

July 19, 2023

Alabama Water Utilities
728 Volare Drive
Birmingham, AL 35244

**RE: Brookwood SEU WWTP Improvements
Engineer's Project No. SW-20026**

ADDENDUM No. 1

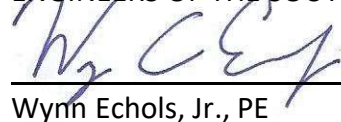
The changes, modifications and / or additions covered by and set forth in this Addendum No. 1 shall become part of and be incorporated into the Specifications, Contract Documents, and Bid Documents for the above referenced project.

GENERAL

1. The sign-in sheet for the mandatory pre-bid meeting is attached.
2. The Contractor's Builder's Risk insurance shall include the value of the Owner purchased equipment which equals \$178,600.
3. The equipment submittal for the tertiary filter and UV unit are attached for informational purposes.

This Addendum No. 1 shall be attached to the front of your set of Specifications and made a part of the Specifications and Contract Documents. Acknowledgement of Receipt of Addendum No. 1 shall be provided by email to our office.

ENGINEERS OF THE SOUTH, LLC

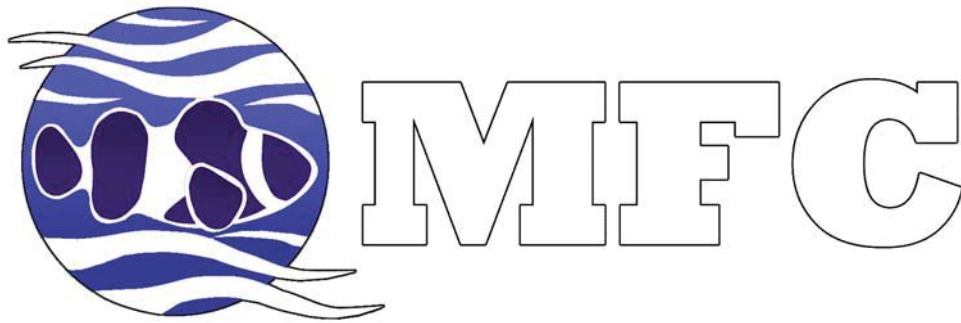


Wynn Echols, Jr., PE

Brookwood SEU WWTP Improvements
Engineer's Project No. SW-20026

PRE-BID CONFERENCE – AGENDA
JULY 18, 2023

NAME	COMPANY / CONTACT NUMBER
<u>Wynn Echols</u>	<u>EOS / 205-327-9140</u>
<u>Julia Mosley</u>	<u>Mark Johnson 205-499-9170</u>
<u>Harry Chandler</u>	<u>AWU 205-987-8352</u>
<u>Alan Moody</u>	<u>EMC - 205-237-0468</u>
<u>Seth Newton</u>	<u>EMC - 607-279-5388</u>
<u>Clayton Webster</u>	<u>Price Civil 205-764-2537</u>
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Filter Submittal Information

Project: *Weatherly WRF Site 2 Improvements*
Owner: *Weatherly Utility Services*
Location: *Pelham, Alabama*
Engineer: *Engineers of the South*
Area Rep: *Pump & Process Equipment, Inc (McGee)*
Date: *February 2021*

Table of Contents:

Section 1: Filter Drawings & Components
Section 2: Electrical / Controls
Section 3: Hoist
Section 4: Compressed Air System
Section 5: Brochure/Literature

Municipal Filtration Company, LLC
Madison, WI 53726
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C: 608-240-8987
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E: klindsley@municipalfilter.com

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Filter Drawings and Components:

Drawings:

General Arrangement (M4200512-GA)

Plan (M4200512-Plan)

Erection (M4200512-GE)

Algae Cover (M4200512-Cover)

Components:

Bray Valves & Actuators

ASCO Red-Hat Solenoid Valves

DeStaCo Hold-Down Clamps

Ingersoll Rand Inline Air Filter

Filter Media Element Drawings & Components:

Drawing:

Filter Element Details (M4200000-Element-GA)

Components:

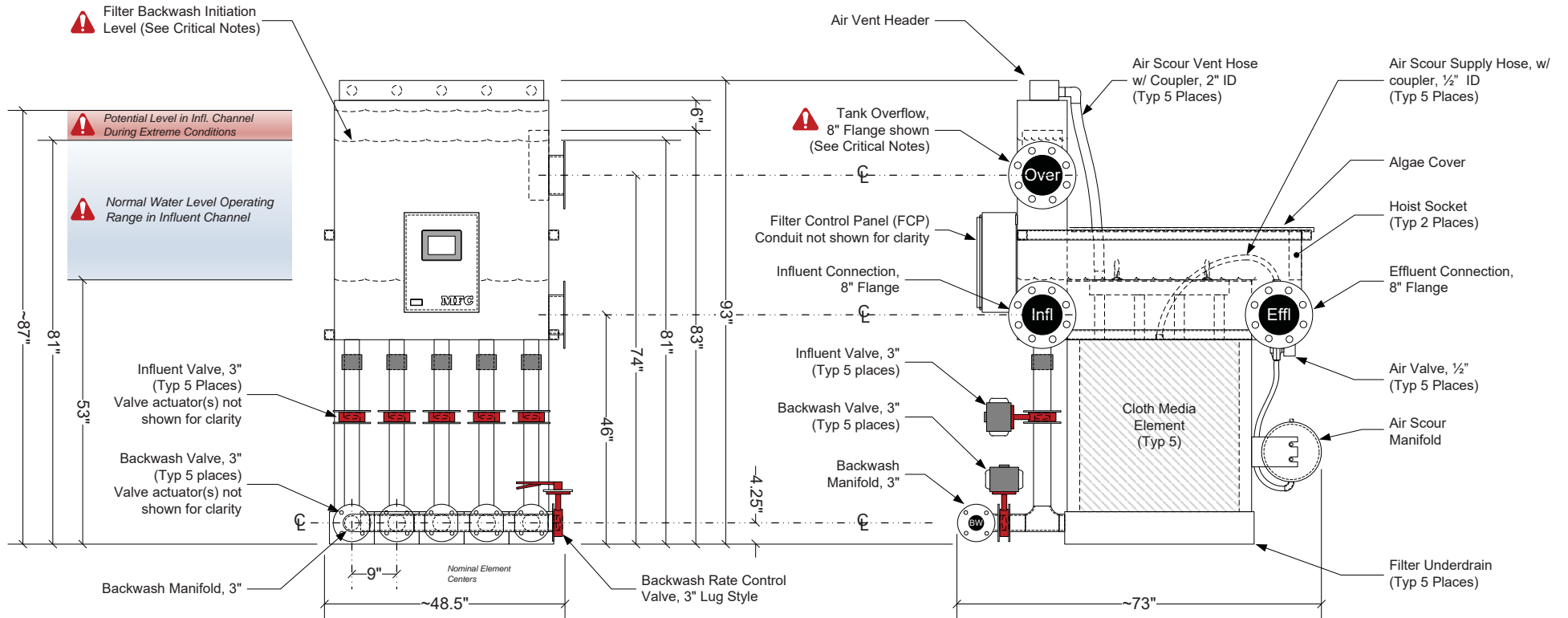
MFC TS-3 Cloth Media

Sierra Pacific Element Clamps

Air Supply Hose, 3/4" ID EPDM, 200psi

Vent Hose, 3" ID EPDM, 150psi

Banjo Hose Couplings & Fittings



General Notes:

- All filter tank materials & fasteners to be Type 304 Stainless Steel or other non-corrosive materials.
- All internal piping to be Schedule 10 Stainless Steel.
- All connections to be ANSI standard 125 lb Flanges.
- All piping and piping connections to and from filter by others.
- Nominal assembly / dry weight: 2650 Lbs. Nominal operating / wet weight: 6900 Lbs.
- Structural stiffeners and some tankage components not shown for clarity.
- Filter shall be mounted to concrete floor or pad and anchored with stainless steel anchorage.
- Concrete, pad, anchors, design, and installation by others.
- Manual Hoist included for element removal (not shown this drawing).
- Cover included for outdoor installations where sunlight can cause algae growth on media.
- Clean compressed air source regulated to 85-90psi required to operate valves & air scour system.
- Filter control panel (FCP) factory mounted to tank at influent side.
- Wiring and conduit for filter power (120VAC, 1Ph, 60Hz, 20Amp) by others.

Critical Notes:

- Filter influent channel backwash initiation float level is set approximately 2" below the overflow weir. Level in the influent channel may be up to and over the overflow weir during extreme conditions. Engineer shall design all upstream elevations and hydraulics to accommodate ALL water levels expected in the filter influent channel, including levels up to and over the overflow weir.
- Overflow box dimensions & pipe/flange diameter are shown to match influent piping. Engineer shall design all overflow piping, flange sizes, elevations, and down-stream hydraulics to accommodate 100% of influent flow in the event of atypical or extreme operational circumstances where full bypass or overflow is desired. Overflow piping may be optionally directed to effluent, backwash, or other location as determined by the engineer.

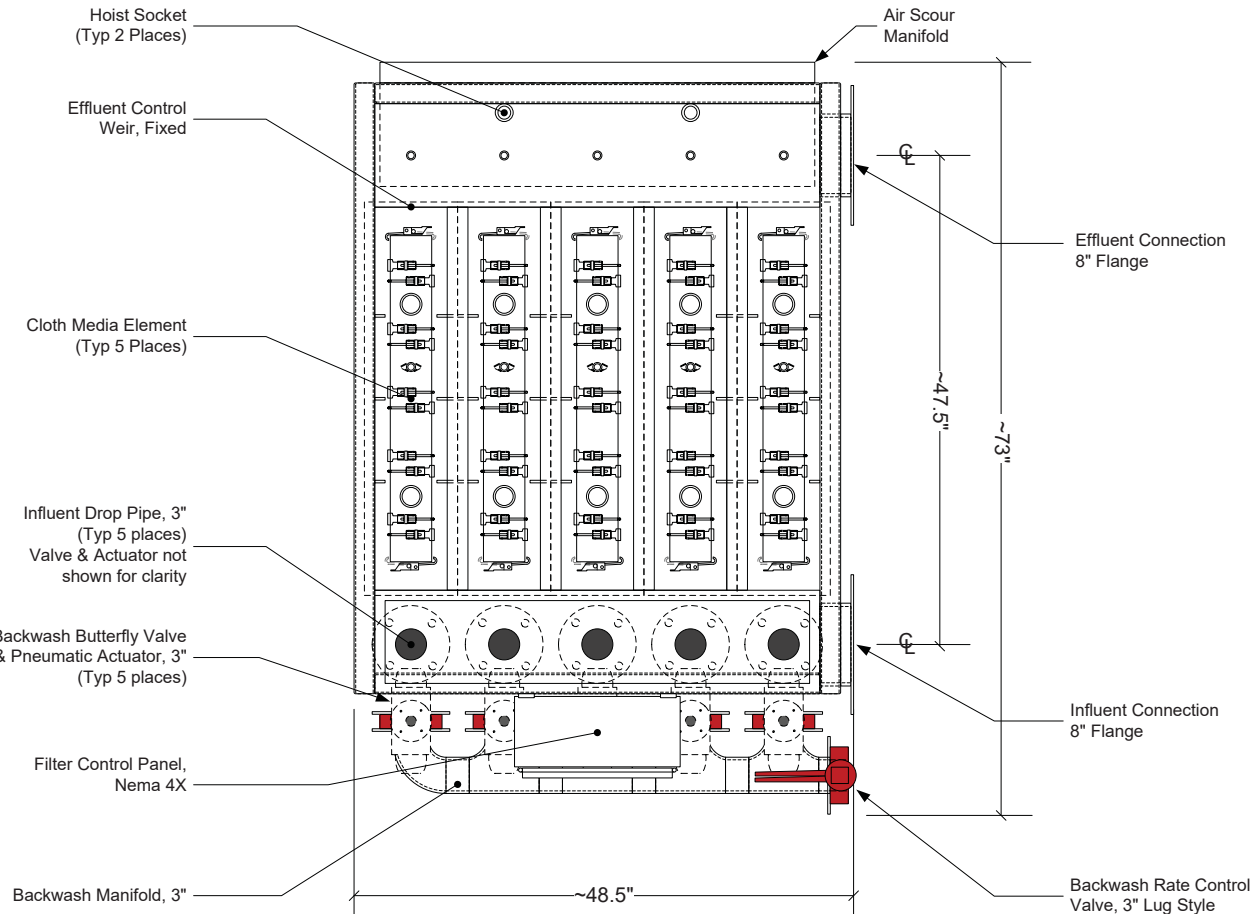
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Construction.**



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Drawing Name:
Filter General Arrangement

File Name:	M4200512-GA-Weatherly.vsdX
Project:	Weatherly WRF, Pelham, AL (PPEI)
Date:	02-19-21 Sheet: 1 of 1
Drawing No.:	M4200512-GA



Notes:

- The following components are not shown for clarity: Air vent header & hoses, influent pneumatic valve actuators, air scour manifold, air scour supply hose, overflow or overflow flange, conduit, fasteners, anchorage, covers, hoists, and piping connections.
- Filter control panel (FCP) may be optionally shipped loose for field mounting near the filter or remotely. Conduit from remote mounted FCP to filter junction box (not shown) by others.

- Work with drawing M4200512-GA .

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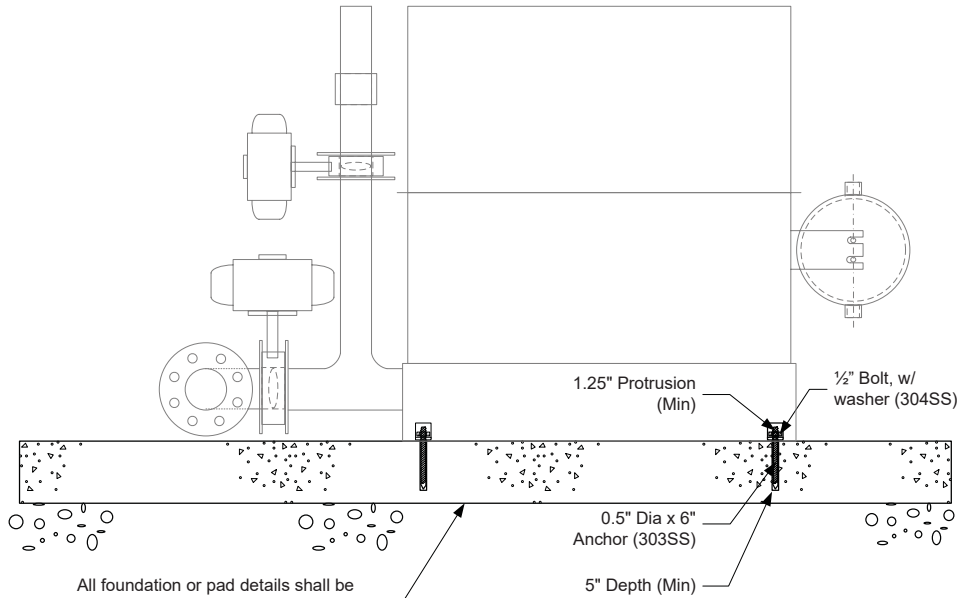


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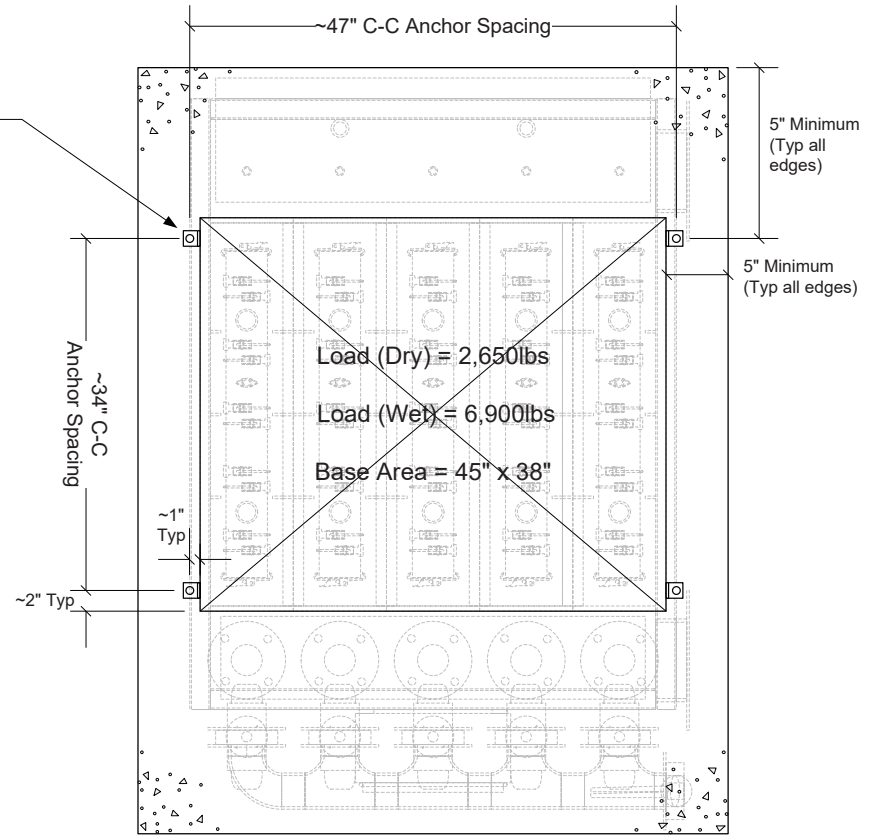
Drawing Name:
Filter General Arrangement

File Name:	M4200512-GA-Weatherly.vsdX		
Project:	Weatherly WRF, Pelham, AL (PPEI)		
Date:	02-19-21	Sheet:	1 of 1
Drawing No.:	M4200512-Plan		

3/4" Hole Thru Tab for 1/2" Dia x 6" min Lgth Anchors w/ 1.25" min projection. (Typ 4 places)



All foundation or pad details shall be determined by consulting engineer familiar with local building codes.



Concrete Pad Shown:
57" x 74" x 6" Depth (See Note)



Critical Notes:

- All tankage materials & fasteners to be Type 304 Stainless Steel.
- Anchors to be 1/2" Diameter minimum Cinch or Epoxy anchors as determined by engineer or contractor.
- Field locate & drill anchors following tank placement on pad.
- Concrete details shown are for reference only. Final concrete and anchorage details shall be determined by engineer or installing contractor.
- All anchorage supplied by others.

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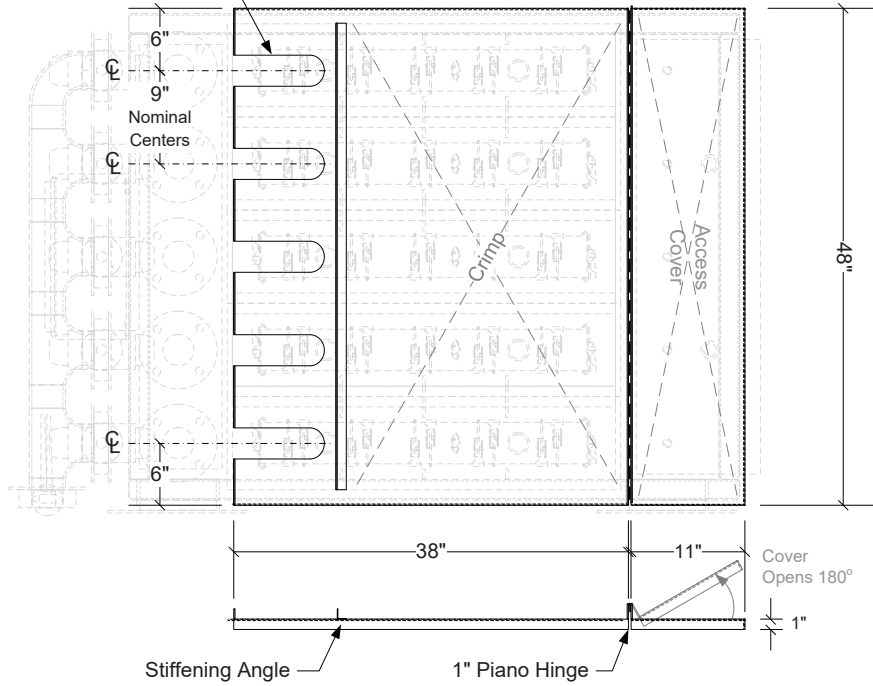


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Drawing Name:
**Filter General
Erection**

File Name:	M4200512-GA-Weatherly_vsd	
Project:	Weatherly WRF, Pelham, AL (PPEI)	
Date:	02-19-21	Sheet: 1 of 1
Drawing No.:	M4200512-GE	

Cutout for 2" Hose,
w/ Edge Trim (Typ 5 places)



- Notes:
- Cover Material: 16ga Type 304 Stainless Steel
 - All edges ground smooth and deburred.
 - Inside radius of hose cutouts covered with vinyl edge trim to prevent hose abrasion. Using cover without edge trim in place may result in damage to air vent hoses requiring replacement.
 - Cover is light gauge material and typically rests freely over the clean water side of the filter.
 - Although not typically affected by rain or other weather conditions, cover may become dislodged in high winds or hurricanes and should be properly secured or weighted if high winds are expected.
 - Cover cannot support ANY loads, including people, tools, or other equipment. DO NOT set anything on the algae cover.
 - Filter shown for reference only.

- Work with drawing M4200512-GA & M4200512-Plan

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Drawing Name:
Filter Cover Details

File Name:	M4200512-GA-Weatherly.vsd		
Project:	Weatherly WRF, Pelham, AL (PPEI)		
Date:	02-19-21	Sheet:	1 of 1
Drawing No.:	M4200512-Cover		



Bray[®]

SERIES 30/31 Wafer/Lug
2" - 20" (50mm-500mm)

BUTTERFLY VALVES
RESILIENT SEATED

CELEBRATING
20
YEARS

100 The
High
Performance
Company

SERIES 30

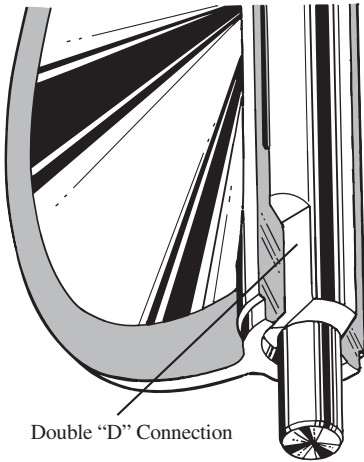
2"-20" (50mm-500mm)

Bray® Controls is proud to offer a high quality line of butterfly valves to meet the requirements of today's market. Combining years of field application experience, research and development, Bray has designed many unique features in the Series 30/31 not previously available. The results are longer service life, greater reliability, ease of parts replacement and interchangeability of components.

DISC AND STEM CONNECTION

(A) Features a high-strength through stem design. The close tolerance, double "D" connection that drives the valve disc is an exclusive feature of the Bray valve.

It eliminates stem retention components being exposed to the line media, such as disc screws and taper pins, which commonly result in leak paths, corrosion, and vibration failures. Disc screws or taper pins, due to wear and corrosion, often



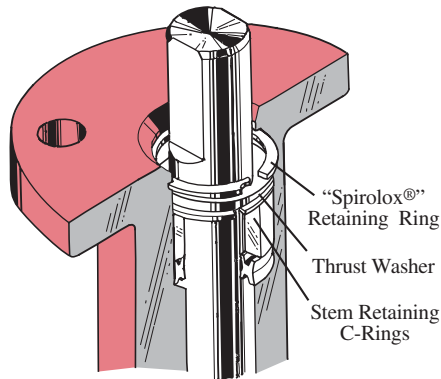
require difficult machining for disassembly. Disassembly of the Bray stem is just a matter of pulling the stem out of the disc. Without fasteners obstructing the line flow, the Series 30/31 C_v values are higher than many other valves, turbulence is reduced, and pressure recovery is increased. The stem ends and top mounting flange are standardized for interchangeability with Bray actuators.

DISC (B) Casting is spherically machined and hand polished to provide a bubble-tight shut off, minimum torque, and longer seat life. The disc O.D. clearance is designed to work with all standard piping.



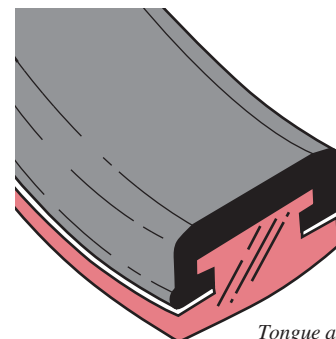
STEM RETAINING ASSEMBLY (C)

The stem is retained in the body by means of a unique Stainless Steel "Spirolox®" retaining ring, a thrust washer and two C-rings, manufactured from brass as standard, stainless steel upon request. The retaining ring may be easily removed with a standard hand tool. The stem retaining assembly prevents unintentional removal of the stem during field service.



BRAY UNIQUE SEAT DESIGN (H)

One of the valve's key elements is Bray's unique *tongue and groove* seat design. This resilient seat features lower torque than many valves on the market today and provides complete isolation of flowing media from the body. The tongue-and-groove seat to body retention method is superior to traditional designs, making field replacement simple and fast. The seat is specifically designed to seal with slip-on or weld-neck flanges. The seat features a molded O-ring which eliminates the use of flange gaskets. An important maintenance feature is



STEM BUSHING (D)

Non-corrosive, heavy duty acetal bushing absorbs actuator side thrusts.

STEM SEAL (E)

Double "U" cup seal design is self-adjusting and gives positive sealing in both directions. Prevents external substances from entering the stem bore.

NECK (F) Extended neck length allows for 2" of piping insulation and is easily accessible for mounting actuators.

PRIMARY AND SECONDARY SEALS (G)

The Primary Seal is achieved by an interference fit of the molded seat flat with the disc hub. The Secondary Seal is created because the stem diameter is greater than the diameter of the seat stem hole. These seals prevent line media from coming in contact with the stem or body.

*"Spirolox®" designation is a registered trademark of Kaydon Ring and Seal, Inc.

that all resilient seats for Bray butterfly valves Series 20, 21, 30, 31 and 34 are completely interchangeable.

ACTUATOR MOUNTING FLANGE AND STEM CONNECTION (I)

Universally designed to ISO 5211 for direct mounting of Bray® power actuators and manual operators.

FLANGE LOCATING HOLES (J)

Provide quick and proper alignment during installation.

BODY (K) One-piece wafer or lug style. Polyester coating for excellent corrosion resistance. Bray valve bodies meet ANSI 150 pressure ratings for hydrostatic shell test requirements.

DESIGN FEATURES

Bray’s Series 30 valve is a wafer version with flange locating holes, and the Series 31 is the companion lug version for dead-end service and other flange requirements. All Bray valves are tested to 110% of full pressure rating before shipment.

A major design advantage of Bray valve product lines is international compatibility. The same valve is compatible with most world flange standards –ANSI Class 125/150, BS 10 Tables D and E, BS 4504 NP 10/16, DIN ND 10/16, AS 2129 and JIS10. In addition the valves are designed to comply with ISO 5752 face-to-face and ISO 5211 actuator mounting flanges. Therefore, one valve design can be used in many different world markets.

Due to a modular concept of design, all Bray® handles, manual gear operators and pneumatic and electric actuators mount directly to Bray valves. No brackets or adapters are required.



Bray interchangeability and compatibility offers you the best in uniformity of product line and low-cost performance in the industry today.

POLYESTER COATING CORROSION PROTECTION

Bray’s standard product offers valve bodies with a polyester coating, providing excellent corrosion and wear resistance to the valve’s surface. The Bray polyester coating is a hard, gloss red finish.

Chemical Resistance –resists a broad range of chemicals including: dilute aqueous acids and alkalis, petroleum solvents, alcohols, greases and oils. Offers outstanding resistance to humidity and water.

Weatherability– outdoor tested resistant to ultra-violet radiation.

Abrasion Resistance – excellent resistance to abrasion.

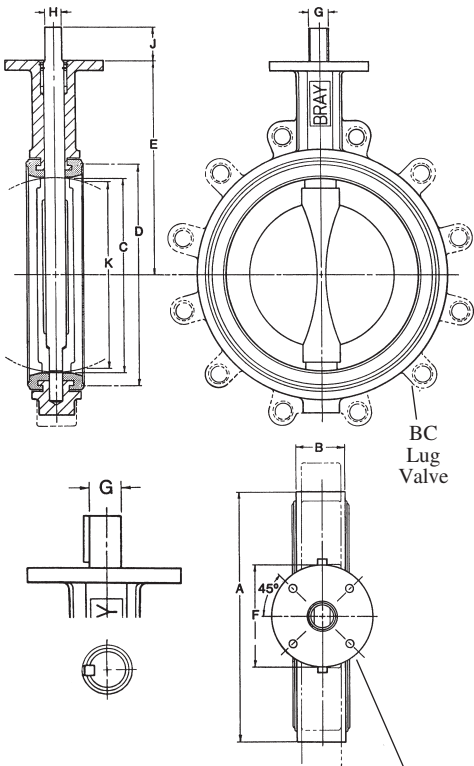
Impact Resistance –withstands impact without chipping or cracking.

NYLON 11 COATING

Optionally available for valve bodies where outstanding protection and performance is needed. A thermoplastic produced from a vegetable base, this coating is inert to fungus growth and molds. Nylon 11 is *USDA Approved*, as well as certified to ANSI/NSF 61 for water service.

Corrosion Resistance – superior resistance to a broad range of chemical environments. Salt spray tested in excess of 2,000 hours and seawater immersion tested for over 10 years without corrosion to metal substrates.

Nylon 11 features a very low coefficient of friction and excellent resistance to impact and ultra-violet radiation.



DIMENSIONS SERIES 30 Wafer

Valve Size ins mm	A	B	C	D	E	F	Mounting Flange Drig.			G	H	J	K
							BC	No. Holes	Hole Dia.				
2 50	3.69	1.62	2.00	2.84	5.50	3.54	2.76	4	.39	.55	.39	1.25	1.32
2 1/2 65	4.19	1.75	2.50	3.34	6.00	3.54	2.76	4	.39	.55	.39	1.25	1.91
3 80	4.88	1.75	3.00	4.03	6.25	3.54	2.76	4	.39	.55	.39	1.25	2.55
4 100	6.06	2.00	4.00	5.16	7.00	3.54	2.76	4	.39	.63	.43	1.25	3.57
5 125	7.06	2.12	5.00	6.16	7.50	3.54	2.76	4	.39	.75	.51	1.25	4.63
6 150	8.12	2.12	5.75	7.02	8.00	3.54	2.76	4	.39	.75	.51	1.25	5.45
8 200	10.50	2.50	7.75	9.47	9.50	5.91	4.92	4	.57	.87	.63	1.25	7.45
10 250	12.75	2.50	9.75	11.47	10.75	5.91	4.92	4	.57	1.18	.87	2.00	9.53
12 300	14.88	3.00	11.75	13.47	12.25	5.91	4.92	4	.57	1.18	.87	2.00	11.47

SERIES 31 Lug

Lug Bolting Data		
BC	No. Holes	Threads UNC-2B
4.75	4	5/8-11
5.50	4	5/8-11
6.00	4	5/8-11
7.50	8	5/8-11
8.50	8	3/4-10
9.50	8	3/4-10
11.75	8	3/4-10
14.25	12	7/8-9
17.00	12	7/8-9

Valve Size ins mm	A	B	C	D	E	F	Mounting Flange Drig.			G	J	KEY SIZE	K
							BC	No. Holes	Hole Dia.				
14 350	17.05	3.00	13.25	15.28	13.62	5.91	4.92	4	.57	1.38	2.00	.39x.39	13.04
16 400	19.21	4.00	15.25	17.41	14.75	5.91	4.92	4	.57	1.38	2.00	.39x.39	14.85
18 450	21.12	4.25	17.25	19.47	16.00	8.27	6.50	4	.81	1.97	2.50	.39x.47	16.85
20 500	23.25	5.00	19.25	21.59	17.25	8.27	6.50	4	.81	1.97	2.50	.39x.47	18.73

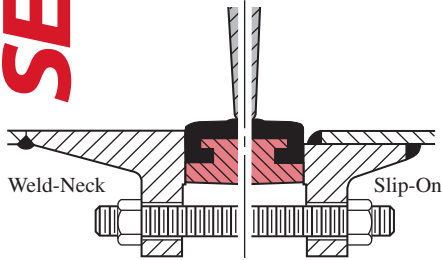
Lug Bolting Data		
BC	No. Holes	Threads UNC-2B
18.75	12	1-8
21.25	16	1-8
22.75	16	1 1/8-7
25.00	20	1 1/8-7

See chart for Actuator Mounting Flange Drilling.

SELECTION DATA

FLANGE REQUIREMENTS

Bray valves are designed for installation between ANSI Class 125/150 lb. weld-neck or slip-on flanges, BS 10 Tables D & E, BS 4504 NP 10/16, DIN ND 10/16, AS 2129 and JIS 10, either flat faced or raised faced. While weld-neck flanges are recommended, Bray has specifically designed its valve seat to work with slip-on flanges, thus eliminating common failures of other butterfly valve designs. When using raised face flanges be sure to properly align valve and flange. Type C stub-end flanges are not recommended.



PRESSURE RATINGS*

For bi-directional bubble-tight shut off, disc in closed position:

Inches	mm	psig	bar
2-12	50-300	175	12
14-20	350-500	150	10

For Dead-end Service Applications:

With *downstream flanges installed* or with *vulcanized seats*, the dead-end pressure ratings are equal to valve bi-directional ratings as stated above. With no downstream flanges or with seats that are not vulcanized, the dead-end pressure rating for 2"-12" valves is 75 psi (5 bar) for 14"-20" valves, 50 psi (3.5 bar).

*Pressure Ratings are based on standard disc diameters. For low pressure application, Bray offers a standard reduced disc diameter to decrease seating torques and to extend seat life, thus increasing the valve's performance and reducing actuator costs for the customer.

VELOCITY LIMITS

For On/Off Services:

Fluids – 30 ft / sec (9m/s)

Gases – 175 ft / sec (54m/s)

C_v VALUES—VALVE SIZING COEFFICIENT

Valve Size		Disc Position (degrees)								
ins	mm	90°	80°	70°	60°	50°	40°	30°	20°	10°
2	50	144	114	84	61	43	27	16	7	1
2 1/2	65	282	223	163	107	67	43	24	11	1.5
3	80	461	364	267	154	96	61	35	15	2
4	100	841	701	496	274	171	109	62	27	3
5	125	1376	1146	775	428	268	170	98	43	5
6	150	1850	1542	1025	567	354	225	129	56	6
8	200	3316	2842	1862	1081	680	421	241	102	12
10	250	5430	4525	2948	1710	1076	667	382	162	19
12	300	8077	6731	4393	2563	1594	1005	555	235	27
14	350	10538	8874	5939	3384	2149	1320	756	299	34
16	400	13966	11761	7867	4483	2847	1749	1001	397	45
18	450	17214	14496	10065	5736	3643	2237	1281	507	58
20	500	22339	18812	12535	7144	4536	2786	1595	632	72

C_v is defined as the volume of water in U.S.G.P.M. that will flow through a given restriction or valve opening with a pressure drop of one (1) p.s.i. at room temperature. Recommended control angles are between 25°–70° open. Preferred angle for control valve sizing is 60°–65° open.

EXPECTED SEATING/UNSEATING TORQUES (Lb.-Ins.)

Valve Size		Full-Rated Pressure Valves				Reduced Disc Diameter
		Δ P (PSI)				Δ P (PSI)
ins	mm	50	100	150	175	50
2	50	125	130	135	140	125
2 1/2	65	195	205	215	220	195
3	80	260	275	290	297	260
4	100	400	425	450	462	267
5	125	615	670	725	755	410
6	150	783	871	953	1003	537
8	200	1475	1650	1825	1915	983
10	250	2240	2520	2800	2940	1493
12	300	3420	3870	4320	4545	2280
14	350	4950	5700	6450	—	3300
16	400	6400	7700	9000	—	4267
18	450	7850	9850	11850	—	5267
20	500	10300	12900	15500	—	6867

Valve Torque Rating – Bray has classified valve torque ratings according to 3 types: non-corrosive lubricating service, general service, and severe service. Torques listed above are for general services. Consult Bray for torque information corresponding to specific applications.

TO USE TORQUE CHART, NOTE THE FOLLOWING:

- 1) For Bray valves, Series 20, 21, 30, 31 and 34.
- 2) Review Technical Bulletin No. 1001, Expected Seating/Unseating Torques, for explanation of the 3 service classes and their related seating/unseating torque values for given pressure differentials of Full-Rated and Reduced Disc Diameter valves.
- 3) Dynamic Torque values are not considered. See

Technical Bulletin No. 1002 for evaluation of Dynamic Torque values vs. Seating/Unseating Torque values.

- 4) Do not apply a safety factor to above torque values when determining actuator output torque requirement.
- 5) For 3 way assemblies where one valve is opening and other is closing, multiply torque by 1.5 factor.

SPECIFICATIONS

RECOMMENDED SPECIFICATIONS FOR BRAY SERIES 30/31 SHALL BE:

- Polyester coated, cast iron, wafer or lug bodies.
- With flange locating holes that meet ANSI Class 125/150 (or BS 10 Tables D & E, BS 4504 NP 10/16, DIN ND 10/16, AS 2129 and JIS 10) drillings.
- Through-stem direct drive double "D" design requiring no disc screws or pins to connect stem to disc with no possible leak paths in disc/stem connection.
- Stem mechanically retained in body neck and no part of stem or body exposed to line media.
- Tongue-and-groove seat design with primary hub seal and a molded O-ring suitable for weld-neck and slip-on flanges. Seat totally encapsulates the body with no flange gaskets required.
- Spherically machined, hand polished disc edge and hub for minimum torque and maximum sealing capability.
- Equipped with non-corrosive bushing and self-adjusting stem seal.
- Bi-directional and tested to 110% of full rating.
- Bi-directional pressure ratings:
2"-12" valves: 175 psi, 14"-20" valves: 150 psi
- Lug bodies for dead end service
With downstream flanges or vulcanized seats, pressure ratings are equal to bi-directional ratings as stated above.
With no downstream flanges or non-vulcanized seats: 2"-12" valves: 75 psi, 14"-20" valves: 50 psi
- No field adjustment necessary to maintain optimum field performance.
- The valve shall be Bray Series 30 wafer / 31 lug or equal.

WEIGHTS

Valve Size		Series 30	Series 31
ins	mm		
2	50	5.5	7.0
2½	65	7.0	8.0
3	80	7.5	9.0
4	100	11.5	15.0
5	125	14.0	20.0
6	150	17.0	23.0
8	200	34.0	42.0
10	250	49.0	66.0
12	300	67.0	88.0
14	350	95.0	114.0
16	400	135.0	166.0
18	450	200.0	226.0
20	500	260.0	305.0

Weights are in lbs.

MATERIALS SELECTION

2" - 20" (50mm-500mm)

BODY:

- Cast Iron ASTM A126 Class B
- Ductile Iron ASTM A536
- Cast Steel ASTM A216 WCB
- Aluminum ASTM B26

SEAT:

- Buna-N – Food Grade
- EPDM – Food Grade
- FKM*
- White Buna-N – Food Grade

STEM:

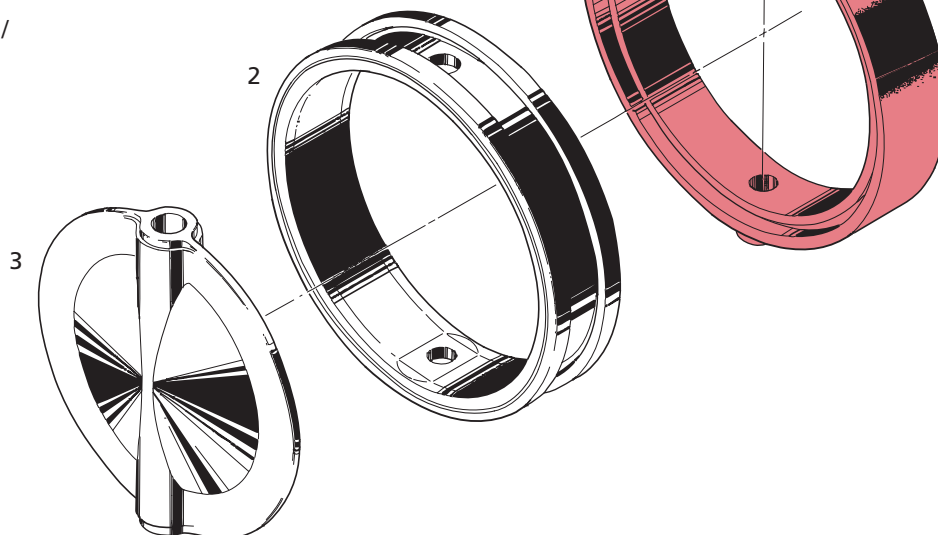
- Coated Carbon Steel
- 416 Stainless Steel ASTM A582 Type 416
- 304 Stainless Steel ASTM A276 Type 304
- 316 Stainless Steel ASTM A276 Type 316
- Monel

DISC:

- Aluminum Bronze ASTM B148-954
- Coated Ductile Iron ASTM A536 Gr. 65-45-12
- Ductile Iron, Nylon 11 Coated, ASTM A536 Gr. 65-45-12
- Ductile Iron, Halar® Coated, ASTM A536 Gr. 65-45-12
- 316 Stainless Steel ASTM A351 CF8M
- Hastelloy® C-276 ASTM B575 Alloy N10276

COMPONENTS

No.	Qty.	Description
1	1	Body
2	1	Seat
3	1	Disc
4	1	Stem
5	1	Stem Seal
6	1	Stem Bushing
7	2	Stem Retainer
8	1	Thrust Washer
9	1	Retaining Ring



TEMPERATURE RANGE OF SEATS

Type	Maximum	Minimum
EPDM	+250°F(121°C)	-40°F(-40°C)
Buna-N	+212°F(100°C)	0°F(-18°C)
FKM*	+400°F(204°C)	0°F(-18°C)

*FKM is the ASTM D1418 designation for Fluorinated Hydrocarbon Elastomers (also called Fluoroelastomers).

Hastelloy® is a registered trademark of Haynes International, Inc.

Halar® is a registered trademark of Ausimont U.S.A., Inc.

ASSEMBLY

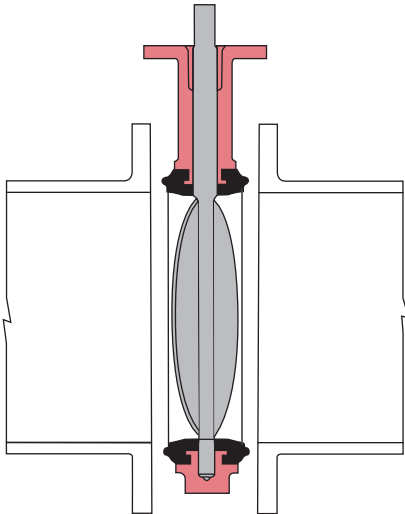
INSTALLATION

Position the disc in the partially open position, maintaining the disc within the body face-to-face. Place the body between the flanges and install flange bolts. *Do not use flange gaskets.* Before tightening flange bolts, carefully open the disc to the full open position to ensure proper alignment and clearance of the disc O.D. with the adjacent pipe I.D. Leave disc in the full open position and tighten flange bolts per required

specification. Once bolts are tightened, carefully rotate disc to closed position to ensure disc O.D. clearance.

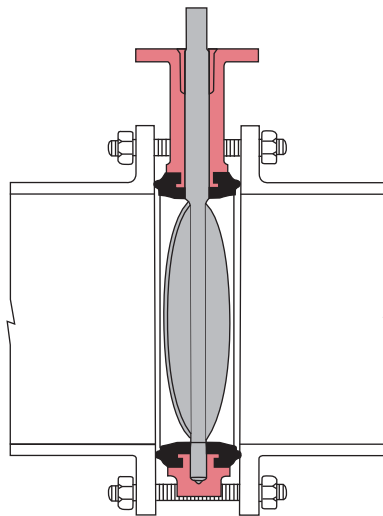
MAINTENANCE AND REPAIR

The many Bray features minimize wear and maintenance requirements. No routine lubrication is required. All components – stem, disc, seat, bushing, stem seal, etc., are field replaceable, no adjustment is needed. If components require replacement, remove the valve from the line by placing the disc near the closed position, spread the flanges, support the valve, then remove the flange bolts. No valve maintenance, including removal of manual or power actuators, should be performed until the piping system is completely depressurized.

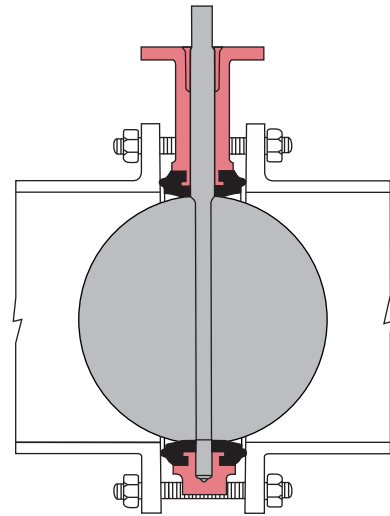


Disc in the Near Closed Position

All statements, technical information, and recommendations in this bulletin are for general use only. Consult Bray representatives or factory for the specific requirements and material selection for your intended application. The right to change or modify product design or product without prior notice is reserved.
United States patent number 5,152,501.
Other patents issued and applied for worldwide.



Disc in the Partially Open Position



Disc in the Full Open Position

DISASSEMBLY

Remove the handle, gear operator, or actuator from actuator mounting flange. Remove “Spirolox®” retaining ring. Remove stem with its thrust washer and two C-ring stem retainers. Remove bushing and seal. Remove the disc from the seat, protecting disc edge at all times. Push the seat into an oval shape, then remove the seat from the body.

ASSEMBLY

Push the valve seat into an oval and push it into the body with seat stem holes aligned to body stem holes. Push stem into the stem hole of body. For aid in inserting disc, slightly protrude stem beyond the I.D. of the top of the seat. Install a light coating of foodgrade silicone oil (for silicone free applications use soap and water) on the I.D. of seat. Insert the disc into the seat by lining up the disc hole with the stem hole of the seat. Note: the broached double “D” flats

in the disc must be toward the bottom of valve body. (Take special care when lining disc up with stem.) With a downward pressure and rotating the stem back and forth, push the stem until the stem touches the bottom of the body stem hole. Make certain that when pushing the stem through disc bottom, the broached flats of stem and disc are aligned. After the stem has engaged the disc, but before the stem is firmly seated in the body, replace the stem seal and bushing. Install the two C-ring stem retainers in the groove in the stem and thrust washer on top of the C-rings. Seat the stem firmly in the body and install the “Spirolox®” retaining ring back into position.



DISTRIBUTOR

Bray® CONTROLS

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Bray[®]

SERIES 92/93 Rack & Pinion
Double Acting & Spring Return

PNEUMATIC ACTUATOR

SERIES 92/93

Styling, strength, compactness, and simplicity of design have been combined to produce the best rotary actuator on the market today. Bray Controls introduces this newest line of high performance, highest quality pneumatic actuators, the Series 92/93.

Engineering excellence and precision manufacturing has produced a modular product line with reduced overall size requirements and economic savings. In addition all Brayline Accessories are fully modular and directly mount to the actuator – providing flexibility and efficiency at reduced cost.

Bray Series 92/93 actuators are rack and pinion, opposed-piston actuators available in two versions: double acting for rotation of 90°, 135° and 180°, and spring return for 90° rotation. Their ideal use is actuating butterfly, ball or plug valves, but they can be applied anywhere a rotation of 90°, 135° or 180° is needed. Rotated on low friction acetal bearings, Bray units are well suited to handle offset loads to the gear and output shaft assembly.

The Series 92/93 actuators were designed primarily for pneumatic operation up to a maximum pressure of 140 psig (10 Bar) and for temperature ranges of -40°F (-40°C) to +200°F (+95°C). For higher and lower temperature applications, consult factory.

All double acting and spring return units are suitable for both on-off and throttling applications. Actuators which can be actuated with other media such as hydraulic oil or water are also available as an option.

The Series 92/93 is completely enclosed and self contained. The many features minimize maintenance and provide safe, simple disassembly and assembly.

The INTEGRAL PORTING (A) reduces the cost of external tubing that is also easily damaged. The unique, lubricated ACETAL PISTON GUIDES (B) and RINGS (C). Both have a very low coefficient of friction and absorb the side thrusts of the pistons. The piston cylinder walls in the body are honed to a very fine finish thus reducing the overall coefficient of friction. These features extend the life of the actuator and make the Series 92/93 one of the most efficient actuators on the market.

The OUTPUT SHAFT BEARINGS (D) on the top and bottom of the pinion are made of low-friction acetal.

The OUTPUT SHAFT and PINION GEAR (E) are one-piece, manufactured from hardened alloy steel and zinc-plated for corrosion protection.

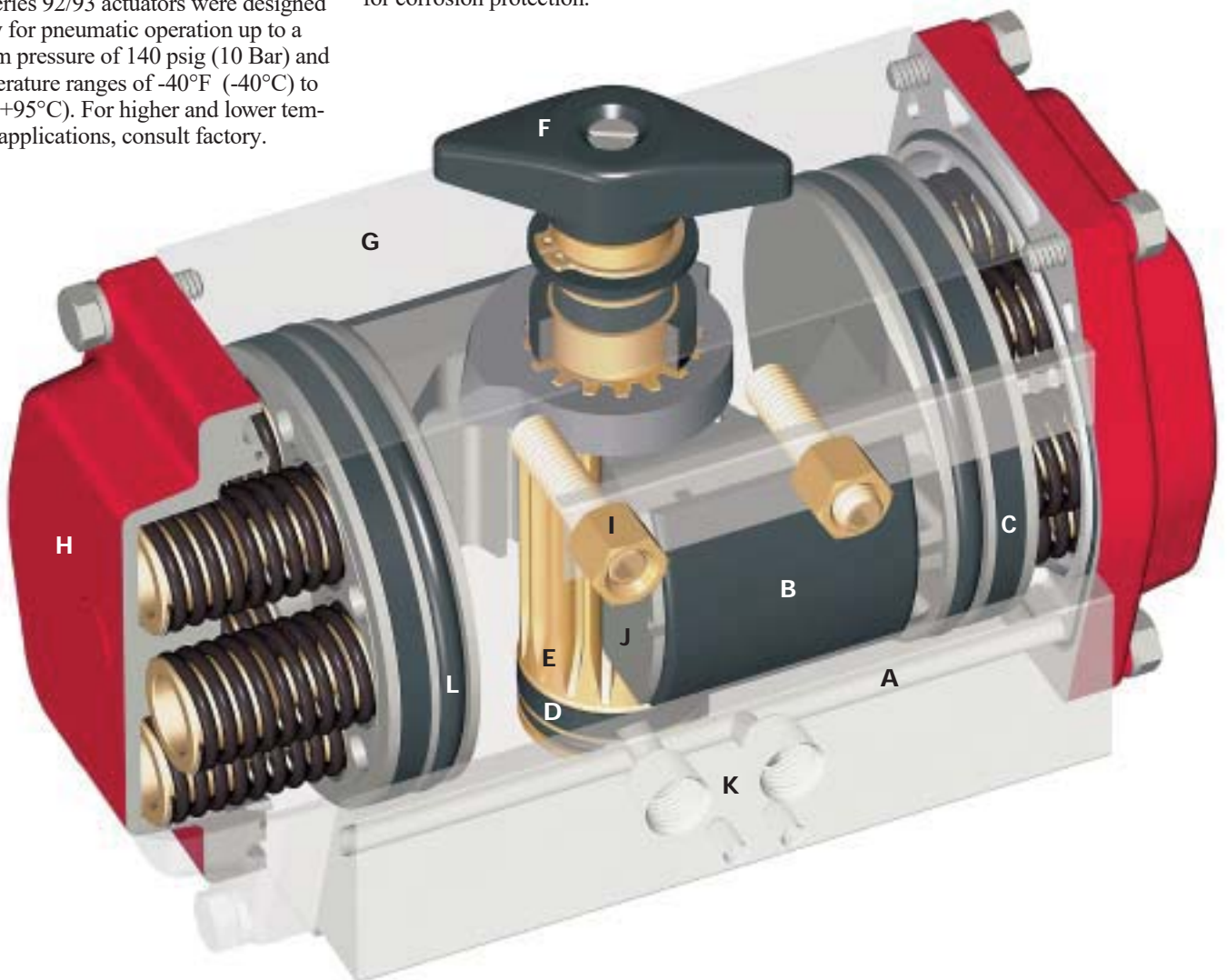
The SHAFT POSITION INDICATOR (F) clearly shows open or closed position and is easily removable for MANUAL OVERRIDE FUNCTION of the actuator.

The BODY (G) is extruded aluminum with anodized corrosion protective coating. The END CAPS (H) are polyester coated for chemical resistance. This coating is resistant to dilute aqueous acids, salts, aliphatic hydrocarbons, detergents, petroleum solvents, alcohols, greases and oils.

The TRAVEL STOP (I) adjusting screws limit the travel of the actuator to specific degrees of rotation in both open and closed directions. The PISTONS (J) are die-cast aluminum.

The two PNEUMATIC SUPPLY PORTS (K) are 1/8" NPT on size 48 actuators. The other sizes have 1/4" NPT ports. NAMUR interface is standard on all actuator sizes.

All Bray Series 92/93 actuators have permanently lubricated factory packed bearings and guides. No further lubrication is necessary under normal operating conditions. All seals, including PISTON SEALS (L), are permanently lubricated Buna-N O-rings.





TRAVEL STOP Two independent adjusting screws are located on the center of the output shaft to precisely limit the travel of the actuator to specific degrees of rotation. The travel stops permit bidirectional adjustment of actuator movement in both the open and closed positions.



SPRING RETURN Bray's Series 93 spring return models employ a unique cartridge system. The actuator was designed to save both space and cost. The housing length of the spring return unit is the same as the double acting unit. Converting from double acting to spring return actuation is just a matter of removing the end caps and adding the unique spring cartridges. The actuator can be disassembled and assembled without cumbersome equipment or danger to the installer due to springs releasing. 40, 60, 80, and 100 psi services are standard, optional ratings are available.



DIRECT MOUNTING Bray actuators comply with ISO 5211 dimensions and mount directly to Bray valves without using external linkages. Field installation is simple, misalignment is minimized and contamination buildup between valve and actuator is reduced. Bray can provide linkage for mounting actuators to other devices requiring 90° to 180° rotation.

BrayLINE

SERIES 63 3-WAY AND 4-WAY SOLENOID VALVE

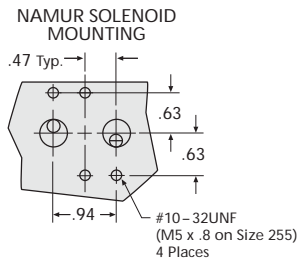
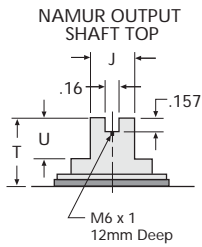
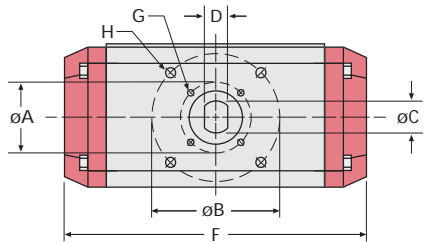
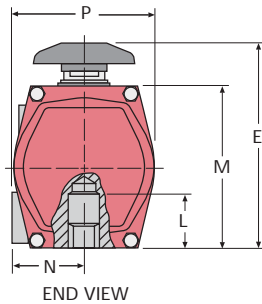
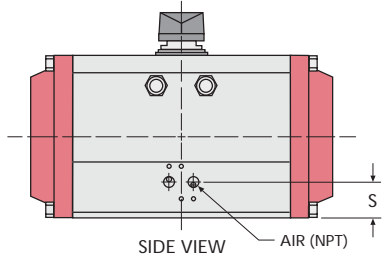
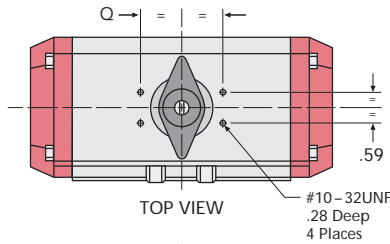
For electrical operation of pneumatic actuator on-off functions, Bray Series 63 solenoids are direct-mounted to the actuator by NAMUR interface. The pilot operated spool control valve is convertible from 3-Way (3/2) to 4-Way (5/2). Both watertight (NEMA 4, 4X) and explosion proof (NEMA 4, 4X, 7, 9) housings are standard. NPT and IP65

DIN connections are offered with both single and dual coils. The air supply connection is 1/4" NPT and the electrical connection is 1/2" NPT. A manual override screw is located on the top of the valve body. Stainless Steel housings, digital Bus solenoids and a Series 55 speed control that allows independent control in both directions of travel are also available.



Brayline Accessories and Bray Actuators both comply with VDI/VDE 3845 (NAMUR recommendations).

Double Acting/ Spring Return



SERIES 92/93 DIMENSIONS

SIZE	48	63	83	92	118	127	160*	210	255‡
AIR NPT	1/8	1/4	1/4	1/4	1/4	1/4	1/4	1/4	1/4
A ISO "F"†	1.42 F 03	1.97 F 05	1.97 F 05	1.97 F 05	2.76 F 07	2.76 F 07	—	4.92 F 12	6.50 F 16
B ISO "F"†	1.97 F 05	2.76 F 07	2.76 F 07	2.76 F 07	4.92 F 12	4.92 F 12	4.92 F 12	6.50 F 16	7.87x4.72 Rect.
C	.55	.55	.75	.75	1.18	1.18	1.18	1.97	2.50
D	.40	.40	.51	.51	.87	.87	.87	.47	.62
E	3.88	4.53	5.43	5.78	7.28	8.09	9.36	11.45	13.35
F	4.00	5.58	7.40	8.59	11.90	12.31	15.54	17.80	26.70
G (UNC)	10-32 x .23	1/4-20 x .32	1/4-20 x .32	1/4-20 x .32	5/16-18 x .46	5/16-18 x .46	—	1/2-13 x .78	M16x2 x 28mm
H (UNC)	1/4-20 x .25	5/16-18 x .40	5/16-18 x .40	5/16-18 x .40	1/2-13 x .69	1/2-13 x .69	1/2-13 x .75	5/8-11 x 1.11	M16x2 x 28mm
J	.38	.38	.50	.50	1.12	1.12	1.12	1.12	1.12
L	1.30	1.38	1.46	1.46	2.20	2.20	2.20	2.76	4.25
M	2.50	3.46	4.27	4.61	5.52	6.32	7.80	10.04	11.89
N	1.60	1.72	2.02	2.18	2.53	2.72	3.07	4.25	4.75
P	2.19	3.11	3.83	4.17	4.91	5.44	6.82	8.83	10.75
Q	1.58	1.58	1.58	1.58	1.58	1.58	2.56	2.56	2.56
S	1.25	.89	.89	.94	1.36	1.36	1.39	1.44	1.50
T	1.10**	.79	.79	.79	.79	.79	1.18	1.18	1.18
U	.47	.47	.47	.47	.47	.47	.75	.75	.75

Note: Double Acting and Spring Return actuators have the same overall dimensions.

† ISO "F" means mounting flange-drilling pattern.

* Dimensions for Size 160A in table. Size 160B (keyed stem version) has C dimension of 1.38 and D dimension of .39.

‡ Dimensions for Size 255A in table. Size 255B actuator has a C dimension of 3.00 and D dimension of .75.

** Size 48 has a T dimension of .79 with use of NAMUR top plate.

Actuator Speeds

SIZE	48	63	83	92	118	127	160	210	255
Open Stroke/ Close Stroke	1/4	1/4	1/4	1/4	1/2	1/2	1	2	2 3/4

Times are in seconds, at 80 PSIG with 6ft. tubing, internal diameter approximately 1/4".

Actuator Weights

SIZE	48	63	83	92	118	127	160	210	255
Double Acting	1.8	3.4	6.1	8.4	16.4	20.9	38.1	65.0	144.0
Spring Return	2.4	4.1	7.9	10.8	21.7	27.3	52.6	95.3	192.6

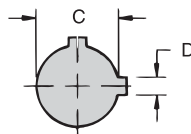
Weights are in lbs. Spring Return unit weights are with full set of springs per piston.

Actuator Volumes (ins³)

SIZE	48	63	83	92	118	127	160	210	255
Counter- clockwise	5.7	9.6	24.8	34.8	73.8	96.7	187.5	360.0	750.0
Clockwise	4.8	13.4	32.6	45.9	95.5	130.8	259.6	450.0	900.0

Counter-clockwise: Air volume in cubic inches required to push pistons apart, full travel.

Clockwise: Air volume in cubic inches required to push pistons together, full travel.



TORQUE

DOUBLE ACTING TORQUE CURVE

Series 92 – (Air to Air)



The Series 92 Actuator has a constant output torque throughout travel from start to end, clockwise or counterclockwise rotation.

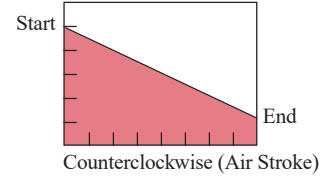
SERIES 92 ACTUATOR TORQUE DATA

Double Acting Pneumatic Operated
Torque Output (Lb.-Ins.)

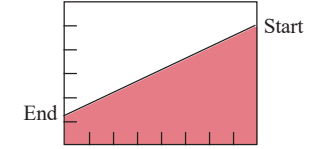
Actuator Size	Air Supply Pressure (PSIG)				
	40	60	80	100	120
48	75	113	150	188	225
63	145	221	297	373	449
83	351	536	721	906	1091
92	493	753	1013	1272	1532
118	1058	1615	2171	2728	3285
127	1410	2152	2894	3636	4378
160	2797	4270	5742	7214	8687
210	5783	8826	11870	14914	17957
255	14211	21691	29171	36650	44130

SINGLE ACTING TORQUE CURVES

Series 93 – (Spring Return)



Counterclockwise (Air Stroke)



Clockwise (Spring Stroke)

SERIES 93 ACTUATOR TORQUE DATA Air Operated, With Spring Return, Torque Output (Lb.-Ins.)

Actuator Size	No. Springs per Piston	Air Supply Pressure (PSIG)											
		40		60		80		100		120		Spring Stroke	
		Start	End	Start	End	Start	End	Start	End	Start	End	Start	End
48	1	51	32	89	70	126	107	164	145	201	182	43	24
	2/1	39	10	77	48	114	85	152	123	189	160	65	36
	2			64	27	101	64	139	102	176	139	86	49
	3/2			52	5	89	42	127	80	164	117	108	61
63	3					77	21	115	59	152	96	129	73
	2	91	65	167	141	243	217	319	293	395	369	80	54
	3	64	27	140	103	216	179	292	255	368	331	118	81
	4			113	65	189	141	265	217	341	293	156	108
	5			86	27	162	103	238	179	314	255	194	135
83	6					135	65	211	141	287	217	232	162
	2	210	167	395	352	580	537	765	722	950	907	184	141
	3	156	76	341	261	526	446	711	631	896	816	275	195
	4			281	176	466	361	651	546	836	731	360	255
	5			220	97	405	282	590	467	775	652	439	316
	6					369	185	554	370	739	555	536	352
92	2	310	232	570	492	830	752	1089	1011	1349	1271	261	183
	3	218	101	478	361	738	621	997	880	1257	1140	392	275
	4			386	231	646	491	905	750	1165	1010	522	367
	5			294	94	554	354	813	613	1073	873	659	459
	6					462	229	721	488	981	748	784	551
	118	2	692	469	1249	1026	1805	1582	2362	2139	2919	2696	589
3		509	174	1066	731	1622	1287	2179	1844	2736	2401	884	549
4				883	437	1439	993	1996	1550	2553	2107	1178	732
5				700	142	1256	698	1813	1255	2370	1812	1473	915
6						1073	404	1630	961	2187	1518	1767	1098
127		2	880	465	1622	1207	2364	1949	3106	2691	3848	3433	945
	3			1357	733	2099	1475	2841	2217	3583	2959	1419	795
	4			1094	261	1836	1003	2578	1745	3320	2487	1891	1058
	5					1568	529	2310	1271	3052	2013	2365	1326
	6					1302	57	2044	799	2786	1541	2837	1592
	160	2	1819	1118	3292	2591	4764	4063	6236	5535	7709	7008	1679
3		1399	349	2872	1822	4344	3294	5816	4766	7289	6239	2448	1398
4				2452	1123	3924	2595	5396	4067	6869	5540	3147	1818
5				2030	353	3502	1825	4974	3297	6447	4770	3917	2240
6						3154	1196	4626	2668	6099	4141	4546	2588
210		2	3833	2508	6876	5551	9920	8595	12964	11639	16007	14682	3275
	3	2859	868	5902	3911	8946	6955	11990	9999	15033	13042	4915	2924
	4			4930	2275	7974	5319	11018	8363	14061	11406	6551	3896
	5			3949	638	6993	3682	10037	6726	13080	9769	8188	4877
	6					6022	2031	9066	5075	12109	8118	9839	5848
	255	2	9487	6747	16967	14227	24447	21707	31926	29186	39406	36666	7464
3		7125	3015	14605	10495	22085	17975	29564	25454	37044	32934	11196	7086
4				12243	6762	19723	14242	27202	21721	34682	29201	14929	9448
5				9880	3030	17360	10510	24839	17989	32319	25469	18661	11811
6						14998	6778	22477	14257	29957	21737	22393	14173

SPECIFICATIONS

SPACE SAVING MODULAR PRODUCT LINE

The actuator shall be pneumatically operated and must travel a minimum of 90° in each direction and must be able to overtravel at 3% in each direction past 90°. The actuator shall be totally enclosed and contained in a single enclosure, with no external moving parts. All pneumatic passage ways must be integral to the actuator housing so as to eliminate the need for external tubing. Actuator shall be rack and pinion design, and the output torque shall be linear throughout travel. Actuator shall be provided with pistons that have acetal piston guides and rings thus greatly extending the life of the actuator and reducing friction to the minimum. Actuator must be supplied with two independent travel stop adjustments, the 0° and 90° travel positions have travel adjustments of +5° to -5° (see Diagram A below). The actuator shall be provided with mechanical visual position indicator, and the indicator must be able to be removed easily thus exposing the output shaft for use of manually overriding the

actuator when needed. The output shaft and pinion must be of one piece and must be manufactured out of hardened alloy steel and zinc plated for corrosion protection. Actuator shall be able to mount in any position without loss of performance. The actuator shall bolt directly to Bray valve mounting flange without need for any brackets.

Actuator housing shall be anodized aluminum and all external fasteners shall be carbon steel, zinc plated. Springs shall be spring steel, coated for corrosion protection. All seals shall be Buna-N and bearings made of lubricated acetal resin.

The actuator shall be factory lubricated. Actuator design must have smooth housing lines so it will self-drain. The actuator shall be factory tested to ensure proper operation.

STANDARD MATERIALS

- Body: Extruded aluminum alloy, anodized
- End Caps: Die cast aluminum alloy with corrosion resistant polyester coating
- Pistons: Die cast aluminum alloy
- Output Shaft/Pinion: Carbon Steel, zinc plated
- Travel Stop: Alloy Steel
- Shaft Bearings: Acetal
- Piston Guides: Acetal
- Fasteners: Stainless Steel
- Springs: Spring Steel, protective coating
- O-Ring Seals: Buna-N
- Options: Polyester coated body exterior
Electroless Nickel plated body exterior
Hard Anodized body exterior
Stainless Steel pinion

SPRING RETURN – MODULAR DESIGN

The Spring Return System for fail-safe services must be installed in the same housing as the double acting actuator, with no additional housing extensions required, therefore saving weight and space. The spring system must be supplied as a self-contained spring cartridge system. This is a safety feature that ensures disassembly of the actuator without danger of spring release when end caps are removed. Actuator shall be Bray Series 92 or 93 or approved equal.

SERVICE DATA:

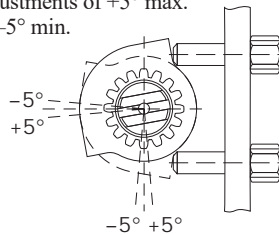
Actuators shall be designed for pneumatic operation up to a maximum pressure of 140 PSIG (10 Bar) and for temperature ranges of -40°F (-40°C) to +200°F (+95°C). Filtered air is recommended but not required. All double acting and spring return units shall be suitable for both on-off and throttling applications. Optional units shall be able to operate with other media such as hydraulic oil or water, consult factory for further information.

OPTIONAL EQUIPMENT

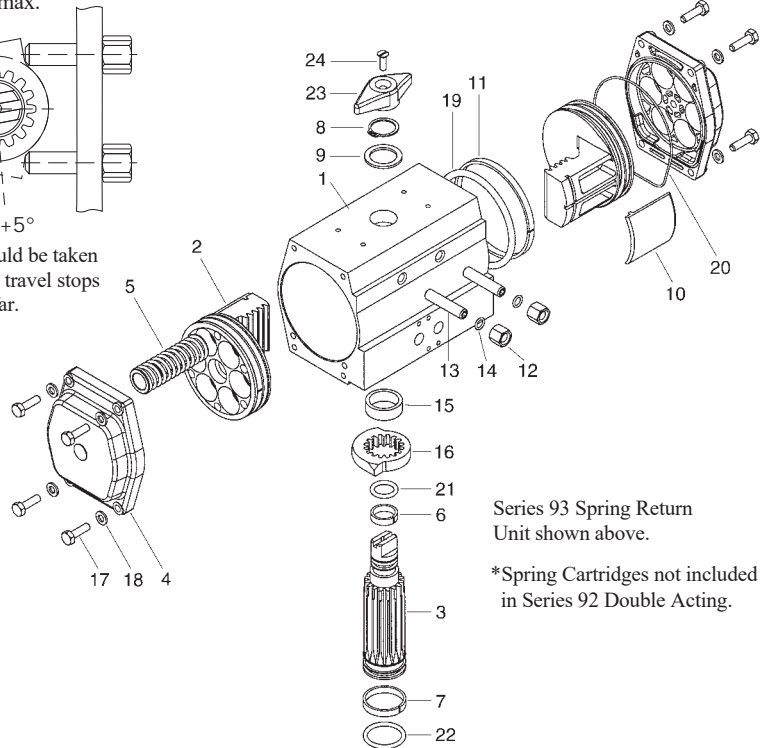
See Bray brochure #1030 for Solenoid, brochures #1011 and #1029 for Pneumatic and Electro-Pneumatic Positioners and brochures #1012 and #1015 for Valve Status Monitors.

Diagram A Travel Stop Adjustments

The 0° and 90° travel positions have travel adjustments of +5° max. to -5° min.



Caution: Care should be taken not to over adjust the travel stops in too far or out too far.



Series 93 Spring Return Unit shown above.

*Spring Cartridges not included in Series 92 Double Acting.

ACTUATOR COMPONENTS

Item No.	Qty.	Description
1	1	Body
2	2	Piston
3	1	Pinion
4	2	End Cap
5*	12 max.	Spring Cartridge Assembly
6	1	Upper Bearing
7	1	Lower Bearing
8	1	Retaining Ring
9	1	Nylon Washer
10	2	Acetal-Bearing Pad
11	2	Acetal-Guide Ring
12	2	Stop Nut
13	2	Travel Adjusting Screw Stop
14	2	O-Ring-Travel Stop
15	1	Acetal Spacer
16	1	Travel Stop
17	8	Hex Head Cap Screw
18	8	Washer
19	2	O-Ring-Piston
20	2	O-Ring-End Cap
21	1	O-Ring-Shaft-Top
22	1	O-Ring-Shaft-Bottom
23	1	Indicator Pointer
24	1	Indicator Pointer Screw

DISTRIBUTOR



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281.894.5454 FAX 281.894.9499 www.bray.com

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B-1032 5/03

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

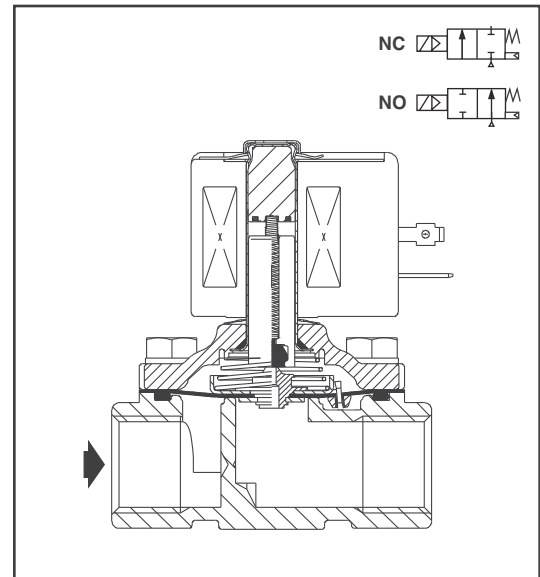
Electrical

Standard Coil and Class of Insulation	Watt Rating and Power Consumption				Spare Coil Part Number			
	DC Watts	AC			General Purpose		Explosionproof	
		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

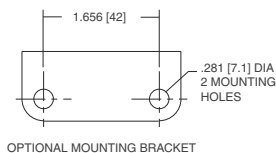
CSA certified. RedHat II meets applicable CE directives.
 Refer to *Engineering Section* for details.

Dimensions: inches (mm)

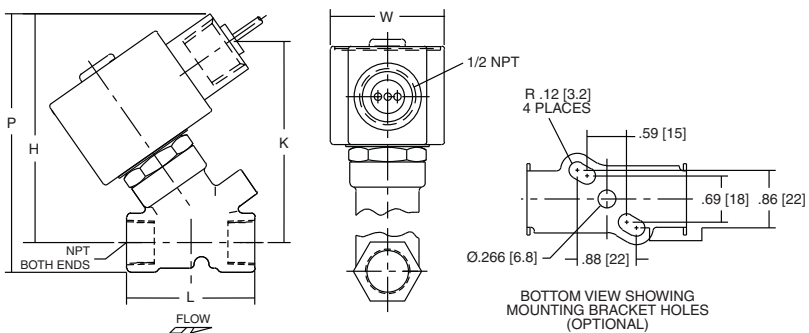
Const. Ref.		H	K	L	P	W
1*	ins.	3.85	3.00	1.91	3.41	1.69
	mm	98	76	49	87	43
2*	ins.	4.17	3.25	2.28	3.63	1.69
	mm	106	83	58	92	43
5	ins.	3.84	2.31	2.75	3.28	2.28
	mm	98	59	70	83	58
6*	ins.	3.38	1.94	2.75	2.80	2.28
	mm	86	49	70	71	58
7	ins.	4.19	2.50	2.81	3.47	2.39
	mm	106	64	71	88	61
8	ins.	4.13	2.47	2.81	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.

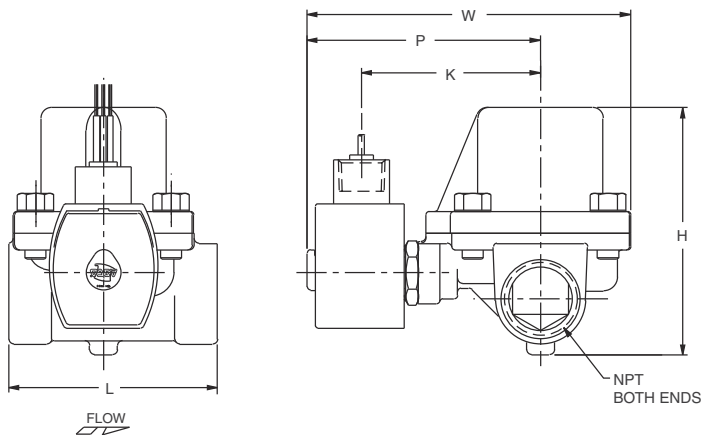
IMPORTANT: Valves may be mounted in any position, except as noted in specifications table.



Const. Ref. 1, 2

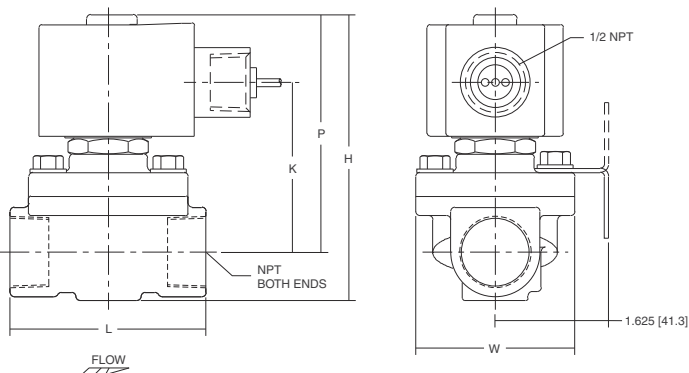


Const. Ref. 13



Selected Equipment

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



Stainless steel: vertical clamps

- U-shaped clamping bar
- Flanged bases

Application areas

DE-STA-CO toggle clamps made of stainless steel are resistant to corrosion and chemicals. These clamps are recommended for use in the chemical and food industries.

Product features

- Corrosion-resistant and heat-resistant steel
- Smooth surfaces without burrs
- Rivets made of stainless steel
- Oil-resistant, ergonomically shaped DE-STA-CO handle grip

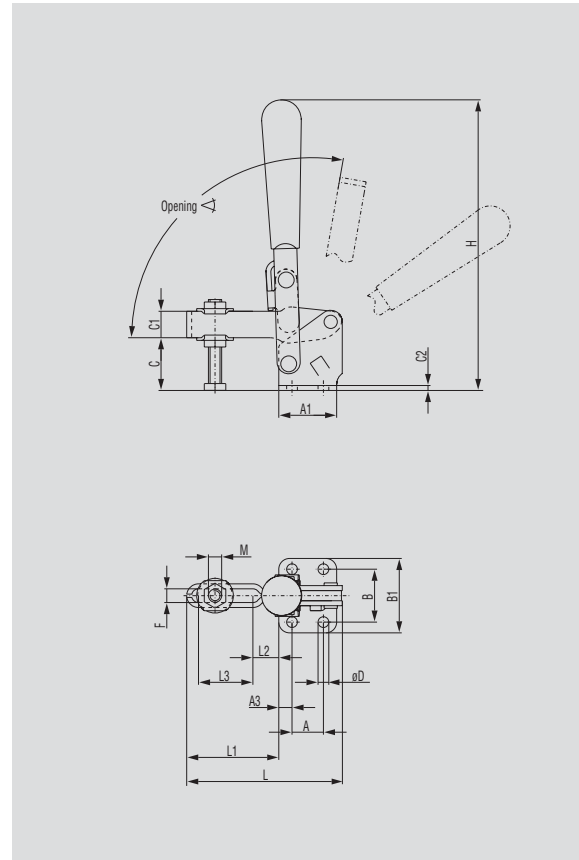
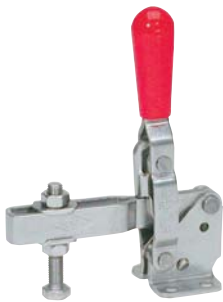
Accessories

Vertical clamps in stainless steel versions are generally delivered with standard adjustment spindles made of stainless steel.

Models 201-USS, 202-USS, 207-USS, 210-USS

Model no.	Holding Capacity ▲ [lbs.]	Bar Opening ◁ +10°	⚖️ [lbs.]	🔧 Standard equipment	🔩 Flanged Washers
201-USS	125	110°	0.15	201943	102911
202-USS	250	104°	0.35	202943	215905
207-USS	450	115°	0.70	509907-M	507907
210-USS	750	106°	1.29	237943	235906

See additional adjustment spindles beginning on page 9.1.



Model no.	A	A1	A3	B	B1	C	C1	C2	øD	F	H	L	L1	L2	L3	M
201-USS	0.63	1.00	.19	0.94	1.31	0.63	0.31	0.08	0.17	0.21	3.03	2.02	1.02	0.13	0.73	M5 or #10
202-USS	0.50	1.00	0.26	1.06	1.56	0.94	0.38	0.12	0.22	0.25	4.21	2.72	1.72	0.51	0.98	M6 or 1/4
207-USS	0.75	1.38	0.31	1.25	1.75	1.25	0.63	0.11	0.28	0.33	5.63	4.41	3.06	0.50	1.96	M8 or 5/16
210-USS	1.25	1.91	0.31	1.78	2.53	1.67	0.79	0.11	0.33	0.40	7.58	5.53	3.63	0.94	2.56	M10 or 3/8



Ingersoll Rand ARO Flow 1500 Air System Accessories – 3/8 in. In-Line Filter

Model# ARO F35231-310



Product Summary

Pneumatic Oil Filter, Filter Rating - Air Treatment 0.3 micron, Connection Size - Air Treatment 3/8 In. NPT, Max. Incoming Pressure - Air Treatment 250 psi, Max. Flow - Air Treatment 107 cfm, Bowl Material - Air Treatment Metal, Size - Air Treatment Compact, Bowl Size - Air Treatment 1.2 oz., Max. Temp. 175 Degrees F, Drain Port Size Push Type, Manual Drain Type, Housing Material Aluminum, Overall Height 6.16 In., Overall Width 2.24 In.

Features + Benefits

- 0.3 micron filter
- 1.2 oz. Metal bowl w/ sight glass
- 107 cfm

Key Specs

Housing Material	Aluminum
Bowl Material	Metal w/ sight glass
Bowl Size	1.2 oz
Drain Type	Manual
Connection Size	3/8" NPT
Filter Rating	0.3 micron
Air Flow	107 cfm
Max. Temperature	175 F
Max. PSI	250 psi
Size/Dimensions	6.16" x 2.24"
For removal of;	Oil, Oil Vapor, Particles, Water



Pneumatic Filters, Regulators, Lubricators, Filter/Regulators and Combination Units

Product Information

- | | |
|---|--|
| EN Product information | SL Specifikacije izdelka |
| ES Especificaciones del producto | SK Špecifikácie produktu |
| FR Spécifications du produit | CS Specifikace výrobku |
| IT Specifiche prodotto | ET Toote spetsifikatsioon |
| DE Technische produktdaten | HU A termék jellemzői |
| NL Productspecificaties | LT Gaminio techniniai duomenys |
| DA Produktspecifikationer | LV Ierices specifikācijas |
| SV Produktspecifikationer | PL Dane techniczne narzędzia rozmiar |
| NO Produktspesifikasjoner | BG Информация за продукта |
| FI Tuote-erittely | RO Informații privind produsul |
| PT Especificações do produto | RU Технические характеристики изделия |
| EL Προδιαγραφές προϊόντος | ZH 产品信息 |
| | JA 製品仕様 |
| | KO 제품 상세 |



Save These Instructions

Product Description

Intended Use:

The air line Filters, Regulators, Lubricators, Filter/Regulators and Combination Units are intended for use in industrial compressed air systems only. No other use is recommended.

For additional information refer to Air Line Filters, Regulators, Lubricators, Filter/Regulators and Combination Units Product Safety Information Manual 15301765.

Manuals can be downloaded from fluids.ingersollrand.com.

Filters

ARO compressed air filters are designed to remove airborne solid and liquid contaminant's which may plug small orifices and hinder performance, or cause excessive wear and premature equipment failure. Several filter elements are offered, including models with coalescing elements for removal of oil aerosols and particles down to 0.3 micron.

Regulators

ARO air line regulators provide controlled, consistent air pressure as required for specific pneumatic equipment connected to the air system. Standard relieving-type regulators are offered in a variety of adjustable pressure ranges, with convenient spring options for easy conversion should requirements change. Non-relieving models are also offered for applications where the venting of downstream overpressure is undesirable.

Lubricators

ARO fog-type lubricators help ensure that pneumatic devices receive the required lubrication to maintain operating performance, reduce wear and prolong service life. They are designed to provide the correct amount of oil required for most general applications in a pneumatic system, delivering a constant ratio of oil to CFM. Precise oil feed adjustment allows the proper oil delivery rate. Lubricators should be installed close to the downstream application to ensure effective distribution of oil to the pneumatic components.

Filter/Regulators

ARO compressed air filter/regulators are designed to remove airborne solid and liquid contaminant's which may plug small orifices and hinder performance, or cause excessive wear and premature equipment failure. Several filter elements are offered, including models with coalescing elements for removal of oil aerosols and particles down to 0.3 micron. In addition to filtration the regulators portion provides controlled, consistent air pressure as required for specific pneumatic equipment connected to the air system. Standard relieving-type regulators are offered in a variety of adjustable pressure ranges, with convenient spring options for easy conversion should requirements change. Non-relieving models are also offered for applications where the venting of downstream overpressure is undesirable.

Combination Units

ARO combination units are an assembled version of a filter, regulator and lubricator or a filter/regulator and lubricator. See Product Descriptions above for individual descriptions of components.

Product Specifications

Flows (scfm) [dm³/s]

Series	Size	Filter (& Coalescing)	Regulator	Lubricator	Piggyback
1000	1/8"	35 (38) [17 (18)]	45 [21]	32 [15]	43 [20]
1000	1/4"	48 (45) [23 (21)]	59 [28]	57 [27]	46 [22]
1500	1/4"	72 (70) [34 (33)]	86 [41]	51 [24]	71 [34]
1500	3/8"	106 (91) [50 (43)]	84 [40]	105 [50]	89 [42]
2000	3/8"	150 (155) [71 (73)]	179 [84]	85 [40]	132 [62]
2000	1/2"	194 (181) [92 (85)]	215 [101]	156 [74]	165 [78]
2000	3/4"	213 (185) [101 (87)]	210 [99]	222 [105]	173 [82]
3000	3/4"	279 (285) [132 (135)]	293 [138]	368 [174]	236 [111]
3000	1"	297 (330) [140 (156)]	290 [137]	328 [155]	250 [118]

Selected Equipment

Filter: Air Flow is at 90 psig (6.2 bar) inlet and 10 psig (0.7 bar) pressure drop.

Lubricator: Air Flow is at 90 psig (6.2 bar) inlet and 7 psig (0.5 bar) pressure drop.

Regulator & Piggyback: Air Flow is at 100 psig (6.9 bar) inlet, 90 psig (6.2 bar) set pressure and 33 psig (2.3 bar) pressure drop.

Bowl Capacity (oz) [mL]

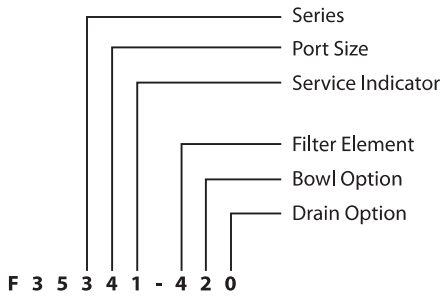
Bowl	Filter (& Coalescing) and Piggyback				Lubricator	
	Polycarbonate		Metal		Polycarbonate	Metal
	Manual	Auto	Manual	Auto	n/a	n/a
1000	0.5 (0.3) [14 (9)]	0.7 (0.5) [20 (14)]	0.4 (0.3) [13 (9)]	0.7 (0.5) [21 (14)]	0.6 [17]	0.7 [21]
1500	1.2 [36]	1.0 [31]	1.2 [37]	1.0 [30]	1.9 [56]	1.5 [43]
2000	1.9 [57]	2.3[68]	2.4 [72]	2.8 [83]	4.3 [128]	3.7 [110]
3000	n/a	n/a	5.3 (4.7) [156 (138)]	5.9 (5.2) [174 (154)]	n/a	3.7 [110]

	Polycarbonate Bowl	Metal Bowl	Regulator
Temperature Range	23°F - 125°F (-5°C - 52°C)	23°F - 175°F (-5°C - 79°C)	23°F - 140°F (-5°C - 60°C)
Maximum Pressure	150 psi (10.3 bar)	250 psi (17.2 bar)	250 psi (17.2 bar)

Model Identification

Filters

(Not all combinations available)



Series

- 1 – 1000 Series
- 2 – 1500 Series
- 3 – 2000 Series
- 4 – 3000 Series

Selected Equipment

Port Size

- | | |
|--------------|--------------|
| 1 – 1/8" NPT | A – 1/8" BSP |
| 2 – 1/4" NPT | B – 1/4" BSP |
| 3 – 3/8" NPT | C – 3/8" BSP |
| 4 – 1/2" NPT | D – 1/2" BSP |
| 5 – 3/4" NPT | E – 3/4" BSP |
| 6 – 1" NPT | F – 1" BSP |

Selected Equipment

Service Indicator

- 1 – None
- 2 – Mechanical (standard w/coalescing) (available on 2000 & 3000 Series only)

Selected Equipment

Filter Element

- 3 – 0.3 micron coalescing
- 4 – 5 micron

Selected Equipment

Bowl Option

- 0 – Polycarbonate w/guard (not available on 3000 Series)
- 1 – Metal w/sight glass (not available on 1000 Series)
- 2 – Metal

Selected Equipment

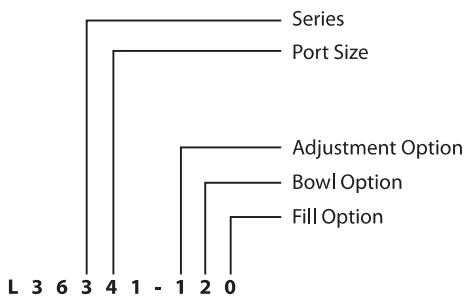
Drain Option

- 0 – Manual
- 1 – Automatic

Selected Equipment

Lubricators

(Not all combinations available)

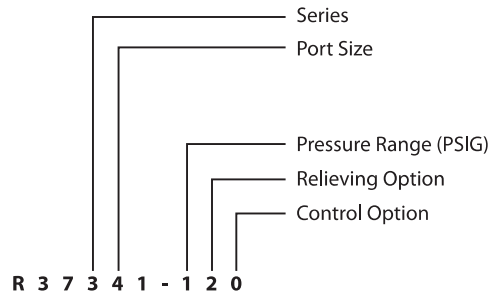


Series

- 1 – 1000 Series
- 2 – 1500 Series
- 3 – 2000 Series
- 4 – 3000 Series

Regulators

(Not all combinations available)



Series

- 1 – 1000 Series
- 2 – 1500 Series
- 3 – 2000 Series
- 4 – 3000 Series

Port Size

- | | |
|--------------|--------------|
| 1 – 1/8" NPT | A – 1/8" BSP |
| 2 – 1/4" NPT | B – 1/4" BSP |
| 3 – 3/8" NPT | C – 3/8" BSP |
| 4 – 1/2" NPT | D – 1/2" BSP |
| 5 – 3/4" NPT | E – 3/4" BSP |
| 6 – 1" NPT | F – 1" BSP |

Pressure Range (PSIG)

- 1 – 0 - 140 (No gauge)
- 2 – 0 - 60 (No gauge)
- 3 – 10 - 200 (No gauge) (available on 2000 & 3000 Series only)
- 4 – 0 - 30 (No gauge)
- 6 – 0 - 140 w/ flush mount gauge

Relieving Option

- 0 – Relieving
- 2 – Non-Relieving

Control Option

- 0 – Standard Knob

Port Size

- | | |
|--------------|--------------|
| 1 – 1/8" NPT | A – 1/8" BSP |
| 2 – 1/4" NPT | B – 1/4" BSP |
| 3 – 3/8" NPT | C – 3/8" BSP |
| 4 – 1/2" NPT | D – 1/2" BSP |
| 5 – 3/4" NPT | E – 3/4" BSP |
| 6 – 1" NPT | F – 1" BSP |

Adjustment Option

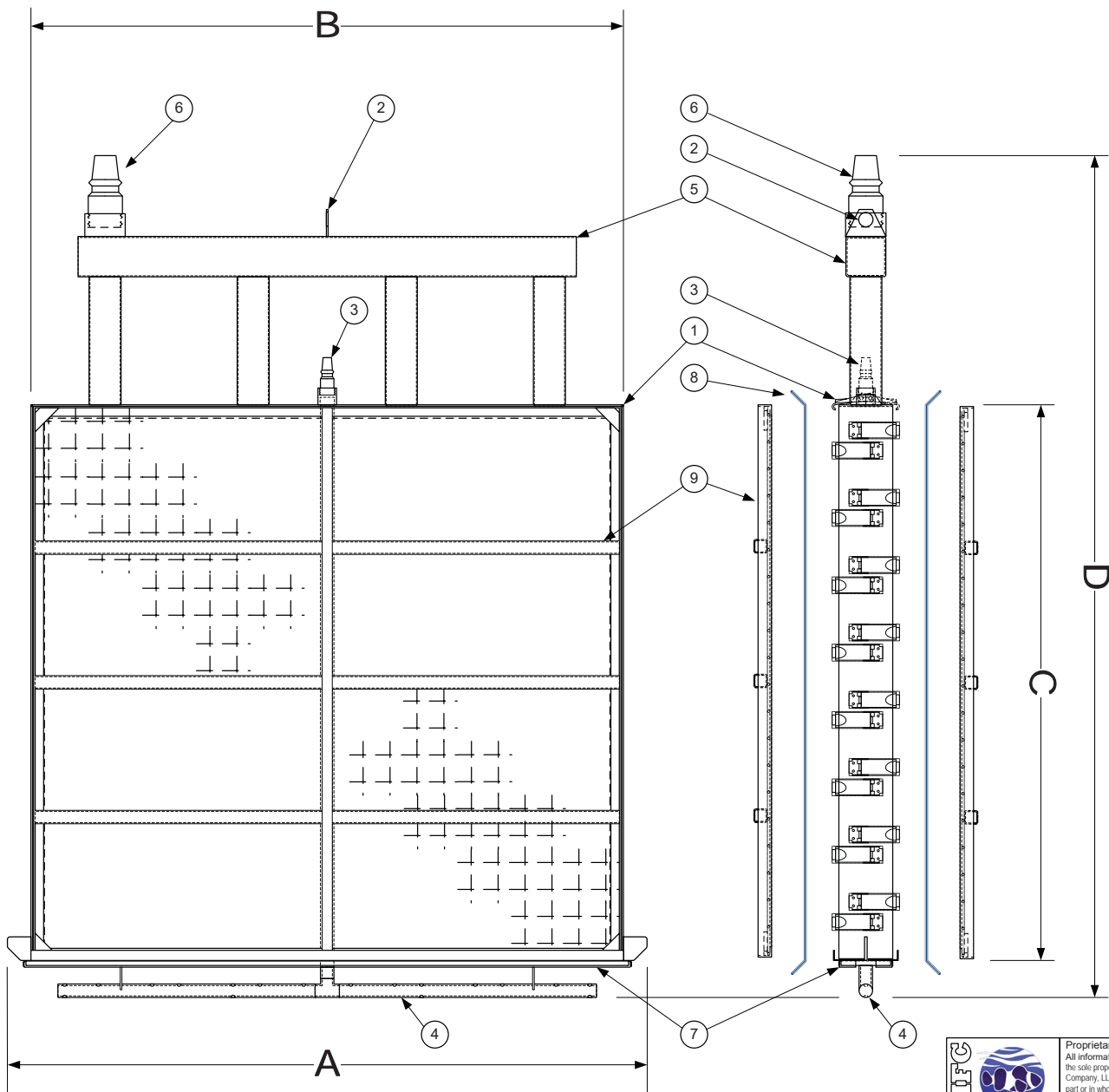
- 1 – Standard

Bowl Option

- 0 – Polycarbonate w/guard (not available on 3000 Series)
- 1 – Metal w/sight glass (not available on 1000 Series)
- 2 – Metal

Fill Option

- 0 – Standard



No.	Qty	Description
1	1	Cloth Media Element Frame w/ Clamps
2	1	Element Lifting Point
3	1	Air Scour Supply Hose Connection w/ Hose Barb (Size E)
4	1	Air Scour Distribution Header
5	1	Air Scour Vent Header w/ 2" standpipes
6	1	Air Scour Vent Hose Connection w/ Hose Barb (Size F)
7	1	Element Gasket, 1/2" Neoprene Rubber
8	2	Cloth Media Panel (Effective Area = G)
9	2	Media Retainer / Cover

MFC	A	B	C	D	E	F	G
Mx200003	15 1/2"	11 1/2"	25 3/4"	32"	1/2"	1.5"	3sf
Mx200006	25 1/4"	21 1/4"	25 3/4"	44"	1/2"	2"	6sf
Mx200012	36"	32"	32"	53"	1/2"	2"	12sf
Mx200024	47 1/2"	44"	41 1/4"	62 1/2"	3/4"	3"	24sf
Mx200048	70 1/2"	67"	57"	77 1/2"	1"	3"	48sf

* All Dimensions are approximate and subject to change.

- Notes:
- All materials to be type 304 stainless steel, neoprene, acrylic, or other non-corrosive material.
 - Air scour supply & vent hoses (w/ couplers) not shown for clarity.

**For Approval Only.
Not For
Construction.**



Proprietary Information
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Drawing Name:
**Filter Element
General Arrangement**

File Name: M4200000-Element-GA.vsd
Project: Weatherly WRF, Pelham, AL (PPEI)
Date: 02-19-21 Sheet: 1 of 1
Drawing No.: M4200000-Element-GA



1909 Commonwealth Avenue, Madison, WI 53726
 P: 608.240.8987 W: www.municipalfilter.com



TS-3 Blue Acrylic Pile Cloth Media

Municipal Filtration Co. LLC – *Cloth Media, Acrylic – Mx2000XX-Media*

Technical Specs

Item	Fx2000xx-Media	Nominal Particle Retention	10um
Fabric Color	Blue	Water Permeability	.5" HL @ 10gpm/sf
Fabric Material	100% Acrylic	Air Permeability	260 CFM @ .5" WG
Fabric Backing	Knitted Acrylic	Acid Resistance	Good
Fabric Pile Height	14/32"	Alkali Resistance	Good

Media Panel Sizes

Pre-Installation Dimensions (Excess cut-off following installation into element frame)

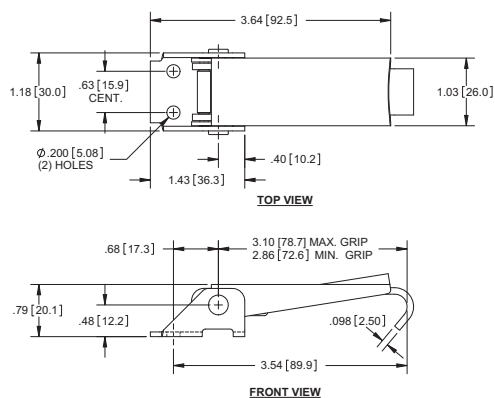
Element Size	Media Width (in)	Media Length (in)
Mx200003	14.5	30
Mx200006	24.5	30
Mx200012	35	36
Mx200024	48	46
Mx200048	70	60

DRAW PULL LATCHES

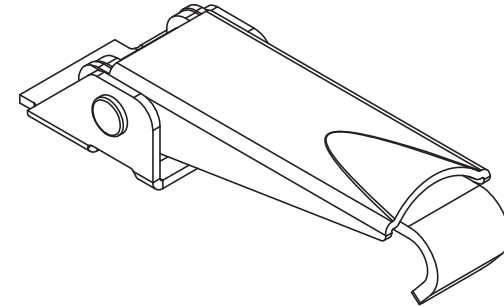
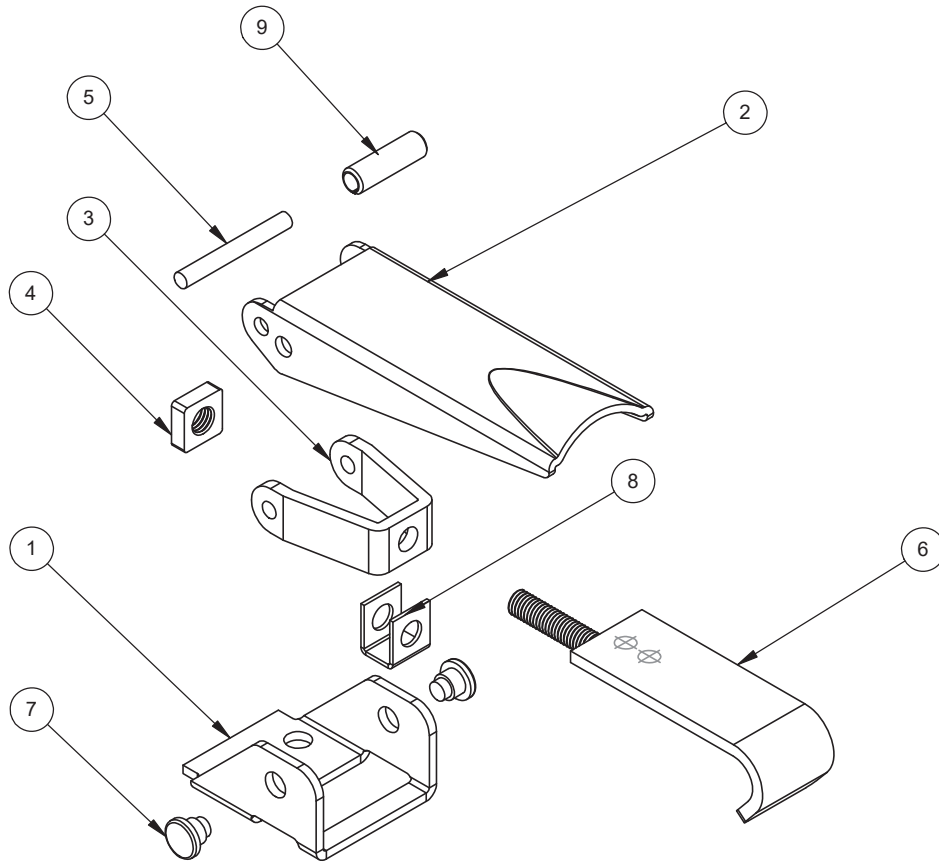
MEDIUM ADJUSTABLE DRAW PULL LATCH

PART NUMBER	DESCRIPTION	MATERIAL	FINISH
2172SS-L01	Latch	316 Series Stainless Steel	Electro-polished

- Working load: 600 lb.



REVISIONS					
REV.	DESCRIPTION	BY	DATE	CHK	DATE



ITEM NO.	QTY.	DESCRIPTION	MATERIAL	FINISH
9	1	SPRING PIN	316SS	ELECTROPOLISHED
8	1	CLIP	316SS	ELECTROPOLISHED
7	2	PIVOT PIN	316SS	ELECTROPOLISHED
6	1	CATCH	316SS FULL HARD	ELECTROPOLISHED
5	1	LEVER PIN	316SS	ELECTROPOLISHED
4	1	SQUARE NUT	316SS	ELECTROPOLISHED
3	1	CATCH BRACKET	316SS	ELECTROPOLISHED
2	1	LEVEL	316SS	ELECTROPOLISHED
1	1	BASE	316SS	ELECTROPOLISHED

NOTES:

1. ALL COMPONENTS ARE SAME AS P/N: 2172SS-L01 EXCEPT FOR MATERIAL.
2. (20) LATCHES TO BE SHIPPED INSIDE A .1MM THICK HEAT SEALED POLYBAG.
3. (5) MASTER POLYBAGS PER SPEP MASTER CARTON.

CUSTOMER APPROVAL	
X SIGN	DATE
PRINT NAME	
COMPANY NAME	

SIERRA PACIFIC

ENGINEERING AND PRODUCTS® SPEP.COM

CONFIDENTIAL PROPRIETARY INFORMATION | PLOT DATE: 12/1/2015

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UNSPECIFIED TOLERANCES

ANGLES: ±3°

INCHES	MM
.XX ±.030	.X ±.76
.XXX ±.015	.XX ±.38
.XXXX ±.005	.XXX ±.13

DRN BY: MM	DATE DRN: 11/25/2015
CHK BY: TAJ	DATE CHK: 11/25/2015
UNITS: INCHES	THIRD ANGLE PROJECTION
SCALE: .75:1	
CUST. NO.: 29714	
CUST. P. N.:	

PART NUMBER: 2172SST-L01				
DESCRIPTION: MED. ADJUSTABLE DRAW PULL LATCH STAINLESS STEEL, ELECTROPOLISHED				
WEIGHT: 0.216	SIZE: A	DWG. NO. 20249	SHEET 1 OF 2	REV. NC

EPDM RUBBER SPRAY HOSE (BLACK)



BULK HOSE

AG 200 (also available in red)

Apache P/N	I.D. x O.D.	Length	Spiral	W.P.	Wt. 100'
10031600	1/4" x 1/2"	500'	2	200#	9.0#
10031620	3/8" x 11/16"	500'	2	200#	14.0#
10031630	1/2" x 13/16"	500'	2	200#	21.0#
10031640	5/8" x 15/16"	500'	2	200#	24.0#
10031650	3/4" x 1-1/8"	500'	2	200#	32.0#
10031660	1" x 1-25/64"	500'	2	200#	44.0#

AG 300 (also available in red)

Apache P/N	I.D. x O.D.	Length	Spiral	W.P.	Wt. 100'
10031700	1/4" x 9/16"	500'	2	300#	12.0#
10031720	3/8" x 23/32"	500'	2	300#	17.0#
10031730	1/2" x 27/32"	500'	4	300#	25.0#
10031740	5/8" x 1"	500'	4	300#	30.0#
10031750	3/4" x 1-5/32"	500'	4	300#	37.0#
10031760	1" x 1-25/64"	500'	4	300#	53.0#

3000 SERIES (also available in red)

Apache P/N	I.D. x O.D.	Length	Spiral	W.P.	Wt. 100'
10040507	1-1/4" x 1-25/32"	250'	4	200#	77.0#
10041007	1-1/2" x 2-1/32"	200'	4	200#	86.0#
10041011	2" x 2-1/2"	300'	4	150#	108.1#

Applications: Versatile general purpose hose, which is excellent for air and water service as well as many agricultural chemicals including LASSO® herbicide. The EPDM tube and cover resists heat, sunlight, ozone and weathering. Exceeds RMA class C medium oil resistance requirements. Suitable for applications such as oil mist lubricating air lines, but NOT suitable for the transfer of petroleum products.

Construction: Closely plied reinforcement of 2 or 4 spiral high tensile textile cord provides excellent coupling retention and kink resistance.

Fittings: Universal quick couplings, long or short shank, insert type, reusable.

Note: 85% of 1/4"-1" reels come in a single 500' length. The reels may have up to 3 pieces, the minimum length of any one piece is 50'.

Versiflo® 150 Water S&D



Product Specifications

Application

General-purpose water suction and discharge for medium- to heavy-duty applications. Can be used in Lasso® applications.

Branding (Spiral)

Example: Continental ContiTech Versiflo® 150 Water Suction & Discharge

Construction Tube

Black EPDM synthetic rubber (wrapped finish)

Couplings

Contact fitting manufacturer for proper fitting recommendation and coupling procedure.

Reinforcement

Spiral plied synthetic fabric with wire helix

Order Codes

542-528 (1 1/4"-6")

541-528 (8"-14")

Temperature Range

-25°F to 200°F (-32°C to 93°C)

Packaging

542-528 - 100' lengths, coiled and polywrapped

541-528 - custom lengths

Verisiflo® 150 Water S&D

SAP #	ID	Nom. OD		Max. WP		Bend Radius		Vacuum HG		Weight		
		in.	mm	in.	mm	psi	MPa	in.	mm	in.	mm	lb./ft.
Black	in.	mm	in.	mm	psi	MPa	in.	mm	in.	mm	lb./ft.	kg/m
20016820	1¼	31.8	1.63	41.4	150	1.03	4	102	29	737	0.53	0.79
20016822	1½	38.1	1.87	47.5	150	1.03	4	102	29	737	0.65	0.97
20016828	2	50.8	2.39	60.7	150	1.03	7	178	29	737	0.87	1.29
20016831	2½	63.5	2.89	73.4	150	1.03	10	254	29	737	1.08	1.61
20016834	3	76.2	3.42	86.9	150	1.03	14	356	29	737	1.44	2.14
20016838	4	101.6	4.45	113.0	150	1.03	18	457	29	737	2.00	2.98
20016841	6	152.4	6.60	167.6	150	1.03	24	610	29	737	4.56	6.79
20115258	8	203.0	8.75	238.0	150	1.03	48	1200	29	737	7.40	11.00
20669573	10	254.0	10.96	278.0	150	1.03	60	1500	29	737	12.20	18.20
20669574	12	305.0	13.23	336.0	150	1.03	72	1800	29	737	18.70	27.90

Air & Multipurpose
General Purpose
Heavy Duty
Push-on

Chemical Transfer

Cleaning Equipment

Food
Transfer
Washdown

Marine

Material Handling
Abrasives
Bulk Transfer
Cement & Concrete

Mining

Petroleum
Aircraft Fueling
Dispensing
Dock
Transfer

Spray

Steam

Vacuum

LPG Delivery

Water
Discharge
Suction & Discharge
Washdown

Welding

Coupling Systems

Equipment

Appendix

Polypropylene Cam Lever Couplings

FEATURES

- Stainless steel rings, arms & pins.
- Most complete line of polypropylene couplings available.
- Versatile — interchangeable with all types of cam lever couplers.
- Precision molded — insures a uniform and accurate fit.
- Durable — Polypropylene is glass filled for rugged strength and durability.
- Smooth operating — finger rings are designed for easy opening of cam levers.
- Complete series of 1/2", 3/4", 1", 1 1/4", 1 1/2", 2", 3" and 4" NPT thread.
- BSP threads available 1" - 3" sizes (excluding 1 1/4").
- Operating conditions:
 - 3/8" thru 2" — 100 P.S.I. at 0°F; 125 P.S.I. at 70°F; 70 P.S.I. at 150°F
 - 2 1/2", 3" & 4" Cap-50 P.S.I.; Couplings 75 P.S.I. max.
- Economical and superior in performance.
- Standard with EPDM gaskets. Buna "N", and FKM (viton type) also available.



WARNING: Couplings should not be disconnected under pressure or with liquid in the line.



3" C & All 4" Couplings have 3 Arms for POSITIVE SEAL!

CAM LEVER COUPLINGS

FDA CAM LEVER COUPLINGS														
ITEM	DESCRIPTION	1/4"	3/8"	1/2"	3/4"	1"	1 1/4"	1 1/2" x 1 1/4"	1 1/2"	2"	2 1/2"	3"	3" 3 ARMS	4" 3 ARMS
A	Male Adapter-Female Thread	75A1/4	75A3/8	75A1/2	75A3/4	100A	125A	150125A	150A	200A		300A		400A
B	Female Coupler- Male Thread			75B1/2	75B3/4	100B	125B	150125B	150B	200B		300B	303B200A	400B
C	Female Coupler-Hose Shank			050C	075C	100C	125C	150125C	150C	200C		300C	303C	400C
D	Female Coupler-Female Thread		075D3/8	050D	075D	100D	125D	150125D	150D	200D		300D		400D
E	Male Adapter-Hose Shank			050E	075E	100E	125E	150125E	150E	200E		300E		400E
F	Male Adapter-Male Thread			050F	075F	100F	125F	150125F	150F	200F		300F		400F
PL	Plug for Female Coupler			75PL	75PL	100125PL	100125PL	150PL	150PL	200PL	250PL	300PL		400PL
CAP	Cap for Male Adapter			075CAP	075CAP	100125CAP	100125CAP	150CAP	150PCAP	200CAP	250CAP	300CAP		400CAP (2 arms)
CAPSH	Cap w/Short Arms							200CAPSH						

NOTE: *1/4", 3/8" and 1/2" series couplings interchange with 3/4" size couplings. Coupling ends are 3/4" size.
 **1 1/4" series couplings interchange with 1" size couplings. Coupling ends are 1" size.
 ***1 1/2" x 1 1/4" couplings interchange with 1 1/2" size couplings. Coupling ends are 1 1/2" size.

1½" & 2" Polypropylene 90° Couplings

FEATURES

- Precision molded in polypropylene, reinforced with fiberglass for strength and durability.
- Stainless steel rings, cam levers and pins resist corrosion.
- Banjo 90° angle couplings and adapters will reduce the number of elbows and other pipe fittings used in plumbing applications.

1½" 90° POLY CAM LEVER COUPLINGS

PART NO	DESCRIPTION	MAX PSI	GASKET	QTY
150A90	1½" 90° Male Adapter-1½" Female Thread	225	EPDM	1
150C90	1½" 90° Female Coupler-1½" Hose Shank	225	EPDM	1
150D90	1½" 90° Female Coupler-1½" Female Thread	300	EPDM	1
150F90	1½" 90° Male Adapter-1½" Male Thread	300	EPDM	1

2" 90° POLY CAM LEVER COUPLINGS

PART NO	DESCRIPTION	MAX PSI	GASKET	QTY
200A90	2" 90° Male Adapter-2" Female Thread	225	EPDM	1
200B90	2" 90° Female Coupler-2" Male Thread	225	EPDM	1
200C90	2" 90° Female Coupler-2" Hose Shank	225	EPDM	1
200D90	2" 90° Female Coupler-2" Female Thread	200	EPDM	1
200F90	2" 90° Male Adapter-2" Male Thread	225	EPDM	1





POLY STRAIGHT HOSE BARBS

PART NO	DESCRIPTION	QTY
HB025	1/4" Male Thread x 1/4" Hose Barb	10/bag
HB025-038	1/4" Male Thread x 3/8" Hose Barb	10/bag
HB025-050	1/4" Male Thread x 1/2" Hose Barb	10/bag
HB038	3/8" Male Thread x 3/8" Hose Barb	10/bag
NEW HB038-025	3/8" Male Thread x 1/4" Hose Barb	10/bag
HB038-050	3/8" Male Thread x 1/2" Hose Barb	10/bag
NEW HB050-025	1/2" Male Thread x 1/4" Hose Barb	10/bag
HB050-038	1/2" Male Thread x 3/8" Hose Barb	10/bag
HB050	1/2" Male Thread x 1/2" Hose Barb	10/bag
HB050-075	1/2" Male Thread x 3/4" Hose Barb	10/bag
HB075-038	3/4" Male Thread x 3/8" Hose Barb	10/bag
HB075-050	3/4" Male Thread x 1/2" Hose Barb	10/bag
HB075-058	3/4" Male Thread x 5/8" Hose Barb	10/bag
HB075	3/4" Male Thread x 3/4" Hose Barb	10/bag
HB075-100	3/4" Male Thread x 1" Hose Barb	10/bag
HB100-075	1" Male Thread x 3/4" Hose Barb	10/bag
HB100	1" Male Thread x 1" Hose Barb	10/bag
HB100-125	1" Male Thread x 1 1/4" Hose Barb	10/bag
HB125-075	1 1/4" Male Thread x 3/4" Hose Barb	10/bag
HB125-100	1 1/4" Male Thread x 1" Hose Barb	10/bag
HB125	1 1/4" Male Thread x 1 1/4" Hose Barb	10/bag
HB125-150	1 1/4" Male Thread x 1 1/2" Hose Barb	10/bag
HB150-100	1 1/2" Male Thread x 1" Hose Barb	10/bag
HB150-125	1 1/2" Male Thread x 1 1/4" Hose Barb	10/bag
HB150	1 1/2" Male Thread x 1 1/2" Hose Barb	10/bag
HB150-200	1 1/2" Male Thread x 2" Hose Barb	10/bag
HB200-150	2" Male Thread x 1 1/2" Hose Barb	10/bag
HB200	2" Male Thread x 2" Hose Barb	10/bag
HB300	3" Male Thread x 3" Hose Barb	1
HB400	4" Male Thread x 4" Hose Barb	1



316 SS HOSE BARBS

PART NO	DESCRIPTION	QTY
HB025SS	1/4" Male Thread x 1/4" Hose Shank	1
HB025-038SS	1/4" Male Thread x 3/8" Hose Shank	1
HB025-050SS	1/4" Male Thread x 1/2" Hose Shank	1
HB038SS	3/8" Male Thread x 3/8" Hose Shank	1
HB038-050SS	3/8" Male Thread x 1/2" Hose Shank	1
HB050SS	1/2" Male Thread x 1/2" Hose Shank	1
HB050-058SS	1/2" Male Thread x 5/8" Hose Shank	1
HB050-075SS	1/2" Male Thread x 3/4" Hose Shank	1
HB075-050SS	3/4" Male Thread x 1/2" Hose Shank	1
HB075SS	3/4" Male Thread x 3/4" Hose Shank	1
HB075-100SS	3/4" Male Thread x 1" Hose Shank	1
HB100-075SS	1" Male Thread x 3/4" Hose Shank	1
HB100SS	1" Male Thread x 1" Hose Shank	1
HB125SS	1 1/4" Male Thread x 1 1/4" Hose Shank	1
HB150SS	1 1/2" Male Thread x 1 1/2" Hose Shank	1
HB200SS	2" Male Thread x 2" Hose Shank	1
HB300SS	3" Male Thread x 3" Hose Shank	1



Drawings:

Interconnection (M1200000-Interconnection)

FCP Panel Layout (M1200500-Layout)

FCP Panel Wiring (M1200500-Wiring)

Component Cutsheets:

Attabox Nema 4X Enclosure

Automation Direct DL-05AA PLC & I/O

**Automation Direct EA9-T7CL-R Touch Screen
Operator Interface Panel & Accessories**

Eaton Circuit Breakers

Phoenix Contact Relays

Automation Direct Ice Cube Relays

Rhino DC Power Supply

**FESTO Solenoid Valve Terminal &
Accessories**

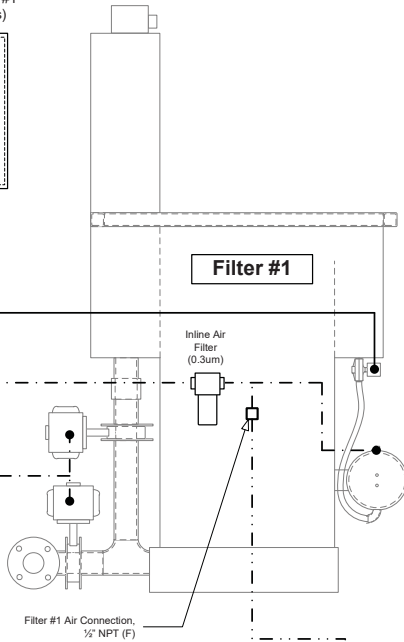
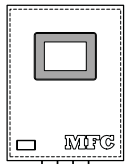
Weidmuller Duplex Receptacle

Gems LS-1950 Float Switch(s)

Square D Pumptrol Pressure Switch

Filter Control Panel (FCP)

Factory mounted to influent end of filter #1 (see GA drawings)



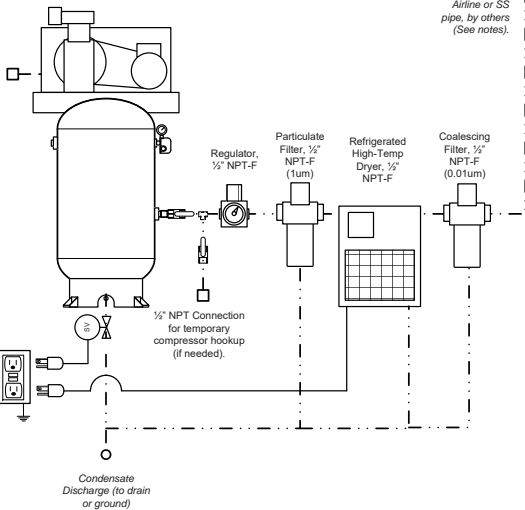
Filter #1 Air Connection, 1/2" NPT (F)

1/2" Min Dia Airline or SS pipe, by others (See notes).

Filter Panel Power
(120VAC, 1ph, 60Hz, 20A)

5 HP Compressor
(230VAC, 1ph, 60Hz, 50A)

Dryer/Condensate Outlet
(120VAC, 1ph, 60Hz, 20A)



Condensate Discharge (to drain or ground)

- Conduit & Wiring by MFC
- - - - - Conduit & Wiring by Others
- · - · - Air Line by MFC
- · · · · Air Line by others

Compressed Air System Components for MFC Filter Systems (Mx200000 Series):

MFC Cloth Media filters use a combination of pneumatically operated butterfly valves and pressurized air scour to backwash filter elements, eliminating pumps, motors, mechanical moving parts & maintenance items. A small compressor is included to provide clean/dry air @ 85-90 psi for these operations. Even though air requirements are minimal, a robust compressed air system is included to maintain the highest operational efficiencies possible.

Compressor:

Included Compressor: Champion VR-5 5HP Two-Stage compressor w/ 80gal Vert. Receiver, (230V, 1Ph operation) and automated condensate relief.

Regulator:

Air pressure to filter must be regulated to 85-90psi.

Included Regulator: Wilkerson Model R16-XX-000 Regulator, 1/2" NPT-F or equivalent.

Inline Air Filters:

In order to maintain proper operation of valve actuators & air scour solenoids, air to the filter must be clean & free from dust, debris, & excessive oil.

Included Filters: Aircel Particulate Filter (1um) and Coalescing Filter (0.01um). An IR 0.3um particulate filter is also included at the FCP.

Dryers:

Drying equipment is included due to high humidity (filter located outside);

Included Dryer: Aircel DHT20 High Temperature Refrigerated Air Dryer with automated condensate discharge, 1/2" NPT.

Air Line/Piping (by others):

All airline, hose or piping between the compressor/dryer system and MFC filter to be supplied by others. Minimum airline size shall be 1/2" dia minimum and material shall be stainless steel, copper pipe or rubber hose housed in conduit (150psi min).

AIRLINE CRITICAL NOTE: DO NOT USE Galvanized pipe, black pipe, or other corrosive material as this may cause damage to the filter's air scour system & components.

HOUSING NOTE: Submitted compressed air equipment is intended for indoor use only. All components shall be housed in a building, enclosure, or other appropriate shelter and shall NOT be left outdoors prior to or during installation, construction, or operation. All housings, shelters, enclosures, or other buildings are to be provided and installed by others.

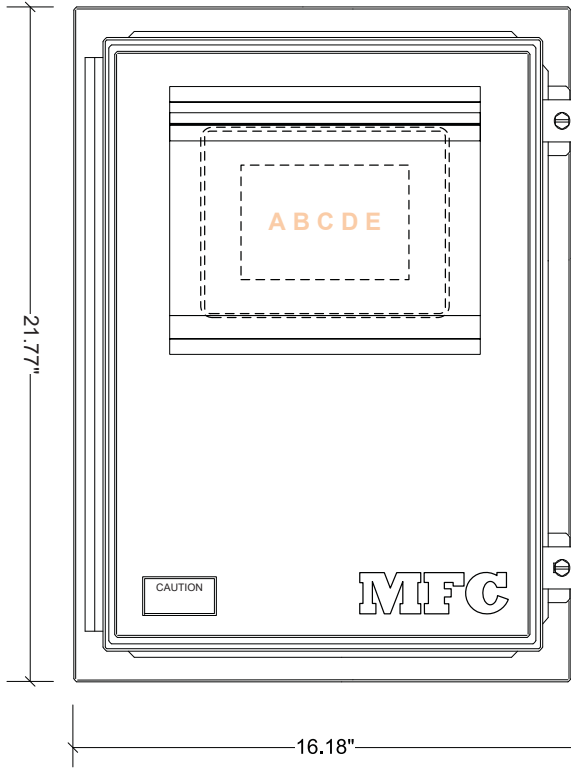
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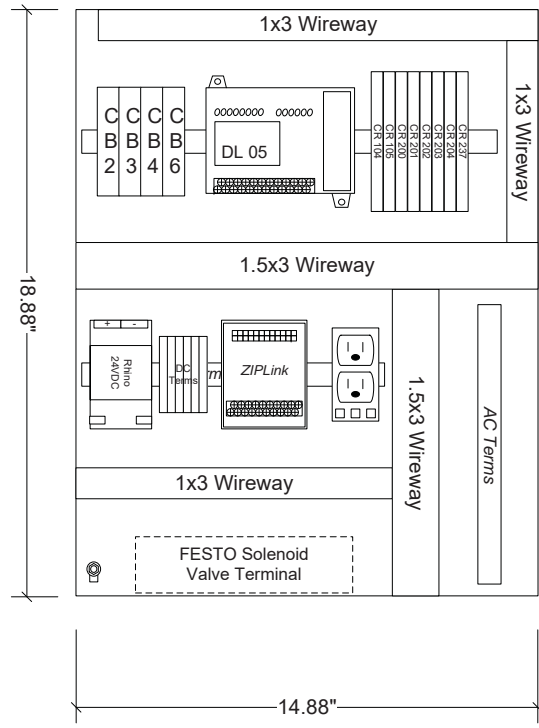
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Drawing Name:
Filter & Compressed Air Interconnection Details

File Name:	M1200000-Interconnection.vsdX	
Project:	Weatherly WRF, Pelham, AL (PPEI)	
Date:	02-19-21	Sheet: 1 of 1
Drawing No.:	M1200000-Interconnection	



Filter Control Panel
AttaBox Model FR201610HPL
Nema 4X, FiberGlass, Wall Mount



Subpanel Layout
AttaBox Model BP2016A
Aluminum

AC Terminal Strip Listing		DC Terminal Strip Listing	
End	A10	End	
3	A11	+1	
3	Spacer	+1	
3	G	+1	
Spacer	G	Spacer	
101	G	-1	
104	Spacer	-1	
105	N	-1	
Spacer	N	End	
200	N		
201	End		
202			
203			
204			
Blank			

No	Part-No.	Qty	Description
1	FR201610HPL	1	AttaBox Nema 4X, Fiberglass, Wall Mount Enclosure
2	BP2016A	1	AttaBox Subpanel, Aluminum
3	FRMGFTKIT	1	AttaBox Mounting Foot Kit, Premier
4	D0-05AA	1	Automation Direct DL-05 PLC Micro-processor
5	D0-16TD2	1	Automation Direct 16-pt DC (Sourcing) Output Card for D0-05/06 PLCs
6	EA9-T7CL-R	1	Automation Direct C-More Touch Screen Panel, TFT, Color, LED
7	EA-2CBL	1	Automation Direct Cable, Shielded, 3M, RS-232, 15pin D-Shell to RJ12
8	PSL-24-030	1	DC Power Supply, Input 120VAC/60Hz, Output 24VDC, 30W
9	FAZ-D01-1-SP	2	EATON Din Mount Circuit Breaker, D-Curve, 1Amp, 1 Pole
10	FAZ-D08-1-SP	1	EATON Din Mount Circuit Breaker, D-Curve, 8Amp, 1 Pole
11	FAZ-D15-1-SP	1	EATON Din Mount Circuit Breaker, D-Curve, 15Amp, 1 Pole
12	PLC-RSC-120UC/21	8	Phoenix Contact Relay & Socket, 120VAC Coil, SPDT, 6A Contact
13	781-1C-120A	0	Automation Direct Cube Relay, 120VAC Coil, 1PDT, 15A Contact
14	781-1C-SKT	0	Automation Direct Relay Socket, DIN Mount, for 781 Cube Relays
15	DN-T12-A	14	Terminal Block, Grey, for 35mm Din Rail
16	DN-T12W-A	3	Terminal Block, White, for 35mm Din Rail
17	DN-T12GRN-A	3	Terminal Block, Green, for 35mm Din Rail
18	DN-T12B-A	6	Terminal Block, Blue, for 35mm Din Rail
19	DN-EB35	13	End Block, Grey, for 35mm DIN Rail
20	DN-S1210	5	Spacers, Grey, for 35mm DIN Rail
21	DN-R35S1	3	DIN Rail, 35mm, Cut to Length
22	T1-1030W-1	3	Conduit Wireway, Cut to length, White, 1.0" Wide x 3.0" Deep
23	T1-1530W-1	2	Conduit Wireway, Cut to length, White, 1.5" Wide x 3.0" Deep
24		1	DIN Rail Mount Duplex Outlet, 15A
25		1	Electrical Caution Sticker
26		1	Sunshield for 7" C-More HMI, 304SS w/ hinged front panel
27	573606	1	FESTO Solenoid Valve Terminal, 14mm, 12-Port for Nema 4X Encl.
28			Electrical Caution Sticker
29	ZL-RTB20	1	Automation Direct ZIPLink feedthrough Module for 16pt output, Din Mount
30	ZL-D0-CBL24	1	Automation Direct ZIPLink Cable, 24-pin, 0.5m

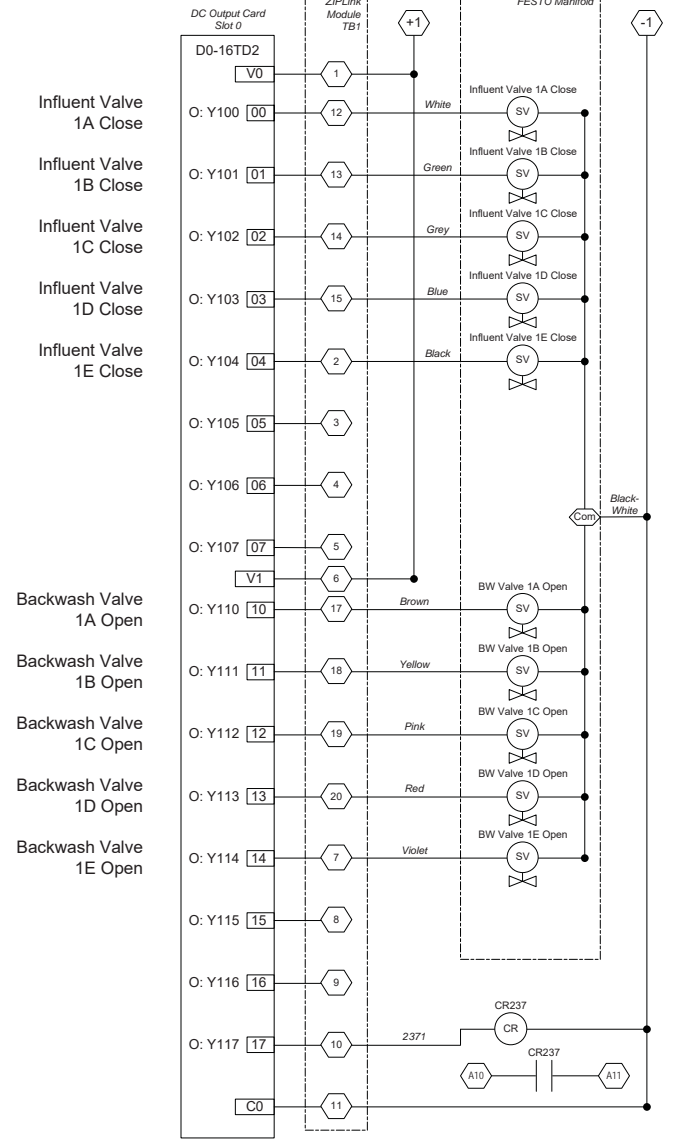
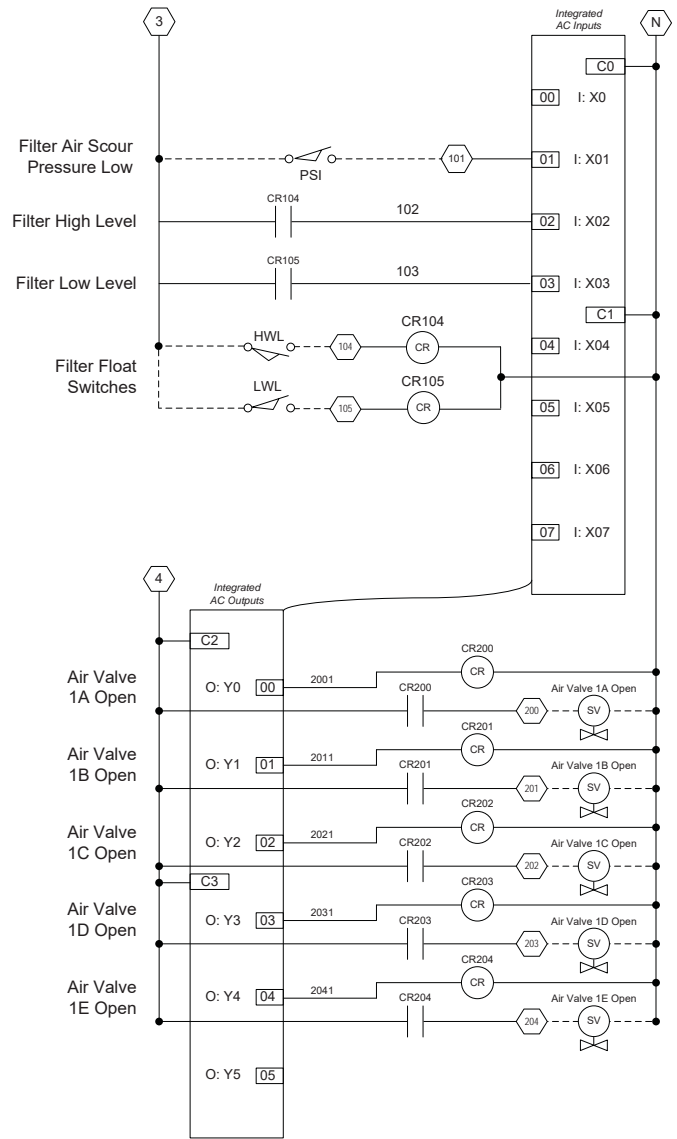
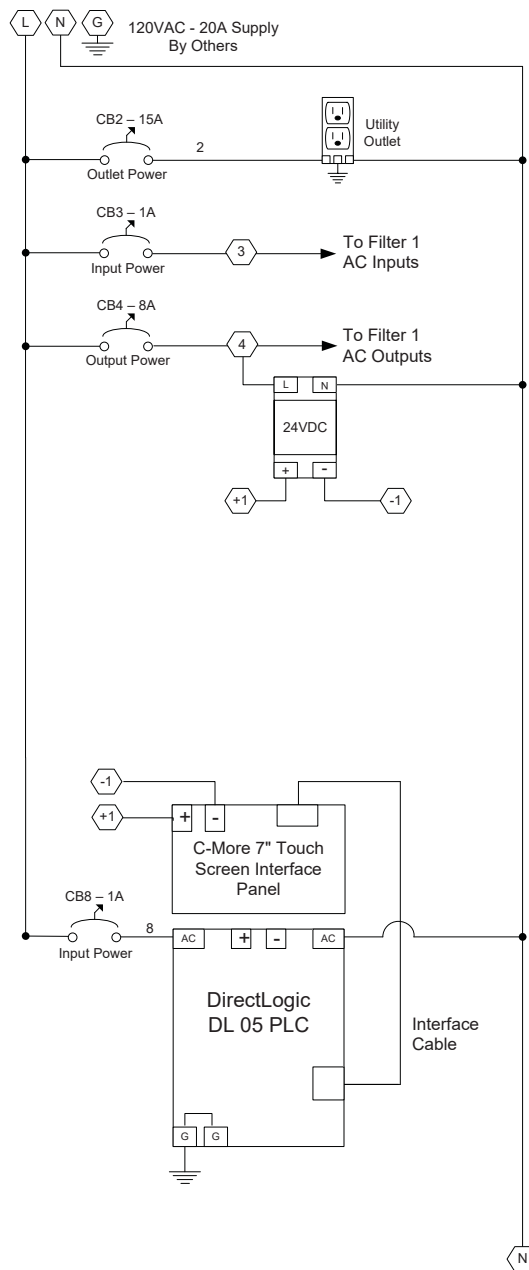
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Drawing Name:
**Filter Control Panel
Electrical Details**

File Name: M1200500-FCP.vsd
Project: Weatherly WRF, Pelham, AL (PPEI)
Date: 02-12-21 Sheet: 1 of 1
Drawing No.: M1200500-Layout



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Drawing Name:
**Filter Control Panel
Electrical Details**

File Name: M1200500-FCP.vsd
Project: Weatherly WRF, Pelham, AL (PPEI)
Date: 02-19-21 Sheet: 1 of 1
Drawing No.: M1200500-Wiring



PROVEN PROTECTION BY DESIGN

**ATTABOX INDUSTRIAL ENCLOSURES
FIBERGLASS AND POLYCARBONATE
ELECTRICAL, INDUSTRIAL
AND INSTRUMENTATION ENCLOSURES**

AttaBoxTM
A BRAND OF **ROBROY** ENCLOSURESTM

Freedom™ Series

Proven Protection Made Possible By The Freedom To Design For Your Individual Application Needs

Freedom (FR) Series enclosures are developed for maximum design flexibility and pleasing aesthetics. These attractive yet highly durable enclosures fiberglass-reinforced polyester enclosures are ideal for diverse applications including: high-end electronics, OEM housings and conspicuous industrial applications, both indoors and out. They can be relied on for protection in corrosive environments where a full seal against the outside environment is critical and a watertight seal is a must.

A unique benefit of feature-laden **Freedom** Series enclosures is the internal panel management system empowering the end user to select and use only the features required for their specific application --- and to use every cubic inch of valuable internal enclosure space!

The **Freedom** Series offers an additional feature of panel mounting in the cover for use as an operator interface in industrial equipment control stations.

FREEDOM SERIES ATTRIBUTES

- Available in 2 cover options:
 1. *Opaque cover*
 2. *Flush bonded window*
- Maximum visibility to raised panels and control devices
- High temperature, flame retardant, non corrosive, environmental designs
- Stands up to an exceptionally broad range of chemical exposures
- Results in an environmentally sealed, environmentally sound space
- High impact resistance
- Double insulated material No incidental electrical contact
- Solid construction in a lightweight design
- UV Resistant

FREEDOM SERIES INDUSTRY STANDARDS

UL/cUL File #	E64358
NEMA Ratings (UL508A, UL50 & UL50e)	1, 3, 3S, 4X, 12, 13
CSA Std. C22.2 File #	LR069014
IEC 60529 Ratings	IP66
UL 1741 File #	E333478
Temperature Range	(-76° F to +274° F) (-60° C to +134° C)
Window Temperature Range	(-26° F to +170° F) (-32° C to +76° C)
Flammability Rating	UL94-5V
Window Flammability Rating	UL94-HB
Self Extinguishing	Non-Halogenated, Non-flame propagating
NFPA No. 101 Flame Spread	Class A (1)
Impact Rating	IK10
Certifications	UL, CSA, CE, REACH, RoHS
Outdoor UV Exposure (UL 746C)	(f1) Rated
Chemical Resistance	See chart on page 120

Freedom | HPL

HINGED, 2 LOCKABLE PULL LATCHES



CONSTRUCTION

Material	Hot Compression Molded Fiberglass Reinforced Polyester (Thermoset)
Gasket	Poured Seamless Polyurethane Gasket
Cover Screw Size	#10-32 x 1-1/4
Cover Screw Torque	20-24 in.-lbs.
Hinge and Latch Hardware	304 Stainless Steel

INDUSTRY STANDARDS

UL/cUL File #	E64358
NEMA Ratings (UL508A, UL50 & UL50e)	1, 3, 3S, 4X, 12, 13
CSA Std. C22.2 File #	LR069014
IEC 60529 Ratings	IP66
UL 1741 File #	E333478
Temperature Range	(-76° F to +274° F) (-60° C to +134° C)
Flammability Rating	UL94-5V
Self Extinguishing	Non-Halogenated, Non-flame propagating
NFPA No. 101 Flame Spread	Class A (1)
Impact Rating	IK10
Certifications	UL, CSA, CE, REACH, RoHS
Outdoor UV Exposure (UL 746C)	(f1) Rated
Chemical Resistance	See chart on page 120

ACCESSORIES

PANELS

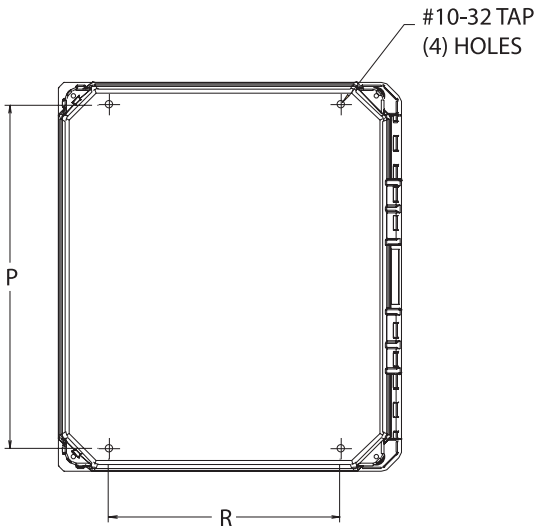
Aluminum Back Panel	BP__A	pg. 108
Carbon Steel Back Panel	BP__CS	pg. 108

ACCESSORIES

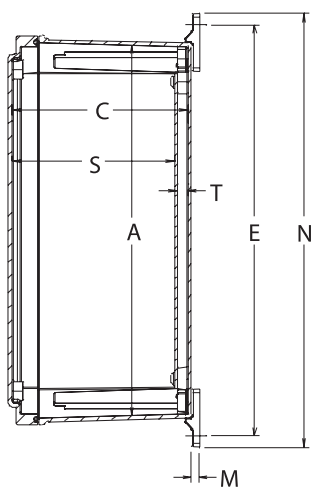
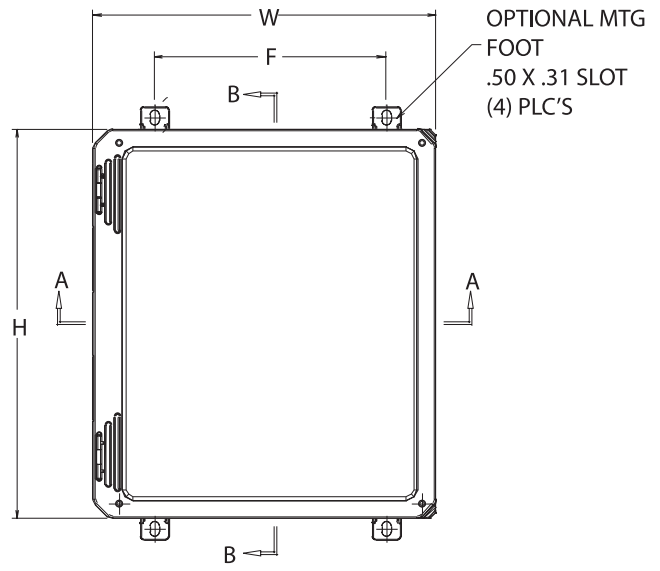
Mounting Feet	pg. 81
Drain & Breather Vents	pg. 102
PluggIt	pg. 103
Panel Management System	pg. 76-81
All Other Accessories	Pg. 102-117

MODIFICATIONS

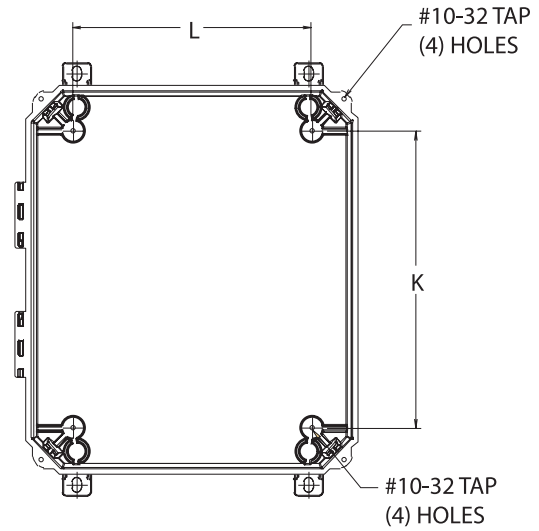
Custom Colors	pg. 10-11
Silk Screening	pg. 10-11
EMI/RFI Shielding	pg. 10-11
Custom Window	pg. 10-11
Custom Cutouts/Holes	pg. 10-11



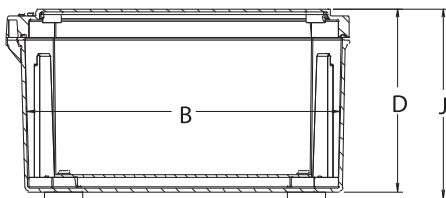
REAR VIEW



SECTION B-B



COVER
REMOVED



SECTION A-A

FREEDOM OPAQUE COVER SERIES ENCLOSURES

SIZE ID NUMBER	OVERALL H X W X D	INSIDE A X B X C	MOUNTING P X R	K	L	S	T	OPT. MOUNT. FEET E X F	N	J	M	SHIPPING WEIGHT	PANEL NUMBER
FR60604HW FR60604HPL	7.41 x 7.79 x 4.31 (188 x 198 x 110)	6.77 x 6.77 x 4.06 (172 x 172 x 103)	5.93 x 4.00 (151 x 102)	4.25 (108)	4.25 (108)	3.60 (92)	.38 (10)	8.24 x 4.00 (209 x 102)	9.02 (229)	4.56 (116)	.25 (6)	3.8 lbs	BP66*
FR80604HW FR80604HPL	9.41 x 7.79 x 4.31 (239 x 198 x 110)	8.77 x 6.77 x 4.06 (223 x 172 x 103)	7.91 x 4.00 (201 x 102)	6.25 (159)	4.25 (108)	3.60 (92)	.38 (10)	10.21 x 4.00 (259 x 102)	10.98 (279)	4.56 (116)	.25 (6)	4.1 lbs	BP86*
FR80804HW FR80804HPL	9.39 x 9.76 x 4.31 (239 x 248 x 109)	8.74 x 8.74 x 4.06 (222 x 222 x 103)	7.91 x 6.00 (201 x 152)	6.25 (159)	6.25 (159)	3.60 (92)	.38 (10)	10.21 x 6.00 (259 x 152)	10.98 (279)	4.56 (116)	.25 (6)	4.9 lbs	BP88*
FR100806HW FR100806HPL	11.42 x 9.79 x 6.31 (290 x 249 x 160)	10.73 x 8.73 x 6.06 (273 x 222 x 154)	9.89 x 6.00 (251 x 152)	8.25 (210)	6.25 (159)	5.60 (142)	.38 (10)	12.19 x 6.00 (310 x 152)	12.96 (329)	6.56 (167)	.25 (6)	6.2 lbs	BP108*
FR121006HW FR121006HPL	13.45 x 11.83 x 6.31 (342 x 301 x 160)	12.69 x 10.69 x 6.06 (322 x 272 x 154)	11.88 x 8.00 (302 x 203)	10.25 (260)	8.25 (210)	5.60 (142)	.38 (10)	14.18 x 8.00 (360 x 203)	14.95 (380)	6.56 (167)	.25 (6)	8.0 lbs	BP1210*
FR141206HW FR141206HPL	15.44 x 13.86 x 6.34 (392 x 352 x 161)	14.72 x 12.72 x 6.06 (374 x 323 x 154)	13.91 x 10.00 (353 x 254)	12.25 (311)	10.25 (260)	5.60 (142)	.38 (10)	16.21 x 10.00 (412 x 254)	16.98 (431)	6.59 (167)	.25 (6)	10.0 lbs	BP1412*
FR141208HW FR141208HPL	15.44 x 13.86 x 8.34 (392 x 352 x 212)	14.66 x 12.66 x 8.06 (372 x 322 x 205)	13.91 x 10.00 (353 x 254)	12.25 (311)	10.25 (260)	7.60 (193)	.38 (10)	16.19 x 10.00 (411 x 254)	16.96 (431)	8.59 (218)	.25 (6)	12.5 lbs	BP1412*
FR161408HW FR161408HPL	17.58 x 15.96 x 8.34 (447 x 405 x 212)	16.69 x 14.69 x 8.06 (424 x 373 x 205)	15.96 x 12.00 (405 x 305)	14.25 (362)	12.25 (311)	7.60 (193)	.38 (10)	18.26 x 12.00 (464 x 305)	19.04 (484)	8.59 (218)	.25 (6)	13.3 lbs	BP1614*
FR181610HW FR181610HPL	19.77 x 18.15 x 10.34 (502 x 461 x 263)	18.63 x 16.63 x 10.06 (473 x 422 x 256)	17.94 x 14.00 (456 x 356)	16.25 (413)	14.25 (362)	9.60 (244)	.38 (10)	20.24 x 14.00 (514 x 356)	21.02 (534)	10.59 (269)	.25 (6)	20.2 lbs	BP1816*
FR201610HW FR201610HPL	21.79 x 18.16 x 10.34 (554 x 461 x 263)	20.63 x 16.63 x 10.06 (524 x 422 x 256)	19.96 x 14.00 (507 x 356)	18.25 (463)	14.25 (362)	9.59 (244)	.38 (10)	22.26 x 14.00 (566 x 356)	23.04 (585)	10.59 (269)	.25 (6)	21.7 lbs	BP2016*

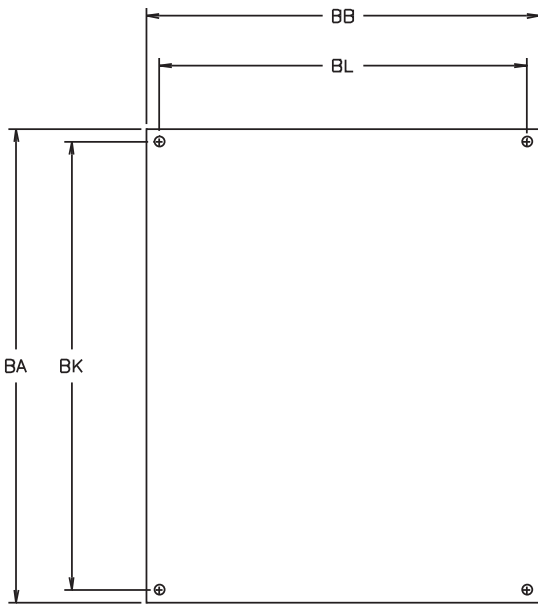
All measures are in inches, items in parentheses are in millimeters.

*Panel sold separately.

** Clear cover option available. Consult factory.

*** Screw down cover option available. Consult factory.

**** HLL cover option available. Consult factory.



BACK PANEL DIMENSIONS

PART NUMBER	BA	BB	BK	BL	PANEL THK.	PANEL TYPE	HOLE DIA.	#OF HOLES
BP66	4.88 (124)	4.88 (124)	4.25 (108)	4.25 (108)	.080 (2)	Flat	.25 (6)	4
BP86	6.88 (175)	4.88 (124)	6.25 (159)	4.25 (108)	.080 (2)	Flat	.25 (6)	4
BP88	6.88 (175)	6.88 (175)	6.25 (159)	6.25 (159)	.080 (2)	Flat	.25 (6)	4
BP108	8.88 (225)	6.88 (175)	8.25 (210)	6.25 (159)	.080 (2)	Flat	.25 (6)	4
BP1210	10.88 (276)	8.88 (225)	10.25 (260)	8.25 (210)	.080 (2)	Flat	.25 (6)	4
BP1412	12.88 (327)	10.88 (276)	12.25 (311)	10.25 (260)	.080 (2)	Flat	.25 (6)	4
BP1614	14.88 (378)	12.88 (327)	14.25 (362)	12.25 (311)	.080 (2)	Flat	.25 (6)	4
BP1816	16.88 (429)	14.88 (378)	16.25 (413)	14.25 (362)	.080 (2)	Flat	.25 (6)	4
BP2016	18.88 (480)	14.88 (378)	18.25 (464)	14.25 (362)	.090 (2)	Flat	.25 (6)	4

Caution: Metric units are for reference; do not convert.

Suffix - Available materials

AL - Aluminum

CS - Painted Carbon Steel

Example: BP1210A



Mounting Feet

OTHER ACCESSORY KITS

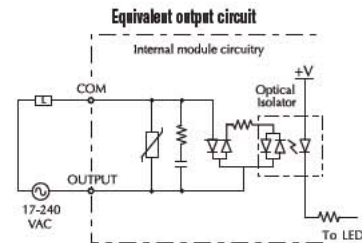
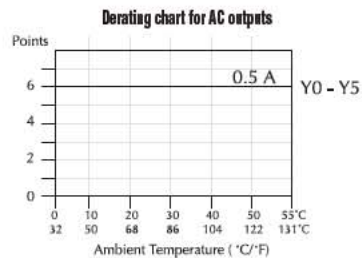
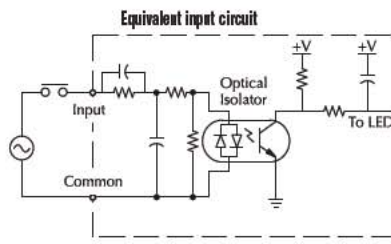
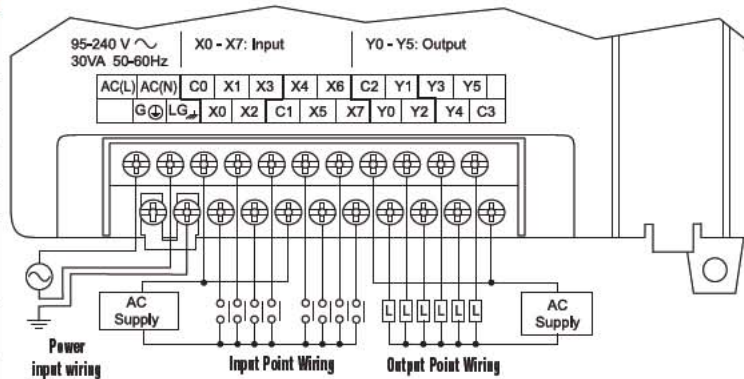
SIZE ID	MTG. FOOT KIT	OPAQUE COVER SCREW KIT	PULL LATCH KIT	HINGE KIT
60604	FRMGFTKIT	FRWKIT	FRHPLKIT	FR3HINGEKIT
80604	FRMGFTKIT	FRWKIT	FRHPLKIT	FR4HINGEKIT
80804	FRMGFTKIT	FRWKIT	FRHPLKIT	FR4HINGEKIT
100806	FRMGFTKIT	FRWKIT	FRHPLKIT	FR5HINGEKIT
121006	FRMGFTKIT	FRWKIT	FRHPLKIT	FR5HINGEKIT
141206	FRMGFTKIT	FRWKIT	FRHPLKIT	FR6HINGEKIT
141208	FRMGFTKIT	FRWKIT	FRHPLKIT	FR6HINGEKIT
161408	FRMGFTKIT	FRWKIT	FRHPLKIT	FR6HINGEKIT
181610	FRMGFTKIT	FRWKIT	FRHPLKIT	FR6HINGEKIT
201610	FRMGFTKIT	FRWKIT	FRHPLKIT	FR6HINGEKIT

DL05 I/O Specifications

D0-05AA

Wiring diagram and specifications

D0-05AA Specifications		
AC Power Supply Specifications	Voltage Range	95-240VAC (30VA)
	Number of Input Pts.	8
	Number of Commons	2 (isolated)
	Input Voltage Range	90-120VAC
	Frequency Range	47-63Hz
	Input Current	8mA @ 100 VAC at 50 Hz 10mA @ 100 VAC at 60Hz
	On Current/Voltage Level	>6mA/75VAC
	OFF Current/Voltage Level	<2mA/20VAC
	OFF to ON Response	<40ms
	ON to OFF Response	<40ms
AC Input Specifications	Fuses	None
	Number of Output Points	6
	Number of Commons	2 (isolated)
	Output Voltage Range	17-240VAC 47-63Hz
	Peak Voltage	264VAC
	ON Voltage Drop	1.5 VAC >50mA 4.0VAC <50mA
	Maximum Current	0.5A/pt 1.5A/common
	Maximum Leakage Current	4mA at 264VAC
	Maximum Inrush Current	10A for 10ms
	Minimum Load	10mA
	OFF to ON Response	1ms
	ON to OFF Response	1ms + 1/2 cycle
	Fuses	None (external recommended)



Features at a Glance

The DL05 and DL06 micro PLCs are complete self-contained systems. The CPU, power supply, and I/O are all included inside the same housing. Option modules are available to expand the capability of each PLC family for more demanding applications. The standard features of these PLCs are extraordinary and compare favorably with larger and more expensive PLCs.

The specification tables to the right are meant for quick reference only. Detailed specifications and wiring information for each model of the DL05 and DL06 PLCs can be found in those specific sections.

Program capacity

Most boolean ladder instructions require a single word of program memory. Other instructions, such as timers, counters, etc., require two or more words. Data is stored in V-memory in 16-bit registers.

Performance

The performance characteristics shown in the tables represent the amount of time required to read the inputs, solve the Relay Ladder Logic program and update the outputs.

Instructions

A complete list of instructions is available at the end of this section.

Communications

The DL05 and DL06 offer powerful communication features normally found only on more expensive PLCs.

Special features

The DC input and DC output PLCs offer high-speed counting or pulse output. Option module slots allow for discrete I/O expansion, analog I/O, or additional communication options.

DL05 CPU Specifications

System capacity

Total memory available (words).....	6K
Ladder memory (words).....	2,048
V-memory (words).....	4,096
User V-memory.....	3,968
Non-volatile user V-memory.....	128
Battery backup.....	Yes ¹
Total built-in I/O.....	14
Inputs.....	8
Outputs.....	6
I/O expansion.....	Yes ¹

Performance

Contact execution (Boolean).....	0.7µs
Typical scan (1K Boolean) ²	1.5-3ms.

Instructions and diagnostics

RLL ladder style.....	Yes
RLLPLUS/flowchart style (Stages).....	Yes/256
Run-time editing.....	Yes
Supports Overrides.....	Yes
Scan.....	Variable/fixed
Number of Instructions.....	133
Types of Instructions:	
Control relays.....	512
Timers.....	128
Counters.....	128
Immediate I/O.....	Yes
Subroutines.....	Yes
For/next loops.....	Yes
Timed interrupt.....	Yes
Integer math.....	Yes
Floating-point math.....	No
PID.....	Yes
Drum sequencers.....	Yes
Bit of word.....	Yes
ASCII print.....	Yes
Real-time clock/calendar.....	Yes ¹
Internal diagnostics.....	Yes
Password security.....	Yes
System and user error log.....	No

Communications

Built-in ports.....	Two RS-232C
Protocols supported:	
K-sequence (proprietary protocol).....	Yes
DirectNet master/slave.....	Yes
Modbus RTU master/slave.....	Yes
ASCII out.....	Yes
Baud rate:	
Port 1.....	9,600 baud (fixed)
Port 2.....	selectable 300-38,400 baud (default 9,600)

Specialty Features

Filtered inputs.....	Yes ³
Interrupt input.....	Yes ³
High speed counter.....	Yes, 5kHz ²
Pulse output.....	Yes, 7kHz ²
Pulse catch input.....	Yes ³

1- These features are available with use of certain option modules. Option module specifications are located later in this section.

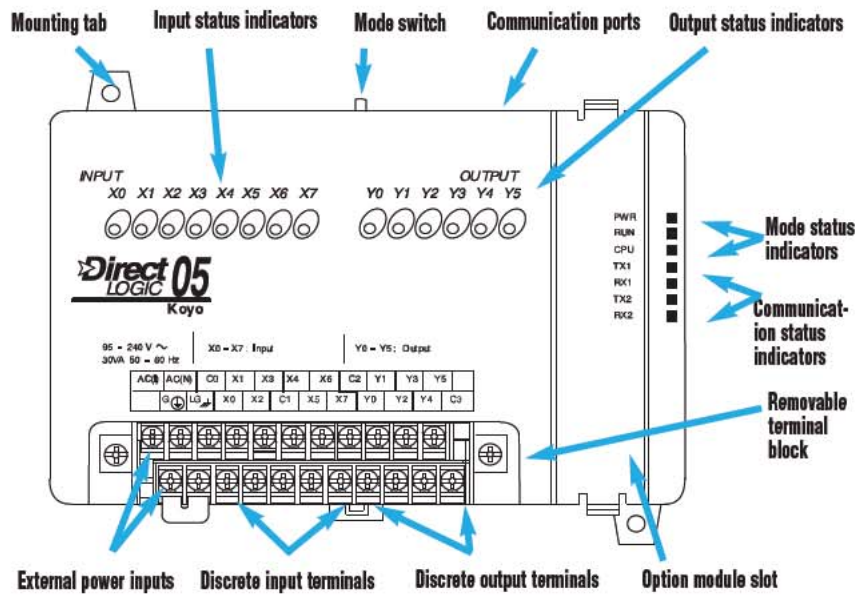
2- Our 1K program includes contacts, coils, and scan overhead. If you compare our products to others, make sure you include their scan overhead.

3- Input features only available on units with DC inputs and output features only available on units with DC outputs.

Features at a Glance

DirectSOFT software

The DL05 and DL06 PLCs use the same familiar *DirectSOFT* programming software that our larger PLCs use. A FREE version of *DirectSOFT* gives you all the great features of the full version, but with a 100 word PLC program download limitation. For programs larger than 100 words, the full package is required. The FREE PC DS100 software may be sufficient to program the DL05 and DL06. If you are programming with a full package version prior to v5.0, you will need v2.4 or later for the DL05 PLCs and v4.0 or later for the DL06. We always recommend the latest version for the most robust features. See the Software section in this catalog for a complete description of *DirectSOFT* including features, part numbers of programming packages and upgrades.



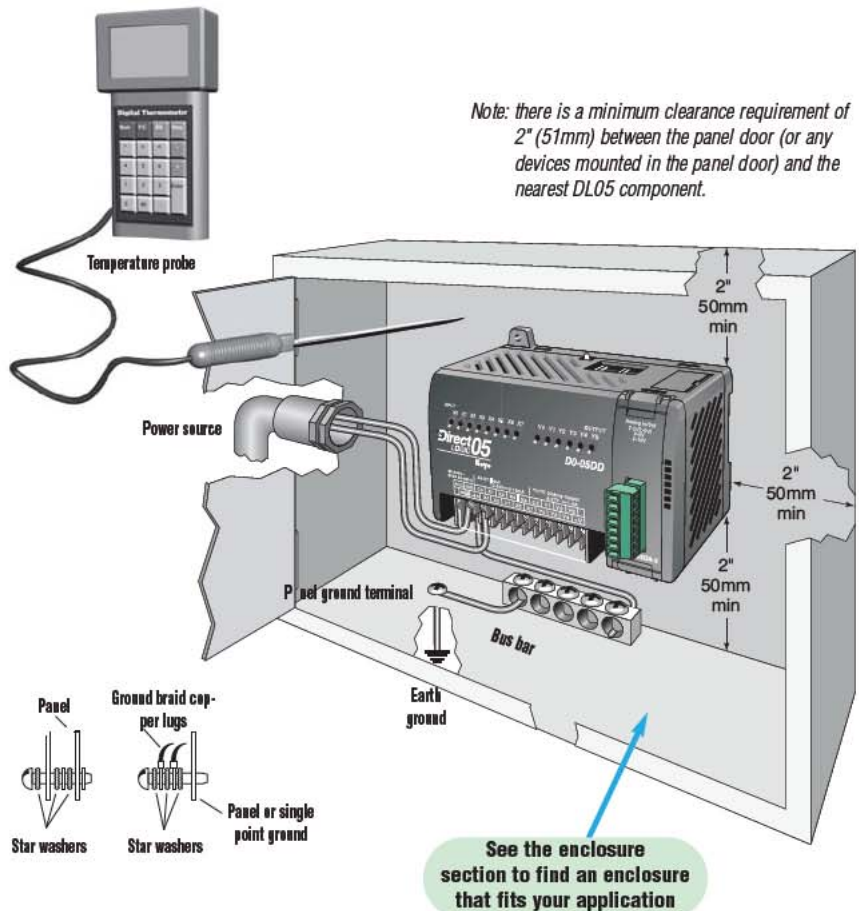
Hardware features diagrams

Product Dimensions and Installation

It is important to understand the installation requirements for your DL05 or DL06 system. Your knowledge of these requirements will help ensure that your system operates within its environmental and electrical limits.

Plan for safety

This catalog should never be used as a replacement for the user manual. You can purchase, download free, or view online the user manuals for these products. The DO USER M is the publication for the DL05 PLCs, and the DO 06USER M is the publication for the DL06 PLCs. The DO OPTIONS M is the user manual for the option modules. These user manuals contain important safety information that must be followed. The system installation should comply with all appropriate electrical codes and standards.

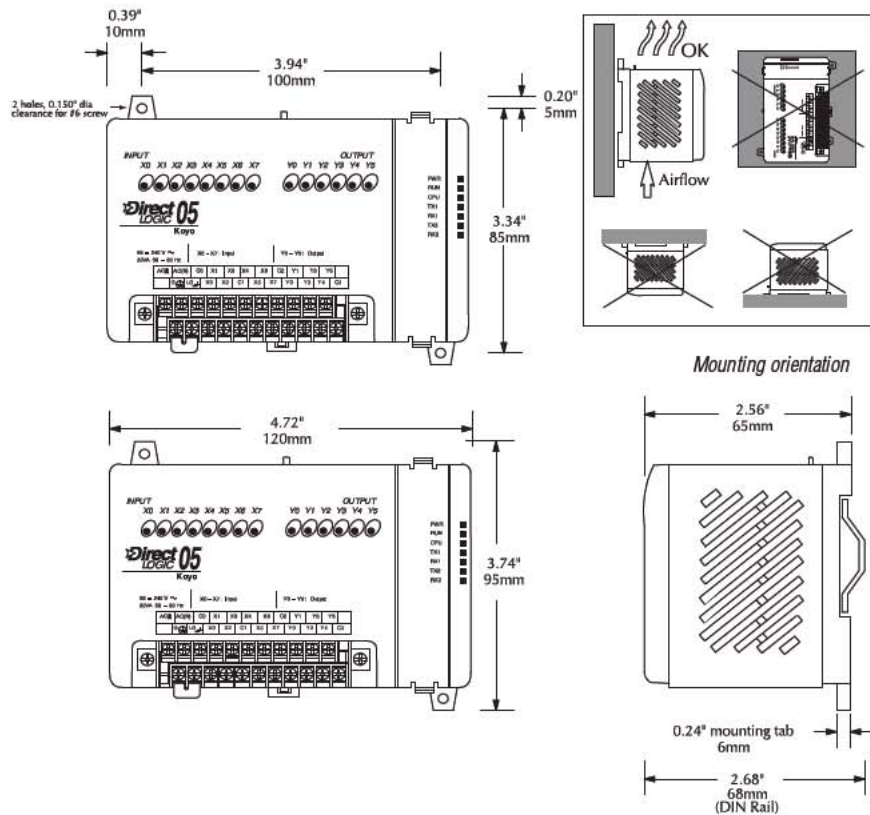


Environmental Specifications for DL05 and DL06	
Storage Temperature	-4° F-158°F (-20°C to 70°C)
Ambient Operating Temperature	32°F-131°F (0° to 55°C)
Ambient Humidity	5 to 95% relative humidity (non-condensing)
Vibration Resistance	MIL STD 810C Method 514.2
Shock Resistance	MIL STD 810C Method 516.2
Noise Immunity	NEMA (ICS3-304)
Atmosphere	No corrosive gases

Product Dimensions and Installation

Unit dimensions and mounting orientation

DL05 and DL06 PLCs must be mounted properly to ensure ample airflow for cooling purposes. It is important to follow the unit orientation requirements and to verify that the PLC's dimensions are compatible with your application. Notice particularly the grounding requirements and the recommended cabinet clearances.

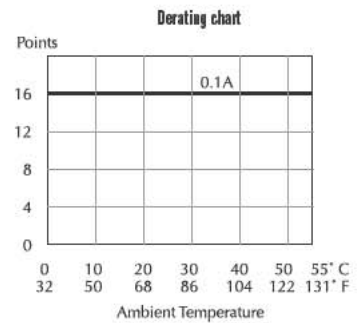
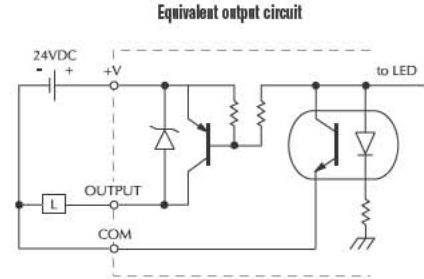
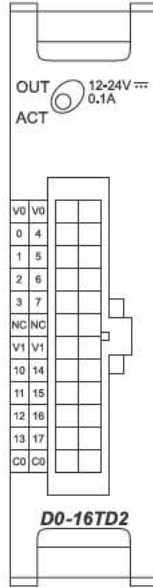


DL05/06 I/O Option Modules

D0-16TD2

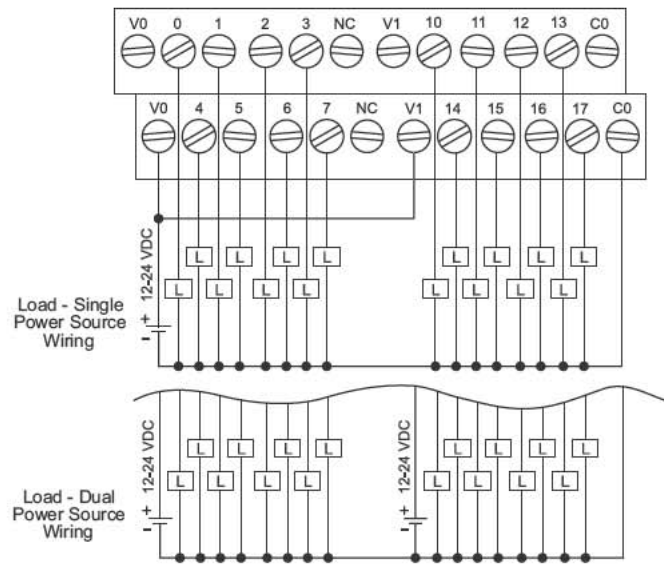
16-point DC output module

D0-16TD2 Output Specifications	
Number of Outputs	16 (sourcing)
Peak Voltage	50.0 VDC
Maximum Output Current	0.1 A/point, 0.8 A/common
Minimum Output Current	0.5 mA
Maximum Leakage Current	1.5 μ A @ 26.4 VDC
On Voltage Drop	1.0 VDC @ 0.1 A
Maximum Inrush Current	1A for 10ms
Off to On Response	< 0.5 ms
On to Off Response	< 0.5 ms
Status Indicators	Module activity: one green LED
+V Terminals & Common	2 (8 points/+V Term.) Isolated, 1 Common
Fuse	No fuse
Connector Type	24-pin Molex 43025-2400 (see Z/PLinks for wiring options)
Base Power Required (5V)	Max. 200mA (all pts. on)



See Wiring Solutions for part numbers of ZIPLink cables and connection modules compatible with this I/O module.

Typical Wiring Example



PLC I/O Modules to ZIPLink Connector Modules - DL05/06

DL05/06 PLC Output Module ZIPLink Selector				
PLC		ZIPLink		
Output Module	# of Terms	Component	Module Part No.	Cable Part No.
DO-10TD1	13	Feedthrough	ZL-RTB20	ZL-DO-CBL13
DO-16TD1	24	Feedthrough	ZL-RTB20	ZL-DO-CBL24 *
		Fuse	ZL-RFU20 ³	ZL-DO-CBL24 *
		Relay (sinking)	ZL-RRL16-24-1	ZL-DO-CBL24 *
DO-10TD2	13	Feedthrough	ZL-RTB20	ZL-DO-CBL13
DO-16TD2	24	Feedthrough	ZL-RTB20	ZL-DO-CBL24 *
		Fuse	ZL-RFU20 ³	ZL-DO-CBL24 *
		Relay (sourcing)	ZL-RRL16-24-2	ZL-DO-CBL24 *
DO-08TR	10	See Note 2		
FO-04TRS ¹	13	Feedthrough	ZL-RTB20	ZL-DO-CBL13

DL05/06 PLC Fixed I/O ZIPLink Selector				
PLC		ZIPLink		
PLC	# of Terms	Component	Module Part No.	Cable Part No.
DL05	18	See Note 2		
DL06	20 (Input side only)	Feedthrough	ZL-RTB20	ZL-DO6X-CBL20
	20 (Output side only)	Feedthrough	ZL-RTB20	ZL-DO6Y-CBL20

* Select the cable length by replacing the * with: Blank = 0.5 m, -1 = 1.0 m, or -2 = 2.0 m.

¹ Caution: The FO-04TRS relay outputs are derated not to exceed 2A per point when used with the ZIPLink wiring system.

² These modules are not supported by the ZIPLink wiring system.

³ Note: Fuses (5 x 20 mm) are not included. See Edison Electronic Fuse section for (5 x 20 mm) fuse. S500 and GMA electronic circuit protection for fast-acting maximum protection. S506 and GMC electronic circuit protection for time-delay performance. Ideal for inductive circuits.

To ensure proper operation, do not exceed the voltage and current rating of ZIPLink module. ZL-RFU20 = 2A per circuit; ZL-RFU40 = 400mA per circuit.



NOTE: ZIPLINK CONNECTOR MODULES AND ZIPLINK CABLES SPECIFICATIONS ARE IN THE ZIPLINK CATALOG SECTION.



Feedthrough Connector Modules

Feedthrough modules provide low-cost and compact field wiring screw termination solutions allowing quick connection with ZIPLink cables to PLC I/O modules. ZIPLink modules mount on 35mm DIN rail (part #DN-R35S1). Module ZL-RTB20 will mount on 15mm DIN rail (part #DN-R15S1).



ZL-RTB20

Specifications												
Feedthrough Modules	Part #	Pcs/ Pkg	Price/ Pkg	Weight (lbs)	Part #	Pcs/ Pkg	Price/Pkg	Weight (lbs)	Part #	Pcs/ Pkg	Price/ Pkg	Weight (lbs)
		ZL-RTB20			0.26	ZL-RTB40			0.22	ZL-RTB50		
Description⁴	20-Pole Feedthrough Connector Module			40-Pole Feedthrough Connector Module			50-Pole Connector Module for interfacing SureServo I/O to a controller					
Maximum Voltage	300 VAC/VDC			36 VAC/VDC			0-30 VDC ²					
UL Voltage Rating	0-250 VAC/VDC			0-30 VAC/VDC ²			24VDC					
Maximum Current per Circuit	2A			500mA			0.2 A					
Maximum Current per Common Circuit	4A ¹			N/A			N/A					
Maximum Current per Module	40A (all conductors combined including commons)			32A (all conductors combined including commons)			10A					
Number of Terminal Block Positions	20			40			50					
Surrounding Temperature Range	32 to 140°F (0 to 60°C)											
Terminal Block Contacts	Copper alloy, tin-lead plated											
Wire Range (Rated Cross Section)³	12-24 AWG Solid or Stranded Copper Conductor (2.5 mm ²)											
Wire Strip Length	0.24-0.27 in (6-7 mm)											
Screw Torque	4.4 in-lbs (0.5 N-m)											
Connector Type	Molex Micro-Fit 3.0, 24 pin connector Example: Receptacle 43020-2400 Pins 43031 Series, Male			3M 34000 Series IDC Connector, strain relief is required to latch to header. Example: Socket 3417-7640, Strain relief 3448-3040			3M mini DELTA Ribbon (MDR), 101 Series, 50 pin Example: Plug 10150 - 3000VE, Shell 10350 - 52A0 - 008					
Connecting Cables (Sold Separately)	Click on link: Wiring Selection Guides . Click on link: Connection Cable Specifications Tables .						ZL-SVC-CBL50 (0.5 m/1.6 ft) ZL-SVC-CBL50-1 (1m/3.3 ft) ZL-SVC-CBL50-2 (2m/6.6 ft) Click on link: Connection Cable Specifications Tables .					
Cable/Wire Clearance	0.5 in (12.7 mm) Required											
Mounting Restrictions	None											
Approvals	File # E200031 UL, cUL, Class 1, Division 2, Groups A,B,C,D Hazardous Locations, CE, EN 61131-2:2007											

¹ The 4 common circuits are at terminal block positions 1, 6, 11, and 16.
Each common circuit has 2 cable wires per terminal.

² Use Class 2 power supply

³ Use conductors rated 60°/75°C

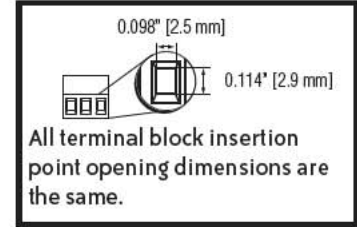
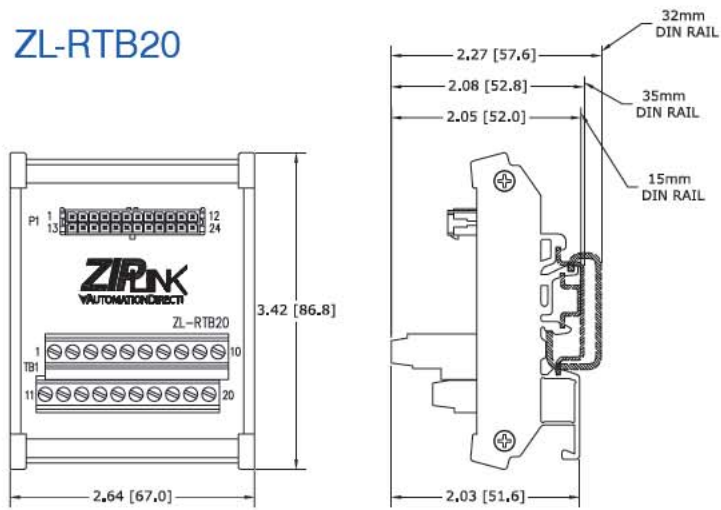
⁴ Connecting cables are for internal wiring only.



NOTE: SEE WIRING DETAILS AND DIMENSIONAL DRAWINGS ON OUR WEB SITE AT : <http://www.automationdirect.com/static/manuals/ziplinks/ziplinks.html>.

Module Dimensions

ZL-RTB20



Note: Dimensions shown in Inches [mm]



Connection Cables (cont.)

ZIPLink Connection Cables			
Part Number	Description	Insulation Rating	Weight (lbs)
CLICK ZIPLink Cables			
ZL-C0-CBL11	Cable for module with 11 terminals to 24-pin connector, 24 AWG, 1.6 ft. (0.5 m)	300V, 80°C	0.21
ZL-C0-CBL11-1	Cable for module with 11 terminals to 24-pin connector, 24 AWG, 3.3 ft. (1.0 m)	300V, 80°C	0.31
ZL-C0-CBL11-2	Cable for module with 11 terminals to 24-pin connector, 24 AWG, 6.6 ft. (2.0 m)	300V, 80°C	0.56
ZL-C0-CBL11-1P	Cable for module with 11 terminals to pigtail, 24 AWG, 3.3 ft. (1.0 m)	300V, 80°C	0.21
ZL-C0-CBL11-2P	Cable for module with 11 terminals to pigtail, 24 AWG, 6.6 ft. (2.0 m)	300V, 80°C	0.26
ZL-C0-CBL20	Cable for module with 20 terminals to 24-pin connector, 24 AWG, 1.6 ft. (0.5 m)	300V, 80°C	0.25
ZL-C0-CBL20-1	Cable for module with 20 terminals to 24-pin connector, 24 AWG, 3.3 ft. (1.0 m)	300V, 80°C	0.31
ZL-C0-CBL20-2	Cable for module with 20 terminals to 24-pin connector, 24 AWG, 6.6 ft. (2.0 m)	300V, 80°C	0.61
ZL-C0-CBL20-1P	Cable for module with 20 terminals to pigtail, 24 AWG, 3.3 ft. (1.0 m)	300V, 80°C	0.21
ZL-C0-CBL20-2P	Cable for module with 20 terminals to pigtail, 24 AWG, 6.6 ft. (2.0 m)	300V, 80°C	0.26
DL05 and DL06 ZIPLink Cables			
ZL-D0-CBL13	Cable for module with 13 terminals to 24-pin connector, 24 AWG, 1.6 ft. (0.5 m)	300V, 80°C	0.26
ZL-D0-CBL24	Cable for module with 24-pin connector to 24-pin connector, 24 AWG, 1.6 ft. (0.5 m)	300V, 80°C	0.26
ZL-D0-CBL24-1	Cable for module with 24-pin connector to 24-pin connector, 24 AWG, 3.3 ft. (1.0 m)	300V, 80°C	0.36
ZL-D0-CBL24-2	Cable for module with 24-pin connector to 24-pin connector, 24 AWG, 6.6 ft. (2.0 m)	300V, 80°C	0.56
ZL-D0-CBL24-L	Cable for module with 24-pin connector to 24-pin connector for LED module, 24 AWG, 1.6 ft. (0.5 m)	300V, 80°C	0.26
ZL-D0-CBL24-1L	Cable for module with 24-pin connector to 24-pin connector for LED module, 24 AWG, 3.3 ft. (1.0 m)	300V, 80°C	0.36
ZL-D0-CBL24-2L	Cable for module with 24-pin connector to 24-pin connector for LED module, 24 AWG, 6.6 ft. (2.0 m)	300V, 80°C	0.56
ZL-D0-CBL24-1P	Cable for module with 24-pin connector to 24-wire pigtail, 24 AWG, 3.3 ft. (1.0 m)	300V, 80°C	0.26
ZL-D0-CBL24-2P	Cable for module with 24-pin connector to 24-wire pigtail, 24 AWG, 6.6 ft. (2.0 m)	300V, 80°C	0.56
ZL-D06X-CBL20	Cable used to connect DirectLOGIC 06 PLC fixed inputs with 20 terminals to the ZL-RTB20 ZIPLink module with a 24-pin connector, can be used on the input side terminal block only, 24 AWG, 1.6 ft. (0.5 m)	300V, 80°C	0.36
ZL-D06Y-CBL20	Cable used to connect DirectLOGIC 06 PLC fixed outputs with 20 terminals to the ZL-RTB20 ZIPLink module with a 24-pin connector, can be used on the output side terminal block only, 24 AWG, 1.6 ft. (0.5 m)	300V, 80°C	0.36



ZL-C0-CBL11



ZL-D0-CBL24-1



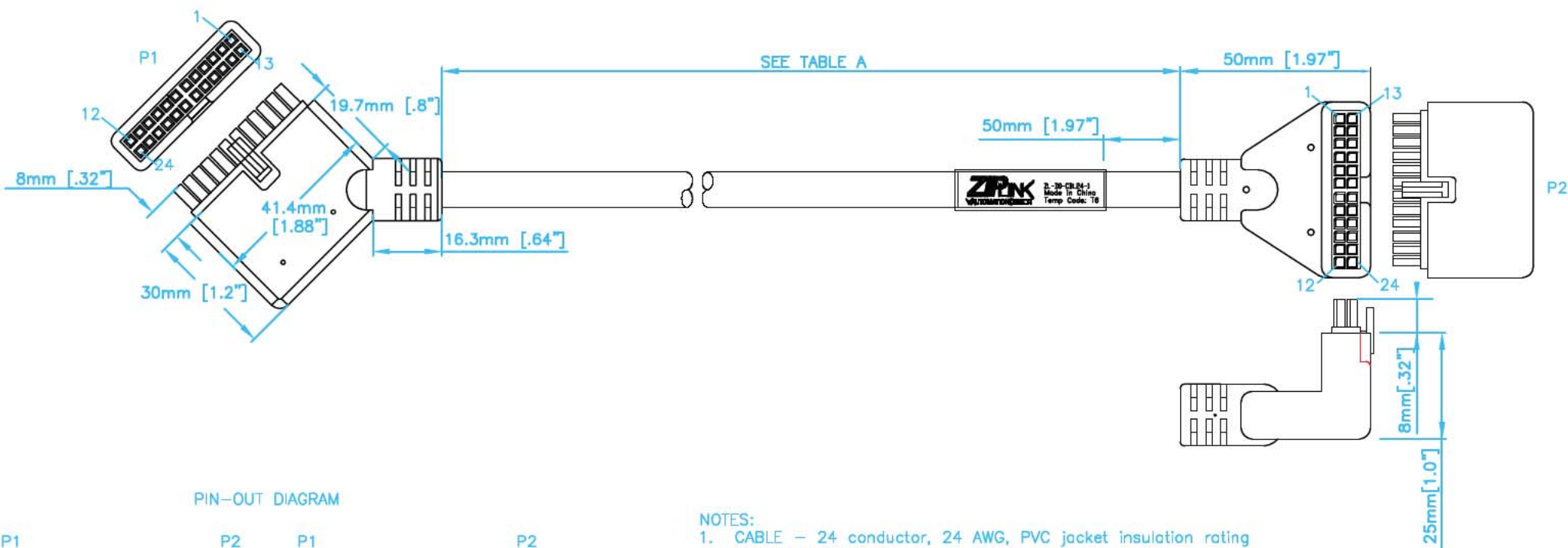
ZL-D0-CBL24-1P

TABLE A

PART NO	LENGTH
ZL-D0-CBL24	0.5m [1.6 ft]
ZL-D0-CBL24-1	1.0m [3.3 ft]
ZL-D0-CBL24-2	2.0m [6.6 ft]

PLC END

ZIPLINK END



PIN-OUT DIAGRAM

P1		P2	P1		P2
12	BLUE	2	24	ORANGE/BLACK	14
11	PINK	3	23	RED/BLACK	15
10	LIGHT BLUE	4	22	WHITE	16
9	LIGHT GREEN	5	21	GREEN/BLACK	17
8	GRAY	6	20	GRAY/BLACK	18
7	YELLOW	7	19	YELLOW/BLACK	19
6	PURPLE	8	18	PURPLE/WHITE	20
5	GREEN	9	17	GREEN/WHITE	21
4	ORANGE	10	16	ORANGE/WHITE	22
3	RED	11	15	RED/WHITE	23
2	BROWN	12	14	BROWN/WHITE	24
1	BLACK	1	13	BLACK/WHITE	13

NOTES:

1. CABLE - 24 conductor, 24 AWG, PVC jacket insulation rating 80°C (176°F), 300V
2. CURRENT - 0.5A per conductor, 32A maximum cable current
3. VOLTAGE - 240V AC/DC rated operating voltage 265V AC/DC maximum voltage
4. OPERATING TEMPERATURE - 0-60°C (32-140°F)
5. P1 and P2 CONNECTOR - 24-pin receptacle equivalent to Molex Micro-Fit3.0 part # 43025-2400
6. MINIMUM BEND RADIUS - 80 mm [3.15 in]
7. CONNECT P1 TO PLC, CONNECT P2 TO ZIPLINK MODULE

ZL-D0-CBL24-n	
Rev: A	Date: 09/2010
Units: mm [inches]	
Scale: .03940	
ZIPLINK DL05/DL06 Cable	

C-more 7" TFT Color Touch Panel - Base Model

EA9-T7CL-R

C-more EA9 series touch screen interface panel, 7-inch color TFT (7.0 inch viewable screen), 64K colors, 800 x 480 pixel WVGA screen resolution, 800MHz CPU, 12-24 VDC powered, NEMA 4/4X, IP65 (when mounted correctly; for indoor use only)(not tested by UL), non-replaceable LED backlight. Includes (1) serial port, USB 2.0 Type A and B ports and Ethernet port; supports SD memory card. Compatible with EA9-PGMSW programming software version 6.3 or later.



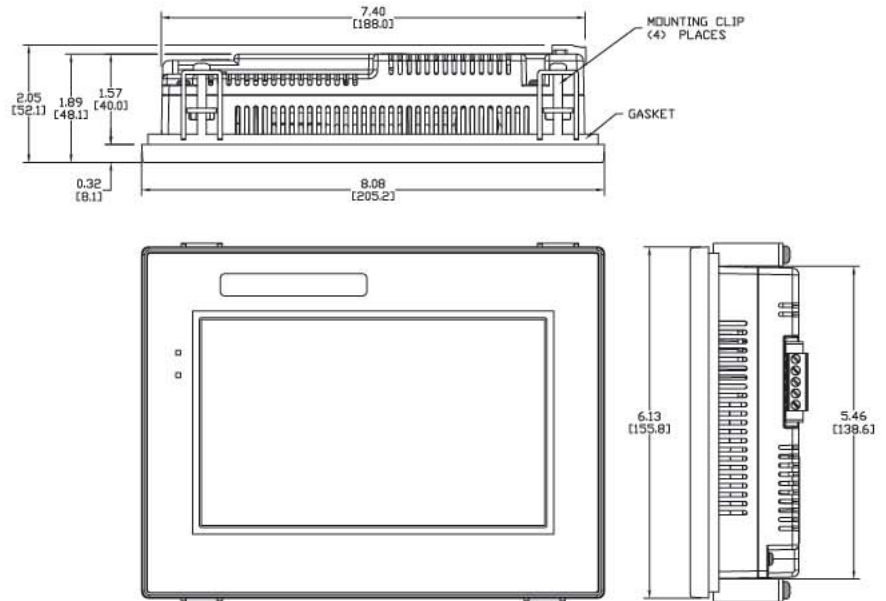
Features

- 7.0" diagonal color TFT (Thin Film Transistor) LCD display with 64K colors
- 800 x 480 pixel resolution
- 350 NITS display brightness
- 50,000 hour average backlight half-life
- Analog resistive (1024 X 1024) touch screen allowing unlimited touch areas
- USB port B (program/download) and USB port A (USB device options)
- Ethernet 10/100 Base-T port (program/download & PLC communication)
- Remote Internet access
- Serial PLC interface (RS-232/422/485)
- One built-in SD memory card slot
- 12-24 VDC powered, 110VAC power adapter (optional)
- 26MB project memory
- Data logging
- 0 to 50°C [32 to 122°F] operating temperature range
- NEMA 4/4X, IP65(not tested by UL) when mounted correctly, indoor use only
- Slim design saves panel space
- UL, cUL & CE agency approvals
- 2-year warranty from date of purchase

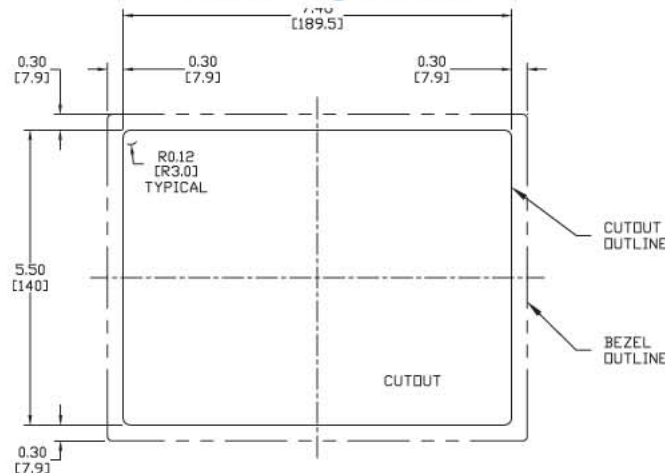


Function	Available
Ethernet	Yes
USB	Yes
SD Card	Yes
Audio Out	No
HDMI Video Out	No
Expansion Module	No

Dimensions inches [mm]



Mounting Cutout



C-more Selection Guide & Specifications

Specification	Model	EA9-T6CL-R	EA9-T6CL	7" TFT color w/ base features	EA9-T7CL-R	EA9-T7CL
Part Number		EA9-T6CL-R	EA9-T6CL	EA9-T7CL-R	EA9-T7CL	
Price						
Display Actual Size and Type		5.7" TFT color		7.0" TFT color		
Display Viewing Area		4.54" x 3.40" [115.2 mm x 86.4 mm]		6.00" x 3.60" [152.4 mm x 91.4 mm]		
Weight		1.56 lb [710g]	1.59 lb [720g]	1.46 lb [660g]	1.48 lb [670g]	
Screen Pixel		320 x 240 (QVGA)		800 x 480 (WVGA)		
Display Brightness		280 nits (typ)		350 nits (typ)		
LCD Panel Dot Pitch		0.18 mm x 0.18 mm		0.190 mm x 0.190 mm		
Color Scale		65,536 colors				
Backlight Average Lifetime*		50,000 hours @ 25°C				
Touch Panel Type**		Four-wire analog resistive, single touch				
Project Memory		26MB				
Number of Screens		Up to 999 screens – limited by project memory				
Realtime Clock		Realtime clock built into panel, backed up for 30 days at 25°C				
Calendar – Month / Day / Year		Yes - monthly deviation 60sec (Reference)				
Serial Port 1		15-pin D-sub female – RS232C, RS-422/485				
Serial Port 2		N/A	3-wire terminal block – RS-485	N/A	3-wire terminal block – RS-485	
Serial Port 3		N/A	RJ-12 modular jack – RS-232C	N/A	RJ-12 modular jack – RS-232C	
USB Port – Type B		USB 2.0 High speed (480 Mbps) Type B – Download/Program – Max. cable length 15-feet				
USB Port – Type A		USB 2.0 High speed (480 Mbps) Type A – for USB device options – Max. cable length 15-feet – Bus Power – Less than 200mA at 5VDC				
Ethernet Port		N/A	10/100 Base-T, auto MDI/MDI-X			
Ethernet Port - Expansion Module		N/A	EA-ECOM	N/A	EA-ECOM	
Audio Line Out		N/A	3.5 mm mini jack – requires amplifier and speaker(s)	N/A	3.5 mm mini jack – requires amplifier and speaker(s)	
Mic In (Future)		N/A	3.5 mm mini jack	N/A	3.5 mm mini jack	
SD Card Slot		1 slot supports max 2GB (SD,) max 32GB (SDHC)				
HDMI Video Out		N/A				
HDMI Supported Resolution		N/A				
Supply Power		10.2-26.4 VDC Class 2 or SELV (Safety Extra-Low Voltage) Circuit or Limited Energy Circuit (LEC), or use the AC/DC Power Adapter, EA-AC, to power the touch panel from a 100-240 VAC, 50/60 Hz power source. Reverse Polarity Protected				
Power Consumption		16.0 W 1.30 A @ 12VDC 0.66 A @ 24VDC				
Internal Fuse (non-replaceable)		4.0 A				
Altitude		Up to 2000m (6562ft)				
Operating Temperature		0 to 50°C (32 to 122°F) Maximum surrounding air temperature rating: 50°C (122°F) IEC 60068-2-14 (Test Nb, Thermal Shock)				
Storage Temperature		-20 to +60°C (-4 to +140°F) IEC 60068-2-1 (Test Ab, Cold) IEC 60068-2-2 (Test Bb, Dry Heat) IEC 60068-2-14 (Test Na, Thermal Shock)				
Humidity		5-95% RH (non-condensing)				
Environment		For use in Pollution Degree 2 environment, no corrosive gases permitted				
Noise Immunity		(EN61131-2), EN61000-4-2 (ESD), EN61000-4-3 (RFI), EN61000-4-4 (FTB), EN61000-4-5 (Serge), EN61000-4-6 (Conducted) EN61000-4-8 (Power frequency magnetic field immunity) (Local Test) RFI, (145MHz, 440Mhz 10W @ 10cm), Impulse 1000V @ 1µs pulse				
Withstand Voltage		1000VAC, 1min. (FG to Power supply)				
Insulation Resistance		> 10M ohm @ 500VDC (FG to Power supply)				
Vibration		IEC60068-2-6 (Test Fc)				
Shock		IEC60068-2-27 (Test Ea)				
Emission		EN55011 Class A (Radiated RF emission)				
Enclosure		NEMA 250 type 4/4X indoor use only UL50 type 4X indoor use only IP-65 indoor use only (When mounted correctly)		NEMA 250 type 4/4X indoor use only UL50 type 4X indoor use only IP-65 (not tested by UL) (When mounted correctly)		
Agency Approvals		UL508, E157382, Class 1, Div 2, Groups A, B, C CE (EN61131-2), RoHS (2011/65/EU) CUL Canadian C22.2		UL61010, E157382 CE (EN61131-2), RoHS (2011/65/EU) CUL Canadian C22.2		

NOTES: *The backlight average lifetime is defined as the average usage time it takes before the brightness becomes 50% of the initial brightness. The lifetime of the backlight depends on the ambient temperature. The lifetime will decrease under low or high temperature usage.

**The touchscreen is designed to respond to a single touch. If it is touched at multiple points at the same time, an unexpected object may be activated.

C-more Communication Protocols & Cables

Cable Description	Cable Part Number	
Communication cable, 15-pin male D-sub to 6-pin RJ12, shielded, 9.8ft/3m cable length. For use with <i>C-more</i> or <i>C-more</i> Micro panel and AutomationDirect PLCs with RJ12 ports.	EA-2CBL	
Communication cable, 15-pin male D-sub to 15-pin D-sub HD15 male, shielded, 3m/9.8ft cable length. For use with <i>C-more</i> or <i>C-more</i> Micro panel and a DL06, D2-250(-1), D2-260 or D2-262 (bottom port) CPU.	EA-2CBL-1	

Example Cables:

EA-2CBL



EA-2CBL-1



C-more Accessories

Non-glare Screen Covers

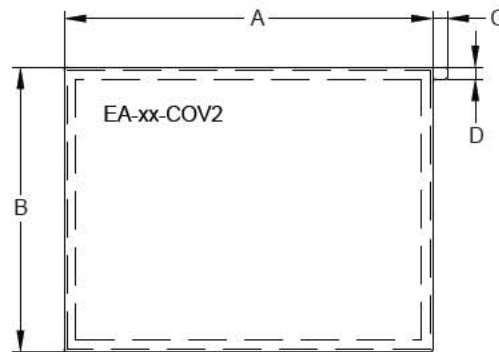
The non-glare screen covers are protective overlays used to protect the touch screen while helping to reduce the glare from external light sources.

Part Numbers: EA-7-COV2



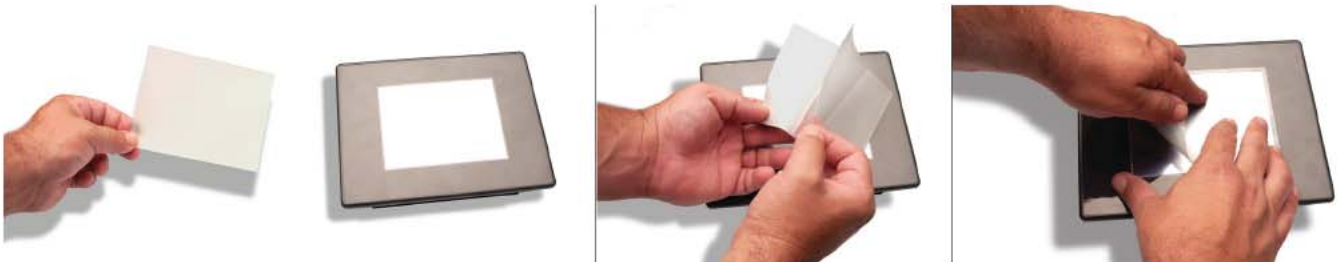
EA-7-COV2

Dimensions inches [mm]



Non-glare Screen Covers Dimensions - Inches [mm]				
Part Number	A	B	C	D
EA-6-COV2	4.91 [124.8]	3.80 [96.4]	0.197 [5.0]	0.157 [4.0]
EA-7-COV2	6.40 [162.6]	4.00 [101.5]		
EA-8-COV2	7.32 [185.8]	5.44 [138.2]		
EA-10-COV2	8.91 [226.2]	6.61 [168.0]		
EA-10W-COV2	9.23 [234.5]	5.38 [136.7]		
EA-12-COV2	10.26 [260.6]	7.64 [194.1]		
EA-15-COV2	12.56 [319.1]	9.37 [238.1]		

Installation



NOTE: The Protective Cover ships with a thin protective sheet on the face of the cover that needs to be carefully removed. If your panel is not clear, the protective sheet may not have been removed.

UL 489 and UL 1077 DIN rail miniature circuit breakers



Powering Business Worldwide

UL 1077 DIN rail supplementary protectors

FAZ circuit breakers PRODUCT OVERVIEW

Optimum and efficient protection



Optimum product quality, tested reliability and safety stand for best protection of personnel, installations and plant. Eaton's FAZ DIN rail mountable circuit breaker is designed for use in control panel applications.

Powerful offering for machine and system builders

The FAZ is available with B, C, D, K, S, and Z characteristics in accordance with UL 1077, CSA C22.2 No.235 and IEC 60947-2. These devices are CE marked.

Typical applications

Supplementary protection

- Control circuits
- Lighting
- Business equipment
- Appliances

Features

- Complete range of UL 1077 recognized DIN rail mounted miniature circuit breakers up to 63A current rating
- Standard ratings of 10 kAIC up to 277/480 Vac
- Current limiting design provides fast short-circuit interruption that reduces the let-through energy, which can damage the circuit
- Suitable for supplementary protection
- Thermal-magnetic overcurrent protection
 - Six levels of short-circuit protection, categorized by B, C, D, K, S, and Z curves
- Trip-free design—breaker can not be defeated by holding the handle in the ON position
- Captive screws cannot be lost
- Fulfill UL 1077, CSA C22.2 No.235 and also IEC 60947-2 Standard
- Field-installable shunt trip and auxiliary switch subsequent mounting
- Module width of only 17.7 mm (per pole)
- Contact position indicator (red/green)
- Easy installation on DIN rail
- Possibility for sealing the toggle in ON or OFF position

FAZ complies with the latest national and international standards

Standards—Supplementary Protection

UL 1077, CSA C22.2 No. 235

Apply to supplementary protectors intended for use as overcurrent, or overvoltage or undervoltage protection within an appliance or other electrical equipment where branch circuit protection is already provided, or is not required.



RoHS

These devices are RoHS compliant.



VDE

Devices with B, C, and D curves are VDE compliant.



CCC

Devices with B, C, and D curves are CCC compliant.



ABS

These devices are ABS compliant.



UL 1077 DIN rail supplementary protectors

FAZ circuit breakers

PRODUCT OVERVIEW

Discover these advanced features

Breakers install on standard DIN rail

Available in one-, two-, three-, four-pole, 1+N and 3+N models

Color-coded indicator provides breaker status for easy troubleshooting



Captive Posidrive terminal screws with finger and back-of-hand protection (IP20)

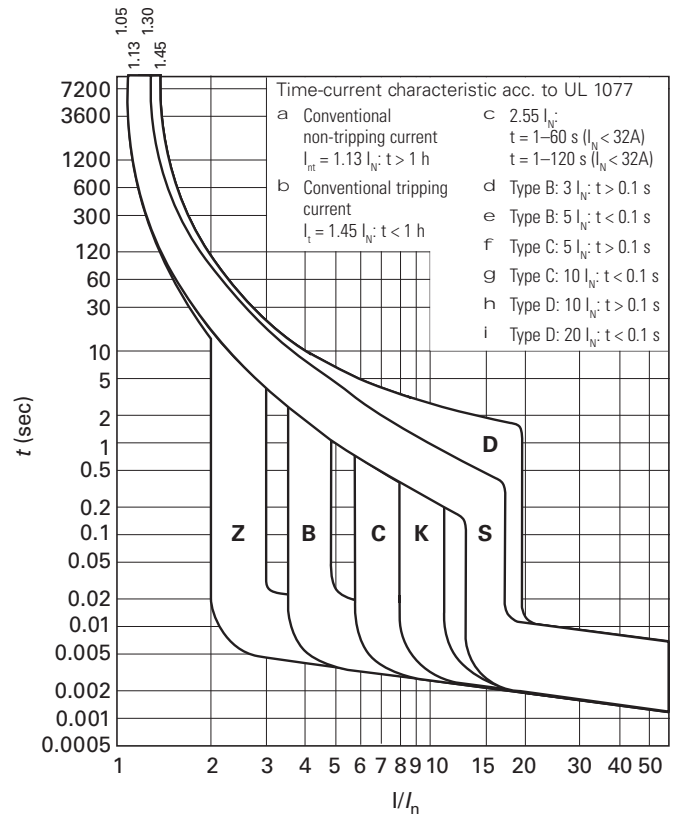
Trip-free design; breaker cannot be defeated by holding the handle in the ON position

Breaker information printed on the front of the device for quick identification

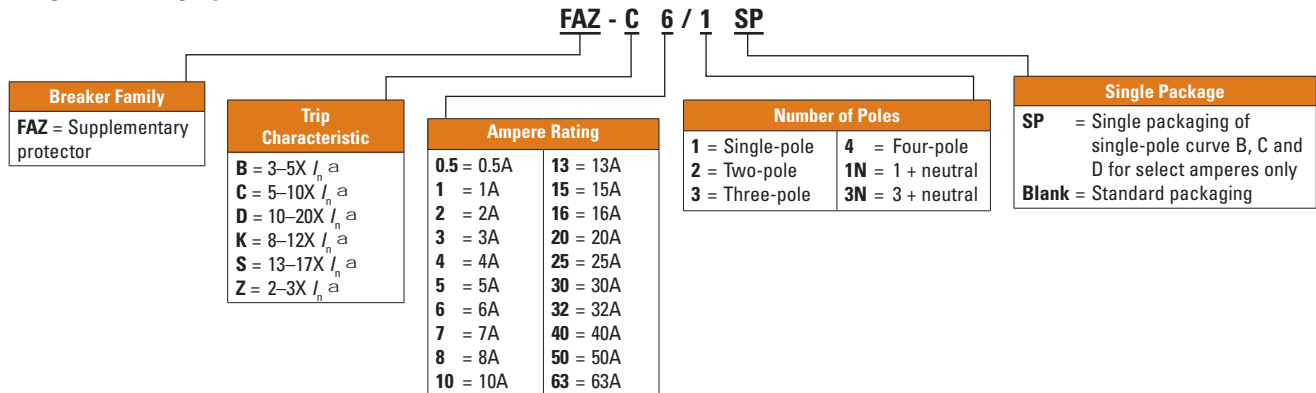
Six tripping curves to choose from

Eaton FAZ supplementary protectors are available with six different tripping characteristics, including Type B, C, D, K, S, and Z. Definitions for each trip curve are contained on the ordering pages and can be used to determine the optimal characteristic for your application. For example, low-level short-circuit faults in control wiring, such as PLCs, are best protected by devices with Type B trip characteristics (3–5X continuous rating of the device (I_n)).

Even though not required by NEC or CEC for supplementary protectors, Eaton's FAZ devices are current limiting, which means that they interrupt fault currents within one half cycle. Current limiting devices offer superior protection by reducing peak let-through current and energy.



Catalog Numbering System



^a I_n = Rated current for instantaneous trip characteristics.

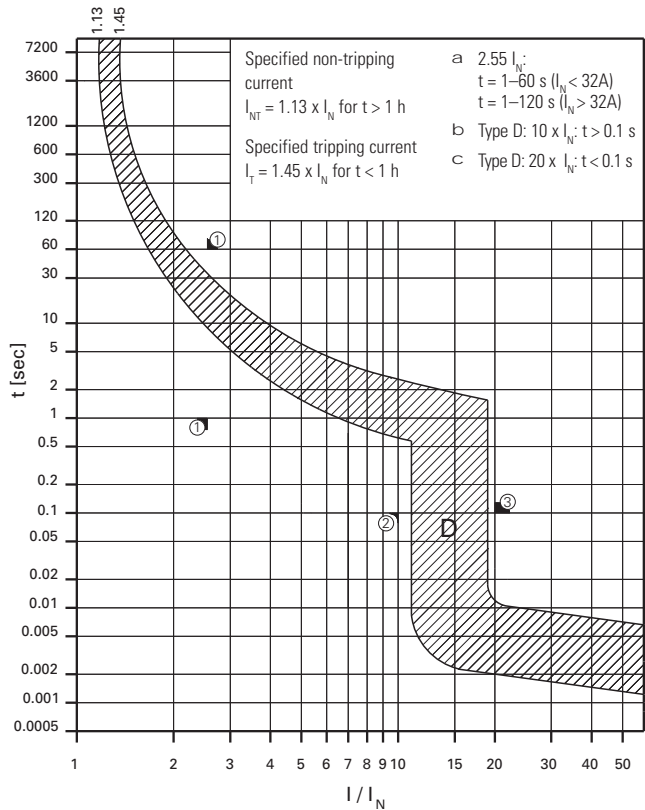
UL 1077 DIN rail supplementary protectors

FAZ circuit breakers PRODUCT SELECTION

FAZ product selection—D curve (10–20X I_n current rating)

- Designed for highly inductive loads
- Response time of instantaneous trip: 10–20X I_n current rating
- UL recognized and CSA Certified as supplementary protectors
- For international and domestic use (conform to IEC 60947-2)
- UL file number 177451

Suitable for applications where high levels of inrush current are expected. Instantaneous trip is 10–20X rating of device (I_n). The high magnetic trip point prevents nuisance tripping in high inductive applications such as motors, transformers and power supplies.



D Curve (10–20X I_n current rating)—designed for inductive loads a



	Single-pole ^b	Two-pole	Three-pole	Four-pole	Single-pole + Neutral	Three-pole + Neutral
Amperes	Catalog Number	Catalog Number	Catalog Number	Catalog Number	Catalog Number	Catalog Number
0.5	FAZ-D0.5/1-SP	FAZ-D0.5/2	FAZ-D0.5/3	FAZ-D0.5/4	FAZ-D0.5/1N	FAZ-D0.5/3N
1	FAZ-D1/1-SP	FAZ-D1/2	FAZ-D1/3	FAZ-D1/4	FAZ-D1/1N	FAZ-D1/3N
2	FAZ-D2/1-SP	FAZ-D2/2	FAZ-D2/3	FAZ-D2/4	FAZ-D2/1N	FAZ-D2/3N
3	FAZ-D3/1-SP	FAZ-D3/2	FAZ-D3/3	FAZ-D3/4	FAZ-D3/1N	FAZ-D3/3N
4	FAZ-D4/1-SP	FAZ-D4/2	FAZ-D4/3	FAZ-D4/4	FAZ-D4/1N	FAZ-D4/3N
5	FAZ-D5/1-SP	FAZ-D5/2	FAZ-D5/3	FAZ-D5/4	FAZ-D5/1N	FAZ-D5/3N
6	FAZ-D6/1-SP	FAZ-D6/2	FAZ-D6/3	FAZ-D6/4	FAZ-D6/1N	FAZ-D6/3N
7	FAZ-D7/1-SP	FAZ-D7/2	FAZ-D7/3	FAZ-D7/4	FAZ-D7/1N	FAZ-D7/3N
8	FAZ-D8/1-SP	FAZ-D8/2	FAZ-D8/3	FAZ-D8/4	FAZ-D8/1N	FAZ-D8/3N
10	FAZ-D10/1-SP	FAZ-D10/2	FAZ-D10/3	FAZ-D10/4	FAZ-D10/1N	FAZ-D10/3N
13	FAZ-D13/1-SP	FAZ-D13/2	FAZ-D13/3	FAZ-D13/4	FAZ-D13/1N	FAZ-D13/3N
15	FAZ-D15/1-SP	FAZ-D15/2	FAZ-D15/3	FAZ-D15/4	FAZ-D15/1N	FAZ-D15/3N
16	FAZ-D16/1-SP	FAZ-D16/2	FAZ-D16/3	FAZ-D16/4	FAZ-D16/1N	FAZ-D16/3N
20	FAZ-D20/1-SP	FAZ-D20/2	FAZ-D20/3	FAZ-D20/4	FAZ-D20/1N	FAZ-D20/3N
25	FAZ-D25/1-SP	FAZ-D25/2	FAZ-D25/3	FAZ-D25/4	FAZ-D25/1N	FAZ-D25/3N
30	FAZ-D30/1-SP	FAZ-D30/2	FAZ-D30/3	FAZ-D30/4	FAZ-D30/1N	FAZ-D30/3N
32	FAZ-D32/1-SP	FAZ-D32/2	FAZ-D32/3	FAZ-D32/4	FAZ-D32/1N	FAZ-D32/3N
40	FAZ-D40/1-SP	FAZ-D40/2	FAZ-D40/3	FAZ-D40/4	FAZ-D40/1N	FAZ-D40/3N
50 ^c	FAZ-D50/1-SP	FAZ-D50/2	FAZ-D50/3	FAZ-D50/4	FAZ-D50/1N	FAZ-D50/3N
63 ^c	FAZ-D63/1-SP	FAZ-D63/2	FAZ-D63/3	FAZ-D63/4	FAZ-D63/1N	FAZ-D63/3N

a In North America, these switches are UL recognized and CSA Certified as supplementary protection devices. Per the intent of NEC (National Electrical Code), Article 240, and CEC (Canadian Electrical Code), Part 1 C22.1, supplementary breakers cannot be used as a substitute for the branch circuit protective device. They can be used to provide overcurrent protection within an appliance or other electrical equipment where branch circuit overcurrent protection is already provided, or is not required.

b Option for single packaging on single-pole B, C and D curves only; add suffix SP when ordering.

c IEC 60947-2 only.

UL 1077 DIN rail supplementary protectors

FAZ circuit breakers

TECHNICAL DATA



Technical Data

Description	B Curve	C Curve	D Curve
Electrical			
Approvals	UR (UL 1077), CSA (CSA 22.2 No. 235), CE		
Standards	IEC/EN 60947-2		
Short-circuit trip response	3–5 I_n	5–10 I_n	10–20 I_n
Supplementary Protectors—UL/CSA			
Current range	1–63A	0.5–63A	0.5–40A
Maximum voltage ratings—UL/CSA			
Single-pole, single-pole + neutral	277 Vac 48 Vdc	277 Vac 48 Vdc	277 Vac 48 Vdc
Two-, three-pole, four-pole and three-pole + neutral	480Y/277 Vac	480Y/277 Vac	480Y/277 Vac
Two poles in series	96 Vdc	96 Vdc	96 Vdc
Thermal tripping characteristics			
Single-pole	1.35 x I_n @ 40°C	1.35 x I_n @ 40°C	1.35 x I_n @ 40°C
Multi-pole	1.45 x I_n @ 40°C	1.45 x I_n @ 40°C	1.45 x I_n @ 40°C
Short-circuit ratings (at max. voltage)			
Single-pole	10 kA (5 kA for 40–63A device)	10 kA (5 kA for 40–63A device)	5 kA
Two-, three-pole	10 kA (5 kA for 40–63A device)	10 kA (5 kA for 40–63A device)	5 kA
Single-pole	10 kA @ 48 Vdc	10 kA @ 48 Vdc	10 kA @ 48 Vdc
Two poles in series	10 kA @ 96 Vdc	10 kA @ 96 Vdc	10 kA @ 96 Vdc
Miniature Circuit Breaker—IEC			
Current range	1–63A	0.5–63A	0.5–63A
Maximum voltage ratings—IEC 68898-1			
Single-pole	230 Vac	230 Vac	230 Vac
Two-, three-pole	230/400 Vac	230/400 Vac	230/400 Vac
Maximum voltage ratings—IEC 60947-2			
Single-pole	240 Vac 48 Vdc	240 Vac 48 Vdc	240 Vac 48 Vdc
Two-, three-pole	240/415 Vac	240/415 Vac	240/415 Vac
Two poles in series	96 Vdc	96 Vdc	96 Vdc
Thermal tripping characteristics			
Single-pole	> 1 hour @ 1.05 x I_n	> 1 hour @ 1.05 x I_n	> 1 hour @ 1.05 x I_n
Multi-pole	< 1 hour @ 1.3 x I_n	< 1 hour @ 1.3 x I_n	< 1 hour @ 1.3 x I_n
Interrupt ratings (at max. voltage)			
IEC 60947-2	15 kA	15 kA	15 kA (10 kA for 50 and 63A)
IEC 60898	10 kA	10 kA	10 kA (50 and 63A not available)
Operational switching capacity	7.5 kA	7.5 kA	7.5 kA
Max. backup fuse [gL/gG]	125A	125A	125A
Rated impulse withstand— U_{imp}	4000 Vac	4000 Vac	4000 Vac
Rated insulation voltage— U_i	440 Vac	440 Vac	440 Vac
Environmental/General			
Selectivity class	3	3	3
Lifespan (operations)	> 10,000 (1 operation = ON/OFF)	> 10,000 (1 operation = ON/OFF)	> 10,000 (1 operation = ON/OFF)
Shock (IEC 68-2-22)	10g–120 ms	10g–120 ms	10g–120 ms
Operating temperature range	–40 to +167°F (–40 to +75°C)	–40 to +167°F (–40 to +75°C)	–40 to +167°F (–40 to +75°C)
Shipment and short-term storage	–40 to +185°F (–40 to +85°C)	–40 to +185°F (–40 to +85°C)	–40 to +185°F (–40 to +85°C)
Housing material	Nylon	Nylon	Nylon
Mechanical			
Standard front dimension			
Device height	80 mm	80 mm	80 mm
Terminal protection	Finger and back-of-hand proof to IEC 536	Finger and back-of-hand proof to IEC 536	Finger and back-of-hand proof to IEC 536
Mounting width per pole	17.5 mm	17.5 mm	17.5 mm
Mounting	IEC/EN 60715 top-hat rail	IEC/EN 60715 top-hat rail	IEC/EN 60715 top-hat rail
Degree of protection	IP20	IP20	IP20
Terminals top and bottom	Twin-purpose terminals	Twin-purpose terminals	Twin-purpose terminals
Supply connection	Line or load side	Line or load side	Line or load side
Terminal capacity [mm ²]	1 x 25 (AWG 4–18)/2 x 10 (AWG 8–18)	1 x 25 (AWG 4–18)/2 x 10 (AWG 8–18)	1 x 25 (AWG 4–18)/2 x 10 (AWG 8–18)
Torque	2.4 Nm	2.4 Nm	2.4 Nm
Imperial torque	21 lb-in (AWG 18–12), 25 lb-in (AWG 10–8), 36 lb-in (AWG 6–4)	21 lb-in (AWG 18–12), 25 lb-in (AWG 10–8), 36 lb-in (AWG 6–4)	21 lb-in (AWG 18–12), 25 lb-in (AWG 10–8), 36 lb-in (AWG 6–4)
Thickness of busbar material	0.8–2 mm	0.8–2 mm	0.8–2 mm
Mounting position	As required	As required	As required

UL 1077 DIN rail supplementary protectors

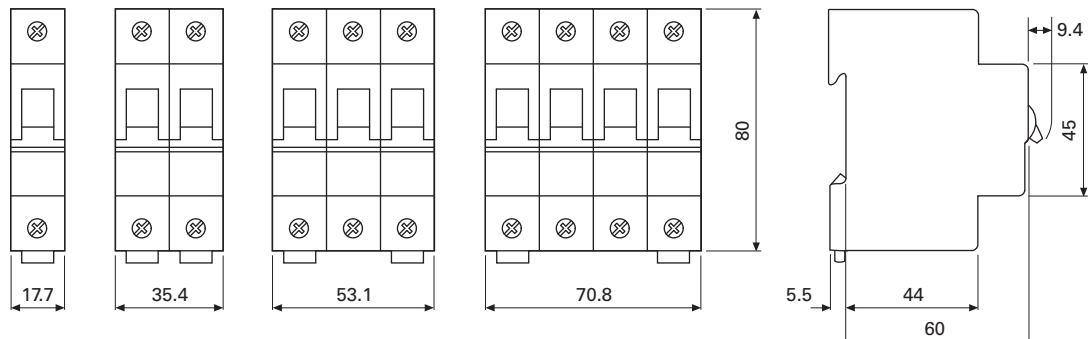
FAZ circuit breakers

ACCESSORY TECHNICAL DATA

Dimensions are in millimeters, and not intended for manufacturing purposes.

Miniature circuit breakers

FAZ



Relay Module - PLC-RSC-120UC/21 - 2966197

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PLC relay, consisting of base terminal block PLC-BSC.../21 with screw connection and pluggable miniature relay with power contact, for assembly on DIN rail NS 35/7.5, 1 PDT, input voltage 120 V AC / 110 V DC


The illustration shows the version PLC-RSC-24DC/21

Product Features

- Narrow design
- Efficient connection to system cabling using V8 adapter
- Safe isolation according to DIN EN 50178 between coil and contact
- RT III sealed relay
- Integrated input circuit and interference suppression circuit
- Functional plug-in bridges



Key commercial data

Packing unit	1 PCE
GTIN	 4 017918 130718
Custom tariff number	85364900
Country of origin	GERMANY

Technical data

Note:

Utilization restriction	EMC: class A product, see manufacturer's declaration in the download area
-------------------------	---

Dimensions

Width	6.2 mm
-------	--------

Relay Module - PLC-RSC-120UC/21 - 2966197

Technical data

Dimensions

Height	80 mm
Depth	94 mm

Ambient conditions

Ambient temperature (operation)	-40 °C ... 55 °C
Ambient temperature (storage/transport)	-40 °C ... 85 °C

Coil side

Nominal input voltage U_N	120 V AC (110 V DC)
	110 V DC
Nominal input current at U_{IN}	3.5 mA (at $U_N = 120$ V AC)
	3 mA (at $U_N = 110$ V DC)
Typical response time	6 ms
Typical release time	15 ms
Operating voltage display	Yellow LED
Protective circuit	Bridge rectifier Bridge rectifier

Contact side

Contact type	Single contact, 1-PDT
Contact material	AgSnO
Maximum switching voltage	250 V AC/DC (The separating plate PLC-ATP should be installed for voltages larger than 250 V (L1, L2, L3) between identical terminal blocks in adjacent modules. Potential bridging is then carried out with FBST 8-PLC... or ...FBST 500...)
Minimum switching voltage	5 V (at 100 mA)
Maximum inrush current	(on request)
Min. switching current	10 mA (at 12 V)
Limiting continuous current	6 A
Interrupting rating (ohmic load) max.	140 W (at 24 V DC)
	20 W (at 48 V DC)
	18 W (at 60 V DC)
	23 W (at 110 V DC)
	40 W (at 220 V DC)
	1500 VA (for 250 V AC)

General

Test voltage relay winding/relay contact	4 kV AC (50 Hz, 1 min.)
Operating mode	100% operating factor
Mechanical service life	2×10^7 cycles
Inflammability class according to UL 94	V0

Relay Module - PLC-RSC-120UC/21 - 2966197

Technical data

General

Name	Standards/regulations
Standards/regulations	IEC 60664
	EN 50178
	IEC 62103
Pollution degree	3
Surge voltage category	III
Mounting position	Any
Assembly instructions	In rows with zero spacing

Connection data

Connection method	Screw connection
Conductor cross section solid min.	0.14 mm ²
Conductor cross section solid max.	2.5 mm ²
Conductor cross section stranded min.	0.14 mm ²
Conductor cross section stranded max.	2.5 mm ²
Conductor cross section AWG/kcmil min.	26
Conductor cross section AWG/kcmil max.	14
Stripping length	8 mm
Screw thread	M3

Classifications

eCl@ss

eCl@ss 4.0	27371102
eCl@ss 4.1	27371102
eCl@ss 5.0	27371001
eCl@ss 5.1	27371001
eCl@ss 6.0	27371001
eCl@ss 7.0	27371001
eCl@ss 8.0	27371001

ETIM

ETIM 2.0	EC000196
ETIM 3.0	EC000196
ETIM 4.0	EC000196
ETIM 5.0	EC000196

Relay Module - PLC-RSC-120UC/21 - 2966197

Classifications

UNSPSC

UNSPSC 6.01	30211916
UNSPSC 7.0901	39121515
UNSPSC 11	39121515
UNSPSC 12.01	39121515
UNSPSC 13.2	39121515

Approvals

Approvals


Approvals


UL Recognized / UL Listed / cUL Recognized / GOST / cUL Listed / GL / UL Listed / cUL Listed / cULus Recognized / cULus Listed

Ex Approvals

Approvals submitted

Approval details

UL Recognized 

UL Listed 

cUL Recognized 

GOST 

Relay Module - PLC-RSC-120UC/21 - 2966197

Approvals

cUL Listed

GL

UL Listed

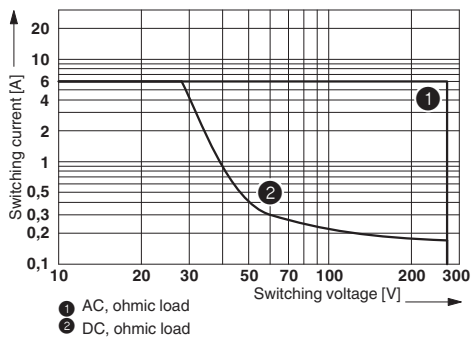
cUL Listed

cULus Recognized

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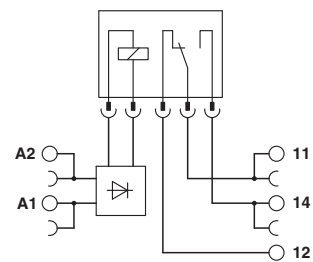
Drawings

Diagram



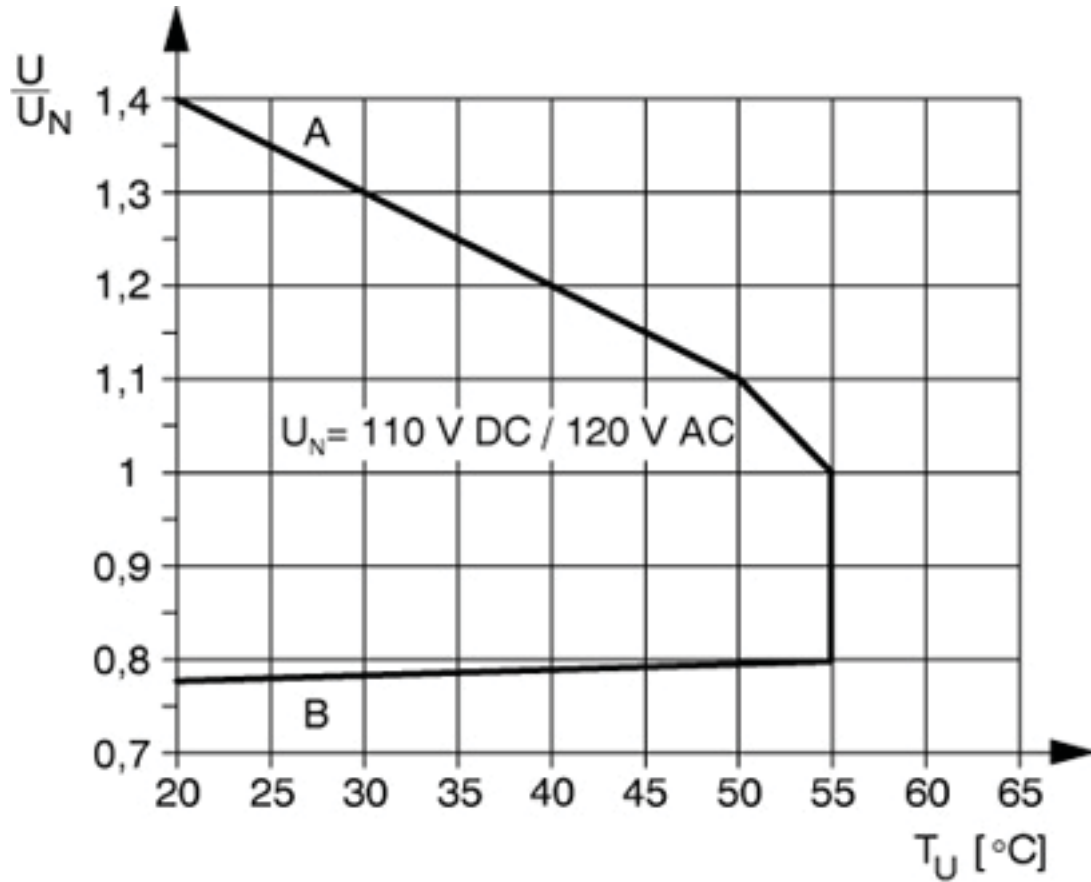
Interrupting rating

Circuit diagram



Relay Module - PLC-RSC-120UC/21 - 2966197

Diagram



Curve A

Maximum permissible continuous voltage U_{max} with limiting continuous current on the contact side (see relevant technical data)

Curve B

Minimum permissible operate voltage U_{op} after pre-excitation (see relevant technical data)

78 Series Electromechanical Relay Selection Guide



Specification	781 Series	782 Series	783 Series	784 Series
Coil Voltages	120VAC, 240VAC, 12VAC, 12VDC, 24VAC, 24VDC	120VAC, 240VAC, 12VAC, 12VDC, 24VAC, 24VDC	120VAC, 240VAC, 12VAC, 12VDC, 24VAC, 24VDC	120VAC, 240VAC, 12VAC, 12VDC, 24VAC, 24VDC
Configuration	SPDT	DPDT	3PDT	4PDT
Contact Rating	15A	15A	15A	15A
Base Socket	5 pin spade terminal	8 pin spade terminal	11 pin spade terminal	14 pin spade terminal
Agency Approvals	UL Recognized (E191059), CE, IEC Std 947-4-1 and 947-5-1, CSA 244610	UL Recognized (E191059), CE, IEC Std 947-4-1 and 947-5-1, CSA 244610	UL Recognized (E191059), CE, IEC Std 947-4-1 and 947-5-1, CSA 244610	UL Recognized (E191059), CE, CSA 244610



These ice cube style relays are power relays designed for applications demanding high power control in various factory machines and control panels. They are ideal for electrical control panels requiring stable and reliable relays.

Features

- Small package design
- Silver alloy gold flashed contact
- High open contact dielectric strength (up to 2500V rms)
- High reliability and long life
- High vibration and shock resistance
- LED indicator on all models, so you can easily see if the relay is working properly without using a voltmeter
- Flag indicator shows relay status in manual or powered condition
- A pushbutton allows manual operation of the relay without the need for power to the coil
- Lock-Down door, when activated, holds pushbutton and contacts in the “operate” position, allowing circuits to be analyzed.
- SPDT, DPDT, 3PDT and 4PDT models
- Finger grip cover allows easier removal of relays from sockets than conventional relays
- I.D. tag/write labels for identifying relays in multi-relay circuits

78 Series Relays Selection Guide

NOTE: Not recommended for low current switching. Find contacts' Minimum Switching Requirement on following page.
 For low current switching, please see the QM4N1 and QM4X1 series.

Part Number	Coil Voltage	Configuration	Dimensions	Relay Socket Part Number	Dimensions
781-1C-12D	12VDC	SPDT	Figure 1	781-1C-SKT	Figure 5
781-1C-12A	12VAC				
781-1C-24D	24VDC				
781-1C-24A	24VAC				
781-1C-120A	120VAC				
781-1C-240A	240VAC	DPDT	Figure 2	782-2C-SKT	Figure 6
782-2C-12D	12VDC				
782-2C-12A	12VAC				
782-2C-24D	24VDC				
782-2C-24A	24VAC				
782-2C-120A	120VAC	3PDT	Figure 3	783-3C-SKT	Figure 7
782-2C-240A	240VAC				
783-3C-12D	12VDC				
783-3C-12A	12VAC				
783-3C-24D	24VDC				
783-3C-24A	24VAC	4PDT	Figure 4	784-4C-SKT-1	Figure 8
783-3C-120A	120VAC				
783-3C-240A	240VAC				
784-4C-12D	12VDC				
784-4C-12A	12VAC				
784-4C-24D	24VDC				
784-4C-24A	24VAC				
784-4C-120A	120VAC				
784-4C-240A	240VAC				

78 Series Electromechanical Relay Specifications

78 Series Relay Specification Table												
Part Numbers	781-1C-12D	781-1C-12A	781-1C-24D	781-1C-24A	781-1C-120A	781-1C-240A	782-2C-12D	782-2C-12A	782-2C-24D	782-2C-24A	782-2C-120A	782-2C-240A
General Specifications												
*Service Life: Mechanical / Electrical Operations	Mechanical: 10,000,000 operations unpowered Electrical: 100,000 operations @ rated resistive load											
Operating Temperature	-40°C to 55°C (-40°F to 131°F)											
Response Time	20ms											
Vibration Resistance	± 1mm (10-35 Hz) and 3gn (35-50Hz)											
Shock Resistance	15gn											
Weight	26g (0.92 oz)						36g (1.27 oz)					
**Agency Approvals and Standards	UL Recognized File E191059, CE, CSA											
Environmental Protection	IP40											
NEMA B300 Pilot Duty Rated	Yes											
Coil Specifications												
Standard	Mechanical flag indicator, LED Indicator, lockable push to test button											
Coil Input Voltage	12VDC	12VAC	24VDC	24VAC	120VAC	240VAC	12VDC	12VAC	24VDC	24VAC	120VAC	240VAC
Coil Resistance	115Ω	44Ω	450Ω	177Ω	4.43kΩ	17.72kΩ	177Ω	44Ω	640Ω	177Ω	4.43 kΩ	17.72 kΩ
Power Consumption	1.4 W DC, 1.9 VAC						1.15 W DC, 1.4 VAC					
Dropout Voltage (% of nominal voltage or more)	10%	15%	10%	15%		10%		15%	10%	15%		10%
Pull-in Voltage (% of nominal voltage or less)	85%	85%	85%	85%		80%		85%	80%	85%		85%
Max. Voltage (Max. continuous voltage)	110% of the rated coil voltage											
Contact Specifications												
Contact Type	SPDT						DPDT					
Contact Material	Silver alloy, gold flashed											
Minimum Switching Requirement	10mA @ 17VDC											
Max. Contact Rating	Refer to Contact Ratings charts.											
Dielectric Strength Between Contacts	Between coil contact: 2000V rms; Between poles 2000V rms; Between contacts 1500V rms											

*Note: These devices are rated for 1,000 cycles when used in a motor application. (Per Table 45.1, UL 508).

**Note: UL listed when used with sockets 781-1C-SKT, 782-2C-SKT, 783-3C-SKT, 784-4C-SKT, or 784-4C-SKT-1. Current limited to rating of relay or socket, whichever is less.

NEMA Mechanical Switching Ratings and Test Values for AC Control Circuit Contacts											
Contact Rating Designation	Thermal Continuous Test Current (A)	Maximum AC Current, 50/60Hz (A)								Voltamperes	
		120 Volts		240 Volts		480 Volts		600 Volts			
		Make	Break	Make	Break	Make	Break	Make	Break	Make	Break
B300	5	30	3.00	15	1.50	---	---	---	---	3600	360

This chart is provided as a guideline only, and the ratings and values are not guaranteed to be accurate. It is the users' responsibility to properly size their control circuit devices. The chart values are from NEMA Standard ICS 5-2000, Table 1-4-1.

781 Series Contact Ratings (current)				
Voltage	Resistive			*Motor Load
	Nominal	UL	CSA	UL
28VDC	15A	15A	12A	---
120VAC	15A	15A	15A	1/2Hp
277VAC	15A	12A	12A	1Hp

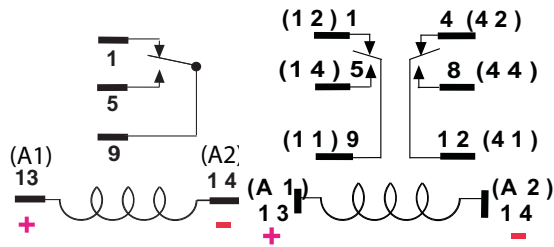
782 Series Contact Ratings (current)				
Voltage	Resistive			*Motor Load
	Nominal	UL	CSA	UL
28VDC	15A	15A	12A	---
120VAC	15A	15A	15A	1/2Hp
277VAC	15A	12A	12A	1Hp

78 Series Wiring Diagrams and Dimensions

Wiring Diagrams (viewed from pin end)

781-1C-XXX

782-2C-XXX



ALTERNATE NEMA OR IEC () NUMBERS, VIEWED FROM PIN SIDE

Dimensions

inches [mm]

Figure 1: 781-1C

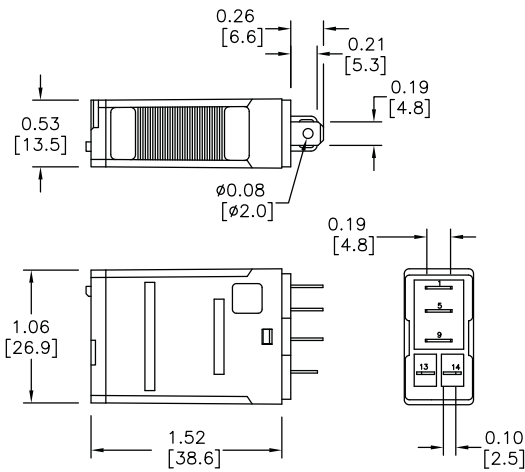
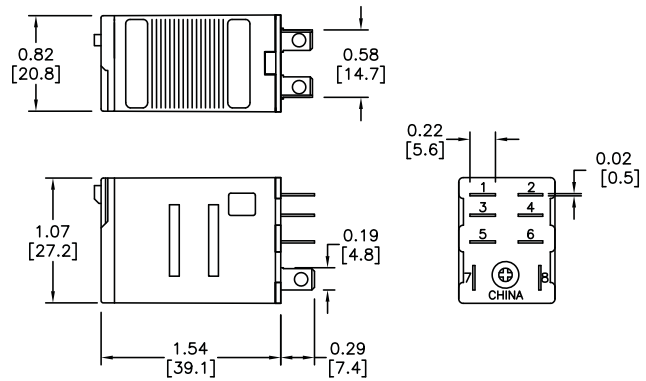


Figure 2: 782-2C



78 Series Relay Socket Dimensions

Dimensions

inches [mm]

Figure 5: 781-1C-SKT

DIN-rail mounting, SPDT, for use with 781 series relays

Note: See Table on next page for maximum screw torques and wire sizes

UL Recognized
file number: E225080

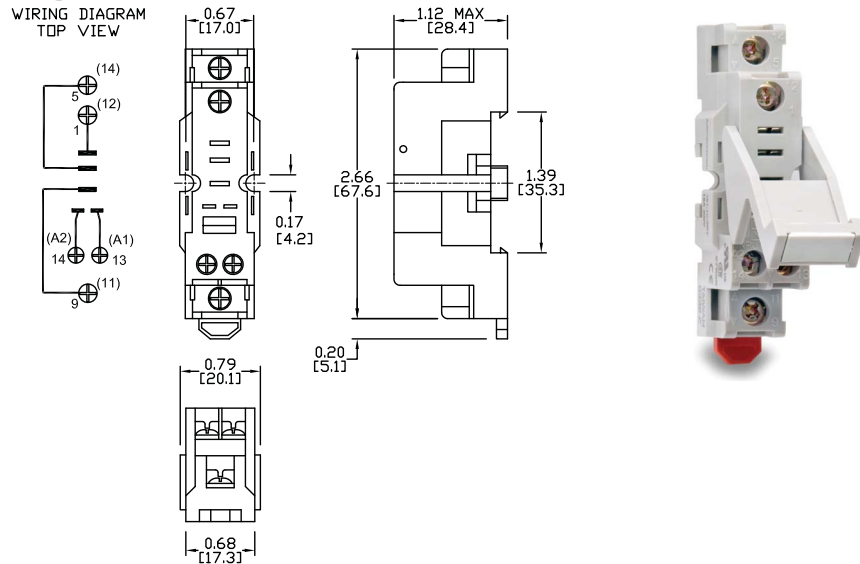
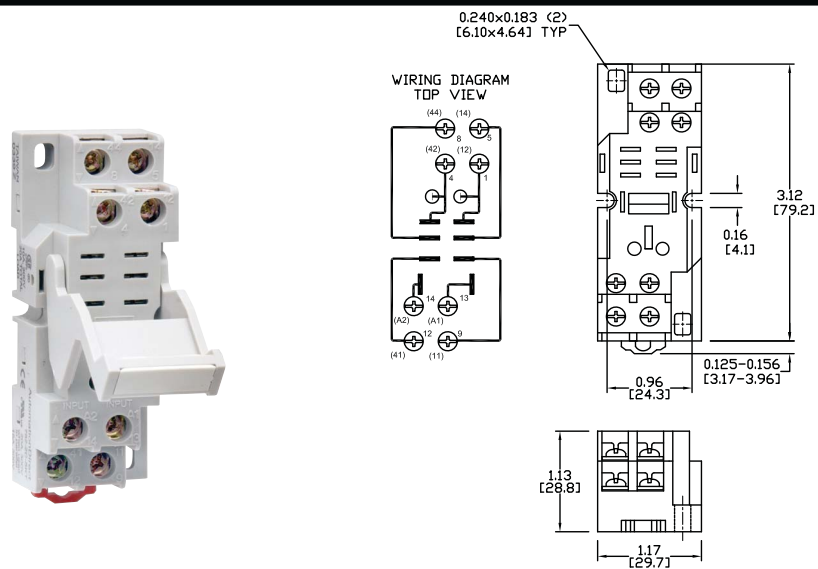


Figure 6: 782-2C-SKT

DIN-rail mounting, DPDT, for use with 782 series and AD-70S2 relays

Note: See Table on next page for maximum screw torques and wire sizes

UL Recognized
file number: E225080



RHINO PSL Series Power Supplies Specifications

Low Cost NEC Class 2 Supplies*



PSL-05-010, PSL-12-010, PSL-24-010



PSL-12-030, PSL-24-030

The RHINO PSL series power supplies are plastic low-profile switching supplies available in 5, 12 and 24 VDC adjustable output models. There are 9 models with power ratings from 7.5W to 91W. They have an integral DIN rail mounting adapter and feature universal 90 to 264 VAC input voltage, adjustable DC output, DC-OK LED indication, and output current limitation.

These are designed to fit in shallow depth control panels often used in the building automation industry. Screw terminals are provided for simple and speedy wiring terminations.

The RHINO PSL series is both UL508 listed for demanding industrial applications and UL60950-1 recognized for NEC Class 2* compliance in industrial, commercial and residential applications.

Features

- Low-profile housing - only 2.15 inches (55mm) deep (MCB form factor)
- 5, 12, 24VDC adjustable outputs
- Output power ratings from 7.5 to 91W
- Integral DIN rail mounting adapter
- Universal input voltage range 90-264 VAC, 125-375 VDC
- DC-OK LED indication
- UL508 Listed, File No. E198298
- UL60950-1 Recognized for NEC Class 2 compliance*
- Protection Class II Double Isolation

*PSL-12-090 is not NEC Class 2



PSL-12-060, PSL-24-060



PSL-12-090, PSL-24-090

PSL Single-Phase Series Input Specifications								
Part No.	Input Voltage Range	Input Frequency Range	Input Current Max. (@ 115/230 VAC)	Inrush Current I_{2t} @ 77°F (+25°C) typ. (@ 115/230 VAC)	Efficiency	Recommended Backup Protection	Turn-on Time	
PSL-05-010	100-240 VAC UL Approved	47-63 Hz	0.3 A / 0.2 A	<15A / <30A	> 77.0%	8A B -or 4A C characteristic circuit breaker	<3 sec	
PSL-12-010								
PSL-12-030								
PSL-12-060		90-264 VAC 125-375 VDC		0.8 A / 0.6 A	<25A / 50A	> 82.0%	13A B -or 8A C characteristic circuit breaker	<1.5 sec
PSL-12-090				1.5 A / 1.0 A	<30A / 60A	> 84.0%	16A B -or 8A C characteristic circuit breaker	
PSL-24-010				1.5 A / 0.9 A	<40A / <80A	> 84.0%	16A B -or 8A C characteristic circuit breaker	
PSL-24-030				0.8 A / 0.2 A	<15A / <30A	> 80.0%	13A B -or 8A C characteristic circuit breaker	
PSL-24-060				0.8 A / 0.6 A	<25A / <50A	> 83.0%	13A B -or 8A C characteristic circuit breaker	
PSL-24-090*				1.5 A / 1.0 A	<30A / <60A	> 86.0%	16A B -or 8A C characteristic circuit breaker	
PSL-24-090*	2.2 A / 1.0 A	<30A / <60A	> 85.0%	16A B -or 8A C characteristic circuit breaker				

*PSL-24-090 is UL Listed for 125-250 VDC input.

Output Specifications					
Part Number	Output Voltage	Output Voltage Range	Output Current	Output Power (Max.)	Min. Hold-Up Time at Nominal Load (@115/230VAC)
PSL-05-010	5VDC	N/A	1.5 A	7.5W	10ms / 30ms
PSL-12-010	12VDC	N/A	0.83 A	10W	
PSL-12-030		11.5-14.5 VDC	2.1 A	25W	25ms / 30ms
PSL-12-060			4.5 A	54W	16ms / 30ms
PSL-12-090			12-14 VDC	6.0 A	72W
PSL-24-010		24VDC	N/A	0.42 A	10W
PSL-24-030	24-28 VDC		1.25 A	30W	25ms / 30ms
PSL-24-060	2.5 A		60W	16ms / 30ms	
PSL-24-090	22-24 VDC		3.8 A	91.2W	10ms / 30ms

RHINO PSL Series Power Supplies Specifications

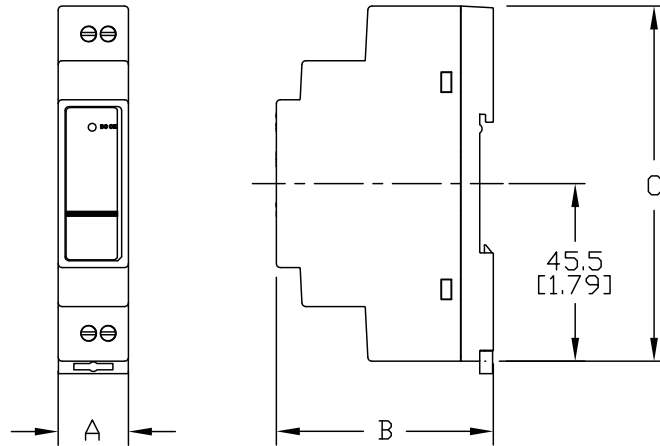
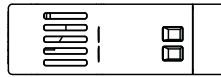
General Specifications	
Enclosure Material	Plastic (PC), closed
Signals	Green LED DC OK
MTBF	> 500,000 hrs. as per Telcordia
Connection method	Screw connection
Protection Class II	to IEC/EN 60536
Leakage Current	<0.25mA @ 240VAC
Startup with capacitive loads	Max. 3,000µF
Line Regulation	< 1% typ. (@ 90-264Vac, 100% load)
Load Regulation	< 2% typ. (@ 90-264Vac, 100% load)
Residual ripple/ peak switching (20MHz) (at nominal values)	< 50mVpp / < 150mVpp
Operating Temperature (Surrounding air temperature)	-25°C to 71°C (-13°F to 160°F) Derate above +55°C (2.5%/°C)
Storage Temperature	-25°C to 85°C (-13°F to 185°F)
Humidity at 25°C, no condensation	< 95% RH
Vibration (operating)	IEC60068-2-6, Sine Wave: 10-500Hz @ 19.6m/S ² (2G peak); 10 min per cycle, 60 min for all X, Y, Z directions
Shock (operating)	IEC60068-2-27, Half Sine Wave: 4G for a duration of 22ms, 3 shocks for each 3 directions, 9 times in total
Pollution degree	Pollution degree 2
Altitude (operating)	2000m (6562ft) maximum

Certification and Standards	
Safety entry low voltage	SELV (EN60950)
Electrical safety (of information technology equipment)	UL/C-UL recognized to UL60950-1 and CSA C22.2 No. 60950-1, CB scheme to IEC60950-1, Limited Power Source (LPS) PSL-12-090 is not LPS
Industrial control equipment	UL/C-UL listed to UL508 and CSA C22.2 No. 107.1-01 (File No. E197592)
Class 2 Power Supply	UL/C-UL recognized to UL60950-1 and CSA C22.2 No. 60950-1 (File No. E198298) PSL-12-090 is not a Class 2 power supply
CE	In conformance with EMC directive 2014/30/EC and low voltage directive 2014/35/EC
ITE	EN55022, EN61000-3-2, EN61000-3-3, EN55024
RoHS	Yes

Additional Data	
Part No.	Wire Size / Torque*
PSL-05-010	26-12 AWG / 0.8 N·m [7.0 lb-in]
PSL-12-010	
PSL-12-030	24-12 AWG / 0.45 N·m [4.0 lb-in]
PSL-12-060	22-12 AWG / 0.45 N·m [4.0 lb-in]
PSL-12-090	20-12 AWG / 0.45 N·m [4.0 lb-in]
PSL-24-010	26-12 AWG / 0.8 N·m [7.0 lb-in]
PSL-24-030	24-12 AWG / 0.45 N·m [4.0 lb-in]
PSL-24-060	22-12 AWG / 0.45 N·m [4.0 lb-in]
PSL-24-090	2x24 AWG or 22-12 AWG / 0.45N·m [4.0 lb-in]

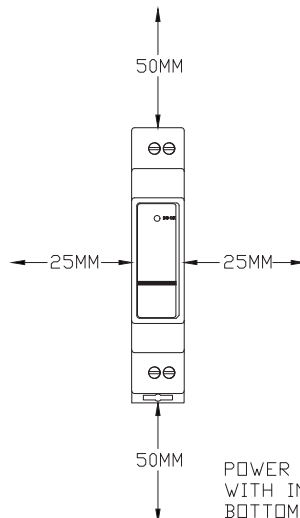
*Stripping length 7 mm (0.28 in)

RHINO PSL Series Power Supplies Dimensions



Dimensions				
Part No.	Weight kg [lb]	Width (A)	Depth (B)	Height (C)
		mm [inches]		
PSL-05-010	0.06 [0.13]	18.0 [0.71]	55.6 [2.19]	91.0 [3.58]
PSL-12-010	0.06 [0.13]	18.0 [0.71]		
PSL-12-030	0.14 [0.31]	53.0 [2.08]		
PSL-12-060	0.22 [0.49]	71.0 [2.80]		
PSL-12-090	0.35 [0.77]	89.9 [3.54]		
PSL-24-010	0.06 [0.13]	18.0 [0.71]		
PSL-24-030	0.14 [0.31]	53.0 [2.08]		
PSL-24-060	0.22 [0.49]	71.0 [2.80]		
PSL-24-090	0.35 [0.77]	89.9 [3.54]		

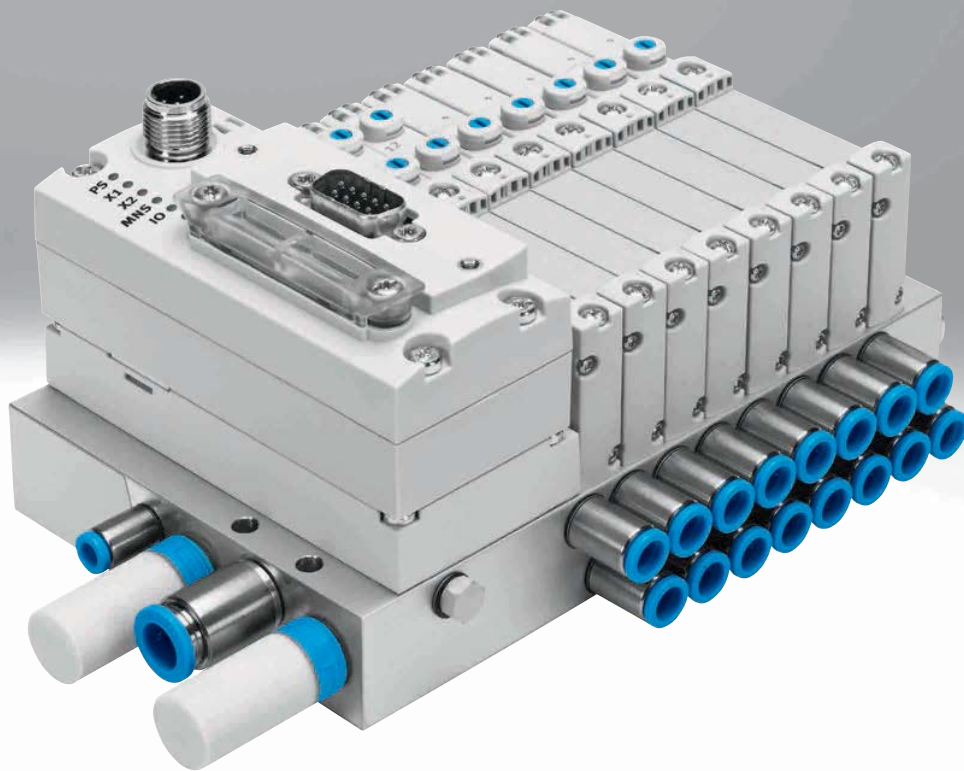
REQUIRED CLEARANCES
TO ENSURE PROPER COOLING:



POWER SUPPLY SHALL BE MOUNTED
WITH INPUT TERMINALS AT THE
BOTTOM.

Solenoid valves VUVG/valve terminals VTUG

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e / r

Festo core product range
Covers 80% of your automation tasks

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Always in stock

Superb:

Festo quality at an attractive price

Easy:

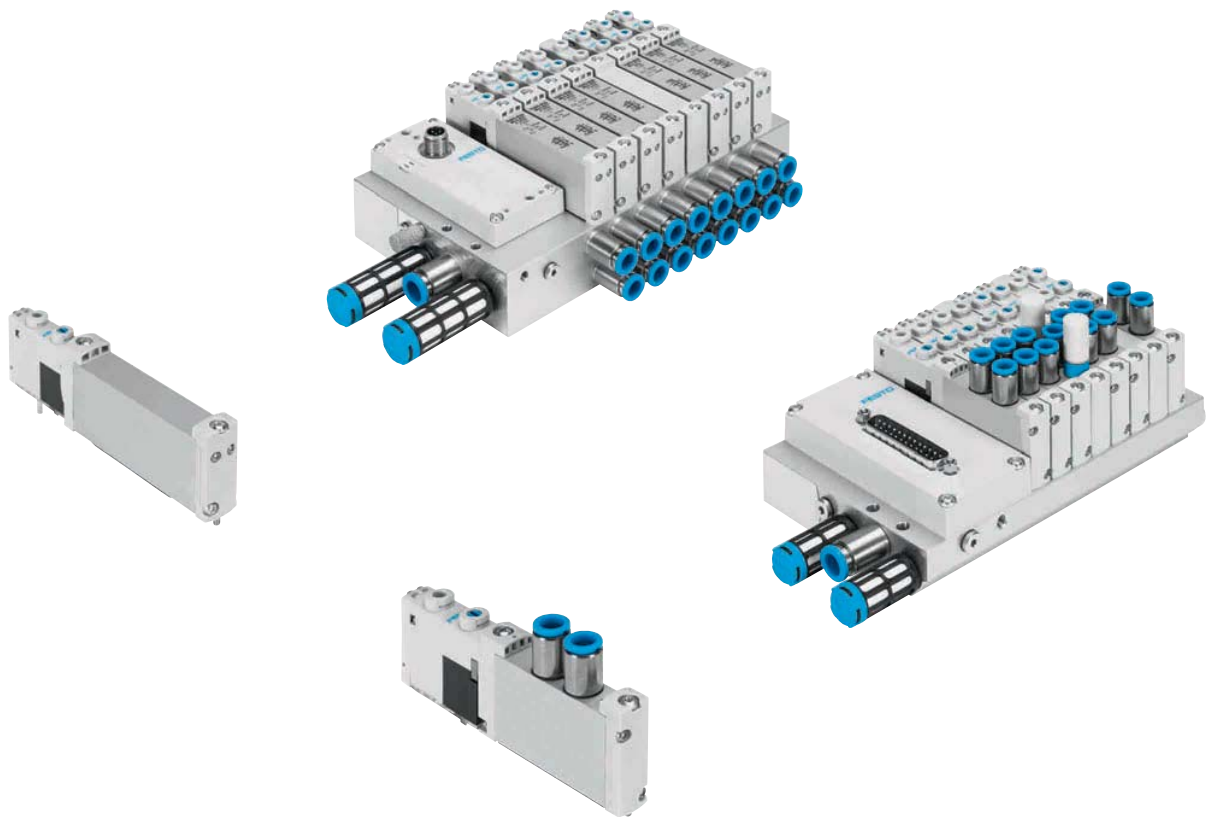
Simplified procurement and warehousing

q Generally ready for shipping ex works in 24 hours
In stock at 13 Service Centres worldwide
More than 2200 products

v Generally ready for shipping ex works in 5 days
Assembled for you at 4 Service Centres worldwide
Up to 6×10^{12} variants per product family

Just look
for the
star!

Key features



Innovative

- Festo-specific I-Port interface for bus nodes (CTEU)
- IO-Link mode for direct connection to a higher-order IO-Link master
- Festo-specific I-Port interface with interlock
- Variable multi-pin plug connection using Sub-D or ribbon cable
- Reversible piston spool valves, up to 24 valve positions
- Reduced power consumption
- Excellent price/performance ratio

Flexible

- Choice of quick push-in connectors
- Multiple pressure zones possible
- Sub-D variant and fieldbus interface with degree of protection to IP67
- Internal or external pilot air with the same manifold rail possible through the use of blanking plugs
- Sub-base valves with working ports underneath for installation in control cabinets

Reliable

- Sturdy and durable metal components
 - Valves
 - Manifold rails
- Fast troubleshooting thanks to LED display
- Manual override: choose from non-detenting, detenting or covered

Easy to install

- Easy mounting thanks to captive screws and seal
- Connection technology easy to change
- Inscription label holder for labelling

Valve terminal configurator

A valve terminal configurator is available to help you select a suitable valve terminal VTUG. This makes it much easier to order the right product.

Valve terminals VTUG are ordered via an ident. code. All valve terminals are supplied fully assembled and individually tested.

This reduces assembly and installation time to a minimum.

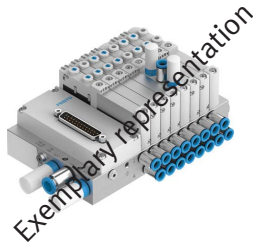
Download CAD data [a](http://www.festo.com) www.festo.com

Ordering system for valve terminal VTUG
[a](http://www.festo.com) Internet: vtug

Valve manifold VTUG

Part number: 573606

FESTO



Data sheet

Overall data sheet – Individual values depend upon your configuration.

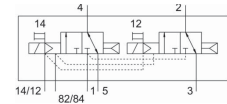
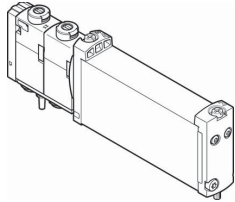
Feature	Value
Valve function	5/2, monostable 2x3/2, open, monostable 3/2, closed, monostable 3/2, open, monostable 2x3/2, closed, monostable 5/2, bistable 5/3, closed 2x3/2, open/closed, monostable 5/3, exhausted 5/3, pressurized
KC characters	KC EMC
Valve size	10 mm 14 mm 18 mm
Max. standard nominal flow rate	330 l/min at 10 mm 1200 l/min at 18 mm 630 l/min at 14 mm
Standard nominal flow rate	130 l/min ... 1150 l/min
Pneumatic working port	G1/4 QS-6 QS-4 QS-10 QS-1/4 QS-3/16 QS-5/32 M7 QS-8 G1/8 QS-5/16 QS-3 QS-3/8 QS-1/8 M5
Operating pressure	-0.9 bar ... 10 bar
Electrical actuation	I-Port Fieldbus IO-Link® Individual connection Multi-pin AP interface
Max. no. of valve positions	24
Max. no. of pressure zones	13
Electrical I/O system	no
Ambient temperature	-5 °C ... 60 °C

Feature	Value
Degree of protection	IP65 IP67 IP40 IP69K
Certification	RCM compliance mark c UL us - Recognized (OL) c CSA us (OL)
Type code	VTUG
Exhaust air function	With flow control option
Actuation type	Electrical
Sealing principle	Soft
Design	Piston gate valve
Type of control	Pilot-controlled
Pilot air supply port	Internal External
Valve manifold design	Fixed grid
Signal status display	LED
Operating pressure for valve manifold with internal pilot air supply	1.5 bar ... 8 bar
Pilot pressure	1.5 bar ... 8 bar
Suitability for vacuum	yes
Nominal pick-up current per solenoid coil	47 mA to 20 ms
Nominal operating voltage DC	24 V
Nominal current with current reduction	15.5 mA after 20 ms
Permissible voltage fluctuations	+/- 10 % +/- 25 %
Certificate issuing authority	UL MH19482
Operating medium	Compressed air as per ISO 8573-1:2010 [7:4:4]
Information on operating and pilot media	Operation with oil lubrication possible (required for further use)
CE marking (see declaration of conformity)	As per EU EMC directive As per EU RoHS directive
Vibration resistance	Transport application test with severity level 2 as per FN 942017-4 and EN 60068-2-6
Shock resistance	Shock test with severity level 2 as per FN 942017-5 and EN 60068-2-27
Corrosion resistance class (CRC)	2 - Moderate corrosion stress
Storage temperature	-10 °C ... 60 °C
Temperature of medium	-5 °C ... 60 °C
Pilot medium	Compressed air as per ISO 8573-1:2010 [7:4:4]
Pilot air port 12/14	G1/8
Pneumatic connection 1	QS-10 QS-16 QS-4 QS-3 QS-6 G1/8 QS-5/16 G3/8 QS-12 QS-3/8 QS-1/2 QS-1/4 QS-8 G1/4
Note on materials	RoHS-compliant
Seals material	HNBR NBR

Air solenoid valve VUVG-B14-T32C-AZT-F-1T1L

Part number: 573476

FESTO



Data sheet

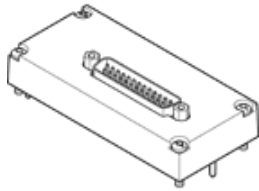
Feature	Value
Valve function	2x3/2, closed, monostable
Lap	Overlap
Actuation type	Electrical
Valve size	14 mm
Standard nominal flow rate	490 l/min
Pneumatic working port	Flange
Operating voltage	24V DC
Operating pressure	1.5 bar ... 10 bar
Design	Piston gate valve
Reset method	Pneumatic spring
Degree of protection	IP65 IP67
Certification	c UL us - Recognized (OL) c CSA us (OL)
Type code	VUVG
Exhaust air function	With flow control option
Sealing principle	Soft
Mounting position	Any
Manual override	Detenting Non-detenting
Type of control	Pilot-controlled
Pilot air supply port	External
Symbol	00992905
Signal status display	LED
Pilot pressure	1.5 bar ... 8 bar
Max. switching frequency	3 Hz
Switching time off	29 ms
On switching time	10 ms
Duty cycle	100%
Max. positive test pulse with 0 signal	1600 µs
Max. negative test pulse on 1 signal	3000 µs
Coil characteristics	22 V DC: 1.0 W
Permissible voltage fluctuations	+/- 10 %
Operating medium	Compressed air as per ISO 8573-1:2010 [7:4:4]
Information on operating and pilot media	Operation with oil lubrication possible (required for further use)
Vibration resistance	Transport application test with severity level 2 as per FN 942017-4 and EN 60068-2-6

Feature	Value
Shock resistance	Shock test with severity level 2 as per FN 942017-5 and EN 60068-2-27
Corrosion resistance class (CRC)	2 - Moderate corrosion stress
Temperature of medium	-5 °C ... 60 °C
Pilot medium	Compressed air as per ISO 8573-1:2010 [7:4:4]
Ambient temperature	-5 °C ... 60 °C
Product weight	102 g
Electrical connection	Via sub-base
Type of mounting	On terminal strip
Note on materials	RoHS-compliant
Seals material	HNBR NBR
Housing material	Wrought aluminum alloy

Electrical interface VAEM-L1-S-M1-25

Part number: 573445

FESTO

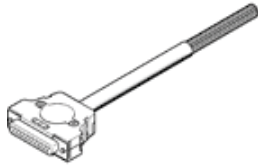


Data sheet

Feature	Value
Corrosion resistance classification CRC	2 - Moderate corrosion stress
Authorization	c CSA us (OL) c UL us - Recognized (OL)
Product weight	53 g
Materials note	Conforms to RoHS

Connecting cable
NEBV-S1G25-K-2.5-N-LE25-S6
 Part number: 575417

FESTO



Data sheet

Feature	Value
Mounting type	4-40UNC
Assembly position	Any
Product weight	429 g
Electrical connection	Plug socket Sub-D 25-pin
Operating voltage range DC	<= 30 V
Acceptable current load at 40°C	2.6 A
Cable length	2.5 m
Cable attribute	For static applications
Min. cable bending radius	122 mm
Cable diameter	10.2 mm
Cable diameter tolerance	± 0,25 mm
Cable structure	25x0,34
Protection class	IP40
Ambient temperature	-5 ... 80 °C
Materials note	Conforms to RoHS
Degree of contamination	2
Corrosion resistance classification CRC	0 - No corrosion stress
Materials information, cable sheaths	PVC
Materials information, housing	Reinforced PC
Material information for crimp connectors	Bronze Gold plated

Plastic tubing PUN-H-1/4-BL-150-CB

Part number: 567948

FESTO

Approved for use in food processing (hydrolysis resistant)



Data sheet

Feature	Value
Outer diameter, inches	1/4
Bending radius relevant for flow rate	0.085 Fuß
Min. bending radius	0.032 Fuß
Temperature dependent working pressure	-14.4 ... 145 Psi
Operating medium	Compressed air in accordance with ISO8573-1:2010 [7::-]
Note on operating and pilot medium	Lubricated operation possible
Food-safe	See Supplementary material information
Ambient temperature	-31 ... 145 °F
Product weight according to length	0.23 oz/ft
Pneumatic connection	For push-in connector outside diameter 1/4"
Color	blue
Shore hardness	D 52 +/-3
Materials note	Free of copper and PTFE Conforms to RoHS
Materials information for tubing	TPE-U(PU)

AC Outlet DIN-Rail Mountable Receptacles

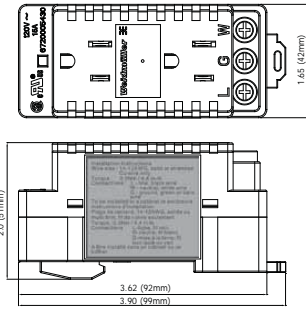


DIN-rail receptacles, 5A, 15A and 20A power outlets, provide a convenient power source for portable computers or test devices for in-the-panel troubleshooting. They mount on standard 35mm DIN-rail. The terminations accept slotted or Phillips screwdrivers. The mounting foot includes a latching lock - slide it open, mount the module on the DIN-rail and slide the lock closed.

- Easily snaps onto 35mm DIN-rail
 - Panel mountable, model dependent
 - 5A, 15A or 20A versions
 - Easy to wire
-
- NEMA rated enclosure with UL94 VO flammability rating
 - UL508A, cULus, and cURus and CSA* approved
 - Latching mounting foot makes installation and removal from DIN-rail easy

*Applies to part number 6720005430

Dimensional Drawing



15 Amp Duplex w/LED



This new DIN-rail mountable duplex receptacle makes adding a 120V maintenance AC outlet to control cabinets quick and easy. It mounts on standard 35mm DIN-rail and requires just 42mm of rail space. An LED indicates that 120V is applied to the module. The terminations accept slotted or Phillips screwdrivers. The mounting foot includes a latching lock – slide it open, mount the module on the DIN-rail and slide the lock closed.


- requires just 42mm of DIN-rail
- includes power status LED
- latching mounting foot makes installation and removal from DIN-rail easy
- CSA certified and cURus recognized


Technical data

Voltage	120 VAC nominal
Current	15A max.
Wire Size (AWG)	14-12 AWG (Solid or stranded, copper only)
Stripping Length mm/in.	8.8-11 / 0.347-0.433
Terminations	Screw terminals, slotted or Phillips
	"L":line "W":neutral "G":ground
Terminal Torque	0.5Nm/4.4 in-lb
Mounting	TS35 DIN-Rail
Width	42mm/1.65 in.
Length	99mm/3.90 in.
Height	51mm/2.01 in.

Approvals/Certifications

Description

 CSA certified, file 251163, Project 2345434, according to C22.2 No. 42

 cURus recognized, file E340886, according to UL498 and C22.2 No. 182.3

Ordering data

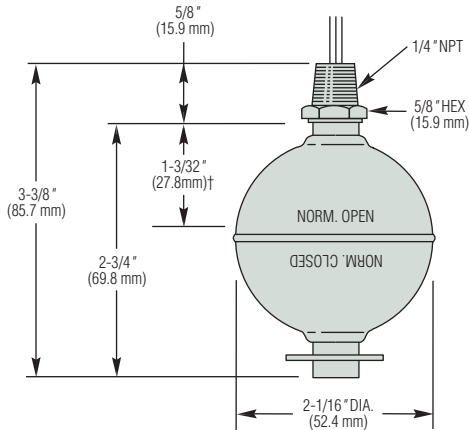
Type	Part No.
DUPLEX 120VAC OUTLET W/LED	6720005430

Large Size – Alloys

LS-1950 – All Stainless Steel For High Pressure and Temperature

For high performance applications, the LS-1950 provides high temperature and pressure capabilities. Materials of construction comply with FDA food contact regulations.

Dimensions



†L₁ = Switch actuation level, nominal (based on a liquid specific gravity of 1.0 and N.O. dry circuit – dimension will vary for N.C. circuit).

Common Specifications

Electrical Termination: No. 18 AWG, 24" L., Polymeric Lead Wires (except Part No. 79999 which has Teflon® lead wires).

Approvals: LS-1950 Series switches are U.L. Recognized – File No. E45168 and are CSA Listed - File No. 30200 (Part No. 79999 is U.L. Recognized only).

Switch Operation: Selectable, N.O. or N.C., by inverting float on unit stem. Units are shipped N.O. unless otherwise specified.

How to Order – Select Part Number based on specifications required.

Series Number	Materials		Min. Liquid Sp. Gr.	Operating Temperature	Pressure, PSI, Max.	Switch ¹	Part Number
	Stem and Mounting	Float					
LS-1950	316 Stainless Steel	0.75		-40°F to +300°F (-40°C to +149°C)	750	SPST, 20 VA	01950 ⚡
						SPST, 100 VA ²	26717 ⚡
						SPST, 20 VA	79999 ⚡

Notes

- See "Electrical Data" on Page X-5 for more information.
- UL Resistive Rated

⚡ – Stock Items.



Exceptionally accurate and rugged for higher temperatures and in pressurized or corrosive liquids. For oils, water and chemicals.





SQUARE D®

Pumptrol® Pressure Switches

Proven, Long-Life Water
and Air Control Switches



Designed to monitor and control electrically driven water pumps, Pumptrol Pressure Switches are ideal for jet, submersible and reciprocating systems. These durable pressure switches monitor systems to start and stop a pump at pre-set pressures.

Features

- NEMA Type 1 enclosure
- 2 pole, rated 1-1/2HP @ 115 Vac, 2HP @ 230 Vac
- Adjustable cut-in/out
- Maximum pressure 220 PSIG
- Diaphragm actuated
- UL, CSA Listed
- Mechanical life: 100,000 operations (minimum test standards)

Applications

Rural customers usually rely on wells to supply their water. Pumps are used to bring up the water from the well and to pressurize the water pipes in the home. Water is pumped into a storage tank to compress an air bladder that exerts pressure on the water in the home. When the desired pressure is reached, the pump must be stopped. This is where the pressure switch opens a set of electrical contacts to stop the pump.

As your customer uses water, the pressure in the storage tank falls. When the lowest desired pressure is reached, the switches close to start the pump and recharge the system pressure. The most common water pump pressure settings are 20 to 40 pounds per square inch (p.s.i.), 30 to 50 p.s.i. or 40 to 60 p.s.i. The low number is the cut-in pressure, and the high number is the cut-out pressure. Your customer will normally be looking for a replacement device for their system, so just match the low and high pressures with the new device.

a brand of
Schneider
Electric



SQUARE D

Water Pump Pressure Switches – Type FSG

Cut-in Pressure (PSIG)	Cut-Out Pressure (PSIG)	Pressure Connection (NPSF Internal)	Additional Features	Catalog Number
20	50	1/4"		FSG2J18CP
20	40	1/4"		FSG2J20BP
20	40	1/4"		FSG2J20CP
20	40	1/4"	Manual cut-out lever	FSG2J20M1BP
20	40	1/4"	Manual cut-out lever	FSG2J20M1CP
20	40	1/4"	Low pressure cut-off	FSG2J20M4BP
20	40	1/4"	Low pressure cut-off	FSG2J20M4CP
20	40	1/4"	Pulsation plug	FSG2J20PBP
20	40	1/4"	Pulsation plug	FSG2J20PCP
20	40	3/8"		FSG3J20BP
20	40	3/8"		FSG3J20CP
30	50	1/4"		FSG2J21BP
30	50	1/4"		FSG2J21CP
30	50	1/4"	Manual cut-out lever	FSG2J21M1BP
30	50	1/4"	Manual cut-out lever	FSG2J21M1CP
30	50	1/4"	Low pressure cut-off	FSG2J21M4BP
30	50	1/4"	Low pressure cut-off	FSG2J21M4CP
40	60	1/4"		FSG2J24BP
40	60	1/4"		FSG2J24CP
40	60	1/4"	Low pressure cut-off	FSG2J24M4BP
40	60	1/4"	Low pressure cut-off	FSG2J24M4CP

Selected Equipment





Drawing:

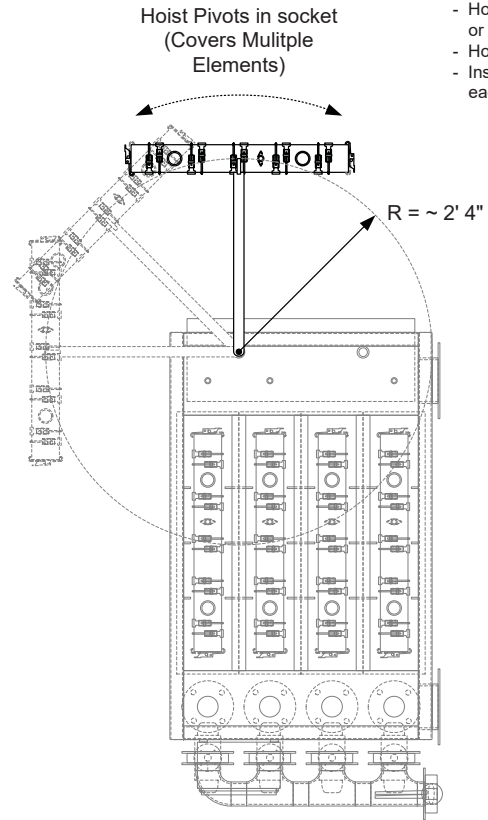
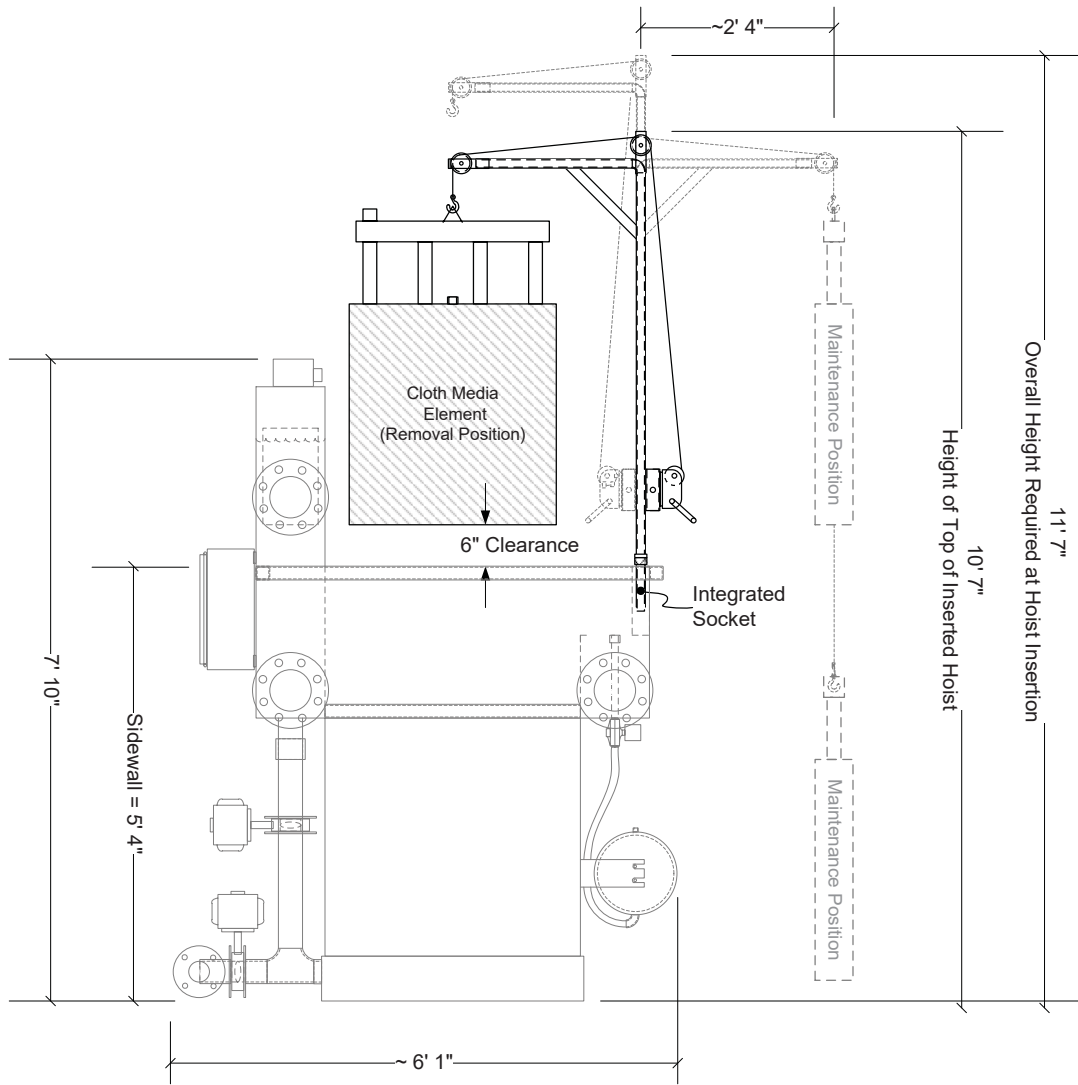
Hoist Detail (M4200012-Hoist-SS)

Component Cutsheets:

Oz Lifting Stainless Steel Brake Winch

SS Winch Cable, Hook & Sheaves

Section 3: Hoist



Notes:

- All hoist materials are 100% 304SS, nylon, or other non-corrosive material.
- Sockets are integrated into the filter effluent channel and allow access to multiple element locations.
- Max Hoist Capacity = 250 Lbs.
- Hoist Weight = 55 Lbs
- Hoist-Winch is not to be used to move people or loads above people.
- Hoist should be kept indoors when not in use.
- Inspect Cable and Hook connections before each use.

**For Approval Only.
Not For
Construction.**



Proprietary Information
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Drawing Name:

Filter Hoist Details

File Name: M4200512-GA-Weatherly.vsdX

Project: Weatherly WRF, Pelham, AL (PPEI)

Date: 02-12-21 Sheet: 1 of 1

Drawing No.: M4200012-Hoist-SS



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CARBON STEEL & STAINLESS STEEL BRAKE WINCHES

Features:

- All steel construction
- Compact design
- Ergonomic handle
- Multiple frame mounting positions
- Fully enclosed gearing
- Solid machined gears
- Automatic weatherproof weston brake
- Dual cable anchor point
- Large diameter drum
- Rubber handle
- High gear ratio
- Individual test certificate & serial number

Performance Characteristics:

Model	Wire rope dia.	1st layer	Mid drum	Full drum
OZ1000BW - OZ1000BWSS	1/8"	7 ft.	74 ft.	140 ft.
OZ1000BW - OZ1000BWSS	3/16"	5 ft.	34 ft.	75 ft.
OZ1500BW - OZ1500BWSS	3/16"	7 ft.	66 ft.	140 ft.
OZ1500BW - OZ1500BWSS	1/4"	5 ft.	27 ft.	89 ft.
OZ2000BW - OZ2000BWSS	1/4"	8 ft.	36 ft.	85 ft.
OZ2000BW - OZ2000BWSS	5/16"	7 ft.	22 ft.	52 ft.
Load rating				
OZ1000BW - OZ1000BWSS		1000 lbs.	750 lbs.	500 lbs.
OZ1500BW - OZ1500BWSS		1500 lbs.	1250 lbs.	750 lbs.
OZ2000BW - OZ2000BWSS		2000 lbs.	1500 lbs.	1000 lbs.



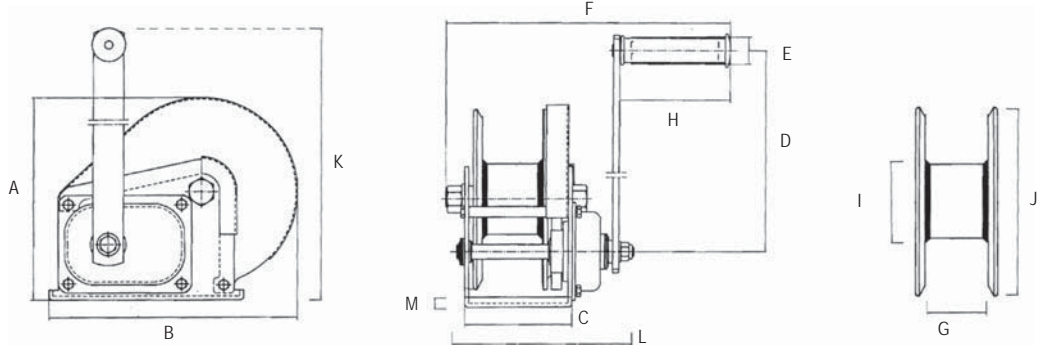
Type 304 stainless steel ideal for harsh environments where corrosion resistance is important

**Test Certificate
- Included -**

Standards:

CE
ANSI B30.21
ANSI B30.16

Specifications: (1000, 1500, 2000 lbs.)



Model	OZ1000BW - OZ1000BWSS	OZ1500BW - OZ1500BWSS	OZ2000BW - OZ2000BWSS
Safe Working Load (lbs.)	1000 lbs.	1500 lbs.	2000 lbs.
Gear Ratio	4.2:1	5:1	10:1
Dimensions (in.)			
A	6.22"	7.73"	8.35"
B	7.20"	9.36"	11.10"
C	3.46"	4.21"	5.00"
D	8.26"	12.68"	12.99"
E	1.06"	1.06"	1.06"
F	10.43"	10.63"	11.81"
G	1.98"	2.30"	2.52"
H	4.29"	4.29"	4.29"
I	1.90"	2.38"	3.00"
J	5.33"	7.00"	7.09"
K	10.20"	15.31"	15.35"
L	5.98"	6.89"	7.87"
M	0.12"	0.14"	0.16"
Net Weight (lbs.)	8.15 lbs.	16.97 lbs.	22.06 lbs.

Bolt hole pattern available on our website.



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Winch Cable, 304SS, 5/32 In. x 20ft.

[Oz Lifting Products, LLC - Winch Cable, 304SS, 5/32 In. x 20ft – winch cables – OZ53220SS](#)

Technical Specs

Item	Winch Cable	Items Included	Latch Hook
Material	304SS	Latch Material	304SS
Size	5/32"	Latch Working Load Limit	½ Ton
Length	20 ft.		
Working Load Limit	1000 lb.		
Strand Type	7 x 19		



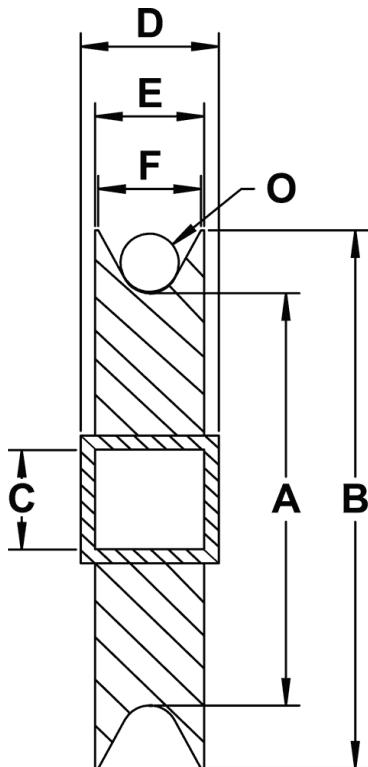
1/4" Cable x 3" Diameter Stainless Steel Sheave

Grade 304 stainless steel heavy duty sheave for use with cable up to 1/4" diameter.

Working load limit: 800 lbs. Weight: 0.8 lb. Ultimate block strength is 4 times the working load limit.

Technical Specs

Item	Sheave	Pitch Diameter (A)	2.5 in.
Material	304SS	Sheave Diameter (B)	3.0 in.
Max Cable Size (O)	1/4"	Bushing Diameter (C)	0.5 in.
Weight	0.8 lb.	Bushing Width (D)	0.46875 in.
Working Load Limit	800 lb.	Sheave Width (E)	0.4375 in.
Ultimate Block Strength	3200 lb.	Sheave Inside Width (F)	0.3125 in.





Drawings:

**Compressed Air System Interconnection Diagram
(M1200000-Interconnection)**

Components:

Champion Compressor (VRV5-8) w/ Auto-Drain

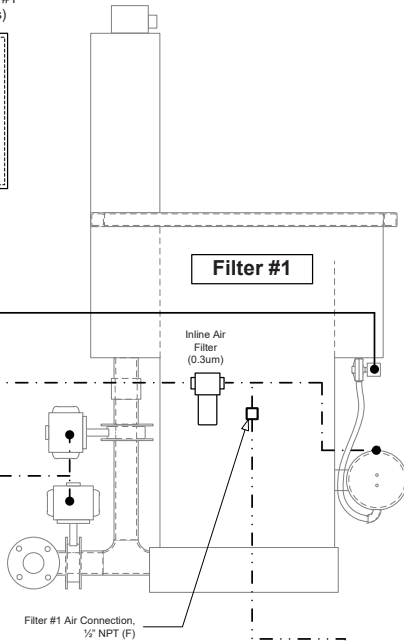
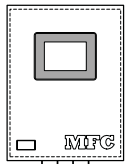
Aircel High-Temp Dryer (DHT20)

Aircel Inline Air Filters (AF651 & AF6501-C)

Wilkerson Regulator, 1/2" NPT (R16-XX-000)

Filter Control Panel (FCP)

Factory mounted to influent end of filter #1 (see GA drawings)

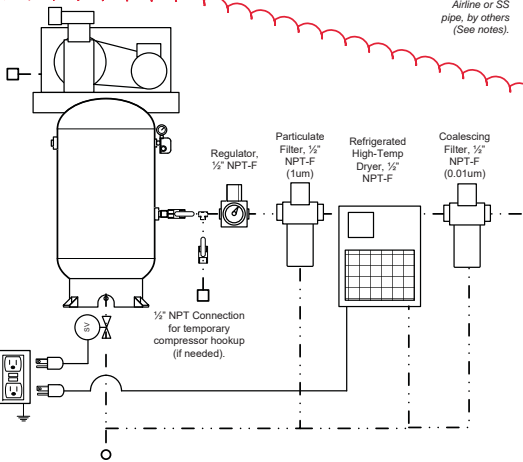


Filter #1 Air Connection, 1/2" NPT (F)

1/2" Min Dia Airline or SS pipe, by others (See notes).

Filter Panel Power (120VAC, 1ph, 60Hz, 20A)

5 HP Compressor (230VAC, 1ph, 60Hz, 50A)



Dryer/Condensate Outlet (120VAC, 1ph, 60Hz, 20A)

Condensate Discharge (to drain or ground)

- Conduit & Wiring by MFC
- - - - - Conduit & Wiring by Others
- · - · - · Air Line by MFC
- · · · · · Air Line by others

Compressed Air System Components for MFC Filter Systems (Mx200000 Series):

MFC Cloth Media filters use a combination of pneumatically operated butterfly valves and pressurized air scour to backwash filter elements, eliminating pumps, motors, mechanical moving parts & maintenance items. A small compressor is included to provide clean/dry air @ 85-90 psi for these operations. Even though air requirements are minimal, a robust compressed air system is included to maintain the highest operational efficiencies possible.

Compressor:

Included Compressor: Champion VR-5 5HP Two-Stage compressor w/ 80gal Vert. Receiver, (230V, 1Ph operation) and automated condensate relief.

Regulator:

Air pressure to filter must be regulated to 85-90psi.

Included Regulator: Wilkerson Model R16-XX-000 Regulator, 1/2" NPT-F or equivalent.

Inline Air Filters:

In order to maintain proper operation of valve actuators & air scour solenoids, air to the filter must be clean & free from dust, debris, & excessive oil.

Included Filters: Aircel Particulate Filter (1um) and Coalescing Filter (0.01um). An IR 0.3um particulate filter is also included at the FCP.

Dryers:

Drying equipment is included due to high humidity (filter located outside);

Included Dryer: Aircel DHT20 High Temperature Refrigerated Air Dryer with automated condensate discharge, 1/2" NPT.

Air Line/Piping (by others):

All airline, hose or piping between the compressor/dryer system and MFC filter to be supplied by others. Minimum airline size shall be 1/2" dia minimum and material shall be stainless steel, copper pipe or rubber hose housed in conduit (150psi min).

AIRLINE CRITICAL NOTE: DO NOT USE Galvanized pipe, black pipe, or other corrosive material as this may cause damage to the filter's air scour system & components.

HOUSING NOTE: Submitted compressed air equipment is intended for indoor use only. All components shall be housed in a building, enclosure, or other appropriate shelter and shall NOT be left outdoors prior to or during installation, construction, or operation. All housings, shelters, enclosures, or other buildings are to be provided and installed by others.

**For Approval Only.
Not For
Construction.**



Proprietary Information
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Drawing Name:
Filter & Compressed Air Interconnection Details

File Name:	M1200000-Interconnection.vsdX		
Project:	Weatherly WRF, Pelham, AL (PPEI)		
Date:	02-19-21	Sheet:	1 of 1
Drawing No.:	M1200000-Interconnection		

CHAMPION

2-15 HP | RECIPROCATING AIR COMPRESSORS

RV-Series





Distinct Value Ultimate Confidence

A Winning Combination

Champion compressors are proven units, known for their reliability over decades of use. We know our products and understand how they operate in many different operating environments. No matter the application, Champion gets the job done.



Value & Confidence Collide

With Champion, you not only get value, you also get the confidence that comes with owning a solid, reliable compressor. The RV-Series exemplifies quality, reliability, long life and tremendous value. Champion provides the total package—a low cost solution with a broad range of options—saving money and providing peace of mind.



Design Advantage



- Splash Lubricated Air Compressor Pump
- Two-Stage Design
- 100% Cast Iron Compressor Pump
- Alloy Steel Reed Valves
- Oil Level Sight Glass
- Oil Drain
- Deep Finned Intercooler
- Large, Cast Iron Flywheel
- Industrial Grade Intake Filter and Silencer
- Factory Filled with ChampLub AC Lubricant
- All Pumps are Factory Tested Prior to Shipment



SIMPLEX	4.5 CFM @ 175 PSI	8.2 CFM @ 175 PSI	16.5 CFM @ 175 PSI	24.0 CFM @ 175 PSI	32.0 CFM @ 175 PSI	46.8 CFM @ 175 PSI
	433 RPM	759 RPM	715 RPM	570 RPM	699 RPM	1020 RPM

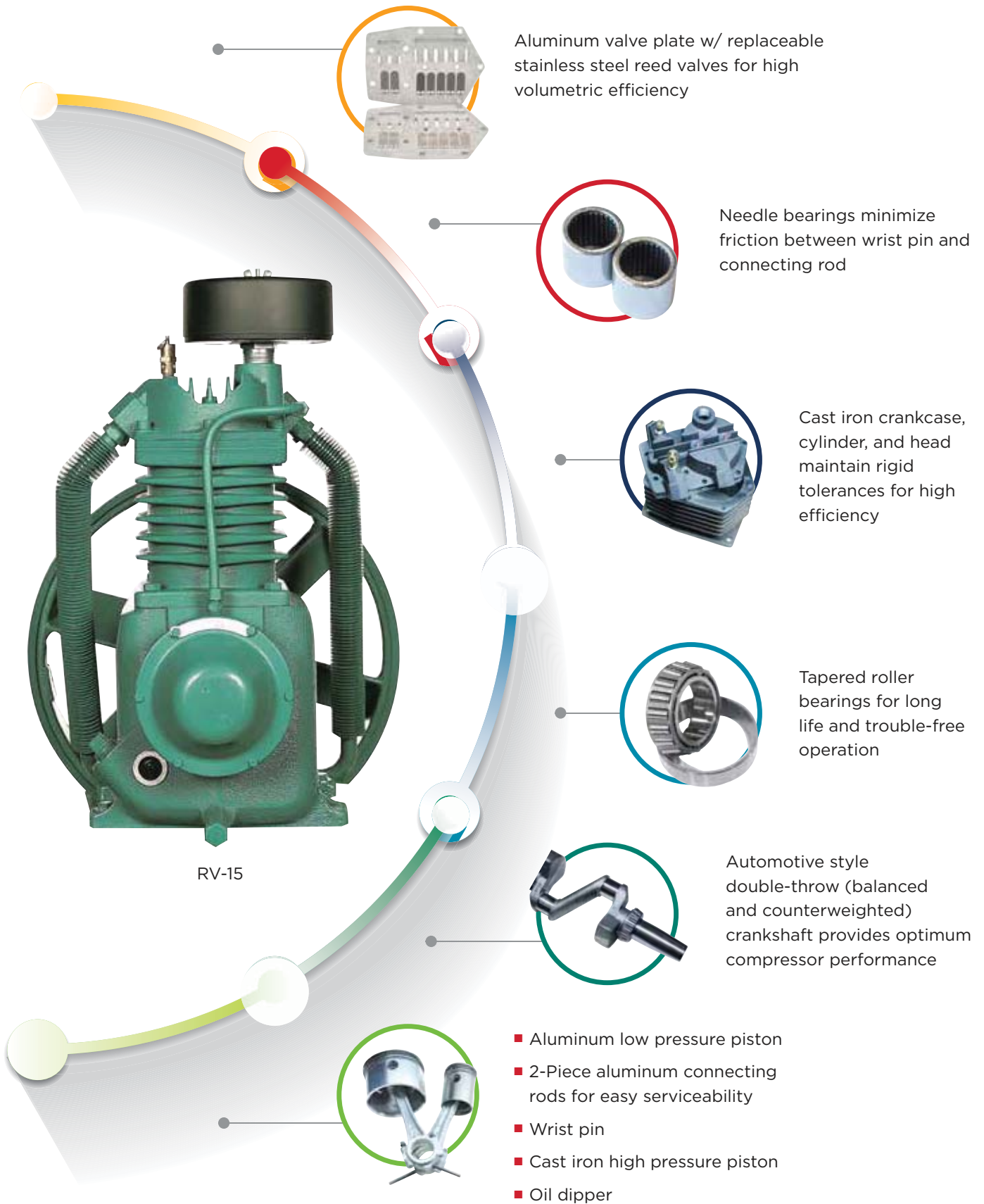


RV-15



RV-30

It's all in the Details



The image features a central photograph of a green RV-15 compressor. A large, curved, multi-colored callout line (yellow, red, blue, green) originates from the top of the compressor and curves around its right side, ending at the bottom. This line connects to seven circular callout boxes, each containing a detailed view of a specific component. The components are: 1) An aluminum valve plate with stainless steel reed valves. 2) Needle bearings. 3) A cast iron crankcase, cylinder, and head assembly. 4) A tapered roller bearing. 5) An automotive-style double-throw crankshaft. 6) A 2-piece aluminum connecting rod. 7) A wrist pin. Additionally, a separate callout at the bottom left shows a cast iron high pressure piston and an oil dipper. The model number 'RV-15' is printed below the main compressor image.

RV-15

Aluminum valve plate w/ replaceable stainless steel reed valves for high volumetric efficiency

Needle bearings minimize friction between wrist pin and connecting rod

Cast iron crankcase, cylinder, and head maintain rigid tolerances for high efficiency

Tapered roller bearings for long life and trouble-free operation

Automotive style double-throw (balanced and counterweighted) crankshaft provides optimum compressor performance

- Aluminum low pressure piston
- 2-Piece aluminum connecting rods for easy serviceability
- Wrist pin
- Cast iron high pressure piston
- Oil dipper

Complete Compressor Packages

Standard Features

- Automatic Start/Stop Operation
- Magnetic Starter*
- ASME Coded Receiver
- NEMA Rated Electric Motors
- 0-300 PSIG Air Pressure Gauge on Tank
- Preset Pressure Switch
- Available Voltages
 - Single Phase—208, 230 on 2-7.5 HP (RV-10, RV-15)
 - Three Phase—208, 230, 460, 575 on 7.5 (RV-30), 10 & 15 HP

Available Options

- Pneumatic Tank Drains
- Vibration Isolators
- Low Oil Level Monitor
- Air-Cooled Aftercoolers

*Option not available on 5 HP, 3600 RPM model

Sales & Service Distributors Across America

An Extensive Network

Your sales, service and technical support needs will be handled quickly and easily by our extensive network of Champion factory-trained, authorized local distributors. Maintaining and adequately servicing your compressor has never been easier.

Over **1,100** Champion distributors ready to provide solutions to all your compressed air needs

To find a distributor visit:
www.championpneumatic.com

Pump Model RV-10A

RV-SERIES | 2-3 HP RECIPROCATING COMPRESSORS

MOTOR HP	TANK CAPACITY GAL.	HORIZONTAL PACKAGES			VERTICAL PACKAGES			125 PSI RATING		175 PSI RATING	
		RV-SERIES MODEL	DIMENSIONS L x W x H INCHES	APPROX. SHIP WEIGHT LBS.	RV-SERIES MODEL	DIMENSIONS L x W x H INCHES	APPROX. SHIP WEIGHT LBS.	RPM	CFM DEL'Y	RPM	CFM DEL'Y
2	RV-10	-	-	-	VRV2-6	35.3 x 29 x 75.5	499	520	5.7	433	4.5
3	RV-10	-	-	-	VRV3F-6	35.3 x 29 x 75.5	509	802	9.2	759	8.2

Pump Model RV-15A

RV-SERIES | 5-7.5 HP RECIPROCATING COMPRESSORS

MOTOR HP	TANK CAPACITY GAL.	HORIZONTAL PACKAGES			VERTICAL PACKAGES			125 PSI RATING		175 PSI RATING	
		RV-SERIES MODEL	DIMENSIONS L x W x H INCHES	APPROX. SHIP WEIGHT LBS.	RV-SERIES MODEL	DIMENSIONS L x W x H INCHES	APPROX. SHIP WEIGHT LBS.	RPM	CFM DEL'Y	RPM	CFM DEL'Y
5	80	-	-	-	VRV5-8	35.3 x 30.9 x 74.8	570	759	18.1	715	16.5
5	80	-	-	-	VRV5-8*	35.3 x 28.6 x 74.8	560	684	16.3	641	14.6
7.5	80	-	-	-	VRV7F-8	35.3 x 30.9 x 74.8	630	975	22.8	975	22.1
7.5	80	-	-	-	VRV7F-8*	35.3 x 30.9 x 74.8	630	983	23	983	22.4

* Unit shipped with 3600 RPM motor

Pump Model RV-30A

RV-SERIES | 7.5-15 HP RECIPROCATING COMPRESSORS

MOTOR HP	TANK CAPACITY GAL.	HORIZONTAL PACKAGES			VERTICAL PACKAGES			125 PSI RATING		175 PSI RATING	
		RV-SERIES MODEL	DIMENSIONS L x W x H INCHES	APPROX. SHIP WEIGHT LBS.	RV-SERIES MODEL	DIMENSIONS L x W x H INCHES	APPROX. SHIP WEIGHT LBS.	RPM	CFM DEL'Y	RPM	CFM DEL'Y
7.5	80	-	-	-	VRV7-8	40.8 x 31.6 x 74.8	710	628	29.8	570	24.0
7.5	80S**	-	-	-	VRV7-8S	40.5 x 33.4 x 62.3	753	628	29.8	570	24.0
7.5	120	HRV7-12	71.8 x 30.3 x 53.2	882	VRV7-12	42.1 x 34.5 x 75.2	882	628	29.8	570	24.0
10	120	HRV10-12	71.8 x 30.3 x 53.2	895	VRV10-12	42.1 x 34.4 x 75.2	895	756	36.6	699	32.0
15	120	HRV15F-12	71.8 x 30.3 x 53.2	1017	VRV15F-12	42.1 x 34.4 x 75.2	1017	1020	48.1	1020	46.8

**80S is an 80 gallon squat version of a 120 gallon receiver

Bare Pumps

RV-SERIES | RECIPROCATING COMPRESSOR

MODEL	# OF CYLINDERS	BORE DIA. INCHES	STROKE INCHES	OIL CAPACITY QUARTS	UNIT DIMENSIONS L x W x H INCHES	APPROX. SHIP WEIGHT LBS.	MINIMUM RPM	MAXIMUM RPM
RV-10A	2	4.6 & 2.5	2.5	2	18.7 x 16.5 x 21.9	124	400	1050
RV-15A	2	4.6 & 2.5	3	2	18.7 x 16.5 x 21.9	124	400	1050
RV-30A	4	4.6 & 2.5	3	4	19.2 x 23.9 x 21.8	233	400	1050

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delivering **superior products** built with
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Aircel

Refrigerated Air Dryers

DHT Series

High Inlet Temperature

20 - 125 scfm



DHT Series High Inlet Temperature Refrigerated Air Dryer | 20 - 125 scfm



The Aircel DHT Series (20 - 125 scfm) high inlet temperature refrigerated air dryers are designed for air-cooled, reciprocating type air compressors. This compressed air dryer combines an oversized refrigerated circuit, high-efficiency heat exchangers, and separator into a single compact unit. Also includes single point air in/out, drain, and electrical connections.

These dryers can accept compressed air up to 205°F and provide clean, dry air at the outlet. Our high inlet temperature refrigerated dryers have been **designed specifically for use with smaller reciprocating air compressors that typically do not incorporate an aftercooler.**

DHT Series dryers are perfect for auto body and service shops, as well as anywhere utilizing 5 to 30 HP compressors. With excellent heat transfer coefficients and low pressure drop, these dryers will outperform the competition in protecting your compressed air system, machinery, and tools.

Capacity Flow Suggestion

Air Compressor Size (HP)	Dryer Model	Flow Capacity (scfm)
5	DHT 20	20
7.5	DHT 40	40
10	DHT 40	40
15	DHT 50	50
20	DHT 75	75
25	DHT 100	100
30	DHT 125	125

DHT Series Features

- Timer drain
- Brazed plate heat exchanger (DHT-20)
- Aluminum block heat exchanger (DHT-40 to DHT-125)
- Refrigerant suction pressure gauge
- Discharge gauge (DHT-100 to DHT-125)
- R-134a refrigerant
- NEMA 1 Standard
- Power on-light
- Maximum inlet temperature of 205°F
- Maximum inlet pressure of 200 psig
- Environmentally friendly R-134a refrigerant

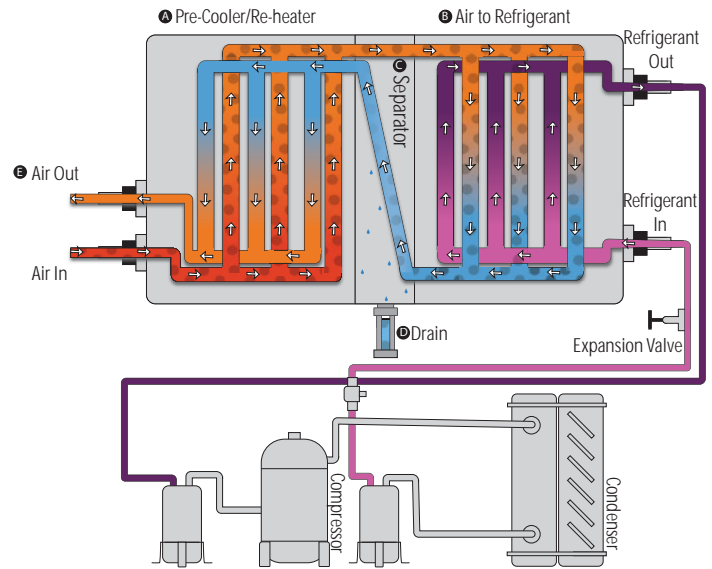
DHT Series Options

- Various voltage options
- Water cooled condenser
- Condenser cleaner assembly
- Low ambient temperature protection¹
- Two valve bypass
- NEMA 4
- NEMA 4X
- Corrosion resistant package²

¹ Low ambient package brings ambient temperature down to 32°F

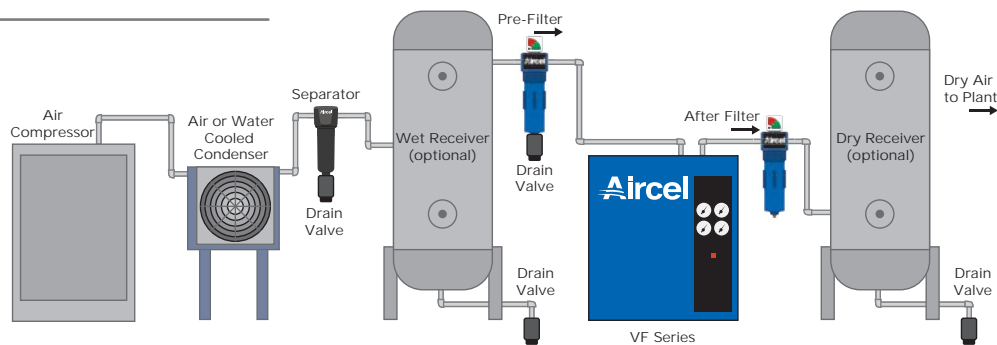
² Corrosion resistant package includes: NEMA 4 enclosure, e-coated condenser, isolation pads, vibration absorbers, and epoxy painted refrigeration lines

How It Works



- Hot compressed air (up to 205°F) enters the system and moves into the pre-cooler/re-heater (A), where it is cooled by the cold, dry outgoing air.
- The air is then directed through the air-to-refrigerant heat exchanger (B), where it is cooled to its final dew point by the refrigeration system.
- The cold, saturated air flows into the three stage stainless steel mist eliminator (C), where liquids and contaminants are removed from the air. This separated condensate is then ejected from the system via the Aircel programmable timer drain (D).
- The cold, dry air is then reheated by the incoming warm air (E) before leaving the dryer.

Recommended Installation



DHT Specifications

Dimensions (in.)

Model Number	Capacity	Voltage	Connection (NPT)	Weight (lbs)	Height	Width	Depth	Refrigerant	Air Cooled kW	Nominal HP	Max Pressure	Optional Pressure Ratings
DHT-20	20	115-1-60	1/2"	95	15	16	16	R-134a	0.57	0.33	232	208/230-1-60; 230-3-60; 430-3-60; 575-3-60
DHT-40	40		1"	125	22	24	18	R-134a	0.83	0.50	200	
DHT-50	50		1"	140	22	24	18	R-134a	0.83	0.50	200	
DHT-75	75		1"	240	22	24	18	R-134a	1.05	0.75	200	
DHT-100	100		1-1/2"	330	30	36	25	R-134a	1.05	0.75	200	
DHT-125	125	208/230-1-60	1-1/2"	360	30	36	25	R-134a	1.35	1.25	200	230-3-60; 430-3-60; 575-3-60

Capacity rated in accordance with CAGI @ 175 psig, 180°F inlet, 100°F ambient and a PDP of 50°F

Operating pressure: 40 to 200 psig | Ambient air temperature: 40°F to 120°F (32°F with ambient low temperature option) | Inlet air temperature: 40°F to 205°F

For larger capacities and custom dryer options, please contact an Aircel factory representative

Recommended Filtration



To protect your dryer investment, we recommend that you install a high performance pre-filter directly in front of your refrigerated air dryer. By doing this, you will prevent insulating oil and dirt build-up in the heat exchanger and ensure optimal performance and reliability of the dryer throughout its lifetime.

By protecting your equipment and keeping the dryer efficiency at its best, these filters will literally pay back their cost and more in savings on your monthly energy bill.

To simplify the selection process, Aircel has matched the AF Series to the refrigerated dryer offering in connection size and flow rate.

Capacity Correction Factors

To Size the Dryer Capacity for Actual Conditions

Adjusted Capacity = scfm x (C1 x C2 x C3 x C4)

Example:

- Dryer Model: DHT-100
- Standard Capacity: 100 scfm
- Actual Operating Conditions:
- 95°F ambient: C1 = 1.03
- 160 psig system pressure: C2 = 0.96
- 150°F inlet: C3 = 0.96
- 50°F required dew point: C4 = 1

Adjusted Capacity: 100 scfm x 1.03 x 0.96 x 0.96 x 1 = 104.8 scfm

To Size the Dryer Model for Actual Conditions

Adjusted Capacity = scfm / (C1 / C2 / C3 / C4)

Example:

- Given Flow: 80 scfm
- Actual Operating Conditions:
- 75°F ambient: C1 = 1.1
- 200 psig system pressure: C2 = 1.12
- 150°F inlet: C3 = 1.06
- 50°F required dew point: C4 = 1

Adjusted Capacity: 80 scfm / (1.1 / 1.12 / 1.06 / 1) = 57.9 scfm

Selected Dryer Model: DHT-75

Correction Factors for Differing Ambient Temperature (C1)

Ambient Temperature (°F)	75	85	95	100	105	115	120
Correction Factor	1.1	1.07	1.03	1	0.96	0.82	0.55

Correction Factors for Differing System Air Pressure (C2)

System Pressure (psig)	30	45	60	75	90	100	115	130	145	160	175	190	200
Correction Factor	0.3	0.5	0.7	0.75	0.8	0.83	0.86	0.9	0.93	0.96	1	1.1	1.12

Correction Factors for Differing Inlet Air Temperature (C3)

Inlet Temperature (°F)	90	100	150	180	200	205
Correction Factor	1.3	1.27	1.06	1	0.98	0.90

Correction Factors for Differing Pressure Dew Point Requirements (C4)

Dew Point (°F)	38	41	45	50	55	60
Correction Factor	0.65	0.73	0.8	1	1.1	1.22



Versatile Design

Aircel's AF series filters include smart design features and innovative technology to provide a compressed air filtration solution for a wide range of applications. Aircel's unique AF series filters are designed to combine high performance, energy savings, flexibility and optimum reliability.



Top Cap

Unique push-fit design and double O-ring seal for simple and secure installation.



Multi-layer Filtration

Deep bed multi-wrap borosilicate glass microfiber with stainless steel support cylinders and a polyester needle felt sleeve.



End Cap

Durable and non-corrosive glass filled nylon cap which is attached to the element with a multi-part urethane resin.



AF SERIES

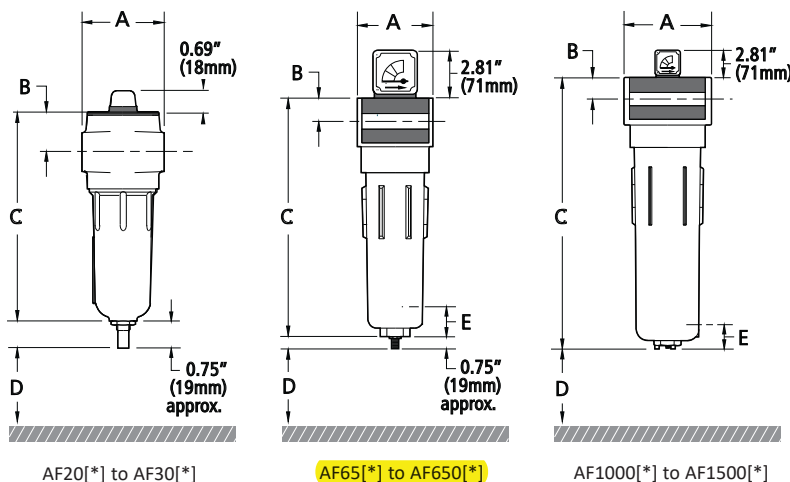
TECHNICAL SPECIFICATIONS



Filter model	Flow rate		Dimensions inches (mm)					NPT connections			Weight lbs	Replacement element model
	scfm	Nm ³ /h	A	B	C	D	E	In/Out	Side	Bottom**		
AF20[*]	20	34	2.83 (72)	1.38 (35)	7.32 (186)	2.95 (75)	N/A	1/4"	N/A	1/4"	1.4	A20[*]E
AF30[*]	30	51	2.83 (72)	1.38 (35)	7.32 (186)	2.95 (75)	N/A	3/8"	N/A	1/4"	1.4	A30[*]E
AF65[*]	65	110	4.33 (110)	1.50 (38)	10.75 (273)	5.98 (152)	1.30 (33)	1/2"	1/4"	1/4"	5.4	A65[*]E
AF75[*]	75	128	4.33 (110)	1.50 (38)	10.75 (273)	5.98 (152)	1.30 (33)	3/4"	1/4"	1/4"	5.4	A75[*]E
AF100[*]	100	170	4.33 (110)	1.50 (38)	14.09 (358)	5.98 (152)	1.30 (33)	1"	1/4"	1/4"	6.1	A100[*]E
AF150[*]	150	255	4.33 (110)	1.50 (38)	14.09 (358)	5.98 (152)	1.30 (33)	1"	1/4"	1/4"	6.0	A150[*]E
AF225[*]	225	382	5.75 (146)	2.01 (51)	19.06 (484)	6.50 (165)	1.65 (42)	1 1/2"	1/2"	1/4"	12.2	A225[*]E
AF300[*]	300	510	5.75 (146)	2.01 (51)	19.06 (484)	6.50 (165)	1.65 (42)	1 1/2"	1/2"	1/4"	12.3	A300[*]E
AF450[*]	450	765	5.75 (146)	2.01 (51)	19.06 (484)	6.50 (165)	1.65 (42)	2"	1/2"	1/4"	12.3	A450[*]E
AF650[*]	650	1105	5.75 (146)	2.01 (51)	26.97 (685)	6.50 (165)	1.65 (42)	2"	1/2"	1/4"	14.8	A650[*]E
AF1000[*]	1000	1700	9.06 (230)	2.68 (68)	28.43 (722)	7.01 (178)	1.65 (42)	3"	1/2"	1/4"	40.6	A1000[*]E
AF1250[*]	1250	2125	9.06 (230)	2.68 (68)	33.23 (844)	7.01 (178)	1.65 (42)	3"	1/2"	1/4"	44.1	A1250[*]E
AF1500[*]	1500	2550	9.06 (230)	2.68 (68)	39.06 (992)	7.01 (178)	1.65 (42)	3"	1/2"	1/4"	48.3	A1500[*]E

Notes

* Fill in element grade (AF5, AF1, AF01, AC01 and -C- for Coalescer and -D- for reverse flow for Particulate) to appropriate model number.



Grade	Standard Filter Grade			Vapor Filter
	AF5	AF1	AF01	AC01
Particle removal	5.0 micron	1.0 micron	0.01 micron	0.01 micron
Maximum carryover at 68°F / 20°C	5 ppm	0.1 ppm	0.01 ppm	0.003 ppm
Recommended temperature	100°F / 38°C	100°F / 38°C	100°F / 38°C	77°F / 25°C
Maximum temperature	248°F / 121°C	248°F / 121°C	248°F / 121°C	122°F / 50°C
Pressure drop (clean and dry)	0.4 psid / 30 mbar	1.0 psid / 70 mbar	1.5 psid / 100 mbar	1.0 psid / 70 mbar
Pressure drop (saturated)	1.0 psid / 70 mbar	2 psid / 140 mbar	3.0 psid / 210 mbar	N/A
Pressure drop (change element)	6.0 psid / 400 mbar	6.0 psid / 400 mbar	6.0 psid / 400 mbar	see note
Element media	Borosilicate Glass Microfiber			Carbon impregnated paper
Maximum working pressure	232 psig / 16 barg (300 psig / 20 barg without auto float drain)			
Housing material	High quality aluminum			

Note: Activated charcoal (AC01) filters must not operate in oil saturated conditions and will not remove certain types of gases including carbon monoxide and carbon dioxide. Change interval depends on application. Please contact your distributor.

Correction Factors

For maximum flow rate, multiply model flow rate shown in the specification chart by the correction factor corresponding to the working pressure. See specifications for maximum pressure. Note: To reduce pressure drop by 50%, reduce flow rate by 30%.

Operating Pressure (psig)	10	20	30	40	50	60	70	80	90	100	110	125	150	175	200	225	250	275	300
Correction Factor	0.32	0.45	.055	0.64	0.71	0.78	0.84	0.90	0.95	1.00	1.05	1.12	1.22	1.32	1.41	1.49	1.58	1.65	1.73



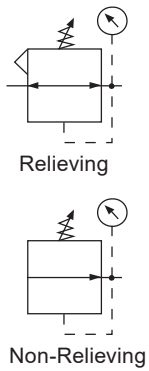
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Please visit us at airceldryers.com

Aircel, LLC. reserves the right to update or change specifications at any time without prior notice.

Regulator R16

 = "Most Popular"



R16-02-000

Features

- Non-Rising Adjustment Knob with Friction Lock Knob
- Standard with Two Full Flow 1/4" NPT / BSPT-Rc Gauge Ports
- Panel Mount Nut
- High Flow Capacity
- Balanced Valve Design for Excellent Regulation Characteristics

Specifications

Flow Capacity*	1/4	71.5 SCFM (33.7 dm ³ /s)
	3/8	80.5 SCFM (38.0 dm ³ /s)
	1/2	88.0 SCFM (41.5 dm³/s)
Adjusting Range Pressure		0 to 60 PSIG (0 to 4.1 bar)
		0 to 125 PSIG (0 to 8.6 bar)
		0 to 250 PSIG (0 to 17.2 bar)
Maximum Supply Pressure		300 PSIG (20.7 bar)
Operating Temperature		32° to 150°F (0° to 65.5°C)
Port Size	NPT / BSPP-G	1/4, 3/8, 1/2
Gauge Port (2 ea.)	NPT / BSPT-Rc	1/4
Weight	lb. (kg)	1.7 (0.77)

* Inlet pressure 100 PSIG (6.9 bar). Secondary pressure 90 PSIG (6.2 bar).

Materials of Construction

Body	Zinc
Bonnet	PBT
Diaphragm	Nitrile / Zinc
Panel Nut	Acetal
Seals	Nitrile
Springs	Steel
Valve Assembly	Brass / Nitrile / Acetal

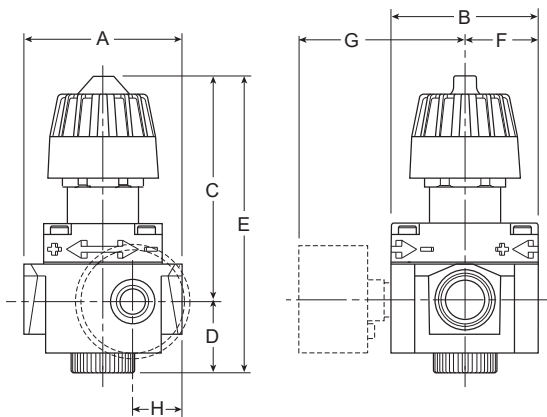
WARNING

**Product rupture can cause serious injury.
Do not connect regulator to bottled gas.
Do not exceed maximum primary pressure rating.**

CAUTION:

REGULATOR PRESSURE ADJUSTMENT – The working range of knob adjustment is designed to permit outlet pressures within their full range. Pressure adjustment beyond this range is also possible because the knob is not a limiting device. This is a common characteristic of most industrial regulators, and limiting devices may be obtained only by special design.

For best performance, regulated pressure should always be set by increasing the pressure up to the desired setting.



NOTE: 1.31" Dia. (33.3 mm) hole required for panel nut mounting.

Dimensions

Models	Inches (mm)	A	B	C	D	E	F	G	H
Standard Unit R16-XX-000		2.99 (76)	2.59 (66)	3.99 (101.3)	1.20 (30.5)	5.19 (132)	1.29 (33)	— —	1.02 (25.9)
With Gauge R16-XX-G00		2.99 (76)	2.59 (66)	3.99 (101.3)	1.20 (30.5)	5.19 (132)	1.29 (33)	2.80 (71)	1.02 (25.9)



Section 5: Literature



MFC FIXED PLATE Cloth Media Filtration



FIXED PLATE CLOTH MEDIA - NO MOVING PARTS

Innovative fixed panel design uses simple open-close valves and gravity to produce filtration and backwash flow. Having NO internal or submerged moving parts eases installation, reduces maintenance, and simplifies overall operation.

www.municipalfilter.com



REDUCED MAINTENANCE

SIMPLE OPERATION

INNOVATIVE DESIGN

MFC's Cloth Media Filter systems feature an innovative fixed panel design that uses simple gravity to produce filtration and backwash flow. These high performance, low-operating cost, tertiary cloth media filters are suitable for both large and small wastewater treatment applications. MFC fixed plate packaged systems are available in completely assembled, 100% stainless steel free-standing units with capacities from 10gpm to 6.0 MGD. Modular systems are available for larger flows typically above 2.0 MGD and are specifically designed for installation into new or existing concrete tankage.

SIMPLE OPERATION

MFC's fixed plate cloth media filters utilize a patented design to generate backwash flow WITHOUT backwash manifolds, spray headers, or other moving parts. Backwash is produced by already available differential head, simple open-close valves, and gravity along with a small amount of pressurized air to enhance cleaning.



NO MOVING PARTS

All filter components remain stationary during filtration and backwash, reducing maintenance and power usage. Also, ALL fabricated components, including tankage and internal components, are 100% stainless steel for long life and eased maintenance. Acrylic cloth media removes solids particles down to 10um, is chemically resistant, and can be changed easily without disrupting incoming flow. Alternate media types are also available (IE: 5um).

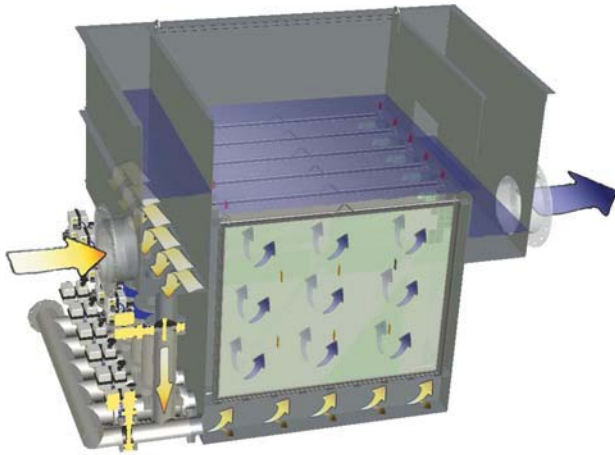
REDUCED MAINTENANCE

All mechanical equipment, including filter panels, can be removed from the filter without dewatering or diverting incoming flow at any time. All connections required for removal of the cloth media elements are located at the top of the tank, within easy reach, eliminating the need for operators to enter the filter tank for normal maintenance.

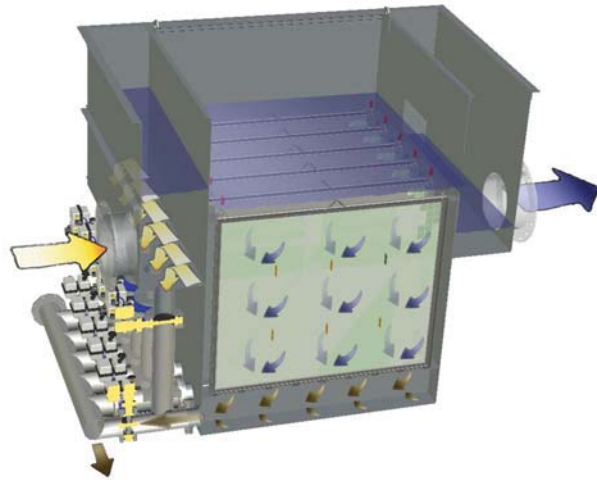
Filtering

Backwash

Each independent media plate is made up of 2x rectangular cloth panels which face each other within a stationary framework. Influent enters the filter & is directed to the bottom of each plate. Suspended solids fall to the bottom of the channel or collect on the interior surfaces of the cloth plates. Clean, treated water collects in the filter's main bay and exits over the fixed weir.



As solids accumulate on the cloth surfaces, water level in the influent channel begins to rise, eventually initiating a backwash operation. Each independent cloth plate is cleaned in sequence by allowing gravity to force flow in reverse. Backwash flow is produced entirely by gravity, by simply opening each plate's



associated backwash valve. Air is injected into the interior of the plate during backwash to enhance cleaning.

NO MOVING PARTS

FIXED CLOTH MEDIA





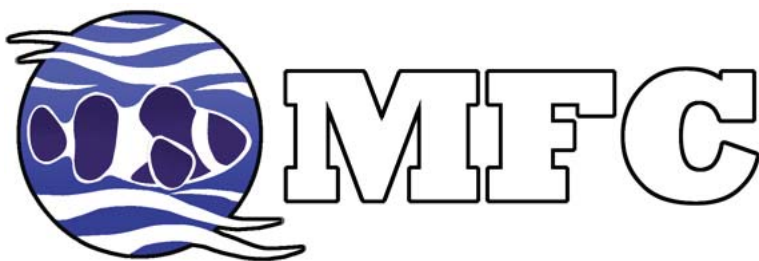
PROVEN PERFORMANCE

MFC's Cloth Media Plate Filters

use proven fixed plate cloth media technology to produce exceptional suspended solids and turbidity removal even at high or fluctuating solids loadings, producing reuse quality effluent with TSS less than 2-4 mg/l and NTU below 1 NTU for most wastewater types. MFC's fixed plate cloth media filtration systems are ideally suited for:

- Municipalities, large and small
- Residential & Commercial Developments
- Industrial Applications
- Food Processing
- Reuse Applications (including California Title 22)
- Phosphorous Removal Applications

Please contact MFC or your local rep for specific equipment sizing, pricing, and recommendations.



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SUBMITTAL
NONCON-5000-3-5 x 6
March 03, 2021

PART 1 - GENERAL

1.1 Scope of Work

- A. Glasco UV will provide a single bank standalone complete high output ultraviolet lamp (UV) fluoropolymer tube disinfection systems. The systems are low-pressure high output UV lamp “closed” style FEP Tube reactors. Each standalone system is capable of treating 285 MGD flow and has remote electronics. The systems will be complete and operational with all of the controls as indicated.

1.2 Summary

- A. GLASCO UV will provide the following major components:
 1. One (1) stainless steel reactor. System is designed for 285 GPM.
 2. One (1) remote Ballast Control Center
 3. One (1) UV monitoring
 4. One (1) UV monitoring system
 5. Safety equipment (face shields)
 6. Spare parts

1.3 Submittals

A. Shop Drawings:

1. General layout and arrangement drawings
2. Power wiring single line diagrams
3. Ballast Control Center wiring diagrams
4. Cut sheets on components.

B. Product Data:

1. Data and cut sheets have been attached for all major components.

C. Glasco's Installation, Operation and Maintenance manuals are included.

1. O&M Manual for the NONCON Series will be provided. O&M Manuals will contain the following additional information
2. Parts list.
3. Assembly instructions.
4. Performance guarantee.
5. Maintenance recommendations.
6. Startup procedures.
7. List of spare parts.

SHOP DRAWING / SUBMITTAL REVIEW	
<input checked="" type="checkbox"/> APPROVED	<input type="checkbox"/> APPROVED AS NOTED
<input type="checkbox"/> REVISE AND RESUBMIT	<input type="checkbox"/> REJECTED
<small>CORRECTIONS OR COMMENTS MADE ON THE SUBMITTALS DURING THIS REVIEW DO NOT RELIEVE THE CONTRACTOR FROM COMPLIANCE WITH THE REQUIREMENTS OF THE CONTRACT DOCUMENTS. THIS CHECK IS ONLY FOR REVIEW OF GENERAL CONFORMANCE WITH THE DESIGN CONCEPT OF THE PROJECT. THE CONTRACTOR IS RESPONSIBLE FOR CONFIRMING AND COORDINATING ALL DIMENSIONS IN THE FIELD, CHECKING TOLERANCES, CLEARANCES, QUANTITIES, FABRICATION PROCESSES, TECHNIQUES OF CONSTRUCTION, COORDINATION OF HIS WORK WITH OTHER TRADES, AND PERFORMING THE WORK IN A SAFE MANNER.</small>	
BY: <u>WCE</u>	DATE: <u>5/6/2022</u>

8. Wiring diagrams
9. Software integration.
10. Trouble shooting.
11. Dimensional drawings have been attached as exhibits to this submittal.
12. Electrical wiring diagrams for system installation have been provided with noted recommendations.

D. Manufacturer's Certificate:

1. The NONCON-5000 system meets the specification.
2. When installation and startup have been performed, a final certificate will be provided.

E. Manufacturer's Field Reports will be provided.

1.4 Design Criteria

1. Disinfection Criteria

1. Peak flow is 285 GPM
2. Influent Characteristics:
 - a. Fecal coliform: <126/100ML
 - b. BOD: <30 mg/l
 - c. TSS: <30 mg/l
 - d. UV transmittance: 65%
 - e. Effluent temperature: 33 to 85
3. Effluent Requirements for design of UV System:
 - a. Fecal Coliform: <126/100 ml
4. UV dosage will be 30 mJ/cm² at peak flow at end of lamp life.

2 PRODUCTS

2.1 MANUFACTURER

A. GLASCO UV will provide the NONCON-5000-3-5 x 6. This is designed for 285 GPM

2.2 DESIGN, CONSTRUCTION AND MATERIALS

A. General

1. All module welded metal components in contact with effluent will be Type 304 stainless steel.
2. All metal components will be Type 304 stainless steel with the exception of the Lamp Rack Assembly, which will be constructed of aircraft grade aluminum and be capable of sustaining intermittent pedestrian traffic on the lamp racks.
3. All wiring exposed or unexposed to UV light within the UV reactor or electrical ballast enclosure will be Teflon™ coated.
4. All wires connecting the lamps to the ballasts will be enclosed inside the frame of lamp rack and not exposed to the effluent.
5. The effluent water shall be conveyed through the UV reactor through fluoropolymer tubes.
6. All wetted components in the UV reactor will be: FEP, 304 SS, PVC, ABS or other non-reactive, non-corrosive material.

B. Lamp Array Configuration:

1. The lamp array configuration will be the uniform array with all lamps parallel to each other and to the flow.
2. The system is designed to avoid any immersion of UV lamps in the Effluent.
3. The UV lamps will be arranged around the outside of the FEP tubes in such a way that each water tube shall have no less than 6 lamps irradiating it.

C. Inlet/Discharge Flow Distribution:

1. Each Reactor will have an inlet and discharge transition tanks.
2. The UV Reactor will have 6" flange pattern on the inlet and outlet boxes
3. The UV disinfection system will have flow inlet distribution that distributes wastewater through the FEP tubes.
4. The UV system will have a 304 Stainless steel channel and will be non-corrosive.

D. FEP Tube UV Reactor

1. Within the ultraviolet reactor, FEP UV transmitting tubes are arranged in a horizontal and vertical array. These FEP tubes are in a parallel mode and are attached at one end to the inlet flow distributor sheet and to the outlet flow distributor sheet with appropriate leak proof fittings. The FEP tubes will be adequately supported by integral mounting brackets.
2. In between and around the FEP tubes, lamp rack assemblies will be placed in such a fashion so as to provide uniform and adequate ultraviolet light intensity. The lamp racks slide in and out between and around a row of FEP tube array.
3. Within the FEP UV reactor, all UV sensitive materials will be protected from the UV light.
4. The flow path of the wastewater will be through UV transmitting FEP tubes in such a way that it is a minimum of 99% plug flow. The flow of wastewater will be in sufficient turbulent mode; therefore, the Reynold's number in each unit will be greater than 50,000 at peak daily flow. A turbulent flow will be in such a way that it will constantly scour the inner walls of the AFP tube and help prevent scaling or fouling.
5. The ultraviolet light reactor will be covered from five sides with stainless panels. The sixth side (top) will have access doors. The lamp racks will be accessible through these doors.
6. The air temperature inside the FEP UV reactor shall be maintained by means of heat exchanger. The control of the lamp temperature shall ensure optimum UV light emissions from the UV lamp. The heat exchanger shall ensure that no outside air or dust can get into the UV reactor and settle on the AFP tubes and UV lamps.
7. Cooling of the UV reactor shall utilize an air to water heat exchanger.
8. Each UV Reactor shall consist of 1 bank.
9. During the appropriate stage in the treatment process when the flow from the SBR decant has stopped, the FEP tubes will be capable of being empty, and the UV lamps will be able to be turned off. This will be controlled by the UV panel.

E. Fluoropolymer Tubes

The system incorporates high quality and high clarity fluoropolymer tubes. Tubes are manufactured from virgin resins. The FEP tubes have the following characteristics:

1. High UVC transmission
2. Rated from -99 to 450 F
3. Crack resistant
4. Chemically inert
5. Electrically neutral

F. UV Lamps:

The Ultraviolet Disinfection System will have germicidal UV lamps. These lamps will be located on the lamp rack assemblies. The ultraviolet disinfection lamps will have the following characteristics:

1. A low pressure, high output non-amalgam mercury vapor lamp of the hot cathode type.
2. The filament shall be of the clamped design, significantly rugged to withstand shock and vibration.
3. Each lamp will produce at least 90% emissions at the germicidal frequency of 253.4 (254nm) nanometers.
4. The power consumption will be a maximum of 155 input watts per lamp including ballast losses.
5. The rated UV output at 253.7 nanometers will be a nominal 52 @ UV254
6. The rated UV efficiency shall be a nominal 32% of actual lamp input wattage exclusive of ballast losses.
7. Watts at 100 hours of operation.
8. The minimum UV intensity from the lamps will be >400 microwatts/cm² at 1 meter.
9. Rated lamp life is 13,000 hours
10. Each lamp shall be single ended. Each lamp will have a nominal arc length of 1400 millimeters.
11. Each lamp has a minimum length of 1554 mm.
12. Each lamp will produce no measurable amount of ozone.
13. Each lamp envelope is made of quartz and is capable of transmitting at 90% of UV light at 254 nm.
14. UV lamp base will be either ceramic or metallic
15. Electrical connections will be at one end of the lamp and have 4 pins, dielectrically tested for 2,500 volts.
16. During periods in the process when there is no effluent flow going through the UV reactor(s) the UV lamps shall be turned off.
17. UV Lamps shall be available for purchase from non-related parties or OEM's under agreement from the original UV manufacturer

G. UV Lamp Racks

1. The UV lamp racks will be placed between rows of the FEP tubes.
2. The lamp racks will slide in and out within a track that will be attached to the main frame of the UV reactor.
3. The use of cranes, hoists or other mechanical lifting devices is not required.
4. The lamp rack assemblies will be made from stainless steel.
5. Lamp rack assembly is capable of sustaining intermittent pedestrian traffic on the lamp racks with no damage or deformation.
6. There are no quartz sleeves, O rings, Seals or waterproof connections required for installing UV lamps onto the lamp rack assembly.
7. Electrical mounting sockets are attached to one end of the lamp rack.
8. The other end of the rack are slotted holes to slide lamps in and out during installation and removal of lamps.
9. Quick power disconnects will allow quick disconnect of the lamp rack assembly to the main power.
10. Lamp Racks are removable for service during plant operation without impacting Hydraulic flow or effective disinfection.
11. Removing a lamp rack or module does not result in the disruption of the hydraulic flow.
12. Ballast required for each lamp rack will be incorporated in the Ballast Control Center.
13. The ballast used to energize the UV lamps are high frequency electronic ballasts.
14. The electronic ballasts are rated at 120-277 V + 10% without discernible change of characteristics.
15. The electronics ballast have the following features:
 - a. Power factor greater than or equal to 0.95.
 - b. Electrical conversion efficiency greater than or equal to 90%.
 - c. Ballast will have high frequency phase returns from the UV lamps.
 - d. The ballast operating frequency will be between 40 and 150 KHz.
 - e. The ballast will have a thermal overload protector when ballast skin temperature reaches 75°C.

H. Electrical Ballast Control Center (BCC)

1. The NONCON reactor will be powered by modified Ballast Control Center (BCC).
2. Electrical contractor is responsible for bringing protected power.

4. Each lamp will have a corresponding LED. LED shall be displayed through a window kit. A green LED indicates a functioning lamp and an extinguished LED means lamp out or other problem like damaged ballast.
5. Each system will track operational hours as a way to remind when lamps require changing (8760 to 12,000 hours).
6. The UV monitoring system will measure and display the UV output on a 0-100% basis.
7. The Ballast Control Center will be provided with 12' cable from the unit to the BCC
8. 220 volts 20 Amps Power In.

I. UV Intensity Monitor:

1. One (1) UV module in each UV bank will be equipped with a UV intensity monitor system.
2. The intensity sensors will be placed around a representative FEP tube.
3. The UV sensors will sense 253.7 nm UV light and will provide a signal, which will be displayed on the system display panel.
4. The UV monitor has a 4-20 mA output

J. Control Center

1. A single ballast control center will be provided.

2. The following will be included:
 - Hand/Off/Auto Switch
 - On/Off switch
 - UV Unit Low UV Warning
 - UV Unit UV Intensity

3. The UV System Control Center (SCC/PLC) will provide the following:
 - a. Lamp status
 - b. Run time
 - c. UV intensity

2.3 LAYOUT AND COMPONENTS

Number of reactors:	1
Banks per reactor:	1
Number of BCCs:	1
Modules per bank:	3
Lamps per module:	5
Lamps per reactor:	15
FEP tubes:	6
Reactor Length:	10' 1"
Reactor Height:	26"
Reactor Width:	22"
Connection:	6" RF Flange
Ballast Control Center:	24" x 12" x 30"

2.4 SPARE PARTS

A. The following spare parts will be provided:

2	UV lamps
3	Operation Manual
1	Operators safety kit
1	Cleaning Kit

PART 3 EXECUTION

3.1 SHIPPING AND EQUIPMENT DELIVERY

- A. All equipment and materials shall be inspected against approved Shop Drawings at time of delivery. Equipment and materials damaged or not meeting requirements of the approved Shop Drawings shall be immediately returned to the EQUIPMENT SUPPLIER for replacement or repair.
- B. The CONTRACTOR shall handle and store the equipment and materials in a dry location and protect them from the elements according to the manufacturer's instructions. **DO NOT LET GET WET!!!!!!**

3.2 COMMISSIONING AND START UP

- A. Manufacturer's representative will inspect equipment installation, piping and wiring to ensure proper installation of each component in accordance with approved submittals. CONTRACTOR will at its own cost any modifications required to meet EQUIPMENT SUPPLIER installation recommendations. A written statement certifying that the equipment has been properly installed and interconnected will be provided by the EQUIPMENT SUPPLIER. One (1) four-hour day is required.
- B. Manufacturer's representative will coordinate commissioning of the system and verify that each component of the SYSTEM is ready for operation. SYSTEM commissioning includes testing and calibration of each component of the system. A written statement certifying that the SYSTEM has been commissioned and is ready for operation will be provided.
- C. Manufacturer's representative will coordinate initial system start up to ensure that procedures are being followed.

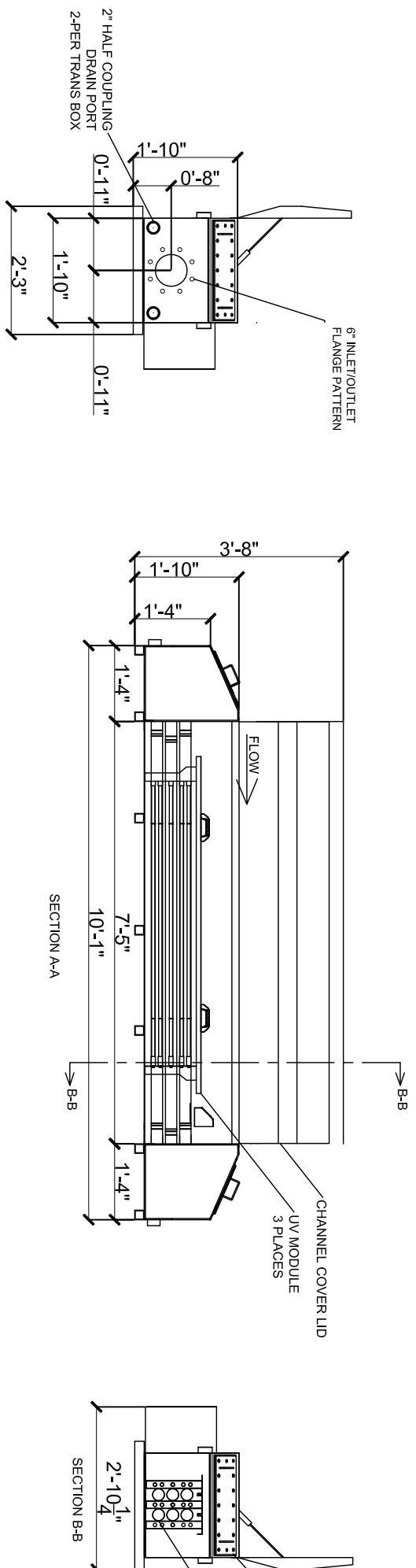
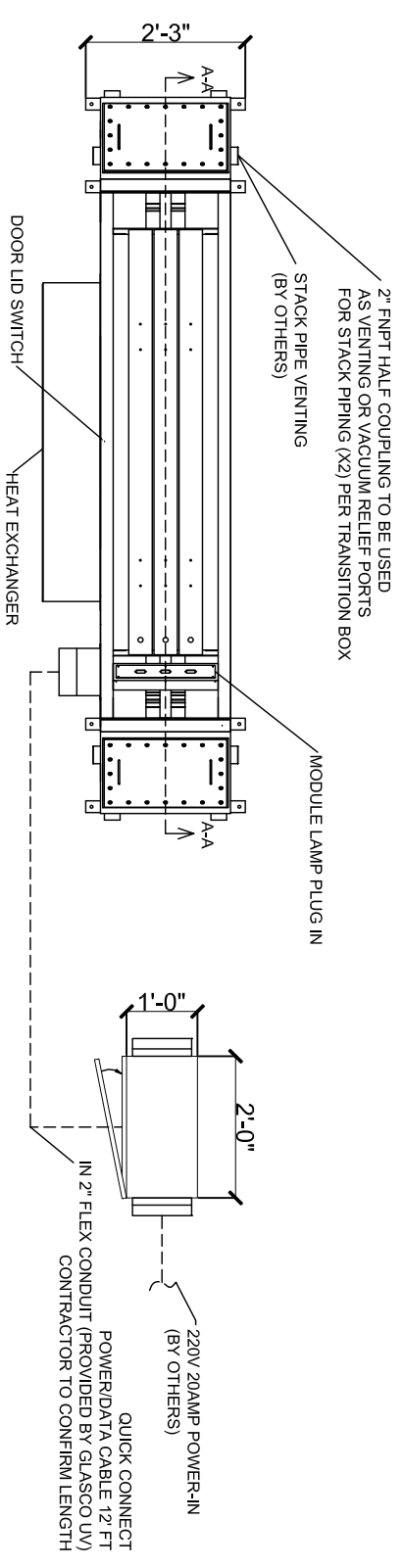
3.3 TRAINING

A. Manufacturer's representative will provide operator training at the site for a period no less than one (1) 4-hr day. Training will include operation, maintenance and troubleshooting for each component of the SYSTEM.

3.4 WARRANTY

- B. The SYSTEM will be free from defects in materials and workmanship for a period of 12 months from Final Acceptance of the system, or 18 months from shipment, whichever occurs later.
- C. A full lamp warranty will be provided in the event that the lamp fails before the first 1,000 hours. The lamp warranty will be pro-rated to 13,000 hours.

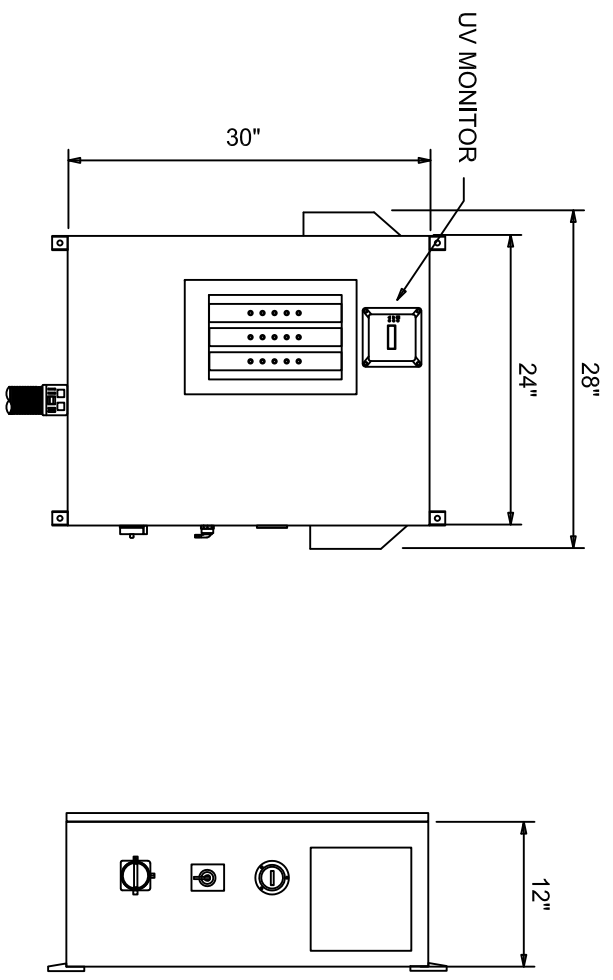
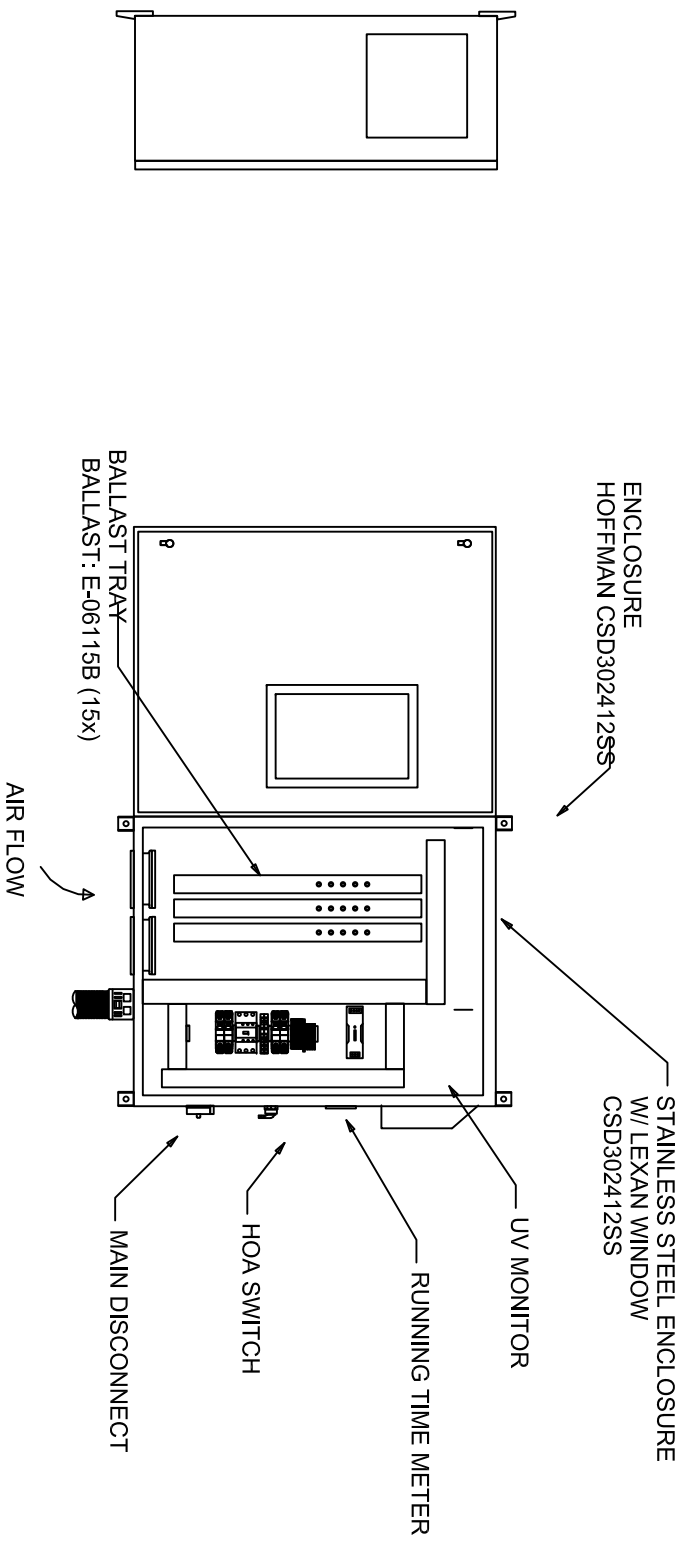
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TOLERANCES UNLESS OTHERWISE SPECIFIED:	MANUFACT:	SIZE:	DATE:
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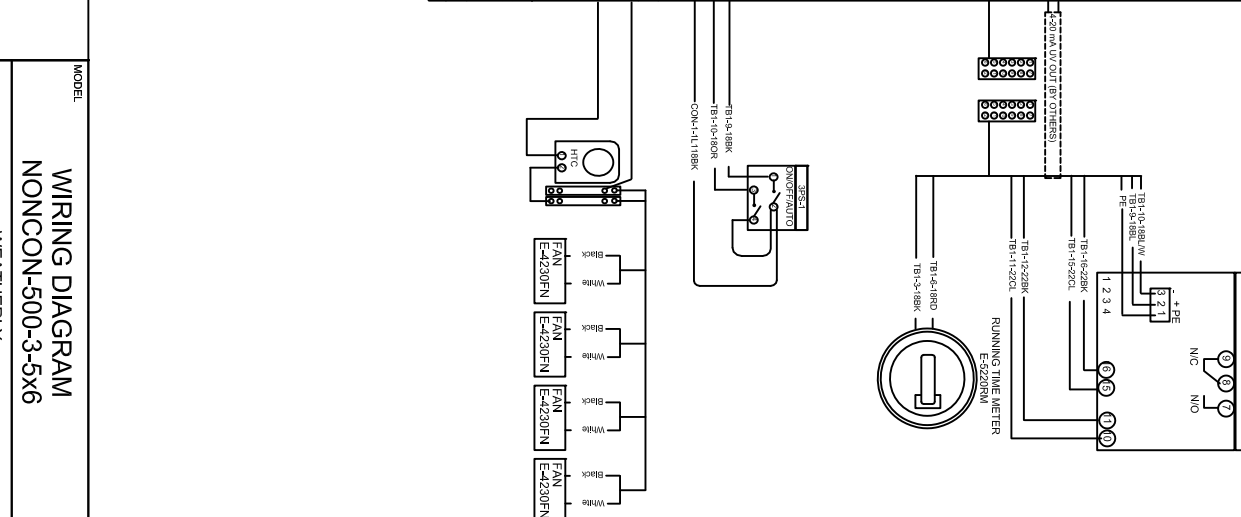
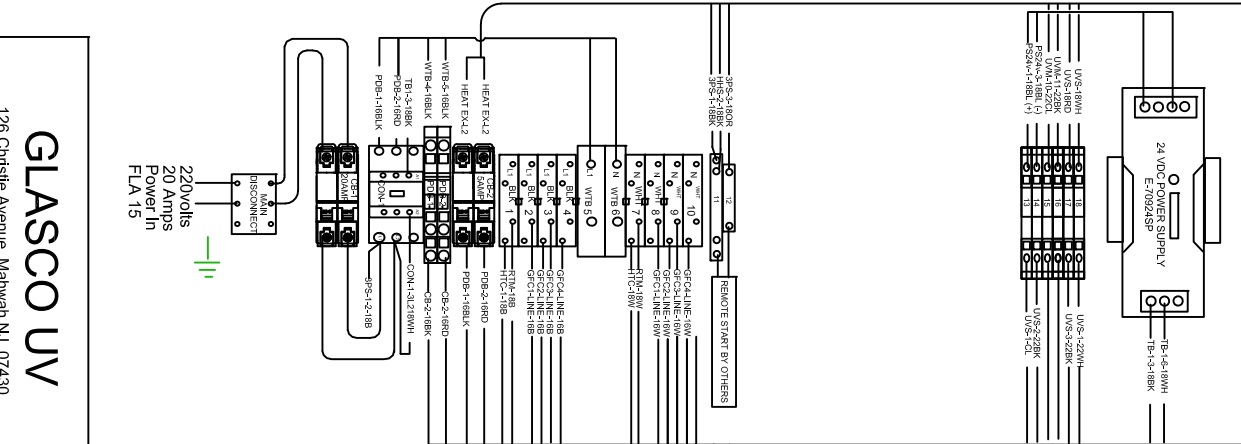
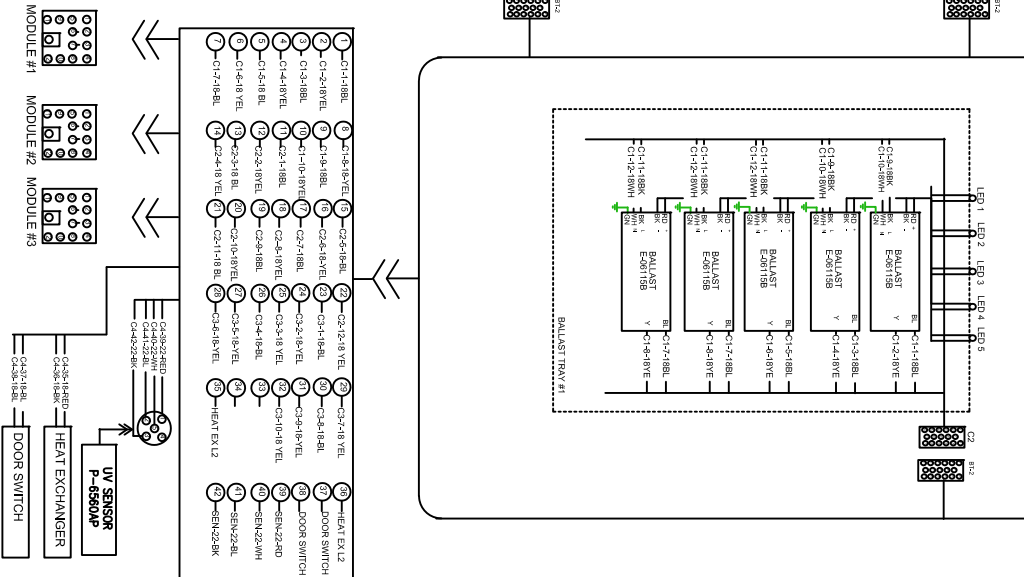
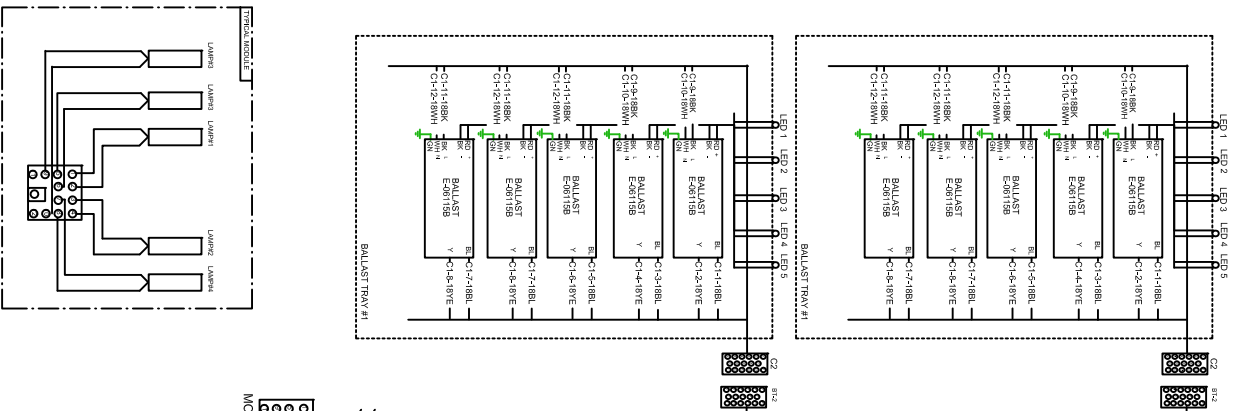
WEATHERLY
2008-26125
NONCON-500-3-5x6



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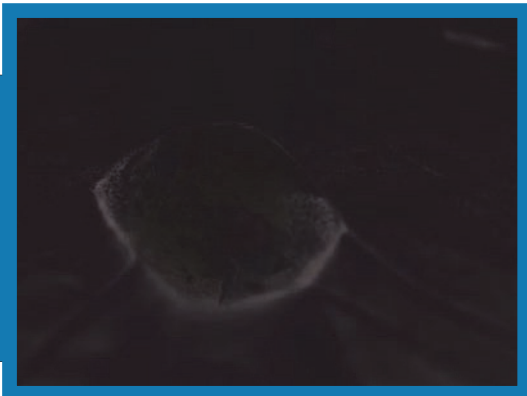
WIRING DIAGRAM NONCON-500-3-5X6

MODEL	NONCON-500-3-5X6		
WEATHERLY			
JOB REFERENCE	2008-26125	REV A	PAGE: 1 OF 1
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GLASCO UY

Customer since 1983



Germicidal Lamps



Creating True Value
and
True Partnership

World Wide Suppliers
of Quality Germicidal Lamps



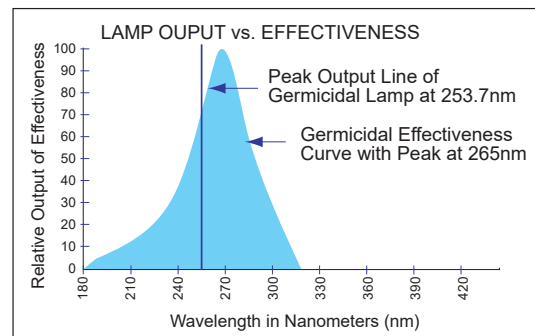
Company Profile:

Founded in 1983, LightSources Inc. has been offering superior products and processes for over 25 years to our OEM customers and is the leading manufacturer of quartz germicidal lamps in the world. In 1993, LightTech Lamp Technology Ltd. was started in Hungary in order to serve the growing demand for germicidal lamps and sleeves for both the European and Asian markets. The combination of our state of the art manufacturing facilities, technology and capability allow us to bring quality products to the market with reduced lead times and high performance. Both companies design and manufacture lamps for a wide variety of special lighting applications spanning multiple market segments within many

industries and applications. While both companies core focus remains on germicidal, photochemical and skin tanning applications, we also manufacture specialty lamps for LCD backlighting and compact fluorescent applications. Both companies are recognized within their respective markets for excellence in product design and manufacture and in meeting our customers' unique requirements for performance, quality and reliability. As true global organizations, our sales staff is available to serve you in several languages.

UV-Action:

- LightSources & LightTech low-pressure, mercury-arc germicidal lamps are specially designed to produce the highest amounts of uv radiation - where 90% of energy is typically generated at 254nm. This radiation is very close to the peak of the germicidal effectiveness curve of 265nm, the most lethal wavelength to microorganisms. (see graph).
- Our germicidal lamps are used extensively in the air purification markets and have been utilized in applications such as food and beverage, medical, HVAC (Heating, Ventilation and Air Conditioning), pharmaceutical and the semiconductor sterilization industries.
- Our germicidal lamps are essential components in the drinking water, wastewater and ground water remediation industries as well.



Ozone-Action:

- "VH" (or Very High ozone producing lamps) generate energy at 185nm in addition to the 254nm wavelength.
- The UV emission at 185nm produces abundant amounts of ozone in air. Ozone is an extremely active and effective oxidizer, destroying microorganisms as well as acting as a deodorizer.
- A primary advantage of the ozone generated by our UV germicidal lamps is that it can be carried through the air into places not easily reachable by direct UV exposure.

Advantages of UV Radiation:

- Environmentally friendly, no dangerous or toxic chemicals that require specialized storage and/or handling and there are no concerns of overdosing. Since no chemicals are added to the air/water there are no process by-products to be concerned with.



- Cost effective - low initial capital cost and reduced operating costs.
- Effective - UV radiation offers immediate treatment process with no requirements for holding tanks or long retention/exposure times.
- Compatibility - UV radiation is highly compatible with other water and air treatment processes while introducing no changes in taste, odor, pH, conductivity or chemical properties of the air/water in which it is used.



High Output (HO) Quartz Lamps

High Output (HO) lamps yield up to 66% more UV output when compared to standard lamps of the same length. HO lamps offer system designers unique opportunities to decrease the number of lamps required without compromising functionality of the system. This has the added potential benefits of reduced system footprint, increased efficiency and/or increased system capacity. HO lamps are produced and are available in the same configurations of standard

lamps. Custom lengths and configurations may also be produced to the customer's specific requirements. The table below represents a sampling of the more common lamp sizes. We can custom design the ideal HO lamp for your unique application.



High Output (HO) Quartz Germicidal Lamps

	Tube Diameter mm	BF - BF mm	Arc Length mm	Power ¹ W	Current mA	Voltage ¹ V	UV output ¹ @ 254nm		Rated ¹ Life hrs.
							μW/cm ²	W	
Low Ozone									
GHO36T5L	15	842	755	87	800	110	260	28	16,000
GHO64T5L	15	1554	1421	155	800	195	395	54	16,000

Note 1: Lamp data is based on measurements performed under laboratory conditions in air at room ambient temperature. Measurements were performed on a high-frequency, current limited electronic ballast and represent average values at 1 meter.



**LightTech Lamp
Technology, Ltd.**

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email: saleschina@light-sources.com

In 1990 the EPA developed the TCLP test (Toxicity Characteristic Leaching Procedure) to simulate the effect of disposing waste in conventional landfills under complex environmental conditions. The method is designed to determine the mobility of toxic material in liquid, solid and multiphasic waste.

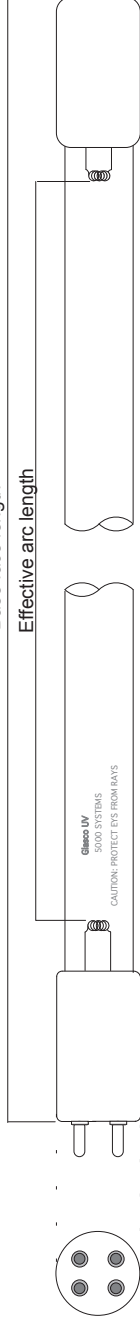
The EPA developed the Toxic Characteristic Leaching Procedure to determine the toxicity of waste. The TCLP test does NOT measure the total mercury content but rather the potential of mercury to leach into groundwater if a waste is disposed of in a landfill. TCLP is designed to simulate the leaching a waste will undergo if disposed in a sanitary landfill. This test includes mercury, lead, cadmium, and other hazardous materials. Passing this test for mercury, for instance, requires a yield of less than 0.2 milligrams per liter upon completion of the test. Lamps that PASS the TCLP are considered as non-hazardous waste by the EPA. We are proud to be among the first to offer the majority of our germicidal lamps as TCLP compliant.

While lamps that pass TCLP may be classified as non-hazardous waste by the EPA, LightSources and LightTech strongly encourage the recycling of spent germicidal lamps. Please contact your local environmental agency for assistance with lamp recycling or visit www.lamprecycle.org.

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Tube material: Ozone free quartz
Overall length(nominal): 62 inches; 1576 mm.
Effective arc length: 56 inches; 1421mm.
Envelope diameter: 0.59 inches; 15 mm.
Base face length: 61.2 inches; 1554 mm.
Base diameter: 0.7 inches; 18.5 mm.

Lamp watts: 155
Base type: Four-pin slimline
Operating amps: 825 MA.
Rated life: 13,000 hours
UV output after 100 hours: 27 watts
Wavelength: 254 nanometer
Manufacturer: Light Sources



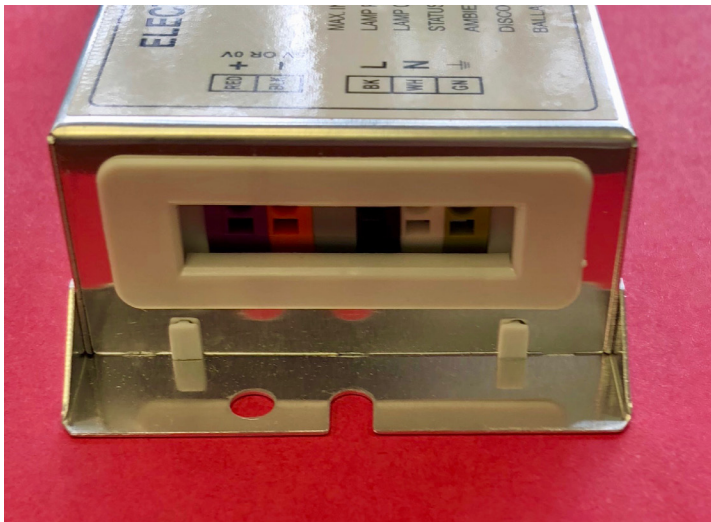
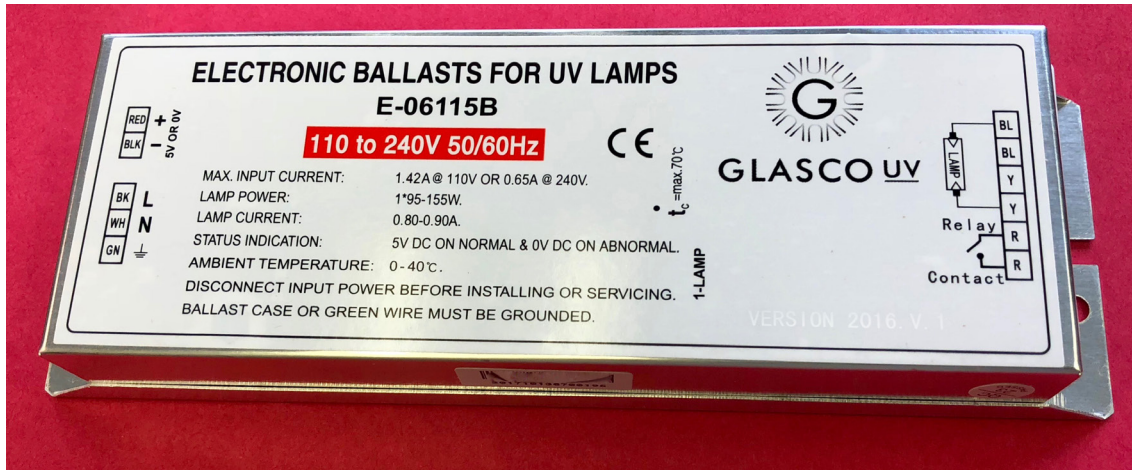
THIS DRAWING CONTAINS DESIGNS AND OTHER INFORMATION WHICH ARE THE PROPERTY OF GLASCO UV. EXCEPT FOR RIGHTS EXPRESSLY GRANTED BY CONTRACT TO US GOVERNMENT, THIS DRAWING MAY NOT IN WHOLE OR IN PART, BE DUPLICATED OR DISCLOSED OR USED FOR MANUFACTURE OF THE PART DISCLOSED HEREIN, WITHOUT PRIOR WRITTEN PERMISSION OF GLASCO UV.

GLASCO UV		TYPICAL UV LAMP	
126 Christie Avenue Mahwah NJ 07430 PH 201-934-3348 FAX 201-934-3388 www.glascouv.com			
MODEL			
DRAWING NO.	DATE	SHEET	1 OF 1
	08/13/2018		

DATA SHEET

(E-06115B) BALLAST

The E-06115B is an electronic developed to operate a single GHO64T5L UV lamp. A ballast regulates the current to a lamp and provides sufficient voltage to start the lamp. Without a ballast to limit its current, a UV lamp connected directly to a high voltage power source would rapidly and uncontrollably increase its current draw.



POWER END



LAMP END

Ballast will be housed in different environment and will be wired into a system that has other electrical components, controls and protection. Any work done on a ballast shall be done with all electricity cut off and proper lock out procedures followed. Please work safely.

Part #	E-06115B
Lamp type	GHO64T5L
Lamp watts (nominal)	155
Lamps powered	1
Ballast type	Instant start
Voltage	110-240 V
Input frequency	50/60 Hz
Operating frequency	30~50KHz
Max input current	1.42 Amps @ 110 V 0.65 Amps @ 240 V
Efficiency	>90%
Power factor	>99
ATHD	10%
Crest factor	<1.7
Status indicator	5 V DC on normal 0 V DC on abnormal
Ambient temperature	0-40 c
Max. temperature	70 c
Grounding	Required
Dimensions	6.75" x 2.5" x 1.5" 171 mm x 64 mm x 38 mm
Weight	1lb (0.41 kg)
Connections	Push to connect
Approval	CE



The E-10624M UV monitor can be used with a variety of sensors. The UV meter is designed to work in conjunction with a UV sensor to provide operational status of a UV lamp. Depending on the sensor and the requirements, the E-10624M can display UV lamp output UV-values displayed in “W/m²”, “mW/cm²” or “%”.

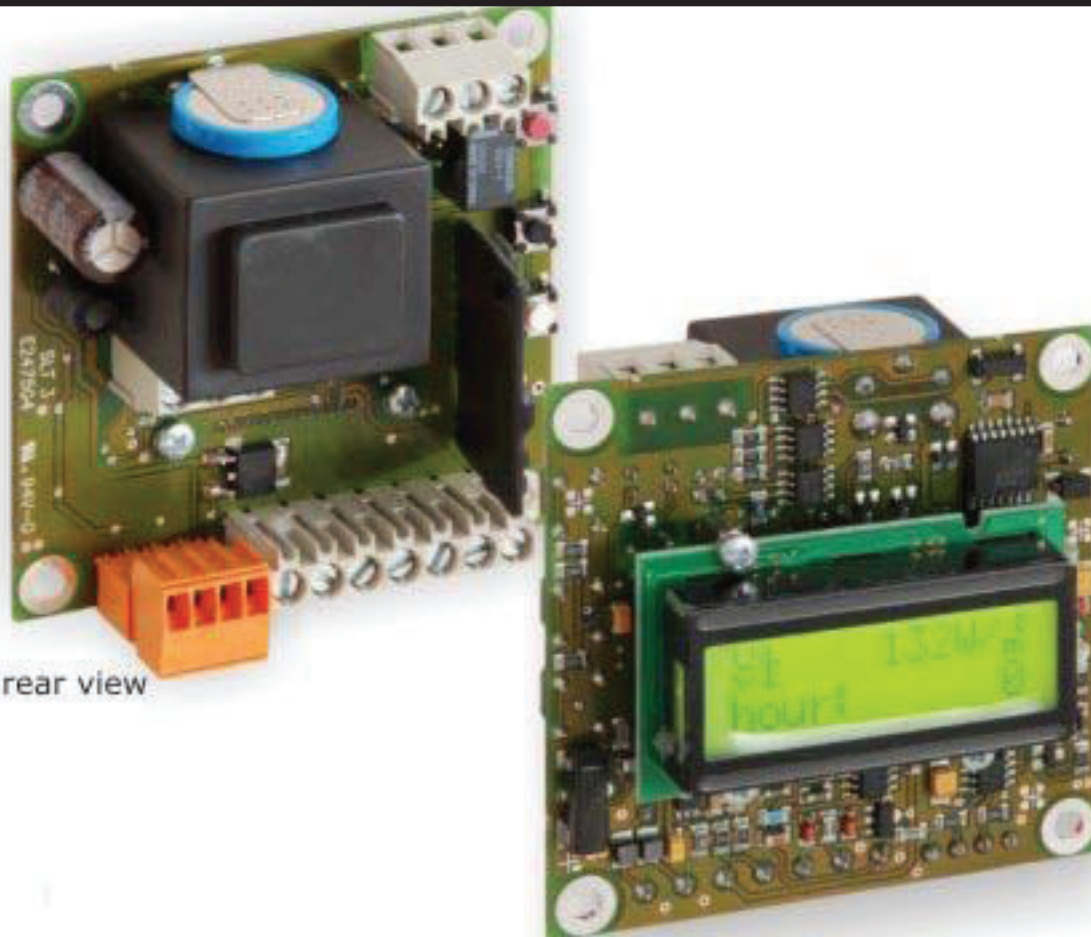
The monitor can reduce maintenance costs by determining exactly when lamps need to be serviced. The continuously monitors relative lamp output from 0% to 100%. It provides a method of determining exactly when lamps need to be cleaned or replacement.

As the lamps age, the monitor tracks the lamp output through the display. A warning threshold can be set to turn on a warning indicator and activate a relay for external control.

Thresholds are programmable from 0% to 100% levels. In addition to the display and alarms, the monitor has a 4 to 20ma output which represents the 0% to 100% on the display. This output can be used for remote monitoring or sent to a data collection systems/



The system is “calibrated” after initial installation of the lamp bank and readjusted after after 100 hour burn in. The monitor is adjusted to indicate 100% for new/clean lamps. Then appropriate operator alert levels are set for the specified decrease in intensity.



Part #	E-10624M
Meter type	Digital for 254 nm
Supply voltage	24 v
Lamp monitored	1 to array
Operation temperature	113F
Ambient temperature	32 to 104 F
Size	3" x 3" x 2"
Hour counter	Resettable
Display	Multicolor 2 line LCD backlight
UV alarm	Potential free relay
UV value	Forwarded via 4-20 mA
Country of origin	Germany



UVC-Sensor E-4060SM

Analog 1/4-inch UV sensor



Features

- Sensors are intended for monitoring UV lamps in water/air purification and disinfection systems for detecting absolute UV irradiance values
- UV values are indicated in "W/m²", "mW/cm²" or "%"
- UV values are indicated in "W/m²", "mW/cm²" or "%" with the appropriate UV-monitor via 4-20mA, 0-2V or 0-10V interface
- Sensors incorporate internal digital signal processing and an integrated signal converter for the appropriate analog industrial interface for optimal operation with analog PLC
- All digital UV-sensors are adjusted to cover the complete specified measurement range
- Low Pressure Types: range 2...500W/m²

Technical Specification

Supply Voltage: 12...24V DC

Sensitive Element: silicon carbide diode (SiC)

Spectral Range: 210 - 380nm (220 - 290nm with UVC filter on request)

Operation Temperature: 0 - 60°C (32 - 140°F)

Max. Pressure / IP Code: 10bar at front / IP64 on terminal ends if connected to appropriate sensor cable

Body Material: stainless steel 1.4404

Mounting: pipe thread ISO228 G¼ (use MF001-A to adapt to G1)

Wiring: ready-to-use GLASCO sensor cables available in several lengths

UV light is harmful to your eyes and skin. Exposure to UV light can cause blindness or other permanent damage.

If you work safely, you will not encounter problems. We REQUIRE operators to use protective eyewear and faceshields when performing work on the system.

The faceshield described below are good for UV systems. This particular model has a brand name of ELVEX, but others are commercially available.

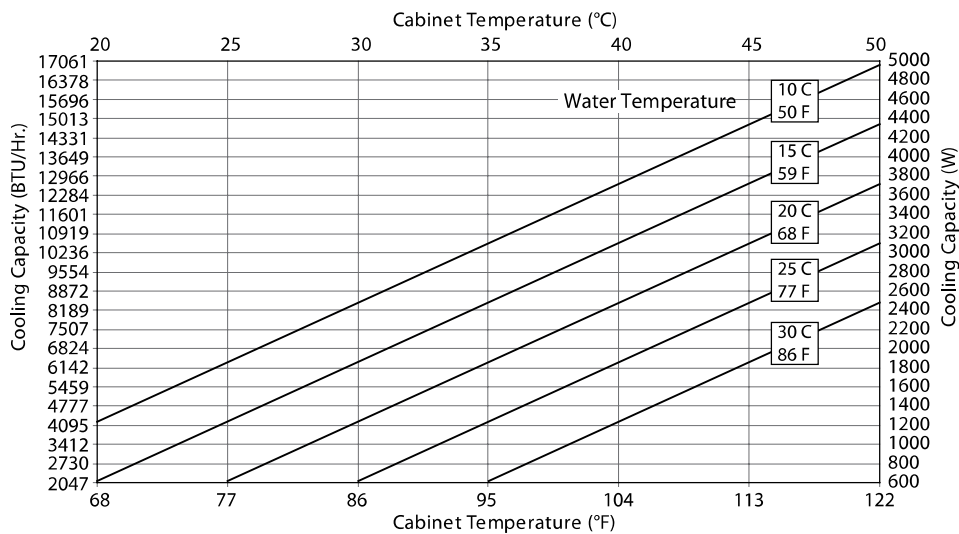
Color:	Clear
Material:	Lexan Polycarbonate
Thickness:	0.07 inches
Heat Tolerance:	up to 265 F
UV Protection:	99.9%
Standard:	ANSI Z87.1-2003 requires protective glasses under face shields.



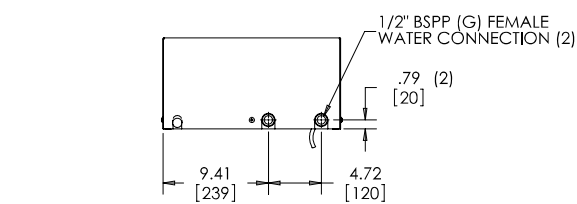
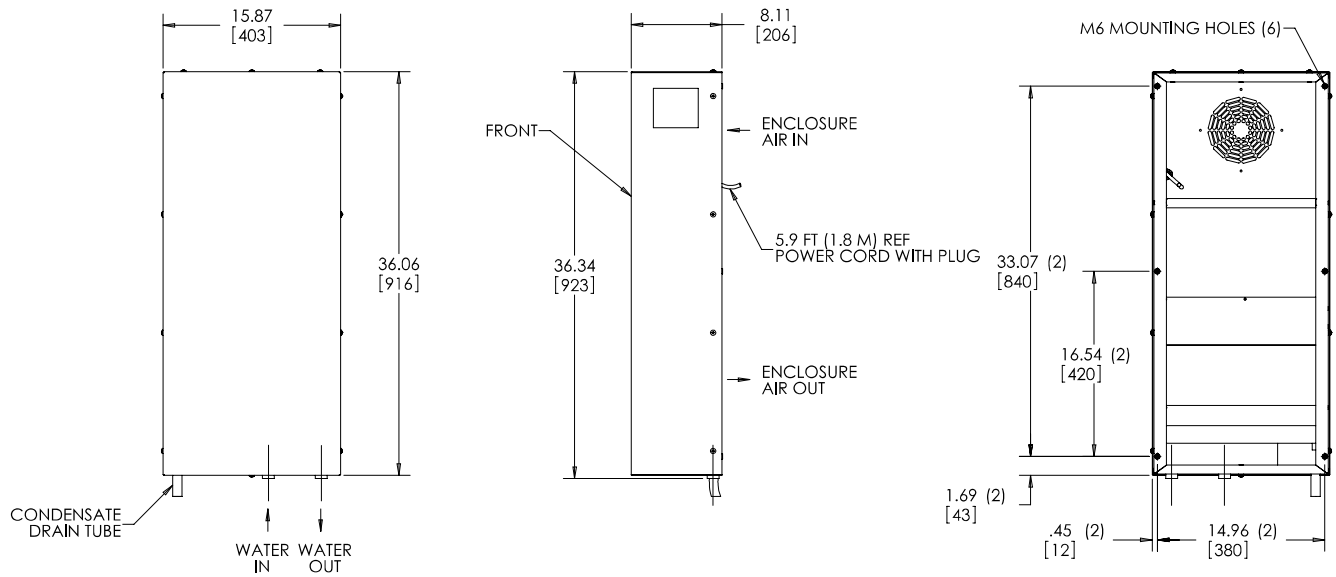
Performance Data **WCHE06 Models 3100 Watt**

CATALOG NUMBER		
Indoor Model	WCHE06926002	WCHE06926005
Indoor Model Stainless Steel		WCHE06926006
COOLING PERFORMANCE		
Nominal:		
BTU/Hr. @ Δt 25 C	10577	10577
Watts @ Δt 25 C	3100	3100
Refrigerant	NA	NA
Refrigerant Charge (ounces/grams)	NA	NA
Inside Cabinet Temperature Range:		
Maximum (°F/°C)	122/50	122/50
Minimum (°F/°C)	50/10	50/10
Ambient Operating Temperature Range:		
Maximum (°F/°C)	158/70	158/70
Minimum (°F/°C)	50/10	50/10
Flow at 0 Static Pressure:		
Internal loop 50 Hz (Airflow: CFM / m ³ /hr.)	507/860	507/860
External loop 50 Hz (Waterflow: GPM @ 95 F)	2.20	2.20
Internal loop 60 Hz (Airflow: CFM / m ³ /hr.)	507/860	507/860
External loop 60 Hz (Waterflow: GPM @ 95 F)	2.20	2.20
ELECTRICAL DATA		
Rated Voltage	230	230
Frequency [Hz]	50/60	50/60
Operating Range	+/- 10%	+/- 10%
Max. Power Consumption (W at 50/60 Hz)	115	115
Max. Nominal Current (A at 50/60 Hz)	1	1
Starting Current (Amps)	1.20	1.20
Agency Approvals	CE, EAC	CE, EAC
Power Input Description	Cord with NE MA 6-15 plug	3 meter cable with open ends
ENCLOSURE PROTECTION		
UL Type	IP55	IP55
CONTROLLER		
Description	Basic Mechanical Thermostat	
Thermostat Location	Behind front cover, near the fan	
Factory Thermostat Setting (°F/°C)	95/35	95/35
SOUND LEVEL		
At 1.0 Meters	58 dBA	58 dBA
UNIT CONSTRUCTION		
Material	Mild Steel Sheet Metal Type 304 Stainless Steel	
Finish	RAL 7035 light-gray, semi-textured powder-coat paint Stainless Steel	
UNIT DIMENSIONS		
Height (in./mm)	36.41/925	
Width (in./mm)	15.75/400	
Depth (in./mm)	8.07/205	
Weight (lb./kg)	46.30/21	

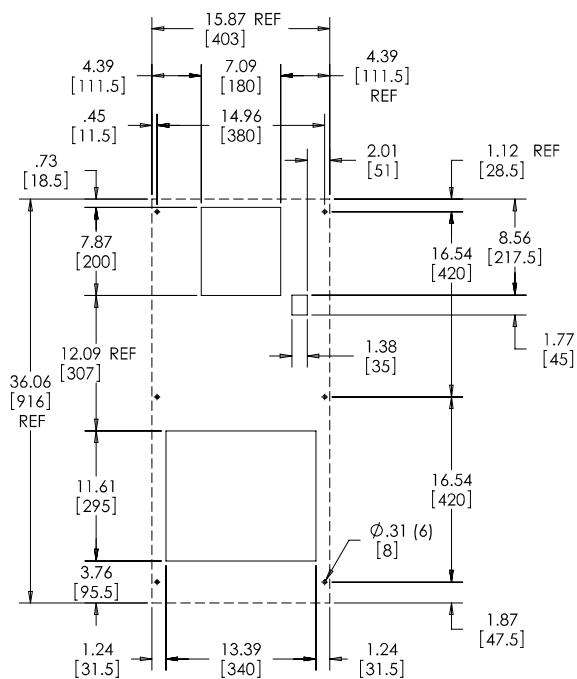
Performance Curves for WCHE06 Models 3100 Watt



WCHE06 Models 3100 Watt



NOTE: "G" to NPT adapting valves are included and shipped with the unit.



CUTOUT DIMENSIONS

89091147

Visit www.PentairProtect.com to download 2D and 3D CAD drawings into the overall design of your electrical system.

NONCON

S E R I E S



PRODUCT OVERVIEW

The “NONCON 5000” Series is a “flow through” fluoropolymer style of ultraviolet (UV) water and wastewater disinfection systems.

Unlike our other systems where the UV lamps are immersed in the water (using protective quartz sleeves), the “NONCON 5000” uses non conductive transparent fluoropolymer tubes to transport the water close to the UV lamps.

The UV lamps are positioned in the air and shine germicidal rays (@ 254 nm) through the fluoropolymer tubes directly at their intended targets, microorganisms. Lamps are not in the water.

STANDARD FEATURES

- Stainless steel disinfection reactor **OR**
- Open channel insert for large flows
- Low-pressure high-output UV lamps
- Fluoropolymer flow through tubes
- Multi-voltage power (120-277)
- UV monitoring
- Lamp status and run time indicators
- 45 psi pressure-rated
- Remote electronics
- Environmental temperature management
- Air release valves
- Drain ports

NONCON 5000



GLASCO UV

NONCON UV DISINFECTION SYSTEMS

Systems use special fluoropolymer (FEP) tubes to transport water, wastewater and other liquids in close proximity to the UV lamps. The fluoropolymer tubes are transparent and allow UV light in the 254 nm range to penetrate the tube's walls and disable microorganisms. Lamps are positioned around the tubes in a reflective reactor.

The tubes are manufactured in the United States from a high quality polymer resin. The tubes, which are highly transparent, are neutrally charged (the “**non-conductive**” in “NONCON”) and thus, not susceptible to fouling and scaling from positively charged minerals. In traditional UV systems, the quartz sleeves need to be cleaned.

Over 100 years ago, scientists found that when pathogens were exposed to UV light, their reproduction was limited. The light resided in the UVC range of the spectrum. Specifically, they discovered that light in the 254 nanometer (nm) range was the most effective. When pathogens are exposed to UV light, their cells become damaged and this inhibits reproduction. UV light damages the cell's DNA and RNA and once damaged, they are unable to replicate and therefore, rendered harmless.

The amount of damage is a result of the intensity of the UV light multiplied by the time the water is exposed to the light (time x intensity). The dosage, referred to as microwatts, is often expressed as mJ/cm². Doses > 30,000 microwatt dose (30 mJ) are accepted for wastewater disinfection.



OPTIONS

- 80 psi
- PLC controls
- Open channel
- Skid mounting

APPLICATIONS

- Wastewater
- Process waters
- Opaque liquids
- Juices, milks, beverages

NONCON 5000



GLASCO UV

www.glascouv.com

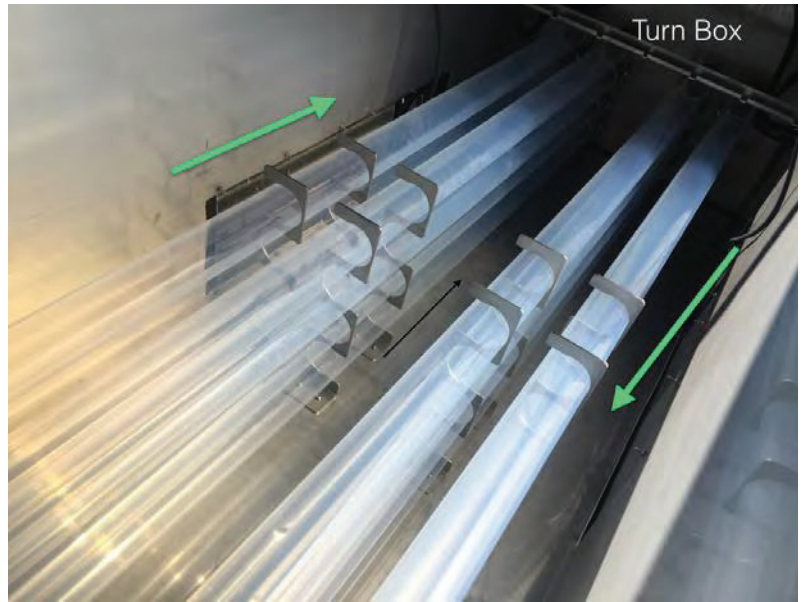


NONCON 5000

NONCON OPERATION

Facility connects to the “NONCON” reactor via flange or in the case of larger projects, directly into a poured concrete channel. Water or wastewater enters a pressurized transition box and then feeds into a bank of transparent tubes. Water and wastewater travels through the tubes and exits into the discharge pressure box. Tubes are rated at 45 psi.

Systems are designed based on a peak flow rate, a UV transmission percentage (UVT%) and information related to the plant’s discharge permit. The number of tubes and associated UV lamps are based on the biological testing (bioassay) testing and computational fluid dynamic (CFD) modeling.



NONCON OPERATION (SYSTEM CONTROLS AND REDUNDANCY)

NONCON uses a remote Ballast Control Center (BCC). This stainless steel enclosure provides a single point of control for operators and removes sensitive components from reactor, which may be damaged in the event of moisture or flooding. The BCC houses ballasts, power controls, operating displays and UV monitor in a controlled environment. NONCON lamps (low-pressure high-output) are sensitive to temperature. To maintain optimal lamp temperature, reactor will be provided with a heat exchanger.

System has flexibility when designing for redundancy. Standalone, banks “in-series”, “U-turn” box (shown above) or in parallel. Unlike traditional open channel UV systems, the FEP tube systems have very low maintenance costs due to the lack of quartz sleeve fouling.

NONCON 5000



NONCON

S E R I E S

Information, Operation, Instruction and Maintenance Manual

PROJECT: Typical EXAMPLE ONLY

UV SYSTEM: NONCON

MODEL #: NONCON-

VERSION: VERSION 1.0

DATE: August 27, 2018

NONCON

S E R I E S

INSTALLATION, OPERATION AND MAINTENANCE MANUAL

NONCON SERIES

Fluoropolymer Ultraviolet Disinfection Systems



Manufactured by:
Glasco Ultraviolet
126 Christie Street
Mahwah, NJ 07430
(201) 934-3348 Fax (201) 934-3388
www.glascoouv.com

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I. Safety Instructions

In order to protect end users and operators from injury, safety precautions must be followed. This Installation, Operation and Maintenance Manual outlines important safety issues. The following WARNING SYMBOLS will be found throughout the manual to alert the end users to take important precautions:



INFORMATION. This symbol signifies helpful information.



CAUTION This symbol indicates a potentially dangerous situation. Failure to adhere to this warning may lead to serious injury and or death.



ELECTRIC SHOCK. This symbol signifies helpful information and indicates a potentially dangerous situation. Failure to adhere to this warning may lead to serious injury and or death.



EYE PROTECTION. This symbol indicates that UV resistant eye protection must be worn to protect from UV light as well as debris.



HAND PROTECTION. This symbol signifies that hand protection must be worn to protect the lamps from skin oils as well as protect the operator from UV light and sharp materials caused by a broken lamp.

II. General Information



Please read this manual prior to installing, starting up and operating the equipment. The equipment uses sophisticated technology, but has been designed to make operation and maintenance easy. If you have questions or feel uncomfortable performing any of the required tasks, please contact GLASCO UV. Do not attempt any service if you are untrained in electrical and mechanical operations of industrial equipment.

All local safety codes and regulations should be followed. As with servicing all wastewater plant equipment, ensure that your safety clothing and your tools are in good working order. In addition and a helpful reminder: be careful of slip, fall, overhead and trip hazards around the plant.

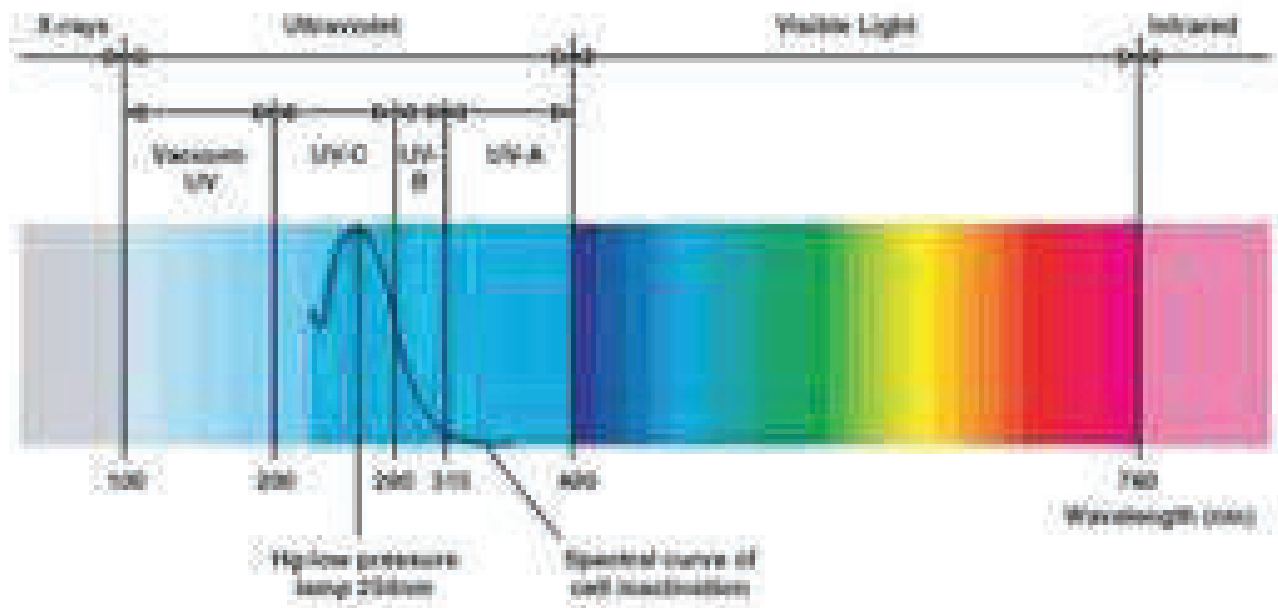


The UV system needs to be maintained and does require YEARLY replacement parts. GLASCO UV recommends that key spare and replacement parts be kept on hand. In order for the system to operate properly, please only use genuine factory parts. Failure to use genuine parts will void the warranty and may damage the system.

1. About Ultraviolet (UV) Disinfection

The technology uses UV light to target and disable disease-causing microorganisms (pathogens).

Over 100 years ago, scientists discovered that if you exposed pathogens to UV light, their reproduction was limited. The UV light source that they used, resided in the UVC range of the light spectrum. Specifically, they discovered that light in the 254 nanometer (nm) range was the most effective wavelength. Today, specialized UV lamps are used for a variety of disinfection applications.



When wastewater pathogens are exposed to UV light, their cells become damaged and this damage inhibits reproduction. The UV light, produced by a special UV lamp, damages the cell's DNA and RNA and once damaged, they are unable to replicate. This physical process renders them harmless.

The amount of damage is a result of the intensity of the UVC output multiplied by the time the water is exposed to the light. The applied dosage is expressed as milliwatt seconds per square centimeter (mW.s/cm²) or millijoules per square centimeter (mJ/cm²). Dosages of 30,000 uW.s/cm² (30 mJ cm²) are common for meeting a typical 126/100 200/100 ml (fecal/ecoli) discharge permit. Dosage will be inline with permit requirements.

Using UV for disinfection is a practical and acceptable technology, but do not confuse disinfection with sterilization. Sterilization means the complete and total inactivation of microorganisms.

a) Why are plants and operators selecting UV technology?

- To move away from chlorine processes
- UV is considered a green technology
- No chemicals are added, so there is no need for chemical removal
- No chemical storage
- UV works instantly without requiring a residence time
- Easy maintenance

b) What are limitations of UV technology?

The quality of the effluent entering UV system needs to be monitored. Effluent that is outside of the design parameters may cause permit violations.

Primary concerns relate to the UV transmittance (**UVT**) of the water and the Total Suspended Solids (**TSS**). While turbidity can impact UV system efficiency, UVT and TSS are the primary measurements.

UVT is the measurement of UV absorbing materials in the water. The levels are determined by using a 254 nm spectrophotometer to compare distilled water (100%) to an effluent sample through a 1 cm path. Many plants average 65%, but higher and lower values are not uncommon. The UVT% measurement is one of the primary numbers used to design a system so it is of great importance to ensure that the plant operates within design parameters.

Changes in wastewater UVT can be due to industrial wastes, breakdown in upstream processes or high mineral content (iron).

TSS is the measurement of solids in the water that will interfere with the delivery of UV light. Most plants have to meet a certain permit level (i.e. 30 mg/l) in order to satisfy the discharge permit. The solids, which vary in size, not only prevent proper UV light transmission, but actually house pathogens. The TSS number is impacted by the upstream processes (filter, membrane, clarifiers, etc.).

In addition to the above issues, the UV system needs to be cleaned on a periodic basis based on effluent conditions.

Cleaning involves using a brush and swapping it through the tube. This will need to be done based on plant operating conditions. Low flows or low pressure flows may lead to biofilm or other slime build up. Higher flows and higher pressure flows have a way of pushing debris and cleaning tube.

2. Preparation for Installing UV System

The following information is meant to be used by engineers, contractors, operators and owners to help better understand the technology, its benefits and potential hazards.



a) Important Safety Information

UV light is extremely harmful to eyes and skin and will cause burns. Do not look directly or indirectly at the UV light. Do not expose your skin for any prolonged time. Use protective clothing and eyewear (make sure it is UV resistant) when servicing equipment.

If accidentally exposed to UV light for an extended period, immediately seek medical attention. Symptoms for eye exposure include burning, itching and redness. Symptoms for skin exposure are similar to sun burn.

Use gloves when handling lamps. The reason is that skin oils will adhere to the lamps and prevent UV light from properly emanating. If the lamps become dirty, wipe them with a lint free cloth with denatured alcohol.

UV lamps can become razor sharp if broken.

b) Optimizing System Performance

The UV lamps need to be maintained. As a general rule, the lamps need to be changed after a year of usage (9,000-12,000 hours).

c) Common Plant Design

Your UV system has been designed on a set of parameters. These parameters are described below and are based on the entire plant operating properly. Ensure that pre-processes are providing good effluent that meets the design parameters. If you have concerns, please test the effluent's UV transmission (UVT%) and compare it to the design parameters.

d) Environmental Issues Relating to UV Lamps

UV lamps need to be recycled like fluorescent lamps because they contain mercury. Please follow your local recycling laws. Please visit www.lamprecycle.org to find a recycler in your area. In the event that you are unable to find a disposal location, please contact GLASCO.

e) Receiving UV Equipment and Spare Parts

It is important to compare the shipment's contents to the actual packing list. Any deviations must be brought to the factory's attention. Additionally, lamps need to be inspected for damage. If shipment or parts are damaged, immediately contact factory and hold broken contents and their containers for inspection by shipping company.

f) Electrical Configuration and Maintenance

The UV disinfection system uses sophisticated electronics and specialty lamps. Unlike other equipment in the wastewater plant, the UV system's electronics require clean power. The system has been designed to use a certain specified voltage. UV equipment must be protected from surges. If the plant is susceptible to brown outs, please contact factory. Electronics may have fan cooling. If equipped, please clean filters.

III. Components, Assembly and Operation

1. Components

The UV disinfection system will come with a number of components. The following list highlights the main ones.

- Stainless steel disinfection tube reactor – with cooling (environmental management system)
- Ballast Control Center (BCC) – houses electronics, controls, PLC and displays
- UV Modules
- Ultraviolet lamps
- UV monitoring probe
- Spare parts
- Safety supplies (optional)
- Warranty information

a) **Stainless Steel Disinfection Reactor**

The horizontal fluoropolymer tube reactor system is designed with an inlet and outlet that will need to be piped to and from the facility's piping. The reactor comes with UV modules, cooling system, pressure release valves and UV monitoring system.



Water comes through the inlet box, into the pressurized disinfection tubes and out the pressurized outlet box. NONCON comes in gravity (45 psi) and high pressure (80 psi) configurations.

i) **Environmental Management**

The UV lamps create heat and if not properly cooled, they will experience problems. High heat lowers UVC output. It diminishes lamp life. It can put a strain on the electronic ballasts. And high heat can damage the FEP Tubes.

To address this situation, the system will come equipped with an environmental management system (EMS). This may include fans, heat exchangers or other technologies that are designed to maintain an optimum operating temperature.

ii) Utilities

The system uses a heat exchanger to keep the chamber cool. From time to time you will need to top off with anti freeze.



b) Ballast Control Center (BCC)

The BCC will need to be mounted near the channel. Prior to final placement, check this distance before final placement.

The BCC requires clean power. Information on voltage and cycle will be on the nameplate. Power surges and fluctuations may damage the electronics of the system and void the warranty.

The BCC will contain the ballasts and other electrical controls. Fans have been integrated to cool the electrical components. The BCC will display operation status via PLC. Ensure that the fan filters are checked on a periodic basis.



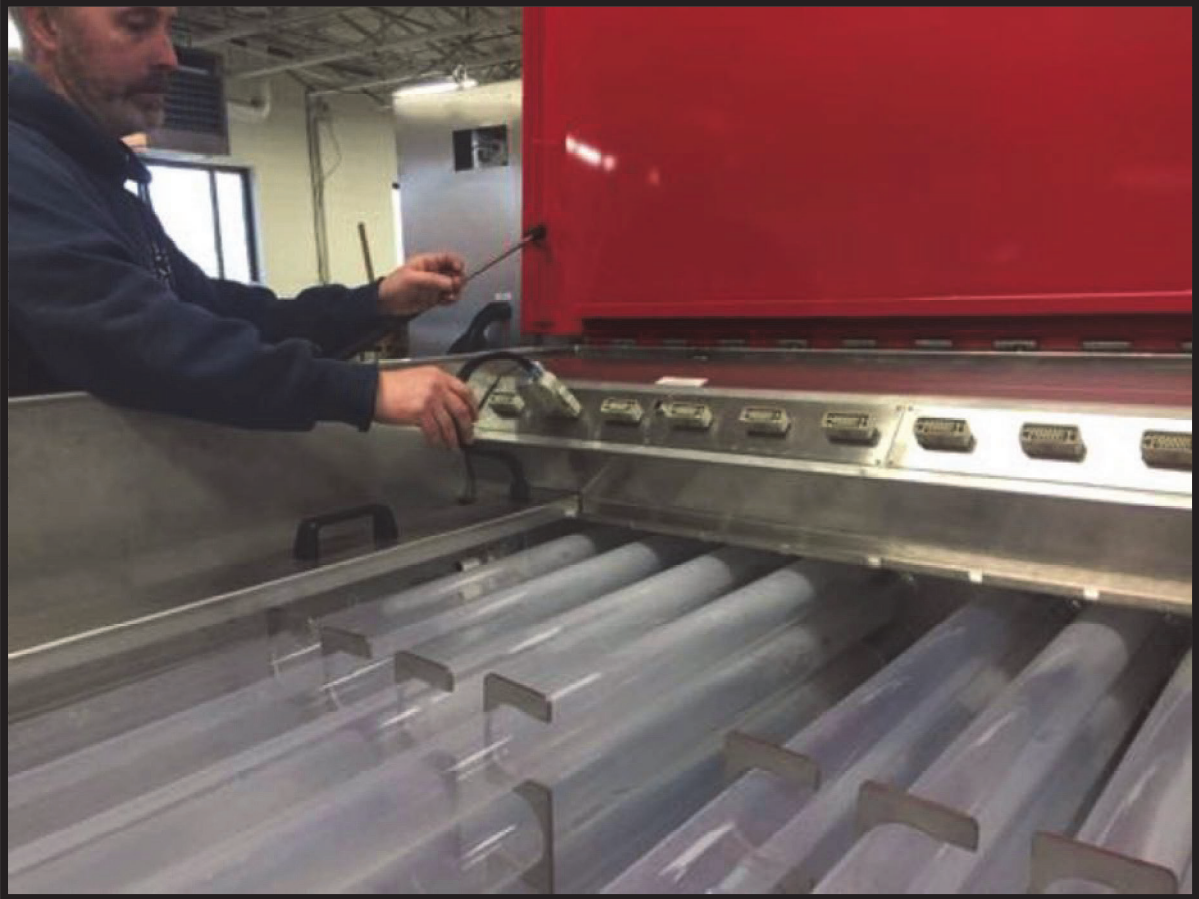


The BCC needs to be located within a certain defined distance from the unit. Measure distance before final placement. Operators will be able to use displays for maintenance.

c) Disinfection Lamp Modules

The disinfection modules are designed to hold the UV lamps in the UV reactor around the disinfection tubes. They are constructed of stainless steel and hold the lamps.

To connect or disconnect the module, simply unplug the module cable.





The UV lamp plugs into the connector on one end and is supported on the other end. Push lamp end cap into the module first and then plug into connector.

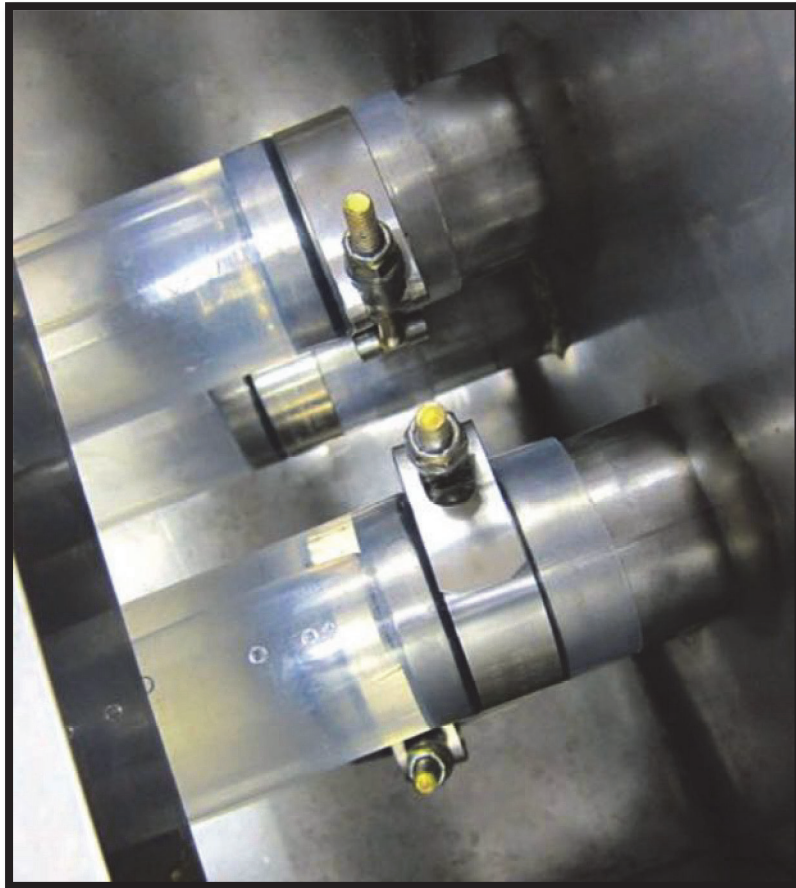
d) Disinfection Flow Through Tubes

The disinfection modules are designed to hold the UV lamps in the UV reactor around the disinfection flow through tubes. The “NONCON 5000” uses non-conductive transparent fluoropolymer tubes to transport the water close to the UV lamps.

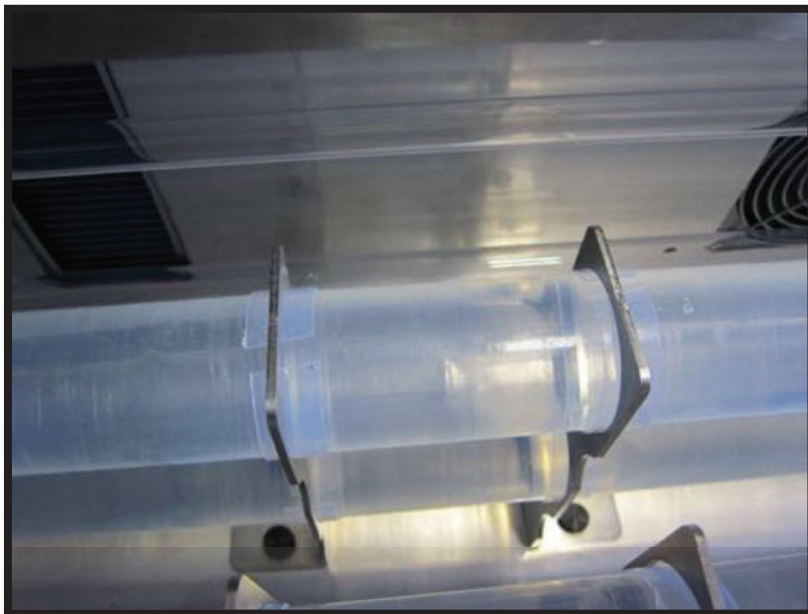
The UV lamps are positioned in the air and shine their rays (@ 254 nm) through the fluoropolymer tubes and to their intended targets, microorganisms. The lamps are not in the water.

The tubes have a rating of 45 psi (the IP Series can handle 80 psi). When working around the tubes, insure that the pressure in the system has been released.





Tubes are attached to their corresponding stainless steel ports via a band clamp. After initial start up, check and re-tighten. Water and vibration may have loosened in shipping or start up.



A stainless steel support structure holds the suspended tubes. Tubes have protection against the stainless supports to prevent vibrations from cutting tubes.

2. Lamps Inspection and Installation



Insure that lamps have not been broken. We recommend that you use gloves when handling lamps to prevent them from becoming dirty. If lamps have broken, take extra care to prevent yourself from becoming injured.

Take the module and place it on a clean work surface or hang in on a factory supplied optional wall rack. You will need to install a lamp into each lamp holder.

3. Ballast Control Center (BCC)



The plant electrician will need to bring protected power to the BCC. Your UV system has been designed to work on a constant power supply. The electronic ballasts are susceptible to power fluctuations. Low voltage will cause ballast failures. The ballasts have been labeled with the voltage and cycle. It is imperative that the appropriate voltage range is maintained. If you have questions, call factory. Failure to provide adequate power will void the warranty.

This configuration incorporates a remote modified NEMA style enclosure with window kit. The enclosure will have been designed for indoor or outdoor use. If used in an outdoor environment, consult factory for recommendations. Glasco recommends protecting the enclosure from high heat and extreme environmental conditions. If this information was not taken into consideration during the design phase, the BCC may need to be modified.

The BCC is generally provided with basic displays: Lamp on/off indicators, running time meter and UV intensity meter. The BCC will have an Hand/Off/Auto.

The BCC contains ballasts. The ballasts drive the UV lamps. In order to keep the ballasts running at optimum performance, it is necessary to cool the ballasts. As ballasts heat up, they become exponentially less efficient. The BCC will come with a fan cooling system. Insure that the fans are operational and filters are checked and cleaned on a periodic basis.



a) BCC OUI (See PLC SOP document)

1) Lamp Status

2) Running Time Metering

3) Ultraviolet Output

After 100-hour burn-in, the UV display is procedurally set to Full-Scale (100%). This is done during nominal operating and water quality conditions. This UV reading is not NIST calibrated to absolute mW/cm^2 intensity. It is simply a relative % of a single lamp. Initial setup is 100 %, since everything is brand new.

When inserting the sensor, insure that the actual sensor is touching the lamp. This will allow you to get the best reading.



See attached O&M Manual for your UV monitoring system

b) BCC Electrical

1) Over-Current and Ground Fault Protection

The system features Over-current protection via Circuit Breakers, as well as Ground Fault Protection via GFCI devices. These are housed in the BCC.

Circuit Breakers CBs are provided to protect a single channel Module or groups of channel Modules. Some systems are wired with multiple CBs, for example, so neighboring Modules remain operating if one CB trips. One CB handles Odd numbered Modules, while one CB protects Even numbered Modules. Your system will be clearly labeled inside.

A GFCI is provided, within the Ballast Control Center, and is dedicated for each individual reactor Module. So a fault in any single Module does not affect the disinfection performance of any other Module.

The functions of Over-current and Ground Fault protection may be combined in a single device. These are wired for dedicated individual Module protection like the GFCI discussion above, when used.

2) Electronic Ballast

The provided electronic ballast is specially designed for germicidal performance in challenging water treatment conditions. The ballast controls the start-up and maintenance of the conductive arc in the mercury vapor lamp under conditions of varying temperature.

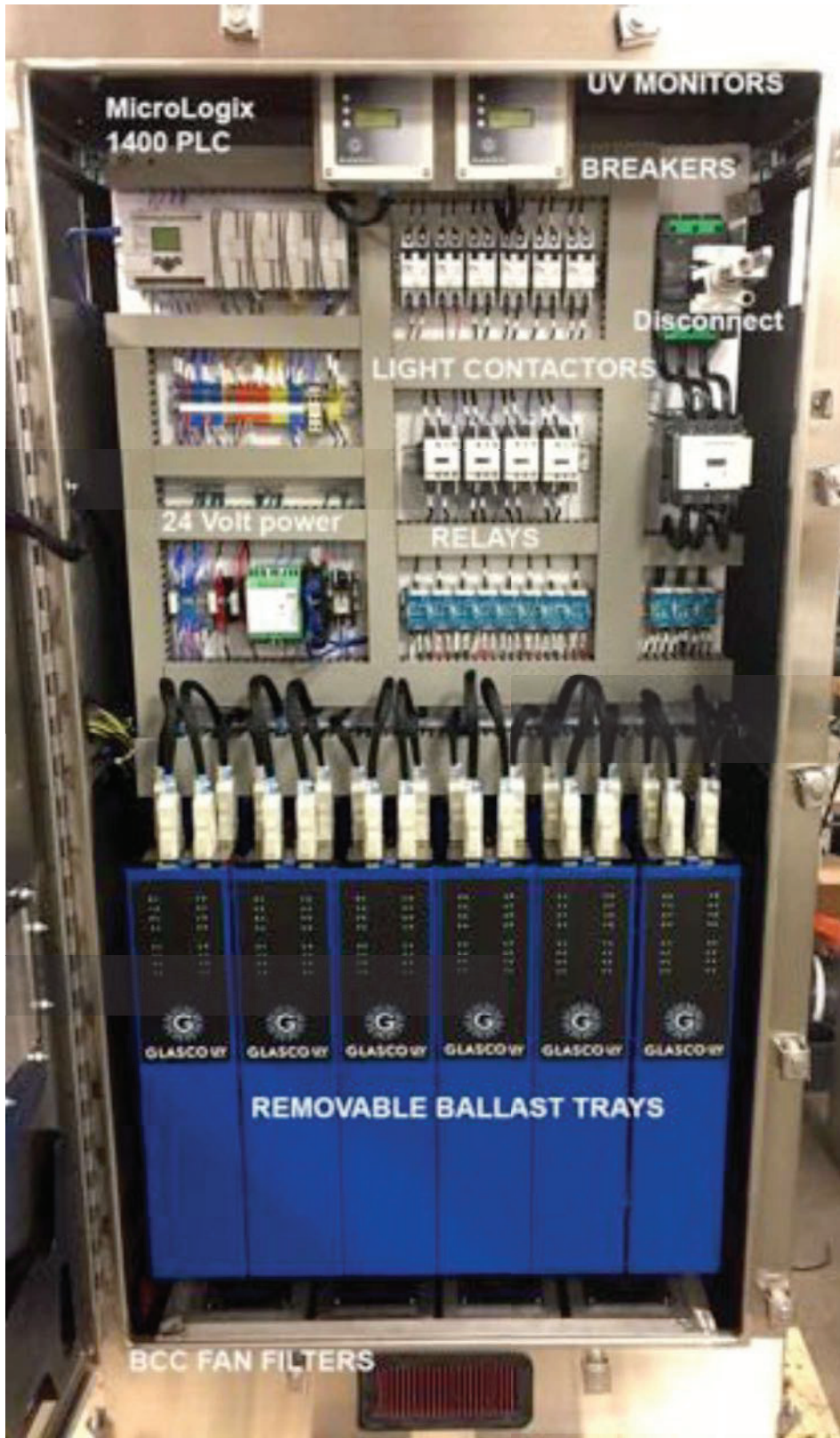
The ballasts will need to be replaced if found defective. To replace the ballast, simply disconnect the wires, loosen holding screws and insert new ballast. Send defective ballast back to for warranty work or out of warranty service.

To Power Off:

1. Turn off breaker from main PLANT control panel by others and use lock out. If plant does not have a lock out procedure then following all power down instructions and leave note at breaker stating time and date shut off and a message not to power up.
2. Turn off UV external On/Off Switch (if H/O/A switch turn to OFF)
3. Turn off Internal Breaker
4. Disconnect module cable from BCC



The BCC connects to the disinfection reactor via a multi pin cable. Power down from BCC before disconnecting. Undo latch and pull cable from receptacle.



IV. Parts List – See Project List

Fluoropolymer Tube

UV Lamp

Electronic Ballast

UV Sensor

UV Meter

Lamp LED

Run Time Meter

Box Fan

Band Clamp

Heat Exchanger

Glasco Ultraviolet
126 Christie Avenue
Mahwah, NJ 07430
(201) 934-3348 Fax (201) 934-3388

V. Troubleshooting UV Horizontal Tube System

This guide provides information and recommendations on how to correct basic operational problems. When performing any of these tasks, be sure to wear protective clothing and eyewear. In addition, protect yourself from shock hazards.

Symptom:	Check:
Power Center	
UV lamp LED(s) Off	Power Off, wait, power On, observe LED(s). The “intelligent” ballasts will keep a lamp Off for various causes, in some cases this may be a false trip. If the LED(s) come On and then flicker Off, it means that the ballast is good and that the problem is past the ballast. If problem recurs, see “LED stays Off”.
UV lamp LED(s) stays Off.	Power Off, Open Reactor, Remove cable from a known good module and connect known bad module into the receptacle. If the problem is fixed, then it is most likely bad ballast. If the problem follows, it is most likely associated with module. If suspected to be the module, lift module out. Examine for damage, water infiltration and really blackened lamp ends. If none, power On, and observe through your UV face shield, at safe distance, if lamp actually lights. If Lamp lights and LED is On, suspect loose electrical connection. If Lamp lights and LED is still Off, call Authorized Service for Ballast Control Center repair. If lamps are still Off, suspect bad ballast and replace.
GFCI Breaker Off (All lamp LEDs for a module off)	Ground Fault occurred. May be a false trip. Power the effected module Off (if not already powered by GFCI On/Off Breaker combination). Examine cable connectors for tightness. If suspicious, loosen, disconnect, clean, dry and re-connect. Lift module out of channel and examine for water infiltration. If so see “Water Infiltration”. Reset GFCI, and Power On, (or Power On and reset GFCI). If problem recurs, refer to Authorized Service for Ballast Control Center repair.
UV Monitor Alarm UV Monitor Warn UV Monitor Low	Check Panel LED to see if lamp is extinguished. Check the age of the Lamp. Refer to Lamp replacement records. Check the physical positioning of the UV Sensor Probe. The sensor element inside may not be “looking” in the same direction as the probe tube is pointing. The probe may have shifted within the retaining compression nut. Sometimes this is pulled by the weight of the cable. Check for debris or film on the UV probe window. Clean and rough position with Lamp powered Off.

VI. Maintenance Schedule

The time and frequency of maintenance has a lot to do with the specific wastewater plant and the quality of the actual water. Due to the nature of wastewater, some plants will have to do more maintenance than others.

The primary maintenance task is keeping the quartz sleeves clean. This can be an every day task (worst case scenario) or more infrequently (quarterly). This schedule will be determined after start up.

ITEM	FREQUENCY	DESCRIPTION
UV Lamps Operation	Weekly to monthly	Check LEDs to see if lamps are operating
UV Lamp Change	1x every 12-14 months or after 9,000 hours	Replace all lamps
Ballast Control Center	Monthly	Check for moisture in enclosure. Ensure that seals are functional.
Ballast Control Center	Bi Yearly	Clean BCC with water and or stainless steel polish. No not hose clean, as water will get into fans and vents.
Fan Operation	Monthly	Check to see if working
Fan Filters	Monthly	Clean periodically to allow for cooling.
UV Meter	Monthly	Check for low readings. If low, check for debris on sensor, moisture, high heat or bad lamps
Modules	2x a year	Remove modules for visual inspection.

VII. Attachments

If your unit came with optional equipment, instructions will be attached to this manual. This includes informational material on the following:

- UV Monitoring System
- Wiring Diagrams

WARRANTY REGISTRATION

MODEL NUMBER: _____

SERIAL NUMBER: _____

REPRESENTATIVE NAME: _____

INSTALLATION DATE: _____

NAME: _____

ADDRESS: _____

CITY: _____ STATE: _____ POSTAL CODE: _____

COUNTRY: _____

PHONE: _____ EMAIL: _____

Please fill out the above information and forward it to GLASCO. This will provide the WWTP with a five (5) year warranty on the stainless steel components and a one (1) year warranty on the electrical components. UV lamps are warranted for one year.

This warranty applies to equipment that has been installed and maintained according to the instructions in this manual. GLASCO is not responsible for damage due to improper use, operation or installation. GLASCO is not responsible for improper plant design or changes to the effluent.

The warranty applies to replacing defective equipment. GLASCO UV shall have no liability hereunder, either direct or contingent, for any consequential damages.

Please note that bad power (spikes, brown outs, surges) will damage the UV system electronics. System operates +/- 5% of input voltage.

126 Christie Avenue * Mahwah, NJ 07430
(201) 934-3348 Fax (201) 934-3388
www.glascoouv.com

Safety Data Sheet	revised: 05.08.2011
	Rev. Nr.: 2
trade name: Ultraviolet wave emitter filled with mercury lesser 2.5 %	Ident.- Nr.:

Informations about manufacturer/supplier

Heraeus Holding GmbH
Reinhard-Heraeus-Ring, D-63801 Kleinostheim
D – 63801 Kleinostheim

contact person: Mr. Köhler phone: +49-(0)6181-355607

Composition/information on ingredients

Chemical characterization (substance)

Emitter consistent of quartz glass filled with small amounts of mercury (< 2.5 %).

CAS-No.	Compo	Content [%]
7439-97-6/	Mercury	< 2.5

Hazard identification

Hazard information

The emitter is not dangerous under regular conditions.

Overexposition of radiation to skin or eyes causes burns.

Mechanical destruction may cause danger by splinter of glass and liberation of mercury. Mercury is harmful to aquatic organisms and may cause long-term adverse effects in the aquatic environment.

Liberated mercury may cause chronic toxic effects to human (see chap. "Toxilogical information").

First-aid measures

General information

Burns caused by overexposition of radiation or severe injuries caused by splinter of glass should be treated by a physician.

Safety Data Sheet	revised: 05.08.2011
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Accidental release measures

Personal precautions:

If the emitter is mechanical destroyed amounts of mercury can be liberated. In this case provide sufficient air exchange and/or ventilation in working rooms.

Avoid any contact with mercury.

Balls of mercury take up with a special mercury tongs and put it in a closable containment out of plastic material.

Very small balls which can not take up with the tongs grit with zinc powder or a special mercury absorber to bind the mercury. These materials eliminate very accurately from the surfaces and put it in a closable containment as described before.

Mercury and the materials with the fixed mercury forward to disposal in accordance with locally valid waste-disposal-regulations.

(For the danger caused by vapours of mercury see chap. "Toxicological information".)

Environmental precautions:

Mercury do not allow to enter surface and ground water, the sewage system or soil.

Methods for cleaning up/taking up:

Clean up the decontaminated surfaces with wet cleaning rags. The rags forward to disposal as described before.

Further information:

Handling and storage

Handling

Advice on safe handling

Avoid mechanical stress (danger of broken glass).

Ensure adequate ventilation at the working place.

Storage

Requirements for storage rooms and vessels

Storage must be made according to legal regulations.

Safety Data Sheet	revised: 05.08.2011
	Rev. Nr.: 2
trade name: Ultraviolet wave emitter filled with mercury lesser 2.5 %	Ident.- Nr.:

Exposure controls / Personal protection

Advice on limits

Japan:	OEL:	0.05	mg/m ³	(Mercury)
Australia:	TWA:	0.1	mg/m ³	(Mercury)
Russia:	TWA:	0.005	mg/m ³	(Mercury)
France:	VME:	0.05	mg/m ³	(Mercury)
Germany:	MAK:	0.1	mg/m³	(Mercury)
USA:	REL:	0.05	mg/m ³	(Mercury)
Mexico:	TWA:	0.05	mg/m ³	(Mercury)

Personal protective equipment

Respiratory protection:

If mercury is liberated and ventilation of the working place is not sufficient use filter with combination Hg-P3.

Hand protection:

If glass is broken use cut resistance gloves.

Eye protection:

If glass is broken use eye protection.

Body protection:

Protective and hygiene measures:

Skin contaminated with mercury wash immediately with soap and plenty of water.
Contaminated clothes change immediately.

Physical and chemical properties

Appearance

Form :	Solid
Colour:	Colourless
Odour :	Odourless

Aspects relevant for security

Test method

Melting point :	appr. 2000 °C	(quartz glass)
Boiling point :	not applicable	
Flash point :	not applicable	
Solubility in water :	insoluble	

Toxicological information

Safety Data Sheet	revised: 05.08.2011
trade name: Ultraviolet wave emitter filled with mercury lesser 2.5 %	Rev. Nr.: 2 Ident.- Nr.:

Acute toxicity

No acute toxicity is caused by mercury.

Chronic toxicity

Inhalation of mercury vapour for a longer period of time can damage the central nerve system. Symptoms are: trembling of muscles, degeneration of muscles, emotional instability, lack of concentration, impaired vision.

(Important! Liberated mercury remove completely as described in chap. "Accidental release measures" .)

Ecological information

Mercury is harmful to aquatic organisms and may cause long-term adverse effects in the aquatic environment.

Advice on disposal

Disposal

Dispose the product according to legal regulations.

Disposal of the materials which are generated in the case of a broken emitter (see chap. "Accidental release measures") must also be done according to legal regulations.

Disposal of packing

Packages which are not contaminated with mercury should be recycled.

Transport information

Contact the manufacturer/ supplier for the mercury content of the emitter.

Land transport

Transportation must be done according to the legal regulations of the concerned countries.

Marine transport (IMDG)

No dangerous good in the sense of IMDG if mass of Hg is lesser 1 Kg per emitter (chap. 3.3.1; special provision: 941).

Air transport (IATA/ICAO)

No dangerous good in the sense of IATA if mass of Hg is lesser 100 mg per emitter and additionally the quantity of mercury per package is 1 g or less (chap. 4.4; special provision: A69).

Safety Data Sheet	revised: 05.08.2011
	Rev. Nr.: 2
trade name: Ultraviolet wave emitter filled with mercury lesser 2.5 %	Ident.- Nr.:

Otherwise following classification is correct:

UN-No.: UN 2809
Proper Shipping Name: MERCURY CONTAINED IN MANUFACTURED ARTICLES)
Main risk: 8
Subsidiary risk: ---
Packing group: III
Label: 8

Further information

The data given here is based on today's stand of our knowledge and experience. The purpose of this Safety Data Sheet is to describe the product in terms of their safety requirements. The data does not signify any warranty with regard to the products properties.



NONCON-5000 Start Up

NONCON
S E R I E S


GLASCO UV



Ballast Control Center

NONCON
SERIES





NONCON-5000 Installation. 3 MGD Plant. Remote Ballast Control Center with AB PLC Touch Screen OUI and Lamp Status Displays. glascouv.com NONCON-314-2018





GLASCO UV

Operator Training
NONCON

www.glascouv.com

NONCON-5000

Banks

1

Flow rate Discharge

6 lps

transmission

65%

Tubes

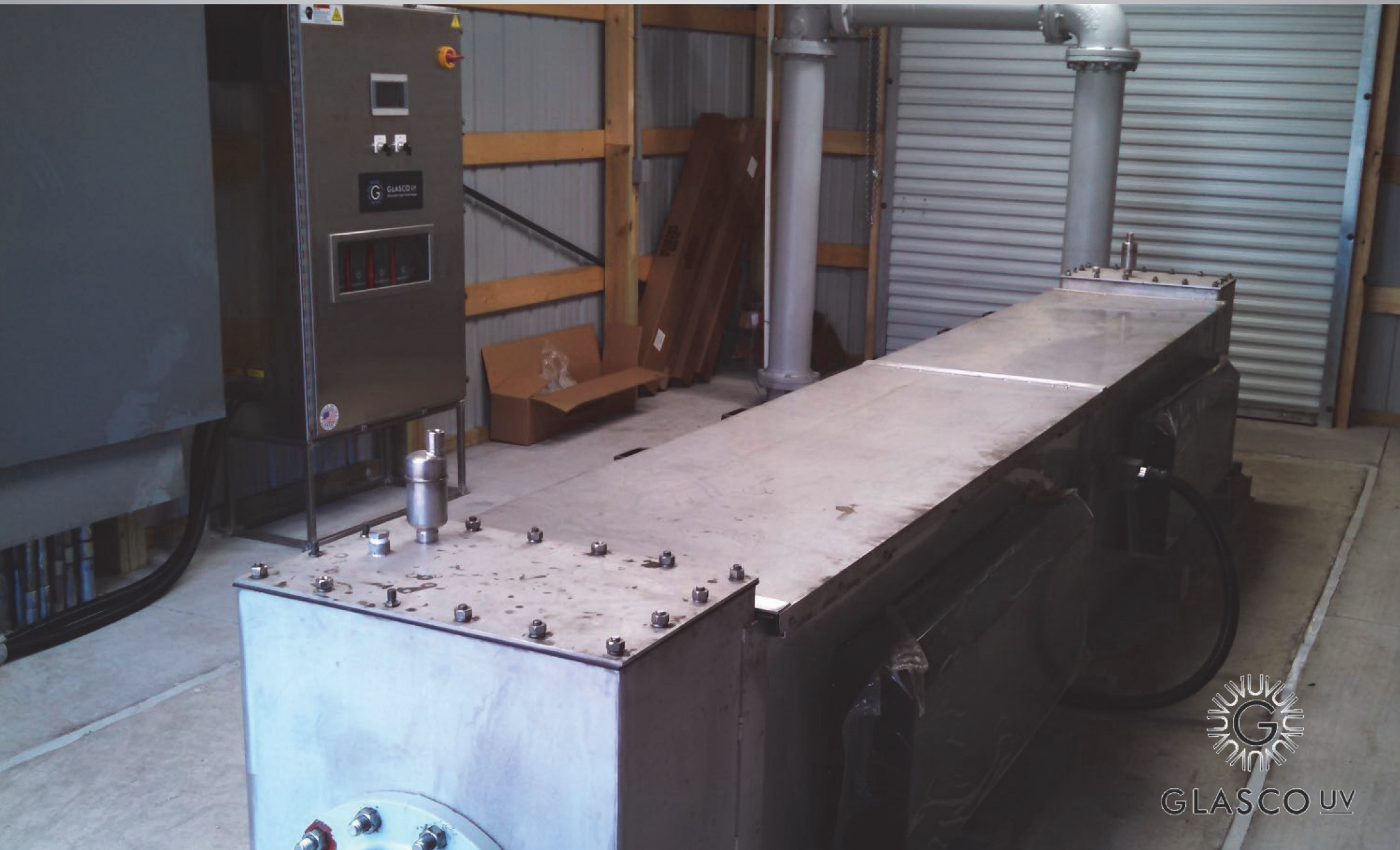
FEP Fluoropolymer

NONCON Wastewater



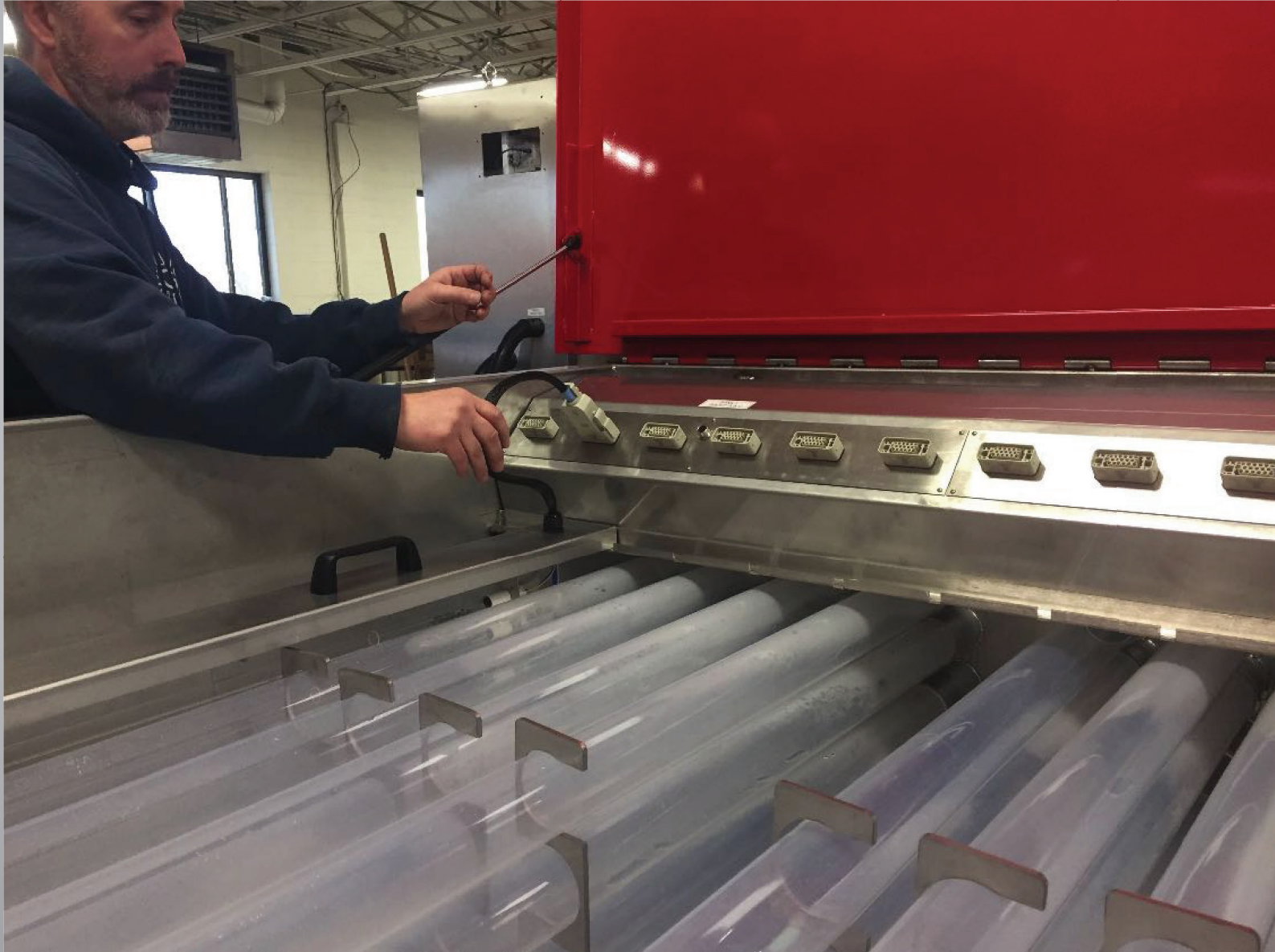
GLASCO UV

NONCON



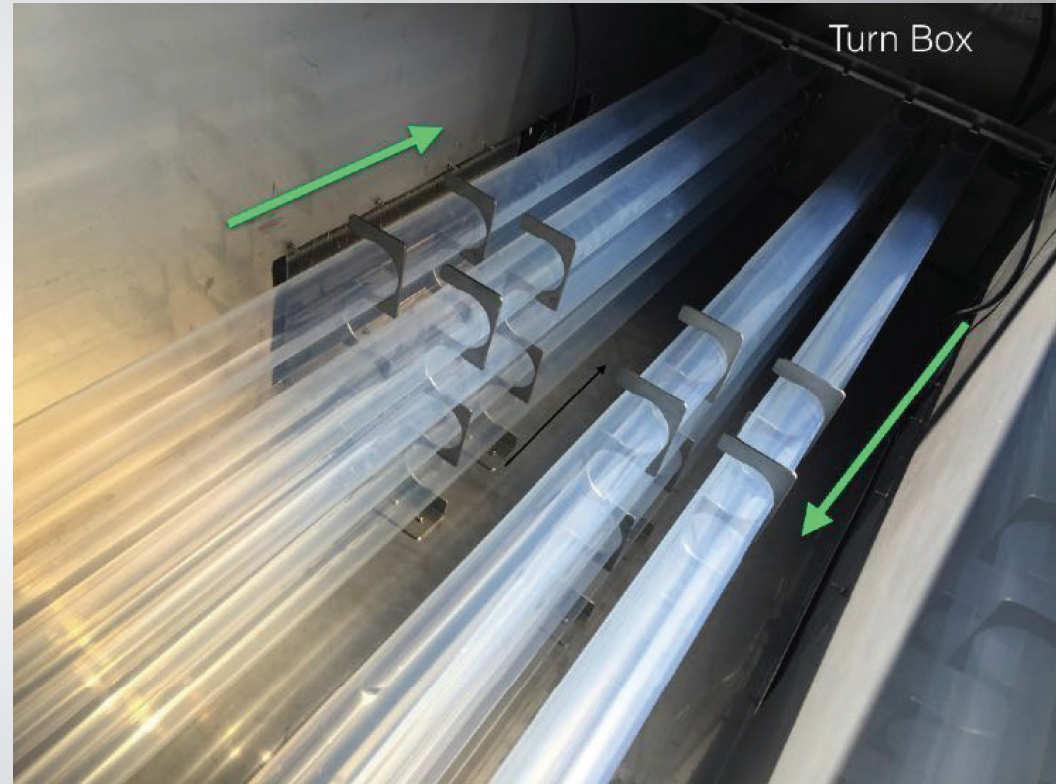
GLASCO UV

NONCON FEP Tubes



LASCO UV

NONCON FEP Tubes



GLASCO UV

How does all of this work? (1 of 2)

- It is hard to tell what is happening inside the system. As water enters the unit and flows through the tubes, it is exposed to UV light, which is invisible to the naked eye. The light comes from specialty mercury vapor lamps. The lamps are protected from the water by the use of clear like tubes, called quartz sleeves.
- The UV light destroys the microorganisms ability to reproduce by scrambling the DNA/RNA. This prevents reproduction.
- Sizing is based on a peak flow rate, the quality of the water (UV Transmission %) and the required discharge permit. Based on those inputs and a safety factor, a certain number of lamps are used.
- Once through the UV system, the water goes to discharge. At this point, periodic samples are taken to insure that the permit is being met.
- While the technology is very effective in disabling microbes, it does require maintenance and inspection.
 - The tubes can foul due to impurities in the water. Some bio slime can stick inside the tubes and they may need to be brushed periodically.



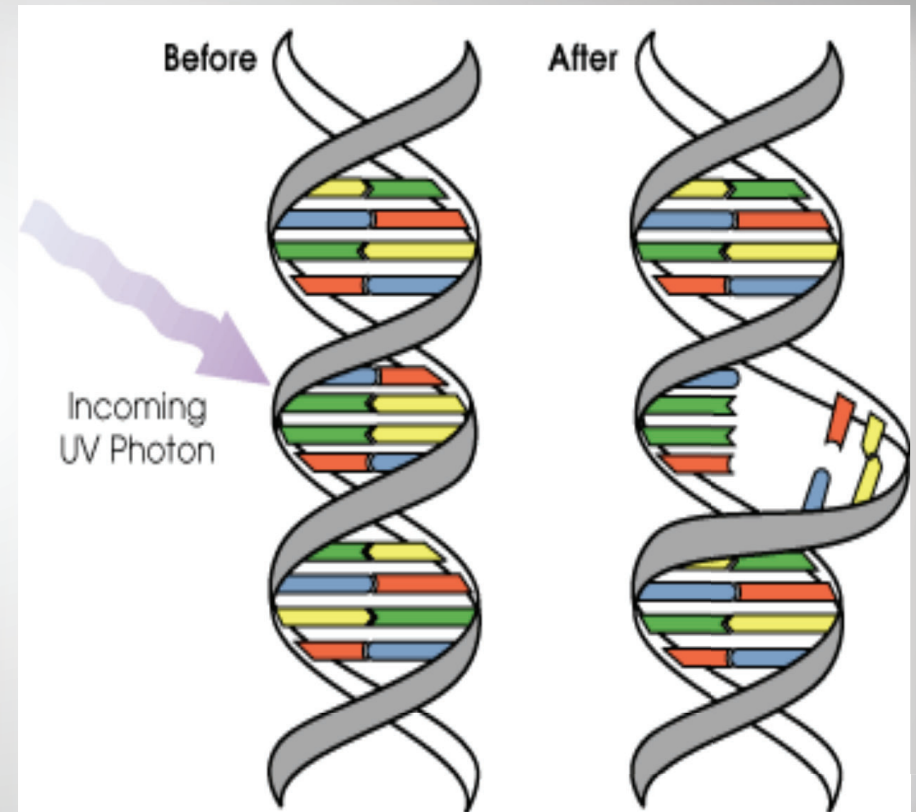
How does all of this work? (2 of 2)

- The UV lamps need to be replaced every 12,000 hours.
- To help manage the system, a UV sensor has been placed inside a dedicated module. This sensor reads the actual UVC output at 100% from new. In the event of dropping, it could be aging lamps, lower transmission effluent, fouling of tubes or something else. This is meant as a helpful tool, but a low reading or a Zero reading may not indicate that the system is not working. The % on the meter has nothing to do with the kill.
- UV lamps are meant to be used 24 x 7, but they do have the ability to be cycled On/Of during the day.
- In the event of low flow or no flow, the UV system may become overheated. System has built in cooling to accommodate this.
- The UV system is powered from a remote Ballast Control Center / System Control Center. The main component is the ballast. This electronic device needs to be cooled. Fans and filter need to be inspected regularly.

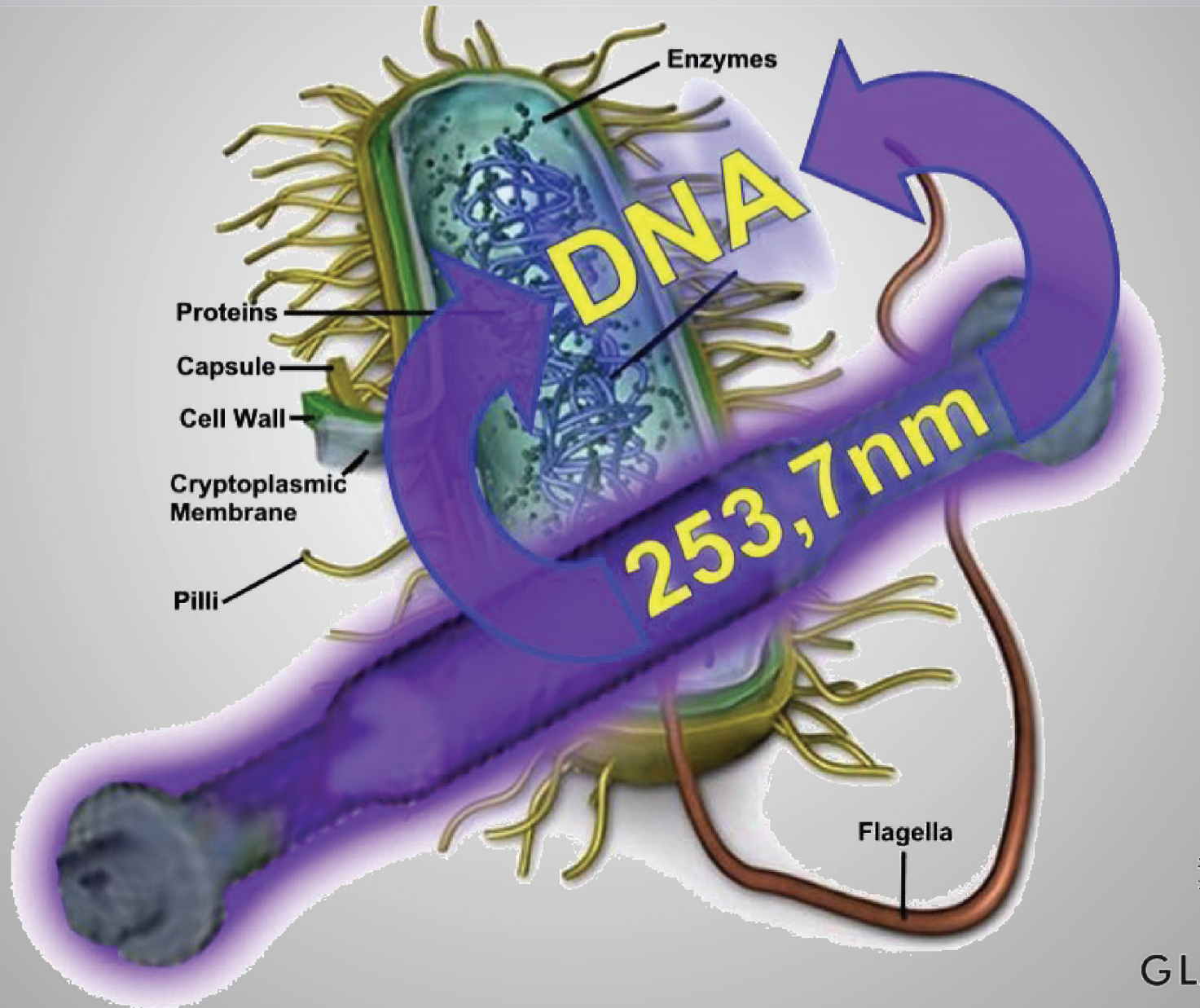


About UV Light Disinfection

- UVC light damages DNA
- 254 nm wavelength most effective
- Dosage expressed millijoules/cm² (mJ/cm²)
- Sizing Intensity (mW/cm²) x Contact Time (sec)
- *Chlorine is concentration (mg/L) x Contact Time (minutes)*
- *Typical Dosage 30 mJ = 30,000 uWs/cm²*



UV Light Disinfection



Microorganisms



- E-Coli
- Salmonella
- Legionella
- Virbrio Cholerae
- Fecal Coliform

- Hepatitis
- Poliovirus
- Coxsackie
- Rotavirus

- Giardia
- Cryptosporidium



E-Coli (bacteria) Common

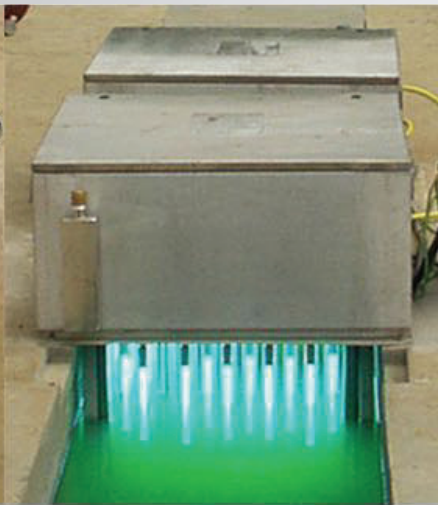
- 90% (1 log) 1.5 mJ
- 99% (2 log) 2.4 mJ
- 99.9% (3 log) 4.1 mJ
- 99.99% (4 log) 5.6 mJ
- MOST Systems Sized at 30 mJ



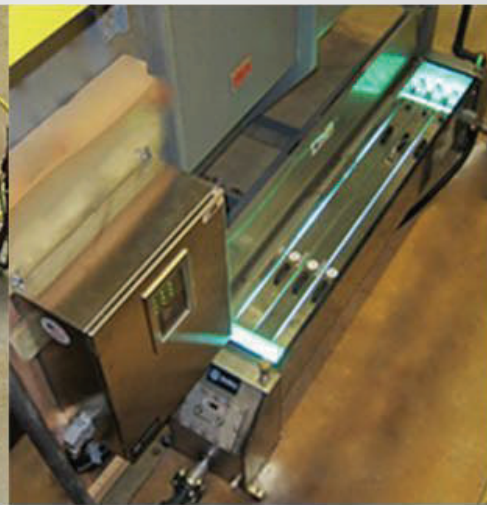
Wastewater Configurations



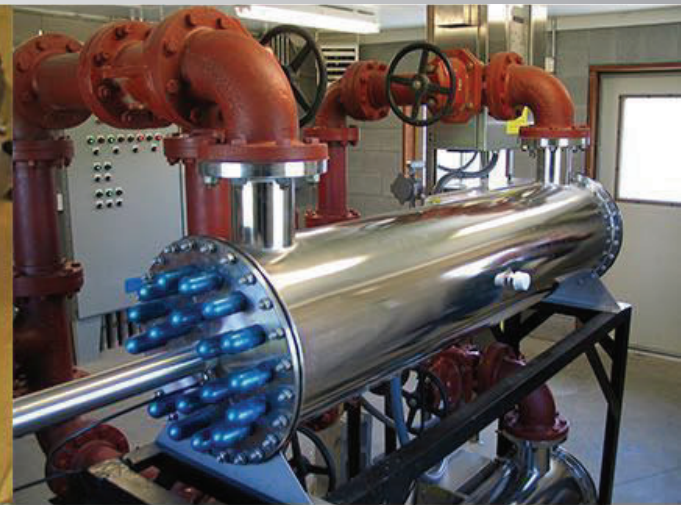
Horizontal



Vertical



FEP Tube



Chamber

NONCON is being used. FEP tube systems are the lowest maintenance of any of the systems due to the non stick of the TEFLON tubes. Unlike quartz based systems, that plate materials (iron, manganese, etc), the tubes remain clean and the lamps are not in the effluent.



Safety



- UV light is dangerous - you must protect your eyes and skin.
- Electricity is present in the Ballast Control Center and the chamber. Always Power Off and lock out system.
- Lamps if broken can be sharp. Wear gloves.
- Units are pressurized. No work should be done unless depressurized.



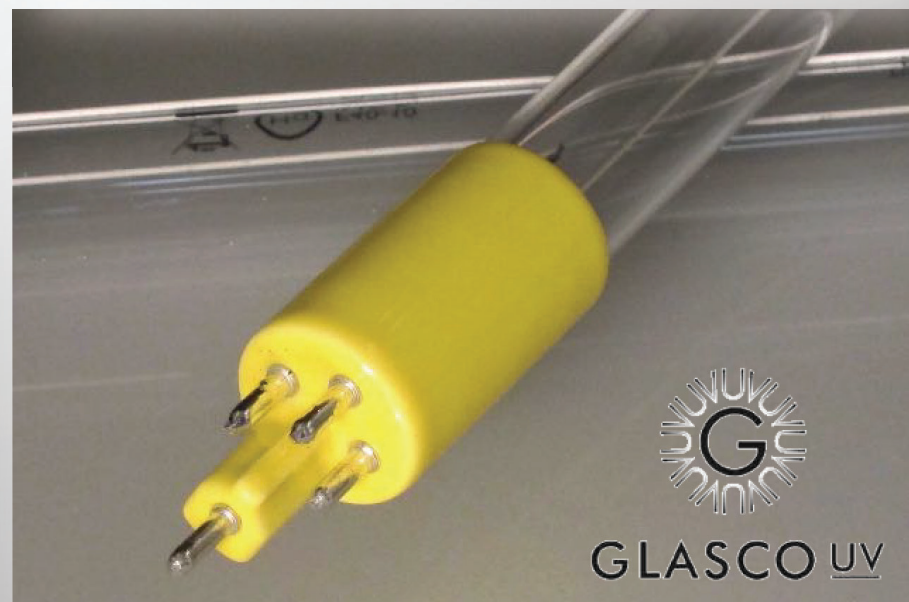
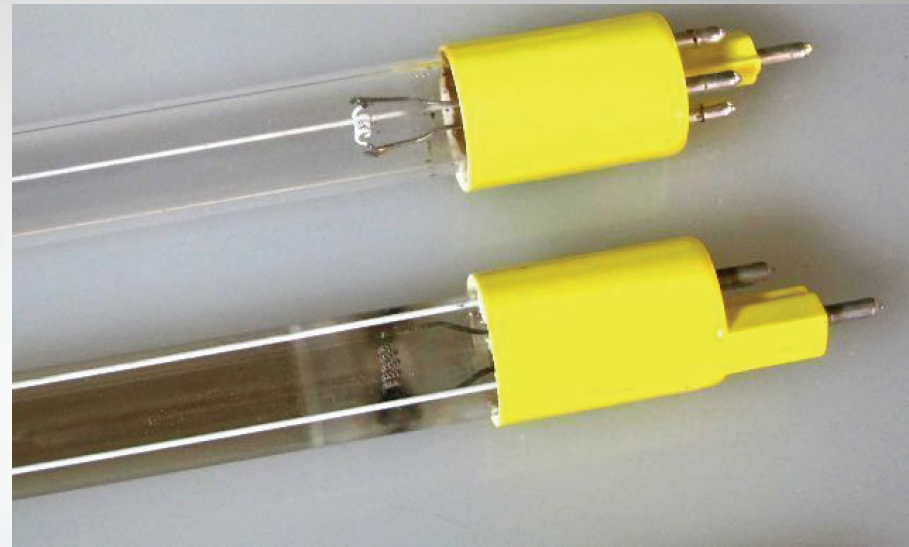
What Comprises System?

- Major Components
 - FEP Tube Reactor
 - UV modules
 - Remote electronics power and control UV lamps
 - UV monitoring sensor

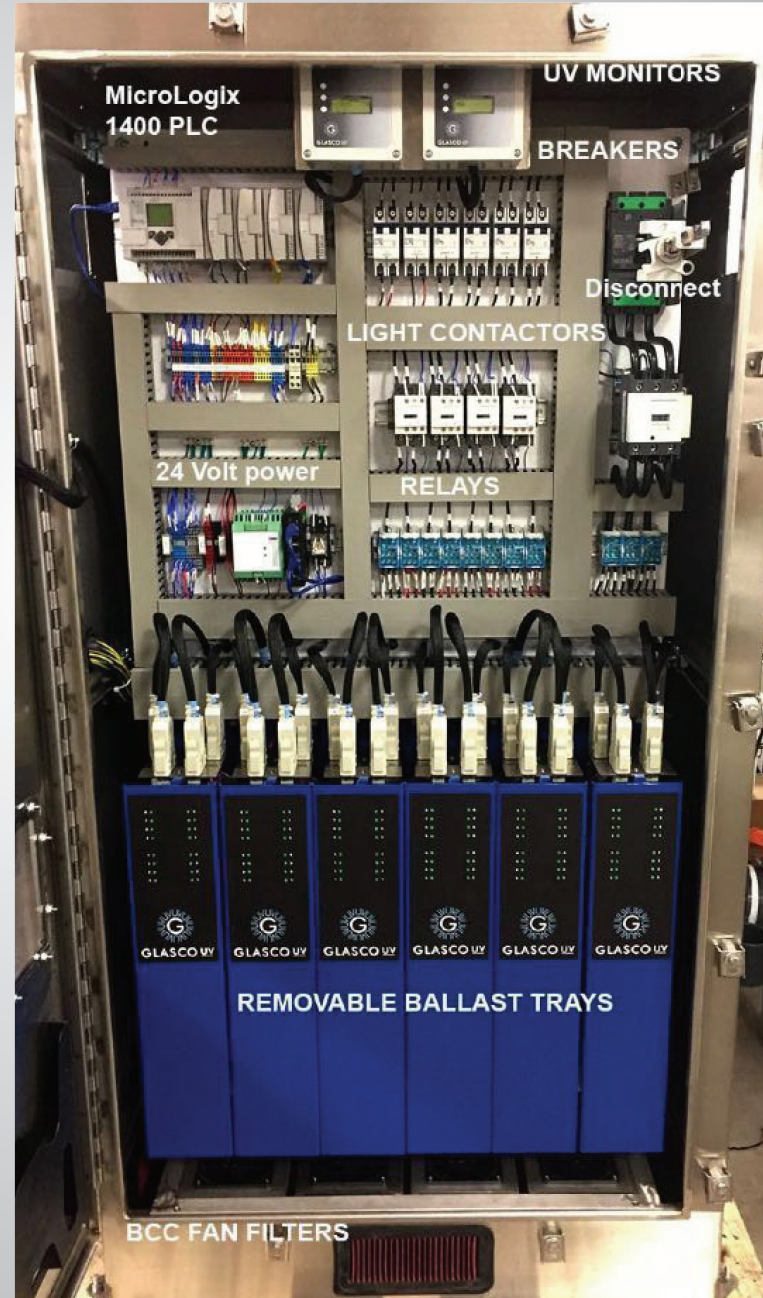


UV Lamps

- Low pressure mercury
 - High output 90%+ output in 254 nm
- 12,000 hours
- Rated in watts & UVC watts
- Solarizes (darkens) end life
- Sharp if broken



Ballast Control Center



GLASCO UV

Ballasts

- Mercury (Hg) Vapor Lamps require a ballast to operate
- Converts line current into the proper voltage, amperage and waveform
- Provides proper warm up and cool down
- Built in protection and controls (input power quality correction, end of lamp life, dimming)
- Needs to be kept cool and dry
- Life >10 years
- Ballast Control Centers house ballasts



UV Monitoring

- A UV Sensor monitors output of a lamp offer lifetime (new 100%)
- Some sensors view an array of lamps and are auto cleaned - others monitor a single lamp
- Low UV reading may mean (lamps aging, fouled tubes or changes in wastewater quality)



NONCON REACTORS



GLASCO UV

Start Up Checklist

- Prior to Start Up:
 - Verification that components have been received
 - Verify that lamps are not damaged
 - Install UV lamps Install UV sensor
 - Verify that Ballast Control Center power is accurate
 - Power On UV System
 - Operate system breakers for individual modules
 - Check air flow in BCC and in NONCON reactor



Start Up Checklist (2)

- Check to see if all lamps are working via PLC or lamp indicators
- Check to see that system is recording hours
- Check to see UV monitors output
 - Calibrate with new lamps in the wastewater to 100%



Training Checklist

- Training:
 - How to install lamps and tubes
 - Preventing seal failures
 - How to Power On/Off ,breakers and disconnects
 - How to drain and pressurize
 - How to check the fans or air handling system
 - Check compressor for oil and maintenance
 - How to access and clean tubes with brush
 - How to re-calibrate the UV sensor



How UV Systems are Sized

- Basic information required:

- Peak Flow Peak instant flow rate (avg and min)
- UVT% UV % transmission of effluent (typ 70-99%)
- TSS Total Suspended Solids (<30 mg/l)
- BOD5 Biological Oxygen Demand (<30 mg/l)
- Fe Iron Level (<0.3 mg/)
- Influent Count in (???,??? mpn/ 100 ml) – Usually unknown
- Discharge Permit ??/100 ml
- Location (indoor or outdoor)



How To Size

- Methods for sizing
 - Bioassay (biology)
 - Systems biologically tested
 - Always used for municipal drinking water
 - EPA Point Source Summation Method – UV DIS (light physics)
 - Uses flow rate, UVT, lamp spacing, lamp output, end of lamp life, fouling
 - CON: UV manufacturer's can overstate their lamp output and the lamp life. This makes it harder for engineers to design specifications



GLASCO UV



GLASCO UV

For further information

info@glascouv.com

www.glascouv.com