ROBOTICS

Product manual

Feather Duster V2

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Product manual
Feather Duster V2

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Original instructions.

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Sweden

Table of contents

Overview of this manual

About this manual

This manual contains instructions for:

- mechanical and electrical installation of the robot
- maintenance of the robot
- mechanical and electrical repair of the robot.

Usage

This manual should be used during:

- installation, from lifting the robot to its work site and securing it to the foundation, to making it ready for operation
- maintenance work
- repair work and calibration.

Who should read this manual?

This manual is intended for:

- installation personnel
- maintenance personnel
- repair personnel.

Prerequisites

A maintenance/repair/installation craftsman working with an ABB Robot must:

- be trained by ABB and have the required knowledge of mechanical and electrical installation/repair/maintenance work.

Organization of chapters - NOT MANDATORY

The manual is organized in the following chapters:

Chapter	Contents

References

Documentation of ABB products, referred to in the manual, is listed in the table below.

Document name of ABB products	Document ID
Product manual - IRC5	*3HAC047136-001*
Operating manual - General safety information [i]	*3HAC031045-001*
Operating manual - Getting started, IRC5 and RobotStudio	*3HAC027097-001*
Operating manual - Service Information System	*3HAC050944-001*
Operating manual - IRC5 with FlexPendant	*3HAC050941-001*
Product manual - IRB 6640	*3HAC026876-001*
Product manual - IRB 6700	*3HAC044266-001*
Product specification - IRB 6640	*3HAC028284-001*

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Document name of ABB products	Document ID
Product specification - IRB 6700	*3HAC044265-001*
Application manual - DeviceNet Master/Slave	*3HAC050992-001*

i This manual contains all safety instructions from the product manuals for the manipulators and the controllers.

Documentation of non-ABB products, be referred to while using the Feather Duster V2, is listed in the table below.

Document name of non-ABB products	Download from...	Document ID
Product Manual of Motor 80WD-M02410-24V	http://dj.hstyq.com/Up-load/down/80WD/80WD-M02410-24V%20Model.pdf	
LPT080 Series Slip Ring with Through Bore 80mm	https://www.slipring.cn/up-Load/product/month_1710/20171018173252791.pdf	
Ultra-High Speed, Sheath-Sensing Ioniser, SJ-H Series	https://www.keyence.com.cn/mykey-ence/?ptn=001&dlLangType=en-GB&dlLangId=	

Revisions

Revision	Description
A	First edition.
B-onging	Changes made in: • Added the lifting method when lifting the feather duster from the package. See *Lifting Feather Duster V2 with lifting accessories on page 53*. • Changed the screenshots of FlexPendant. See *Start-up of the Feather Duster V2 motor on page 77*. • Updated the connect method of the feather shaft. See *Repairing activities on page 98*. • Updated several article number. See *Spare parts on page 181*.

Product documentation

Categories for user documentation from ABB Robotics

The user documentation from ABB Robotics is divided into a number of categories. This listing is based on the type of information in the documents, regardless of whether the products are standard or optional.

All documents can be found via myABB Business Portal, *www.myportal.abb.com*.

Product manuals

Manipulators, controllers, DressPack/SpotPack, and most other hardware is delivered with a **Product manual** that generally contains:

- Safety information.
- Installation and commissioning (descriptions of mechanical installation or electrical connections).
- Maintenance (descriptions of all required preventive maintenance procedures including intervals and expected life time of parts).
- Repair (descriptions of all recommended repair procedures including spare parts).
- Calibration.
- Decommissioning.
- Reference information (safety standards, unit conversions, screw joints, lists of tools).
- Spare parts list with corresponding figures (or references to separate spare parts lists).
- References to circuit diagrams.

Technical reference manuals

The technical reference manuals describe reference information for robotics products, for example lubrication, the RAPID language, and system parameters.

Application manuals

Specific applications (for example software or hardware options) are described in **Application manuals**. An application manual can describe one or several applications.

An application manual generally contains information about:

- The purpose of the application (what it does and when it is useful).
- What is included (for example cables, I/O boards, RAPID instructions, system parameters, software).
- How to install included or required hardware.
- How to use the application.
- Examples of how to use the application.

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Operating manuals

The operating manuals describe hands-on handling of the products. The manuals are aimed at those having first-hand operational contact with the product, that is production cell operators, programmers, and troubleshooters.

How to read the product manual

Reading the procedures

The procedures contain all information required for the installation or service activity and can be printed out separately when needed for a certain service procedure.

Safety information

The manual includes a separate safety chapter that must be read through before proceeding with any service or installation procedures. All procedures also include specific safety information when dangerous steps are to be performed.

Read more in the chapter *Safety on page 13*.

Illustrations

The manipulator is illustrated with general figures that does not take painting or protection type in consideration.

Likewise, certain work methods or general information that is valid for several robot models, can be illustrated with illustrations that show a different robot model than the one that is described in the current manual.

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1 Safety

1.1 General safety information

1.1.1 Limitation of liability

Limitation of liability

Any information given in this manual regarding safety must not be construed as a warranty by ABB that the Feather Duster V2 (hereinafter, the Product) will not cause injury or damage even if all safety instructions are complied with.

The information does not cover how to design, install and operate a complete system, nor does it cover all peripheral equipment that can influence the safety of the entire system.

In particular, liability cannot be accepted if injury/damage has been caused for any of the following reasons:

- Use of the Product in other ways than intended.
- Incorrect operation or maintenance.
- Operation of the Product when the safety devices are defective, not in their intended location or in any other way not working.
- When instructions for operation and maintenance are not followed.
- Non-authorized design modifications made in or around the Product.
- Repairs carried out by in-experienced or non-qualified personnel.
- Foreign objects.
- Force majeure.

Nation/region specific regulations

To protect personnel, the complete system must be designed and installed in accordance with the safety requirements set forth in the standards and regulations of the country where the Product is installed.

To be observed by the supplier of the complete system

The integrator is responsible that the safety devices necessary to protect people working with the Product are designed and installed correctly.

When integrating the Product with external devices and machines:

- The supplier of the complete system must ensure that all circuits used in the safety function are interlocked in accordance with the applicable standards for that function.
- The supplier of the complete system must ensure that all circuits used in the emergency stop function are interlocked in a safe manner, in accordance with the applicable standards for the emergency stop function.

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1.1.1 Limitation of liability
Continued

The integrator of the final application is required to perform an assessment of the hazards and risks (HRA).

Note

The integrator is responsible for the safety of the final application.

Safe access

The Product shall be designed to allow safe access to all areas where intervention is necessary during operation, adjustment, and maintenance.

Where it is necessary to perform tasks within the safeguarded space there shall be safe and adequate access to the task locations.

Safety zones, which must be crossed before admittance, must be set up in front of the Product's working space. Light beams or sensitive mats are suitable devices.

Turntables or the like should be used to keep the operator out of the Product's working space.

A safety fence is recommended to ensure safeguarded space. Sufficient space must be provided around the Product to protect those working with or on it from hazards such as crushing.

The fence or enclosure must be dimensioned to withstand the force created if the load being handled by the Product is dropped or released at maximum speed.

Also consider the maximum possible impact caused by a breaking or malfunctioning rotating tool or other device fitted to the Product.

Safe handling

Users shall not be exposed to hazards, including slipping, tripping, and falling hazards.

It must be possible to safely turn off tools, such as milling cutters, etc. Make sure that guards remain closed until the cutters stop rotating.

It should be possible to release parts by manual operation (valves).

Safe design

Emergency stop buttons must be positioned in easily accessible places so that the Product can be stopped quickly. If any of the buttons do not stop all the product workcell motion, each emergency stop button must be marked, if more than one is provided, to indicate its designated safety function.

Grippers/end effectors must be designed so that they retain work pieces in the event of a power failure or a disturbance to the controller.

Unauthorized modifications of the originally delivered product/system are prohibited. Without the consent of ABB it is forbidden to attach additional parts through welding, riveting, or drilling of new holes into the castings. The strength could be affected.

CAUTION

Ensure that a gripper is prevented from dropping a work piece, if such is used.

1.1.2 Protective stop and emergency stop

Overview

The protective stops and emergency stops are described in the product manual for the controller.

1.2 Safety actions

1.2.1 Fire extinguishing

Note

Use a CARBON DIOXIDE (CO_2) extinguisher in the event of a fire in the Product or controller.

1.2.2 Make sure that the main power has been switched off

Description

Working with high voltage is potentially lethal. Persons subjected to high voltage may suffer cardiac arrest, burn injuries, or other severe injuries. To avoid these personal injuries, switch off the main power on the controller before proceeding work.

Note

Switch off all main power switches in a MultiMove system.

1.3 Safety risks

1.3.1 Safety risks during installation and service work

Requirements on personnel

Only persons who know the Product and are trained in the operation and handling of the Product are allowed to maintain the Product. Persons who are under the influence of alcohol, drugs or any other intoxicating substances are not allowed to install, maintain, repair, or use the Product.

- Those in charge of operations must make sure that safety instructions are available for the installation in question.
- Those who install or service/maintain the Product must have the appropriate training for the equipment in question and in any safety matters associated with it.
- Personnel should be trained on responding to emergency or abnormal situations.

General risks during installation and service

The instructions in the product manual must always be followed.

- Never turn the power on to the Product before it is properly fixed and bolted to its foundation/support.
- Make sure that no one else can turn on the power to the controller and Product while you are working with the system. A good method is to always lock the main switch on the controller cabinet with a safety lock.
- Make sure that no one else can turn on the power to the controller and Product while you are working with the system. A good method is to remove the power cable to the controller.
- If the Product is installed at a height, hanging, or other than standing directly on the floor, there may be additional risks than those for a Product standing directly on the floor.
- Energy stored in the Product for the purpose of counterbalancing certain axes may be released if the Product, or parts thereof, are dismantled.
- Never use the Product as a ladder, which means, do not climb on the controller, motors, or other parts during service work. There is a risk of slipping because of the high temperature of the motors and oil spills that can occur on the Product. There is also a risk of the Product being damaged.
- To avoid damaging the Product, make sure that there are no loose screws, turnings, or other parts inside the Product after work has been performed.

Safety risks during operational disturbances

Corrective maintenance must only be carried out by qualified personnel who are familiar with the entire installation as well as the special risks associated with its different parts.

Continues on next page

If the working process is interrupted, extra care must be taken due to risks other than those associated with regular operation. Such an interruption may have to be rectified manually.

Spare parts and special equipment

ABB does not supply spare parts and special equipment which have not been tested and approved by ABB. The installation and/or use of such equipment could negatively affect the structural properties of the Product and as a result of that affect the active or passive safety operation. ABB is not liable for damages caused by the use of non-original spare parts and special equipment. ABB is not liable for damages or injuries caused by unauthorized modifications to the Product.

Personal protective equipment

Always use suitable personal protective equipment, based on the risk assessment for the Product installation.

Allergenic material

See *Environmental information on page 170* for specification of allergenic materials in the Product, if any.

1.3.2 Moving equipment is potentially lethal

Description

Any moving equipment is a potentially lethal machine.

When running, the Product may perform unexpected and sometimes irrational movements. Moreover, all movements are performed with great force and may seriously injure any personnel and/or damage any piece of equipment located within the working range of the Product.

Safe handling

	Action	Note
1	Before attempting to run the Product, make sure all emergency stop equipment is correctly installed and connected.	Emergency stop equipment such as gates, tread mats, light curtains, etc.
2	Usually the hold-to-run function is active only in manual full speed mode. To increase safety it is also possible to activate hold-to-run for manual reduced speed with a system parameter. The hold-to-run function is used in manual mode, not in automatic mode.	How to use the hold-to-run function is described in section *How to use the hold-to-run function* in the *Operating manual - IRC5 with FlexPendant*.
3	Make sure no personnel are present within the working range of the Product before pressing the start button.	

1.3.3 First test run may cause injury or damage

Description

After installation and performing service activities, there are several safety risks to take into consideration before the first test run.

Safe handling

Use this procedure when performing the first test run after installation, maintenance, or repair.

DANGER

Running the Product without fulfilling the following aspects, may involve a risk of injury and cause severe damage to the Product.

	Action
1	Remove all tools and foreign objects from the Product and its working area.
2	Verify that the Product is properly secured to its position by all screws, before it is powered up.
3	Verify that any safety equipment installed to secure the position or restrict the Product motion during service activity is removed.
4	Verify that the fixture and work piece are well secured, if applicable.
5	Install all safety equipment properly.
6	Make sure all personnel are standing at a safe distance from the Product, and is out of its reach behind safety fences, or similar.
7	Verify that all required covers or paddings are properly secured to the Product, if any.
8	If maintenance or repair has been done, pay special attention to the function of the part that was serviced.

Collision risks

CAUTION

When programming the movements of the Product, always identify potential collision risks before the first test run.

1.3.4 Work inside the working range of the Product

WARNING

If work must be carried out within the work area of the Product, then the following points must be observed:

- The operating mode selector on the controller must be in the manual mode position to render the three-position enabling device operational and to block operation from a computer link or remote control panel.
- The position *Manual mode with full speed (100%)* may only be used by trained personnel who are aware of the risks that this entails. *Manual mode with full speed (100%)* is not available in USA or Canada.
- Also, be aware of any danger that may be caused by rotating tools or other devices mounted on the Product or inside the cell. Keep away from rotating and moving parts to not get entangled with hair or clothing.
- Keep clear of moving parts so that limbs, hands, or fingers do not get trapped or crushed by the Product.
- To prevent anyone else from taking control of the Product, always put a safety lock on the cell door and bring the three-position enabling device with you when entering the working space.

WARNING

NEVER, under any circumstances, stay beneath any part of the Product! There is always a risk that the Product will move unexpectedly when its parts are moved using the three-position enabling device or during other work inside the working range of the Product.

1.3.5 Enabling device and hold-to-run functionality

Three-position enabling device

The three-position enabling device is a manually operated, constant pressure push-button which, when continuously activated in one position only, allows potentially hazardous functions but does not initiate them. In any other position, hazardous functions are stopped safely.

The three-position enabling device is of a specific type where you must press the push-button only half-way to activate it. In the fully in and fully out positions, operating the Product is impossible.

Note

The three-position enabling device is a push-button located on the teach pendant which, when pressed halfway in, switches the system to MOTORS ON. When the enabling device is released or pushed all the way in, the Product switches to the MOTORS OFF state.

To ensure safe use of the teach pendant, the following must be implemented:

- The enabling device must never be rendered inoperational in any way.
- During programming and testing, the enabling device must be released as soon as there is no need for the Product to move.
- Anyone entering the working space of the Product must always hold the teach pendant. This is to prevent anyone else from taking control of the Product without his/her knowledge.

Hold-to-run function

The hold-to-run function allows movement when a button connected to the function is actuated manually and immediately stops any movement when released. The hold-to-run function can only be used in manual mode.

How to operate the hold-to-run function for IRC5 is described in *Operating manual - IRC5 with FlexPendant*.

1.3.6 Risks associated with live electric parts

Voltage related risks, general

Work on the electrical equipment of the Product must be performed by a qualified electrician in accordance with electrical regulations.

Although troubleshooting may, on occasion, need to be carried out while the power supply is turned on, the Product must be turned off (by setting the main switch to OFF) when repairing faults, disconnecting electric leads, and disconnecting or connecting units.

The main supply to the Product must be connected in such a way that it can be turned off from outside the working space of the Product.

Make sure that no one else can turn on the power to the controller and Product while you are working with the system. A good method is to always lock the main switch on the controller cabinet with a safety lock.

The necessary protection for the electrical equipment and Product during installation, commissioning, and maintenance is guaranteed if the valid regulations are followed.

Voltage related risks, IRC5 controller

A danger of high voltage is associated with, for example, the following parts:

- Be aware of stored electrical energy (DC link, Ultracapacitor bank unit) in the controller.
- Units such as I/O modules, can be supplied with power from an external source.
- The main supply/main switch
- The transformers
- The power unit
- The control power supply
- The rectifier unit (Note: capacitors!)
- The drive unit
- The drive system power supply
- The service outlets
- The customer power supply
- The power supply unit for additional tools, or special power supply units for the machining process.
- The external voltage connected to the controller remains live even when the Product is disconnected from the mains.
- Additional connections.

Voltage related risks, product

A danger of low voltage is associated with the Product in:

- The power supply for the motors.
- The user connections for tools or other parts of the installation.

Continues on next page

Voltage related risks, tools, material handling devices, etc.

Tools, material handling devices, etc., may be live even if the Product system is in the OFF position. Power supply cables which are in motion during the working process may be damaged.

1.3.7 Hot parts may cause burns

Description

During normal operation, many parts become hot. Touching these may cause burns.

There is also a risk of fire if flammable materials are put on hot surfaces.

Safe handling

Always use your hand, at some distance, to feel if heat is radiating from the potentially hot component before actually touching it.

Wait until the potentially hot component has cooled if it is to be removed or handled in any other way.

Do not put anything on hot metal surfaces, e.g. paper or plastic.

1.3.8 Brake testing

When to test

During operation, the holding brake of the motor normally wears down. A test can be performed to determine whether the brake can still perform its function.

How to test

The function of the holding brake of the motor may be verified as described below:

1. Run related part to a position where the combined weight of the part and any load is maximized (maximum static load).
2. Switch the motor to the MOTORS OFF.
3. Inspect and verify that the part maintains its position.

   If the part does not change position as the motors are switched off, then the brake function is adequate.

1.4 Safety signals and symbols

1.4.1 Safety signals in the manual

Introduction to safety signals

This section specifies all safety signals used in the user manuals. Each signal consists of:

- A caption specifying the danger level (DANGER, WARNING, or CAUTION) and the type of danger.
- A brief description of what will happen if the the danger is not eliminated.
- Instruction about how to eliminate danger to simplify doing the work.

Danger levels

The table below defines the captions specifying the danger levels used throughout this manual.

Symbol	Designation	Significance
	DANGER	Warns that an accident *will* occur if the instructions are not followed, resulting in a serious or fatal injury and/or severe damage to the product. It applies to warnings that apply to danger with, for example, contact with high voltage electrical units, explosion or fire risk, risk of poisonous gases, risk of crushing, impact, fall from height, and so on.
	WARNING	Warns that an accident *may* occur if the instructions are not followed that can lead to serious injury, possibly fatal, and/or great damage to the product. It applies to warnings that apply to danger with, for example, contact with high voltage electrical units, explosion or fire risk, risk of poisonous gases, risk of crushing, impact, fall from height, etc.
	ELECTRICAL SHOCK	Warns for electrical hazards which could result in severe personal injury or death.
	CAUTION	Warns that an accident may occur if the instructions are not followed that can result in injury and/or damage to the product. It also applies to warnings of risks that include burns, eye injury, skin injury, hearing damage, crushing or slipping, tripping, impact, fall from height, etc. Furthermore, it applies to warnings that include function requirements when fitting and removing equipment where there is a risk of damaging the product or causing a breakdown.
	ELECTROSTATIC DISCHARGE (ESD)	Warns for electrostatic hazards which could result in severe damage to the product.

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Symbol	Designation	Significance
	NOTE	Describes important facts and conditions.
	TIP	Describes where to find additional information or how to do an operation in an easier way.

1.4.2 Safety symbols on product labels

Introduction to labels

This section describes safety symbols used on labels (stickers) on the product.

Symbols are used in combinations on the labels, describing each specific warning. The descriptions in this section are generic, the labels can contain additional information such as values.

Note

The safety and health symbols on the labels on the product must be observed. Additional safety information given by the system builder or integrator must also be observed.

Types of labels

Both the Product and the controller are marked with several safety and information labels, containing important information about the product. The information is useful for all personnel handling the Product, for example during installation, service, or operation.

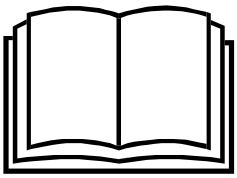
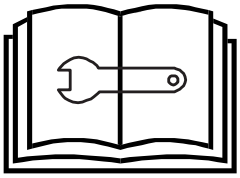
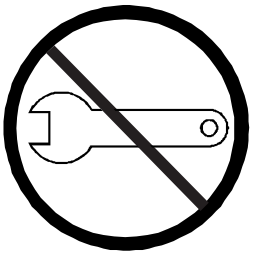
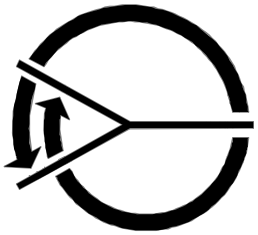
The safety labels are language independent, they only use graphics. See *Symbols on safety labels on page 30*.

The information labels can contain information in text (English, German, and French).

Symbols on safety labels

Symbol	Description
 xx0900000812	**Warning!** Warns that an accident *may* occur if the instructions are not followed that can lead to serious injury, possibly fatal, and/or great damage to the product. It applies to warnings that apply to danger with, for example, contact with high voltage electrical units, explosion or fire risk, risk of poisonous gases, risk of crushing, impact, fall from height, etc.
 xx0900000811	**Caution!** Warns that an accident may occur if the instructions are not followed that can result in injury and/or damage to the product. It also applies to warnings of risks that include burns, eye injury, skin injury, hearing damage, crushing or slipping, tripping, impact, fall from height, etc. Furthermore, it applies to warnings that include function requirements when fitting and removing equipment where there is a risk of damaging the product or causing a breakdown.
 xx0900000839	**Prohibition** Used in combinations with other symbols.

Continues on next page

Symbol	Description
 xx0900000813	**See user documentation** Read user documentation for details. Which manual to read is defined by the symbol: • No text: *Product manual*. • EPS: *Application manual - Electronic Position Switches*.
 xx0900000816	**Before disassemble, see product manual**
 xx0900000815	**Do not disassemble** Disassembling this part can cause injury.
 xx0900000814	**Extended rotation** This axis has extended rotation (working area) compared to standard.
 xx0900000808	**Brake release** Pressing this button will release the brakes. This means that the parts of the Product can fall down.

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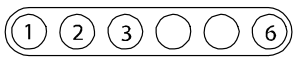
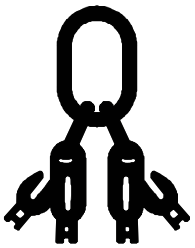
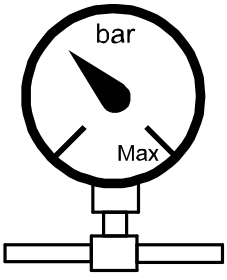
1.4.2 Safety symbols on product labels

Continued

Symbol	Description
  xx0900000817	**Crush** Risk of crush injuries.
 xx0900000818  xx1300001087	**Heat** Risk of heat that can cause burns. (Both signs are used)
 xx0900000820  xx1000001140	**Brake release buttons**
 xx0900000821	**Lifting bolt**

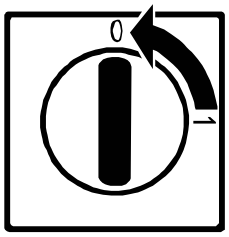
Continues on next page

Symbol	Description
 xx1000001242	**Chain sling with shortener**
 xx0900000823	**Oil** Can be used in combination with prohibition if oil is not allowed.
 xx0900000824	**Mechanical stop**
 xx1000001144	**No mechanical stop**
 xx0900000825	**Stored energy** Warns that this part contains stored energy. Used in combination with *Do not disassemble* symbol.
 xx0900000826	**Pressure** Warns that this part is pressurized. Usually contains additional text with the pressure level.

Continues on next page

1.4.2 Safety symbols on product labels

Continued

Symbol	Description
 xx0900000827	**Shut off with handle** Use the power switch on the controller.
 xx1400002648	**Do not step** Warns that stepping on these parts can cause damage to the parts.
 xx1800002608	**Must wear safety helmet**
 xx1800002609	**No entering** Warns that entering the working areas can cause injuries or damages.

2 About Feather Duster V2

2.1 Feather Duster V2 system

2.1.1 Introduction

General

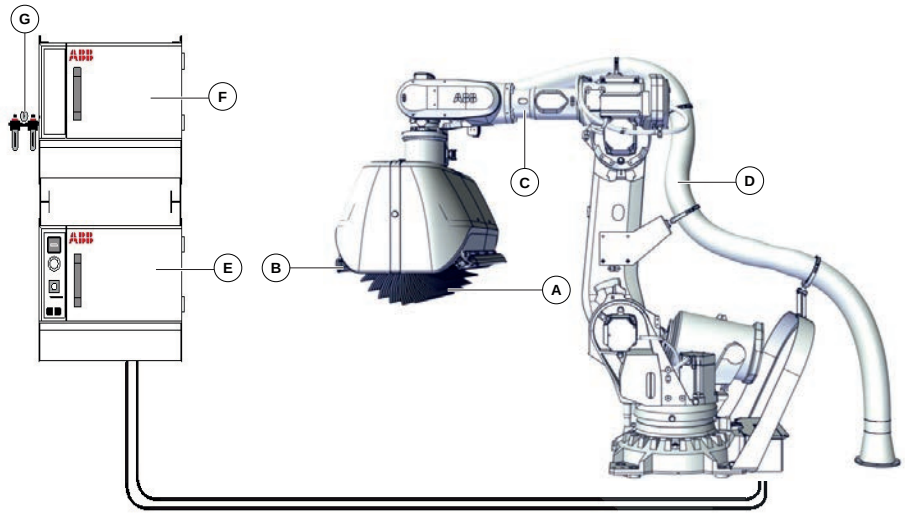
The Feather Duster V2 is a pre-paint finishing equipment mounted on a 6-axis manipulator. It is used to remove dust and dirt particles from car bodies and to-be-painted surfaces.

The Feather Duster V2 utilizes brushes manufactured from ostrich feathers to remove contaminants, which are then vacuumed with an exhaust fan. It replaces the tack-off machine with more flexibility and high efficiency.

Besides the robot on which the Feather Duster V2 is installed and the robot controller, a complete Feather Duster V2 system mainly consists of a feather roller, ionization unit, exhaust system, compressed air system and process cabinet.

Structure

The following figure shows the complete Feather Duster V2 system.



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Item	Description	Note
A	Feather roller	See *Feather roller on page 40*.
B	Ionization unit	See *Ionization unit on page 42*.
C	Robot	ABB IRB 6640 or IRB 6700 For applicable robot variants, see *Robot on page 50*.
D	Exhaust system	See *Exhaust system on page 45*.

Continues on next page

2.1.1 Introduction
Continued

Item	Description	Note
E	Controller	ABB IRC5, used to control the robot motion. For more information, see *Product manual - IRC5*.
F	Process cabinet	Used to control the Feather Duster. It is also an interface to automats (for example, PLC cabinet), Connect process cabinet with IRC5 to control Feather Duster V2 is recommended. Besides, Device Net are used for communication.
G	Compressed air system	See *Compressed air system on page 46*.

Functions

The Feather Duster is designed to remove contaminants from car bodies and to-be-painted surfaces using the rotating ostrich feather brushes. The brushes come across the body shell with an immersion depth of approximately 30 mm to 40 mm. Through this movement, the contaminants are absorbed by the brushes and then vacuumed with an exhaust fan.

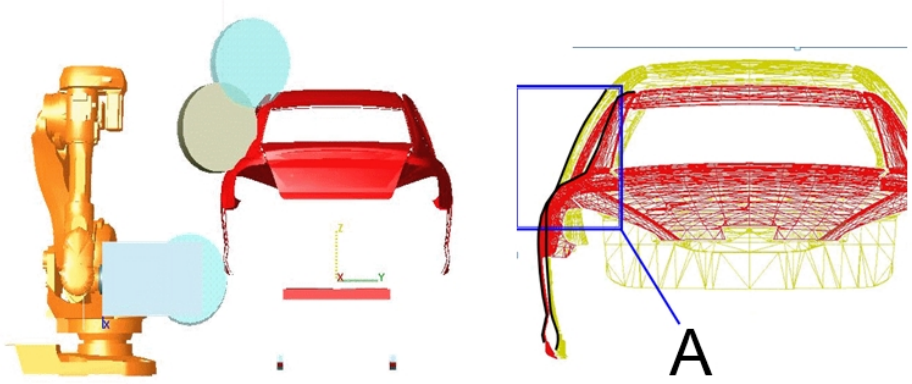
An ionization unit including an ionizing air knife and an ionizing bar is mounted on the Feather Duster to deliver an ionized air stream, both to remove any static charge from the feather brushes just prior to the exhaust slot and to neutralize the surfaces after cleaning. Removable carbon fiber covers allow easy access to the inner mechanical and electrical components, which are based on a modular design principle.

Benefits

As a pre-paint finishing equipment using ostrich feathers and integrated on a robot, the Feather Duster aims at providing a more flexible and easier way to increase production efficiency. Compared with a tack-off machine, it has a lot of benefits:

- Installation on a 6-axis robot for a perfect profile follow-up and flexible movement to obtain optimum cleaning and tracking of the car body on both horizontal and critical surfaces.

  The following figure shows the cleaning of critical zone.



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A	Critical zone

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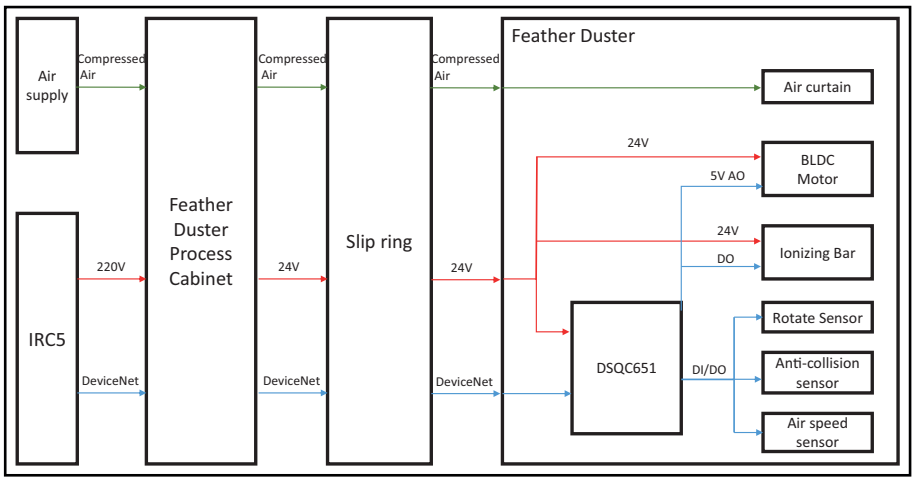
- High reliability (MTBF > 50,000 hours) and easy maintenance.
- Reduction of possible contamination caused by dust collecting surfaces and mechanical parts in the roof.
- Modular design and convenient installation.
- Symmetrical removable carbon fiber covers allow easy access to mechanical and electrical parts.
- Low air consumption thanks to optimized air gaps and reduced amount of required rollers.
- Easy programming, high flexibility, large working area and accessibility.
- Common graphic user interface for both cleaning and painting robots.
- Modularity electrical circle structure ensures the convenience during disconnection and reassembly.

2.1.2 Process diagram

General process diagram

The following figures shows the general process diagram.



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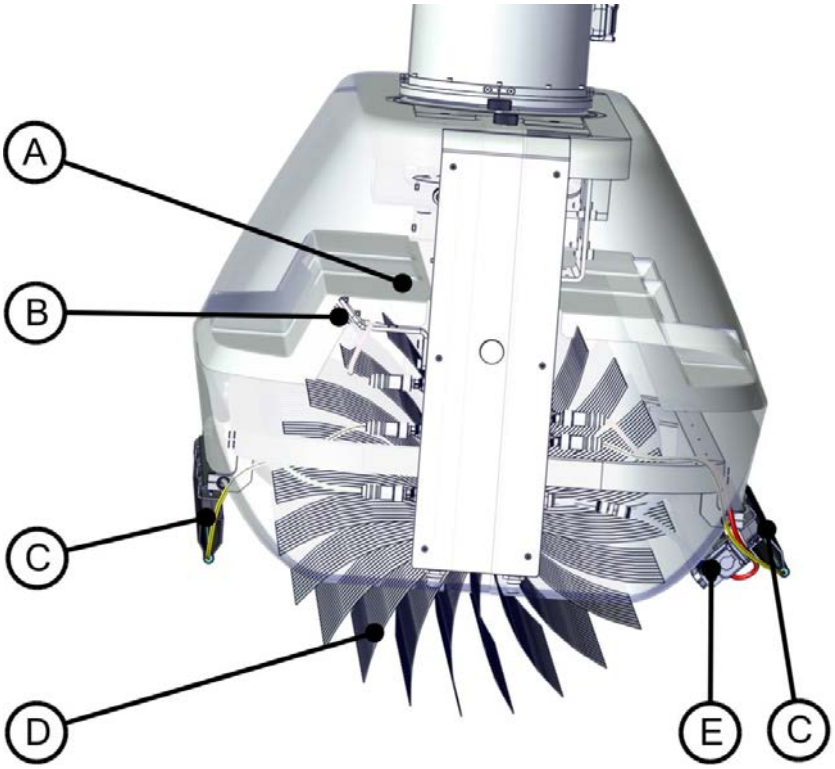
2.2 Main components

2.2.1 Component overview

General

Components on the main body of the Feather Duster V2 are shown as follows.



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A	Suction slot with flexible lips
B	Ionizing bar
C	Safety edge sensor
D	Feather roller
E	Ionizing air knife

2.2.2 Feather roller

General

The Feather Duster V2 is equipped with a roller which is an assembly of ostrich feathers disks stacked on an aluminum shaft. The shaft is equipped with coupling hubs for quick change.

An approach sensor monitors the speed of the roller shaft. The rotation speed of the feather roller can therefore be optimally controlled and adjusted to the car body and the conveyor speed, achieving a uniform relative speed between feathers and car body.

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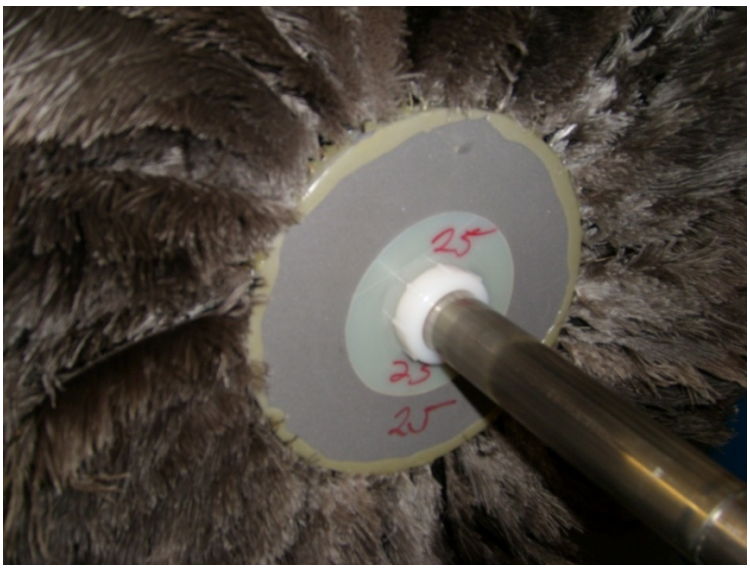
The feather roller is adapted to nearly all body profiles and can be replaced quickly and easily.



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Function

The feathers on the rotating feather roller run across the surface of the car body with low pressure. The contact effect and subsequent separation generate positive and negative electrostatic charge on the car body and feathers, respectively. The dust particles, charged positively and negatively as well, are consolidated by the relatively opposite charge potential and then absorbed by the feathers.

The rotating feather roller transfers the feathers that are full of dust particles to the area of the ionizing bar installed inside the roller covers. The ionizing bar neutralizes the electrostatic charges on the feathers. The suction slot then sucks the neutralized dust particles off the feather roller.

2.2.3 Ionization unit

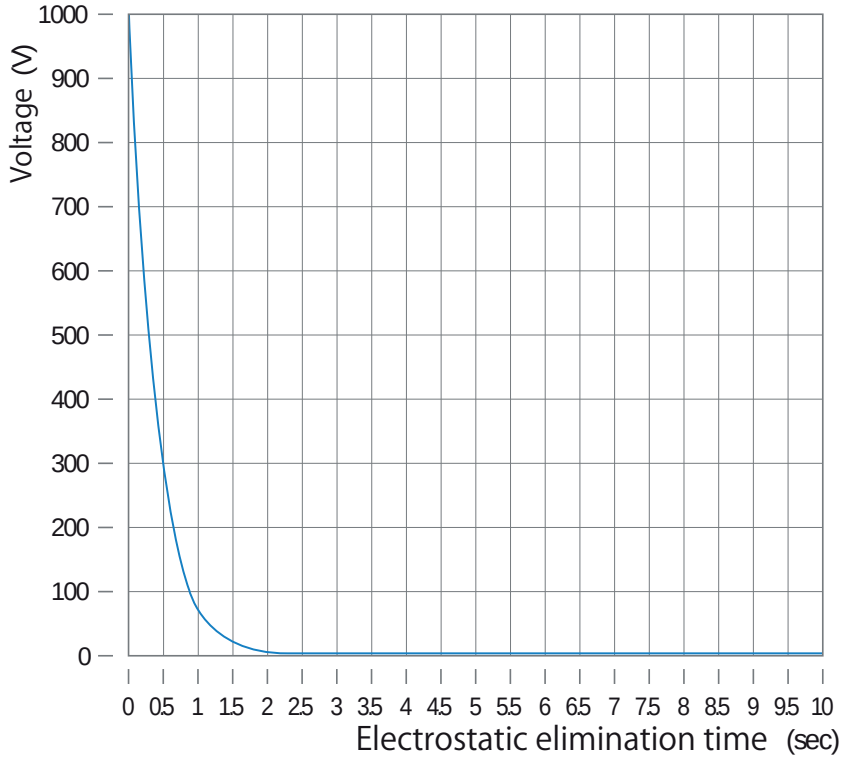
General

The Feather Duster V2 is equipped with an ionizer unit whose purpose is to reduce or eliminate static charge from the cleaned surface. The ionizer unit includes an ionizing bar and an ionizing air air knife.

High voltage generator

The AC high voltage generator produces both positive and negative ions at a rate of 1to 68 times per second (1Hz-68Hz line frequency).

As shown in the following figure, the ionizing bar has an adjustable excitation voltage. The generation speed of positive ions is improved as the increasing setting voltages, from 0V to 1000V.



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During the first half of the cycle, the discharge begins when the potential reaches up to setting voltage. During the second half of the cycle, negative ions are generated when the potential reaches the negative value of the setting voltage.

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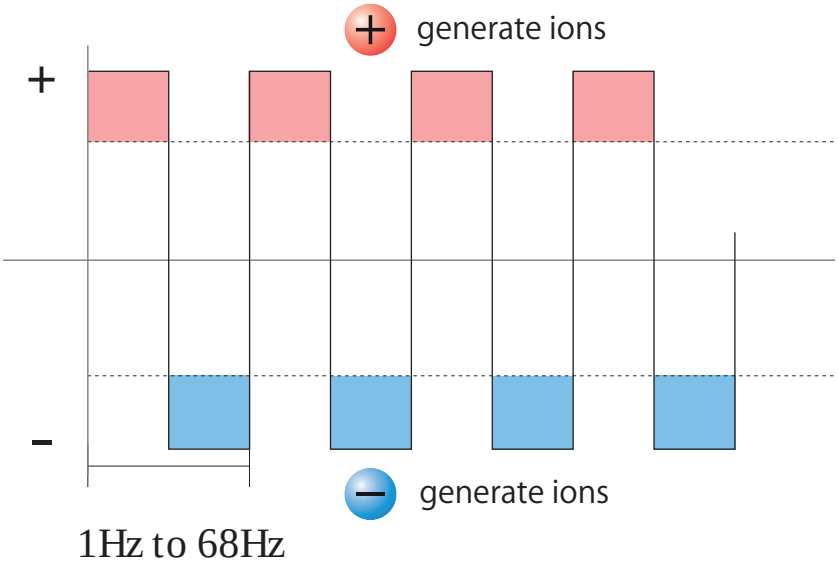
When the potential is between the setting voltage and the negative setting voltage, no ions are generated, which results in a gap between positive and negative ions.



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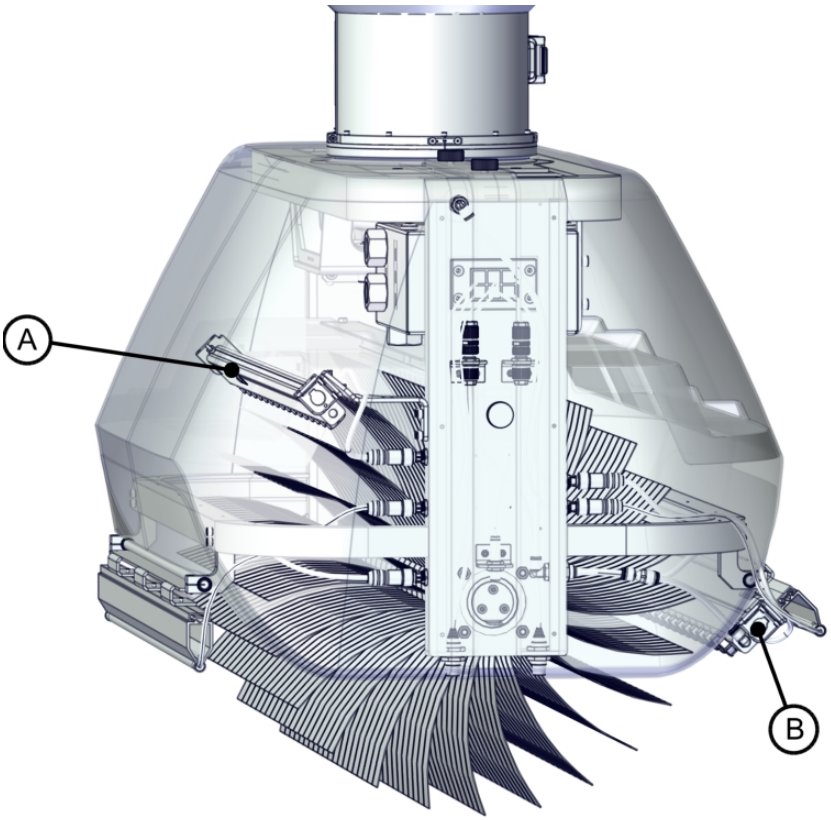
Ionizing air knife and ionizing bar

Each Feather Duster V2 has an ionizing air knife and an ionizing bar.



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A	Ionizing bar

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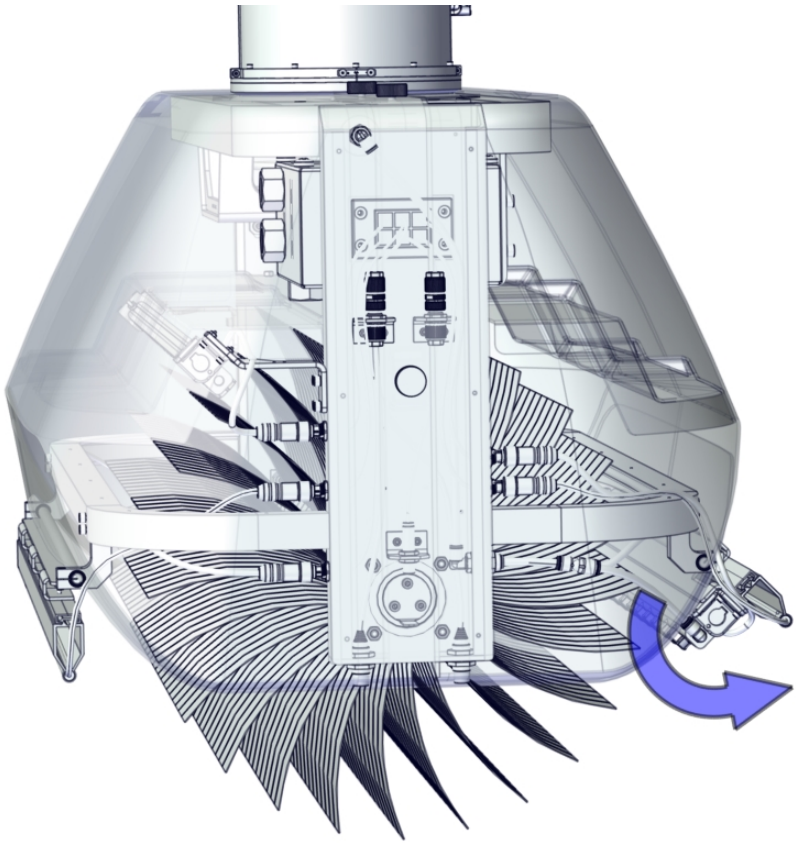
2.2.3 Ionization unit
Continued

B	Ionizing air knife

The ionizing air knife blows ions onto the feathers and car body. It creates an air curtain that sweeps contaminants off the car body and neutralizes the body surface after cleaning. The ionizing bar neutralizes the dust particles on feathers.

The ionizing bar bracket of the ionizing air knife could be adjusted so that the air stream can properly blow onto the car body surface. This is critical for achieving better dust elimination effects.



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2.2.4 Exhaust system

General

The Feather Duster V2 works with an exhaust fan to suck and exhaust dust particles from the feathers. The exhaust system of the Feather Duster V2 mainly includes a suction slot with two flexible lips, an exhaust manifold, and an exhaust hose.

The 1,016 mm (diameter: 40”) long suction slot is installed on the cover and spans the full length of the feather shaft. The suction slot collects dusts and contaminants from the feathers, and then the dusts and contaminants are exhausted through the exhaust manifold and exhaust hose.

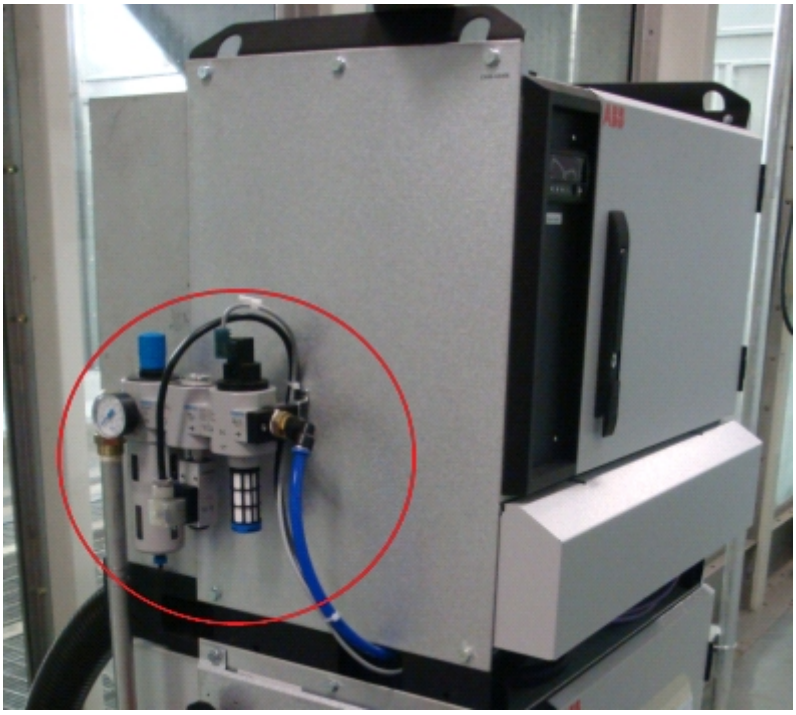
The exhaust air volume vary depending on the exhaust fan location, fan power and ductwork arrangement. The Feather Duster V2 requires an air flow of at least 15 m^3/min at 1,500 Pa.

A pressure sensor connected to the ductwork ensures that the exhaust is running. If no exhaust air flows, a fault will be generated.

2.2.5 Compressed air system

General

The compressed air system is required to supply air to the ionizing air knife. The compressed air system is provided with a solenoid controlled air valve mounted on the process cabinet. If the air pressure is lower than the setting value, a fault will be generated.



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Item	Value
Pressure	3.5 - 6 bar
Filter accuracy	5 µm
Volume	3 m^3/min

3 Installation and commissioning

3.1 Introduction

Safety information

Before any installation work is conducted, it is extremely important that all safety information is observed!

There are general safety aspects that must be read through, as well as more specific safety information that describes the danger and safety risks when performing the procedures. Read chapter *Safety on page 13* before performing any installation work.

3.2 Technical specification

Feather Duster

Item	Specification
Weight	120 kg
Cover dimension (L x W x H)	1,270 mm x 720 mm x 570 mm
Roller width	1,000 mm
Motor power	0.25
Reduction ration of motor reducer	8:1
Roller speed	10-125 rpm variable (motor: 80-1000 rpm)
Exhaust air flow	15 m^3/min at 1,500 Pa dynamic
Compressed air supply	1.5 m^3/min at 3.5 bar, per robot
Downdraft air velocity	0.3 m/s (±0.05)
Humidity requirement	60-70%
Temperature requirement	20 °C to 25 °C
Conveyor system deviation	≤ 25 mm

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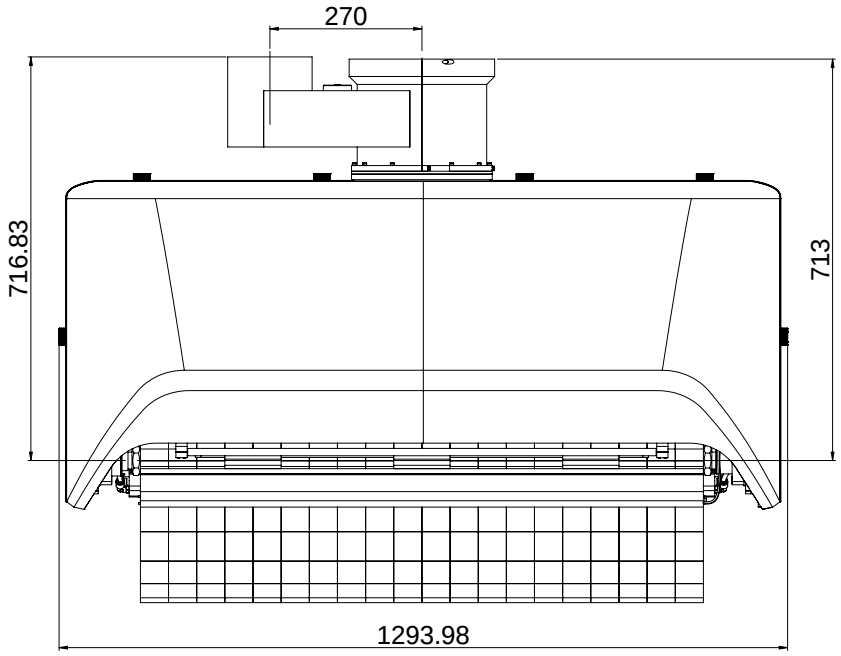
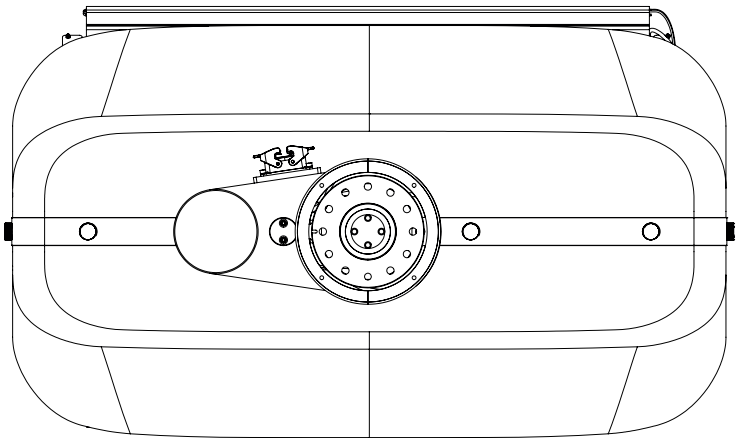
Dimensions





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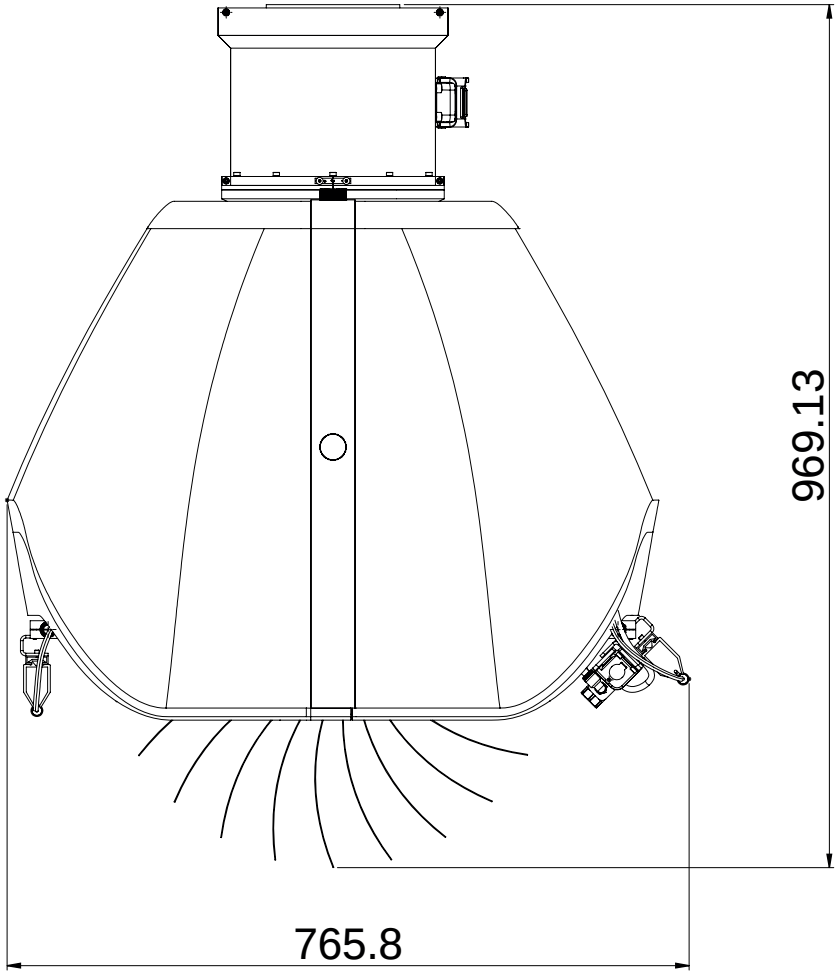
3.2 Technical specification
Continued



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Robot

The following ABB robots are applicable to the installation of the Feather Duster.

- IRB 6700-175/3.05 (recommended)
- IRB 6700-200/2.60
- IRB 6700-205/2.80
- IRB 6640-185/2.8

No particular option is required for the robot. For detailed robot specifications, see *Product specification - IRB 6700* and *Product specification - IRB 6640*.

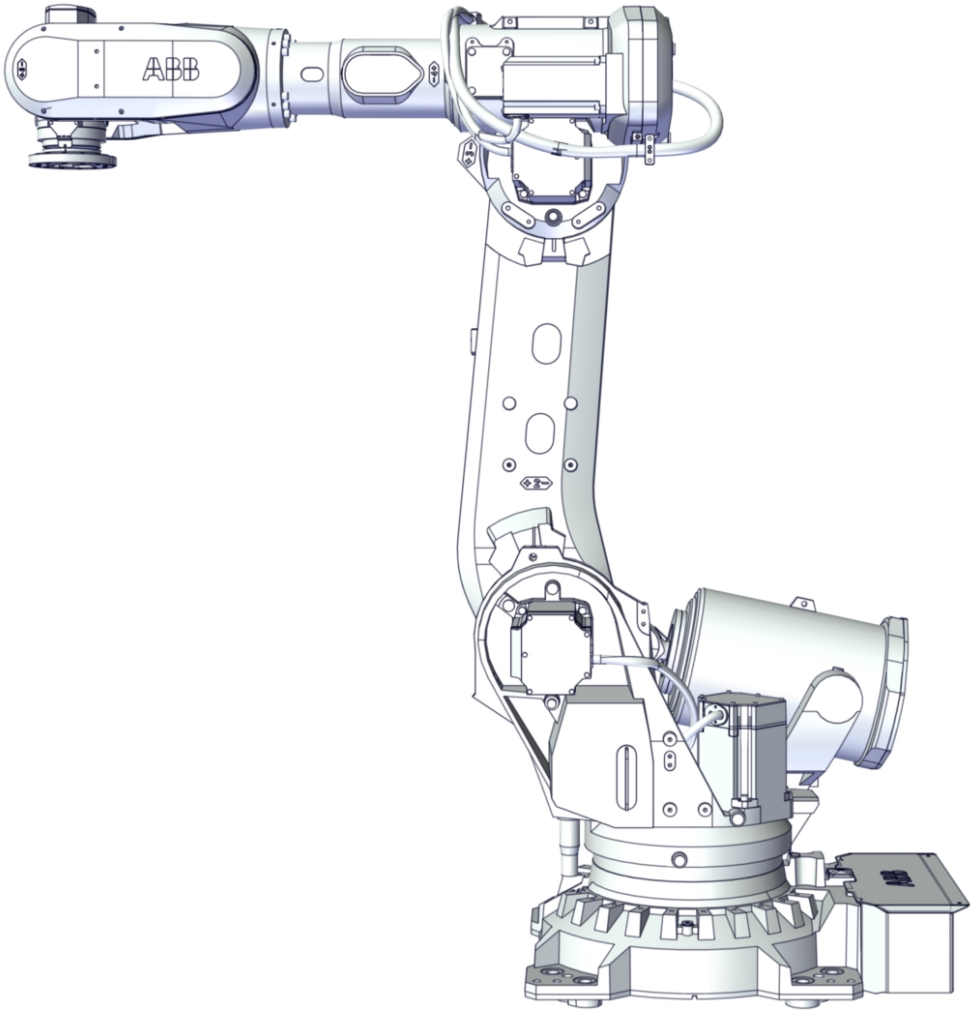
For compatibility with other robot variants, please contact ABB.

3.3 On-site installation

3.3.1 Pre-installation procedure

Robot position

The robot must be positioned as shown in the following figure. The flange surface of axis 6 must be horizontal.



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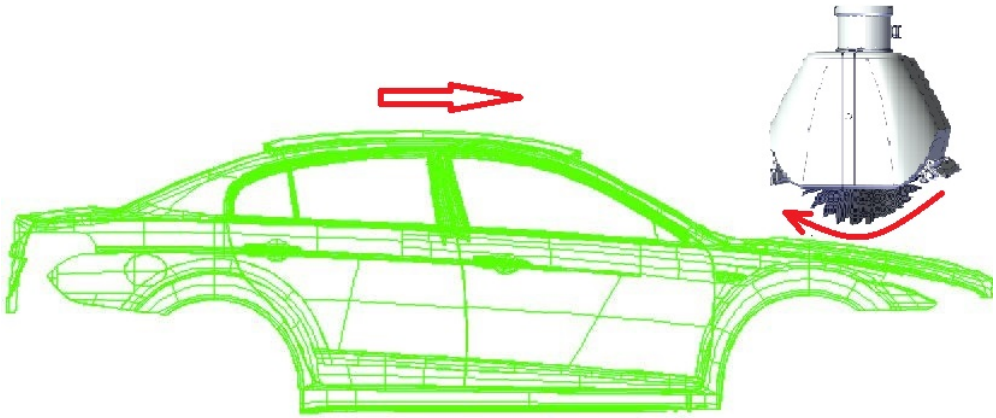
3.3.1 Pre-installation procedure
Continued

Correct feather rotation

The following figure shows the correct orientation of the feather rotation relative to the vehicle travel. Note that the curve of the feathers follows the vehicle travel. In this case, the feathers will not bent backward while spinning.



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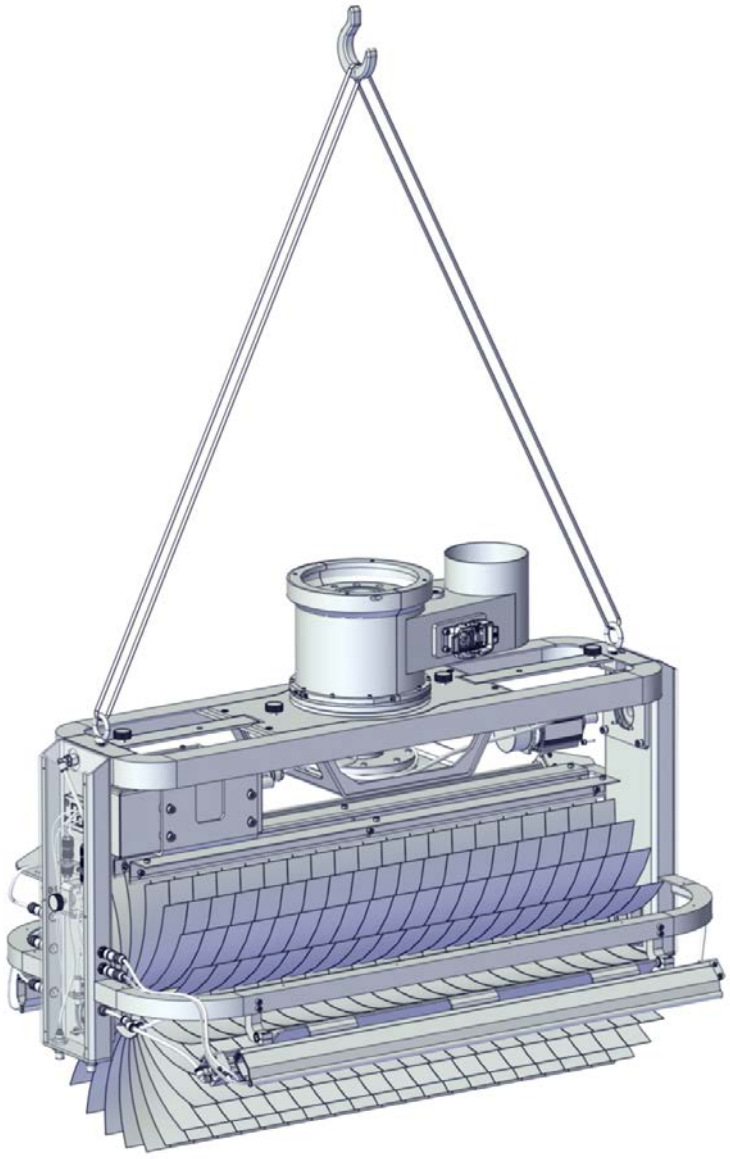
3.3.2 Lifting Feather Duster V2 with lifting accessories

Introduction



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CAUTION

The exhaust pipe covers and cable guide covers may packed around the steel column, but not installed. Make sure they are carefully secured or moved aside before lifting the Feather Duster V2.

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3.3.2 Lifting Feather Duster V2 with lifting accessories
Continued

During the packing or shipping procedure, taking two of spared M12 eye bolts on Interface Column as lifting point to lift the Feather Duster V2.

Note

These spared M12 eye bolts must be removed after the completion of this lifting operation.

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Required equipment

Equipment	Article number	Note
Overhead crane	-	
Roundsling	-	1 pcs, lifting capacity: > 120 kg
Lifting eye nut	-	M12, DIN580 (2 pcs)
Feather roller support	3HAW050024260	

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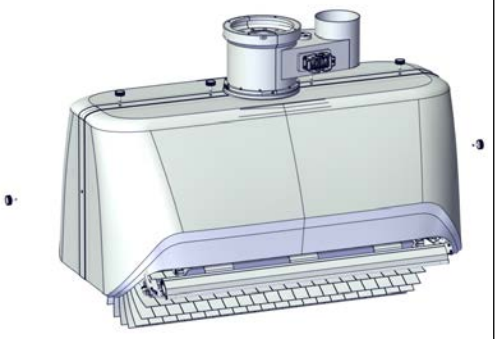
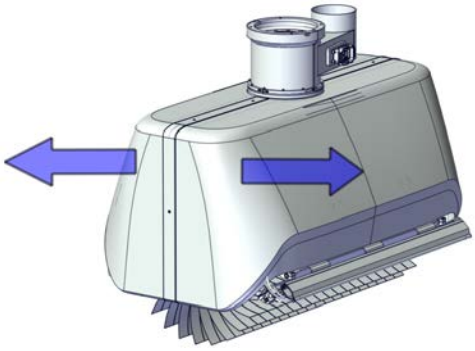
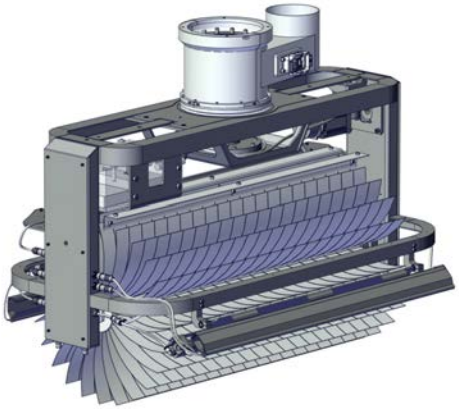
Lifting the Feather Duster V2

Use this procedure to lift the Feather Duster V2.

Removing the PDCPD cover

	Action	Note
1	Remove the 6 screws on the covers.	 xx1800001270
2	Separate and remove the 2 covers respectively in proper order.	 xx1800001321  xx1800001322

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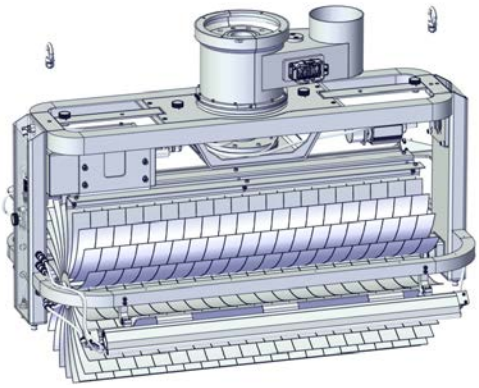
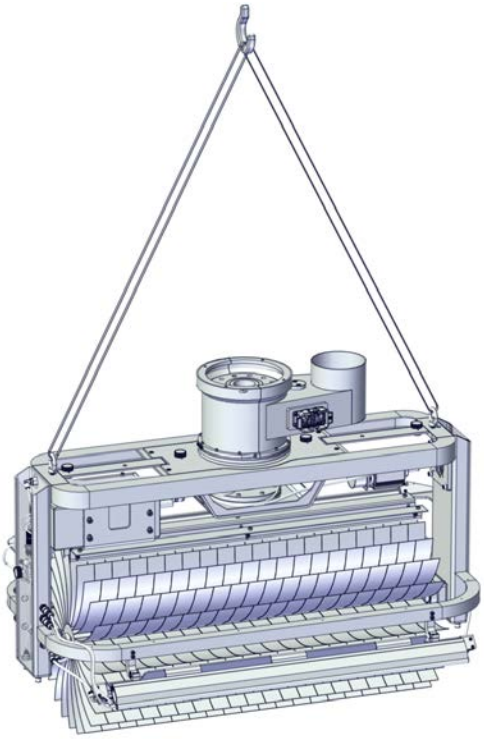
3.3.2 Lifting Feather Duster V2 with lifting accessories
Continued

Fit the lifting accessories

	Action	Note
1	Fit the lifting screws (2 pcs) to the steel structure frame. **CAUTION** The lifting eye nuts must be fitted to the positions shown in the figure to balance the Feather Duster V2 while lifting.	 xx1800001324
2	Fit the round-sling to the lifting eye nut and to the overhead crane.	 xx1800001325
3	**CAUTION** The Feather Duster V2 weighs 120 kg. All lifting accessories used must be sized accordingly!	
4	**WARNING** Personnel must not, under any circumstances, be present under the suspended load!	

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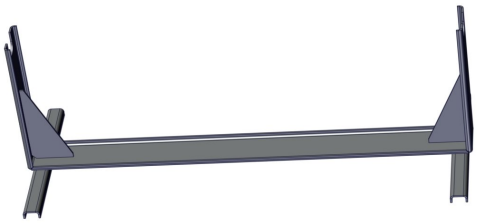
	Action	Note
5	Raise the overhead crane to lift the Feather Duster V2.	
6	Lift the Feather Duster V2 down onto the feather roller support.	 xx1800001769

3.3.3 Installing the Feather Duster V2

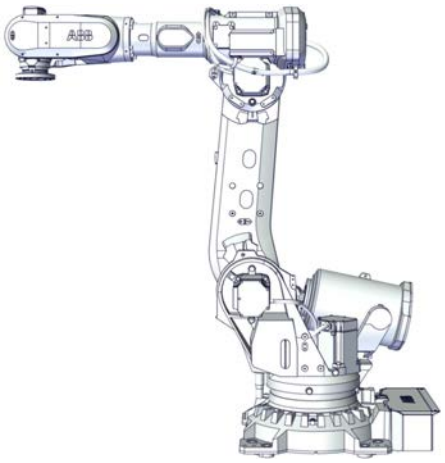
Required equipment

Equipment	Article number	Note
Overhead crane	-	
Roundsling	-	2 pcs , lifting capacity: > 120 kg
Lifting screw	-	M12, DIN580 (2 pcs)

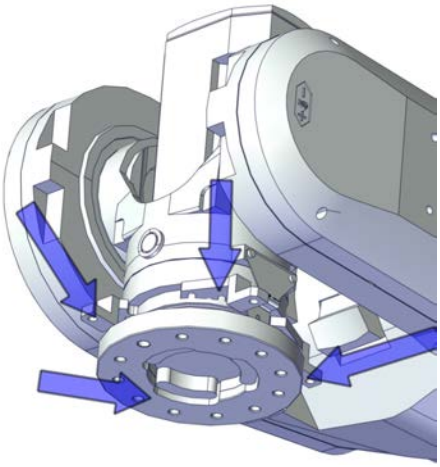
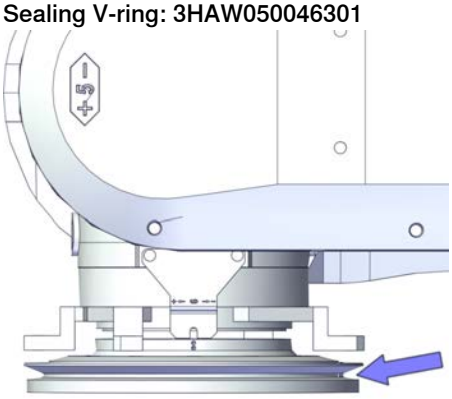
Procedure

Use this procedure to install the steel structure frame to the robots.

Preparations on the robot

	Action	Note
1	Make sure the robot is calibrated.	
2	Jog axes 5 and 6 of the robot to +90° and 0° respectively.	 xx1800001328
3	Remove the turning disk of the robot.	For details, see *Product manual - Product.ProductName*.

Continues on next page

	Action	Note
4	Install the convert adapters, starting from the one shown in the figure. **CAUTION** Install one convert adapter each time. Do not remove more than two screws at a time.	• Convert adapter for IRB 6700-175/3.05 and IRB 6700-205/2.80: 3HAW050046072 • Convert adapter for IRB 6700-200/2.60: 3HAW050046073 • Convert adapter for IRB 6640-185/2.8: 3HAW050024386  xx1800001326
5	Secure the convert adapters with screws and washers. **Note** For IRB 6700, the replacement screws are 10 mm longer than the removed screws from the robot.	• IRB 6700-175/3.05 and IRB 6700-205/2.80: Original screws: M8x40, class 12.9, DIN912 (8 pcs) Replacement screws: M8x50, class 12.9, DIN912 (8 pcs) Tightening torque: 35 Nm • IRB 6700-200/2.60: Original screws: M6x30, class 12.9, DIN912 (8 pcs) Replacement screws: M6x40, class 12.9, DIN912 (8 pcs) Tightening torque: 14 Nm
6	Refit the turning disk of the robot.	For details, see *Product manual - Product.ProductName*.
7	Install the V-ring to the turning disk. Make sure that the lip of the V-ring is towards the axis 5 of the robot, and the lower surface of the V-ring is at the same level as the axis 6 plane.	Sealing V-ring: 3HAW050046301  xx1800001327

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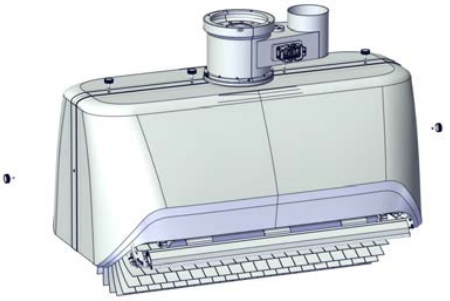
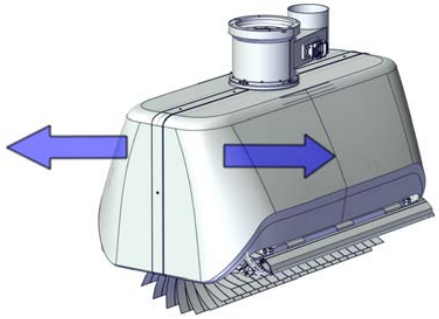
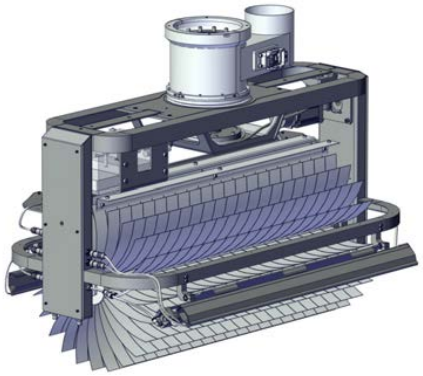
3.3.3 Installing the Feather Duster V2
Continued

Preparations on the Feather Duster V2

	Action	Note
1	Release the 6 screws.	Screw: Round head screw with embossing (6 pcs)  xx1800001270
2	Remove the PDCPD cover.	 xx1800001321  xx1800001322

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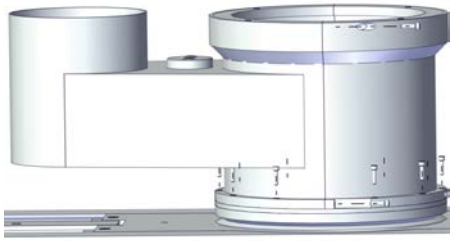
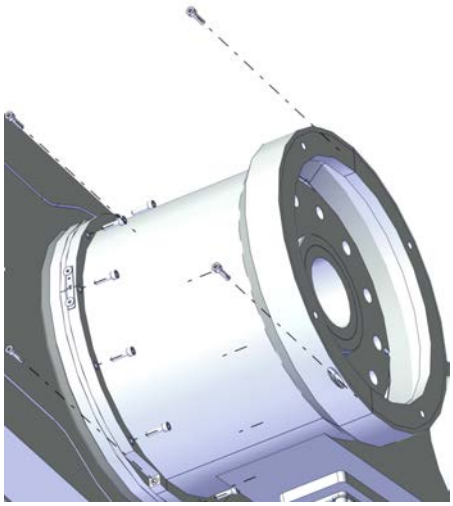
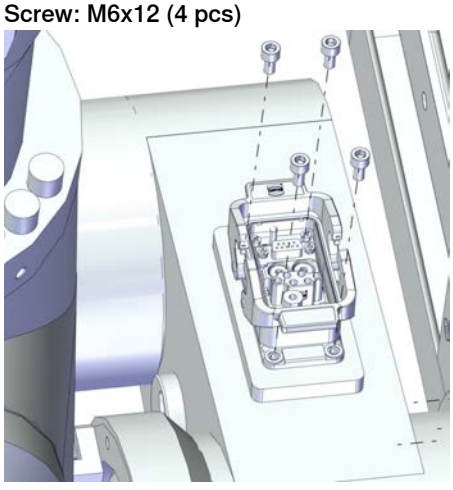
	Action	Note
3	Release the screws on exhaust pipe cover.	Screw: M4x16 (14 pcs)  xx1800001329  xx1800001334
4	Remove the cable socket.	Screw: M6x12 (4 pcs)  xx1800001335

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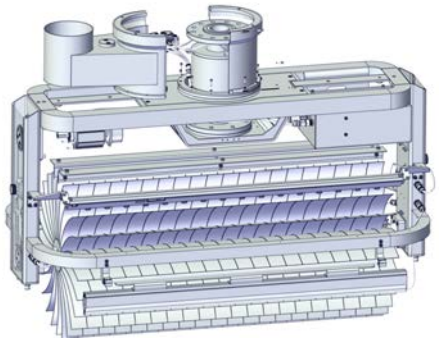
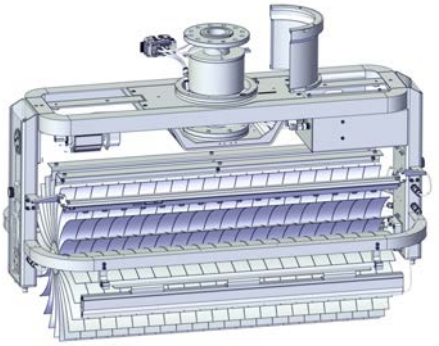
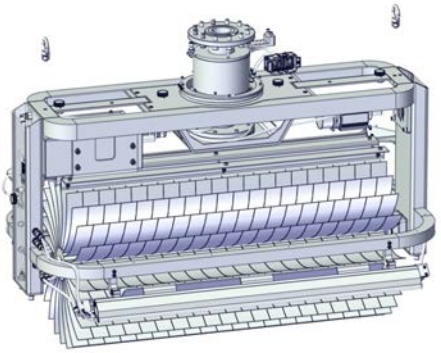
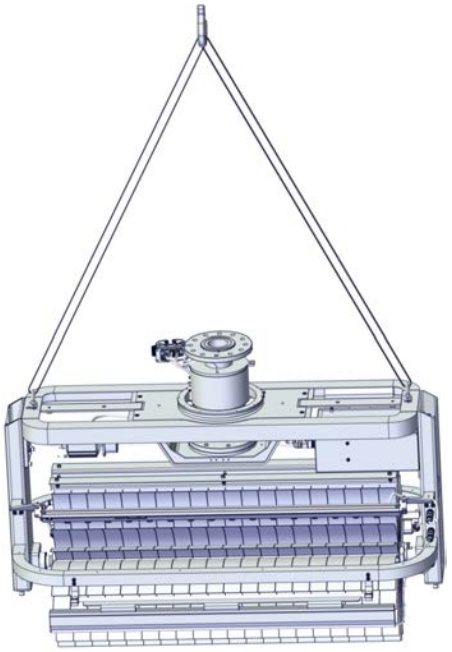
3.3.3 Installing the Feather Duster V2
Continued

	Action	Note
5	Remove the exhaust pipe covers by removing the screws securing them and the fixing plate. **CAUTION** Always properly support the fixing plate while removing the screws. The fixing plate, together with the longer reinforcement supports and upper cable chain cover installed on it, may drop a little distance after screws are removed. Prevent damages or injuries due to sudden dropping.	 xx1800001336  xx1800001337

Lifting the Feather Duster V2 to the robot

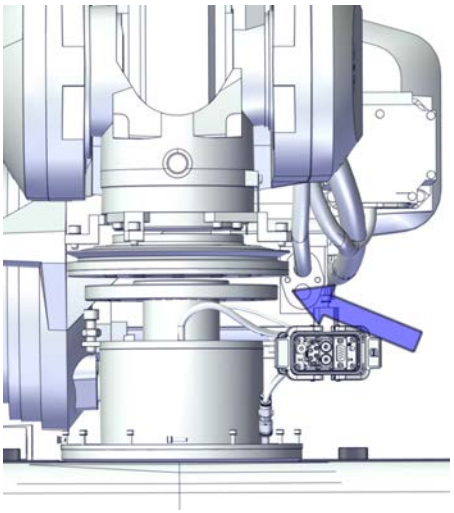
	Action	Note
1	Fit the lifting screws to the steel structure frame. **CAUTION** The lifting eye nuts must be fitted to the positions shown in the figure to balance the Feather Duster V2 while lifting.	M12, DIN580 (2 pcs)  xx1800001333

Continues on next page

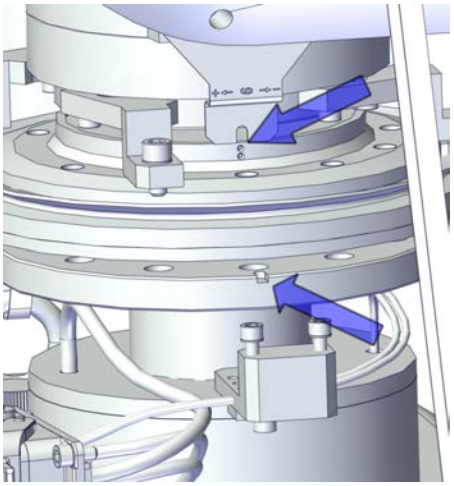
	Action	Note
2	Fit the round-slings to the lifting screws at each side of the frame and to the overhead crane. **CAUTION** The lifting eye nuts must be fitted to the positions shown in the figure to balance the Feather Duster V2 while lifting.	 xx1800001341
3	**CAUTION** The Feather Duster V2 weighs 120 kg. All lifting accessories used must be sized accordingly!	
4	**WARNING** Personnel must not, under any circumstances, be present under the suspended load!	
5	Raise the overhead crane to lift the Feather Duster V2.	

Continues on next page

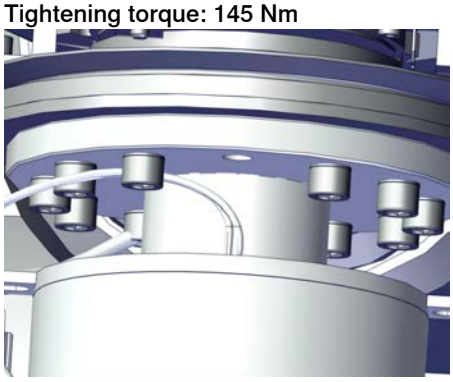
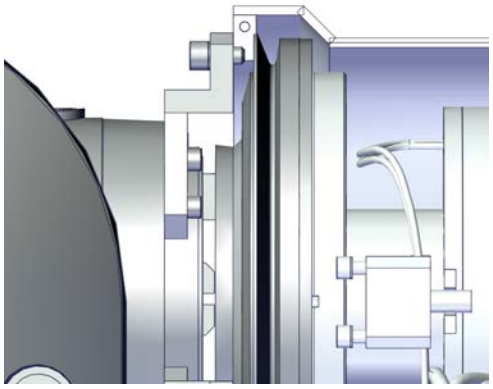
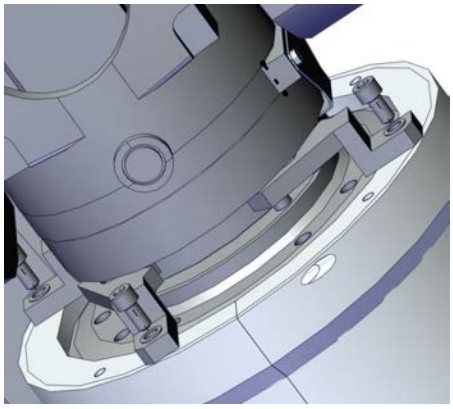
3.3.3 Installing the Feather Duster V2
Continued

	Action	Note
6	Move the Feather Duster V2 under the axis 5 of the robot, with the flange of the steel structure frame vertically aligned with the axis 6 but not pressed to each other.	 xx1800001331

Installing the Feather Duster V2 to the robot

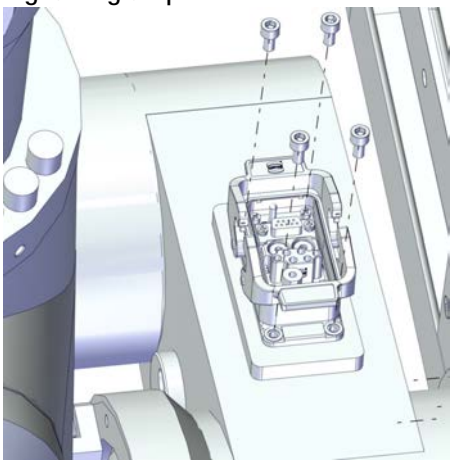
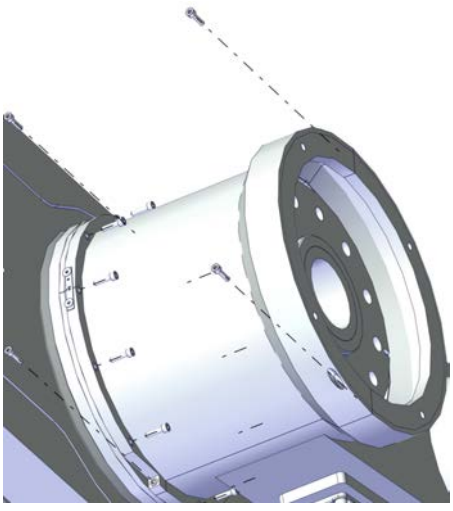
	Action	Note
1	Adjust the installation orientation by aligning the 3 mm-deep groove on the column with the 0° calibration mark of axis 6.	 xx1800001332
2	Fit the screws and washers but not tighten yet.	 xx1800001342

Continues on next page

	Action	Note
3	Insert the locating pin to locate the steel structure frame	 xx1800001343
4	Tighten all the screws.	Screw: M12x25 (11 pcs) Tightening torque: 145 Nm  xx1800001344
5	Fit the exhaust pipe covers and secure them to the convert adaptors with screws and washers. **CAUTION** When fitting the exhaust pipe covers, make sure the inner edge of the covers must press on the lip of the V-ring on the axis 6.  xx1800001345	 xx1800001346 Screw: M8x20 (4 pcs) Tightening torque: 43 Nm

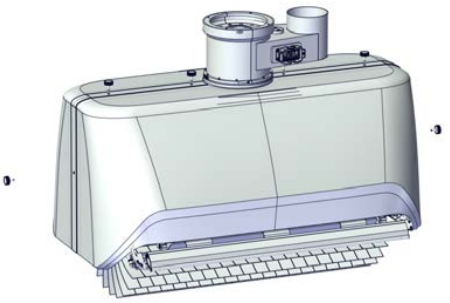
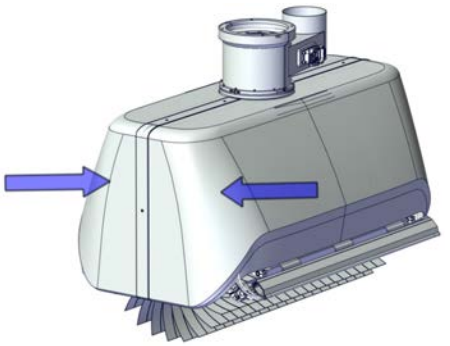
Continues on next page

3.3.3 Installing the Feather Duster V2
Continued

	Action	Note
6	Refit the socket and cable chain.	Screw: M6x12 (4 pcs) Tightening torque: 10 Nm  xx1800001335
7	Secure the two halves of the exhaust pipe covers with screws.	 xx1800001329  xx1800001334 Screw: M4x16 (14 pcs) Tightening torque: 3 Nm

Continues on next page

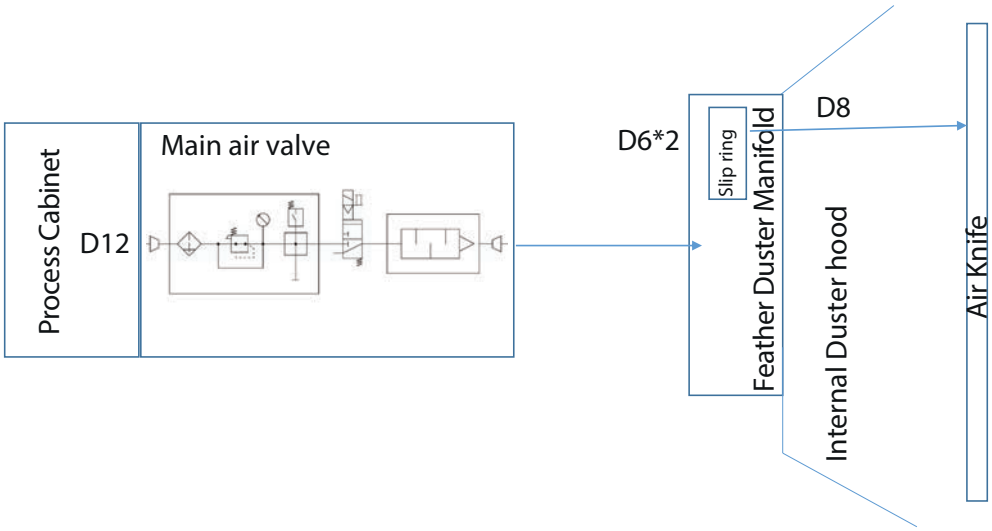
Refitting the PDCPD cover

	Action	Note
1	Refit the PDCPD covers.	Screw: Round head screw with embossing (6 pcs)  xx1800001270  xx1800001323

3.3.4 Connecting exhaust hose and cables

Pneumatic system overview

The following figure shows the pneumatic system.



xx1800001348

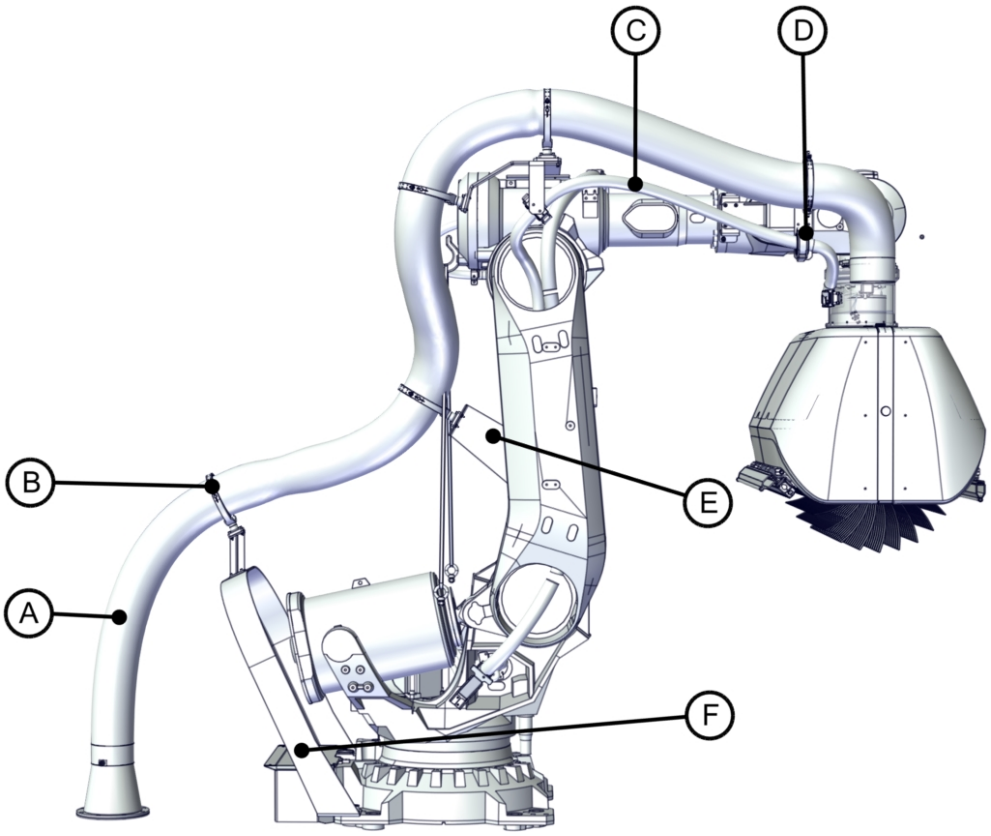
The components in the air valve are from left to right, quick fitting, reducer, regulator, valve, silencer, reducer, and quick fitting.

Continues on next page

Routing introduction

After the Feather Duster V2 is correctly installed on the robot, connect external exhaust hose and electrical cables to make the Feather Duster V2 ready for operation. The Feather Duster V2 is delivered with internal cabling fitted. To replace internal cables, see *Replacing the cable chain on page 105*.

The electrical cables are combined with the air tube within a protection flexible conduit. Exhaust hose and conduit are fixed at different locations on the robot to minimize wearing during operation.



xx1800001591

A	Exhaust hose
B	Hose holder
C	Cabling
D	Cable clamp
E	Fixing plate
F	Support frame

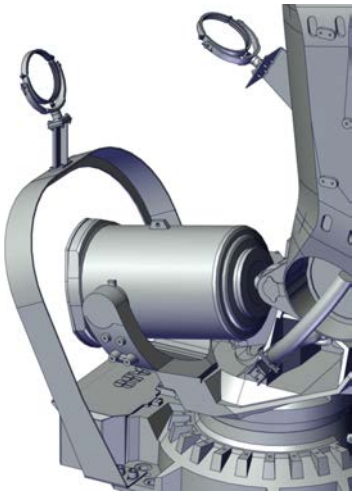
Continues on next page

3.3.4 Connecting exhaust hose and cables
Continued

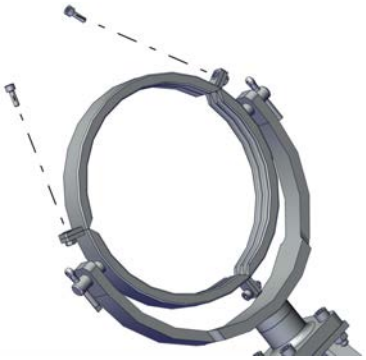
Procedure

Use this procedure to routing and connecting the exhaust hose and cables.

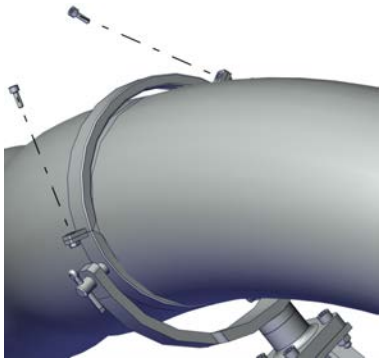
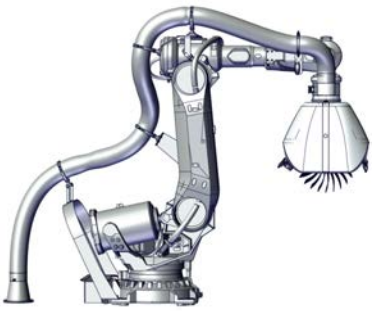
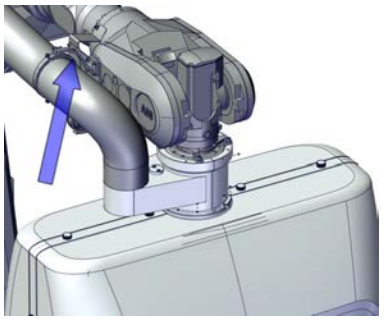
Installing the fixing plates

	Action	Note
1	Install the support frame to the robot base.	 xx1800001545
2	Install fixing plates.	See *Routing introduction on page 69* for the installation positions of the fixing plates.

Routing and connecting the exhaust hose

	Action	Note
1	Remove the screws on a hose holder.	 xx1800001350

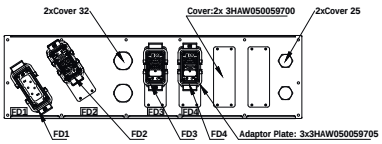
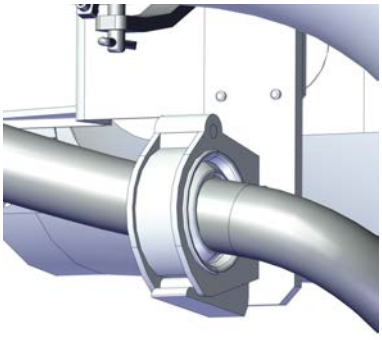
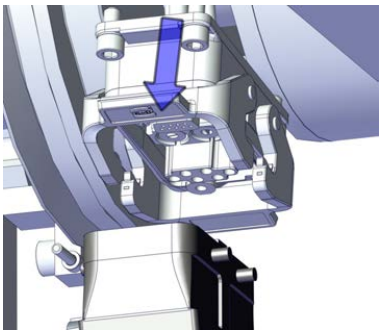
Continues on next page

	Action	Note
2	Separate the two halves of the hose holder by pulling them sidewards and then turning a little in different directions.	 xx1800001541
3	Put the exhaust hose to the hose holder.	 xx1800001542
4	Close the hose holder and tighten the screws.	
5	Repeat the previous steps until the exhaust hose is routed through all the hose holders. **CAUTION** The exhaust hose sections between every two hose holders must not be straightened. When the robot axis turns or bents, the exhaust hose must be flexible to move together.	 xx1800001543
6	Secure the exhaust hose to the exhaust hose connector with an adjustable hoop.	 xx1800001544

Continues on next page

3.3.4 Connecting exhaust hose and cables
Continued

Routing and connecting the external cabling

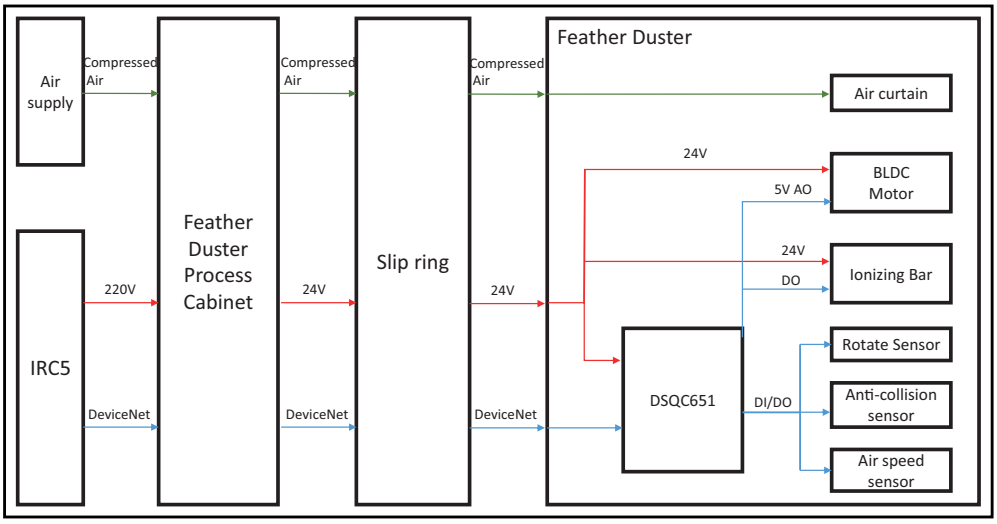
	Action	Note
1	Route the cabling from the robot base.	
2	Install the Harting connector plate to the process cabinet.	 xx1800001349
3	Route the cabling up though the robot arms and final to the Feather Duster V2.	
4	Secure the cabling with cable clamps. **CAUTION** The cable sections between every two clamps must not be straightened. When the robot axis turns or bents, the cabling must be flexible to move together.	 xx1800001768
5	Insert the connectors to the cable plug.	 xx1800001574

3.4 Electrical connection

Electrical system

The electrical system of the Feather Duster V2 mainly exists in the process cabinet, the ionization unit and the motor.

The Feather Duster V2 can be controlled by DeviceNet.



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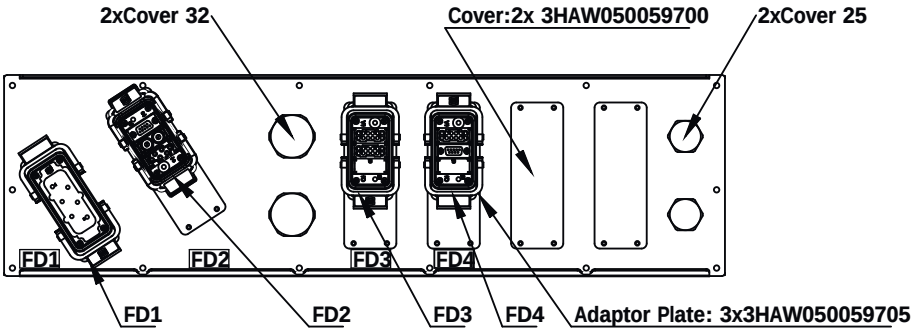
Process cabinet

There are five *Harting* connectors on the process cabinet.

For details, refer the circuit diagram (Art. No. 3HAX010000300) of the process cabinet.



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Connector	Function
FD1	Main power supply input
FD2	Signal
FD3	Compress air valve
FD4	Vacuum sensor

Continues on next page

Connector components

The following table lists the *Harting* connector components installed on the process cabinet.

Connector	Quantity	Harting part number	Description
FD1	1	HARTING:09 30 016 0301	Bulkhead mounting
	1	HARTING:09 31 006 2601	Han HSB 06 Pos. Male insert,6-pole+PE
FD2	1	Harting:09 14 002 4501	Penumatic module
	2	Harting:09 14 000 6174	Penumatic connector Male
	1	Harting:09 14 006 3101	6P Female insert
	2	Harting:09 33 000 6204	Han E F Crimp Contact Ag 1.5 mm/16AWG
	1	Harting:09 62 810 0301	Housing
	1	Harting:09 14 010 0313	Hinged Frame for Han-Modular
	1	Harting:09 14 009 3101	Han D-Sub module female
	5	Harting:09 67 000 5476	D SUB Female turned contact_AWG 22-26_PL1
FD3	1	Harting.09 30 010 0301	Bulkhead mounting, Standard hoods/housings
	2	Harting.09 14 012 3101	Module for female contacts
	1	Harting.09 14 000 9950	Dummy module
	6	Harting.09 15 000 6205	Female contact
	1	Harting.09 14 010 0303	Frame for modules
FD4	1	Harting.09 30 010 0301	Bulkhead mounting housing
	1	1 Harting.09 14 012 3101	Module for female contacts
	9	Harting.09 15 000 6205	Female contact
	1	Harting.09 14 009 3101	D-Sub 9 Shield female
	5	Harting.09 67 000 5476	D SUB FE turned contact_AWG 22-26_PL1
	1	Harting.09 14 000 9950	Dummy module
	1	Harting.09 14 010 0303	Frame for modules, Han-Modular

The following table lists the mating *Harting* connectors to the previous ones. You can order them with the Feather Duster as separate parts or assembled on an ABB harness.

Connector	Quantity	Harting part number	Description
FD1	1	HARTING.19 30 016 1521	Hood
	1	HARTING.19 00 000 5090	Cable Gland M25 CD9-16
	1	HARTING.09 31 006 2701	Han 6 HsB screw-type connection 35 A 400/690 V 6 kV 3 Male

Continues on next page

Connector	Quantity	Harting part number	Description
FD2	2	HARTING.19 62 810 0527	Hood 10B
	2	HARTING.09 14 010 0303	Hinged frame 10B for 3 modules
	2	HARTING.09 14 006 3001	Han Power Module 16A
	2	HARTING.09 14 002 4501	Han Penumatic Modules
	2	HARTING.09 14 009 3001	D-Sub Serial Bus Module Male
	4	HARTING.09 14 000 6279	Han Penumatic Modules Tube Contacts Female without end valve
	4	HHARTING.09 33 000 6121	Han E M Crimp Contact Ag WG 16AWG
	10	HARTING.09 67 000 5576	D SUB MA turned contact_AWG 22-26_PL1
FD3	1	HARTING.19 30 010 1521	Hood 10B, 2LevelLock, SideEntryM25
	1	HARTING.09 14 010 0313	Hinged frame 24B for 6 modules
	1	HARTING.09 14 012 3001	Han DD module, crimp male 12P
	6	HARTING.09 15 000 6103	Male Pin 0.5mm
	1	HARTING.09 14 012 3001	Han DD module, crimp male 12P
	1	HARTING.09 14 000 9950	Dummy module
FD4	1	HARTING.19 30 010 1521	Hood
	1	HARTING.09 14 010 0313	Frame
	1	HARTING.09 14 012 3001	Connector Mod
	2	HARTING.09 15 000 6103	Male Pin 0.5mm
	1	HARTING.09 14 009 3001	Serial Bus module 9+shield Male
	5	HARTING.09 67 000 5576	D SUB MA turned contact_AWG 22-26_PL1
	1	HARTING.09 14 000 9950	Dummy module

Note

Recommended tools: (Crimp) HARTING.09 99 000 0001 / (Retract) HARTING.09 99 000 0012

Controller for the roller motor

A Wheatstone Movidrive MXF6030W328B is used in the process cabinet to control the rotation speed of the roller. The DeviceNet is applied to the project. You can refer to the Wheatstone documentation for installation, operation, and program details. The documentation information is listed in *References on page 7*.

3.5 System start-up

Introduction

General

This chapter contains the instructions for setting up the Feather Duster V2 system once the physical installation has been completed, and the robot and robot controller have been started up.

To start up the robot system, refer to the controller and robot documentation. See *References on page 7*.

Performing the first run

Use this procedure to perform the first test run after a service activity (repair, installation or maintenance).

	Action
1	Remove all service tools and peripheral equipment from the robot and its working area.
2	Install safety equipment properly.
3	Make sure all the personnel stand a safe distance away from the robot, for example, out of its reach behind safety fences and so on.
4	Pay special attention to the function of the part previously serviced.

Setting the robot TCP

Use this procedure to set the TCP.

	Action
1	Use the FTP software to connect the robot.
2	Download \HOME\robdata\robdata.sys and backup the current file before any modification.
3	Use the shopfloor editor or UE editor to open the file robdata.sys.

4	Add one line to define the TCP for the Feather Duster V2.
	`PERS tooldata Tool_Cleaner:`
	`=[TRUE,[[0,0,900],[1,0,0,0]],[125.1,[7.1,3.8,319.5],[1,0,0,0],26.302,12.415,18.623]];`

5	Save the file.
6	Download the modified file to the controller to replace the previous one.
7	Warm start the robot.

Continues on next page

Start-up of the Feather Duster V2 motor

Startup procedure

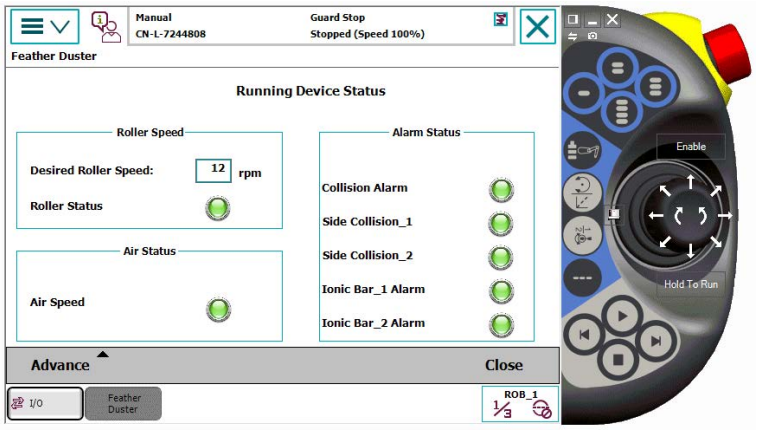
The following figure shows the home page of Feather Duster V2 FlexPendant application, which is a navigation page with the add-in version displayed at the lower right corner.

xx1800001598

If click on the Start Device button, detailed version information about the Feather Duster V2 roller speed, alarm status and air status will be displayed as shown in the following figure.

CAUTION

The green light means the connection is in good condition. If the light shows red warning, the connection of the device must has problems. Please check the connect condition.



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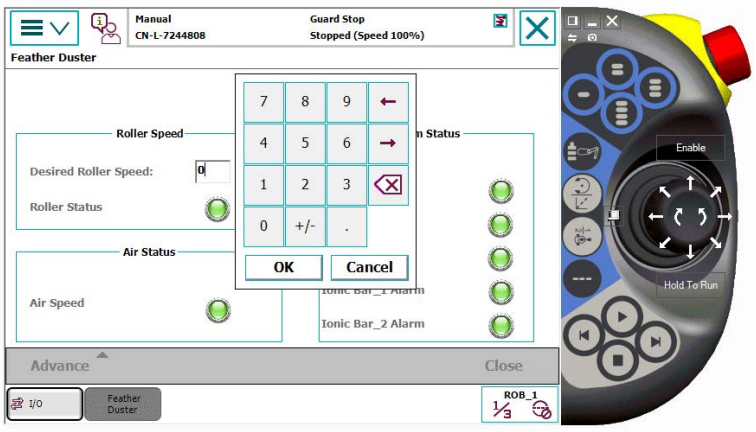
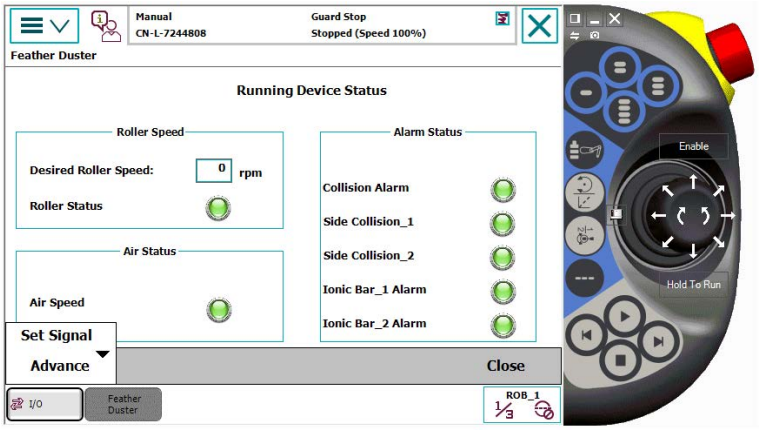
3.5 System start-up
Continued

Set the desired roller speed as the figure illustrated below.



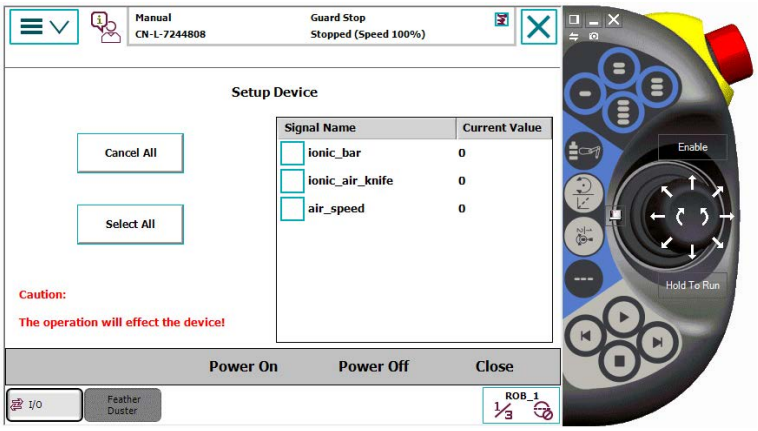
xx1800002798

Pressing on the button at the left bottom of the window to set preferred signals.



xx1800002799

The sub-page is showed after starting the set signal application, in which the Select All and Cancel All button will be enabled.

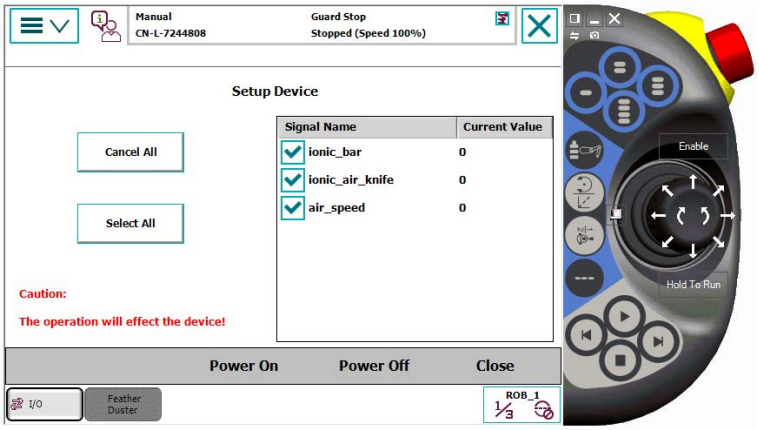


xx1800002800

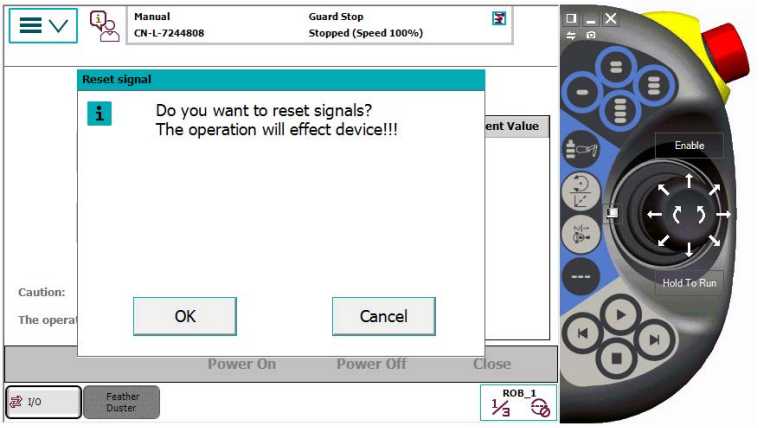
Continues on next page

CAUTION

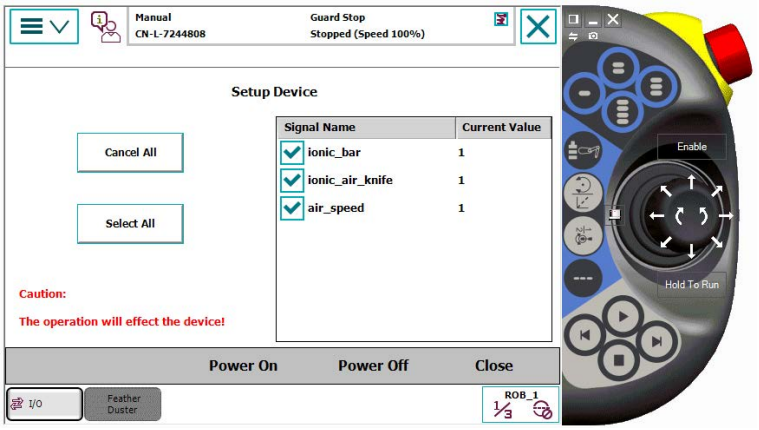
To ensure the safe use of Feather Duster V2, Ionizing bar, ionizing air knife and air speed sensor are normally disabled by default. These devices must be enabled before the commissioning or the cleaning of dust and dirt particles from car body.



xx1800003225



xx1800003226



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4 Maintenance

4.1 Introduction

Structure of this chapter

This chapter describes all the maintenance activities recommended for the Feather Duster V2.

It is based on the maintenance schedule found at the beginning of the chapter. The schedule contains information about required maintenance activities including intervals, and refers to procedures for the activities.

Each procedure contains all the information required to perform the activity, including required tools and materials.

The procedures are gathered in different sections and divided according to the maintenance activity.

Safety information

Observe all safety information before conducting any service work!

There are general safety aspects that must be read through, as well as more specific safety information that describes the danger and safety risks when performing the procedures. Read the chapter *Safety on page 13* before performing any service work!

4.2 Maintenance schedule

4.2.1 Specification of maintenance intervals

Introduction

The intervals are specified in different ways depending on the type of maintenance activity to be carried out and the working conditions of the Feather Duster V2:

- Calendar time: specified in months regardless of whether the system is running or not.
- Operating time: specified in operating hours. More frequent running means more frequent maintenance activities.

4.2.2 Maintenance schedule

Scheduled and non-predictable maintenance

The Feather Duster V2 must be maintained regularly to ensure proper function.

Non-predictable situations also give rise to inspections of the Feather Duster. Any damages must be attended to immediately!

Life of each component

Component	Lifetime
Cables	1,000,000 cycles
Timing belt	Over 16,000 hours
Feather roller	Over 6 months
Motor	Over 10 years

Activities and intervals

The table below specifies the required maintenance activities and intervals:

Maintenance activities	Daily	Weekly	Every 2,500 hours	Every 6 months	Every 16,000 hours	When necessary	Reference
Cleaning activities							
Cleaning the Feather Duster V2		x					*Cleaning activities on page 85*
Inspection activities							
Inspecting for faults	x						
Inspecting the Feather Duster V2	x						Check for abnormal wear or contamination.
Inspecting feathers	x						*Inspecting feathers on page 88*
Inspecting the ionization unit		x					*Inspecting the ionization unit on page 89*
Inspecting cables		x					*Inspecting the cabling and exhaust hose on page 91*
Inspecting the timing belt			x				*Inspecting the timing belt on page 93*
Replacement/changing activities							
Replacing the feather roller						x	*Replacing the feather roller on page 98*
Replacing the timing belt					x		*Replacing the timing belt on page 121*

Continues on next page

4.2.2 Maintenance schedule

Continued

Maintenance activities	Daily	Weekly	Every 2,500 hours	Every 6 months	Every 16,000 hours	When necessary	Reference
Replacing the bearing housing							*Replacing the bearing housing on page 128*
Overhaul							
Overhaul of complete product					x		

4.3 Cleaning activities

4.3.1 Cleaning the Feather Duster V2

General

The Feather Duster V2 is used to remove dust particles and contaminants from car body and to-be-painted surfaces. It is important to keep the Feather Duster V2 clean first.

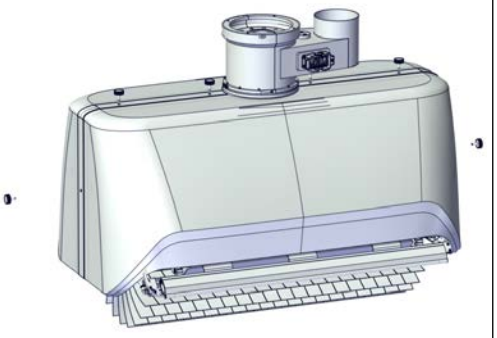
It is recommended to clean and inspect the whole Feather Duster every week.

Cleaning procedure

Preparations before the removal

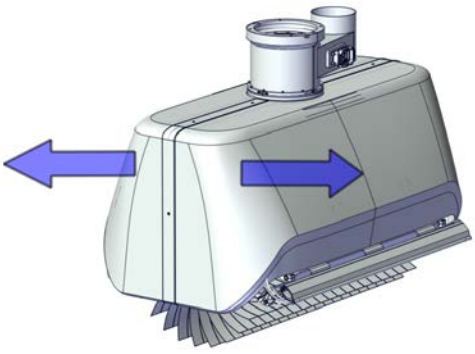
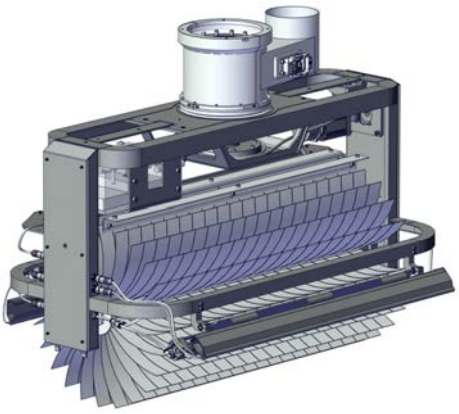
	Action	Note
1	Jog the robot a proper height for easily access the Feather Duster V2.	

Removing the PDCPD cover

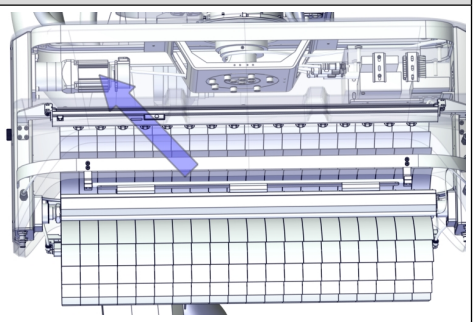
	Action	Note
1	Remove the 6 screws on the covers.	 xx1800001270

Continues on next page

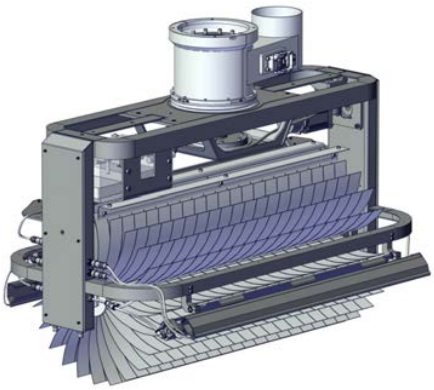
4.3.1 Cleaning the Feather Duster V2
Continued

	Action	Note
2	Separate and remove the 2 covers respectively in proper order.	 xx1800001321  xx1800001322

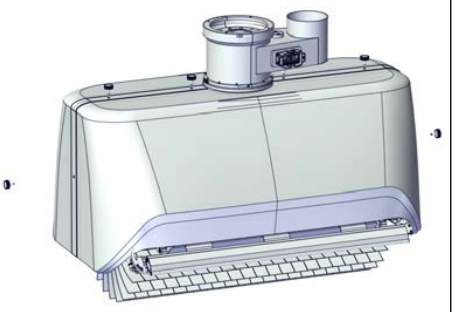
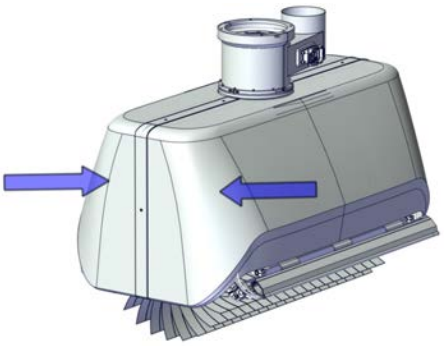
Cleaning surfaces

	Action	Note
1	Clean the surface of motor.	 xx1800001592

Continues on next page

	Action	Note
2	Clean the ionizer unit and its support frame.	 xx1800001322
3	Sweep the duster and dirt on the feather directly by human hand.	
4	Make sure that the ionizing air knife is properly aligned. To adjust the ionizing air knife, see *Adjusting the ionizing air knife on page 90*	

Refitting the PDCPD cover

	Action	Note
1	Refit the PDCPD covers.	Screw: Round head screw with embossing (6 pcs)  xx1800001270  xx1800001323

Alcohol may be used but with care. Strong alcohol, for example, acetone must be avoided. High pressure cleaning equipment may be used, but spraying directly on the Feather Duster V2 must be avoided.

4.4 Inspection activities

4.4.1 Inspecting feathers

General

The feathers wear normally. It is necessary to replace them every six months.

Feather care

Ostrich feathers contain millions of tiny hairs on each of their threads. These hairs grab on to the dirt and removes it from the car body. The feather hairs may drop due to wear, tearing by sharp edges and aging. The Feather Duster V2 is no longer effective and feathers on the feather roller should be replaced when no more hairs can be seen at the feathers tips. See *Replacing the feather roller on page 98*.

Note

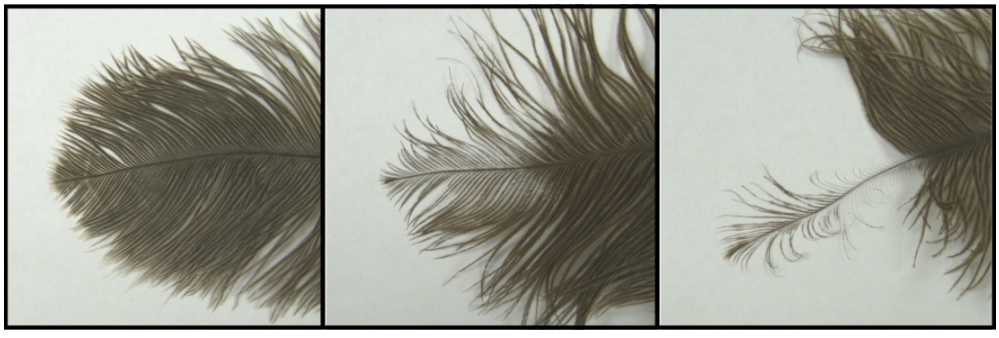
When replacing feathers, take care to ensure that the feathers are not damaged or contaminated.

- Wash hands before installing feathers
- Keep grease and oil away from feathers
- Keep the feather roller in its package until it is ready for installation
- Reseal packages if they have been opened for inspection
- Do not put feathers on the floor directly. Always use the ABB-provided feather roller support (Art. No:3HAW050024260) to support the feather roller.

Inspection, feathers

Visual inspection, no tools are required.

Other tools and procedures are specified in the *replacement procedure*.



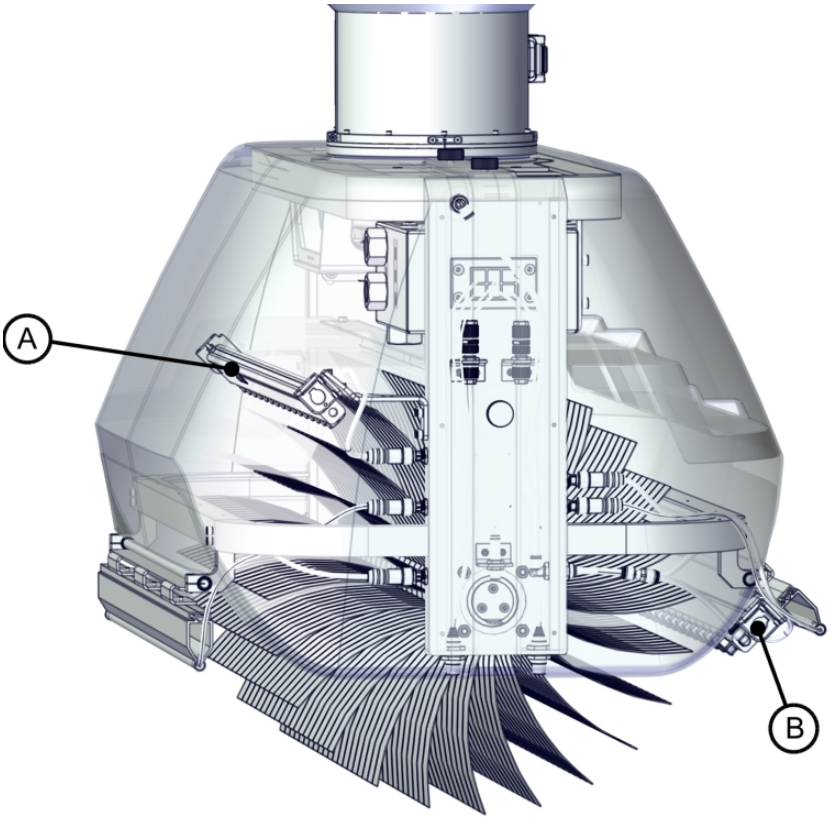
xx1600000678

A	Feather in good condition
B	Worn feather, to-be-replaced soon
C	Destroyed feather, must be replaced

4.4.2 Inspecting the ionization unit

Location of the ionization unit

The ionization unit including the ionizing air knife and ionizing bar is located as shown in the figure.



xx1800001266

A	Ionizing bar
B	Ionizing air knife

Required tools and equipment

Visual inspection, no tools are required.

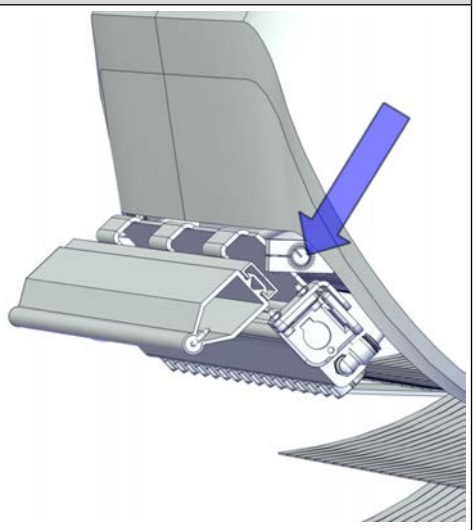
Continues on next page

4.4.2 Inspecting the ionization unit
Continued

Adjusting the ionizing air knife

The ionizing bar bracket could be adjusted so that the air stream can properly blow onto the car body surface. This is critical for achieving better dust elimination effects.

Use this procedure to adjust the ionizing air knife.

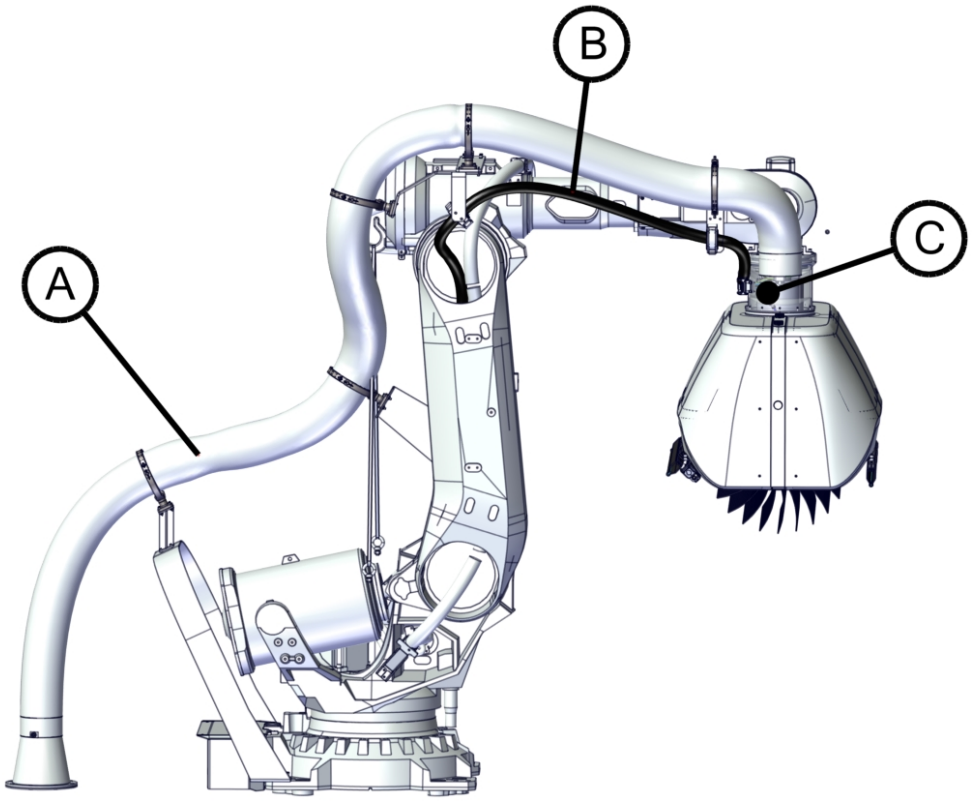
	Action	Note
1	Rotate the ionizing bar directly.	 xx1800001546
2	Rotate the ionizing bar bracket until a proper angle of the air knife is achieved.	 xx1800001547

4.4.3 Inspecting the cabling and exhaust hose

Location of the cabling and exhaust hose

The Feather Duster V2 cabling comprises the cabling from the Feather Duster V2 to the robot base, both internal and external, as well as the cabling to the process cabinet.

The Feather Duster V2 exhaust hose routes from the Feather Duster V2 to the exhaust fan.



xx1800001552

Required tools and equipment

Visual inspection, no tools are required.

Other tools and procedures may be required if the spare part needs to be replaced. These are specified in the replacement procedure.

Continues on next page

4.4.3 Inspecting the cabling and exhaust hose
Continued

Inspection, cabling and exhaust hose

Use this procedure to inspect the robot cabling.

	Action	Note
1	Visually inspect: • the cabling from the Feather Duster V2 to the robot base, both internal and external • the cabling to the process cabinet • the exhaust hose from the Feather Duster V2 to the exhaust fan Look for abrasions, cuts or crush damages. **Note** To inspect the internal cabling, remove the carbon fiber covers first.	
2	Replace the cabling or exhaust hose if wear or damage is detected.	

4.4.4 Inspecting the timing belt

Location of timing belt

The timing belt is located as shown in the figure.

xx1800001548

Required tools and equipment

Equipment	Article number	Note
Standard toolkit	-	Content is defined in section *Standard toolkit on page 178*.
Steel tape	-	

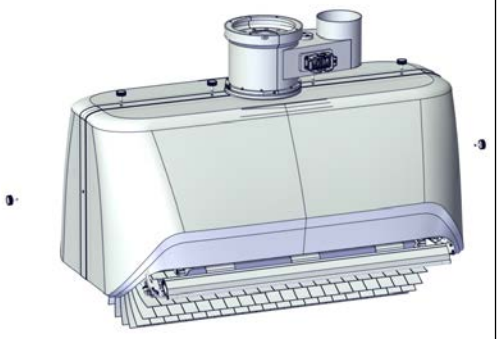
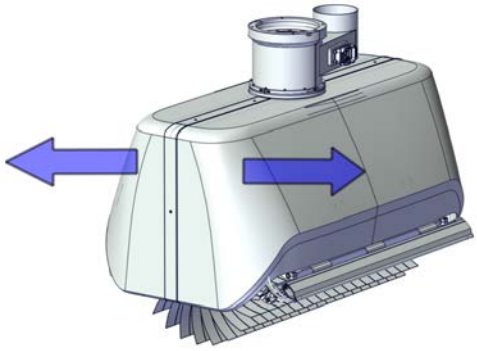
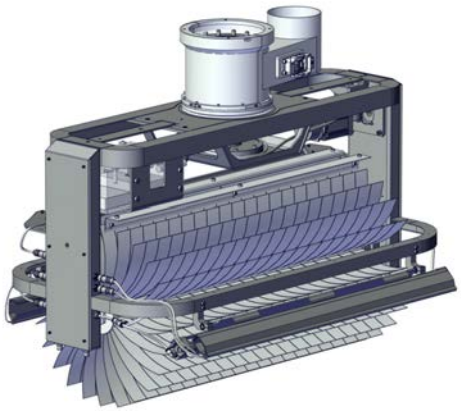
Continues on next page

4.4.4 Inspecting the timing belt
Continued

Inspecting the timing belt

Use this procedure to inspect the timing belt.

Removing the PDCPD cover

	Action	Note
1	Remove the 6 screws on the covers.	 xx1800001270
2	Separate and remove the 2 covers respectively in proper order.	 xx1800001321  xx1800001322

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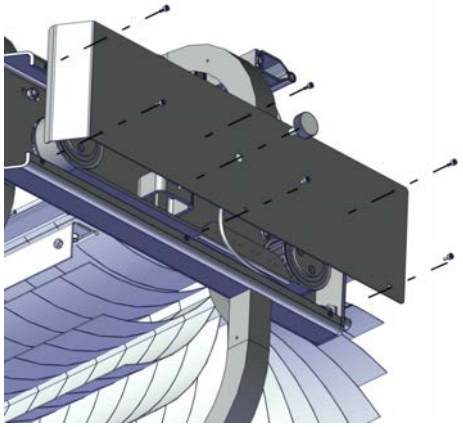
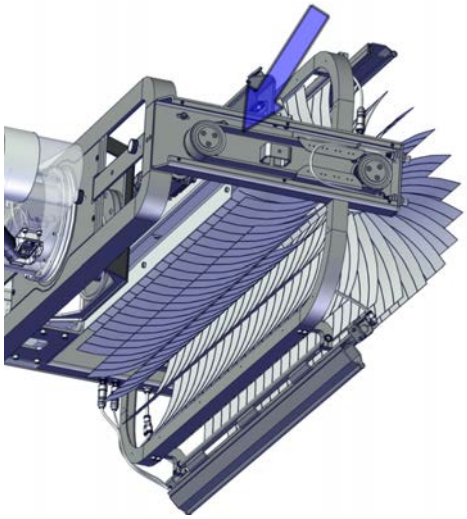
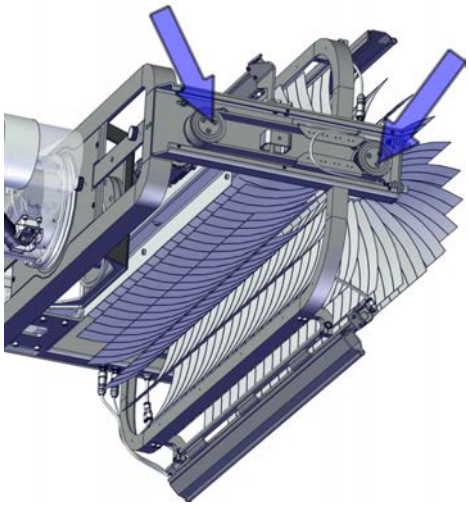
Checking the timing belt

	Action	Note
1	Gain access to the timing belt by removing the tunnel cover.	 xx1800001549
2	Check the timing belt for damage or wear.	 xx1800001550
3	Check the timing belt pulley for damage.	 xx1800001551

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4.4.4 Inspecting the timing belt

Continued

	Action	Note
4	If any damage or wear is detected, the part must be replaced!	
5	Check the timing belt for tension. Wen you pinch the timing belt, the distance between two sides should be approximately 50--55 mm. If the belt tension is not correct, adjust it!	 xx1600000686

5 Repair

5.1 Introduction

Structure of this chapter

This chapter describes all repair activities recommended for the Feather Duster V2 and any external unit.

It is made up of separate procedures, each describing a specific repair activity. Each procedure contains all the information required to perform the activity, for example spare parts numbers, required special tools, and materials.

The procedures are gathered in sections, divided according to the component location on the Feather Duster V2.

Required equipment

The details of the equipment required to perform a specific repair activity are listed in the respective procedures.

The details of equipment are also available in different lists in the chapter *Reference information on page 173*.

Safety information

There are general safety information and specific safety information. The specific safety information describes the danger and safety risks while performing specific steps in a procedure. Make sure to read through the chapter *Safety on page 13* before commencing any service work.

5.2 Repairing activities

5.2.1 Replacing the feather roller

Location of the feather roller

The feather roller is located as shown in the figure.

xx1800001265

Required spare parts

Spare part	Article number	Note
front cover	3HAX010000247	PDCPD cover
back cover	3HAX010000248	PDCPD cover
Feather brush	3HAX010000293	20 pieces per pack. One pack of brushes are stacked on the shaft.
Roller shaft	3HAX010000439	
Shaft bearing with housing	3HAW050024230	
Fix connected axis	3HAW050024228	

Required tools and equipment

Equipment	Article number	Note
Standard toolkit	-	Content is defined in section *Standard toolkit on page 178*.

Continues on next page

Equipment	Article number	Note
Feather roller support	3HAW050024260	

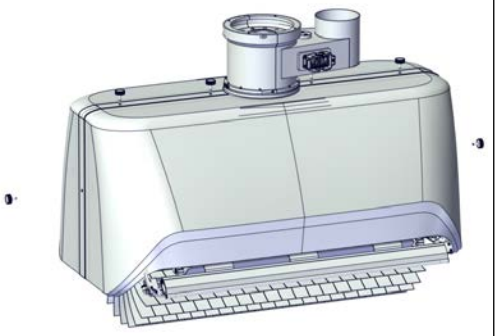
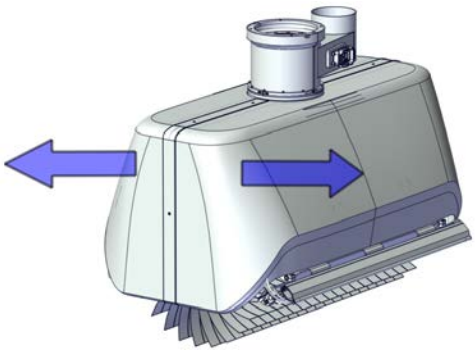
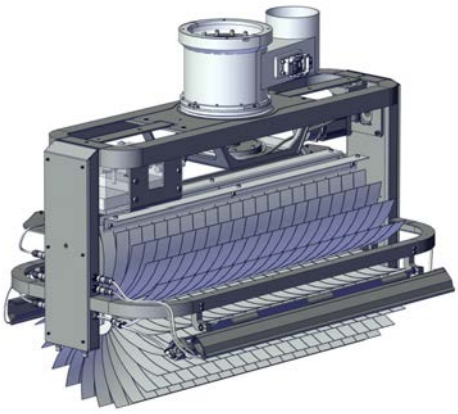
Removing the feather roller

Use these procedures to remove the feather roller.

Preparations before the removal

	Action	Note
1	Jog the robot a proper height for easily access the Feather Duster V2.	

Removing the PDCPD cover

	Action	Note
1	Remove the 6 screws on the covers.	 xx1800001270
2	Separate and remove the 2 covers respectively in proper order.	 xx1800001321  xx1800001322

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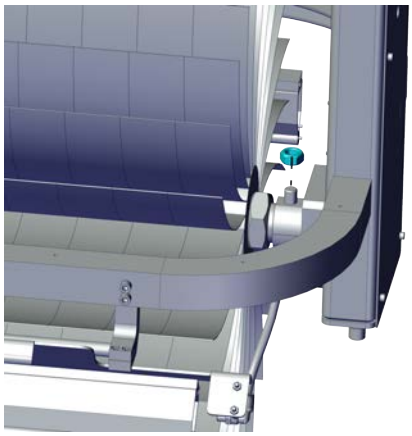
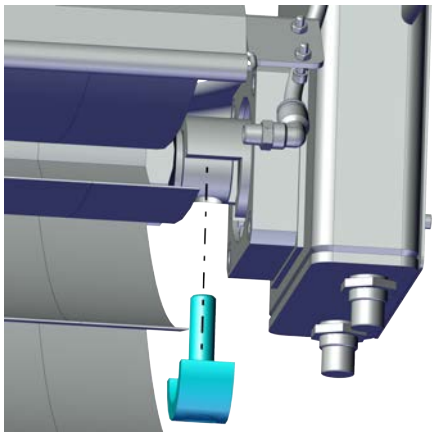
5.2.1 Replacing the feather roller

Continued

Removing the feather roller

	Action	Note
1	Remove the nut on setting screws on both side of the feather roller.	 xx1800003228
2	Remove the designed setting screws on both side of the feather roller.	 xx1800003229

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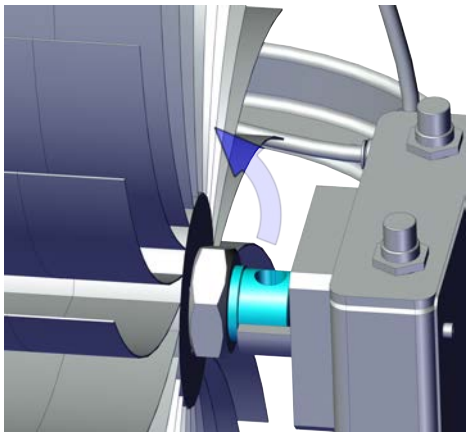
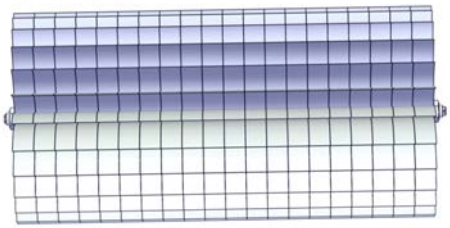
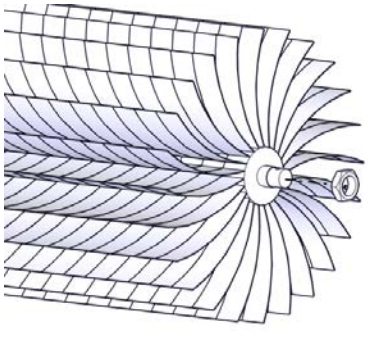
	Action	Note
3	Uplift the feather roller from the groove. **CAUTION** Pay attention not to collide with the ionizing air knife or safety edge sensor.	 xx1800003231  xx1800001556
4	Put the feather roller on the feather roller support.	 xx1600000734

Replacing the feather brushes

Removing the feather brushes

	Action	Note
1	Remove the locknut at either end of the roller shaft.	 xx1600000920

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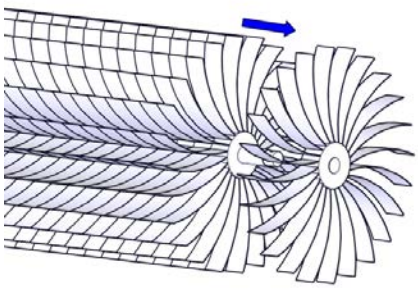
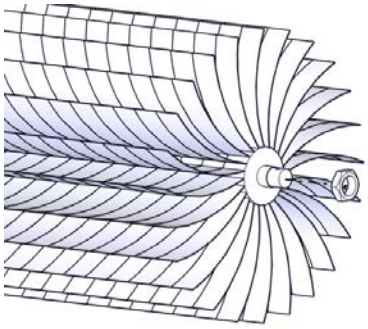
5.2.1 Replacing the feather roller
Continued

	Action	Note
2	Remove feather brushes one by one.	 xx1600000921

Refitting the feather brushes

	Action	Note
1	Stack feather brushes one by one to the roller shaft. Make sure the feathers are in correct orientation.	See *Correct feather rotation on page 52* for correct feather orientation.
2	Secure with the locknut. **CAUTION** Do not press the locknut too tight; otherwise, the brushes may be distorted.	 xx1600000920

Refitting the feather roller

Use these procedures to refit the feather roller.

Refitting the feather roller

	Action	Note
1	Put the feather roller back on to the frame. **Note** The roller has a boss at one end. The boss must be aligned with the key slot on the support shaft. This ensures the correct installation of the feather roller.	

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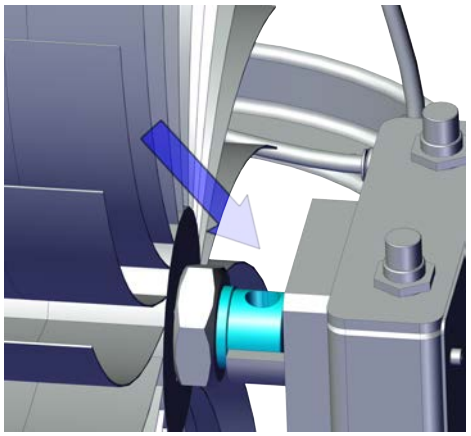
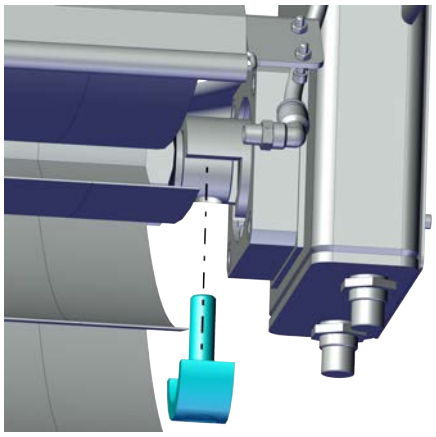
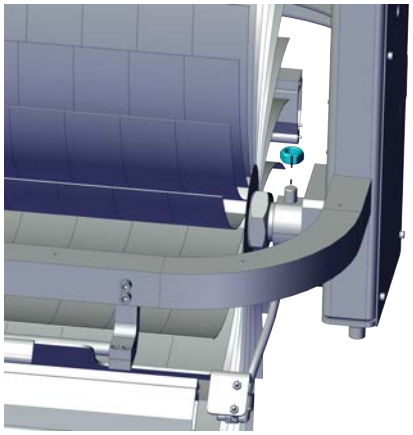
	Action	Note
2	Insert both side of the feather roller into the groove of the connected shaft.	 xx1800003230
3	Insert the setting screws back to both side of the feather roller.	 xx1800003229
4	Install the nuts on the setting screws.	 xx1800003228

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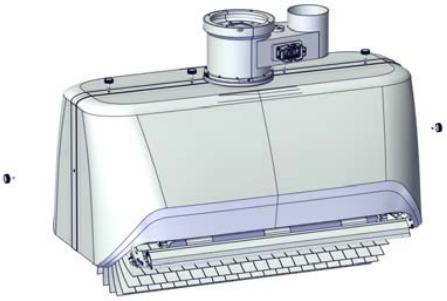
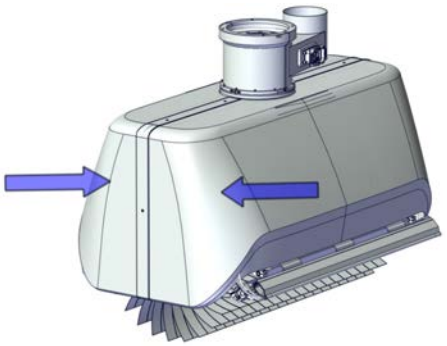
5.2.1 Replacing the feather roller
Continued

Refitting the PDCPD cover

	Action	Note
1	Refit the PDCPD covers.	Screw: Round head screw with embossing (6 pcs)  xx1800001270  xx1800001323

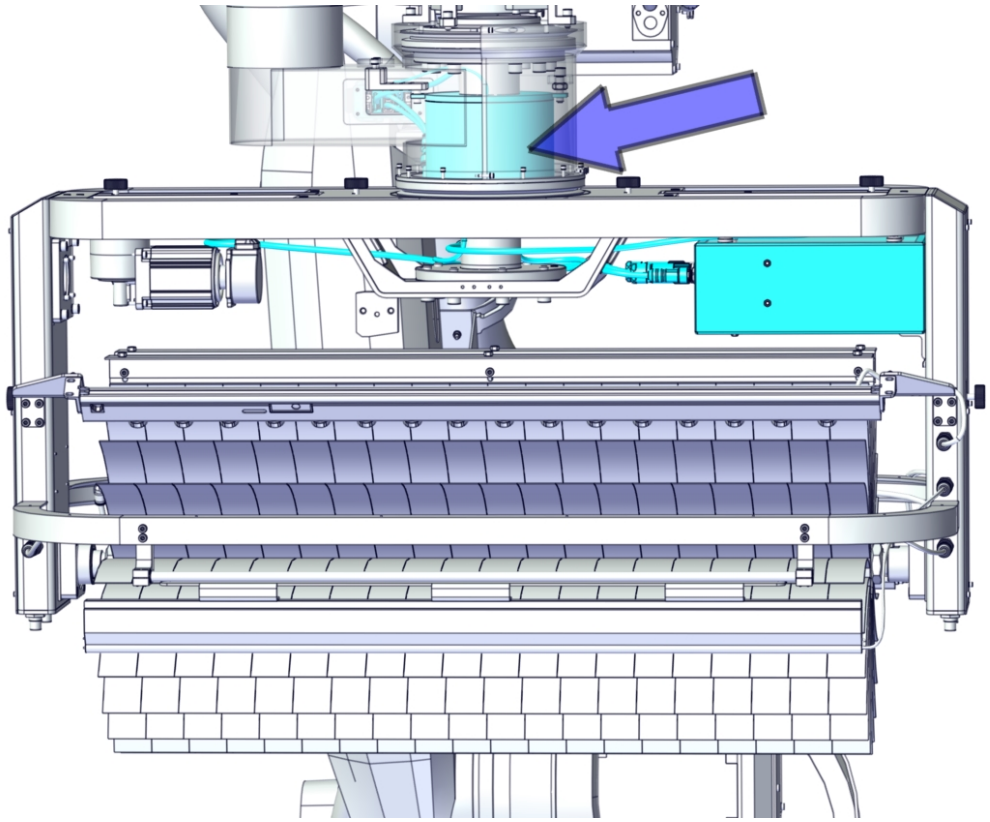
5.2.2 Replacing the cable chain

Location of the cable chain

The Feather Duster V2 cabling comprises the cabling from the Feather Duster V2 to the robot base, both internal and external, as well as the cabling to the controller box.

External cabling is easy to be replaced. This section mainly concerns the replacement of the internal cabling, especially the cable chain. While, the connection between the controller box and the feather duster has to be replaced either.

The cable chain is located as shown in the figure.



xx1800001572

Required spare parts

Spare part	Article number	Note
front cover	3HAX010000247	PDCPD cover
back cover	3HAX010000248	PDCPD cover
Controller box	3HAX010000301	
LPT080-0220-05S-01A	3HAX010000411	Slip ring

Continues on next page

5.2.2 Replacing the cable chain
Continued

Required tools and equipment

Equipment	Article number	Note
Standard toolkit	-	Content is defined in section *Standard toolkit on page 178*.

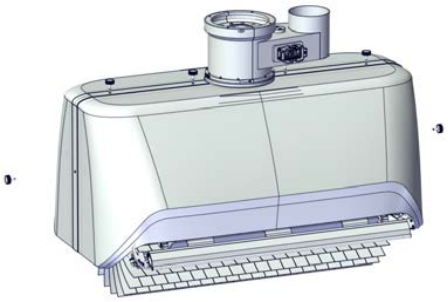
Removing the cable chain

Use these procedures to remove the internal cable harness.

Preparations before the removal

	Action	Note
1	Jog the robot a proper height for easily access the Feather Duster V2.	

Preparations on the Feather Duster V2

	Action	Note
1	Release the 6 screws.	Screw: Round head screw with embossing (6 pcs)  xx1800001270

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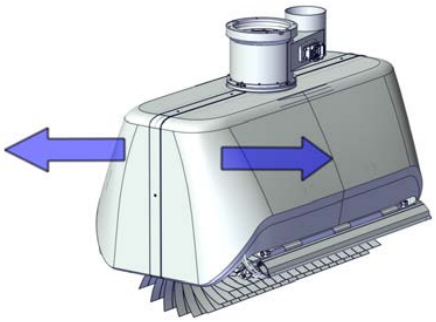
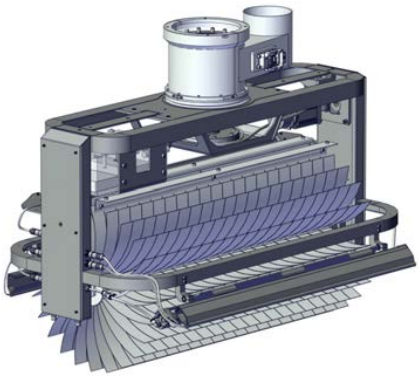
	Action	Note
2	Remove the PDCPD cover.	 xx1800001321  xx1800001322

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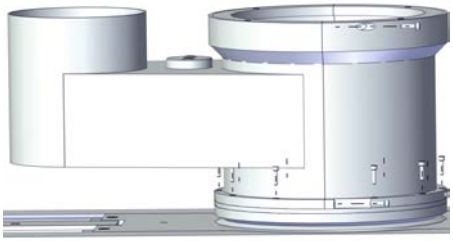
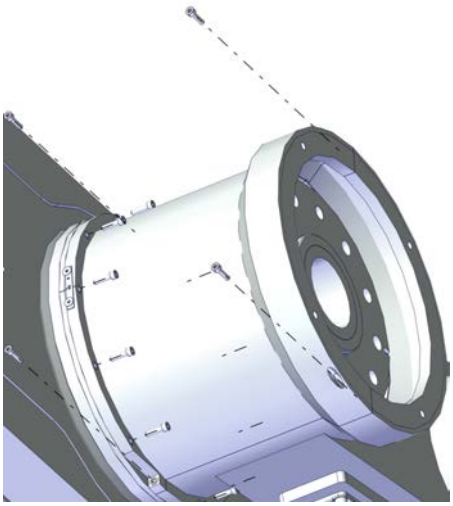
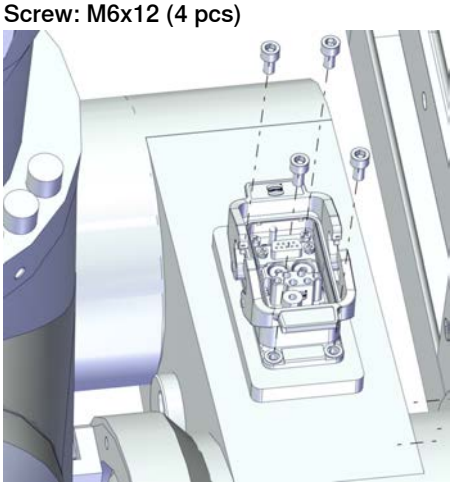
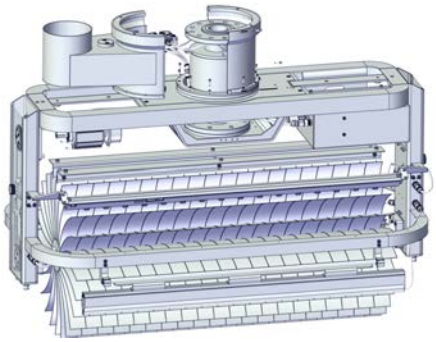
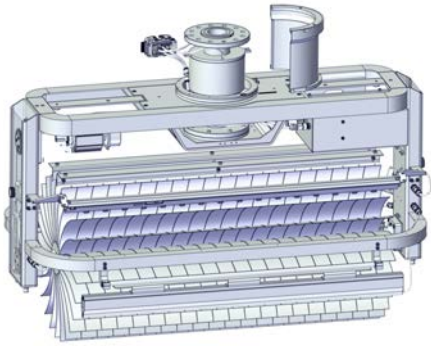
5.2.2 Replacing the cable chain

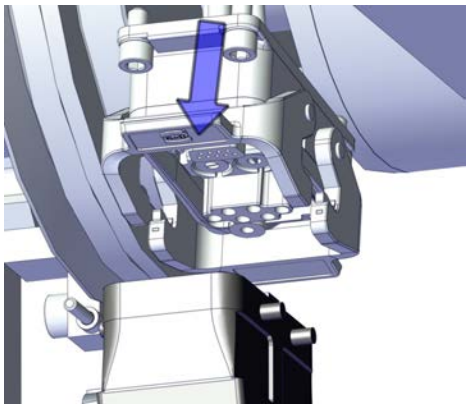
Continued

	Action	Note
3	Release the screws on exhaust pipe cover.	Screw: M4x16 (14 pcs)  xx1800001329  xx1800001334
4	Remove the cable socket.	Screw: M6x12 (4 pcs)  xx1800001335

Continues on next page

	Action	Note
5	Remove the exhaust pipe covers by removing the screws securing them and the fixing plate. **CAUTION** Always properly support the fixing plate while removing the screws. The fixing plate, together with the longer reinforcement supports and upper cable chain cover installed on it, may drop a little distance after screws are removed. Prevent damages or injuries due to sudden dropping.	 xx1800001336  xx1800001337

Removing the cable chain

	Action	Note
1	Plug off the external connectors.	 xx1800001574

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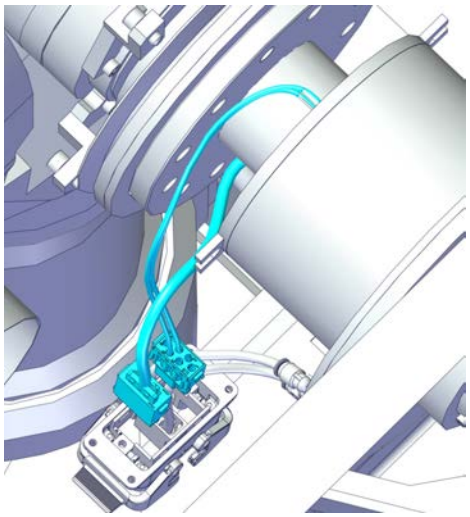
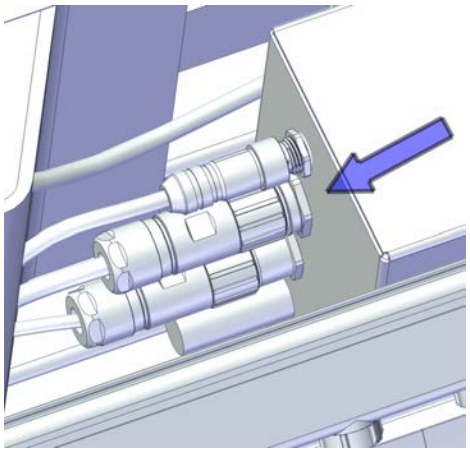
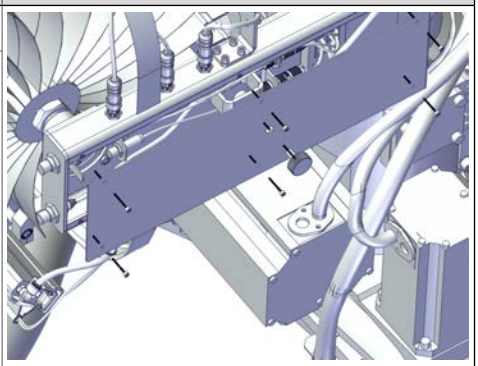
5.2.2 Replacing the cable chain
Continued

	Action	Note
2	Disconnect the cable between slider and the plug.	 xx1800001576
3	Plug off the internal connectors next to the connector box.	 xx1800001575
4	Remove the plug and internal cable chain.	

Removing the tunnel covers

	Action	Note
1	Remove the screws.	 xx1800001573
2	Remove the tunnel covers on both side of the feather duster.	

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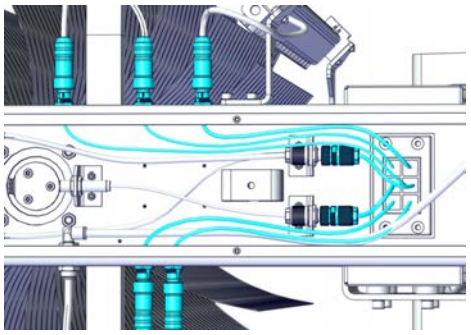
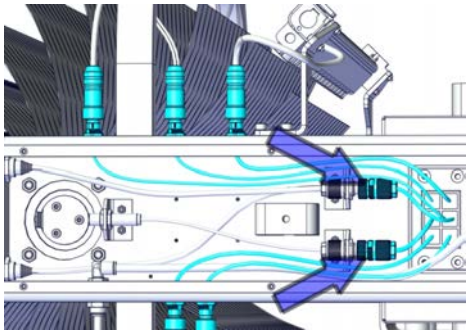
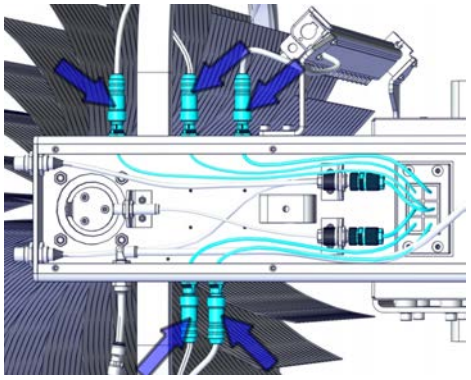
Removing the controller box

	Action	Note
1	Plug off the 2 internal plugs.	 xx1800001753  xx1800001754
2	Remove the 5 connector bases from the tunnel frame.	 xx1800001755

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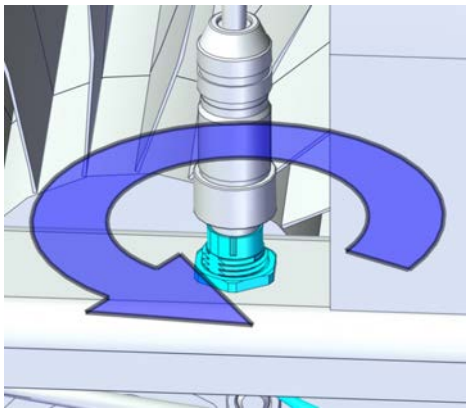
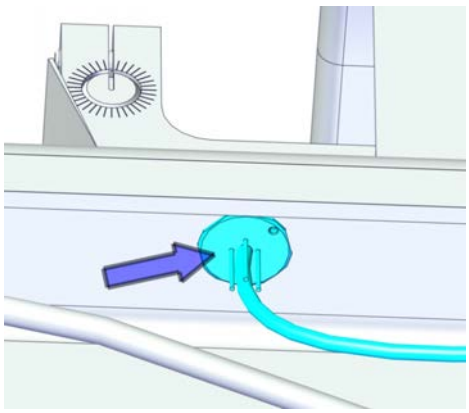
5.2.2 Replacing the cable chain

Continued

	Action	Note
3	Release the nut on connector base, and remove the cable from the back of tunnel frame.	 xx1800001756  xx1800001757

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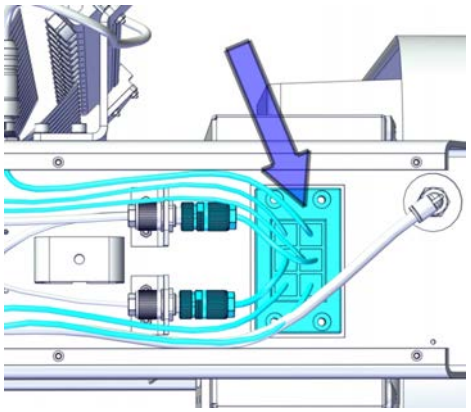
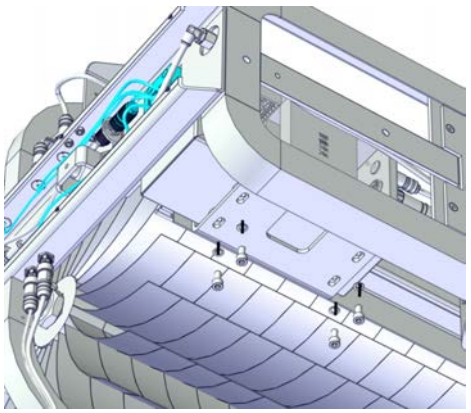
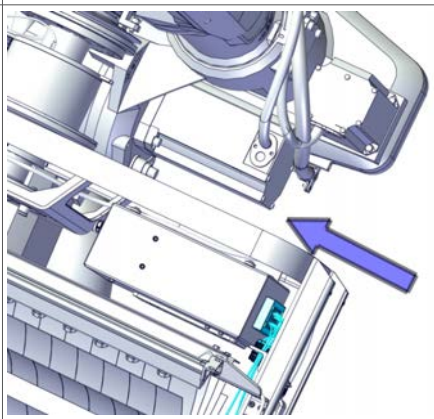
	Action	Note
4	Remove the cable harness on the tunnel by releasing the screws on the controller box.	 xx1800001758  xx1800001759
5	Remove the controller box and its cable chain.	 xx1800001760

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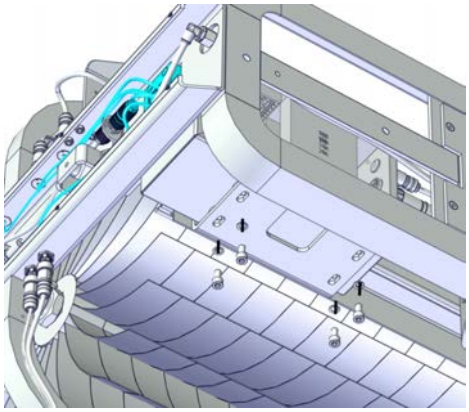
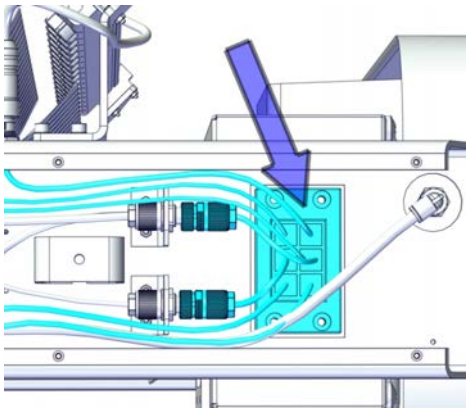
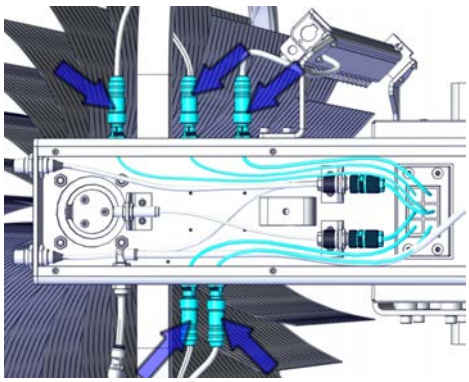
5.2.2 Replacing the cable chain
Continued

Refitting the cable chain

Use these procedures to refit the internal cable harness.

Refitting the controller box

	Action	Note
1	Refit the screws on the controller box.	 xx1800001759 Screw: M6x10 (4 pcs) Tightening torque: 15 Nm
2	Insert the cable harness of the controller box back to tunnel frame.	 xx1800001758
3	Refit the 5 connector bases to the tunnel frame.	 xx1800001755

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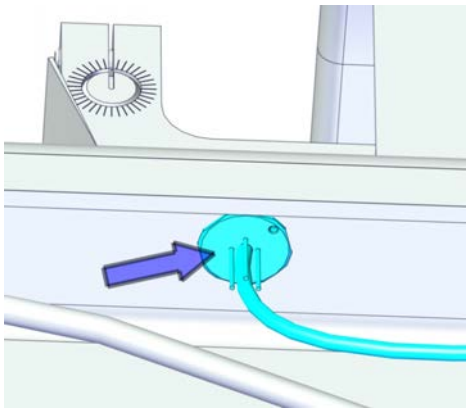
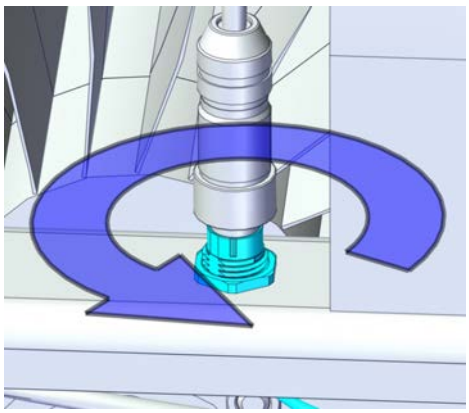
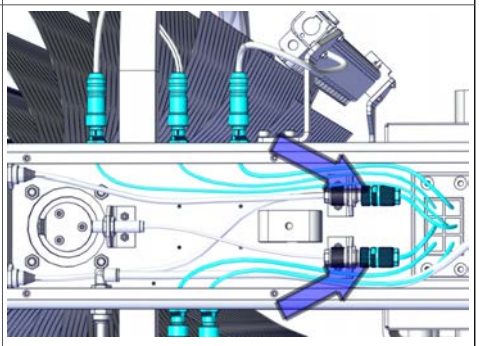
	Action	Note
4	Refit the nuts on cable base.	 xx1800001757  xx1800001756
5	Insert the 2 internal plugs.	 xx1800001754

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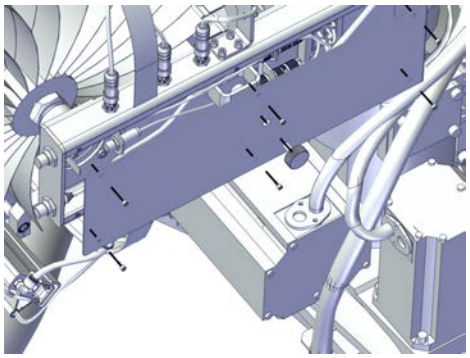
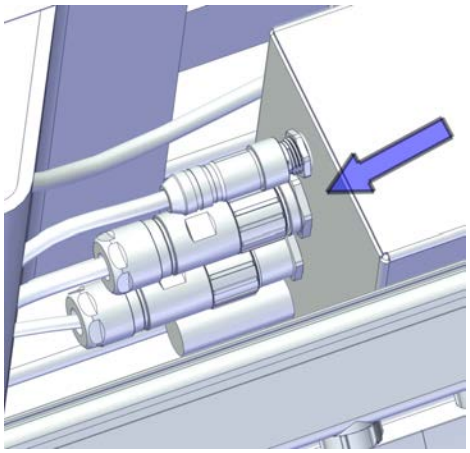
5.2.2 Replacing the cable chain
Continued

Refitting the tunnel covers

	Action	Note
1	Refit the tunnel covers on both side of the feather duster.	 xx1800001573 Screw: M4x8 (12 pcs) Tightening torque: 2 Nm Screw: Round head screw with embossing (2 pcs)
2	Secure with screws.	

Refitting the cable chain

	Action	Note
1	Refit the internal connectors next to the connector box.	 xx1800001575

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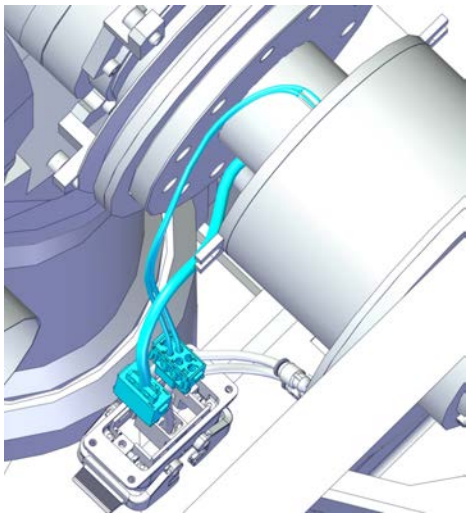
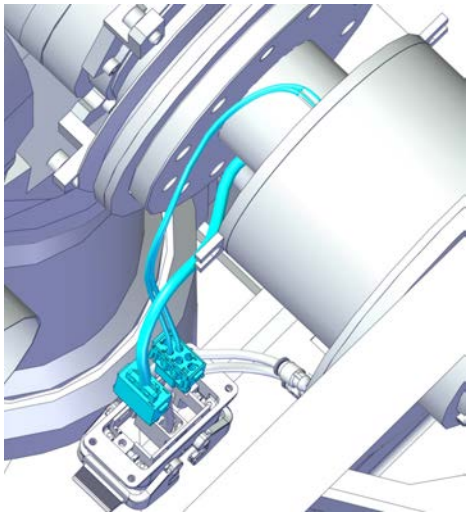
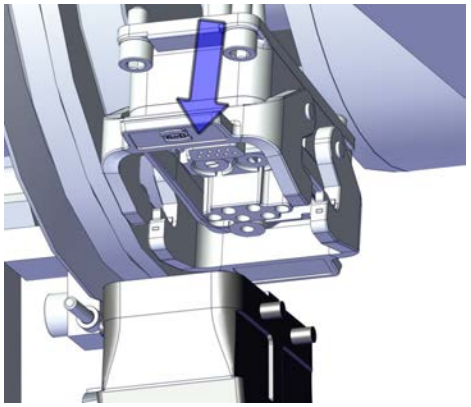
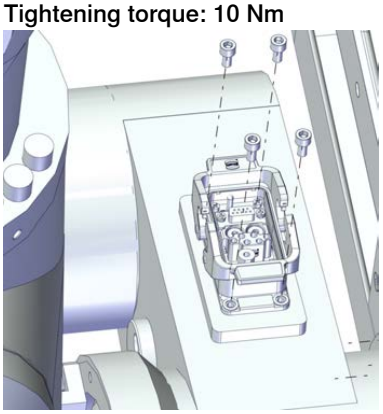
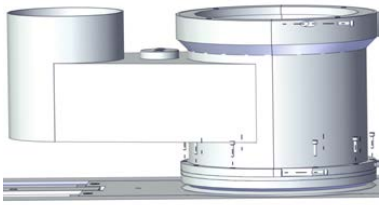
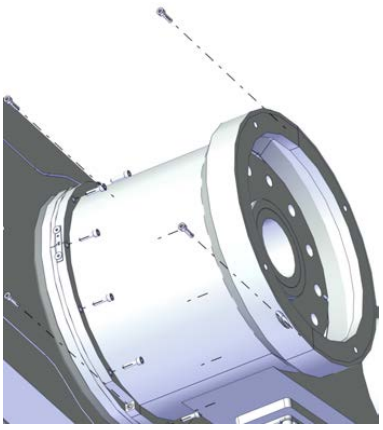
	Action	Note
2	Connect the able between slider and the plug.	 xx1800001576  xx1800001576
3	Connect the external connectors.	 xx1800001574

Continues on next page

5.2.2 Replacing the cable chain

Continued

Refitting the socket

	Action	Note
1	Refit the socket and cable chain.	Screw: M6x12 (4 pcs) Tightening torque: 10 Nm  xx1800001335
2	Secure the two halves of the exhaust pipe covers with screws.	 xx1800001329  xx1800001334 Screw: M4x16 (14 pcs) Tightening torque: 3 Nm

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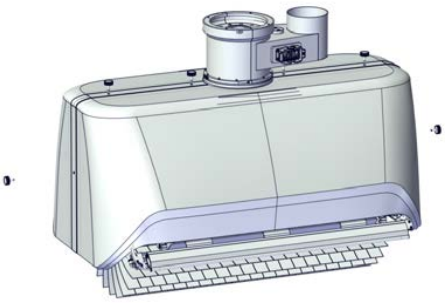
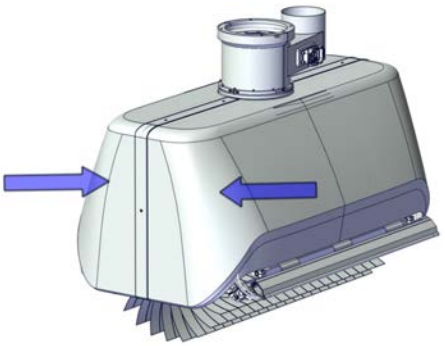
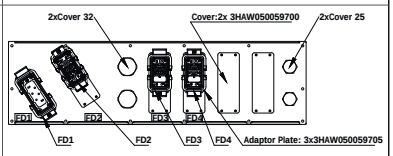
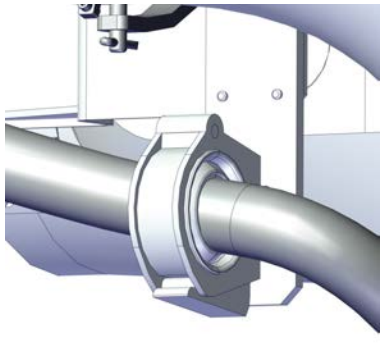
Refitting the PDCPD cover

	Action	Note
1	Refit the PDCPD covers.	Screw: Round head screw with embossing (6 pcs)  xx1800001270  xx1800001323

Routing and connecting the external cabling

	Action	Note
1	Route the cabling from the robot base.	
2	Install the Harting connector plate to the process cabinet.	 xx1800001349
3	Route the cabling up though the robot arms and final to the Feather Duster V2.	
4	Secure the cabling with cable clamps. **CAUTION** The cable sections between every two clamps must not be straightened. When the robot axis turns or bents, the cabling must be flexible to move together.	 xx1800001768

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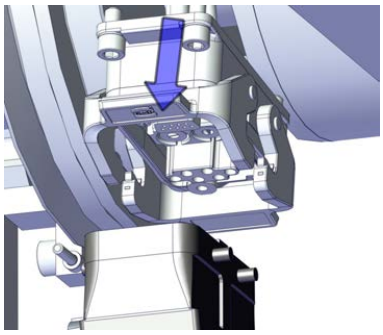
5.2.2 Replacing the cable chain

Continued

	Action	Note
5	Insert the connectors to the cable plug.	 xx1800001574

5.2.3 Replacing the timing belt

Location of the timing belt

The timing belt is located as shown in the figure.

xx1800001548

Required spare parts

Spare part	Article number	Note
front cover	3HAX010000247	PDCPD cover
back cover	3HAX010000248	PDCPD cover
High torque timing belt	3HAX010000268	

Required tools and equipment

Equipment	Article number	Note
Standard toolkit	-	Content is defined in section *Standard toolkit on page 178*.
Steel tape	-	

Continues on next page

5.2.3 Replacing the timing belt
Continued

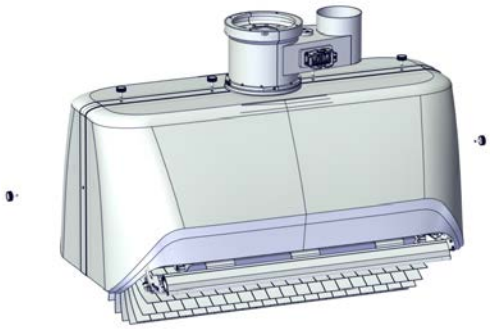
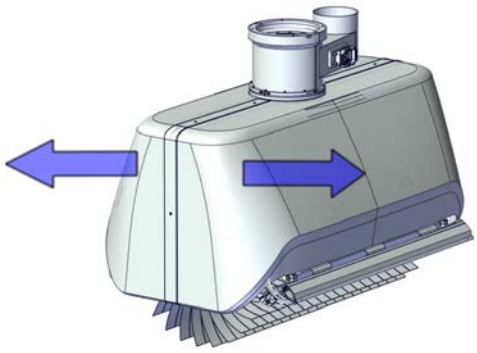
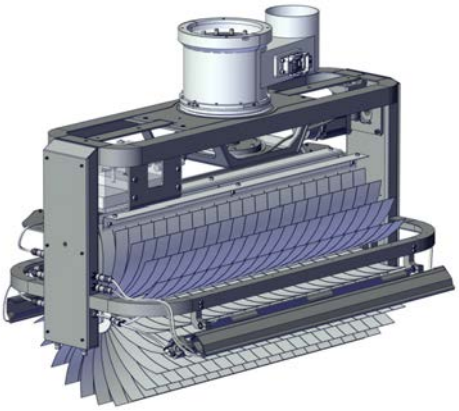
Removing the timing belt

Use these procedures to remove the timing belt.

Preparations before the removal

	Action	Note
1	Jog the robot a proper height for easily access the Feather Duster V2.	

Removing the PDCPD cover

	Action	Note
1	Remove the 6 screws on the covers.	 xx1800001270
2	Separate and remove the 2 covers respectively in proper order.	 xx1800001321  xx1800001322

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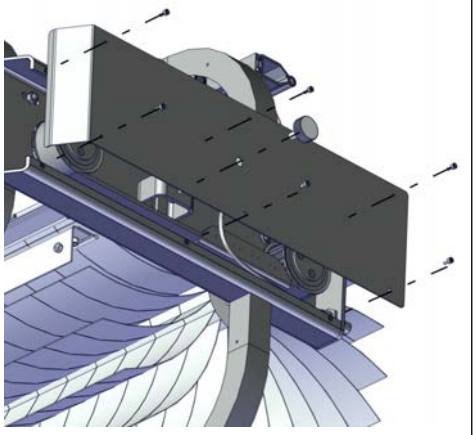
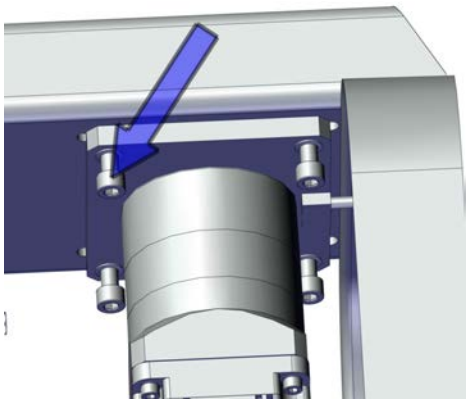
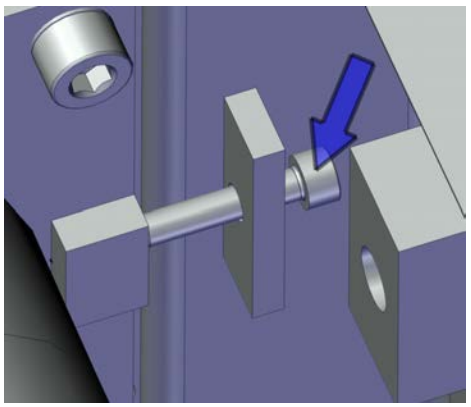
Removing the tunnel covers at the motor side

	Action	Note
1	Remove the screws.	 xx1800001549
2	Remove the tunnel covers.	

Removing the timing belt

	Action	Note
1	Loosen but not remove the screws on the adjustable plate.	 xx1800001557
2	Loosen the screw above the motor.	 xx1800001767
3	Slightly adjust the motor to release the belt tension.	

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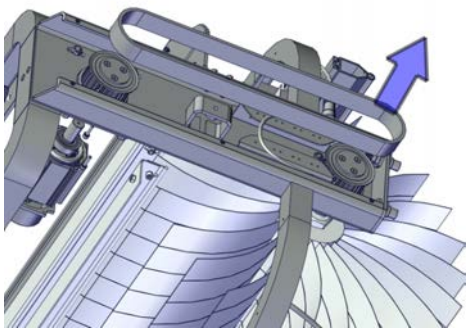
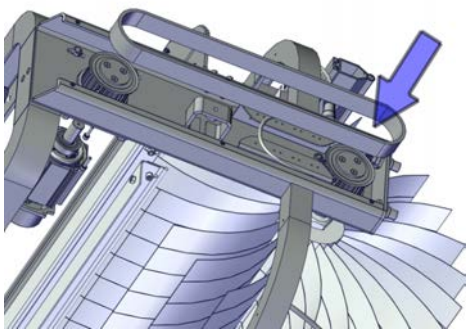
5.2.3 Replacing the timing belt
Continued

	Action	Note
4	Remove the timing belt.	 xx1800001558

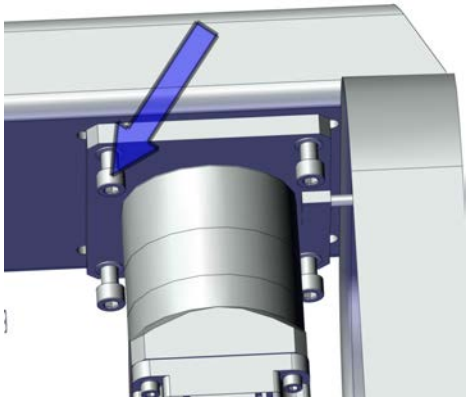
Refitting the timing belt

Use these procedures to refit the timing belt.

Refitting the timing belt

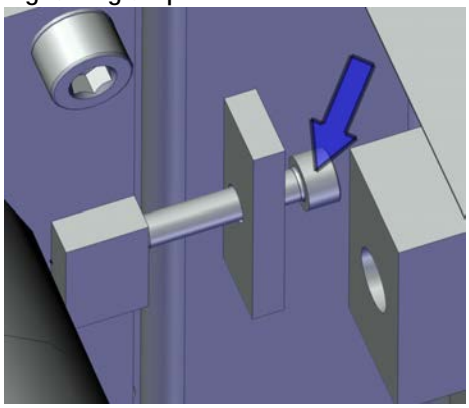
	Action	Note
1	Refit the timing belt.	 xx1800001559

Continues on next page

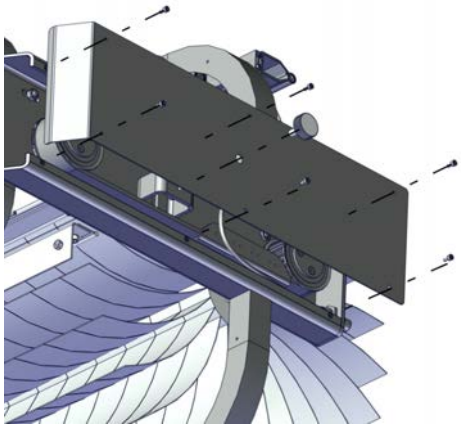
	Action	Note
2	Slightly adjust the motor, at the same time measure the belt tension using a steel tape.	Distance between two belt sides should be approximately 50--55 mm while you pitch the timing belt.  xx1600000686
3	Tighten the screws on the adjustable plate when a proper timing belt is achieved.	Screws: M8x25 (4 pcs) Tightening torque: 43 Nm  xx1800001557

Continues on next page

5.2.3 Replacing the timing belt
Continued

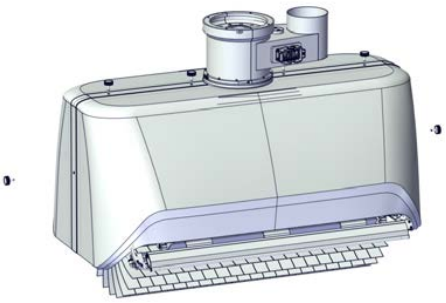
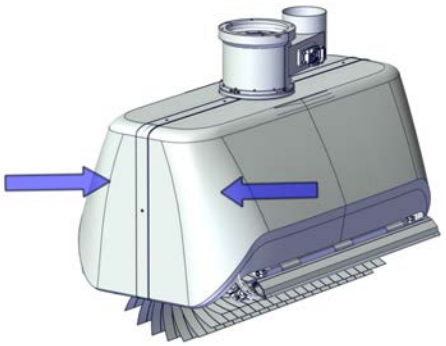
	Action	Note
4	Tighten the screw above the motor to fix the adjustable plate.	Screws: M5x25 (1 pcs) Tightening torque: 5 Nm  xx1800001767

Refitting the tunnel covers at the motor side

	Action	Note
1	Refit the tunnel covers.	 xx1800001549 Screw: M4x8 (6 pcs) Tightening torque: 2 Nm
2	Refit the screws.	

Continues on next page

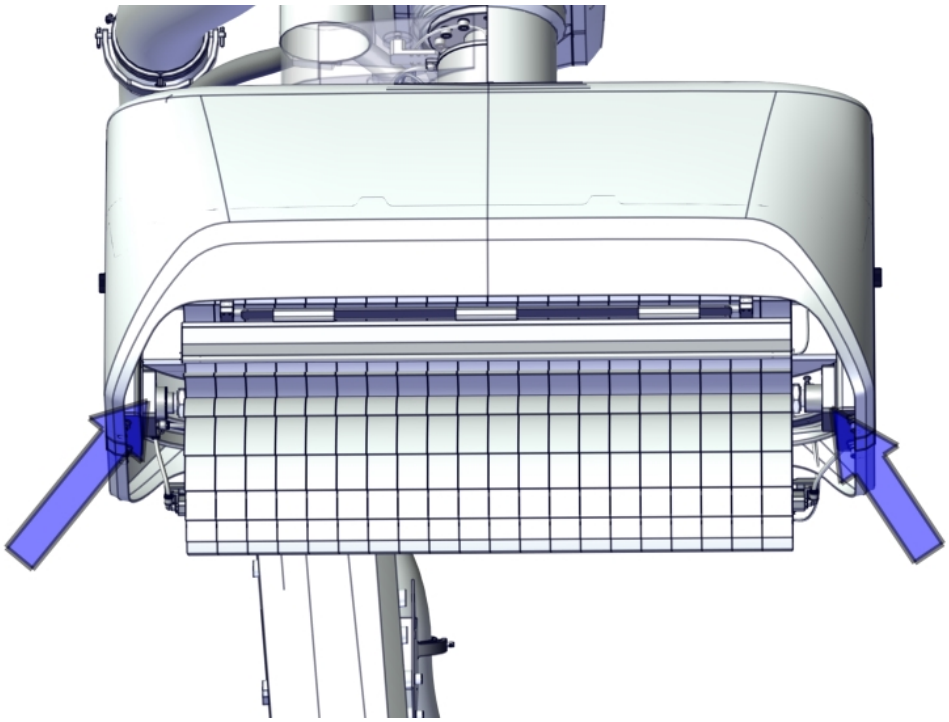
Refitting the PDCPD cover

	Action	Note
1	Refit the PDCPD covers.	Screw: Round head screw with embossing (6 pcs)  xx1800001270  xx1800001323

5.2.4 Replacing the bearing housing

Location of the bearing housings

The bearing housings are located as shown in the figure.



xx1800001560

Required spare parts

Spare part	Article number	Note
front cover	3HAX010000247	PDCPD cover
back cover	3HAX010000248	PDCPD cover
Shaft bearing with housing	3HAW050024230	
High torque timing belt	3HAX010000268	

Required tools and equipment

Equipment	Article number	Note
Standard toolkit	-	Content is defined in section *Standard toolkit on page 178*.
Steel tape	-	

Continues on next page

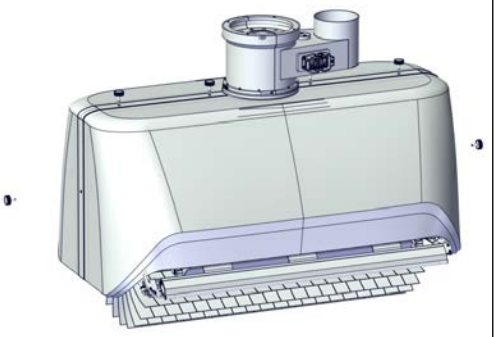
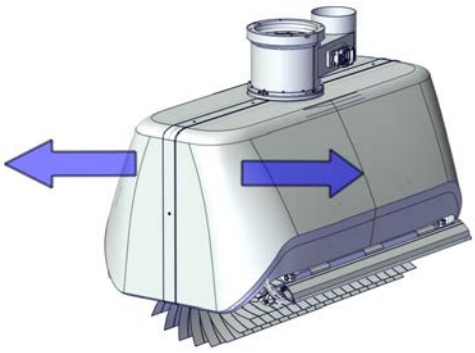
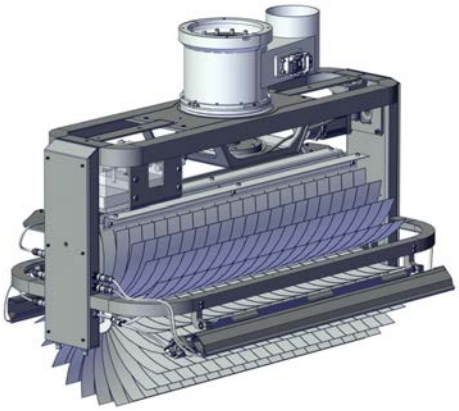
Removing the bearing housings

Use these procedures to remove the bearing housings.

Preparations before the removal

	Action	Note
1	Jog the robot a proper height for easily access the Feather Duster V2.	

Removing the PDCPD cover

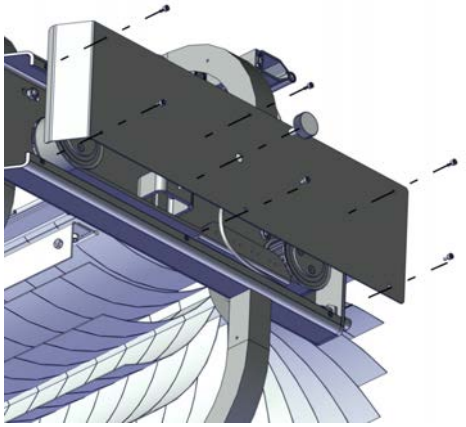
	Action	Note
1	Remove the 6 screws on the covers.	 xx1800001270
2	Separate and remove the 2 covers respectively in proper order.	 xx1800001321  xx1800001322

Continues on next page

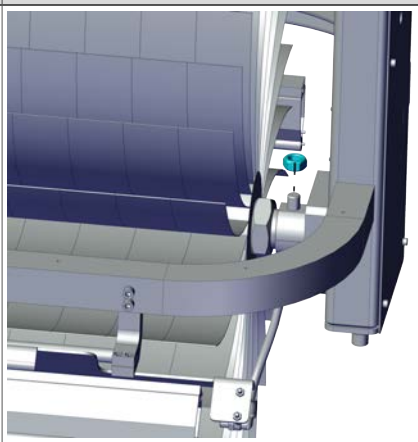
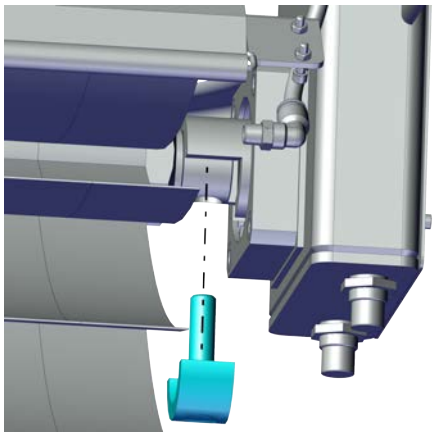
5.2.4 Replacing the bearing housing

Continued

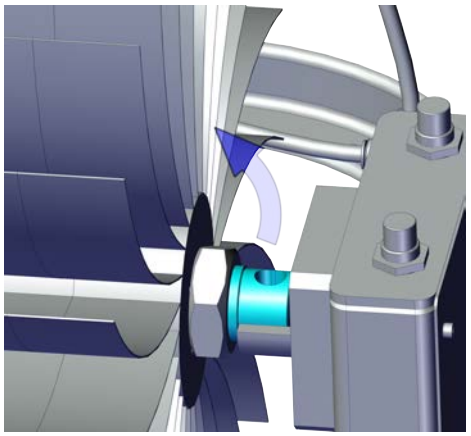
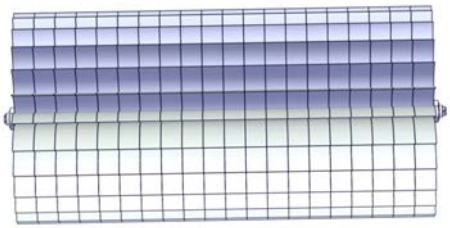
Removing the tunnel covers at the motor side

	Action	Note
1	Remove the screws.	 xx1800001549
2	Remove the tunnel covers.	

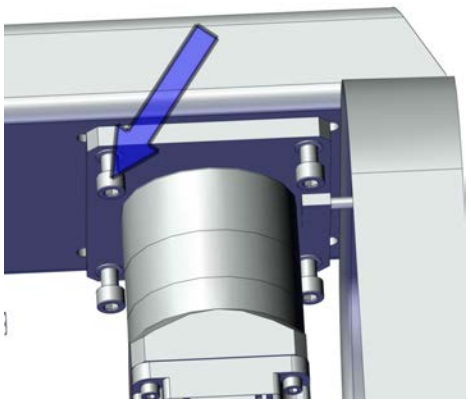
Removing the feather roller

	Action	Note
1	Remove the nut on setting screws on both side of the feather roller.	 xx1800003228
2	Remove the designed setting screws on both side of the feather roller.	 xx1800003229

Continues on next page

	Action	Note
3	Uplift the feather roller from the groove. **CAUTION** Pay attention not to collide with the ionizing air knife or safety edge sensor.	 xx1800003231  xx1800001556
4	Put the feather roller on the feather roller support.	 xx1600000734

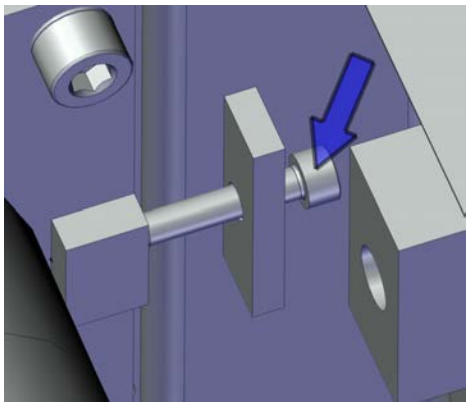
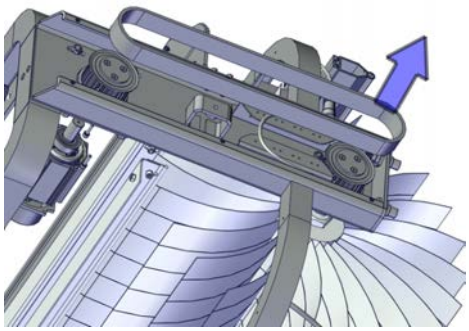
Removing the timing belt

	Action	Note
1	Loosen but not remove the screws on the adjustable plate.	 xx1800001557

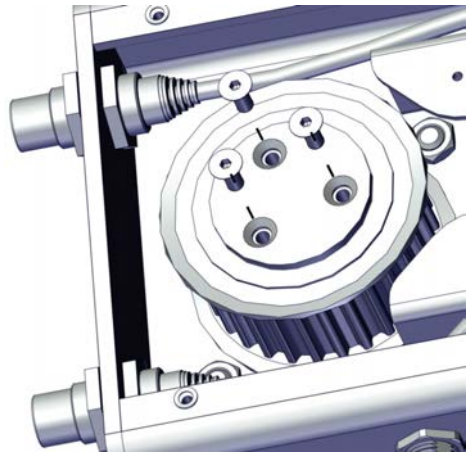
Continues on next page

5.2.4 Replacing the bearing housing

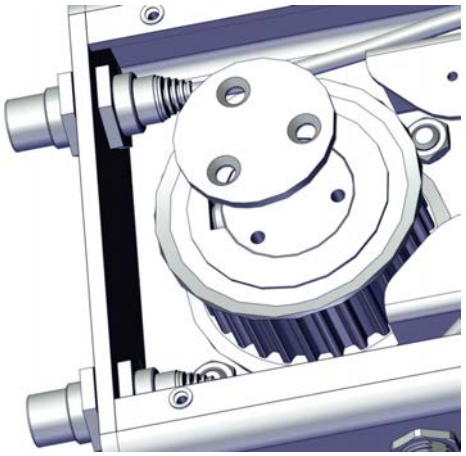
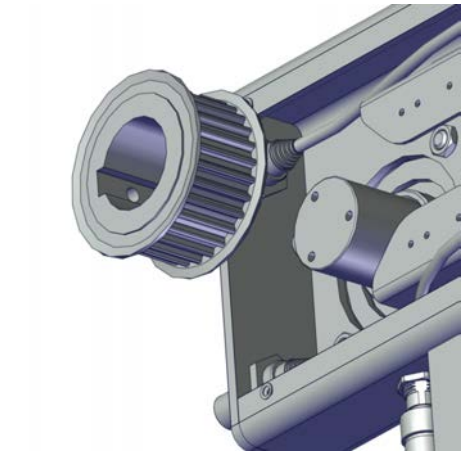
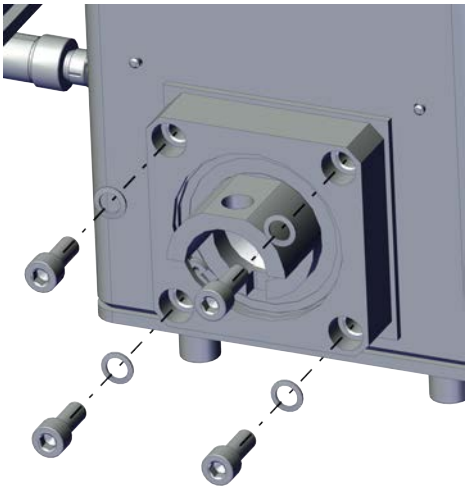
Continued

	Action	Note
2	Loosen the screw above the motor.	 xx1800001767
3	Slightly adjust the motor to release the belt tension.	
4	Remove the timing belt.	 xx1800001558

Removing the bearing housing at the motor side

	Action	Note
1	Remove the screws.	 xx1800001561

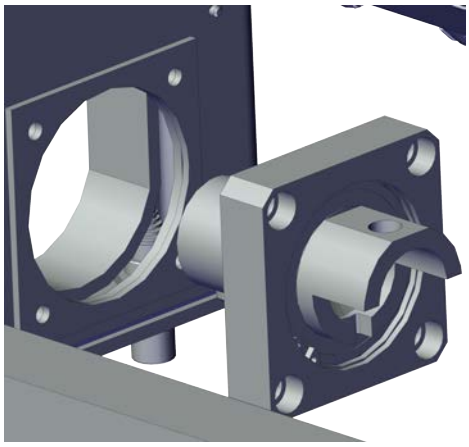
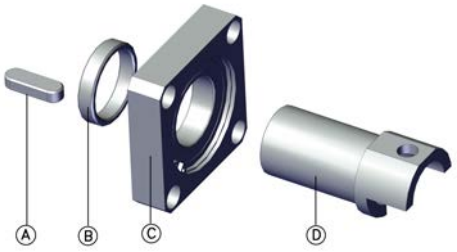
Continues on next page

	Action	Note
2	Remove the shaft end slice.	 xx1800001562
3	Remove the lower timing belt pulley.	 xx1800001563
4	Remove the screws and washers.	 xx1800003233

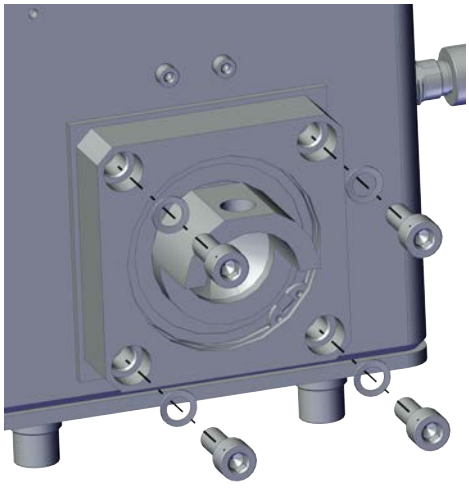
Continues on next page

5.2.4 Replacing the bearing housing

Continued

	Action	Note
5	Remove the bearing housing together with the connected shaft.	 xx1800003234
6	Remove the key and shaft sleeve to detach the connected shaft from the bearing housing.	 xx1800003235 A – Key B – Shaft sleeve C – Bearing housing D – Connected shaft

Removing the bearing housing at the ionization unit power supply box side

	Action	Note
1	Remove the screws and washers.	 xx1800003236

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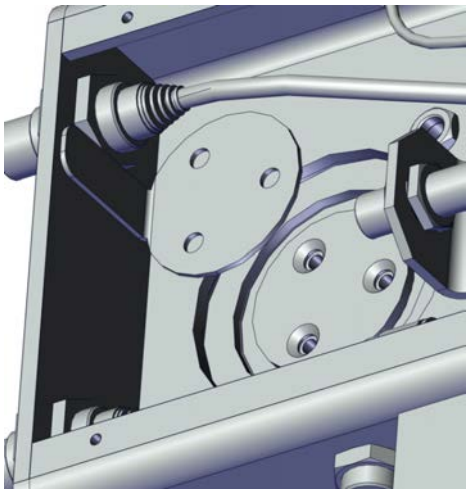
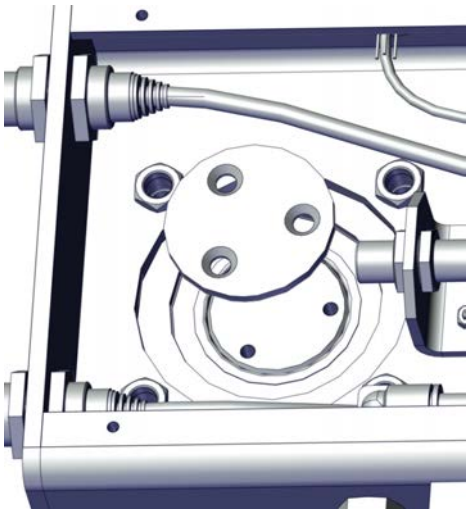
	Action	Note
2	Remove the tentacle on the back side.	 xx1800001568  xx1800001569
3	Remove the shaft end slice.	 xx1800001570

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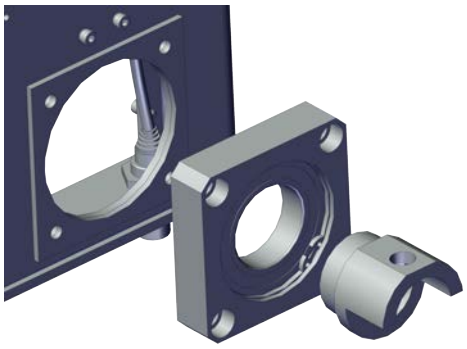
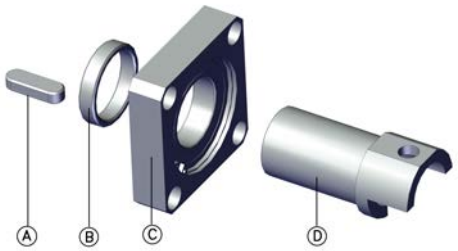
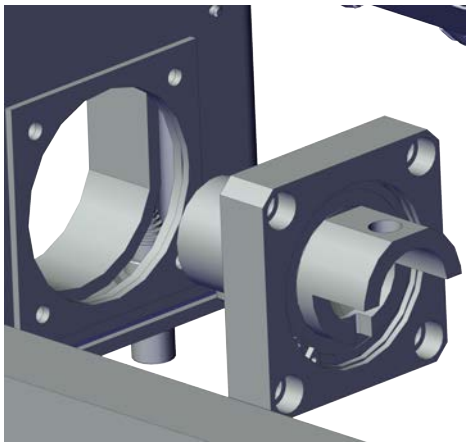
5.2.4 Replacing the bearing housing
Continued

	Action	Note
4	Remove the bearing housing together with the fixed connected shaft.	 xx1800003237

Refitting the bearing housings

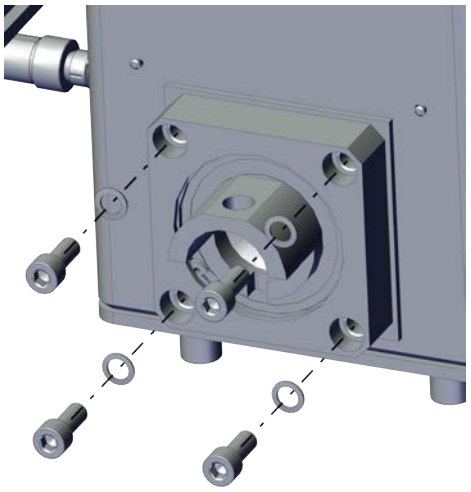
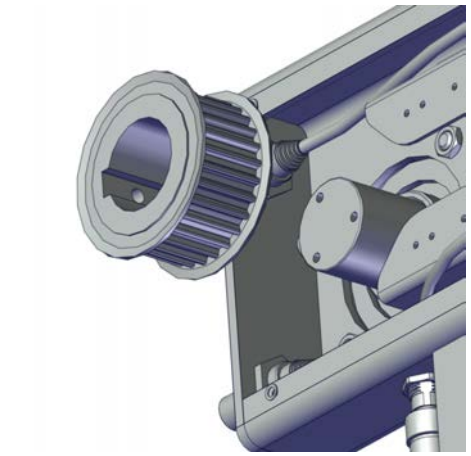
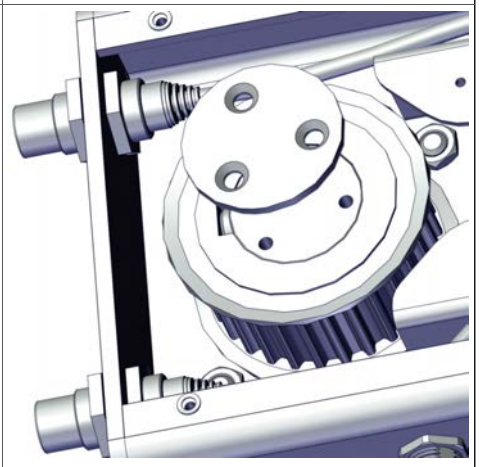
Use these procedures to refit the bearing housings.

Refitting the bearing housing at the motor side

	Action	Note
1	Refit the connected shaft to the bearing housing.	 xx1800003235
2	Refit the shaft sleeve and the key to key slot on the connected shaft.	
3	Refit the bearing housing together with the connected shaft.	 xx1800003234

A	Key
B	Shaft sleeve
C	Bearing housing
D	Connected shaft

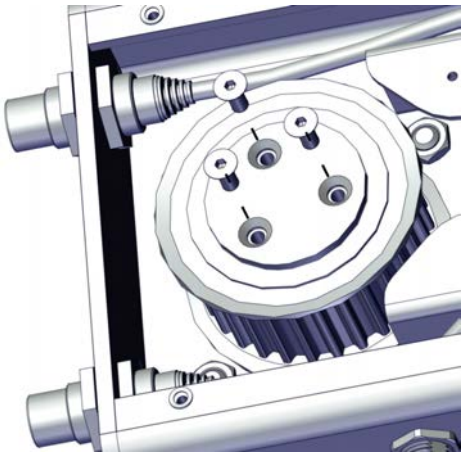
Continues on next page

	Action	Note
4	Secure with screws and washers.	 xx1800003233
5	Refit the lower timing belt pulley.	 xx1800001563
6	Refit the shaft end slice.	 xx1800001562

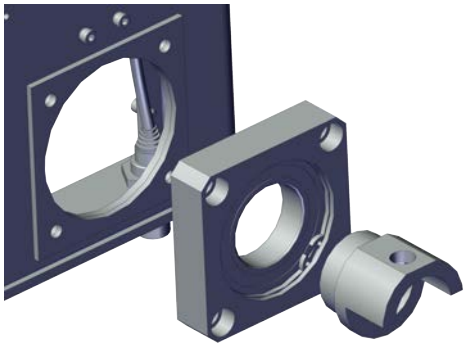
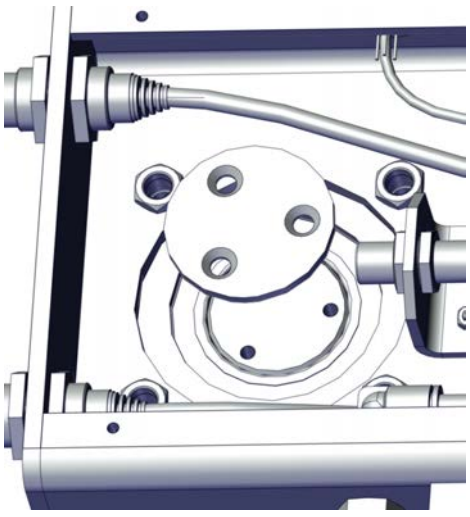
Continues on next page

5.2.4 Replacing the bearing housing

Continued

	Action	Note
7	Secure with screws.	 xx1800001561

Refitting the bearing housing at the ionization unit power supply box side

	Action	Note
1	Refit the fixed connected shaft to the bearing housing.	 xx1800003237
2	Refit the shaft end slice.	 xx1800001570

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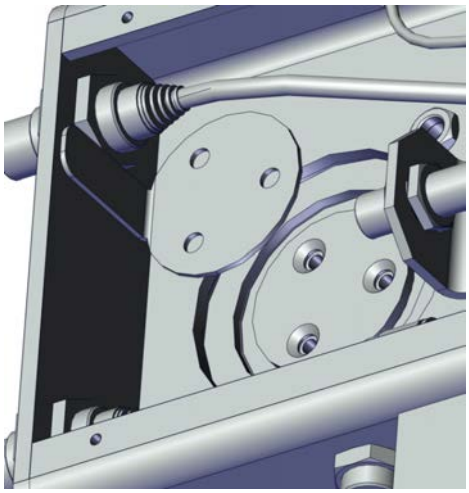
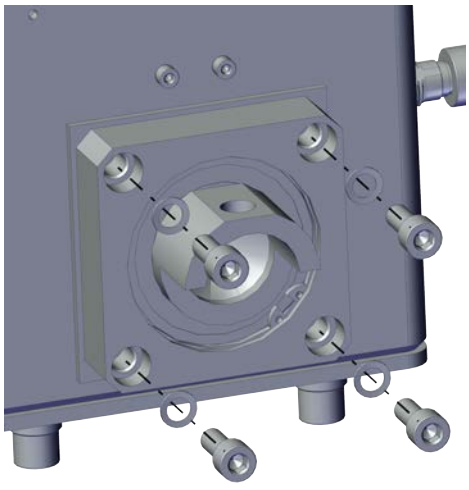
	Action	Note
3	Refit the tentacle and secure it with screws.	 xx1800001569  xx1800001568
4	Refit the bearing housing together with the fixed connected shaft.	 xx1800003236

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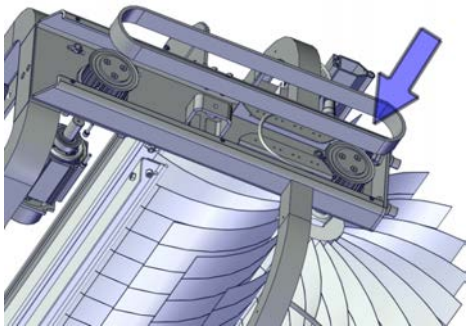
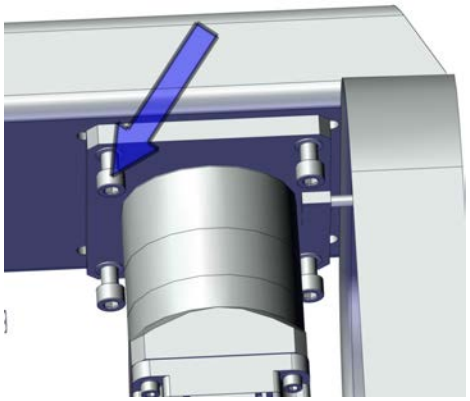
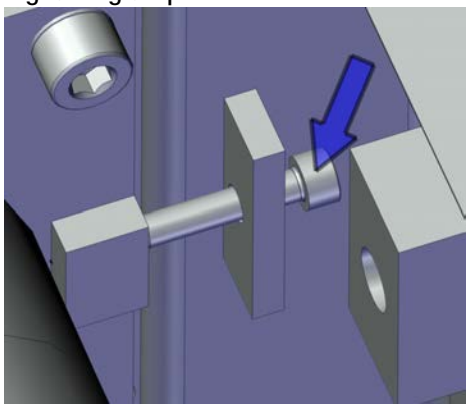
5.2.4 Replacing the bearing housing

Continued

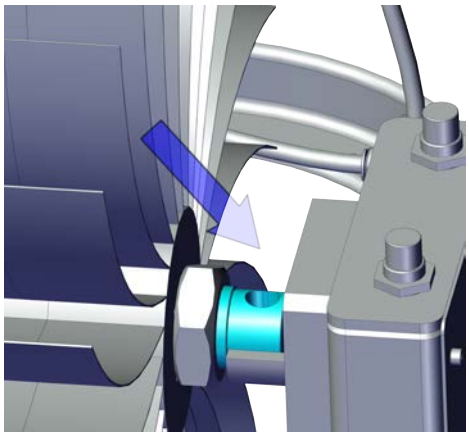
Refitting the timing belt

	Action	Note
1	Refit the timing belt.	 xx1800001559
2	Slightly adjust the motor, at the same time measure the belt tension using a steel tape.	Distance between two belt sides should be approximately 50--55 mm while you pitch the timing belt.  xx1600000686
3	Tighten the screws on the adjustable plate when a proper timing belt is achieved.	Screws: M8x25 (4 pcs) Tightening torque: 43 Nm  xx1800001557

Continues on next page

	Action	Note
4	Tighten the screw above the motor to fix the adjustable plate.	Screws: M5x25 (1 pcs) Tightening torque: 5 Nm  xx1800001767

Refitting the feather roller

	Action	Note
1	Put the feather roller back on to the frame. **Note** The roller has a boss at one end. The boss must be aligned with the key slot on the support shaft. This ensures the correct installation of the feather roller.	
2	Insert both side of the feather roller into the groove of the connected shaft.	 xx1800003230

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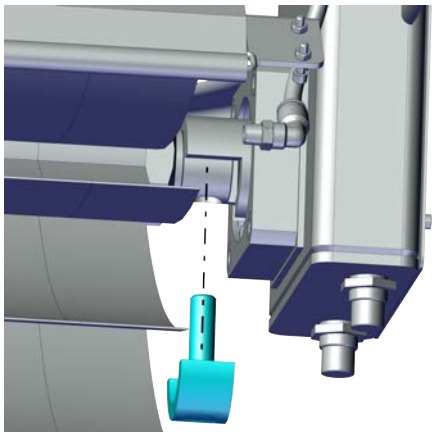
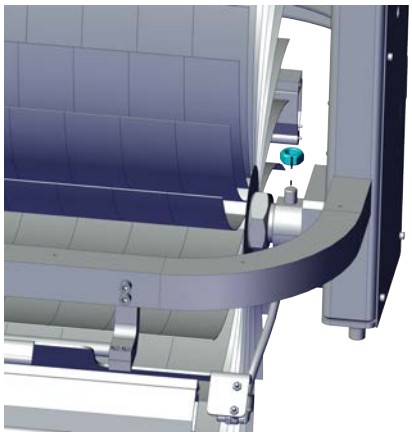
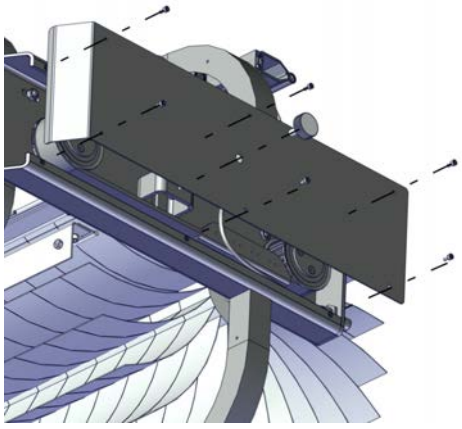
5.2.4 Replacing the bearing housing
Continued

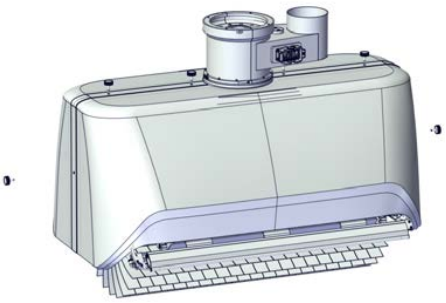
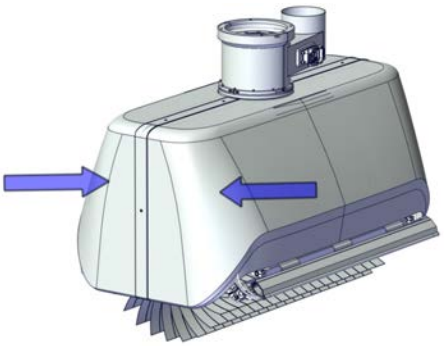
	Action	Note
3	Insert the setting screws back to both side of the feather roller.	 xx1800003229
4	Install the nuts on the setting screws.	 xx1800003228

Refitting the tunnel covers at the motor side

	Action	Note
1	Refit the tunnel covers.	 xx1800001549 Screw: M4x8 (6 pcs) Tightening torque: 2 Nm
2	Refit the screws.	

Continues on next page

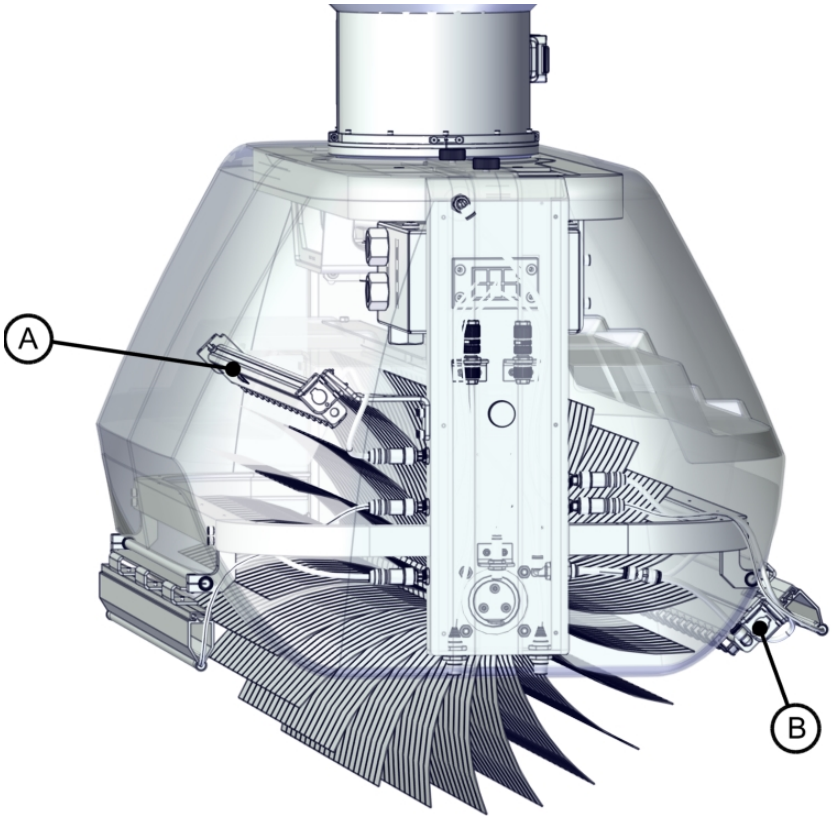
Refitting the PDCPD cover

	Action	Note
1	Refit the PDCPD covers.	Screw: Round head screw with embossing (6 pcs)  xx1800001270  xx1800001323

5.2.5 Replacing the ionization unit

Location of the ionization unit

The ionization unit including the ionizing air knife and ionizing bar is located as shown in the figure.



xx1800001266

A	Ionizing bar
B	Ionizing air knife

Required spare parts

Spare part	Article number	Note
front cover	3HAX010000247	PDCPD cover
back cover	3HAX010000248	PDCPD cover
Lonization Sensor Cable 2	3HAX010000310	Ionizing air knife
Lonization Sensor Cable 1	3HAX010000309	Ionizing bar

Required tools and equipment

Equipment	Article number	Note
Standard toolkit	-	Content is defined in section *Standard toolkit on page 178*.

Continues on next page

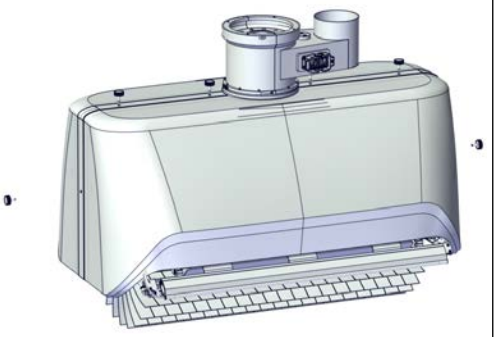
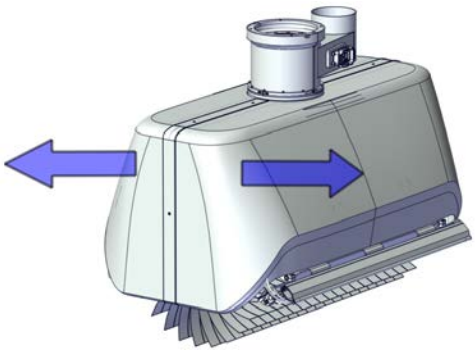
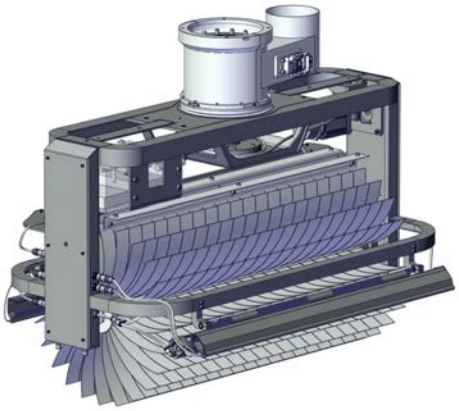
Replacing the ionizing air knife

Use these procedures to replace the ionizing air knife.

Preparations before the removal

	Action	Note
1	Jog the robot a proper height for easily access the Feather Duster V2.	

Removing the PDCPD cover

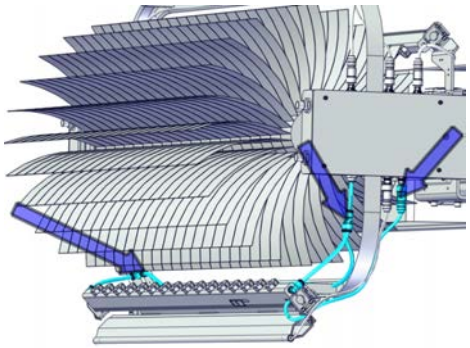
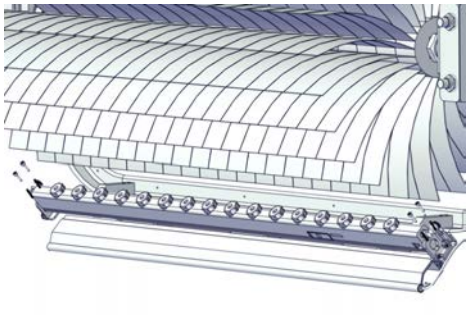
	Action	Note
1	Remove the 6 screws on the covers.	 xx1800001270
2	Separate and remove the 2 covers respectively in proper order.	 xx1800001321  xx1800001322

Continues on next page

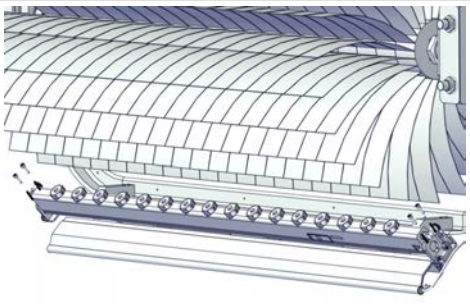
5.2.5 Replacing the ionization unit

Continued

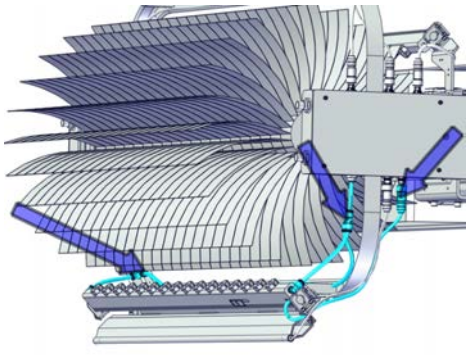
Removing the ionizing air knife

	Action	Note
1	Disconnect the connectors.	 xx1800001579
2	Remove the ionizing air knife with its bracket by removing the screws. **CAUTION** Support the ionizing air knife while removing it; otherwise, it may drop suddenly after the screws at one end are removed.	 xx1800001580

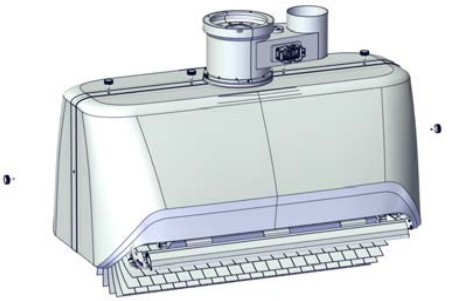
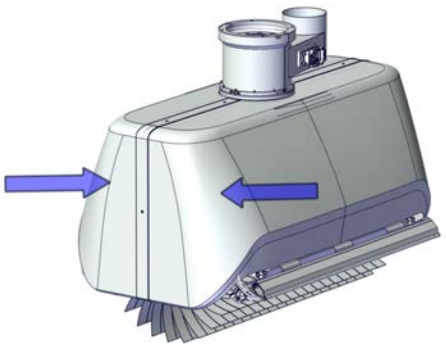
Refitting the ionizing air knife

	Action	Note
1	Refit the ionizing air knife with its bracket.	 xx1800001580 Screw: M6x30 (4 pcs) Tightening torque: 10 Nm

Continues on next page

	Action	Note
2	Connect the connectors.	 xx1800001579
3	Adjust the orientation of the ionizing air knife.	See *Adjusting the ionizing air knife on page 90*.

Refitting the PDCPD cover

	Action	Note
1	Refit the PDCPD covers.	Screw: Round head screw with embossing (6 pcs)  xx1800001270  xx1800001323

Replacing the ionizing bar

Use these procedures to replace the ionizing bar.

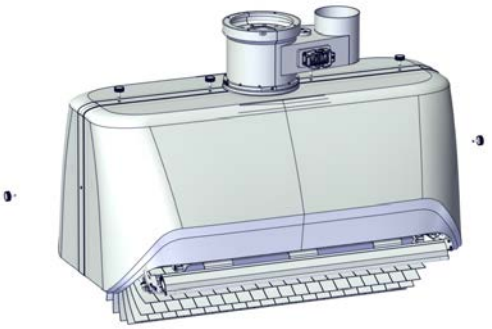
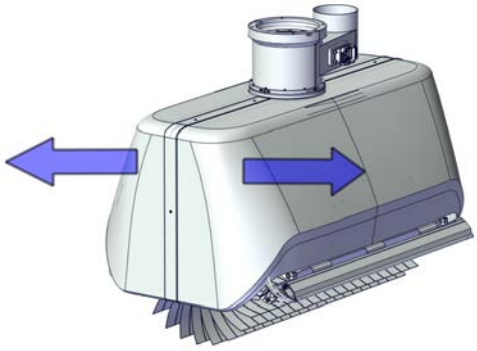
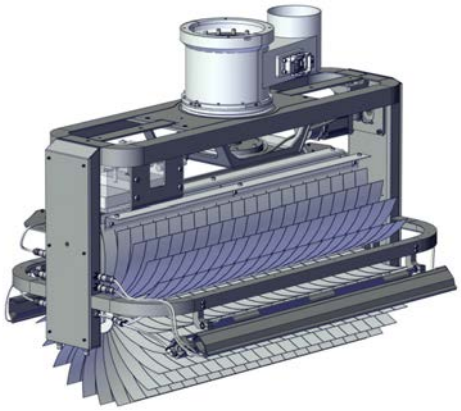
Preparations before the removal

	Action	Note
1	Jog the robot a proper height for easily access the Feather Duster V2.	

Continues on next page

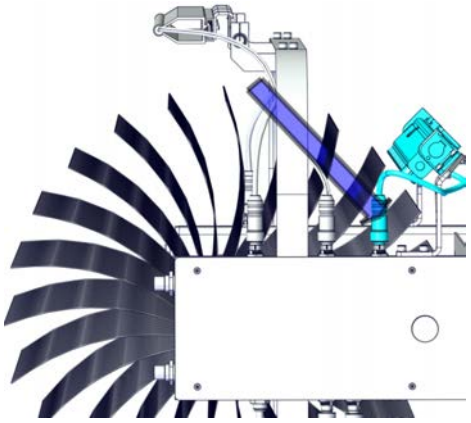
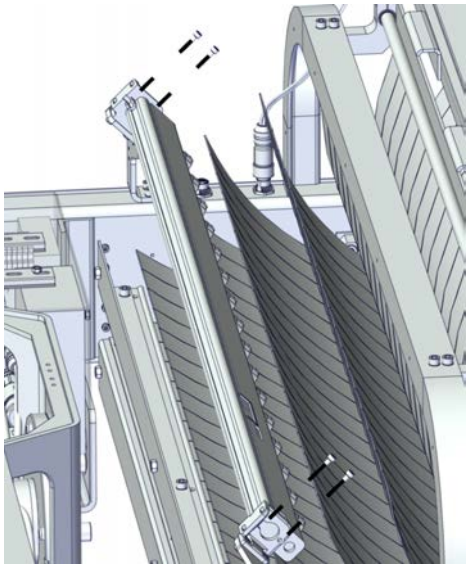
5.2.5 Replacing the ionization unit
Continued

Removing the PDCPD cover

	Action	Note
1	Remove the 6 screws on the covers.	 xx1800001270
2	Separate and remove the 2 covers respectively in proper order.	 xx1800001321  xx1800001322

Continues on next page

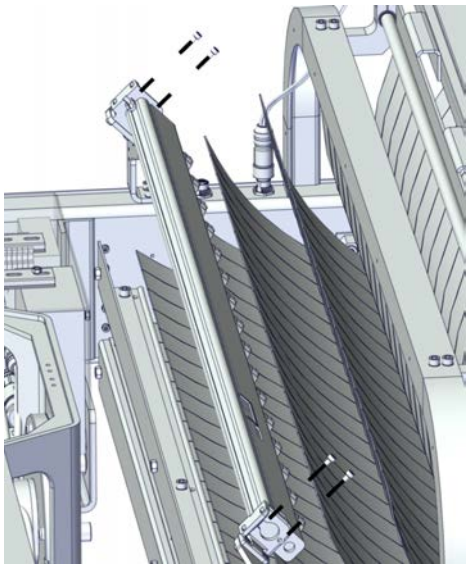
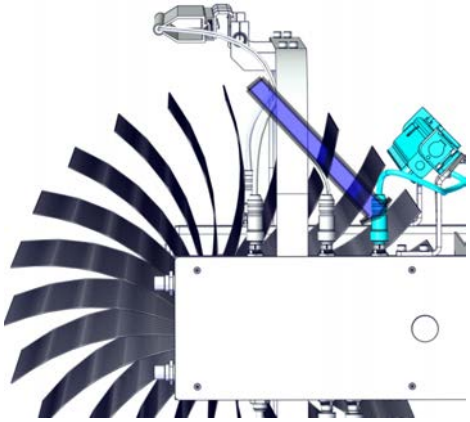
Removing the ionizing bar

	Action	Note
1	Disconnect the connector.	 xx1800001581
2	Remove the ionizing bar by removing the screws.	 xx1800001582

Continues on next page

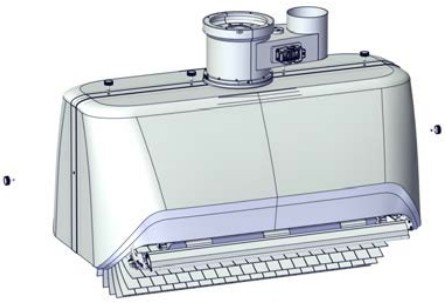
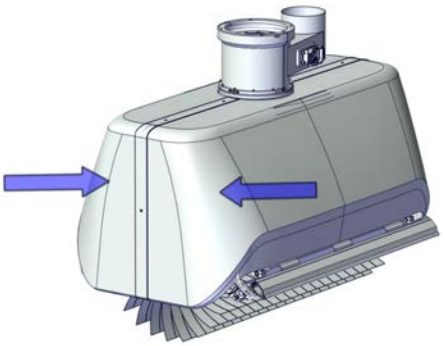
5.2.5 Replacing the ionization unit
Continued

Refitting the ionizing air knife

	Action	Note
1	Refit the ionizing bar.	 xx1800001582 Screw: M6x10 (4 pcs) Tightening torque: 15 Nm
2	Secure the cable with the locking nut.	 xx1800001581

Continues on next page

Refitting the PDCPD cover

	Action	Note
1	Refit the PDCPD covers.	Screw: Round head screw with embossing (6 pcs)  xx1800001270  xx1800001323

5.2.6 Replacing the safety edge sensor

Location of the safety edge sensor

The Feather Duster V2 have two safety edge sensors, one of which is optional.

The safety edge sensors are located as shown in the figure.

Required spare parts

Spare part	Article number	Note
front cover	3HAX010000247	PDCPD cover
back cover	3HAX010000248	PDCPD cover
Anti Collision Cable 1	3HAX010000307	Safety edge sensor
Anti Collision Cable 2	3HAX010000308	Safety edge sensor

Required tools and equipment

Equipment	Article number	Note
Standard toolkit	-	Content is defined in section *Standard toolkit on page 178*.

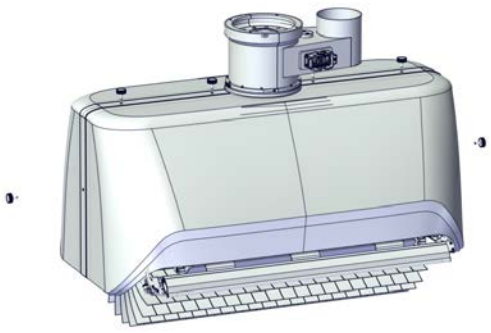
Removing the safety edge sensors

Use these procedures to remove the safety edge sensors.

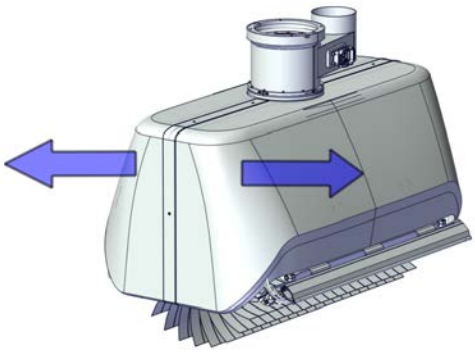
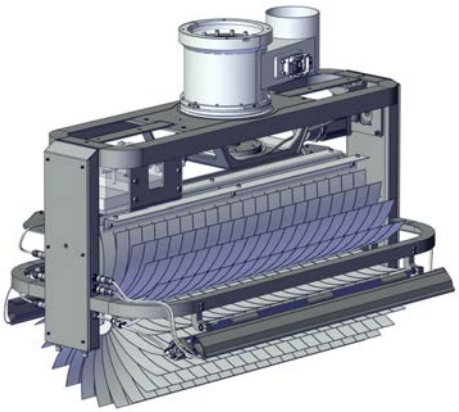
Preparations before the removal

	Action	Note
1	Jog the robot a proper height for easily access the Feather Duster V2.	

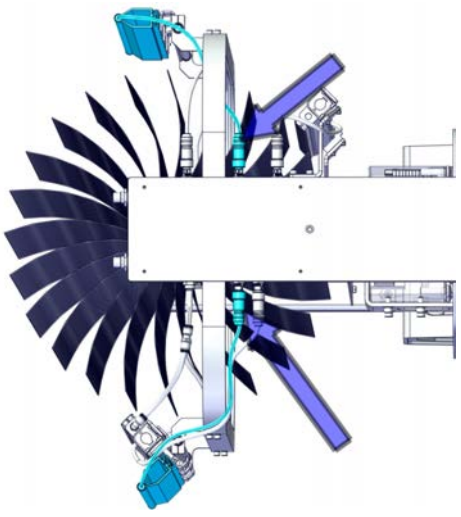
Removing the PDCPD cover

	Action	Note
1	Remove the 6 screws on the covers.	 xx1800001270

Continues on next page

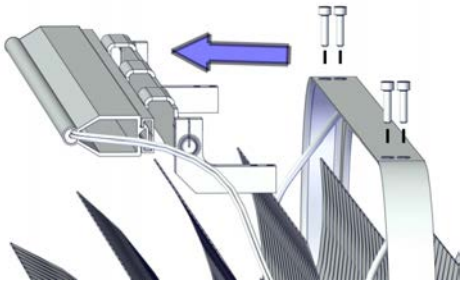
	Action	Note
2	Separate and remove the 2 covers respectively in proper order.	 xx1800001321  xx1800001322

Removing the optional safety edge sensor

	Action	Note
1	Disconnect the connector by loosening the locking nut. **Note** Do not mix the connector with the one of standard safety edge sensor.	 xx1800001584
2	Pull out the cables from the connector.	

Continues on next page

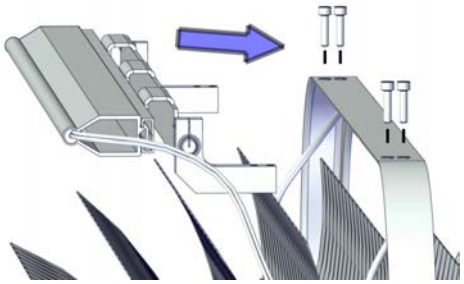
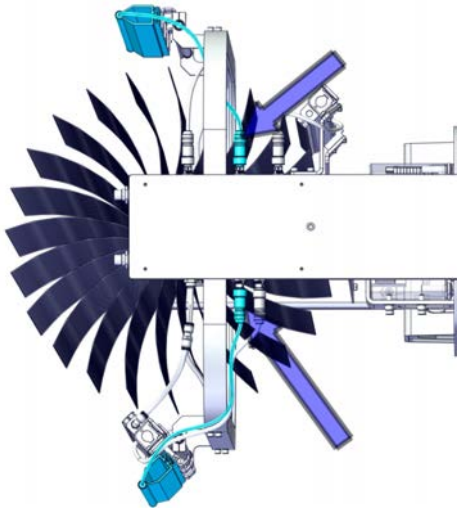
5.2.6 Replacing the safety edge sensor
Continued

	Action	Note
3	Remove the optional safety edges sensor by removing the screws and washers.	 xx1800001585

Refitting the safety edge sensors

Use these procedures to refit the safety edge sensors.

Refitting the standard safety edge sensor

	Action	Note
1	Refit the safety edge sensor.	 xx1800001586 Screw: M6x25 (4 pcs) Tightening torque: 10 Nm
2	Route the cabling.	
3	Secure the cabling by fastening the cable gland.	 xx1800001584

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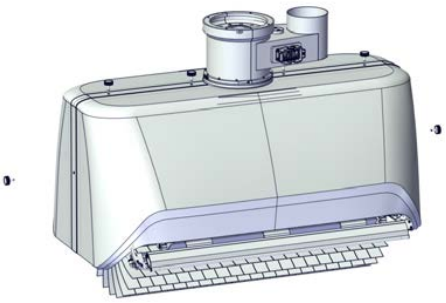
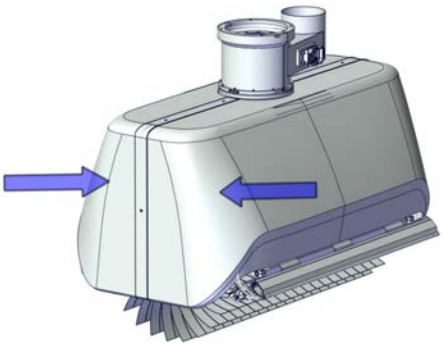
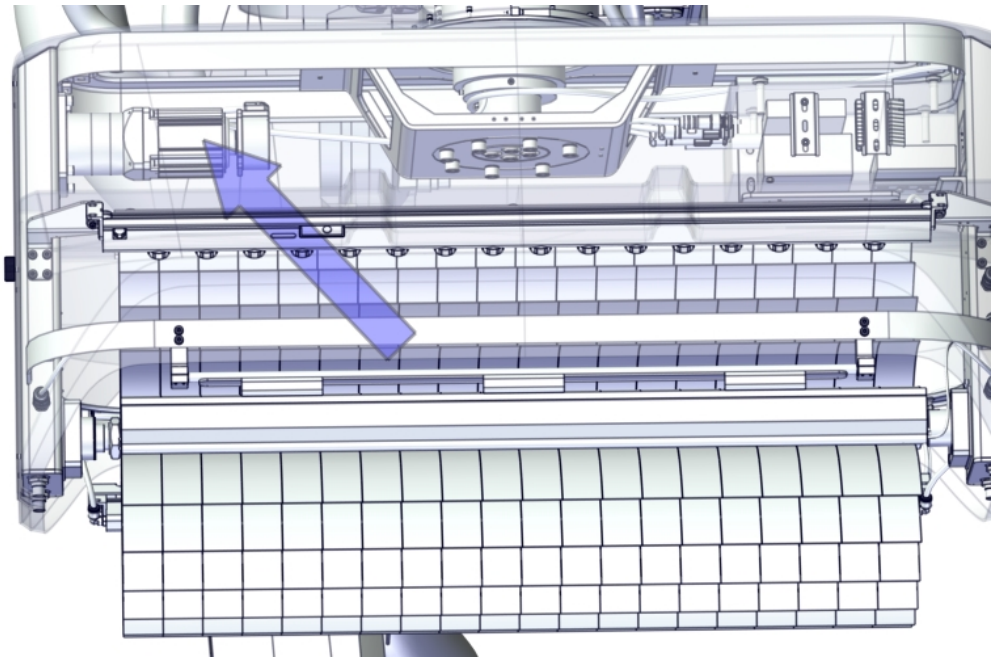
Refitting the PDCPD cover

	Action	Note
1	Refit the PDCPD covers.	Screw: Round head screw with embossing (6 pcs)  xx1800001270  xx1800001323

5.2.7 Replacing the motor

Location of the motor

The motor is located as shown in the figure.



xx1800001592

Required spare parts

Spare part	Article number	Note
front cover	3HAX010000247	PDCPD cover
back cover	3HAX010000248	PDCPD cover
High torque timing belt	3HAX010000268	
Timing belt pulley	3HAW050024229	
80WD-M02410-24V-ABB	3HAX010000272	

Required tools and equipment

Equipment	Article number	Note
Standard toolkit	-	Content is defined in section *Standard toolkit on page 178*.
Steel tape	-	

Continues on next page

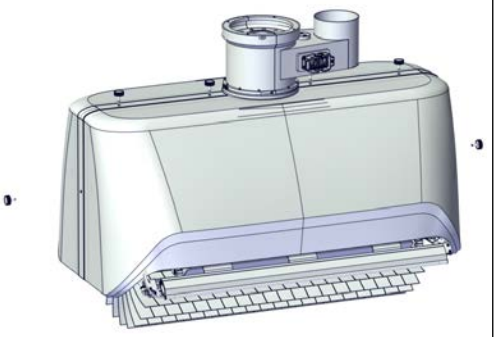
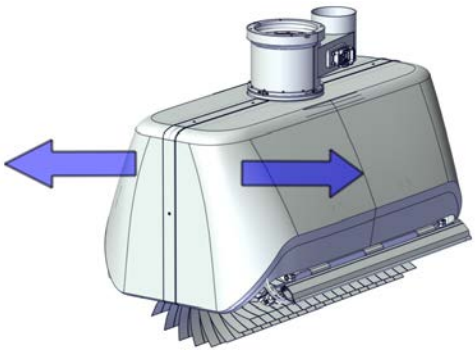
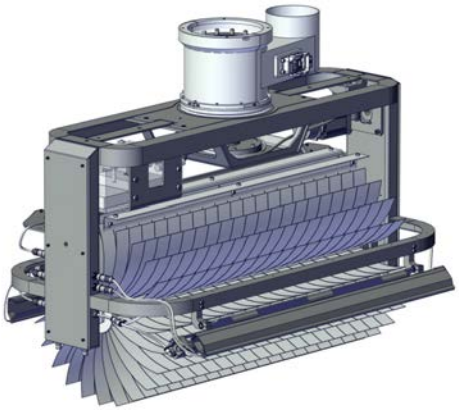
Removing the motor

Use these procedures to remove the motor.

Preparations before the removal

	Action	Note
1	Jog the robot a proper height for easily access the Feather Duster V2.	

Removing the PDCPD cover

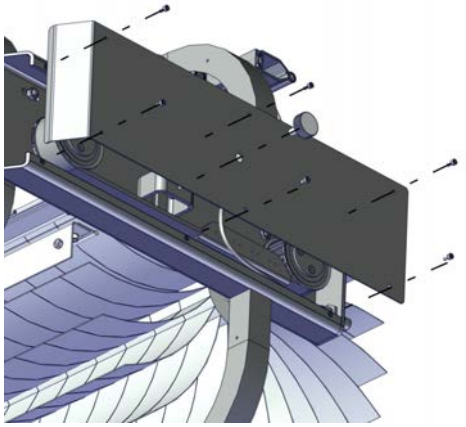
	Action	Note
1	Remove the 6 screws on the covers.	 xx1800001270
2	Separate and remove the 2 covers respectively in proper order.	 xx1800001321  xx1800001322

Continues on next page

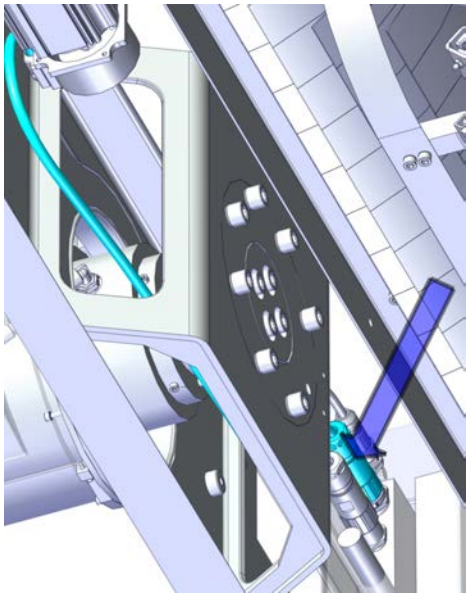
5.2.7 Replacing the motor

Continued

Removing the tunnel covers at the motor side

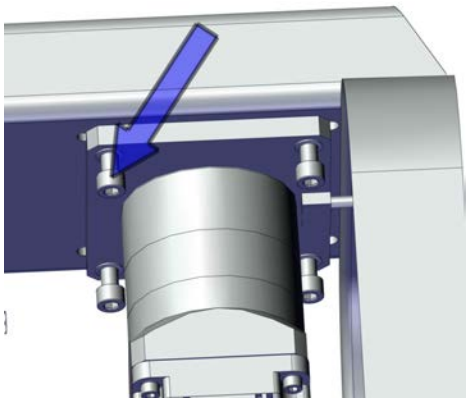
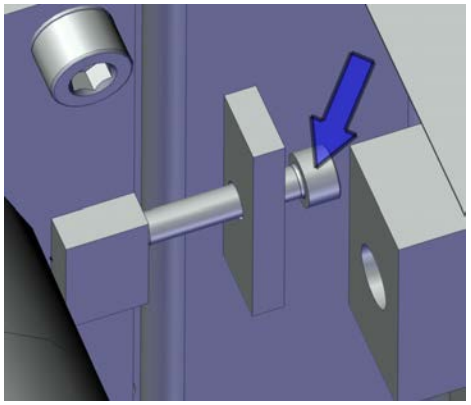
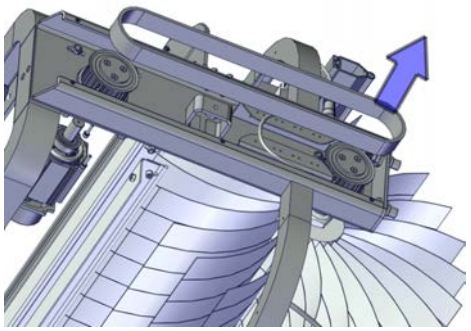
	Action	Note
1	Remove the screws.	 xx1800001549
2	Remove the tunnel covers.	

Disconnecting the motor connector

	Action	Note
1	Disconnect the connector by loosing the cable gland.	 xx1800001587

Continues on next page

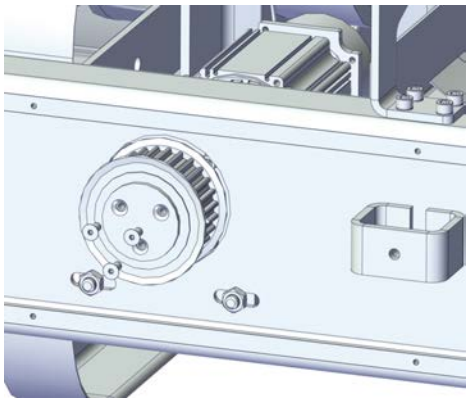
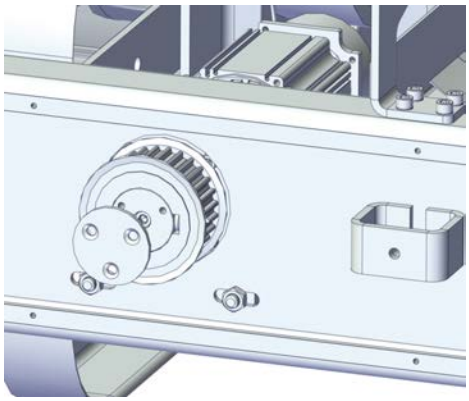
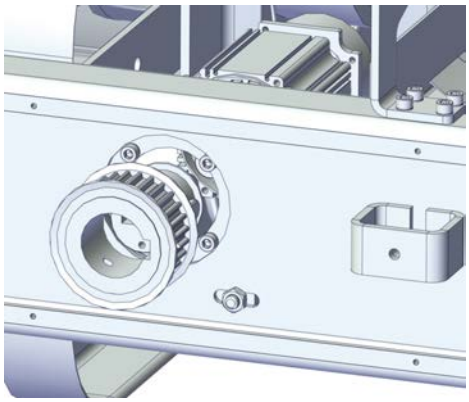
Removing the timing belt

	Action	Note
1	Loosen but not remove the screws on the adjustable plate.	 xx1800001557
2	Loosen the screw above the motor.	 xx1800001767
3	Slightly adjust the motor to release the belt tension.	
4	Remove the timing belt.	 xx1800001558

Continues on next page

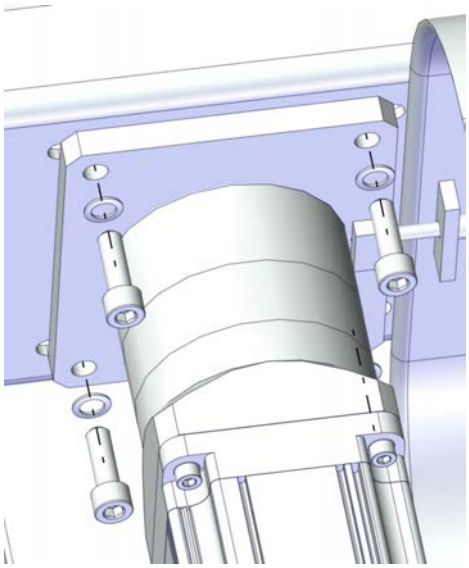
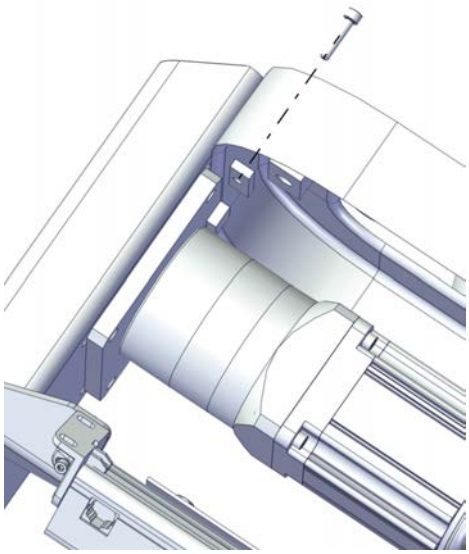
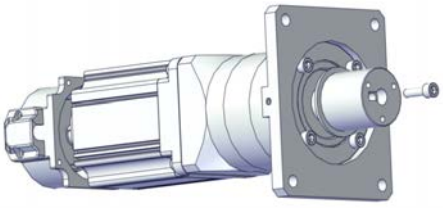
5.2.7 Replacing the motor
Continued

Removing the upper timing belt pulley

	Action	Note
1	Remove the screws.	 xx1800001588
2	Remove the pulley cover.	 xx1800001589
3	Remove the upper timing belt pulley.	 xx1800001590

Continues on next page

Removing the motor

	Action	Note
1	Remove the screws and washers on the adjustable plate.	 xx1800001593  xx1800001594
2	Move the motor a little backward and adjust its orientation to remove it.	
3	Remove the screw and washer.	 xx1800001595

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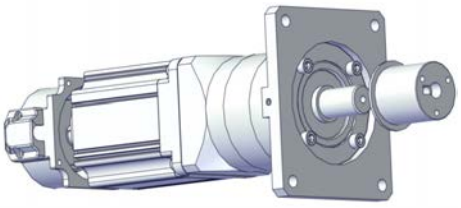
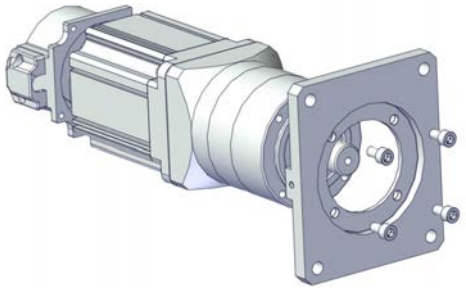
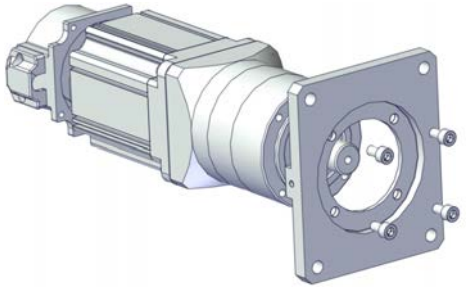
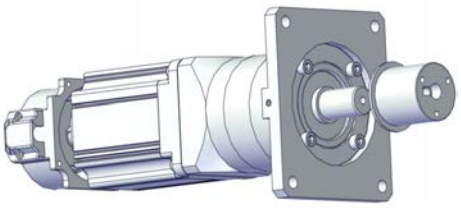
5.2.7 Replacing the motor
Continued

	Action	Note
4	Remove the pulley hub from the motor.	 xx1800001596
5	Remove the adjustable plate from the motor by removing the screws and washers.	 xx1800001597

Refitting the motor

Use these procedures to refit the motor.

Refitting the motor

	Action	Note
1	Refit the adjustable plate to the motor.	Screw: M6x12 (4 pcs) Tightening torque: 10 Nm  xx1800001597
2	Refit the pulley hub. Make sure the key on the motor axis aligned with the key slot of the pulley hub.	 xx1800001596

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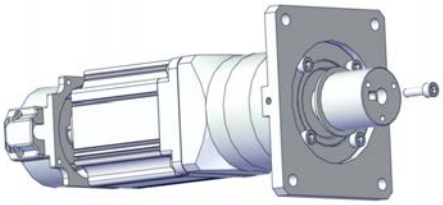
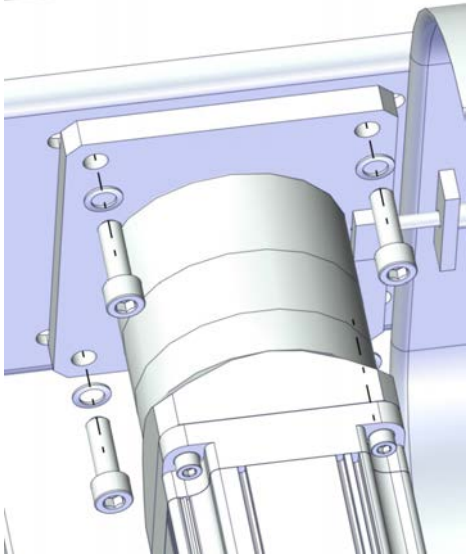
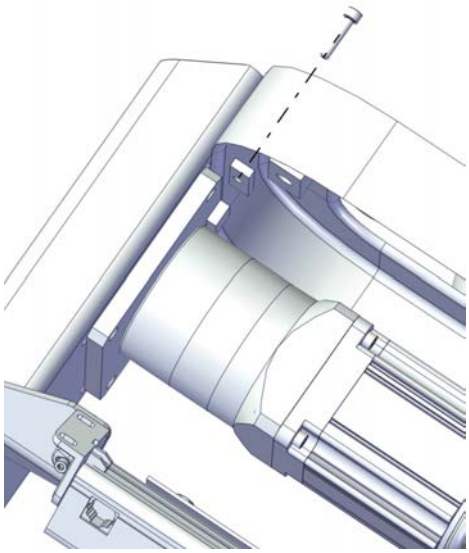
	Action	Note
3	Secure with screw and washer.	Tightening torque: M6x20 Screw: (1 pcs) Tightening torque: 10 Nm  xx1800001595
4	Refit the motor with the motor connector pointing to the side of ionizing air knife.	

Continues on next page

5.2.7 Replacing the motor

Continued

	Action	Note
5	Refit the screws and washers of the adjustable plate but not tighten yet.	Screw: M8x25 (4 pcs) Tightening torque: 25 Nm  xx1800001593 Screw: M5x25 (1 pcs) Tightening torque: 5 Nm  xx1800001594

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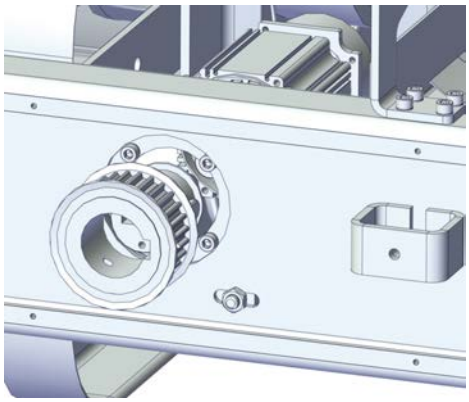
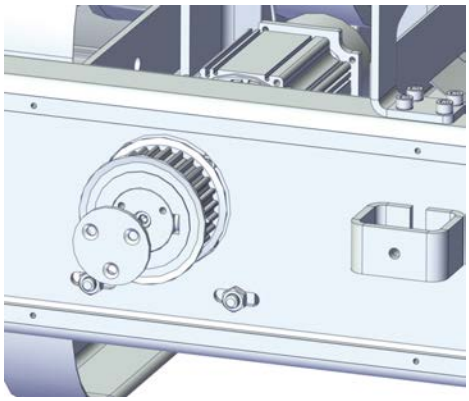
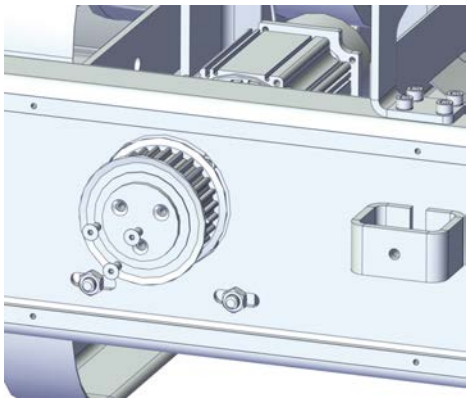
Refitting the upper timing belt pulley

	Action	Note
1	Refit the upper timing belt pulley. Make sure the key on the pulley hub aligned with the key slot of the pulley.	 xx1800001590
2	Refit the pulley cover.	 xx1800001589
3	Secure with screws.	 xx1800001588 Screw: M5x10 (3 pcs) Tightening torque: 5.9 Nm

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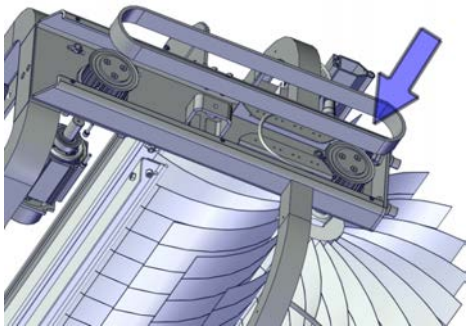
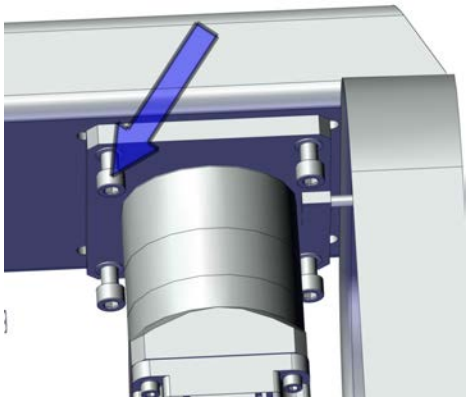
5.2.7 Replacing the motor

Continued

Refitting the timing belt

	Action	Note
1	Refit the timing belt.	 xx1800001559
2	Slightly adjust the motor, at the same time measure the belt tension using a steel tape.	Distance between two belt sides should be approximately 50--55 mm while you pitch the timing belt.  xx1600000686
3	Tighten the screws on the adjustable plate when a proper timing belt is achieved.	Screws: M8x25 (4 pcs) Tightening torque: 43 Nm  xx1800001557

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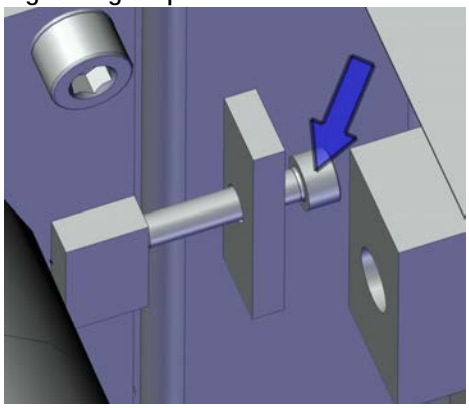
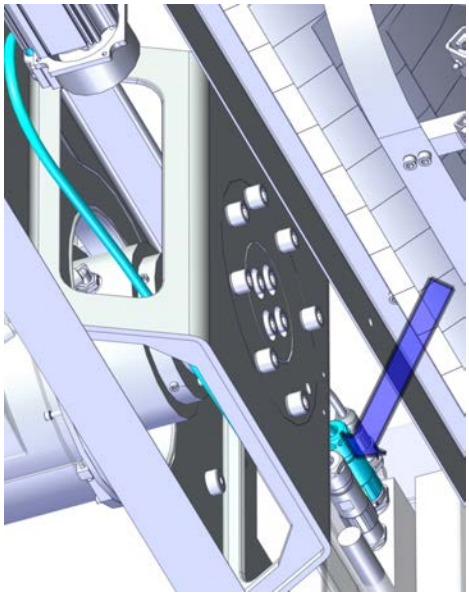
	Action	Note
4	Tighten the screw above the motor to fix the adjustable plate.	Screws: M5x25 (1 pcs) Tightening torque: 5 Nm  xx1800001767

Connecting the motor connector

	Action	Note
1	Connect the connector and secure with the cable gland.	 xx1800001587

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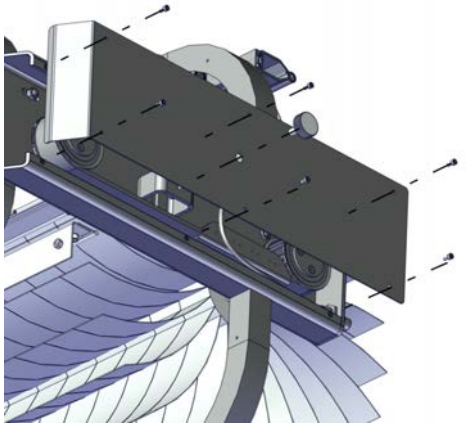
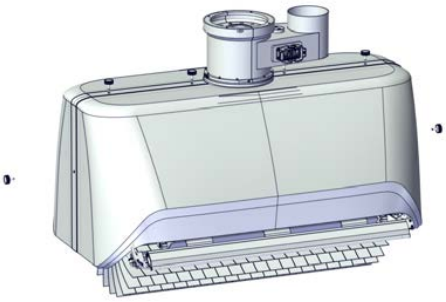
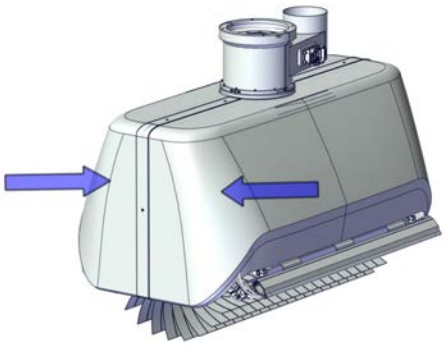
5.2.7 Replacing the motor
Continued

Refitting the tunnel covers at the motor side

	Action	Note
1	Refit the tunnel covers.	 xx1800001549 Screw: M4x8 (6 pcs) Tightening torque: 2 Nm
2	Refit the screws.	

Refitting the PDCPD cover

	Action	Note
1	Refit the PDCPD covers.	Screw: Round head screw with embossing (6 pcs)  xx1800001270  xx1800001323

6 Decommissioning

6.1 Introduction

Introduction

This section contains information to consider when taking a product out of operation.

It details with how to handle potentially dangerous components and potentially hazardous materials.

General

All used grease/oils and dead batteries must be disposed of in accordance with the current legislation of the country in which the product is installed.

If the product is partially or completely disposed of, the various parts must be grouped together according to their nature (which is all iron together and all plastic together), and disposed of accordingly. These parts must also be disposed of in accordance with the current legislation of the country in which the product is installed.

Safety information

Before any service work is commenced, it is extremely important that all safety information is observed! Read Safety before performing any service work.

6.2 Environmental information

Hazardous material

There are no hazardous materials used in this product.

6.3 Dismantle

Disassembly of the Feather Duster V2

> **Note**
>
> Use the safety pins to secure each parts of the Feather Duster V2 to prevent uncontrolled movement.

> **Note**
>
> Shut off the electrical and air supplies before removing all the connections.

> **Note**
>
> When disassemble the elevator, make sure that the pressure block has been placed in the fetal membrane.

Disassemble each parts of the Feather Duster V2 from the foundation base plate.

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7 Reference information

7.1 Introduction

General

This chapter includes general information, complementing the more specific information in the different procedures in the manual.

7.2 Unit conversion

Converter table

Use the following table to convert units used in this manual.

Quantity	Units		
Length	1 m	3.28 ft.	39.37 in
Weight	1 kg	2.21 lb.	
Weight	1 g	0.035 ounces	
Pressure	1 bar	100 kPa	14.5 psi
Force	1 N	0.225 lbf	
Moment	1 Nm	0.738 lbf-ft	
Volume	1 L	0.264 US gal	

7.3 Screw joints

General

This section describes how to tighten the various types of screw joints on the Feather Duster V2.

The instructions and torque values are valid for screw joints comprised of metallic materials and do *not* apply to soft or brittle materials.

UNBRAKO screws

UNBRAKO is a special type of screw recommended by ABB for certain screw joints. It features special surface treatment (Gleitmo as described below) and is extremely resistant to fatigue.

Whenever used, this is specified in the instructions, and in such cases, *no other type of replacement screw* is allowed. Using other types of screws will void any warranty and may potentially cause serious damage or injury.

Gleitmo treated screws

Gleitmo is a special surface treatment to reduce the friction when tightening the screw joint. Screws treated with Gleitmo may be reused 3-4 times before the coating disappears. After this the screw must be discarded and replaced with a new one.

When handling screws treated with Gleitmo, protective gloves of **nitrile rubber** type should be used.

Screws lubricated in other ways

Screws lubricated with Molycote 1000 should *only* be used when specified in the repair, maintenance or installation procedure descriptions.

In such cases, proceed as follows:

1. Apply lubricant to the screw thread.
2. Apply lubricant between the plain washer and screw head.
3. Screw dimensions of M8 or larger must be tightened with a torque wrench. Screw dimensions of M6 or smaller may be tightened without a torque wrench *if* this is done by trained and qualified personnel.

Lubricant	Article number
Molycote 1000 (molybdenum disulphide grease)	3HAC042472-001

Tightening torque

Before tightening any screw, note the following:

- Determine whether a **standard** tightening torque or **special** torque is to be applied. The **standard torques** are specified in the following tables. Any **special torques** are specified in the repair, maintenance or installation procedure descriptions. **Any special torque specified overrides the standard torque!**
- Use the *correct tightening torque* for each type of screw joint.
- Only use *correctly calibrated* torque keys.

Continues on next page

- Always *tighten the joint by hand,* and never use pneumatic tools.
- Use the *correct tightening technique*, that is *do not* jerk. Tighten the screw in a slow, flowing motion.
- Maximum allowed total deviation from the specified value is **10%**!

Oil-lubricated screws with slotted or cross-recess head screws

The following table specifies the recommended standard tightening torque for *oil-lubricated screws* with *slotted or cross-recess head screws.*

Note

A special torque specified in the repair, maintenance or installation procedure overrides the standard torque.

Oil-lubricated screws with allen head screws

The following table specifies the recommended standard tightening torque for *oil-lubricated screws* with *allen head screws.*

Note

A special torque specified in the repair, maintenance or installation procedure overrides the standard torque.

Dimension	Tightening torque (Nm) Class 8.8, oil-lubricated	Tightening torque (Nm) Class 10.9, oil-lubricated	Tightening torque (Nm) Class 12.9, oil-lubricated
M5	6	-	-
M6	10	-	-
M8	24	34	40
M10	47	67	80
M12	82	115	140
M16	200	290	340
M20	400	560	670
M24	680	960	1150

Lubricated screws (Molycote, Gleitmo or equivalent) with allen head screws

The following table specifies the recommended standard tightening torque for *screws lubricated with Molycote 1000, Gleitmo 603 or equivalent* with *allen head screws.*

Note

A special torque specified in the repair, maintenance or installation procedure overrides the standard torque.

Dimension	Tightening torque (Nm) Class 10.9, lubricated [i]	Tightening torque (Nm) Class 12.9, lubricated [i]
M8	28	35

Continues on next page

Dimension	Tightening torque (Nm) Class 10.9, lubricated [i]	Tightening torque (Nm) Class 12.9, lubricated [i]
M10	55	70
M12	96	120
M16	235	280
M20	460	550
M24	790	950

[i] Lubricated with Molycote 1000, Gleitmo 603 or equivalent

Water and air connectors

The following table specifies the recommended standard tightening torque for *water and air connectors* when *one* or *both* connectors are made of *brass*.

Note

A special torque specified in the repair, maintenance or installation procedure overrides the standard torque.

Dimension	Tightening torque Nm - Nominal	Tightening torque Nm - Min.	Tightening torque Nm - Max.
1/8	12	8	15
1/4	15	10	20
3/8	20	15	25
1/2	40	30	50
3/4	70	55	90

7.4 Standard toolkit

General

All service (repairs, maintenance, and installation) procedures contains lists of tools required to perform the specified activity.

All special tools required are listed directly in the procedures while all the tools that are considered standard are gathered in the standard toolkit and defined in the following table.

This way, the tools required are the sum of the standard toolkit and any tools listed in the instruction.

Contents, standard toolkit

Qty	Tool	Rem.
1	Socket head cap 2-17 mm	
1	Torque wrench 0.3-45 Nm	
1	Ratchet head for torque wrench 1/2	
1	Hex socket head cap no. 2.5 socket 1/2" bit L=110 mm	
1	Small screwdriver	
1	T-handle with ball head	
1	Small cutting plier	
1	Plastic mallet	

7.5 Special tools

General

All service instructions contain lists of tools required to perform the specified activity. The required tools are a sum of standard tools, defined in the section *Standard toolkit on page 178*, and of special tools, listed directly in the instructions and also gathered in this section.

Contents, special toolkit

Qty	Tool	Rem.
1	Feather roller support	3HAW050024260
1	Steel tape	

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8 Spare parts

8.1 Introduction

General

This chapter specifies all spare parts and replacement articles of the Feather Duster V2. It is divided in 2 sections:

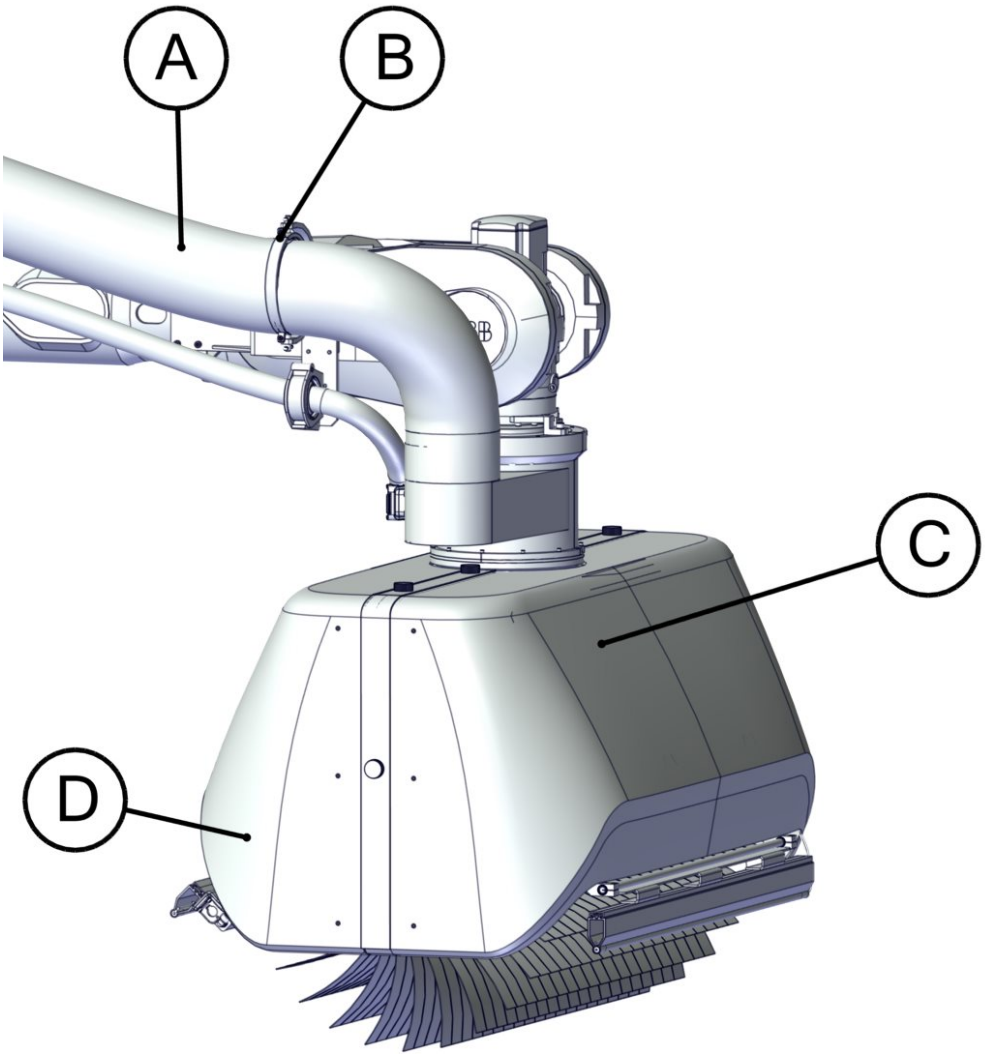
- Mechanical spare parts
- Electrical parts and cables

Some parts are available in several types, depending on the Feather Duster V2 configuration. To acquire the type of material required for your Feather Duster V2, contact ABB.

8.2 Spare part list and illustration

Mechanical spare parts

	Spare part number	Description
A	3HAWL001003	Exhaust hose
B	3HAX010000365	Exhaust pipe support
C	3HAX010000247	front cover
D	3HAX010000248	back cover



xx1800001761

	Spare part number	Description
E	3HAW050024386	Convert adapter for IRB 6640-185/2.8
	3HAW050046072	Convert adapter for IRB 6700-175/3.05 and IRB 6700-205/2.80
	3HAW050046073	Convert adapter for IRB 6700-200/2.60
F	3HAW050046301	Sealing V-ring

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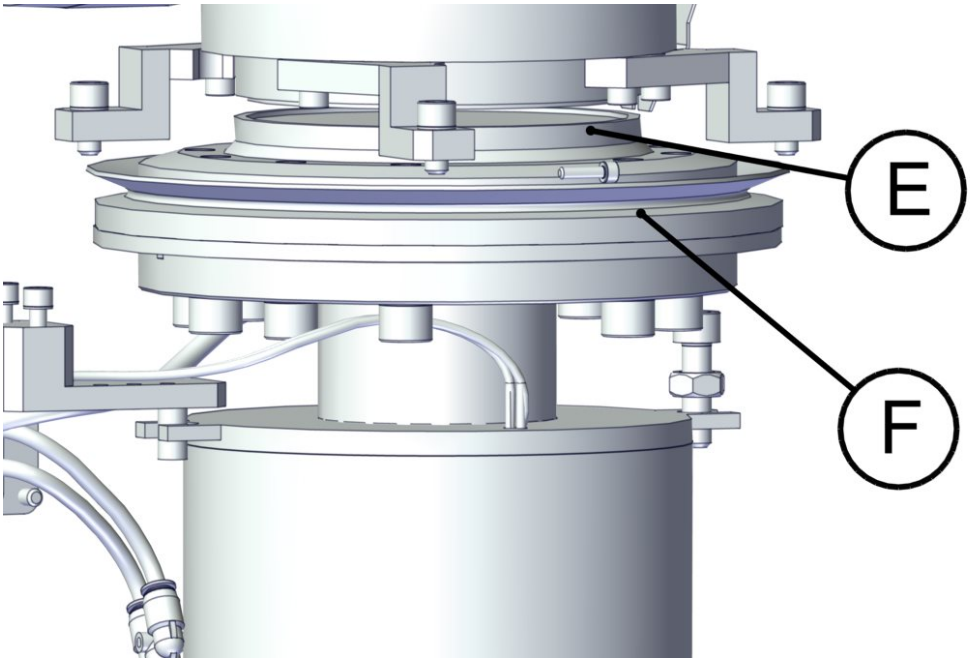
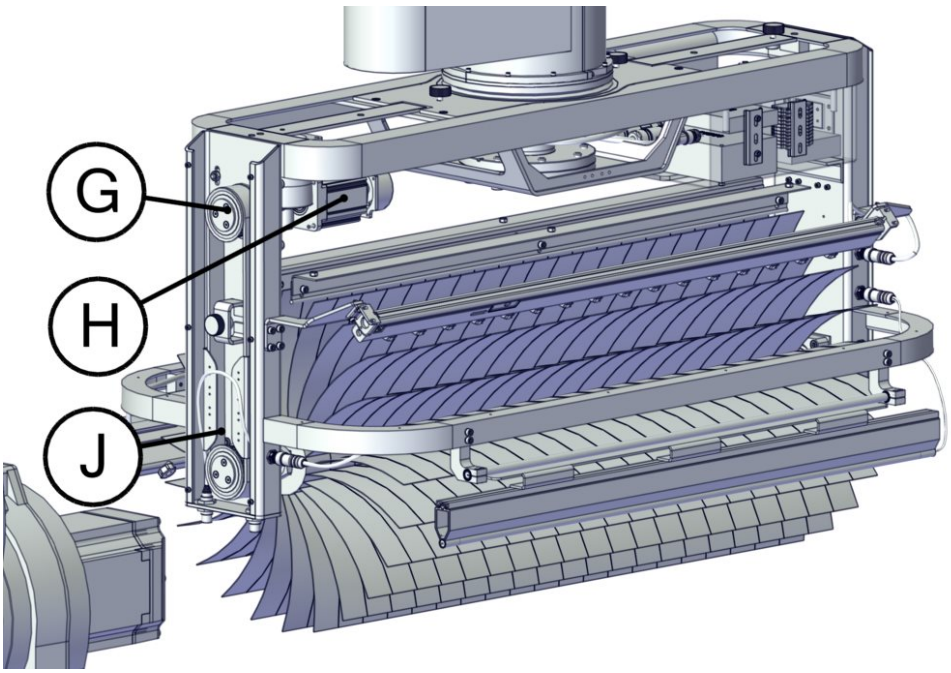


xx1800001762

	Spare part number	Description
G	3HAW050024229	Timing belt pulley
H	3HAX010000272	80WD-M02410-24V-ABB
J	3HAX010000268	High torque timing belt



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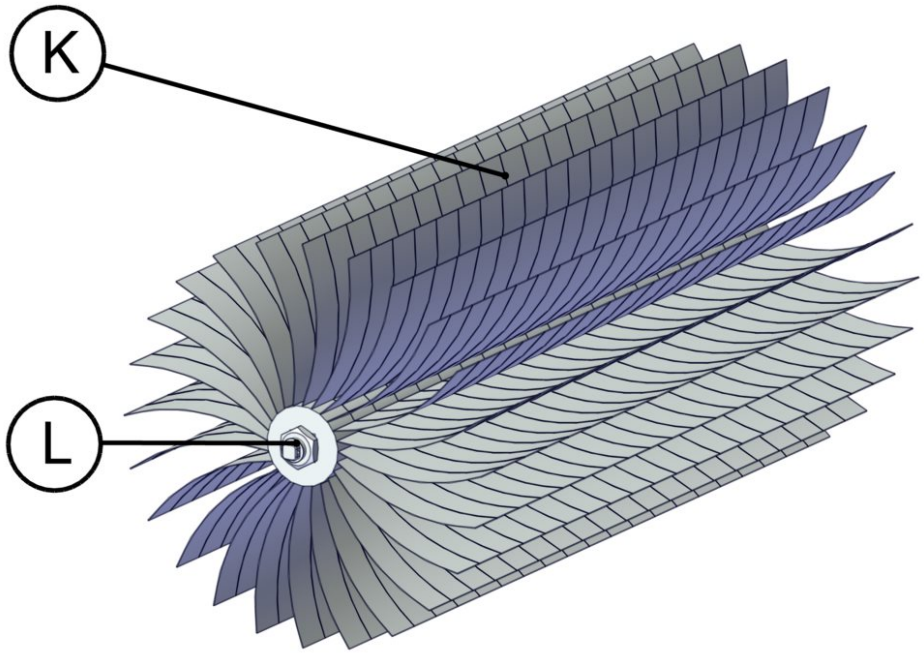
8.2 Spare part list and illustration
Continued

	Spare part number	Description
K	3HAX010000293	Feather brush 20 pieces per pack. One pack of brushes are stacked on the shaft.
L	3HAX010000439	Roller shaft



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	Spare part number	Description
M	3HAX010000309	Lonization Sensor Cable 1
N	3HAW050024230	Shaft bearing with housing
P	3HAX010000307	Anti Collision Cable 1
Q	3HAX010000308	Anti Collision Cable 2
R	3HAX010000310	Lonization Sensor Cable 2

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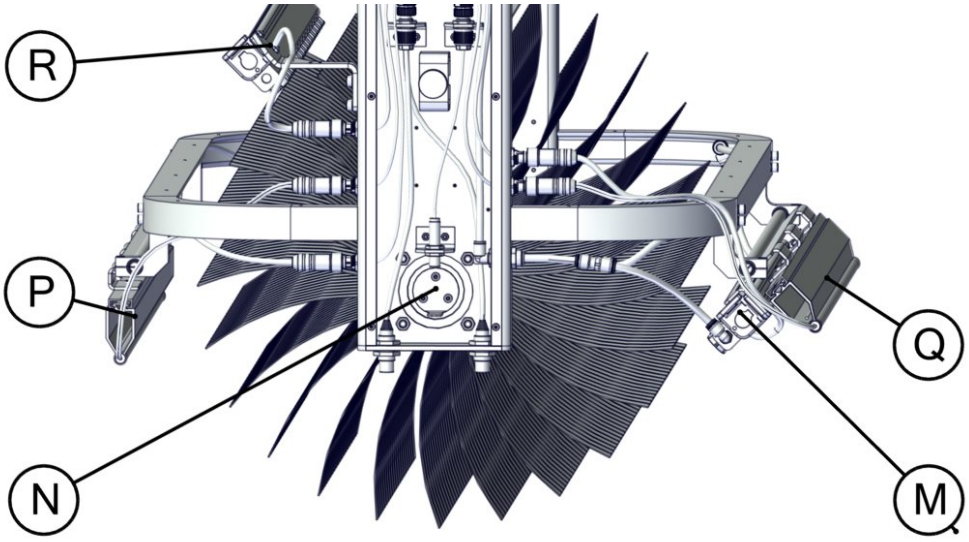

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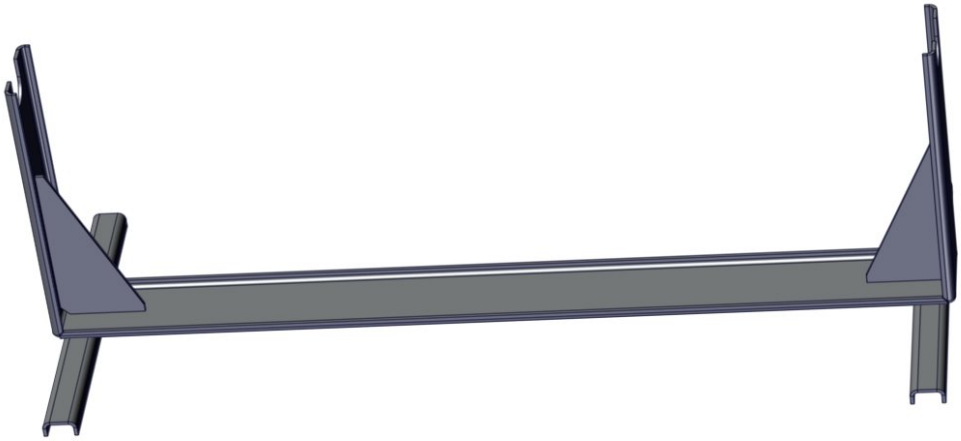
	Spare part number	Description
S	3HAW050024260	Feather roller support



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Electrical spare parts

	Spare part number	Description
-	3HAX010000301	Controller box
-	3HAX010000305-003	Harness Cabinet to IRC5_PLC 3M
-	3HAX010000303-003	Harness Cabinet to Robot Base 3M
-	3HAX010000303-005	Harness Cabinet to Robot Base 5M
-	3HAX010000303-010	Harness Cabinet to Robot Base 10M
-	3HAX010000303-015	Harness Cabinet to Robot Base 15M

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8.2 Spare part list and illustration
Continued

	Spare part number	Description
-	3HAX010000303-030	Harness Cabinet to Robot Base 30M
-	3HAX010000304-002	Harness Cabinet to Penumatic Supplier 2m
-	3HAX010000304-015	Harness Cabinet to Penumatic Supplier 15m
-	3HAX010000302-003	Harness Cabinet Power Supply 3M
-	3HAX010000302-005	Harness Cabinet Power Supply 5M
-	3HAX010000302-010	Harness Cabinet Power Supply 10M
-	3HAX010000302-015	Harness Cabinet Power Supply 15M
-	3HAX010000302-030	Harness Cabinet Power Supply 30M
-	3HAX010000306	Rotation Sensor Cable
-	3HAX010000411	LPT080-0220-05S-01A
-	3HAX010000311	Side Anti-collision Cable 1
-	3HAX010000312	Side Anti-collision Cable 1 adaptor
-	3HAX010000313	Side Anti-collision Cable 2

9 Circuit diagrams

Overview

The circuit diagrams are not included in this manual, but delivered as separate documents. See the article numbers in the tables below.

Document	Document number	Note
Feather Duster Cabinet Circuit Diagram	3HAX010000300	
Feather Duster Connection Box Diagram	3HAX010000301	
FD1 Harness	3HAX010000302	
FD2 Harness	3HAX010000303	
FD3 Harness	3HAX010000304	
FD4 Harness	3HAX010000305	
Feather Duster Rotation Sensor Cable	3HAX010000306	
Feather Duster Anti Collision Cable 1	3HAX010000307	
Feather Duster Anti Collision Cable 2	3HAX010000308	
Feather Duster Ionization Sensor Cable 1	3HAX010000309	
Feather Duster Ionization Sensor Cable 2	3HAX010000310	
Feather Duster Side Anti-collision Cable 1	3HAX010000311	
Feather Duster Side Anti-collision Cable 1 adaptor	3HAX010000312	
Feather Duster Side Anti-collision Cable 2	3HAX010000313	

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Index

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