

Assembly and operating instructions

DockLock

safe

Hydraulic zero-point clamping system



Manufacturer:

HAINBUCH GmbH
SPANNENDE TECHNIK
Erdmannhäuser Straße 57
71672 Marbach
Germany

Phone: +49 7144.907-333
Fax: +49 7144.18826

verkauf@hainbuch.de
www.hainbuch.com

Sales Germany:

HAINBUCH GmbH
SPANNENDE TECHNIK
Erdmannhäuser Straße 57
71672 Marbach
Germany

Phone: +49 7144.907-333
Fax: +49 7144.18826

verkauf@hainbuch.de
www.hainbuch.com

Vischer & Bolli Automation GmbH
Member of HAINBUCH Group
Heuriedweg 34
88131 Lindau
Germany

Phone: +49 8382 96 19 -0
Fax: +49 8382 96 19 -30

verkauf@vb-automation.com
www.vb-automation.com

Contents

1	General.....	5
1.1	About these instructions.....	5
1.2	Other applicable documents.....	5
2	Safety information in these instructions.....	5
2.1	Presentation of safety information and hazards	5
2.2	General safety information	7
3	Introduction	9
4	Product description and areas of application	9
4.1	Intended use.....	10
4.2	Reasonably foreseeable misuse	10
4.3	Structural changes.....	10
4.4	Spare parts	10
4.5	Ambient and operating conditions	10
5	Operating personnel	11
5.1	Personal protective equipment.....	11
5.2	Protection during handling and assembly.....	11
5.3	Protection during commissioning and operation	12
6	Information on the cassette/cylinder cover	12
7	Data sheets for the products.....	12
8	Permitted pressure medium (HLP ISO VG46) and hydraulic couplings.....	13
9	Possible integration of the zero-point clamping system into a machine.....	13
10	Preparing the zero-point clamping system for assembly.....	14
10.1	Specifications for the preparation of locking devices	14
10.2	Specifications for the preparation of pallets.....	15
10.2.1	Sizing the clamping bolt holes in the pallets.....	15
10.2.2	Arranging the clamping bolt holes in the pallets	16
10.3	Specifications for piston position control (clamped/released check).....	18
10.3.1	Functioning of the piston position control (evaluation unit)	18
10.3.2	Use of the piston position control (evaluation unit).....	18
11	Assembling the zero-point clamping system	19
11.1	Assembling the cassettes/cylinders	19
11.2	Aligning a built-in cylinder with indexing.....	19
11.3	Assembling the index pins on an indexable pallet	20
11.4	Assembling the piston position control	20
12	Operating the zero-point clamping system.....	21
12.1	Clamping process	21
12.2	Release process	22

12.3	Overload of the clamping system.....	22
12.4	Unforeseen failure.....	23
12.5	Restart after unforeseen failure	23
12.6	Blowing out the cassettes/cylinders.....	23
12.7	Care and maintenance.....	24
13	Production interruption, storage and disposal	25
14	Definitions	26

List of tables

Table 1 – Hazard symbols in these instructions	6
Table 2 – Assignment of data sheets.....	12
Table 3 – Item numbers of couplings	13

List of figures

Figure 1 – Information on the cylinder cover.....	12
Figure 2 – Clamping bolt holes	16
Figure 3 – Types of clamping bolts	17
Figure 4 – Recommended clamping bolt arrangements	17
Figure 5 – Evaluable clamping states	18
Figure 6 – Sectional view of the clamping/release process	21

1 General

1.1 About these instructions

These instructions contain important information for safe and proper use of the product. The instructions are part of the product and must be kept accessible to the operating personnel at all times. Before starting any work, the personnel must have read and understood these instructions. A prerequisite for safe working is the observance of all safety instructions in these instructions as well as compliance with the regulations according to the EC Machinery Directive 2006/42/EC. Illustrations in these instructions are for basic understanding and may differ from the actual design. In addition to these instructions, the technical data sheets (see chapter 7) as well as the installation drawings and maintenance instructions for the respective product apply.

1.2 Other applicable documents

The following documents are related to these assembly and operating instructions:

- Data sheet of the respective product (see chapter 7). The data sheets contain the corresponding installation drawings as well as the maintenance and assembly instructions.
- EU Declaration of Incorporation
- Consideration of the achievable performance levels according to ISO 13849-1
- Current catalog (clamping book)

All the above documents are available on request at the following link:

<https://www.hainbuch.com/kontakt/>

2 Safety information in these instructions

Where it was not possible to eliminate all risks posed by the products by design, residual risks remain, which are included as safety information at the appropriate points in these instructions. Residual risks arise when changing pallets or fixtures and when setting up a machine, but also when operating the products.

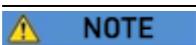
2.1 Presentation of safety information and hazards

The following signal words and symbols are used in the safety information:

	Indicates a hazard with a high degree of risk which, if not avoided, will result in death or serious injury.
---	--

	Indicates a hazard with a medium degree of risk which, if not avoided, may result in death or serious injury.
---	---

	Indicates a hazard with a low level of risk that, if not avoided, may result in a minor or moderate injury.
---	---

	Failure to follow the instructions or directions may result in damage to or improper operation of the device.
---	---

In some safety information, additional hazard symbols are integrated. Hazard symbols (including others) are also found in most workplaces in the industrial sector. The following table lists the meaning of the individual hazard symbols contained herein.

	<p>Caution: Suspended loads. The hazard arises during pallet or fixture changes and when setting up the machine tool with the products, if a crane or other lifting device is used.</p>
	<p>Caution: Risk of crushing. The hazard arises when changing pallets or fixtures and when setting up the machine tool with the products. The workpiece carriers can be heavy. There is a risk of crushing when putting them on.</p>
	<p>Read instructions. Draws attention to the need to read these and all other instructions supplied with the machine carefully.</p>
	<p>Wear protective gloves. Alerts to hot or rough surfaces, or sharp edges. Wear appropriate protective gloves to protect hands.</p>
	<p>Wear safety shoes. Safety shoes must be worn to protect the feet when there is a risk of objects falling.</p>
	<p>Wear safety goggles. Appropriate safety goggles must be worn to protect the eyes from flying objects (such as chips).</p>
	<p>Wear hearing protection. Appropriate hearing protection must be worn to protect the ears from loud noises (for example when blowing off/blowing out the work area with compressed air).</p>

Table 1 – Hazard symbols in these instructions

2.2 General safety information

The general safety information listed here must be observed when installing and operating the hydraulically controlled DockLock zero-point clamping system. The instructions contain further safety information that must be observed in the event of special hazardous situations.

During the preparation and assembly of the DockLock zero-point clamping system, the following relevant hazards arise:

DANGER

Suspended loads when setting up the machine or moving the fixture/pallet. Danger to life due to falling/swiveling.

Move loads only under supervision. Do not leave suspended loads unattended.

Use adequately dimensioned lifting gear. Wear appropriate personal protective equipment. Do not step under suspended loads or within their swivel range.



WARNING

Improper assembly, disassembly or operation of the products. Risk of injury, especially to limbs and risk of material damage.

Use the products only according to these instructions or after consultation with HAINBUCH.

HAINBUCH cannot assume any warranty for malfunctions resulting from improper assembly, disassembly or operation.

During operation of the DockLock zero-point clamping system, the following relevant hazards arise:

DANGER

Breakage due to overloading the clamping system during operation. Severe injuries and material damage possible.

The forces acting on a cassette/cylinder must not exceed the specified draw-in force. Breakage of the clamping system in case of severe overload.

Only use screws for fastening the clamping bolts that can absorb the forces acting on the system. Do not load the system beyond the draw-in force.

DANGER

Ejection of parts due to incorrect clamping. Severe injuries and material damage possible.

The correct tension must be checked after each clamping process. Any unintentional activation of the release signal must be prevented.

The operation of the clamping system without or with a piston position control (evaluation unit) not offered/approved by HAINBUCH leads to the exclusion of any warranty with regard to incorrect clampings and their consequences.

DANGER

Fixture/pallet falling down due to incorrect release signal. Severe injuries and material damage possible.

Before starting any work on the product: Switch off or disconnect the power supply and secure it against being switched on again.

Ensure that there is no residual energy left in the system. Only use couplings that can be disconnected without pressure.

⚠ WARNING The fixture/pallet or the workpiece falling down when the clamping bolt axis is in horizontal position or during overhead applications. Risk of injury and material damage.

In case of horizontal or overhead application, secure the fixture or pallet against falling before releasing it (by using straps or a crossbar, for instance).

⚠ WARNING Breakage of hoses/connections when the maximum operating pressure is exceeded (see Figure 1). Risk of injury, especially to limbs/face and risk of material damage.

A pressure relief valve must be installed to operate the clamping system. Do not exceed the maximum operating pressure of the clamping system.

During the maintenance and repair of the DockLock zero-point clamping system, the following relevant hazards arise:

⚠ DANGER Breakage of the clamping system due to the use of third-party spare parts. Severe injuries and material damage possible.

Only use original DockLock spare parts and original DockLock clamping bolts. Proper functioning is only ensured if original spare parts are used.

HAINBUCH will not assume any warranty in the event of improper maintenance or the installation of third-party parts.

⚠ WARNING Ejection of parts when removing covers of cassettes/cylinders. Risk of injury, especially to limbs/face and risk of material damage.

The covers of the clamping systems are under spring preload. When opening the covers, parts can be ejected. Disassembly/assembly of the covers may only be carried out by trained HAINBUCH personnel and in compliance with the associated disassembly and assembly instructions.

3 Introduction

Thank you for purchasing one of our products. We wish you best results with it. With your DockLock zero-point clamping system, you have chosen a product that clearly distinguishes itself from other clamping systems on the market thanks to its high attenuation of machining vibrations, its wear resistance and its low sensitivity to dirt.

Please read these assembly and operating instructions carefully **before** commissioning the product.

4 Product description and areas of application

Zero-point clamping systems are critical components in the production of workpieces on machine tools to achieve results with high dimensional accuracy at the highest repetition rate and shortest set-up time. By using our products, it is possible to combine highest precision with greatest possible cost-efficiency when machining workpieces in industrial production.

The DockLock zero-point clamping systems require hydraulic control. They can be used on a wide variety of machine types and for almost any conceivable machining requirement. There are two product types:

- Surface-mounted cassettes that are attached to the existing machine table
- Flanged cylinders and built-in cylinders that are inserted into a machine table or pallet

»Cassettes« and »cylinders« are distinguished by the fact that a cassette is enclosed in a housing that absorbs all pressures (forces) generated inside. The forces acting in a cylinder must be absorbed by the machine table or pallet in which they are installed.

The cassettes or cylinders used for clamping the workpieces can be arranged on the machine table as required. This ensures a high degree of flexibility with regard to the machining of different workpieces on machine tools.

Further applications of the DockLock zero-point clamping systems result from the unlimited clamping time. The systems are released hydraulically and clamp with spring force. The clamping and thus the draw-in force of the cassettes/cylinders are maintained until the clamping system is opened again by a hydraulic release signal. To maintain an existing clamping, the pressure medium does not have to be connected to the clamping system.

As a result, our zero-point clamping systems can also be used in the design of robot cells, production islands and production lines for positioning equipment and robots, if planned accordingly.

In addition, DockLock zero-point clamping systems can be used for handling and logistics of workpiece pallets by an industrial robot within a robotic cell.

The product can be used virtually anywhere for turning, milling, et cetera, if:

- The forces acting on the system during operation do not exceed the maximum permissible forces
- The system is operated within its defined parameters
- The conditions of use and environment are observed
- The specifications of these instructions are adhered to
- A suitable fixture is used to check the clamping position

4.1 Intended use

This product is used for positioning and clamping fixtures or workpieces on machine tools, handling equipment or other suitable technical equipment.

The product is intended for commercial and industrial applications.

Intended use also includes compliance with all specifications in these instructions.

4.2 Reasonably foreseeable misuse

A reasonably foreseeable misuse of the product exists, for example:

- If the system is used in turning applications without suitable means for checking the clamping position and the maximum permissible forces acting on the system are exceeded.
- If the technical data or pressure and performance limits specified by the manufacturer are exceeded during use.
- If untrained personnel work with the products or are assigned to the machine.
- If applicable general safety regulations are disregarded when working with the products or on the machine.

4.3 Structural changes

Modifications, alterations and reworking of the product can change and impair its function and/or safety or cause damage to the product.

Make structural changes only with written approval of HAINBUCH.

4.4 Spare parts

Only original HAINBUCH spare parts are to be used for repairs and modifications to the product.



Breakage of the clamping system due to the use of third-party spare parts. Severe injuries and material damage possible.

Only use original DockLock spare parts and original DockLock clamping bolts. Proper functioning is only ensured if original spare parts are used.

HAINBUCH will not assume any warranty in the event of improper maintenance or the installation of third-party parts.

4.5 Ambient and operating conditions

Inappropriate ambient and operating conditions can cause hazards from the product that can lead to severe injuries and considerable material damage and/or significantly reduce the service life of the product. All information on the ambient conditions and technical operating conditions can be found in the data sheets for the respective product.



Contaminated operating environment of the clamping system (by cooling lubricants or oil, for instance). Risk of slipping and falling.

The safety and accident prevention regulations must be observed when operating and handling machine tools and other technical equipment.

Ensure a clean working environment before starting assembly and installation work. Wear appropriate personal protective equipment.

It must be ensured that the product is only used within its defined application parameters and that the product is adequately dimensioned according to the application.

Make sure that the interfaces (contact surfaces and clamping chamber) are always clean.

The cooling emulsion used must contain anti-corrosion additives.

5 Operating personnel

The work described in these instructions to prepare for assembly and the assembly itself may only be carried out by trained specialist personnel, in particular the manufacture of locking devices (locking plates) and pallets, the setting up of the systems on machine tools and the maintenance work described.

For assembly preparation and assembly, extensive specialist knowledge of the machine tool used in each case and its functions is also necessary.

When working on and with the product, the occupational health and safety regulations must be complied with.

Only adequately qualified personnel may be used to operate the products. This is the only way to identify hazards at an early stage, to avoid them and to ensure knowledge of relevant standards and safety regulations.

The country-specific accident prevention regulations and the general safety instructions must be observed.

5.1 Personal protective equipment

When working on and with the product, the respective occupational health and safety regulations must be observed, and the required personal protective equipment must be worn.

Applicable safety and accident prevention regulations must be observed when operating the products.

Wear close-fitting protective clothing when handling moving parts.

5.2 Protection during handling and assembly

Improper handling/assembly may result in hazards from the product that can lead to severe injuries and material damage. For details on assembly, see chapter 11.

Secure the product against accidental actuation during all work. Disconnect and/or use appropriate safety valves/safety switches. The applicable accident prevention regulations must be observed.

Use suitable transport equipment and take appropriate precautions against entrapment and crushing.

 **WARNING**

Improper assembly, disassembly or operation of the products. Risk of injury, especially to limbs and risk of material damage.

Use the products only according to these instructions or after consultation with HAINBUCH.

HAINBUCH cannot assume any warranty for malfunctions resulting from improper assembly, disassembly or operation.

5.3 Protection during commissioning and operation

Falling and ejected components can cause severe injuries or even death. During operation, the appropriate protective systems of the machine must be activated.

To prevent accidents and/or material damage, the presence of persons in the range of movement of the machine must be restricted. Prevent unintended access for persons to this area, for example, by means of protective covers, protective fences, light barriers, etc.

⚠ DANGER Fixture/pallet falling down due to incorrect release signal. Severe injuries and material damage possible.

Before starting any work on the product: Switch off or disconnect the power supply and secure it against being switched on again.

Ensure that there is no residual energy left in the system. Only use couplings that can be disconnected without pressure.

6 Information on the cassette/cylinder cover

Figure 1 shows all the information on the cassette/cylinder cover that is used to uniquely identify and allocate a cassette or a cylinder.

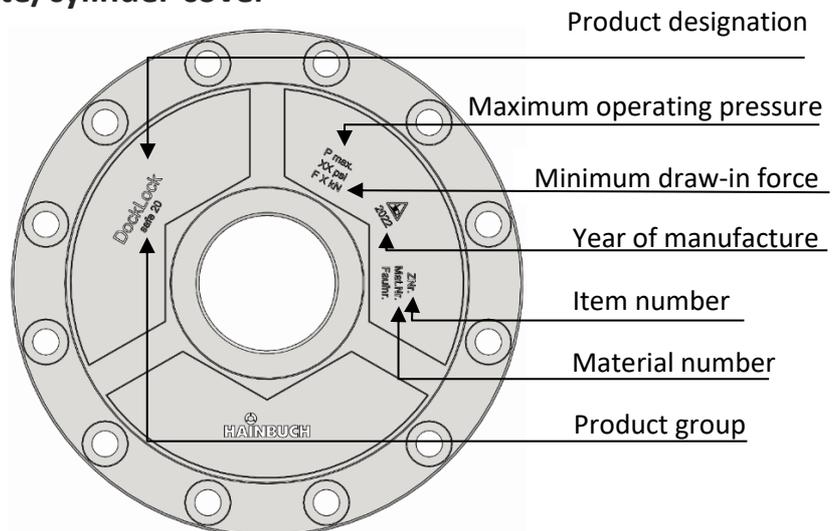


Figure 1 – Information on the cylinder cover

7 Data sheets for the products

In addition to the technical data, the data sheet of the corresponding product contains all applicable part numbers as well as all associated documentation such as installation drawings and assembly instructions. In Table 2 the data sheets for the corresponding product designation on the cassette or cylinder cover are listed.

Product designation	Description	Data sheet
safe 20 S	1 t-System safe 20 Standard	DB safe 20 S
safe 20 A	1 t-System safe 20 Auto	DB safe 20 A
safe 20 X	1 t-System safe 20 special version	DB safe 20 X
safe 30 S	2 t-System safe 30 Standard	DB safe 30 S
safe 30 SL	2 t-System safe 30 SlimLine	DB safe 30 SL
autosafe 30	2 t-System safe 30 Auto	DB autosafe30-30
autosafe 30-31	2 t-System safe 30-31 Auto	DB autosafe30-31
autosafe 30-60	2 t-System safe 30-60 Auto	DB autosafe30-60
safe 50 S	3 t-System safe 50 Standard	DB safe 50 S

Table 2 – Assignment of data sheets

8 Permitted pressure medium (HLP ISO VG46) and hydraulic couplings

For operation of the products hydraulic oil of specification »HLP ISO VG46« must be used. The corresponding data sheet (see chapter 7) must be observed when using the pressure medium.

The amount of hydraulic oil required in the clamping system increases with the number of cylinders/cassettes used. The standard pump offered (2 liter capacity) is sufficient to operate the following number of cylinders/cassettes:

safe20: up to 30 cylinders/cassettes

safe30: up to 15 cassettes

safe50: up to 8 cassettes

Any use of more than the number of cylinders/cassettes specified above only after consultation with HAINBUCH. The tank and/or the pump must then be dimensioned accordingly larger.

Only high-pressure hoses (braided hoses) with minimum elongation may be used.

Only original DockLock hydraulic couplings may be used. These cannot be disconnected under pressure. This ensures that fixtures are fully clamped (depressurized) before uncoupling. It must be ensured that the system is clamped before each operation and that there is no residual pressure left in the system.

The hydraulic couplings can be ordered under the following item numbers:

Item	Item number
Coupling plug / dust cap	758812 / 758812-1
Coupling sleeve / dust cap	758813 / 758813-1

Table 3 – Item numbers of couplings

9 Possible integration of the zero-point clamping system into a machine

 **WARNING** Breakage of hoses/connections when the maximum operating pressure is exceeded (see Figure 1). Risk of injury, especially to limbs/face and risk of material damage.

A pressure relief valve must be installed to operate the clamping system. Do not exceed the maximum operating pressure of the clamping system.

 **WARNING** The fixture/pallet or the workpiece falling down when the clamping bolt axis is in horizontal position or during overhead applications. Risk of injury and material damage.

In case of horizontal or overhead application, secure the fixture or pallet against falling before releasing it (by using straps or a crossbar, for instance).

DockLock cassettes/cylinders can either be integrated into the hydraulic system of the machine tool or production line, or operated with an independent hydraulic pump. The hydraulic system is connected directly to the corresponding cassette/cylinder. Necessary connection and distribution work on the hydraulics and the machine tool must correspond to the state of the art and be planned and carried out by trained specialist personnel.

Unless otherwise specified, DockLock cassettes/cylinders are actuated with an operating pressure of 70 bar. Pressure deviations must not exceed +/- 5 % of the operating pressure.

If DockLock hydraulics are not used, it must be ensured that the pressure build-up to release the lock takes at least 2.5 seconds.

10 Preparing the zero-point clamping system for assembly

To operate a DockLock zero-point clamping system, a few specifications must be observed and two assemblies must be prepared:

- **Locking device:** Used to hold the cassettes/cylinders. The locking device is either the machine table or a separately created mounting plate.

The locking device must be designed differently depending on the type of product (surface-mounted cassettes or built-in cassettes/cylinders):

- For **surface-mounted cassettes:** In preparation for mounting surface-mounted cassettes, a few bores must be drilled in the locking device in order to screw the surface-mounted cassettes to the pallet and, if necessary, to route the oil lines through the holes.
- For **built-in cassettes/cylinders:** In preparation for assembling the built-in cassettes/cylinders, it is necessary to provide appropriately dimensioned installation spaces in the locking device.

- **Workpiece carrier** (hereinafter referred to as »pallet«): Serves to hold the clamping bolts. The workpiece(s) is/are attached to the pallet.

The pallet must be prepared regardless of the type of product. A few locating holes must be drilled in the pallet for mounting the clamping bolts, which are used for subsequent fastening on the locking device.

In order to prepare the zero-point clamping system for assembly on the machine, the instructions in this chapter must be implemented one after another.

10.1 Specifications for the preparation of locking devices

Locking devices are the devices used to hold the workpieces or the workpiece carriers (such as pallets, see chapter 10.2). Each locking device must be designed for the specific application. The design must also take the hydraulic oil supply into account (hoses, lines, directly in the device).

 **NOTE** Leakage possible due to leaky material in locking devices.

In case of hydraulic supply by means of deep-hole bores, the material must be tight and free of blowholes, and it must withstand a continuous load of at least 100 bar. The minimum wall thickness is 5 mm for steel and 10 mm for cast iron.

When designing the locking devices, the forces to be expected on the clamping system as a whole and on the individual cassettes/cylinders must be taken into account. During operation, no cassette/cylinder of the system is allowed to be loaded beyond the draw-in force (axial and radial) specified on the data sheet. Once a cassette/cylinder was exposed to a load above the specified draw-in force, all parts must be disassembled, inspected and replaced if necessary. The system must not be put back into operation until all affected parts have been checked.

Preferably, steel or cast iron should be used for the manufacture of locking devices. The following minimum strength classes are required:

Material	Material No.
Steel	1.1191 (Ck45) / 1.2085 or the like
Cast iron	EN-GJL-300 (GG-30; 0.6030)

For each individual product (item number), corresponding installation drawings for the preparation of the locking devices and assembly plans are available. The installation drawings show the dimensions of the installation volumes for accommodating the cassettes/cylinders.

For the selection of the corresponding installation drawing, see the data sheet of the product (for assignment to the product see chapter 7).

All sharp corners and edges on self-prepared locking devices must be deburred or chamfered to avoid risk of injury.

10.2 Specifications for the preparation of pallets

Pallets or workpiece carriers must be designed and constructed according to individual requirements of the machine, the workpieces and the expected load during machining.

There is no special recommendation for the material. Deformation due to workpiece clamping must be avoided.

All sharp corners and edges on self-prepared pallets must be deburred or chamfered to avoid risk of injury.

10.2.1 Sizing the clamping bolt holes in the pallets

The following two figures show the sizing of the clamping bolt holes for fastening the clamping bolts in the pallet. The clamping bolts can also be mounted directly in the workpiece. In this case, the use of a pallet is not necessary.



DANGER Breakage of the clamping system due to the use of third-party spare parts. Severe injuries and material damage possible.

Only use original DockLock spare parts and original DockLock clamping bolts. Proper functioning is only ensured if original spare parts are used.

HAINBUCH will not assume any warranty in the event of improper maintenance or the installation of third-party parts.

The holes differ according to the system type of the clamping bolts (1 t, 2 t or 3 t). The clamping bolts can either be through-bolted (sections A, see figures) or screwed into a blind hole (sections B, see illustrations in Figure 2).

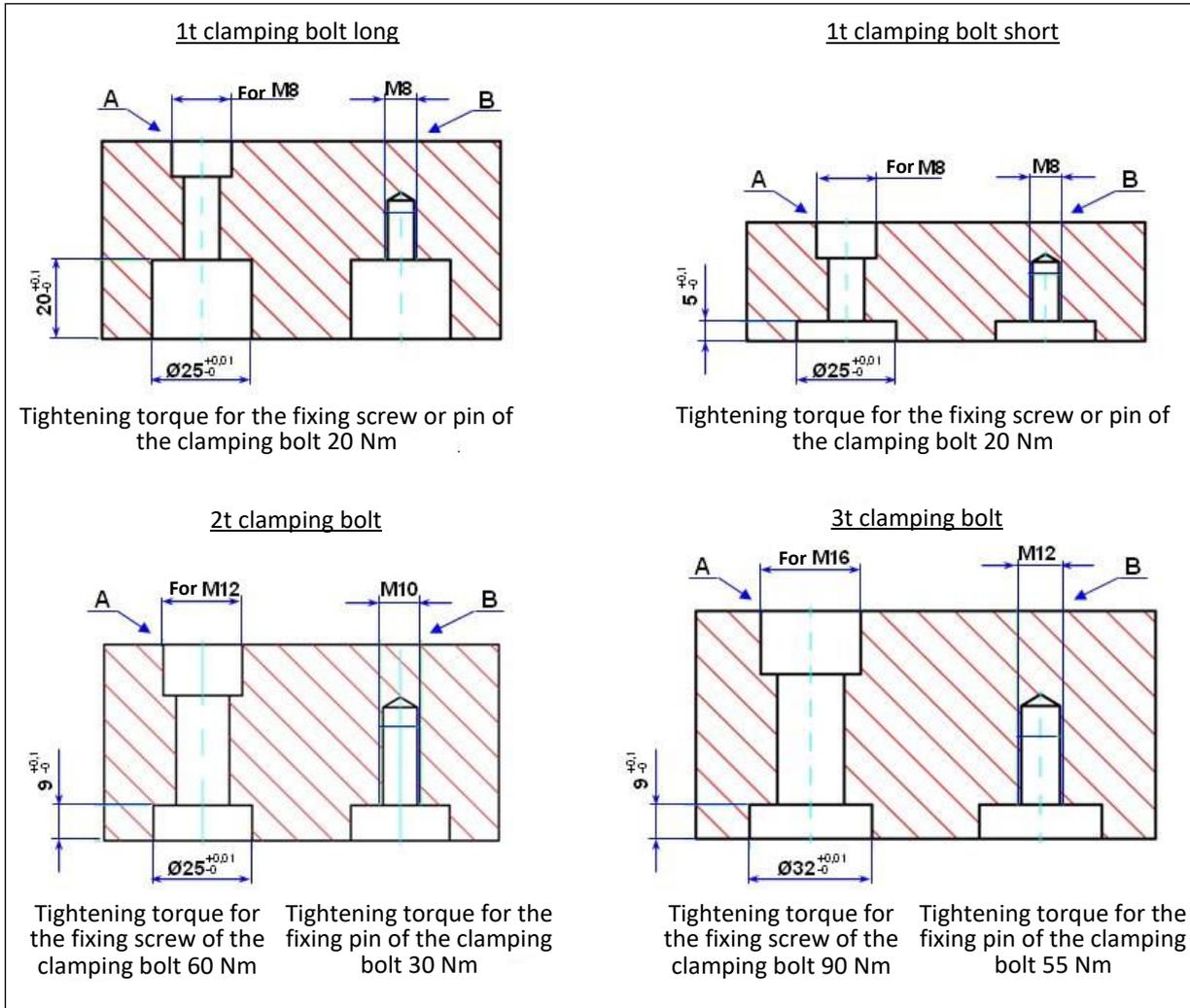


Figure 2 – Clamping bolt holes

10.2.2 Arranging the clamping bolt holes in the pallets

In order to clamp a pallet or workpiece carrier reliably and accurately, at least **one** centering clamping bolt is required. This also applies to arrangements with more than one clamping bolt. To secure a workpiece against twisting in all directions, at least **two** clamping bolts are required (one centering clamping bolt (see Figure 3/1) and one compensating clamping bolt (see Figure 3/2)).

Three different types of clamping bolts are distinguished (see Figure 3). Each type performs a specific function in the clamping bolt arrangement. Therefore, in a clamping bolt arrangement (pallet, workpiece carrier, or directly in the workpiece) with more than two clamping bolts, all three types of clamping bolt types must be installed. The clamping bolts without centering function (see Figure 3/3) are used to increase the holding force and have no function for the alignment.

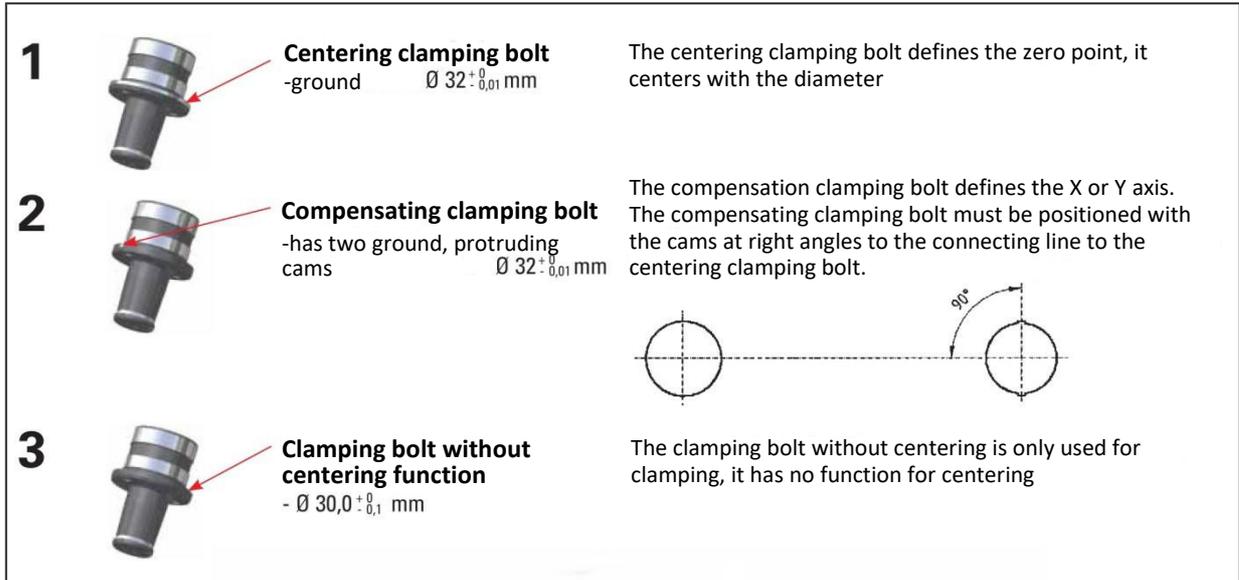


Figure 3 – Types of clamping bolts

The clamping bolts must be distributed as evenly as possible on the pallet or workpiece carrier in order to minimize the vibrations generated during machining of the workpiece and to distribute the forces generated during machining as evenly as possible.

When positioning the individual types of clamping bolts, the system shown in Figure 4 is recommended.

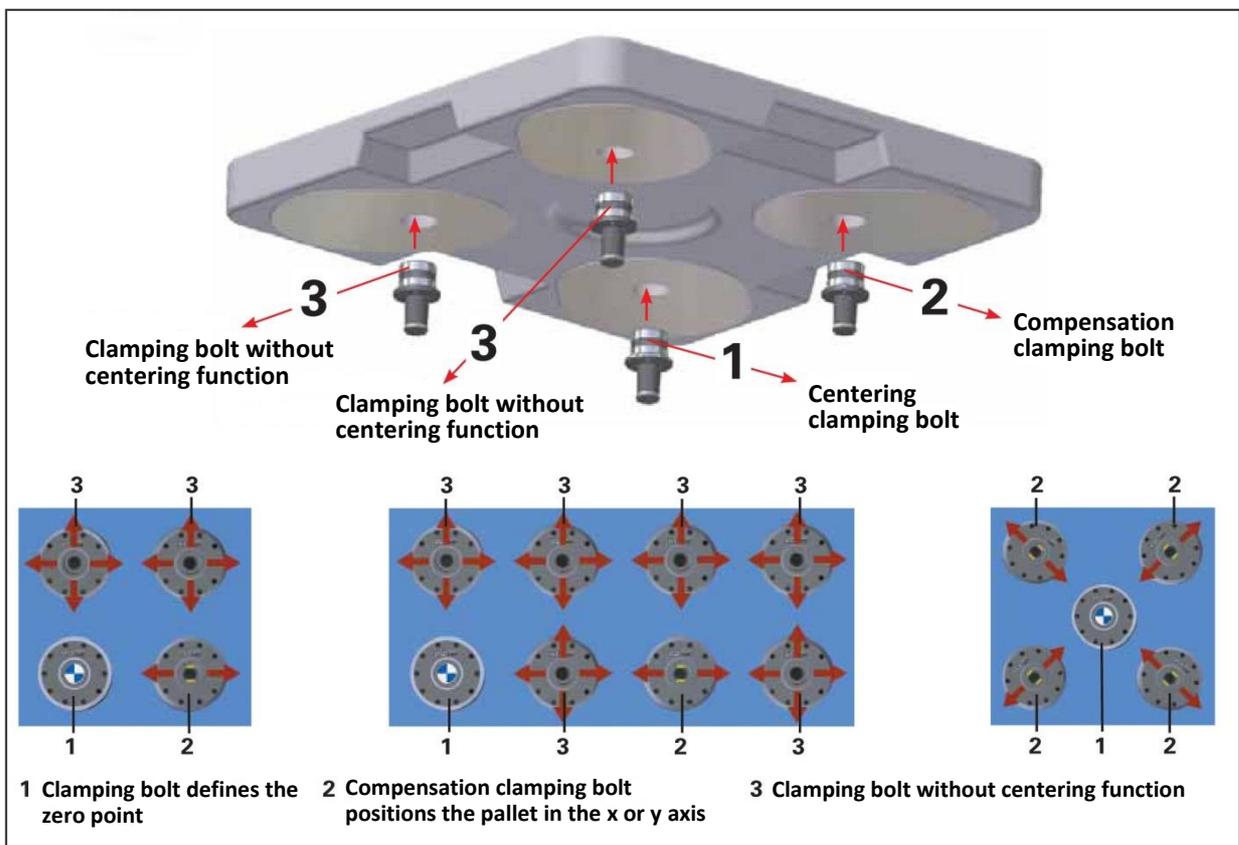


Figure 4 – Recommended clamping bolt arrangements

10.3 Specifications for piston position control (clamped/released check)

In order to operate the zero-point clamping system automated on a machine tool, it is necessary to install a piston position control (evaluation unit) for safety reasons.

10.3.1 Functioning of the piston position control (evaluation unit)

Whether a clamping/releasing operation has been successfully performed is checked by the piston position control using a suitable gear oil flow divider. Here, the quantity of oil moved is measured. The counter must be zeroed before each measuring process. During a release process, a certain amount of oil flows to the clamping system until it reaches the opening position stop and is thus open.

During a clamping process, the oil quantity flows back again due to the spring force acting on the piston. If a clamping system is correctly clamped, it does not return to the home position because the piston grips the clamping bolt via the collet and tightens it with the spring force before reaching the home position. If a clamping system is not correctly clamped (incorrect clamping), more oil flows back from the clamping system because the piston does not grip the clamping bolt via the collet and returns to the home position. Clamping without a clamping bolt corresponds to the same situation as incorrect clamping. See Figure 5 for illustration.

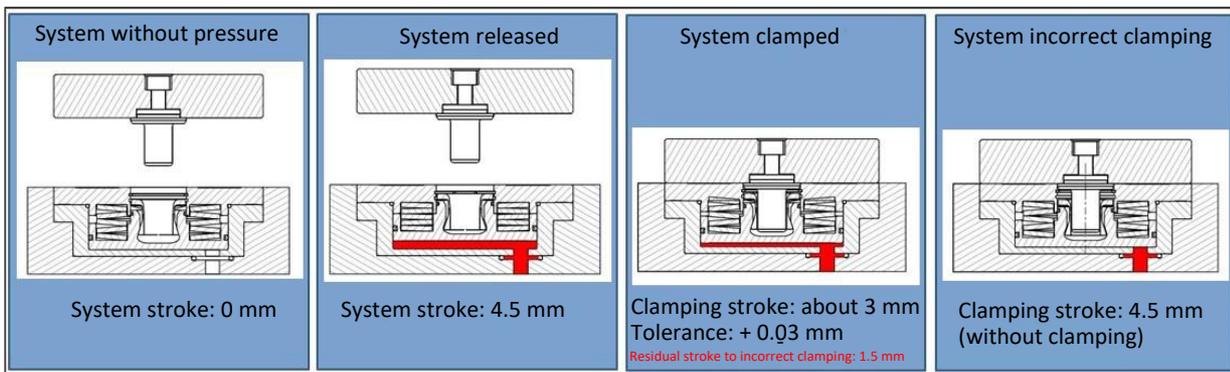


Figure 5 – Evaluable clamping states

If the quantity of oil moved does not match the programmed and preset values, no release is issued to the higher-level control. A release is only issued if the set values are reached. Anything else is to be considered an incorrect clamping or incorrect application and no release will be given.

10.3.2 Use of the piston position control (evaluation unit)

To ensure that the measured oil quantity only varies within small tolerances and thus incorrect measurements can be excluded, no more than 10 cylinders/cassettes may be evaluated by each sensor of a piston position control. Therefore, for pallets with more than 10 cylinders/cassettes, fields with a maximum of 10 cylinders/cassettes must be defined. For each field a separate sensor is required. The number of sensors installed thus depends on the number of cylinders/cassettes to be monitored.

Up to 10 cylinders/cassettes per sensor can be reliably evaluated even if several pallets are machined at one clamping on different machines. Since the oil quantity of an incorrect clamping exceeds all tolerances in the clamping system and all conceivable viscosity changes of the hydraulic oil, the measurement result is also reliable for machining involving several machines.

Fields for piston position control can also be programmed if different fixtures with different numbers of clamping bolts are to be used. For this, it is sufficient to define the number of cylinders/cassettes as a field and to set or calibrate the necessary values during commissioning.

All clamping positions must be set or calibrated individually before commissioning the clamping system. To set/calibrate the piston position control, use individual clamping adapters, to simulate incorrect clamping or clamping without a clamping bolt of an individual clamp. The values set for commissioning must be repeatable.

The hydraulic lines must be vented. Air in the hydraulic system leads to deviations in the oil quantity measurement. Use only high-pressure hoses (braided hoses) with minimum elongation. Elongations in hoses that are under pressure falsify the measurement result.

Once a clamping system has been clamped, the clamping is maintained until a new release signal is applied. Detailed considerations of the respective performance levels achievable in piston position control are available on request at the following link:

<https://www.hainbuch.com/kontakt/>

11 Assembling the zero-point clamping system

Applicable accident prevention regulations must be observed when assembling the zero-point clamping system. For assembling, the installation drawings and assembly instructions of the corresponding data sheet must be observed (see chapter 7).

The zero-point clamping system must only be assembled by trained specialist personnel. Detailed system knowledge of the machine as well as of the zero-point clamping system is required for assembly.

WARNING

Improper assembly, disassembly or operation of the products. Risk of injury, especially to limbs and risk of material damage.

Use the products only according to these instructions or after consultation with HAINBUCH.

HAINBUCH cannot assume any warranty for malfunctions resulting from improper assembly, disassembly or operation.

In order to prepare the zero-point clamping system for assembly on the machine, the instructions in this chapter must be implemented one after another.

11.1 Assembling the cassettes/cylinders

When the locking device has been completely prepared (see chapter 10.1), fasten the cassettes/cylinders on or in the locking device. For the selection of the corresponding assembly instructions, see the data sheet of the product (for assignment to the product see chapter 7).

11.2 Aligning a built-in cylinder with indexing

For further information, see the data sheet of the product (see chapter 7). The following steps are necessary to align a built-in cylinder with indexing in the locking device. The work steps are not relevant for all other products.

1. Tighten the fixing screws to the torque specified in the installation drawing (see tables in chapter 7).
2. Loosen all screws with 1/16 turn.
3. Clamp alignment bar onto cylinder with indexing grooves.
4. Check the directional error. To do this, place a dial gage on the alignment bar.

5. Correct errors with a brass mandrel by lightly tapping the indexing grooves not occupied by the alignment bar.
6. Tighten the fastening screws again to the specified torque.

11.3 Assembling the index pins on an indexable pallet

For further information, see the data sheet of the product (see chapter 7). The following steps are necessary to mount the index pins on an indexable pallet:

1. Mount the clamping bolts (item number 751 500 or 752 500).
2. Clean the index pins (item number 751 580) and index tapped holes with white gas.
3. Mount the index pins and allow them to protrude 1.6 mm to 1.7 mm.
4. Connect the pressure medium to the built-in cylinder.
5. Unlock the built-in cylinder.
6. Align pallet with protruding index pins on index grooves.
7. Lock the built-in cylinder.
8. Turn back the index pins until no preload is felt anymore.
9. Screw all 4 pins back in to the stop.
Screw in the pins only to the stop, without pretension, otherwise the pallet would be lifted again.
10. Unscrew each index pin individually and treat with Loctite 262 or 270 according to instructions, as well as the threaded hole.
11. Screw the index pins back in to the exact stop position.
12. Loosen the pallet using the pressure medium and carefully pull it off, put it away and let it dry according to Loctite instructions.
13. Remove excess Loctite after drying.
14. Check indexing repeatability with dial gage laterally: < 0.01 mm.
15. If desired, lightly mill over the entire pallet.

11.4 Assembling the piston position control

Install and adjust a piston position control before commissioning according to the specifications (see chapter 10.3).

Integrate the piston position control per field directly into the inlets and outlets of the cassettes/cylinders. It must be ensured that the operating personnel can clearly see at all times during operation of the zero-point clamping system whether all cassettes/cylinders are clamped or released.

12 Operating the zero-point clamping system

A single operating cycle consists of a clamping operation and a release operation. When operating, observe the respective data sheet of the product (see chapter 7).

12.1 Clamping process

The clamping of a once clamped fixture is maintained until a new release signal is applied to the clamping system.

⚠ DANGER

Ejection of parts due to incorrect clamping. Severe injuries and material damage possible.

The correct tension must be checked after each clamping process. Any unintentional activation of the release signal must be prevented.

The operation of the clamping system without or with a piston position control (evaluation unit) not offered/approved by HAINBUCH leads to the exclusion of any warranty with regard to incorrect clampings and their consequences.

⚠ DANGER

Fixture/pallet falling down due to incorrect release signal. Severe injuries and material damage possible.

Before starting any work on the product: Switch off or disconnect the power supply and secure it against being switched on again.

Ensure that there is no residual energy left in the system. Only use couplings that can be disconnected without pressure.

1. Feed the pressure medium through the opening in the housing under the pull piston (Figure 5/2). The pull piston is then at the upper stop to initiate a clamping process. The pull piston (Figure 5/2), which encloses the collet (Figure 5/1), allows it to open through a release.
 2. Insert the clamping bolt (Figure 5/4) into the collet.
 3. Drain the pressure medium through the opening in the housing under the pull piston (Figure 5/2). The pull piston (Figure 5/2) moves downwards due to the force of the spring assembly (Figure 5/3). The collet (Figure 5/1) is placed against the pull piston (Figure 5/2).
 4. The clamping process is completed.
- process

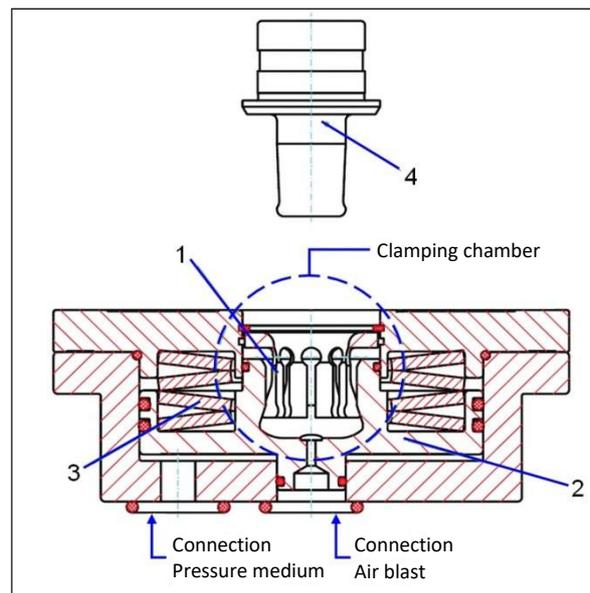


Figure 6 – Sectional view of the clamping/release process

12.2 Release process



Loss of pallets in the event of incorrect control or faulty operation. Risk of injury and material damage.



Accidental actuation of the release signal must be avoided.

Disconnect the energy supply after the clamping process.

1. Feed the pressure medium through the opening in the housing under the pull piston (Figure 5/2). The pull piston (Figure 5/2), which encloses the collet (Figure 5/1), allows it to open through the release.
2. Lift the clamping bolt (Figure 5/4) out of the collet (Figure 5/1) .
3. The release process is completed.
4. Either insert another clamping bolt into the collet and clamp again, or if not required, drain the pressure medium through the opening in the housing under the pull piston (Figure 5/2). Only pressurize the clamping system for the changeover process. Do not leave the clamping system under permanent pressure.

12.3 Overload of the clamping system

The system can be loaded up to the limits of its draw-in force, beyond which it starts to leave the zero point. If the system is loaded beyond, it leaves the Z-system. Overloads of this kind must always be avoided. The clamping systems may only be operated within the permissible limits

Breakage of the weakest component occurs when loads exceed the specified holding force. In this case, the screw connection between the fixture and the clamping bolt starts to fail. Due to the design of the collet, the bolt is still held in the system even under high overload.

During this overload, the collet is deformed and destroyed to such an extent that the clamping system cannot perform any further clamping processes and the collet (and possibly other system components) must be replaced.



Breakage due to overloading the clamping system during operation. Severe injuries and material damage possible.

The forces acting on a cassette/cylinder must not exceed the specified draw-in force. Breakage of the clamping system in case of severe overload.

Only use screws for fastening the clamping bolts that can absorb the forces acting on the system. Do not load the system beyond the draw-in force.

The clamping system must be taken out of service immediately after an overload. Then all components must be checked and replaced if necessary.

The clamping system must not be started up again until it has been ensured that all components function properly and are not damaged.

Radial loads are only absorbed by the centering and compensating bolts. The floating clamping bolts contribute only a small part (friction) to the radial load absorption. The required moment must be calculated according to the type of clamping bolt used.

12.4 Unforeseen failure

In the event of a system failure of the machine during the release cycle of the DockLock zero-point clamping system, a small amount of oil may flow back over a certain period of time. Thus, during an unforeseen failure, an undefined amount of residual oil may remain in the system.

12.5 Restart after unforeseen failure

The following steps are necessary for a restart:

1. Set the clamping system to »Clamp«. This causes all pistons to move downwards, regardless of whether a pallet is present or not.
2. Set the clamping system to »Release«. The pistons move back up to the defined release position, which is monitored by the sensors. The system is thus reset.
3. Resume normal operation.

12.6 Blowing out the cassettes/cylinders

Change operations on cassettes/cylinders including blowing out may only be performed with activated air blast.

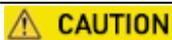
The product range includes cassettes/cylinders with or without air blast device. Blowing out the cassettes/cylinders is necessary to achieve high dimensional accuracy and to prevent dirt and chips from entering the clamping chamber as far as possible.



CAUTION

Impurities (such as metal chips) in the air connections of the locking devices. Danger of injury, especially to the face.

Wear protective goggles when blowing out cassettes/cylinders.



CAUTION

Exhaust noise of the compressed air. Risk of hearing damage. Wear hearing protection when blowing out cassettes/cylinders.



To ensure the correct functioning of the air blast (islands and clamping chamber), the systems must be supplied with sufficient compressed air. It must be possible to regulate the air volume and air pressure for air blast separately. Insufficient blow-out air prevents thorough cleaning of the interfaces. Ensure sufficiently large cross-sections and observe the line lengths (losses). Each cassette and cylinder must be sufficiently supplied with air. The support islands must be pressurized with compressed air during the changeover processes. This requires a higher pressure than during the query of the support.

The following steps are necessary for air-blast of the cassettes/cylinders:

1. Clamp the locking cylinder to be able to perform an air-blast.
2. Switch on the air-blast
3. Release the locking cylinder
4. Remove the fixture
5. Insert new fixture or cover clamping bolt
6. Switch off the air-blast
7. Clamp the locking cylinder

12.7 Care and maintenance

The zero-point clamping system is designed for operation with little maintenance.

The care and maintenance of the cassettes/cylinders is carried out in three stages:

- It is recommended to blow out the cassettes/cylinders **before each new work step** (see chapter 12.6)
- The clamping chamber of the cassettes/cylinders must be cleaned every two weeks in accordance with the respective maintenance instructions (see data sheet, chapter 7). In case of contamination, maintenance should be preferred at shorter intervals. Perform regular visual and functional checks.
- In case of visible damage or signs of malfunction, take the zero-point clamping system out of operation immediately. Commissioning must not be performed again until the damage has been repaired, for instance by replacing a damaged unit.
- After a **specified number of clamping cycles**, check the draw-in force of the cassettes/cylinders. The number of clamping cycles until the draw-in force is checked depends on the respective product and can be found in the corresponding data sheet (see chapter 7). The check of the draw-in force can also be performed by the customer service.

Repairs to the products are not to be carried out by yourself. The repair as well as the opening of the cassettes/cylinders are the responsibility of the manufacturer. No liability is assumed for consequential damage due to unauthorized opening of the products.

⚠ DANGER

Breakage of the clamping system due to the use of third-party spare parts. Severe injuries and material damage possible.

Only use original DockLock spare parts and original DockLock clamping bolts. Proper functioning is only ensured if original spare parts are used.

HAINBUCH will not assume any warranty in the event of improper maintenance or the installation of third-party parts.

⚠ WARNING

Ejection of parts when removing covers of cassettes/cylinders. Risk of injury, especially to limbs/face and risk of material damage.

The covers of the clamping systems are under spring preload. When opening the covers, parts can be ejected. Disassembly/assembly of the covers may only be carried out by trained HAINBUCH personnel and in compliance with the associated disassembly and assembly instructions.

⚠ NOTE

Malfunctions and material damage possible.

Observe the maintenance intervals specified in the relevant data sheet to ensure that the cassettes/cylinders continue to function properly.

Defective products can be sent directly to HAINBUCH for repair, well packaged and wrapped in oil paper. See front page for address. No liability is assumed for transport damage due to insufficiently packaged goods.

13 Production interruption, storage and disposal

For production interruption, storage and disposal, the corresponding data sheet (see chapter 7) must be observed.

- Production interruption:** Cassettes/cylinders not in use must be provided with cover clamping bolts to prevent contamination of the clamping chamber. The cover clamping bolts are not included in the scope of delivery and must be ordered separately (see also catalog/clamping book).
- Storage:** Storage of cassettes/cylinders is possible in oiled condition and wrapped in oil paper. If the cassettes/cylinders are to be stored for a longer period of time, a cyclical optical condition check (monthly) is recommended.
- Disposal:** When disposing of cassettes/cylinders, the applicable legal requirements must be complied with. The main component of the products is metal or metal alloys. The rubber seals and hydraulic oil used must be disposed of separately.

14 Definitions

The following are explanations of the terms used in these assembly and operating instructions and on the associated data sheet.

Draw-in force:	Maximum permissible force by which a cassette/cylinder may be loaded axially or radially. Force with which the system retracts mechanically when clamped and depressurized.
Limit draw-in force:	Minimum force at which a cassette/cylinder must draw-in. If this is not reached, the clamping springs of the system must be replaced (maintenance/repair).
Holding force:	Force at which the weakest component begins to fail, there is a breakage of the screw of the clamping bolt fastening if this force is exceeded for a cassette/cylinder.
Operating pressure for release:	The pressure required for the operation of the system.
Repeatability:	Describes the accuracy achieved when a fixture is removed from a system, placed back on the system and then clamped again .
Clamping cycles until maintenance:	Number of clamping cycles (cycle = clamping and release) at which maintenance of the system is recommended.
Clamping cycles until testing the draw-in force:	Number of clamping cycles at which a test of the available draw-in force is to be carried out.
Volume until released:	Required (moving) volume of pressure medium to release a cassette/cylinder.
Time until released:	Required time to release a cassette/cylinder (depending on line cross sections, number of cassettes/cylinders, pump type).
Pre-centering:	Accuracy at which the clamping fixtures must be pre-positioned on the system to ensure that the fixtures can be inserted into the systems.
Clamping duration:	Describes the duration of maintaining the clamping of a system. Once a system is clamped, it remains clamped until energy is supplied again to release it.
Piston position control:	Also referred to as »evaluation unit«. Monitoring of the clamping function, whether it is correctly clamped or an incorrect clamping (system not clamped) has occurred.