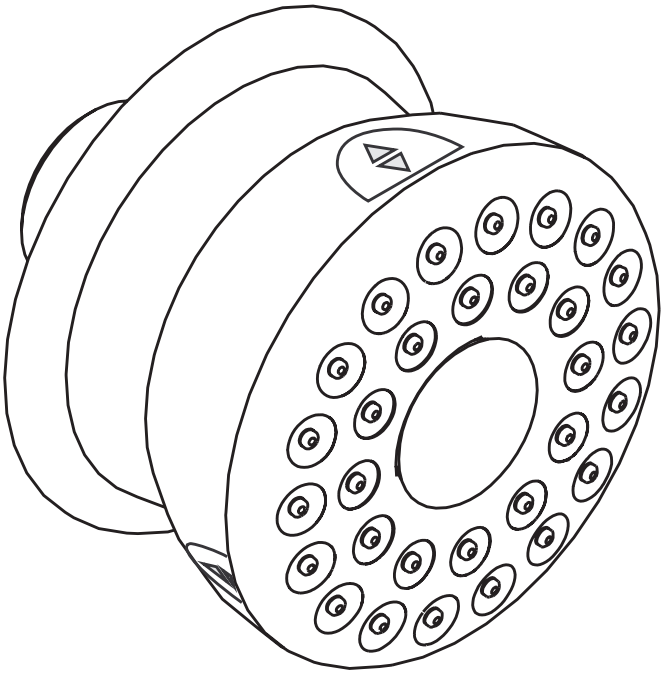
Specification sheet revised 1/2008

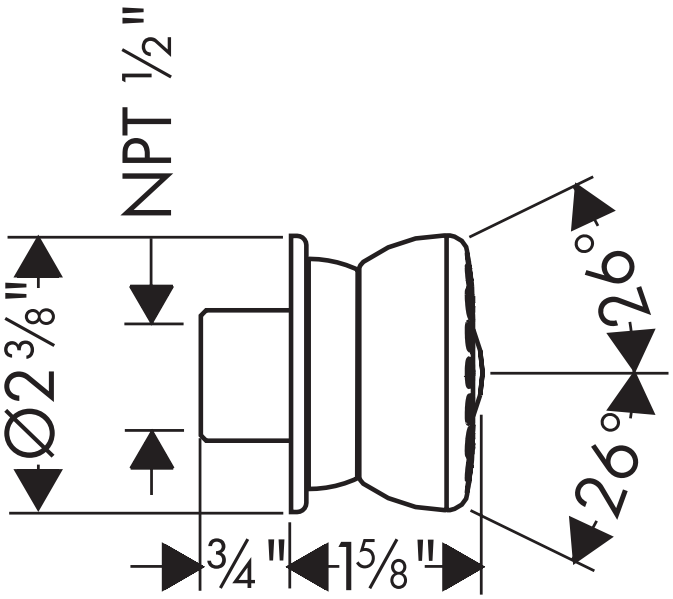
hansgrohe

Bodyvette Stop Bodyspray

28467XX1

Available in Chrome (00), Oil Rub Bronze (62), Steel (80), Brushed Nickel (82), Polished NIckel (83), Polished Brass (93)





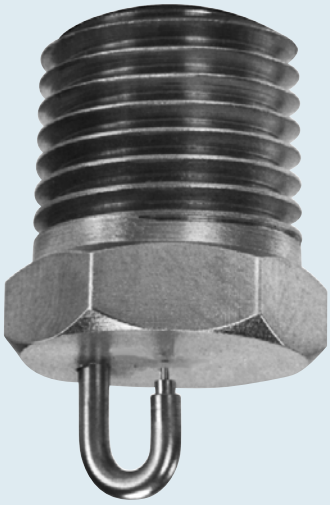
Product Specification

Rubit™ cleaning system
Adjustable spray angle
1/2" female NPT inlet
Built-in temporary shutoff – shuts water off to a trickle
1.6 gpm

hansgrohe

PJ

Smallest Physical Size



Metal

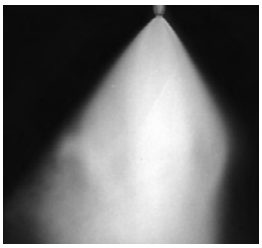
DESIGN FEATURES

- High energy efficiency
- One-piece, compact construction
- No whirl vanes or internal parts
- 1/8" or 1/4" male connection
- 100-mesh screen, 10 micron paper filter or polypropylene filter optional

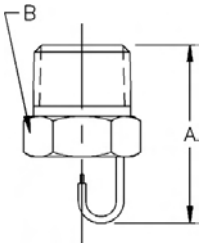
SPRAY CHARACTERISTICS

- Finest fog of any direct pressure nozzle
- Produces high percentage of droplets under 50 microns

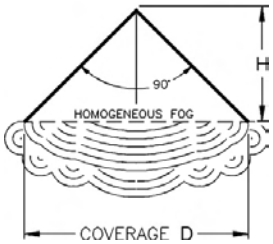
Spray pattern: Cone-shaped Fog
Spray angle: 90°. For best 90° pattern operate nozzle at or above 60 psi
Flow rates: 0.013 to 1.4 gpm



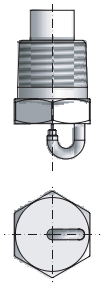
Fog



Male



Fog Pattern



PJ with polypropylene filter

Dimensions are approximate. Check with BETE for critical dimension applications.

PJ Flow Rates and Dimensions

Impingement, 90° Spray Angle, 1/8" or 1/4" Pipe Sizes

Male Pipe Size	Nozzle Number	K Factor	GALLONS PER MINUTE @ PSI 30 PSI	40 PSI	50 PSI	60 PSI	80 PSI	100 PSI	200 PSI	400 PSI	Approx. Orifice Dia. (in.)	Approx. Coverage (inches) D	Approx. Spray Height H (in.)	Pipe Size	Approx. Dim. (in.) A	B	Wt. (oz.) Metal
	PJ6	0.00095			0.006	0.007	0.008	0.010	0.013	0.019	0.006	10	5				
	PJ8	0.00180			0.013	0.014	0.016	0.018	0.025	0.036	0.008	10	5				
1/8	PJ10	0.00269		**0.017**	0.019	0.021	0.024	0.027	0.038	0.054	0.010	10	5	1/8	0.75	0.44	
	PJ12	0.00364		**0.023**	0.026	0.028	0.033	0.036	0.051	0.073	0.012	10	5				
	PJ15	0.00585	0.032	**0.037**	0.041	0.045	0.052	0.059	0.083	0.117	0.015	10	5				
OR	PJ20	0.0106	0.058	**0.067**	0.075	0.082	0.095	0.11	0.15	0.21	0.020	12	6				0.25
	PJ24	0.0158	0.087	**0.10**	0.11	0.12	0.14	0.16	0.22	0.32	0.024	16	8				
	PJ28	0.0206	0.11	**0.13**	0.15	0.16	0.18	0.21	0.29	0.41	0.028	18	9	1/4	0.97	0.56	
1/4	PJ32	0.0285	0.16	**0.18**	0.20	0.22	0.25	0.28	0.40	0.57	0.032	22	11				
	PJ40	0.0443	0.24	**0.28**	0.31	0.34	0.40	0.44	0.63	0.89	0.040	24	12				

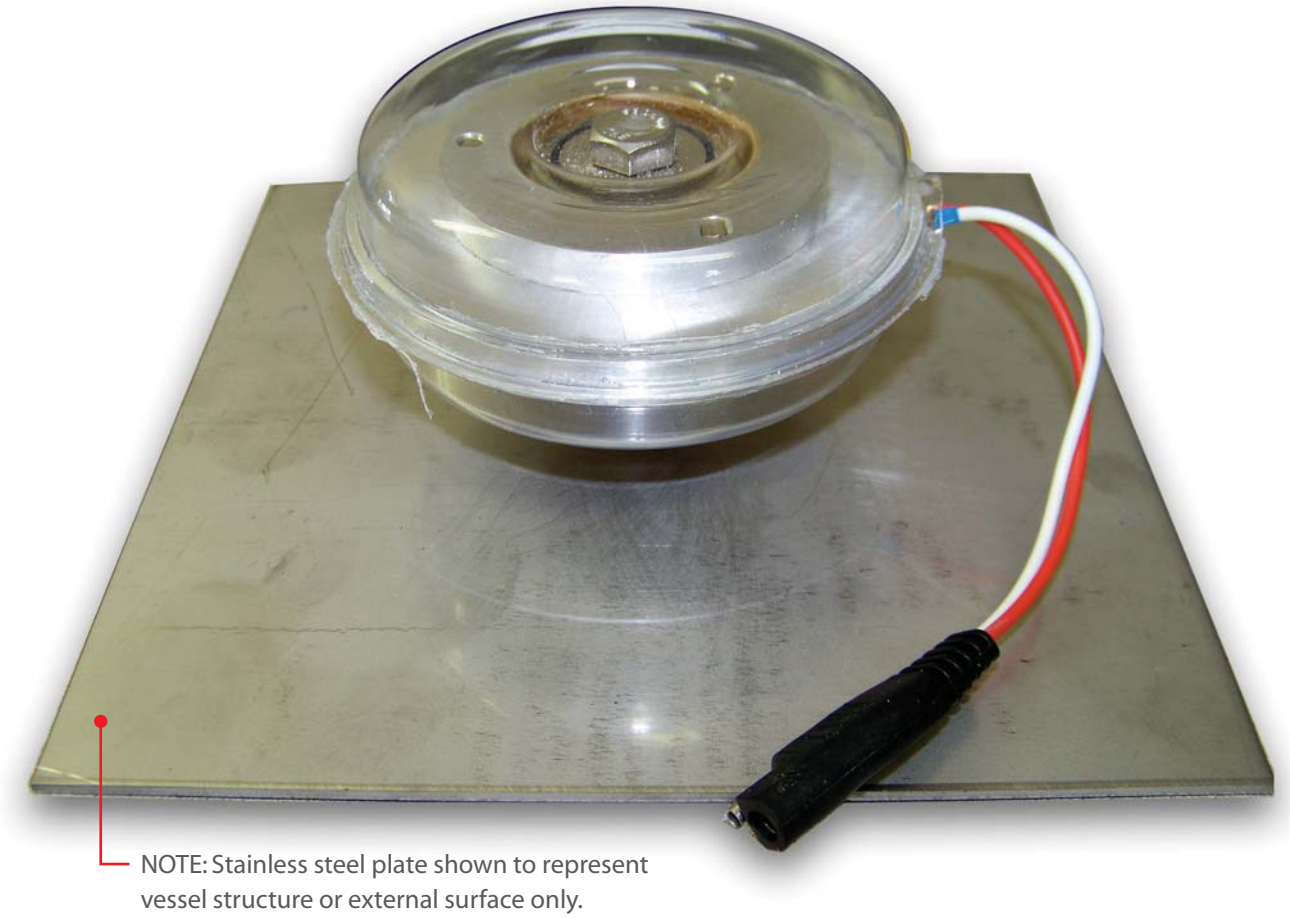
Flow Rate (GPM) = $K\sqrt{PSI}$

Standard Materials: Brass, 303 Stainless Steel and 316 Stainless Steel.

Spray angle performance varies with pressure. Contact BETE for specific data on critical applications.

Audio - So SoundHearts:

SO SoundHearts - Transducers with non-magnetic bolt with 2 pole transducer connector.
Mounted externally on stainless steel shell vessel.
Hard wire into facility audio system by others.

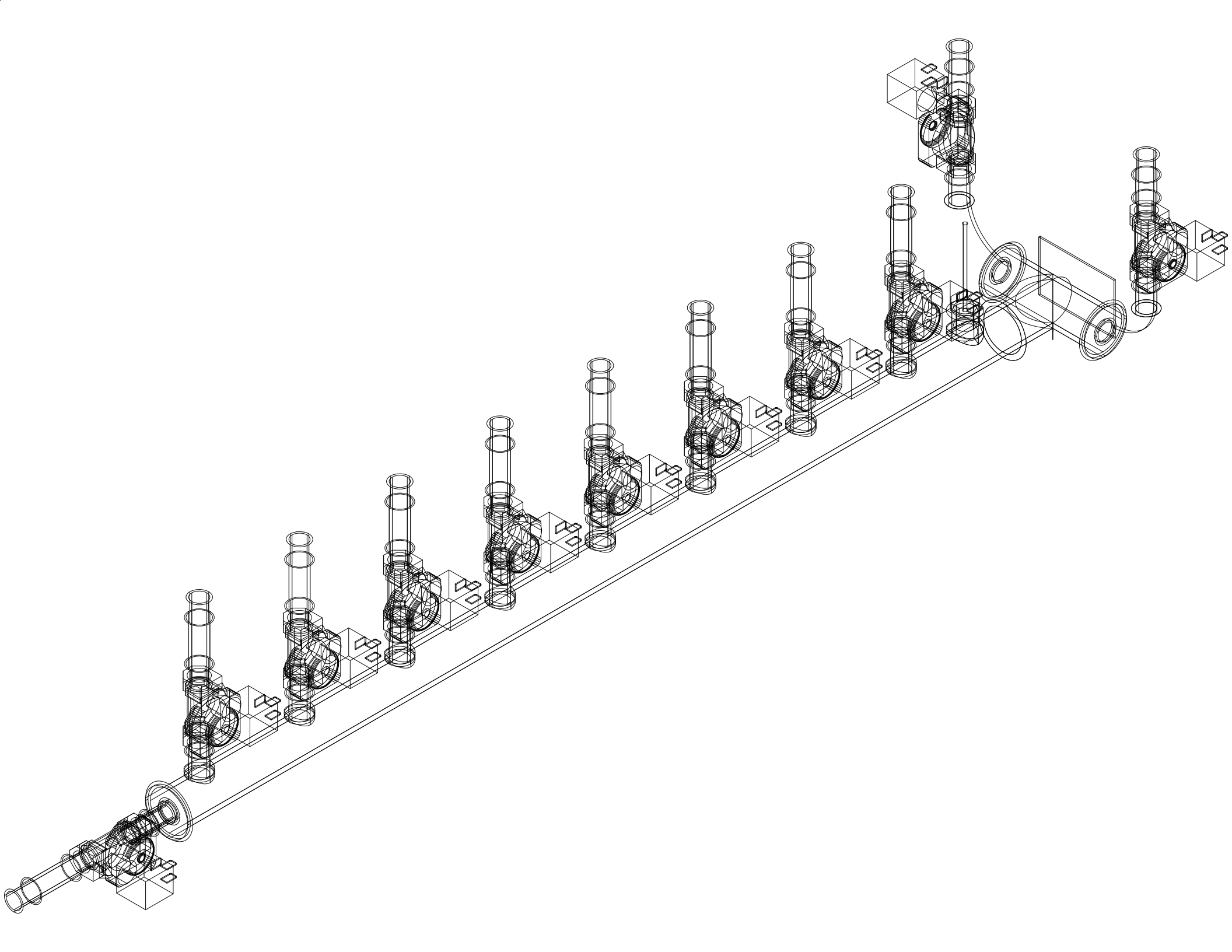


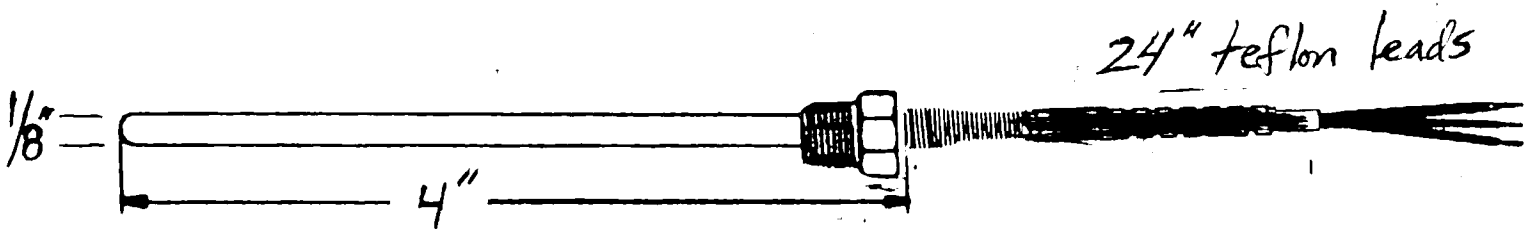
NOTE: Stainless steel plate shown to represent vessel structure or external surface only.

SO Sound Solutions Specification Document

Items Included in SO Sound System:

- SO SoundHearts® (Transducers with non-magnetic bolt with 2 pole transducer connector)
- 150 W SO Sound Custom Amplifier – supports up to 4 SO Sound Hearts and includes one stereo input connection port and one stereo output for powered speakers or headphone Jack.
- One power supply & Power Cable
- Access to a standard 110 V power source to support SO Sound Amp and additional speakers
- We recommend using a surge protector with all electronic products including ours.





TD THERMAL DEVICES 401 Center Street • P.O. Box 560 • Mt. Airy, Maryland 21771

SCALE:	APPROVED BY:	DRAWN BY Steve Canning
DATE: 3/10/09		REVISED
		DRAWING NUMBER

Valworx®

Electric Actuated Ball Valve

2-way Brass Body
1/4" to 4" NPT

SERIES
5600
5601

Features

- Direct mount ISO5211 full port brass ball valve
- Highly visible LED light gives continuous status indication
- Industrial IP65 weatherproof actuator, UV protected
- Multi-voltage capable with auto-voltage sensing
- Electronic torque limiter - protects against valve jams
- Anti-condensation heater
- Manual override with visual valve position indicator
- Electrical connections via external DIN plugs, no need to remove the cover
- Two dry contact auxiliary limit switches used to confirm valve open/closed position

Applications

On-off control of water, air, oil and other media compatible with the materials of construction. Steam service up to 25 PSI with optional high temperature mounting bracket. Suitable for vacuum service up to 29"Hg. Actuator designed for 75% duty cycle.

Temperature Range

Working Temperature: 0 to 158° F (-18 to 70° C)
Media temperatures up to 266° F (130° C)
with optional high temp. mounting bracket

Ball Valve Temperature Rating: 0 to 366° F (-18 to186° C) maximum

Actuator Temperature Rating: -4 to +158° F (-20 to 70° C) maximum

Construction

Valve Body	Brass
Ball	Chrome plated brass
Ball Seats	Teflon with energized Viton O-ring backing
Stem Seals	Teflon and double Viton O-rings
Actuator Enclosure	Anti-corrosive Polyamide
Position Indicator	Glass filled Polyamide
Fasteners	Stainless Steel

Operation

Electric actuated valve uses power-to-open and power-to-close, stays in the last known position with power failure. On receipt of a continuous voltage signal, the motor runs and via a flat gear system rotates the ball 90°. The motor is automatically stopped by internal cams striking limit switches. On receipt of a reversing continuous signal, the motor turns in the opposite direction reversing the valve position.

Description

Full port 2-piece brass ball valve is designed for unrestricted flow and low pressure drop. Teflon ball seats are energized with O-rings for low torque and extended life. Unique leak free stem seal design incorporates double O-rings and two Teflon auxiliary seals for the perfect stem seal design (negating the need for stem seal adjustment common to conventional style ball valves). These valves enjoy the reputation of having the highest performance and lowest operating torque in the industry. Lower operating torque equates to the use of a smaller size actuator, which in turn leads to a smaller profile and a less expensive package.

Optional Functions

Failsafe BSR - Battery Spring Return Kit
- actuator fails to a safe position with loss of power
Modulating DPS - Digital Positioning System
- valve position controlled by 4-20mA or 0-10V control signal

Specifications (English units)

Stock Number	Pipe Size (NPT)	Orifice Size (inch)	Cv Flow Factor	Pressure Max.(PSI)*	Cycle Time/90° (seconds)	Max. Current Draw (Amps)				
						115VAC	240VAC	24VAC	12VDC	24VDC
HIGH VOLTAGE: 85-240v AC or DC										
560002	1/4	0.39	6	600	11	0.17	0.09	-	-	-
560003	3/8	0.39	7	600	11	0.17	0.09	-	-	-
560004	1/2	0.56	19	600	11	0.17	0.09	-	-	-
560006	3/4	0.75	34	600	11	0.17	0.09	-	-	-
560008	1	1.00	50	600	11	0.17	0.09	-	-	-
560010	1-1/4	1.18	103	600	11	0.17	0.09	-	-	-
560012	1-1/2	1.50	267	600	11	0.17	0.09	-	-	-
560016	2	2.00	307	600	11	0.17	0.09	-	-	-
560020	2-1/2	2.50	626	600	14	0.24	0.11	-	-	-
560024	3	3.00	1012	300	14	0.24	0.11	-	-	-
560032	4	3.74	1612	150	30	0.22	0.09	-	-	-
LOW VOLTAGE: 12-24v AC or DC										
560102	1/4	0.39	6	600	12	-	-	0.085	2.05	1.00
560103	3/8	0.39	7	600	12	-	-	0.085	2.05	1.00
560104	1/2	0.56	19	600	12	-	-	0.085	2.05	1.00
560106	3/4	0.75	34	600	12	-	-	0.085	2.05	1.00
560108	1	1.00	50	600	12	-	-	0.085	2.05	1.00
560110	1-1/4	1.18	103	600	12	-	-	0.085	2.05	1.00
560112	1-1/2	1.50	267	600	12	-	-	0.085	2.05	1.00
560116	2	2.00	307	600	12	-	-	0.085	2.05	1.00
560120	2-1/2	2.50	626	600	16	-	-	1.20	3.08	1.40
560124	3	3.00	1012	300	16	-	-	1.20	3.08	1.40
560132	4	3.74	1612	150	35	-	-	0.90	2.10	1.20

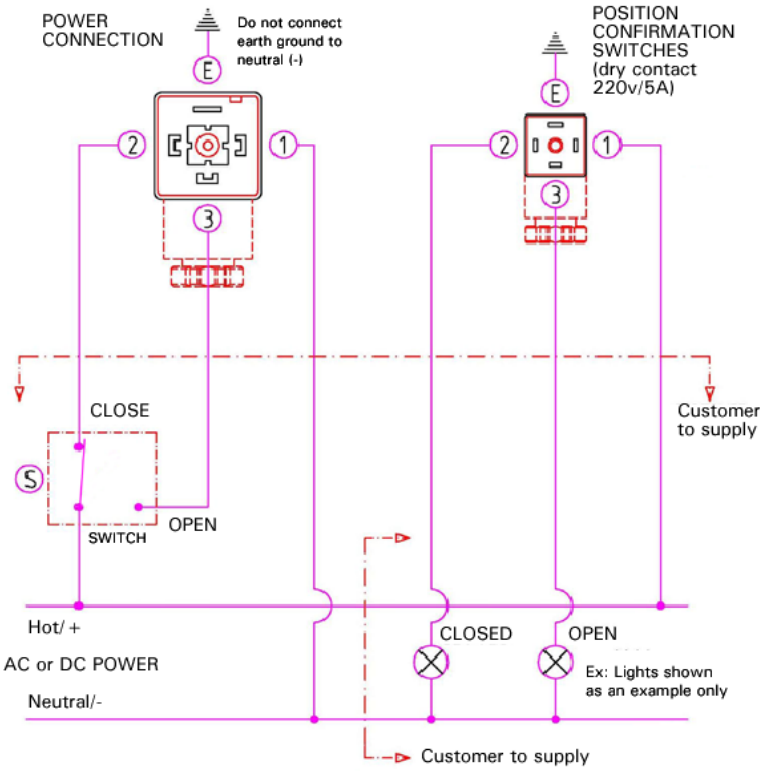
Cv is the GPM of water at 60° F that will pass through the valve with 1 PSI pressure drop

* Pressure @ 158° F (pressure reduced on 1/4" thru 2-1/2" sizes to 550 PSI @ 200° F, 400 PSI @ 266° F)

Electrical Wiring for On/Off and Failsafe BSR Versions

Voltage: 85-240V AC or DC, 12-24V AC or DC

Auto-voltage sensing



FUNCTION: ON-OFF VERSION

Power Connection

Power to PIN 1(N/-) and PIN 2 (H/+) closes the valve.

Power to PIN 1(N/-) and PIN 3 (H/+) opens the valve.

Stays in last known position with loss of power.

FUNCTION: ON-OFF with FAILSAFE BSR OPTION

Wiring is the same as standard ON-OFF version.

Power open, power close - trickle charges battery system in either open or closed position.

Actuator sent by battery power to pre-set failsafe position with power failure.

Actuator returns to pre-failure position on power resumption.

Factory preset to fail normally closed (optional normally open position).

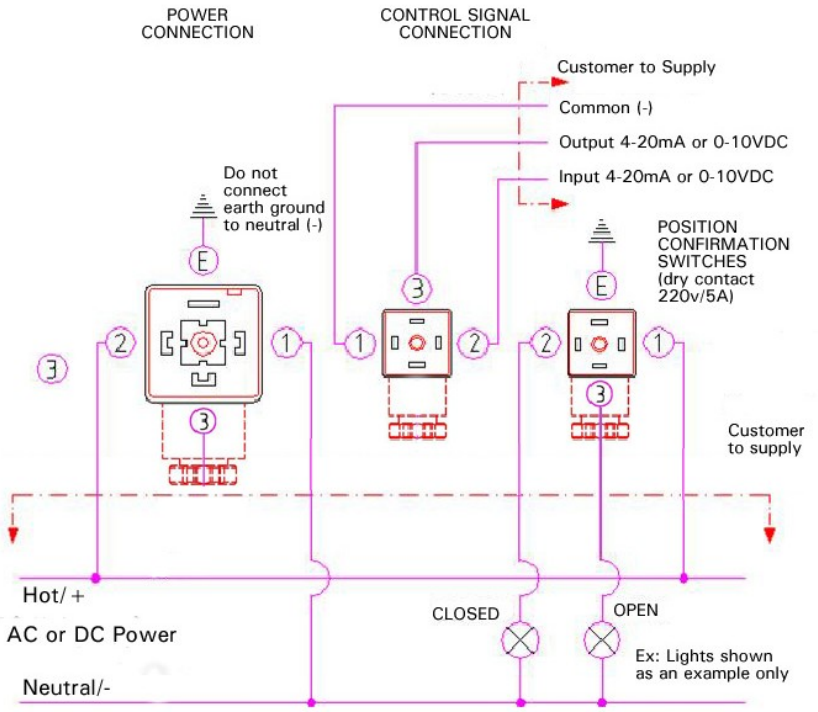
Wiring I.D. for Optional Pre-wired DIN Plug Cables	
PIN 1	Black
PIN 2	White
PIN 3	Red
GRD (E)	Green

Electrical Wiring for Modulating DPS Versions

Voltage: 85-240V AC or DC, 12-24V AC or DC

Control Signal: 4-20mA or 0-10V

Auto-voltage sensing



FUNCTION: MODULATING DPS VERSION

Power open, power close - actuator movement controlled by input signal 4-20mA or 0-10VDC.

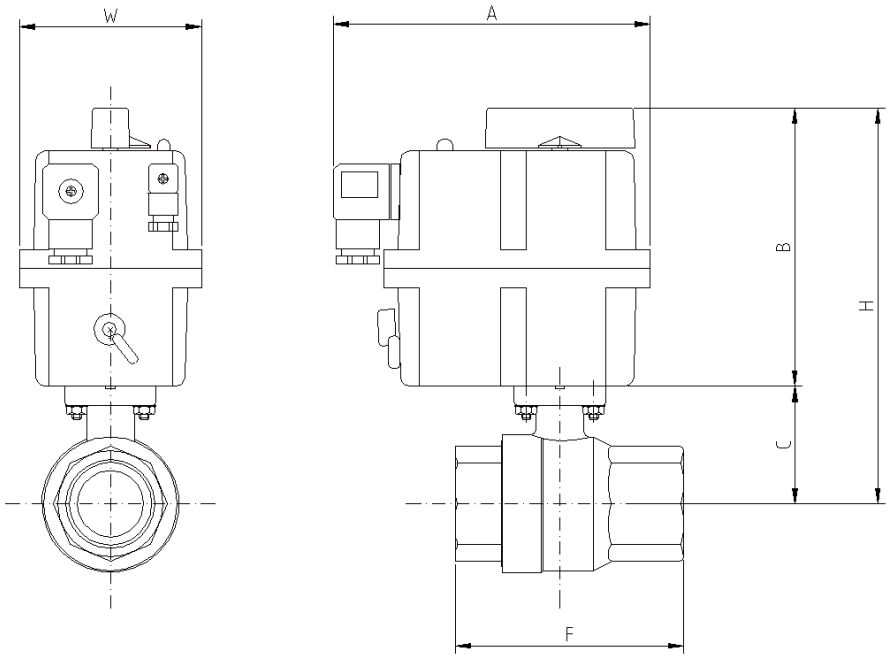
Standard operation: 4mA or 0V = actuator closed, 20mA or 10V = actuator open (can be reversed).

Actuator closes with loss of control signal, stays in last known position with loss of main power.

Output signal (in same format as supply signal) provided as standard.

Wiring I.D. for Optional Pre-wired DIN Plug Cables	
PIN 1	Black
PIN 2	White
PIN 3	Red
GRD (E)	Green

Dimensions: inches (mm)



Dimensions remain unchanged for all versions (on-off, failsafe & modulating)							
NPT	A	B	C	F	H	W	Weight lbs (kg)
1/4"	7.00 (178)	5.87 (149)	1.28 (32.5)	2.64 (67)	7.15 (182)	4.33 (110)	4.9 (2.3)
3/8"	7.00 (178)	5.87 (149)	1.28 (32.5)	2.64 (67)	7.15 (182)	4.33 (110)	4.8 (2.2)
1/2"	7.00 (178)	5.87 (149)	1.28 (32.5)	2.64 (67)	7.15 (182)	4.33 (110)	4.8 (2.2)
3/4"	7.00 (178)	5.87 (149)	1.36 (34.5)	3.00 (76)	7.23 (184)	4.33 (110)	5.0 (2.7)
1"	7.00 (178)	5.87 (149)	1.79 (45.5)	3.35 (85)	7.66 (195)	4.33 (110)	5.7 (2.6)
1-1/4"	7.00 (178)	5.87 (149)	1.93 (49)	3.66 (93)	7.80 (198)	4.33 (110)	6.3 (2.9)
1-1/2"	7.00 (178)	5.87 (149)	2.52 (64)	4.13 (105)	8.39 (213)	4.33 (110)	7.8 (3.5)
2"	7.00 (178)	5.87 (149)	2.88 (73.2)	4.80 (122)	8.75 (222)	4.33 (110)	9.4 (4.3)
2-1/2"	7.00 (178)	7.72 (197)	3.48 (88.4)	6.10 (155)	11.20 (285)	4.33 (110)	14.2 (6.5)
3"	7.00 (178)	7.72 (197)	3.85 (97.8)	6.89 (175)	11.60 (295)	4.33 (110)	18.7 (8.5)
4"	7.00 (178)	7.72 (197)	4.59 (117)	8.03 (204)	12.30 (312)	4.33 (110)	28.5 (13)

Valworx

Doc: j3.dps.0209

Modulating DPS "Digital Positioning System" for J3 Electric Actuators

Series
J3-DSP

Modulating DPS (Digital Positioning System)

Standard features include:

- DSP kit is retro-fittable to the standard J3 on-off actuator
- Self-calibrating
- Provides a proportional output signal
- DSP virtually eliminates 'hunting'
- Economically priced.

The DPS modulating kit is pre-installed at the factory when ordered as an option with a J3 actuator or J3 electric actuated valve assembly.

The DPS system provides accurate modulating function whereby the movement of the actuator is controlled by either a 4-20mA or a 0-10VDC control signal. Any change in the control input signal results in a corresponding and proportional change in the position of the actuator. Nominal impedance: 4-20mA signal 100 ohms; 0-10v signal 10K ohms

This is achieved with the use of an unique internal digital positioning system.

An internal microprocessor on the DPS circuit board continuously monitors digitally the analogue input and output signals and compares them to the physical position via an output shaft feedback system, moving the actuator as required to balance the signals.

Digital control ensures highly sensitive and repeatable control, with all the usual positioner characteristics coming in at under 1% (actuator only - including hysteresis, linearity & precision). Overall accuracy of valve assembly will vary depending on the type of valve used and method of mounting the valve.

The DPS is self calibrating, and on initial start-up or on restoration following a power cut, will go through a short automatic set-up sequence.

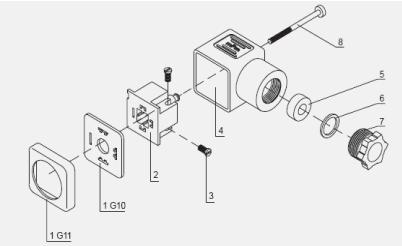
In situations where the actuator is used in manual mode (eg: commissioning) and put back into automatic mode with the actuator out of it's normal operating quadrant, the DPS will auto-adjust itself back into the correct quadrant, re-set itself, and be ready for use.

The DPS can be supplied as a retro-fit kit containing all the parts required to convert a standard on-off actuator to a modulating unit, and can be used in conjunction with the battery spring return BSR kit to produce failsafe modulating functionality.

AC (1ph) OR DC SUPPLY - WIRING FOR MODULATING ACTUATORS

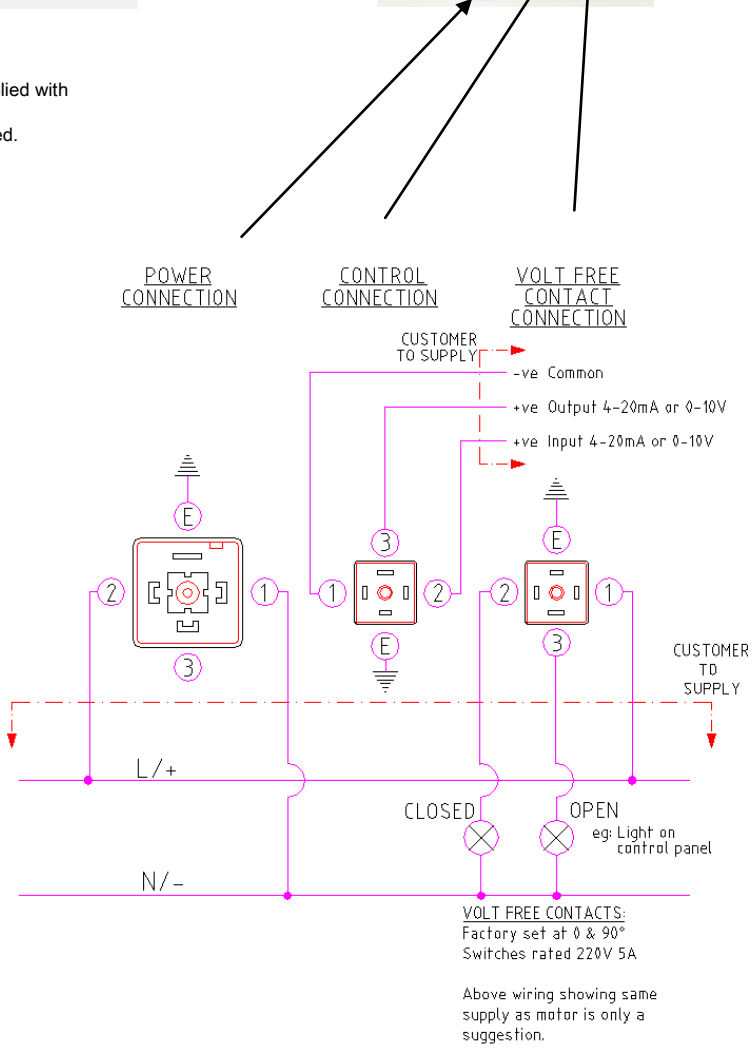
All electrical connections are made by external DIN plugs

(no need to remove cover):



Parts (1) through (7) supplied with

the kit. Three DIN plugs included.



NB: READ INSTALLATION, OPERATION & MAINTENANCE INSTRUCTIONS BEFORE CONNECTING.

FUNCTION: MODULATING VERSION

Power open, power close - actuator movement controlled by input signal (4-20mA or 0-10VDC)

Standard operation: 4mA or 0V = actuator closed, 20mA or 10V = actuator open (can be reversed)

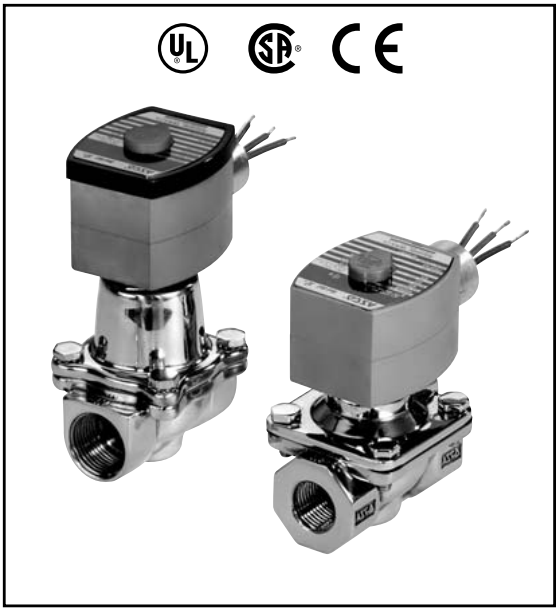
Standard operation: Actuator closes on loss of control signal, stays put on loss of mains power

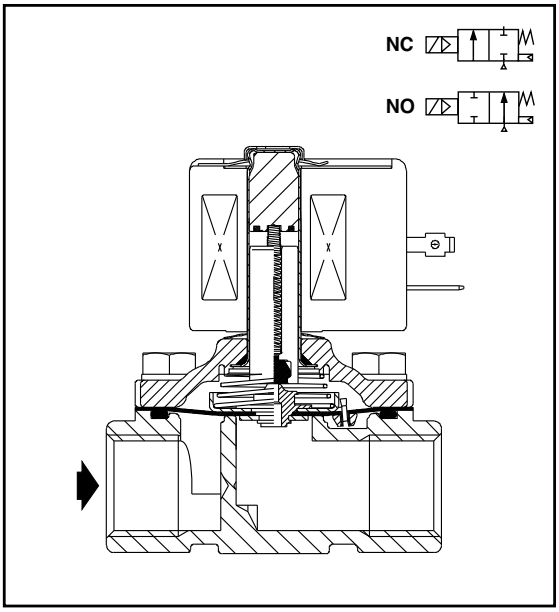
Output signal (in same format as supply signal) provided as standard.

Wiring for Pre-wired DIN Cables	
PIN 1	Black
PIN 2	White
PIN 3	Red
GRD (E)	Green

Features

- Wide range of pressure ratings, sizes, and resilient materials provide long service life and low internal leakage
- High Flow Valves for liquid, corrosive, and air/inert gas service
- Industrial applications include:
  - Car wash
  - Laundry equipment
  - Air compressors
  - Industrial water control
  - Pumps





Construction

Valve Parts in Contact with Fluids		
Body	Brass	304 Stainless Steel
Seals and Discs	NBR or PTFE	
Disc-Holder	PA	
Core Tube	305 Stainless Steel	
Core and Plugnut	430F Stainless Steel	
Springs	302 Stainless Steel	
Shading Coil	Copper	Silver

Electrical

Standard Coil and Class of Insulation	Watt Rating and Power Consumption				Spare Coil Part Number			
		AC			General Purpose		Explosionproof	
	DC Watts	Watts	VA Holding	VA Inrush	AC	DC	AC	DC
F	-	6.1	16	40	238210	-	238214	-
F	11.6	10.1	25	70	238610	238710	238614	238714
F	16.8	16.1	35	180	272610	97617	272614	97617
F	-	17.1	40	93	238610	-	238614	-
F	-	20	43	240	99257	-	99257	-
F	-	20.1	48	240	272610	-	272614	-
H	30.6	-	-	-	-	74073	-	74073
H	40.6	-	-	-	-	238910	-	238914

Standard Voltages: 24, 120, 240, 480 volts AC, 60 Hz (or 110, 220 volts AC, 50 Hz). 6, 12, 24, 120, 240 volts DC. Must be specified when ordering.
Other voltages available when required.

Solenoid Enclosures

Standard: RedHat II - Watertight, Types 1, 2, 3, 3S, 4, and 4X; RedHat - Type I.

Optional: RedHat II - Explosionproof and Watertight, Types 3, 3S, 4, 4X, 6, 6P, 7, and 9; Red-Hat - Explosionproof and Watertight, Types 3, 4, 4X, 7, and 9.

(To order, add prefix "EF" to catalog number, except Catalog Numbers 8210B057, 8210B058, and 8210B059, which are not available with Explosionproof enclosures.)
See Optional Features Section for other available options.

Nominal Ambient Temp. Ranges

RedHat II/
RedHat AC: 32˚F to 125˚F (0˚C to 52˚C)

RedHat II DC: 32˚F to 104˚F (0˚C to 40˚C)
RedHat DC: 32˚F to 77˚F (0˚C to 25˚C)
(104˚F/40˚C occasionally)

Refer to Engineering Section for details.

Approvals

UL listed as indicated. CSA certified.
RedHat II meets applicable CE directives.
Refer to Engineering Section for details.

2/2 SERIES 8210

ASCO®

Specifications (English units)

Pipe Size (ins.)	Orifice Size (ins.)	Cv Flow Factor	Operating Pressure Differential (psi)							Max. Fluid Temp. °F		Brass Body			Stainless Steel Body			Watt Rating/ Class of Coil Insulation ⑦	
			Min.	Max. AC			Max. DC												
				Air-Inert Gas	Water	Light Oil @ 300 SSU	Air-Inert Gas	Water	Light Oil @ 300 SSU	AC	DC	Catalog Number	Const. Ref. ④	UL ⑤ Listing	Catalog Number	Const. Ref. ④	UL ⑤ Listing	AC	DC
NORMALLY CLOSED (Closed when de-energized), NBR or PTFE ② Seating																			
3/8	3/8	1.5	①	150	125	-	40	40	-	180	150	8210G073 ③	1P	●	8210G036 ③	1P	●	6.1/F	11.6/F
3/8	5/8	3	0	150	150	-	40	40	-	180	150	8210G093	5D	❍	-	-	-	10.1/F	11.6/F
3/8	5/8	3	5	200	150	135	125	100	100	180	150	8210G001	6D	❍	-	-	-	6.1/F	11.6/F
3/8	5/8	3	5	300	300	300	-	-	-	175	-	8210G006	5D	❍	-	-	-	17.1/F	-
1/2	7/16	2.2	①	150	125	-	40	40	-	180	150	8210G015 ③	2P	●	8210G037 ③	2P	●	6.1/F	11.6/F
1/2	5/8	4	0	150	150	-	40	40	-	180	150	8210G094	5D	❍	-	-	-	10.1/F	11.6/F
1/2	5/8	4	0	150	150	125	40	40	-	175	150	-	-	-	8210G087	7D	●	17.1/F	11.6/F
1/2	5/8	4	5	200	150	135	125	100	100	180	150	8210G002	6D	❍	-	-	-	6.1/F	11.6/F
1/2	5/8	4	5	300	300	300	-	-	-	175	-	8210G007	5D	❍	-	-	-	17.1/F	-
1/2	3/4	4	5	-	300	-	-	300	-	180	125	8210G227	5D	❍	-	-	-	17.1/F	40.6/H
3/4	5/8	4.5	0	150	150	125	40	40	-	175	150	-	-	-	8210G088	7D	●	17.1/F	11.6/F
3/4	3/4	5	5	125	125	125	100	90	75	180	150	8210G009	9D	❍	-	-	-	6.1/F	11.6/F
3/4	3/4	5	0	150	150	-	40	40	-	180	150	8210G095	8D	❍	-	-	-	10.1/F	11.6/F
3/4	3/4	6.5	5	250	150	100	125	125	125	180	150	8210G003	11D	❍	-	-	-	6.1/F	11.6/F
3/4	3/4	6	0	-	-	-	200	180	180	-	77	8210B026 ② ‡	10P	-	-	-	-	-	30.6/H
3/4	3/4	6	0	350	300	200	-	-	-	200	-	8210G026 ② ‡	40P	●	-	-	-	16.1F	-
1	1	13	0	-	-	-	100	100	80	-	77	8210B054 ‡	31D	-	8210D089	15D	-	-	30.6/H
1	1	13	0	150	125	125	-	-	-	180	-	8210G054	41D	●	8210G089	45D	●	16.1/F	-
1	1	13	5	150	150	100	125	125	125	180	150	8210G004	12D	❍	-	-	-	6.1/F	11.6/F
1	1	13.5	0	300	225	115	-	-	-	200	-	8210G027 ‡	42P	●	-	-	-	20.1/F	-
1	1	13.5	10	300	300	300	-	-	-	175	-	8210G078 ②	13P	-	-	-	-	17.1/F	-
1 1/4	1 1/8	15	0	-	-	-	100	100	80	-	77	8210B055 ‡	32D	-	-	-	-	-	30.6/H
1 1/4	1 1/8	15	0	150	125	125	-	-	-	180	-	8210G055	43D	●	-	-	-	16.1/F	-
1 1/4	1 1/8	15	5	150	150	100	125	125	125	180	150	8210G008	16D	❍	-	-	-	6.1/F	11.6/F
1 1/2	1 1/4	22.5	0	-	-	-	100	100	80	-	77	8210B056 ‡	33D	-	-	-	-	-	30.6/H
1 1/2	1 1/4	22.5	0	150	125	125	-	-	-	180	-	8210G056	44D	●	-	-	-	16.1/F	-
1 1/2	1 1/4	22.5	5	150	150	100	125	125	125	180	150	8210G022	18D	●	-	-	-	6.1/F	11.6/F
2	1 3/4	43	5	150	125	90	50	50	50	180	150	8210G100	20P	●	-	-	-	6.1/F	11.6/F
2 1/2	1 3/4	45	5	150	125	90	50	50	50	180	150	8210G101	21P	●	-	-	-	6.1/F	11.6/F
NORMALLY OPEN (Open when de-energized), NBR Seating (PA Disc-Holder, except as noted)																			
3/8	5/8	3	0	150	150	125	125	125	80	180	150	8210G033	23D	●	-	-	-	10.1/F	11.6/F
3/8	5/8	3	5	250	200	200	250	200	200	180	180	8210G011 ⑧ ⑨	39D	●	-	-	-	10.1/F	11.6/F
1/2	5/8	4	0	150	150	125	125	125	80	180	150	8210G034	23D	●	-	-	-	10.1/F	11.6/F
1/2	5/8	3	0	150	150	100	125	125	80	180	150	-	-	-	8210G030	37D	●	10.1/F	11.6/F
1/2	5/8	4	5	250	200	200	250	200	200	180	180	8210G012 ⑧ ⑨	39D	●	-	-	-	10.1/F	11.6/F
3/4	3/4	5.5	0	150	150	125	125	125	80	180	150	8210G035	25D	●	-	-	-	10.1/F	11.6/F
3/4	5/8	3	0	150	150	100	125	125	80	180	150	-	-	-	8210G038	38D	●	10.1/F	11.6/F
3/4	3/4	6.5	5	-	-	-	250	200	200	-	180	8210C013	24D	●	-	-	-	-	16.8/F
3/4	3/4	6.5	5	250	200	200	-	-	-	180	-	8210G013	46D	●	-	-	-	16.1/F	-
1	1	13	0	125	125	125	-	-	-	180	-	8210B057 ⑥ ⑩	34D	●	-	-	-	20/F	-
1	1	13	5	-	-	-	125	125	125	-	180	8210D014	26D	●	-	-	-	-	16.8/F
1	1	13	5	150	150	125	-	-	-	180	-	8210G014	47D	●	-	-	-	16.1/F	-
1 1/4	1 1/8	15	0	125	125	125	-	-	-	180	-	8210B058 ⑥ ⑩	35D	●	-	-	-	20/F	-
1 1/4	1 1/8	15	5	-	-	-	125	125	125	-	180	8210D018	28D	●	-	-	-	-	16.8/F
1 1/4	1 1/8	15	5	150	150	125	-	-	-	180	-	8210G018	48D	●	-	-	-	16.1/F	-
1 1/2	1 1/4	22.5	0	125	125	125	-	-	-	180	-	8210B059 ⑥ ⑩	36D	●	-	-	-	20/F	-
1 1/2	1 1/4	22.5	5	-	-	-	125	125	125	-	180	8210D032	29D	●	-	-	-	-	16.8/F
1 1/2	1 1/4	22.5	5	150	150	125	-	-	-	180	-	8210G032	49D	●	-	-	-	16.1/F	-
2	1 3/4	43	5	-	-	-	125	125	125	-	150	8210 103	30P	●	-	-	-	-	16.8/F
2	1 3/4	43	5	125	125	125	-	-	-	180	-	8210G103	50P	●	-	-	-	16.1/F	-
2 1/2	1 3/4	45	5	-	-	-	125	125	125	-	150	8210 104	27P	●	-	-	-	-	16.8/F
2 1/2	1 3/4	45	5	125	125	125	-	-	-	180	-	8210G104	51P	●	-			16.1/F	-

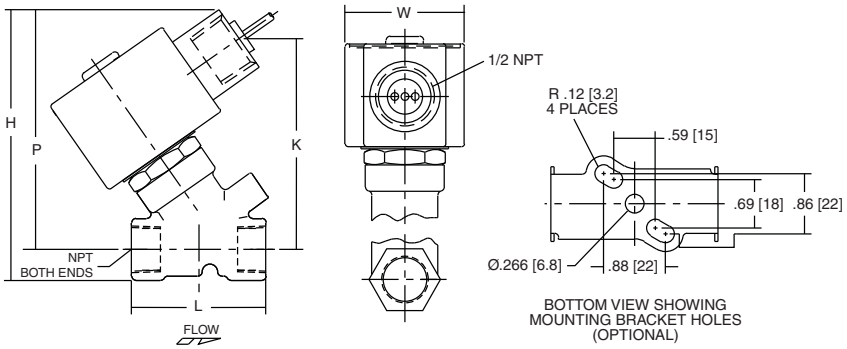
① 5 psi on Air; 1 psi on Water.
② Valve provided with PTFE main disc.
③ Valve includes ULtem (G.E. trademark) piston.
④ Letter "D" denotes diaphragm construction; "P" denotes piston construction.
⑤ ❍ Safety Shutoff Valve; ● General Purpose Valve.
Refer to Engineering Section (Approvals) for details.
⑥ Valves not available with Explosionproof enclosures.
⑦ On 50 hertz service, the watt rating for the 6.1/F solenoid is 8.1 watts.
⑧ AC construction also has PA seating.
⑨ No disc-holder.
⑩ Stainless steel disc-holder.
‡ Must have solenoid mounted vertical and upright.

Dimensions: inches (mm)

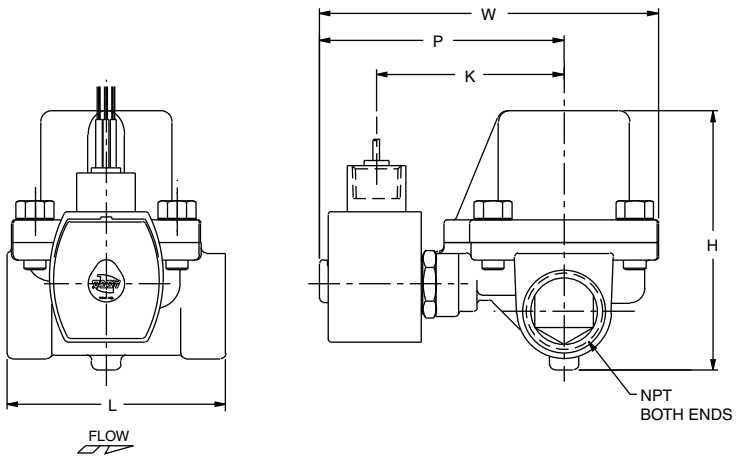
Const. Ref.		H	K	L	P	W
1*	ins.	3.85	3.00	1.91	3.41	1.69
	mm	98	76	49	87	43
2*	ins.	4.17	3.25	2.28	3.63	1.69
	mm	106	83	58	92	43
5	ins.	3.84	2.31	2.75	3.28	2.28
	mm	98	59	70	83	58
6*	ins.	3.38	1.94	2.75	2.80	2.28
	mm	86	49	70	71	58
7	ins.	4.19	2.50	2.81	3.47	2.39
	mm	106	64	71	88	61
8	ins.	4.13	2.47	2.81	3.44	2.29
	mm	105	63	71	87	58
9*	ins.	3.66	2.10	2.81	2.96	2.28
	mm	93	53	71	75	58
10*	ins.	5.25	X	2.81	4.59	2.31
	mm	133	X	71	117	59
11*	ins.	4.16	2.66	3.84	3.52	2.75
	mm	106	68	98	89	70
12	ins.	5.64	3.15	3.75	4.01	3.36
	mm	143	80	95	102	85
13	ins.	4.44	3.22	3.75	4.19	5.81
	mm	113	82	95	106	147
15*	ins.	5.34	X	3.75	4.47	3.84
	mm	136	X	95	114	98
16	ins.	5.64	3.15	3.66	4.01	3.56
	mm	143	80	93	102	90
18	ins.	6.11	3.30	4.38	4.16	3.92
	mm	155	84	111	106	100
20*	ins.	7.33	3.71	5.06	4.57	4.87
	mm	186	94	129	116	124
21*	ins.	7.33	3.71	5.50	4.57	4.87
	mm	186	94	140	116	124
23	ins.	4.35	2.65	2.75	3.79	2.28
	mm	110	67	70	96	58
24	ins.	5.06	X	3.78	4.44	2.75
	mm	129	X	96	113	70
25	ins.	4.64	2.81	2.81	3.94	2.28
	mm	118	71	71	100	58
26	ins.	6.53	X	3.75	4.91	3.19
	mm	166	X	95	125	81
27	ins.	8.22	X	5.50	5.47	4.87
	mm	209	X	140	139	124
28	ins.	6.53	X	3.66	4.91	3.19
	mm	166	X	93	125	81
29	ins.	7.03	X	4.38	5.06	4.40
	mm	179	X	111	129	112

* DC dimensions slightly larger.
IMPORTANT: Valves may be mounted in any position, except as noted in specifications table.

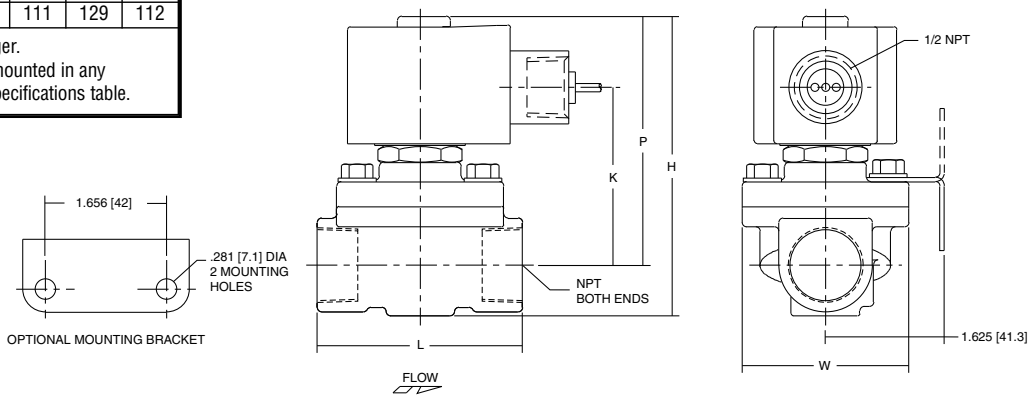
Const. Ref. 1, 2



Const. Ref. 13



Const. Ref. 5-9, 11, 20, 21, 23 , 25, 37,38

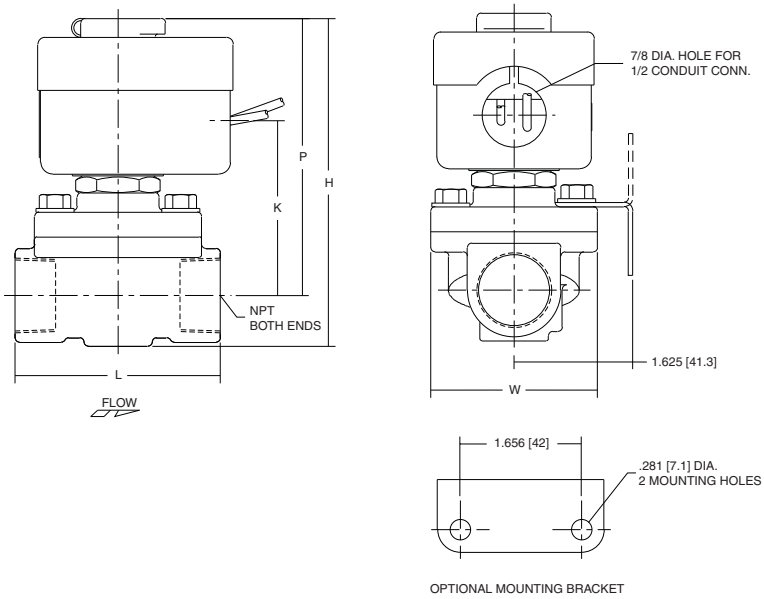


Dimensions: inches (mm)

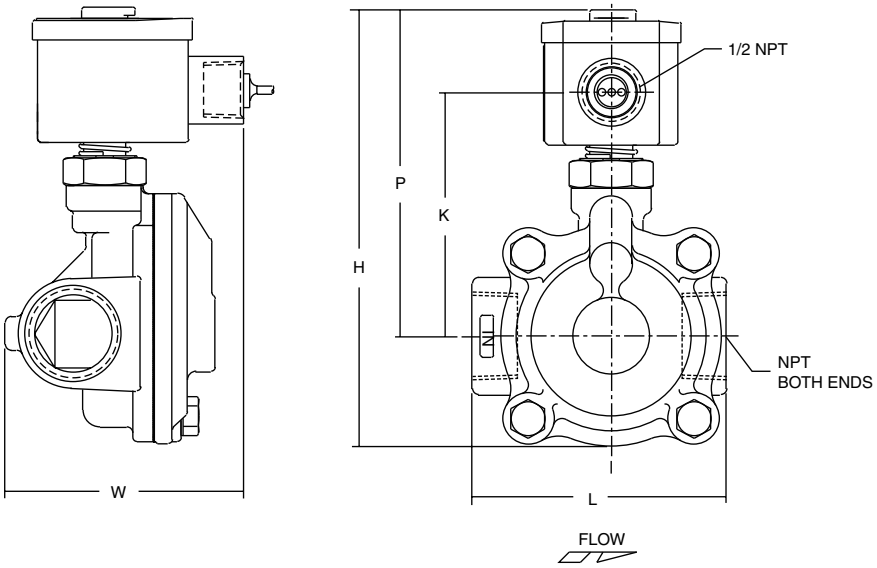
Const. Ref.		H	K	L	P	W
30	ins.	8.22	X	5.06	5.47	4.87
	mm	209	X	129	139	124
31	ins.	5.25	X	3.75	4.44	3.25
	mm	133	X	95	113	83
32	ins.	5.69	X	3.66	4.69	3.25
	mm	145	X	93	119	83
33	ins.	6.06	X	4.38	4.94	3.91
	mm	154	X	111	125	99
34	ins.	6.91	X	3.75	6.09	3.25
	mm	176	X	95	155	83
35	ins.	7.34	X	3.66	6.34	3.25
	mm	186	X	93	161	83
36	ins.	7.66	X	4.38	6.56	3.91
	mm	1.95	X	111	167	99
37	ins.	4.61	2.75	2.81	3.89	2.39
	mm	117	70	71	99	61
38	ins.	4.61	2.75	2.81	3.89	2.39
	mm	117	70	71	99	61
39	ins.	5.42	2.31	2.75	4.86	3.80
	mm	138	59	70	123	97
40	ins.	5.20	3.29	2.81	4.50	2.28
	mm	132	83	71	114	58
41	ins.	5.13	3.10	3.75	4.32	3.25
	mm	130	79	95	110	83
42	ins.	6.43	4.40	3.93	5.62	3.25
	mm	163	112	100	143	83
43	ins.	5.57	3.35	3.66	4.57	3.25
	mm	142	85	93	116	83
44	ins.	5.90	3.57	4.38	4.79	3.91
	mm	150	91	111	122	99
45	ins.	5.26	3.17	3.75	4.38	3.84
	mm	134	81	95	111	98
46	ins.	4.95	3.10	3.84	4.31	2.75
	mm	126	79	98	110	70
47	ins.	6.43	3.59	3.75	4.81	3.52
	mm	163	91	95	122	90
48	ins.	6.43	3.59	3.66	4.81	3.73
	mm	163	91	93	122	95
49	ins.	6.91	3.75	4.38	4.96	4.40
	mm	176	95	111	126	112
50	ins.	8.13	4.15	5.06	5.37	4.87
	mm	207	105	129	136	124
51	ins.	8.13	4.15	5.50	5.37	5.18
	mm	207	105	140	136	132

IMPORTANT: Valves may be mounted in any position, except as noted in specifications table.

Const. Ref. 10, 15, 24, 26-36

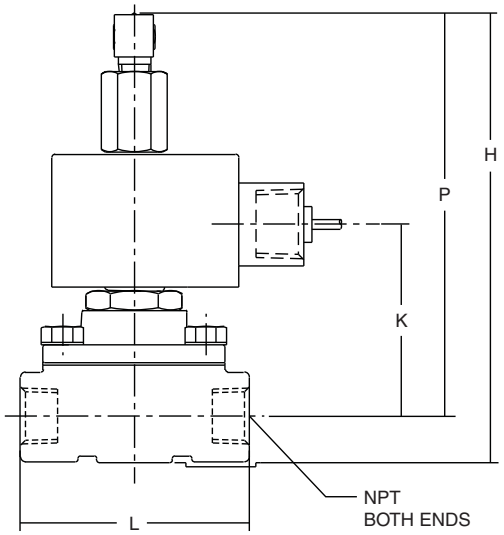


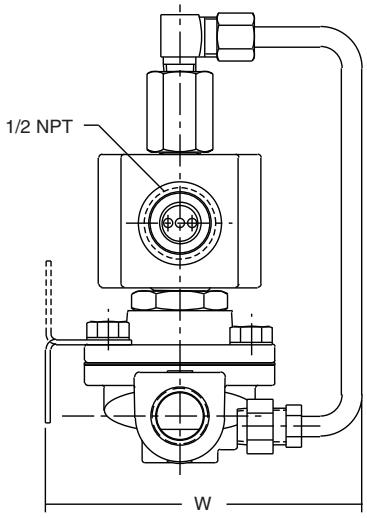
Const. Ref. 12, 16, 18



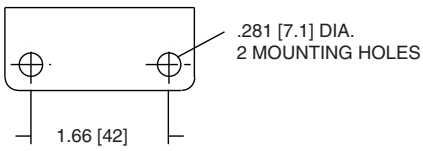
Dimensions: inches (mm)

Const. Ref. 39



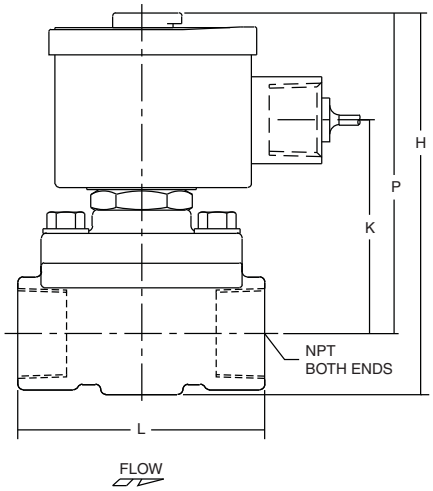


FLOW

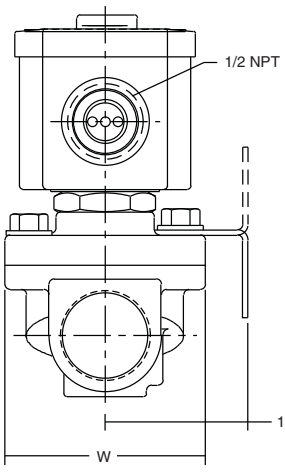


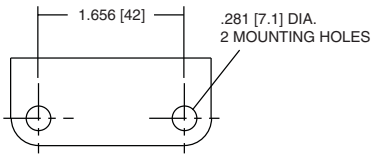
SHOWING MOUNTING
BRACKET ONLY

Const. Ref. 40-51



FLOW





OPTIONAL MOUNTING BRACKET

4.4 Device 4PP420.0571-65

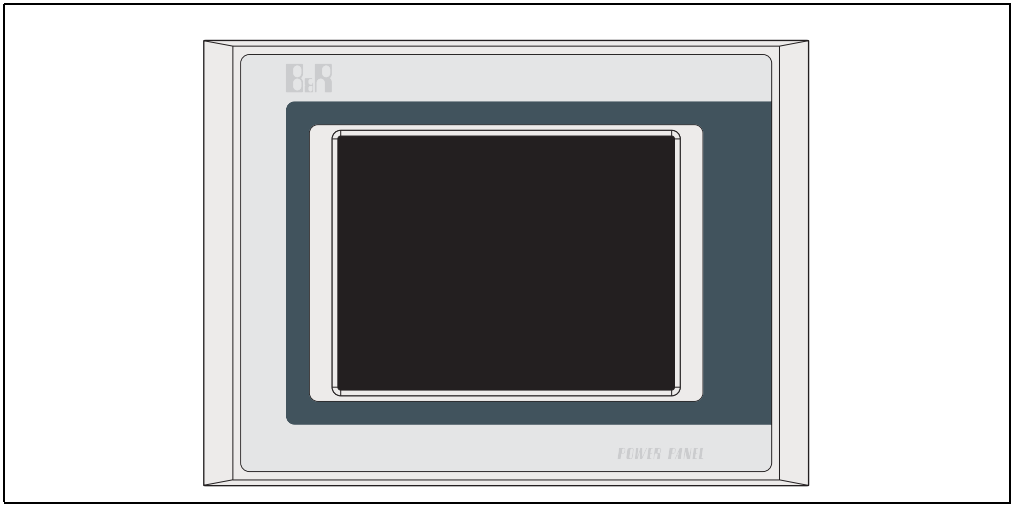


Figure 103: Front view - 4PP420.0571-65

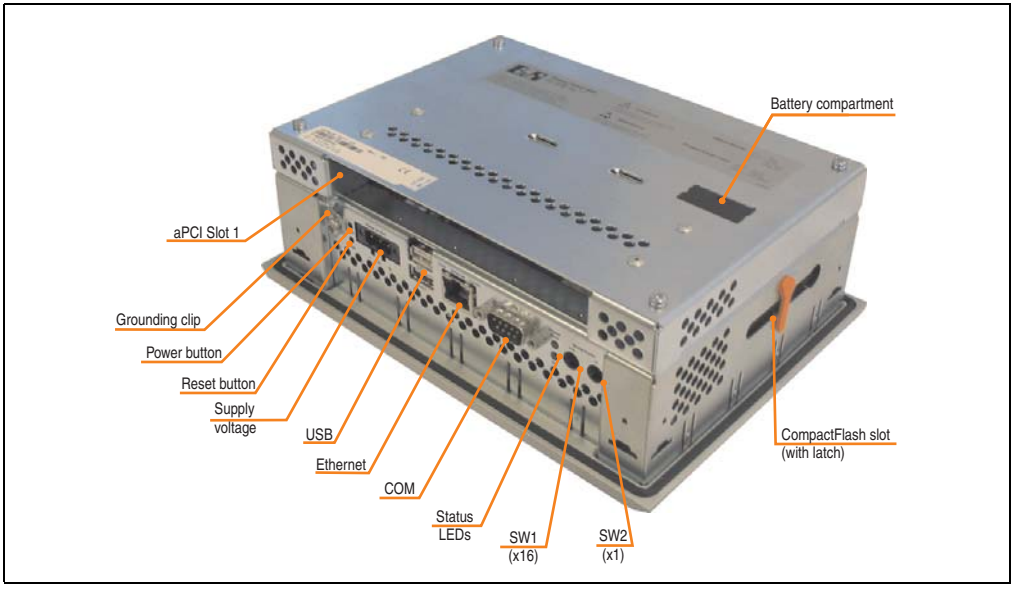


Figure 104: Rear view - 4PP420.0571-65

4.4.1 Technical data

Features	4PP420.0571-65
Boot loader / Operating system	Automation Runtime
Processor Type Expanded command set L1 cache L2 cache Floating point unit (FPU) Cooling Method	 Geode LX800 500 MHz, 32-bit x86 MMX technology, 3D Now 128 KB (64 KB L cache / 64 KB D cache) 128 KB Yes Passive (heat sink)
Flash	2 MB (for firmware)
Memory Type Quantity	 DDR SDRAM 128 (64 MB < Rev. C0)
Graphics Controller Memory	 Geode LX800 8 MB shared memory (reserved by main memory)
SRAM Quantity Battery-buffered	 512 KB Yes
Watchdog Controller	 MTCX[1)]
Power failure logic Controller Buffer time	 MTCX[1)] 10 ms
Real-time clock (RTC) Battery-buffered Accuracy	 Yes At 25°C: typically 30 ppm (2.5 seconds) [2)] per day
Battery Type Removable Lifespan Backup capacitor (for changing battery) Buffer time	 Renata 950 mAh Yes, accessible from the outside 3 years [3)] 10 minutes
Ethernet Controller Transfer rate Connection Cables NE2000-compatible	 Intel 82551ER 10/100 Mbps RJ45 twisted pair (10 Base T / 100 Base T) S/STP (category 5) -
CompactFlash Type Amount Connection	 Type I 1 slot Primary IDE device
Serial interface COM Type UART Transfer rate Connection	 RS232, modem-capable, not electrically isolated 16C550 compatible, 16-byte FIFO Max. 115 kBaud 9-pin DSUB

Table 62: Technical data - 4PP420.0571-65

Features	4PP420.0571-65
USB interface	
Type	USB 1.1, USB 2.0[4)]
Amount	2
Transfer rate	Low speed (1.5 MBit/s), full speed (12 MBit/s), to high speed (480 Mbit/s)[4)]
Connection	Type A
Current load	Max. 500 mA per connection
Reset button	Yes, accessible from the outside
Power button	Yes, accessible from the outside
LEDs	1x CF (yellow) 1x combined power (red/green) and user (yellow)
Mode / Node switch	2, 16 digits each
aPCI slots	1 (see B&R System 2005 manual for available aPCI interface modules)
Display	
Type	Color LCD
Diagonal	5.7 in (144 mm)
Colors	512 colors [4)]
Resolution	QVGA, 320 x 240 pixels
Contrast	40:1
Viewing angle (see page 488)	
Horizontal	Direction R / direction L =40°
Vertical	Direction U = 40°/ direction D = 50°
Background lighting	
Brightness	200 cd/m²
Half-brightness time	50000 hours
Screen rotation	Yes, see chapter 3 "Commissioning", section "Screen rotation" on page 361
Touch screen	
Technology	Analog, resistive
Controller	Elo, serial, 12- bit
Degree of transmission	Up to 80% ± 5%
Filter glass	-
Degree of transmission	
Coating	
Keys/LED	-
Function keys	
Soft keys	
Cursor keys	
Number block	
Other keys	
Key lifespan	
LED brightness	
Electrical characteristics	
Power supply	
Rated voltage	18 - 30 VDC
Rated current	0.5 A
Starting current	Maximum 1.2 A
Power consumption	Typically 12 W
Electrical isolation	Yes
Bleeder resistance	0 Ohm

Table 62: Technical data - 4PP420.0571-65 (Forts.)

Mechanical characteristics	4PP420.0571-65
Outer dimensions	
Width	212 mm
Height	156 mm
Depth	76 mm
Front	
Frame	Aluminum, naturally anodized[5)]
Design	Gray[5)]
Membrane	Polyester
Dark gray border around display	Similar to Pantone 432CV[5)]
Light background	Similar to Pantone 427CV[5)]
Gasket	Flat gasket around display front
Housing	Metal
Weight	Approx. 1.7 kg (without aPCI interface modules)
Environmental characteristics	
Ambient temperature	
Operation	0 .. +50°C
Storage	-20 .. +60°C
Transport	-20 .. +60°C
Relative humidity	See 4.4.2 "Temperature humidity diagram" on page 170
Vibration	
Operation (continuous)	2 - 9 Hz: 1.75 mm amplitude / 9 - 200 Hz: 0.5 g
Operation (occasional)	2 - 9 Hz: 3.5 mm amplitude / 9 - 200 Hz: 1 g
Storage	2 - 8 Hz: 7.5 mm amplitude / 8 - 200 Hz: 2 g / 200 - 500 Hz: 4 g
Transport	2 - 8 Hz: 7.5 mm amplitude / 8 - 200 Hz: 2 g / 200 - 500 Hz: 4 g
Shock	
Operation	15 g, 11 ms
Storage	30 g, 15 ms
Transport	30 g, 15 ms
Protection type	IP20 back side (only with installed CompactFlash card, inserted aPCI module or with an optional aPCI cover) IP65 / NEMA 250 type 4X, dust and sprayed water protection (front side)
Altitude	Max. 3000 m

Table 62: Technical data - 4PP420.0571-65 (Forts.)

1) Maintenance Controller Extended.

2) At max. specified ambient temperature: typ. 50 ppm (4 seconds) - worst-case 100 ppm (8 seconds).

3) Typical lifespan (at 50% buffer operation, temperature 25°C when off, 50°C when on).
Maximum lifespan in 24-hour operation (no buffer) 6 years at 25°C or 5 years at 50°C.
Maximum lifespan switched off: 2 years at 25°C or 1 year at 50°C.

4) The actual value depends on the operating system or diver being used.

5) Depending on the process or batch, there may be visible deviations in the color and surface structure.

4.4.2 Temperature humidity diagram

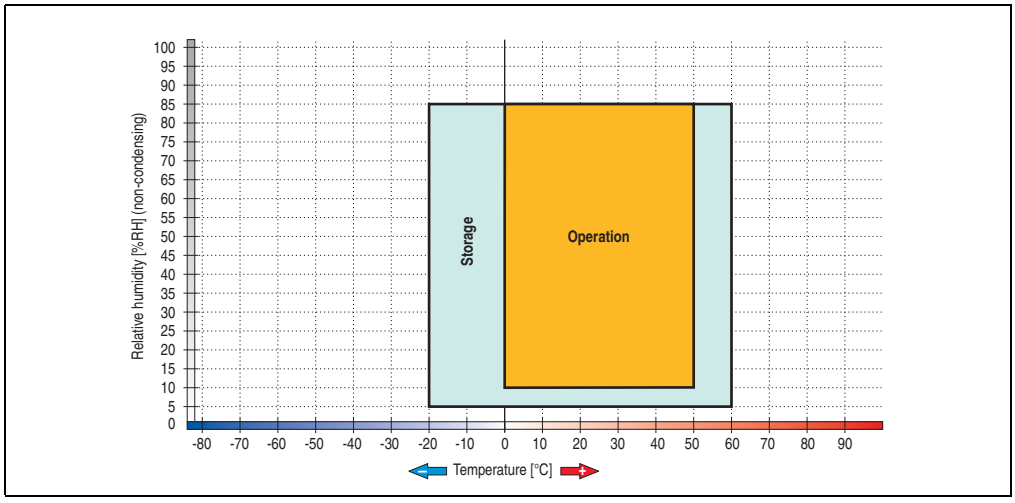


Figure 105: Temperature humidity diagram - 4PP420.0571-65

4.4.3 Dimensions

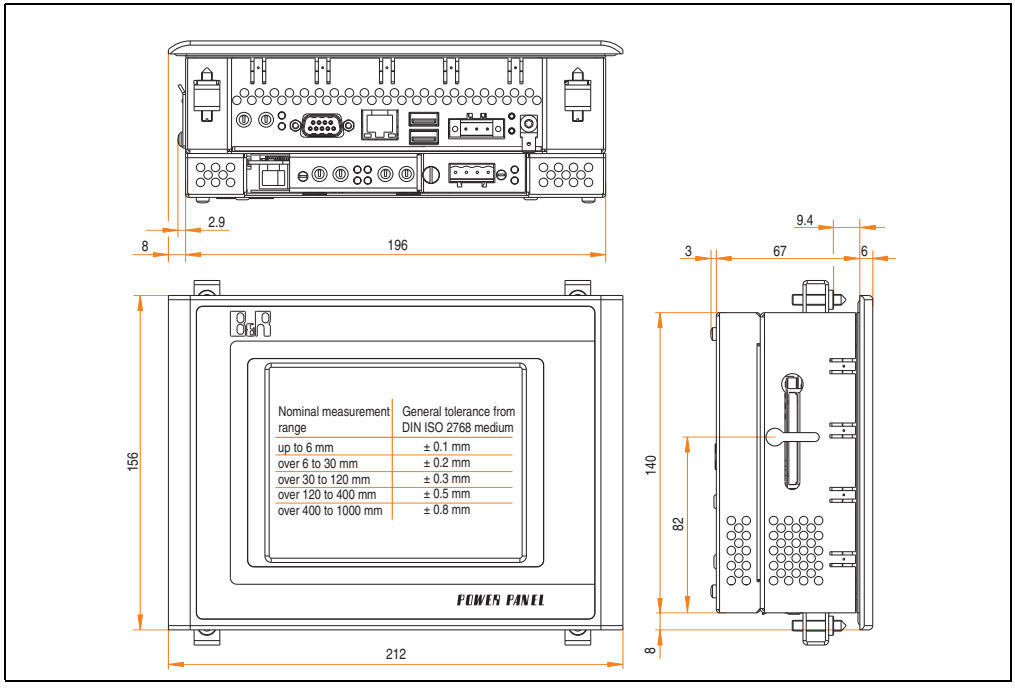


Figure 106: Dimensions - 4PP420.0571-65

4.4.4 Cutout installation

The cutout hole is to be made according to the following dimensions for cutout installation. The device must be mounted using the retaining clips included in delivery.

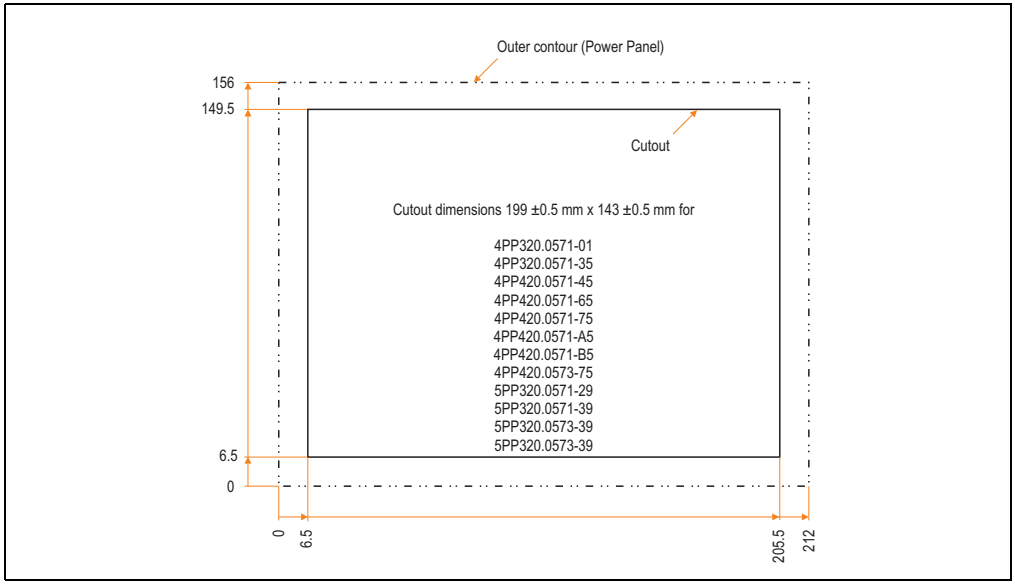


Figure 107: Cutout installation - 4PP420.0571-65

4.4.5 Contents of delivery

The following components are included in the delivery of the Power Panel device:

Amount	Component
1	Power Panel PP420, 5.7" QVGA, 1 aPCI, touch screen
4	Retaining clips included
1	Lithium battery 3 V / 950 mAh included

Table 63: Contents of delivery - 4PP420.0571-65

SUPER | VISION
INTERNATIONAL

DLS-2 | Digital Lighting System
for portable spas

SUPER VISION INTERNATIONAL

LIGHT + COLOR + IMAGINATION

svi

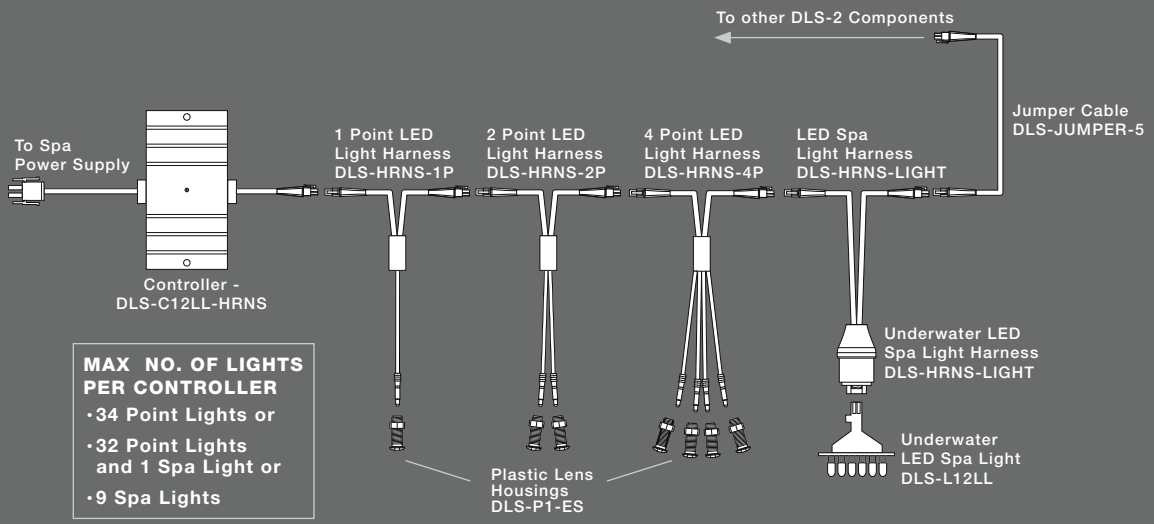
www.svision.com

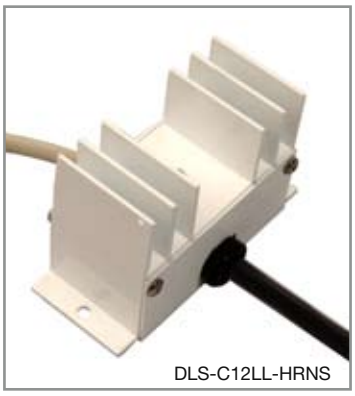
DLS20806

SUPER VISION INTERNATIONAL

DLS-2
Digital Lighting System

DLS-2 Digital Lighting System can be configured to create a variety of lighting effects.





DLS-C12LL-HRNS

DLS-2 Controller
A low voltage LED controller designed to connect to the 12V light output section on a standard portable spa controller.

DLS-2 System

The DLS-2 System incorporates a low voltage LED controller designed to connect to the 12V light output on a standard portable spa controller. The DLS-2 Controller has one output for daisy chaining up to 34 LED point lights or 32 point lights & 1 underwater spa light. Twelve different color modes are available. Select a solid color or color changing mode by toggling the power on/off.

Features

- Robust over-molded design
- 105˚ C rated wire
- Can be foamed into spa for easy installation
- Water resistant compression fit and plug-in connectors for easy maintenance

Color Modes

- Slow Color Change
- Blue/Green Fade
- Party Mode - multi color change
- Tri-Color Fade - Blue, Green, Red
- Blue
- Orange
- Purple
- Green
- Red
- Hot Pink
- Cyan
- White

DLS-HRNS-1P

1 Point LED Light Harness

DLS-HRNS-2P

2 Point LED Light Harness

DLS-HRNS-4P

4 Point LED Light Harness

DLS-P1-ES

Plastic Lens Housing
Clear plastic lens housing that accepts the LED point lights.

DLS-JUMPER-5

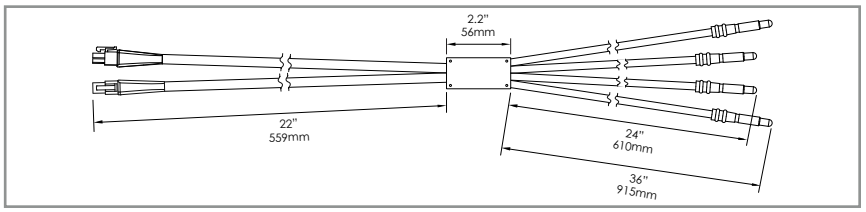
Jumper Cable
Extension wire used to connect other DSL-2 components.

DLS-HRNS-LIGHT

Underwater LED Spa Light Harness
4 foot harness accepts one Underwater LED Spa Light.

DLS-L12LL

Underwater LED Spa Light
12 LED variable intensity RGB light used as the main underwater light for the DLS-2 portable spa lighting system.



4 Point LED Light Harness Drawing

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