CP-PC-2254E

azbil

Environment-Resistant Cylindrical Proximity Switches

Model FL7M-_____-C

Features

These proximity switches have a highly oil-resistant polyurethane (PUR) cable. They are designed for use in harsh coolant-filled environments like engine and transmission processing lines at automobile plants.

- **Highly coolant-resistant polyurethane is used for cable sheath/insulation.**
- **Standard models are available in M8, M12, M18, and M30 sizes.
Aluminum-chip resistant models are available in M12, M18, and M30 sizes.**
- **Special cable molding method boosts the seal with the sensor.**

Please read “Terms and Conditions” from the following URL before ordering and use.
https://www.azbil.com/products/factory/order.html

Azbil Corporation
Advanced Automation Company
Yamatake Corporation changed its name to Azbil Corporation on April 1, 2012.

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Kanagawa 251-8522 Japan
URL: http://www.azbil.com

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There are good reasons why Model FL7M-_ _ _ _ _C switches are used in harsh environments exposed to coolant attacks.

Switches incorporate superior materials to meet the evolving needs of the manufacturing plant.

In metal processing factories, to improve manufacturing speed and efficiency, the use of highly penetrating synthetic coolant has recently increased.

When switches are under constant stress in such harsh environments…

If the cable is PVC...

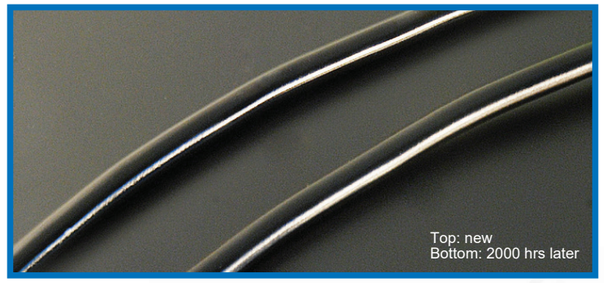
Chloromethane (PVC) cables bloat or harden when attacked by coolant. Eventually the insulation degrades and the connection is lost, causing switch malfunction.

Bloat

Hardening

As seen above, chloromethane (PVC) cables become severely deteriorated.

If the cable is PUR...



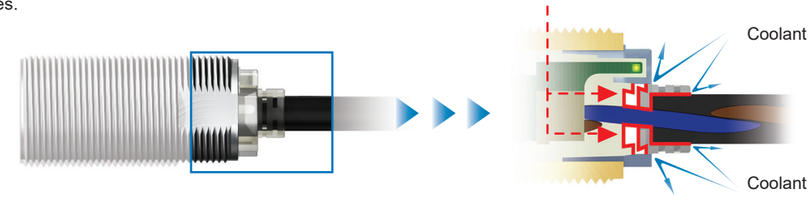
In contrast, polyurethane (PUR) cable retains almost the same appearance and performance.

Very reliable oil-resistant polyurethane (PUR) cables are used in Model FL7M-_ _ _ _ _-C environment-resistant cylindrical proximity switches.

Effective countermeasures against coolant intrusion.

Like the Model FL7M, Model FL7M-_____C switches are protected against coolant infiltration from the cable core.

In FL7M switches, the joint between the cable and switch is sealed, so the circuits are completely protected. This is a successful solution to the problem of coolant infiltration along the cable core wires.



Switch protection and stability are verified by product tests.

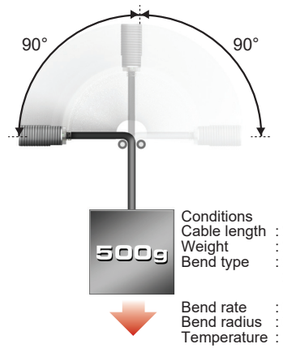
COOLANT IMMERSION TEST

For the soluble cutting oil immersion test, an accelerated product life test was conducted under the conditions below.

Classification of test oil	JIS classification	Details of test	Oil name
Water-insoluble cutting fluid	Equivalent to type 3 No.8	Immersion in 70˚C oil for 500 hrs	BM405
Water-miscible cutting fluid (emulsion)	Equivalent to type A1 No.1	Immersion in 70˚C oil for 500 hrs	EC50-T3
Water-miscible cutting fluid (soluble/synthetic)	Equivalent to type A2 No.1	Immersion in 70˚C oil for 500 hrs	PFS760

Note: The cutting oils used for these tests are products of Yushiro Chemical Industry Co., Ltd.

CABLE BENDING TEST



Conditions
Cable length : 500 mm
Weight : 500 g
Bend type : 90˚ left and right (one 2-way movement counts as 1 bend)
Bend rate : 60 bends/min
Bend radius : 6R
Temperature : Normal

PVC and PUR cables are tested according to the conditions shown to the left. The table below shows the number of bends before the cable's electrical connection was lost.

Cable type	M8 / M12 standard	M8 / M12 bend-tolerant	M8 / M30 standard	M8 / M30 bend-tolerant
Chloromethane (PVC)	7,000	240,000	7,000	581,000
Polyurethane (PUR)	20,000	285,000	36,000	639,000

Note: The values shown are measured values, not guaranteed ones.

For even harsher coolant environments, use environment-resistant proximity switches.

ORDER GUIDE

Standard type

Exterior		Sensing distance	Operation Mode	Setting indicator	Catalog listing
Appearance	Size (O.D.)				
Preleaded type (2 m cable)*1 	M8	2mm	N.O.	●	FL7M-2J6HD-C
			N.C.		FL7M-2K6H-C
	M12	3mm	N.O.	●	FL7M-3J6HD-C
			N.C.		FL7M-3K6H-C
	M18	7mm	N.O.	●	FL7M-7J6HD-C
			N.C.		FL7M-7K6H-C
	M30	10mm	N.O.	●	FL7M-10J6D-C
			N.C.		FL7M-10K6-C
Preleaded connector type (30 cm cable)*2 	M8	2mm	N.O.	●	FL7M-2J6HD-CC03
			N.C.		FL7M-2K6H-CC03
	M12	3mm	N.O.	●	FL7M-3J6HD-CC03
			N.C.		FL7M-3K6H-CC03
	M18	7mm	N.O.	●	FL7M-7J6HD-CC03
			N.C.		FL7M-7K6H-CC03
	M30	10mm	N.O.	●	FL7M-10J6D-CC03
			N.C.		FL7M-10K6-CC03

*1. Bend-tolerant cables are available. Their catalog listings have the appended letters “-CR” (example: FL7M-2J6HD-CR).
Also, 5 m cables are available. Their catalog listings have the appended letters “-C5/-CR5” (example: FL7M-2J6HD-C5).
*2. 0.5 m and 1 m cables are available. Their catalog listings have the appended letters “-CC05” and “-CC1” respectively.

Aluminum-chip resistant type

Exterior		Sensing distance	Operation Mode	Setting indicator	Catalog listing
Appearance	Size (O.D.)				
Preleaded type (2 m cable)*1 	M12	2mm	N.O.	●	FL7M-2J6AD-C
			N.C.		FL7M-2K6A-C
	M18	4mm	N.O.	●	FL7M-4J6AD-C
			N.C.		FL7M-4K6A-C
	M30	8mm	N.O.	●	FL7M-8J6AD-C
			N.C.		FL7M-8K6A-C
Preleaded connector type (30 cm cable)*2 	M12	2mm	N.O.	●	FL7M-2J6AD-CC03
			N.C.		FL7M-2K6A-CC03
	M18	4mm	N.O.	●	FL7M-4J6AD-CC03
			N.C.		FL7M-4K6A-CC03
	M30	8mm	N.O.	●	FL7M-8J6AD-CC03
			N.C.		FL7M-8K6A-CC03

*1. Bend-tolerant cables are available. Their catalog listings have the appended letters “-CR” (example: FL7M-2J6AD-CR).
Also, 5 m cables are available. Their catalog listings have the appended letters “-C5/-CR5” (example: FL7M-2J6AD-C5).
*2. 0.5 m and 1 m cables are available. Their catalog listings have the appended letters “-CC05” and “-CC1” respectively.

SPECIFICATIONS

Standard type

Size			M8	M12	M18	M30
Catalog listing			FL7M-2_6H(D)-C	FL7M-3_6H(D)-C	FL7M-7_6H(D)-C	FL7M-10_6(D)-C
			FL7M-2_6H(D)-CC03	FL7M-3_6H(D)-CC03	FL7M-7_6H(D)-CC03	FL7M-10_6(D)-CC03
Actuation method			High-frequency oscillation (shielded)			
Rated sensing distance			2 ±0.2 mm	3 ±0.3 mm	7 ±0.7 mm	10 ±1 mm
Standard target object			8 x 8, 1 mm, iron	12 x 12, 1 mm, iron	18 x 18, 1 mm, iron	30 x 30, 1 mm, iron
Differential travel			15% max. of sensing distance			
Rated supply voltage (operating voltage range)			12/24 Vdc (10 to 30 Vdc)			
Leakage current			0.55 mA max.			
Control output			Switching current 3 to 100 mA, voltage drop 3 V max. (at 100 mA switching current with 2 m cable), output dielectric strength 30 Vdc			
Indicator lamps			N.O. type: Operation indication: Lights up (orange or green) upon output Setting indication: Lights up (green) in stable sensing area			
			N.C. type: Operation indication: Lights up orange upon output			
Ambient operating temperature			–25 to +70˚C			
Protective structure			IP67 (IEC standard), IP67G (JEM standard)			
Circuit protection			Surge absorption, load short-circuit protection, reverse connection protection circuit			
Wiring method			Preleaded, Preleaded connector			
Material	Cable	Sheath	Polyurethane (PUR)			
		Insulation	Polyurethane (PUR)			
	Switch	Housing	SUS	Ni-plated brass		
		Sensing surface	PBT			
	Connector	Housing	Polyurethane (PUR), PBT			
		Holder	Glass-lined polyester resin			
		Contacts	Gold-plated brass			

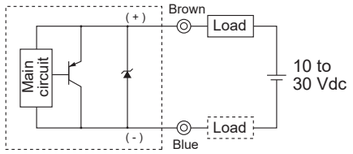
Aluminum-chip resistant type

Size			M12	M18	M30
Catalog listing			FL7M-2_6A(D)-C	FL7M-4_6A(D)-C	FL7M-8_6A(D)-C
			FL7M-2_6A(D)-C03	FL7M-4_6A(D)-CC03	FL7M-8_6A(D)-CC03
Actuation method			High-frequency oscillation (shielded)		
Rated sensing distance			2 ±0.2 mm	4 ±0.4 mm	8 ±0.8 mm
Standard target object			12 x 12, 1 mm, iron	30 x 30, 1 mm, iron	54 x 54, 1 mm, iron
Differential travel			20 % max. of sensing distanceble), output dielectric strength 30 Vdc		
Rated supply voltage (operating voltage range)			12/24 Vdc (10 to 30 Vdc)		
Leakage current			0.55 mA max.		
Control output			Switching current 3 to 100 mA, voltage drop 3 V max. (at 100 mA switching current with 2 m cable), output dielectric strength 30 Vdc		
Indicator lamps			N.O. type: Operation indication: Lights up (orange or green) upon output Setting indication: Lights up (green) in stable sensing area		
			N.C. type: Operation indication: Lights up orange upon output		
Ambient operating temperature			–25 to +70˚C		
Protective structure			IP67 (IEC standard), IP67G (JEM standard)		
Circuit protection			Surge absorption, load short-circuit protection, reverse connection protection circuit		
Wiring method			Preleaded, Preleaded connector		
Material	Cable	Sheath	Polyurethane (PUR)		
		Insulation	Polyurethane (PUR)		
	Switch	Housing	SUS	Ni-plated brass	
		Sensing surface	PBT		
	Connector	Housing	Polyurethane (PUR), PBT		
		Holder	Glass-lined polyester resin		
		Contacts	Gold-plated brass		

WIRING DIAGRAMS

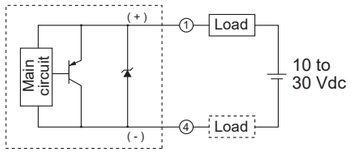
Standard and aluminum-chip resistant types

Preleaded type



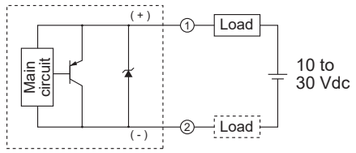
The load may be connected to either pole.

Preleaded connector type (N.O.)



The load may be connected to either pole.

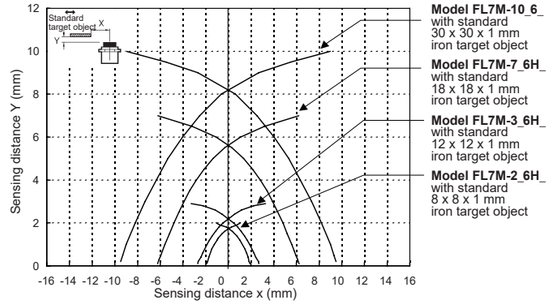
Preleaded connector type (N.C.)



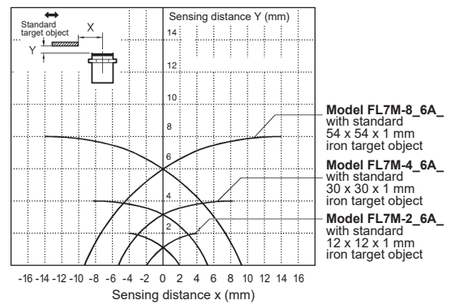
The load may be connected to either pole.

SENSING AREA (typical)

Standard type



Aluminum-chip resistant type

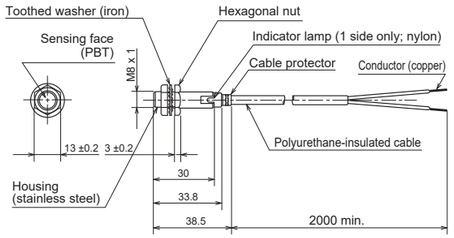


EXTERNAL DIMENSIONS (for both standard and aluminum-chip resistant types)

(unit: mm)

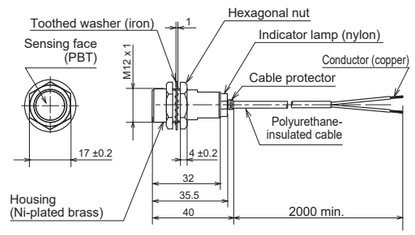
Preloaded type

M8 (standard type only)



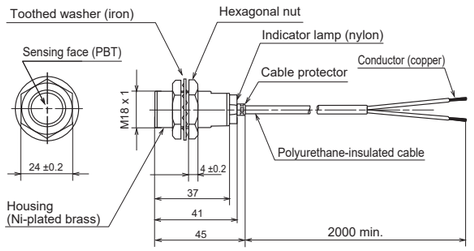
Insulated cable (oil-resistant, 0.3 mm², 27/0.12 dia., 2-core), dia. 4.1
Cap color: blue

M12



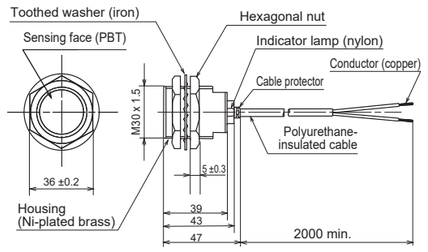
Insulated cable (oil-resistant, 0.3 mm², 27/0.12 dia., 2-core), dia. 4.1
Cap color: blue

M18



Insulated cable (oil-resistant, 0.5 mm², 20/0.18 dia., 2-core), dia. 5.7
Cap color: blue

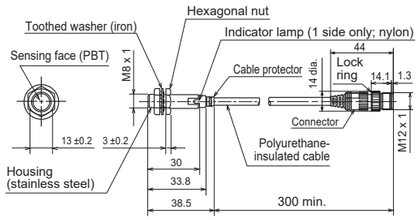
M30



Insulated cable (oil-resistant, 0.5 mm², 20/0.18 dia., 2-core), dia. 5.7
Cap color: blue

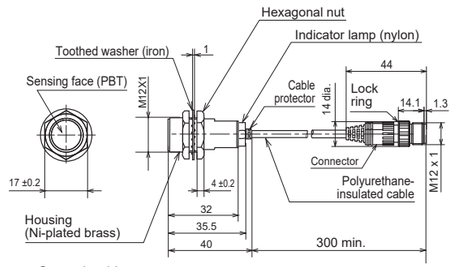
Preloaded Connector type

M8 (standard type only)



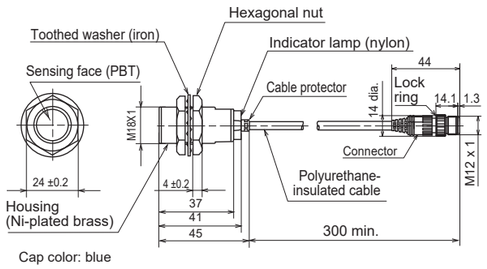
Cap color: blue

M12



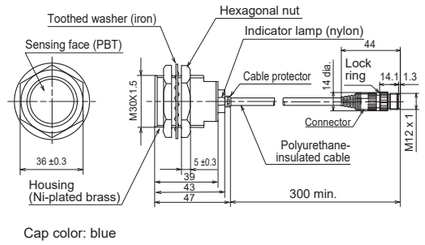
Cap color: blue

M18



Cap color: blue

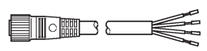
M30



Cap color: blue

CONNECTOR WITH CABLE

● **Model PA5 connector with cable**

Shape	Power	Cable properties	Cable length	Catalog listing	Core colors
	DC	Oil-resistant, polyurethane-insulated	2 m	**PA5-4ISX2CK**	1: brown, 2: white, 3: blue, 4: black
			5 m	**PA5-4ISX5CK**	

Environment-resistant switches

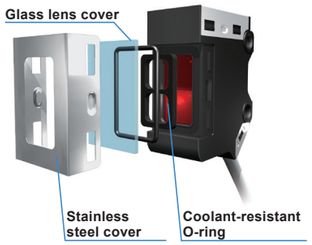
Environment-resistant photoelectric switches Model H2B

Problems ▶ **Mist coolants are often used near photoelectric sensors. Since most swithches are made of resin, coolant intrusion through cracks in the case or lens, attenuation of light intensity, and similar problems occur after a short period of time, and the number of such cases is increasing.**

Structural reinforcement to resist coolants

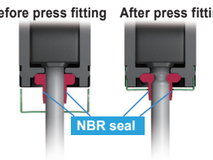
Protection for switch housing

Protection for optical parts



Protection for cable interior

Cable port
High sealing performance by press-fit NBR seal



Cable interior
Epoxy potting prevents water intrusion

Water intrusion via cable relay terminal
Products can be used with 10 m cable

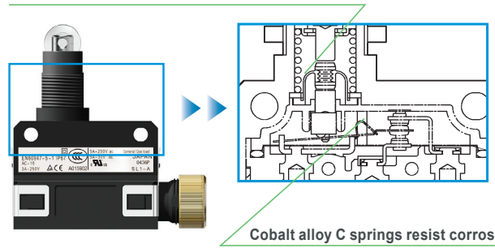
- No more need to worry about cracked cases or attenuation of light due to lens fogging
- High sealing performance ensures normal operation even after 500-hour immersion heat cycle test

Environment-resistant limit switch Mode SL1-_C

Problems ▶
- **Internal plunger cup seal deteriorates, causing insulation failure**
- **Springs break due to corrosion, causing faulty operation**

The number of problems occurring after a short period of time is increasing.

Integrally molded seal (pin/rubber)
Structure that does not easily crack during sliding
Coolant is shut out



Cobalt alloy C springs resist corrosion

Various types are environment-resistant.

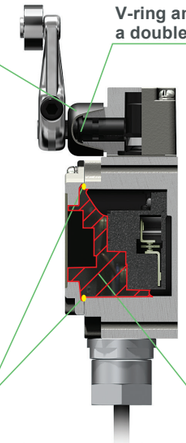
Model	Actuator type
SL1-AC	Roller plunger
SL1-BC	Boot seal roller plunger
SL1-DC	Cross roller plunger
SL1-EC	Long roller plunger
SL1-HC	Plunger
SL1-PC	Short roller lever

- New cup seal shape remedies problem of cracking followed by insulation deterioration
- Cobalt alloy C springs resist corrosion by coolant

Environment-resistant limit switch Model 1LS-J_____-MD03

Boot seal

V-ring and O-ring provide a double seal



Secured by O-ring and epoxy filling

Filled with epoxy resin

- V-ring and O-ring between the head and shaft provide a double seal
- The internal switch terminals, the cable core, and the conduit section are filled with epoxy resin after the connector is tightened
- The joint between the housing and cover is sealed by O-ring and epoxy resin filling