Welch®

Liquid Lab Catalog

- Key Features
- Welch Brand Tubing & Specs
- Liquid Pump Specifications
- Tubing Connectors & Fittings
- Chemical Compatability

Welch
Rietschle Thomas
A Thomas Industries Company

www.welchvacuum.com

WELCH® LIQUID LAB CATALOG

From
Welch Rietschle Thomas

Welch Vacuum has been your supplier of vacuum pumps for laboratory applications for over 100 years. In 1996 Welch Vacuum became a wholly owned subsidiary of Thomas Industries, the world leader in OEM compressors and vacuum pumps as well as a manufacturer of various liquid pump technologies. This enabled us to draw on the wide range of Thomas liquid, oil-free compressor and vacuum pump technologies. In August 2002, Thomas Industries aquired Werner Rietschle GmbH to create Rietschle Thomas. This brought additional vacuum pump and compressor technologies that are available for the creation of Welch laboratory application specific vacuum pumps.

In January 2004, Welch Rietschle Thomas introduced its liquid pump line. The new liquid line utilized all of Thomas Industries liquid pump technology experience to develop the unique Lok-n-Flow peristaltic pumps for laboratory applications. With over 25 years of experience developing liquid pump solutions for its OEM customers, Rietschle Thomas and Welch Rietschle Thomas developed the first cartridge design peristaltic pump systems for the lab.

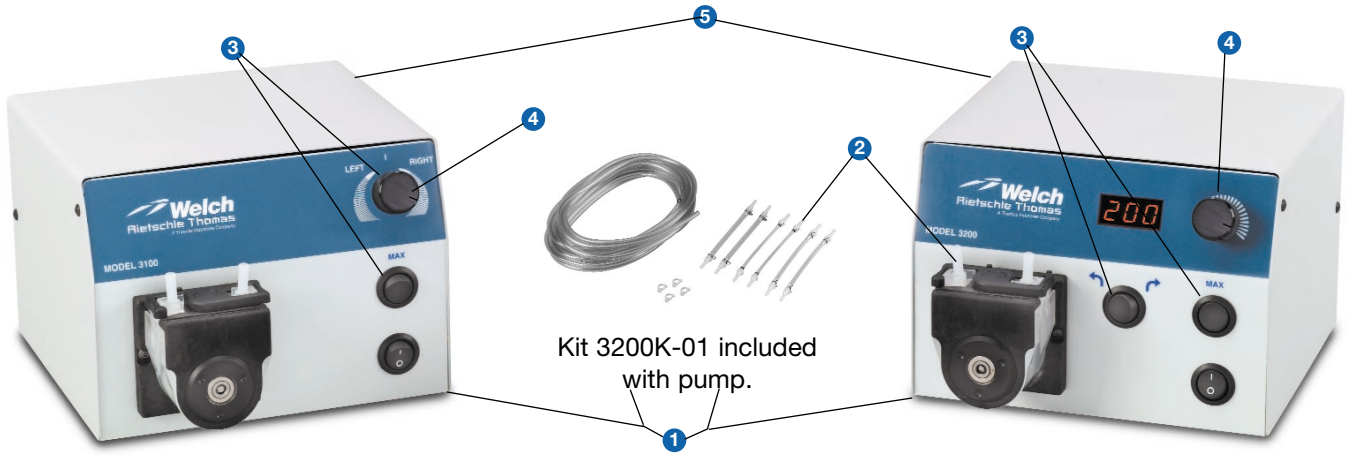
Through innovation and design Welch continues to strive to bring its laboratory customers the finest vacuum and liquid pump technologies to meet your changing requirements. We are proud to offer our resources to serve your laboratory vacuum and liquid needs.

CONTENTS **Page**

See our online catalog for additional information, list prices, and repair part information.

www.welchvacuum.com

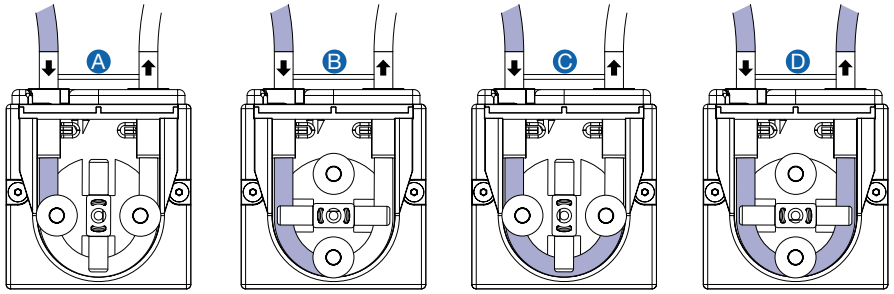
Welch® Peristaltic Pump Features



Model 3100 Model 3200

1. **Complete system - pump head, tubing & drive**
   - Order with just one catalog number
   - Ready out of the box
2. **Lok-n-Flow cartridges – easily replaceable tubing cartridge**
   - Economizes the use of expensive tubing
   - Tubing waste dramatically reduced
   - No tools necessary – changing tubing is as easy as 1, 2, 3 (see page 2)
   - Reduce maintenance time with fast tubing changes
3. **Bi-directional (reversible) flow control & max flow button**
   - Clean up and priming made easy
4. **Variable speed**
   - Digital and analog flow control
5. **Console drive**
   - Stackable & portable
   - Power supply within housing

...a wide selection of tubing materials and pump accessories.

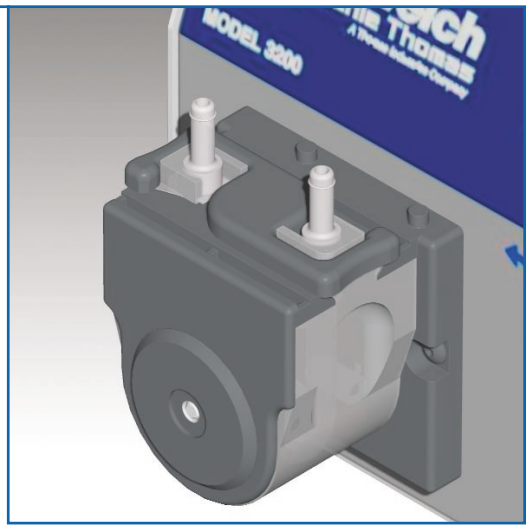


Figures A, B, C and D illustrate the basic operating principle of Welch's peristaltic pumps. As the Lok-n-Flow rollers rotate and compress the cartridge tubing a vacuum is created drawing fluid into the pump head. The continuous alternating cycle between compression and rotation of the roller moves the solution at a controlled flow rate. Since the solution only comes in contact with the tubing, clean up and cross contamination control from application to application is easy by just changing the tubing.

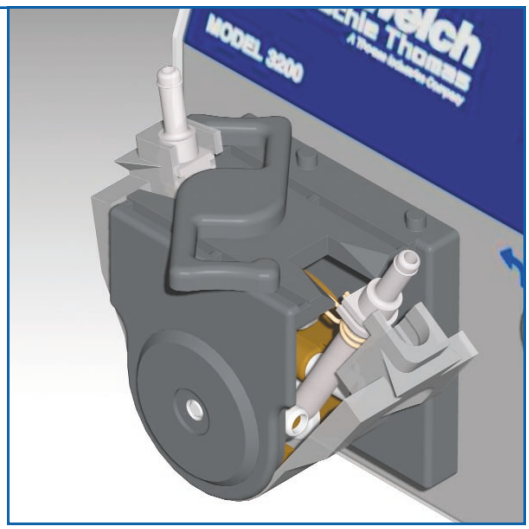
Welch model 3100 and 3200 peristaltic pumps are designed with today's end user in mind. The days of tubing creep, special tools, and disposing of tubing before you need to are in the past. With Welch's Lok-n-Flow head and cartridge design, just use and replace what is needed (Refer to page 2, "Changing tubing is as easy as 1, 2, 3"). Welch brand tubing and Lok-n-Flow cartridge assemblies are made of the highest quality materials - silicone, Santoprene® rubber, PVC, and Viton®. Chemical compatibility charts for these materials are available on pages 10 through 12 or visit our web site at www.welchvacuum.com.

Changing tubing is as easy as . . .

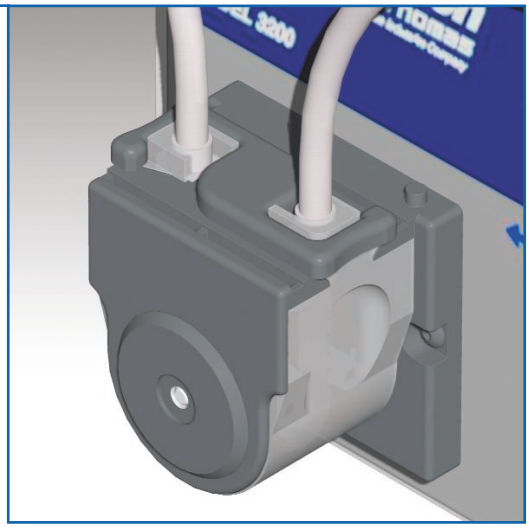
1 Disconnect application tubing from pump.



2 Remove tubing cartridge from head and replace.



3 Snap tubing into head, attach application tubing and the tubing change is complete.



Common Applications

Laboratory Research and Development
- Dispensing and metering
- Cell tissue transfer
- Staining
- Perfusion
- Liquid Chromatography
- Fluid transfer of acid and base solutions

Pharmaceutical Manufacturing
- Dispensing
- Filtration
- Nutrient addition
- Adjusting pH in fermentation process
- Footswitch available for on demand fluid transfer

Commercial Food Processing
- Pumping viscous fluids and small particulates without clogging
- Easy cleanup
- Able to use on multiple processes
- Lok-n-Flow tubing cartridges – eliminate cross contamination

Environmental
- Waste water sampling with suspended solids
- Footswitch for remote operation
- Self-priming
- Wide range of tubing material available to handle all types of solutions
- Sterilizable tubing

General Industry
- Long tubing life for continuous duty
- Self-priming
- Able to run dry
- Slurry solutions for lapping
- The perfect choice for any application that is moving liquids, gases, solids, or mixed phased media

Welch® Brand Tubing, Replacement

Product Picture	Material	Advantage	Limitations	Physical Characteristics
	Silicone (Peroxide - Cured)	Biocompatible, odorless, nontoxic, fungus-resistant, and no added taste to transported fluids. High strength for higher physical stress applications leading to longer pumping life.	Do not use with concentrated solvents, oils or acids. Relatively high gas permeability.	A flexible, long life translucent material with good chemical and environmental resistance. Very good electrical resistance characteristics.
	Santoprene® rubber	Opaque material protects light sensitive fluids from UV and visible light. Ideal for cell and tissue work. Long pumping life reduces cost and fluid exposure.	Potential leaching of USP mineral oil or blend material.	Flexible tough opaque, beige thermoplastic rubber with very good abrasion, heat, UV and ozone resistance.
	PVC	An economical choice for general laboratory applications. See through tubing allows easy flow monitoring. Handles virtually all inorganic chemicals. Good for viscous fliuds.	Potential leaching. Limited pump life.	An economically high performance material with great versatility for a wide range of uses. Moderate chemical resistance.
	Viton®	Chemical resistant tubing resists corrosives, solvents, and oils at elevated temperatures.	Limited pump life.	A unique fluoroelastomer with excellent physical and chemical resistance characteristics. Ideal for use in applications involving harsh environments and/or corrosive chemicals while maintaining performance.

Single Snap-Grip Clamps (20/pk)

Properly secures application tubing to the pump

Item	Cat. No.
Snap Clamps	3101K-01

Starter Tubing Kit

Everything you need to get started

(25 Ft.) 4.8mm General PVC Tubing, (4 pcs.) hose clamps, (2 pcs.) 1.6mm silicone, (2 pcs.) 3.2mm silicone, (2 pcs.) 4.8mm silicone assemblies

Item	Cat. No.
Tubing Kit	3200K-01

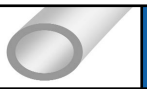
Replacement Tubing Cartridge Kits (5 per Pkg.)		
Material	**O.D. Size (mm)**	**Cat. No.**
Silicone	1.6	3432K-01
	3.2	3432K-02
	4.8	3432K-04
Santoprene® rubber	1.6	3433K-01
	3.2	3433K-02
	4.8	3433K-04
PVC	1.6	3434K-01
	3.2	3434K-02
	4.8	3434K-04
Viton®	1.6	3435K-01
	3.2	3435K-02
	4.8	3435K-04

* Please contact Welch Technical Service for additional tubing material and sizes, (847)-676-8819.
* Use only Welch brand tubing cartridges for maximum life.

Tubing Cartridge Kits & Accessories

Acids	Alkalines	Organic Solvents	Pressure	Vacuum	Viscous Fluids	Sterile Fluids	Temperature Range	Cleaning/Sterilization
Poor	Poor	Not Rec.	Fair	Good	Fair	Excellent	-51 to 238 °C (-59.8 to 460 °F)	Wash with hot soap & water solution (non-oily soap) and rinse with deionized water. Ethylene oxide or autoclavable. To autoclave tubing, thoroughly clean and rinse with deionized or distilled water. Loosely coil tubing keeping ends open and wrap in a lint free cloth. Autoclave using 15 minute cycles at 121ºC, 15 psig. Tubing clarity will diminish during process. To bring tubing clarity back, dry tubing at a temperature not to exceed 75ºC.
Good	Good	Not Rec.	Excellent	Excellent	Excellent	Good	-58 to 135 °C (-72 to 275 °F)	Ethylene oxide, autoclave or gamma irradiation. Repeated autoclaving will not affect overall life. To autoclave tubing, thoroughly clean and rinse with deionized or distilled water. Loosely coil tubing keeping ends open and wrap in a lint free cloth. Autoclave using 15 minute cycles at 121ºC, 15 psig. Tubing clarity will diminish during process. To bring tubing clarity back, dry tubing at a temperature not to exceed 75ºC.
Good	Good	Not Rec.	Good	Good	Excellent	Poor	-51 to 135 °C (-58 to 275 °F)	Ethylene oxide or chemical disinfectant is the preferred method, but tubing can be autoclaved. To autoclave tubing, thoroughly clean and rinse with deionized or distilled water. Loosely coil tubing keeping ends open and wrap in a lint free cloth. Autoclave using 15 minute cycles at 121ºC, 15 psig. Tubing clarity will diminish during process. To bring tubing clarity back, dry tubing at a temperature not to exceed 75ºC.
Excellent	Excellent	Test See Pg 10 "48 hour compatibility test"	Good	Good	Good	Fair	-25 to 260 °C (-25 to 500 °F)	Sterilization is not recommended.

Additional chemical compatibility information available on page 10.

	Tubing (10Ft)	
Material	**O.D. Size (mm)**	**Cat. No.**
Silicone	1.6	3232K-01
	3.2	3232K-02
	4.8	3232K-04
Santoprene® rubber	1.6	3233K-01
	3.2	3233K-02
	4.8	3233K-04
PVC	1.6	3234K-01
	3.2	3234K-02
	4.8	3234K-04
Viton®	1.6	3235K-01
	3.2	3235K-02
	4.8	3235K-04
General PVC	1.6	NA
	3.2	NA
	4.8	3231K-04

Large Tube Cutter

25 mm O.D. Capacity

Item	Cat. No.
Cutter	3103K-03
Replacement Blades	3103K-04

Small Tube Cutter

12.7 mm O.D. Capacity

Item	Cat. No.
Cutter	3103K-01
Replacement Blades	3103K-02

Selecting Replacement Tubing Cartridges

Step 1 - Pick a chemically compatible tubing material for your application (pages 10 through 12).

Step 2 - Pick tubing size for your flow range. See flow charts below.

Silicone

5 Lok-n-Flow cartridges per pack
Available in three tubing sizes

Size	Cat. No.
1.6 mm	3432K-01
3.2 mm	3432K-02
4.8 mm	3432K-04

Santoprene® rubber

5 Lok-n-Flow cartridges per pack
Available in three tubing sizes

Size	Cat. No.
1.6 mm	3433K-01
3.2 mm	3433K-02
4.8 mm	3433K-04

PVC

5 Lok-n-Flow cartridges per pack
Available in three tubing sizes

Size	Cat. No.
1.6 mm	3434K-01
3.2 mm	3434K-02
4.8 mm	3434K-04

Viton®

5 Lok-n-Flow cartridges per pack
Available in three tubing sizes

Size	Cat. No.
1.6 mm	3435K-01
3.2 mm	3435K-02
4.8 mm	3435K-04

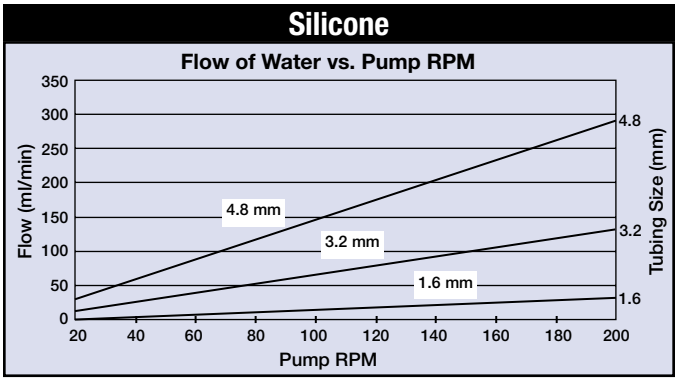
Model 3100

Kit 3200K-01
with every

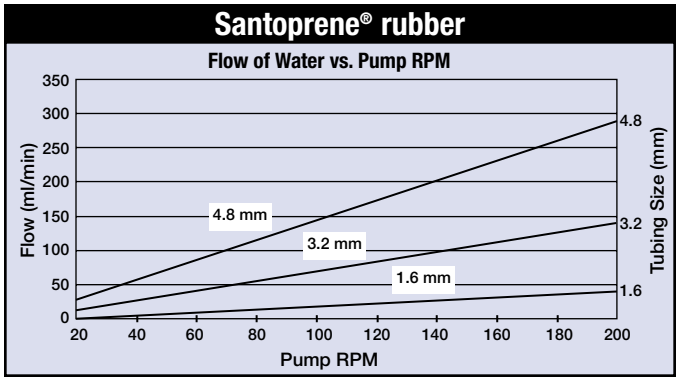
Model No.	3100 (analog)	
Country	USA, Canada & Japan	Europe & Asia
Flow Range	3 - 300 mL/min	3 - 300 mL/min
Rpm	20 to 200	20 to 200
Speed control	Bi-directional ±2%	Bi-directional ±2%
Max Button	Yes	Yes
Pump head	Welch Lok-n-Flow easy-change cartridge design	Welch Lok-n-Flow easy-change cartridge design
Motor	Reversible	Reversible
Weight, lb(Kg)	6(2.7)	6(2.7)
Overall Dimensions	————	————
L in. (cm)	7(17.8)	7(17.8)
W in. (cm)	7.5(19.0)	7.5(19.0)
H in. (cm)	5.5(14)	5.5(14)
Shipping Weight, lb(Kg)	10(4.5)	10(4.5)
Shipping Carton Dimensions L x W x H in. (cm)	9 x 12 x 12 (22.9 x 30.5 x 30.5)	9 x 12 x 12 (22.9 x 30.5 x 30.5)
Power	Universal voltage design (90 - 230V, 50/60Hz)	Universal voltage design (90 - 230V, 50/60Hz)
Wiring	Wired for 115V, 60Hz, with N. American 115V Plug	Wired for 230V, 50Hz, with Cont. Euro. (Schuko) Plug
Catalog No.	3100B-01	3100C-02

Representative Flow Charts for

Silicone



Santoprene® rubber



Use only Welch brand tubing cartridges for maximum life.

Pump Systems

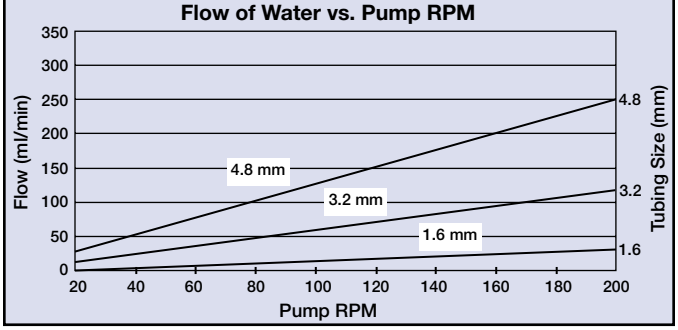
included pump.

Model 3200

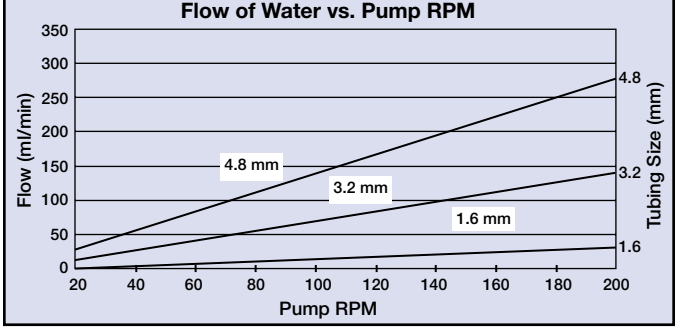
	3200 (digital)	
	USA, Canada & Japan	Europe & Asia
	3 - 300 mL/min	3 - 300 mL/min
	20 to 200	20 to 200
	Bi-directional ±2%	Bi-directional ±2%
	Yes	Yes
	Welch Lok-n-Flow easy-change cartridge design	Welch Lok-n-Flow easy-change cartridge design
	Reversible	Reversible
	6(2.7)	6(2.7)
	_____	_____
	7(17.8)	7(17.8)
	7.5(19.0)	7.5(19.0)
	5.5(14)	5.5(14)
	10(4.5)	10(4.5)
	9 x 12 x 12 (22.9 x 30.5 x 30.5)	9 x 12 x 12 (22.9 x 30.5 x 30.5)
	Universal voltage design (90 - 230V, 50/60Hz)	Universal voltage design (90 - 230V, 50/60Hz)
	Wired for 115V, 60Hz, with N. American 115V Plug	Wired for 230V, 50Hz, with Cont. Euro. (Schuko) Plug
	3200B-01	3200C-02

1.6, 3.2 & 4.8 mm* Tubing

Peristaltic PVC



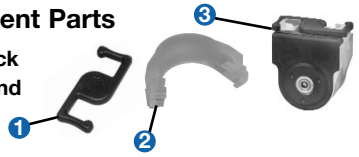
Viton®



*For reference only, actual flow rates may vary depending on chemicals and temperatures.

Replacement Parts, Accessories & Kits

Pump Replacement Parts



1. Replacement Lock
2. Replacement Band
3. Repl. Head

Description	Cat. No.
Repl. Locks (5 Pk)	3200K-03
Repl. Bands (5 Pk)	3200K-04
Replacement Head	3200K-02

On/Off Maintained Foot Switch

3-prong U.S. Standard plug with 8 Ft. cord, Maintained On/Off Foot Switch, CSA, NEMA & UL Enclosure Type 1.

Description	Cat. No.
On/Off Hand Free Control	1430A

Small Barbed Fittings Kits

Small Barbed Fitting Kit - 4 fittings of each - Straight: 1/16", 1/8", 3/16"; Elbows: 1/16", 1/8", 3/16"; Reducers: 1/8" x 1/16", 3/16" x 1/8", 1/4" x 3/16" ; Tees: 1/16", 1/8", 3/16"; Ys: 1/8", 3/16"; Reducer Tees & Elbows: 1/8" x 1/16"; Crosses: 1/16", 1/8".

Material	Cat. No.
KYNAR® PVDF	3550K-90
HDPE	3551K-90

Individual kits available on page 7

Quick Disconnect Fittings Kits

8 (Nylon) fittings of each - Female Open Flow: 1/16", 1/8", 3/16"; 2 (Nylon) fittings of each - Female Shut-Off; Female to Female Shut-Off; Male Swivel: 1/16", 1/8", 3/16"; Male Shut-Off: 1/16", 1/8", 3/16"; Male Open Flow:1/16", 1/8", 3/16"; Female Shutoff: 1/16", 1/8", 3/16"; Locking Male: 1/16", 1/8", 3/16"; Swivel Locking Male: 1/16", 1/8", 3/16".

Material	Cat. No.
Quick Disconnect Kit	3652K-90

Individual pieces available on page 8

Barbed Tubing Connectors*

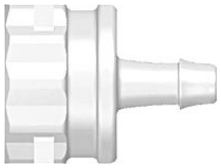
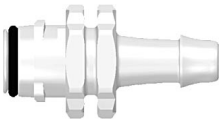
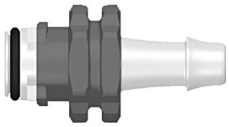
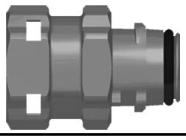
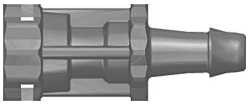
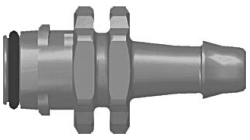
- **An economical solution requiring no tools to connect the pump to our tubing**
- **Made of chemical resistant Kynar® PVDF and HDPE (See chart page 10)**
- **The perfect choice for connecting the pump to your application**

Product Picture			Kynar® PVDF (5/Pkg)	HDPE (5/Pkg)
	Size	Description	Cat. No.	Cat. No.
	1/16"	Equal Leg Coupler	3550K-01	3551K-01
	1/8"	Equal Leg Coupler	3550K-02	3551K-02
	3/16"	Equal Leg Coupler	3550K-03	3551K-03
	1/8"-1/16"	Reduction Couplers	3550K-04	3551K-04
	1/16"-1/8"	Reduction Couplers	3550K-05	3551K-05
	1/4"-3/16"	Reduction Couplers	3550K-06	3551K-06
	1/16"	Crosses	3550K-07	3551K-07
	1/8"	Crosses	3550K-08	3551K-08
	1/16"	Equal Barb Elbows	3550K-09	3551K-09
	1/8"	Equal Barb Elbows	3550K-10	3551K-10
	3/16"	Equal Barb Elbows	3550K-11	3551K-11
	1/16"	Equal Barb Tees	3550K-12	3551K-12
	1/8"	Equal Barb Tees	3550K-13	3551K-13
	3/16"	Equal Barb Tees	3550K-14	3551K-14
	1/8"-1/16"	Reduction Barb Tees	3550K-15	3551K-15
	1/8"-1/16"	Reduction Elbow	3550K-16	3551K-16
	1/8"	Y-Connectors	3550K-17	3551K-17
	3/16"	Y-Connectors	3550K-18	3551K-18

*Material compatibility information is available on page 10.

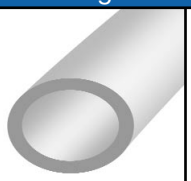
Nylon Quick Connect Fittings*

- **Superior to other locking systems, cannot be disengaged accidentally like push-button types**
- **Shut-off valve connectors stop the flow of solution until completely clicked into place**
- **Swivel connectors great for assemblies which require tubing to be attached prior to final connection**

Product Picture	Description (1 per pack)	Cat. No.
	1/16" Female Quick Disconnect fittings	3652K-01
	1/8" Female Quick Disconnect fittings	3652K-02
	3/16" Female Quick Disconnect fittings	3652K-03
	1/16" Male Quick Disconnect fittings	3652K-04
	1/8" Male Quick Disconnect fittings	3652K-05
	3/16" Male Quick Disconnect fittings	3652K-06
	1/16" Male Swivel Quick Disconnect fittings	3652K-07
	1/8" Male Swivel Quick Disconnect fittings	3652K-08
	3/16" Male Swivel Quick Disconnect fittings	3652K-09
	1/16" Locking Male Quick Disconnect fittings	3652K-10
	1/8" Locking Male Quick Disconnect fittings	3652K-11
	3/16" Locking Male Quick Disconnect fittings	3652K-12
	1/16" Locking Male Swivel Quick Disconnect fittings	3652K-13
	1/8" Locking Male Swivel Quick Disconnect fittings	3652K-14
	3/16" Locking Male Swivel Quick Disconnect fittings	3652K-15
	Female - Female Shut-Off Quick Disconnect	3652K-16
	Female - Male Shut-Off Quick Disconnect	3652K-17
	1/16" Female Shut-Off Quick Disconnect	3652K-18
	1/8" Female Shut-Off Quick Disconnect	3652K-19
	3/16" Female Shut-Off Quick Disconnect	3652K-20
	1/16" Male Shut-Off Quick Disconnect	3652K-21
	1/8" Male Shut-Off Quick Disconnect	3652K-22
	3/16" Male Shut-Off Quick Disconnect	3652K-23

*Material compatibility information is available on page 10.

Chemical Compatibilities

Tubing & Fitting Chemical Resistance Code		
	A	Excellent (No Effect)
	B	Good (Minor Effect)
	C	Fair (Moderate Effect)
	D	Poor (Severe Effect)
	1	Satisfactory to 72° F
	2	Satisfactory to 120° F

48 Hour Chemical Compatibility Test

Welch® brand tubing is made of the highest quality materials to meet your application needs. To ensure the tubing material is compatible with your application solutions we recommend you conduct a quick and simple 48-hour compatibility test.

1) Cut a small sample piece of tubing.

2) Weigh, measure, and visually inspect the sample and record results.

3) Place tubing in a sample jar with a lid.

4) Place sample with tubing aside for 48 hours. If process solution is elevated above ambient, store sample jar at processing temperature.

5) After 48 hours, remove tubing, weigh, measure, and visually inspect.

6) If no visible changes, try in pump.

CAUTION

The following chemical compatibility data is for reference only. The data has been compiled from outside sources provided by material suppliers and resin manufacturers. The particular conditions of your use and application of our products are beyond our control. Thus, it is imperative that you test our products in your specific application to determine their ultimate suitability. All information is provided without implied or expressed warranty or guarantee by Welch Rietschle Thomas, or the resin and feedstock manufacturers. Welch Rietschle Thomas assumes no liability with respect to the accuracy or completeness of the information contained herein and none of the information provided constitutes a recommendation or endorsement of any kind by Welch Rietschle Thomas.

DANGER

Variations in temperature, pressure, and concentrations can cause equipment to fail, even though it passed an initial test.

Chemical	Tubing				Fittings		
	Silicone	Santoprene®	PVC	Viton®	Nylon	Kynar® PVDF	Polyethylene
Acetaldehyde	A	C	D	D	A	D	C
Acetamide	B	B	D	B	A	C	A
Acetate Solvent	C	D	D	D	A	A	A
Acetic Acid	C	C	D	B	–	–	–
Acetic Acid 20%	B	A	D	B	D	A	A
Acetic Acid 80%	B	C	C	B	D	C	A2
Acetic Acid, Glacial	B	D	D	D	B	A1	A2
Acetic Anhydride	C	A	D	D	A1	B1	D
Acetone	D	C	D	D	A	D	B1
Acetyl Chloride (dry)	C	D	C	A	B	A2	D
Acetylene	B	B	A1	A	A	A	A
Acrylonitrile	D	C	B1	D	A1	A1	A
Adipic Acid	–	C	A2	A2	–	A2	–
Alcohols:Amyl	D	A3	A2	A	–	–	–
Alcohols:Benzyl	–	C	D	A	–	–	–
Alcohols:Butyl	B	A	A2	A	–	–	–
Alcohols:Diacetone	D	D	B1	D	–	–	–
Alcohols:Ethyl	B	A	C	A	–	–	–
Alcohols:Hexyl	B	A	A2	C	–	–	–
Alcohols:Isobutyl	A	A	A1	A	–	–	–
Alcohols:Isopropyl	A	B	A1	A	–	–	–
Alcohols:Methyl	A	A	A1	C	–	–	–
Alcohols:Octyl	B	B	–	B	–	–	–
Alcohols:Propyl	A	A	A1	A	–	–	–
Aluminum Chloride	B	A	A2	A	B1	A	B2
Aluminum Chloride 20%	B	A	A1	A	D	A	B2
Aluminum Fluoride	B	A	A2	A	A1	A	A2
Aluminum Hydroxide	–	A	A2	A	A1	A	A2
Aluminum Nitrate	B1	A1	B2	A2	A1	A2	–
Aluminum Potas. Sulfate 10%	A	A	A2	A	D	B	A2
Aluminum Potas. Sulfate 100%	A	A	A2	A	D	–	A2
Aluminum Sulfate	A	A	A2	A	A2	A	A2
Alums	A1	B	–	A	A	–	–
Amines	B	B	D	D	D	–	C1
Ammonia 10%	–	A	B1	D	A	A	C1
Ammonia Nitrate	–	C	B	D	D	A	–
Ammonia, anhydrous	C	A	A2	D	A1	A	B2
Ammonia, liquid	–	A	A1	D	B1	A	C1
Ammonium Acetate	–	A	A	A	A	–	–
Ammonium Bifluoride	–	D	A2	A	–	A	A2
Ammonium Carbonate	C	A	A2	A	A1	A	B2
Ammonium Chloride	C	B	A2	A	B	A	A2
Ammonium Hydroxide	A	A	A	B	A	A	A1
Ammonium Nitrate	C	B	A2	A	A1	A	A1
Ammonium Persulfate	D	A	A2	A	D	A1	A2
Ammonium Phos., Dibasic	A	A	A2	A	C1	A	A2
Ammonium Phos., Monobasic	A	A	A	A	B	–	A
Ammonium Phos., Tribasic	A	A	A	A	B	–	C
Ammonium Sulfate	A	A	A2	A	A1	A	A1
Ammonium Sulfite	–	A1	A2	D	A1	–	–
Amyl Acetate	D	D	D	D	B2	A2	C1
Amyl Alcohol	D	A3	A2	A	A1	A	B2
Amyl Chloride	D	D	D	B1	C1	A	D
Aniline	B	D	C1	A	A2	A1	B2
Aniline Hydrochloride	D	D	B2	A	–	–	–
Antifreeze	C	C	A	A	–	–	–
Antimony Trichloride	–	–	A2	A2	D	A	B2
Aqua Regia (80% HCl, 20% HNO3)	D	D	C1	B	–	–	–
Arochlor 1248	B	D	–	A	A1	–	C1
Aromatic Hydrocarbons	D	D	D	A	–	–	–
Arsenic Acid	A	A	A1	A2	C1	A	B2
Asphalt	D	D	A2	A	A	A	A1
Barium Carbonate	–	–	A2	A	A1	A	B2
Barium Chloride	A	A	A1	A	A	A	A1
Barium Cyanide	–	C	D	A	A1	–	B
Barium Hydroxide	A	A	A2	A	A1	A	B2
Barium Nitrate	B	A	A	A	A1	–	B1
Barium Sulfate	A	A	B1	A	A1	A	B2
Barium Sulfide	A	A	A2	A	A1	A	B2
Beer	A	A	A2	A	A1	A	A2
Beet Sugar Liquids	A	A	A2	A	A	A	A1
Benzaldehyde	D	D	D	D	A1	A2	A1
Benzene	D	D	C1	A	A1	A2	C1
Benzene Sulfonic Acid	D	A	A	A	–	–	–
Benzoic Acid	B	B	A	A	D	A	B2
Benzol	D	D	–	A	D	A	C1
Benzyl Chloride	D	D	–	A2	A2	–	–
Bleaching Liquors	B	D	A1	A	C	–	–
Borax (Sodium Borate)	B	A	A1	A	–	–	–
Boric Acid	A	D	A2	A	B	A	A2
Bromine	D	D	C1	A	D	A	D
Butadiene	D	B	C1	B	C1	A	D
Butane	D	A	C1	A	A2	A	C1
Butanol (Butyl Alcohol)	B	A	C1	A	B1	A	A2
Butter	B	B	–	A	–	–	–
Buttermilk	A	D	A1	A	–	–	–
Butyl Amine	B1	D	D	D	A2	A1	–
Butyl Ether	D	D	A2	D	A2	A1	–
Butyl Phthalate	A1	D	–	C1	A2	B1	–
Butylacetate	D	D	D	D	A	B2	C1
Butylene	D	D	A1	A	B1	A	B1
Butyric Acid	D	D	B1	B1	C1	A	D
Calcium Bisulfide	C	A	A2	A	–	–	–
Calcium Bisulfite	A	A	B	A	A2	A	A1
Calcium Carbonate	A	A	A2	A	A	A	B2
Calcium Chlorate	–	–	B2	A	–	A	–

Chemical Compatibilities

Chemical	Tubing				Fittings		
	Silicone	Santoprene®	PVC	Viton®	Nylon	Kynar® PVDF	Polyethylene
Calcium Chloride	A	A	C	A	A1	A	B2
Calcium Hydroxide	A	A	B	A	A2	A2	B2
Calcium Hypochlorite	B	D	B1	A	D	A	B2
Calcium Nitrate	B1	A2	A2	A2	A1	A2	–
Calcium Oxide	A	A	B	B	B	A	–
Calcium Sulfate	–	B	B2	A	D	A	B2
Cane Juice	A	A	A1	A	–	–	–
Carbolic Acid (Phenol)	D	D	D	A	D	A1	B1
Carbon Bisulfide	–	D	D	A	A	–	–
Carbon Dioxide (dry)	B	B	A2	B	A1	A	C1
Carbon Dioxide (wet)	B	B	A1	B	A1	A	C1
Carbon Disulfide	–	D	D	A1	B1	B2	C1
Carbon Monoxide	A2	B	A2	A	A1	B	B2
Carbon Tetrachloride	D	D	D	A	D	A2	B1
Carbon Tetrachloride (dry)	D	D	–	A2	–	A2	–
Carbon Tetrachloride (wet)	D	D	–	–	–	A2	–
Carbonated Water	–	A	A	A	A	–	A
Carbonic Acid	A	D	A2	A	A1	A	B2
Catsup	–	A	A	A	A	A	–
Chlorinated Glue	–	D	–	A	–	–	–
Chlorine (dry)	D	C	D	A	D	A	B
Chlorine Water	D	D	A2	A	C1	B	B1
Chlorine, Anhydrous Liquid	D	D	D	A	D	A1	B2
Chloroacetic Acid	D	D	B1	D	D	A1	C1
Chlorobenzene (Mono)	D	D	D	A	D	A1	C1
Chlorobromomethane	D	D	D	A	C	–	–
Chloroform	D	D	D	A	A	A	C1
Chlorosulfonic Acid	D	D	D	D	–	–	–
Chromic Acid 10%	C	D	A2	B	D	A	A2
Chromic Acid 30%	C	D	A1	A	D	A2	A2
Chromic Acid 5%	C	D	A2	A	D	A	B
Chromic Acid 50%	C	D	D	A	D	A2	A2
Cider	B1	A	A	A	–	–	–
Citric Acid	A	A	B2	A	A1	A	A1
Citric Oils	–	D	–	A	–	–	–
Clorox® (Bleach)	–	B	A	A	A	A	–
Copper Chloride	A1	A	A1	A	D	A	B
Copper Cyanide	A	A	A2	A	D	A	B2
Copper Nitrate	–	A	A2	A	D	A	B2
Copper Sulfate >5%	A	A	A2	A	D	A	B2
Copper Sulfate 5%	A	A	A2	A	D	A	B2
Cream	–	D	–	A	–	–	–
Cresols	D	D	D	A	D	A2	C1
Cresylic Acid	D	D	D	A	D	B1	B1
Cupric Acid	A1	A2	A2	A2	D	–	–
Cyanic Acid	A1	C	–	A	–	–	–
Cyclohexane	D	D	D	A	–	–	–
Cyclohexanone	D	D	D	D	–	–	–
Detergents	A	B	A	A	A1	A	A1
Diacetone Alcohol	D	D	D	D	A1	D	B1
Dichlorobenzene	D	D	D	C	D	A	–
Dichloroethane	–	D	D	C	A1	A	C1
Diesel Fuel	D	B	A1	A	A	A	C1
Diethyl Ether	D	D	D	D	A1	A1	–
Diethylamine	B	A	D	A	A	D	D
Diethylene Glycol	B1	A2	C1	A2	A1	A	B2
Dimethyl Aniline	D	D	D	D	A	A1	–
Dimethyl Formamide	C	D	D	C	A	D	–
Diphenyl	D	B	–	A2	–	–	–
Diphenyl Oxide	C	D	D	A	–	B2	–
Dyes	–	C	B	A	–	–	–
Epsom Salts (Magnesium Sulfate)	A	A	A1	A	A1	A	A2
Ethane	D	B	A1	A	D	A	–
Ethanol	B	A	C	A	A1	–	B
Ethanolamine	B	B	D	D	A	C1	–
Ether	D	D	D	C	A	B1	C1
Ethyl Acetate	B	D	D	D	A2	D	C1
Ethyl Benzoate	D	D	D	A1	–	D	–
Ethyl Chloride	D	C	D	A	A1	A	C1
Ethyl Ether	D	D	D	D	A1	A2	–
Ethylene Bromide	D	C	D	A	–	A	–
Ethylene Chloride	D	D	D	B	A	A	C1
Ethylene Chlorohydrin	C	A	D	A	D	A	–
Ethylene Diamine	A	B	D	B	D	B	–
Ethylene Dichloride	D	D	D	A	A1	A	C1
Ethylene Glycol	A	A	A	A	A	A	A1
Ethylene Oxide	D	D	D	D	A1	A	C1
Fatty Acids	C	C	A	A	A1	A	A
Ferric Chloride	B	B	A	A	A	A	A1
Ferric Nitrate	C	A	A	A	A1	A	B2
Ferric Sulfate	B	A	A	A	A1	A	A2
Ferrous Chloride	–	A	A	A	D	A	A1
Ferrous Sulfate	–	–	A	B	D	A	A1
Fluoboric Acid	–	A	A	B	D	A1	B2
Fluorine	D	–	D	C	D	A1	C1
Fluosilicic Acid	–	A	D	B1	D	A1	B1
Formaldehyde 100%	B	C	A	D	D	A	B
Formaldehyde 40%	–	B1	A	A	A	A	A2
Formic Acid	B	A	A1	C	D	A	B2
Freon 113	D	C	B	B	–	–	–
Freon 12	D	A	A2	B	–	–	–
Freon 22	D	A	A	D	–	–	–
Freon TF	D	A	B	B	–	–	–
Freon® 11	D	D	A2	B	D	A	C
Fuel Oils	D	B	A2	A	A1	B	C1
Furan Resin	D	D	A	D	–	–	–

Chemical	Tubing				Fittings		
	Silicone	Santoprene®	PVC	Viton®	Nylon	Kynar® PVDF	Polyethylene
Furfural	D	D	D	D	B	B2	C1
Gallic Acid	D	B	B	A	A	A1	B2
Gasoline (high-aromatic)	D	A	A	A	A	A	C1
Gasoline, leaded, ref.	D	B	B	A1	A2	A	–
Gasoline, unleaded	D	B	C2	A1	A2	A	–
Gelatin	A	A	B	A	A1	A	A2
Glucose	A	A	A2	A	A	A	A2
Glue, P.V.A.	A	A	C	B	A1	–	A1
Glycerin	A	A	A	A	A1	A	A1
Glycolic Acid	A	A	B	A	–	B	A2
Grape Juice	A	D	A	A	–	–	–
Grease	D	D	A	A	–	A	–
Heptane	D	B	C1	A	A	A	B1
Hexane	D	B	B1	A	B	A	C1
Honey	A	–	A	A	A	A	B
Hydraulic Oil (Petro)	B	A	A	A	A1	A	C
Hydraulic Oil (Synthetic)	B	A	A	A	A1	A	A
Hydrazine	B	B	–	A	-	A	–
Hydrobromic Acid 100%	D	D	A1	A	D	A	B1
Hydrobromic Acid 20%	D	D	B2	A	D	A	B2
Hydrochloric Acid 100%	D	D	D	A	D	A	–
Hydrochloric Acid 20%	D	C	A2	A	D	A	A2
Hydrochloric Acid 37%	B	B	B	A	D	A	B2
Hydrochloric Acid, Dry Gas	–	–	A2	–	A1	A	A2
Hydrocyanic Acid	C	B	B	A	B	A	A2
Hydrocyanic Acid (Gas 10%)	D	A	A	A	–	–	–
Hydrofluoric Acid 100%	D	D	C	B	D	A	–
Hydrofluoric Acid 20%	D	B	B	A	C1	A	A2
Hydrofluoric Acid 50%	D	D	B1	B	D	A	A1
Hydrofluoric Acid 75%	D	D	C	B	D	A	C1
Hydrofluosilicic Acid 100%	D	B	B1	A	D	A1	B1
Hydrofluosilicic Acid 20%	D	B	A2	A	D	A	B2
Hydrogen Gas	C	A	A2	A	A2	A	A2
Hydrogen Peroxide 10%	A	D	A1	A	C1	A	A2
Hydrogen Peroxide 100%	B	D	A	A	D	A1	C2
Hydrogen Peroxide 30%	B	D	A1	A	D	A	C2
Hydrogen Peroxide 50%	B	D	A1	A	D	A1	C2
Hydrogen Sulfide (aqua)	C	A	B1	D	C1	A	A
Hydrogen Sulfide (dry)	C	A	A2	D	C1	A	A
Hydroquinone	–	A	B	B	D	–	–
Hydroxyacetic Acid 70%	–	A	D	A	–	–	–
Ink	–	A	C	A	C	A	–
Iodine	–	D	A	A	A	A2	A1
Iodine (in alcohol)	–	–	A	–	C	A	B
Isooctane	D	B1	A1	A1	A1	A2	–
Isopropyl Acetate	D	D	D	D	B1	D	B1
Isopropyl Ether	D	D	B	D	A1	D	A
Isotane	–	D	A	A	D	A	–
Jet Fuel (JP3, JP4, JP5)	D	D	C	A	C	B	B
Kerosene	D	A	A2	A	A	A	C1
Ketones	–	D	D	D	A2	C1	C1
Lacquer Thinners	D	D	D	D	A1	-	B1
Lacquers	D	D	D	D	A1	D	B1
Lactic Acid	A	A	B1	A	B	B1	A1
Lard	B	D	A1	A	A1	A	B1
Latex	A	–	–	A	A1	A	–
Lead Acetate	A	A	B	D	A	A	A2
Lead Nitrate	B1	A1	A2	A2	–	A2	–
Lead Sulfamate	B	A	B	A	B1	A	A1
Ligroin	D	B	–	A	D	A	C2
Lime	–	A	B	A	A1	A	B1
Linoleic Acid	B1	–	A2	B1	–	A2	–
Lithium Chloride	A1	A1	D	A1	–	A2	–
Lubricants	D	D	B2	A	A1	A	–
Lye: Ca(OH)2 Calcium Hydroxide	A	A	B2	B1	A2	A2	B2
Lye: KOH Potassium Hydroxide	C	B	B	B	C	A	A
Lye: NaOH Sodium Hydroxide	A1	B2	A	B1	A	D	B2
Magnesium Bisulfate	–	B	A2	–	A1	-	-
Magnesium Carbonate	–	A	B	A	–	A	A2
Magnesium Chloride	A	A	B	A2	A1	A	A2
Magnesium Hydroxide	A	A	A2	A	B1	A	A2
Magnesium Nitrate	–	A	A2	A	A1	A	A2
Magnesium Sulfate (Epsom Salts)	A	A	A1	A	A1	A	A2
Maleic Acid	–	D	A2	A	A	A	B2
Maleic Anhydride	–	D	–	A	–	A	–
Malic Acid	B	D	A2	A	A	A	B2
Manganese Sulfate	A1	A2	C	A2	A2	A2	–
Mayonnaise	–	A	D	A	–	–	–
Melamine	C	D	D	A	A	–	–
Mercuric Chloride (dilute)	–	A	A	A	D	A	A2
Mercuric Cyanide	A	A	A	A1	A2	A	A2
Mercurous Nitrate	–	B1	A	A1	–	A	–
Mercury	–	A	A	A	A	A	A2
Methane	D	B	B	A	A	A	–
Methanol (Methyl Alcohol)	A	A	A1	C	B1	A	A1
Methyl Acetate	D	B	D	D	A2	B1	B1
Methyl Acetone	–	D	D	D	A	D	–
Methyl Acrylate	D	B	–	D	–	–	–
Methyl Alcohol 10%	A	A	A1	C	B1	A	A1
Methyl Bromide	–	D	D	A	B1	A	–
Methyl Butyl Ketone	D	D	A	D	D	D	–
Methyl Cellosolve	D	B	D	D	C	A	–
Methyl Chloride	D	D	D	A1	B1	A	C1
Methyl Dichloride	–	–	A	A1	C	D	-
Methyl Ethyl Ketone	D	D	D	D	A1	D	B2
Methyl Ethyl Ketone Peroxide	B	D	–	D	–	–	–

Chemical Compatibilities

Chemical	Tubing				Fittings		
	Silicone	Santoprene®	PVC	Viton®	Nylon	Kynar® PVDF	Polyethylene
Methyl Isobutyl Ketone	D	D	D	D	B2	D	B1
Methyl Isopropyl Ketone	C	D	D	D	A	–	–
Methyl Methacrylate	C	D	A	D	–	–	–
Methylamine	–	–	D	D	–	C	–
Methylene Chloride	–	–	D	B	C1	B1	C1
Milk	A	A	A2	A	–	–	–
Mineral Spirits	D	C	A	A	A	–	–
Molasses	–	A	A	A	A1	B1	A
Monochloroacetic acid	–	A1	–	C	D	B1	–
Monoethanolamine	B	D	D	D	A	C	–
Morpholine	–	D	–	–	A2	B1	–
Motor oil	–	B1	B	–	A2	B	–
Mustard	–	A	B	D	–	–	–
Naphtha	D	D	A1	A	A	A	A
Naphthalene	D	D	D	A	A1	A2	A
Natural Gas	A	A	A	A	–	–	–
Nickel Chloride	A	B	A	A	C1	A	B2
Nickel Nitrate	–	A2	A	A2	A1	A2	-
Nickel Sulfate	A	A	A	A	A1	A	B2
Nitrating Acid (<15% HNO3)	–	A	D	–	–	–	–
Nitrating Acid (>15% H2SO4)	–	A	D	–	–	–	–
Nitrating Acid (_1% Acid)	–	A	D	–	–	–	–
Nitrating Acid (_15% H2SO4)	–	A	D	–	–	–	–
Nitric Acid (20%)	D	D	A1	A	D	A	C1
Nitric Acid (50%)	D	D	B1	A	D	A1	C1
Nitric Acid (5-10%)	C	B	A1	A	D	A1	B2
Nitric Acid (Concentrated)	D	D	B1	A	–	–	–
Nitrobenzene	D	D	D	B	B1	A1	C1
Nitromethane	D	D	B2	D	B1	A2	–
Nitrous Acid	–	D	A	B	-	B	–
Nitrous Oxide	–	A	A	B	C	D	–
Oils:Citric	–	D	B	A	–	–	–
Oils:Cottonseed	A	C	B2	A	–	–	–
Oils:Diesel Fuel (20, 30, 40, 50)	D	B	B	A	–	–	–
Oils:Fuel (1, 2, 3, 5A, 5B, 6)	C	D	A2	B	–	–	–
Oils:Hydraulic Oil (Petro)	B	A	A	A	–	–	–
Oils:Hydraulic Oil (Synthetic)	B	A	A	A	–	–	–
Oils:Linseed	A	D	A2	A	–	–	–
Oils:Mineral	C	B	B	A	–	–	–
Oils:Orange	D	C	C1	A	–	–	–
Oils:Silicone	C	D	A	A	–	–	–
Oils:Transformer	B	B	B	A	–	–	–
Oils:Turbine	D	D	A1	A	–	–	–
Oleic Acid	D	C	C2	B	A	A	C2
Oleum 100%	D	D	D	A	D	D	D
Oleum 25%	D	D	D	A	D	C1	D
Oxalic Acid (cold)	B	D	B	A	B2	B	A2
Ozone	A	C	B	A	D	A	–
Palmitic Acid	D	D	B1	A1	A	A2	–
Paraffin	–	B	B	B	A1	A	B
Pentane	D	B	A	A	A1	A	D
Perchloric Acid	D	A	C	A	D	A	–
Perchloroethylene	D	D	C1	A	C1	A	D
Petrolatum	D	A	B	A	D	A	B
Petroleum	D	B1	–	A2	A1	A	–
Phenol (10%)	D	D	C1	A	D	A	A2
Phenol (Carbolic Acid)	D	D	D	A	D	A1	B1
Phosphoric Acid (>40%)	D	B	B	A	B1	B	–
Phosphoric Acid (crude)	D	D	B2	A	B1	A	B1
Phosphoric Acid (molten)	–	A	D	–	–	D	–
Phosphoric Acid (_40%)	C	B	B	A	–	–	–
Phosphoric Acid Anhydride	–	A	–	–	–	D	–
Phosphorus	–	–	A1	–	–	A1	–
Phosphorus Trichloride	–	D	D	A1	–	–	–
Photographic Developer	B	A	A	A	–	-	A
Photographic Solutions	A	B1	A	B1	A1	B2	–
Phthalic Acid	B1	A	–	A1	B1	A2	–
Phthalic Anhydride	–	A	D	A	–	A	–
Picric Acid	D	A	D	A	C1	A1	–
Propylene Glycol	A	C	C1	A	A	-	B2
Resorcinal	–	D	C	A1	D	-	–
Rosins	A	A	C1	A	A1	-	B1
Rum	A	A	A	A	–	–	–
Rust Inhibitors	–	C	–	A	–	–	–
Potash (Potassium Carbonate)	–	A	A	A	A	A	B
Potassium Bromide	A1	A	A	A	A1	A	A
Potassium Chlorate	B	A	A	A	C1	A	A
Potassium Chloride	A	A	A	A	A1	A	A
Potassium Cyanide Solutions	A	B	A	A	A1	A	A
Potassium Dichromate	A	A	A	A	B1	A	A
Potassium Ferrocyanide	–	A	A	A	B1	A	A1
Potassium Hydroxide (Caustic Potash	C	B	A1	B	C1	A	A
Potassium Nitrate	A	A	A	A	B1	A	B
Potassium Permanganate	–	A	A1	A	D	A	A
Potassium Sulfate	A	A	A2	A2	A1	A	A2
Potassium Sulfide	A	A	A2	A	A	A	A2
Propane (liquefied)	D	C	A1	A	A1	A	C1
Pyrogallic Acid	–	A	A	A	-	A	–
Salicylic Acid	–	–	B1	A1	A1	A	–
Potassium Hypochlorite	–	B2	B1	–	B1	A1	–
Potassium Ferricyanide	–	A1	A	A	B1	A2	–
Potassium Iodide	–	A	A2	A	A1	A2	–
Propylene	D	D	B1	A1	D	A2	A2
Potassium Bicarbonate	A1	A	A	A	A1	B	A
Potassium Chromate	–	A	A	A	B	B	A
Pyridine	D	D	D	D	C1	D	B1

Chemical	Tubing				Fittings		
	Silicone	Santoprene®	PVC	Viton®	Nylon	Kynar® PVDF	Polyethylene
Salt Brine (NaCl saturated)	A1	A2	A	A2	A	A	–
Sea Water	A1	B2	A2	A	A2	A	A2
Shellac (Bleached)	–	B2	–	A	A1	–	A1
Shellac (Orange)	–	D	–	A	A1	–	A1
Silicone	C	A	A	A	A1	A	A
Silver Nitrate	A	A	A1	A	A1	A	B2
Soap Solutions	A	B	A	A	A1	A1	C2
Soda Ash (see Sodium Carbonate)	A	A1	A	A	–	–	–
Sodium Acetate	D	B	B1	D	B1	A	B2
Sodium Benzoate	–	A1	B1	A1	B1	A2	–
Sodium Bicarbonate	A	A	A2	A	A	A	A2
Sodium Bisulfate	A	A	A2	A	A1	A	A2
Sodium Bisulfite	A	A	A2	A	C1	A	–
Sodium Borate (Borax)	A	A	A2	A	A	A	A2
Sodium Bromide	–	A1	B2	A1	B1	A2	–
Sodium Carbonate	A	A	A2	A	B1	A	B2
Sodium Chlorate	C	A	A1	A	D	A	B2
Sodium Chloride	A	A	A2	A	A1	A	A2
Sodium Chromate	–	A	–	A	C	A	–
Sodium Cyanide	A	A1	A2	A2	A1	A	A2
Sodium Ferrocyanide	–	A	A	A	-	A	–
Sodium Fluoride	–	A	A2	A	B	A	A2
Sodium Hydrosulfite	C	B	C	A	A	–	–
Sodium Hydroxide (20%)	A2	B2	A	C	A	A	A2
Sodium Hydroxide (50%)	A1	B2	A	D	A	D	A2
Sodium Hydroxide (80%)	A1	B1	A	D	C	D	B2
Sodium Hypochlorite (<20%)	B	C	A	A1	D	A	A
Sodium Hypochlorite (100%)	B	C	B	A1	D	A	B2
Sodium Hyposulfate	–	C	–	–	–	–	–
Sodium Metaphosphate	A	B	A	A	A1	A	A1
Sodium Metasilicate	–	A	A	A	–	–	–
Sodium Nitrate	D	B	A2	A	A1	A	A2
Sodium Perborate	B	B	A2	A	B1	-	A1
Sodium Peroxide	D	B1	B2	A	A1	A	A
Sodium Polyphosphate	D	B	A1	A	A1	A	A
Sodium Silicate	A	A	A2	A	A1	A	A2
Sodium Sulfate	A	A	A2	A	A	A	A2
Sodium Sulfide	A	A	A2	A2	A1	A	A2
Sodium Sulfite	A	A	A2	A2	D	A	B1
Sodium Tetraborate	A	B	A2	A	A	-	A2
Sodium Thiosulfate (hypo)	A	A2	A2	A	B	A	A1
Stannic Chloride	B	C1	A2	A	B1	A	A2
Stannous Chloride	B	A1	A1	A	C1	A	B2
Starch	–	A	A	A	–	–	–
Stearic Acid	B	B1	B2	A1	A2	A	B1
Stoddard Solvent	D	C1	C1	A	A	A	C2
Styrene	D	D	D	B	A1	–	–
Sulfate (Liquors)	B	B	B	A1	B1	A	A2
Sulfur Chloride	C	D	C1	A	A1	A1	C1
Sulfur Dioxide	B	B	A1	A	C1	A	B1
Sulfur Dioxide (dry)	B	D	A2	A	B1	A	B1
Sulfur Hexafluoride	B	A	B	–	–	–	–
Sulfur Trioxide	B	D	A	A	–	–	–
Sulfur Trioxide (dry)	B	D	A1	A	A1	C1	C1
Sulfuric Acid (<10%)	C	B2	A1	A	C1	A	A1
Sulfuric Acid (10-75%)	D	B1	A1	A2	D	A	A1
Sulfuric Acid (75-100%)	D	D	D	A1	D	A	B1
Sulfuric Acid (cold concentrated)	D	D	D	B	D	A	C
Sulfuric Acid (hot concentrated)	D	D	D	A2	D	C	D
Sulfurous Acid	D	C	A2	A	D	A	B2
Tallow	–	B	–	A	A1	–	–
Tannic Acid	B	A	A1	A	C1	B	B2
Tanning Liquors	B	A	A1	A	A1	–	A1
Tartaric Acid	A	A2	A1	A	B2	B	A1
Tetrachloroethane	D	D	C	A	C1	A	–
Tetrachloroethylene	D	D	D	A	A1	-	B
Tetrahydrofuran	D	D	D	D	A	B1	C1
Tin Salts	B	–	A	A	-	A	–
Toluene (Toluol)	D	D	D	C	A1	A1	C1
Tomato Juice	–	A	A	A	A1	A	A1
Trichloroacetic Acid	D	D	B	C	C	B	–
Trichloroethane	D	D	C	A	C1	A	–
Trichloroethylene	D	D	D	A	C1	B	C1
Tricresylphosphate	C	C	D	A2	A2	D	B1
Triethylamine	–	A	B	D	A1	A2	–
Trisodium Phosphate	A	A	A	A	A	A	–
Turpentine	D	D	D	A	B	A	C1
Urea	B	B	D	A	A	A	–
Urine	–	D	A	A1	B	A	A2
Varnish	D	D	D	A	A	-	C1
Vinegar	A	B	B	A	A	B	B2
Vinyl Acetate	D	D	D	A1	-	A2	–
Vinyl Chloride	–	D	D	A1	A1	B1	–
Water, Acid, Mine	B	C	B	A	A	A	A2
Water, Deionized	–	A	A2	A1	A1	A2	–
Water, Distilled	C	A	A2	A	A1	A	A2
Water, Fresh	B	A	B	A	A1	A	A2
Water, Salt	B	A	B	A	A2	A	A2
Weed Killers	A	C	–	A	A	–	–
Whiskey & Wines	A	C	A2	A	A1	A	C
White Liquor (Pulp Mill)	A	A	A2	A	A1	A1	A2
White Water (Paper Mill)	–	A	A	A	A	-	–
Xylene	D	D	D	B	A2	A	C1
Zinc Chloride	B	A	B	A	A	A	A1
Zinc Sulfate	A	A	A2	A	A	A	A2

Ordering, Service & Trademarks

HOW TO ORDER

From Welch® Dealers:
Welch Rietschle Thomas products can be ordered from authorized laboratory dealers. Please check the Welch web site at www.welchvacuum.com or call (847-676-8800) or fax for a list of Welch dealers in the United States, Canada, and other locations.

From Welch in the U.S.A and Canada:
To order your vacuum pumps, parts and accessories:
Online @ www.welchvacuum.com
E-mail: welchvacuum@thomasind.com
Fax: 920-451-4397

From Rietschle Thomas sales offices.
See country directory on back cover

Mail:
Welch Rietschle Thomas
1419 Illinois Ave.
P.O. Box 29
Sheboygan, WI 53082-0029

Payment Terms:
Net 30 days with approved credit; Mastercard, Visa or American Express accepted for your convenience.

Minimum Order: $50.00

TECHNICAL ASSISTANCE

Call: (847) 676-8819
Fax: (847) 677-8606
Email: welchvacuum@thomasind.com
Online: www.welchvacuum.com

WELCH REPAIR SERVICE

For warranty or non-warranty repairs, a RA number is needed prior to returning product for inspection. All paid repairs come with a new pump warranty. All returns must come with a P.O. with approved credit or credit card number. An RA number is obtained by filling out a safety service form located on the Welch web site, www.welchvacuum.com. A Welch customer service representative will then call or fax you with the RA number and shipping instructions.

The reason for the safety service form is that it contains information on what chemicals may have been ingested into the pump during its use. Worker safety rules require this information prior to a repairman examining the pump.

For Repair Service Inquiry:

Email: serviceusa@rtpumps.com

Fax: 410-712-4148

Call: 410-712-4100
8:00 a.m. to 4:30 p.m. Eastern Time

WARRANTY
This Welch Peristaltic pump is warranted to be free from defects in material and workmanship. The liability of Welch Rietschle Thomas under this warranty is limited to servicing, adjusting, repairing or replacing any unit or component part which in the judgment of Welch Rietschle Thomas has not been misused, abused or altered in any way causing impaired performance or rendering it inoperative. No other warranties are expressed or implied. The method of executing this warranty: servicing, adjusting, repairing or replacing shall be at the discretion of Welch Rietschle Thomas. Peristaltic pumps that have been used for pumping fluid, for any period, however short, will be repaired under this warranty rather than replaced.

The warranty is effective for one year from the date of original purchase when:

1. The warranty card has been completed and returned.
2. The product is returned to the factory or other designated service centers, freight prepaid.
3. The product in our judgment is defective through no action or fault of the user.

If the product has become defective through misuse, abuse, or alteration, repairs will be billed regardless of the age of the product. In this event, an estimate of the repair costs will be submitted and authorization of these charges will be required before the product is repaired and returned.

To reduce additional charges and delays either within or outside of the warranty period, contact Welch Rietschle Thomas @ 410-712-4100 for a return authorization number. Products without a return authorization number will be refused by our receiving department. Before shipping, properly pack the pump, insure it against loss or damage, and on the outside of the pump packaging and the packing slip write in the return authorization number. Pumps damaged due to improper packaging are the customer's responsibility.

For service outside the U.S.A and Canada, contact your closest Rietschle Thomas sales office. See country directory on back cover.

TRADEMARKS

The following is a registered trademark of Welch Rietschle Thomas:

Welch®

The following are registered trademarks of other companies:

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