rexroth
A Bosch Company

IGV / VGV cylinder for guide vane adjustment in gas turbines

Series CXEX for potentially explosive atmospheres

Operating instructions
RE 07105-B/11.19

Replaces: 07.18
English

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The cover shows an example configuration. The product supplied may therefore differ from the figure shown.

The original operating instructions were prepared in German.

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Contents

1 About this documentation

1.1 Validity of the documentation

This documentation applies to electro-hydraulic IGV / VGV cylinders of type:
• CXEX... for potentially explosive atmospheres

This documentation is intended for system manufacturers, assemblers, operators, service engineers and system end-users.
This documentation contains important information on the safe and proper transport, storage, assembly, commissioning, operation, use, maintenance, disassembly and simple troubleshooting of the product.

- You should read this documentation thoroughly, and in particular chapter 2 "Safety instructions" and chapter 3 "General information on damage to property and damage to product", before handling the product.

The applicable documentation is the one included with the product at the time of delivery (digital and/or hardcopy).

1.2 Required and amending documentation

- The product must not be commissioned until you have been provided with the documentation marked with the book symbol 🕮 and you have understood and observed it. For operating instructions and data sheets, please refer to our website at: `www.boschrexroth.com/various/utilities/mediadirectory/`.

Table 1: Required and amending documentation

	Title	Document number	Document type
🕮	Hydraulic fluids on base of mineral oils and related hydrocarbons	90220	Data sheet
🕮	General product information on hydraulic products	07008	Data sheet
🕮	General information on the assembly, commissioning and maintenance of hydraulic systems	07900	Data sheet

1.3 Representation of information

Consistent safety instructions, symbols, terms and abbreviations are used in this documentation so that you can quickly and safely work with the product. For a better understanding, they are explained in the following sections.

1.3.1 Safety instructions

In this documentation, safety instructions are contained in chapter 2.6 "Product-specific safety instructions" and in chapter 3 "General information on damage to property and damage to product" and wherever a sequence of actions or instructions are explained which bear the danger of personal injury or damage to property. The hazard avoidance measures described must be observed.

Safety instructions are structured as follows:

⚠ SIGNAL WORD

Type and source of danger!
Consequences in case of non-compliance
- ▶ Hazard avoidance measures
- ▶ <Enumeration>

- **Warning sign:** Draws attention to the danger
- **Signal word:** Identifies the degree of danger
- **Type and source of danger:** Specifies the type and source of danger
- **Consequences:** Describes the consequences of non-compliance
- **Precaution:** Specifies how the danger can be prevented

Table 2: Risk classes according to ANSI Z535.6-2006

Warning sign, signal word	Meaning
⚠ DANGER	Indicates a dangerous situation which will cause death or severe injury if not avoided.
⚠ WARNING	Indicates a dangerous situation which may cause death or severe injury if not avoided.
⚠ CAUTION	Indicates a dangerous situation which may cause minor or moderate (personal) injury if not avoided.
NOTICE	Damage to property: The product or the environment could be damaged.

1.3.2 Symbols

The following symbols indicate notices which are not safety-relevant but increase the comprehensibility of the documentation.

Table 3: Meaning of the symbols

Symbol	Meaning
	If this information is not observed, the product cannot be used and/or operated optimally.
▶	Individual, independent action
1. 2. 3.	Numbered instruction: The numbers indicate that the actions must be carried out one after the other.

1.3.3 Designations

The following designations are used in this documentation:

Table 4: Designations

Designation	Meaning
IGV cylinder	Hydraulic drive at an inlet guide vane for gas turbines
VGV cylinder	Hydraulic drive at an adjustable guide vane for gas turbines
Attachment devices	Load stand, lifting slings, load chains
Installation	Gas turbine
Console	Installation surface for IGV / VGV cylinders on the customer side

1.3.4 Abbreviations

The following abbreviations are used in this documentation:

Table 5: Abbreviations

Designation	Meaning
ATEX	EU Explosion Protection Directive (ATmosphère EXplosible)
EPL	Equipment Protection Level
Ex	Explosion protection mark according to Directive 2014/34/EU
IGV	Inlet Guide Vane for gas turbines
VGV	Variable Guide Vane for gas turbines
S	Center of gravity

2 Safety instructions

2.1 General information on this chapter

The product has been manufactured according to the generally accepted codes of practice. However, there is still the danger of personal injury and damage to property if you do not observe this chapter and the safety instructions in this documentation.

- Read this documentation completely and thoroughly before working with the product.
- Keep this documentation in a location where it is accessible to all users at all times.
- Always include the required documentation when you pass the product on to third parties.
- In addition to the safety instructions contained in this documentation, also observe the documentation of the components of the IGV / VGV cylinder (see order-specific documentation).

2.2 Intended use

The product is an electric and hydraulic system component. According to EU Directive 2006/42/EC and DIN EN ISO 4413, the IGV / VGV cylinder is a component that is not ready for use.
The product is exclusively intended for integration into an installation and serves the guide vane adjustment in gas turbnines.
According to the Pressure Equipment Directive 2014/68/EU, the IGV / VGV cylinder is not to be classified as pressure equipment, but as controlling equipment, since pressure is not the essential factor for design, but strength, dimensional stability and stability against static and dynamic operating load.

The product is only intended for industrial use and not for private use.
Intended use includes having read and understood this documentation, especially chapters 2 "Safety instructions" and 3 "General information on damage to property and damage to product".
IGV / VGV cylinders may only be used within the technical data, performance limits, specifications, and operating and environmental conditions specified in the documentation specific to the order. Determination of this information is derived from the customer specification and does not consider any further operating conditions at the customer. External forces may thus not exceed the forces indicated in the customer specification.

2.2.1 Intended use in potentially explosive atmospheres

Only IGV / VGV cylinders with Ex marking (see chapter 5.5 "Identification of the IGV / VGV cartridge") are suitable for use in potentially explosive atmospheres. The products comply with the requirements of the EU Explosion Protection Directive 2014/34/EU for the areas of application determined in chapter 5.5.1 "Explosion protection marking". They can be used in potentially explosive atmospheres according to the device group and category specified there.

2.3 Improper use

Any use deviating from the intended use is improper and thus not admissible. Bosch Rexroth AG does not assume any liability for damage caused by improper use. The user assumes all risks involved with improper use. The following case of foreseeable misuse is also regarded as being improper:

- Operation of the IGV / VGV cylinder with any hydraulic fluid not compliant with the documentation of the related order.

2.4 Qualification of personnel

The activities described in this documentation require basic knowledge of mechanics, electrics and hydraulics as well as knowledge of the appropriate technical terms. For transporting and handling the product, additional knowledge of dealing with lifting gear and the related attachment devices is required. In order to ensure safe use, these activities may only be carried out by a corresponding expert or an instructed person under the direction and supervision of an expert.
Experts are those who can assess the work to be undertaken, recognize potential hazards and apply the appropriate safety measures due to their professional training, knowledge and experience, as well as their understanding of the relevant regulations pertaining to the work to be undertaken. An expert must observe the relevant specific professional rules and have the necessary electrical and hydraulic expert knowledge.

Bosch Rexroth offers measures supporting training in specific fields.
An overview of the training contents can be found online at:
`www.boschrexroth.com/en/xc/training/training`

2.5 General safety instructions

- Observe the valid regulations on accident prevention and environmental protection.
- Observe the safety regulations and provisions of the country in which the product is used / applied.
- Only use Rexroth products in technically perfect condition.
- Observe all notices on the product.
- Persons who assemble, operate, disassemble or maintain Rexroth products must not consume any alcohol, drugs or pharmaceuticals that may affect their ability to react.
- Only use accessories and spare parts approved by Bosch Rexroth in order to exclude any hazard to persons due to unsuitable spare parts.
- Comply with the technical data and environmental conditions specified in the product documentation.
- The installation or use of inappropriate products in safety-relevant applications could result in unintended operating conditions when being used which in turn could cause personal injuries and/or damage to property. Therefore, only use a product for safety-relevant applications if this use is expressly specified and permitted in the documentation of the product, e.g. in safety-related parts of control systems (functional safety).
- Do not commission the product until you can be sure that the end product (for example a system) where the Rexroth products are installed complies with the country-specific provisions, safety regulations and standards of the application.

2.6 Product-specific safety instructions

The installation of the IGV / VGV cylinders into the installation may - due to the operation of the IGV / VGV cylinders and the overall system - result in risks which can only be identified and minimized by means of a risk assessment of the installation.

⚠ WARNING

Electrostatic charging and spark formation as well as hot surfaces!
Danger to life in the potentially explosive atmospheres!

- Before working with the IGV / VGV cylinder, ensure that no explosive atmosphere can occur during the work.
- Make sure that the equipotential bonding of the IGV / VGV cylinder in ATEX version is always connected in order to prevent electrostatic charging. In addition, observe the information in the operating instructions for the attached electrical components enclosed with the order-specific documentation.
- When applying additional surface protection (e.g. coating), make sure that the overall layer thickness of the protective structure including condition as supplied may not exceed 200 µm.
- Protect the IGV / VGV cylinder and the attached components and electrical connections, such as connectors and mating connectors, against mechanical load (e.g. impact).
- Do not pull the connectors under load.
- Immediately after installation in the system, remove all load stands from the IGV / VGV cylinder and then close the tapped holes of the attachment points with blanking plugs.
- Make sure that the ignition temperature of the hydraulic fluid is at least 50 Kelvin above the maximum admissible surface temperature of the components.

⚠ WARNING

(Pressurized) hydraulic fluid and oil mist leaking!
Danger to life! Risk of injury! Explosion hazard! Risk of fire! Environmental pollution! Damage to property!

- Switch the system off immediately (emergency off switch).
- Identify and remedy the leakage.
- Never try to stop or seal the leakage or the oil jet using a cloth.
- Avoid direct contact with the leaking hydraulic fluid.
- Wear your personal protective equipment, see chapter 2.7 "Personal protective equipment".
- Keep open fire and ignition sources away from the IGV / VGV cylinder.
- Make sure that the grounding (electric welding circuit) during welding works at the installation is not led via the IGV / VGV cylinder.
- When dealing with hydraulic fluids, you must imperatively observe the notices of the hydraulic fluid manufacturer.

⚠ WARNING

Danger due to pressurized IGV / VGV cylinder!
Risk of injury! Severe injury when working at systems that have not been stopped!
Damage to property!
- Make sure that the IGV / VGV cylinder has been completely depressurized.
- Observe the specifications of the system manufacturer and the system end-user.

⚠ CAUTION

Danger due to hot surfaces!
Risk of injury! Risk of burning!
- Only touch the surfaces of the IGV / VGV cylinder with protective gloves or do not work at hot surfaces. During or after the operation, temperatures may rise to values higher than 60 °C (140 °F), depending on the operating conditions.
- Allow the IGV / VGV cylinder to cool down sufficiently before touching it.
- Observe the protective measures of the system manufacturer.

2.7 Personal protective equipment

During operation and maintenance works as well as during installation and removal of the IGV / VGV cylinder, always wear the following personal protective equipment:
- Protective gloves
- Ear protection
- Safety shoes
- Safety goggles
- Protective helmet

2.8 Obligations of the machine end-user

In order to ensure safety when handling the IGV / VGV cylinder and its components, the machine end-user of the system must:

- guarantee the intended use of the IGV / VGV cylinder and its components according to chapter 2.2 "Intended use".
- instruct the operating personnel regularly in all items of the operating instructions and make sure that they are observed.
- put up an easily visible "Hot surface warning" warning sign at the place of installation of the IGV / VGV cylinder.
- comply with the applicable provisions, rules and directives on explosion protection.

The machine end-user is responsible for compliance with the specified safety measures for the specific application of the IGV / VGV cylinder and its components.

2.9 Visual displays

Table 6: Visual displays

Display	Item	Function
Filter clogging indicator	Filter housing	Pressure differential in the filter (as degree of contamination in the hydraulic fluid) Green: Filter element OK. Red: Check filter element and replace if necessary.

3 General information on damage to property and damage to product

NOTICE

Danger due to improper handling!

Damage to property!

- The product may only be operated according to chapter 2.2 "Intended use".
- Do not knock against areas relevant for the functioning (e.g. piston rod surfaces, mounting surfaces) and attachment parts (e.g. position transducers, valves) of the IGV / VGV cylinder.
- Do not position or place the IGV / VGV cylinder onto attachment parts.
- Never use the IGV / VGV cylinder as handle or step. Do not place or position any objects on top of it.

Contamination of the hydraulic fluid by fluids and foreign particles!

Early wear! Malfunctions! Damage to property!

- During assembly and disassembly of the IGV / VGV cylinder, provide for cleanliness in order to prevent foreign particles like e.g. welding beads or metal chips from getting into the hydraulic lines and causing product wear or malfunctions.
- Make sure that all connections, hydraulic lines and attachment parts (e.g. measuring devices) are free from dirt.
- Check before commissioning whether all hydraulic and mechanical connections are connected and tight and that all the seals and caps of the plug-in connections are correctly installed and undamaged.
- Keep the piston rod free from contamination.
- For removing lubricants or any other contamination, use industrial residue-free wipes.
- Only complete cleaning processes at the IGV / VGV cylinder if the hydraulic connections are closed.
- For connecting the IGV / VGV cylinder, use sealants which are approved of for industrial use and do not lead to contamination in the hydraulic system.
- Only use hydraulic fluids complying with the requirements and the cleanliness class (see chapter 8.1.1 "Flushing the system"). For example, use additional filters attached to the unit in order to clean the hydraulic fluid and achieve the required cleanliness class.

NOTICE

Mixing hydraulic fluids!

Damage to property!

- Generally avoid any mixing of hydraulic fluids of different manufacturers and/or of different types of the same manufacturer.
  A mixture of hydraulic fluids may occur for example due to hydraulic fluid residues in the IGV / VGV cylinder.
- Check the compatibility of the various hydraulic fluids and their compatibility with the components and seals.

Improper cleaning!

Damage to property!

- Cover all openings with the appropriate protective threads in order to prevent cleaning agents from penetrating the system.
- Check that all seals of the hydraulic system and all caps of the electric plug-in connection are firmly fitted to prevent the penetration of cleaning agents.
- Do not use aggressive and/or easily inflammable cleaning agents for cleaning. Clean the product using a suitable cleaning liquid and residue-free industrial wipes.
- Do not use high-pressure washers.
- Do not use compressed air for the cleaning at functional interfaces like e.g. piston rods and in sealing areas.
- Keep the warning signs on the IGV / VGV cylinder always in a legible condition. Replace damaged and illegible signs.

Operation with lack of hydraulic fluid!

Damage to property!

- Observe the system manufacturer's specifications regarding the point "Control of the hydraulic fluid" and the prescribed remedial measures for the control result.

Leaking or spilt hydraulic fluid!

Environmental pollution and pollution of the ground water!

- Use an oil binding agent in order to bind the leaked hydraulic fluid.
- Immediately remedy possible leakage.
- When filling and draining the hydraulic fluid, always put a collecting pan with sufficient capacity under the IGV / VGV cylinder.
- Observe the information in the safety data sheet of the hydraulic fluid and the system manufacturer's provisions.
- Dispose of the hydraulic fluid in accordance with the national regulations in the country of use.

4 Scope of delivery

The scope of delivery comprises the IGV / VGV cylinder including accessories as ordered by the customer and confirmed in the order confirmation. In addition, the ports are closed by means of blanking plugs and/or cover plates. They exclusively serve as protection against contamination of the IGV / VGV cylinder during transport.

4.1 Documentation

The documentation consists of:
- Operating instructions
- Test record
- Installation drawing
- Hydraulic circuit diagram
- Order parts list
- Data sheets and operating instructions of the components
- Declaration of conformity (depending on version)
- Certificates
- Other documents, e.g. a wiring diagram

5 Product information

5.1 Performance description

The IGV / VGV cylinder is an electro-hydraulic drive and is used as actuator for guide vanes at gas turbines.

5.2 Product description

IGV / VGV cylinders have been designed for use at guide vanes in gas turbines and have been configured for the customer-specific applications.

Components The basic set-up of an IGV / VGV cylinder with its most important parts can be seen in the installation drawing.

Hydraulic cylinder The IGV / VGV cylinder has been designed as double-acting cylinder with double piston rod. On the customer-side piston rod end, there is a thread. In the back part of the drive, a stroke adjustment and a position transducer have been accommodated under a protective pipe (protective cover). The cylinder has two separate line connections for pressure (P) and tank (T).

Hydraulic control The hydraulic control of the cylinder is effected by means of the control block function integrated in the cylinder housing. The latter directly connects both cylinder chambers (without pipelines). In the cylinder housing, the functions required to control the cylinder have been considered (see hydraulic circuit diagram).

Position measurement system The position measurement system records the position of the piston of the IGV / VGV cylinder for the superior open-loop / closed-loop control system. Depending on the customer specification, different position measurement systems can be used. The position transducer is located below a protective pipe at the back (lower) end of the IGV / VGV cylinder or laterally, on the cylinder housing.

For further information on the position measurement system, please refer to the product-specific documentation.

Stroke adjustment Below the protective pipe (protective cover), the IGV / VGV cylinder is equipped with a stroke adjustment.

Proximity switch Inductive proximity switches (order-specific) are used for the end position control in IGV / VGV cylinders. The optionally installed proximity switches work in a contactless manner. The proximity switches are triggered by the lock nut during movement of the piston rod. The proximity switches are set and supplied by Bosch Rexroth according to the relevant customer specification.

Distributor The servo valve and the position transducer are wired in a distributor at the IGV / VGV cylinder.

5.3 Functional description

General

The electro-hydraulic IGV / VGV cylinder consists of the control cylinder (cylinder housing with integrated control block function), the stroke adjustment and the attached position transducer.
The pilot oil supply is effected externally, by means of a central supply unit.
The electric energy supply and the signal transmission are effected by means of a branch and connection box (distributor).

Hydraulic cylinder

The IGV / VGV cylinder consists of a double-acting cylinder (piston rod on both sides). In the IGV / VGV cylinder, the piston pressurized in opening and/or opposite direction is guided.
For the position sensing, a position transducer is attached to the IGV / VGV cylinder.
The connection to the central pilot oil supply is established by means of a pressure port (P) and a tank port (T).

Control system

Depending on the version, the hydraulic control integrated in the cylinder housing comprises the following components:
- a filter to avoid the deposition of coarse dirt
- a check valve as well as an optional orifice
- the servo valve in special version (10% trimmed, see hydraulic circuit diagram) for the control function.

Please observe that the servo valve requires a superimposed dither signal.
For recommendations on frequency and amplitude, please refer to the servo valve data sheet. Optimization of frequency and amplitude for the relevant application is necessary.
For the exact circuit / version, please refer to the hydraulic circuit diagram.

All control parts are connected with the IGV / VGV cylinder via internal channels (no pipelines).

Mode of operation

With the IGV / VGV cylinder, the actuating piston is controlled via the servo valve which is controlled by the system controller according to a preset position command value. The actual value is permanently checked in the system controller by means of a command/actual value comparison via the position measurement system at the IGV / VGV cylinder. The maximum achievable actuating time of the IGV / VGV cylinder in both directions may moreover be limited by means of an orifice, depending on the order.

For further information, refer to the hydraulic circuit diagram enclosed to the order-specific documentation.

5.4 Component overview

For a component overview of the installed components (such as pressure filters, valves, etc.) please refer to the parts list from the order-specific documentation.

5.5 Identification of the IGV / VGV cylinder

The unit is unambiguously identified by:
- the name plate
- the order-specific documentation
- the delivery note and accompanying documents

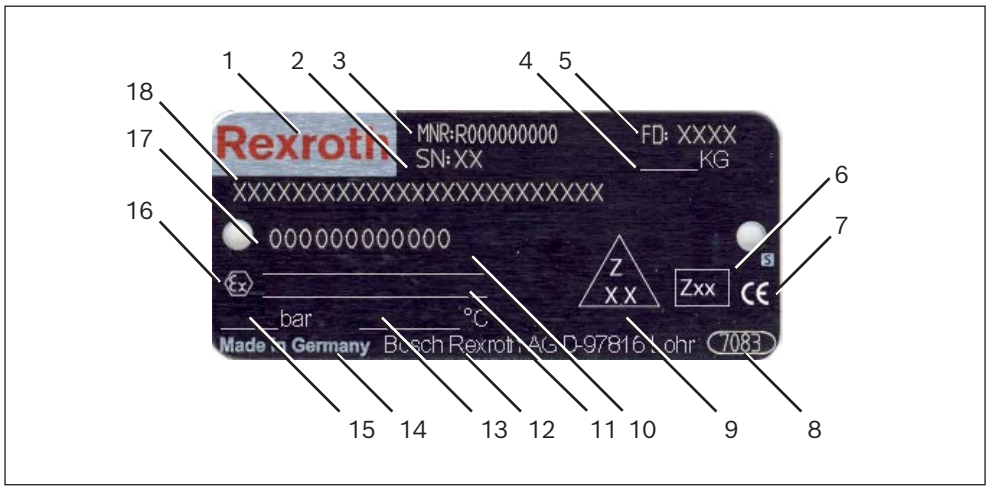

Fig. 1: Name plate

1 Manufacturer
2 Serial number
3 Material number
4 Weight (without oil filling)
5 Coded date of production
6 Personal stamp of the assembler
7 CE mark (order-dependent)
8 Area number / works number
9 Personal stamp of the inspector
10 Ex marking 1
(only with ATEX version)
11 Ex marking 2
(only with ATEX version)
12 Manufacturer address
13 Temperature range
14 Designation of origin
15 Nominal pressure
16 Explosion protection mark
(only with ATEX version)
17 Customer order number
(SAP commissions no.)
18 Material short text

Depending on the order and the customer's request, the name plate may comprise further information.

5.5.1 Explosion protection marking

The marking of the IGV / VGV cylinder for potentially explosive atmospheres according to Directive 2014/34/EU can be found on the name plate.

According to EU Directive 1999/92/EC, the user / machine end-user has to classify potentially explosive atmospheres into zones. Table 7 lists the area of application of the IGV / VGV cylinders according to their device group and category of the zones.

Table 7: Area of application according to II 3G

Device group according to 2014/34/EU	Device category according to 2014/34/EU	Equipment protection level (EPL)	Area of application Properties	Usable in the following zones according to 1999/92/EC
II	3G	Gc	Potentially explosive atmospheres where explosive gases, mists or vapors (= device group II) are normally not present or occur only rarely or short-time. Corresponds to zone 2 according to Directive 1999/92/EC. Normal safety level.	2

Type of protection

The type of protection describes the type of measures taken to prevent an ignition in the surrounding explosive atmosphere.

Table 8: Types of protection

Marking	Type of protection
Ex h	Structural safety c according to EN 80079-37

Classification into explosion groups

The classification (see table 9) is based on the experimentally determined boundary gap width or the minimum ignition current ratio for the explosive atmosphere for which a device may be installed (see IEC 60079-20-1).

The explosion group IIA includes less hazardous substances, explosion group IIC includes the most hazardous substances. Products for a certain explosion group may always be used in areas with a lower hazardousness.

Table 9: Examples for the categorization of gases, mists and vapors in explosion groups

Explosion group			Examples for gases, mists and vapors
IIA	IIB	IIC	Acetone, ammonia, petrol, benzene, carbon monoxide, ethylene alcohol, methane, hydrogen sulfide, propane
			Ethylene, city gas, acetaldehyde
			Hydrogen, carbon sulfide, acetylene

Temperature classes for device group II

The temperature classes provide information about the suitability of a hydraulic product for the use in a certain potentially explosive atmosphere due to explosive gases, mists or steam.

Please note that the maximum surface temperature of the IGV / VGV cylinder must be below the ignition temperature of the surrounding explosive gas, mist and steam.

Hydraulic products of the device group II, category 3G are classified into the temperature classes T1 to T6 according to their maximum surface temperature.

Table 10: Temperature class for device group II

Temperature class	Maximum permissible surface temperature
T1	450 °C
T2	300 °C
T3	200 °C
T4	135 °C

Additional information

Special conditions must be observed when using the operating equipment.

Table 11: Additional information

Marking	Condition
X	Observe the warning labels on the IGV / VGV cylinder!

6 Transport and storage

6.1 Transporting the IGV / VGV cylinder

⚠ WARNING

Falling of the IGV / VGV cylinder or individual components!
Danger to life! Risk of injury! Damage to property!
- Use lifting gear (e.g. load stands, lifting slings) as attachment devices, which can safely bear the weight of the IGV / VGV cylinder with its components.
- For transporting the IGV / VGV cylinder, always use several attachment devices and attachment points.
- The use of load stands is to be preferred.
- Do not stand or walk under lifted loads.
- Wear your personal protective equipment, see chapter 2.7 "Personal protective equipment".

⚠ CAUTION

Uncontrolled rolling away and tilting of the IGV / VGV cylinder or individual components!
Risk of injury! Damage to property!
- Observe the lifting capacity of the lifting gear.
- Ensure a stable position of the center of gravity.
- Secure the IGV / VGV cylinder or the individual components against rolling or falling.

Lifting the IGV / VGV cylinder at attachment parts (e.g. valve)!
Risk of injury! Damage to property!
- Only transport the IGV / VGV cylinder as described in chapter 6.1 "Transporting the IGV / VGV cylinder".
- Use the intended tapped holes for mounting the attachment devices.

NOTICE

Force effect caused by lifting gear on attachments (subplates, piping, valves etc.) during lifting!
Damage to property!
- Fasten the lifting gear (e.g. load chains, lifting slings) at the IGV / VGV cylinder so that during lifting, the lifting gear is free, i.e. does not rest against attachments.

Depending on the size and the situation on site, the IGV / VGV cylinder can be transported using a forklift, a crane or any other lifting gear.
When moving and lifting the IGV / VGV cylinder, please observe the following directives:

- Transport the IGV / VGV cylinder in its original packaging, if possible, or on wooden blocks (prism-shaped squared timber) holding the IGV / VGV cylinder in a stable position and bearing its weight.
- Make sure that when transporting the IGV / VGV cylinder on wooden blocks, there are no force effects on attachment parts (valves, position measurement system, etc.).

Bosch Rexroth recommends using lifting slings in order to prevent damage to coated or primed components.

- Be very careful when transporting the IGV / VGV cylinder.
- Before maintenance work or disassembly of the IGV / VGV cylinder from the console of the guide vane, check the attachment devices for corrosion and ensure that the attachment devices are screwed in securely to the stop.
- For the weight of the IGV / VGV cylinder (without packaging and oil filling) please refer to the name plate or the supplied package list, or the installation drawing, if required.

The IGV / VGV cylinder is delivered including oil filling.

6.1.1 Transporting the IGV / VGV cylinder using a forklift

To transport the IGV / VGV cylinder using a forklift, proceed as follows:

1. Move the fork of the forklift under the packaging of the IGV / VGV cylinder or under the IGV / VGV cylinder secured for transport.
2. Carefully lift the load for checking the center of gravity position.
   Ensure a stable center of gravity position (S).
3. Make sure that the IGV / VGV cylinder cannot move out of the intended position.
4. Secure the IGV / VGV cylinder against the occurring acceleration forces and the related undesired motion of the IGV / VGV cylinder.
5. During transport, only lift the IGV / VGV cylinder as far off the floor as necessary for the transport.

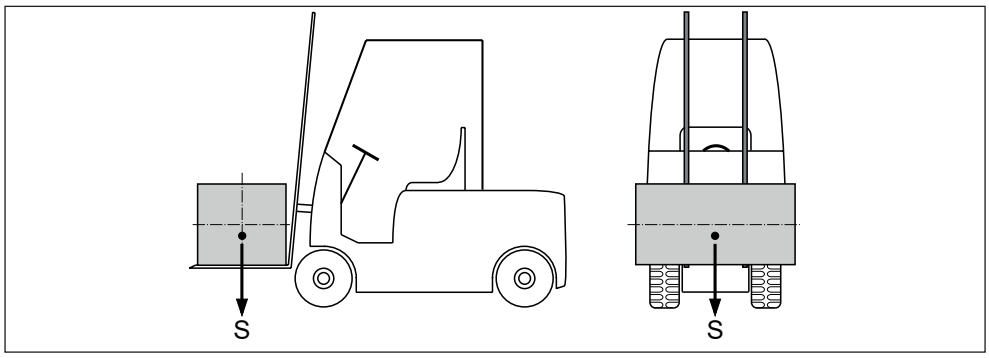

Fig. 2: Transport using a forklift

6.1.2 Transporting the IGV / VGV cylinder using lifting gear

1. Fasten the attachment devices at the IGV / VGV cylinder so that you can safely lift it at a minimum of two points.

The weight of the IGV / VGV cylinder (see chapter 6.1 "Transporting the IGV / VGV cylinder") and the attachment points for attachment devices available at the IGV / VGV cylinder are specified in the installation drawing.
Observe the load-bearing capacity of the attachment devices at the IGV / VGV cylinder.

2. Only fasten approved attachment devices, such as load stands and lifting slings with sufficient lifting capacity at the attachment points at the IGV / VGV cylinder.
3. Slowly and carefully lift the IGV / VGV cylinder to check the center of gravity position (S).
4. Make sure that the IGV / VGV cylinder cannot move out of the intended position.
5. During transport, only lift the IGV / VGV cylinder as far off the floor as necessary for the transport.

6.2 Storing the IGV / VGV cylinder

External preservation

The IGV / VGV cylinders are externally preserved by means of galvanic coating.

If you have any questions regarding external preservation, please contact the Bosch Rexroth service.

Internal preservation

On delivery, the IGV / VGV cylinder is filled with hydraulic fluid (test oil), which provides for internal preservation. By default, the IGV / VGV cylinders are tested with mineral oil (HL, HLP) according to DIN 51524, part 2. Other test media may also be used according to the order. The line connections are closed with covers after testing and filling.

6.2.1 Storage conditions

Table 12: Storage conditions

Denomination	Area
Temperature range	-20 °C to +50 °C
Relative air humidity (no condensation)	Max. 65%
UV protection	100%
Condensation	None
Additional ozone formation near storage place	None

6.2.2 Storage times

The maximum storage times given in table 13 "Storage times" are achieved with internal preservation, i.e. filling the IGV / VGV cylinders with hydraulic fluid.

IGV / VGV cylinders filled with oil must not be exposed to direct solar radiation or other heat sources as due to the increase in the ambient temperature, the hydraulic pressure in the IGV / VGV cylinder increases.

Table 13: Storage times

Storage conditions	Packaging	Max. storage time in months Filling with hydraulic fluid
Storage in dry rooms with constant temperature	For carriage overseas	24
	Not for carriage overseas	24
Outdoor storage (protected against damage, exposure to sunlight and water ingress)	For carriage overseas	12
	Not for carriage overseas	12

If the product is to be stored for more than six months, unprotected parts like fitting surfaces or mechanical interfaces must be protected with corrosion protection oil.

- Protect fitting surfaces from humidity.
- As deformations at the seals cannot be excluded, renew the seals.

Observe chapter 12.2 "Exchanging components".

- Contact Bosch Rexroth for the preservation and later commissioning of the IGV / VGV cylinder if the IGV / VGV cylinder must be stored for a period exceeding the durations in table 13 "Storage times".

Improper storage may lead to embrittlement of seals and potential leakage.

6.2.3 Inspection during the storage time

In order for the IGV / VGV cylinder to remain in perfect condition during the storage period, the following conditions have to be met:

- During the storage period, subject the IGV / VGV cylinder to a careful inspection (at least once per year), see table 13 "Storage times". While doing so, observe in particular the following:
  - External preservation: visual inspection for damage and rust formation
  - Hydraulic fluid: control with regard to oxidation or acidification
  - Inspection of the preservation of fitting surfaces or mechanical interfaces
- During the storage period, extend and retract the IGV / VGV cylinder several centimeters (at least once per year), see table 13 "Storage times", in order to prevent the seals from bonding. To do so with oil-filled hydraulic cylinders, connect the supplied hose to the measuring coupling ports of both cylinder chambers. Depending on the results, you may have to take corrective measures, see chapter 15 "Troubleshooting".

In this connection, also observe step 3 in chapter 7.4.1 "Mounting the IGV / VGV cylinder at the guide vane".

In order to prevent damage at the seals, Bosch Rexroth recommends rotating the IGV / VGV cylinder by 90° every six weeks unless it is stored vertically.

6.2.4 Notice on packed IGV / VGV cylinders

- If you open the packaging for control purposes, you have to close it again properly.
- In case of packaging for carriage overseas, enclose new drying agents.

7 Assembly

Regarding lifting and moving of the IGV / VGV cylinder, the same rules apply as already described in chapter 6.1 "Transporting the IGV / VGV cylinder".

- During installation into the system remember that damage at the IGV / VGV cylinder and the attached components may reduce the functionality / service life.

7.1 Supply state

The IGV / VGV cylinder is supplied in the stroke setting specified by the customer. This customer-specific stroke setting is documented on the installation drawing.
On delivery, the IGV / VGV cylinder is filled with test oil.
Supplied accessory parts are already assembled according to the delivery note and need to be mounted.

7.2 Unpacking the IGV / VGV cylinder

- Remove the packaging of the IGV / VGV cylinder.
- Check the delivery for completeness using the delivery documents.
- Carry out a visual inspection for transport damage at the IGV / VGV cylinder.
- Dispose of the packaging material in accordance with the national regulations in the country of use and/or your company-internal specifications.

7.3 Installation conditions

NOTICE
Faulty installation of the IGV / VGV cylinder at the guide vane console! Damage to property! ▶ Assemble the IGV / VGV cylinder so that the cylinder piston rod which is connected to the guide vane and/or its push rod via a coupling is aligned and so that there is no axial offset. ▶ Avoid radial forces on the cylinder piston rod as well as on the push rod.

Mounting surfaces at the system must be designed so that any torsion of the IGV / VGV cylinder in the installed condition is avoided. The IGV / VGV cylinder must be installed so that unintended lateral loads during operation are avoided. Stroke length, load and mounting must be observed in order to avoid bending and kinking in every stroke position (extract from: DIN EN ISO 4413: 2011-04/5.4.2.1).

- Fasten the IGV / VGV cylinder so that the load acts axially on the center line of the IGV / VGV cylinder.
- Make sure that the IGV / VGV cylinder and particularly the attached components are not damaged during installation.
- Make sure that the mounting surfaces and elements at the guide vane are able to absorb the occurring forces.

The mounting must minimize the following (extract from: DIN EN ISO 4413: 2011-04/5.4.2.7):
• Excessive deformation of the IGV / VGV cylinder due to pushing or pulling load
• Introduction of lateral or bending loads

7.4 Assembling the IGV / VGV cylinder

Do not use the connection elements to set installation differences.

- Remove the protective devices like e.g. flange covers only when establishing the corresponding connection.
- The IGV / VGV cylinder is delivered including test oil filling. For this reason, drain the hydraulic fluid in provided collecting containers by means of the supplied hose prior to assembly at the guide vane.

To prepare the IGV / VGV cylinder for attachment proceed as follows:
- Have the installation drawing and the hydraulic circuit diagram ready.
  – Check whether the material short text on the name plate corresponds to the installation drawing.
- Get tools and aids ready.
- Carefully lift the IGV / VGV cylinder out of the transport packaging.
- Check whether all accessory parts are available.
- Attach the accessories unless they have already been attached by Bosch Rexroth.

For information on the attachment of the accessory parts, please refer to the related documents.

- It is imperative to provide for absolute cleanliness.
  – The IGV / VGV cylinder and all other parts used must be installed free from dirt.
  – Make sure that the installation surfaces are clean. Also check the hydraulic lines.
- Check whether all fittings at the IGV / VGV cylinder are tight. In case of loose connections, please contact the Bosch Rexroth service.

  You can now start to attach the IGV / VGV cylinder.

7.4.1 Mounting the IGV / VGV cylinder at the guide vane

⚠ CAUTION

Unintended motion of the IGV / VGV cylinder during installation!
Risk of injury! Danger of crushing! Damage to property!
- Keep the IGV / VGV cylinder in a stable and secured position until it is fixedly mounted at the console.
- Be careful when assembling the unit.
- Only complete the stroke adjustment when the system is depressurized.
- Only re-connect the hydraulic lines after assembly of the protective pipe and only pressurize it then.

NOTICE

Damage at the position measurement system in case of lateral attachment!
Damage to property!
- Make sure that during assembly of the coupling, the piston rod is not twisted.

General notes on assembly, alignment and fastening

The IGV / VGV cylinder should be assembled complying with the assembly, coupling and setting instructions of the customer (e.g. system manufacturer).
- Work carefully.
- Check whether the connection bores fit.
- Tighten the screws cross-wise.
- Make sure that the piston rod is aligned with the push rod.

Proceed as follows when installing the IGV / VGV cylinder:
- Align the IGV / VGV cylinder at the site of installation.
  – In this connection, make sure that the piston rod is aligned with the push rod.
- Screw the IGV / VGV cylinder to the console evenly and crosswise considering the preload forces.
- Now pin the console (if necessary).

For easier movement of the piston rod, the supplied hydraulic hose can be connected to the ports of the measuring coupling of the two cylinder chambers. After completed assembly of the relevant IGV / VGV cylinder, the hydraulic hose is to be removed again and the connections of the measuring coupling are to be re-closed.

- Assemble the coupling at the piston rod.

With laterally attached position measurement system (fig. 3 / item 1), loosen the screw (fig. 3 / item 2) at the piston rod end before assembly of the coupling in order to allow for slight rotation of the piston rod and/or alignment of the coupling as there is no anti-rotation feature for the piston rod. After the assembly of the coupling, tighten this screw again.

For the corresponding tightening torque, please refer to the installation drawing. The maximum admissible tightening torque, see installation drawing, must not be exceeded at the key face of the piston rod.
The coupling is not included in the scope of delivery.

Stroke adjustment

The following figure illustrates the stroke adjustment with laterally attached position measurement system:

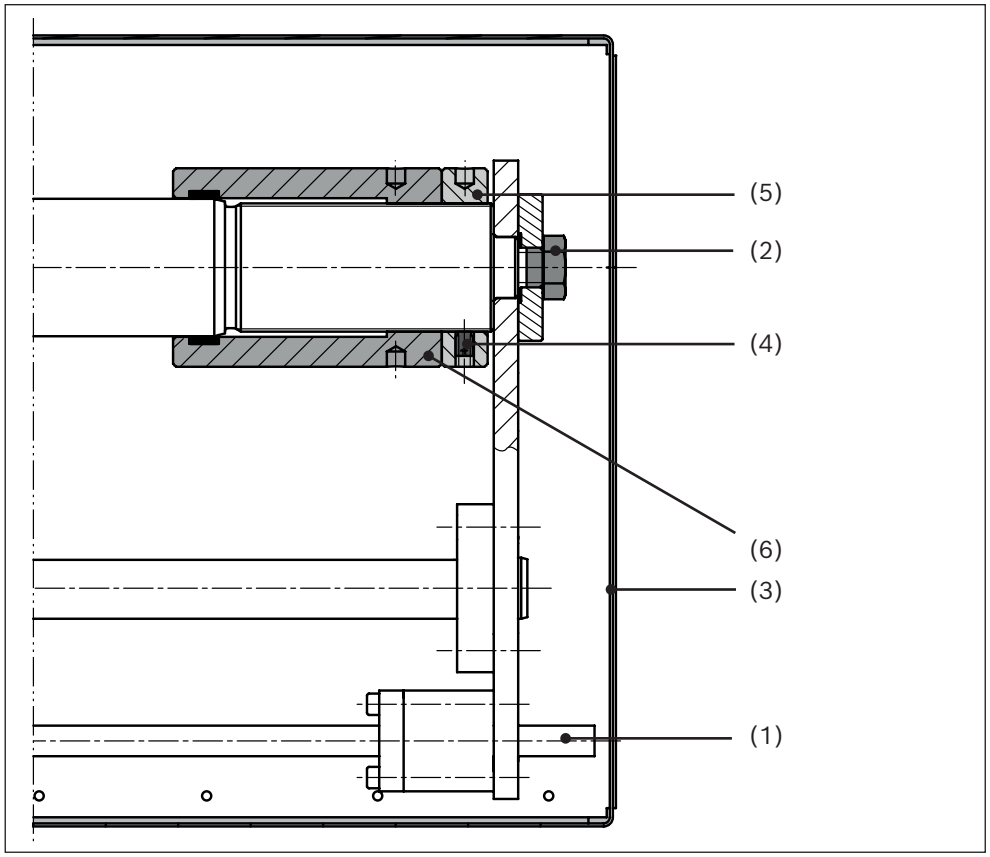

Fig. 3: Stroke adjustment (with laterally attached position measurement system)

1 Position measurement system	**4** Grub screw
2 Screw	**5** Lock nut
3 Protective pipe	**6** Stroke nut

To make a stroke adjustment, proceed as follows:

- Remove the protective pipe (fig. 3 / item 3) by loosening and removing the mounting screws.
  – Keep the mounting screws.

The piston rod of the IGV / VGV cylinder must be retracted to its end position. The stroke nut (fig. 3 / item 6) must not be moved to stop.

- Carefully pull the cable guide out of the groove.
- Remove the grub screw (fig. 3 / item 4) in the lock nut (fig. 3 / item 5).
- Loosen the lock nut (fig. 3 / item 5).

- Now carefully perform the customer-specific stroke adjustment.

The setting is effected by rotating the stroke nut (fig. 3 / item 6).

- Re-tighten the lock nut (fig. 3 / item 5).
- Secure the lock nut by assembling the grub screw (fig. 3 / item 4).
- Carefully push the protective pipe (fig. 3 / item 3) over.
  - In this connection, ensure correct guiding of the cable. The cable must not be squeezed.
  - Carefully plug the cable guide into the groove.
- Now secure the protective pipe (fig. 3 / item 3) again, using the mounting screws.

The attachment process is completed.

Proximity switch adjusting the X direction

NOTICE

Risk of collision during set-up of the proximity switches!
Damage to property!
- Observe the admissible setting range on the installation drawing.
  If the proximity switches are screwed in too deep, there is a risk of collision with the lock nut (fig. 4 / item 3)!

The following figure shows the proximity switches for setting the cylinder stroke:

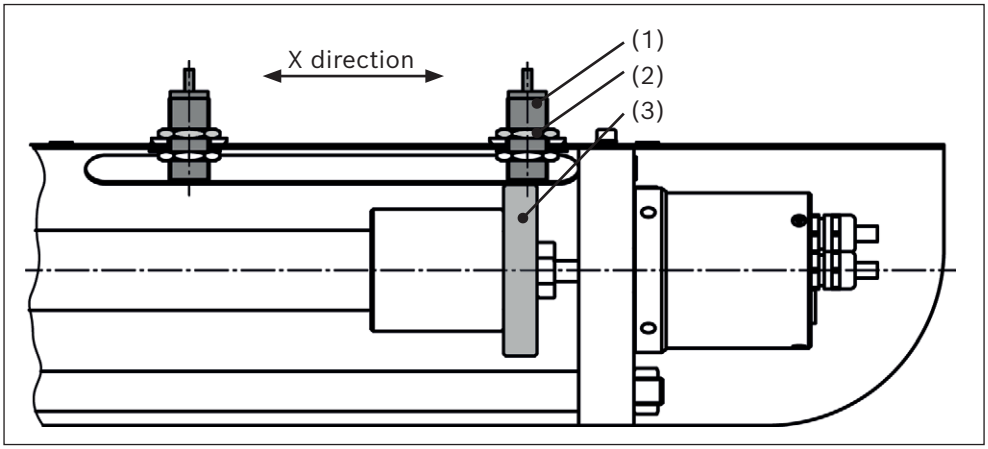

Fig. 4: Setting the proximity switches

1 Proximity switch
2 Upper mounting nut
3 Lock nut

It is possible to adjust the proximity switches in X direction within the range of the cylinder stroke.
- Loosen the upper mounting nut (fig. 4 / item 2) of the proximity switches (fig. 4 / item 1).
- Move the proximity switches in X direction to the desired position.

The admissible setting range (see installation drawing) is to be checked and must imperatively be complied with. It has been selected so that the distance corresponds to half the maximum switching distance possible. The inspection windows in the protective sheet serve as additional control option. In order to exclude the mutual influencing of two identical sensors, comply with the minimum distance according to the data sheet (see order-specific documentation).

- Tighten the loosened mounting nuts applying the required tightening torque.

For the tightening torque, please refer to the installation drawing in the order-specific documentation.

7.4.2 Hydraulically connecting the IGV / VGV cylinder

The hydraulic connection has to be established according to the specifications of the hydraulic circuit diagram.

7.4.3 Electrically connecting the IGV / VGV cylinder

⚠ WARNING

Improper electrical connection in potentially explosive atmospheres!

Danger to life! Risk of injury! Explosion hazard!

- Carry out the electrical connections in the system properly and carefully. For the ATEX version of the IGV / VGV cylinder, also observe the ATEX instructions in the operating instructions of the attached electrical components.
- Connect the equipotential bonding to the IGV / VGV cylinder. The positions provided for this purpose are marked in the installation drawing enclosed with the order-specific documentation.

⚠ WARNING

Destruction of the electronics or uncontrolled movements in connection with the activated hydraulics as well as excessive housing voltage and excessive leakage current due to faulty connection!

Electric shock! Danger to life! Risk of injury! Damage to property!

- The control loops may only be commissioned by accordingly qualified specialists.
- Connect or disconnect plug-in connections (e.g. mating connectors) only when in de-energized state.
- Make sure that the electric connection is established according to the specifications of the wiring diagram or according to the specifications of the relevant data sheets / operating instructions of the electric components.

The IGV / VGV cylinder is supplied with a mounted distributor, to which all electric components of the Bosch Rexroth IGV / VGV cylinder have already been wired. Observe the specifications in the terminal box!

8 Commissioning

⚠ CAUTION

Dangerous motion when operating the IGV / VGV cylinder!
Risk of injury! Danger of crushing!
- Do not touch the area of the IGV / VGV cylinder.

Undesired electrical voltage at the IGV / VGV cylinder!
Risk of injury! Electric shock! Damage to property!
- Provide for equipotential bonding. In this connection, observe chapter 7.4.3 "Electrically connecting the IGV / VGV cylinder".

Excessive hydraulic pressure in the IGV / VGV cylinder!
Risk of injury! Damage to property!
- Secure the maximum hydraulic pressure for the IGV / VGV cylinder by means of suitable measures, e.g. by means of a pressure relief valve.

8.1 First commissioning

- Before the installation, clean all mounting surfaces from dirt, scales, chips, etc.
  - For that purpose, use industrial residue-free wipes.
  - Particularly welded pipes must be blank on the inside and flushed.
- Observe the installation information of the fitting manufacturer.
  - Sealants like hemp and kit are not admissible as they may cause contamination and thus malfunctions.
- The hydraulic lines should be dimensioned in accordance with the performance data in the hydraulic circuit diagram and/or in the installation drawing.
- Check whether the IGV / VGV cylinder has been correctly connected according to the installation drawing, the hydraulic circuit diagram and the wiring diagram.
- Check whether all flanges and fittings have been tightened.
- Check the system for leak-tightness.

8.1.1 Flushing the system

When flushing the system, the IGV / VGV cylinder must be disconnected from the system.
- Take measures in order to exclude the IGV / VGV cylinder when flushing the system.

In case of questions or doubt, please contact the Bosch Rexroth service. The address can be found in chapter 17 "Appendix".

Before commissioning of the IGV / VGV cylinder, it has to be ensured that the maximum admissible cleanliness class of the hydraulic fluid (see chapter 8.1.2 "Filling the IGV / VGV cylinder with hydraulic fluid and bleeding it") for the overall system is not exceeded.

8.1.2 Filling the IGV / VGV cylinder with hydraulic fluid and bleeding it

⚠ WARNING

Measuring coupling and/or plug screw might fly out uncontrollably!
Danger to life! Risk of injury! Damage to property!
- During the filling and bleeding procedure, do not screw the measuring coupling and/or the plug screw out completely.

The basic contamination of the hydraulic fluid used must not exceed the maximum admissible cleanliness class according to ISO 4406 (c) class 18/16/13. The cleanliness classes specified for the components (like valves) must be adhered to in hydraulic systems.

- Fill and bleed the IGV / VGV cylinder in several switching processes (retraction and extension of the IGV / VGV cylinder) and through a measuring coupling, if necessary.
- Observe the relevant hydraulic circuit diagram and the safety instructions of these operating instructions, see chapter 3 "General information on damage to property and damage to the product".

If you are not sure how your IGV / VGV cylinder is to be filled and bled, please contact the Bosch Rexroth service. The address can be found in chapter 17 "Appendix".

To move the piston rod out of the supply state, valves have to be controlled. For possible functions, refer to the relevant hydraulic circuit diagram.

- Only operate the IGV / VGV cylinder at low pressure until the bleeding process of the hydraulic system is completed.
- If the visual clogging indicator is triggered during the bleeding procedure at the pressure filter, you can reset it again by pressing it in.
- Observe the fluid level in the oil tank and top up, if necessary.

8.1.3 Commissioning the IGV / VGV cylinder

In normal operation, operating tasks directly at the IGV / VGV cylinder are not necessary. The IGV / VGV cylinder is controlled and/or regulated via the customer’s control system.

Please observe that the servo valve requires a superimposed dither signal. For recommendations on frequency and amplitude, please refer to the servo valve data sheet. Optimization of frequency and amplitude for the relevant application is necessary.
The servo valve (control function only) must not be applied for any safety function.

8.2 Re-commissioning after standstill

- In the re-commissioning, observe the commissioning instructions, see chapter 8.1 "First commissioning".

9 Operation

Information on operating the IGV / VGV cylinder can only be provided in connection with the system / turbine.

- For this information, please refer to the operating instructions of the system / turbine manufacturer.
- For the operating parameters and the function of the IGV / VGV cylinder, please refer to the valid, order-specific documentation.

9.1 Operating conditions

Please note the following data in table 14 "Limitations of use", unless otherwise stated in the order-specific documentation:

Table 14: Limitations of use

Denomination		Area
Operating pressure		Up to max. 200 bar
Velocity		Up to max. 3 m/s
Frequency		Up to max. 2 Hz
Ambient temperature [1])	Interface to IGV / VGV cylinder	-20 °C to +60 °C
	Hydraulic cylinder part	Max. +60 °C
Operating temperature (hydraulic fluid)		0 °C to +70 °C

[1]) For the ATEX version of the IGV / VGV cylinder, the temperature information on the name plate shall apply.
Also observe chapter 5.5 "Identification of the IGV / VGV cylinder"!

The strokes must be designed by the control system in such a way that a sufficient lubricating film and thus low-wear operation for the seals is achieved. Continuous operation in the short-stroke range leads to wear on seals and damage to the mating surfaces.
The replacement interval for seals recommended in section 10.3 "Maintenance schedule" can be significantly shortened, especially for use with short strokes and simultaneously higher frequencies. Regular checks are therefore necessary!
The maximum values given in Table 14 "Limitations of use" should not be used simultaneously.

10 Maintenance and repair

According to DIN 31051, maintenance means all measures for maintaining and restoring as well as for determining and evaluating the actual condition of technical systems.

The tasks are divided into three partial areas:
- Maintenance: Measures for maintaining the command condition
- Inspection: Measures for determining and evaluating the actual condition
- Repair: Measures for restoring the command condition

Due to these measures, the functionality of the system and the IGV / VGV cylinder can be ensured.
Bosch Rexroth IGV / VGV cylinders have the structural prerequisites for high functionality (operational safety, life cycle). They only require little maintenance work. The latter is, however, indispensable in order to ensure functionality.
Experience has shown that 70% of the faults and damage in systems and hydraulic cylinders are indirectly caused by the hydraulic fluids. Consequently, the primary inspection and maintenance task is the examination and completion of measures to maintain the functionality (condition, cleanliness class) of the hydraulic fluid.

Ensure that no foreign substance can enter the hydraulic circuit.

10.1 Cleaning and care

- Ensure absolute cleanliness in all work.
- Before loosening fittings and components, clean the external environment using industrial residue-free wipes.
- Cover all openings with suitable protective caps in order to prevent dirt from penetrating the system.

10.2 Inspection

Document the inspection results
- so that considering functionality and economy, the inspection and maintenance intervals can be adjusted to the actual operating conditions.
- so that by comparing the documented values, you can identify faults at an early point in time.

10.3 Maintenance schedule

In the table below, the individual work is arranged by maintenance interval and by assemblies / parts.

- Document all maintenance and repair work.

Table 15: Maintenance schedule

When?	Where?	What?	Comments
Every 3 months	Hydraulic components of the IGV / VGV cylinder	Visual inspection Remove possible contamination and remove leakage.	This allows for better identification, observation and removal of leakage as necessary.
	Hydraulic lines and fittings		Remove any parts lying around. Immediately remove leaked fluid (slip hazard).
	Electrical connections, cables, distributors, connectors and mating connectors, electric cables, all electric devices, equipotential bonding, grounding	Visual inspection	In case of damage or visible signs of aging, have them replaced without delay. Ensure correct fastening.
	Visual clogging indicator at the filters	Visual inspection Check the function.	If the visual clogging indicator at one filter responds, the filter element is contaminated and must be replaced.
Every 6 months Moreover the same extent as for "Every 3 months"	All components	Clean contaminated parts. Remove possible dust accumulation. Immediately wipe off leaked hydraulic fluid using a cloth.	This allows for better identification, observation and removal of leakage as necessary.
Every 24 months (every 36 months at the latest) Moreover the same extent as for "Every 6 months"	Filter	Exchange the filter element.	Observe chapter 12.2 "Exchanging components".
	Servo valves	Check the switching times and the function.	
	Position measurement system	Check the function.	
	Hydraulic lines	Check all lines and fittings for leakage and externally visible damage. Immediately remedy any damage.	Immediately renew the hydraulic lines in case of: • damage • leakage
	Electrical connections, cables, distributors, connectors and mating connectors, electric cables, all electric devices, equipotential bonding, grounding	According to DIN EN 60079-17 check list Very detailed	In case of damage (or visible signs of aging), have them replaced without delay. Ensure correct fastening.
Every 5 years (every 6 years at the latest) Additionally, the same extent as for "Every 24 months"	All seals	Exchange of the seals	The seals may only be exchanged by a certified Bosch Rexroth Service Center (see chapter 17 "Appendix").

10.4 Maintenance and repair

⚠ WARNING

Ignition risk of IGV / VGV cylinder with Ex marking due to insufficient maintenance or repair!

Danger to life! Explosion hazard! Risk of injury!

- Check and remove dust accumulation on the IGV / VGV cylinder regularly.
- Check regularly that the equipotential bonding at the IGV / VGV cylinder is always connected.
- Check regularly that the equipotential bonding shows no signs of corrosion.
- Check after repair and maintenance works that the equipotential bonding at the IGV / VGV cylinder is connected.

After a system has been commissioned, regular checks are required in order to determine whether the IGV / VGV cylinder functions perfectly.

During these checks, you must particularly watch out for the following:

• Possible leakage., e.g. at oil ports.

Possible leakage of the piston rod seal can, depending on the version, be seen from oil leaking at the housing bore marked with "L".

• Extreme temperatures and contamination shorten the life cycle of the IGV / VGV cylinder. For possible amending requirements, please refer to the installation and maintenance instructions of the system manufacturer and the data sheet of the hydraulic fluid used.

For maintenance and repair, please contact the Bosch Rexroth service. The address can be found in chapter 17 "Appendix".

• Removed protective devices have to be reinstalled and checked for proper function directly after completion of any maintenance and repair work!

10.5 Replacing wear parts

For replacing wear parts, please contact the Bosch Rexroth service.
The address can be found in chapter 17 "Appendix".

IGV / VGV cylinders include the following wear parts: seals, guide belts and filter elements. Those are excluded from the warranty!

Opening the IGV / VGV cylinder will invalidate the warranty claim!

10.6 Replacing spare parts

NOTICE
Malfunction of the system due to the use of incorrect spare parts! Damage to property! ▶ Only use components listed in the order-specific documentation (parts list). ▶ Only use new seals with the required media resistance. ▶ As the sealing material may differ despite being of identical appearance, the material number should be checked.

To order and to replace spare parts and in case of questions or doubt, please contact the Bosch Rexroth service.
The address can be found in chapter 17 "Appendix".

Opening the IGV / VGV cylinder will invalidate the warranty claim!

- ▶ Order spare parts according to the spare part parts list in the corresponding order-specific documentation.

11 Decommissioning

11.1 Preparing for decommissioning

⚠ WARNING

Danger caused by parts flying around or oil leakage!
Risk of injury! Damage to property!
- Make sure that the IGV / VGV cylinder has been depressurized.
- Depressurize hydraulic accumulators that might exist on the oil side.
- Unload the IGV / VGV cylinder from external forces.
- Observe the specifications of the system manufacturer and the system end-user.

⚠ WARNING

Explosion hazard in explosive atmospheres!
Danger to life! Risk of injury! Damage to property!
- Do not disconnect plug-in connections under tension or load, e.g. mating connectors.

For decommissioning and disassembly of the IGV / VGV cylinder from the guide vane console, the following must be observed:
1. For safety reasons, you must not loosen any lines, connections and components as long as the system is under pressure. Unload the IGV / VGV cylinder, switch off pumps and electric motors and secure the system against restarting.
2. Provide collecting containers that are large enough to accommodate the total volume of the hydraulic fluid.

11.2 Decommissioning the system

- Drain the hydraulic fluid into the collecting tanks provided.
- In this connection, ensure complete draining of the lines and actuators.
- If necessary, carry out bleeding measures.

11.3 Preparing for disassembly

Before starting the works at the IGV / VGV cylinder, take the following measures:

- Provide for an easily readable hydraulic circuit diagram and a wiring diagram.
- Provide for clean and suitable tools and a clean workplace.
- During disassembly, no dirt may penetrate the hydraulic system. Seal the connection points using steel plugs, flange covers or special plastic plugs suitable for that purpose.
- Make sure that the IGV / VGV cylinder and the attached components are not damaged.
- Use a stable support for putting down the IGV / VGV cylinder and the removed parts.

11.4 Disassembly process

Regarding lifting and moving of the IGV / VGV cylinder during disassembly, the same rules apply as already described in chapter 6.1 "Transporting the IGV / VGV cylinder".

- Remember during removal that damage at the IGV / VGV cylinder and the attached components may reduce the functionality / service life.
- Attach protective devices such as plug screws at the line connections directly after removal from the system in order to prevent contamination particles from getting inside the IGV / VGV cylinder.

11.5 Preparing the IGV / VGV cylinder for storage/further use

- For storing the IGV / VGV cylinder for later re-use, complete the necessary steps according to chapter 6.2 "Storing the IGV / VGV cylinder".

12 Component exchange

12.1 Preparing the components for storage / further use

- In this connection, please also observe table 7 "Storage conditions" in chapter 6.2 "Storing the IGV / VGV cylinder".
- Moreover observe the storage conditions of the individual components; in this connection, refer to the order-specific documentation.

In case of questions regarding the storage of individual components and in case of doubt, please contact the Bosch Rexroth service.
The address can be found in chapter 17 "Appendix".

12.2 Exchanging components

To exchange defective components and in case of questions or doubt, please contact the Bosch Rexroth service.
The address can be found in chapter 17 "Appendix".

Opening the IGV / VGV cylinder will invalidate the warranty claim!

13 Disposal

- Dispose of the individual materials according to the legal regulations. Particular attention is necessary when disposing of components with hydraulic fluid residues.
- Observe the disposal information in the hydraulic fluid safety data sheet.
- When disposing of electric and electronic components (e.g. position measurement systems, valves) comply with the country-specific legal provisions and regulations.

13.1 Environmental protection

Careless disposal of the IGV / VGV cylinder, its components and the hydraulic fluid leads to environmental pollution.
Please observe the following points:

- Dispose of the product components in accordance with the national regulations in your country and/or your company-internal specifications.
- Dispose of the hydraulic fluid according to the legal regulations and moreover observing the safety data sheet of the hydraulic fluid used.

14 Extension and modification

You will be considered responsible for any extensions to or modifications of the product.

Declarations become invalid

If you undertake any extensions to or modifications of the product marketed by Bosch Rexroth, this means you are changing the condition as supplied. Any statements made by Bosch Rexroth regarding this product will then become invalid.

In case of questions, please contact the Bosch Rexroth service.
The address can be found in chapter 17 "Appendix".

15 Troubleshooting

15.1 How to proceed for troubleshooting

Troubleshooting primarily refers to the replacement of defective components.

Only replace the components mentioned in the parts list (spare part list) by new, interchangeable and tested components in original equipment quality.

For repairing the defective IGV / VGV cylinder, please contact the Bosch Rexroth service. The address can be found in chapter 17 "Appendix".

After remedy of the actual damage, you should imperatively remove the causes and/or consequential damage as well. After a component failure caused by wear, you must for example flush the system and clean and/or change the hydraulic fluid.

Table 16: Troubleshooting

Error	Possible cause of error	Troubleshooting
Stick-slip effect	Air in the IGV / VGV cylinder	▶ Bleed the IGV / VGV cylinder, see chapter 8.1.2 "Filling the IGV / VGV cylinder with hydraulic fluid and bleeding it".
	Seals are worn	▶ Initiate the exchange of the seals, see chapter 10.5 "Replacing wear parts".
	Introduced radial forces on piston rod and IGV / VGV cylinder	▶ In this connection, observe chapter 7.3 "Installation conditions".
Leakage at line connections	Fittings are loose	▶ Tighten the fittings firmly applying the corresponding tightening torque.
	Seals are worn	▶ Initiate the exchange of the seals, see chapter 10.5 "Replacing wear parts".
Leakage at the piston rod	Seals are worn	▶ Initiate the exchange of the seals, see chapter 10.5 "Replacing wear parts".
	Introduced radial forces on piston rod and IGV / VGV cylinder	▶ In this connection, observe chapter 7.3 "Installation conditions".
Visual clogging indicator is triggered during bleeding	Entrapped air in the IGV / VGV cylinder	▶ Press in the visual clogging indicator several times, if necessary, see chapter 8.1.2 "Filling the IGV / VGV cylinder with hydraulic fluid and bleeding it". ▶ Repeat the bleeding procedure, see chapter 8.1.2 "Filling the IGV / VGV cylinder with hydraulic fluid and bleeding it".

16 Technical data

Refer to the applicable order-specific documentation.

17 Appendix

17.1 Repair locations

Service center for Europe	Bosch Rexroth AG Bürgermeister-Dr.-Nebel-Straße 8 97816 Lohr am Main, Germany	Email: service@boschrexroth.de www.boschrexroth.com/de/de/service/startseite-service
Service center for America	Bosch Rexroth Corporation 2315 City Line Road Bethlehem, PA 18017, USA	Email: info@boschrexroth-us.com www.boschrexroth.com/en/us
Service center for Asia/ Pacific	Bosch Rexroth Pty Ltd 104 Bluestone Circuit Brisbane QLD 4076 4073 Seventeen Mile Rocks, Australia	Email: bri@boschrexroth.com.au www.boschrexroth.com/en/au
	Bosch Rexroth Corporation 5-1,Higashi-Nakanuki-machi 300-8588 Tsuchiura-Shi, Ibaraki-Ken, Japan	Email: info@boschrexroth.co.jp www.boschrexroth.com/ja/jp
	Bosch Rexroth (India) Private Limited. Near Village Iyava, Sanand Viramgam Highway, Taluka Sanand, 382170 Ahmedabad, India	Email: info@boschrexroth.co.in www.boschrexroth.com/en/in/service/rexroth-service-new
	International Service Hotline:	+49 (0) 9352 / 40 50 60

17.2 List of addresses

For addresses of our regional offices and the local Bosch Rexroth distribution organization, please refer to: `www.boschrexroth.com`

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