Installation, Operation and Maintenance Manual
MAN 715 Rev. 0
August 2023

Biffi TPD Series - Turn Pneumatic

Compact Pneumatic Actuator – Double-Acting Actuator

BIFFI

Before carrying out any operation with the actuator or any maintenance intervention, all the instructions, procedures and warnings described in this Installation, Operation and Maintenance Manual (IOM) must be read and understood.

Furthermore, please refer to the confirmation documentation for further information depending on the configuration of the pneumatic actuator referred to in the present IOM.

- TO BE KEPT FOR FUTURE REFERENCE -

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NOTICE

Biffi Italia s.r.l. has taken every care in collecting and verifying the documentation used in drafting the present instruction manual. Nevertheless, Biffi Italia s.r.l. does not provide any guarantees with regard to this IOM. Biffi Italia s.r.l. shall not be held responsible for any mistake or inaccuracy contained herein, or for any damage whether accidental or arising from the use of this manual.

Biffi Italia s.r.l. is the owner of intellectual property rights with regard to the content hereof, which can be subject to subsequent modifications without prior notice.

NOTICE

The information contained in this IOM refers only to the actuator and not to any of the accessories (such as: pneumatic control panel, device indicating the open/closed status of the valve, etc.) for which reference must be made to the relevant documentation.

Section 1: Introduction

NOTICE

Biffi Italia s.r.l. owns all intellectual property rights over the content of this manual. Any reproduction thereof, in whole or in part, is prohibited without the prior written permission of Biffi Italia s.r.l. Biffi Italia s.r.l. reserves the right to make changes without notice with respect to the content of this document.

1.1 Purpose of this Manual

The purpose of this manual is to specify the expected use of the actuator as intended in the design and to provide the necessary instructions as regards transport, handling, installation, adjustment and use, staff training, accident prevention, maintenance and spare parts ordering. A description of the main technical features of the actuator is also included.

However, in terms of conditions of use, risk assessment and accident prevention, the content of the manual cannot be a substitute for the users' experience.

1.2 Who Should Use this Manual

- Safety Supervisor of the plant where the actuator is being used.
- Personnel in charge of lifting and transport.
- Personnel in charge of assembly, use and adjustment.
- Personnel in charge of maintenance and disposal.

1.3 Safe Keeping of this Manual

For a proper safekeeping, please keep the manual in a protected and dry place, sheltered from dust and sunbeams. A copy of the manual must always be available to hand for both operator and maintenance technician.

Do not remove, add or modify any part of the manual: only the Manufacturer of the actuator is entitled to make any changes.

NOTICE

This manual must be kept at the actuator location at all times and for the entire life cycle, even in case of conveyance or sale to third parties.

1.4 Supplements and Revisions

This manual reflects the state-of-the-art technology existing when the machine was marketed and cannot be considered as inadequate due to subsequent revisions made on the basis of new knowledge.

The Manufacturer reserves the right to make changes to the production and relevant documentation, without being bound to make changes to the previous production and documentation, except in those cases where the health and safety of persons and property is concerned.

1.5 Reading through this Manual

Warnings and pieces of information have each been inserted within the most appropriate section and are not repeated elsewhere. For this reason, the manual must be read first entirely and in sequence, from beginning to end, and all such information must be understood and kept in mind. Afterwards, only the required sections can be referred to.

1.6 Symbols Used in the Text

The graphical symbols used in this manual to point out precautions or warnings that must be observed, are listed below:

NOTICE

It is absolutely MANDATORY to carry out the actions indicated by this sign.

⚠ CAUTION

It is absolutely PROHIBITED to carry out the actions indicated by this sign.

⚠ WARNING

It indicates an action or behavior likely to cause damage to property or persons.

Hereunder is a list of the graphic symbols used in this manual in order to make reading easier, and understanding of certain significant parts of the text more immediate. Each symbol (ISO 7000) is identified by its related image, code number and meaning.

0421 EXAMINE – CHECK

0717 CALL FOR MAINTENANCE

0981 DATA CARRIER

Section 2: General Information

NOTICE

The manual is an integral part of the machine. It should be carefully read before carrying out any operation and it should be kept for future references.

2.1 Identification Data of the Manufacturer

Biffi Italia s.r.l.

Phone: +39 0523 94.44.11
Fax: +39 0523 94.18.85
Email: biffi_italia@biffi.it
Website: www.biffi.it

Strada Biffi n. 165
29017 Fiorenzuola d'Arda (PC)
Italy

Member Company under the management and coordination of Emerson Electric Co. (USA)

Cap. Soc. € 1.820.000 i. v. – Registro Imprese di Piacenza/Cod. Fisc./P. IVA n. 01018580330

R.E.A. di Piacenza n. 121628 - Meccanografico PC 00279 - Authorized Economic Operator IT AEOF 11 0383

2.2 Instruction Manual Identification Data

The identification code, the revision number and the edition of this manual are featured on the header of each page: these data must be specified when purchasing additional copies of the manual.

2.3 Requesting Technical Assistance

For any information regarding:

- use
- maintenance
- installation

You may contact Biffi Italia s.r.l. After Sales Service:

Biffi Italia s.r.l.
- After Sales Service -

Strada Biffi 165 – 29017 Fiorenzuola d'Arda (PC), Italy
Phone: +39 0523 94 45 23
Fax: +39 0523 94 18 85
e-mail: service@biffi.it

NOTE:
Any inquiry or request for assistance submitted to the After Sales Service must indicate the data featured on the rating plate of the machine.

2.4 Spare Parts Ordering

The parts subject to normal wear and tear require periodic replacement. Whenever ordering spare parts, make sure they can be clearly identified by submitting the relevant info, such as code number featured in the diagrams, ID data featured on the physical label, any reference code mentioned in this IOM, etc.).

The request must be addressed to:

Biffi Italia s.r.l.
- Spare parts service -

Strada Biffi 165 – 29017 Fiorenzuola d'Arda (PC), Italy
Phone: +39 0523 94 45 23
Fax: +39 0523 94 18 85
e-mail: service@biffi.it

NOTICE

Always use genuine spare parts to preserve the safety conditions provided by the manufacturer.

2.5 Intended Use

The actuator is designed to be used by adequately instructed and trained technical personnel for PROFESSIONAL applications only.

The machine must only be used as intended by the manufacturer, namely in accordance with the definition given under the heading “Actuator applications”, with the relevant details regarding performance, features and restrictions, listed in Section 3, “Technical Description”, and with the procedures for use, adjustment, maintenance and cleaning described in this manual.

In particular:

- The actuator must be installed properly;
- The characteristics regarding the electrical power supply, pneumatic supply, hydraulic supply, etc.:
  - Must correspond to the values indicated on the actuator rating plate;
  - Must have a variability that does not exceed the contractual limit values or those indicated on the actuator rating plate.
- The environmental operating conditions must always be observed;
- The specified performance values must always be observed, namely: pressure, temperature, load conditions, etc.;
- The procedures described in this manual as regards use and maintenance must always be observed;
- All the provisions concerning the safety of persons and property must be strictly observed.

Any exception to what so far stated must be decided upon during the contractual stage. Should that not be the case, the Purchaser shall be charged with both civil and criminal liability in relation to any improper use whatsoever of the actuator.

Any other use not specifically indicated must be considered IMPROPER.

2.6 Misuses

Any use of the actuator not described in this manual must be regarded as “not intended” by the manufacturer.

When installed in the plant together with all the accessories specified in the order acknowledgement, the actuator cannot be operated if the guards provided by the manufacturer are not fixed in place, and/or if the safety equipment is not assembled, not connected, not adjusted, deliberately excluded or in any way ineffective.

2.7 Limitation of Use

Please refer to the environmental conditions where the actuator is employed. In addition to the information given in Section 3.12 - Technical data, the provisions listed below must also be observed:

⚠ CAUTION

- ATMOSPHERE AT RISK OF FIRE
  It is FORBIDDEN to use TPD series actuators in environments at risk of fire and not equipped with suitable systems for the prevention and extinguishing of fires.

NOTE:
The TPD Series pneumatic actuators can be installed in areas at risk of fire exclusively if they are suitably protected (for example, by means of flameproof covering or of materials with specific fire resisting characteristics). Please refer to the documentation relating to the order confirmation for the installation instructions concerning this problem.

- EXPLOSIVE ATMOSPHERE
  It is FORBIDDEN to use TPD series actuators beyond the limits indicated on the rating plate as regards ATEX certification.

NOTE:
TPD series pneumatic actuators can be used in explosive atmosphere with the following classification of zones: zone 1/21.

- ENVIRONMENTAL PRESSURE
  It is FORBIDDEN to use TPD series actuators in “underwater” environments.

NOTE:
TPD series actuators comply with standard EN 60529:1991 + A1:2000 with reference to IP66M and IP67M degrees of protection. Consistently with the test conditions provided by the Standard, TPD series actuators can be installed partially or totally immersed, but cannot be installed in underwater environments where the actuator can be externally exposed to the action of hydrostatic pressure.

- CORROSIVE ATMOSPHERE
  It is FORBIDDEN to use TPD series actuators in environments containing acids, except for the information below.

NOTE:
The quality of the products used and the varnishing method offer a C5I/C5M protection classification, pursuant to Standard UNI EN ISO 12944, in that way making the actuator suitable for industrial/maritime/off-shore applications.

For any installation instructions differing from those set out in the present IOM, kindly refer to the documentation relative to the order acknowledgement.

⚠ WARNING

Non-compliance with prohibition notices may cause harm to persons and damage to property.

2.8 General Safety Provisions

The general provisions as regards health, safety and accident prevention are described in detail in Section 4 - Health and Safety Provisions.

They refer to all the stages of actuator use, from installation to operation and from transport to disposal. The general safety provisions are not repeated in any of the other sections; therefore, before carrying out any operations, make sure you fully understand them.

2.9 Limitation of Liability

Biffi Italia s.r.l. declines all liability arising from the misuse or not reasonably foreseeable use of the actuator, use of non-genuine spare parts and from any modification or tampering whatsoever.

The safety supervisor is responsible for the thorough and scrupulous enforcement of the safety provisions. The safety supervisor must also ascertain that the personnel entrusted with the use of the machine hold the qualifications to carry out the required task, are knowledgeable about the instructions described in this manual and about the general safety provisions applicable to the actuator.

⚠ WARNING

Failure to observe the safety rules may cause personal injury and may damage actuator components.

2.10 Warranty

Biffi Italia s.r.l. guarantees that all the items produced are free of defects in workmanship and manufacturing materials and meet relevant current specifications, provided they are installed, used and serviced according to the instructions contained in the present manual. The warranty can last either one year from the date of installation by the initial user of the product, or eighteen months from the date of shipment to the initial user, depending on which event occurs first. All detailed warranty conditions are specified in the documentation forwarded together with the product.

The warranty does not cover special products or components not covered by warranty in their turn by subcontractors, or materials that were used or installed inappropriately, which were modified or repaired by unauthorized staff.

In the event that a fault condition is caused by improper installation, maintenance or use, or by irregular working conditions, the repairs will be charged according to applicable fees.

The warranty and Biffi Italia s.r.l. liability shall lapse in the event that any modification or tampering whatsoever be performed on the actuator.

2.11 Regulatory Reference Framework

Biffi Italia s.r.l. actuators are designed, manufactured and controlled according to the Quality Control System in compliance with EN ISO 9001 International Standard.

Biffi Italia s.r.l. actuators, subject matter of the present document, are designed, manufactured and tested in compliance with the requirements and provisions laid down in the Directives and Standards listed below:

IMPLEMENTED DIRECTIVES

2006/42/EC	Machinery Directive
2014/68/EU	Directive for pressure PED equipment
2014/35/EU	"Low Voltage" Directive
2014/30/EU	"Electromagnetic Compatibility" Directive
2014/34/EU	Directive and safety instructions intended for use in potentially explosive atmospheres

HARMONIZED STANDARDS

UNI EN ISO 12100: 2010	Safety of machinery - General principles for design - Risk assessment and risk reduction

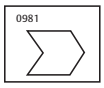
2.12 Demolition and Disposal

At the end of its lifespan, the actuator must be dismantled and the various parts and components must be disposed of accordingly.

NOTICE

During this stage, strictly comply with all the relative regulations in force in the Country where the actuator was in use.

The actuator CE Mark plate must be totally destroyed.



For further information:
Section 13 - Dismantling and Disposal

Section 3:Technical Description

3.1 Fields of Application

The subject matter of the present manual are the double-acting actuators of the Turn Pneumatic (TPD) series and their various configurations.

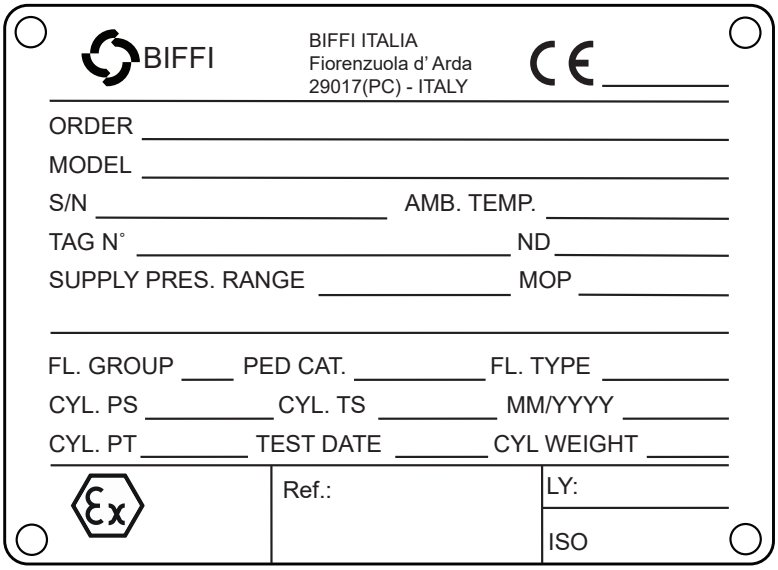
The present manual applies ONLY to the actuator intended as a mechanical device that delivers an operating torque for the 90° rotation of a quarter-turn valve, which is moved by a pneumatic cylinder.

The present manual DOES NOT apply to any accessories installed on the actuator, for which you have to refer to the relevant annexed documentation specified on the order acknowledgement (of which this manual is an integral part).

3.2 Identification Data of the Actuator

The main identification data of the order acknowledgement are featured on the plate affixed to the actuator and shown in Figure 1 below.

Figure 1. Rating Plate



NOTICE

The purchaser must make sure the plate is never removed from the actuator and the featured data are always clearly legible.

⚠ CAUTION

It is forbidden to modify the information and the marks without previous written authorization by Biffi Italia s.r.l.

The rating plate shown in Figure 1 complies with the directives listed in Section 2.11 and features clearly legible and ineffaceable data, namely:

- In the upper part:
  - Name and address of the manufacturer.
  - CE Mark pursuant to Directive 97/23/EC (until 18/07/2016) or 2014/68/EU (from 19/07/2016) and the identification number of the notified body. Optional featuring: the identification number of the notified body is present if the product is marketed in Countries where Directive 97/23/EC (until 18/07/2016) or 2014/68/EU (from 19/07/2016) is a mandatory requirement or on the purchaser's demand when the above-mentioned Directive is not applicable.
- "ORDER" field – Customer order number.
- "CONFIRM" field – Order acknowledgement number.
- "MODEL" field – Reference number of the actuator subject matter of the order. NOTE: The product identification code can be easily interpreted by referring to Section 3.10, where the meaning of the various fields is explained in detail.
- "S/N" field – Serial number of the production list associated to the machine. NOTE: the actuator is one of the elements of the entire supply (Section 3.1), which includes also the accessories, control panel and sundry items.
- "MANUFACTURE YEAR" field – year of manufacture.
- "FLUID" field – type of pressurized fluid used inside the pneumatic cylinder.
- "ALLOWABLE TEMPERATURE RANGE" field – external environment temperature range in which the actuator can be used.
- "MAX. ALLOWABLE PRESSURE" field – maximum allowable pressure of fluid inside the pneumatic cylinder.
- "SUPPLY PRESSURE" field – reference pressure range as regards the operating conditions specified in the order acknowledgement.
- "VALVE TAG" field – identification data of the valve on which the actuator has to be installed.
- "DN" field – nominal dimension of the line on which the valve is installed (optional feature).
- " " field – line left empty for any particular remarks regarding the order acknowledgement.
- In the lower part:
  - The mark and data regarding the actuator performance and application limits pursuant to Directive 94/9/EC (ATEX):

    CE Ex II 2 GD c 135 °C (T4)

NOTE:

The meaning of the marking pursuant to Directive 94/9/EC is given below:

II	=	group II (surface)
2	=	category 2 (zone 1)
G	=	explosive atmosphere with the presence of gases, vapors or mists
D	=	explosive atmosphere with the presence of dusts
c	=	constructional safety according to EN 13463-5
135 °C (T4)	=	maximum surface temperature/temperature classification
-40 to +100 °C	=	ambient temperature range (refer to minimum allowable temperature according to the project configuration – refer to Section 3.12.1)

Table 1. Correspondence Between Hazardous Areas, Substances and Categories Pursuant to Directive 94/9/EC

Substance	Hazardous area	Category
Gases, vapors or mists	Zone 0	1G
Gases, vapors or mists	Zone 1	2G or 1G
Gases, vapors or mists	Zone 2	3G, 2G or 1G
Dusts	Zone 20	1D
Dusts	Zone 21	2D or 1D
Dusts	Zone 22	3D, 2D or 1D

NOTE:
This indication refers to the performance levels resulting from qualification tests performed by competent authority or certification laboratory.

3.3 General Safety Provisions

The list below contains the general safety provisions that must be strictly observed:

⚠ WARNING

Uses different from or additional to those provided in this IOM are not permitted and Biffi Italia s.r.l. will not be liable for any damages arising from non-intended uses.

⚠ WARNING

All maintenance interventions must be performed according to the instructions contained in the IOM: no mechanical modification is permitted without prior written authorization from Biffi Italia s.r.l.

⚠ WARNING

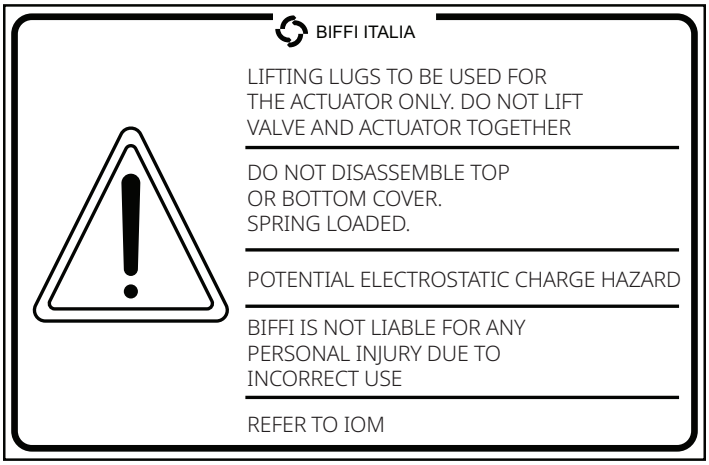
Unauthorized replacements or using non-genuine spare parts will undermine the actuator's safety; all spare parts must be requested from Biffi Italia s.r.l.

⚠ WARNING

All electrical equipment/components must not be opened when still live. The actuator must not be opened when still pressurized.

The adhesive plate shown in Figure 2, featuring information on the proper use of the actuator and on safety provisions, is affixed to all the TPD series models.

Figure 2. Identification Plate



3.4 Safety Provisions for Installation in Hazardous Areas

⚠ WARNING

Before proceeding with the installation procedures, carefully read the indications specified in the IOM.

The actuators can be provided with electrical equipment or components which, pursuant to Directive ATEX, are subject to separate certification, and mechanical components that are in compliance with the same Directive.

All the electrical and mechanical equipment and components must be suitable for use in zones classified with the presence of gas belonging to group II and or with the presence of combustible dusts. The temperature classification and/or the maximum temperature regarding components must meet the temperature limits provided for the different versions of the actuator.

TPD series pneumatic actuators must be installed and serviced according to the installation and servicing regulations for places classified against the risk of explosion due to the presence of gases/dusts or for mines (for instance: EN 60079-14, EN 60079-17, or other national regulations/standards).

⚠ WARNING

The TPD series pneumatic actuator must be adequately connected to the ground via the anti-loosening and anti-rotation device.

The electric resistance measured between the various metal parts of the actuator and the reference point must be checked at the time of the first installation and during the scheduled inspections.

⚠ WARNING

The actuator must not be isolated from the ground; periodically check the actuator grounding to ensure its efficiency through time.

As regards the actuator earth connection, refer to Section 3.18.

In case of combustible dusts, clean on a regular basis to prevent the formation of layers. All maintenance operations must be performed according to the indications provided in the instruction manual.

Depending on the type of application and substances, the user must periodically check the conditions below:

- Incrustations, dirt, wear, and smooth operation of the actuator;
- Vibrations and/or strange noises. In that case, stop the actuator, identify the causes and call the manufacturer.

However, residual risks can arise while the TPD series actuator is running normally if:

- The provided maintenance schedule is not observed;
- The actuator is not used according to the design specifications.

3.5 Actuator Applications

The actuator identified as "TURN PNEUMATIC TPD Series" is designed and produced to open/close quarter turn valves, such as ball, butterfly or plug valves in both ON-OFF and modulating service.

The kinematic mechanism is driven by a double acting pneumatic cylinder:

1. The pressurizing of the lower chamber causes the clockwise rotation of the valve stem and, consequently, the closing of the valve.
2. The pressurizing of the upper chamber causes the counterclockwise rotation of the valve stem and, consequently, the opening of the valve.

3.6 General Description

NOTE:
The technical description is deliberately simplified. The purpose is to provide useful pieces of information for staff assigned to installation and maintenance to work under safe conditions, such as operating principle, layout, component identification, different configurations and options.

Our TPD Series Turn Pneumatic actuators are provided with a "helical spline" kinematic mechanism that converts the linear movement generated by a pneumatic cylinder into a 90° rotation.

When the upper chamber of the cylinder is being pneumatically supplied, the pressure applied to the piston exerts a thrust and subsequent downward movement. The rotation of the rotary element (output drive) and the transmission of torque to the valve stem are obtained by interaction and contact between the components of the kinematic mechanism.

The relevant reaction torque is absorbed by the structure of the actuator.

The helical spline is designed to ensure:

- An angular rotation equal to 90° (the strokes needed to ensure such rotation depend on the size of the kinematic mechanism);
- The possibility to adjust, by means of specific stroke limits (called Stoppers), the initial angular position as well as the final angular position of the output drive within a ± 5° tolerance range.

In that way, not only is the functional rotation of the valve always guaranteed, but also any misalignment between the valve stem and the output drive can be adjusted within a ± 5° error range.

The actuator is provided with various types of interfaces, namely:

- To couple the actuator to the valve (refer to Section 3.13)
- To connect the output drive to the valve stem (refer to Section 3.14)

NOTE:
Connection to the valve stem is done by means of a bush insert or a sleeve machined internally (by Biffi Italia s.r.l. or by the customer) to fit the geometry of the valve stem.

- Pneumatic supply for upper and lower chambers of the pneumatic cylinder (refer to Section 3.15).
- To fix the control system in place (refer to Section 3.18).
- To hoist the actuator only by means of the provided lugs (refer to Section 3.18).
- To connect the shaft indicating the actuator status to the associated indicator device (refer to Section 3.18).
- To fix the position indicator in place (refer to Section 3.18).

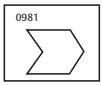
3.7 Main Features

The main features of compact TPD series actuators are described here below:

- The kinematic mechanism is available in 10 different sizes, each distinguished by the maximum deliverable structural torque, which cover a torque range: 500 to 300000 Nm.
- Each kinematic mechanism can be assembled to different cylinders for the purpose of modulating the delivered torque according to the required valve performance, in its various determining positions, namely:
  - Valve unseating while opening (BTO)
  - Valve seating while opening (ETO)
  - Valve unseating while closing (BTC)
  - Valve seating while closing (ETC)
  - Intermediate positions (RUN)
- Each mechanism is available in two configurations distinguished by the different helical spline profiles in order to modulate the profile of the operating torque delivered by the actuator.

Table 2. Constant and Variable Helical Spline Profiles

Type of Profile	Operating Torque
RP - Constant helical spline profile	The operating torque reproduces the typical torque generated by a “rack/pinion” kinematic gear.
SY - Variable helical spline profile	The operating torque is similar to the typical torque generated by a scotch yoke mechanism.



Product range (type of mechanism and cylinder size):
Refer to Table 3.

The table below contains data regarding:

Size and type of TPD series actuators, each associated to its maximum operating torque (MOT) plus the type of pneumatic cylinder, identified by the nominal diameter (DN), applicable to each size.

Table 3. Output Torque Curve Type – Cylinders

Output Torque Curve Type				Pneumatic Cylinder		
Size	Helical spline profile type		MOT (Nm)	DN (mm)		
0.A	RP	SY	500	-	-	175
0.1	RP	SY	1000	-	235	-
0.3	RP	SY	3000	280	335	-
0.9	RP	SY	9000	385	435	-
1.5	RP	SY	15000	485	535	-
3	RP	SY	30000	585	635	-
6	RP	SY	60000	735	785	-
14	RP	SY	120000	-	-	1000
18	RP	SY	160000	-	-	1100
32	RP	SY	300000	-	-	1300

NOTICE

Biffi Italia s.r.l. reserves the right to make changes without notice with respect to the data. For updated information, please refer to Biffi Italia s.r.l. website, catalogues, etc.

3.8 Options and Configurations

The design solutions and the characteristics of the materials make the TPD series actuators suitable for use in different environmental conditions and temperature ranges:

- The three different available configurations make the actuator suitable for the temperature ranges listed below;
- It is also possible, upon customer's request, to use stainless steel for some of the structural components, treatments or materials in order to obtain tightness measures different from what provided by standard configurations.

Table 4. Environmental Operating Conditions

Environmental Conditions	Δt	Optional: Stainless Steel External Threaded Parts
Standard *	-20 to +100 °C	✔
Special *	-40 to +100 °C	✔
Extreme	-60 to +100 °C	✔

NOTES:
✔ Provided
✕ Not provided
* Pressurized parts pursuant to PED Directive 97/23/EC (until 18/07/2016) or 2014/68/EU (from 19/07/2016).

3.9 Accessories

TPD series actuators can be equipped, upon request, with various types of accessories, such as:

- "Manual override" device (actuator is operated manually in case of pneumatic supply failure)
- Valve status indicator device (microswitch box, positioner, sundry items)
- Control panel
- Sundry items

As already mentioned in Section 3.1, the present manual DOES NOT contain any instruction as regards the use or maintenance of any of the accessories installed on TPD series actuators, for which you are kindly requested to refer to the documentation relative to the order acknowledgement (of which this manual is an integral part).

3.10 Reading and Understanding the Product ID Code

The code of the actuator model featured on the rating plate (refer to Section 3.2) is explained in the table below:

Table 5. Explanation of Product ID Code

		TP	D	0.3	RP	385	-	-
Type	TP Series							
Function	S = single acting D = double acting							
Actuator size	0.A 0.1 0.3 0.9 1.5 3 6 14 18 32							
Output Torque Curve Type	RP type SY type							
Cylinder size	Refer to Table 3							
-								
-								

NOTE:

The actuator ID code DOES NOT feature the data specified below (in that regard, please refer to the documentation relative to the order acknowledgement):

- Type of interface used to couple the actuator to the valve
- Type of accessory used for manual override operations
- Seal configuration and materials for each temperature range
- Optional: use of stainless steel for external threaded parts that have a structural function

3.11 Main Components and Materials

3.11.1 TPD 0.A Actuator

This section contains a list of the main components of TPD 0.A actuator and the type of material used in their manufacture.

Figure 3. Main components and materials – TPD 0.A

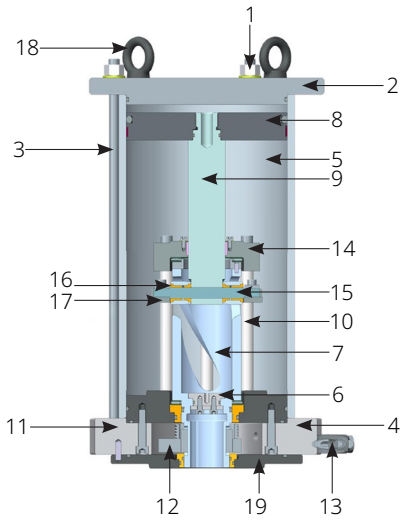


Table 6. Explanation of Product ID Code

Item	Description	Material
1	Tie rod nut	Alloy steel or stainless steel (optional)
2	End flange	Carbon steel
3	Tie rod	Alloy steel or stainless steel (optional)
4	Head flange	Carbon steel
5	Cylinder	Carbon steel
6	Output drive plug	Carbon steel
7	Output drive	Alloy steel
8	Piston	Carbon steel
9	Stem	Alloy steel
10	Central tube	Carbon steel
11	Base	Carbon steel
12	Sector for adjustment	Carbon steel
13	Stopper + Cover	Alloy steel or stainless steel (optional)
14	Upper flange	Carbon steel
15	Pin	Carbon steel
16	Bars	Chromium-plated steel
17	Guide ring	Aluminium bronze alloy
18	Lugs	Carbon steel
19	Lower flange	Carbon steel

NOTE:
Please refer to the documentation relative to the order acknowledgement for further details about the specifications of all spare parts materials and of the relevant reference standard.

3.12 Technical Data

3.12.1 General Data

Table 7. General Technical Data

Description	Value	Unit of Measure
Maximum allowable pressure	12[1]	bar
	174.05[1]	psi
Operating pressure	See ID plate	
Operating temperature range – standard applications	-20 to +100	°C
	-4 to 212	°F
Operating temperature range – special applications	-40 to +100	°C
	-40 to +212	°F
Operating temperature range – extreme applications	-60 to +100	°C
	-76 to +212	°F
Supply fluid	Instrument air or nitrogen	
Storage temperature (Refer to Section 6.2)	-	-
Storage environment humidity (Refer to Section 6.2)	-	-

NOTES:
1. It is absolutely mandatory to protect, by means of a safety valve, the hydraulic circuit against any pressure rates higher than the one shown in Table 7. The safety valve limits the pressure inside the hydraulic circuit and intervenes when the maximum allowable pressure is exceeded. The safety valve can be supplied by Biffi Italia s.r.l. inside the control panel. Refer to the confirmation documentation (namely the hydraulic functional diagrams) in order to verify the presence of the overpressure valve for limiting the hydraulic circuit pressurization above the maximum allowable pressure specified in Table 7.
2. The actuator ID code (Section 3.10) DOES NOT feature the data specified hereafter (in that regard, please refer to the documentation relative to the order acknowledgement): seal configuration and materials for each temperature range.

⚠ CAUTION

It is strictly forbidden to exceed the maximum allowable pressure detailed in Table 7.

3.12.2 Overall Dimensions, Weights and Estimated Center of Gravity Position

Figure 4. TPD Actuator Dimensions

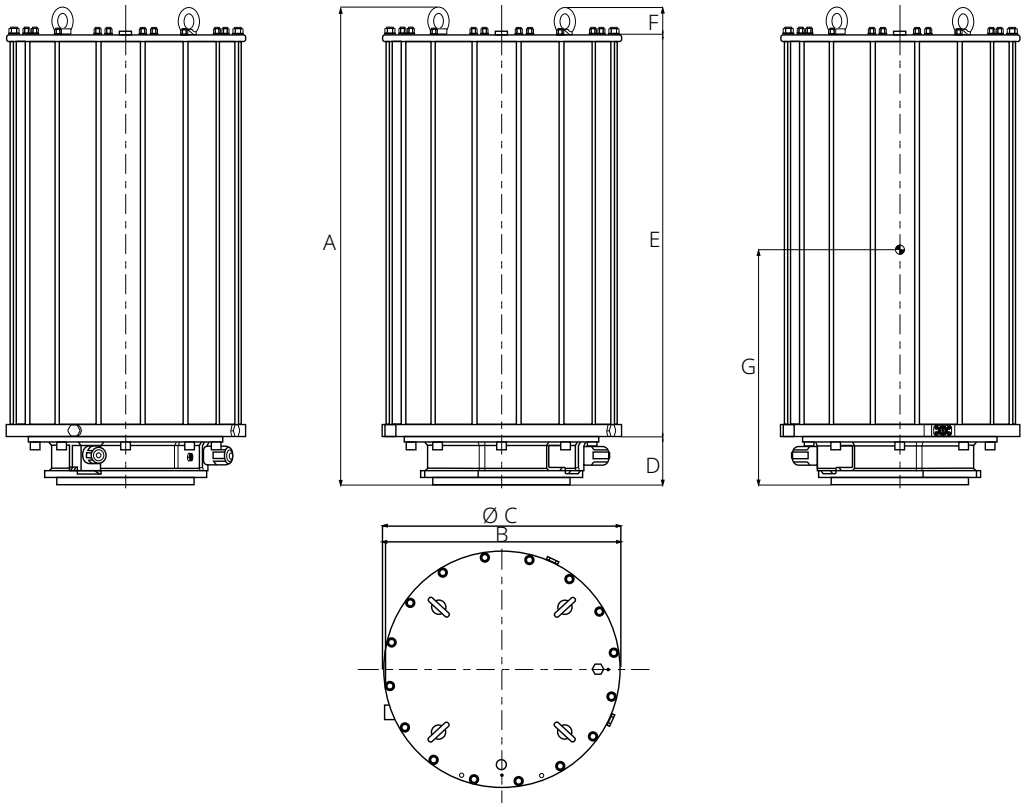


Table 8. Technical Data for Each Model

Model of Actuator	Dimensions (mm)							Total Weight (kg)	Cylinder Weight (kg)	Intermediate Flange Weight
	A	B	Ø C	D	E	F	G			
	xx = RP/SY									
TPD 0.A xx 175	475	312	255	20	410	45	200	58	13	-
TPD 0.1 xx 235	610	374	325	50	507	53	250	124	25	-
TPD 0.3 xx 280	700	390	365.5	50	592	53	270	160	35	-
TPD 0.3 xx 335	700	445	420.5	50	595	53	284	202	46	-
TPD 0.9 xx 385	975	495	465	115	782	53	445	336	75	-
TPD 0.9 xx 435	975	540	515	115	782	53	455	385	88	-
TPD 1.5 xx 485	1100	600	580	125.5	884.5	74	458	561	115	-
TPD 1.5 xx 535	1100	650	630	125.5	886.5	74	472	634	132	-
TPD 3 xx 585	1321	700	680	140	1107	74	567	927	187	-
TPD 3 xx 635	1321	748	735	140	1107	74	582	1054	249	-
TPD 6 xx 735	1679	840	835	170	1415	94	717	1675	373	-
TPD 6 xx 785	1679	900	895	170	1415	94	785	1790	398	-
TPD 14 xx 935	2246	1054	1060	190	1824	232	977	3015	350/290[3]	130
TPD 14 xx 1000	2246	1120	1125	190	1824	232	1033	3320	350/290	130
TPD 18 xx 1000	2776	1120	1125	240	2304	232	1091	3815	550/400	150
TPD 18 xx 1100	2776	1221	1230	240	2304	232	1246	4427	550/400	150
TPD 32 xx 1200	2822	1326	1335	290	2269	262	1276	5960	780/590	180
TPD 32 xx 1300	2822	1426	1435	290	2269	262	1320	6530	780/590	180

NOTES:
- With reference to Section 3.10, the alphanumeric **xx** sequence, featured in the identification code of the actuator model, is indicated in general terms in the columns of the dimensional data because the external dimensions DO NOT depend on the kinematic mechanism type (xx = RP/SY).
- In TPD 14/18/32 actuators, the external cylinder is divided into two parts: lower cylinder and upper cylinder. The table includes the weights of both parts, according to this convention: lower cylinder/ upper cylinder weight.
- For the overall dimensions and the weight, please refer to the confirmation documentation.

3.13 Valve Coupling Interface (Top Mounting)

TPD series actuators allow direct coupling to the valve (without having to use a spool piece). The standard options for valve coupling interfaces available for TPD series actuators are listed below:

NOTE:
Refer to the confirmation documentation in order to verify if the top mounting complies with the standard solutions listed in the present document or if it is a custom solution for which the presence of a spool piece can be provided.

- **Standard – ISO 5211**
  In standard configuration, TPD series actuators are provided with a coupling interface compliant with Standard ISO 5211 (Refer to Table 10) which allows direct coupling to the valve if the coupling flanges of valve and actuator belong to the same coupling class (for instance, both flanges are F30 class).

NOTE:
For sizes and dimensions, please refer to Biffi document SCN 7976.

- **Custom ISO 5211**
  In some configurations, TPD series actuators allow direct coupling to the valve even if the coupling flanges belong to different coupling classes, pursuant to Standard ISO 5211 (Refer to Table 11). In that case, the actuator interface flange is provided with bore sizes that are compliant with Standard ISO 5211, but belong to a coupling class that is lower than the actuator maximum operating torque. For instance, the actuator torque output is consistent with class F30, but the valve coupling interface has an F25 class bore size.
  NOTE: The safety factors required by the customer's specifications when sizing the actuator performance with respect to the torque values required by the valve, can determine the choice of an actuator belonging to a coupling class higher than that of the valve (considering the coupling classes compliant with Standard ISO 5211). The interface Custom ISO 5211 allows, also in such case, direct coupling without having to use an interface flange or spool piece.

NOTE:
For sizes and dimensions, please refer to Biffi document SCN 7977.

- **Compatible with Biffi ALGA/ALGAS series**
  TPD series actuators can be provided with a customized interface (Refer to Table 12), which, as regards size, is compliant and compatible with Biffi ALGA/ALGAS product line in their standard configuration.
  NOTE: This type of interface requires, as for ALGA/ALGAS, the use of an interface flange or spool piece. This option allows an ALGA/ALGAS model to be replaced by a TP series model.

NOTE:
For sizes and dimensions, please refer to Biffi document SCN 7975.

In short, TPD series actuators can be provided with three different valve coupling interfaces, as shown in the table below:

Table 9. Types of Valve Interfaces

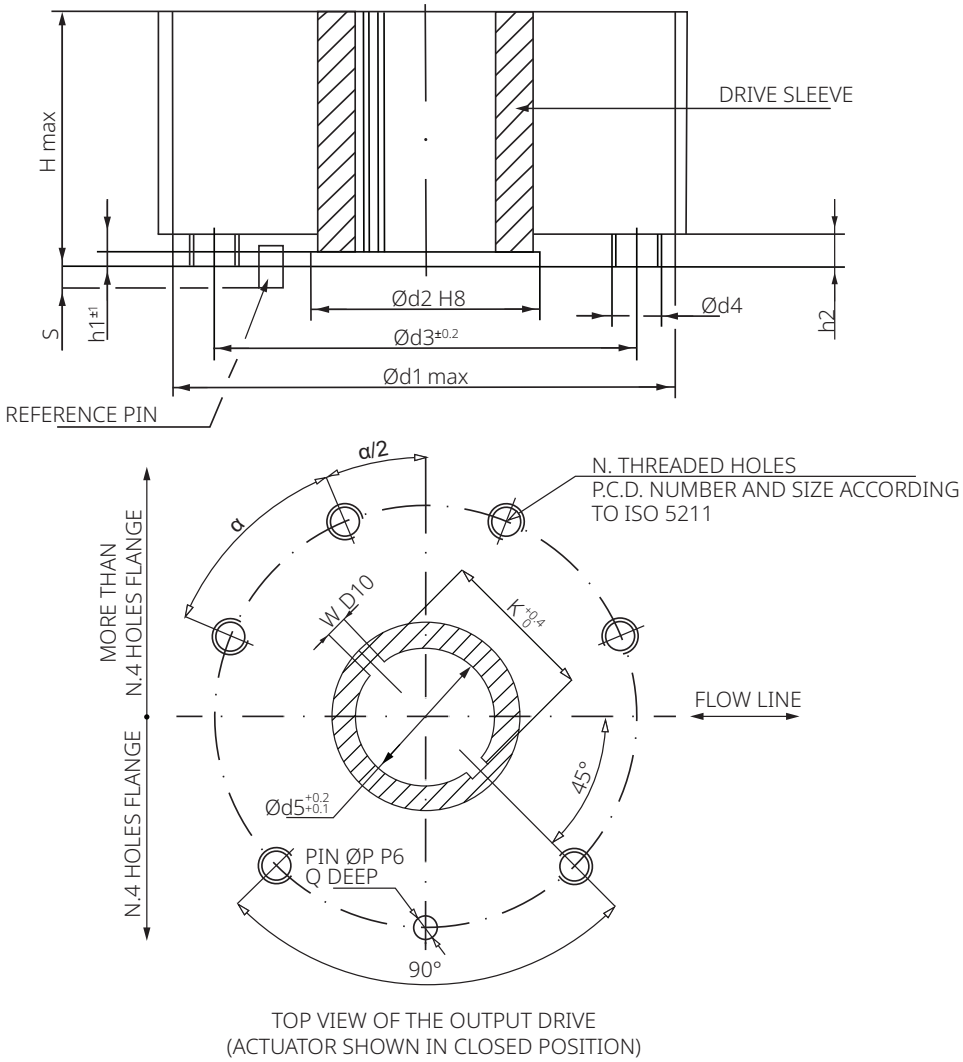
Standard - ISO 5211	Custom ISO 5211	Custom ALGA/ALGAS Interchangeable
This configuration allows actuator-to-valve direct coupling if the coupling flange sizes are compliant with Standard ISO 5211 and belong to the same coupling class.	This configuration allows actuator-to-valve direct coupling if the coupling flange sizes are compliant with Standard ISO 5211, but the valve flange belongs to a coupling class lower than that of the actuator.	Where applicable, the coupling interfaces of TPD and ALGA/ALGAS series actuators having the same size can be interchanged.

The drawings and geometrical data of the three different interfaces (Tables 10, 11 and 12) are given on the pages below.

NOTE:
Please refer to the documentation relative to the order acknowledgement to check the type of valve coupling interface (top mounting) provided with the supplied actuator.

1. STANDARD ISO 5211 INTERFACE (extract from document SCN 7976)

Figure 5. Standard ISO 5211 Interface



TOP VIEW OF THE OUTPUT DRIVE
(ACTUATOR SHOWN IN CLOSED POSITION)

Table 10. Technical Data for Standard Flanges Compliant with ISO 5211

Actuator Model	Flange	Ød1 max	Ød3	Ød4	N	h2	H max	Ød5	W	K	α	Ød2	h1	ØP	Q	S
TPD 0.A xx - zzzz	F10	125	102	M10	4	12	5.5	36	6	41.6	90°	70	5	5	5	5
TPD 0.1 xx - zzzz	F12	150	125	M12	4	14	98	55	10	60.6	90°	90	6	5	5	5
TPD 0.3 xx - zzzz	F16	210	165	M20	4	22	98	70	12	75.6	90°	93	5	16	10	20
TPD 0.9 xx - zzzz	F25	300	254	M16	8	24	172	86	14	93.6	45°	112	5	16	10	20
TPD 1.5 xx - zzzz	F30	350	298	M20	8	22	183	112	18	119.6	45°	144	6	16	10	20
TPD 3 xx - zzzz	F35	415	356	M30	8	32	224	157	25	167.8	45°	195	9	20	15	20
TPD 6 xx - zzzz	F40	475	406	M36	8	38	255	200	28	212.8	45°	250	14	20	15	20
TPD 14 xx - zzzz	F48	560	483	M36	12	38	295	175	45	195.8	30°	250	15	20	15	20
TPD 18 xx - zzzz	F60	686	603	M36	20	38	325	200	45	220.8	18°	276	15	20	20	25
TPD 32 xx - zzzz	F60	780	603	M36	20	38	365	220	50	242.8	18°	315	15	20	20	25

NOTES:
- With reference to Section 3.10, the alphanumeric sequences **xx** and **zzzz**, featured in the identification code of the actuator model are indicated in general terms, because the type of interface used for actuator to valve coupling depends NEITHER:
  - On the kinematic mechanism (xx = RP/SY)
  - Nor on the type of cylinder (zzzz)

2. CUSTOM ISO 5211 INTERFACE (extract from document SCN 7977)

Figure 6. Custom ISO 5211 Interface

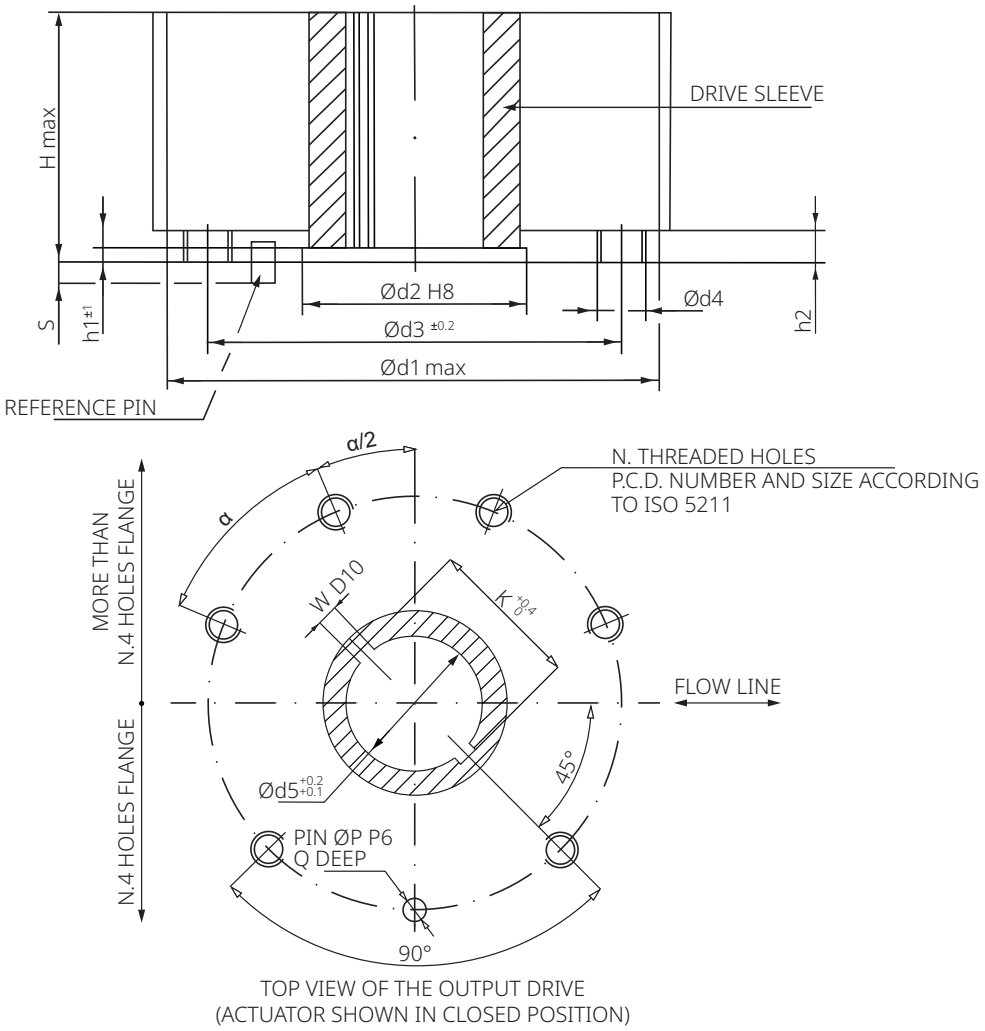


Table 11. Technical Data for Custom Flanges Compliant with ISO 5211

Actuator Model	Flange	Ød1 max	Ød3	Ød4	N	h2	H max	Ød5	W	K	α	Ød2	h1	ØP	Q	S
TPD 0.A xx - zzzz	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
TPD 0.1 xx - zzzz	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
TPD 0.3 xx - zzzz	F14	210	140	M16	4	24	98	70	12	75.6	90°	93	5	16	10	20
TPD 0.9 xx - zzzz	F16	300	165	M20	4	22	172	86	14	93.6	90°	112	5	16	10	20
TPD 1.5 xx - zzzz	F25	350	254	M16	8	24	183	112	18	119.6	45°	144	6	16	10	20
TPD 3 xx - zzzz	F30	415	298	M20	8	22	224	157	25	167.8	45°	195	9	20	15	20
TPD 6 xx - zzzz	F35	475	356	M30	8	32	255	200	28	212.8	45°	250	14	20	15	20
TPD 14 xx - zzzz	F40	560	406	M36	8	38	295	175	45	195.8	30°	250	15	20	15	20
TPD 18 xx - zzzz	F48	686	483	M36	12	38	325	200	45	220.8	30°	276	15	20	20	25
TPD 32 xx - zzzz	F48	780	483	M36	20	38	365	220	50	242.8	30°	315	15	20	20	25

NOTES:
- With reference to Section 3.10, the alphanumeric sequences **xx** and **zzzz**, featured in the identification code of the actuator model are indicated in general terms, because the type of interface used for actuator to valve coupling depends NEITHER:
  - On the kinematic mechanism (xx = RP/SY)
  - Nor on the type of cylinder (zzzz)

3. CUSTOM ALGA/ALGAS INTERCHANGEABLE INTERFACE
(extract from document SCN 7975)

Figure 7. ALGA/ALGAS Interchangeable Interface

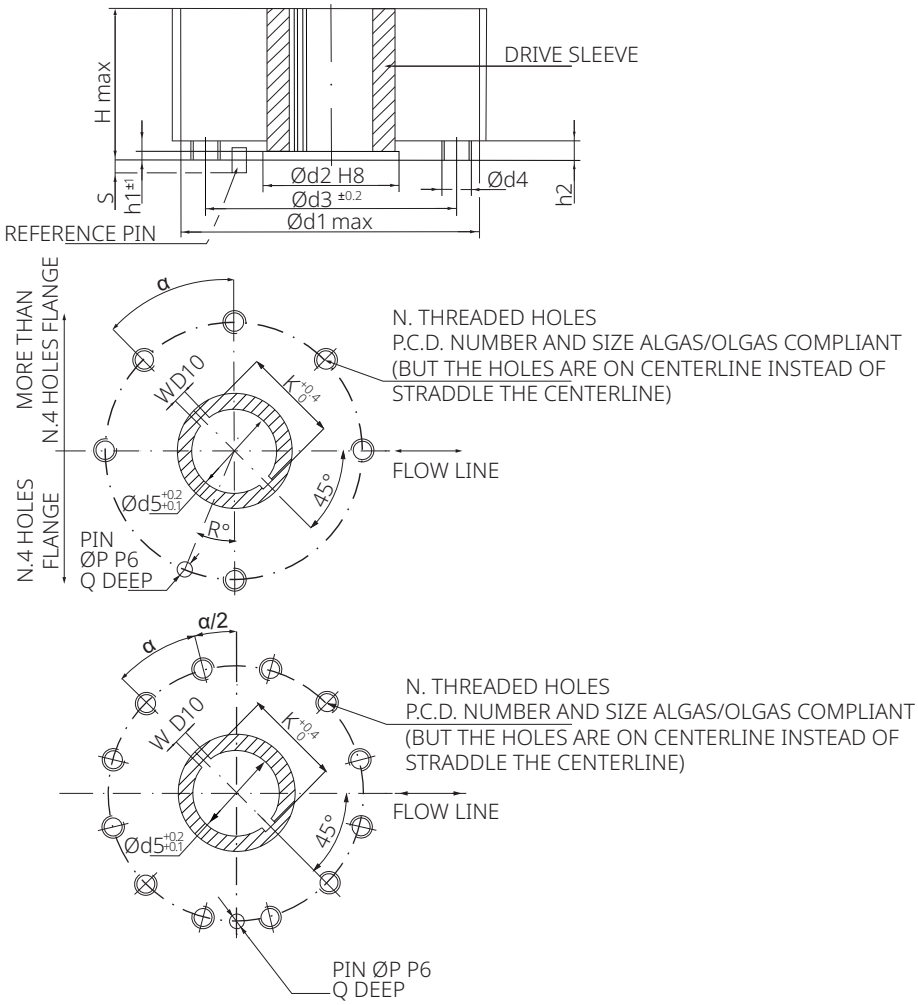


Table 12. Technical Data for Custom Flanges Interchangeable with ALGA/ALGAS Actuators

Actuator Model	Ød1 max	Ød3	Ød4	N	h2	H max	Ød5	W	K	Ød2	h1	ØP	Q	S	R°	α
TPD 0.A xx - zzzz	125	102	M10	4	12	56.5	36	6	41.6	70	5	5	5	5	22.5°	N/A
TPD 0.1 xx - zzzz	150	125	M12	4	14	98	55	10	60.6	90	6	5	5	5	22.5°	N/A
TPD 0.3 xx - zzzz	210	165	M20	4	22	98	70	12	75.6	93	5	16	10	20	22.5°	N/A
TPD 0.9 xx - zzzz	300	254	M16	8	24	172	86	14	93.6	112	5	16	10	20	22.5°	45°
TPD 1.5 xx - zzzz	350	298	M20	8	22	183	112	18	119.6	144	6	16	10	20	22.5°	45°
TPD 3 xx - zzzz	415	356	M30	8	32	224	157	25	167.8	195	9	20	15	20	22.5°	45°
TPD 6 xx - zzzz	475	406	M36	8	38	255	200	28	212.8	250	14	20	15	20	22.5°	45°
TPD 14 xx - zzzz	560	483	M36	12	38	295	175	45	195.8	250	15	20	15	20	N/A	15°
TPD 18 xx - zzzz	686	603	M36	16	38	325	200	45	220.8	290	15	20	20	25	N/A	11.25°
TPD 32 xx - zzzz	780	603	M36	16	38	365	220	50	242.8	310	15	20	20	25	N/A	11.25°

NOTES:
- With reference to Section 3.10, the alphanumeric sequences **xx** and **zzzz**, featured in the identification code of the actuator model are indicated in general terms, because the type of interface used for actuator to valve coupling depends NEITHER:
  - On the kinematic mechanism (xx = RP/SY)
  - Nor on the type of cylinder (zzzz)

3.14 Connecting the Stem Valve

Documents SCN 7975, SCN 7976, SCN 7977 contain also geometrical data as regards the output drive interface (actuator rotary element).

Since there are no standard geometrical data regarding the valve stem, Biffi Italia s.r.l. provides a bush insert or a sleeve, suitably machined, which allows a rigid connection between actuator and valve.

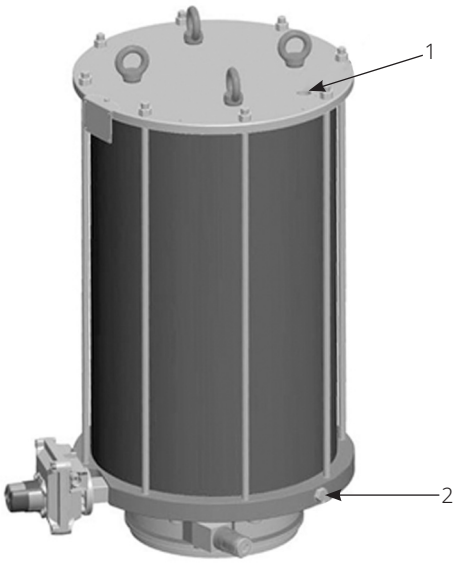
The above-described connection element is supplied separately from the actuator and is used when the actuator is installed on the valve.

NOTE:
Please refer to the documentation relative to the order acknowledgement to check geometric consistency between the valve stem and the connection element/actuator.

3.15 Pneumatic Interfaces (TPD 0.A/0.1/0.3/0.9/1.5/3)

The actuators TPD 0.A/0.1/0.3/0.9/1.5/3 are provided with two pneumatic interfaces, as shown in the Figure 8:

Figure 8. Position of Pneumatic Interfaces



1 Pneumatic interface supplying the upper chamber of the pneumatic cylinder. This chamber is pressurized to open the valve.

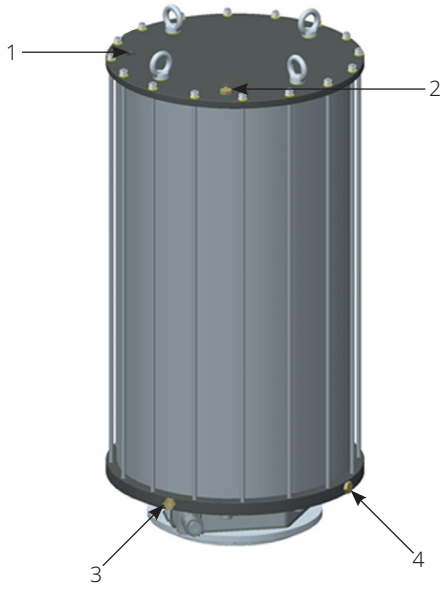
2 Pneumatic interface supplying the lower chamber of the pneumatic cylinder. This chamber is pressurized to close the valve.

NOTE:
Please refer to the documentation relative to the order acknowledgement (in particular to the pneumatic functional diagram) to check the connection modes available for the pneumatic interfaces.

3.16 Pneumatic Interfaces (TPD 6)

The actuator TPD 6 is provided with two pneumatic interfaces supplying the upper chamber and two supplying the lower chamber:

Figure 9. Position of Pneumatic Interfaces

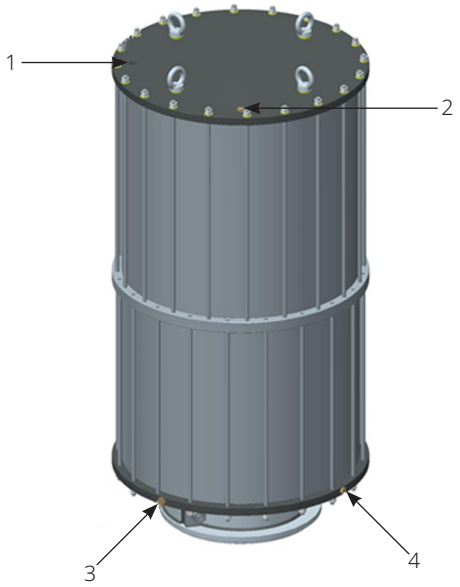


1 and 2	Pneumatic interfaces supplying the upper chamber of the pneumatic cylinder. This chamber is pressurized to open the valve.
3 and 4	Pneumatic interfaces supplying the lower chamber of the pneumatic cylinder. This chamber is pressurized to close the valve.

NOTE:
Please refer to the documentation relative to the order acknowledgement (in particular to the pneumatic functional diagram) to check the connection modes available for the pneumatic interfaces.

3.17 Pneumatic Interfaces (TPD 14/18/32)

Figure 10. Position of Pneumatic Interfaces



1 and 2	Pneumatic interfaces supplying the upper chamber of the pneumatic cylinder. This chamber is pressurized to open the valve.
3 and 4	Pneumatic interfaces supplying the lower chamber of the pneumatic cylinder. This chamber is pressurized to close the valve.

NOTE:
Please refer to the documentation relative to the order acknowledgement (in particular to the pneumatic functional diagram) to check the connection modes available for the pneumatic interfaces.

The pneumatic interfaces fitted on each TPD series model are listed in Table 13.

Table 13. Pneumatic Interfaces and Air Consumption

Model	Upper Chamber Pneumatic Interface (Pursuant To Standard NPT)	Lower Chamber Pneumatic Interface (Pursuant To Standard NPT)	Upper Chamber Displacement (Liters)	Lower Chamber Displacement (Liters)
TPD 0.A xx 175	1/2″	1/4″	2.4	7.2
TPD 0.1 xx 235	3/4″	1/2″	5.3	13
TPD 0.3 xx 280	3/4″	1/2″	10	28
TPD 0.3 xx 335	3/4″	1/2″	15	40
TPD 0.9 xx 385	1″	3/4″	24	74
TPD 0.9 xx 435	1″	3/4″	30	94
TPD 1.5 xx 485	1″	3/4″	49	135
TPD 1.5 xx 535	1″	3/4″	60	165
TPD 3 xx 585	1″	3/4″	90	250
TPD 3 xx 635	1″	3/4″	105	295
TPD 6 xx 735	1″	1″	174	519
TPD 6 xx 785	1″	1″	198	592
TPD 14 xx 935	1″	1″	355	975
TPD 14 xx 1000	1″	1″	405	1115
TPD 18 xx 1000	1″	1″	485	1295
TPD 18 xx 1100	1″	1″	587	1568
TPD 32 xx 1200	1″	1″	832	2205
TPD 32 xx 1300	1″	1″	977	2588

NOTE:
With reference to Section 3.10, the alphanumeric **xx** sequence featured in the identification code of the actuator model is indicated in general terms, because the pneumatic interface DOES NOT depend on the kinematic mechanism type (xx = RP/SY).

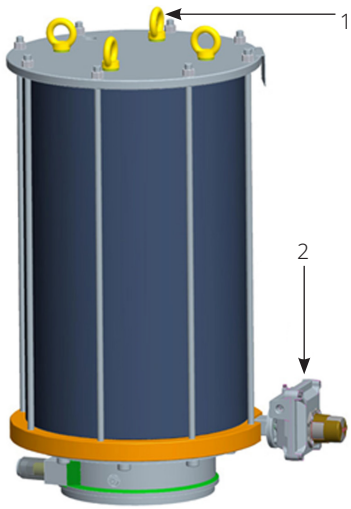
NOTE:

Generally speaking, displacement refers to the volume of air required for the complete execution of a closing or opening function of the valve.

3.18 Other Interfaces, Devices and Accessories

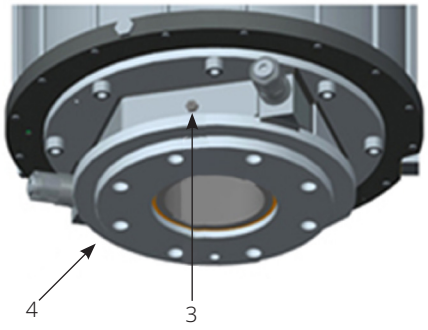
Figure 11 shows the typical position, on a generic model of the TPD series, of the following types of interfaces:

Figure 11. Position of Interfaces, Devices and Accessories



1. **Lifting lugs**
   Used for vertical lifting; for their use, please refer to Section 5 - Transport And Handling. The actuator can also be provided with eyes for horizontal lifting, see Section 5.2.1.
2. **Valve status indicator device**
   The diagnostic information regarding the valve status is obtained by means of a shaft directly connected to the output drive via mechanical transmission (Figure 12 shows one of the possible devices in place).
3. **Overpressure valve**
   Its function is to prevent the actuator lower chamber from being pressurized (both the lower chamber of the pneumatic cylinder and the base) (see also the first NOTE on the next page) in the event of a failure in the seal tightness of the piston.
4. **Actuator earth grounding interface**
   All TPD series actuators are provided with a threaded interface on the base (4) for the earth connection.

Figure 12. Lower View With Example of Overpressure Valve Positioning



NOTICE

Depending on the plant configuration, the valve shown in Figure 12 can be replaced by a plug. Refer to the confirmation documentation (namely the pneumatic functional diagrams) in order to verify the presence of the overpressure valve for preventing the actuator lower chamber from being pressurized (both the lower chamber of the pneumatic cylinder and the base).

NOTICE

Make sure the earth grounding interface on the actuator is connected to the control panel, from the related interface (refer to Figure 12), to prevent the risk of electrostatic charges.

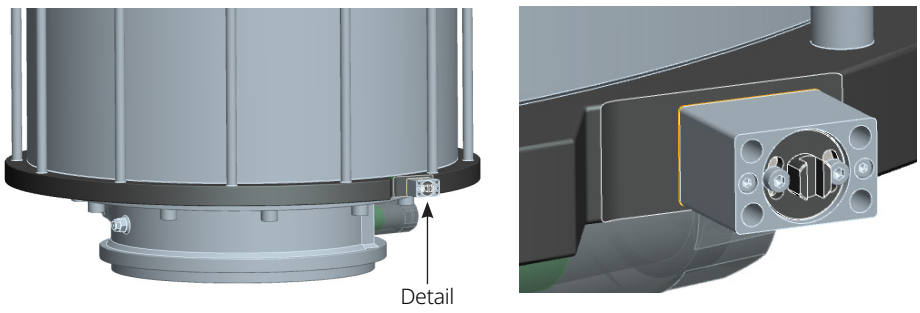
The head and end flanges are provided with bores to which specific brackets are fastened for the control panel installation.

NOTE:

Biffi Italia s.r.l. can provide different types of control system to meet the customer's specifications, for which you can refer to the documentation relative to the order acknowledgement.

The connection and coupling interfaces of the position indicator device are located in the lower part of the actuator (refer to Figure 13 - detail).

Figure 13. Detail of Connection and Coupling Interface of Valve Status Indicator Device



NOTE:

Any indicator device requested by the customer can be installed by means of a customizable coupling and flange (both provided by Biffi Italia s.r.l.), for which you can refer to the documentation relative to the order acknowledgement.

3.19 Minimum Requirements for Installing Control, Signalling and Diagnostic Devices on Board the Actuator

NOTICE

To prevent degradation of the features of TPD series actuators, specified by the marking pursuant to Directive 94/9/EC (ATEX) (refer to Figure 1), only equipment having the same type of marking or superior features are suitable for installation on board the actuator.

Section 4: Health and Safety Provisions

4.1 Introduction

Notwithstanding the fact that:

1. The actuator described in this manual has been designed using the latest technologies, so that it can be operated by trained and qualified personnel under conditions of utmost safety.
2. The personnel should be trained in aspects of general safety provisions, as regards those in force in the country where the actuator is installed and those valid for the plant in which the actuator is installed, all staff members must be aware that distraction, overconfidence in performing operating and maintenance procedures, non-observance of safety provisions and inexperience can all result in severe accidents and cause damage to persons and property.

Therefore, operators and maintenance technicians interacting with the actuator should:

- Read and understand the contents of the entire "Installation, Operation and Maintenance Manual" and of the enclosed documentation.
- Be always aware that paying attention is essential to preventing damage to both staff and actuator: no safety system or code of practice can guarantee absolute safety, unless staff members interact with the actuator in a professional, accurate and scrupulous manner.

NOTE:

Biffi Italia s.r.l. shall in no way be liable for any damages or accidents to persons or property resulting from failure to comply with:

- The contents of this Installation, Operation and Maintenance Manual;
- The code of practice as regards the use of the actuator specified by Biffi Italia s.r.l.;
- The current health and safety regulations;
- The instructions provided by the suppliers of commercial parts.

4.2 Duties of the Safety Officer

The duties of the safety officer are basically the following:

CIRCULATION OF SAFETY INFORMATION

The information included in this manual must be disclosed to all personnel in charge of:

- Actuator transport and handling
- Installation and commissioning
- Adjustment, operation and cleaning
- Maintenance
- Final dismantling

CIRCULATION OF SAFETY INFORMATION

All information and code of practice provisions must be observed by the staff interacting with the actuator:

- Staff members accessing the actuator must be skilled and trained
- Access to “danger zones” must be permitted to authorized personnel only
- All staff members interacting with the actuator must be considered “exposed person"
- Operators must be especially knowledgeable on the actuator intended use, misuses, limitation of use, process materials and performance limits

The definitions of danger zone and exposed person are laid down in Annex 1 of Machinery Directive 2006/42/EC, Chapter 1 – “Essential health and safety requirements”, Section 1.1.1 – “Definitions”. The “Definitions” are reported in full hereunder:

- «Danger zone»: any zone within and/or around machinery in which an exposed person is subject to a risk to his health or safety;
- «Exposed person»: any person wholly or partially in a danger zone.

4.3 Duties of the Staff Interacting with the Actuator

Operators

They must promptly inform their immediate superior of any fault detected on the actuator, so that the situation can be resolved in good time and any potential future danger avoided.

Maintenance technicians

They must perform adequate preventative maintenance on the actuator, assign repairs to skilled technicians and always use genuine spare parts.

The instructions contained in this manual and in the enclosed documentation, as regards the required competence to carry out maintenance activities, must be closely observed at all times.

4.4 Residual Risks

Residual risks refer to those hazards that are identified, but cannot be completely eliminated through design, mechanical, electrical or functional solutions, because they are intrinsically related to the nature and application of the machine. Such risks can and must be avoided by observance of the relevant codes of practice specified by the manufacturer.

Table 14.

Risk	Cause	Code of Practice
Partial or extensive removal of external layers applied to protect against atmospheric corrosion	a) Accidental fall during transport	a1) Observance of the indications regarding transport and handling, specified in Section 5. a2) Prevention of improper use: in case of scratches or dents, have the actuator checked by skilled and authorized staff, or else return it to the manufacturer.
Reduction or total loss in performance for damages caused by violent impacts	a) Accidental fall during transport	a1) Observance of the indications regarding transport and handling, specified in Section 5. a2) Prevention of improper use: Have the actuator checked by skilled and authorized staff, or else return it to the manufacturer.
Accidental working fluid leak or explosion	a) Reduced material thickness b) Overpressure	a1) Avoid contact with corrosive substances. a2) Check for wear or corrosion on a regular basis, because these cannot be totally eliminated as they depend on the actuator environmental and operating conditions. b) Ensure that the actuator is not exposed to heat sources or placed in excessively hot environments.

4.5 Information on Personal Protective Equipment (P.P.E.)

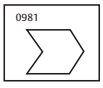
Before proceeding with any type of intervention, assigned staff must be equipped with suitable personal protective equipment suitable for the job to be carried out. The type of P.P.E. to be used is decided by the Safety Officer appointed by the Employer. Nonetheless, in Table 15 are listed some PPE that Biffi Italia s.r.l. suggests to have always available because their usage represents the minimum safety level that must be guaranteed to all personnel interacting with the actuator during any transport, installation, processing, maintenance and disposal stage.

Table 15. Personal Protective Equipment

Piece of Equipment	Type of Protection	Operations Requiring its Use
	GLOVES Hand protection against contact with sharp objects or substances that are skin irritant or toxic	- Contact with sharp objects. - Contact with cleaning equipment. - Contact with lubricant grease or oil. - Actuator lifting or handling operations.
	OVERALLS Protection against risk of trapping, dragging and direct skin contact with irritant or toxic substances	- Contact with sliding or moving parts. - Difficult access to operational areas. - Contact with cleaning equipment. - Contact with lubricant grease or oil.
	HELMET Head protection against abrasion hazard from cuts or impacts and against brain damage hazard from impact	- Difficult access to operational areas. - Access to areas with potential slip hazard. - Access to areas with suspended loads. - Actuator lifting or handling operations.
	GOGGLES and FACE MASK Eyes and face protection against possible contact with irritant or toxic substances	- Contact with lubricant grease or oil. - Interventions on or contact with pressurized parts. - Actuator cleaning operations. - Proximity to machine parts that could eject pressurized fluids.
	SAFETY BOOTS Feet protection against crushing, cutting and slipping hazards	- Maintenance interventions. - Cleaning operations. - Actuator lifting or handling operations. - Assembling/disassembling the actuator or its components.

The use of P.P.E. is mandatory for the staff members specified below:

Operators and Maintenance technicians
Consider whether to have spare P.P.E. available for external personnel that might be authorized, for whatever reason, to interact with the actuator.



For further information:
Local regulations in force with regard to health and safety at work.

Section 5: Transport and Handling

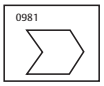
5.1 Transport of the Actuator

5.1.1 General Information

NOTE:
The actuator is packed and transported by Biffi Italia s.r.l.

TPD actuator can be transported either already assembled to the valve or still separated from it therefore, depending on the type of conveyance, different provisions will have to be observed, as described below:

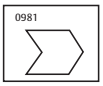
Conveyance of actuator only
Before using the actuator, make all relevant adjustments as indicated in the present manual.



For further information:
Section 5.

Conveyance of assembled actuator + valve group
Adjustments are made beforehand, therefore no checks need to be made before installation.

P.P.E. to be used for lifting and handling operations:



Weights:
Refer to Table 8.

5.2 Lifting the Actuator

5.2.1 Lifting Points

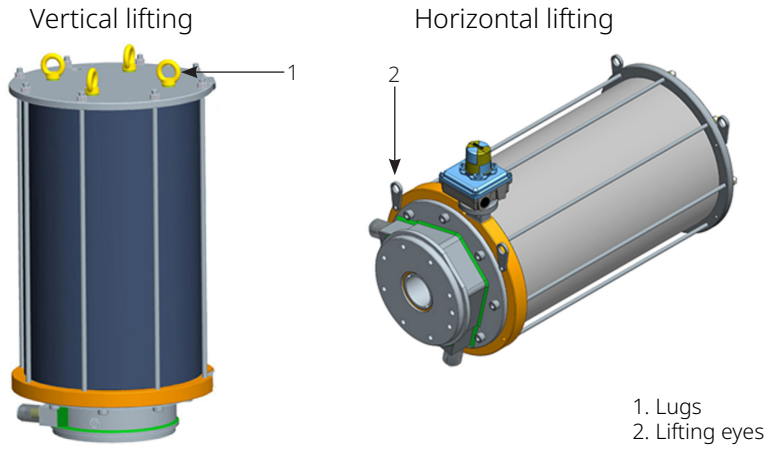
The actuator is provided with lifting points for lifting and handling it:

A. Rig the slings through the lugs located on the top of the actuator. Lift the actuator (without valve) by keeping it in vertical position.

B. The actuator can also be provided with lifting eyes through which the slings shall be rigged in order to lift the actuator (without valve) by keeping it in horizontal position.

Figure 14 shows an example of configuration of the lifting points:

Figure 14. Lugs/Eyes for Lifting the Actuator Only



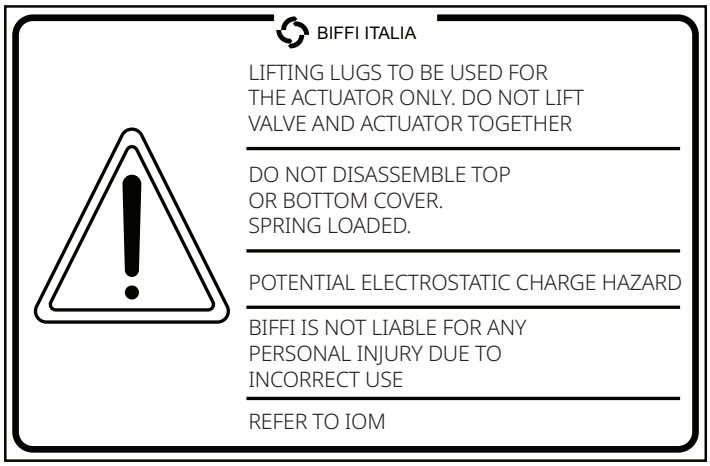
1. Lugs
2. Lifting eyes

⚠ WARNING

The lugs/eyes fitted on the actuator are designed to lift exclusively the actuator WITHOUT the valve.

For a correct use of the lifting lugs/eyes, please refer to the adhesive plate shown in Figure 15.

Figure 15.



For lifting and moving the actuator, use only hooks fitted with safety latch, like the one, for example, shown in Figure 16:

Figure 16. Example of hook with safety latch

5.2.2 Codes of Practice for Lifting Operations

⚠ WARNING

The lugs/eyes fitted on the actuator are designed to lift exclusively the actuator WITHOUT the valve.

NOTE:
Lifting and handling operations must be performed by adequately skilled personnel, pursuant to relevant current regulations.

- Wear protective clothing (helmet, gloves, overall, safety shoes, etc.).
- Use lifting equipment of adequate load limit.
- For lifting unbalanced loads, use ropes of different lengths or chains with adjustable length.
- Check each time the conditions of all equipment used and discard it if not in perfect working order.
- Do not knot or twist the ropes so as not to reduce the lifting capacity or produce torsional effects on the load being lifted.
- Use the utmost caution and remain at a safe distance from lifted actuator unless absolutely necessary; do not stand or pass under suspended loads.
- Pay attention in putting under tension the ropes to prevent the load shifting sideways in an uncontrolled manner.
- Use slings of such length that the angles of the leg from vertical are as narrow as possible ($\alpha MAX < 45°$).
- During handling, do not transport the suspended actuator above staff members in charge of the operation.

NOTE:
When α angle widens:
- The traction exerted on the respective ropes increases. It is thus necessary to use ropes with greater nominal load capacity.
- The working condition of the lugs is aggravated.

⚠ WARNING

Potential risk:
Breaking of slings.

Elimination of the potential risk – Code of practice:
Always ascertain that the lifting capacity of the ropes used is adequate for the load and for the way it is harnessed. Amply underrate the working load limit, also in consideration of any wear condition of the equipment.

NOTE:
The weights indicated in Table 8 refer to the actuator only. The overall weight of the machine, inclusive of the actuator's accessories, is specified on the delivery note.

5.3 Actuator Handling

5.3.1 General Handling Provisions

Biffi Italia s.r.l. has provided purpose designed hooking (lugs and eyes) and lifting points on the actuator (→ Figure 14). For handling operations by means of overhead lifting equipment, a crane or similar means can be used. If the actuator is packed on a pallet, then a fork lift truck will have to be used.

⚠ WARNING

Code of practice:
Strictly follow all handling procedures foreseen by Biffi Italia s.r.l., both with regard to the hooking points, and to the means to use. In any case, always comply with the health and safety regulations in force in the country of installation.

- Check the track in advance so as to identify any hindrance or obstacle (narrow or low passageways, ragged paving, clutter).
- Prevent suspended loads from swaying excessively and traverse at low speed.

⚠ WARNING

Code of practice:
Provide for a person to stay on the ground and assist the driver in case of insufficient visibility.

Section 6: Receipt and Installation of Actuator

6.1 Receipt and Inspection

Checks to be carried out on receiving the actuator:

1. Check that the model, the serial number and the technical data featured on the ID plate (refer to Section 3.2) are the same as the ones featured on the order acknowledgement, on the delivery note or on the acceptance certificate.
2. Check that the fitted accessories comply with those listed in the order acknowledgement and the delivery note (refer to Section 3.2).
3. Upon arrival the Client must very carefully check the conditions of all the material received and report immediately any damage to the carrier. It is recommended to produce photographic evidence of any damage detected.

Contact as soon as possible Biffi Italia s.r.l. (refer to Section 2.1). If needed, restore varnishing according to the specifications featured in the order acknowledgement.

4. If the actuator arrives already assembled onto the valve, the settings have already been made.
5. If the actuator is delivered separately from the valve, please refer to the paragraphs below as regards installation and commissioning.

6.2 Storage

In the event that the actuator is not going to be installed straight away, it must be stored in a dry and airy place, preferably protected against direct sun light.

The surface where the actuator has to be stored must be clean, flat and suitable for the weight. Make sure it is stable and cannot fall off. Paper documents require special care.

NOTICE

Particular attention must be paid to the coupling surface with the valve, in order to prevent it from being damaged and preserve its characteristics.

In the event that the actuator has to be stored for a long period, the provisions below must be closely observed:

- Indoor storage in a sheltered environment:
  - Rest the actuator on a wooden surface, being careful not to damage the coupling surface with the valve.
  - Coat the coupling surface with oil, grease or protective disk to preserve its characteristics.
  - Make sure the plastic plugs are in place on both hydraulic and electrical ports (if fitted). In a sheltered environment, the plugs need not be water or weatherproof, as they are only meant to prevent debris from getting inside.
  - Check that the lids of electrical enclosures, if fitted, are properly closed.
  - Periodically operate the actuator.
- In the event that storage in a sheltered environment is not feasible:
  In addition to the above provisions, implement also those here below:
  - Make sure the actuator is protected against atmospheric agents (cover it with a tarpaulin).
  - Replace the plastic plugs for the hydraulic and electrical ports (if fitted) with water and weather proof metal plugs.
  - Periodically operate the actuator.

6.3 Customer Duties

- Provision of installation site

NOTE:
The Purchaser is responsible for equipping the installation premises in accordance with the health and safety regulations in force in their own Country.

- Provision of lighting system
  If the actuator is installed indoors, the room must be provided with proper lighting system, so as to prevent any hazard conditions.

⚠ WARNING

Safe installation information:
The lighting of the premises where the actuator is installed must not create dark areas, strong, dazzling or stroboscopic effects.

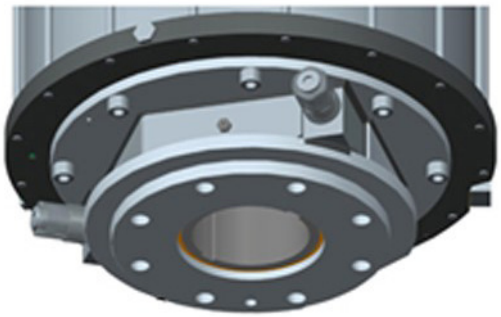
6.4 Assembly Procedures

NOTE:
The procedures of this section refer to the vertical installation of the actuator.
For the procedures referring to horizontal installation, please refer to the confirmation documentation.

6.4.1 Assembly

The actuator can be coupled to the valve via the coupling flange fitted with threaded bores.

Figure 17. Example of Coupling Flange



- With regard to the different coupling interfaces, please refer to Section 3.13.
- With regard to the bush insert or sleeve that can be used to connect the actuator output drive to the valve stem, please refer to Section 3.14.

NOTE:
With regard to the type of coupling interface fitted on the actuator, please refer to the documentation specified in the order acknowledgement.

- P.P.E. to be used during installation procedures:

NOTICE

- Non-observance of the procedures described below will invalidate the product warranty.
- Installation, commissioning, maintenance and repair interventions must be performed by adequately skilled and trained personnel.
- Refer to the documentation relative to the order acknowledgement to ensure that installation is consistent with the plant.
- Refer to the documentation relative to the order acknowledgement to check consistency between actuator to valve interface and coupling elements.

⚠ WARNING

Assembly not performed in compliance with the provisions specified in the present document can:
- Give rise to severe accidents and cause damage to persons and property
- Affect the actuator functional performance

NOTICE

When the lower chamber is pressurized, the actuator status corresponds to the closed-valve position. For a proper assembly of the actuator, set the valve stem and/or the actuator so that the direction of rotation generated by the actuator and its status are consistent with the position of the valve.

⚠ WARNING

Assembly not performed in compliance with the above provision can:
- Give rise to severe accidents and cause damage to persons and property
- Affect the actuator/valve functional performance

- Procedure

1. Refer to the instructions provided in section 4 when handling and lifting the actuator for installation purposes.
2. Operate the actuator so that, during assembly, it is in the same position as that of the valve.
3. To prepare the valve for actuator assembly, proceed as follows:
   A. Lubricate the valve stem with oil or grease to facilitate assembly. Do not lubricate or apply grease to the flange.
   B. Clean thoroughly and remove all traces of oil or grease from the coupling flanges of both actuator and valve.
4. If a stem extension or a fitting insert (both provided separately) is being used, fix it in place by means of specific dowel screws.
5. Lift the actuator by using the provided lifting points (→ Section 4.2) ensuring the lifting equipment and slings are suitable for the weights to be lifted (→ Weights: Table 8).
6. Have ready to hand all the components required to perform correct coupling between:
   A. Valve stem and actuator bush insert or sleeve, namely:
      — Keys and tabs
      — Threaded dowel screws
   B. Valve-actuator coupling flanges
      — Dowel or locating pins, if required
      — Threaded fasteners (stud bolts, bolts and nuts)

7. Position the actuator vertically above the valve and lower it slowly so that the insert located on the valve stem can fit into the actuator coupling area. Do not force the actuator inside, but allow it to reach coupling by its own weight.
8. Check that the bores on the two coupling flanges correspond. If the bores on the two coupling flanges are not aligned, activate the stoppers (elements used to adjust the angular stroke - refer to Section 7.2) to generate a rotation of the actuator and complete the coupling operation.
9. Tighten the actuator bolts to the valve. The tightening torques to be applied, in order to ensure proper coupling between valve and actuator, are specified in the table below:

Table 16. Tightening torques (applicable for ASTM A320 L7 screws and ASTM A194 gr.7 s3 nuts)

Thread size	Tightening torque (Nm)
M8	20
M10	40
M12	70
M14	110
M16	160
M20	320
M22	420
M24	550
M27	800
M30	1100
M33	1400
M36	1700

NOTES:
If the items are supplied by Biffi Italia s.r.l., the customer will receive:
- Stud bolts material: ASTM A320 L7
- Nuts material: ASTM A194 gr. 7 s3

NOTICE

Refer to the documentation relative to the order acknowledgment to check the materials of the threaded fasteners used to fix the actuator to the valve. If the items are supplied by Biffi Italia s.r.l., apply the torques indicated in Table 16.

6.4.3 Pneumatic Connections

The present manual contains a description of the procedures to be observed in order to perform connection of pneumatic interfaces in the proper way. With regard to a correct functional connection, please refer to the relevant pneumatic diagram specified in the order acknowledgement.

- P.P.E. to be used during installation procedures:

NOTICE

The steps described below must be carried out before proceeding to connect the actuator to the pneumatic line:

- Make sure the pneumatic line pressure rate corresponds to the value indicated on the actuator rating plate.
- Make sure the pipes and fittings of the pneumatic line are suitable for the job to be carried out (type, material and size).
- Make sure that, before reaching the actuator, the pressurized fluid is adequately filtered and cleaned from any solid and liquid residues.

⚠ WARNING

Operating the actuator at a pressure rate higher than the limit values specified on the rating plate (refer to Section 3.2) may:

- Give rise to severe accidents and cause damage to persons and property
- Affect the actuator functional performance

- Procedure:

1. Accurately deburr the ends of rigid pipes, if fitted.
2. Thoroughly clean the inside of pipes by blowing air or nitrogen through them.
3. Shape and fasten the pipes in such a way as not to cause unusual stress at the mouthpiece or loosening of threaded connections.
4. Carry out the connections according to the provided functional diagram (refer to Section 3.14).
5. Check for leaks from the pneumatic connections.

6.4.4 Electrical Connections (If Foreseen)

Some actuators might need to be connected to the mains.

- P.P.E. to be used during installation procedures:

NOTICE

The steps described below must be carried out before proceeding to connect the actuator to the electric line:

- Make sure the characteristics of the electrical power supply correspond to the indications given on the rating plates of electric components on the actuator, if fitted.
- Make sure the components used are suitable for the job to be carried out (type, material and size).
- Observe the safety provisions laid down in Standard CEI 64-8 (equivalent to IEC 60364).
- Read the technical documentation provided by the Supplier, as regards electrical devices, if used.

⚠ WARNING

Before proceeding with any intervention, disconnect the power supply from the mains.

⚠ WARNING

Operating the actuator at a voltage rate higher than the limit values specified on the rating plate (refer to Section 3.2) may:

- Give rise to severe accidents and cause damage to persons and property
- Affect the actuator functional performance

- Procedure:

1. Remove the plastic plugs from the conduits.
2. Screw the cable glands to full extent.
3. Insert the wires for electrical terminals connection.
4. To ensure proper wiring, refer to the wiring diagram specified in the order acknowledgement.
5. Tighten the cable gland.
6. Replace the plastic plugs at the conduit mouthpiece with weatherproof metal plugs.

Section 7: Commissioning and Adjustments

7.1 Inspections Prior to Commissioning

NOTICE

- Make sure the pneumatic line pressure rate corresponds to the value indicated on the actuator rating plate.
- Make sure the mains supply voltage corresponds to the value indicated on the actuator rating plate.

⚠ WARNING

Operating the actuator at pressure or voltage rates higher than the limit values specified on the rating plate (refer to Section 3.2) may:
- Give rise to severe accidents and cause damage to persons and property
- Affect the actuator functional performance

NOTICE

Make sure the environmental limits of the installation location correspond to the limit values specified on the actuator rating plate.

⚠ WARNING

Operating the actuator in environmental conditions that are inconsistent with the temperature limit values specified on the rating plate (refer to Section 3.2) may:
- Give rise to severe accidents and cause damage to persons and property
- Affect the actuator functional performance

— Visually check for leaks on the various pneumatic connections present on the actuator (and in the control panel). If necessary, carry out the pneumatic connections again (refer to Sections 3.15, 3.16 and 3.17).

— Visually check integrity of varnish coating. If needed, restore according to the specifications indicated in the order acknowledgement.

NOTICE

Ensure that the actuator can:

- Perform all the functions as provided by the pneumatic functional diagram
- Transmit all the diagnostics signals (consistent with the wiring diagram) with regard to the different status conditions of the actuator during the performance of its various functions.

Please refer to the documentation relative to the order acknowledgement with regard to the pneumatic functional diagram and the wiring diagram.

⚠ WARNING

Using the actuator under partial operating conditions with respect to the provided functions, or if the diagnostics is not complete, can affect the functional performance of the plant where the actuator is integrated.

⚠ CAUTION

It is absolutely FORBIDDEN to commission the actuator prior to having performed all the inspections described above and under obvious faulty or potentially hazardous conditions.

7.2 Calibrating the Angular Stroke

- P.P.E. to be used during installation procedures:

The angular stroke (0 to 90°) of the quarter turn valve might need to be adjusted owing to misalignment between valve stem and actuator. In all TPD series models, the rotation angle of the output drive can be adjusted by changing by ± 5° its end positions (OPEN – CLOSED) within the limit values (-5°; +95°), by means of two mechanically adjustable end stoppers.

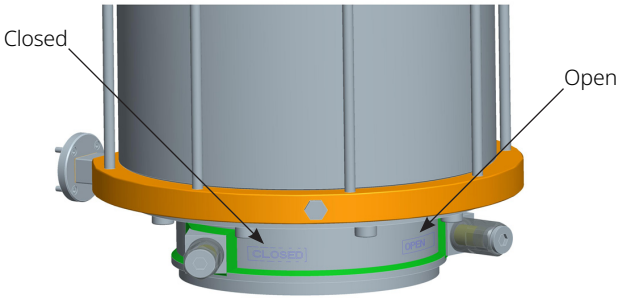
Both stoppers are located in the lower part of the actuator, protected by the head flange of the pneumatic cylinder.

NOTICE

The same design solution was implemented for the stoppers, which are exactly the same and both protected so as to prevent them from being polluted by polluting agents. Please refer to the documentation relative to the order acknowledgement with regard to overall dimensions and interface drawing, to clearly identify the stoppers position and make adjustments to the actuator open and closed positions, if needed.

The two stoppers provided on every TPD series actuator are identified by specific labels (as shown in the figure below).

Figure 18. Stopper Operation



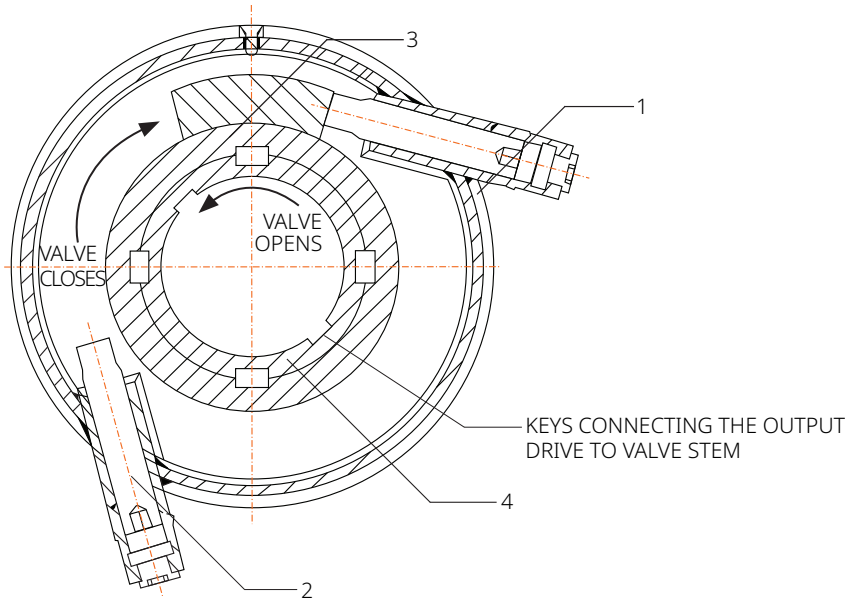
The function of the two stoppers is described here below:

- Stopper CLOSED:
  This adjustment allows changing the angular position of the output drive within the following range: -5°; +5°, so that the output drive can be aligned with the valve stem when in CLOSED status.
- Stopper OPEN:
  This adjustment allows changing the angular position of the output drive within the following range: +85°; +95°, so that the output drive can be aligned with the valve stem when in OPEN status.

For the sake of clarity, Figure 19 shows a plan view of a section of an actuator base, with the structural details of the stoppers and their operation.

Figure 19 shows also the structural detail of the groove orientation for the output drive keys.

Figure 19. Stopper Operation



In detail:

1. Stopper for CLOSED valve
2. Stopper for OPEN valve
3. Sector for adjustment
4. Output drive (lower part)

Note that:

- The output drive is in closed position (refer also to Figures 5, 6 and 7).
- Direction of rotation of the valve when closing or opening

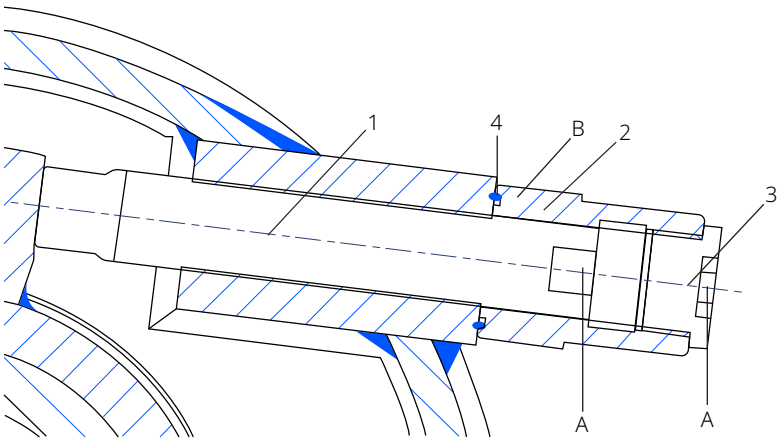
Moving stopper 1 position forward or backward allows adjusting the angular position of the output drive when resting against the stopper in CLOSED status.

A similar operation can be performed on stopper 2 to adjust the angular position of the output drive in OPEN status.

NOTE:
With regard to the type of coupling interface fitted on the actuator, please refer to the documentation specified in the order acknowledgement.

For the sake of clarity, Figure 20 shows the structural solution implemented for each stopper, the main components and the type of wrench to be used.

Figure 20. Stopper Components



1. Stopper
   This consists of a right-hand threaded dowel screw and is screwed inside the housing located on the base of the actuator. By using a type A wrench, the stopper can be moved forward or backward, to change the contact position with the adjustment sector and, consequently the extreme angular position of the output drive.
2. Stopper guard
   This is screwed onto the stopper and can be moved by using a type B wrench. Its functions are:
   - To protect the stopper against direct contact with polluting agents, as it is fitted with a seal – item 4.
   - To keep the stopper in place by tightening it.
3. Plug
   This prevents polluting agents from getting inside the stopper guard. By using a type A wrench, it can be removed so as to reach and move the stopper.
4. Seal
   This prevents polluting agents from getting inside the stopper guard.

- Procedure:

NOTE:
The stoppers can be moved easily when the component identified as “adjustment sector” is not in contact with the stopper. If the actuator is operated by the pressurized cylinder, it generates a torque that affects the stopper and prevents it from being moved.

With reference to Figure 20:

1. Remove the plug (3).
2. Loosen the stopper guard (2).
   NOTE: when the stopper guard is being loosened, the seal (4) could come out of its housing.
3. Move the stopper (1) by right or left-hand rotation so as to displace forward or backward, depending on the type of adjustment required.
4. When the stopper required position is reached, put the seal (4) back in its housing located in the stopper guard (2).
5. Tighten the stopper guard (2) so as to lock the stopper (1) in place.
6. While performing the previous step, keep the stopper (1) steady by means of the specific wrench.
7. Put the plug (3) back in place.

Table 17 indicates the type of wrench needed to rotate the stopper (1), remove and tighten both the guard (2) and the plug (3):

Table 17. Wrench Sizes for Stopper Adjustment

Actuator Model	Stopper (1, Figure 20) Type A Wrench	Guard (2, Figure 20) Type B Wrench	Plug (3, Figure 20) Type A Wrench
TPD 0.A xx - zzzz	6	19	6
TPD 0.1 xx - zzzz	8	24	6
TPD 0.3 xx - zzzz	8	24	6
TPD 0.9 xx - zzzz	12	46	12
TPD 1.5 xx - zzzz	14	46	17
TPD 3 xx - zzzz	14	46	17
TPD 6 xx - zzzz	19	60	17
TPD 14 xx - zzzz	17	65	17
TPD 18 xx - zzzz	17	65	17
TPD 32 xx - zzzz	17	65	17

NOTE:
With reference to Section 3.10, the alphanumeric sequences **xx** and **zzzz**, featured in the identification code of the actuator model, are indicated in general terms because the type of interface used for actuator to valve coupling depends NEITHER:
- On the kinematic mechanism (xx = RP/SY)
- Nor on the type of cylinder (zzzz)

Section 8: Biffi Limit Switch Box (If Fitted)

Biffi limit switch box, in its various configurations, is one of the devices that can be installed on TPD series actuator to indicate the position of the actuator.

This paragraph can be applied and is valid only and exclusively if Biffi limit switch box is identified in the order acknowledgement as the position indicator device being used.

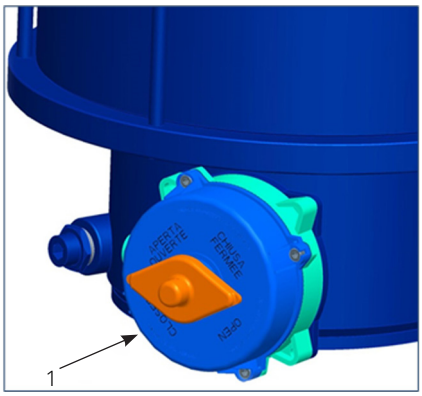
NOTE:

As a standard, the actuator is delivered with the valve position indicator device already installed (whichever it may be). Therefore, the scope of this section is not to provide a description for installing Biffi limit switch box on board the machine, but rather a description regarding the calibration of the limit switches housed inside the box.

8.1 Calibration of Biffi Limit Switches (If Fitted)

Microswitches are placed inside a special box (1), located at the base of the actuator, shown in Figure 21:

Figure 21. Stoppers: Position Adjustment



NOTICE

Operate only the microswitch corresponding to the direction of motion being carried out, as clearly indicated on the microswitch. Reference documentation: → wiring diagrams.

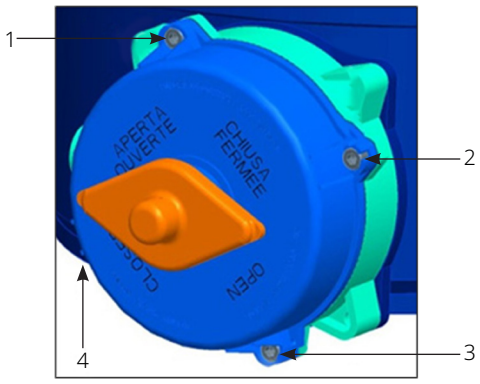
8.1.1 Limit Switch Calibration Procedure

- P.P.E. to be used during installation procedures:

- Procedures

1. Disconnect the power supply from the main supply.
2. Unscrew the fastening screws on the cover, see Figure 22.
3. Remove the cover cautiously.
4. Locally move the actuator to open or closed status, accordingly.

Figure 22.

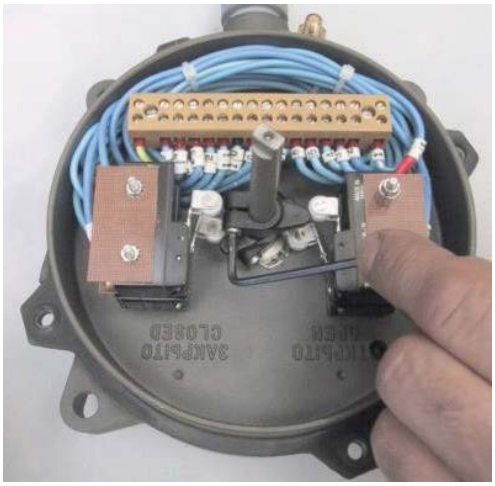


⚠ WARNING

Potential risk:
Damages to the seal and coupling surfaces.

5. Loosen the screw of the actuating cam associated to the microswitch and calibrate it accordingly, refer to Figure 23.
6. Tighten the screw.
7. Operate the actuator and calibrate any other microswitch, using the same procedure described above.
8. Put the cover back in place, making sure the camshaft grips with the indicator drive shaft.
9. Ensure that the cover is properly oriented and the indicator is pointed to the correct valve status (“Open” or “Closed”).
10. Tighten the screws on the cover.
11. Restore the power supply.

Figure 23. Cam Calibration



NOTICE

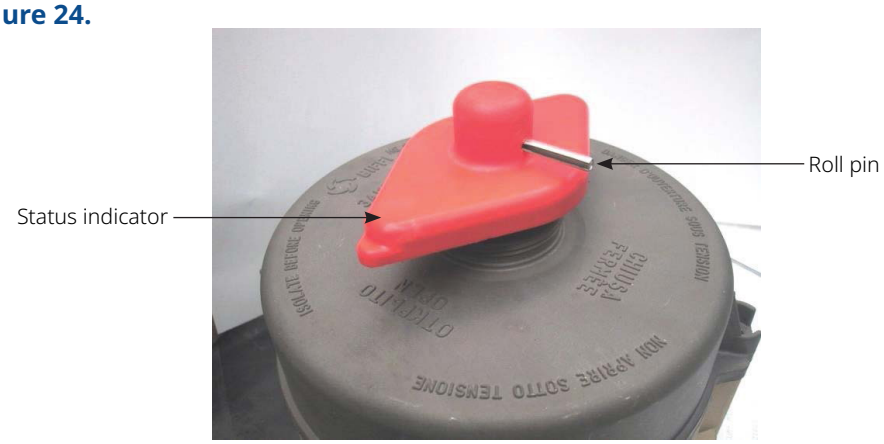
Limit switches should trigger before the actuator is halted by the stoppers at stroke end. Calibrate the associated cams accordingly.

8.1.2 Indicator Reset Procedure

If the indicator does not point to the correct valve status (“Open” or “Closed”), proceed as described below:

1. Remove the roll pin from the status indicator.
2. Slowly turn the indicator to the correct position.
3. Put the roll pin back in place.

Figure 24.



Section 9: Routine Maintenance

TPD series actuators are designed to run without requiring maintenance for long periods under hard operating and environmental conditions (refer to Section 3.12) and in unmanned areas.

Despite that, owing to the great number of different conditions in terms of environment, operation and installation, it is however recommended, for this type of product, to perform routine maintenance interventions on a biannual basis, as described below.

NOTE:
With reference to the Remark note contained in Section 3.1, the instructions regarding maintenance apply to the actuator only and not to its accessories.

9.1 General Information

To ensure an optimal performance level of the machine, it is recommended to observe the procedures and schedules provided.

Assigned staff:	Qualified and authorized mechanical maintenance technician. Qualified and authorized electrical maintenance technician (only if electrical connections are fitted).
Number of staff:	2 maintenance technicians
P.P.E.:	
Residual risks:	The main causes for potential serious damage to persons and property that could occur during maintenance are: accumulation of pressure inside the cylinder.
Eliminating the residual risk:	Strictly observe the procedures specified in the Instruction Manual and always proceed with extreme caution.

⚠ WARNING

Risk of damage to persons and property:
Before proceeding with any maintenance intervention, disconnect the pneumatic supply and release pressure from the cylinder via the control panel.

NOTE:
Overconfidence in maintenance procedures, resulting from the cyclic and recurrent repetition of the same actions, can lead to a relaxed behavior towards maintenance interventions and a decreased attention span. Such attitude can also give rise to extremely serious and irreversible damage to persons and property. Therefore, it is highly recommended to proceed always with utmost care and, in case of doubt, refer to the IOM or contact Biffi Italia s.r.l. After Sales Service.

9.2 Monitoring and Visual Inspection Activities

The interventions recommended to be performed every two years of running time, are listed in the table below:

Table 18. Maintenance Summary Table

Every 2 years		
Type of Intervention	**Description**	**Ref.:**
	Check that valve is moved correctly by the actuator, with all the provided modes and declared motion times. If the actuator is used infrequently, it is good practice to perform some motions using all the provided controls (remote, local, emergency), if this activity is compatible with the plant conditions. During the motion, check, if possible, consistency in the diagnostic indication as regards the status of actuator/valve. (Refer to the documentation relative to the order acknowledgement to check the type of actuator status indicator device installed).	-
	Check for pressure leaks in the pneumatic circuit.	-
	If the actuator is equipped with a desiccant filter for pneumatic air, check the drain pan for collection of condensate water and clean it regularly; filter maintenance is determined by the type of filter installed. To disassemble the filter, please refer to the Supplier's documentation. With regard to the control panel components, refer to the documentation relative to the order acknowledgement and to the functional wiring and pneumatic diagrams.	-

9.3 Monitoring and Visual Inspection Activities for SIL Certification

To keep the SIL level at the initial level, is it mandatory, pursuant to the provisions of Standard IEC 61508, to check the actuator smooth operation at regular intervals, as described below:

Table 19. Checks for SIL Certification

Check	**Frequency**
Perform: - a complete valve open/close motion, or - a partial valve open/close motion (if the actuator model is provided with such function)	Annual
Perform the periodic maintenance interventions specified in Section 9.2.	Refer to Section 9.2

Section 10: Supplementary Maintenance

Supplementary maintenance interventions prescribed by Biffi mainly regard replacement of non-metal material of the pneumatic cylinder, which can deteriorate and lose efficiency owing to the combined effect of:

- Ageing (mainly dependent on the environmental conditions where it is used),
- Number of motions (dependent on the actuator application in the plant where it is integrated).

On the basis of the various different conditions in terms of environment, installation and operation under which TPD series actuators can be subject, for the purpose of ensuring machine optimum performance levels, Biffi Italia s.r.l. recommends that the supplementary maintenance interventions described in the present manual be executed in a preventative and planned manner, every time a stoppage of the plant, where a TPD series actuator is installed, is scheduled for maintenance purposes.

Unplanned supplementary maintenance intervention will be required when a decrease in efficiency is assessed as being due to the actuator and, in particular, to the seals.

NOTE:

Section 12 is a useful reference for identifying potential problems arising from poor maintenance.

NOTE:

The supervisor of the plant, where the TPD series actuator is installed, is responsible for:

- Verifying the feasibility of supplementary maintenance interventions described in this manual, on the premises where the actuator is installed or in a specialist workshop.
- Verifying the need to disassemble the actuator from the valve (in that respect, refer to valve operating instructions).
- Planning supplementary maintenance of TPD series actuators in line with the plant maintenance schedule, in order to ensure availability, within the required timing, of maintenance personnel and spare parts.

10.1 General Information About Supplementary Maintenance

Assigned staff:	Qualified and authorized mechanical maintenance technician. Qualified and authorized electrical maintenance technician (only if electrical connections are fitted).
Number of staff:	2 maintenance technicians
P.P.E.:	

NOTE:
The supplementary maintenance interventions described below require the actuator to be disassembled and certain internal and external components to be handled.

⚠ WARNING

Potential risk of damage to persons and property:
When the valve opens/closes, a chamber (upper or lower) of the actuator is pressurized. The pressure of the chambers is set to zero when the actuator is not operating the valve; the final user is however advised to verify that this condition is applied for the actuator being used. Strictly comply with the provisions specified in the present manual.

⚠ WARNING

Failure to observe the procedures and prohibitions specified in this manual can have serious consequences as regards the safety of persons and property.

Before proceeding with any of the supplementary maintenance interventions described in this manual:

NOTE:
Ensure that the plant infrastructures are consistent with the health and safety of staff in charge of maintenance and that:

- Space and equipment are adequate for components lifting and handling operations.
- Fixtures and hand tools can guarantee compliance with the dis/assembly provisions specified in this manual.
- No component, once disassembled, is at risk of falling by gravity, owing to installation conditions.
- The pressure inside the cylinder chambers has been exhausted.

Refer to Tables 21, 22 and 23 in Section 10.4 for useful information as regards:

- Lifting and handling equipment for the components being disassembled
- Space required for components disassembly and handling
- Fixtures and/or hand tools required for components dis/assembly (even in those cases where installation conditions can cause components to fall if not adequately handled)

NOTICE

In view of the complexity and residual risks mentioned in the present manual, supplementary maintenance interventions can be performed exclusively by personnel provided by Biffi or qualified on a training course provided by Biffi Italia s.r.l.

TOOLS REQUIRED:

The tools listed in the table below are required during assembly and disassembly of the pneumatic cylinder:

Table 20. Hand Tool Types for Pneumatic Cylinder Assembly and Disassembly

Name	Image	Threaded Item
Open-end spanner		Locking nuts of tie rods (1, Figure 26/1A and 1B, Figure 30)

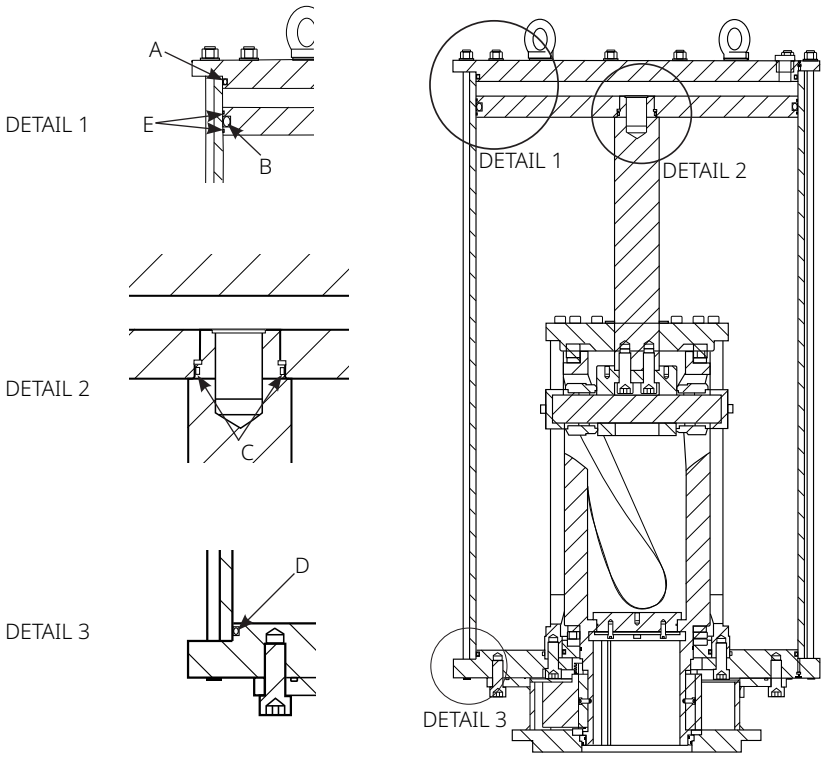
Contact Biffi Italia s.r.l. (refer to Section 2.1) for further information.

10.2 Replacing the Seals for TPD 0.A /0.1/0.3/0.9/1.5/3/6

10.2.1 Position of Seals and Components to be Disassembled

Figure 25 shows a 2D section of a TPD 0.A /0.1/0.3/0.9/1.5/3/6 series actuator model, with a detailed view of all the pneumatic cylinder seals.

Figure 25. Pneumatic Cylinder Seals



Pneumatic Cylinder Seals Type

A – end flange seal

B – piston outside seal

C – piston inside seal

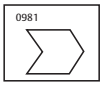
D – head flange seal

E – sliding ring

0981

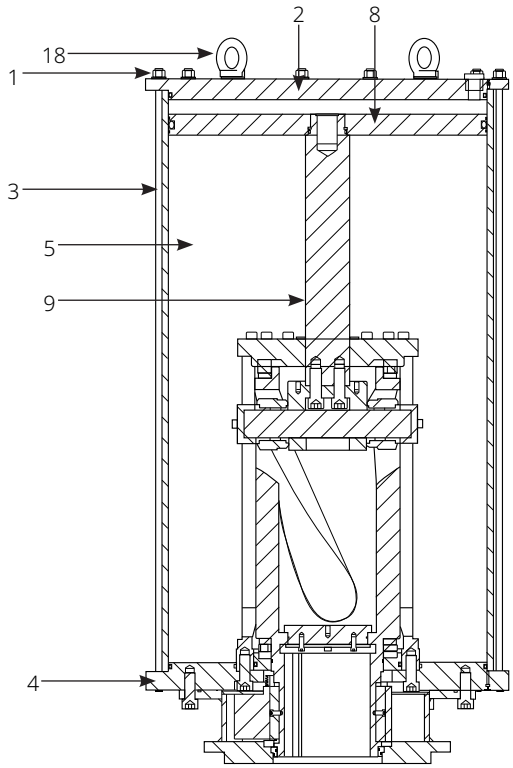
The codes for the pneumatic cylinder seals, for all TPD series actuator models, are listed in Tables 24 and 25.

Figure 26 shows a detailed 2D view of the main components, identified by numeric indexing, that have to be disassembled or used when replacing the pneumatic cylinder seals.



The numbers in Figure 26 are the same as the ones used for Figures 3 and 4.

Figure 26. Pneumatic Cylinder Components



Components to be 'disassembled' when replacing pneumatic cylinder seals

1. Tie rod nut
2. End flange
3. Tie rod
4. Head flange
5. Cylinder
8. Piston thrust flange
9. Piston rod
18. Lifting lug

10.2.2 Replacing the Seals (TPD 0.A/0.1/0.3/0.9/1.5/3/6)

NOTE:

- Carefully read Section 10.1.
- Refer to Section 10.4 for useful information as regards size, weight, space required to handle the components being disassembled.

10.2.2.1 Assessing the Need for Replacing the Seals (TPD 0.A/0.1/0.3/0.9/1.5/3/6)

The plant supervisor will decide whether to proceed with a replacement of the seals of the pneumatic cylinder. However, Biffi Italia s.r.l. suggests to take into consideration the factors below:

- Visually check for air leaks near the head flange (4, Figure 26) and near the end flange (2, Figure 26).
- Check feasibility for a total seal replacement intervention on the basis of the operating modes described in Sections 10.2.2.2, 10.2.2.3 and 10.2.2.4 and on the information contained in Section 10.4.
- Check how long since the last total replacement of the cylinder seal and plan the actuator supplementary maintenance interventions to be performed together with the plant maintenance schedule.

10.2.2.2 Disassembling the Pneumatic Cylinder (TPD 0.A/0.1/0.3/0.9/1.5/3/6)

NOTE:

The supplementary maintenance interventions described below require disassembly of all the accessories with which the actuator is equipped (control panel, valve status indicator device, manual override device, and sundry items). Consequently, the pneumatic cylinder disassembly procedure refers to the components featured in Figure 26, which represents the actuator status required at the start of the present procedure. In this regard, refer to the documentation relative to the order acknowledgement.

NOTICE

Make sure to have received and have to hand all the documentation relative to all the components (actuator and accessories) that have to be disassembled and reassembled.

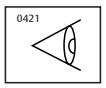
Strictly observe all the procedures and provisions indicated here below, so as to guarantee the safety of all staff members in charge of maintenance and the integrity of the actuator.

⚠ WARNING

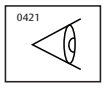
Risk of damage to persons and property:
Before proceeding with any maintenance intervention, disconnect the pneumatic supply and release pressure from the cylinder via the control panel; verify there is no residual pressure inside the pneumatic cylinder.

- Procedure:

1. Verify the valve is in “CLOSED” position so that the piston is in “UP” position, i.e. near the end flange.
2. Remove the fitting screwed to the pneumatic interface 1 (refer to Figures 8 and 9) and used to supply the cylinder upper chamber.



Once the pneumatic fitting is removed, the pneumatic interface 1 (refer to Figures 8 and 9) allows inspection of the upper chamber of the pneumatic cylinder. In that status, the piston shall never rest against the end flange, but there must always be a few millimeter gap.



A useful diagnostic indication of the actuator status is provided also by the device indicating the valve status (if it was considered appropriate not to disassemble it) or by the position of its interface shaft (refer to Figure 13).

3. Ensure the cylinder (5, Figure 26) is locked in place by means of the specific fixture.

NOTE:

The cylinder (5, Figure 26) is locked in its mounting position, by means of: head and end flanges (2 and 4, Figure 26), the tie rods (3, Figure 26) and tie rods nuts (1, Figure 26). Since the cylinder disassembly operation requires the removal of nuts and tie rods, the cylinder is no longer locked. Biffi Italia s.r.l. can provide the specific fixture that allows the cylinder to stay locked, by keeping it in place, during disassembly and seal replacement (Section 10.4).

4. Remove the tie rod nuts (1, Figure 26).
5. Remove the tie rods (3, Figure 26).
6. Remove, by means of the lugs (18, Figure 26), the end flange (2, Figure 26) from its housing in the cylinder (5, Figure 26).

NOTICE

The above operation must be performed with great care, so as to prevent spoiling the outer varnish coating. Restore any damaged varnish coating.

7. Remove the piston thrust flange (8, Figure 26). This operation is facilitated by the presence of threaded bores (Figure 27), which are not used to keep the component fastened, but can be used for:
   A. Easing the unscrewing of thrust flange (8, Figure 27) from the stem (9, Figure 27): insert and screw in some screws to be unscrewed.
   B. Partially unscrew the flange.
   C. Remove the screws and insert the lifting lugs for thrust flange. Complete the unscrewing and lift the plate.

NOTE:

The weight of the thrust flange, the number of threaded bores present on the thrust flange, the type of thread of the lifting lugs to be used for unscrewing and lifting the thrust flange are featured in Table 23.

Figure 27. Piston (Detail)

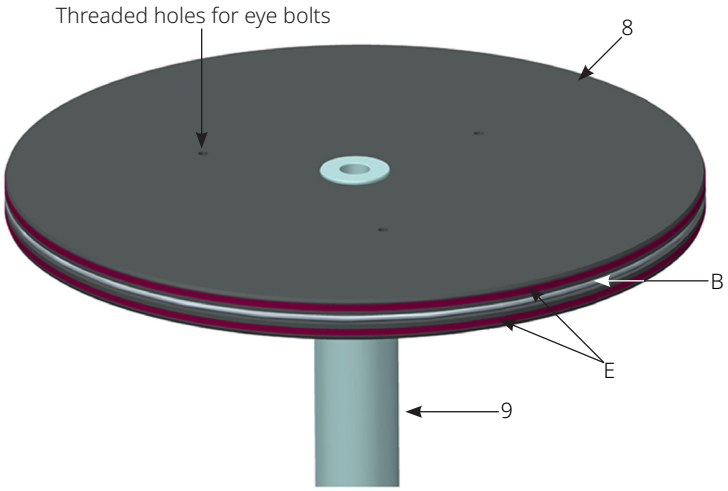


Figure 27 shows, in detail, the thrust flange (8), the stem (9) onto which the flange is screwed, the outer seal of the piston (B), the sliding rings of the piston (E) and the threaded bores, on the upper face of the thrust flange, to be used for unscrewing and removing the flange from the stem.

8. Remove the cylinder locking fixture (5, Figure 26).
9. Lift the cylinder and remove it from the actuator (refer to Table 23 as regards weights and the height to which the cylinder has to be lifted in order to pull it out of the kinematic mechanism).

NOTE:

The height required to pull the cylinder out is one of the main parameters to be considered when assessing the space needed to perform supplementary maintenance interventions on the premises or in a specialist workshop. As regards the height and weight of the parts to be moved, refer to Table 23.

NOTICE

The cylinder (5, Figure 26) is not provided with screw interfaces for handling purposes. Use padded clamps or jaws so as to prevent damaging:

- The treatment inner coating, applied to protect the cylinder against corrosion and to facilitate the piston sliding movement.
- The treatment outer coating, applied to protect the cylinder against corrosion.

10.2.2.3 Replacing the Seals (TPD 0.A/0.1/0.3/0.9/1.5/3/6)

When the pneumatic cylinder is totally disassembled, all the seals can be replaced, namely on the cylinder and on the piston sliding ring (refer to Figure 25). The operations described below must be performed beforehand:

1. Thoroughly clean the slots and housings of seals and sliding ring; lubricate with protective film of grease.
2. Put the seals and sliding ring accurately in place on the relevant component, being careful that the material does not get pinched or damaged.

NOTE:
The first seal to be replaced and restored in place is the seal of the head flange (D, Figure 25) in order to reassemble the cylinder (5, Figure 26).

3. Grease and lubricate the seals in their housings and the sliding ring, so as to keep them in place during assembly.

NOTE:
As regards seal lubrication, Biffi Italia s.r.l. recommends this grease: AGIP-ENI LCX 2/32 for NBR/Viton®/Neoprene seals; Aeroshell® Grease 7 for Fluorosilicone seals.

10.2.2.4 Reassembling the cylinder (TPD 0.A/0.1/0.3/0.9/1.5/3/6)

The cylinder is reassembled by following in reverse order the sequence described in Section 10.2.2.2.

NOTE:
- As regards the type of hand tools required to assemble the cylinder, refer to Table 20.
- The tie rods nuts (1, Figure 26) are functional to the structural integrity of the pneumatic cylinder; the tightening torque to be applied is detailed in terms of the type of tie rod and the material. Refer to Tables 21 and 22.

- Procedure:

1. Ensure that the seal (D, Figure 27) of head flange (4, Figure 26) has been replaced and assembled.
2. Lift the cylinder (5, Figure 26) and put it back in place by performing the operations below:
   - A. Thoroughly clean the cylinder inner surface and ensure that neither the surface nor the mouthpieces are damaged.
   - B. Lubricate the entire inner surface and mouthpiece chamfers.
   - C. Lift the cylinder at such a height to avoid coming into collision with the piston stem and the inner mechanism.

D. Slowly lower it towards the head flange.

E. The lower part of the cylinder should rest against the head flange (as shown in Figure 25 – detail 3): proceed with the utmost caution in order to avoid damaging the seal (D, Figure 25).

F. In the event that, during this maintenance operation, the actuator position can cause the cylinder to fall, when in place as described at the previous point, a fixture suitable to lock the cylinder must be provided.

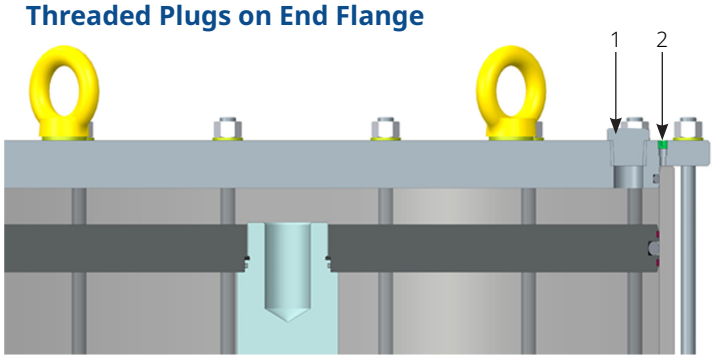
NOTICE

The cylinder (5, Figure 26) is not provided with screw interfaces for handling purposes. Use padded clamps or jaws so as to prevent damaging:

- The treatment inner coating, applied to protect the cylinder against corrosion and to facilitate the piston sliding movement.
- The treatment outer coating, applied to protect the cylinder against corrosion.

3. Ensure the cylinder (5, Figure 26) is locked in place by means of the specific fixture.
4. Verify the following items have been replaced and assembled: seal C (detail 2, Figure 25), seal B (detail 2, Figure 25) and the sliding rings of piston E (detail 1, Figure 25).
5. Lift the thrust flange (8, Figure 26) and center it with respect to the stem (9, Figure 26).
6. Re-screw the thrust flange (8, Figure 26) on the stem (9, Figure 26). Proceed with the utmost caution in order to avoid damaging the assembled seals.
7. Reassemble the tie rods (3, Figure 26) by screwing them in the bores on the head flange.
8. Reassemble the end flange (2, Figure 26) as follows:

Figure 28. Threaded Plugs on End Flange



1. Plug for pneumatic interface (the quantity depends on the actuator size)
2. Closure plugs for vents (if fitted)

A. Remove the threaded plug (or plugs) (refer to Figure 28) from the end flange (2, Figure 26) so as to allow the seal to settle in place during assembly.

B. Pay attention when assembling the end flange (2, Figure 26) by centering it with the cylinder (5, Figure 26); avoid damaging seal A (detail 1, Figure 25). The end flange should rest against the cylinder. In particular, verify the bores used for fastening the pneumatic panel are properly aligned: the bores on the end flange shall be aligned with the bores on the head flange.

9. Tighten the nuts (1, Figure 26) on the tie rods (3, Figure 26).

NOTICE

Tightening the tie rods and the nuts to the specific torque will guarantee the integrity of the pneumatic cylinder intended as pressure equipment.

- Refer to the documentation relative to the order acknowledgement with regard to the linkage material (1 and 3, Figure 26) the type of thread.
- Apply the tightening torques indicated in tables:
  - Table 21 - Tightening torques – Tie rod material: ASTM A320 – L7. Nut material: ASTM A 194 gr 7 s3
  - Table 22 - Tightening torques – Tie rod material: ASTM A320 B8M CL 2 – Nut material: EN ISO3506-2 A4-80

⚠ WARNING

Failure to observe the provisions above can:

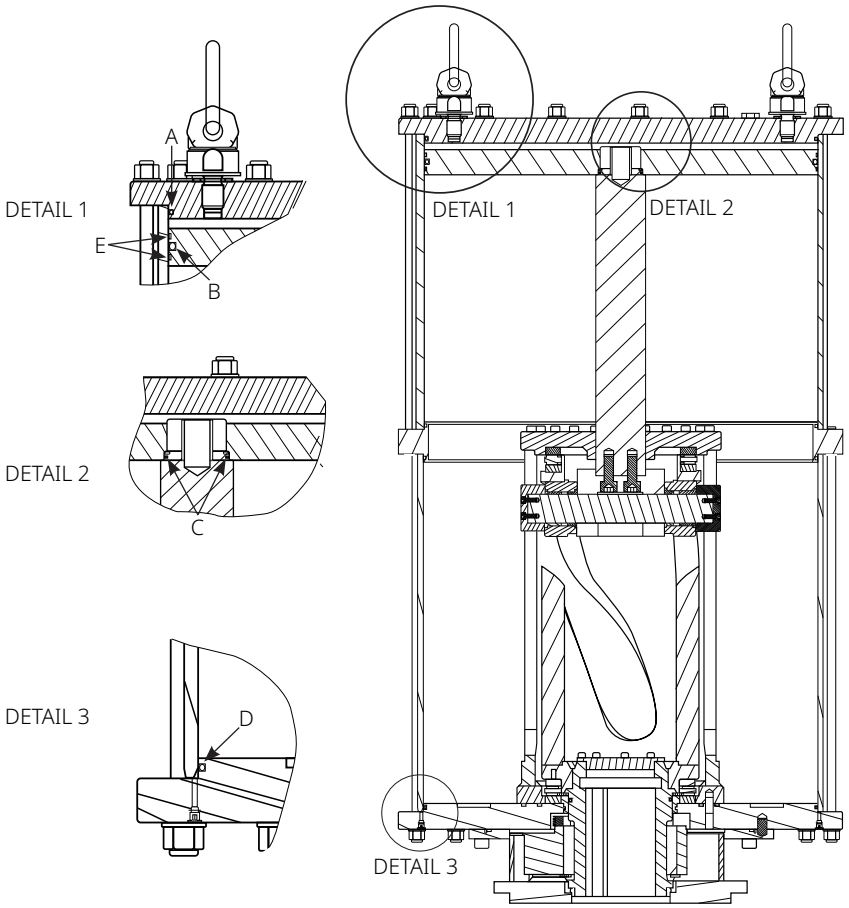
- Affect the actuator performance
- Cause serious consequences as regards the safety of persons and property.

10.3 Replacing the Seals for TPD 14/18/32

10.3.1 Position of Seals and Components to be Disassembled

Figure 29 shows a 2D section of a TPD 14/18/32 generic actuator model, with a detailed view of all the pneumatic cylinder seals.

Figure 29. Pneumatic Cylinder Seals



Pneumatic Cylinder Seals for TPD Series Actuators

A – end flange seal

B – piston outside seal

C – piston inside seal

D – head flange seal

E – sliding ring

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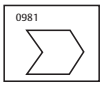
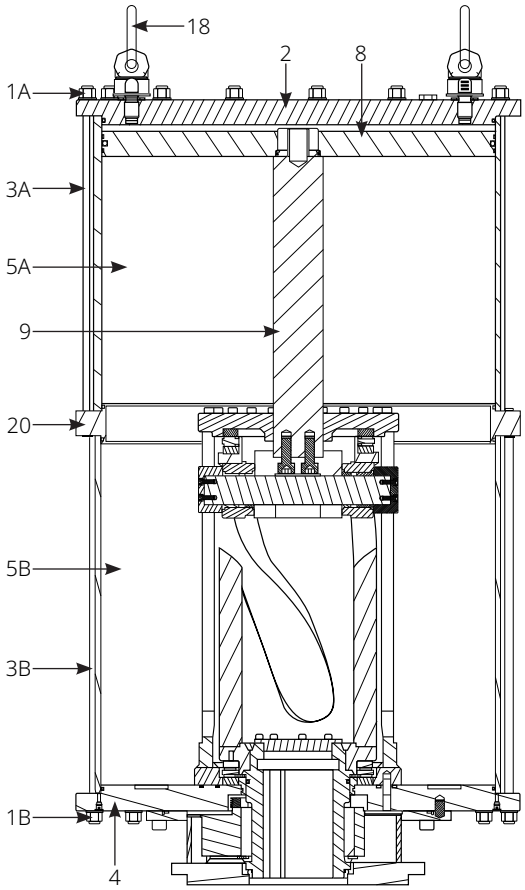
The codes for the pneumatic cylinder seals, for all TPD series actuator models, are listed in Tables 24 and 25.

Figure 30 shows a detailed 2D view of the main components, identified by numeric indexing, that have to be disassembled or used when replacing the pneumatic cylinder seals.



The numbers in Figure 30 are the same as the ones used for Figure 29.

Figure 30. Pneumatic Cylinder Components



Components to be 'disassembled' when replacing pneumatic cylinder seals

1A. Upper tie rod nut
1B. Lower tie rod nut
2. End flange
3A. Upper tie rod
3B. Lower tie rod
4. Head flange
5A. Upper cylinder
5B. Lower cylinder
8. Piston thrust flange
9. Stem
18. Lifting lug
20. Intermediate flange

10.3.2 Replacing the Seals (TPD 14/18/32)

NOTE:
- Carefully read Section 10.1.
- Refer to Section 10.4 for useful information as regards size, weight, space required to handle the components being disassembled.

10.3.2.1 Assessing the Need for Replacing the Seals (TPD 14/18/32)

The plant supervisor will decide whether to proceed with a replacement of the seals of the pneumatic cylinder. However, Biffi Italia s.r.l. suggests to take into consideration the factors below:

- Vsually check for air leaks near the head flange (4, Figure 30) and near the end flange (2, Figure 30).
- Assess the need for partially replacing the seals (i.e. only seals A, B, C, E in Figure 29, with the exception of the seal of the head flange D, Figure 29) or the need for the complete replacing (i.e. all seals).

NOTE:
TPD 14/18/32 actuators are fitted with a pneumatic cylinder divided into two parts: the upper cylinder (5A, Figure 30) and the lower cylinder (5B, Figure 30).
- For the partial replacing of the seals, only the upper cylinder shall be disassembled.
- For the complete replacing of the seals, both cylinders shall be disassembled.

- Check feasibility for a total seal replacement intervention on the basis of the operating modes described in Sections 10.3.2.2, 10.3.2.3 and 10.3.2.4 and on the information contained in Section 10.4.
- Check how long since the last total replacement of the cylinder seal and plan the actuator supplementary maintenance interventions to be performed together with the plant maintenance schedule.

10.3.2.2 Disassembling the Upper and Lower Pneumatic Cylinders (TPD 14/18/32)

NOTICE

Before proceeding with any operation, ensure that:
- The electrical power supply for the components on board the actuator is disconnected.
- The pneumatic supply for the actuator is disconnected.

NOTE:
The supplementary maintenance interventions described below require disassembly of all the accessories with which the actuator is equipped (control panel, valve status indicator device, manual override device, and sundry items). Consequently, the upper pneumatic cylinder disassembly procedure refers to the components featured in Figure 30, which represents the actuator status required at the start of the present procedure. In this regard, refer to the documentation relative to the order acknowledgement.

NOTICE

Make sure to have received and have to hand all the documentation relative to all the components (actuator and accessories) that have to be disassembled and reassembled.

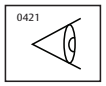
Strictly observe all the procedures and provisions indicated here below, so as to guarantee the safety of all staff members in charge of maintenance and the integrity of the actuator.

⚠ WARNING

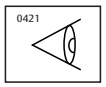
Risk of damage to persons and property
Before proceeding with any maintenance intervention, disconnect the pneumatic supply and release pressure from the cylinder via the control panel; verify there is no residual pressure inside the pneumatic cylinder.

- Procedure:

1. Verify the valve is in "CLOSED" position so that the piston is in "UP" position, i.e. near the end flange.
2. Remove the fitting screwed to the pneumatic interface 1 (Figure 10) and used to supply the cylinder upper chamber.



Once the pneumatic fitting is removed, the pneumatic interface 1 (Figure 10) allows inspection of the upper chamber of the pneumatic cylinder. In that status, the piston shall never rest against the end flange, but there must always be a few millimeter gap.



A useful diagnostic indication of the actuator status is provided also by the device indicating the valve status (if it was considered appropriate not to disassemble it) or by the position of its interface shaft (refer to Figure 13).

3. Ensure the upper cylinder (5A, Figure 30) is locked in place by means of the specific fixture.

NOTICE

The fixture used must allow the cylinder (5A, Figure 30) to stay locked in place even after removal of the nuts (1A, Figure 30) and of tie rods (3A, Figure 30), without spoiling the outer varnish coating of the cylinder.

NOTE:
The cylinder (5, Figure 26) is locked in its mounting position, by means of: head and end flanges (2 and 4, Figure 26), the tie rods (3, Figure 26) and tie rods nuts (1, Figure 26). Since the cylinder disassembly operation requires the removal of nuts and tie rods, the cylinder is no longer locked. Biffi Italia s.r.l. can provide the specific fixture that allows the cylinder to stay locked, by keeping it in place, during disassembly and seal replacement (Section 10.4).

4. Remove the tie rod nuts (1A, Figure 30).
5. Remove the tie rods (3A, Figure 30).
6. Remove, by means of the lugs (18, Figure 30), the end flange (2, Figure 30) from its housing in the cylinder (5, Figure 30).

NOTICE

The above operation must be performed with great care, so as to prevent spoiling the outer varnish coating. Restore any damaged varnish coating.

7. Remove the piston thrust flange (8, Figure 30). This operation is facilitated by the presence of threaded bores (Figure 27), which are not used to keep the component fastened, but can be used for:
   A. Easing the unscrewing of thrust flange (8, Figure 27) from the stem (9, Figure 27): insert and screw in some screws to be unscrewed.
   B. Partially unscrew the flange.
   C. Remove the screws and insert the lifting lugs for thrust flange. Complete the unscrewing and lift the plate.

NOTE:

The weight of the thrust flange, the number of threaded bores present on the thrust flange, the type of thread of the lifting lugs to be used for unscrewing and lifting the thrust flange are featured in Table 23.

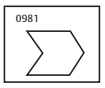
NOTICE

The upper cylinder (5A, Figure 30) is not provided with screw interfaces for handling purposes Use padded clamps or jaws so as to prevent damaging:
- The treatment inner coating, applied to protect the cylinder against corrosion and to facilitate the piston sliding movement.
- The treatment outer coating, applied to protect the cylinder against corrosion.

8. Hook the clips/jaws (attached to lifting chains or ropes) to the upper cylinder (5A, Figure 30) and partially tension the chains.
9. Remove the upper cylinder locking fixture (5A, Figure 30).
10. Lift the upper cylinder and remove it from the actuator (refer to Table 23 as regards weights and the height to which the cylinder has to be lifted in order to pull it out of the kinematic mechanism).

NOTE:

The height required to pull the cylinder out is one of the main parameters to be considered when assessing the space needed to perform supplementary maintenance interventions on the premises or in a specialist workshop. As regards the height and weight of the parts to be moved, refer to Table 23.



Carefully read the following point 11:

11. If the partial replacing of the seals has been scheduled, proceed as per following Section 9.3.2.3. If the complete replacing of the seals has been scheduled, proceed with the disassembly procedure for lower cylinder as described from point 12) hereunder.
12. Lock the lower cylinder (5B, Figure 30) in place by means of the specific fixture.

NOTICE

The fixture used must allow the cylinder (5B, Figure 30) to stay locked in place even after removal of the nuts (1B, Figure 30) and of tie rods (3B, Figure 30), without spoiling the outer varnish coating of the cylinder.

The cylinder (5B, Figure 30) is locked in its mounting position, by means of: head flange (4, Figure 30), the tie rods (3B, Figure 30) and tie rods nuts (1B, Figure 30). Since the cylinder disassembly operation requires the removal of nuts and tie rods, the lower cylinder is no longer locked.

Biffi Italia s.r.l. can provide the specific fixture that allows the lower cylinder to stay locked, by keeping it in place, during disassembly and seal replacement (Section 10.4).

13. Remove the tie rod nuts (1B, Figure 30).
14. Remove the tie rods (3B, Figure 30).
15. Remove the intermediate flange (20, Figure 30). Insert at least three stud bolts in the threaded bores used for fastening the tie rods and tighten some lifting eye nuts onto them. If necessary, assess the need for using some spacers since the base of the lifting lugs does not come completely into contact with the surface of the intermediate flange.

NOTE:
The weight of the intermediate flange is indicated in Table 23.

NOTICE

The lower cylinder (5B, Figure 30) is not provided with screw interfaces for handling purposes Use padded clamps or jaws so as to prevent damaging:
- The treatment inner coating, applied to protect the cylinder against corrosion and to facilitate the piston sliding movement.
- The treatment outer coating, applied to protect the cylinder against corrosion.

16. Hook the clips/jaws (attached to lifting chains or ropes) to the lower cylinder (5B, Figure 30) and partially tension the chains.
17. Remove the lower cylinder locking fixture (5B, Figure 30).
18. Lift the lower cylinder (5B, Figure 30) and remove it from the actuator (refer to table T 9.8 as regards weights and the height to which the cylinder has to be lifted in order to pull it out of the kinematic mechanism).

NOTE:
The height required to pull the cylinder out is one of the main parameters to be considered when assessing the space needed to perform supplementary maintenance interventions on the premises or in a specialist workshop. As regards the height and weight of the parts to be moved, refer to Table 23.

10.3.2.3 Replacing the Seals (TPD 14/18/32)

After disassembling the upper cylinder (partial replacing of the seals) or the upper or lower cylinders (complete replacing of seals), the procedure for replacing the seals can start. The operations described below must be performed beforehand:

1. Thoroughly clean the slots and housings of seals and sliding ring; lubricate with a protective thin film of grease.
2. Put the seals and sliding ring accurately in place on the relevant component, being careful that the material does not get pinched or damaged.

NOTE:
For a complete replacing, the first seal to be replaced and restored in place is the seal of the head flange (D, Figure 29) in order to reassemble the lower cylinder (5B, Figure 30).

3. Grease and lubricate the seals in their housings and the sliding ring, so as to keep them in place during assembly.

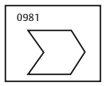
NOTE:
As regards seal lubrication, Biffi Italia s.r.l. recommends this grease: AGIP-ENI LCX 2/32 for NBR/Viton/Neoprene seals; Aeroshell Grease 7 for Fluorosilicone seals.

10.3.2.4 Reassembling the Cylinder (TPD 14/18/32)

The cylinder is reassembled by following in reverse order the sequence described in Section 9.3.2.2.

NOTE:

- As regards the type of hand tools required to assemble the cylinder, refer to Table 20.
- The tie rods nuts (1, Figure 30) are functional to the structural integrity of the pneumatic cylinder; the tightening torque to be applied is detailed in terms of the type of tie rod and the material. Refer to Tables 21 and 22.



Carefully read the following information:

- If the complete replacing of the seals has been scheduled, follow the procedure indicated from point 1).
- If the partial replacing of the seals has been scheduled, follow the procedure indicated from point 7).

- Procedure:

1. Ensure that the seal (D, Figure 28) of head flange (4, Figure 30) has been replaced and assembled.
2. Lift the lower cylinder (5B, Figure 30) and put it back in place by performing the operations below:
   - A. Thoroughly clean the cylinder inner surface and ensure that neither the surface nor the mouthpieces are damaged.
   - B. Lubricate the entire inner surface and mouthpiece chamfers.
   - C. Lift the cylinder at such a height to avoid coming into collision with the piston stem and the inner mechanism.
   - D. Slowly lower it towards the head flange.
   - E. The lower part of the cylinder should rest against the head flange (as shown in Figure 29 – detail 3): proceed with the utmost caution in order to avoid damaging the seal (D, Figure 25).
   - F. In the event that, during this maintenance operation, the actuator position can cause the cylinder to fall, when in place as described at the previous point, a fixture suitable to lock the cylinder must be provided.

NOTICE

The cylinder (5B, Figure 30) is not provided with screw interfaces for handling purposes. Use padded clamps or jaws so as to prevent damaging:

- The treatment inner coating, applied to protect the cylinder against corrosion and to facilitate the piston sliding movement.
- The treatment outer coating, applied to protect the cylinder against corrosion.

3. Lift the intermediate flange and rest it on the lower cylinder: pay attention to position it so that its bores for the tie rods (3B, Figure 30) are perfectly aligned with the ones present on the head flange (4, Figure 30). In particular, verify the bores used for fastening the pneumatic panel are properly aligned: the bores on the intermediate flange shall be aligned with the bores on the head flange.
4. Reassemble the tie rods (3B, Figure 30).
5. Tighten the nuts (1B, Figure 30) on the tie rods (3B, Figure 30).

NOTICE

Tightening the tie rods and the nuts to the specific torque will guarantee the integrity of the pneumatic cylinder intended as pressure equipment.

- Refer to the documentation relative to the order acknowledgement with regard to the linkage material (1B and 3B) and the type of thread.
- Apply the tightening torques indicated in tables:
  - Table 21 - Tightening torques – Tie rod material: ASTM A320 – L7. Nut material: ASTM A 194 gr 7 s3
  - Table 22 - Tightening torques – Tie rod material: ASTM A320 B8M CL 2 - Nut material: EN ISO3506-2 A4-80

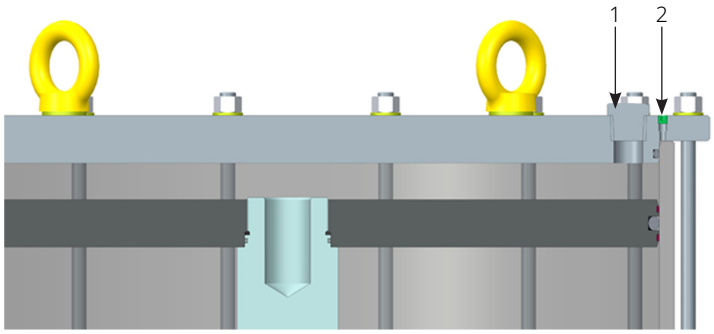
⚠ WARNING

Failure to observe the provisions above can:

- Affect the actuator performance.
- Cause serious consequences as regards the safety of persons and property.

6. Remove the lower cylinder locking fixture (5B, Figure 30).
7. Verify the following items have been replaced and assembled: seal C (detail 2, Figure 29), seal B (detail 2, Figure 29) and the sliding ring of piston E (detail 1, Figure 29).
8. Lift the thrust flange (8, Figure 30) and center it with respect to the stem (9, Figure 30).
9. Re-screw the flange (8, Figure 30) on the stem (9, Figure 30). Proceed with the utmost caution in order to avoid damaging the assembled seals and the threads.
10. Reassemble the upper cylinder (5A, Figure 30) and pay attention not to hit the sliding rings (E, Figure 29) and the outer seal of the piston.
11. Reassemble the tie rods (3A, Figure 30).
12. Verify the seal (A, Figure 29) is properly assembled; reassemble the end flange (2, Figure 30) and fasten it, by means of the tie rods nuts (1, Figure 30), as follows:
    A. Remove the threaded plug (or plugs) (refer to Figure 28) from the end flange (2, Figure 26) so as to allow the seal to settle in place during assembly.

Figure 31. Threaded Plugs on End Flange



1. Plug for pneumatic interface (the quantity depends on the actuator size)
2. Closure plugs for vents (if fitted)

B. Pay attention when assembling the end flange (2, Figure 30) by centering it with the upper cylinder (5A, Figure 30); avoid damaging seal A (detail 1, Figure 29). The end flange should rest against the cylinder.

C. Tighten the nuts (1A, Figure 30) on the tie rods (3A, Figure 30).

NOTICE

Tightening the tie rods and the nuts to the specific torque will guarantee the integrity of the pneumatic cylinder intended as pressure equipment.

- Refer to the documentation relative to the order acknowledgement with regard to the linkage material (1A and 3A, Figure 30) and the type of thread.
- Apply the tightening torques indicated in tables:
  - Table 21 - Tightening torques – Tie rod material: ASTM A320 – L7. Nut material: ASTM A 194 gr 7 s3
  - Table 22 - Tightening torques – Tie rod material: ASTM A320 B8M CL 2 - Nut material: EN ISO3506-2 A4-80

⚠ WARNING

Failure to observe the provisions above can:

- Affect the actuator performance.
- Cause serious consequences as regards the safety of persons and property.

10.4 Information Necessary for Seal Replacement

NOTE:

This section contains pieces of information that are necessary to perform maintenance operations under safe conditions. Such information might be obsolete as a result of amendments and upgrading subsequent to the release of the present document. Refer to the rating plate and to the documentation relative to the order acknowledgement to identify the type of actuator and accessories purchased and check the data with Biffi Italia s.r.l. After Sales Service.

SPECIAL FIXTURE

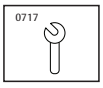
To lock the cylinder in place during disassembly operations, a special fixture is required, as already indicated in Sections 10.2.2.2 and 10.3.2.2. The characteristics of the fixture are:

- It can adapt to the outer cylinder without interfering with the tie rods.
- It can be fixed to the head flange.
- It consists of 2 or more jaws to grip the cylinder.
- The cylinder outer varnish coating is not spoiled by the grip.

Owing to the fact that TPD series actuators can be equipped with various different types of pneumatic cylinders (refer to Table 3), there are various types of fixtures available, to suit the cylinder in use.

NOTE:

Biffi Italia s.r.l. can provide the specific fixture to lock the cylinder.



Contact Biffi Italia s.r.l. (refer to Section 2.1) for further information.

TIGHTENING TORQUE TABLES

Table 21. Tightening Torques – Tie Rod Material: ASTM A320 – L7. Nut Material: ASTM A 194 gr 7 s3

Tightening Torques (Standard Linkage)	
Thread Size	**Tightening torque (Nm)**
M8	-
M10x1.5	40
M12x1.75	70
M14	-
M16x2	160
M20x2.5	320
M22	-
M24x3	550
M27x3	800
M30	-
M33	-
M36	-

Table 22. Tightening Torques – Tie Rod Material: ASTM A320 B8M CL 2 - Nut Material: EN ISO3506-2 A4-80

Tightening Torques (Stainless Steel Linkage)	
Thread Size	**Tightening torque (Nm)**
M8	-
M10x1.5	30
M12x1.75	58
M14	-
M16x2	130
M20x2.5	250
M22	-
M24x3	440
M27x3	535
M30	-
M33	-
M36	-

Table 23. Information Useful for Seal Replacement on Pneumatic Cylinder of TPD Series Actuators

Model	Cylinder (5, Figure 26 and Figure 30)			Nut And Tie Rod Type (1, 3, Figure 26 and Figure 30) Thread Size	Thrust Flange (8, Figure 26 and Figure 30) Bores Qty and Thread For Lifting Lugs	End Flange (2, Figure 26 and Figure 30) Weight (kg)	Thrust Flange (8, Figure 26 and Figure 30) Weight (kg)	Intermediate Flange (20, Figure 30) Weight (kg)
	DN (mm)	Height (mm)	Weight (kg)					
TPD 0.A xxk 175	175	352	13	M12 x 1.75	2 x M10	9	5.1	-
TPD 0.1 xxk 235	235	440	25	M16 x 2	2 x M10	15	11.8	-
TPD 0.3 xxk 280	280	525	35	M12 x 1.75	2 x M10	20	14.5	-
TPD 0.3 xxk 335	335	525	46	M12 x 1.75	2 x M10	30	21	-
TPD 0.9 xxk 385	385	718	75	M12 x 1.75	2 x M10	37	32	-
TPD 0.9 xxk 435	435	718	88	M12 x 1.75	2 x M10	46	41	-
TPD 1.5 xxk 485	485	820	115	M16 x 2	3 x M16	63	55	-
TPD 1.5 xxk 535	535	820	132	M16 x 2	3 x M16	80	70	-
TPD 3 xxk 585	585	1035	187	M16 x 2	3 x M16	108	85	-
TPD 3 xxk 635	635	1035	249	M16 x 2	3 x M16	126	103	-
TPD 6 xxk 735	735	1347	373	M16 x 2	3 x M16	178	150	-
TPD 6 xxk 785	785	1347	398	M20 x 2.5	3 x M16	204	172	-
TPD 14 xxk 935	935	1670	350/290	M24 x 3	3 x M16	356	325	130
TPD 14 xxk 1000	1000	1670	350/290	M24 x 3	3 x M16	449	371	130
TPD 18 xxk 1000	1000	1900	550/400	M24 x 3	3 x M16	449	371	150
TPD 18 xxk 1100	1100	1900	550/400	M24 x 3	3 x M16	540	472	150
TPD 32 xxk 1200	1200	2185	780/590	M24 x 3	3 x M16	650	571	180
TPD 32 xxk 1300	1300	2185	780/590	M24 x 3	3 x M16	840	725	180

10.5 Lubrication

Under normal operating conditions, TPD series actuators are lubricated for life.

In case the cylinder motions are extremely frequent, lubrication of the sliding and contact surfaces should be restored with grease.

The type of grease used and recommended by BIiffi Italia s.r.l. for refilling and lubrication purposes at normal temperature, is described below:

Manufacturer:	AGIP
Type:	GR MU/EP2
NLGI grade:	2
Worked penetration (dmm):	280
Dropping point ASTM (°C):	185
ISO grade:	X2
Equivalent grease:	ESSO BEACON EP2 BP GREASE LTX2 SHELL ALVANIA GREASE R2 ARAL ARALUB HL2 CHEVRON DURALITH GREASE EP2 CHEVRON SPHEEROL AP2 TEXACO MULTIFAK EP2 MOBILPLEX 47 PETROMIN GREASE EP2

In case of special operating conditions or temperatures beyond the normal range, please contact Biffi Italia s.r.l.

Section 11: Spare Parts

For information on requesting spare parts, please refer to Section 2.4.

Refer to Section 10.2 and Figure 29 for the spare parts that need to be replaced after supplementary maintenance interventions.

The tables below contain the codes for the spare parts kits regarding:

- The actuator generic model
- The type of seal material

Each single part number of the kit indicated in the table below includes the following components:

Seals (refer to Figures 25 and 29)	Type A, Type B, Type C, Type D
Sliding ring (refer to Figures 25 and 29)	Type E

NOTE:
The data in the following tables refer to the product configuration updated to the revision date of the present manual. Please refer to the documentation relating to the order acknowledgement and to the drawings for detailed information on spare parts.

11.1 Pneumatic Cylinder Seals (Material: NBR)

Table 24. List of Seal Kits For Pneumatic Cylinder of TPD Series Actuators – NBR Material

Actuator Model	Spare Part Kit – Material: NBR (Refer to Figures 25 and 29)
TPD 0.A xx 175	G0203P00AD0
TPD 0.1 xx 235	G0203P01BD0
TPD 0.3 xx 280	G0203P03AD0
TPD 0.3 xx 335	G0203P03BD0
TPD 0.9 xx 385	G0203P09AD0
TPD 0.9 xx 435	G0203P09BD0
TPD 1.5 xx 485	G0203P15AD0
TPD 1.5 xx 535	G0203P15BD0
TPD 3 xx 585	G0203P30AD0
TPD 3 xx 635	G0203P30BD0
TPD 6 xx 735	G0203P60BD0
TPD 6 xx 785	G0203P60CD0
TPD 14 xx 935	G0203PB14D0
TPD 14 xx 1000	G0203PC14D0
TPD 18 xx 1000	G0203PB18D0
TPD 18 xx 1100	G0203PC18D0
TPD 32 xx 1200	G0203PC32D0
TPD 32 xx 1300	G0203PD32D0

NOTE:
With reference to Section 3.10, the alphanumeric **xx** sequence, featured in the identification code of the actuator model, is indicated in general terms. The seals DO NOT depend on the kinematic mechanism (xx = RP/SY).

11.2 Pneumatic Cylinder Seals (Fluorosilicone Material)

Table 25. List of Seal Kits For Pneumatic Cylinder of TPD Series Actuators – Fluorosilicone Material

Actuator Model	Spare Part Kit – Material: NBR (Refer to Figures 25 and 29)
TPD 0.A xx 175	G0203P00AD1
TPD 0.1 xx 235	G0203P01BD1
TPD 0.3 xx 280	G0203P03AD1
TPD 0.3 xx 335	G0203P03BD1
TPD 0.9 xx 385	G0203P09AD1
TPD 0.9 xx 435	G0203P09BD1
TPD 1.5 xx 485	G0203P15AD1
TPD 1.5 xx 535	G0203P15BD1
TPD 3 xx 585	G0203P30AD1
TPD 3 xx 635	G0203P30BD1
TPD 6 xx 735	G0203P60BD1
TPD 6 xx 785	G0203P60CD1
TPD 14 xx 935	G0203PB14D1
TPD 14 xx 1000	G0203PC14D1
TPD 18 xx 1000	G0203PB18D1
TPD 18 xx 1100	G0203PC18D1
TPD 32 xx 1200	G0203PC32D1
TPD 32 xx 1300	G0203PD32D1

NOTE:
With reference to Section 3.10, the alphanumeric **xx** sequence, featured in the identification code of the actuator model, is indicated in general terms. The seals DO NOT depend on the kinematic mechanism (xx = RP/SY).

Section 12: Troubleshooting

The indications provided in this section serve the purpose of facilitating the Purchaser's maintenance technicians in identifying the probable causes of shortcomings or failures that could be related to the TPD actuator.

This list has been drawn up on the basis of data processed by Biffi Italia s.r.l. after examining the failures or shortcomings occurred over the years on actuators already installed. Therefore, this list should not be considered complete and exhaustive, but rather a collection of the most frequent cases.

Table 26. Troubleshooting

EVENT	POSSIBLE CAUSE	SOLUTION
Actuator not working	Electrical power supply failure (if electric/electronic components are fitted)	Check the status of the electrical power supply line and restore operation
	Pneumatic power supply failure	Check the status of the pneumatic power supply line and ensure that the on-off valve is open
	Valve stuck	Repair or replace
	Control panel failure	Contact Biffi Italia s.r.l. After Sales Service → Phone, e-mail: Section 2.1
Actuator excessively slow	Low supply pressure	Restore the correct rate: → 3.12 - Technical Data
	Worn out valve	Replace
Actuator excessively fast	High supply pressure	Restore the correct rate: → 3.12 - Technical Data
	Improper calibration of flow control valves	Perform a new calibration
Leakage in hydraulic circuits	Worn out or damaged seals	Contact Biffi Italia s.r.l. After Sales Service → Phone, e-mail: Section 2.1
Incorrect valve position	Improper stopper adjustment	Perform a new calibration
	Improper signalling from microswitches (if fitted)	Perform a new calibration
	Leakage in check valve of hydraulic control unit	Contact Biffi Italia s.r.l. After Sales Service → Phone, e-mail: Section 2.1

Section 13: Dismantling and Disposal

NOTICE

Before proceeding with the dismantling operations, create around the actuator a space big enough to allow all handling movements and prevent risks generated by the premises. Interrupt the pneumatic power supply and release pressure from the actuator cylinder, from the control unit and from the storage tank, if fitted.

⚠ WARNING

Potential risk:
The presence of pneumatic energy (pressurized fluid) represents a source of potential hazard: before proceeding with any dismantling operation, it is mandatory to interrupt the pneumatic power supply and release pressure from the actuator chambers and from the control unit, if fitted.

Procedure:

- The valve should be removed and disposed of by a specialist company or qualified personnel.
- Dismantle the actuator and group the components according to the type of material (e.g., metal, plastic, fluids, etc.) and dispose of them as separately collected fractions, in compliance with the Laws and Regulations in force.

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