HARWIL®

FLUID FLOW AND LIQUID LEVEL SWITCHES

Liquid Level Pump Up/Pump Down Controllers
Pump Emergency Shutdown Controllers

Wetted Surfaces
Brass • Stainless Steel • Hastelloy® C
Titanium • Tantalum • Noryl® • Fortron®
Teflon® • Hypalon® • EPDM • Viton®

Harwil Corporation
541 Kinetic Drive
Oxnard, CA 93030-7923

www.harwil.com

Phone: (805) 988-6800
Fax: (805) 988-6804
Email: harwil@harwil.com

Operational Information

We DO NOT use multiple choice menu driven voice mail in response to your important telephone call.
WE ANSWER THE TELEPHONE with actual human beings experienced in taking your order for standard products or providing technical application assistance.
Our PERSON TO PERSON order desk is open 7:30 am to 4:00 pm (PST), Monday through Friday.
Our tape reorder is on at all other times. We WILL respond to your important message at the beginning of our next business day.
Our FAX machine is never turned off. (805) 988-6804

Technical Application Assistance

In depth technical information to help you select the optimum HARWIL product for your particular application is as close as your telephone and fax machine.

- Tel: (805) 988-6800, FAX (805) 988-6804
- We can modify standard units for special applications.
- We also design and manufacture completely new models for O.E.M. applications.

Emergency Deliveries

Our 50 year history of supplying support items such as level controllers, fluid flow and liquid level switches to a broad spectrum of industries has “burned” into our collective brains the importance of fast delivery of emergency orders to keep our customers “on line.” To this end we:

- Attempt to keep reasonable numbers of all standard models in stock, i.e. physically on our “emergency shelf” for instantaneous delivery of small orders.
- We have shipped orders received by 9:00 AM local time that same day.

Origin of Products

99% of the products listed in this catalog are conceived, designed, developed, manufactured and marketed by HARWIL Corporation. The exception in the current catalog is The Intrinsically Safe Relay which is a product of Warrick Controls, Inc. (USA)

Background

HARWIL Corporation was formed in 1956. Electromechanical fluid flow and liquid level switches were one of our initial product lines and are now the major product line. Current development is directed toward electronic and electro-optical flow and level switches and controls.

Trademarks

Viton® is a registered trademark of DuPont performance Elastomers.

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Table of Contents

Fluid Flow Switches: Typical Operational Parameters - Extended Values Available

Controllers

Liquid Level Switches

Model	Insertion Thread Size	On/Off Liquid Differential	Wetted Surface	Specific Gravity	Working Fluids	Temp (°F)	Psig	Electric Switch	Page
L-5	2" NPT	≈ 1/4"	Brass, Bronze EPDM 302/316 Stainless	Cont. ADJ down to 0.6	Contaminated Fluids Compatible with Brass	180	300 Psig	SPDT 15A 120/240 VAC 124 VDC Plus Dry Circuit	26
L-5SS	2" NPT	≈ 1/4"	302SS 316 Stainless Viton®, Teflon®	Cont. ADJ down to 0.6	Contaminated & Corrosive Fluids	180	300 Psig	SPDT 10A 120/240 VAC 124 VDC Plus Dry Circuit	26
L-8N	1 1/4" NPT	≈ 1/4"	Noryl® (PPO) EDPM, 316SS 302SS	Cont. ADJ down to 0.6	Contaminated & Corrosive	180	75 Psig	SPDT 15A 120/240 VAC 124 VDC Plus Dry Circuit	28
L-8CR	1 1/4" NPT	≈ 1/4"	Fortron® (PPS) Viton®, Hast.® C	Cont. ADJ down to 0.6	Contaminated & Corrosive	180	75 Psig	SPDT 15A 120/240 VAC 124 VDC Plus Dry Circuit	28
L-21N	1 1/4" NPT	Variable 4 Steps 1", 2", 3", 5" Differential	Noryl® (PPO) 316SS	0.7	Water to Mildly Corrosive Fluids	180	200 Psig	SPDT 15A 120/240 VAC 124 VDC	30
L-21VCR	1 1/4" NPT	Variable 4 Steps 1", 2", 3", 5" Differential	Fortron® (PPS) Hast.® C	0.7	Water to Corrosive Fluids	200	200 Psig	SPDT 15A 120/240 VAC 124 VDC	30
L-30N	1 1/4" NPT	≈ 1/4"	Noryl® (PPO) EPDM 316SS	0.7	Contaminated & Mildly Corrosive Mixtures	180	100 Psig	SPDT 15A 120/240 VAC 124 AC Plus Dry Circuit	32
L-30CR	1 1/4" NPT	≈ 1/4"	Fortron® (PPS) Viton®, Hast.® C	0.7	Contaminated & Corrosive Mixtures	200	100 Psig	SPDT 15A 120/240 VAC 124 AC Plus Dry Circuit	34
L-40N	1 1/4" NPT	≈ 1/4"	Noryl® (PPO) 316SS	0.7	Contaminated & Mildly Corrosive Mixtures	180	250 Psig	SPST Reed Sw. 120/240 VAC 300VDC Plus Dry Circuit	36
L-40CR	1 1/4" NPT	≈ 1/4"	Fortron® (PPS) Hast.® C	0.7	Contaminated & Corrosive Mixtures	200	250 Psig	SPST Reed Sw. 120/240 VAC 300VDC Plus Dry Circuit	36
L-40N /SG	1 1/4" NPT	≈ 1/4"	Noryl® (PPO) 316SS	0.7	Contaminated & Corrosive Mixtures	180	140 Psig	SPST Reed Sw. 120/240 VAC 300VDC Plus Dry Circuit	38
L-40VCR /SG	1 1/4" NPT	≈ 1/4"	Fortron® (PPS) Hast.® C	0.7	Contaminated & Corrosive Mixtures	200	150 Psig	SPST Reed Sw. 120/240 VAC 300VDC Plus Dry Circuit	38

Miscellaneous

Model	Type	Description	Page
Series 27	Intrinsically Safe Solid State Relay for Use in Hazardous Areas.	Allow all Harwil Flow & Level Switches to be used in Class I, II, & III Hazardous Areas.	46
Protective Coatings	Epoxy and PTFE coating of Standard Flow and Level Switches provide additional protection against corrosive chemicals and environments.		48
	CHEMICAL RESISTANCE CHARTS		49-72

Fluid Flow Switch Application Information Request

For Application Assistance, Please copy and mail or fax the following information to our Technical Staff.

Name:		Title:	
Company:			
Address:			
City, State:		ZIP:	
Phone:		Fax:	

Working Fluid _____ Flow Range (GPM):_____Low_____High_____Switch Point

Pipe Size (in") _____ Pipe Material _____

Switch On/Off Flow Hysteresis (GPM) _____ Pressure Drop (PSI): Normal Flow _____

Max Flow _____

Temp (°F) Max_____ Min_____ Pressure (PSI) Max_____ Min_____

Switch Voltage AC _____ DC _____ Switching Current (AMP) _____

Electric Load Type: Resistive _____ Inductive _____

Please note switch electric Power load option

Option A. Medium Power (15 AMP/120-240 VAC) for Driving Motors, Heaters, Solenoid Valves, Motor Contractors, etc. Direct: _____

Option B. Low Power "Dry Circuits" for Interface with PLC, Computer Input, etc.: _____

Special Conditions and Requirements: _____

_____

_____

_____

Drawing:

541 Kinetic Drive, Oxnard, CA 93030
Tel: (805) 988-6800 Fax: (805) 988-6804
Email: harwil@harwil.com

Liquid Level Switch Application Information Request

For Application Assistance, Please copy and mail or fax the following information to our Technical Staff.

Name:		Title:	
Company:			
Address:			
City, State:		ZIP:	
Phone:		Fax:	

Working Fluid _____ Tank Size (Inches or Feet) _____

Tank Material _____

Operational Mode

A. Limit Switch _____ High _____ Low _____

B. Pump Up _____ Pump Down _____ Level Differential (in") _____

Pressure (PSI): Working _____ Max _____

Temp. (°F/°C): Working _____ Max _____

Switch Voltage AC _____ DC _____ Switching Current (AMP) _____

Electric Load Type: Resistive _____ Inductive _____

Please note switch electric Power load option

Option A. Medium Power (15 AMP/120-240 VAC) for Driving Motors, Heaters, Solenoid Valves, Motor Contractors, etc. Direct: _____

Option B. Low Power "Dry Circuits" for Interface with PLC, Computer Input, etc.: _____

Special Conditions and Requirements: _____

_____

_____

_____

Drawing:

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Email: harwil@harwil.com

Harwil Corporation Product/Component Billing and Return Terms

Ownership of all products and components is transferred from Harwil Corp. to the purchasing entity at the time and place of initial delivery of subject products and components to the transporting carrier (UPS, USPS, FedEx, Etc.) Harwil Corp. will make its best efforts to follow up, monitor, and trace shipment of all items indicated above, but cannot guarantee delivery and cannot assume any liability for any damages, labor costs or delays incidental thereto.

- Non Credit Terms . . . . . Cash, C.O.D. or VISA / MasterCard
- Credit Terms . . . . . Net 30 days on approved credit
- Credit Approval . . . . . Allow two weeks for application approval
- F.O.B. . . . . Oxnard, CA

Invoices:

Will be dated the day of shipment. All accounts are due and payable in terms stated on the invoice.

Claims:

If product and/or component shortage, breakage or discrepancy is found, advise us at once in writing. No claims honored after 20 days from date of shipment.

Returns:

No credit will be allowed for goods returned without an approved material return authorization (MRA) number.

Restocking Charges:

A restocking fee of 20% will be charged for merchandise returned unused and in good condition.

Finance Charges:

After 30 days, a finance charge of 1.5% (18% per annum) will be charged on all past due accounts. A reminder statement will be sent at 60 days past due. After 90 days, a second statement will be sent, incurring a $5.00 follow-up service charge. All additional statements and telephone calls will be billed at $5.00 each.

Delinquent Invoices:

An Overdue Invoice (60 days or more) or exceeding written credit limit will require holding delivery of current and future purchase orders until either or both conditions are corrected.
An invoice that is 90 days delinquent will be mailed a final 10 day notice. Response requires payment or contact with our accounting department for special payment arrangements. No response assumes customer does not intend to honor the debt and the account will be turned over to our Collection Agency which could effect subject credit rating.
Collection Fees and related costs will be added to the original invoice plus other charges as listed above.
We appreciate your interest in our products and strive to provide you with dependable high quality products that satisfy your requirements. We do not have the financial resources to act as a bank or lending institution to companies that do not pay their invoices in a timely manner. If you experience payment difficulties, we will be happy to work with you to arrange a mutually satisfactory payment schedule. Please call our accounts receivable representative, at telephone number (805) 988-6800 or FAX (805) 988-6804

Please acknowledge receipt of this notice by signing and dating as indicated below, and returning a copy to Harwil Corp. 541 Kinetic Drive, Oxnard, CA 93030

_____	_____	_____
Name	Title	Date

Again, thank you for your interest in our products.

Certificate of Conformance

All HARWIL Corporation ("HARWIL") products are manufactured using new materials and components. Our products meet the applicable performance and materials specifications indicated in our current Specifications Sheets and Parts Lists. HARWIL endeavors to obtain its materials and components from American Companies.

DOMINANCE OF HARWIL LIMITED EXPRESS WARRANTY

HARWIL warrants that all HARWIL products will be free from defects in material and workmanship for a period of one year from the date of original shipment. This warranty shall be limited to the replacement and reconditioning of our products and parts. HARWIL reserves the right and sole discretion to modify or change the composition, design and appearance of its products at anytime.

THIS WARRANTY SHALL BE IN LIEU OF ALL WARRANTIES OF MERCHANTABILITY AND OF ALL WARRANTIES OF FITNESS FOR A PARTICULAR PURPOSE RELATING TO HARWIL PRODUCTS AND PARTS. BUYER'S SOLE REMEDY HEREUNTO SHALL BE REPLACEMENT OR RECONDITIONING AS SET FORTH HEREIN.

HARWIL shall incur no obligations hereunder and no liability in the event of (a) buyer not fulfilling its responsibilities, including as set forth herein; (b) neglect, alteration or improper product use, including use with non-compatible devices or chemicals; or (c) repair by other than HARWIL. ANY LAWSUIT RELATING TO THIS WARRANTY MUST BE COMMENCED WITHIN ONE YEAR OF THE DATE IT ACCRUES.

Each user of our product should make appropriate analysis and tests to determine the suitability of the product for the intended use prior to purchase. HARWIL provides no warranty and assumes no responsibility for corrosive attack on any material, component or design features associated with any of its products.

Corrosion resistance information listed in HARWIL specification sheets, installation sheets and product brochures is solely for general background information. This table has been compiled from literature published by various material suppliers and by equipment manufacturers who use these materials in their products. Inasmuch as these data are based on tests by entities over which HARWIL has no control, HARWIL does not guarantee or accept responsibility for the accuracy of such tests. When using the table, please remember that in any given case several factors such as concentration, temperature, degrees of agitation and presence of impurities influence the rate of corrosion. The guide is intended, in a general way, to rate materials for resistance to chemicals which contain their usual impurities and for types of equipment in common use. Ratings should be used only as a general guide to first approximation of your material requirements rather than as the final answer.

- When in doubt, test materials before installation.
- After installation, follow up with preventative maintenance and periodic inspection.

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FLUID FLOW SWITCH

Model Q-1

0.12 to 8.0 GPM

Detects and Signals Flow Change

- Superior Long Term Performance
- Continuous Adjustment While Operating
- 6 Interchangeable orifices plus 2:1 continuous switch adj. each orifice.
- Line Pressure to 300 psig
- Temperature 180°F Continuous
- Calibrated Independent of Line Pressure and Temperature
- Maintains Calibration Limits when Subjected to Reasonable Line Hydraulic Hammer or Surge Pulses
- SPDT 15 amp switching capacity model or Dry Circuit Computer/PLC Interface model
- Intrinsically Safe Relay Allows Model Q-1 to be used in Hazardous Areas. (see page 46)
- Maintenance and checkout is a snap for your present personnel using an uncomplicated standard test meter.

Non-Magnetic

Typical Working Fluids

- Alcohols
- Contaminated Ground Water
- Filtered Sewage Water
- Glycols
- Oils
- Pure Water
- Seawater
- Soap Solutions
- Tap Water

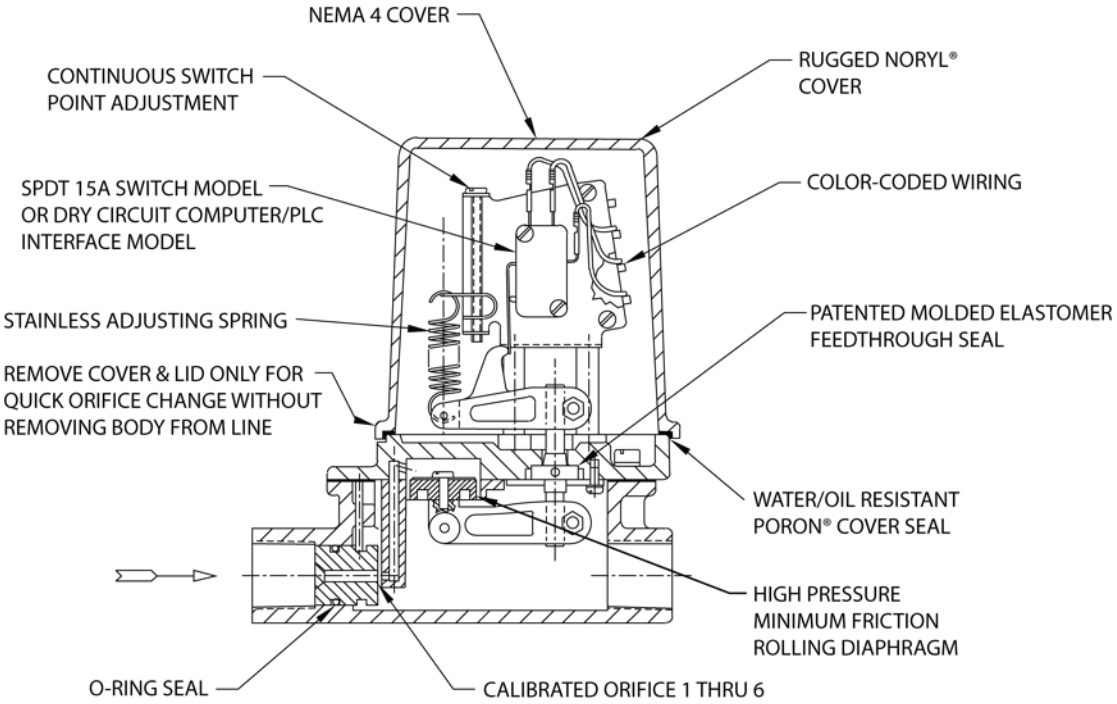
Typical Uses:

Monitoring flow of coolant water and fluids supplied to:

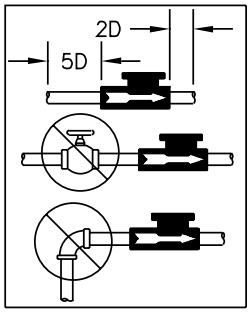
- Air Condition Systems
- Brakes and Clutches
- Computer Systems
- Diffusion Vacuum Pumps
- Diodes, SCRs, Triacs, etc.
- Electro Magnets
- High Power Transistors
- Marine and Stationary Engines
- Oil Supplied to Large Bearing and Gear Systems
- Plastic Molding Equipment
- RF and Radar Transmitter
- Spot welders
- Transformers
- Vacuum Systems

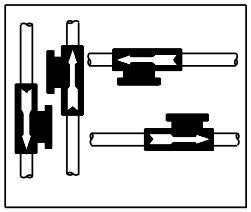
In Chemical Processing

- Fluid Blending Systems
- Heat Transfer Fluids
- Liquid Scrubbers
- Liquid Transfer
- Monitor Filter Clogging
- On/Off Control of Chemical Feed Pumps
- Starting Back-up Pumps
- Water Treatment



TURBULENT FLOW REDUCTION





MOUNT IN ANY POSITION

HARWIL®

Limited Warranty Page 7

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Email: harwil@harwil.com

Model Q-1

Specifications:

Flow Range - Water Calibrated @ 70°F

Orifice #	Continuous Switch Point Adjustment Range GPM	Note
1	0.12 to 0.25	
2	0.25 to 0.50	
3	0.50 to 1.0	Maximum recommended flow rate for each orifice is 4x upper-end of adj. range.
4	1.0 to 2.0	
5	2.0 to 4.0	
6	4.0 to 8.0	

Hysteresis (% Flow Change to Activate/Deactivate Switch)

≈ 5% at upper end of flow range
≈ 25% at lower end of flow range

Differential pressure drops across unit (Normal Operating Conditions)

≈ 1.0 psig at lower end of flow range
≈ 5.0 psig at upper end of flow range

Working Line Pressure

300 psig max. @ 180˚F Max
(Proof tested to 1200 psig @ 180˚F)

Materials

Brass body Noryl®, stainless steel, and plastic hardware. Working fluid "sees" red brass, 316 stainless steel, phosphor bronze, Noryl® (PPO), PVC, and EPDM elastomer seal. (Hypalon® and Viton® elastomer seals are available on special order.)

Electrical Switch Characteristics

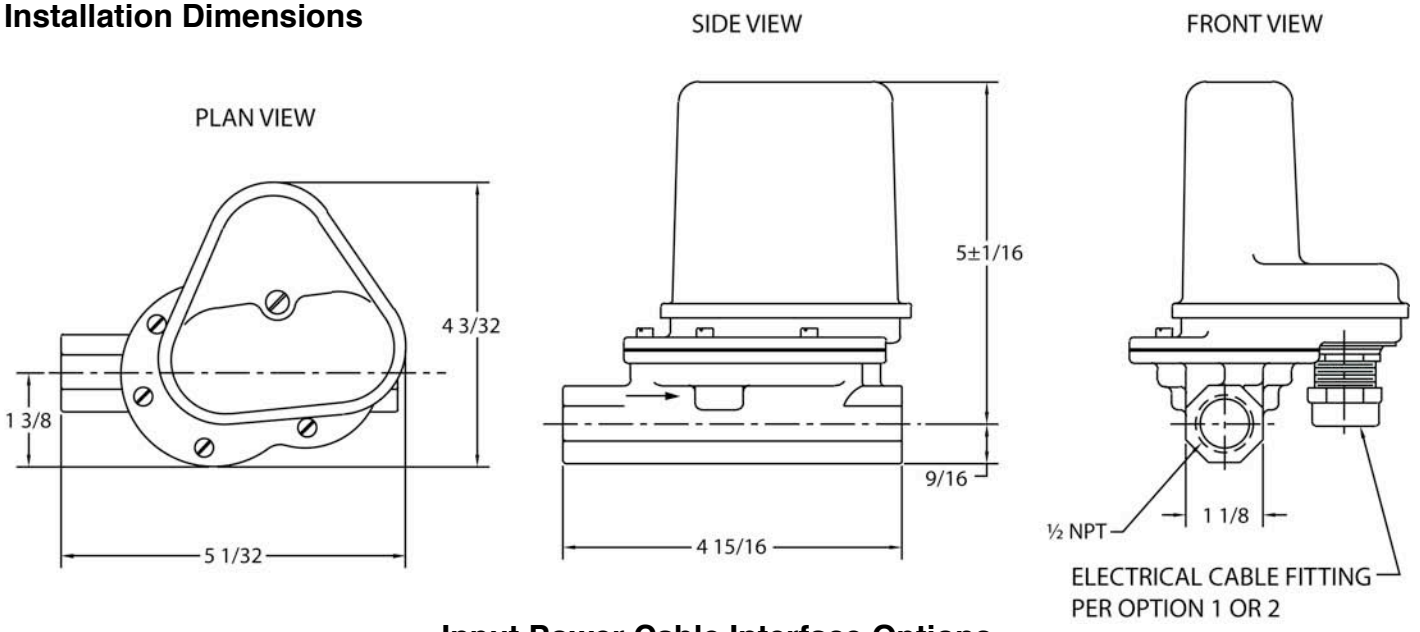
SPDT
15 amp, 1/2 hp @ 125 or 250 VAC
1/2 amp @ 125 VDC, 1/4 amp @ 250 VDC
5 amp @ 125 VAC (tungsten lamp load)
UL and CSA Listed
10,000,000 Operations Median

Model Q-1 can also be fitted with a SPDT Gold Cross Bar Switch for computer/PLC interface.

Maximum Continuous Temperature: 180°F (may be extended to 200°F for short periods.)

Weight: 3.5 lb.

Installation Dimensions



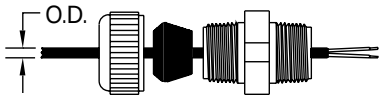
Input Power Cable Interface Options

Option No. 1

Sample Part #

Q - 1 / 3 / A

Basic Model # | Orifice # | Grommet Size



Grommet Size	Cable OD	Grommet Size	Cable OD
A	0.25"	B	0.37"
AA	0.30"	C	0.50"

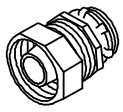
Option No. 2

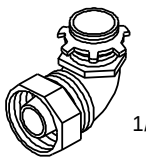
Sample Part #

Q - 1 / 6 / F

Basic Model # | Orifice # | 1/2" Flexible Coduit Fitting

1/2" STRAIGHT F





1/2" 90˚ F90˚

- Installation drawing and a numbered parts list is supplied with each unit.
- Current Price Information is Listed on Separate Sheet.
- Special One Day Delivery Available.

FLUID FLOW SWITCH

Model Q-4E

4 to 70 GPM

Detects and Signals Flow Change

- Superior Long Term Performance
- Line Pressure to 300 Psig
- Continuous Adjustment While Operating
- Temperature 180°F Continuous
- Four individual Drag Disk options plus continuous adjustment provides wide operating range
- For use in particle contaminated fluids
- SPDT 15 amp switching capacity model or Dry Circuit Computer/PLC Interface model
- Intrinsically Safe Relay Allows Model Q-4E to be used in Hazardous Areas (see page 46).
- Maintains Calibration Limits When Subjected to Reasonable Line Hydraulic Hammer or Surge Pulses
- Maintenance and checkout is a snap for your present personnel using an uncomplicated standard test meter.

Non-Magnetic

Typical Working Fluids

- Alcohols
- Glycols
- Hydrocarbons
- Oils
- Pure Water
- Sea Water
- Sewage
- Soap Solutions
- Tap Water
- Waste Water

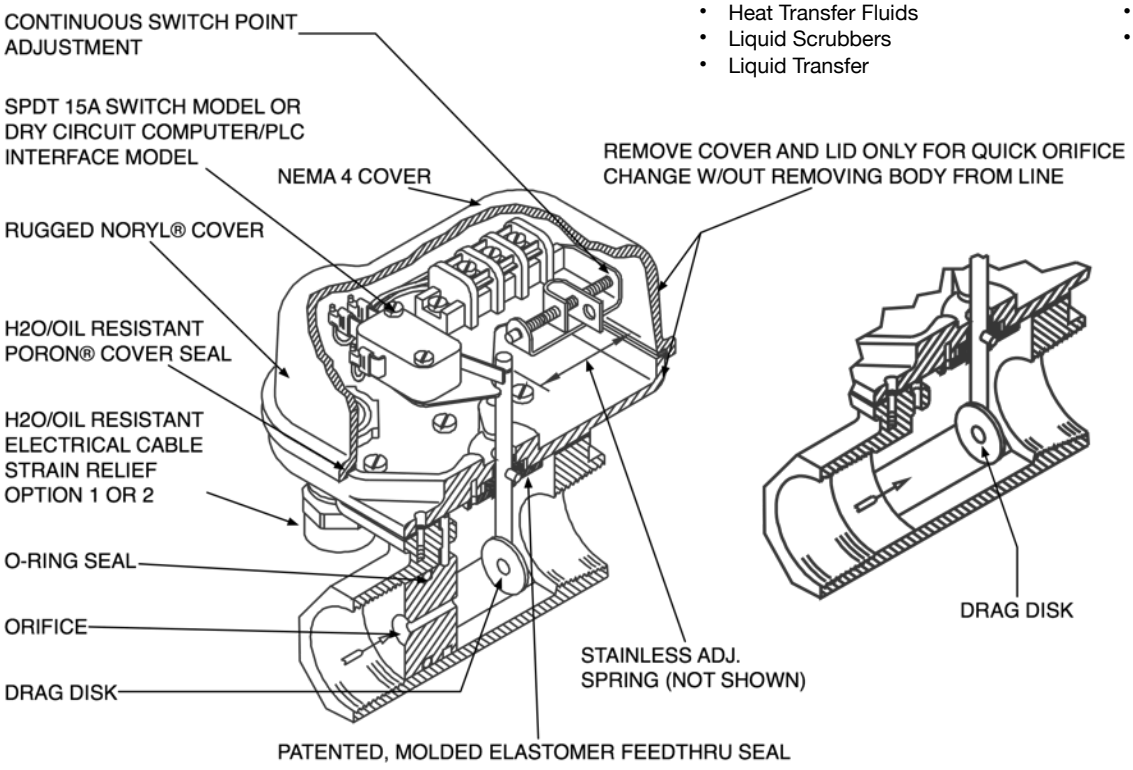
Typical Uses:

Monitoring flow of coolant water and fluids supplied to:

- Air Condition Systems
- Brakes and Clutches
- Computer Systems
- Diffusion Vacuum Pumps
- Diodes, SCR's, Triacs, etc.
- Electro Magnets
- Fluids for Ceramic Cutting & Grinding Wheels
- Grinding and Polishing Fluids
- High Power Transistors
- Marine & Stationary Engines
- Plastic Molding Equipment
- Pressurized Oil for Floating Bearings & Ways
- Refrigeration Systems
- RF and Radar Transmitter
- Spot welders
- Transformers
- Vacuum Systems
- Water & Oil Based Cutting Fluids

In Chemical Processing

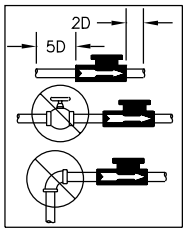
- Contaminated Groundwater
- Fire Sprinkler Flow Alarms
- Fluid Blending Systems
- Heat Transfer Fluids
- Liquid Scrubbers
- Liquid Transfer
- Monitor Filter Clogging
- On/Off Control of Chemical Feed Pumps
- Starting Back-up Pumps
- Water Treatment

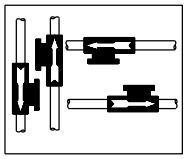


MODEL Q-4E/1
(USES ORIFICE & DRAG DISK)

MODELS Q-4E/2, 3 & 4
(USE DRAG DISK ONLY)

TURBULENT FLOW REDUCTION





MOUNT IN ANY POSITION

Limited Warranty Page 7

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Email: harwil@harwil.com

Model Q-4E

Specifications:

Flow Range - Water Calibrated @ 70°F

Model #	Continuous Switch Point Adjustment Range GPM	Note
Q-4E/1	4–8	Orifice/Drag Disk
Q-4E/2	6–20	Drag Disk Only
Q-4E/3	15–35	Drag Disk Only
Q-4E/4	25–70	Drag Disk Only

Hysteresis (% Flow Change to Activate/Deactivate Switch)

≈ 5% at upper end of flow range
≈ 25% at lower end of flow range

Differential pressure drops across unit (Normal Operating Conditions)

≈ 1.0 psig at lower end of flow range
≈ 5.0 psig at upper end of flow range

Working Line Pressure

300 psig max. @ 180˚F Max
(Proof tested to 1200 psig @ 180˚F)

Materials

Brass body, Noryl®, stainless steel, and plastic hardware. Working fluid "sees" red brass, 316 stainless steel, phosphor bronze and EPDM elastomer seal. (Hypalon® and Viton® Elastomer Seals are available on special order.)

Electrical Switch Characteristics

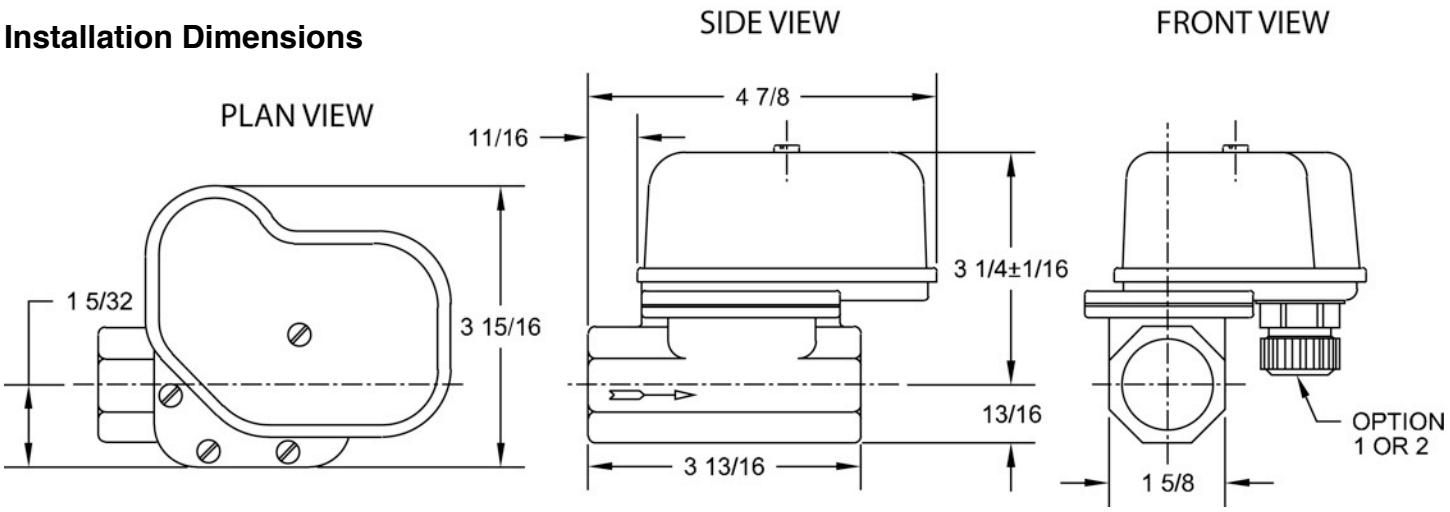
SPDT
15 amp, 1/2 hp @ 125 or 250 VAC
1/2 amp @ 125 VDC, 1/4 amp @ 250 VDC
5 amp @ 125 VAC (tungsten lamp load)
UL and CSA Listed
10,000,000 Operations Median

Model Q-4E can also be fitted with a SPDT Gold Cross Bar Switch for computer/PLC interface.

Maximum Continuous Temperature: 180°F (may be extended to 200°F for short periods.)

Weight: 5 lb.

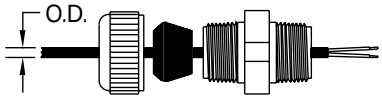
Installation Dimensions



Input Power Cable Interface Options

Option No. 1

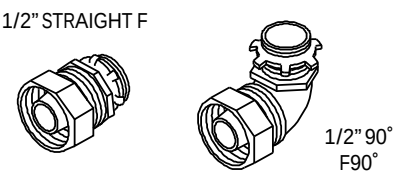
Basic Model # → Q - 4E / 1 / B ← Grommet Size
Sample Part #
Orifice/Drag Disk #



Grommet Size	Cable OD	Grommet Size	Cable OD
A	0.25"	B	0.37"
AA	0.30"	C	0.50"

Option No. 2

Basic Model # → Q - 4E / 3 / F ← ½" Flexible Conduit Fitting
Sample Part #
Orifice/Drag Disk #



- Installation drawing and a numbered parts list is supplied with each unit.
- Current Price Information is Listed on Separate Sheet.
- Special One Day Delivery Available.

FLUID FLOW SWITCH

Model Q-5

5 to 85,000+ GPM
for pipes 1” - 48”+

Detects and Signals Flow Change

- Superior Long Term Performance
- Line Pressure to 300 Psig
- Continuous Adjustment While Operating
- Temperature 180°F Continuous
- Multiple quick change targets plus continuous spring adjustment provide very wide operating range
- For use in highly particle contaminated fluids
- SPDT 15 amp switching capacity model or Dry Circuit Computer/PLC Interface model
- Intrinsically Safe Relay Allows Model Q-5 to be used in Hazardous Areas.
- Maintains Calibration Limits When Subjected to Reasonable Line Hydraulic Hammer or Surge Pulses
- Calibrated Independent of Line Pressure and Temperature

Typical Working Fluids

- Alcohols
- Glycols
- Pure Water
- Sea Water
- Sewage Water
- Slurries
- Soap Solutions
- Tap Water

Typical Uses

Water Treatment

- Contaminated Groundwater
- Irrigation Systems
- Municipal Water Supply Systems
- Sewage Treatment Plants

In Chemical Processing

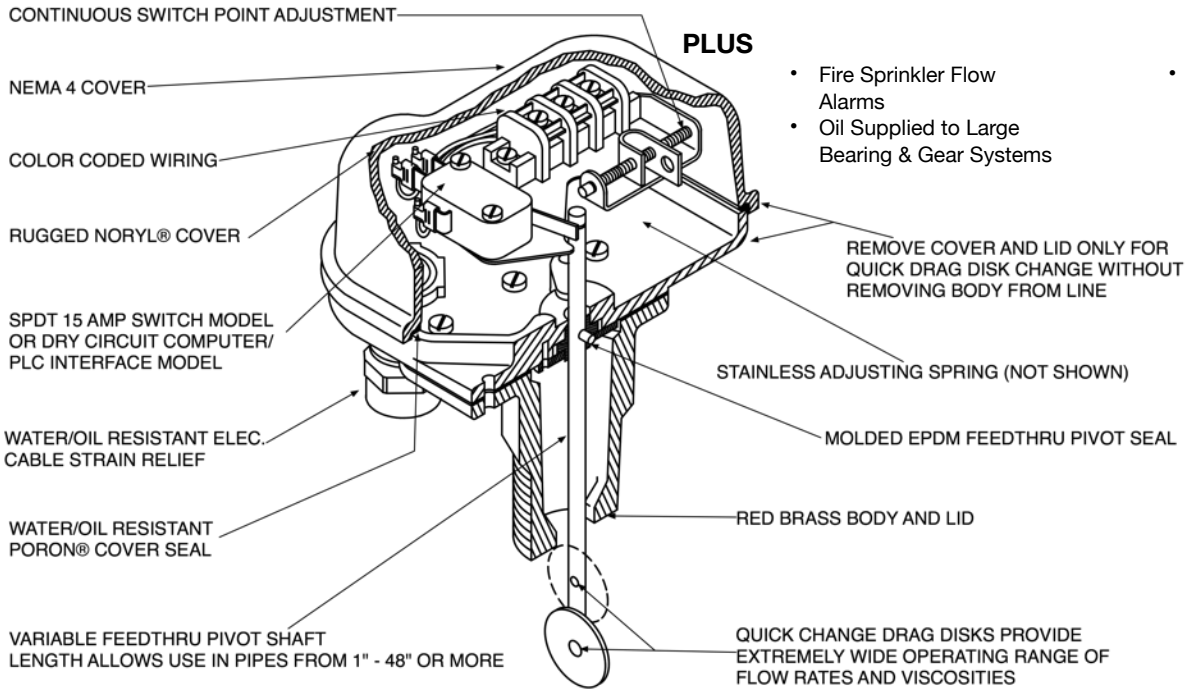
- Fluid Blending Systems
- Heat Transfer Fluids
- Liquid Scrubbers
- Liquid Transfer
- Monitor Filter Clogging
- Water Treatment

To Monitor Flow of Coolant Supplied to:

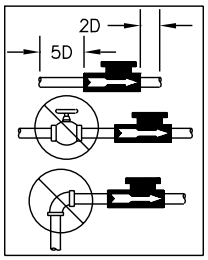
- Air Condition Systems
- Brakes & Clutches
- Computer Systems
- Diodes, SCR's, Triacs, etc.
- Electro Magnets
- High Power Transistors
- Plastic Molding Equipment
- RF and Radar Transmitter
- Spot welders
- Transformers
- Vacuum Diffusion Pumps

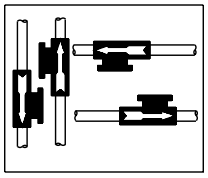
PLUS

- Fire Sprinkler Flow Alarms
- Oil Supplied to Large Bearing & Gear Systems
- Steam Boiler Feed Water



TURBULENT FLOW REDUCTION





MOUNT IN ANY POSITION

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Limited Warranty Page 7

541 Kinetic Drive, Oxnard, CA 93030
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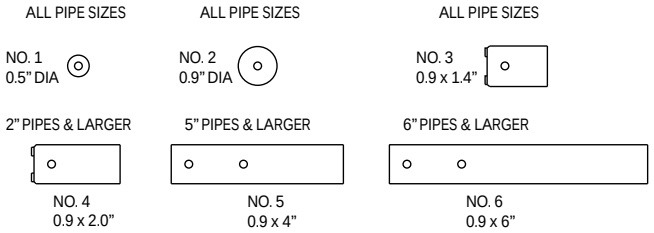
Model Q-5

Model Selection Chart

Pipe Size NPT	Flow Limits Between Which Switch Point May Be Set GPM	Part Number			
		Model	Pivot Shaft No.	Target No.	Electric Cable 1 or 2
1	5-15	Q-5	2	2	---
	12-36	Q-5	2	1	---
1 1/2	7-21	Q-5	3	3	---
	10-30	Q-5	3	2	---
	20-75	Q-5	3	1	---
2	14-42	Q-5	3	4	---
	20-60	Q-5	3	2	---
	50-150	Q-5	3	1	---
2 1/2	21-63	Q-5	3	4	---
	30-90	Q-5	3	2	---
	70-210	Q-5	3	1	---
3	27-81	Q-5	5	4	---
	45-135	Q-5	5	2	---
	110-330	Q-5	5	1	---
3 1/2	36-108	Q-5	5	4	---
	60-180	Q-5	5	2	---
	150-450	Q-5	5	1	---
4	45-135	Q-5	5	4	---
	75-225	Q-5	5	2	---
	200-600	Q-5	5	1	---
5	51-153	Q-5	5	5	---
	120-360	Q-5	5	2	---
	300-900	Q-5	5	1	---
6	65-195	Q-5	5	6	---
	80-240	Q-5	5	5	---
	190-570	Q-5	5	2	---
	450-1350	Q-5	5	1	---
8	103-309	Q-5	5	6	---
	126-378	Q-5	5	5	---
	300-900	Q-5	5	2	---
	800-2400	Q-5	5	1	---
10	172-516	Q-5	5	6	---
	211-633	Q-5	5	5	---
	500-1500	Q-5	5	2	---
	1200-3600	Q-5	5	1	---

LARGE PIPE SIZE INFORMATION AVAILABLE BY REQUEST.

Target (Drag Disk/Strip) Number



Hysteresis (% Flow Change to Activate / Deactivate Switch)

≈ 10% at upper end of flow range
≈ 30% at lower end of flow range

Differential Pressure Drops Across Unit (Normal Operating Conditions)

1" - 3" Pipe, less than 1 psi
4" - 48" Pipe, Negligible

Working Line Pressure

300 psig max. @ 180°F Max (Proof tested to 1200 psig @ room temperature)

Materials

Brass body, Noryl® cover, 316 stainless steel hardware.

Fluid "sees" red brass, phosphor, bronze, EPDM elastomer seal. (Other seal material available.)

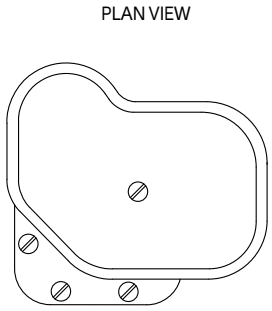
Electrical Switch Characteristics

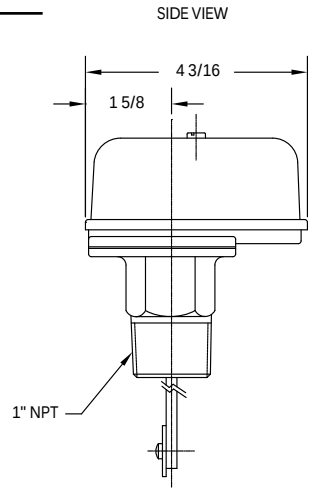
SPDT, 15 amp, 1/2 hp @ 125 or 250 VAC,
1/2 amp @ 125 VDC, 1/4 amp @ 250 VDC,
5 amp @ 125 VAC (tungsten lamp load)
UL and CSA Listed
10,000,000 Operations Median

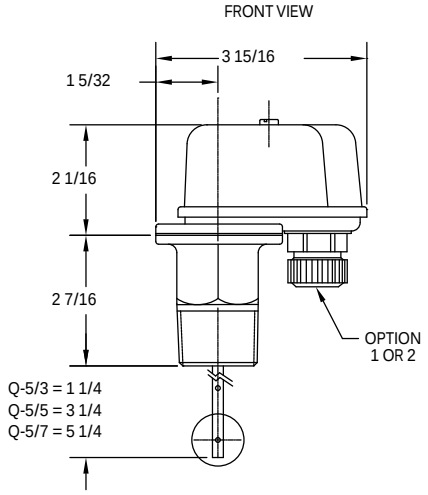
Model Q-5 can also be fitted with a SPDT Gold Cross Bar Switch for computer/PLC interface.

Weight: 3.5 lb.

Installation Dimensions







Input Power Cable Interface Options

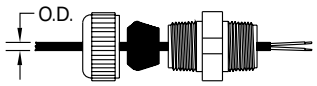
Option No. 1

Sample Part #

Basic Model # → Q - 5 / 3 / 2 / B ← Grommet Size pg. 9

Drag Disk Feedthru Shaft Length

Drag Disk Size



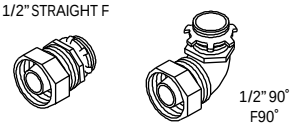
Option No. 2

Sample Part #

Basic Model # → Q - 5 / 3 / 2 / F ← ½" Flexible Conduit Fitting

Drag Disk Feedthru Shaft Length

Drag Disk Size



See grommet size chart on page 9.

- Installation drawing and a numbered parts list is supplied with each unit.
- Current Price Information is Listed on Separate Sheet.
- Special One Day Delivery Available.

FLUID FLOW SWITCH

Model Q-5SS

10 to 102,000+ GPM
for pipes 1”-48”+

316 STAINLESS STEEL - TEFLON® - VITON® - WETTED SURFACES

Reliable, Inexpensive

For Use in Mildly Corrosive Chemicals

Generally accepted for use with 316 Stainless Steel
For instance, mildly corrosive fluids such as:

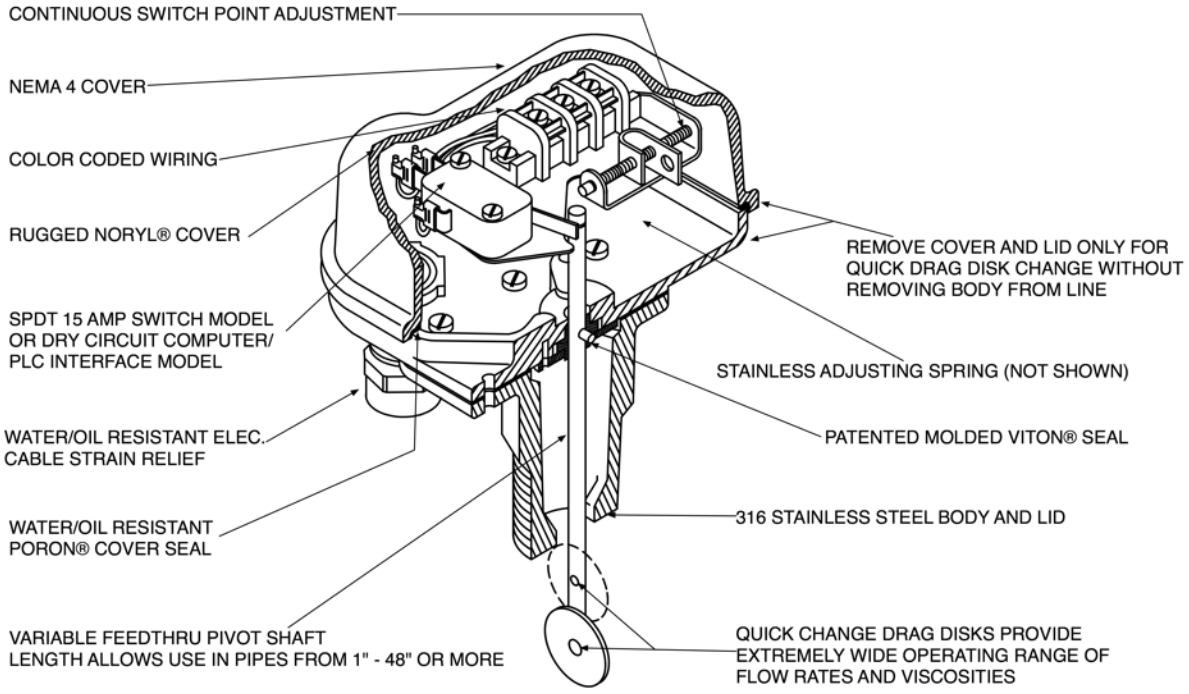
- Aluminum Sulfate
- Crude Oil
- Diluted Sulfuric Acid
- Ethyl Chloride
- Hydrochloric Acid
- Lactic Acid
- Magnesium Hydroxide
- Nickel Sulfate
- Nitric Acid
- Phenol
- Potassium Dichromate
- Zinc Sulfate

Plus

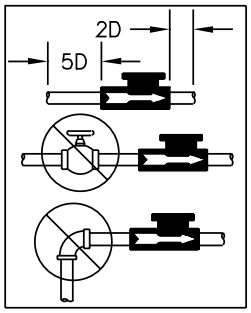
- Alcohols
- Filtered Sewage Water
- Gasoline
- Glycols
- Oils
- Pure Water
- Soap Solutions
- Tap Water

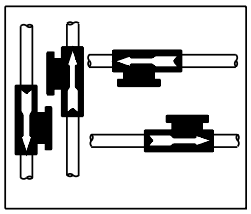
Special Features

- Wetted surfaces of 316 stainless steel, Teflon® and Viton®
- Responds to flow only, independent of pressure and temperature
- Continuously adjustable while operating
- Mount in any position
- Line pressure to 300 psig
- Temperature to 180°F continuous
- No damage or calibration change when subjected to reasonable hydraulic hammer or surge pulses
- Maintenance and checkout is a snap for your present personnel using an uncomplicated standard test meter
- Extensive Chemical Corrosive List On Page 49.



TURBULENT FLOW REDUCTION





MOUNT IN ANY POSITION

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Email: harwil@harwil.com

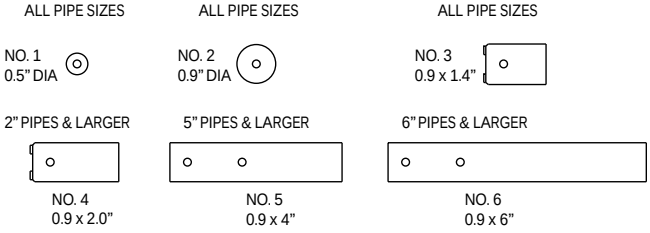
Model Q-5SS

Model Selection Chart

Pipe Size NPT	Flow Limits Between Which Switch Point May Be Set GPM	Part Number			
		Model	Pivot Shaft No.	Target No.	Electric Cable 1 or 2
1	10-20	Q-5SS	2	2	---
	20-60	Q-5SS	2	1	---
1 1/2	14-42	Q-5SS	3	3	---
	20-60	Q-5SS	3	2	---
	30-90	Q-5SS	3	1	---
2	21-63	Q-5SS	3	4	---
	30-90	Q-5SS	3	2	---
	60-180	Q-5SS	3	1	---
2 1/2	36-108	Q-5SS	3	4	---
	90-150	Q-5SS	3	2	---
	90-270	Q-5SS	3	1	---
3	45-135	Q-5SS	5	4	---
	75-225	Q-5SS	5	2	---
	130-390	Q-5SS	5	1	---
3 1/2	56-168	Q-5SS	5	4	---
	85-285	Q-5SS	5	2	---
	180-540	Q-5SS	5	1	---
4	77-231	Q-5SS	5	4	---
	130-390	Q-5SS	5	2	---
	235-705	Q-5SS	5	1	---
5	84-252	Q-5SS	5	5	---
	200-600	Q-5SS	5	2	---
	350-1050	Q-5SS	5	1	---
6	103-309	Q-5SS	5	6	---
	125-375	Q-5SS	5	5	---
	300-900	Q-5SS	5	2	---
	550-1650	Q-5SS	5	1	---
8	189-567	Q-5SS	5	6	---
	232-696	Q-5SS	5	5	---
	550-1650	Q-5SS	5	2	---
	950-2850	Q-5SS	5	1	---
10	292-876	Q-5SS	5	6	---
	358-1074	Q-5SS	5	5	---
	850-2550	Q-5SS	5	2	---
	1450-4350	Q-5SS	5	1	---

LARGE PIPE SIZE INFORMATION AVAILABLE BY REQUEST.

Target (Drag Disk/Strip) Number



Hysteresis (% Flow Change to Activate / Deactivate Switch)

≈ 10% at upper end of flow range
≈ 30% at lower end of flow range

Differential Pressure Drops Across Unit (Normal Operating Conditions)

1" - 3" Pipe, less than 1 psi
4" - 48" Pipe, Negligible

Working Line Pressure

300 psig max. @ 180°F Max (Proof tested to 1200 psig @ room temperature)

Materials

316 Stainless steel body, Noryl® cover, 316 stainless steel hardware.

Working fluid "sees" 316 stainless, Teflon® gasket and Viton® elastomer seal.

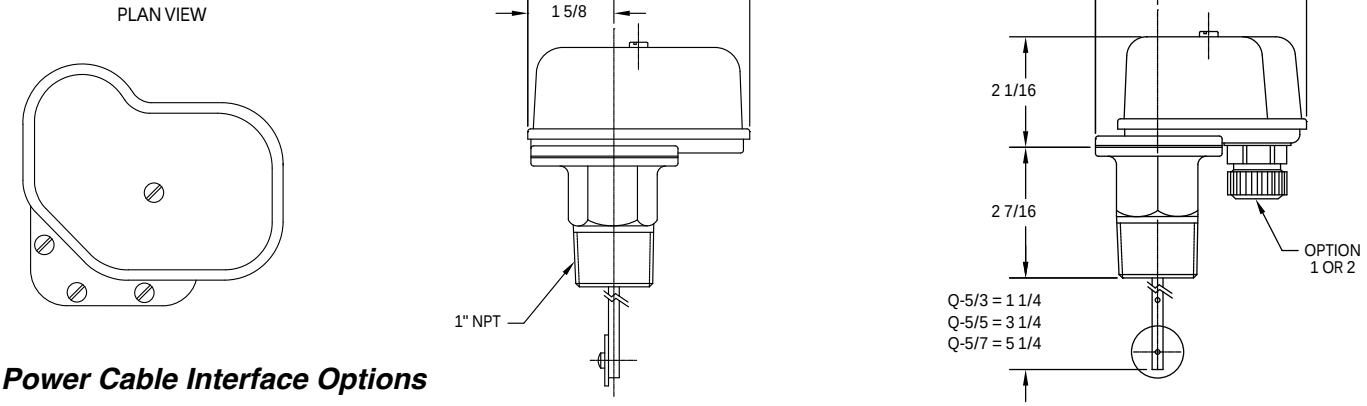
Electrical Switch Characteristics

SPDT, 15 amp, 1/2 hp @ 125 or 250 VAC,
1/2 amp @ 125 VDC, 1/4 amp @ 250 VDC,
5 amp @ 125 VAC (tungsten lamp load)
UL and CSA Listed
10,000,000 Operations Median

Model Q-5SS can also be fitted with a SPDT Gold Cross Bar Switch for computer/PLC interface.

Weight: 3.5 lb.

Installation Dimensions



Input Power Cable Interface Options

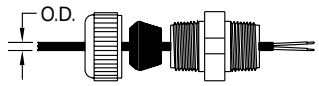
Option No. 1

Sample Part #

Basic Model # → Q - 5SS / 3 / 2 / B ← Grommet Size pg. 9

Drag Disk Feedthru Shaft Length

Drag Disk Size



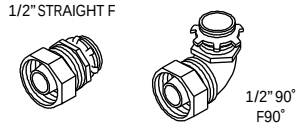
Option No. 2

Sample Part #

Basic Model # → Q - 5SS / 3 / 2 / F ← ½" Flexible Conduit Fitting

Drag Disk Feedthru Shaft Length

Drag Disk Size



See grommet size chart on page 9.

- Installation drawing and a numbered parts list is supplied with each unit.
- Current Price Information is Listed on Separate Sheet.
- Special One Day Delivery Available.

FLUID FLOW SWITCH

Model QD-1

QD-4E, QD-5, QD-5SS

Model QD-1

0.12 to 8.0 GPM
For 1/2" Pipes

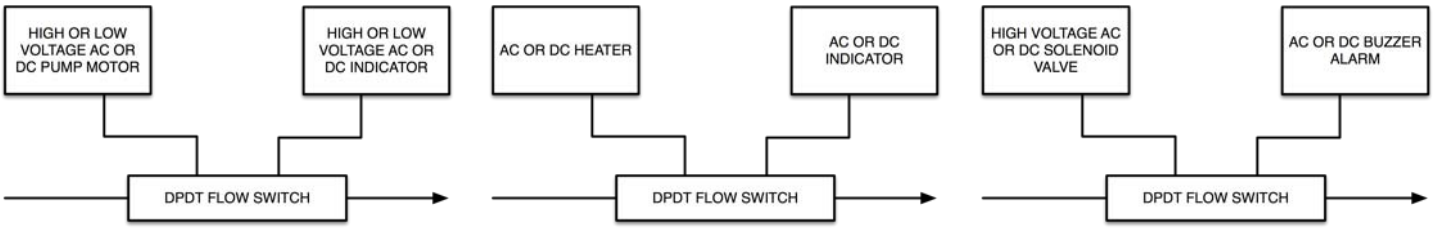
Model QD-4E

4 to 70 GPM
For 1" Pipes

Models QD-5, QD-5SS

5-102,000 GPM & Up
For Pipes 1" - 48" & Up

Supplied with Optional Feature -
Two SPDT Switches to Provide DPDT Action.



Two Physically Ganged BUT Electronically Independent Switches Provide:

- Combination of two isolated AC or DC Circuits.
- Combination of two isolated High or Low Voltage Circuits.
- Combination of two isolated Power or Gold Cross Bar computer/PLC Dry Circuit.

Performance, Physical and Electrical Specifications are the same as Standard Single Switch Units (Q-1, Q-4E, Q-5) with the following modifications:

- Nominal Differential Flow between the two Microswitch Actuation Points is -
  Model QD-1 ≈ 5% Model QD-4E ≈ 5% Model QD-5 ≈ 5%
- Electrical Connection is made directly to switch terminals with standard spade Quick-Connects supplied with each unit.

Reference Part Number:

- See page 8 for Q-1
- See Page 10 for Q-4E
- See Page 12 for Q-5
- See Page 14 for Q-5SS

- Add D to part # to designate DPDT Action Desired.

SAMPLE PART #: **QD-1 / 3 / A**
QD-5 / 5 / 3 / F

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Miscellaneous Background Information

FLOW SWITCH MODEL Q-1:

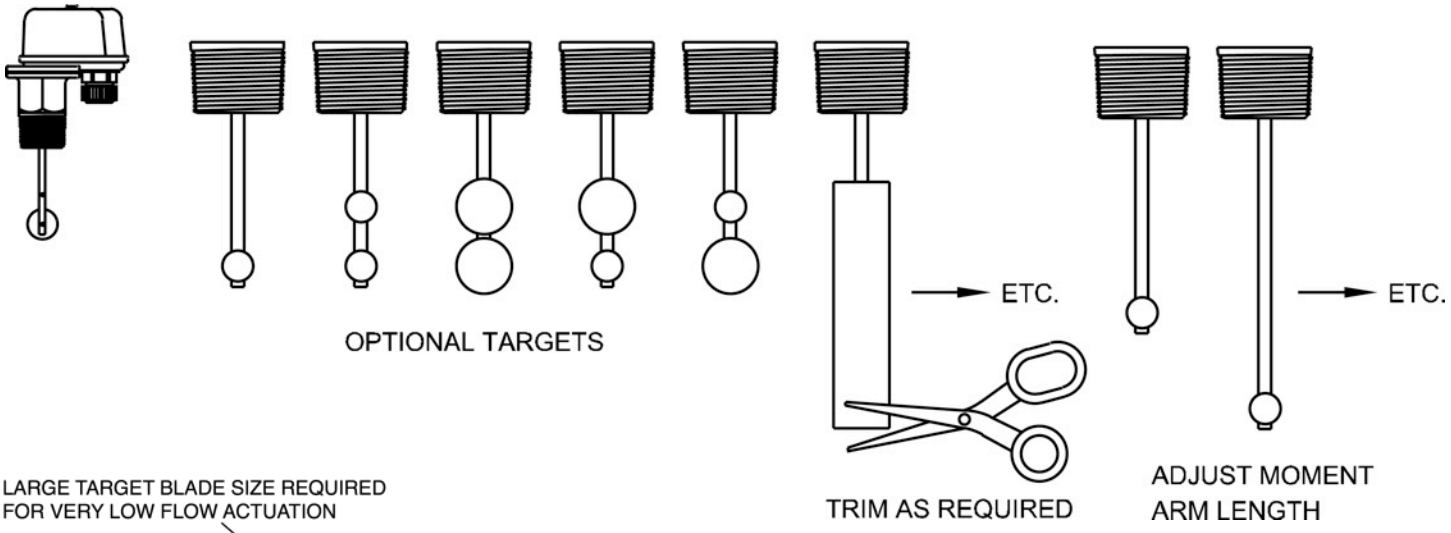
The dimensions of the 6 orifices listed in Model Q-1 are

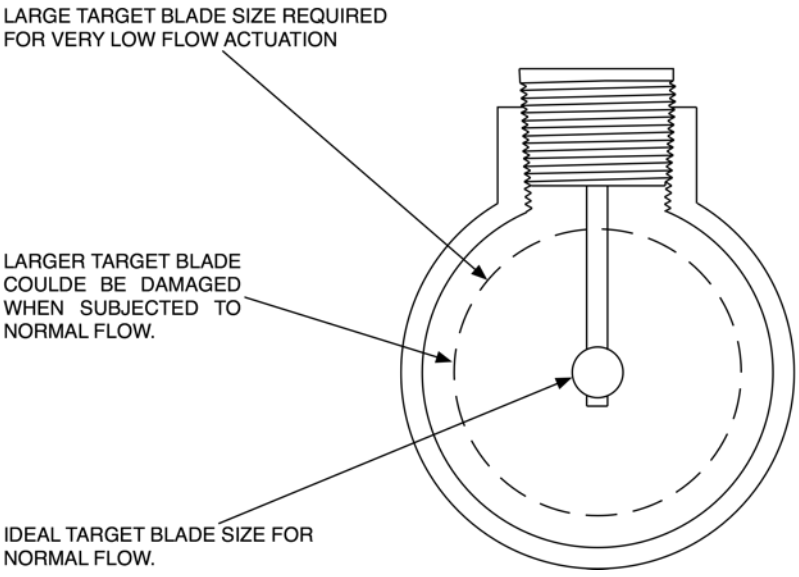
Orifice No.	Orifice J.D. (inches)
1	0.073 (Drill No. 49)
2	0.094 (Drill No. 42)
3	0.150 (Drill No. 25)
4	0.196 (Drill No. 9)
5	0.277 (Letter J)
6	0.375 (3/8)

NOTE: Each orifice size provides a 2:1 flow range as listed under Model Q-1 Specifications. Model Q-1 can be provided with a blank orifice which the end user can drill as required to provide any desired 2:1 flow adjusting range. For example orifice No. 4 with a 0.196" I.D. hole has a normal 2:1 adjustable range 1.0 to 2.0 GPM. A blank orifice can be drilled approximately half way between orifice No. 4 and No. 5 that is drill "B" (0.238") to provide a flow range of 1.5 to 3.0 GPM. The end user can thus drill blank orifices as required to produce any 2:1 incremental sub division of the total operating range 0.12 to 8.0 GPM.

Models Q-5 / QD-5 / QD-5SS

These are supplied with target blades 0.9" wide for all lengths of blade. This allows blade and support shaft to be inserted into standard one inch NPT female fittings without removing fitting from main flow line.





Flow Sensitivity vs Target Size vs Structural Load Limits

Target type flow switches present a classic turn down rate limit situation, that is, flow systems frequently require detection of flow at low to very low flow rate, E.G. 0.5 to 2.0 GPM in pipe size 1.0 inches to 6 inches and larger. This translated into very low ft/sec flow past the target blade which, in turn, may produce drag forces too small to operate the flow switch. This catch 22 situation is normally accommodated by limiting the high flow end, (i.e. turn down ratio, higher flow rate) may be available at greater complexity and increased cost.

- Installation drawing and a numbered parts list is supplied with each unit.
- Current Price Information is Listed on Separate Sheet.
- Special One Day Delivery Available.

FLUID FLOW SWITCH Model Q-8N (PPO)

8 to 1900 GPM & Up
for pipes 1”- 10” & Up

Noryl® Engineering Plastic (PPO) Polyphenylene Oxide

During normal operations flow switches increase efficiency, save time and money by the continuous monitoring of deviations from optimum flow rates. During emergency conditions flow switches signal system malfunctions such as line breakage, pump failure, incorrect valve opening or closing, pipe, valve or filter clogging, etc.

COMPONENT RECOGNIZED /c (E85349)

Typical Working Fluids

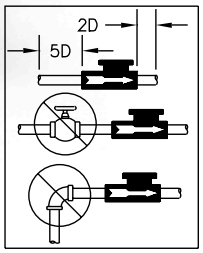
- For use in corrosive liquids such as mild acid and base solutions and related fluids.
- Extensive chemical list is available (see page 49).

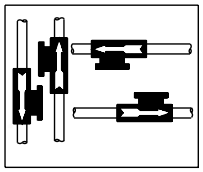
Reliable, Inexpensive

For use in highly particle-contaminated liquids such as:

- Contaminated Groundwater
- Medium Slurries
- Rusty Coolant Water
- Sea Water
- Sewage
- Waste Water

TURBULENT FLOW REDUCTION

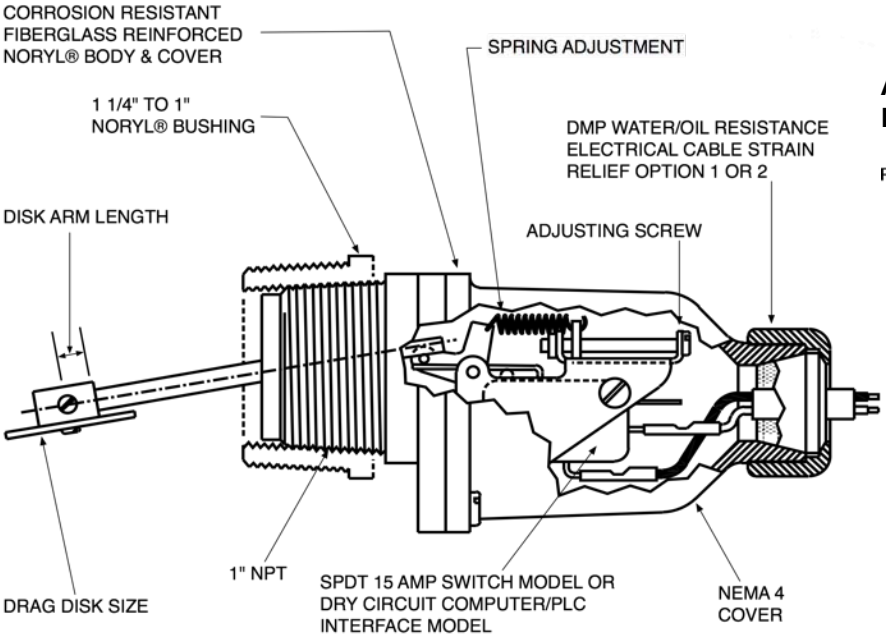




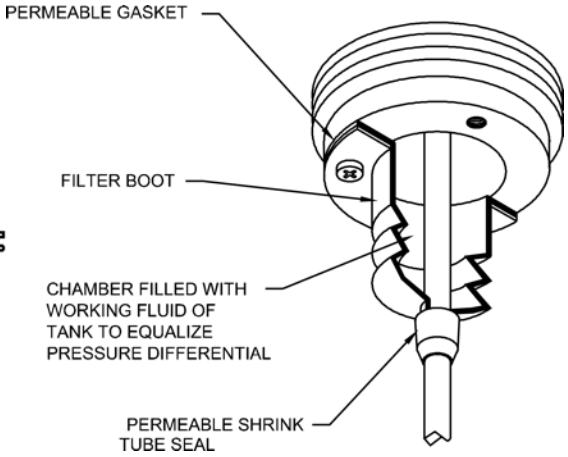
MOUNT IN ANY POSITION

Special Features

- Particle contamination resistance is provided by a single convolute elastomeric seal which is continually flushed by working fluid flow.
- Wetted surfaces of Noryl®, 316 Stainless Steel, EPDM Elastomeric Standard (Viton® Special Order.)
- Continuous adjustment while operating
- Responds to flow only, independent of line pressure, temperature, environment
- Temperature to 150°F continuous
- Line pressure to 50 psig operating - 100 psig non-operating
- SPDT 15 amp switching capacity model or Dry Computer/PLC Interface model
- Maintenance and checkout is a snap for your present personnel using an uncomplicated standard test meter.
- Maximum flow range flexibility is provided by three adjustment options:
  - Option 1 - Continuous adjustment while operating via FORCE/BALANCE spring
  - Option 2 - Step incremental adjustment via drag disk size change
  - Option 3 - Continuous adjustment via drag disk moment arm change



Available with Optional Filter Boot For Use In Highly Particle Contaminated Liquids



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541 Kinetic Drive, Oxnard, CA 93030
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Model Q-8N

Flow Range Water Calibrated @ 70˚F

Model Selection Chart

Pipe Size	Flow Limits Between Which Switch Point May Be Set GPM	Model Part Number (Power Cable Interface Option 1 or 2)
1	8-13	Q-8N / 1 / 2 /---
	18-28	Q-8N / 1 / 1 /---
1 1/2	15-30	Q-8N / 2 / 3 /---
	25-50	Q-8N / 2 / 1 /---
2	25-50	Q-8N / 2 / 3 /---
	50-105	Q-8N / 2 / 1 /---
2 1/2	35-80	Q-8N / 2 / 3 /---
	80-155	Q-8N / 2 / 1 /---
3	50-90	Q-8N / 3 / 3 /---
	90-180	Q-8N / 3 / 1 /---
4	75-155	Q-8N / 3 / 3 /---
	155-310	Q-8N / 3 / 1 /---
5	120-245	Q-8N / 3 / 3 /---
	245-480	Q-8N / 3 / 1 /---
6	180-350	Q-8N / 3 / 3 /---
	350-700	Q-8N / 3 / 1 /---
8	300-600	Q-8N / 3 / 3 /---
	600-1200	Q-8N / 3 / 1 /---
10	500-950	Q-8N / 3 / 3 /---
	950-1900	Q-8N / 3 / 1 /---

LARGE PIPE SIZE INFORMATION AVAILABLE BY REQUEST.

A Four Part Model # Completely Defines Each Unit

Basic Model #	Drag Disk Arm Length (See X)	Drag Disk Size	Input Power Cable Interface Option
Q-8N	1 or 2 or 3	1 or 2 or 3	1 or 2
	1=1.15”	1=0.5” dia.	SEE BELOW
	2=1.85”	2=0.83” dia.	
	3=3.31”	3=1.0” dia.	
Q-8N	/ ↓	/ ↓	/ ↓

Hysteresis (% Flow Change to Activate/Deactivate Switch)

- ≈ 10% @ upper end of range
- ≈ 30% @ lower end of range

Differential pressure drops across unit

(Normal Operating Conditions)

- 1" - 3" pipe - less than 0.5 psi
- 4 - 10" pipe - negligible

Working Line Pressure

- 50 psig max. @ 180°F Max operating
- 100 psig @ 180°F Max non-operating

Wetted Surfaces

- Noryl® - (10% glass fibers)
- 316 Stainless Steel Standard
- EPDM Elastomer (Viton® Special Order)

Electrical Switch Characteristics

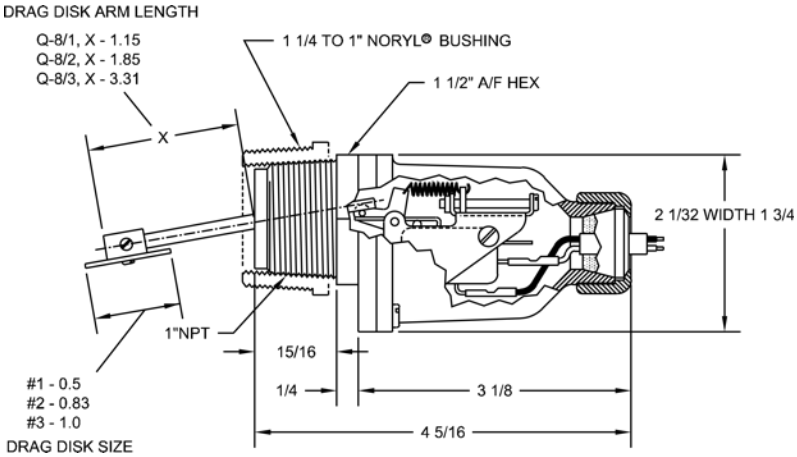
SPDT UL and CSA listed
15 amp, 1/2 HP @ 125 or 250 VAC
1/2 amp @ 125 VDC (Tungsten lamp load)
10,000,000 operations median

Model Q-8N can also be fitted with a SPDT Gold Cross Bar Switch for computer/PLC interface.

Maximum Continuous Temperature: 180°F

Optional Filter Boot Available in EPDM, (Viton® Special Order)

Weight: 1/2 lb.

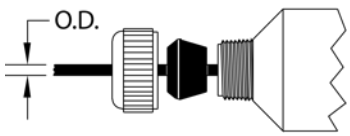


Input Power Cable Interface Options

Option No. 1

Q-8N / 1 / 1 / B

basic model # & body material
drag disk arm length
drag disk size
grommet size



Grommet Size	Cable OD	Grommet Size	Cable OD
A	0.25”	B	0.37”
AA	0.30”	C	0.50”

Option No. 2

Sample Part #

Basic Model # & Body Material

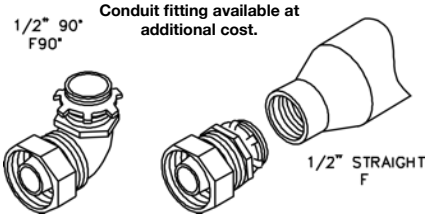
½” NPT Female Thread

Q - 8N / 1 / 1 / F

Drag Disk Arm Length

Drag Disk Size

Conduit fitting available at additional cost.



- Installation drawing and a numbered parts list is supplied with each unit.
- Current Price Information is Listed on Separate Sheet.
- Special One Day Delivery Available.

FLUID FLOW SWITCH

Model Q-8CR

8 to 1900 GPM & Up
for pipes 1”- 10” & Up

Tycona Fortron® (PPS) Polyphenylene Sulfide

During normal operations flow switches increase efficiency, save time and money by the continuous monitoring of deviations from optimum flow rates. During emergency conditions flow switches signal system malfunctions such as line breakage, pump failure, incorrect valve opening or closing, pipe, valve or filter clogging, etc.

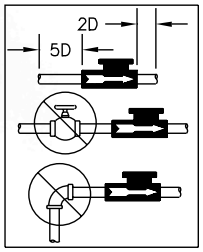
COMPONENT RECOGNIZED /c (E85349)

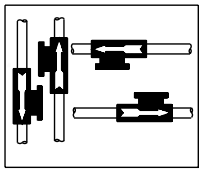
For use in highly particle-contaminated liquids such as:

- Contaminated Groundwater
- Machine Cutting Oils
- Medium Slurries
- Rusty Coolant Water
- Sea Water
- Sewage
- Waste Water

Reliable, Inexpensive

TURBULENT FLOW REDUCTION

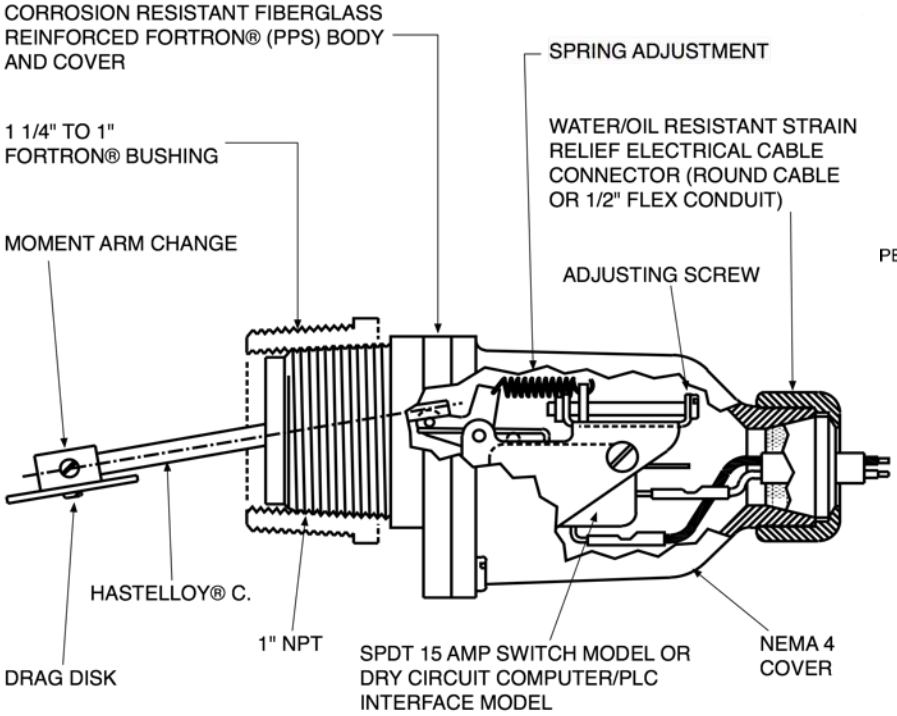




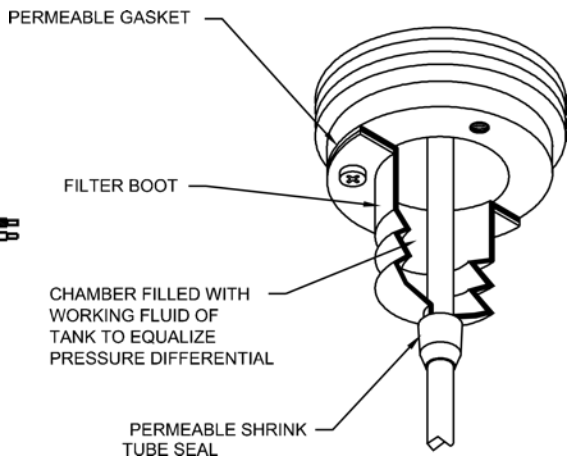
MOUNT IN ANY POSITION

Special Features

- Particle contamination resistance is provided by a single convolute elastomeric seal which is continually flushed by working fluid flow.
- Wetted surfaces of Fortron® PPS, Hastelloy® C, (Titanium, Tantalum, Special Order) and Viton®.
- Continuous adjustment while operating
- Responds to flow only, independent of line pressure, temperature, environment
- Temperature to 200°F continuous
- Line pressure to 50 psig operating; 100 psig non-operating
- SPDT 15 amp switching capacity model or Dry Circuit Computer/PLC Interface model
- Fortron® (PPS) test strips available for chemical environment testing.
- Extensive Chemical Corrosive List Available.
- Maximum flow range flexibility is provided by three adjustment options:
  - Option 1 - Continuous adjustment while operating via FORCE/BALANCE spring
  - Option 2 - Step incremental adjustment via drag disk size change
  - Option 3 - Continuous adjustment via drag disk moment arm change



Available with Optional Filter Boot For Use In Highly Particle Contaminated Liquids



HARWIL®

Limited Warranty Page 7

541 Kinetic Drive, Oxnard, CA 93030
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Email: harwil@harwil.com

Model Q-8CR

Flow Range Water Calibrated @ 70˚F

Model Selection Chart

Pipe Size	Flow Limits Between Which Switch Point May Be Set GPM	Model Part Number (Power Cable Interface Option 1 or 2)
1	8-13	Q-8CR / 1 / 2 / ---
	18-28	Q-8CR / 1 / 1 / ---
1 1/2	15-30	Q-8CR / 2 / 3 / ---
	25-50	Q-8CR / 2 / 1 / ---
2	25-50	Q-8CR / 2 / 3 / ---
	50-105	Q-8CR / 2 / 1 / ---
2 1/2	35-80	Q-8CR / 2 / 3 / ---
	80-155	Q-8CR / 2 / 1 / ---
3	50-90	Q-8CR / 3 / 3 / ---
	90-180	Q-8CR / 3 / 1 / ---
4	75-155	Q-8CR / 3 / 3 / ---
	155-310	Q-8CR / 3 / 1 / ---
5	120-245	Q-8CR / 3 / 3 / ---
	245-480	Q-8CR / 3 / 1 / ---
6	180-350	Q-8CR / 3 / 3 / ---
	350-700	Q-8CR / 3 / 1 / ---
8	300-600	Q-8CR / 3 / 3 / ---
	600-1200	Q-8CR / 3 / 1 / ---
10	500-950	Q-8CR / 3 / 3 / ---
	950-1900	Q-8CR / 3 / 1 / ---

LARGE PIPE SIZE INFORMATION AVAILABLE BY REQUEST.

A Four Part Model # Completely Defines Each Unit

Basic Model #	Drag Disk Arm Length (See X)	Drag Disk Size	Input Power Cable Interface Option
Q-8CR	1 or 2 or 3	1 or 2 or 3	1 or 2
	1=1.15”	1=0.5” dia.	SEE BELOW
	2=1.85”	2=0.83” dia.	
	3=3.31”	3=1.0” dia.	
Q-8CR	/ ↓	/ ↓	/ ↓

Hysteresis (% Flow Change to Activate/Deactivate Switch)

- ≈ 10% @ upper end of range
- ≈ 30% @ lower end of range

Differential pressure drops across unit (Normal Operating Conditions)

- 1” - 3” pipe - less than 0.5 psi
- 4” - 10” pipe - negligible

Working Line Pressure

- 50 psig max. @ 200°F Max operating
- 100 psig @ 200°F Max non-operating

Wetted Surfaces

- Fortron®, Hastelloy® C, and Viton®

Electrical Switch Characteristics

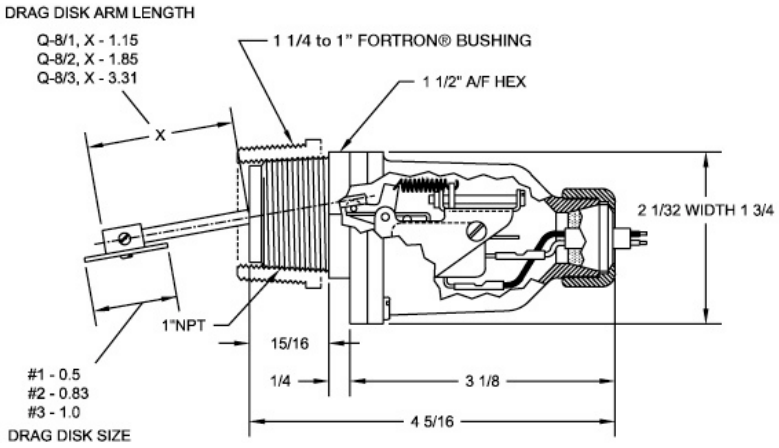
SPDT UL and CSA listed
15 amp, 1/2 HP @ 125 or 250 VAC
1/2 amp @ 125 VDC, 1/4 amp @ 250VDC
5 amp @ 125 VDC (Tungsten lamp load)
10,000,000 operations median

Model Q-8CR can also be fitted with a SPDT Gold Cross Bar Switch for computer/PLC interface.

Maximum Continuous Temperature: 200°F

Optional Filter Boot Available in EPDM, (Viton® Special Order)

Weight: 1/2 lb.

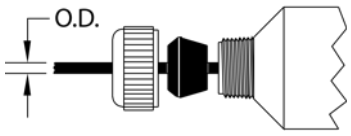


Input Power Cable Interface Options

Option No. 1

Q-8CR / 1 / 1 / B

basic model # & body material
drag disk arm length
drag disk size
grommet size

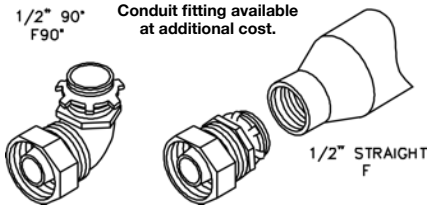


Grommet Size	Cable OD	Grommet Size	Cable OD
A	0.25”	B	0.37”
AA	0.30”	C	0.50”

Option No. 2

Q-8CR / 1 / 1 / F

basic model # & body material
drag disk arm length
drag disk size
½” NPT Female Thread



- Installation drawing and a numbered parts list is supplied with each unit.
- Current Price Information is Listed on Separate Sheet.
- Special One Day Delivery Available.

FLUID FLOW SWITCH

Model Q-10N & Q-10VCR

COMPONENT RECOGNIZED /c **(E85349)**

Extremely Wide Operating Range:

- Down to 0.9 GPM in 1.0 inch pipes
- Up to 1025 GPM in 16 inch pipes

FLEXIBLE Design:

Model Q-10 is provided with three factory adjustable parameters which provide performance flexibility to meet a multitude of applications:

- Target Area
- Target Length
- Target Stiffness

Two Standard Models are Available

Model Q-10N for mild acids, bases
Model Q-10CR for concentrated acids, bases, ketones, esters, alcohols, phenols, etc.

Extensive Chemical Corrosive List On Page 49.

Low Cost

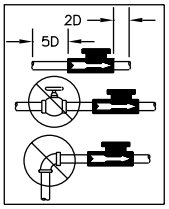
Available with NO, NC or SPDT Reed Switch

Send Us Your Special Requirements

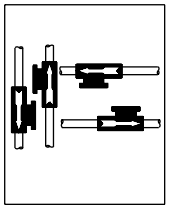
We Will Quote A Special Unit To Meet Those Requirements

- Designed for a broad spectrum of industrial fluids - pure water, tap water, sea water, cooling tower water, glycol solutions, acids, bases, hydrocarbons, ketones, lubricating oils, gasoline, JP-4, plating solutions.
- Responds to fluid flow only, independent of line pressure and temperature.
- Max flow may be five times normal flow.
- Positive stop eliminates fatigue effects of turbulence, vibration and flow surge on flow detecting element.
- Quick response.
- Small size and low profile provides easy mounting in crowded installations.
- Very low pressure drop - typically less than 1.0 psig at normal flow rate.
- Line pressure to 250 psig at room temperature.
- Temperature to 200°F continuous.
- Switches 5 VDC to 240 VAC.
- Switches resistive and light inductive loads.
- Switches Dry Circuit Computer/PLC inputs.
- Switch employs magnetic coupling.

TURBULENT FLOW REDUCTION



MOUNT IN ANY POSITION



Typical Uses

Monitoring flow of coolant water supplied to:

- RF and Radar transmitters
- High power transistors, SCR's etc.
- Computer systems
- Electromagnets
- Transformers
- Brakes and clutches
- Lasers
- Spot welders
- Vacuum systems
- Marine and stationary engines
- Emergency washdown showers
- Fire sprinkler flow alarms

In Chemical Processing

- Liquid transfer
- Water treatment
- Sewage systems (filtered)
- Fluid blending systems
- Monitoring pump output, valve position, systems flow status
- Liquid scrubbers
- Starting back-up pumps
- Monitor filter clogging
- Heat transfer fluids
- Contaminated groundwater

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Model Q-10N & Q-10VCR

Flow Range Water Calibrated @ 70˚F

Model Selection Chart

Pipe Size	Nominal ON/ OFF Switch Point Range (GPM)	Model Number (N or VCR)	Target Blade Number	Switch Oper. Norm. Open or Norm Closed	Power Chord Length
1	1.3-0.9	Q-10 -- /	1 /	--- /	---
	4-2	Q-10 -- /	2 /	--- /	---
1 1/2	8-4	Q-10 -- /	3 /	--- /	---
	17-14	Q-10 -- /	4 /	--- /	---
2	10-7	Q-10 -- /	5 /	--- /	---
	16-11	Q-10 -- /	6 /	--- /	---
3	22-15	Q-10 -- /	7 /	--- /	---
	36-25	Q-10 -- /	8 /	--- /	---
4	39-27	Q-10 -- /	9 /	--- /	---
	64-45	Q-10 -- /	10 /	--- /	---
5	61-43	Q-10 -- /	11 /	--- /	---
	100-70	Q-10 -- /	12 /	--- /	---
6	88-62	Q-10 -- /	13 /	--- /	---
	144-101	Q-10 -- /	14 /	--- /	---
8	156-109	Q-10 -- /	15 /	--- /	---
	256-179	Q-10 -- /	16 /	--- /	---
10	244-171	Q-10 -- /	17 /	--- /	---
	400-280	Q-10 -- /	18 /	--- /	---
12	351-246	Q-10 -- /	19 /	--- /	---
	576-403	Q-10 -- /	20 /	--- /	---
16	625-438	Q-10 -- /	21 /	--- /	---
	1025-718	Q-10 -- /	22 /	--- /	---

CONSULT THE FACTORY FOR LARGER PIPE SIZES.

Reed Switch Electrical Characteristics:

SPNO Contact ratings:

AC Voltage (Max switching)	300 VAC
DC Voltage (Max switching)	350 VDC
Current (max switching)	0.5 amp
Current (max carrying)	2.5 amp
Power (max) (VA, W)	50 watts
Contact resistance (max initial)	0.15 ohms
Insulation resistance	10^{10} ohms
Operating temperature	-40°F to 240°F (-40°C to 115°C)

SPNC or SPDT, 3 Watt, 100VAC/VDC optional

Computer/PLC Dry Circuit Operation

Inductive Loads

Switch contacts have been tested with small relay and J-C 30 amp motor contactor inductive drive coils at 120 VAC and 240 VAC to 500,000 operations without failure. (Volt Amp approximately 6VA. Steady State/Transient surge approximately 34 VA).

Nominal Working Temperature/Pressure

Q-10N	Q-10VCR
180˚F	180°F @ ambient pressure
250 Psig	200 Psig @ room temperature

Wetted Surfaces

Model Q-10N

G.E. NORYL® (PPO)
(10% glass fibers)
316 Stainless steel

Model Q-10VCR

Tycona Fortron® (PPS)
(40% glass fibers)
Hastelloy® C.

Option No. 1 - NORYL® (PPO) Sample Part #

Basic Model # Target Blade # Power Chord Length

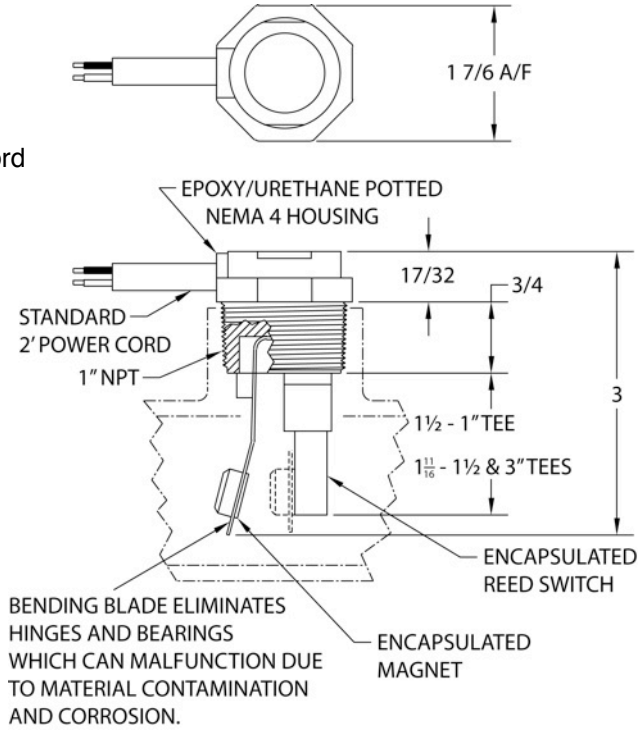
Q - 10N / 13 / NO / 4'

Body Material: NORYL® (PPO) Switch Operation NO, NC, or SPDT

Option No. 2 - Fortron® (PPS) Plastic and Hast. C. metal surfaces

Q - 10VCR / 1 / NC / 2'

NOTE: Model Q-10 employs magnetic coupling between bending blade and switch body. Magnetic particles can accumulate on and around magnetic housing which may affect proper operation. Please conduct appropriate fluid magnetic particle evaluation and operational tests prior to and during installation and use.



- Installation drawing and a numbered parts list is supplied with each unit.
- Current Price Information is Listed on Separate Sheet.
- Special One Day Delivery Available.

FLUID FLOW SWITCH Model Q-12N & Q-12CR

VERY LOW COST

Miniature 1/2" NPT Unit
Available in SPDT, NO or NC Switch Operation

COMPONENT RECOGNIZED /c (E85349)

True Flow Switch Performance Independent of Pressure and Temperature.

Flexible Design

- Target area
- Target Length
- Target stiffness

Which provide performance and flexibility to meet a multitude of pipe size and flow rate applications.

- Extremely Wide Operating Range:
- Down to 0.4 GPM in 3/4 inch pipes
- Up to 590 GPM in 8 inch pipes
- Many more switch points and pipe sizes available, consult factory for free analysis.

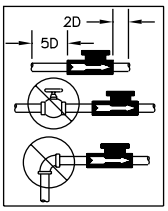
Send Us Your Special Requirements - We Will Quote A Special Unit To Meet Those Requirements

- Designed for a broad spectrum of industrial fluids - pure water, tap water, sea water, cooling tower water, glycol solutions, acids, bases, hydrocarbons, ketones, lubricating oils, gasoline, JP-4, plating solutions.
- Max flow may be five times normal flow.
- Positive stop essentially eliminates fatigue effects of turbulence, vibration and flow surge on flow detecting element.
- Very low pressure drop - typically less than 1.0 psig at normal flow rate.
- Line pressure to 200 psig.
- Temperature to 180°F continuous.
- Switches 5 VDC to 240 VAC.
- Power the driving coil of small ice cube relays as well as some 30 amp power relays.
- Provides dry circuit interface with computer and PLC modules.
- Small size and low profile provides easy mounting in crowded installations.

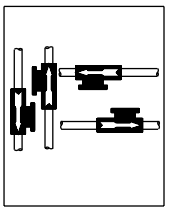
Typical Uses

- Brakes and clutches
- Computer systems
- Electromagnets
- Emergency wash down showers
- Fire sprinkler flow alarms
- High power transistors, SCR's etc.
- Lasers
- Marine and stationary engines
- Monitoring flow and temperature of coolant water supplied to:
  - RF and Radar transmitters
  - Sea water & Fresh water systems
  - Spot welders
  - Transformers
  - Vacuum systems

TURBULENT FLOW REDUCTION



MOUNT IN ANY POSITION



In Chemical Processing

- Liquid transfer
- Starting back-up pumps
- Sewage systems
- Fluid blending systems
- Monitoring pump output, valve position, systems flow status
- Liquid scrubbers
- Water treatment
- Monitor filter clogging
- Heat transfer fluids

NOTE: Model Q-12N employs magnetic coupling between float arm and switch body. Magnetic particles can accumulate on and around magnetic housing which may affect proper operation. Please conduct appropriate fluid magnetic particle evaluation and operational tests prior to and during installation and use.

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Model Q-12N & Q-12CR

Flow Range Water Calibrated @ 70˚F

Model Selection Chart

Pipe Size NPT	Nominal ON/OFF Switch Point Range (GPM)		Target Blade #
	Orifice	No Orifice	
	On Off	On Off	
3/4	0.4 - 0.3	2 - 1	1
	0.8 - 0.5	2 - 1	2
1	0.7 - 0.4	3 - 2	3
	1.0 - 0.8	3 - 2	4
		4 - 3	5
		6 - 5	6
1 1/2		13 - 12	7
		16 - 15	8
		21 - 19	9
2		15 - 12	10
		23 - 18	11
		27 - 22	12
3		33 - 25	13
		57 - 45	14
		65 - 58	15
		82 - 78	16
4		56 - 43	17
		95 - 83	18
		120 - 108	19
		150 - 140	20
5		92 - 69	21
		150 - 130	22
		180 - 170	23
		230 - 220	24
6		135 - 95	25
		220 - 180	26
		260 - 220	27
		340 - 310	28
8		240 - 180	29
		390 - 320	30
		430 - 400	31
		590 - 570	32

CONSULT THE FACTORY FOR LARGER PIPES AND ADDITIONAL SWITCH POINTS.

Electrical Switch Characteristics

SPNO

AC Voltage (Max switching)	300 VAC
DC Voltage (Max switching)	350 VDC
Current (max switching-DC)	0.5 amp
Current (max carrying-DC)	2.5 amp
Power (max resistance load)	50 watts
Contact resistance (max initial)	0.15 ohms
Insulation resistance	10^{10} ohms
Operating temperature	-40°F to 240°F (-40°C to 115°C)

SPNC or SPDT, 3 Watt, 100 VAC/VDC optional

Nominal Working Temperature/Pressure

Q-12N	Q-12CR
180˚F	200°F @ ambient pressure
250 Psig	200 Psig @ room temperature

Inductive Loads

Switch contacts have been tested with small relays and 30 amp J-C relay inductive driving coils at 120/240 VAC to 500,000 operations without failure. Steady state driving coil Volt/Amp rating should be 8VA or less.

Dry Circuit Operation

Switch can interface with microprocessor based controllers and related computer circuits.

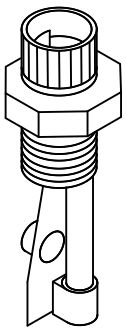
Wetted Surfaces

Model Q-12N	Model Q-12CR
G.E. NORYL® (PPO) GFN-1 (10% glass fibers)	Tycona Fortron® (PPS) (40% glass fibers)
316 Stainless steel	Hastelloy®C
Epoxy	Epoxy

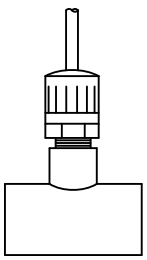
PPO - Polyphenylene Oxide
PPS - Polyphenylene Sulfide

For performance in your working fluid see extensive corrosion resistance guide in the back of the catalog (see page 49).

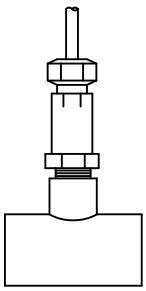
Free parts samples are available for testing in your "exotic" unlisted fluids.



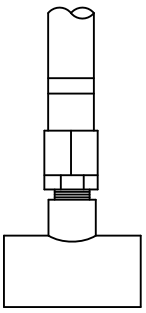
OPTION 1
Basic unit supplied with two 0.187 x 0.020 male spade terminals recessed in 1/2" NPT nipple section.



OPTION 2
Two conductor instrument cable potted in place. PVC tee optional.



OPTION 3
Basic unit with DMP tapered rubber grommet attachment for watertight seal and strain relief. PVC tee optional.



OPTION 4
Basic unit fitted with a 1/2" NPT female thread for mating with 1/2" plastic flexible conduit PVC tee optional.

Sample Part Number

basic model # & body material	pipe size (inches)	target blade #	switch operation	electrical connect opt.	tee size and material	orifice size
Q-12N /	**3/4** /	**2** /	**NO** /	**1** /	**3/4x3/4x1/2 SST PVC** /	**1/4" ORIFICE**
noryl® (PPO) or fortron® (PPS)	3/4" to 8"+	1 thru 32	N.O. or N.C.	option 1, 2, 3, or 4		1/4 or 1/2

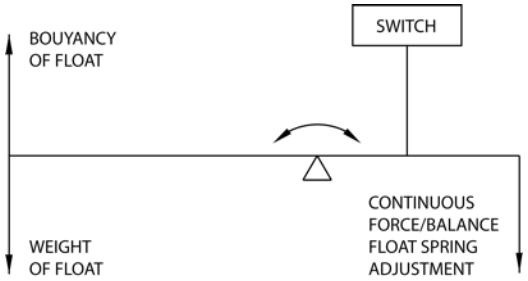
- Installation drawing and a numbered parts list is supplied with each unit.
- Current Price Information is Listed on Separate Sheet.
- Special One Day Delivery Available.

LIQUID LEVEL SWITCH

Model L-5 & L-5SS

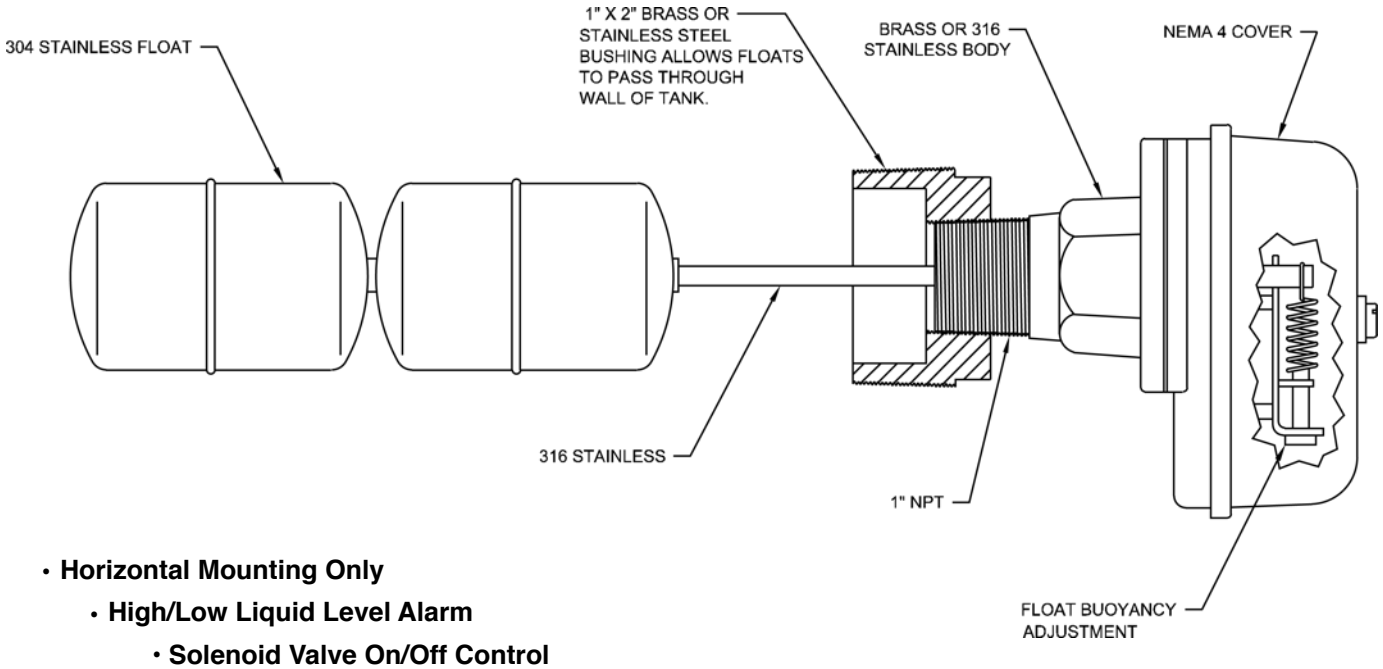
Specific Gravity Compensating

- Featuring continuously adjustable float buoyancy control to allow use in fluids with specific gravity down to 0.6
- Continuous buoyancy control allows switch activation at oil/water interface
- Consult factory for other bicomponent fluid interface systems.



- Wetted surfaces of various combinations of brass, 302, 304, 316 stainless, EPDM, Hypalon®, Viton®, and Teflon® allow operation in a wide spectrum of environments such as:
  - Contaminated ground water
  - Hydrocarbons
  - Machine cutting oils
  - Medium concentrated acids and bases, etc.
  - Rusty coolant water
  - Sea Water
  - Sewage
  - Waste water

- 15 amp, 120 or 230 VAC, SPDT or DPDT switch action
- Gold Cross Bar Dry Circuit Computer/PLC Interface SPDT Switch Model also available
- May be used in hazardous areas when used with intrinsically safe relays.
- Temperature to 180°F
- Pressure to 300 psig
- Available in single float and double float models
- For use in particle contaminated fluids.
- Non-Magnetic



- **Horizontal Mounting Only**
  - **High/Low Liquid Level Alarm**
    - **Solenoid Valve On/Off Control**

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Model L-5 & L-5SS

Specifications

(Same for all models except where shown)

Single Float

Models L-5 and LD-5

Red brass body, phosphor bronze float shaft, 316 stainless screws and washers, 304 stainless float, EPDM seal, cork-chloroprene gasket, and Noryl® cover.

For

Water, seawater, sewage, waste water, slurries, alcohols, gasolines, oils, glycols and soap solutions.

Working Fluid Specific Gravity Range - Adjustable between 0.6 and 1.0+

Nominal Working Temperature / Pressure

180°F max. @ 300 psig

Liquid Level Change to Activate / Deactivate Switch

≈ 1/4" travel

Weight

3 lbs.

Electrical Switch Characteristics

SPDT UL and CSA listed
15 AMP, 1/2 HP @ 125 or 250 VAC
1/2 AMP @ 125 VDC, 1/4 AMP @ 250 VDC
5 AMP @ 125 VAC (Tungsten lamp load)
10,000,000 mechanical operations median

Double Float

Models L-5SS and LD-5SS

316 stainless steel body, float shaft, screws and washers, 302 stainless float, Viton®, Teflon® gasket, and Noryl® cover.

For

All media handled by Models L-5 and LD-5. Also chlorinated organics, hydrocarbons, phenols, medium concentrated acids and bases, compatible with 302 stainless, gasolines, oils.

Working Fluid Specific Gravity Range

Adjustable between 0.6 and 1.0+

Nominal Working Temperature / Pressure

180°F max. @ 300 psig

Liquid Level Change to Activate Switch

≈ 1/4" travel

Weight

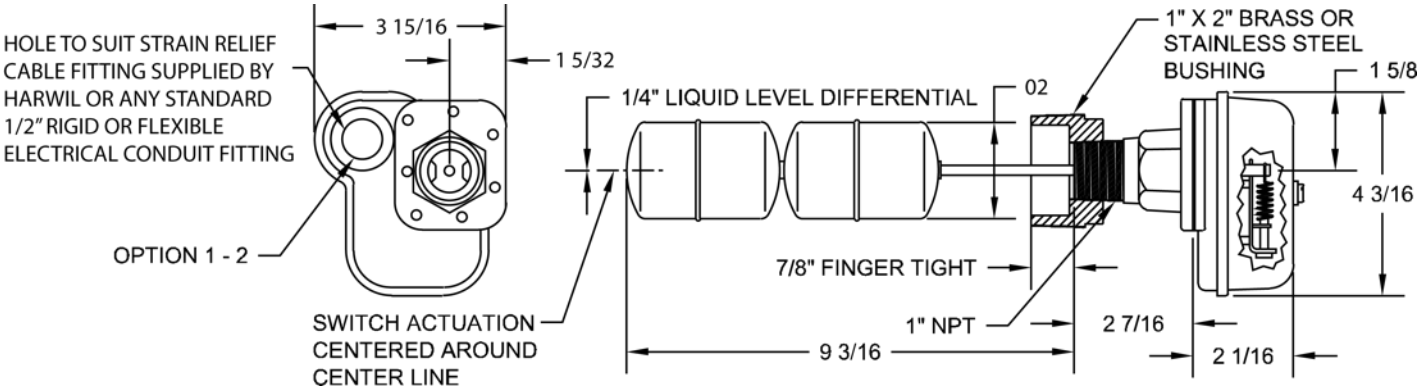
3.5 lbs.

SPDT - Dry Circuit

Gold Cross Bar Contacts for Computer/PLC Interface
0.1 amps or less 5-24 VAC/DC
UL & CSA listed

Models L-5 and L-5SS employ one SPDT microswitch. Models LD-5 and LD-5SS use two SPDT microswitches which activate simultaneously to give DPDT capability.

Installation Dimensions

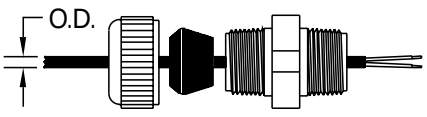


Input Power Cable Interface Options

Option # 1

Basic Model # — Grommet Size

L-5 / A
LD-5 / AA
L-5SS / B

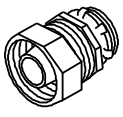


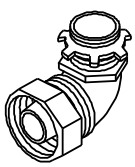
Option # 2

Basic Model # — 1/2" Flexible Conduit Fitting

L-5 / F
LD-5 / F 90°

1/2" STRAIGHT F





1/2" 90° F90°

Grommet Size	Cable OD	Grommet Size	Cable OD
A	0.25"	B	0.37"
AA	0.30"	C	0.50"

- Installation drawing and a numbered parts list is supplied with each unit.
- Current Price Information is Listed on Separate Sheet.
- Special One Day Delivery Available.

LIQUID LEVEL SWITCH

Model L-8N, L-8R & L-8CR

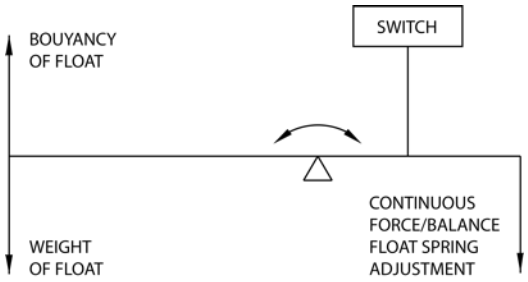
Fortron® (PPS) and Noryl® (PPO)

Specific Gravity Compensating

COMPONENT RECOGNIZED /c (E85349)

Available with Optional Filter Boot For Use in Highly Particle Contaminated Liquids

- Featuring continuously adjustable float buoyancy control to allow use in fluids with specific gravity down to 0.6
- Continuous buoyancy control allows switch activation at oil/water interface.

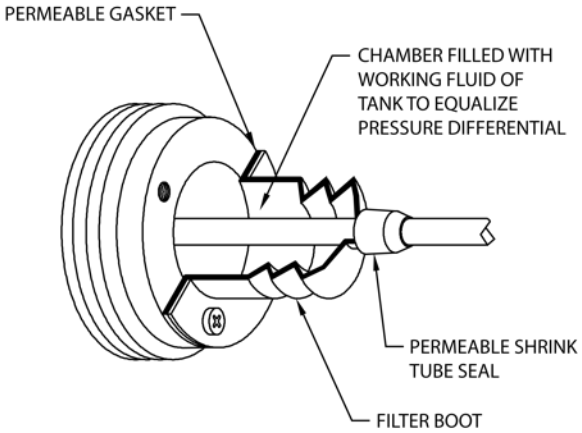


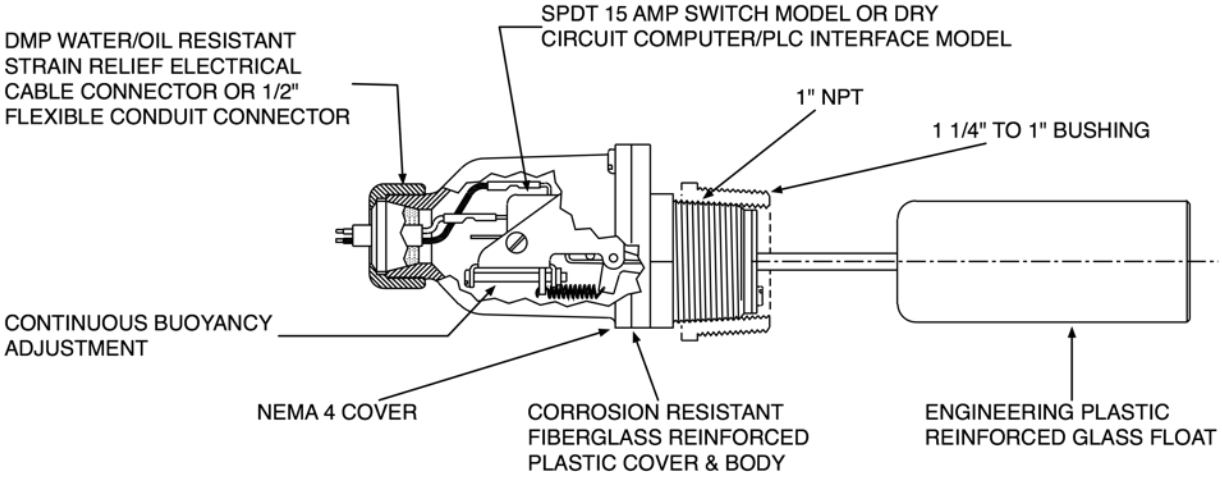
- Consult factory for other bicomponent fluid interface systems.

- Water/Oil Interface switch point
- Foam/Fluid interface switch point
- Wetted surfaces of various combinations of 316 stainless, Hastelloy® C, Teflon®, Fortron® (PPS), Noryl® (PPO), Viton®, EPDM optional and PVC for use in liquids from water, sea water, etc., to low, medium and concentrated acids and bases.
- May be used in hazardous areas when used with intrinsically safe relays.
- 15 amp, 120 or 230 VAC, SPDT switch action
- Gold Cross Bar Dry Circuit Computer/PLC Interface SPDT Switch Model also available.
- Horizontal Mount only
- Temperature to 180°F
- Pressure to 75 psig operating
- Pressure to 100 psig non-operating
- Solenoid valve control
- Liquid level alarm
- Liquid level indication
- Direct pump control
- Extensive Chemical Corrosive List (see page 49)
- Maintenance and checkout is a snap for your present personnel using an uncomplicated standard test meter

Typical Working Fluids

- Alcohols
- Chemical Solutions
- Contaminated Groundwater
- Glycols
- Machine Cutting Oils
- Oils
- Pure Water
- Rusty Coolant Water, Etc.
- Sewage
- Sewage Water
- Soap Solutions
- Tap Water





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Model L-8N, L-8R & L-8CR

Specifications

(Same for all models except where shown)

Model L-8N

Noryl® body, float and bushing, EPDM diaphragm, 316 stainless float shaft and screws (Viton® optional)

For

Mild acids and bases, inorganics, some alcohols, water.

Model L-8R

Fortron® (PPS) body, float and bushing, Viton® diaphragm, 316 stainless float shaft and screws.

For

Medium acids and bases, inorganics, alcohols, most hydrocarbons.

Model L-8CR

Fortron® (PPS) body, float and bushing, Viton® diaphragm, Hastelloy® C float shaft and Teflon screws.

For

Concentrated acids and bases, inorganics, alcohols, hydrocarbons, chlorinated organics, phenols.

Electrical Switch Characteristics

SPDT UL and CSA listed
15 AMP, 1/2 HP @ 125 or 250 VAC
1/2 AMP @ 125 VDC, 1/4 AMP @ 250 VDC
5 AMP @ 125 VAC (Tungsten lamp load)
10,000,000 mechanical operations median

Working Fluid Specific Gravity Range - Adjustable between 0.6 and 1.5 & up

Nominal Working Temperature / Pressure

180°F max. @ 75 psig

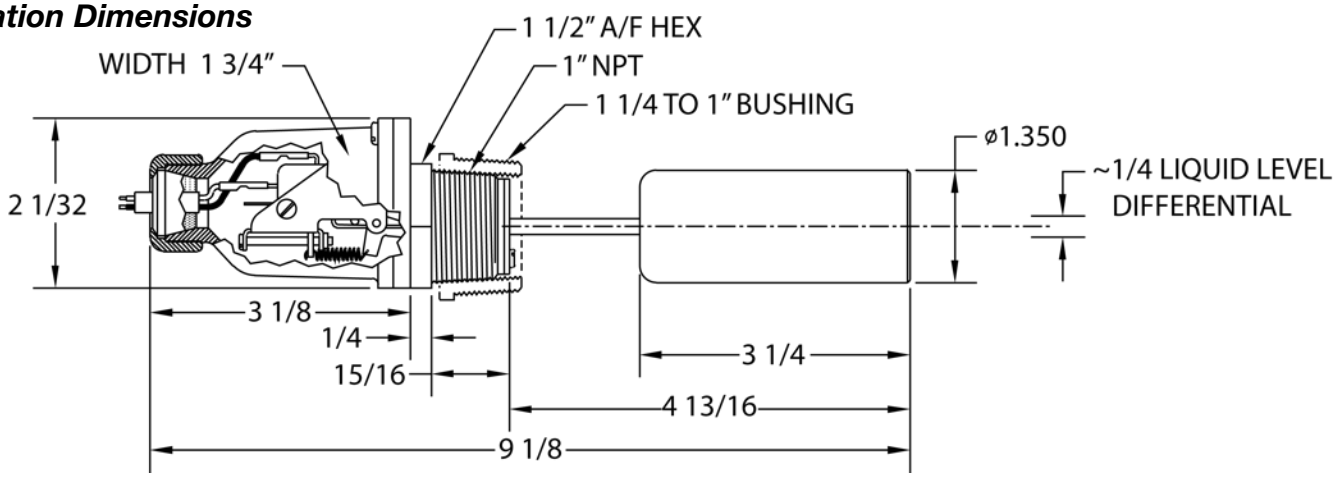
Liquid Level Change to Activate Switch	Weight
≈ 1/4" max. travel	1/2 lb.

SPDT - Dry Circuit UL & CSA listed

Gold Cross Bar Contacts for Computer/PLC Interface
1.0 amps or less 5-24 VAC/DC

Optional filter boot available in EPDM (L-8N) or Viton® (L8CR)

Installation Dimensions



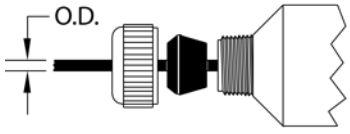
Input Power Cable Interface Options

Option No. 1 Sample Part #:

Basic Model # & Body Material

Grommet Size

L - 8N / A
L - 8R / AA
L - 8CR / C

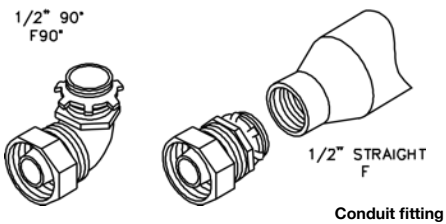


Option No. 2 Sample Part #:

Basic Model #

Grommet Size

L - 8N / F
L - 8R / F
L - 8CR / F90°



Conduit fitting available at additional cost.

Grommet Size	Cable OD	Grommet Size	Cable OD
A	0.25"	B	0.37"
AA	0.30"	C	0.50"

- Installation drawing and a numbered parts list is supplied with each unit.
- Current Price Information is Listed on Separate Sheet.
- Special One Day Delivery Available.

LIQUID LEVEL SWITCH

Model L-21N & L-21VCR

COMPONENT RECOGNIZED /c **(E85349)**

LOW COST - HIGH PERFORMANCE - ALL PLASTIC UNITS

Feature Variable Liquid Level Differential
PLUS Single Point Pump Up/Pump Down Level Control

- Four field replaceable liquid level differential bands are standard.
- ΔH = 1.0" ΔH = 2.0" ΔH = 3.0" ΔH = 5.0"
- Interchangeable differential band modules allow 5 minute on site switching of differential from 1.0" to 2.0" to 3.0" to 5.0" in any sequence to satisfy variable operational requirements as they occur.
- Large Differential provides immunity to nuisance switch tripping due to severe wave action and turbulence.
- Large Differential also provides very low cost single point pump up/pump down level control.
- Model L-21 is ideal for make-up water level control in cooling towers, plating and washing tanks, fish farms, fountains, and aquariums.
- For use in contaminated fluids. However, we suggest appropriate analysis and testing in each situation.

L-21 Employs Magnetic Coupling

L-21N Employs Noryl® Polyphenylene Oxide (PPO) Engineering Plastic and 316 Stainless

Wetted Surfaces For:

- Clean Water
- Contaminated Groundwater
- Filtered Sewage
- Filtered Waste Water
- Inorganic aqueous solutions and related liquids
- Mild Acid/Bases
- Sea Water

L-21VCR Employs Fortron® Polyphenylene Sulfide (PPS) Engineering Plastic and Hast.® C.

Wetted Surfaces For:

- Acids and bases
- Alcohols
- Amines
- Chlorinated organics
- Contaminated Groundwater
- Esters
- Ethers
- Hydro carbons
- Inorganic solutions
- Ketones
- Nitrites
- Phenols
- Waste water

- 11 amp 120/240 VAC SPDT Switch allows direct control of 1/3 hp pumps, 1.2 kw heaters, motor contactors, solenoid valves, etc.
- Intrinsically safe relay allows Model L-21 to be used in hazardous area.
- Temperature to 200°F continuous at 75 psig
- Pressures to 250 psig at 75°F
- Maintenance and checkout is a snap for plant maintenance personnel using any standard multimeter.
- Each unit comes with detailed Instruction Manual and Parts List.
- Plastic test strips are available for testing in your particular "real world" chemical environment.
- Note: Model L-21 employs magnetic coupling between float arm and switch body. Magnetic particles can accumulate on and around magnet housing which may affect proper operation. Please conduct appropriate fluid magnetic particle evaluation and operational tests prior to and during installation and use.
- Extensive Chemical Corrosive List Available (see page 49).

NOTE: Model L-21N employs magnetic coupling between bending blade and switch body. Magnetic particles can accumulate on and around magnetic housing which may affect proper operation. Please conduct appropriate fluid magnetic particle evaluation and operational tests prior to and during installation and use.

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Model L-21N & L-21VCR

Specifications

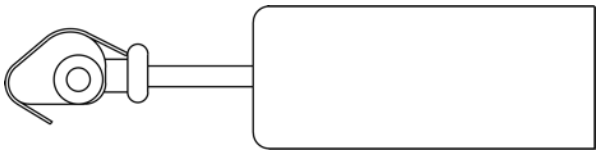
- **L-21N Wetted Surfaces**
  - 1) Noryl® Polyphenylene Oxide (PPO) with 10% glass fiber.
  - 2) 316 Stainless hardware
- **L-21VCR Wetted Surfaces**
  - 1) Tycona Fortron® Polyphenylene Sulfide (PPS) with 40% glass fiber.
  - 2) Hastelloy® C Hardware
- **Electrical Switch Characteristics**
  SPDT UL and CSA listed
  11 A, 1/3 HP; 125/250 VAC
  1/2 A 125 VDC, 1/4 AMP 250 VDC
  4A 125 VAC (lamp load)
- **L-21N**
  - Nominal working temperature & pressure:

• Temperature (˚F)	75	100	150	180
• Pressure (PSI)	250	200	150	75

- **L-21VCR**
  - Nominal working temperature & pressure:

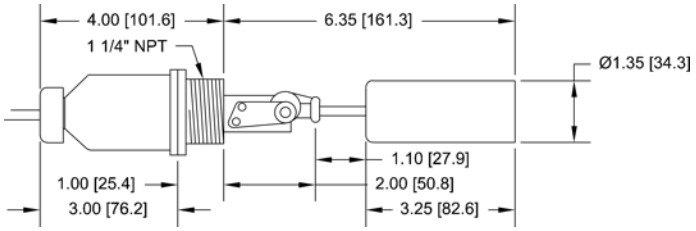
• Temperature (˚F)	75	100	150	200
• Pressure (PSI)	250	225	175	150

- **Working Fluid Spec. Gravity: 0.7 Min.**
  - **(**L-21N and L-21VCR):
- **Weight: 5 oz. (142 g)**

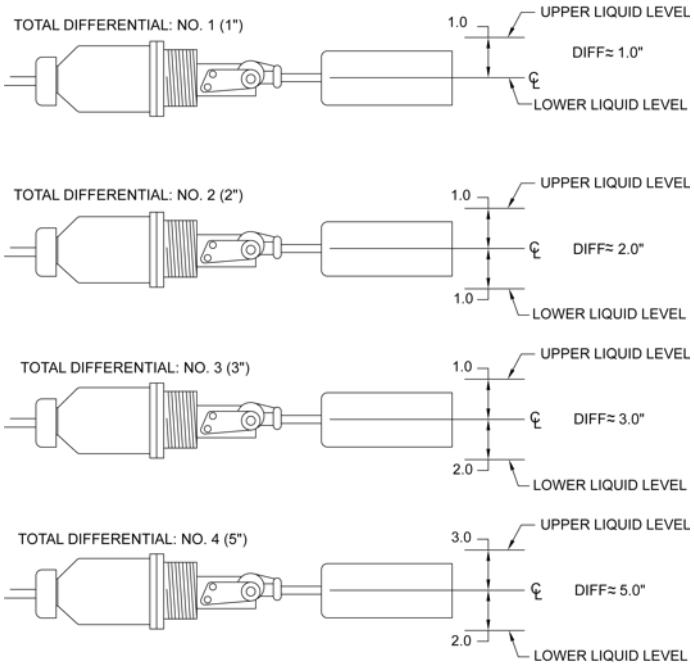


1, 2, 3, and 5 INCH LINE REPLACEABLE DIFFERENTIAL FLOAT UNITS AVAILABLE AS SEPARATE ITEMS

Installation Dimensions



Liquid Level Differential Dimensions



Input Power Cable Interface Options

Option No. 1

Sample Part #

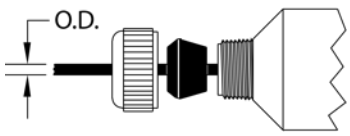
Basic Model # & Body Material

Grommet Size

L - 21N / 11A / 1 / A

Switch Capacity

Liquid Level Differential



Grommet Size	Cable OD	Grommet Size	Cable OD
A	0.25”	B	0.37”
AA	0.30”	C	0.50”

Option No. 2

Sample Part #

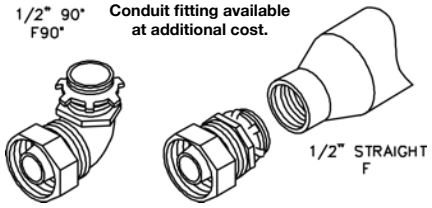
Basic Model # & Body Material

½” NPT Female Thread

L - 21N / DRY / 5 / F

Switch Capacity

Liquid Level Differential



- Installation drawing and a numbered parts list is supplied with each unit.
- Current Price Information is Listed on Separate Sheet.
- Special One Day Delivery Available.

LIQUID LEVEL SWITCH

Model L-30N (PPO) & L-30R (PPS)

Noryl® (PPO) and Fortron® (PPS) Engineering Plastic
Available with Optional Filter Boot

COMPONENT RECOGNIZED ®/c® (E85349)

HORIZONTAL MODEL
L-30N OR L-30R

VERTICAL MODEL
L-30NV OR L-30RV

For Use in Highly Particle Contaminated Liquids:

Sewage, waste water, contaminated ground water, Machine cutting oils, medium slurries

Corrosive Liquids such as:

Acids and bases, sea water, rusty coolant water, various chemicals (see page 49).

Special Features

- Particle contamination resistance is provided by a single convolute elastomeric flexible seal which is continuously flushed by the working fluid.
- Models for vertical or horizontal mounting.
- Maintenance and checkout is a snap for your present personnel using an uncomplicated standard test meter.
- Optional Nitrophyl® (Nitrile) Closed Cell Float for mounting switch in 1" NPT fitting.

Features

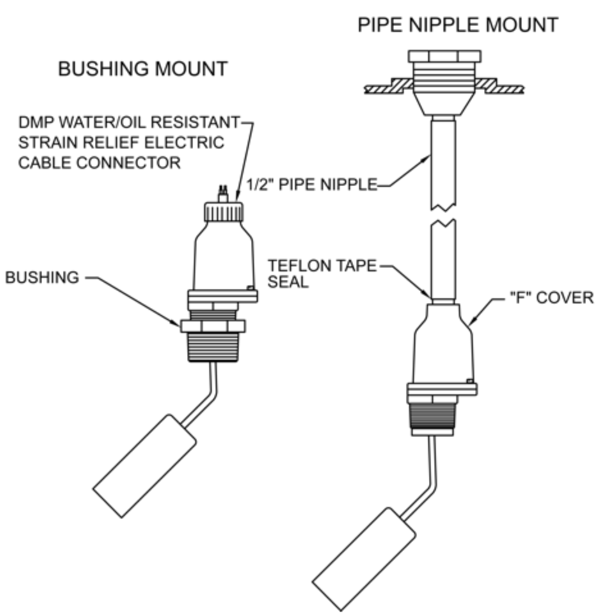
- Wetted surfaces of Fortron® (PPS), Noryl® (PPO), 316 stainless steel, EPDM or Viton® (Hypalon® optional)
- SPDT 15 amp, 120/240 VAC, switching capacity model or Gold Cross Dry Circuit Computer/PLC Interface Model.
- Intrinsically Safe Relay allows Model L-30 to be used in hazardous areas.
- Temperatures to 200°F continuous.
- Pressures to 75 psig operating
- Pressures to 100 psig non-operating.

For

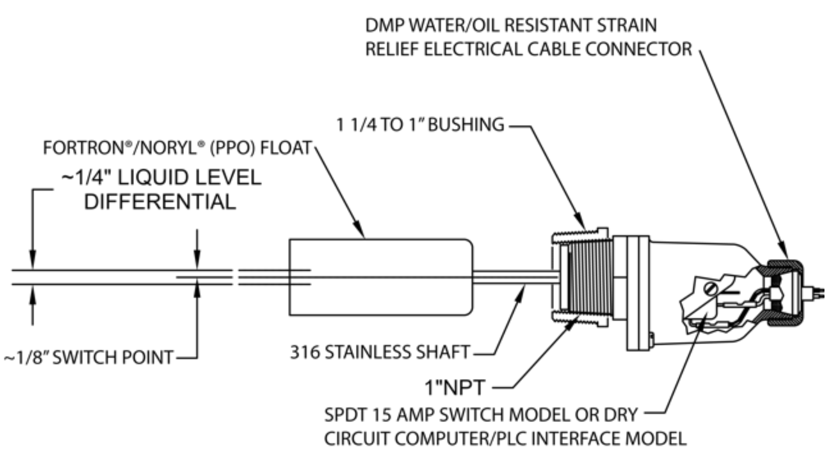
- High/Low Liquid level alarm
- Liquid level indication
- Pump Up/ Pump Down Control
- Solenoid Valve control

Fortron® and Noryl® test strips are available for testing in your particular chemical environment

Extensive Chemical Corrosive List Available



Both horizontal and vertical models are available with DMP cable connector or "F" model 1/2" conduit fitting.



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Model L-30N (NORYL®) & L-30R (Fortron®)

Specifications

Model L-30N (Noryl® PPO)

For use in water, acids, bases, inorganic solutions, sewage, contaminated water

Wetted Surfaces

Noryl® Engineering Plastic (PPO), 316 Stainless Steel, EPDM (Viton® optional)

Nominal Working Temperature & Pressure

Temperature (°F) 180 Max
Pressure (psig) 75 Operating
100 Max Non-operating

L-30R (Fortron® PPS) (Broad Chemical Spectrum)

For use in acids, bases, inorganic solutions, alcohols, ketones, chlorinated organics, esters, ether, hydrocarbons, nitrites, phenols.

Wetted Surfaces

Fortron® Engineering Plastic (PPS), 316 stainless steel, Viton®

Nominal working temperature & pressure

Temperature (°F) 200 Max
Pressure (Psig) 75 Operating
100 Max Non-operating

Optional filter boot available in EPDM

(Viton® Special Order)

Specifications for Models L-30N & L-30R

Working Fluid Spec. Gravity - 0.8 min.

Electrical Switch Characteristics

SPDT UL and CSA listed
15 AMP @ 1/2 HP; 125/250 VAC
1/2 AMP @ 125 VDC, 1/4 AMP @ 250 VDC
5 AMP 125 VAC (Tungsten lamp load)
10,000,000 operations median.

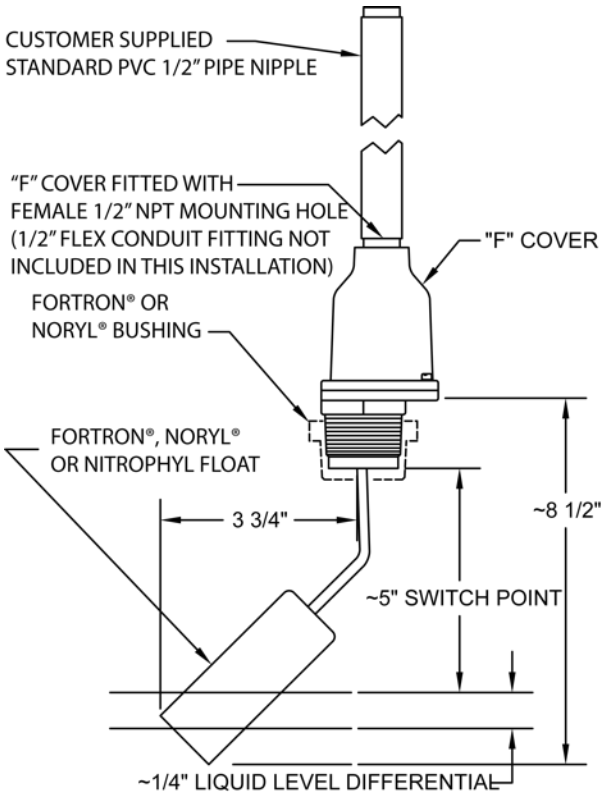
SPDT-Dry Circuit

Gold Cross Bar Contacts for Computer/PLC Interface
0.1 AMP or less 5-24 VAC/DC (UL & CSA listed)

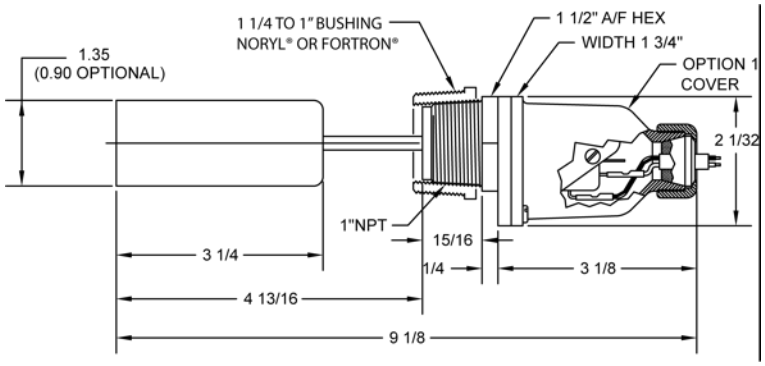
Liquid Level Change to Activate Switch

≈ 1/4" all models

Weight: 1/2 lb



Installation Dimensions



Input Power Cable Interface Options

Option No. 1

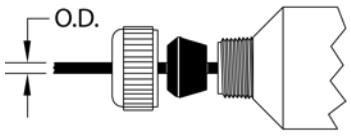
Sample Part #

Basic Model # & Body Material

Grommet Size

L - 30N / A
L - 30RV / AA

Horizontal or Vertical Mount



Grommet Size	Cable OD	Grommet Size	Cable OD
A	0.25"	B	0.37"
AA	0.30"	C	0.50"

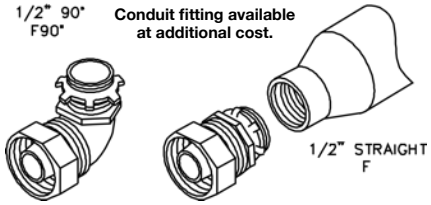
Option No. 2

Sample Part #

Basic Model # & Body Material

½" NPT Female Thread

L - 30NV / F
L - 30R / F



- Installation drawing and a numbered parts list is supplied with each unit.
- Current Price Information is Listed on Separate Sheet.
- Special One Day Delivery Available.

LIQUID LEVEL SWITCH

Model L-30CR

Fortron® (PPS) Engineering Plastic
Available with Optional Filter Boot

COMPONENT RECOGNIZED /c **(E85349)**

For Use in Highly Particle Contaminated Liquids:

- Contaminated groundwater
- Machine cutting oils
- Medium slurries
- Sewage
- Waste water

Broad Spectrum Corrosive Liquids such as:

- Acetic acid
- Acid & base solutions
- Acid mine water
- Aqueous Ammonia
- Benzene
- Crude Oil
- Ferric Chloride
- Paper pulp liquor

HORIZONTAL MODEL
L-30CR

Special Features:

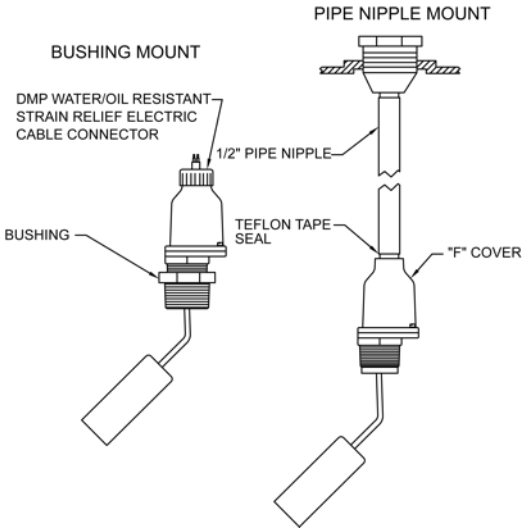
- Corrosion resistance is provided by the wetted surface combination of Fortron® (PPS), Hastelloy® C (Titanium, Tantalum special order) and Viton®.
- Particle contamination resistance is provided by a single convolute elastomeric flexible seal which is continuously flushed by working fluid.
- SPDT 15 amp switching capacity model or Dry Circuit Computer/ PLC interface model.
- Intrinsically Safe Relay allows Model L-30CR to be used in hazardous areas.
- Temperatures to 200°F continuous.
- Pressures to 75 psig operating
- Pressures to 100 psig non-operating.
- Maintenance and checkout is a snap for your present personnel using an uncomplicated standard test meter.

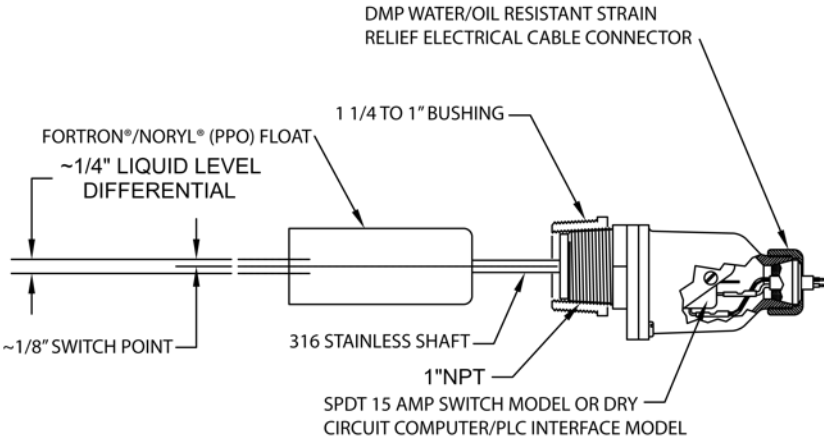
VERTICAL MODEL
L-30CRV

For -

- High/Low Liquid level alarm
- Pump Up/ Pump Down Control
- Liquid level indication
- Solenoid Valve control
- Fortron® PPS test strips are available for testing in your particular chemical environment.
- Extensive Chemical Corrosive List Available

Both horizontal and vertical models are available with DMP cable connector or "F" model 1/2" conduit fitting.





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Model L-30CR

Specifications

Model L-30CR

Float and Body

Fortron® PPS

Wetted Surfaces

Fortron® PPS/Viton®/Hastelloy® C/Standard (Titanium/Tantalum special order)

Corrosion Resistance

Determined by wetted surfaces listed above.
An extensive chemical corrosive list is available (see page 49)

Nominal Working Temperature & Pressure

Temperature (°F) 200 Max
Pressure (Psig) 100 Max

Working Fluid Spec. Gravity

0.7 min.

Weight: 1/2 lb.

Electrical Switch Characteristics

SPDT UL and CSA listed
15 AMP, 1/2 HP @ 125 or 250 VAC
1/2 AMP @ 125 VDC, 1/4 AMP @ 250 VDC
5 AMP @ 125 VAC (Tungsten lamp load)
10,000,000 operations median.

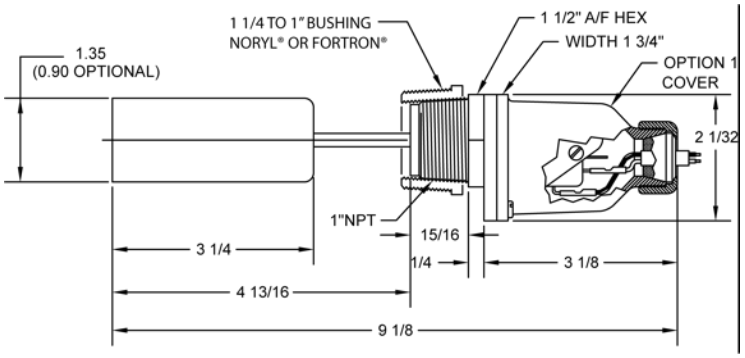
SPDT-Dry Circuit UL & CSA Listed

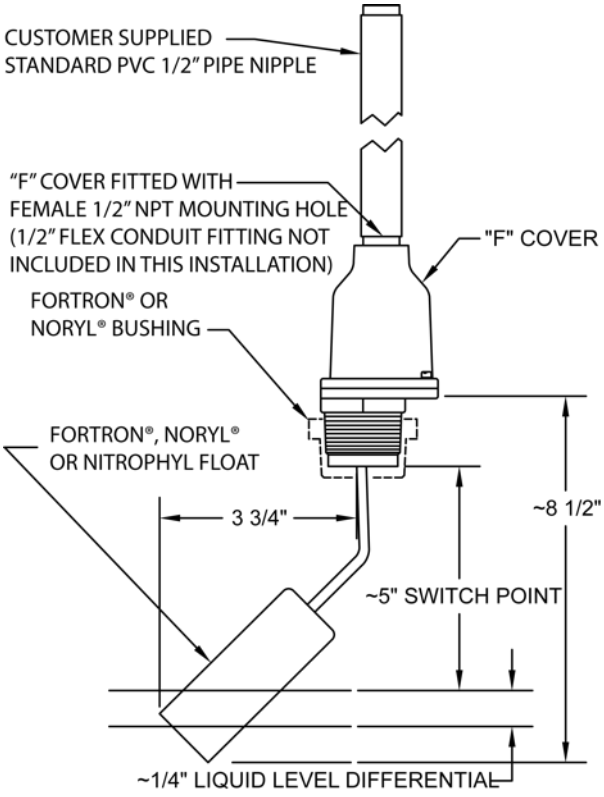
Gold Cross Bar Contacts for Computer/PLC Interface
0.1 AMP or less 5-24 VAC/DC

Liquid Level Change to Activate Switch

≈ 1/4"

Installation Dimensions





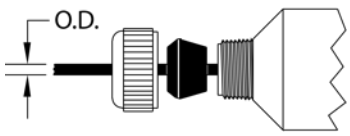
Input Power Cable Interface Options

Option No. 1

Sample Part #

Basic Model # → L - 30CR / A ← Grommet Size

Body Material Fortron® (PPS)



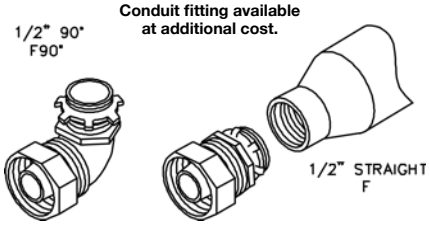
Grommet Size	Cable OD	Grommet Size	Cable OD
A	0.25"	B	0.37"
AA	0.30"	C	0.50"

Option No. 2

Sample Part #

Basic Model # → L - 30CR / F ← ½" NPT Female Thread

Body Material Fortron® (PPS)



- Installation drawing and a numbered parts list is supplied with each unit.
- Current Price Information is Listed on Separate Sheet.
- Special One Day Delivery Available.

LIQUID LEVEL SWITCH

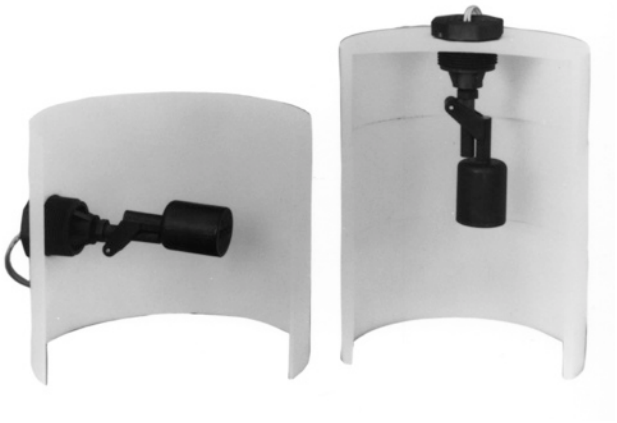
Model L-40N (PPO) & L-40VCR (PPS)

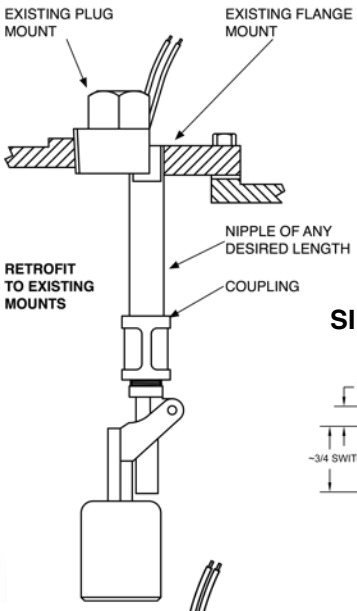
Side and Top Mount
Corrosion Resistant Plastic with Optional Metal Pivot Pin

COMPONENT RECOGNIZED (E85349)

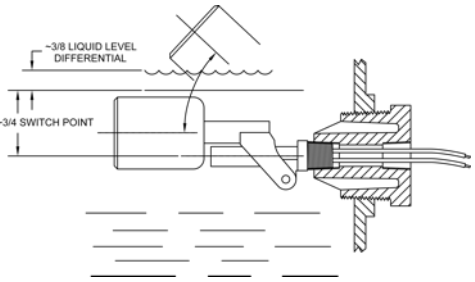
- Noryl® Polyphenylene Oxide (PPO) is suitable for acid and base solutions, pure water, process water, sea water, filtered sewage, contaminated groundwater. Noryl® is not suitable for use in hydrocarbons, petroleum, alcohol and related chemicals.
- The wetted surface of Model L-40 is entirely of Noryl® (PPO) or Fortron® (PPS) except for a small float support Pivot Pin.
- Float support pivot pin is supplied in a variety of materials i.e. 316 Stainless Steel, Hast.® C, Titanium, Tantalum and Teflon® to meet special chemical and operations environments.
- Tycona Fortron® Polyphenylene Sulfide (PPS) is suitable for strong acid and base solutions. All of the solutions listed above including hydrocarbons, petroleum products, alcohols, etc. Fortron® (PPS) is a member of a select class of chemically resistant plastic resins for use in a very broad spectrum of chemicals.
- **10 times less sensitive from deposit and build-up of contaminants than sliding float models.**

LOW COST RELIABLE DESIGN

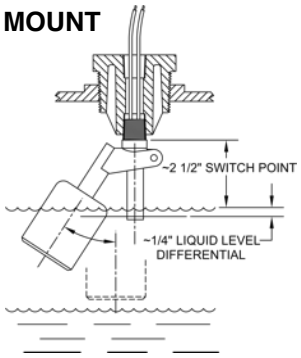


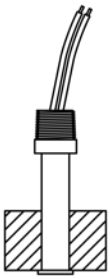


SIDE MOUNT

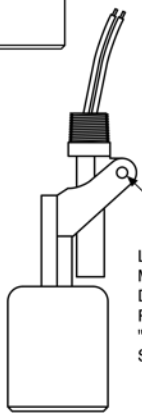


TOP MOUNT

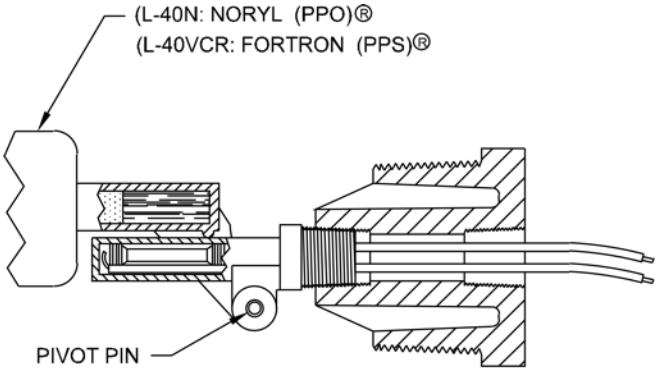




LARGE SURFACE AREA ENCOURAGES CONTAMINATION DEPOSIT AND BUILD-UP.



LOOSE PIVOT AND LONG MOMENT ARM INHIBIT DEPOSITS AND UPGRADE PERFORMANCE 10:1 OVER "DONUT" DESIGN VERY SMALL FLOAT CONTACT AREA.



- Each unit can be supplied with a special made to order 1-1/4" x 1/4" x 1/2" reducer bushing for through wall mounting.
- Output wire can be twisted pair 22 gauge or two conductor PVC heavy wall instrument cable.
- STANDARD - SPST reed switch for 120/240 VAC 50 Watt power or DC dry circuit for computer/PLC interface.

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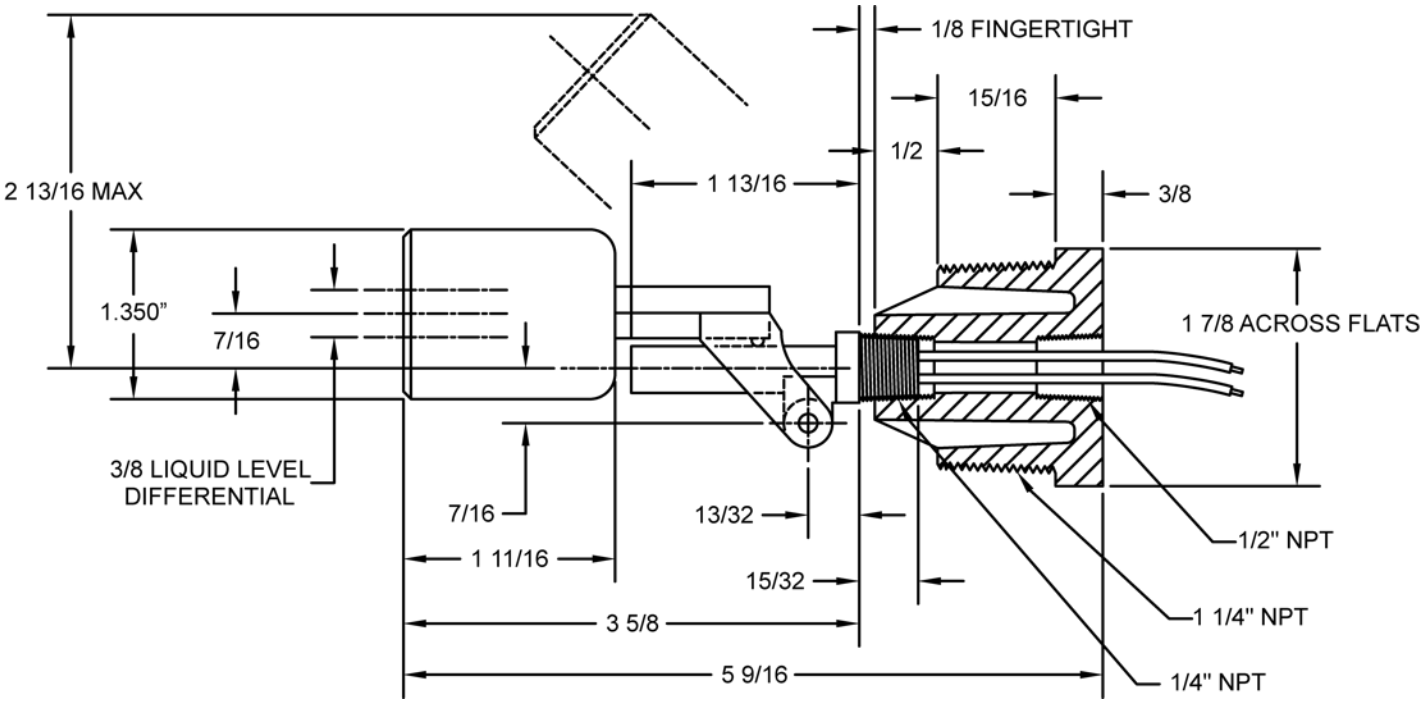
Email: harwil@harwil.com

Installation Dimensions

Model L-40N (NORYL®) & L-40VCR (Forton®)



L-40N **L-40VCR**

Wetted Surfaces

10% Glass reinforced Noryl® (PPO) and 316 stainless steel pivot pin.

Nominal Working Pressure/Temp

Tested to Failure at 800 psig at room temperature

Temp. ˚F (˚C)	0 (-18)	50 (10)	100 (38) 180 (82)
Pressure psig	200	200	175 140

Working Fluid Spec. Gravity

Top Mount 0.8
Side Mount 0.7

Wetted Surfaces

40% Glass re-inforced Fortron® (PPS) and Hastelloy® C pivot pin.

Nominal Working Pressure/Temp

Tested to Failure at 800 psig at room temperature

Temp. ˚F (˚C)	0 (-18)	50 (10)	100 (38) 200 (93)
Pressure psig	250	250	180 150

Working Fluid Spec. Gravity

Top Mount 0.9
Side Mount 0.7

Common Parameters for Both L-40N & L-40VCR

Liquid Level Switch

Nominal ON/OFF Differential
≈ 3/8" (0.375")

Electrical Switch Characteristics - STANDARD

SPNO

AC voltage (max. switching)	300VAC
DC voltage (max. switching)	350VDC
Current (max. switching)	0.5amp
Current (max. carrying)	2.5amp
Contact Rating (VA, W)	50
Capacitance (typical)	0.3pf
Insulation resistance	10^{10} ohms
Operation temperature	-40˚F to 240˚F (-40˚C to 115˚C)

SPNC or SPDT, 3 Watt, 100VAC/VDC optional.

Float Pivot Pin available in:

316 Stainless, Hastelloy® C as standard; Titanium, Tantalum, Teflon as special order.

Corrosion Resistance

See compatibility table in back of catalog (page 49)

Dry Circuit Operating

Switch can interface with microprocessor based controllers and related dry circuits.

Inductive Loads

Switch contacts have been tested with inductive relay and 30 amp motor contactor drive coils at 120 VAC and 240 VAC to 500,000 operations without failure. Maximum allowable volt amp (VA) rating of relay operating coil -- 8.0 VA or less.

PART DESCRIPTION	MODEL	SWITCH OPERATION DRY TANK	MOUNTING POSITION	PIVOT PIN MATERIAL
	L-40N/SG	NO-NORMALLY OPEN	HOR. HORIZONTAL	316 SS TANTALUM
	L-40VCR/SG	NC-NORMALLY CLOSED	VER. VERTICAL	HAST.® C. TEFLON®
				TITANIUM

SAMPLE PART # **L-40N / NO / HOR / 316** **L-40VCR / NO / VER / TITANIUM**

NOTE: Model L-40 employs magnetic coupling between float arm and switch body. Magnetic particles can accumulate on and around magnetic housing which may affect proper operation. Please conduct appropriate fluid magnetic particle evaluation and operational tests prior to and during installation and use.

- Installation drawing and a numbered parts list is supplied with each unit.
- Current Price Information is Listed on Separate Sheet.
- Special One Day Delivery Available.

LIQUID LEVEL SWITCH

Model L-40N/SG (PPO) & L-40VCR/SG (PPS)

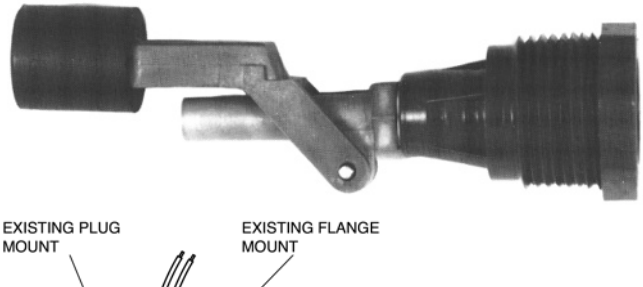
Customer Specified Specific Gravity at Factory

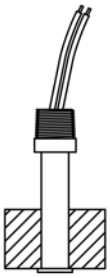
Side and Top Mount

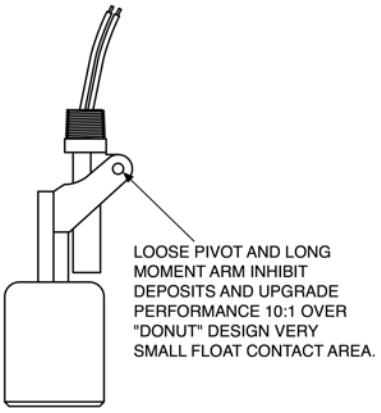
Corrosion Resistant Plastic with Optional Metal Pivot Pin

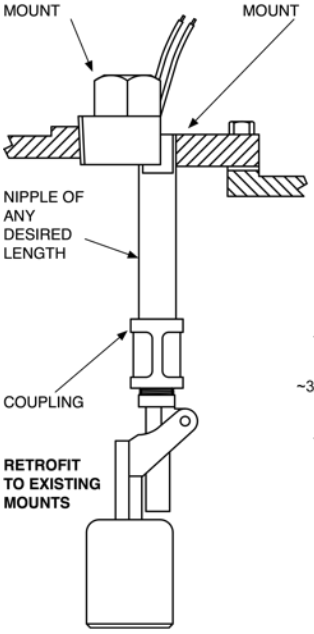
LOW COST RELIABLE DESIGN

- Unique design enhances specific gravity sensitivity.
- Specific gravity features ignores one liquid and detects another with different specific gravity.
- Typical applications include fuel/water detection, peanut oil/ water detection, detection of ground water contamination by underground fuel tanks.
- Noryl® Polyphenylene Oxide (PPO) is suitable for acid and base solutions, pure water, process water, sea water, filtered sewage, contaminated groundwater. Noryl® is not suitable for use in hydrocarbons, petroleum, alcohol and related chemicals.
- The wetted surface of Model L-40N/SG is entirely of Noryl® (PPO) or Fortron® (PPS) except for a small float support Pivot Pin and Nitrophyl float.
- Float support pivot pin is supplied in a variety of materials i.e. 316 Stainless Steel, Hast.® C, Titanium, Tantalum and Teflon® to meet special chemical and operations environments.
- Tycona Fortron® Polyphenylene Sulfide (PPS) is suitable for strong acid and base solutions. All of the solutions listed above including hydrocarbons, petroleum products, alcohols, etc. Fortron® (PPS) is a member of a select class of chemically resistant plastic resins for use in a very broad spectrum of chemicals.
- Float material closed cell Nitrophyl® Nitrile Solid Foam Float
- 10 times less sensitive from deposit and build-up of contaminants than sliding float models.

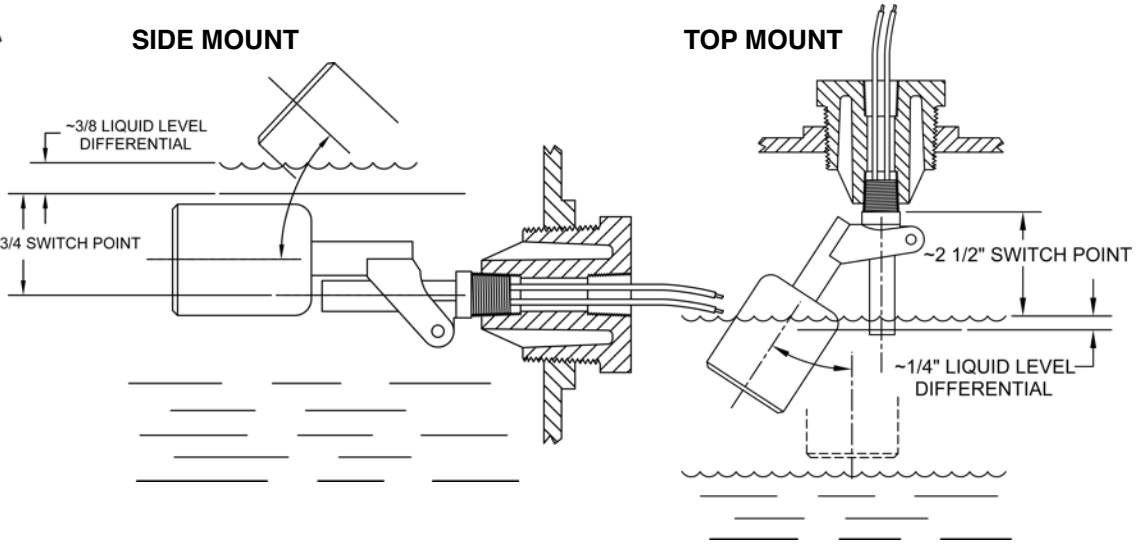








Nominal Switch Point Differentials



- Each unit can be supplied with a special made to order 1-1/4" x 1/4" x 1/2" or 1" x 1/4" x 1/2" reducer bushing for through wall mounting.
- Output wire can be twisted pair 22 gauge or two conductor PVC heavy wall instrument cable.
- **STANDARD -** SPST reed switch for 120/240 VAC 50 Watt power or DC dry circuit for computer/PLC interface.

SOLID FOAM BUNA N CLOSE CELL FLOATS CAN BE MACHINED TO PROVIDE SPECIAL FLOAT SIZES AND SHAPES. CONSULT FACTORY.

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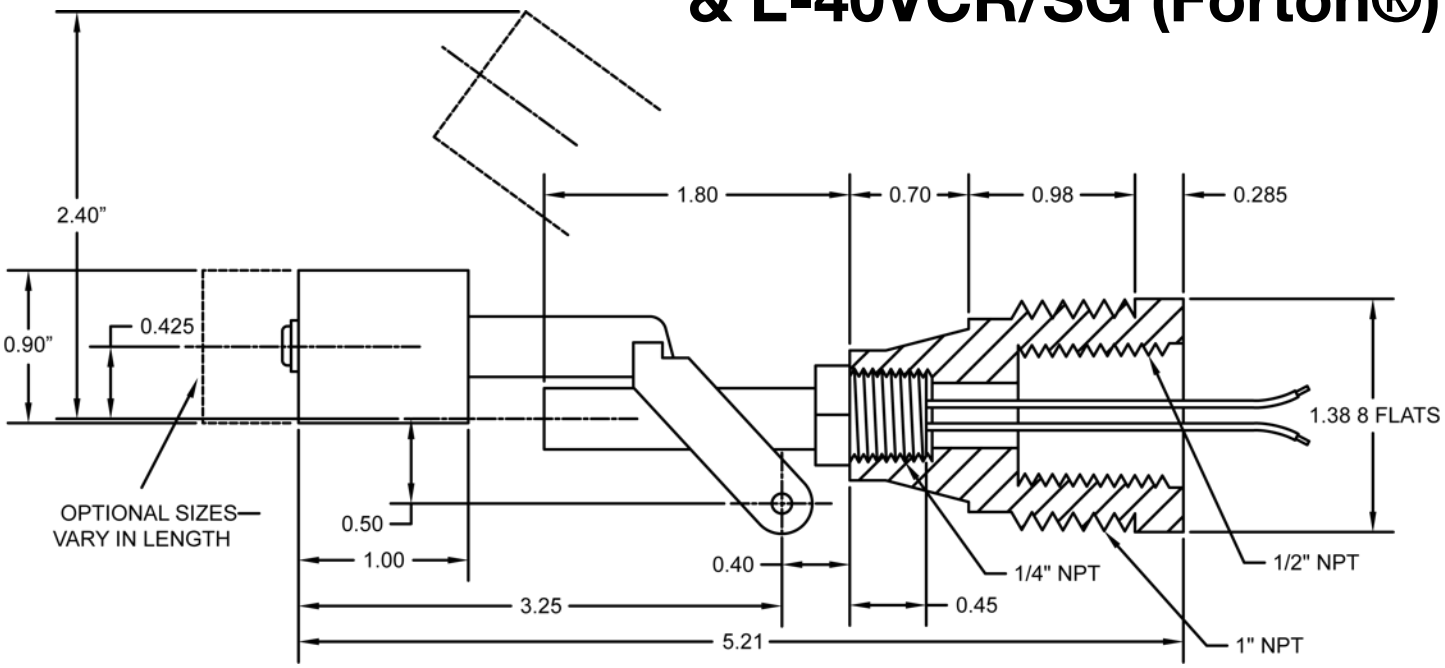
Tel: (805) 988-6800 Fax: (805) 988-6804
Email: harwil@harwil.com

Installation Dimensions

Model L-40N/SG (NORYL®) & L-40VCR/SG (Forton®)



L-40N/SG

Wetted Surfaces

10% Glass reinforced Noryl® (PPO) and 316 stainless steel pivot pin. Nitrophyl float.

Nominal Working Pressure/Temp

Tested to Failure at 800 Psig at room temperature

Temp. ˚F(˚C)	0 (-18)	50 (10)	100 (38)	180 (82)
Pressure psig	200	200	175	140

Working Fluid Spec. Gravity

Top Mount 0.8
Side Mount 0.7

L-40VCR/SG

Wetted Surfaces

40% Glass reinforced Fortron® (PPS) and Hastelloy® C pivot pin. Nitrophyl float.

Nominal Working Pressure/Temp

Tested to Failure at 800 Psig at room temperature

Temp. ˚F(˚C)	0 (-18)	50 (10)	100 (38)	200 (93)
Pressure psig	250	250	180	150

Working Fluid Spec. Gravity

Top Mount 0.9
Side Mount 0.7

Common Parameters for Both L-40N/SG & L-40VCR/SG

Liquid Level Switch

Nominal ON/OFF Differential
≈ 3/8" (0.375")

Electrical Switch Characteristics - STANDARD

SPNO

AC voltage (max. switching)	300VAC
DC voltage (max. switching)	350VDC
Current (max. switching)	0.5amp
Current (max. carrying)	2.5amp
Contact Rating (VA, W)	50
Capacitance (typical)	0.3pf
Insulation resistance	10^{10} ohms
Operation temperature	-40˚F to 240˚F (-40˚C to 115˚C)

SPNC or SPDT, 3 Watt, 100VAC/VDC optional.

Float Pivot Pin available in:

316 Stainless, Hastelloy® C. as standard; Titanium, Tantalum, Teflon as special order.

Corrosion Resistance

See compatibility table in back of catalog (page 49)

Dry Circuit Operating

Switch can interface with microprocessor based controllers and related dry circuits.

Inductive Loads

Switch contacts have been tested with inductive relay and 30 amp motor contactor drive coils at 120 VAC and 240 VAC to 500,000 operations without failure. Maximum allowable volt amp (VA) rating of relay operating coil -- 8.0 VA or less.

PART DESCRIPTION	MODEL	SWITCH OPERATION DRY TANK	MOUNTING POSITION	PIVOT PIN MATERIAL
	L-40N/SG	NO-NORMALLY OPEN	HOR. HORIZONTAL	316 SS TANTALUM
	L-40VCR/SG	NC-NORMALLY CLOSED	VER. VERTICAL	HAST.®C. TEFLON
				TITANIUM

SAMPLE PART # **L-40N / SG / NO / HOR / 316** **L-40SG / NC / VER / 316**
L-40VCR / SG / NC / HOR / HAST. C

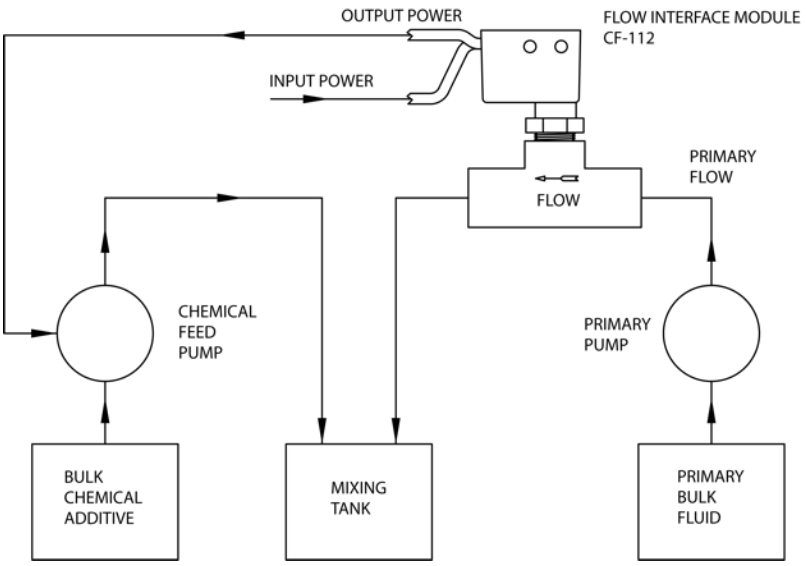
NOTE: Model L-40 employs magnetic coupling between float arm and switch body. Magnetic particles can accumulate on and around magnetic housing which may affect proper operation. Please conduct appropriate fluid magnetic particle evaluation and operational tests prior to and during installation and use.

- Installation drawing and a numbered parts list is supplied with each unit.
- Current Price Information is Listed on Separate Sheet.
- Special One Day Delivery Available.

CHEMICAL FEED PUMP INTERFACE MODULE

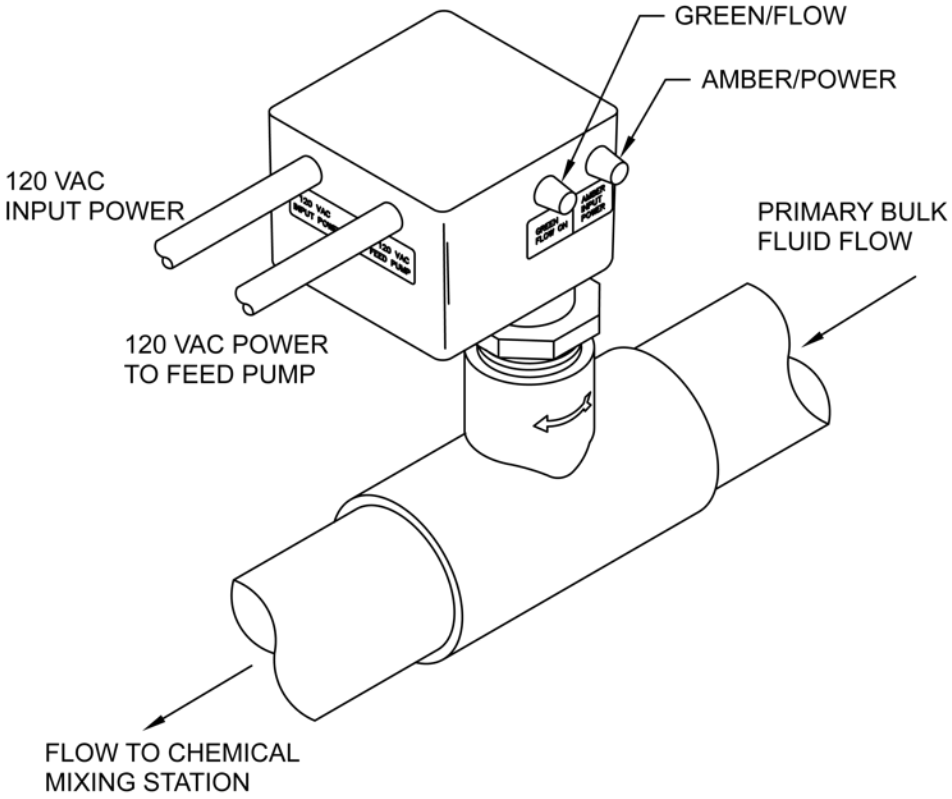
Model CF-112

STAND ALONE INTERFACE MODULE AUTOMATICALLY ACTUATES A CHEMICAL FEED PUMP WHEN PRIMARY BULK FLUID BEGINS TO FLOW.



CF-112 Module can be used in isolated stand alone systems or as part of large complex systems.

- Ideal for metering chlorine to well water for individual homes, ranches, farms, mines, remote industrial sites.
- Adding chlorine or related chemicals to animal drinking water, e.g. chicken, cattle, pig, and similar drinking water systems.
- All manner of fluid systems involving injection of additives to primary bulk fluids in both continuous and batch systems.
- Adding chemical as required to process waste fluids.
- Adding bactericides to cooling tower makeup water plus ph/orp control.
- Boiler treatment additives.
- Metal plating make up solutions.
- Model CF-112 is available for 120 VAC 50-60 Hz power as standard.
- Feed pump to 1/3 HP.
- DC power combinations available per special order.
- Wetted surfaces are G.E. Noryl® (PPO)/316 Stainless/Epoxy or Fortron® (PPS)/ Hast.® C./Epoxy for superior long term chemical resistance.



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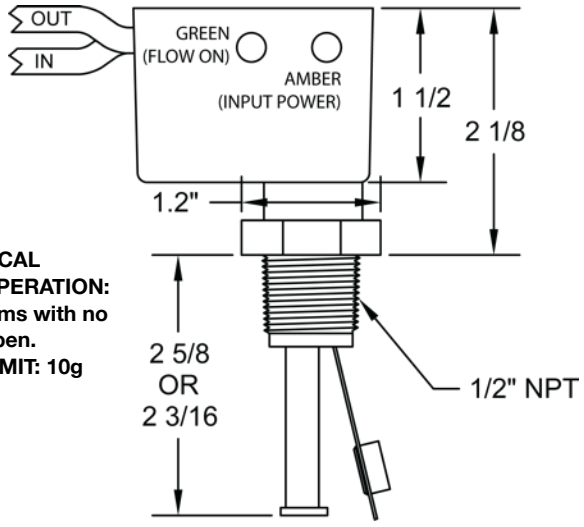
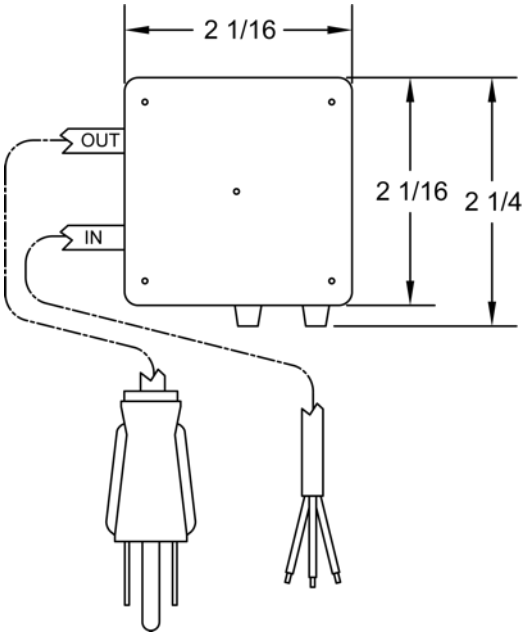
Email: harwil@harwil.com

NOTE: ALL CIRCUITRY POTTED IN FLEXIBLE URETHANE FOR MAX. LONG TERM SHOCK, THERMAL, STRESS, AND MOISTURE PROTECTION.

Model CF-112



MECHANICAL SHOCK OPERATION: 10g for 11ms with no contact open.
SHOCK LIMIT: 10g

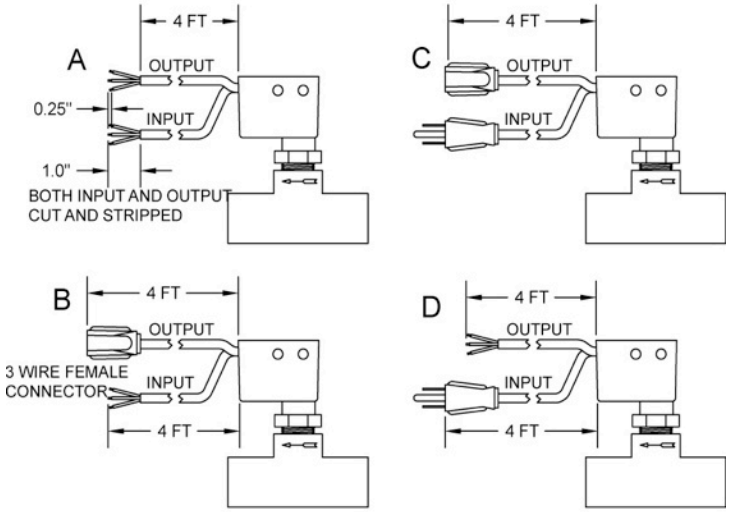


SPECIFICATIONS:

Flow ON/OFF switch set points water calibrated at 70˚F.

Primary Flow Line Size (in.)	Primary Flow On/Off Switch Set Point (GPM)		CF-112 Part Number	
	ON	OFF	Noryl® (PPO) Body	Fortron® (PPS) Body
3/4 FITTED W/ 0.25" ORIFICE	0.4	0.3	CF-112N-1	CF-112CR-1
3/4 (NO ORIFICE)	2.0	1.5	CF-112N-2	CF-112CR-2
1	4	3	CF-112N-3	CF-112CR-3
1.5	13	12	CF-112N-4	CF-112CR-4
2	15	12	CF-112N-5	CF-112CR-5
3	33	25	CF-112N-6	CF-112CR-6
4	56	43	CF-112N-7	CF-112CR-7

Consult factory for larger pipes and lower ON/OFF switch set points.



Wetted Surfaces

Model CF-112 N
Noryl® (PPO)
(10% glass fibers)
316 Stainless Steel
Epoxy

Model CF-112CR
Fortron® (PPS)
(40% glass fibers)
Hastelloy® C
Epoxy

For performance in your working fluid, see extensive corrosion resistance guide on page 49. **Free parts samples available for testing in your "exotic" unlisted fluids.**

FEED PUMP MOTOR MAX. CONTACT RATINGS
VOLTAGE: 120 VAC
LOAD TYPE: RESISTIVE: 10A, MOTOR: 1/3 HP
SWITCH CONTACTS: SPNC OR SPNO
CONSULT FACTORY FOR OTHER AC MOTOR VOLTAGES PLUS DC MOTOR OPERATION.

Max. Nominal Operating Temperature/Pressure

CF-112N: 180˚F @ ambient pressure / 250 Psig @ room temperature
CF-112CR: 200˚F @ ambient pressure / 250 Psig @ room temperature

Sample Part #

Part number from above table
For corresponding pipe size.

Input/Output
Cable Connection
Configuration

CF - 112N - 2 - NO - A

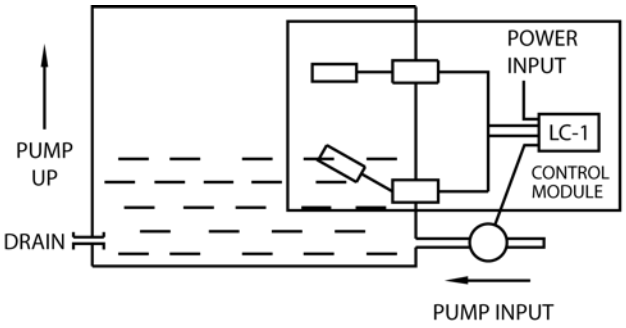
Output Contact Configuration
NO - Normally Open
NC - Normally Closed

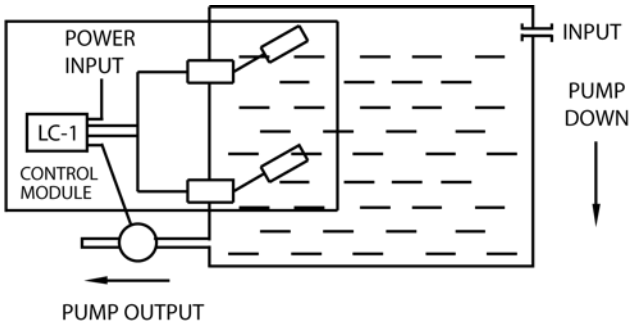
- Installation drawing and a numbered parts list is supplied with each unit.
- Current Price Information is Listed on Separate Sheet.
- Special One Day Delivery Available.

PUMP UP/PUMP DOWN LIQUID LEVEL CONTROL

Model LC-1 Module

The combination of any two Harwil liquid level switches and an electronic control module mounted in a weather-resistant box provide a ready-to-go system for the automatic filling or emptying of tanks or vessels.





System is composed of:

- Electronic Latching/Unlatching Control Module
- Special electronic module design eliminates false starts due to turbulent wave action.
- Nema 4 weather resistant box with two standard 1/2" seal tight flexible conduit fittings.
- A secondary 10 amp SPDT relay output is also provided.
- Color coded w/ ring and labeled terminal strip.
- 120 or 240 VAC 50/60 Hz models available.
- 30 amp DPST motor contactor output for driving 1 1/2 (120 VAC)/3 HP (240 VAC) pumps.

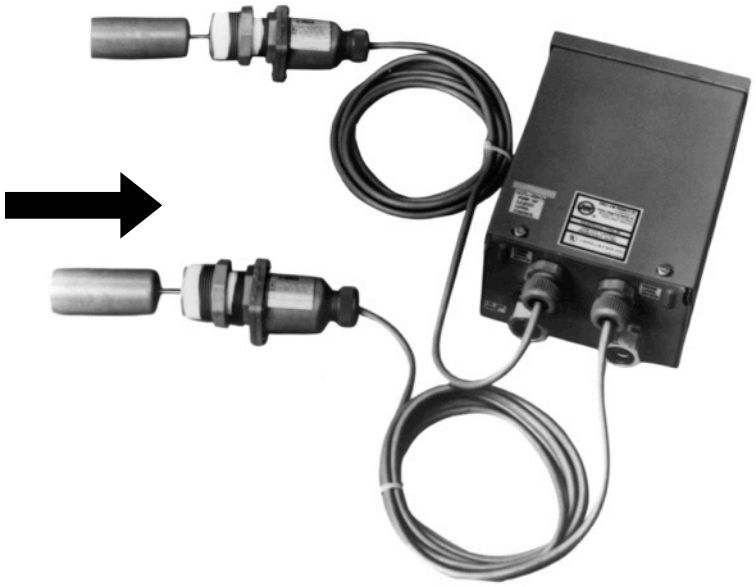
Choose from any two Harwil liquid level switch models.

- Models for clean or contaminated fluids such as water, sea water, sewage, thin slurries, contaminated ground water, etc.
- Models for strong acids, bases, hydrocarbons, alcohols, inorganics, ketones, esters or ethers.
- Each system is provided with a complete, descriptive parts list and an installation and wiring diagram for both level switches and control module.
- Maintenance and check out requires only a standard multimeter.
- LC-1 Control Module is delivered pre-wired and is ready to hook-up to control your liquid level.

UPPER AND LOWER LEVEL SWITCHES COMPRISING ANY TWO OF THE FOLLOWING HARWIL MODELS:

L-40N
L-40VCR
L-30RV
L-30NV
L-30CRV
L-5
L-5SS
LD-5
LD-5SS
L-8R

L-8N
L-8CR
L-21N
L-21VCR
L-30N
L-30R
L-30CR



541 Kinetic Drive, Oxnard, CA 93030
Tel: (805) 988-6800 Fax: (805) 988-6804
Email: harwil@harwil.com

Model LC-1 Module

Electronic Latching Control Module Specifications:

Operating Voltage (Input)

Voltage: 120 or 230 VAC
Tolerance: ±15%
Frequency: 50/60 Hz

Output

Electromechanical relay
Form: Single pole double throw, isolated
Rating: 10 AMPs resistive at 240 VAC

Protection

Transient Protected
Dielectric Breakdown: 1500 volts RMS minimum between input, output and probe.

Environment

Operating Temperatures: -20˚C to +55˚C
Storage Temperatures: -20˚C to +55˚C
Coating: Printed circuit board is conformal coated to resist moisture and corrosion.

Motor Contactor Specifications

Operating Coil

120 VAC or 208-240 VAC 50/60 HZ
Inrush: 31 VA
Continuous use: 7 VA
Pickup: 90 VAC (120 VAC Coil)
170 VAC (208-240 VA Coil)
Coil Insulation: Class B
Coil Connections: Double Male 1/4" quick connect
Maximum Ambient Temperature: 155˚F

Output Power Contacts

Type: DPST - Normally Open
Contact rating per pole:

VOLTS (VAC)	LOCKED ROTOR AMPS (LRA)	FULL LOAD AMPS (FLR)	RESISTIVE AMPS
120/240	100	20	30

VOLTS	MAX NOMINAL MOTOR HORSE POWER
120 VAC	1.5 HP
208-240 VAC	3.0 HP

Terminal Strip - 812 Series

Electrical Rating

Rated voltage - 1600 Volts RMS
Current rating - 30 AMPS

Wire Size

Will accommodate lugs for wire sizes AWG #14 to 12

Hardware

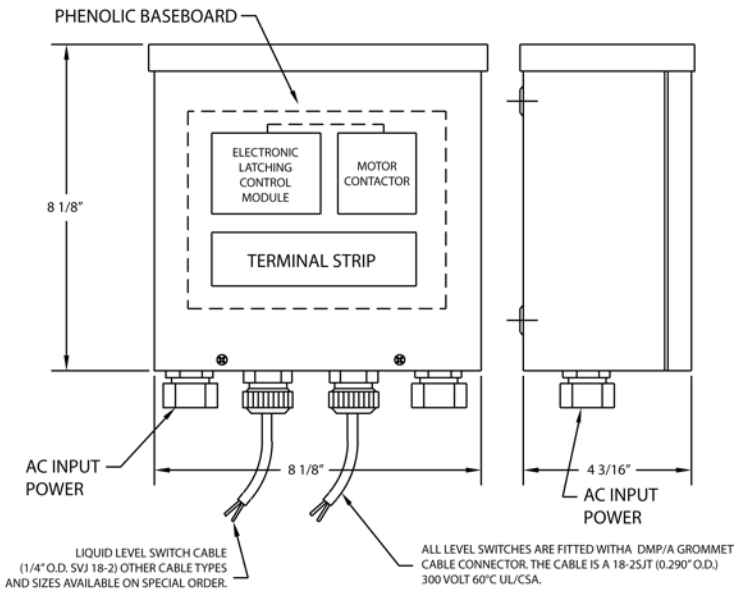
Screws and terminals - brass, nickel plated
Solder terminals - brass, hot-tinned

Molded Material

G.P. phenolic (94V-0).
UL Recognized

Control Box

Rain resistant type 3R UL listed.



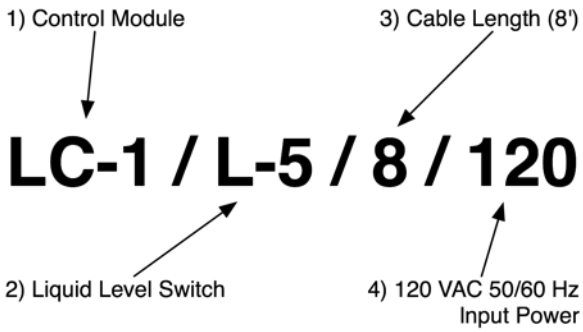
Complete operating instructions, mechanical and electrical installation drawing and a numbered parts list is supplied with each unit.

How to order:

Four items are required to order a complete control system:

1. Basic Model Number: LC-1
2. Level Switch Model Number: Choose from 15 standard models.
3. Length of cable in feet between control module and liquid level switches. Standard cable is 1/4" O.D. SVJ 18-2/90˚C UL listed. Note: if customer is to supply cable, enter "O"
4. Operating Voltage.

Sample Part Numbers:



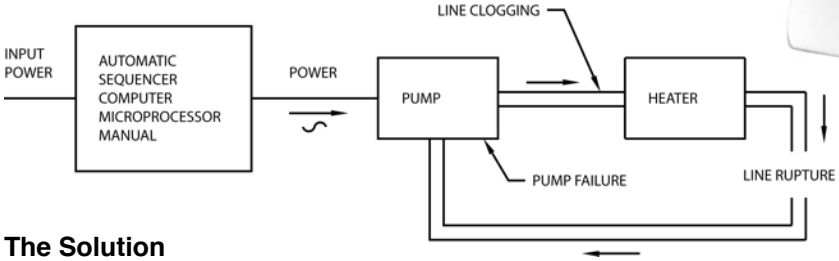
- Installation drawing and a numbered parts list is supplied with each unit.
- Current Price Information is Listed on Separate Sheet.
- Special One Day Delivery Available.

AUTOMATIC FLOW SHUT DOWN CONTROL

Model SDC-101

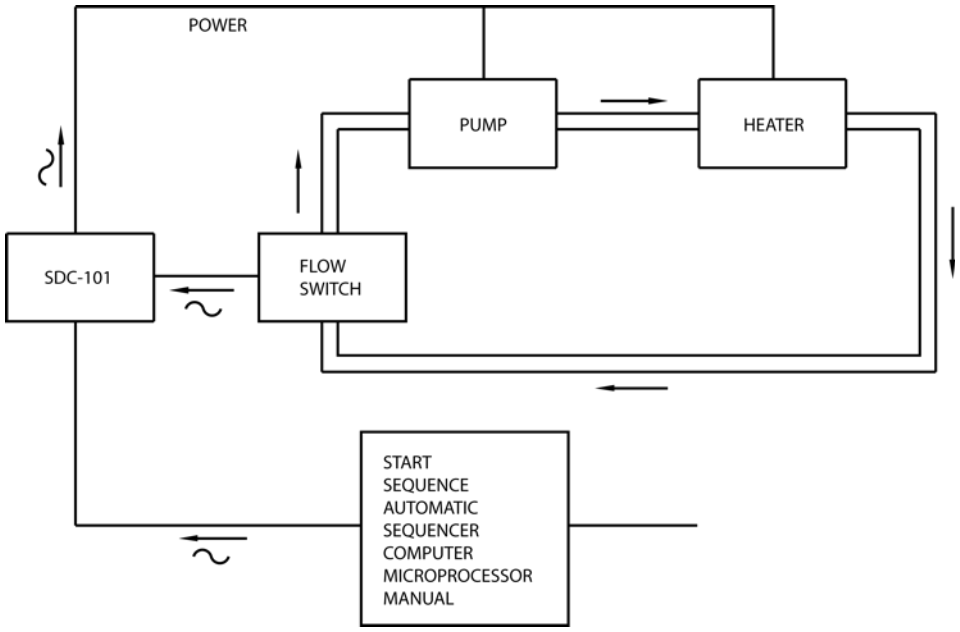
The Problem

- Failure to establish programmed flow after pump turn on signal has been applied.
- Failure to maintain proper flow during normal operation due to line clogging, line rupture, incorrect valve positioning, etc.



The Solution

- Insertion of an SDC-101 shut down control in the input power line of pumps, heaters, valves, etc., that are flow critical will interrupt power automatically upon loss of flow.
- Power will remain off until the problem has been corrected and proper flow re-established.
- Loss of pump prime is a persistent fluid system problem. A flow switch at the pump output is a viable solution, except that it presents a “catch 22” situation, i.e. lack of flow at start up will not allow the flow switch to supply power to the pump. A manual push to start or automatic time delay relay switch in parallel with the flow switch is required to supply power to the pump motor during startup. After the pump is up to speed the parallel switch kicks out and the flow switch takes over flow monitoring. Model SDC-101 is provided with a parallel variable time delay relay switch/flow switch combination to provide pump protection during startup as well as the continuous phase of operation.



SDC-101 modules may be connected to monitor:

- Critical points in simple one pump systems or, in series, with pumps, heaters, valves, etc., so that failure of any part will shut the whole system down.
- Isolated or remote components and sub-systems.

For Use In:

- Chemical process industry
- Sanitation
- Food processing
- Aerospace ground support systems
- Water treatment
- Mining
- Agriculture
- Transportation

Additional Features:

- Continuous adjustment of time delay cycle.
- 120/240 VAC and DC power options
- Rain resistant housing for rugged, industrial usage
- Can be used in mobile vehicles, ships, trains, etc.

Operational Features:

- Supplied pre-wired and ready for immediate installation
- All components UL listed or recognized
- Input and output power lines are quickly and easily attached to 30 AMP terminal block
- Terminal block positions are numbered and wiring is color coded for easy, fast and accurate installation and servicing.
- Performance checks are quick and straightforward using an uncomplicated, standard multimeter.

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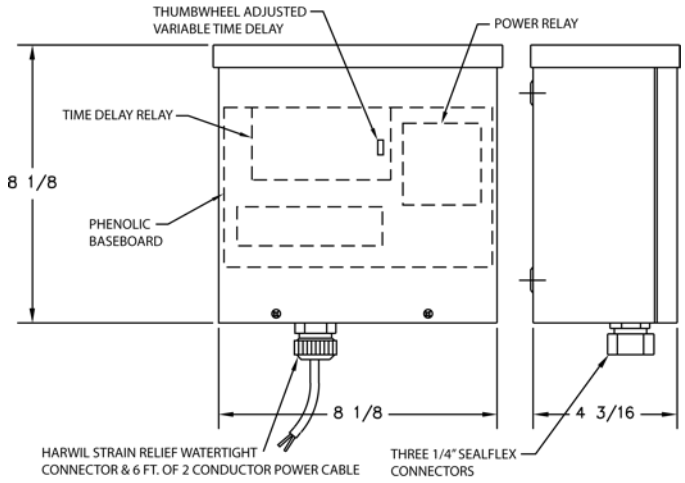
Email: harwil@harwil.com

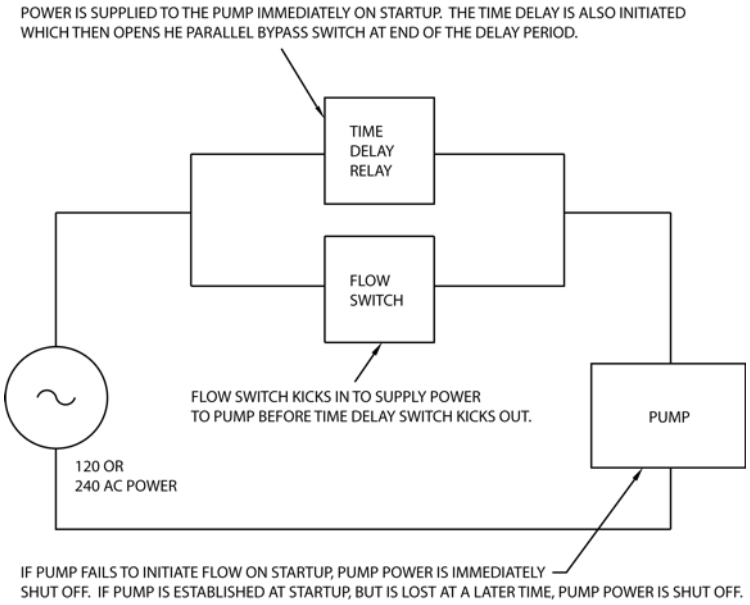
Model SDC-101

Specifications:

Control Box

Rain resistant type 3R - UL listed.





Time Delay Relay

Operation

When rating voltage is applied to the input, the timing cycle begins and the DPDT relay is activated. At the end of the timing cycle, the relay is de-activated and remains in that condition until power is removed from the input. Switching off and then turning on of input power re-starts the timing cycle. This timing sequence will repeat each time the system is turned on.

Input Voltage - 120/240 VAC, 50/60 Hz

Output Contact Arrangement - DPDT

Contact Rating

10 AMP, 1/2 HP @ 120/240 VAC, 50/60 Hz

Standard Time Cycle

1 to 180 sec., Continuously adjustable

Ambient Operating Temp. Range -5˚ to 140˚F

Termination - 1/4" quick disconnect terminals

Motor Contactor Specifications

Operating Coil

120 VAC or 208-240 VAC 50/60 Hz
Inrush: 31 VA
Continuous Use: 7 VA
Pickup: 90 VAC (120 VAC Coil)
170 VAC (208 VA Coil)
Coil Insulation: class B
Coil Connections: Double Male 1/4" quick connect
Maximum Ambient Temperature: 155˚

Output Power Contacts

Type: DPST - Normally Open
Contact rating per pole.

VOLTS (VAC)	LOCKED ROTOR AMPS (LRA)	FULL LOAD AMPS (FLR)	RESISTIVE AMPS
120/240	100	20	30

VOLTS	MAX NOMINAL MOTOR HORSE POWER
120 VAC	1.5 HP
208-240 VAC	3.0 HP

Switch Performance Data

Refer to manufacturer's specification sheets for information regarding performance of:

- **Harwil Fluid Flow switches**
- **Harwil Air Flow switches**
- **Pressure switches**
- **Motion Limit switches**
- **Proximity Switches, etc.** which may be used in conjunction with, but are not included with, the SDC-101 module.

Complete operating instructions. Mechanical and Electrical installation drawing and a numbered parts list is supplied with each unit.

Maintenance and checkout is a snap for your present personnel using an uncomplicated standard test meter.

Terminal Strip - 812 Series

Electrical Rating

Rated voltage - 1600 Volts RMS
Current rating - 30 AMPS

Wire Size

Will accommodate lugs for wire sizes AWG #14 to #12

Hardware

Screws and terminals - brass, nickel plated
Solder terminals - brass, hot-tinned

Molded Material

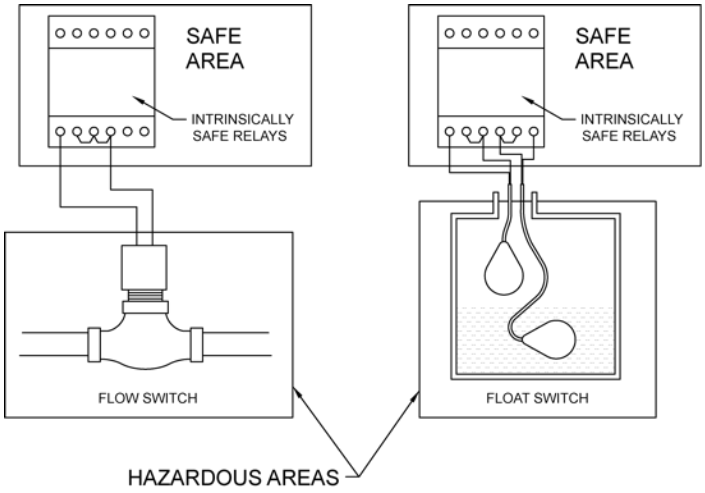
G.P. phenolic (94V-0).
UL Recognized

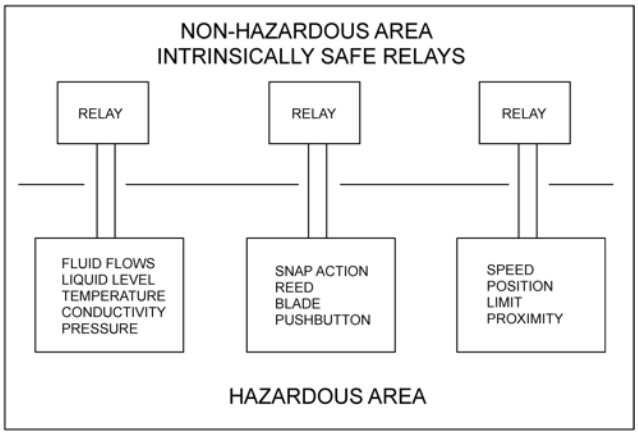
- Installation drawing and a numbered parts list is supplied with each unit.
- Current Price Information is Listed on Separate Sheet.
- Special One Day Delivery Available.

INTRINSICALLY SAFE SOLID STATE HAZARDOUS AREA RELAY

Series 27

ALLOWS USE OF STANDARD, OFF-THE-SHELF SWITCHES IN HAZARDOUS AREAS





What is intrinsically safe?

- Intrinsically safe equipment and wiring is equipment and wiring which is incapable of releasing sufficient thermoelectric energy to cause ignition of a hazardous atmospheric mixture of gases, vapors, or dusts. Intrinsically safe electrical equipment and wiring may be installed in any hazardous location of any group classification for which it is accepted without requiring explosion-proof housings or other means or protection.

Operational Features:

- Modern, cost effective, solid state technology eliminates expensive, old style, explosion proof enclosures.
- Installation and maintenance of equipment is fast, simple, and inexpensive.
- Long-term safety and reliability is increased substantially by elimination of sealed joints, special housings, and gaskets.
- Epoxy encapsulation of solid state circuitry provides protection against harsh industrial environments.
- Immunity to normal shocks, vibrations, thermal expansion, and contraction.

Single Unit Provides Two Modes of Operation for Liquid Level Applications

- 1) Single Non-Latching Input for high or low level alarm.
- 2) Dual Latching Input for Pump Up/Pump Down liquid level control.

Approved For Use in the Following Hazardous Areas:

CLASS 1 AND 2 DIVISION 1 GROUPS A, B, C, D, E, F, AND G

CLASS 3

Approved: Factory Mutual System and U.L.

Versatile Single and Dual Input Switching Logic also allows one Unit to be Used in a Multitude of Alarm and Control Applications, Such as:

Fluid Flow	Pressure	Temperature Limits
Speed	Proximity	Conductivity Position...

541 Kinetic Drive, Oxnard, CA 93030
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Email: harwil@harwil.com

Specifications

Contact Design: SPDT

One normally open (N.O.) and
One normally closed (N.C.)

Contact Ratings

8 amperes resistive load at 120/250 volts A.C. and 8 amperes at 30 volts D.C.

Contact Life

Electrical at rated load = 100,000 cycles.
Mechanical - 10,000,000 cycles

Electronic Module

Solid State components epoxy encapsulated in nylon shell.

Primary (A.C. Supply Line)

(a) Voltage: 120 or 240 VAC, plus 10% minus 15%
(b) Frequency: 50/60 Hertz
(c) Power: Relay energized 2.2 watts

Secondary Nominal Voltage 11.3 VAC, 2.3 mA

Sensitivity

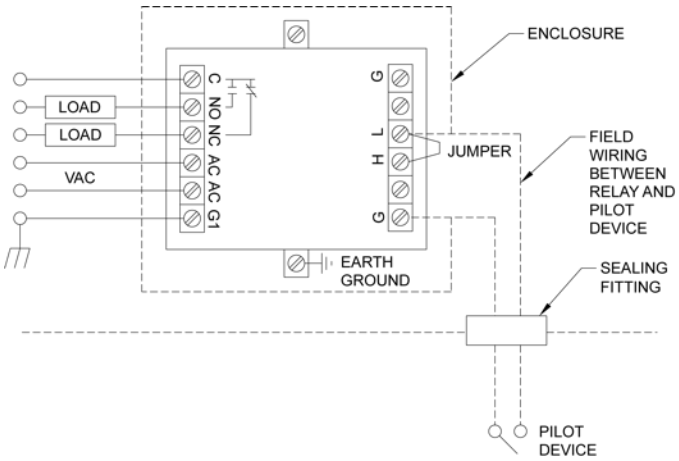
Operates from 0 - 100,000 ohm maximum specific resistance.

Temperature

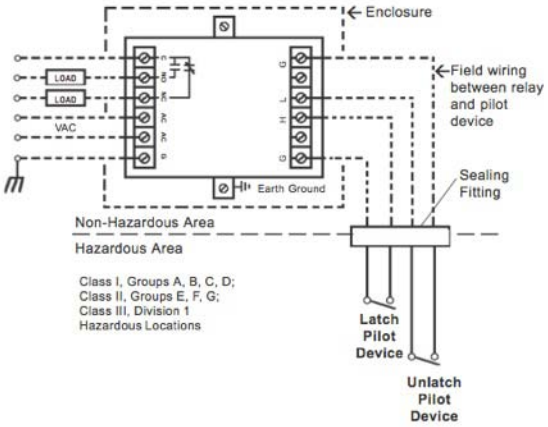
-40˚ to 150˚F ambient. Terminals: Size 6 pan head screws with captivated wire clamping plate.

Single Input (Non-Latching) Pilot Contact Actuated

NOTE: Jumper must be installed as shown to insure proper operation.

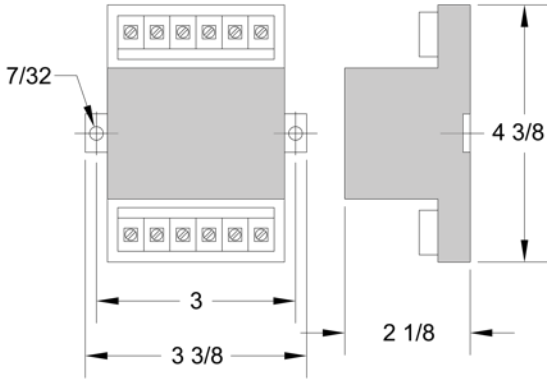


Dual Input (Latching) Pilot Contact Actuated



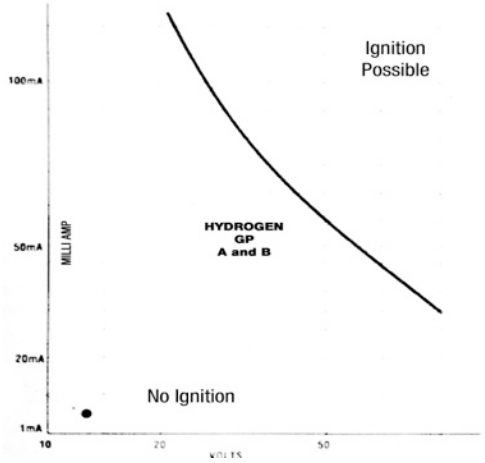
Each unit is provided with detailed installation instruction sheet, wiring diagram, and hazardous area information background resume. Both models are product of Warrick Controls, Inc. a subsidiary of Armstrong International, Inc.

Dimensions



The Switching Current vs. Voltage Plot

shown below illustrates areas of safe and unsafe operation. The operating point of Series 27 Intrinsically Safe Relays confirms the conservative design of this module.



Order Numbers

P/N S17 / A / 3 / C / 0
For use with 24 VAC Input Power
P/N S27 / A / 1 / D / 0
For use with 115/120 VAC 50/60 Input Power
P/N S27 / A / 2 / D / 0
For use with 220/240 VAC 50/60 Hz Input Power

Warranty

Warrick Controls, Inc. warrants to the original user that those products supplied by it and used in the service and in the manner for which they are intended shall be free from defects in materials and workmanship for a period of one (1) year after installation, or fifteen (15) months from the date of shipment. WARRICK DOES NOT MAKE ANY OTHER REPRESENTATIONS OR WARRAN- TIES, EXPRESS OR IMPLED, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OR MERCHANTABILITY AND ANY IMPLIED WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE. In no event shall Warrick be liable for special, direct, indirect or consequential damages, including, but not limited to, loss of use or profits or to interruption of business activity.

- Installation drawing and a numbered parts list is supplied with each unit.
- Current Price Information is Listed on Separate Sheet.
- Special One Day Delivery Available.

EPOXY AND PTFE COATINGS OF FLUID FLOW AND LIQUID LEVEL SWITCHES

Long-Term Protective Coatings

- All metal wetted surfaces of fluid flow switches models Q-1, Q-4E, Q-5, Q-5SS, QD series, Q-8, Q-10, and Q-12 and liquid level switch models L-5, L-5SS, LD series, L-8, L-21, L-30 are now available with baked on epoxy or PTFE (polytetra fluoro ethylene)* coatings.
- PTFE coatings are similar to the non-stick coatings commonly found on household cookware, from spoons to frying pans.
- These plastic coated surfaces provide greater long-term protection against chemical corrosive attack of virgin metal substrate, be it brass, 316 Stainless, or Hastelloy® C.
- Plastic coated surfaces also provide protection on the other end of the scale, for example leaching of alloy components from brass by ultra pure water.
- The coating of low cost substrate metals to provide superior chemical resistance is thus a cost effective solution of special situations where all plastic or exotic metal solutions are not available at any reasonable price, or time scale. These epoxy and PTFE coatings provide increased protection against:

  - Chloric Acid
  - Chromic Acid
  - Contaminated Water
  - Ferric Chloride
  - Gasoline
  - Hydrocarbons
  - Hydraulic Acid
  - NaOH
  - Nitric Acid
  - Sea Water
  - Sewage
  - Skydrol
  - Sulfuric Acid
  - Ultra Pure Water
  - Waste Waters

Coatings Available

- 10 Everlube® 6060 thermal cured PTFE.
- Everslik® 1201 thermal cured epoxy.

Pin Holes and Scratches

All coating of metal substrate for corrosion protection from automobiles to super tankers is subject to imperfections such as pin holes and scratches. Diligent adherence to mil spec quality procedures and careful handling minimizes these effects.

Delivery

A small quantity (10 to 50) of epoxy coated parts of all standard models are normally in stock for immediate delivery. Larger quantities of epoxy and PTFE coated parts are normally available within 4-6 weeks.

How to Order

- All standard fluid flow and liquid level switch models with exposed metal surfaces are available with EPOXY or PTFE coating of these surfaces.
- Adding EC (epoxy coating) or PTFE to the end of a model number is all that is required.

Examples

- UNCOATED MODEL NO: Q-1 / 3 / F — COATED MODEL NO: Q-1 / 3 / F / EC
- UNCOATED MODEL NO: L-30CR / A — COATED MODEL NO: L-30CR / A / PTFE

Warranty

- The Epoxy Coating No. 1201 & PTFE Coating No. 6060 are guaranteed to be applied per mil spec procedures.
- Coatings cannot be guaranteed to be free of pin holes and scratches, however all coatings are subject to written QC procedures and are 100% visually inspected for pin holes and scratches. All units with visible pin holes and scratches are rejected.

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Email: harwil@harwil.com

CHEMICAL RESISTANCE CHART FOR VARIOUS PUMP MATERIALS

Reproduced by permission of Little Giant Pump Company

The recommendations listed on the following pages are based upon information from material suppliers and careful examination of available information and are believed to be accurate. However, since the resistance of metals, plastics, and elastomers can be affected by concentration, temperature, presence of other chemicals and other factors, this information should be considered as a general guide rather than an unqualified guarantee. Ultimately the customer must determine the suitability of the pump used in various solutions.

All recommendations assume ambient temperatures unless otherwise noted. The ratings for these materials are based upon the chemical resistance only. Added consideration must be given to pump selections when the chemical is abrasive, viscous in nature, or has a specific gravity greater than 1:1.
How to use this chart: Column at left lists chemicals in alphabetic order. Columns at right list various pump materials, and their resistance to the chemicals are rated by a letter code.

Chemical	**Effect Ratings**
A --	No Effect - Acceptable
B --	Minor Effect - Acceptable
C --	Moderate Effect - Questionable
D --	Severe Effect - Not Recommended
* --	Not Tested

The performance comments and limitations listed above by Little Giant Pump Company are supplied by Harwil Corporation for information only. Ultimately the customer must determine the suitability of Harwil Corporation products used in various solutions, situations and environments.

	316 SS	Titanium	Hastelloy® C.	PVC (Type 1)	Teflon	Noryl	Polypropylene	Ryton (Fortron®)	Viton	Buna N	Neoprene	Ethylene Propylene	Epoxy
Acetaldehyde	A	A	A	D	A	*	B	A	A	B	D	B	A
Acetamide	A	*	*	*	*	*	*	*	A	A	A	A	A
Acetate Solvent	A	*	*	B	A	*	D	*	D	D	D	*	A
Acetic Acid, Glacial	A	A	A	C	A	C	B	A	D	D	C	B	B
Acetic Acid 20%	A	A	A	B	A	A	A	A	D	C	C	*	B
Acetic Acid 80%	A	A	A	D	A	B	B	*	D	C	D	*	B
Acetic Acid	A	A	A	A	A	A	A	A	C	C	C	B	A
Acetic Anhydride	A	A	A	D	A	D	A	A	D	A	B	B	A
Acetone	A	A	A	D	A	D	B	A	D	D	C	A	B
Acetyl Chloride	A	*	*	*	A	*	*	A	*	*	*	*	A
Acetylene	A	*	*	B	*	*	D	A	A	A	B	A	A
Acrylonitrile	C	*	B	*	*	*	B	A	C	D	D	D	A
ALCOHOLS													
Amy	A	A	A	A	A	C	B	A	A	A	A	A	A
Benzyl	A	A	A	D	*	A	A	*	A	D	B	B	A
Butyl	A	B	A	A	A	A	B	A	A	A	A	A	A

	316 SS	Titanium	Hastelloy® C.	PVC (Type 1)	Teflon	Noryl	Polypropylene	Ryton (Fortron®)	Viton	Buna N	Neoprene	Ethylene Propylene	Epoxy
Diacetone	A	A	A	D	*	A	D	*	D	D	D	A	A
Ethyl	A	A	A	A	*	A	A	*	A	A	A	B	A
Hexyl	A	A	A	A	*	A	A	*	A	A	B	A	A
Isobutyl	A	A	A	*	*	A	*	*	A	C	A	A	A
Isopropyl	A	A	A	*	*	A	A	*	A	C	B	A	A
Methyl	A	A	A	B	A	A	A	*	C	B	A	A	A
Octyl	A	A	A	*	*	A	*	*	A	B	B	A	A
Propyl	A	A	A	A	A	A	A	*	A	A	A	A	A
Aluminum Chloride 20%	C	A	A	A	*	A	A	A	A	A	A	A	A
Aluminum Chloride	C	C	A	A	A	A	A	A	A	A	A	*	A
Aluminum Fluoride	C	D	B	A	A	A	A	*	A	A	A	*	A
Aluminum Hydroxide	A	*	*	A	A	A	A	*	A	A	A	*	A
Alum Potassium Sulfate (Alum 10%)	*	*	B	A	A	*	*	*	A	*	A	*	A
Alum Potassium Sulfate (Alum 100%)	A	*	B	A	A	A	A	*	A	A	A	*	A
Aluminum Sulfate	C	A	A	A	A	A	A	A	A	A	A	A	A
Amines	A	B	A	C	A	B	*	*	D	D	B	B	A

Chemical Resistance Chart (Cont.)

	316 SS	Titanium	Hastelloy® C.	PVC (Type 1)	Teflon	Noryl	Polypropylene	Ryton (Fortron®)	Viton	Buna N	Neoprene	Ethylene Propylene	Epoxy
Ammonia 10%	A	A	A	A	A	A	A	A	A	D	A	*	B
Ammonia, Anhydrous	A	B	A	A	A	A	A	B	D	B	A	A	A
Ammonia, Liquids	A	*	B	A	A	A	A	*	D	B	A	A	A
Ammonia, Nitrate	A	*	*	B	*	A	A	*	*	A	C	*	A
Ammonium Bifluoride	A	*	B	A	*	A	A	*	A	A	A	*	A
Ammonium Carbonate	A	A	B	A	A	A	A	*	B	D	A	A	A
Ammonium Casenite	A	*	*	*	*	A	*	*	*	*	A	*	A
Ammonium Chloride	C	A	A	A	A	A	A	A	A	A	A	A	A
Ammonium Hydroxide	A	A	A	A	A	A	A	A	B	B	A	A	A
Ammonium Nitrate	A	A	A	A	A	A	A	A	A	A	A	A	A
Ammonium Oxalate	A	*	A	*	*	*	*	*	*	A	A	*	A
Ammonium Persulfate	A	A	A	A	A	A	A	*	C	A	A	A	A
Ammonium Phosphate Dibasic	A	A	A	A	A	A	A	*	A	A	A	A	A
Ammonium Phosphate Monobasic	A	A	A	A	A	A	A	*	A	A	A	A	A
Ammonium Phosphate Tribasic	A	A	A	A	A	A	A	*	A	A	A	A	A
Ammonium Sulfate	B	A	A	A	A	A	A	A	D	A	A	A	A
Ammonium Thio-Sulfate	A	A	*	*	*	*	*	*	*	A	A	*	A
Amyl Acetate	A	A	A	D	A	D	D	A	D	D	D	A	A
Amyl Alcohol	A	A	A	A	A	C	A	*	B	B	A	A	A
Amyl Chloride	B	*	A	D	A	D	D	*	A	D	D	D	A
Aniline	A	C	B	D	A	D	B	A	D	D	D	B	A
Anti-Freeze	A	*	A	A	A	A	A	A	A	A	A	A	A
Antimony-Trichloride	D	*	A	A	A	*	*	*	*	*	C	*	A
Aqua Regia (80%, HCL, 20%, HNO)	D	A	D	D	A	D	C	*	C	D	D	D	D
Arochlor 1248	*	*	*	*	*	D	*	*	A	D	D	B	A
Aromatic Hydrocarbons	A	*	*	D	*	D	*	*	A	D	D	D	A
Arsenic Acid A	A	*	*	A	A	A	A	*	A	A	A	*	A
Asphalt	A	*	*	A	*	*	A	A	A	B	B	D	A
Barium Carbonate	A	A	A	A	A	A	A	*	A	A	A	*	A
Barium Chloride	A	A	A	A	A	A	A	A	A	A	A	A	A
Barium Cyanide	A	*	*	*	*	*	*	*	A	C	A	A	A
Barium Hydroxide	A	B	B	A	A	A	A	A	A	A	A	A	A
Barium Nitrate	A	A	*	B	*	A	*	*	A	A	A	A	B
Barium Sulfate	A	A	A	A	A	A	A	A	A	A	A	A	B
Barium Sulfide	A	*	*	A	A	A	A	*	A	A	A	A	A
Beer	A	A	A	A	A	A	D	*	A	D	A	A	A

	316 SS	Titanium	Hastelloy® C.	PVC (Type 1)	Teflon	Noryl	Polypropylene	Ryton (Fortron®)	Viton	Buna N	Neoprene	Ethylene Propylene	Epoxy
Beet Sugar Liquids	A	*	*	A	A	A	A	*	A	A	B	A	A
Benzaldehyde	A	A	A	D	A	D	D	A	D	D	D	A	A
Benzene	A	A	B	D	A	D	D	A	A	D	D	D	A
Benzoic Acid	A	A	A	A	A	A	D	*	A	D	D	D	A
Benzol	A	A	A	D	A	D	A	*	D	D	D	*	A
Borax (Sodium Borate)	A	*	A	A	A	A	A	A	A	B	A	A	A
Boric Acid	A	A	A	A	A	A	A	*	A	A	A	A	A
Brewery Slop	A	*	*	*	*	*	*	*	A	A	A	*	A
Bromine (Wet)	D	A	A	B	A	D	D	D	A	B	D	D	C
Butadiene	A	*	*	A	A	*	*	B	A	A	B	A	A
Butane	A	*	*	A	A	D	C	D	*	A	B	D	A
Butanol	A	*	A	*	A	*	*	*	*	*	*	*	*
Butter	A	*	*	*	*	B	*	*	A	A	B	A	A
Buttermilk	A	*	*	*	A	A	*	*	A	A	A	*	A
Butylene	A	*	*	B	A	*	*	A	A	B	*	D	A
Butyl Acetate	C	*	A	D	A	D	D	A	D	B	D	B	A
Butyric Acid	A	A	A	B	A	A	A	*	D	D	D	B	A
Calcium Bisulfate	A	*	*	A	A	*	*	*	A	A	C	*	A
Calcium Bisulfide	B	A	A	A	A	A	A	*	A	A	A	D	A
Calcium Bisulfite	A	A	A	A	A	A	A	*	A	A	A	*	*
Calcium Carbonate	A	A	A	A	A	A	A	*	A	A	A	*	A
Calcium Chlorate	A	*	B	A	A	*	*	*	A	*	A	*	A
Calcium Chloride	D	A	A	A	A	A	A	A	A	A	D	A	A
Calcium Hydroxide	A	A	A	A	A	A	A	*	A	A	A	A	A
Calcium Hypochlorite	C	A	B	D	A	A	A	*	A	B	D	A	A
Calcium Sulfate	A	A	B	A	A	A	A	A	A	A	D	*	A
Calgon	A	*	*	*	*	A	A	*	A	A	A	*	A
Cane Juice	A	*	*	A	*	*	D	*	*	A	A	*	A
Carbolic Acid (See Phenol)	*	*	*	*	*	*	*	*	*	*	*	*	*
Carbon Bisulfide	A	*	*	D	*	*	D	*	A	D	D	D	A
Carbon Dioxide (Wet)	A	*	A	*	A	*	*	*	*	*	*	*	*
Carbon Disulfide	A	*	*	D	A	D	D	A	A	D	D	D	A
Carbon Monoxide	A	*	*	A	*	B	A	*	A	A	B	A	A
Carbon Tetrachloride	B	A	A	C	A	D	D	C	A	C	D	*	C
Carbonated Water	A	*	*	A	*	A	A	*	A	A	A	A	A
Carbonic Acid	B	*	A	A	A	A	A	*	A	B	A	A	A

Chemical Resistance Chart (Cont.)

	316 SS	Titanium	Hastelloy® C.	PVC (Type 1)	Teflon	Noryl	Polypropylene	Ryton (Fortron®)	Viton	Buna N	Neoprene	Ethylene Propylene	Epoxy
Catsup	A	*	*	A	*A	A	*	A	A	C	*	A	
Chloracetic Acid	D	A	A	A	A	*	D	*	A	D	D	B	B
Chloric Acid	D	*	*	D	A	*	*	*	*	D	D	*	D
Chlorinated Glue	A	*	*	*	*	C	*	*	A	C	D	*	A
Chlorine													
Anhydrous Liquid	D	D	A	D	A	A	D	C	A	D	D	B	B
Chlorine (Dry)	A	D	A	*	A	*	*	C	D	*	D	*	D
Chlorine Water	D	A	B	A	A	C	D	C	A	D	D	*	*
Chlorobenzene (Mono)	A	*	A	D	A	D	D	A	A	D	D	D	A
Chloroform	A	A	A	D	A	D	D	C	A	D	D	D	A
Chlorosultonic Acid	*	A	B	C	A	D	D	D	D	D	D	D	C
Chlorox (Bleach)	A	*	A	A	A	A	D	C	A	C	B	B	A
Chocolate Syrup	A	*	*	*	*	A	A	*	A	A	A	*	A
Chromic Acid 5%	A	A	A	A	*	C	A	A	A	D	D	A	B
Chromic Acid 10%	*	A	A	A	A	A	A	*	A	D	D	*	C
Chromic Acid 30%	*	A	A	A	A	D	A	*	A	D	D	*	D
Chromic Acid 50%	B	A	A	B	A	D	B	B	A	D	D	A	C
Cider	A	*	*	A	*	A	*	*	A	A	A	*	A
Citric Acid	A	A	A	A	A	A	B	*	A	D	A	A	A
Citric Oils	A	*	*	*	*	A	A	*	A	A	D	*	A
Coffee	A	*	*	*	A	A	A	*	A	A	A	*	A
Copper Chloride	D	A	A	A	A	A	A	A	A	A	A	A	A
Copper Cyanide	A	A	A	A	A	A	A	A	B	B	A	A	C
Copper Floborate	D	*	B	A	A	*	*	*	A	B	A	*	A
Copper Nitrate	A	A	A	A	A	A	A	*	A	A	A	*	A
Copper Sulfate													
(5% Solution)	A	A	A	A	A	A	A	A	A	A	A	*	A
Copper Sulfate	*	A	A	A	A	A	A	*	B	B	A	A	A
Cream	A	*	*	*	*	A	A	*	A	A	C	*	A
Cresols	A	*	*	D	*	*	C	A	A	D	D	D	A
Cresylic Acid	A	A	B	B	A	*	*	*	A	D	D	D	A
Cyclohexane	*	A	*	*	*	D	D	A	A	A	D	D	A
Cyanic Acid	*	*	*	*	*	*	*	*	*	C	D	*	A
Detergents	A	*	*	A	*	A	A	A	A	A	B	A	A
Dichlorethane	A	*	A	D	A	*	*	*	C	*	D	*	A
Diesel Fuel	A	*	*	*	*	D	D	A	A	A	D	D	A

	316 SS	Titanium	Hastelloy® C.	PVC (Type 1)	Teflon	Noryl	Polypropylene	Ryton (Fortron®)	Viton	Buna N	Neoprene	Ethylene Propylene	Epoxy
Diethylamine	*	*	*	D	A	B	C	*	D	B	B	B	A
Diethylene Glycol	*	*	*	*	*	A	*	*	A	A	A	A	A
Diphenyl Oxide	*	*	*	*	*	*	*	*	A	D	D	D	A
Dyes	A	*	*	*	*	A	*	*	A	*	C	*	A
Epsom Salts													
(Magnesium Sulfate)	A	A	B	A	*	A	A	*	A	A	A	*	A
Ethane	*	*	*	*	*	D	*	*	A	A	B	D	A
Ethanolamine	A	*	*	*	*	*	*	A	D	B	B	*	A
Ether	A	*	B	D	*	D	A	C	D	D	C	A	A
Ethyl Acetate	A	*	B	D	A	D	C	A	D	D	D	B	A
Ethyl Chloride	A	A	B	D	A	D	D	A	A	D	C	A	A
Ethyl Sulfate	*	*	*	*	*	*	*	*	A	A	*	*	A
Ethylene Chloride	A	B	B	D	A	D	D	A	A	D	D	C	A
Ethylene Dichloride	A	A	B	D	A	D	A	A	A	D	D	C	A
Ethylene Glycol	A	*	A	A	A	A	A	A	A	A	A	A	A
Ethylene Oxide	A	*	*	D	A	A	*	*	D	D	D	C	A
Fatty Acids	A	A	A	A	A	B	A	*	A	C	B	C	A
Ferric Chloride	D	A	B	A	A	A	A	A	A	D	B	A	A
Ferric Nitrate	A	A	A	A	A	A	A	A	A	A	A	A	A
Ferric Sulfate	C	A	A	A	A	A	A	A	A	B	A	*	A
Ferrous Chloride	D	A	B	A	A	A	A	A	A	B	A	*	A
Ferrous Sulfate	C	A	B	A	A	A	A	A	A	B	A	*	A
Fluboric Acid	B	D	A	A	A	B	A	*	A	B	A	*	A
Fluorine	D	D	A	C	C	*	*	*	*	*	*	*	D
Fluosilicic Acid	B	D	B	A	A	A	A	*	B	A	A	*	C
Formaldehyde 40%	A	A	A	B	A	A	A	A	D	B	A	*	A
Formaldehyde	A	A	B	A	A	D	A	A	A	C	D	B	A
Formic Acid	B	C	A	D	A	A	A	A	B	D	D	A	B
Freon 11	A	*	*	B	A	D	*	A	C	C	D	D	A
Freon 12 (Wet)	D	*	*	B	A	D	A	A	A	A	B	B	A
Freon 22	A	*	*	D	*	B	*	A	D	D	A	A	A
Freon 113	A	*	*	C	*	*	*	A	C	A	A	*	A
Freon T.F.	A	*	*	B	*	D	D	A	B	A	A	D	A
Fruit Juice	A	*	*	A	D	A	A	*	A	A	A	*	A
Fuel Oils	A	A	A	A	A	A	B	A	A	A	B	D	A
Furan Resin	A	*	*	*	A	*	*	A	A	D	D	*	A

Chemical Resistance Chart (Cont.)

	316 SS	Titanium	Hastelloy® C.	PVC (Type 1)	Teflon	Noryl	Polypropylene	Ryton (Fortron®)	Viton	Buna N	Neoprene	Ethylene Propylene	Epoxy
Furfural	A	*	B	D	A	D	D	A	D	D	D	B	A
Gallic Acid	A	*	A	A	A	*	*	*	B	A	*	*	*
Gasoline	A	D	A	C	A	D	C	A	A	A	D	C	A
Gelatin	A	*	A	A	A	A	A	*	A	A	A	A	A
Glucose	A	*	*	A	A	B	A	*	A	A	A	A	A
Glue P.V.	A	A	A	*	A	A	*	*	A	A	A	*	A
Glycerine	A	A	A	A	A	A	A	*	A	A	A	A	A
Gycolic Acid	*	*	A	A	A	C	A	A	A	*	*	*	A
Gold Monocyanide	A	*	*	*	*	*	*	*	A	A	A	*	A
Grape Juice	A	*	*	A	*	A	*	*	A	A	A	*	A
Grease	A	*	*	*	*	A	*	A	A	*	*	*	A
Heptane	A	*	A	A	A	D	D	A	A	A	B	D	A
Hexane	A	*	A	C	A	D	C	A	A	A	B	D	A
Honey	A	*	*	A	*	A	A	*	A	A	A	A	A
Hydraulic Oils (Petroleum)	A	*	*	*	A	*	D	*	A	A	B	D	A
Hydraulic Oils (Synthetic)	A	*	*	*	*	*	D	*	A	C	*	*	A
Hydrazine	A	*	*	*	*	*	*	*	A	B	B	A	A
Hydrobromic Acid (20%)	D	A	A	A	A	A	A	*	A	D	C	*	B
Hydrobromic Acid	D	A	A	B	C	D	*	A	A	D	D	A	A
Hydrochloric Acid (Dry Gas)	A	*	A	A	A	*	*	*	*	*	*	A	A
Hydrochloric Acid (20%)	D	C	B	A	A	A	A	D	A	C	C	A	A
Hydrochloric Acid (37%)	D	C	B	A	A	A	A	D	A	C	C	C	A
Hydrochloric Acid (100%)	D	D	C	A	A	*	*	*	C	D	C	*	A
Hydrocyanic Acid	A	A	A	A	A	A	A	*	A	C	B	*	A
Hydrocyanic Acid (Gas 10%)	D	*	*	A	A	*	*	*	*	*	C	A	A
Hydrofluoric Acid (20%)	D	D	B	D	A	A	A	C	A	D	C	A	B
Hydrofluoric Acid (75%)	D	D	C	C	A	D	B	C	A	D	D	C	C
Hydrofluoric Acid (100%)	D	D	B	C	A	*	*	C	*	D	D	*	A
Hydrofluosilicic Acid (20%)	D	D	B	D	A	B	A	*	A	B	B	A	C
Hydrofluosilicic Acid	D	*	C	*	A	*	*	*	*	*	A	*	*
Hydrogen Gas	A	*	*	A	A	*	*	*	A	*	*	*	A
Hydrogen Peroxide (10%)	C	C	A	A	A	*	*	B	*	A	D	*	D
Hydrogen Peroxide (30%)	B	B	A	A	A	*	A	C	A	D	C	*	B
Hydrogen Peroxide	B	B	A	A	A	B	A	C	A	D	D	C	A
Hydrogen Sulfide													
Aqueous Solution	A	A	A	A	A	A	A	A	B	C	B	A	A

	316 SS	Titanium	Hastelloy® C.	PVC (Type 1)	Teflon	Noryl	Polypropylene	Ryton (Fortron®)	Viton	Buna N	Neoprene	Ethylene Propylene	Epoxy
Hydrogen Sulfide (Dry)	A	*	A	A	A	*	*	A	A	*	*	*	A
Hydroxyacetic Acid (70%)	*	B	*	A	*	*	*	*	A	A	A	A	A
Ink	A	*	*	*	*	B	*	*	A	A	A	*	A
Iodine	D	A	B	D	A	A	D	*	A	B	D	B	A
Iodine (in Alcohol)	B	D	A	D	A	C	B	*	A	D	D	*	*
Iodoform	A	*	*	*	A	*	*	*	C	*	*	*	*
Isotane	*	*	*	*	*	D	D	*	A	A	*	*	A
Isopropyl Acetate	B	*	*	*	*	*	*	*	D	D	D	B	A
Isopropyl Ether	A	*	*	*	A	D	D	*	D	B	D	D	*
Jet Fuel (JP3, JP4, JP5)	A	*	*	A	A	D	D	A	A	A	D	D	A
Kerosene	A	A	A	A	A	D	D	A	A	A	D	A	A
Ketones	A	A	A	D	A	D	D	A	D	D	D	D	C
Lacquers	A	*	*	*	*	C	A	*	D	D	D	*	A
Lacquer Thinners	A	A	A	C	A	D	B	*	*	D	D	A	*
Lactic Acid	B	A	A	A	A	A	A	A	B	B	A	B	A
Lard	A	*	*	A	*	*	A	*	A	A	B	*	A
Latex	A	*	*	*	*	A	*	*	A	A	C	A	A
Lead Acetate	A	A	A	A	A	A	A	*	D	B	D	A	A
Lead Sulfamate	*	*	*	*	*	*	A	*	A	B	A	D	A
Ligroin	A	*	*	*	*	D	D	*	A	A	B	A	A
Lime	A	A	*	A	*	A	*	*	A	A	B	D	A
Lubricants	A	A	A	A	A	*	A	A	A	A	D	*	A
Magnesium Carbonate	A	*	B	A	*	A	A	*	*	A	A	A	A
Magnesium Chloride	B	A	A	A	A	A	A	A	A	A	A	A	A
Magnesium Hydroxide	A	A	A	A	A	A	A	A	A	B	B	*	A
Magnesium Nitrate	A	A	A	A	A	A	A	*	A	A	A	*	A
Magnesium Oxide	A	*	*	*	*	*	*	*	*	A	A	A	A
Magnesium Sulfate	A	A	B	A	A	A	A	A	A	A	A	D	A
Maleic Acid	A	A	A	A	A	A	C	*	A	D	A	D	A
Maleic Anhydride	*	*	A	*	*	*	*	*	A	D	D	*	A
Malic Acid	A	*	A	A	A	*	*	*	C	*	A	*	*
Mash	A	*	*	*	*	A	*	*	*	A	A	*	A
Mayonnaise	A	*	*	*	A	A	A	*	A	A	*	*	A
Melamine	D	*	*	*	*	*	*	*	*	C	*	*	A
Mercuric Chloride													
(Dilute Solution)	D	A	B	A	A	A	A	*	A	A	A	A	A

Chemical Resistance Chart (Cont.)

	316 SS	Titanium	Hastelloy® C.	PVC (Type 1)	Teflon	Noryl	Polypropylene	Ryton (Fortron®)	Viton	Buna N	Neoprene	Ethylene Propylene	Epoxy
Mercuric Cyanide	A	A	*	A	A	A	A	*	*	A	*	*	A
Mercury	A	C	A	A	A	A	A	*	A	A	A	A	A
Methanol													
(See Alcohol, Methyl)	*	*	*	*	*	*	*	*	*	*	*	*	*
Methyl Acetate	A	*	A	*	A	*	*	*	D	D	B	B	*
Methyl Acrylate	*	*	*	*	*	*	*	*	D	D	B	B	A
Methyl Acetone	A	*	*	*	A	D	*	*	D	D	D	*	C
Methyl Alcohol (10%)	A	*	A	A	a	A	*	*	*	B	*	*	A
Methyl Bromide	*	*	*	*	*	*	*	*	A	B	D	D	B
Methyl Butyl Ketone	A	*	*	*	*	D	*	*	D	D	D	A	B
Methyl Cellosolve	*	*	*	*	*	C	A	*	D	D	D	B	C
Methyl Chloride	A	A	A	D	A	D	D	*	A	D	D	C	A
Methyl Dichloride	*	*	*	*	*	D	*	*	A	D	D	D	A
Methyl Ethyl Ketone	A	A	A	D	A	D	A	A	D	D	D	A	A
Methyllsobutyl Ketone	A	A	A	D	A	D	C	A	D	D	D	C	B
Methyl Isobutyl Ketone	A	*	*	*	*	D	*	*	D	D	D	B	B
Methyl Methacrylate	*	*	*	*	*	*	*	*	D	D	D	D	A
Methylamine	A	*	*	*	*	B	*	*	*	B	*	*	A
Methylene Chloride	A	A	A	D	A	D	D	*	B	D	D	D	A
Milk	A	*	*	A	*	A	A	*	A	A	A	A	A
Molasses	A	*	*	A	*	B	A	*	A	A	A	*	A
Mustard	A	*	*	A	*	B	A	*	A	B	C	*	A
Naptha	A	A	A	A	A	D	A	A	A	B	D	D	A
Napthalene	B	A	A	D	A	D	B	A	C	D	D	D	A
Nickel Chloride	B	A	A	A	A	A	A	*	A	A	A	A	A
Nickel Sulfate	B	A	B	A	A	A	A	*	A	A	A	A	A
Nitric Acid (10% Solution)	A	A	A	A	A	A	A	D	A	D	D	B	A
Nitric Acid (20% Solution)	A	A	A	A	A	A	A	C	A	D	D	D	B
Nitric Acid (50% Solution)	A	A	A	A	A	A	D	C	A	D	D	D	D
Nitric Acid													
(Concentrated Soultion)	B	A	B	D	A	D	D	C	B	D	D	D	D
Nitrobenzene	B	A	B	D	A	D	C	B	D	D	D	D	B
OILS													
Aniline	A	A	D	D	A	D	A	*	A	D	D	B	A
Anise	A	*	*	*	*	*	*	*	*	*	D	*	A
Bay	A	*	*	*	*	*	*	*	A	*	D	*	A

	316 SS	Titanium	Hastelloy® C.	PVC (Type 1)	Teflon	Noryl	Polypropylene	Ryton (Fortron®)	Viton	Buna N	Neoprene	Ethylene Propylene	Epoxy
Bone	A	*	*	*	*	*	*	*	A	A	D	*	A
Castor	A	*	*	A	*	*	*	*	A	A	A	B	A
Cinnamon	A	*	*	*	A	*	A	*	D	*	D	*	A
Citric	A	*	*	*	*	*	A	*	A	A	D	*	A
Clove	A	*	*	*	*	*	B	*	*	A	*	*	A
Coconut	A	*	*	*	*	*	A	*	A	A	A	A	A
Cod Liver	A	*	*	*	*	*	A	*	A	A	B	A	A
Corn	A	*	*	*	*	*	A	*	A	A	D	C	A
Cottonseed	A	*	*	A	A	*	A	A	A	A	D	C	A
Cresote	A	*	*	*	*	*	D	*	A	A	B	D	A
Diesel Fuel (2D - 5D)	A	*	*	*	*	D	A	A	A	A	D	D	A
Fuel (1 2 3 5A 5B 6)	A	A	A	A	A	D	B	*	A	B	D	D	A
Ginger	A	*	*	*	*	*	*	*	A	A	A	*	A
Hydraulic (See Hydraulic)													
Lemon	A	*	*	*	*	*	D	*	A	*	D	*	A
Linseed	A	*	*	A	*	*	A	*	A	A	D	D	A
Mineral	A	*	A	*	B	B	A	A	A	B	D	A	A
Olive	A	*	*	A	A	*	A	*	A	A	B	*	A
Orange	A	*	*	*	A	*	A	*	A	A	D	*	A
Palm	A	*	*	A	*	*	*	*	A	A	D	*	A
Peanut	A	*	*	A	*	*	D	*	A	A	D	*	A
Peppermint	A	*	*	*	*	*	D	*	A	D	D	*	A
Pine	A	*	*	A	A	*	*	*	A	A	D	*	A
Rape Seed	A	*	*	A	*	*	*	*	A	B	D	*	A
Rosin	A	*	*	*	*	*	A	*	A	A	*	*	A
Sesame Seed	A	*	*	A	*	*	*	*	A	A	D	*	A
Silicone	A	*	*	*	*	A	A	*	A	A	A	*	A
Soybean	A	*	*	A	*	*	A	*	A	A	D	*	A
Sperm	A	*	*	A	*	*	*	*	A	A	D	*	A
Tanning	A	*	*	*	*	*	*	*	A	A	D	*	A
Turbine	A	*	*	A	*	*	*	*	A	A	D	*	A
Oleic Acid	A	*	B	A	A	C	C	*	B	B	D	D	A
Oleum 25%	*	*	A	D	A	D	*	*	A	D	D	D	D
Oleum	A	*	*	D	A	*	D	*	A	C	D	D	A
Oxalic Acid (Cold)	B	C	B	A	A	C	A	*	A	B	B	A	A
Paraffin	A	*	*	A	A	B	A	*	A	A	*	*	A

Chemical Resistance Chart (Cont.)

	316 SS	Titanium	Hastelloy® C.	PVC (Type 1)	Teflon	Noryl	Polypropylene	Ryton (Fortron®)	Viton	Buna N	Neoprene	Ethylene Propylene	Epoxy
Pentane	C	*	B	*	A	D	*	*	A	A	B	D	A
Perchlorethylene	A	*	*	*	A	D	D	A	A	C	D	D	A
Petrolatum	A	*	*	*	A	D	*	*	A	A	B	A	A
Phenol (10%)	A	*	B	A	A	*	*	A	B	D	C	D	C
Phenol (Carbolic Acid)	A	C	A	A	A	C	B	A	A	D	D	D	B
Phosphoric Acid													
(to 40% Solution)	A	A	A	A	A	A	A	A	A	D	D	B	A
Phosphoric Acid													
(40% - 100% Solution)	B	B	A	A	A	A	A	A	A	D	D	B	C
Phosphoric Acid (Crude)	C	C	A	*	A	*	*	A	A	D	D	B	A
Phosphoric Anhydride	A	*	*	D	A	*	*	*	D	D	D	*	*
Phosphoric Anhydride													
(Molten)	A	*	*	D	A	*	*	*	D	C	D	*	A
Photographic (Developer)	A	A	A	A	*	A	A	*	A	A	A	*	A
Phthalic Anhydride	B	*	A	*	A	*	*	*	A	C	*	*	*
Picric Acid	A	*	A	A	A	*	*	*	A	A	A	*	A
PLATING SOLUTIONS													
Antimony Plating 130°F	A	A	A	A	A	A	A	*	A	A	A	*	B
Arsenic Plating 110°F	A	A	A	A	A	A	A	*	A	A	A	*	B
Black Chrome Bath 115°F	C	A	A	A	A	D	A	*	C	D	D	*	D
Barrel Chrome Bath 95°F	D	C	A	A	A	D	A	*	C	D	D	*	D
Brass Plating													
Regular													
Brass Bath 100°F	A	A	A	A	A	A	A	*	A	A	A	*	B
High Speed Brass Bath													
110°F	A	A	A	A	A	A	A	*	A	A	A	*	B
Bronze Plating													
Copper Cadmium													
Bronze Bath R T	A	A	A	A	A	A	A	*	A	A	A	*	B
Copper-Tin Bronze													
Bath 160°F	A	A	A	D	A	A	A	*	A	A	B	*	C
Copper-Zinc Bronze													
Bath 100°F	A	A	A	A	A	A	A	*	A	A	A	*	B
Cadmium Plating													
Cyanide Bath 90°F	A	A	A	A	A	A	A	*	A	A	A	*	B
Fluoborate Bath 100°F	A	D	A	A	A	A	A	*	A	B	C	*	B

	316 SS	Titanium	Hastelloy® C.	PVC (Type 1)	Teflon	Noryl	Polypropylene	Ryton (Fortron®)	Viton	Buna N	Neoprene	Ethylene Propylene	Epoxy
Chromium Plating													
Chromic-Sulphuric Bath													
130°F	C	A	A	A	A	D	A	*	C	D	D	*	D
Fluosilicate Bath 95°F	C	C	A	A	A	D	A	*	C	D	D	*	D
Fluoride Bath 130°F	D	C	A	A	A	D	A	*	C	D	D	*	D
Copper Plating (Acid)													
Copper Sulfate Bath R T	D	A	A	A	A	A	A	*	A	A	A	*	D
Copper Fluorborate Bath													
120°F	D	D	A	A	A	A	A	*	A	B	C	*	D
Copper Plating (Cyanide)													
Copper Strike Bath 120°F	A	A	A	A	A	A	A	*	B	*	A	*	B
Rochelle Salt Bath 150°F	A	A	A	D	A	A	A	*	A	A	B	*	C
High Speed Bath 180°F	A	A	A	D	A	A	A	*	A	A	B	*	C
Copper (Misc.)													
Copper													
Pyrophosphate 140°F	A	A	A	A	A	A	A	*	A	A	A	*	B
Copper (Electroless)													
140°F	*	*	*	A	A	A	A	*	A	D	D	*	B
Gold Plating													
Cyanide 150°F	A	A	A	D	A	A	A	*	A	A	A	*	D
Neutral 75°F	C	A	A	A	A	A	A	*	A	A	A	*	A
Acid 75°F	C	A	A	A	A	A	A	*	A	A	A	*	A
Indium Sulfamate													
Plating R T	C	A	A	A	A	A	A	*	A	A	A	*	A
Iron Plating													
Ferrous													
Chloride Bath 190°F	D	A	D	D	A	A	C	*	A	B	D	*	D
Ferrous Sulfate Bath													
150°F	C	A	A	D	A	A	A	*	A	A	B	*	D
Ferrous Am Sulfate													
Bath 150°F	C	A	A	D	A	A	A	*	A	A	B	*	D
Sulfate Chloride Bath													
160°F	D	A	D	D	A	A	A	*	A	B	C	*	D
Fluorobate Bath 145°F	D	D	B	D	A	A	A	*	A	B	C	*	D
Sulfamate 140°F	D	A	B	A	A	A	A	*	A	A	A	*	A
Lead Fluoborate Plating	C	D	A	A	A	A	A	*	A	B	C	*	A

Chemical Resistance Chart (Cont.)

	316 SS	Titanium	Hastelloy® C.	PVC (Type 1)	Teflon	Noryl	Polypropylene	Ryton (Fortron®)	Viton	Buna N	Neoprene	Ethylene Propylene	Epoxy
Nickel Plating													
Watts Type 115-160°F	C	A	A	D	A	A	A	*	A	A	A	*	D
High Chloride 130-160°F	C	A	A	D	A	A	A	*	A	A	B	*	D
Fluoborate 100-170°F	C	D	A	D	A	A	A	*	A	B	C	*	D
Sulfamate 100-140°F	C	A	A	A	A	A	A	*	A	A	A	*	A
Electroless 200°F	*	*	*	D	A	D	D	*	A	D	D	*	B
Rhodium Plating 120°F	D	D	D	A	A	A	A	*	A	A	B	*	A
Silver Plating 80-120°F	A	A	A	A	A	A	A	*	A	A	A	*	A
Tin-Fluorobate Plating													
100°F	C	D	A	A	A	A	A	*	A	B	C	*	A
Tin-Lead Plating 100°F	C	D	A	A	A	A	A	*	A	B	C	*	A
Zinc Plating													
Acid Chloride 140°F	D	A	D	A	A	A	A	*	A	A	A	*	A
Acid Sulfate Bath 150°F	C	A	A	D	A	A	A	*	*	A	B	*	D
Acid Fluorobate Bath R T	*	D	*	A	A	A	A	*	A	B	C	*	A
Alkaline Cyanide Bath R T	*	A	A	A	A	A	A	*	A	A	A	*	A
Potash	*	*	A	A	*	A	A	*	A	A	B	*	A
Potassium Bicarbonate	*	B	A	A	A	A	A	A	A	A	A	*	A
Potassium Bromide	*	A	B	A	A	A	A	C	*	A	A	A	A
Potassium Carbonate	*	A	A	A	A	A	A	A	A	B	A	*	A
Potassium Chlorate	A	A	B	A	A	A	A	A	A	A	A	*	A
Potassium Chloride	A	A	A	A	A	A	A	A	A	A	A	A	A
Potassium Chromate	B	*	B	A	*	A	*	A	A	A	A	*	C
Potassium Cyanide													
Solutions	B	A	A	A	A	A	A	A	B	A	A	A	A
Potassium Dichromate	A	A	B	A	A	A	A	A	B	A	A	A	A
Potassium Ferrocyanide	*	*	B	A	A	*	*	*	*	D	*	*	A
Potassium Hydroxide													
(50%)	B	C	A	A	A	A	A	A	B	B	A	A	A
Potassium Nitrate	B	A	B	A	A	A	A	C	B	A	A	A	A
Potassium Permanganate	B	B	B	A	A	A	B	A	B	A	A	*	B
Potassium Sulfate	B	A	A	A	A	A	A	A	A	A	A	A	A
Potassium Sulfide	*	*	B	A	A	*	*	*	*	A	*	*	*
Propane (Liquified)	*	*	*	D	A	D	D	*	A	A	B	D	A
Propylene Glycol	*	*	*	*	A	*	*	*	A	A	C	*	A
Pyridine	*	*	*	*	A	D	B	A	D	D	D	B	A

	316 SS	Titanium	Hastelloy® C.	PVC (Type 1)	Teflon	Noryl	Polypropylene	Ryton (Fortron®)	Viton	Buna N	Neoprene	Ethylene Propylene	Epoxy
Pyrogallic Acid	A	*	A	A	A	*	*	*	A	A	*	*	A
Rosins	A	*	B	*	A	*	A	*	*	A	*	*	A
Rum	*	*	*	A	*	A	A	*	A	A	A	*	A
Rust Inhibitors	*	*	*	*	*	*	A	*	A	A	C	*	A
Salad Dressing	*	*	*	A	*	A	A	*	A	A	*	*	A
Sea Water	C	A	*	A	A	A	A	*	A	A	B	A	A
Shellac (Bleached)	*	*	*	*	A	*	A	*	*	A	*	*	A
Shellac (Orange)	*	*	*	*	A	*	A	*	*	A	*	*	A
Silicone	*	*	*	*	*	A	A	*	A	A	A	A	A
Silver Bromide	C	*	*	*	*	A	*	*	*	*	*	*	A
Silver Nitrate	B	A	A	A	A	A	A	*	A	C	A	C	A
Soap Solutions	A	A	B	B	A	A	A	A	A	A	B	*	A
Soda Ash (See Sodium Carbonate)													
Sodium Acetate	A	A	A	A	A	A	A	*	D	C	C	*	A
Sodium Aluminate	*	B	B	*	A	A	*	A	A	A	A	A	A
Sodium Bicarbonate	A	A	*	A	A	A	A	A	A	A	A	A	A
Sodium Bisulfate	*	B	B	A	A	A	A	A	B	A	A	*	A
Sodium Bisulfite	*	A	B	A	A	A	A	A	A	A	A	*	A
Sodium Borate	*	*	A	C	A	*	*	*	A	*	A	*	*
Sodium Carbonate	B	A	A	A	A	A	A	A	A	A	A	A	A
Sodium Chlorate	*	A	B	A	A	A	A	A	A	D	A	*	A
Sodium Chloride	C	A	A	A	A	A	A	A	A	A	A	A	A
Sodium Chromate	A	*	B	*	A	A	A	A	B	A	A	*	C
Sodium Cyanide	*	A	*	A	A	A	A	A	A	A	A	A	A
Sodium Fluoride	*	A	A	D	A	*	*	*	C	D	D	*	A
Sodium Hydrosulfite	*	*	A	C	A	*	*	*	A	*	A	*	*
Sodium Hydroxide (20%)	A	A	A	A	A	A	A	A	A	A	B	A	A
Sodium Hydroxide (50% Solution)	B	A	A	A	A	A	A	B	A	D	C	*	A
Sodium Hydroxide (80% Solution)	D	A	B	A	A	A	A	B	B	D	C	*	A
Sodium Hypochlorite (to 20%)	C	A	A	A	A	A	D	C	A	C	D	B	B
Sodium Hypochlorite	A	A	A	A	A	A	A	C	D	B	A	*	A
Sodium Hyposulfate	A	*	*	*	A	*	*	*	*	*	C	*	C
Sodium Metaphosphate	A	*	*	*	A	*	D	*	A	A	B	A	A
Sodium Metasilicate	A	*	*	*	A	*	*	*	A	A	A	*	A
Sodium Nitrate	A	A	B	A	A	A	A	*	B	C	B	A	A
Sodium Perborate	C	*	*	*	A	A	A	*	A	B	B	A	A

Chemical Resistance Chart (Cont.)

	316 SS	Titanium	Hastelloy® C.	PVC (Type 1)	Teflon	Noryl	Polypropylene	Ryton (Fortron®)	Viton	Buna N	Neoprene	Ethylene Propylene	Epoxy
Sodium Peroxide	A	*	B	A	A	*	*	*	A	C	B	A	A
Sod. Polyphosphate (Mono Di Tribasic)	A	A	A	*	A	A	*	*	A	A	D	A	A
Sodium Silicate	B	A	B	A	A	A	A	*	A	A	A	A	A
Sodium Sulfate	A	A	B	A	A	A	A	A	A	A	A	A	A
Sodium Sulfide	B	A	B	A	A	A	A	A	A	C	A	A	A
Sodium Sulfite	C	A	A	A	A	*	*	*	A	A	A	*	A
Sodium Tetraborate	A	*	*	A	*	A	*	*	A	A	*	*	A
Sodium Thiosulphate ("Hypo")	A	A	*	A	A	A	A	A	A	B	A	A	A
Sorghum	A	*	*	*	*	*	*	*	A	A	A	*	A
Soy Sauce	A	*	*	*	*	A	*	*	A	A	A	*	A
Stannic Chloride	D	A	B	A	A	A	A	*	A	A	A	A	A
Stannic Fluoborate	A	*	*	*	*	A	*	*	A	A	A	*	A
Stannous Chloride	C	A	A	A	A	*	*	*	B	C	D	*	A
Starch	A	*	*	A	A	A	*	*	A	A	A	*	A
Stearic Acid	A	A	A	A	A	A	D	*	A	B	B	B	A
Stoddard Solvent	A	A	A	A	A	D	D	A	A	B	D	D	A
Styrene	A	*	*	*	A	A	*	*	B	D	D	D	A
Sugar (Liquids)	A	*	A	*	A	A	A	*	A	A	B	*	A
Sulfate Liquors	C	*	A	*	*	*	A	*	*	*	C	*	A
Sulfur Chloride	D	*	*	A	A	A	D	*	A	D	D	D	C
Sulfur Dioxide	A	A	B	D	A	D	D	A	D	D	B	A	A
Sulfur Dioxide (Dry)	A	*	A	D	A	*	*	*	A	*	D	*	D
Sulfur Trioxide (Dry)	C	*	*	A	A	D	*	*	A	D	D	B	A
Sulfuric Acid (to 10%)	C	A	A	A	A	A	A	A	A	C	D	D	A
Sulfuric Acid (10-75%)	D	C	B	A	A	B	A	B	A	D	D	D	B
Sulfuric Acid (75-100%)	D	D	B	B	A	A	B	C	A	D	D	*	D
Sulfurous Acid	B	A	B	A	A	A	A	*	A	C	B	B	A
Sulfuryl Chloride	*	*	*	A	A	*	*	*	*	*	*	*	A
Syrup	A	*	*	A	*	A	A	*	A	A	B	*	A
Tallow	A	*	*	*	*	A	*	*	A	A	*	*	A
Tannic Acid	A	A	B	A	A	A	A	*	A	D	A	A	A
Tanning Liquors	A	A	A	A	A	*	A	*	A	C	*	*	A
Tartaric Acid	B	A	B	A	A	A	A	*	A	D	A	*	A
Tetrachlorethane	A	A	A	D	A	D	A	*	A	D	*	D	A
Tetrahydrofuran	A	*	*	D	A	D	C	A	B	D	D	B	A
Toluene Toluoi	A	A	A	D	A	D	D	A	C	D	D	D	A

	316 SS	Titanium	Hastelloy® C.	PVC (Type 1)	Teflon®	Noryl	Polypropylene	Ryton (Fortron®)	Viton	Buna N	Neoprene	Ethylene Propylene	Epoxy
Tomato Juice	A	*	*	A	A	A	A	A	A	A	A	*	A
Trichlorethane	A	A	A	*	A	D	*	*	A	D	D	D	A
Trichlorethylene	A	A	A	D	A	D	D	C	A	D	D	D	A
Trichloropropane	A	*	*	*	*	D	*	*	A	A	A	*	A
Tricresylphosphate	A	B	A	D	A	A	*	*	B	D	D	A	A
Triethylamine	*	*	*	A	*	B	*	*	A	A	B	*	A
Turpentine	A	*	A	A	A	D	B	A	A	D	D	D	A
Urine	A	*	*	A	*	A	A	*	A	A	D	A	A
Vegetable Juice	A	*	*	*	*	A	*	*	A	A	D	*	A
Vinegar	A	A	A	A	A	A	A	A	A	C	B	A	A
Varnish (Use Viton for Aromatic)	A	*	*	*	A	D	A	*	A	B	D	*	A
Water, Acid Mine	A	*	*	A	*	A	A	B	A	A	B	*	A
Water, Distilled Lab Grade 7	A	*	*	A	A	A	A	A	A	A	B	A	A
Water, Fresh	A	*	*	A	A	A	A	A	A	A	B	A	A
Water, Salt	A	*	*	A	*	A	A	A	A	A	B	A	A
Weed Killers	A	*	*	*	*	*	*	*	A	B	C	*	A
Whey	A	*	*	*	*	*	*	*	A	*	*	*	A
Whiskey & Wines	A	*	*	A	A	A	A	*	A	A	A	A	A
White Liquor (Pulp Mill)	A	*	A	A	A	A	A	*	A	A	A	*	A
White Water (Paper Mill)	A	*	*	*	*	*	A	*	A	*	A	*	A
Xylene	A	*	A	D	A	D	D	A	A	D	D	D	A
Zinc Chloride	B	A	B	A	A	A	A	A	A	A	A	A	A
Zinc Hydrosulphite	A	*	*	*	*	A	*	A	*	A	A	A	A
Zinc Sulfate	A	A	B	C	A	A	A	A	A	A	A	A	A

Comparison of Chemical Resistance of Six Plastics Resins

Percent Tensile Strength Retained (24 Hours @ 200˚F)
GE Plastics Quick Reference Chemical Compatibility Guide

	CHEMICAL	ZYTEL 101 Nylon 6-6	LEXAN 14 Polycarbonate	UDEL PolySulfone	NORYL Phenylene Oxide based Resin	PPS FORTRON (RYTON) Polyphenylene Sulfide	GENAL 4300 Phenolic
ACIDS	10% Acetic	30	37	100	100	100	-
	10% chromic	67	100	100	100	100	-
	10% HCL	0	100	100	100	100	-
	10% HNO_3	0	100	100	100	96	-
	30% H_2SO_4	0	100	100	100	100	13
	37% HCL	0	0	100	100	100	83
	85% H_3PO_4	0	100	100	100	100	73
	88% formic	0	38	79	99	75	4
	Acetic anhydride	74	0	0	55	100	-
	Benzene sulfonic	0	20	35	100	100	-
	Glacial acetic	0	67	91	78	98	98
	Lactic	22	100	100	100	100	-

	CHEMICAL	ZYTEL 101 Nylon 6-6	LEXAN 14 Polycarbonate	UDEL PolySulfone	NORYL Phenylene Oxide based Resin	PPS FORTRON (RYTON) Polyphenylene Sulfide	GENAL 4300 Phenolic
	15% NaOH	69	98	100	100	100	-
BASES	28% NH_4OH	85	0	100	100	100	99
	30% NaOH	89	7	100	100	100	63

	CHEMICAL	ZYTEL 101 Nylon 6-6	LEXAN 14 Polycarbonate	UDEL PolySulfone	NORYL Phenylene Oxide based Resin	PPS FORTRON (RYTON) Polyphenylene Sulfide	GENAL 4300 Phenolic
INORGANICS - 10% AQUEOUS SOLUTION	H_2O	66	100	100	100	100	-
	$(NH_4)_2SO_4$	62	100	100	100	100	-
	$Al_2(SO_4)_3$	33	100	100	100	100	-
	$AlCl_3$	19	100	100	100	100	100
	$BaCl_2$	86	100	100	100	100	-
	Br_2	8	48	92	87	64	100
	$Ca(NO_3)_2$	29	100	100	100	100	-
	$CaCl_2$	82	100	100	100	100	-
	$FeCl_3$	13	100	100	100	100	-
	$KMnO_4$	39	100	100	100	100	-
	$MgCl_2$	74	100	100	100	100	-
	Na_2CO_3	80	100	100	100	100	-
	$Na_2Cr_2O_7$	57	100	100	100	100	-
	Na_2S	60	100	100	100	100	-
	$Na_2S_2O_3$	90	100	100	100	100	-
	Na_2SO_4	76	100	100	100	100	-
	NaCl	94	100	100	100	100	-
	$NaHCO_3$	76	100	100	100	100	-
	NaOCl	44	100	100	100	84	85
	NH_4Cl	73	100	100	100	100	-
	NH_4NO_3	47	100	100	100	100	-

	CHEMICAL	ZYTEL 101 Nylon 6-6	LEXAN 14 Polycarbonate	UDEL PolySulfone	NORYL Phenylene Oxide based Resin	PPS FORTRON (RYTON) Polyphenylene Sulfide	GENAL 4300 Phenolic
	2-Aminoethanol	93	0	100	100	100	-
	Amyl alcohol	87	48	100	62	100	-
ALCOHOLS	Butyl alcohol	87	94	100	84	100	100
	Cyclohexanol	84	74	95	27	100	96
	Ethylene glycol	96	100	100	100	100	-

	CHEMICAL	ZYTEL 101 Nylon 6-6	LEXAN 14 Polycarbonate	UDEL PolySulfone	NORYL Phenylene Oxide based Resin	PPS FORTRON (RYTON) Polyphenylene Sulfide	GENAL 4300 Phenolic
AMINES	n-Butylamine	91	0	0	0	49	100
	Anilino	85	0	0	0	96	100
	Dimethylaniline	100	0	0	0	100	-
	Ethylenediamine	78	0	0	51	65	-
	Morphline	93	0	0	0	80	-
	Pyridine	74	0	0	0	93	-

	CHEMICAL	ZYTEL 101 Nylon 6-6	LEXAN 14 Polycarbonate	UDEL PolySulfone	NORYL Phenylene Oxide based Resin	PPS FORTRON (RYTON) Polyphenylene Sulfide	GENAL 4300 Phenolic
ALDEHYDES, KETONES	37% Formaldehyde	77	100	100	100	100	-
	Acetophenone	87	0	0	0	100	-
	Benzaldehyde	98	0	0	0	84	100
	Cyclohexanone	87	0	0	0	99	-
	Furfural	81	0	0	0	100	100
	Methyl elthyl ketone (MEK)	87	0	0	0	100	100

	CHEMICAL	ZYTEL 101 Nylon 6-6	LEXAN 14 Polycarbonate	UDEL PolySulfone	NORYL Phenylene Oxide based Resin	PPS FORTRON (RYTON) Polyphenylene Sulfide	GENAL 4300 Phenolic
CHLORINATED ORGANICS	2-Chloroethanol	12	0	0	53	100	-
	5% aq. Chlorofenol	41	42	0	57	100	-
	Acetyl chloride	0	0	0	0	100	-
	Benzyl chloride	80	0	0	0	100	-
	Carbon tetrachlorid	76	0	17	0	100	-
	Chlorobenzene	73	0	0	0	100	100
	Chloroform	57	0	0	0	87	100
	Epychlorohydrin	84	0	0	0	74	-
	Ethylene chloride	65	0	0	0	72	-

ESTERS

CHEMICAL	ZYTEL 101 Nylon 6-6	LEXAN 14 Polycarbonate	UDEL PolySulfone	NORYL Phenylene Oxide based Resin	PPS FORTRON (RYTON) Polyphenylene Sulfide	GENAL 4300 Phenolic
Amyl acetate	88	46	0	0	100	-
Butyl acetate	95	0	32	0	100	-
Butyl Phthalate	90	46	63	19	100	100
Ethyl acetate	89	0	0	0	100	100

ETHERS

CHEMICAL	ZYTEL 101 Nylon 6-6	LEXAN 14 Polycarbonate	UDEL PolySulfone	NORYL Phenylene Oxide based Resin	PPS FORTRON (RYTON) Polyphenylene Sulfide	GENAL 4300 Phenolic
Butyl ether	100	61	100	0	100	-
Cellosolve	81	78	0	47	89	-
p-dioxane	96	0	0	0	88	100
Tetrahydrofuran	87	0	0	0	76	92

HYDRO-CARBONS

CHEMICAL	ZYTEL 101 Nylon 6-6	LEXAN 14 Polycarbonate	UDEL PolySulfone	NORYL Phenylene Oxide based Resin	PPS FORTRON (RYTON) Polyphenylene Sulfide	GENAL 4300 Phenolic
Cyclohexane	90	75	99	0	100	-
Diesel fuel	87	100	100	36	100	-
Dowtherm	89	0	0	0	100	-
Gasoline	80	99	100	0	100	-
Heptane	84	100	100	36	91	98
Mineral oil	90	100	100	100	100	-
Motor oil	88	100	100	100	100	-
Stoddard solvent	86	100	100	0	100	-
Toluene	76	0	0	0	98	-
Wesson oil	100	99	100	100	100	-
Xylene	91	0	0	0	100	100

NITRILES

CHEMICAL	ZYTEL 101 Nylon 6-6	LEXAN 14 Polycarbonate	UDEL PolySulfone	NORYL Phenylene Oxide based Resin	PPS FORTRON (RYTON) Polyphenylene Sulfide	GENAL 4300 Phenolic
Acetronitrile	93	25	0	69	96	100
Benzonitrile	88	0	0	0	100	-

	CHEMICAL	ZYTEL 101 Nylon 6-6	LEXAN 14 Polycarbonate	UDEL PolySulfone	NORYL Phenylene Oxide based Resin	PPS FORTRON (RYTON) Polyphenylene Sulfide	GENAL 4300 Phenolic
NITRO COMPOUNDS	Nitrobenzene	100	0	0	0	100	100
	Nitro methane	57	0	0	66	71	100

	CHEMICAL	ZYTEL 101 Nylon 6-6	LEXAN 14 Polycarbonate	UDEL PolySulfone	NORYL Phenylene Oxide based Resin	PPS FORTRON (RYTON) Polyphenylene Sulfide	GENAL 4300 Phenolic
PHENOLS	m-Cresol	0	0	0	0	100	-
	Phenol	0	0	0	0	100	100

	CHEMICAL	ZYTEL 101 Nylon 6-6	LEXAN 14 Polycarbonate	UDEL PolySulfone	NORYL Phenylene Oxide based Resin	PPS FORTRON (RYTON) Polyphenylene Sulfide	GENAL 4300 Phenolic
	Dimethyl Sulfoxide	84	0	0	93	100	-
	Cresyldiphenyl pho	88	62	55	19	100	-
MISCELL-ANEOUS	N, N-dimethyl - forr	95	0	0	-	100	94
	Sulfolane	87	0	0	100	97	100
	Triphenyl - phosphi	84	16	77	0	100	-

NOTICE

The results shown herein are typical results that have been obtained in laboratory tests using bars molded from typical lots of resin. These results are for natural colors only. The addition of additives may alter some results.

In addition, design, processing methods and equipment, environment and other variables may affect actual part performance.

Inasmuch as General Electric Company has no control over those variables or the use to which others may put the material, it does not guarantee that the same results as those described herein will be obtained.

Therefore, while these results should assist you in electing compatible materials, they are not a substitute for careful testing of prototype parts in typical operating environments before beginning commercial production.

1. **Zytel 101 is a DuPont Company trademark.**
2. **Lexan 141 is a G.E. Company trademark.**
3. **Udel is a Union Carbide Company trademark.**
4. **Noryl is a G.E. Company trademark.**
5. **Ryton is a Phillips Petroleum Company trademark.**
6. **Genal 4300 is a G.E. Company trademark.**
7. **Fortron is a Hoschest Celenese Company trademark.**

Elastomeric Technical Data Release

	CODE	TYPE (1)	TEMP LIMITS (°F)	PROPERTIES
Silicone	A	SI	-120 to 500	General Purpose, Low Temperature
Buna N	J(4)	NBR	-40 to 250	General Purpose, Oil Resistant, Used in Stock Diaphragms
Ethylene, Propylene	N	EPDM	-40 to 300	Steam, Ozone, Acid & Alkali Resistant
Butyl	T	NR	-40 to 250	Weather, Ozone, Acid & Alkali Resistant, Low Permeability
Viton	V	FPM	0 to 550	Oil, Fuel, Chemical Resistant
Hypalon	Y	CSM	-30 to 300	Weather, Acid & Alkali Resistant

Notes:

CSM = Hypalon
EPDM = Ethylene propylene
FPM = Fluorocarbon (Viton)
NR = Butyl (Natural Rubber)
NBR = Nitrile (Buna N)
SI = Silicone

The General Chemical Resistance of Various Elastomers

The following pages are offered as a general guide and inspection of the suitability of various elastomers in use today for service in these chemicals and fluids. The ratings are based, for the most part, on published literature of various compounders. We cannot guarantee their accuracy nor assume responsibility for use thereof. Several factors must always be considered in using a rubber part in service. The most important as we see them are:

1. **The Temperature of Service:** Higher temperatures increase the effect of all chemicals on polymers. The increase varies with the polymer and the chemical. A compound quite suitable at room temperature might fail miserably at elevated temperatures.
2. **Conditions of Service**: A compound that swells badly might still function well as a static seal yet fail in any dynamic application.
3. **The Grade of the Polymer**: Many types of polymers are available in different grades that vary greatly in chemical resistance.
4. **The Compound Itself**: Compound designed for other outstanding properties may be poorer in performance in a chemical than one designed especially for fluid resistance.

Fluid Chart Key	Natural Rubber	Buna N	EPDM	Hypalon®	Viton®
Material & ASTM Designation	Natural Rubber NR Isoprene IR	Nitrile NBR	Ethylene Propylene EPDM	Hypalon CSM	Flouro Elastomer FPM
Chemical Group	Poly Isoprene	Butadiene Acrylonitrile Copolymer Terpolymer	Ethylene Propylene Copolymer Terpolymer	Chloro-Sulfonated Polyethylene	Flourocarbon Polymer
Generally Resistant To:	Most moderate Chemicals - Wet or Dry, Organic acids, Alcohols, Ketones, Aldehydes	Many Hydrocarbons, Fats, Oils, Greases, Hydraulic fluids, Chemicals	Animal and Vegetable oils, ozone, strong and oxidizing chemicals	Similar to Neoprene with improved acid resistance	All Aliphatic, Arinatuc and Halogenated Hydrocarbons, Acids, Animal and Vegetable oils
Generally Attacked By:	Ozone, strong acids, fats, oils, greases, most hydrocarbons	Ozone, Keytones, Esters, Aldehydes, Chlorinated and Nitro Hydrocarbons (Except PVC blends)	Mineral Oils and Solvents, Aromatics, Hydrocarbons	Concentrated Oxidizing acids, esters, ketones, chlorinated, aromatic and nitro hydrocarbons	Ketones, Low Mole Weight Esters and Nitro Containing Compounds

Key	Natural Rubber	Buna N	EPDM	Hypalon®	Viton®
Bleach Solutions	U	*	A	A	A
Borax	B	B	A	A	A
Bordeaux Mixture	B	*	A	A	A
Boric Acid	A	A	A	A	A
Brine	*	A	A	A	*
Bromine Anhydrous	*	*	*	U	A
Bromine Trifluoride	U	U	U	U	U
Bromine Water	*	*	*	A	A
Bromobenzene	U	U	U	U	A
Bunker Oil	*	A	*	*	A
Butadiene	U	U	C	B	B
Butane	U	A	U	A	A
Butter	U	A	A	B	A
Butyl Acetate	*	*	B	U	U
Butyl Acetyl Ricinoleate	*	*	A	B	A
Butyl Acrylate	*	*	U	*	U
Butyl Alcohol	A	A	B	A	A
Butyl Amine	U	C	U	U	U
Butyl Benzoate	*	*	A	U	A
Butyl Carbitol	*	A	A	B	A
Butyl Cellosolve	*	C	A	B	U
Butyl Oleate	U	*	B	U	A
Butyl Stearate	U	B	B	*	A
Butylene	U	B	U	C	A
Butyraldehyde	C	C	B	C	U
Calcium Acetate	A	B	A	B	U
Calcium Bisulfite	U	A	U	A	A
Calcium Chloride	A	A	A	A	A
Calcium Hydroxide	A	C	A	A	A
Calcium Hypochlorite	U	A	A	A	A
Calcium Nitrate	A	A	A	A	A
Calcium Sulfide	B	B	A	A	A

Key	Natural Rubber	Buna N	EPDM	Hypalon®	Viton®
Cane Sugar Liquors	A	A	A	A	A
Carbamate	U	C	B	B	A
Carbitol	B	B	B	B	B
Carbolic Acid	U	U	B	C	A
Carbon Bisulfide	*	C	U	U	A
Carbon Dioxide	B	A	B	A	A
Carbonic Acid	A	A	A	A	A
Carbon Monoxide	B	A	A	A	A
Carbon Tetrachloride	U	C	U	U	A
Caster Oil	A	A	B	A	A
Cellosolve	U	*	B	B	C
Cellosolve Acetate	U	U	B	*	U
Cellulube	*	U	A	U	A
Chlorine (Dry)	U	*	*	B	A
Chlorine (Wet)	U	*	C	C	A
Chlorine Dioxide	*	U	C	C	A
Chlorine Trifluoride	U	U	U	U	U
Chloroacetone	B	U	A	B	U
Chloroacetic Acid	*	*	B	*	*
Chlorobenzene	U	U	U	U	A
Chlorobromomethane	U	*	B	U	B
Chlorobutadiene	U	U	U	*	A
Chlorododecane	U	U	U	*	A
Chloroform	U	U	U	U	A
O-Chloronapthalene	U	U	U	*	A
1-Chloro 1-Nitro Ethane	U	U	U	U	C
Chlorosulfonic Acid	U	U	U	U	C
Chlorotoluene	U	U	U	U	A
Chrome Plating Solutions	U	U	U	C	A
Chromic Acid	U	U	C	B	A
Citric Acid	U	U	C	B	A
Cobalt Chloride	A	A	A	*	*

Key	Natural Rubber	Buna N	EPDM	Hypalon®	Viton®
Coconut Oil	U	A	A	B	*
Cod Liver Oil	U	A	A	B	A
Coke Oven Gas	U	*	*	*	A
Copper Acetate	*	B	A	B	*
Copper Chloride	A	A	A	A	A
Copper Cyanide	A	A	A	A	A
Copper Sulfate	B	A	A	A	A
Corn Oil	U	A	C	B	A
Cottonseed Oil	U	A	A	B	A
Creosote	U	B	U	C	A
Cresol	U	C	U	C	A
Cresylic Acid	U	C	U	C	A
Cumene	*	*	*	U	A
Cyclohexone	U	A	U	U	A
Cyclohexanol	B	B	U	A	A
Cyclohexanone	*	U	B	U	U
p-Cymene	*	*	*	U	A
Decalin	U	*	*	U	A
Decane	U	B	*	U	A
Denatured Alcohol	A	A	A	A	A
Detergent Solutions	B	A	A	A	A
Developing Fluids	A	A	B	A	A
Diacetone	*	*	A	*	U
Diacetone Alcohol	U	U	A	A	*
Dibenzyl Ether	U	U	B	*	*
Dibenzyl Sebecate	*	*	B	*	B
Dibutyl Amino	U	U	U	U	U
Dibutyl Ether	U	C	C	C	C
Dibutyl Phthalate	C	U	A	U	B
Dibutyl Sebecate	U	U	B	U	B
O-Dechlorobenzene	U	U	U	U	A
Dichloro-Isopropyl Ether	U	U	C	U	C

Key	Natural Rubber	Buna N	EPDM	Hypalon®	Viton®
Dichlorohexylamine	U	C	*	*	*
Diesel Oil	U	A	U	B	A
Diethlamine	B	C	N	C	U
Diethyl Benzene	U	U	U	U	A
Diethyl Ether	U	U	U	C	U
Diethylene Glycol	A	A	A	A	A
Diethyl Sebecate	*	U	B	U	B
Dilsobutylene	*	B	*	C	A
Dilsopropyl Benzene	U	U	U	U	A
Dilsopropyl Ketone	*	U	A	U	U
Dimethyl Aniline	U	*	B	*	U
Dimethyl Formamide	*	B	*	C	U
Dimethyl Phiholate	U	U	B	U	B
Dinitrotoluene	U	U	U	U	C
Dioctyl Phiholate	*	*	B	U	B
Dioctyl Sebecate	U	U	B	U	B
Dioxane	*	*	B	*	*
Dioxolane	U	U	B	*	*
Dipentene	*	B	*	*	A
Diphenyl	*	*	*	*	A
Diphenyl Oxides	*	*	A	*	A
Dowtherm Oil	U	*	U	U	A
Dry Cleaning Fluids	U	C	U	U	A
Epichlorohydrin	U	*	B	*	U
Ethane	U	A	U	B	A
Ethanolamine	B	B	B	B	U
Ethyl Acetate	U	U	B	C	U
Ethyl Acetoacetate	C	U	B	*	U
Ethyl Acrylate	*	*	B	*	U
Ethyl Alcohol	A	A	A	A	A
Ethyl Benzene	U	U	U	U	A
Ethyl Benzoate	*	*	B	*	A

Key	Natural Rubber	Buna N	EPDM	Hypalon®	Viton®
Ethyl Cellosolve	*	*	B	*	U
Ethyl Cellulose	B	*	B	B	U
Ethyl Chloride	B	A	A	C	A
Ethyl Chlorocarbonate	U	*	*	C	A
Ethyl Chloroformate	U	*	*	C	A
Ethyl Ether	*	C	C	U	U
Ethyl Formate	U	U	B	B	A
Ethyl Mercapian	U	U	U	*	A
Ethyl Oxalate	A	U	A	*	A
Ethyl Pentochlorobenzene	U	C	U	U	A
Ethyl Silicate	B	A	A	A	A
Ethylene	*	A	*	*	A
Ethylene Chloride	*	*	C	*	A
Ethylene Chlorohydrin	B	U	*	B	A
Ethylene Diamine	B	A	A	A	U
Ethylene Dichloride	U	U	C	U	A
Ethylene Glycol	A	A	A	A	A
Ethylene Oxide	*	U	C	U	U
Ethylene Trichloride	*	U	C	U	A
Fatty Acids	C	B	U	B	A
Ferric Chloride	A	A	A	A	A
Ferric Nitrate	A	A	A	A	A
Ferric Sulfate	A	A	A	A	A
Fish Oil	*	A	*	*	A
Fluoboric Acid	A	A	A	A	*
Fluorine (Liquid)	*	*	C	*	B
Fluorobenzene	U	U	U	U	A
Fluorocarbon Oils	*	*	A	*	*
Fluorolube	*	A	A	A	B
Fluorinated Cyclic Ethers	*	*	A	*	*
Fluosilicic Acid	A	A	*	A	*
Formaldehyde	*	B	A	A	A

Key	Natural Rubber	Buna N	EPDM	Hypalon®	Viton®
Formic Acid	A	B	A	A	C
Freon 11	U	A	U	A	A
Freon 12	B	A	B	A	B
Freon 13	A	A	A	A	A
Freon 21	U	U	U	U	U
Freon 22	A	U	A	A	U
Freon 31	B	U	A	B	U
Freon 32	A	A	A	A	C
Freon 112	U	B	U	B	A
Freon 113	C	A	U	A	B
Freon 114	A	A	A	A	B
Freon 115	A	A	A	A	B
Freon 142b	A	A	A	A	U
Freon 152a	A	A	A	C	U
Freon 218	A	A	A	A	A
Freon C316	A	A	A	A	*
Freon C318	A	A	A	A	A
Freon 13B1	A	A	A	A	A
Freon 114B2	U	B	U	A	B
Freon 502	A	B	*	*	B
Freon TF	C	A	U	A	A
Freon T-WD602	C	B	B	B	A
Freon TMC	B	B	B	B	A
Freon T-P35	A	A	A	A	A
Freon TA	A	A	A	A	C
Freon TC	U	A	B	A	A
Freon MF	U	A	*	U	*
Freon BF	U	B	*	B	*
Fuel Oil	U	A	U	B	A
Fumaric Acid	A	A	*	B	A
"Futan, Furfuran"	U	U	C	U	*
Furfural	C	U	B	B	U

Key	Natural Rubber	Buna N	EPDM	Hypalon®	Viton®
Gallic Acid	A	B	B	B	A
Gasoline	U	A	U	B	A
Gelatin	A	A	A	A	A
Glauber's Salt	*	*	B	*	A
Glucose	A	A	A	A	A
Glue	A	A	A	A	A
Glycerine	A	A	A	A	A
Gycols	A	A	A	A	A
Green Sulfate Liquor	B	B	A	B	A
Halowax Oil	U	U	U	U	A
n-Hexaldehyde	U	U	A	*	*
Hexene	U	A	U	B	A
n-Hexene-1	U	A	U	B	A
Hexyl Alcohol	A	A	C	B	A
Hydrozine	*	B	A	B	*
Hydraulic Oil (Petroleum)	U	A	U	B	A
Hydrobromic Acid	A	U	A	A	A
Hydrochloric Acid (Hot) 37%	U	U	C	C	A
Hydrochloric Acid (Cold) 37%	B	B	A	A	A
Hydrocyanic Acid	B	B	A	A	A
Hydrofluoric Acid (Conc.) Hot	U	U	U	C	B
Hydrofluoric Acid (Conc.) Cold	U	U	B	A	A
Hydrofluoric Acid-Anhydrous	U	*	B	A	*
Hydrofluosilicic Acid	A	B	A	A	A
Hydrogen Gas	B	A	A	A	A
Hydrogen Peroxide (90%)	U	U	C	C	B
"Hydrogen Sulfide (Wet, Cold)"	U	U	A	B	U
"Hydrogen Sulfide (Wet, Hot)"	U	U	A	C	U
Hydroquinene	B	C	*	*	U
Hypochlorous Acid	B	U	B	*	A
Iodine Pentafluoride	U	U	U	U	U
Iodoform	*	*	A	*	*

Key	Natural Rubber	Buna N	EPDM	Hypalon®	Viton®
Isobutyl Alcohol	A	B	A	A	A
Isoectane	U	A	U	B	A
Isopherone	*	U	A	*	U
Isopropyl Acetate	*	U	A	U	U
Isopropyl Alcohol	A	B	A	A	A
Isopropyl Chloride	U	U	U	*	A
Isopropyl Ether	U	B	U	B	U
Kerosene	U	A	U	C	A
Lacquers	U	U	U	U	U
Lacquer Solvents	U	U	U	U	U
Lactic Acid	A	A	A	A	A
Lard	U	A	U	C	A
Lavender Oil	U	B	U	*	A
Lead Acetate	A	B	A	*	*
Lead Nitrate	A	A	A	A	*
Lead Sulfamate	B	B	A	A	A
Lime Bleach	A	A	A	B	A
Lime Sulfur	U	U	A	A	A
Lindol	*	*	A	C	B
linoleic Acid	*	B	U	*	B
Linseed Oil	U	A	B	B	A
Liquefied Petroleum Gas	U	A	U	B	A
Lubricating Oils (Petrolatum)	U	A	U	B	A
Lye	B	B	A	A	B
Magnesium Chloride	A	A	A	A	A
Magnesium Hydroxide	B	B	A	A	A
Magnesium Sulfate	B	A	A	A	A
Maleic Acid	B	*	C	*	A
Maleic Anhydride	B	*	C	*	A
Malic Acid	*	A	U	B	A
Mercuric Chloride	A	A	A	A	A
Mercury	A	A	A	A	A

Key	Natural Rubber	Buna N	EPDM	Hypalon®	Viton®
Mesityl Oxide	U	U	B	U	U
Methane	U	A	U	B	A
Methyl Acetate	U	U	B	*	U
Methyl Acrylate	U	U	B	*	U
Methylacrylic Acid	U	*	B	*	B
Methyl Alcohol	A	A	A	A	C
Methyl Bromide	*	B	*	U	A
Methyl Butyl Ketone	U	U	A	U	U
Methyl Cellosolve	U	*	B	B	U
Methyl Chloride	U	U	C	U	A
Methyl Cyclopentane	U	*	U	*	A
Methylene Chloride	U	U	U	U	B
Methyl Ethyl Ketone	U	U	A	U	U
Methyl Formate	U	U	B	B	*
Methyl Isobutyl Ketone	U	U	C	U	U
Methyl Methacrylate	U	U	U	*	U
Methyl Oleate	U	U	B	*	A
Methyl Salicylate	*	*	B	*	*
Milk	A	A	A	A	A
Mineral Oil	U	A	U	B	A
Monochlorobenzene	U	U	U	U	A
Monomethyl Aniline	U	U	*	U	B
Monoethanolamine	B	U	B	U	U
Monomethylether	B	A	A	*	*
Monovinyl Acetylene	B	A	A	B	A
Mustard Gas	A	*	A	A	*
Naptha	U	C	U	U	A
Napthalene	U	U	U	U	A
Napthanic Acid	U	B	U	*	A
Natural Gas	C	A	U	A	A
Neatsfoot Oil	U	A	B	*	A
Neville Acid	U	C	B	*	A

Key	Natural Rubber	Buna N	EPDM	Hypalon®	Viton®
Nickel Acetate	A	B	A	*	U
Nickel Chloride	A	A	A	A	A
Nickel Sulfate	B	A	A	A	A
Niter Cake	A	A	A	A	A
Nitric Acid-Concentrate	U	U	C	B	A
Nitric Acid-Dilute	U	U	B	A	A
Nitric Acid-Red Fuming	U	U	U	U	C
Nitrobenzene	U	U	U	U	B
Nitrobenzine	*	*	U	C	A
Nitroethane	B	U	B	C	U
Nitromethane	B	U	B	C	U
Nitrogen	A	A	A	A	A
Nitrogen Tetroxide	U	U	C	U	U
Octadecane	U	A	U	B	A
n-Octane	U	*	U	*	A
Octachlorotoluene	U	U	U	U	A
Octyl Alcohol	B	B	A	A	A
Oleic Acid	C	C	B	C	B
Oleum Spirits	*	B	*	B	A
Olive Oil	U	A	B	B	A
o-Dechlorobenzene	*	U	*	U	A
Oxalic Acid	B	B	A	B	A
Oxygen-Cold	B	B	A	B	A
Oxygen-200°-400° F	U	U	U	U	B
Ozone	U	U	A	A	A
"Paint Thinner, Duco"	U	*	U	*	B
Palmitic Acid	B	A	B	B	A
Peanut Oil	U	A	C	B	A
Perchloric Acid	*	*	B	A	A
Perchlorethylene	U	C	U	U	A
Petroleum-Below 250	U	A	U	B	A
Petroleum-Above 250	U	C	U	U	B

Key	Natural Rubber	Buna N	EPDM	Hypalon®	Viton®
Phenol	*	*	B	C	A
Phenylbenzene	U	U	U	U	A
Phenyl Ethyl Ether	U	U	U	U	*
Phenyl Hydrozine	A	U	C	C	A
Phorone	*	*	B	*	*
Phosphoric Acid-20%	B	B	A	A	A
Phosphoric Acid-45%	U	U	B	B	A
Phosphorous Trichloride	U	U	A	U	A
Pickling Solution	*	*	C	C	B
Picric Acid	B	B	B	B	A
Pinene	U	B	U	B	A
Pine Oil	U	B	U	U	A
Piperidene	U	U	U	U	U
Plating Solution-Chrome	U	*	A	C	A
Plating Solution-Others	*	A	A	A	A
Polyvinyl Acetate Emulsion	*	*	A	B	*
Potassium Acetate	A	B	A	B	U
Potassium Chloride	A	A	A	A	A
Potassium Cupro Cyanide	A	A	A	A	A
Potassium Cyanide	A	A	A	A	A
Potassium Dichromate	B	A	A	A	A
Potassium Hydroxide	B	A	A	A	A
Potassium Nitrate	A	A	A	A	A
Potassium Sulfate	B	A	A	A	A
Producer Gas	U	A	U	B	A
Propane	U	A	U	A	A
Propyl Acetate	U	U	B	U	U
n-Propyl Acetate	U	U	A	*	U
Propyl Alcohol	A	A	A	A	A
Propyl Nitrate	*	*	B	*	U
Propylene	U	U	U	U	A
Propylene Oxide	*	*	B	U	*

Key	Natural Rubber	Buna N	EPDM	Hypalon®	Viton®
Pyranol	U	A	U	U	A
Pydrauls	U	U	B	U	A
Pyridine	U	U	B	U	U
Pyroligneous Acid	*	*	B	B	*
Pyrrole	C	U	C	*	*
Radiation	B	B	B	B	U
Rapeseed Oil	U	B	A	B	A
Red Oil	U	A	U	B	A
Sal Ammoniac	A	A	A	A	A
Salicylic Acid	A	A	A	*	A
Salt Water	A	A	A	A	A
Sewage	B	A	B	A	A
Silicate Esters	U	B	U	A	A
Silicone Greases	A	A	A	A	A
Silicone Oils	A	A	A	A	A
Silver Nitrate	A	B	A	A	A
Skydrol 500	U	U	A	U	U
Skydrol 7000	U	U	A	U	B
Soap Solutions	B	A	A	A	A
Soda Ash	A	A	A	A	A
Sodium Acetate	A	B	A	B	U
Sodium Bicarbonate	A	A	A	A	A
Sodium Bisulfite	A	A	A	A	A
Sodium Borate	A	A	A	A	A
Sodium Chloride	A	A	A	A	A
Sodium Cyanide	A	A	A	A	A
Sodium Hydroxide	A	B	A	A	A
Sodium Hypochlorite	C	B	B	B	A
Sodium Metaphosphate	A	A	A	B	A
Sodium Nitrate	B	B	A	A	*
Sodium Perborate	B	B	A	B	A
Sodium Peroxide	B	B	A	B	A

Key	Natural Rubber	Buna N	EPDM	Hypalon®	Viton®
Sodium Phosphate	A	A	A	A	A
Sodium Silicate	A	A	A	A	A
Sodium Sulfate	B	A	A	A	A
Sodium Thiosulphate	B	B	A	A	A
Soybean Oil	U	A	C	B	A
Stennic(ous) Chloride	A	A	B	A	A
Steam Under 300°F	U	U	A	U	U
Steam Over 300°F	U	U	B	U	U
Stearic Acid	B	B	B	B	*
Stoddard Solvent	U	A	U	C	A
Styrene	U	U	U	U	B
Sucrose Solution	A	A	A	A	*
Sulfite Liquers	B	B	B	B	A
Sulfur	U	U	A	A	A
Sulfur Chloride	U	C	U	B	A
Sulfur Dioxide	C	U	A	C	A
Sulfur Hexafluoride	*	A	A	A	A
Sulfur Trioxide	B	U	B	U	A
Sulfuric Acid (Dilute)	C	U	B	A	A
Sulfuric Acid (Concentrated)	U	U	B	B	A
Sulfuric Acid (20% Oleum)	U	U	U	U	A
Sulfurous Acid	B	B	B	A	A
Tannic Acid	A	A	A	A	A
"Tar, Bituminous"	U	B	U	C	A
Tartaric Acid	A	A	B	A	A
Terpineol	U	B	U	C	A
Tertiary Butyl Alcohol	B	B	B	B	A
Tertiary Butyl Catechol	U	U	B	B	A
Tertiary Butyl Mercaptan	U	U	U	U	A
Tetrabromomethane	U	U	U	*	A
Tetrabutyl Titanate	B	B	A	A	A
Tetrachlorethylene	U	U	U	*	A

Key	Natural Rubber	Buna N	EPDM	Hypalon®	Viton®
Tetraethyl Lead	U	B	U	C	A
Tetrahydrofuran	U	*	B	*	U
Tetralin	U	U	U	U	A
Thionyl Chloride	U	*	U	*	A
Titanium Tetrachloride	U	C	U	U	A
Toluene	U	U	U	U	A
Toluene Diisocyanate	C	*	A	U	*
Transformer Oil	U	A	U	B	A
Transmission Fluid Type A	U	A	U	B	A
Triacetin	B	B	A	B	U
Tributoxy Ethyl Phosphate	B	U	A	U	A
Tributyl Phosphate	B	U	A	C	U
Tributyl Mercaptan	U	U	U	U	A
Trichlorethane	U	U	U	U	A
Trichloreacetic Acid	C	B	B	B	C
Trichlorethylene	U	C	U	U	A
Tricresyl Phosphate	U	U	A	C	B
Triethanol Amine	B	C	B	A	U
Triethyl Aluminum	*	*	*	*	B
Triethyl Borane	*	*	*	*	A
Trinitrotoluene	U	U	U	B	B
Triactyl Phosphate	U	U	A	U	B
Triaryl Phosphate	U	U	A	C	A
Tung Oil	U	A	U	B	A
Turbine Oil	U	B	U	B	A
Turpentine	U	A	U	U	A
Unsymmetrical Dimethyl hydrozine (UDMH)	*	B	A	A	U
Varnish	U	B	U	C	A
Vegetable Oils	U	A	A	B	A
Versalube	A	A	A	A	A
Vinegar	B	B	A	A	A
Vinyl Chloride	*	*	B	U	A

Key	Natural Rubber	Buna N	EPDM	Hypalon®	Viton®
Wagner 21B Fluid	*	C	A	B	U
Water	A	A	A	A	A
Whiskey, Wines	A	A	A	A	A
White Pine Oil	U	B	U	U	A
White Oil	U	A	U	B	A
Wood Oil	U	A	U	B	A
Xylene	U	U	U	U	A
Xylidenes	U	C	U	U	U
Zeolites	A	A	A	A	A
Zinc Acetate	A	B	A	B	U
Zinc Chloride	A	A	A	A	A
Zinc Sulfide	B	A	A	A	A

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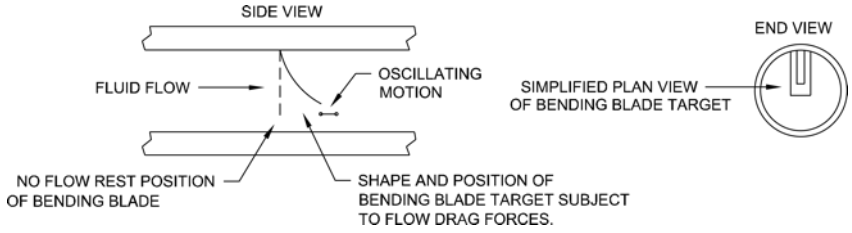
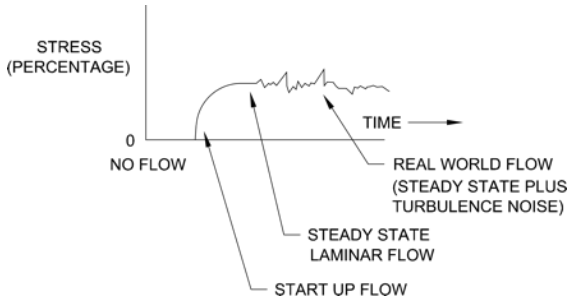
Discussion of Permanent Set and Fatigue Life of Q-12 Flow Sensing Blade

Model Q-12 Flow Switch employs a 316 Stainless target blade which is inserted into the fluid flow which produces a drag force on the target blade which is then displaced in a downstream direction. Fig. I illustrates the basic configuration of this design approach.

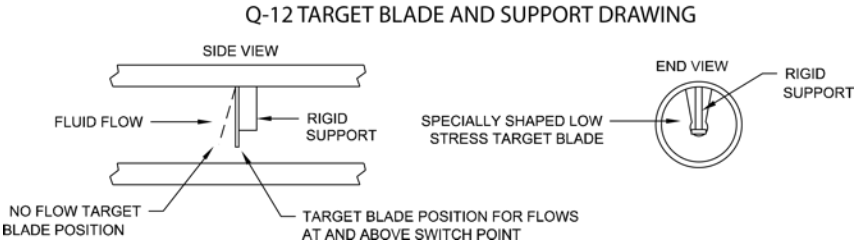


As shown in the side view of Fig. I, the target blade is bent downstream in a fixed position and shape by flow induced forces. Superimposed on this "fixed position" is oscillatory motion produced by turbulence in the fluid flow. The target blade is subjected to a steady stress level plus a variable stress level caused by turbulence.

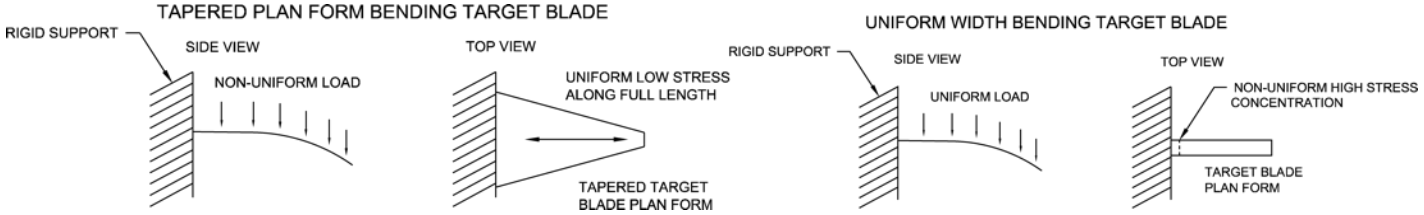


Steady state stress can cause slow creep in a bending blade or beam over long periods plus turbulent noise oscillations can cause beam fatigue which can change the response of the beam to flow drag forces which in turn produces a drift in the switch point and may ultimately lead to failure of the target blade due to fatigue.

The target beam design employed in Model Q-12 plus other design features reduce both steady state and turbulent noise stresses to negligible levels thus providing no significant switch point drift or turbulent noise fatigue for periods measured in years. Fig. III illustrates the design approach used in Model Q-12 to provide this long term trouble free performance.



As shown in Fig. III, the rigid support post restricts the maximum deflection of the target blade and at the same time eliminates the turbulence induced vibration of the blade, thus simultaneously accomplishing the two important performance requirements for long-term elimination of drift and fatigue discussed above. The maximum stress level in the target beam can be further reduced by employing special shapes which are used in Model Q-12. The maximum upper limit of the stress level in the Q-12 bending blade can be measured using standard bending beam equations and "worst case" geometry. Figure IV illustrates the worst case geometry used in our maximum stress measurement program.



Standard generally accepted engineering practice in the design of all types of springs including the bending target blade used in the Q-12 Flow Switch is to limit the maximum stress level to 50% or less of the yield strength of the material employed. This will provide a bending blade with essentially unlimited life with regard to both steady state stresses and turbulent noise vibration stresses. A calculation of the maximum stress level for the worst case target beam illustrated in Fig. IV gave a value of 23% of yield, stress level. This is substantially less than the generally accepted 50% value. When the Q-12 Flow Switch special tapered target configurations shown in Fig. V is introduced the maximum stress level drops to less than 15% of the yield stress level. Thus Model Q-12 Flow Switch is clearly not subject to fatigue due to steady or vibrational loads.

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