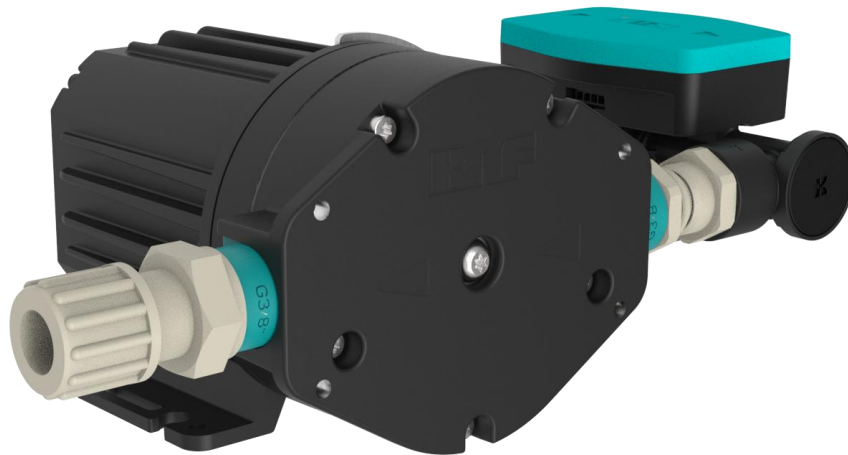


FMS-FC 1.400

INSTALLATION
INSTRUCTIONS

METERING PUMP WITH FLOW CONTROL



FMS-FC 1.400

Before operating the product and the accessories, please read the Installation Instructions and pay attention to the safety precautions.

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1 General information

1.1 Information about the instructions

Contents	The Installation Instructions describe the requirements for correct and safe installation of the product in the complete machine.
Storage location	These Installation Instructions are part of the product. Information that relates to safety should be used for the documentation of the complete machine.
Customer-specific products	Customer-specific products (products that begin with “PL” or “PML”) may differ from the Installation Instructions.

1.2 Warnings

Warnings in the Installation Instructions are identified with the danger symbol, keywords, and colors. These provide an indication of the extent of the danger.



⚠ DANGER

Indicates a dangerous situation that will lead directly to death or serious injury if it is not avoided.



⚠ WARNING

Indicates a dangerous situation that may lead to death or serious injury if it is not avoided.



⚠ CAUTION

Indicates a dangerous situation that may lead to moderate or minor injuries if it is not avoided.

NOTICE

Indicates a situation that may cause damage to property if it is not avoided.

1.3 Disclaimer of liability

The manufacturer can accept no liability for any damage or malfunctions caused by failure to follow the Installation Instructions.

The manufacturer can accept no liability for any damage or malfunctions caused by modification or conversion of the device or improper handling.

The manufacturer can accept no liability for any damage or malfunctions caused by improper modification of parameters.

The manufacturer can accept no liability for any damage or malfunctions caused by the use of non-approved spare parts and accessories.

1.4 Manufacturer's address

KNF Flodos AG
Wassermatte 2
6210 Sursee, Switzerland
Tel +41 (0)41 925 00 25

www.knf.com

1.5 Other applicable documents

The documents listed must also be taken into consideration. The valid versions can be found at www.knf.com.

- Data sheet
- 3D model
- Declaration of incorporation

The following should also be observed:

- Local T&Cs
- Sales documents and agreement between KNF and the customer
- Interface description

2 Safety

2.1 Intended use

The product is intended exclusively for use as follows:

- To transfer liquids and gases
- For operation in accordance with the operating parameters specified in the technical data of the applicable documents

2.2 Reasonably foreseeable misuse

The product may not:

- be operated in an explosive atmosphere;
- be used to transfer explosive media;
- be used to transfer media whose compatibility with the pump head, valves, diaphragms, ultrasonic sensor, and seals has not been established;
- be operated contrary to the specifications in the data sheet.

2.3 Responsibility of the user

The user is responsible for ensuring compliance with the safety precautions in these Installation Instructions. Applicable safety, accident prevention, and environmental protection regulations must be complied with. The user is also responsible for ensuring that the configured firmware parameters guarantee the safe operation of the machine.

2.4 Product-specific dangers

This chapter describes residual risks that have been identified in a risk assessment. Safety precautions and warnings in this chapter and in other chapters in the Installation Instructions must be observed in order to avoid dangerous situations.

DANGER

Danger of injuries and property damage caused by hazardous materials

Poisoning and caustic burns, or undesirable reactions caused by escaping hazardous materials

- Observe the safety data sheets for the media to be transferred.
- Before transferring a medium, check whether it can be transferred safely in the specific instance.
- Ensure that the system is not subject to any risks of explosion – not even under extreme operating conditions (temperature, pressure) or in case of malfunctions.
- Ensure that the product is used by appropriately trained personnel.
- Determine the resistance of the materials in contact with the medium.
- Check that the product and system are leak-tight at the operating temperature of the medium to be transferred.
- Check the product regularly for damage.
- Use the product only if it is in perfect working order.
- Operate the product in accordance with the technical data.
- Carry out work on the pump, ultrasonic sensor, or fluid circuit only after they have been decontaminated and/or a decontamination declaration is available.



DANGER

Danger of injuries and property damage caused by leaks at interfaces to the pump head and ultrasonic sensor

Poisoning and caustic burns, or undesirable reactions caused by escaping hazardous materials

- Wear personal protective equipment.
- Connect the product correctly.
- Use the product only if it is in perfect working order.
- Operate the product in accordance with the technical data.



**⚠ DANGER****Danger of injuries and property damage caused by uncontrolled flows when the pump is not operating**

Poisoning and caustic burns, or undesirable reactions caused by escaping hazardous materials

- Construct the fluid circuit so that the operating pressure on the pressure side of the product is higher than on the suction side.
- Install a shut-off valve in the fluid circuit.

The risk analysis indicates a risk of explosion due to certain materials and substances.

**⚠ DANGER****Danger of injuries and property damage caused by an explosion in the pump**

The pump housing is made from aluminum. If the pump diaphragm is damaged, medium can accumulate in the housing and form hydrogen (especially with acids and lyes). This could cause an explosion in the pump housing.

- Check and monitor the reactivity of the medium with aluminum.
- No flammable materials in the immediate vicinity of the pump and piping.
- Monitor leaks with the optional leak sensor integrated in the housing.

The pump housing is designed to withstand pressure surges caused by explosions. The probability of a fault that would cause an explosion is deemed to be low. When installed in the system, the risks in the complete system must be assessed.



⚠ DANGER

Danger of injuries and property damage caused by an explosion in the connection lines and in the pump

Evaporation of flammable liquids

- When flammable liquids are transferred, an explosive atmosphere can form in the pump and in the lines during filling and emptying.
- With the hoses that are used, make sure that no electrostatic charges can form (use conductive materials, grounding, and potential equalization).
- The hoses and piping used must be able to withstand the potential pressure of explosion.



⚠ DANGER

Danger of injuries and property damage caused by the pump exploding

If the pump has not been used or has been stored for some time, residual medium may evaporate and form an explosive atmosphere.

- If the pump has not been used for some time or is stored: Drain the pump and flush with neutral medium to prevent a subsequent reaction.



⚠ WARNING

Danger of injuries and property damage caused by leaks to the environment

Flammable materials

- Keep flammable materials away from the immediate vicinity of the pump and piping.



⚠ CAUTION

Danger from overheated electrical components

If the pump diaphragm is damaged, medium can reach the electronic circuit board and cause a partial short-circuit. In this case, inadmissibly high currents can occur if the overcurrent protection is insufficient.

- The product must be individually protected with an overcurrent protection device as specified on the rating plate.



⚠ WARNING

Danger from failure of the diaphragms

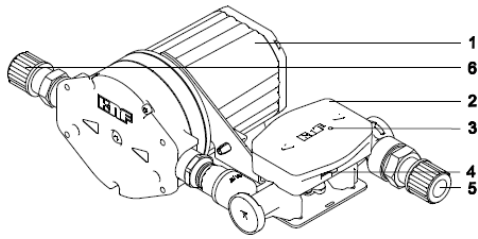
Injuries or damage to equipment caused by escaping media when the pump diaphragms are damaged.

- Take precautions in the design of the final system so that any escaping liquids cannot cause a hazard.
- Detect faults with the leak sensor that is integrated in the housing (available on request).
- Provide a drainage opening for the housing on request.

2.5 Compliance

The declaration of standard SJ-T 11364-2024 “Hazardous Substance Disclosure Table 有害物质含量表” is made in accordance with the specifications detailed in the appendix to this document.

3 Product description



1: Lowpulse diaphragm pump for transferring liquids with minimal pulsation.

2: Ultrasonic sensor for measuring the flow rate based on a time-of-flight difference measurement. Due to the measuring principle, the viscosity of the medium must be known and specified during device configuration.

Controller (in the housing). Fully integrated solution that controls the diaphragm pump based on the sensor data so that it can be regulated directly to a target flow rate, regardless of environmental influences such as counterpressure.

3: Integrated LED display to indicate various device statuses (see also chapter 9).

4: The FMS-FC system is connected to the customer system via an analog/digital or serial interface. In addition to the two basic functions (controlled operation with target value specification and measurement of the flow rate), further functions (air detection, diagnostics, temperature measurement, etc.) are available. (See also chapter 4).

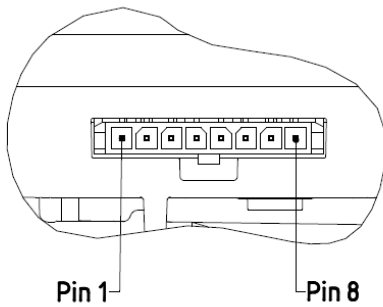
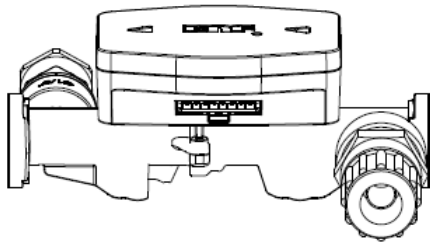
The device configuration (e.g. viscosity input) and initial tests can be carried out using the “KNF Connect” web tool. Separate interface documentation and examples in source code are available for implementation in the final application.

5: Hydraulic connection to the customer system: Suction side

6: Hydraulic connection to the customer system: Pressure side

4 Interfaces

4.1 Pin assignment



Device socket: Molex Micro-Fit 3.0 Header, manufacturer no. 436500800

Number	Description	Function *
PIN 1	Analog/digital GND	GND analog/digital input/output
PIN 2	Analog/digital input *	Target flow rate
PIN 3	Analog/digital output *	Measured flow rate
PIN 4	Serial GND	GND for serial communication
PIN 5	Serial COM 1	Rx (receive)
PIN 6	Serial COM 2	Tx (send)
PIN 7	GND	GND for power supply
PIN 8	24 V	Power supply

* Customer-specific adaptations (e.g. analog input/output, other output values or interfaces) are possible. Please contact your local KNF representative.

4.2 Analog/digital interface

Depending on customer requirements, the product is supplied with analog or digital (standard) inputs and outputs.

4.2.1 Default setting

PIN2 is configured as an analog input 0-5V. The input can also be operated with a PWM signal (10kHz, 5V).

- 0V = 0l/min
- 5V = 5.0l/min

The permissible flow rate range of the product must be observed during activation (refer to the data sheet).

To reduce inaccuracies in the analog circuit, PIN2 can also be configured as a PWM input (direct pulse width detection) upon customer request. Please contact your local KNF representative for more information.

PIN3 is configured as PWM output (10kHz, 5V).

- 0% = 0l/min
- 100% = 5.0l/min

Depending on the input filter of the customer's readout unit, an analog value can also be read out.

4.3 Serial interface

The CANopen protocol is used for communication via the serial interface. The following tools are available:

- KNF Connect for device configuration and initial tests (separate documentation). KNF Connect is not intended for permanent use in the final application.
- Documentation of the serial interface and sample code for implementation in the customer application (separate documentation)
- USB connection cable (see accessories)

5 Functional description

Technical details for implementing the individual functions can be found in the separate interface documentation.

For customer-specific functions or customizing the output options, please contact your local KNF representative.

5.1 Controlled operation with specified flow rate

The product has an integrated PID controller structure so that a flow rate setpoint is maintained within the specified range regardless of the ambient conditions (e.g. counterpressure).

If the flow rate setpoint is not reached (e.g. due to excessive counterpressure), a warning is issued via the serial interface and the LED display (flashing green).

The setpoint specification can be input via the following interfaces:

- Input via the serial interface
- Input via the analog/digital input

For reliable controlled operation, the system must be free of air. For air-free filling, the fluid circuit should be filled from bottom to top, existing valves opened, and the circuit flushed with a high flow rate setpoint.

5.2 Measuring the flow rate

In order to ensure absolute measurement accuracy with the ultrasonic measurement principle, the viscosity of the medium at 20°C must be known and communicated to the device as input via the serial interface (either via KNF Connect or your own implementation).

The temperature-dependent change in viscosity is automatically compensated for by the product with the aid of the integrated temperature probe.

The viscosity is input and the measured values are output via the following interfaces:

- Viscosity input via serial interface
- Measurement output via serial interface
- Measurement output via analog/digital output

Unless otherwise specified, the viscosity is set by default to 1mPas at 20°C. Custom viscosities can also be specified by KNF as the default product configuration.

For an accurate measurement, the system must be free of air. For air-free filling, the fluid circuit should be filled from bottom to top, existing valves opened, and the circuit flushed with a high flow rate setpoint.

5.3 Air detection

The product can detect air bubbles in the measurement channel and output them via the interface. Air detection is output in three stages:

- No air (accuracy within specification)
- Air in the system (limited accuracy)
- Lots of air in the system (no measurement possible)

Air detection is output via the following interfaces:

- Output via LED status display
- Output via serial interface
- Output via analog/digital interface (configurable on request)

5.4 Temperature measurement

The product has a built-in temperature sensor (PT100 probe). The temperature probe is located in the fluid channel, but is not in direct contact with the medium. Due to the measuring arrangement, the response time is relatively slow. In addition, the measurement may deviate from the actual media temperature due to the external ambient conditions.

The temperature is output via the following interface:

- Output via serial interface
- Output via analog/digital output possible on request

5.5 Autostart

The product can be parameterized so that the pump starts transferring the medium immediately when the power supply is applied. Parameterization is carried out via the serial interface.



⚠ CAUTION

Risk of the pump starting up unexpectedly

- When operating in autostart mode, ensure that there is no danger from the pump starting up directly.
- To ensure a safe shutdown, disconnect the power supply to the product.

5.6 Error detection

The product has a built-in fault detection function. Details can be found in the "Maintenance" chapter.

Errors are output via the following interfaces:

- Output via LED status display
- Output via serial interface
- Output via analog/digital output possible on request

6 Installation



⚠ WARNING

Danger as a result of incorrect installation

Injuries or damage to equipment caused by escaping media

- After installation, check the system for leaks with a safe medium.
- Observe the requirements for correct use.
- Take precautions in the design of the final system so that any escaping liquids cannot come into contact with live components.

The following requirements apply to all the activities described in this chapter:

6.1 Installation location

The installation location must:

- protect the product against immersion;
- keep away aggressive and flammable liquids and vapors;
- enable hose connections with no tensile or bending loads;
- take into account cooling of the pump drive;
- consider handling of any leaks;
- have appropriate precautions if flammable media are used.

6.2 Mechanical fixture

- Protect the product against shocks, impacts, and strong vibrations.
- For dimensions, mounting positions, fluid connections, refer to the product data sheet.

6.3 Connecting the fluid system

- Use suitable means to check the fluid connection for leaks.
- For more information about dimensions, refer to the data sheet.

6.4 Electrical connection

For terminal assignment, performance specifications, and control requirements, refer to the data sheet.

Observe the regulatory requirements for electrical installations:

- Overload protection and isolating protective devices according to the current value on the rating plate. The pump must be individually protected
- Contact protection and additional insulation
- Ground connections
- Protection against vibrations, tensile loading, and corrosion

Warning:

The product can be parameterized so that the pump starts transferring the medium immediately when the power supply is applied.

Parameterization is carried out via the serial interface.



⚠ CAUTION

Risk of the pump starting up unexpectedly

- When operating in autostart mode, ensure that there is no danger from the pump starting up directly.
- To ensure a safe shutdown, disconnect the power supply to the product.

7 Initial start-up

The product may not be put into service until it has been determined that the machine in which the product is to be installed complies with the provisions of the Machinery Directive 2006/42/EC, if applicable.



⚠ WARNING

Danger of rupture of the fluid system as a consequence of overpressure

The pump builds up pressure. In a closed system, it is possible that the maximum permitted operating pressure may be exceeded. This can cause injuries or damage to the product and system.

- Prevent operation against a closed system.
- In the case of parts that are in contact with the fluid, use only those that are designed for the system's operating pressure as a minimum.
- If necessary, take suitable measures to limit the maximum system pressure.



⚠ CAUTION

Danger of unexpected chemical reactions with water

Water residues left in the product from testing in the factory may react with the transferred medium.

- Before putting the product into service, flush it with a medium that is not critical with regard to water.



⚠ CAUTION

Danger of hot surfaces

The pump becomes hot during operation. Burns may be caused by hot surfaces or injuries may occur as a result of uncontrolled movements.

- Do not touch the pump while it is operating.
- Ensure sufficient cool air and keep an appropriate distance to adjacent components.
- Operate the product in accordance with the technical data.
- At medium temperatures above 50°C, take safety precautions against burns on fluid components.

Before switching on the product, check the following:

- All hoses attached properly
- Product is mechanically fixed
- Specifications of the power supply correspond with the data on the pump's type plate
- Product outlet not blocked
- All cables properly connected
- Contact protection for electrical connections and moving parts installed

Warnings:

The product can be parameterized so that the pump starts transferring the medium immediately when the power supply is applied. Parameterization is carried out via the serial interface.

The product automatically detects various device states such as warnings, malfunctions, and defects (see Chapter 9 LED status display). In the event of a malfunction (flashing red, motor stops), a so-called SelfReset mechanism is activated: As soon as the cause of the malfunction is resolved, the device automatically switches back to normal operation and the motor restarts independently.



⚠ CAUTION

Risk of the pump starting up unexpectedly

- When operating in autostart mode, ensure that there is no danger from the pump starting up directly.
- For the cases of malfunction, ensure that no danger arise from the automatic restart (SelfReset mechanism).
- To ensure a safe shutdown, disconnect the power supply to the product.

8 Maintenance

Ask your KNF representative about the availability of spare parts for this product.

Maintenance of the pump is possible and documented in the Installation Instructions for the pump.

9 LED status display

The product has a built-in LED status display, which can assume the following statuses.

LED status	Cause	Remedy
Continuous green light	Normal operation	-
Green, flashing (Warning, engine continues to run)	Internal controller cannot keep flow stable	Check fluid circuit. SelfReset: As soon as the fault has been rectified, the device switches to normal operation (continuous green light).
	Specified flow rate cannot be achieved	The product is being operated contrary to the specifications (e.g. counterpressure too high for the specified flow rate setting or reduction of the flow rate due to a fluid with high viscosity). Comply with the flow rate setting according to the specifications (refer to the data sheet). SelfReset: As soon as the flow rate setting is within the specified range, the device switches to normal operation (continuous green light).
	Air in the system	Check the fluid circuit for leaks or air pockets. Use KNF Connect for more precise diagnosis (air level). Flush the product in manual mode at high speed. Note: With foaming media or in closed fluid circuits, air can accumulate in the form of micro-bubbles that prevent measurement. Particles dissolved in the fluid can also deflect ultrasonic signals and trigger the same error message. SelfReset: As soon as there is no more air in the system, the device switches to normal operation (continuous green light).
	Medium temperature too high	Check media temperature according to specification (refer to the data sheet).

Red, flashing (fault, motor is stopped)	Operation above performance limit	<p>Check the performance limits of your product (pressure, flow rate, etc.).</p> <p>Warning: The pump builds up pressure. In a closed system, the maximum permitted operating pressure can be exceeded without the motor immediately reaching its performance limit (see chapter "7 Initial start-up").</p> <p>SelfReset: As soon as the performance limit is reached, the appliance switches to normal operation (continuous green light).</p>
	Supply voltage too high or too low	<p>Check voltage according to specification.</p> <p>SelfReset: As soon as voltage is applied in accordance with the specification, the device switches to normal operation (continuous green light).</p>
	Internal signal fault (e.g. due to EMC)	<p>Check electrical installation according to specification.</p> <p>SelfReset: As soon as there is no longer an internal signal fault, the device switches to normal operation (continuous green light).</p>
Continuous red light (defect, motor is stopped)	The motor is blocked and does not rotate despite being activated by the sensor	<p>Disconnect the product from the power supply. Check the motor and cable for visible damage.</p> <p>Reset: Power OFF/ON required.</p>
	Flow measurement not possible due to inconsistent signals (sensor defective)	<p>Reset: Power OFF/ON required.</p>
	Internal communication error	<p>Reset: Power OFF/ON required.</p>

If the fault cannot be rectified, please consult chapter "10 Rectifying transfer problems".

10 Rectifying transfer problems

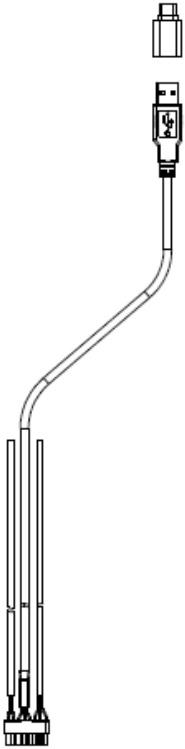
Transfer problems that cannot be detected by the sensor (no output via LED status display or the serial interface) are described below.

Symptom	Cause	Remedy
The pump does not suck or vacuum is insufficient	External valve is closed	Check external valves
	Counterpressure on pressure side is too high	Change pressure conditions on pressure side
	Particles in the product	Flush product Use preventive pre-filters
Pump does not transfer	External valve is closed, or filter is clogged or too small	Check external valves and filters
	Connections or piping are blocked	Check connections or piping Remove blockage
Flow rate is insufficient or unstable	Cross-section of hydraulic hoses or connectors too narrow or restricted	Disconnect the product from the system to determine performance values Remove restriction (e.g. valve), if necessary If applicable, use larger-diameter hoses or connectors
	Higher counterpressure in the system than assumed for the design	Contact KNF representative
	Particles in the product	Flush product Use preventive pre-filters Replace pump head
	Pump has reached the end of its service life	Replace product
Leak on pump head	Diaphragm defective	Contact KNF representative

If the problem cannot be resolved, please contact your local KNF representative (www.knf.com)

11 Accessories/Options

USB connection cable (serial + analog/digital)



12 Returning the product

KNF undertakes to repair the product only on condition that the customer provides a certificate of the pumped medium and cleaning of the pump. To do this, please follow the instructions at www.knf.com/repairs.

Please contact your KNF sales representative directly if you need additional support for your return service.

13 Appendix

13.1 RoHS Declaration for China

SJ-T 11364-2024 Hazardous Substance Disclosure Table / SJ-T 11364-2024 有害物质含量表

This declaration is valid for the KNF products produced by:
 本声明适用于由以下KNF公司生产的产品:


KNF Flodos AG

CH-6210 Sursee

Switzerland

The following information has been made available to comply with SJ-T 11364-2024 the Marking for Control of Pollution Caused by Electronic Information Products as required by China's Management Methods for the Control of Pollution from Electronic Information Products.

提供以下信息旨在遵守中国《电子信息产品污染控制管理办法》所要求的 SJ-T 11364-2024 《电子信息产品污染控制标识》标准。

Part Name 部件名称	Hazardous Substances Table 有害物质含量表						EFUP / 环境友好使 用期限 	China RoHS comment / 中国RoHS注释	EU RoHS compliant 符合欧盟RoHS指令
	Lead 铅 (Pb)	Mercury 汞 (Hg)	Cadmium 镉 (Cd)	Hexavalent Chromium 六价铬 (Cr(VI))	Polybrominated biphenyls 多溴联苯 (PBB)	Polybrominated diphenyl ethers 多溴二苯醚 (PBDE)			
Pump head / 泵头	X	0	0	0	0	0	20	Lead within EU RoHS exemption limit / 铅含量在欧盟RoHS豁免限值以内	Yes / 是
Pump housing / 泵体	X	0	0	0	0	0	20	Lead within EU RoHS exemption limit / 铅含量在欧盟RoHS豁免限值以内	Yes / 是
Pump motor / 泵的电机	X	0	0	0	0	0	20	Lead within EU RoHS exemption limit / 铅含量在欧盟RoHS豁免限值以内	Yes / 是
Additional components for systems / 系统附加部件	X	0	0	0	0	0	20	Lead within EU RoHS exemption limit / 铅含量在欧盟RoHS豁免限值以内	Yes / 是
<p>O: Indicates that this toxic or hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement in SJ-T 11364-2024. 表示该有害物质在该部件所有均质材料中的含量均在 SJ-T 11364-2024 规定的限量要求以下。</p> <p>X: Indicates that this toxic or hazardous substance contained in at least one of the homogeneous materials used for this part is above the limit requirement in SJ-T 11364-2024. 表示该有害物质至少在该部件的某一均质材料中的含量超出 SJ-T 11364-2024 规定的限量要求。</p>									
EFUP / 环境友好使用期限: Environment Friendly Using Period / 环境友好使用期									

